BOTANICAL MUSEUM LEAFLETS

HARVARD UNIVERSITY

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HARVARD UNIVERSITY

VOLUME XXVII

BOTANICAL MUSEUM
CAMBRIDGE, MASSACHUSETTS
1979

DATES OF PUBLICATION - VOLUME 27

Nos. 1-2	March 6, 1980
Nos. 3-4	March 28, 1980
Nos. 5-6	May 25, 1980
Nos. 7-9	June 16, 1980
No. 10	October 28, 1980

CORRECTION

Page 177: Fifth line from bottom should read:

aa. Petals never mucronate; plants rhizomatous. .... **14. S. brevilabris alliance**

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CAMBRIDGE, MASSACHUSETTS, JAN.–FEB. 1979 VOL. 27, NOS. 1–2

SALPIGLOSSIS, LEPTOGLOSSIS AND REYESIA (SOLANACEAE) A SYNOPTICAL SURVEY[1]

ARMANDO T. HUNZIKER & ROSA SUBILS[2]

REVIEW OF THE SYSTEMATIC POSITION

The systematic position of *Salpiglossis, Leptoglossis* and *Reyesia* has been in dispute for an appreciable period of time. *Salpiglossis* was originally proposed by Ruiz & Pavon as part of their class *Didynamia Angiospermia.* Its first position in the natural system was assigned by Hooker (1827; 1834) and Bartling (1830: 136) to the *Bignoniaceae.* However, Sweet (1827; 1828; 1830; 1833) and Don (4: 399. 1837) placed it in the *Solanaceae.* Bentham (1835) regarded it in turn as belonging to the *Scrophulariaceae,* erecting the tribe *Salpiglossideae* in his new system for the family; the tribe included *Salpiglossis, Schizanthus, Browallia, Franciscea, Brunfelsia* and *Anthocercis* and this classification was adopted by Endlicher (1839: 675) and Brongniart (1843: 58; 1850: 110). Ten years later, when describing *Leptoglossis,* Bentham (1845: 143) maintained his earlier stand and assigned it as a new member of the *Salpiglossideae.*

[1] This research was partially supported by a grant from SECYT (Secretaria de Estado de Ciencia y Tecnología, Buenos Aires, Argentina) for studies on South American *Solanaceae.* The authors gratefully acknowledge the help of the artists who prepared the illustrations with their usual skill (Mrs. Nydia M. de Flury: pl. II, IV, V; Mrs. L. Sanchez: pl. VI, VIII).

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Botanical Museum Leaflets (USPS 404-990). Published monthly except during July and August by the Botanical Museum, Harvard University, Cambridge, Massachusetts 02138. Subscription: $25.00 a year, net, postpaid. Orders should be directed to Secretary of Publications at the above address. Second-Class Postage Paid at Boston, Masachusetts.

Clos (1849) followed Bentham in keeping *Salpiglossis* in the *Scrophulariaceae;* at the same time Gay (1849) in describing the new but obviously related genus *Reyesia,* assigned it to the *Bignoniaceae.* Such a disparity of opinion concerning the proper allocation of these three genera in the system can be easily understood if one takes into account both the floral zygomorphy and the tetradynamous androecium.

Even as late as 1888, Baillon accepted the system of Bentham, keeping the tribe *Salpiglossideae* in the *Scrophulariaceae.* The first author to disagree with this classification was John Miers. In a brilliant research published in 1849, he transferred the whole tribe *Salpiglossideae* to the *Solanaceae* (including four genera: *Salpiglossis, Leptoglossis, Browallia* and *Pteroglossis;* this last name, as it is now understood, is a synonym of *Reyesia*). When Bentham elaborated the *Gamopetalae* for the *Genera Plantarum* (2: 882, 913, 1244. 1876), he willingly accepted the ideas of Miers and placed the *Salpiglossideae* (comprising *Salpiglossis, Leptoglossis, Reyesia* and twelve additional genera) in the *Solanaceae.*

By then, the German school was making important contributions for the proper delimitation between *Solanaceae* and *Scrophulariaceae.* As early as 1866 (pag. 518), Wydler published an epoch-making article for the study of floral morphology: by checking carefully the symmetry of each of the four verticils in *Schizanthus,* he arrived at the conclusion that the *Solanaceae* display a unique type of oblique zygomorphy, different from the median one characteristic of the *Scrophulariaceae, Labiatae,* etc.; in his own words: ". . .Der Unterschied in der Blütenbildung zwischen den Solaneen mit symmetrischer Blüthe und den Antirhineen (Labiaten, etc.) ist ein sehr wesentlich."; Wydler was later fully supported by Eichler (1869: 105; 1875, 1: 203).

A further step forward towards an understanding of differences between these two families, was taken by Vesque (1885), Schlepegrell (1892) and Fedde (1896), using an anatomical approach; these authors were able to show convincingly that the presence of internal phloem is a characteristic feature shared by all genera of *Solanaceae,* while the absence of it is a significant characteristic of the *Scrophulariaceae.* These findings supported the inclusion of *Salpiglossideae* in the *Solanaceae,* as Wettstein (1891:34) had already proposed on the basis of external morphology.

Finally, we must mention the important monograph of Robyns (1931); after comparative studies on floral organization in the *Solanaceae*, he verified and extended the early observations of Wydler and Eichler concerning the pattern of symmetry of the several verticils. Of his various conclusions, it is worthwhile to quote the following (1931: 79): "L'organisation florale des Solanacées ne peut donc se comprendre *qu-en relation avec l'obliquité du gynécée*, qui en est le caractère fondamental et distinctif et qui a produit le type bilabié propre à la famille. Le Solanacées forment une famille homogène et naturelle, associant un type vegetatif particulier a *un type floral tout aussi caractéristique et dont toute l'évolution s'est faite d'après un plan uniforme*, sous l'action de la tendance à la zygomorphie, qui s'est manifestée dans toutes les tribes".

GENERIC DELIMITATION AND AFFINITIES

It is surprising that Bentham (1845: 143) proposed *Leptoglossis* without any mention of *Salpiglossis* as a closely related genus. He compared it instead with *Schwenckia* L. and *Browallia* L., genera which are quite different. Nevertheless, the important point is that *Salpiglossis, Leptiglossis* and *Reyesia* were recognized as separate generic entities by Bentham. On the contrary, Wettstein (1891: 36) included *Leptoglossis* and *Reyesia* as sections in *Salpiglossis*. Since then taxonomists in general have accepted Wettstein's classification (Werdermann, 1928; Johnston, 1928, 1929; Millán, 1931), until Hunziker (1977: 45) reinstated the three genera on the basis of morphological and phytogeographical evidence. D'Arcy (1978) also favored this opinion.

The affinities of each genus will be explained further on in this paper. Since all there genera have been confused at one time or the other with *Browallia* L. and *Nierembergia* R. et P. (Torrey, 1859: 155, 156; Hemsley 1882: 437), or with *Hunzikera* D'Arcy (Gray, 1877: 164; Millán, 1941: 489) or *Bouchetia* Dun. in DC. (D'Arcy, 1978: 714)[3], the following artificial key is presented to facilitate their identification:

[3]The delimitation between *Salpiglossideae* and *Nicotianeae* is not clear; further studies are needed for a proper understanding of both tribes.

1. Corolla hypocrateriform (limb broad compared to the narrow cylindrical tube). Disk absent or cupuliform.
   2. Stamens and distal part of the gynoecium exserted. Corolla tube very narrow, lacking a distal expansion. Disk absent. .... **Nierembergia**
   2'. Stamens and stigma included or slightly protruding. Corolla tube with a distinct faucial enlargement at summit of the tube. Disk cupuliform. .... **Hunzikera**

1'. Corolla campanulate or tubular-funnelform. Disk cupuliform.
   2. Anthers ventrifixed.
      3. Corolla campanulate-infundibuliform; tube not ventricose. Stamens generally five (or sometimes four and one staminode), with equal sized anthers. .... **Bouchetia**
      3'. Corolla subcylindrical, slightly ventricose at distal end of the tube. Stamens generally two, with three staminodes (*L. schwenckioides* may have four stamens: two longer ones with small anthers, and two shorter ones with large anthers) .... **Leptoglossis**
   2'. Anthers dorsifixed or basifixed.
      3. Corolla 2.3–4.5 cm long. Stigma large, more or less trumpet-shaped, broader than the adjoining flat laminar part of the style. **Salpiglossis**
      3'. Corolla 0.7-1.3 cm long. Stigma small, semidiscoidal; the adjacent upper spoon-like part of the style much broader, owing to two lateral curved wings. .... **Reyesia**

Salpiglossis R. et P.

Ruiz et Pavón, Fl. Peruv. Chil. Prodr. p. 94, t. 19. 1794.— Bentham, in Bot. Reg. 21, t. 1770. 1835. Bentham in De Candolle Prodr. 10: 201. 1846.— Clos in Gay, Hist. Fís. Pol. Chile, Bot. 5 (1): 127. 1849.— Miers in Ann. Mag. Nat. Hist. Ser. 2, 5 (25): 29. January 1850.— Miers, Ill. South Amer. Pl. 2: 58, pl. 51, 1849-1857.— Bentham & Hooker, Gen. Pl. 2 (2): 909. 1876.— Wettstein in Engler & Prantl, Nat. Pflanzenfam. 4, 3 b: 36, f. 16 B-J. 1891.— Reiche, Fl. Chile 5: 397. 1910.— Werdermann in Notizbl. Bot. Gart. Mus. Berlin-Dahlem 10 (95): 471. 1928.— Robyns in Mém. Ac. Roy. Belgique, Cl. Sc. 11 (8): 18, 42, 44, pl. III D. 1931.

Type species: *Salpiglossis sinuata* R. et P.

This genus includes two endemic species from the southern Andes in Argentina (Mendoza) and Chile (from Valdivia to the Tropic of Capricorn). As it was explained previously, *Leptoglossis* and *Reyesia* are closely related to *Salpiglossis;* from the first one it is easily separated by its dorsifixed anthers, and from the latter by its larger corolla and by details of the androecium and stigma (see key). The recent combining of *Salpiglossis* with *Bouchetia* by D'Arcy (D'Arcy, 1978) is unacceptable for us; the ventrifixed anthers of *Bouchetia,* and a significant number of correlated characters argue strongly against such a novel point of view. In a forthcoming paper we shall discuss this topic in detail.

KEY TO THE SPECIES

1. Glandular hairs of the calyx with elongated pluricellular heads. Pollen in tetrads; androecium with four stamens, and the anterior one very short or reduced to a small staminode. Cylindrical part of the corolla slightly (ca. 1/4) longer than the calyx, and as long as at least 1/3 of the total length of the corolla .... 1. **S. sinuata**

1'. Glandular hairs of the calyx with globoid pluricellular heads. Pollen granular; androecium with four stamens, the anterior one absent. Cylindrical part of the corolla twice or more longer than the calyx, and almost as long as the remaining flared portion of the corolla. .... 2. **S. spinescens**

1. Salpiglossis sinuata R. et P.
(Pl. 1, 2; Pl. 2.)

Ruiz et Pavón, Syst. Veg. 1: 163. 1798. "Habitat ad radices collium Conceptionis Chile, passim in Mochita tractu". Holotype: Chili in siccus gbri-xbri [Ruiz et Pavon s. n.] (MA: 18 76). Isotypes :G ; BM). Bentham, in DeCandolle Prodr. 10: 201. 1846.— Clos in Gay, Hist. Fis. Pol. Chile Bot. 5 (1): 128. 1849.— Schwarze in Jahrb. wissensch. Bot. 52 (2): 195-204, f. 1-3, Taf. I (f. 1-12). 1914. Anatomical studies on the anthers.— Robyns in Bull. Ac. Roy. Belgique, Cl. Sc. 5[e] Sér. 22: 1080, pl. I, II. 1936.— Martin in Am. Midl. Nat. 36: 583, pl. 36. 1946.— Muñoz Pizarro, Flores Silvestres Chile 43 (lám. 26 by E. Sierra Rafols). 1966.— D'Arcy, in Ann. Missouri Bot. Gard. 65: 720. 1978.

Salpiglossis straminea Hooker, Exot. Fl. 3, t. 229. 1827. "The seeds of this rare but highly interesting plant were sent to our Botanic Garden from Chili, by Alexander Cruickshanks, Esq. in 1825. . . The same gentleman has communicated to us well dried specimens of the same plant. . . .".— R. Sweet, Brit. Fl. Gard. 3, t. 231. 1827.

Salpiglossis atropurpurea Graham in Edinb. N. Phil Journ. 4: 176. Oct-Dec 1827. ". . . .It first flowered in the greenhouse of Mr. Neill, Canonmills, Edinburgh, from seeds sent by Dr. Gillies from hills fifty miles beyond Mendoza". In the Edinburgh Herbarium we have seen a specimen prepared from plants cultivated at the Botanic Garden of that institution; although its label does not contain additional information beyond the Latin name, we have chosen it as a lectotype.— R. Graham, in Curtis' Bot. Mag. 55, t. 2811. 1828.— Reichenbach, Fl. Exot. 5, t. 323. 1836. Notwithstanding the pretty illustration of four cultivars (differing in colour and form of the corolla), it must be pointed out that the anterior stamen has been incorrectly placed between the two shorter posterior ones.

Salpiglossis picta Sweet, Brit. Fl. Gard. 3, t. 258. 1828. ". . . our drawing of this magnificent plant was made. . . .from fine specimens. . .raised from seeds that had been sent from Chile. . .".— C. Loddiges, Bot. Cab. t. 1652. 1831.— Heywood *et al.*, Flowering Pl. World, pl. 28 (1). 1978.

Salpiglossis Barclayana Sweet, Brit. Fl. Gard. ser. 2, 2, t. 112 1833. ". . . .Our figure was taken from a plant that flowered in the Nursery of Mr. Lee of Hammersmith. . . .". Apparently there is no herbarium specimen of the plant described by Sweet, but the excellent illustration by E. D. Smith, leaves no doubt about this being a synonym.

Salpiglossis fulva Courtois in Magas. d'Hortic. (Liége) 1:211 (n°. 411). 1833. Again here the plants belonged to a cultivated strain: ". . . .Originaire du Chili, d'où elle a été importée en Belgique en 1830. . ."; the description agrees fully with that of *S. sinuata* R. et P.

Salpiglossis straminea var. *β picta* (Sweet) Hooker, in Curtis' Bot. Mag. 61, p. 3365. 1834. Based on *S. picta* Sweet.

Salpiglossis purpurea Miers in Ann. Mag. Nat. Hist. Ser. 2, 5 (25): 31. January 1850. Holotype: [Chile] Cordilleras, purple

Salpiglossis, Miers 1007 (BM). J Miers, Ill. South Am. Pl. 2: 60, pl. 51. 1849-1857. There is a mistake on this plate: the pair of long stamens shows larger anthers than the shorter ones, whereas the contrary is the true condition.

Salpiglossis purpurea var. *β atropurpurea* (Graham) Miers, in Ann. Mag. Nat. Hist. Ser. 2, 5 (25): 31. January 1850.

Salpiglossis coccinea Lindley et Paxton, Flower Garden 3 (7) pl. 100. September 1852. ". . . It seems to differ from other Salpiglots in nothing except colour, which is here of a clear vivid tender scarlet, charmingly relieved by short veins of a deeper colour. . . .".

Vernacular name in Chile: "panza de burro" (Hartweg *in sched.* 1859; Grandjot, *in sched.* 1931); "palito amargo" (Muñoz Pizarro, 1966: 143); "flor del jote" (Bridges, *in sched.* 1832).

Although the leaves are sometimes entire (for example: *Montero 312*), usually they show at least three lobes on each side of the central vein.

Gametic chromosome number: n = 22 (Vilmorin et Simonet, 1928; Dale 1937: 654; Dale & Rees-Leonard, 1939: 362).

Its area is restricted to the Andes of Chile and Argentina, approximately between parallels 30° and 40° S; sometimes it grows near the sea-coast, but it may reach an altitude of 2000 m in the mountains. Rather common in Chilean territory (from Coquimbo in the north, to Valdivia in the south), it has been collected only four times in Argentina.

Obs. I.—Already in 1714 (2: 729, pl. XXI), Feuillée published an excellent drawing of this plant, accompanied by a detailed description, under the heading "*Rapunti facie, foliis sinuatis, flore amplissimo, sanguineo & striato;* at the end, he stated: "Elle croît dans les lieux humides. Je la trouvait près d'un ruisseau dans le Royaume de Chily, à 37 degrez de hauteur du Pole Austral."

Obs. II.—Since the early years of the last century, *S. sinuata* has been cultivated as an ornamental plant in Europe; from there it has spread and has become a well known garden plant, throughout the temperate regions of the world, on account of its showy flowers variously coloured.[4] Dale (1933; 1937) established that the form of the corolla is affected by a series of multiple alleles; later on (Dale & Rees-Leonard, 1939) he studied the inheritance of the plastid and anthocyanin variegation in both the leaves and the flowers.

Obs. III.—The tetrahedral tetrad pollen of *S. sinuata* was already detected by Hassall (1842: 549), who published a drawing of one tetrad (op.cit.f.44), in his outstanding contribution "On the structure of the pollen granule, considered principally in reference to its eligibility as a means of classification". During the present century, Wodehouse (1929: 343, f. 2) confirmed this observation, adding that the union between the four cells is looser than in the tetrads of Azalea.

ADDITIONAL MATERIAL.

CULTIVATED MATERIAL. Jardin Vilmorin à Verrières, près Paris *Gay*, 1 Oct 1855 "Floribus magnis et minimis et apetalis varia (K). Hort. Bot. Paris [year] 1835 (G).—Hort. Bot. Paris, cult. ex semin. chilens., *Desfontaines* [year] 1830 (FI).—Jardin de Roi a Paris [year] 1842 (FI). —Hort. Bot. Stockh. [year] 1834 (S).—Hort. Bot. Edinb. [sub nom. *Salpiglossis atropurpurea*] (GLAM).—Hort. Bot. Berol., *Bauer*, Sept. 1855 (CORD).—Cult. in Hort. Bot. Berol., *Schoenefeld*, Aug 1839 (P).—Cult. in Hort. Bot. S. Petersburg, *Al. de Bunge* 33 (P).—Jardin du Luxembourg, *Gay*, 20 Jul 1937 (K).—Germany, Pfronten, *Kugler*, Aug 1870. "In Garten" (M).—U.S.A., cult. by J. S. Memam, *Leggett*, 8 Aug 1872 (NY).—Bermudas: Rose Cottage, *Brown et al. 1974*, May/Jun 1914 (NY).

ARGENTINA. Prov. Mendoza: Andes of Chile and Mendoza, *Gillies* (K;GLAM).—Dept. Lujan: La Crucesita, *Covas 3014*, 27 Nov 1944 (RL 10963).—La Crucesita, *Covas*, 22 Dec 1943 (RL 10964).—Dpto. Tunuyan: Campo de Los Andes, Quebrada de la Remonta, *Ruiz Leal 22700*, 14 May 1963. "Flor amarillo-verdosa, exteriormente con venas violáceas (de anchura irregular), interiormente del mismo color, pero con dos lóbulos amarillo-anaranjados surcados (más conspicuamente que los demás) por venas ramificadas de color violáceo" (RL).

CHILE Without complete data: Chili, campagne de La Magicienne, *L. Savatier 1771, [ann.]* 1876-1879 (K).—Chile borealis, *Poeppig* (P).—Cordillera de Chile, *Dombey 329* (G,P).—Leg. *Dombey* [sphalm. Perou] (NY).—Leg. *Gay* [year] 1833 (G;GH). —Leg. *Gay 204* (NY).—Chili, *Cuming 137* (FI).—Cordillera de Chile, *Cuming 246, 294*, [ann.] 1831-1832 (BM; FI; GLAM: GH; K). —Chile, *Cuming 465*, [ann.] 1835 (BR). —La Rosa de La Guardia, *Poeppig 87. (11)*, Decembr. lect (P; W). Aconcagua y Cordillera, *Bridges 378 & 380* (GLAM).—Chili, Cruickshank 30, [ann.] 1826 (K).—Andes, leg. *Capt. Rey-*

[4]There are "nomina nuda" applied to some cultivars; for example: *Salpiglossis intermedia* (Sweet, Hort. Brit. ed. 2: 594. 1830), *S. aurea* and *S. hybrida* (Vilmorin, Fleurs de pleine terre 1863: 762, ed. 1), and *S. variabilis* (Vilmorin, *op. cit.* 1866: 809, ed. 2; Vilmorin, *op. cit.* 1870: 1005, ed. 3).

nolds (GH).—Cajon de Hualtata (Choapa), *Ph. Germain*, X-1894 (BM). Ercilla, *O. Kuntze*, Febr 1892 (NY).—Paso Cruz, 34°, Cord. Chili, 1500 m., *O. Kuntze*, Jan 1892 (CORD: NY).—Prov. Aconcagua: Dpto. Aconcagua: Mts. of Aconcagua Cordillera, *Bridges 380*, 1832 "Flor del jote" (K). Aconcagua, *Bridges 378* (K). Aconcagua, cerca de Rio Blanco, 2400 m alt., *Zollner 6779*, 9 Dec 1972 (CTES).—Dept. Petorca: Cerro Chache, 18 Km east of La Ligua, 1900-2000 m alt., *Morrison 17067*, 30 Dec 1938. "Perenn. herb 0, 6 m, fl. yellow-white-purple" (G; GH; K).—Ligua, 1600 m alt., *Morrison 17080*, 30 Dec 1938. "Perenn. herb. 0.6 m; fl. deep purple, drying black" (GH).—Dept. Quillota: Cerro Caquis, 15 Km east of Melon, ca. 1700 m alt., *Morrison 16856*, 14 Dec 1938. "Ann. herb 0.7 m alt.; fl. deep black purple" (G; K).—Prov. Bio-Bio: Dept. Laja: Antuco, *Junge 6925*, 17 Jan 1941 (CONC).—Los Angeles, 300 ft., *Sandeman 345*, Nov. 1939. "Yellow flowered herb about 2 ft. high, growing in full exposure" (K).—Prov. Colchagua: Cordillera Colchagua, *Philippi* (F; G). Cordillera de Tinguirririca, 1800 m alt., *Pirion 52*, Jan 1929 (GH).—Centinela, San Fernando, *Montero 20*, Oct 1925 (GH). Prov. Concepción: Dept. Coronel: Laraquete, *Sparre 51*, 1 Dec 1953 (CONC).—Küsten Kordillere zw. Sta. Juana und Coronel, *Merxmüller 24812*, 21 Dec 1968 (M).— Dept. Concepción: Concepción, *Junge 5191*, 2 Dec 1934 (CONC; LIL).— Concepción, *F. W. Neger*, [years] 1893-96 (M). La Toma, *Junge 1191.5*, 2 Dec 1934 (LIL). North of Concepción, 130 m alt., *West 4984*, 3 Jan 1936. "Perenn. herb 40-50 cm high, deep maroon-orange flower" (GH). Talcahuano, *Née* (MAF). -Prov. Coquimbo: Dept. Illapel: Illapel, *Philippi 922* (F). —Las Palmas, faldeos de los cerros, 250 m alt., *Marticorena & al. 442*, 4 Jan 1973 (CTES).—La Javilla, 1300 m alt., *Worth et al. 16549*, 16 Nov 1938. "Ann. herb 0.3 m; fl. deep red-purple" (GH; K).—Dept. Ovalle: El Toro, 330 m.s.m., *Jiles 1927*, 28 Oct 1950. "Hierb. casi 1 m alt.; fl. morado oscuro, casi negro, con algo amarillo por dentro. Planta glandulosa" (LIL; S). -Prov. Curicó: Hacienda Monte Grande, 1600 m alt., *Werdermann 506*, Dec 1924 (LIL; US; NY; GH; S; G; U; Z).—Los Quenes, 1000 m alt., *Aravena 33774*, 21 Jan 1942. "Flower light purple" (GH).— Cuesta de Hornos, Dept. Combarbalá, 1840 m alt., *Wagenknecht 5206*, 22 Oct 1942. "Planta de 40 cm; flor color chocolate muy oscuro; crece entre rodados de piedra con escasa vegetación" (US).—Prov. Linares: Dept. Linares: Melado Tal, 1500 m alt., *Zöllner 2436*, 21Jan 1968. "Wuchs auf einer Berghang der Nordseite wo es nur kleines Gebüsch gab" (L). -Dept. Parral: An der Laguna Bulileo, 800 m alt., *Zöllner 3689*, 28 Dec 1969. "Wuchs an sonningen Plätzen, auf Sand" (L).—Tranque Bullileo, 600 m.s.m., *Aravena 69*, 14 Jan 1952. "Abunda en los cerros que rodean la laguna; flores vistosas, 1 m alt." (K; US). -Prov. Malleco: West of Angol, Sierra Nahuelbuta, 650 m alt., *Hutchison 294*, 7 Jan 1952 (US; GH).—Fundo Solano (Los Alpes, Cordillera de Nahuelbuta), ca. 1200 m alt., *Everdam 10343*, 18 Jan 1958. "In dry hard ground" (US).— Prov. Maule: Dept. Cauquenes: Hacienda Cauquenes, Cajón del Ciprés, *Dessauer* [year] 1875 (M).— Baños de Cauquenes, *Dessauer* [year] 1875 (M). -Cauquenes, in collibus subalpinis, *Gay 92*, Jan 1831. "Dans les cordill. de long. des chémins; commune; d'un violet sombre (P). Prov. Ñuble: Dept. Chillán: Cordillera de Chillán, *Philippi* [ann.] 1876 (G). Prov. O'Higgins: Rancagua, La Leona, *Bertero 599*, Nov 1828 (P; GH). —In petrosis calidis montium prope La Quinta et Taquatagua, *Bertero 599*, Oct 1828 (AWH; TOR; L; P; G; NY; FI; GH) and *Bertero 1289* (NY). Copada, 1750-2000 m alt., *Pennell 12236*, 25 Jan 1925. "Perennial herb; corolla white a. violet" (GH). -Prov. Santiago: Dept. Maipo: Rio Maipo, *Meyen*, Feb 1931 (BR).—Rio Yeso, Romeral, 1350 m alt., *Biese*, 8

Nov 1944. "Flor blanca y violeta" (U).—Dept. Melipilla: Las Vizcachas, ca. 10 Km from La Dormida, 1700 1800 m alt., *Morrison 16747*, 7 Dec 1938. "Annual herb, 1 m; fl. purple yellow and white. Plant very viscid, glandular, in full sun, very often with *Schizanthus*" (G; GH).—Dept. Santiago: Al E de Santiago, Los Farallones, 200 m.s.m., *Wall & Sparre 60*, 5 Jan 1947 (S; GH).—Farallones, skiway near Santiago, *White*, 11 Jan 1958. "Full sun; flowers deep purple; 2-3 ft.; common" (US).—Cerro Provincia, 1600 m alt., *Grandjot*, Nov 1932. "Fl. atropurpur." (S).—Sierra near Santiago, 4000 ft. alt. *Sandeman* 317, Oct. 1939 "Herb with port wine red flowers, 2-2.5 ft. high, growing in half exposure on the mountain side" (K).—Santiago de Chile, *Caldcleugh* (G).—Santiago Chile, *Reynold 112* (K).—In montibus pr. Tiltil, 1400 m alt., *Grandjot*, Oct 1931. "Flor atropupur.; n.v.; Panza de burro" (M).—Santiago, 3700 m.s.m., Bro. *Claude-Joseph 808*, Jan 1919 (US). Queltehues, 1400 m alt., *Montero 312*, 24 Dec 1927 (GH).—Rio Yeso, Romeral, 1350 m alt., *Biese 82*, 8 Nov 1944. "Flor blanca y violeta" (US; LIL). Rio Yeso, 12 Km de Romeral, 2000 m.s.m., *Biese 272*, 16 Nov 1944. "Flor violeta" (LIL). Rio Yeso, Chacayes, 1600 m.s.m., *Biese 124*, 9 Nov 1944. "Flor blanco-celeste" (LIL).—Unknown Department: Cumbre de La Dormida, *Senn 4527*, 30 Nov 1948. "Dry rocky hillside; fl. white marked purple and yellow (US).—Prov. Talca: Dept. Talca: Environs de Talca, *Germain* [year] 1855 (G). Talca, *Philippi* (CORD).—Prov. Valdivia: Dept. Valdivia: Panguipulli, Punta Negra (Lonquimay), 1300 m alt., *Hollermayer 734*, 8 Feb 1930. "Bl. rotbraun, bis 60 cm hoch" (M). Près Valdivia, *Buchtien*, Mar 1902 (G). Prov. Valparaíso: Dept. Valparaíso: Valparaíso, *Gay*, Jan 1829 (P). Valparaíso, *Gay 93*. "Fleurs dun blanc sale rayée de violet et de jaune, très rare" (P). Ca 12 Km of Valparaíso, 50-60 m alt., *Morrison 16835*, 10 Dec 1938. "Annual herb to 1 m; fl. yellow" (GH; G; K).—Valparaíso, sides of [?] banks, *Mathews 226*, Sept (GLAM; K). Valparaíso, *Cuming 294* [ann.] 1831 (K). Valparaíso, *Bridges* s.n. [year] 1828. "Sparingly on hills" (G). Valparaíso, *Buchtien* 18 Nov 1895. "Sonnige Abhänge" (GH; M; US).—Valparaíso, *Bridges 379*, 1832 (K).—Limache, Cerro de la Cruz, *Garaventa*, 8 Nov 1927 (GH; M).—Limache, *Looser* s.n. Oct 1927 (M).—In petrosis sterilibus collium Valparaíso, *Bertero 1920*, [years] 1827-1829 (P; G; FI; NY).—Valparaíso, *Cuming 445 & 371* (BM; K; GLAM; GH).— Los Chorrillos, prope Concón, in monte glareos. convall, *Poeppig 163*, octobri floret (P; GH).—Concón, *Miers 345* (Sub nom. *Salpiglossis glutinosa* Miers (BM; K). Valparaíso, Bro. *Claude-Joseph 3650*, Oct 1925 (US).—Valparaíso, *Hartweg* s.n. II-1859. v.n. "panza de burro" (P).—Unknown Department: Cerro La Campana, 1000 m alt., *Zöllner* 2146, Dec 1967. "Nicht häufig" (L).—Cerro La Campana, 10 miles E of El Granizo, 1800 m alt., *Everdam 10117*, 31 Dec 1957. "Flowers purple; rare; under bushes among rocks" (US). Laguna Verde, ca. 300 m alt., *Andreas 60*, 14 Nov 1937 (U).—Laguna Verde, *Zöllner 7230*, 27 Oct 1973 (CTES). Talcaregue, *R. A. Philippi, s.n.* [year] *1870 (GH).—Gay 192* (P).—Bases cordil. du Chilli, *Gay* s.n. [ann.] 1833 (G).

2. Salpiglossis spinescens Clos
(Pl. 1, I.)

Clos in Gay, Fl. Chile 5: 127, 1849. "Se cría en los lugares áridos de Coquimbo y Copiapó". We have been able to study both syntype collections. Chile: Copiapó, *Gay* (G, also photograph 23087, Field Museum series; P; NY); Coquimbo, *Gaudichaud 83,* 1835 (FI); the specimen collected by Gay (P) has been chosen by us as lectotype.—Heuser, Spores of Chile 58, pl. 54 (f. 626). 1971. Description of the pollen grains.

Besides the characters mentioned in the key, this species is very easily recognized by its xeromorphism: its stems are almost leafless, or with small linear-elliptic sessile leaves, (2) 4-8 (9) mm long and scarcely 1 mm in width. It inhabits the Chilean deserts of Atacama and Coquimbo provinces (ca. 700-2800 m alt.); the boreal limit of its area is uncertain, because of the scarcity of materials at hand. For this reason, we have inserted a question mark (Pl. I, 1) in the vicinity of the Tropic of Capricorn, which, most probably, is passed by this species.

ADDITIONAL MATERIAL

CHILE. Prov. Atacama: Dept. Atacama: Atacama, *Philippi* (CORD; W).—Dept. Copiapó: Tierra Amarilla, 700 m alt., *Werdermann 419,* Sept 1924 (CORD; LIL; GH; G; S; BM; K; SI; Z; M; U).—Im Jorquera Tal, *Zöllner 4252,* 12 Jan 1970. "Wuchs im Schatten der Felsen; ein Busch (L).—In Jorquera Tal, *Zöllner 3913,* 2 Jan 1970. "Wuchs unter Felsblöcken, auf der Schattenseite" (L).—Quebrada de Gaipote, entrada a Quebrada de Tapia, 2750 m alt., *Marticorena et al. 508,* 6 Jan 1973 (CTES).—Dept. Chañarales: Quebrada Potrerillos, along old road between Encanche and town of Potrerillos, ca. 2500 m alt., *Johnston 3683,* 21 Oct 1925. "Loose twiggy bush, on rocky hillsides, 3-10 dm tall, corolla white" (GH). Chañarcillo, Geisse s.n. (Z).—Chañarcillo, 1800 m, *Philippi* s.n. (BM).

EXCLUDED NAMES

Salpiglossis acutiloba Johnston = **Leptoglossis acutiloba** (Johnston) A. T. Hunz. et Subils, cfr. infra.
S. albiflora Johnston = **Leptoglossis albiflora** (Johnston) A. T. Hunz. et Subils, cfr. infra.
S. brachysiphon Johnston = **Reyesia chilensis** Gay, cfr. infra.
S. cactorum Johnston = **Reyesia cactorum** (Johnston) D'Arcy, Ann. Missouri Bot. Gard. 65: 712. 1978. Cfr. infra.
S. integrifolia Hooker, Bot. Mag. tab. 3113. 1831 = **Petunia integrifolia** (Hook.) Schinz et Thell., Vierteljahrschr. Naturf. Ges. Züurich 60: 361. 1915.

S. integrifolia Loddiges, Bot. Cab. tab. 1978. 1833 = **Petunia integrifolia** (Hook.) Schinz et Thellung.

S. juniperoides Werdermann = **Reyesia juniperoides** (Werderm.) D'Arcy, Ann. Missouri Bot. Gard. 65: 712. 1978. Cfr. infra.

S. linearis Hooker, Bot. Mag. tab. 3113 in nota (1831) et tab. 3256 (1833) = **Petunia linearis** (Hook.) Paxt. Cfr. Fries, Kungl. Sv. Vetenskapak. Handl. 46, 5: 41. 1911.

S. linearis Johnston, Contr. Gray Herb. 81: 96. 1928 = **Leptoglossis acutiloba** (Johnston) A. T. Hunz. et Subils, Lorentzia 3: 17. 1979. Cfr. infra.

S. linifolia (Miers) Wettstein = **Leptoglossis linifolia** (Miers) Griseb., cfr. infra.

S. lomana (Diels) Macbride = **Leptoglossis lomana** (Diels) A. T. Hunz., Kurtziana 10: 46. 1977. Cfr. infra.

S. parviflora R. A. Phil. = **Reyesia parviflora** (Phil.) A. T. Hunz., Kurtziana 10: 46. 1977. Cfr. infra.

S. ?prostrata Hook. et Arn., Bot. Capt. Beech. Voy. 4: 153. 1833 **Petunia parviflora** Juss. Cfr. Fries, *op. cit.* pag. 38. 1911.

S. schwenckioides (Benth.) Wettst. = **Leptoglossis schwenckioides** Benth., cfr. infra.

S. tenuis (Phil.) Wettst. = **Leptoglossis linifolia** (Miers) Griseb., cfr. infra.

Leptoglossis Bentham

Bentham, Bot. Voy. Sulphur. p. 143. 1845. Miers in Ann. Mag. Nat. Hist. Ser. 2, 5 (25): 35. 1850.—Miers, Ill. South Am. Pl. 2: 64, pl. 53. 1849-1857.—Bentham, in De Candolle Prodr. 10: 196. 1846. Bentham et Hooker, Gen. Pl. 2: 908. 1876. Shinners, Sida 1 (3): 180. 1963.—Hunziker, Kurtziana 10: 46. 1977.—D'Arcy in Ann. Missouri Bot. Gard. 65: 708. 1978. Hunziker, in Hawkes *et al.*, Biol. & Taxon. Solanaceae, p. 77. 1979.

Salpiglossis Sect. III *Leptoglossis* (Benth.) Wettst., in Engl. u. Prantl, Die Natürl. Pflanzenfam. 4 (3b): 36. 1891.—Reiche, Fl. Chile 5: 397. 1910.—Werdermann in Notizbl. Bot. Gart. u. Mus. Berlin-Dahlem 10: 472-475. 1928.—Millán in Bol. Ministerio Agricult. Nac. 30 (1): 21. 1931.

Cyclostigma Phil. in Anal. Univ. Chile 36: 197 (Sert. Mendoc. Alterum: 39). Sept. 1870.

Leptofeddea Diels in Repert. Sp. Nov. 16: 193. 1919. (Monotypic: *L. lomana* Diels).

Type species: *Leptoglossis schwenckioides* Bentham

Small South American genus of seven xerophytic species inhabiting a disjunct area: six in Peru, one in Argentina. This group of species was considered only a section of *Salpiglossis* by Wettstein (*l.c.*) and his followers. Recently, however, very strong arguments (Hunziker, 1977: 46; D'Arcy, 1978: 708) support its reinstatement to generic status: for example, the anthers are ventrifixed, the corolla tube has a distal expansion, the distal portion of the gynoecium is spoonshaped and the calyx shows a unique venation, with five longitudinal stripes without vascularisation between the main veins. Closely allied to *Hunzikera* D'Arcy (a disjunct from southern United States, Mexico and Venezuela), its calyx form and venation are altogether different (see key). The flowers in the related genera *Salpiglossis* and *Reyesia* show a different insertion of the anthers (dorsal in *Salpiglossis:* Pl. II, D, M, basal or dorso-basal in *Reyesia:* Pl. VIII, E, H), in addition to other peculiarities as indicated in the key. The androecium of *Leptoglossis* is somewhat variable, but within a definite pattern: the "anterior" stamen (Robyns, 1931: 78) is always aborted, being represented by a small staminode[5]. *Leptoglossis schwenckioides* appears to be the most variable and less advanced species in the genus showing not infrequently the two "lateral" stamens with anthers smaller than the two "posterior" ones, but with all four being fertile, the remaining five species however, exhibit a normal androecium, i.e. the two posterior stamens are fertile, while the other three are reduced to staminodes.[5].

Another striking feature of the androecium of *Leptoglossis*, is

[5]It may be worth pointing out that we apply the term "staminode" to a structure derived from a partially or almost totally atrophied stamen, usually consisting of a filament and a tiny distal sterile vestige of an anther; in most cases, this vestige appears merely as an apical swelling of the filament, but in extreme cases it disappears, and the only structure left is the filament itself.

the level of adnation of the filaments to the corolla tube. *Leptoglossis linifolia* is unique in this respect, because its very short filaments are adnate to the base of the enlarged distal sector of the corolla tube (Pl. V, M; Pl. VI, K, O, T); on the contrary, the other six species display long filaments adnate up to halfway of the corolla tube or at lower levels (Pl. IV, K; Pl. V, A, K). The pollen grains are separated in all the species of the genus. The disk is usually conspicuous, large, fleshy and with a bright reddish-orange colour.

Gametic chromosome number: n = 10 (Subils, 1979: 19)

Zygotic chromosome number: n = 20 (Diers, 1961: 451)

Diagnostic features at the species level.—*L. lomana* and *L. acutiloba* are the only species in the genus with two kinds of leaves: the basal ones (with a long petiole and a broad blade) forming a rosette at ground level, and the cauline ones (sessile and with a linear blade). The other five species, on the contrary, exhibit only cauline leaves, either with long petioles and broad blades (Pl. IV, C, D), or sessile with narrow blades (Pl. VI, B, L). The pubescence of stems, leaves and calyces is another useful character for diagnostic purposes: *L. Darcyana, L. Ferreyraei* and *L. lomana* show predominantly branched hairs (Pl. IV, B, H, J); *L. albiflora,* on the other hand, displays only simple hairs (Pl. V, D). In *L. schwenckioides* both simple and glandular hairs are noted (Pl. V, L, O). When capitate hairs are present, the head and the foot may be either unicellular or pluricellular (Pl. V, O, P; Pl. VI, A). Another noteworthy feature, the slightly arcuate hairs, is known only in *L. acutiloba* (Pl. V, E, F). The calyx is, as a rule, actinomorphic and 5-cleft (Pl. IV, G, I; Pl. V, N), the only exception being *L. albiflora,* with a zygomorphic and 7-10-cleft calyx (Pl. V, B).

KEY TO THE SPECIES

1. Filaments inserted at the middle or low part of the narrow portion of the corolla tube. Calyx 5-cleft, actinomorphic, or 7-10-cleft and zygomorphic.
    2. Calyx 5-cleft, actinomorphic; plants with or without a rosette of leaves.
        3. Herbs with stems lignified at lower part. Leaves cauline; the rosette leaves wanting.
            4. Hairs simple and capitate. Plants (0.1) 0.3-1 m in height. Flowers in lax cymes aggregated on lateral branches, forming false racemes. Leaves sessile, ... 1. **L. schwenckioides**

4′. Hairs predominantly branched (a few simple, and/or glandular ones as well). Plants 0.05-0.2 m in height.

5. Branched hairs most frequently of dendroid type, with more or less stiff cell walls. Sessile or subsessile flowers arranged in contracted cymes. Petiolate leaves with elliptic blades. Vegetative internodes comparatively long (1.2-5.5 cm long) .... 2. **L. Ferreyraei**

5′. Branched hairs prevailingly of the bifurcate or trifurcate type, with soft walls. Flowers pedicellate arranged in lax cymes. Sessile leaves linear or linear-spathulate. Internodes comparatively short (0.5-3 cm long). .... 3. **L. Darcyana**

3′. Short-lived tiny herbs lacking lignification, 0.05-0.3 m in height, with two types of leaves: the basal ones forming a rosette at ground level (with a long petiole and a broad blade), and the cauline ones (sessile and with a linear blade).

4. Calyx with a dense pubescence of branched hairs (mainly bifurcated). Stems piliferous .... 4. **L. lomana**

4. Calyx with a few simple and capitate hairs. Stems glabrous .... 5. **L. acutiloba**

2.′ Calyx 7-10 cleft, zygomorphic. Annuals 0.1-0.3 m. alt., lacking a rosette of leaves .... 6. **L. albiflora**

1.′ Filaments inserted near the base of the enlarged portion of the corolla tube. Calyx 5-cleft, actinomorphic. Geophyte with gemmiferous roots, (11) 14-35 (40) cm in height, only with cauline leaves. .... 7. **L. linifolia**

1. Leptoglossis schwenckioides Benth.
(Pl. 3, I; Pl. 5, J-L, N, O.)

Bentham, Bot. Voy. Sulphur: 143. 1845. Peru: Huamantango. HOLOTYPE: Huamantango, *Barclay s.n.* (K). TOPOTYPE: Quebrada de Guamantango, *G. W. Barclay 2316,* 10 Jun 1938. "Shrub 3 ft. high; fl. whitish" (BM).—Bentham, in De Candolle Prodr. 10: 196. 1846.—Miers in Ann. Mag. Nat. Hist. Ser. 2, 5 (25): 35. 1850.—Miers, Ill. South Am. Pl. 2: 64, pl. 53. 1849-1857.—D'Arcy in Ann. Missouri Bot. Gard. 65: 710, f. 3A. 1978.

Salpiglossis schwenkioides (Benth.) Wettst. in Engl. u. Prantl, Natürl. Pflanzenfam. 4 (3 b): 36. 1891.

Lack of field observations make it imposible to state whether or not the plants are annual or perennial. Specimens with a lignified base may reach 1 m in height; on the other hand, small floriferous herbarium specimens (v. gr. *Sagastegui et al.* 7528) may measure scarcely 10 cm.

Zygotic chromosome number: 2n = 20 (Diers 1961: 451); this chromosome count is based on *Diers 1108;* we have seen a duplicate of this collection at Stockholm.

ADDITIONAL MATERIAL.

PERU. Dept. Ancash: Prov. Recuay, Marca (Chuccho), elev. 1700 m, *Gómez 473,* 14 Apr. 1965. "En arenal" (USM). Dept. La Libertad: Prov. Trujillo, Cerro Chiputur al N de Trujillo, 1000 m.s.m., *A. López M. 0739,* 9 Sept 1951. "Loma arcillosa, fl. amarillentas" (USM; US). – Dept. Lima: Zapan, 1800 m.s.m., *Vilcapoma 97,* 20 Aug 1972. "Hab. pedregoso, borde de carretera, flores amarillas" (USM). Cerca de ruinas de Cajamarquilla, 400 m.s.m., *Ferreyra 8363,* 24 Jun 1952. "En cauce seco; flores amarillas" (USM). – Prov. Canta: cerca de Canta, 2200-2500 m.s.m., *Ferreyra 7255,* 8 May 1950. "Hab. pedregoso, falda de cerro" (US). Canta Valley, road to Huaral, 20 Km NE of Trapiche, 1000 m.s.m., *Hutchison 1032,* 5 Aug 1957 (M; US; G; S; USM; NY; GH; K; U). – Entre Puente Trapiche y Cerro Huachoc, 800-900 m.s.m., *Ferreyra 14826,* 5 Dec 1962. "Hierba en cauce seco; fl. amarillentas" (USM). Prov. Huarochiri: hillsides above Santa Eulalia, 1200 m alt., *Goodspeed 33098,* 10 Apr 1942. "Bush 1 m high (G; GH; US). Santa Eulalia, *Weberbauer,* [year] 1924. "Planta sufrutescente, fl. amarillo-parduzco" (USM). Bei S. Bartolomé, östl. von Lima, ca. 1800 m alt., *Diers 1108,* 26 May 1959. "Blüte weiss-gelb; kräuterarme Bezirk der Wüstenpflanzen" (S). – San Bartolomé, (Lima-Oroya Railroad), 1500-1600 m alt., *Weberbauer 5290,* Apr 1910 (GH). Prov. Chancay: entre Trapiche y Huaral, camino antiguo por el cerro Huachoc, 800-900 m.s.m., *Ferreyra 11767,* 20 Mar 1956 (USM). – Prov. Cajatambo: Ambar, 2000 m alt., *Stork 11455,* 16 Apr 1939. "Herb to 0.3 m; fl. pale yellow; a root perennial, in sandy gravelly hillsides very dry except in rainy season" (GH). – Dept. ?: *Cuming 1010* (K). Cuesta of Purruchuca, *Cuming 1011* (K). – Peru, *Mathews 1011* (BM). Dept. Cajamarca: Prov. Contumaza : Portachuelo (Ascope — San Benito), 850 m.s.m., *Sagastegui et al.* 7528, 6 May 1971 (MO).

Distribution. Endemic to sandy and stony slopes, usually between 1000 and 2200 m high, in the Peruvian departments of Lima, Ancash, La Libertad and Cajamarca.

2. **Leptoglossis Ferreyraei** A.T. Hunz. et Subils sp. nov. (Pl. 3, 3; Pl. 4.)

Herbae vestitae ca. 10-20 cm altae. Internodia vegetativa 1,2-5,5 cm longa. Pili diversi: plerumque ramificati raro glandulosi (capita unicellularia vel pluricellularia; pedes semper unicellulares). Folia petiolata; laminae ellipticae 1,5-3,5 cm longae, 0,3-1 cm latae. Inflorescentiae cymosae, densae, internodiis brevissimis. Flores sessiles vel subsessiles. Calyx 3,5-4 mm longus, lobulis 5 aequalibus. Corołla 9-15 mm longa. Stamina 2; staminodia 3.

centrale breviore quam lateralia. Fructus quam tubi calycini aequantes vel leviter longiores. Semina matura non adsunt.

Piliferous herbs about 10-20 cm alt., with the basal parts lignified. Vegetative internodes 1.2-5.5 cm long. Hairs mostly branched with rigid and rugose cell walls, a few glanduliferous in calyces and stems (the head unicellular or pluricellular, but the stalk always unicellular). Leaves petiolate exclusively cauline; blades elliptic 1.5-3.5 cm long, 0.3-1 cm wide. Cymes contracted with very short internodes. Flowers sessile or subsessile. Calyx 3.5-4 mm long, with 5 more or less equal lobes. Corolla 9-15 mm long. Stamens 2; staminodes 3, the central one shorter than the 2 laterals. Disc red. Capsule as long as the calyx tube or slightly longer. Mature seeds not seen.

PERU. Dept. Arequipa: Prov. Caravelí: Lomas de Jahuay, entre Nazca y Chala, 300/400 m.s.m., *Ferreyra 14020*, 2 Dec 1959. "Fl. amar.-verd." *Holotypus* (USM).

Obs.—Together with *L. Darcyana*, this species differs from *L. lomana* and *L. acutiloba* in the basally lignified stems, and by not having leaves disposed in rosettes. As indicated in the key, *L. Ferreyraei* is distinguished from *L. Darcyana* mainly by the charactertistics of the pubescence, the petiolate leaves with elliptic blades, the contracted cymes with sessile or subsessile flowers, and the longer vegetative internodes.

In honor of Dr. Ramón Ferreyra of Lima, who collected the holotype specimen. His name is latinized as Ferreyraeus.

ADDITIONAL MATERIAL.

PERU. Dept. Arequipa: Prov. Caravelí: Lomas de Pongo, *Velarde Nuñez 534*, 2/3 August 1947 (US).—Lomas de Jahuay, entre Nazca y Chala, 400/450 m.s.m., *Ferreyra 11490*, 11 Oct 1955. "Fl. parduzco-purpúrea; hierba. Hab. arenos." (USM).

Distribution. Endemic to the coastal xerophytic vegetation of southern Peru (Dept. Arequipa).

3. **Leptoglossis Darcyana** Hunz. et Subils
(Pl. 3, 6.)

Hunziker & Subils in Lorentzia 3: 15, f. 1. 1979. Perú.

HOLOTYPE: Dept. Tacna: Prov. Tacna: Lomas de Sama, 530 m alt., *Zegarra 271*, 6 Oct 1972 (US).—PARATYPES: Dept. Arequipa: Prov. Caravelí, Lomas de Atico, 50-100 m alt., *Ferreyra 13923* (USM).—Dpto. Tacna: Unos 50 Km al N de Tacna, 500/600 m.s.m., *Ferreyra 11660 A*, 1 Dec 1953 (USM).

A rare endemic species of the peculiar "lomas" type of vegetation, found at the desertic Pacific coast in southern Peru, from Arequipa to Tacna; it is closely related to *L. schwenckioides*, and even more to *L. lomana* and *L. acutiloba*. These last two species are sympatric with *L. Darcyana*, differing in their herbaceous ephemeral stems, with two types of leaves: basal petiolate leaves (at congested internodes), and sessile cauline ones at the remaining upper nodes. *L. schwenckioides*, on the other hand, grows at higher elevations in central and northwestern Peru, showing taller stems, and its pubescence lacks any sort of branched hairs.

4. **Leptoglossis lomana** (Diels) A. T. Hunz.
(Pl. 3, 4; Pl. 5, H, I.)

Hunziker in Kurtziana 10: 46. 1977 (based on *Leptofeddea lomana* Diels).—D'Arcy in Ann. Missouri Bot. Gard. 65: 709, f. 3 B. 1978.

Leptofeddea lomana Diels in Repert. Spec. Nov. Regn. Veg. 16: 193. 1919. ISOTYPE: Peru, Mollendo, 20-100 m.s.m., *Weberbauer 1486*, 2 Oct 1902 (K; also photograph Field Mus. Series nr. 3064 at CORD et GH, of the holotype from B).

Tiny ephemerophyte unique to the "lomas", a xerophytic type of vegetation, in southern Peru (Dept. Arequipa), near the Pacific coast (20 to 500 m alt.).

ADDITIONAL MATERIAL.

PERU. Dept. Arequipa: Prov. Camaná: Lomas de Camaná, 100 m.s.m., *Ferreyra 11697*, 2 Dec 1965. "Flor amarillenta; hab. arenoso" (USM). Entre Camaná y Arequipa (Km 161-162), 400-500 m.s.m., *Ferreyra 2574*, 10 Nov 1946. "Hab. arenoso; fl. amarillas" (USM). Prov. Caravelí: Lomas de Capac, Km 651, cerca de Chala, *Scolnik 1020*, 27 Aug 1948. "Flores amarillas" (CORD). Lomas de Capac, Km 648, 200 m.s.m., *Hutchison 1298*, 14 Sept 1957. "Not over 10 cm tall incl. inflorescences; fl. dirty cream" (M; NY; G; K). Prov. Islay: south of Mollendo, *Mexia 4176 & 7776*, 17 Nov 1935. "Herb frequent, scattered;

fl. cream colored" (US; GH; K).—Arriba de Mejía, al sur de Mollendo, 180-200 m.s.m., *Ferreyra 6416,* 12 Nov 1949. "Hab. arenoso; hierba de fl. amarillas" (USM).—Mollendo, *A. W. Hill 343,* 1 Jan 1903 (K).—

5. **Leptoglossis acutiloba** (Johnst.) A. T. Hunz. et Subils (Pl. 3, 5; Pl. 5, C, E, F)

Hunziker et Subils in Lorentzia 3:17. 1979.

Basionym: *Salpiglossis acutiloba* Johnston in Contr. Gray Herb. 85: 179. 1929.

Saliglossis linearis Johnston in Contr. Gray Herb. 81: 96. 1928, not Hooker 1831. Type collection: Peru: Dept. Arequipa: Prov. Arequipa, Tiabaya, 2100-2200 m.s.m., *Pennell 13063,* 8 Apr 1925. "Annual herb; white sand dunes; corolla purplish (Holotype: GH; Isotype: S).

Annual plants native to mountain ranges at altitudes slightly exceeding 2000 m, in southern Peru (Arequipa and Moquegua).

ADDITIONAL MATERIAL.

PERU. Dept. Arequipa: Prov. Arequipa: Tiabaya, ca. 2150 m.s.m., *Pennell 13081,* 6 Apr 1925. "Corolla tube near apex constricted, then abruptly inflated and decurved; tube pale orange yellow, streaked with or becoming wholly mulberry purple; lobes all spreading internally pale orange yellow, reticulate-lined with mulberry purple" (USM; US; S; GH; NY; K).—Tingo, 2100-2300 m.s.m., *Pennell 13119,* 8 Apr 1925. "Annual herb, corolla yellow and purple (detailed descr. with 13081) (NY; S; US; K; USM).—Jura (Baños), 2500-2600 m alt., *Vargas 7984,* 29 Mar 1949 (BM; US). Dept. Moquegua: Prov. Moquegua: Hills SE of Moquegua, 1500-1600 m alt., *Weberbauer 7456,* 22/24-III-1925. "Upper part of corolla greenish, brown veined, tube brown (S; US; BM; G; K).

6. **Leptoglossis albiflora** (Johnst.) A. T. Hunz. et Subils *comb. nov.* (Pl. 3, 2; Pl. 5, A, B, D, G.)

Basionym: *Salpiglossis albiflora* Johnston in Contr. Gray Herb. 85: 178. 1929. TYPE COLLECTION: Peru: Dept. Moquegua: NW of Moquegua, Mt. Estuquiña, 1600-1700 m.s.m., *Weberbauer 7424 a,* 22 Mar 1925. "Corolla white with yellow center" (Holotype: F; isotypes: K; NY; US; BM; G).

Like *L. lomana* and *L. acutiloba,* sharing a small size (10 to 30 cm in height) and an annual growth, *L. albiflora* is readily identifiable by the absence of basal leaves, and, especially, by its unique 7-10-cleft zygomorphic calyx. The geographical distribution is comparatively wide: it has been collected (always at intermediate elevations: 1500 to 2000 m), in the Peruvian departments of Lima, Ayacucho and even as far south as Moquegua[6].

ADDITIONAL MATERIAL.

PERU. Dept. Ayacucho: Entre Nazca y Puquio, 1500-1600 m alt., *Ferreyra 5465*, 19 Mar 1969. "Hab. pedregoso, fl. blancas" (US; USM).—Dept. Lima: Prov. Lima, Cerros al N de Chosica, 1800-1900 m alt., *Weberbauer*, Apr 1923. "Fl. blancas, veget. rala; xerófita con hierbas anuales, arbustos y Cactáceas" (USM).—Matucana, 8000 ft. alt., *Macbride & Featherstone 375*, 12 Apr/3 May 1922 (NY).—Santa Eulalia, *K. Maisch*, 22 Aug 1923 (USM).—Mountains near Chosica (Lima-Oroya railroad), 1600-1700 m alt., *Weberbauer 5325*, Apr 1910 (GH; US).—San Bartolomé (Lima-Oroya railroad), 1500-1600 m alt., *Weberbauer 5297*, Apr 1910 (GH; US).—Prov. Cajatambo, Ambar, 2010 m.s.m., *Stork 11438*, 16 Apr 1939. "Annual herb 0.2-0.3 m; calyx white with green or purple ridges; corolla white with reddish (GH).—Unknown Dept.: Huaytara, 6-8000 ft., *Pearce*, May 1867. "Annual" (K).

7. **Leptoglossis linifolia** (Miers) Griseb.
(Pl. 3, 7; Pl. 6.)

Grisebach in Abh. Königl. Ges. Wiss. Göttingen, Phys. Cl. (1) 24: 241. 1879. (Based on *Nierembergia linifolia* Miers). Transfer incorrectly attributed to Bentham & Hooker by Jackson (Index Kewensis 2: 63. 1895), and to Wettstein by Fries (Kungl. Sv. Vetenskapsak Handl. 46, 5: 38. 1911).—D'Arcy in Ann. Missouri Bot. Gard. 65: 709. 1978.—Hunziker & Subils in Lorentzia 3: 13. 1979.

Nierembergia linifolia Miers in London Journ. Bot. 5: 174. 1846. "In Prov. Argentinis, v. v.". LECTOTYPE: Pampas B.[uenos] Ayres, Cañada de Lucas, *Miers 835* (K).

Nierembergia linifolia α macrophylla Dunal, in De Candolle Prodr. 13 (1): 587. 1852. "Ad Mendoza. . .", [leg. *Gillies*].

Nierembergia linifolia β parviflora Dunal, in De Candolle Prodr. *l. c.* 1852. "In provinciâ Cordovae", [leg. *Gillies*].

Cyclostigma tenue Philippi in Anal. Univ. Chile 36: 197. 1870.

[6] We have been unable to locate specimens of *Weberbauer 3178*; according to Macbride (1962: 143) it belongs to *L. albiflora*; should this identification be correct, the range of *L. albiflora* would be extended northwards to the Dept. La Libertad.

Argentina: Mendoza, *Wenceslao Díaz* [year] 1868-1869 (Holotype: SGO nr. 042803. Isotypes: W, and photogr. Field Mus. nr. 33004; G, and photogr. Field Mus. nr. 26798).

Schwenckia tenuis (Phil.) Griseb. in Abh. Königl. Ges. Wiss. Göttingen, Phys. Cl. (1) 19: 214. 1874. (Pl. Lorentz.: 166).

Salpiglossis linifolia (Miers) Wettstein in Engl. & Prantl. Nat. Pflanzenfam. 4 (3b): 36. 1891.—Millán in Bol. Min. Agric. Nac. (Buenos Aires) 30 (1): 21, f. 7, t, u. 1931.

Salpiglossis tenuis (Phil.) Wettst., *l. c.* 1891.—O. Kuntze, Rev. Gen. Pl. 3 (3): 224. 1898.

Leptoglossis tenuis (Phil.) Jackson, Index Kewensis 1 (3): 63. 1894.

Leptoglossis schwenckioides var. *linifolia* (Miers) Monachino in Lilloa 5: 435. 1940.

Leptoglossis schwenckioides var. *tenuis* (Phil.) Monachino, *l. c.* 1940.

Leptoglossis schwenckioides var. *xerophytica* Monachino, *ibid.* 436. 1940. Argentina: San Luis: Alto Pencoso, *Bruch & Carette*, Feb 1914 (Holotype: NY).

Endemic perennial species of the dry and low areas of central and western Argentina (usually ca. 300 to 600 or 700 m; in the West sometimes up to 1200 m); towards the East it is found up to 62° long. W, and in the North it has been collected at the "chaco" oriental region of Tucuman province. Owing to its gemmiferous roots, it grows frequently at disturbed places bordering the highways.

Gametic chromosome number: n = 10 (Subils 1979: 19; materials from La Rioja and San Luis).

ADDITIONAL MATERIAL.

ARGENTINA. WITHOUT COMPLETE DATA: W. 34° Pampas, *O. Kuntze*, 16 Jan 1892 (CORD; US; NY).– Pampas Reise, *O. Kuntze*, Jan 1892 (NY). Prov. Catamarca: Dept. Paclín: San Antonio, leg. *O. Tatter*, 22 Feb 1886 (CORD: Herb. *Kurtz 4288*). Prov. Córdoba: Dept. Cruz del Eje: Arroyo de La Higuera, cerca de La Higuera, *A. T. Hunziker 9871*, 18 Feb 1952. "Corola magenta (más o menos violácea)" (CORD).—Pichana, *Stuckert 14516*, 20 Nov 1904 (G; CORD).—Dept. Ischilín: Quilino, *Lorentz et Hieronymus 516*, 8 Nov 1872 (CORD; G; US). Quilino, cerca de la captación de agua, *Hosseus 683*, 9

May 1942 (CORD). Alrededores de Villa Quilino, *A. T. Hunziker 9986*, 26 Oct 1952. "Poco frecuente. Cara superior del limbo corolino granate lilácea; al envejecer la flor se aclara mucho, volviéndose apenas lilácea" (CORD). Dept. Marcos Juárez: Barrancas del Río Carcarañá: casi 30 KM al sur de Marcos Juárez, al cruzar el río por la ruta que va a Inriville, *A. T. Hunziker 18960*, 30 Nov 1966 (CORD). Dept. Minas: Cacapiche, *Hieronymus 833*, 19 20 Mar 1877 (CORD). Entre La Higuera y Rumi Huasi, *A. T. Hunziker 9155*, 15 Apr 1951. "Rarísima. Limbo corolino violeta" (CORD). Dept. Río Primero: Entre La Paloma y Las Saladas, Kurtz 4540, 6 Mar 1887 (CORD). Inmediaciones de Río Primero, a orillas del Río Primero, *A. T. Hunziker 10653*, 4 Feb 1955. "Frecuente. Corola rosada" (CORD). Estancia San Teodoro, *Stuckert 22136*, Jan 1911 & *23038*, Jan 1915 (CORD). Dept. Río Seco: Márgenes del Río Dulce, al norte de Mar Chiquita, *Sayago 1721*, Dec 1953 (CORD). Dept. Río Segundo: Villa del Rosario, leg. *E. Piotti* (CORD: Herb. *Kurtz 14824*). Dept. San Alberto: Altautina, *Stuckert 10321 & 10322*, 5 Dec 1901 (CORD; G). Dept. San Justo: Jeanmaire, inmediaciones de la estación, *Ariza & Astegiano 2488*, 6 Dec 1970 (CORD). Ruta 19, Jeanmaire, *Subils et al. 710*, 4 Jan 1964 (CORD). Miramar, *Di Fulvio & Articó 144*, 15 Nov 1969 (CORD). Orilla de Mar Chiquita, entre Miramar y la desembocadura del Plujunta, *A. T. Hunziker 13279 & 13295*, 21 Jan 1957 "Poco frecuente, en manchones, en la vegetación vecina a la orilla. Corola "roseus" (Chromat. Saccardo Nr. 17)" (CORD). Cerca de Jeanmaire, yendo desde La Francia, *A. T. Hunziker 11359*, 26 Nov 1955. "Manchones algo frecuentes en cañada salitrosa. Corola discolor: limbo por dentro purpúreo-lilacino y por fuera blanquecino. A veces todo rosáceo y, más raramente aún, todo blanco" (CORD.) Camino entre J. Cortez y Altos de Chipión, *Sayago 1720*, Dec 1953 (CORD). Mar Chiquita, leg. *Bodenbender* (CORD: Herb. *Kurtz 9872)*. Sacanta, *Stuckert 5993*, Dec 1899 & *7078*, Apr 1899 (CÓRD). Dept. Totoral: Totoral (Villa General Mitre), leg. *J. A. Domínguez*, [year] 1901 (CORD: Herb. *Kurtz 11964*). Prov. La Rioja: Dept. Gral. Belgrano: cerca de Olta, *Roig & Mendez* 8672, 12 Apr 1975. "A orillas del camino, fl. azul-violado" (CORD). Dept. Gral. Ocampo: Ambil, en la ruta 79, entre Tello y Santa Rosa de Catuna, ca. 700 m.s.m., *A. T. Hunziker et al. 13870*, 18 Feb 1959. "Manchón denso. Corola rojiza. Perenne con órganos subterráneos" (CORD. Ruta 79, al cruzar el Río Saladillo, entre Ambil y Santa Rita de Catuna, *A. T. Hunziker et al. 14096*, 4 Mar 1959. "Manchones abundantes a orilla del río" (CORD). Dept. J. F. Quiroga: Malanzán, leg. *Bodenbender*, Dec 1895 Jan 1896 (CORD: Herb. *Kurtz 8940*). Dept. Gob. Gordillo: Sierra de Malanzán: La Aguadita, Chamical, *Roig 8608*, 10 Apr 1975 (CORD). La Aguadita (Ruta prov. 29), *Biurrun & Lasso 170*, 9 Apr 1976. "Flores azulvioláceas" (CORD). Dept. Independencia: Cerro Morado prope Baldecito, leg. *Bodenbender*, Feb 1896 (CORD: Herb. *Kurtz 9018*). —Dept. R. Vera Peñaloza: Salinas de Mascasín, Ruta 20, Km 1042, cerca de límite con San Juan, 510 m.s.m., *A. T. Hunziker, Subils & Bernardello 23185*, 9-I-1979. "Limbo blanco, tubo oscurecido por líneas purpúreas; flores levemente perfumadas. Manchones con varios individuos; poco frecuente" (CORD). Prov. La Pampa: Dpto. Chalileo: Santa Isabel, *Troiani & Steibel 5554*, 15 Feb 1978. "En el puente sobre el Río Salado" (CORD). Santa Isabel, *Cano 3032*, 7 Jan 1964 (US). —Prov. Mendoza: Unknown Dept.: Leg. *Gillies s. n.*, sub nom. *Nierembergia linifolia* n. sp. *Miers* (K: Herb. Hook.). Leg. *Gillies s. n.*, sub nom. *Nicotiana linoides* n.sp. Gill. (K: Herb. Hook).). Dept. La Paz: Desaguadero, inmediaciones del Paso de Las Tropas, *Ruiz Leal 8840,* 16 19 Feb 1944. "Fl. rosada hasta blanca!" (RL; LIL). Entre Paso de las Tropas y Bajada del Gato, *Ruiz Leal 8879,* 29-II-1944 (RL; LIL).—Dept. Las Heras: El Challao, *Ruiz Leal 960,* 29 Jan 1933 (RL; LIL). Dept. Lavalle: (Lagunas del Rosario), Las Tunitas, *Ruiz Leal 14519,* 9 Jan 1952 (RL). Puesto El Tapón, *Roig 6892,* 11 Mar 1970 (Herb. F. Roig). -Dept. Maipú: Fray Luis Beltrán, aprox. 1 km al norte del cruce de Ruta 20 por calle Las Margaritas, *Ambrosetti & del Vitto s. n.,* 14 May 1977 (Herb. *Ruiz Leal 28990*).—Dept. Malargüe: Cordillera de Mendoza, Cordón de Santa Elena, leg. *José Figueroa* (CORD: Herb. *Kurtz 15739*). Dept. San Rafael: San Rafael, Puente Nuevo, a orillas del Río Diamante, *Subils & Di Fulvio 43,* 28 Jan 1959. "Flores lilacinas, hasta blancas" (CORD). Río Diamante, entre Fortín Nuevo y Monte Comán: bei Monte Tucumán, *Kurtz 7056 & 7056 a,* 14 16 Jan 1892. "Fl. coerul., in nassem Flussand; hier un da" (CORD). -Punta del Agua (Nevado), *Ruiz Leal 17469,* 29 Dec 1955. "Frecuente en cerros áridos" (RL).—Dept. Tupungato: Tupungato, en las huayquerías del Carrizal, leg. *E. Mendez* (Herb. *Roig 9540*), 11 May 1975 (CORD). Prov. San Juan: Dept. Calingasta: Entre Villa Corral y Villa Nueva, *Castellanos s. n.,* 27 Jan 1950 (US). -Dept. Caucete: Ruta 20, Km 1043, cerca del límite con La Rioja, *A. T. Hunziker, Subils & Bernardello 23356,* "fl. blanca"; *23357 & 23360,* "fl. amarilla"; *23358,* "fl. cremosa"; *23359,* "fl. lilacina"; 13 Jan 1979 (CORD). -Dept. Rivadavia: Marquesado, a orillas del Río San Juan y cerros vecinos al dique, *Ruiz Leal 16371,* 29 Oct 1954 (RL). Dept. Santa Lucía: Alto de Sierra, *Hicken 85,* 15 Dec 1907. "Suelo pedregoso" (SI). -Dept. Valle Fértil: San Agustín del Valle Fértil, en las inmediac. del dique, *A. T. Hunziker 16673,* 12 Dec 1963, "Rara, corola lila" (CORD). Sierra de Valle Fértil, Toma de Los Alvarez, a orillas del río, a ca. 8 Km al SW de Valle Fértil, *A. T. Hunziker 16735,* 12 Dec 1963. "Rara. Corola lilacina" (CORD).—Dept. Zonda: Pachaco, a orillas del Río San Juan (Ruta 20), *A. T. Hunziker 12996,* 9 Nov 1956. "Limbo y lóbulos al principio blancos, luego amarillentos; tubo por fuera con numerosas rayas long. oscuras" (CORD).—Unknown Dept.: Orillas del Río San Juan, *Hicken 78,* 1 Nov 1907. "Poco difundida" (SI).—En las cercanías de la Estancia Experimental, *Hosseus & Cerceau 2074,* 3 Feb 1921. "Flor blanca" (CORD). Prov. San Luis: Dept. Ayacucho: Entre la Villa de Luján y San Francisco, *Galander s. n.,* 15 Mar 1882 (G; CORD). Dept. Gral. Pedernera: Entre Cramer y Villa Reynolds, 485 m.s.m., *Anderson 1500,* 8 Jan 1969. "En terreno salitroso" (CORD). Dept. Junín: Santa Rosa, 650 m.s.m., *Varela 472,* 7 Feb 1944. "Flores lilas" (NY; LIL). Dept. La Capital: Río Desaguadero, margen este, proximidades de la confluencia con el Río Jarilla, 450 m.s.m., *A. T. Hunziker, Subils & Bernardello 23417,* "flor blanca"; *23419,* "fl. amarillento-lilacina"; *23423,* "fl. cremosa"; *23424,* "fl. lilacina", 27 Jan 1979 (CORD). Salinas de Bebedero, alrededores del Establecimiento CIBA, 390 m.s.m., *A. T. Hunziker, Subils & Bernardello 23449,* "fl. lilacina"; *23454,* "fl. purpúrea"; *23465,* "fl. blanca", 27 Jan 1979 (CORD). Prov. Santiago del Estero: Dept. Aguirre: Pinto, leg. *O. Kuntze,* Oct 1892 (US; NY). -Dept. Atamisqui: Sobre ruta 9, atravesando Salinas Grandes, entre el Río Saladillo e Isla Verde, ca. 200 m.s.m., *A. T. Hunziker & Subils 21285,* 5 Jul 1971 (CORD).—Dept. Banda: Dique Los Quiroga, *Meyer 12804,* 19 Nov 1947 L; BR).—Dept. Capital: Santiago del Estero, *Meyer 6887,* 29 Oct 1944. "Fl. lila" (LIL).—Dept. Loreto: Ruta Nacional 9, entre Loreto y San Vicente, *A. T. Hunziker, Subils & Bernardello 23160,* 23 Dec 1978. "Flores purpúreas" (CORD). Dept. Quebrachos: Camino a Sumampa Viejo, *Balegno 89*, 25 Jan 1944. "Fl. lila" (LIL). Sumampa, *Ragonese 6328*, 27 Oct 1946. "Fl. rosadas" (LIL). Dept. Río Hondo: Río Hondo, *Cabrera 15588*, 1 Mar 1963. "Flor lila" (CORD). Las Termas, *Bartlett 20469*, 11 Jun 1943 (US; GH). Dept. Rivadavia: Unos 10 Km al oeste de La Isleta (al WSW de Ceres), *A. T. Hunziker 10463*, 11 Nov 1954. "Corola rosada; en hondonada salitrosa; frecuente" (CORD). Dept. Robles: Turena, *Maldonado 254*, 6 Dec 1939 (LIL). Unknown Dept.: Río Saladillo, además cerca del pueblo de Santiago, *Lorentz 5*, Princ. Dec 1871 (CORD).—Prov. Tucumán: Dept. Burruyacú: Sierra de Medina, 1200 m.s.m., *Venturi 2721*, 11-I-1924. "Flores azules, en los prados" (LIL; US). Dept. Cruz Alta: La Florida, *Monetti 1218*, (U; US). Dept. Graneros: La Madrid, leg. *O. Tatter*, 26 Jan 1886. "Im Schatten an sandigen Stellen, selten" (CORD: Herb. *Kurtz 4235*). Dept. Leales: Chañar Pozo, *Venturi 483*, Oct 1919. "Flor violeta oscuro. A orillas de bosques ralos" (SI; US; GH). Chañar Pozo, 400 m.s.m., *Venturi 5439*, 25 Oct 1927. "Flor morada. En terreno salado" (CORD; GH; US).

EXCLUDED NAMES

Leptoglossis Coulteri A. Gray in Proc. Am. Acad. 12: 165. 1877 = **Hunzikera Coulteri** (A. Gray) D'Arcy, Ann. Missouri Bot. Gard. 65: 705. 1978.

Leptoglossis texana (Torrey) A. Gray in Proc. Am. Acad. 12: 164. 1877. = **Hunzikera texana** (Torrey) D'Arcy, Phytologia 34: 283. 1976.

Leptoglossis viscosa (Torrey) Millán in Darwiniana 5: 489. 1941. = **Hunzikera texana** (Torrey) D'Arcy in Ann. Missouri Bot. Gard. 65: 706. 1978.

Reyesia Gay[7]

Gay, Hist. Fís. Pol. Chile, Bot. 4: 418, lám. 52. 1849.—Bureau in Bull. Soc. Bot. France 10: 39-45. 1863. The author discusses the peculiar morphology of the reproductive structures of *Reyesia*.—Bentham & Hooker, Gen. Pl. 2 (2): 908. 1876.—Hunziker in Kurtziana 10: 46. 1977.—D'Arcy in Ann. Missouri Bot. Gard. 65: 710. 1978.

Pteroglossis Miers in Ann. Mag. Nat. Hist. Ser. 2, 5 (25): 32. January 1850. Type species: *P. laxa* Miers = *Reyesia chilensis* Gay.

[7]It should be noted that the authority of *Reyesia* has frequently been wrongly attributed to Clos. Starting with Bentham & Hooker (2.2908. 1876), Wettstein (1891:36) and the Index Kewensis (1: 700. 1895), this mistake was repeated by Reiche (1910: 398), Wedermann (1928: 472), D'Arcy (1978: 710, 712) and Hunziker (1979: 77, 82); the latter reference, however, has already been corrected (Hunziker, May 1977).

Type species: *Reyesia chilensis* Gay.

Four species in northern Chile (one of which also extending into adjoining Argentinian territory), usually at rather high altitudes in the Andes (2500-3500 m), except *R. chilensis,* which occurs at lower elevations (100-800 m) near the Pacific Coast. Although the plants are apparently similar in habit to those of *Leptoglossis, Reyesia* is a more advanced genus, because in addition to a number of differentiating characters mentioned in the key, it shows a more developed zygomorphic corolla and an androecium composed of four didynamous elements (these are the two posterior stamens with shorter filaments, and the two lateral ones with longer filaments; the anterior stamen is missing). Moreover, these lateral stamens may be either functional, as is the case in *R. chilensis,* or they may become sterile staminodes in more advanced species (for example: *R. parviflora*). Another peculiarity of *R. chilensis* is shown by the anthers of the shorter posterior pair of stamens: the thecae are unequal and divergent, whereas the ones of the longer pair are more parallel and equal-sized.

Diagnostic features at the species level.—The multicellular glandular hairs of the calyx may be either oblong (*R. chilensis* and *R. cactorum*), or globose (*R. parviflora* and *R. juniperioides*). The stamens are usually glabrous, except in *R. parviflora* which has piliferous filaments; this latter character is correlated with the aggregation of pollen grains, which are united in tetrads in *R. parviflora,* and free in the other three species. The size of the corolla is another useful character.

KEY TO THE SPECIES

1. Capitate hairs of the calyx with an oblong head. Filaments glabrous; pollen grains free.
   2. Corolla 6-8 mm long .... 1. **R. chilensis**
   2'. Corolla (10) 11-12 (15) mm long .... 2. **R. cactorum**

1'. Capitate hairs of the calyx with a globose head. Corolla 8-10 mm long.
   2. Filaments piliferous; pollen grains in tetrads. Stems comparatively delicate, with long internodes .... 3. **R. parviflora**
   2'. Filaments glabrous; pollen grains free. Stems robust, rigid, intricately-branched, with short internodes. ....4. **R. juniperoides**

1. **Reyesia chilensis** Gay
(Pl. 7, 2)

Gay, Hist. Fís. Pol. Chile, Bot. 4: 418, lam. 52. 1849. TYPE: Chile, Prov. Coquimbo, in siccis pr. Copiapó, Gay s. n. [ann.] 1838 (Holotype: P; isotype: K).—Hunziker, Kurtziana 10: 46. 1977.—D'Arcy in Ann. Missouri Bot. Gard. 65: 712, f. 1 D. 1978.

Pteroglossis laxa Miers in Ann. Mag. Nat. Hist. Ser. 2, 5(25): 33. January 1850. HOLOTYPE: Chile, Coquimbo, *Bridges 1389* in herb. Hooker (K); the collection number is not *1839*, as was wrongly transcribed by Miers (l. c.). The calyx has glandular hairs with oblong heads; furthermore, the plate subsequently published by Miers (Ill. South Amer. Pl. 2: 32, tab. 52. 1849-1857) shows that the filaments are glabrous. It follows, then, that this name is a synonym of *R. chilensis*, and not of *R. parviflora* as was believed by D'Arcy (1978: 713).

Salpiglossis chilensis (Gay) Wettstein in Engl. u. Prantl, Natürl. Pflanzenfam. 4 (3 b): 36, f. 16 H-J. 1891.

Salpiglossis brachysiphon Johnston in Contr. Gray Herb. 85: 161. 1929. HOLOTYPE: Chile: Prov. Antofagasta, steep hillside ca. 6 Km N of port [Tocopilla] and about opposite Caleta Duendes, *Johnston 3625*, 18 Oct 1925. "A brittle glandular plant; flowers dilute blue (GH).

Reyesia laxa (Miers) D'Arcy, in Ann. Missouri Bot. Gard. 65: 713. 1978.

Apparently a perennial species (or biennial?); each plant has several stems without a basal rosette of leaves, and the roots attain 4 mm in diameter. The lower leaves have comparatively large blades (almost 6 cm long and 2.2 cm broad) pinnately cleft or almost pinnatisect, and conspicuous petioles (1.2-4 cm long); but at the upper nodes the petioles are shorter and even disappear, and the blades become smaller until the uppermost ones look like filiform, linear scales 2-10 mm long.

ADDITIONAL MATERIAL.

CHILE. Prov. Antofagasta: Dept. Taltal: Taltal, ca. 100 m alt., *Werdermann 821*, Oct 1925 (CORD; G; GH; US; U; K; BM). — Hills SE of Taltal, *Johnston 5084*, 25 Nov 1925. "Rock crevices in dry quebrada" (US; GH). —Western end of Llano Colorado, ca. lat. 25° 29', ca. long. 70° 32', *Johnston 5650*, 13 Dec 1925 (S; GH). Ca. 5 Km SE of Taltal, 200 m alt., *Morrison 17095*, 14 Jan 1939. "Annual herb 0,2 m, fl. white, tiny on filiform stems" (K; GH; G; S).—Ca. 10 Km E of Taltal, *Worth et al. 15823*, 13 Oct 1938. "Perennial herb to 1 dm alt.; fl. pale bluish; stems slender; leaves pinnatifid; infrequent" (GH).—Cerros de Tocopilla, *Barros 6543*, 22 Sept 1940 (US).—Tocopilla, *Barros 5575*, 9 Jan 1941 (US).—Tocopilla, *Jaffuel 1003*, 27 Oct 1930 (GH).—Prov. Atacama: Dept. Vallenar: Vallenar, Alto del Carmen, 800 m alt., *Werdermann* 156, Nov 1923 (BM; G; GH; K; U; US).—Dept. Huasco, ca. 3 Km SW of Huasco, ca 35 m alt., *Worth et al. 16243*, 27 Oct 1938. "Perennial herb 0,1 m alt.; fl. bluish, white outside; calyx glandular-pubescent; stem slender" (GH; K).—Huasco, *C. Roberts*, Febr. 1931. "Sea level". (K).—Prov. Coquimbo: Dept. La Serena: Tres Cruces (Est. Junta de Chingoles, 29° 22' lat.), *Muñoz 325*, 15 Sept 1935 (GH).-Laguna de Elqui, *Barros 5619*, Jan 1945 (US).—Atacama, *R. A. Philippi* (CORD).

2. **Reyesia cactorum** (Johnston) D'Arcy
(Pl. 7, 4.)

D'Arcy in Ann. Missouri Bot. Gard. 65: 712. 1978.

Salpiglossis cactorum Johnston in Contr. Gray Herb. 85: 114. 1929. HOLOTYPE: Chile: Dept. Taltal, rocky hillside near Aguada del Cardon, *Johnston 5258*, 30 Nov 1925 (GH).

A very rare species, sympatric with, and closely related to *R. chilensis*. It is known from a single collection, and it differs from *R. chilensis* in having longer corollas. More material is needed in order to determine the status of this taxonomic entity.

3. **Reyesia parviflora** (Phil.) A. T. Hunz.
(Pl. 7, 3; Pl. 8.)

Hunziker in Kurtziana 10: 46. 1977

Salpiglossis parviflora R. A. Philippi, Viaje al Desierto de Atacama pag. 219. 1860. HOLOTYPE: Chile: Desertum Atacama vallis, *Sandon*, Febr 1854 (SGO 055827; also a photograph at GH). ISOTYPE: W.

Apparently an erect annual plant (12) 16 to 40 (60) cm tall, often with only one main stem, which is more or less branched;

usually it has a basal rosette of broad leaves with long petioles (petioles 10-20 mm long, by exception only 5 mm, or even 44 mm). As a sharp contrast, the linear, cauline leaves are inconspicuous, sessile, squamiform; their length vary between 1 and 3 mm, although in some cases they may reach 12 mm in length and 8 mm in breadth.

ADDITIONAL MATERIAL.

ARGENTINA. Prov. Mendoza: Dept. San Carlos: Puesto Río Colorado, Herb. *Kurtz* (CORD).—Prov. San Juan: Dept. Calingasta: En las colinas entre Villa Nueva y El Leoncito, *Castellanos*, 28 Jan 1950 (LIL 15728).—Precordillera entre Barreales, Tontal y Retamito: Cuesta de La Cortadera, *Kurtz 9772* (leg. *Bodenbender*), 22 Febr 1897. "In coll. glareos." (CORD; S).—Camino a Paso del Espinacito: Pampa Negra, *Castellanos*, 10 Jan 1953 (LIL 35324; US). Cordillera del Espinacito: inter Ciénega Redonda et Quebrada Colorada, *Kurtz 9564* (leg. *Bodenbender*), 5 Febr 1897 (CORD; S).—Dept. Iglesia: Rio de la Tagua, below its confluence with Rio de la Sal (ca. lat. 29° 2′ 5″ S, long. 69° 28′ 42″ W), ca. 2900 m alt., *Johnston 6146*, 12/13 Jan 1926. "Erect plant growing in gravel; corolla yellow" (K; GH; S).—Vicinity of Baños de San Crispín (ca. lat. 29° 11′ S, long. 69° 44′ W), ca. 3300 m alt., *Johnston 6115*, 10/12 Jan 1926. "Erect; corolla yellow" (GH; S; LIL). Río de la Sal, 3060 m alt., *J. H. Hunziker et al. 4874*, 20 Mar 1951. "Corola amarilla. Ladera de grava" (CORD).

CHILE. Guanaqueros, *R. A. Philippi*, Jan 1885 (GH).—Prov. Atacama: *Geisse*, 1889-1890 (GH).—Dept. Vallenar, vicinity of Laguna Grande, ca. 3500 m alt., *Johnston 5957*, 5/6 Jan 1926. "Erect plant; corolla yellow" (GH). Dept. Chañaral, vic. of Potrerillos, ca. 2800 m alt., *Johnston 4743*, 26 Oct 1925. "Corolla yellow" (GH; K).—Quebrada de Doña Inés Chica, *Gigoux*, Jan 1886 (GH).—Des. Atacama, *R. A. Philippi* (BM; W).—Prov. Coquimbo: Coquimbo, *R. A. Philippi* (CORD; K; Fotogr. ex B, Field Mus. 3066: GH; CORD).—Dept. Elqui: Baños del Toro, *Reed* (K).—Baños del Toro, ca. 3500 m alt., *Werdermann 195*, Dec 1923 (BM; GH; U; G). Baños del Toro, ca. 3300 m alt., *Morrison 17266*, 5 Feb 1939. "Annual herb 0,4-0,5 m; fl. yellow" (G; GH; K).—Ca. 95 Km along the road from Rivadavia to La Laguna Dam, 2700 3000 m alt., *Morrison et al 17089*, 6 Jan 1939. "Rocky slopes along the roadside; annual herb 0,35 m; fl. yellow; very rare" (GH). Ca. 98 Km from Rivadavia, ca. 2900 m alt., *Worth et al. 16399*, 5 Nov 1938. "Annual herb 0,12 m alt.: fls. lined with brown inside" (GH). Fundo Río Seco, 14 Km east of Nueva Elqui, near the river, 3200 m alt., *Wagenknecht 18119*, 16 Dec 1940. (S).

Distribution: Always at high elevations in the Andes (2900 to 3500 m). This is the only species in the genus that occurs also in Argentinian territory (Prov. Mendoza and San Juan); in Chile it is confined to the northern provinces of Atacama and Coquimbo.

Obs.—This species was wrongly referred by D'Arcy (1978: 713) to *R. laxa*, undoubtedly due to his lack of access to the holotype of *Pteroglossis laxa.* As was already mentioned, *P. laxa* is a synonym of *R. chilensis,* a view already offered by Bentham & Hooker (1876: 909).

4. **Reyesia juniperoides** (Werdem.) D'Arcy (Pl. 7, 1.)

D'Arcy in Ann. Missouri Bot. Gard. 65: 712. 1978.

Salpiglossis juniperoides Werdermann in Notizbl. Bot. Gart. Mus. Berlin-Dahlem 10 (95): 474. 1928. ISOTYPES: Chile: Prov. Tarapacá: Dept. Tarapacá, Parca, Cordillera de Quipisca, ca. 2500 m alt., *Werdermann 1054,* Mar 1926.

A perennial, erect species, intricately branched, attaining 0.8 m in height (fide Werdermann l. c.); the stems are also aphyllous with their terminal branches spiniform.

ADDITIONAL MATERIAL.

CHILE. Prov. Tarapacá: Dept. Tarapacá: Iquique, Caritaya (Alto de Camiña), *Barros 6549,* 16 Jan 1941 (US).—Quebrada a 43 Km de Azapa, camino a Chapiquiña, *Ricardi* et *Marticorena 25509,* 24 Sept 1958 (CORD).—Mamiña, *A. Pfister 9467,* 12 Jan 1950 (CORD).

SUMMARY AND CONCLUSIONS

In this paper a taxonomic revision of *Salpiglossis* R. et P. (2 spp.), *Leptoglossis* Benth. (7 spp.), and *Reyesia* (4 spp.) (three solanaceous genera of the tribe *Salpiglossideae*) is presented. The long standing disagreement of the systematic position of the tribe is discussed and a key is offered to distinguish these three and related genera, as well as keys for the species within genera. Morphological and phytogeographic observations are included at both the generic and specific levels, supplemented by illustrations and maps. The more important results are as follows:

1. *Salpiglossis* cannot be united with *Bouchetia* Dunal in DC (the authors will discuss this problem in more details in a forthcoming paper). The genus consists of two species: *S. sinuata* R. et P. (Chile and Argentina), and *S. spinescens* Clos (Chile).

2. *Leptoglossis* is a disjunct genus of xerophytes with six Peruvian species [*L. schwenckioides* Benth., *L. Ferreyrae* Hunz. et Subils sp. nov., *L. Darcyana* Hunz. et Subils, *L. lomana* (Diels)

A. T. Hunz., *L. acutiloba* (Johnst.) A. T. Hunz. et Subils, and *L. albiflora* (Johnst.) A. T. Hunz. et Subils comb. nov.], and one Argentinian [*L. linifolia* (Miers) Griseb.]. All the species have separate pollen grains.

3. *Reyesia* has four species also of xerophytic habitats: *R. parviflora* (Phil.) A. T. Hunz. in Argentina and Chile, and the three others in northern Chile [*R. chilensis* Gay, *R. cactorum* (Johnst.) D'Arcy, and *R. juniperoides* (Werd.) D'Arcy]. *Reyesia parviflora* is reinstated as the correct name for the first species, because the type collection of *Pteroglossis laxa* Miers belongs to *R. chilensis*. The only species with pollen grains in tetrads is *R. parviflora*.

BIBLIOGRAPHY

Baillon, H. E. 1888. *Histoire des plantes* 9: 281-359, t. 343-461. Paris.

Bartling, F. T. 1830. *Ordines Naturales Plantarum eorumque Characteres et Affinitates adjecta Generum Enumeratione*. I-IV, 1-498. Gottingae.

Bentham, G. 1835. Revision of Scrophulariaceae: trib. *Salpiglossideae*. In *Bot. Reg.* 21: Sub t. 1770. London.

———. 1845. *The botany of the voyage of H.M.S. Sulphur*. 1-194, 1-60 [pag. 143: *Leptoglossis* gen. nov.] London.

———. 1846. *Scrophulariaceae*. Subord. et Trib. I. *Salpiglossideae*. In De Candolle (Ed.), *Prodr. Syst. Nat.* 10: 190-203.

Bentham, G. et J. D. Hooker. 1876. *Genera Plantarum* 2 (2): 882-980, 1244-1245.

Brongniart, A. 1843. *Enumeration des genres de plantes cultivés au Muséum d'Histoire Naturelle de Paris*. . . . 1-136 (2e ed. 1850, 1-237). Paris.

Clos, D. 1849. Escrofularíneas. In Gay, *Hist. Fís. Pol. Chile, Bot.* 5: 100-188. Paris.

Dale, E. E. 1933. Multiple allelomorphs in *Salpiglossis*. Amer. Nat. 67: 71.

———. 1937. A series of multiple alleles especially affecting the corolla in *Salpiglossis*. Amer. Journ. Bot. 24 (10): 651-656, f.1-14.

Dale, E. E. & O. L. Rees-Leonard. 1939. Plastid variegation and concurrent anthocyanin variegation in *Salpiglossis*. Genetics 24: 356-367.

D'Arcy, W. G. 1978. A preliminary synopsis of *Salpiglossis* and other *Cestreae (Solanaceae)*. *Ann. Missouri Bot. Gard.* 65: 698-724, f. 1-5.

Diers, L. 1961. Der Anteil an Polyploiden in den Vegetationsgürteln der Westkordillere Perus. Zeitschr. Bot. 49 (5): 437-488.

Don, G. 1837. *A general system of gardening and botany* 4 [*Solanaceae*: 397-488, f. 40-44]. London.

Eichler, A. W. 1969. Einige Bemerkungen über den Bau der Cruciferen blüthe und das Dédoublement. In Flora 52: 102-109 [Solanaceae: 104-108], Tab. I.

Eichler, A. W. 1875. *Blüthendiagramme* 1: 199-206, f. 117-118. W. Engelmann, Leipzig.

Endlicher, S. 1839. *Genera Plantarum secundum Ordines Naturales disposita.* I-LX, 1-1483. Part 9 [*Solanaceae* et *Scrophularinae:* 662-696]. Vindobonae.

Fedde, F. 1896. *Beitrage zur vergleichenden Anatomie der Solanaceae.* 1-48, f. 1-6. Arbeit aus dem Bot. Gart. Univ. Breslau.

Feuillée, L. 1714. Journal des observations physiques, mathematiques et botaniques. . . . 2: 504-767, pl. 1-50. Paris.

Gay, C. 1849. Bignoniáceas. In Gay, *Hist. Fís. Pol. Chile, Bot.* 4: 408-420, lam. 52 [pag. 418: *Reyesia*]. Paris.

Gray, A. 1877. Characters of some little-known or new genera of plants. In *Proc. Amer. Acad. Arts & Sc.* 12: 159-165 [*Leptoglossis:* 164-165].

Hassall, A. H. 1841-1842. Observations on the structure of the pollen granule. . . etc. In Ann. & Mag. Nat. Hist. 8 (49): 93-108 (Oct 1841); 9 (Suppl.): 544-573, p. 13-18 (Sept 1842).

Hunziker, A. T. 1977. Estudios sobre *Solanceae.* VIII. Novedades varias sobre tribus, generos, secciones y especies de Sud America. In *Kurtziana* 10: 7-50, f. 1-12 (Mayo 1977).

———. 1979. South American *Solanaceae:* a synoptic survey. In Hawkes *et al.* The Biology and Taxonomy of the Solanaceae. *Linn. Soc. Symposium* Ser. 7: 49-85, f. 1-11. London.

Hooker, W. J. 1827. *Salpiglossis straminea. Exot. Fl.* 3, t. 299. 1827.

———. 1834. *Salpiglossis straminea* var. *picta.* In Curtis' *Bot. Mag.* 71: 3365.

Hemsley, W. B. 1882. In *Biol. Centr. Am.* (ed. F. D. Godman & O. Salvin) Botany 2: 404-438. London.

Johnston, I. M. 1928. Some undescribed American Spermatophytes. In *Contr. Gray Herb.* 81: 85-98.

———. 1929. Papers on the Flora of Northern Chile. In *Contr. Gray Herb.* 85: 1-171.

———. 1929. Some undescribed species from Perú. In *Contr. Gray Herb.* 85: 172-180.

Lindley, J. 1846. *The Vegetable Kingdom.* I-LXVIII, 1-908, f. 1-526. [*Solanaceae:* 618-622, f. 417]. London.

MacBride, J. F. 1962. *Solanaceae.* Flora of Peru. In *Field Mus. Nat. Hist.* 13, 5-B, 1: 1-267. Chicago.

Miers, J. 1849. Observations upon several genera hitherto placed in *Solanaceae,* and upon others intermediate between that family and the *Scrophulariaceae.* In *Ann. Mag. Nat. Hist.* 2nd. Ser. 3 (15): 161-183.

Millan, A. R. 1931. Solanaceas argentinas. Clave para la determinación de los géneros. In *Bol. Ministerio Agr. Nación* 30 (1): 3-21, f. 1-7. Buenos Aires.

———. 1941. Revisión de las especies del género *Nierembergia (Solanaceae)* In *Darwiniana* 5:487-547.

Muñoz Pizzaro, C. 1966. Flores silvestres de Chile. 1-245, p. 1-51 (Láminas de E. Sierra Rafols). Ediciones de la Universidad de Chile.

Remy, J. 1849. Solaneas. In Gay, *Hist. Fís. Pol. Chile, Bot.* 5: 38-100. Paris. Santiago.

Robyns, W. 1931. L'organisation florale des Solanacées zygomorphes. In *Mém. Acad. Roy. Belgique Cl. Sc.* 11 (8): 1-84, pl. I-VI. Bruxelles.

Ruiz, H. et J. Pavon. 1794. *Flora peruvianae et Chilensis prodromus.* I-XXII, 1-154, tab. 1-37. Reprint 1965. J. Cramer. Lehre.

Schlepegrell, G. von. 1892. Beiträge zur vergleichenden Anatomie der Tubifloren. In *Bot. Centralbl.* 49 (7): 193-200; 49 (8): 225-231; 49 (9): 257-263; 49 (10-11): 289-299; 49 (12): 353-360; 49 (13): 385-393, Taf. 1-4; 50 (1): 1-7; 50 (2): 33-39.

Subils, R. 1979. Cromosomas gaméticos de *Leptoglossis linifolia (Solanaceae)* In *Lorentzia* 3: 19-20, f. 1.

Sweet, R. 1827. *Salpiglossis straminea.* In *Brit. Fl. Gard.* 3: pl. 231.

______. 1828. *Salpiglossis picta.* In *Brit. Fl. Gard.* 3: pl. 258.

______. 1830. *Hortus Britannicus.* 2nd. ed. London.

______. 1833. *Salpiglossis barclayana.* In. *Brit. Fl. Gard.* Ser. 2, 2, pl. 112.

Torrey, J. 1859. General Botany of the Boundary. In Emory, *Report on the U.S. and Mexican Boundary Survey* 2 (1) [*Solanaceae:* 151-156]. Washington.

Vesque, J. 1885. Caractères des principales familles gamopétales tirés de l'anatomie de la feuille. Ann. Sc. Nat. 7e. Sér. 1: 183-360, pl. 9-15.

Vilmorin R. de et M. Simonet. 1928. Recherches sur les nombres des chromosomes chez les Solanées. In Zeitsch. indukt. Abstamm. u. Vererbungslehre Suppl. 2: 1520-1536.

Werdermann, E. 1928. Übersicht über die in Chile vorkommenden Arten der Gattung *Salpiglossis* Ruiz et Pav. (*Solanaceae*). In *Notizbl. Bot. Gart. u. Mus. Berlin-Dahlem* 10 (95): 472-475.

Wettstein, R. v. 1891. *Solanaceae.* In Engler u. Prantl, *Natürl. Pflanzenfam.* 4 (3b): 4-38, f. 12-16.

Wettstein, R. v. 1892. Ueber die Systematik der *Solanaceae.* In *Verhandl. d. kais.-königl. zool.-bot. Gesell. in Wien* 42: 29-33.

Wodehouse, R. P. 1929. The origin of symmetry patterns of pollen grains. In Bull. Torrey Bot. Club 56: 342-350, pl 16.

Wydler, H. 1866. Morphologische Mitteilungen. In *Flora* 49: 513-525, f. 1-8.

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PLATE 1

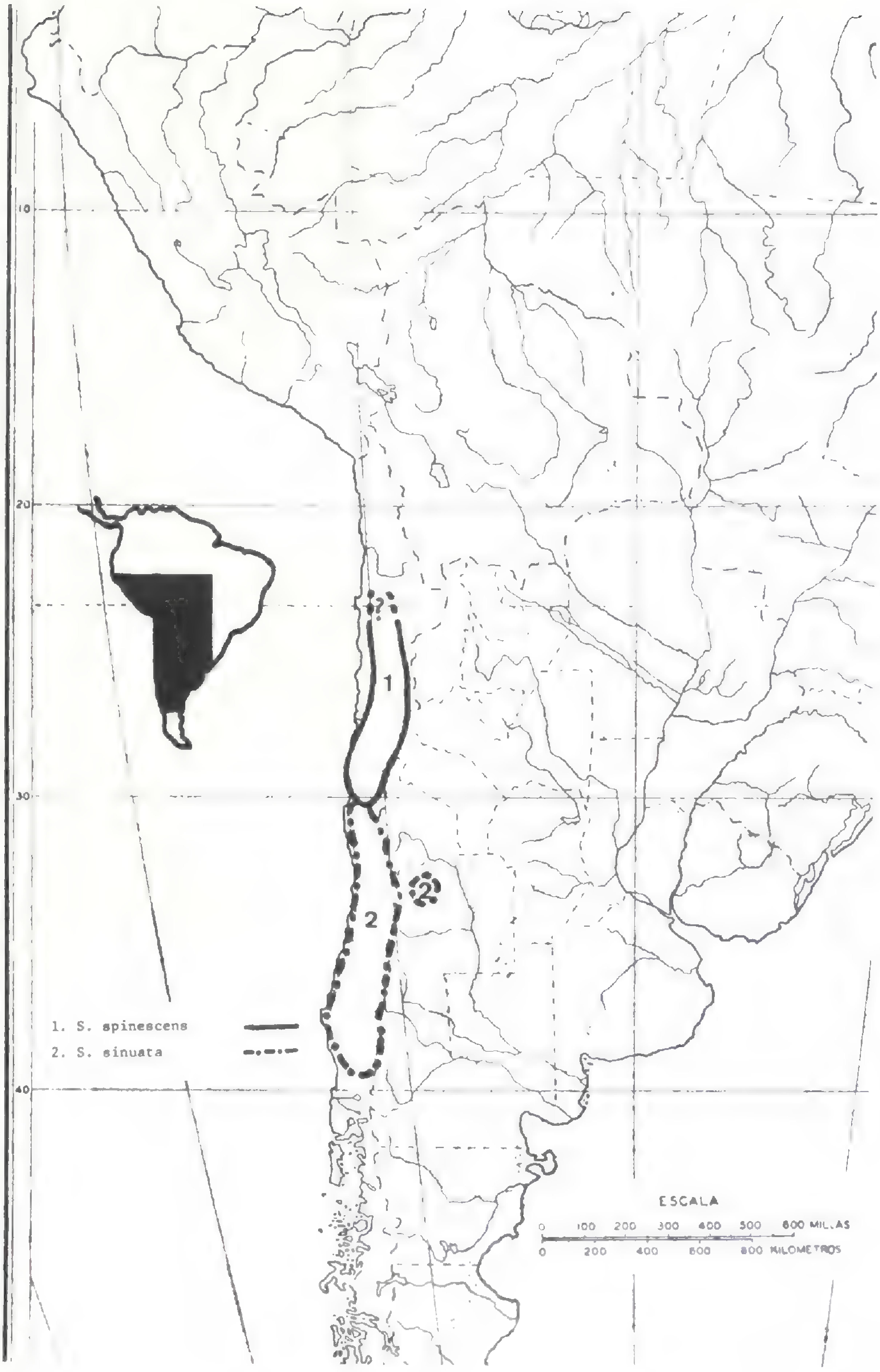


Plate 1. Geographical distribution of the species of *Salpiglossis*.

Plate 2. *Salpiglossis sinuata.* (A, B, C, from *Joseph 808;* others from *Bauer Nov 1855*). A: dehiscing fruit, × 2.6; B: seed (lateral view), × 26.4; C: seed cross section, × 26.4; D: anther (ventral view), × 8.8; E: glandular hair of the calyx, × 132; F: lateral internal view of a theca to show the dorsal insertion of the filament (dorsal side to the left), × 8.8; G: upper part of a floriferous branch, × 0.88; H: pollen tetrad, × 320; I: flower bud, × 1.8; J: longitundinal section of seed, × 26.4; K: portion of calyx showing venation, × x 4.4; L: basal portion of a branch, × 0.88; M: anther (dorsal view), × 8.8; N: ovary cross-section, × 13.2; O: expanded corolla (internal view) showing four didynamous stamens and the anterior staminode, × 1.8; P: gynoecium, × 2.6.

PLATE 2

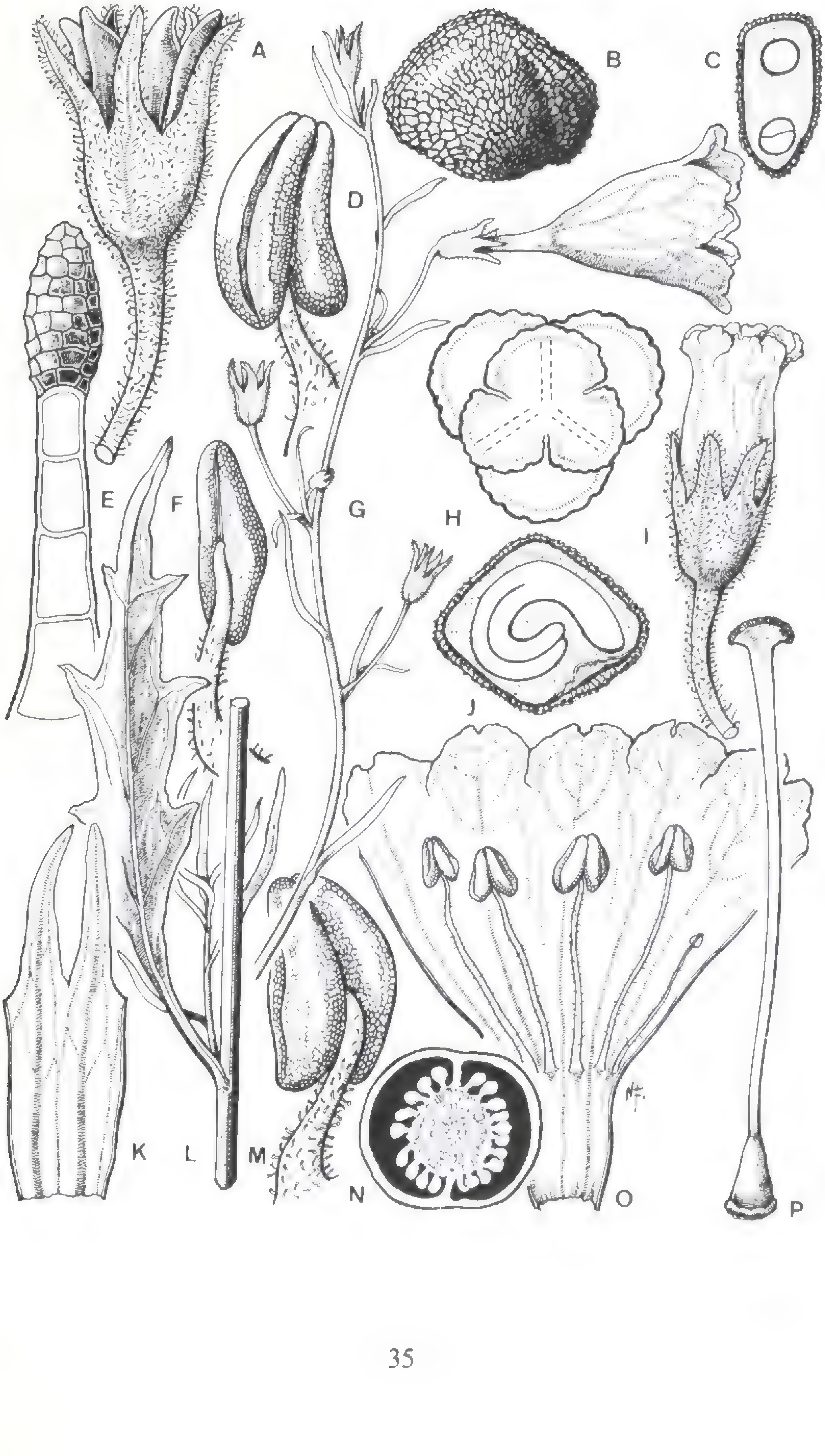


PLATE 3

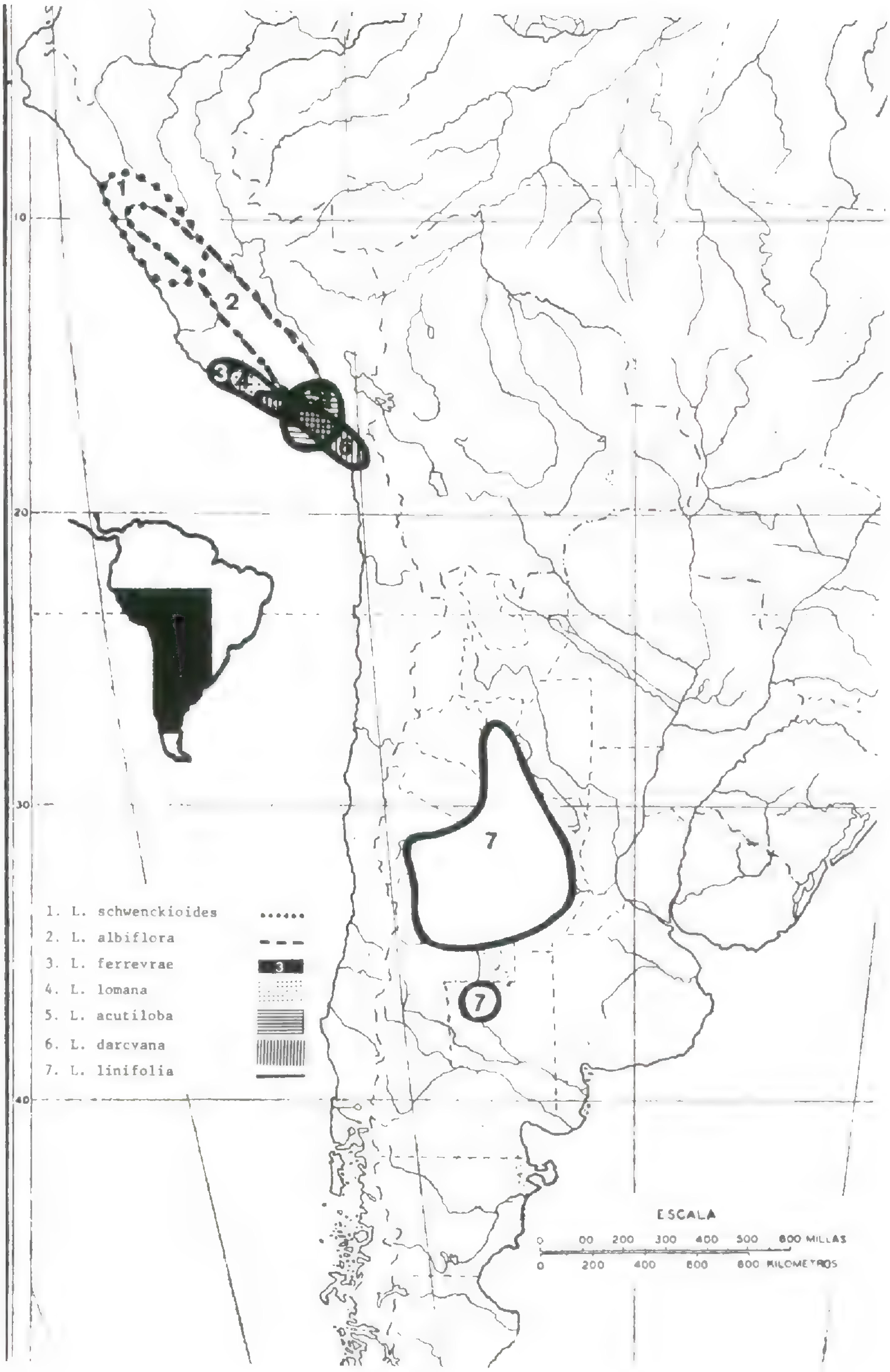


Plate 3. Geographical distribution of the species of *Leptoglossis*.

PLATE 4

Plate 4. *Leptoglossis Ferreyraei* (*Ferreryra 14020*). A: ovary cross section, × 18; B, H, J: branched hairs of the calyx, × 440; C: basal leaf, × 5.3; D: habit, × 0.88; E: gynoecium, × 13.2; F: anther (ventral view), × 18; G: flower, × 3.5; I: flower bud, × 7; K: expanded corolla (internal view) showing two posterior stamens and three staminodes, × 7.

Plate 5. *Leptoglossis albiflora* (*Weberbauer 7424 a*). A: expanded corolla (internal view) displaying three staminodes and the two posterior stamens at a very low level of adnation, × 14; B: zygomorphic calyx with eight dissimilar lobes (note its peculiar pattern of venation), × 4.4; D: hair of the calyx, × 220; G: stigma situated at the peculiar flat wings of the style (see also figs. C, H, J and Q), × 18.—*L. acutiloba* (*Pennell 13081*). C: stigma, × 18; E, F: curved hairs of the calyx, × 220. —*L. lomana* (*Scolnik 1020*). H: stigma × 18; I: branched hair of the calyx, × 220. —*L. schwenckioides* (*Hutchison 1032*). J: stigma, × 18; K: expanded corolla (internal view) of a flower with two pairs of fertile stamens (each pair with unequal anthers) and the anterior staminode, × 7; L, O: calycinal hairs, × 220; N: calyx, × 4.4 —*L. linifolia* (*Di Fulvio 144*). M: expanded corolla of a flower bud, × 7; P: hair of the calyx, × 220; Q: stigma, × 18.

PLATE 5

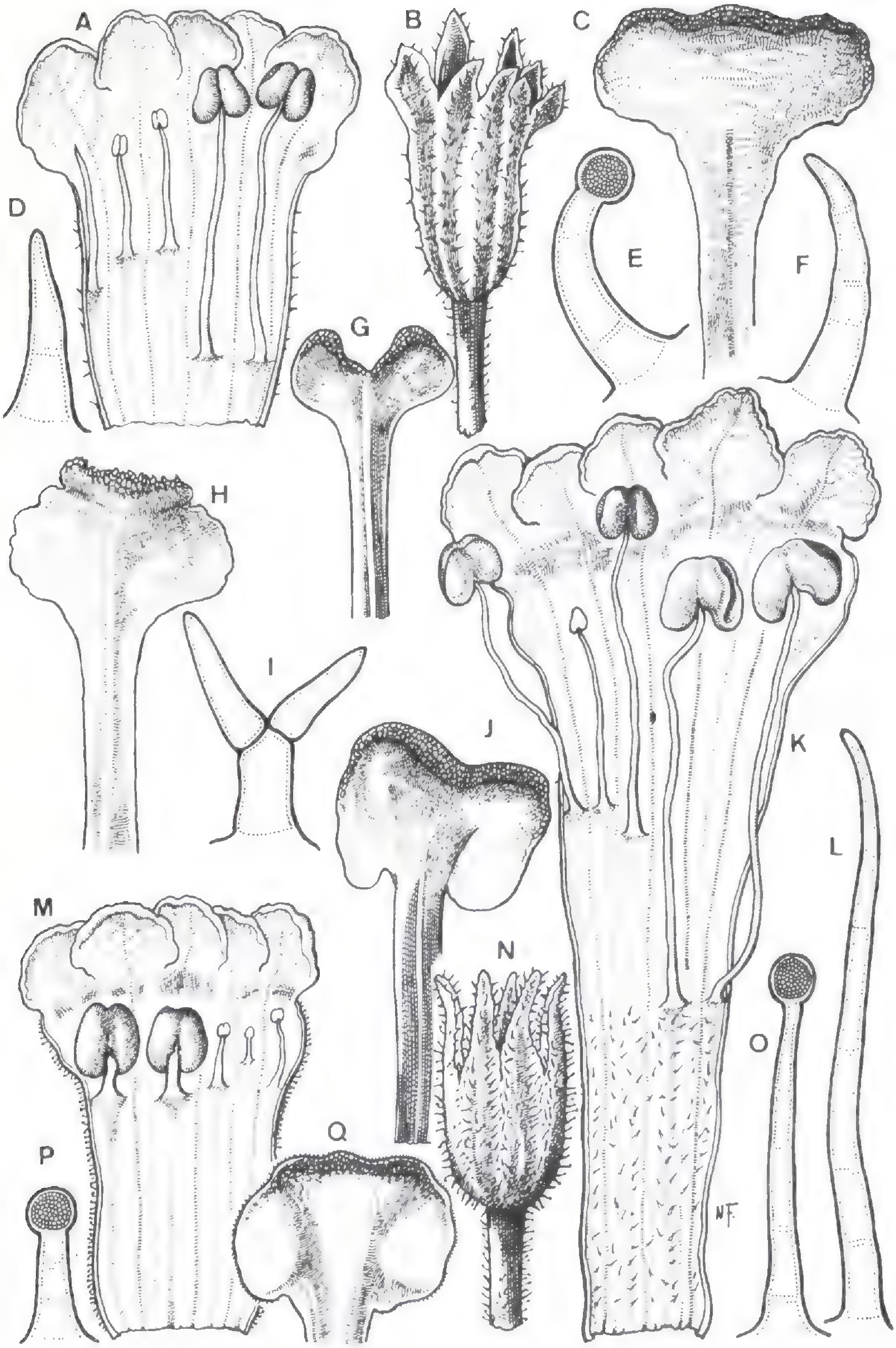


PLATE 6

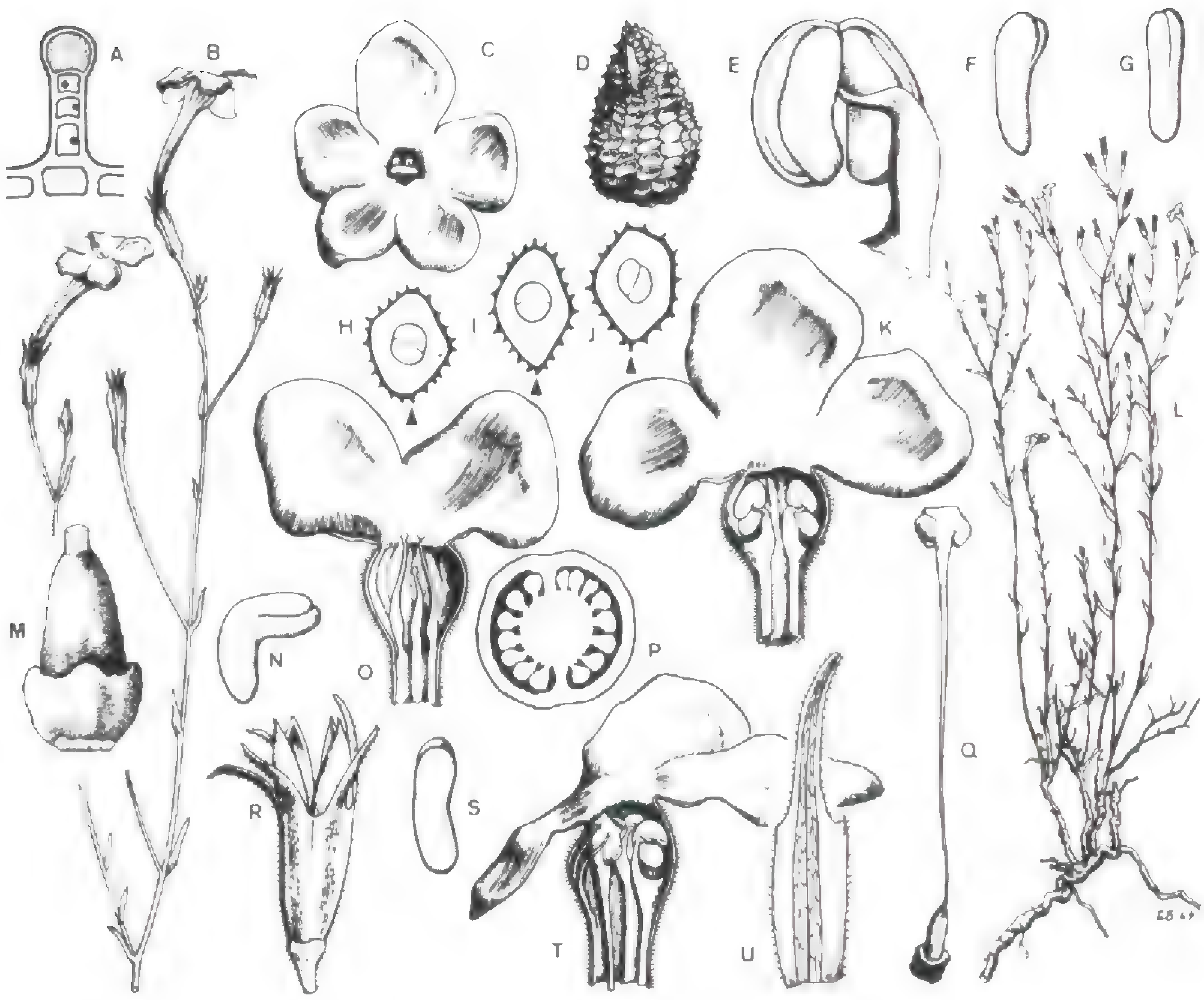


Plate 6. *Leptoglossis linifolia* (fruit and seed: *A. T. Hunziker 11359;* others from *DiFulvio 144*). A: glandular hair of the corolla (outer surface), × 125; B: flowering branch, × 1; C: flower (top view), × 2; D: seed (hilar view), × 25; E: stamen (ventral face), × 10; F, G, N, S: embryos, × 25; H-J: seeds cross sections (the small triangle at the base indicating the position of the hilum, × 25; K, O: the two halves of the upper part of the corolla, one with three staminodes, the other with the two posterior stamens, × 4; L: habit (note the sprouting roots), × 0.25; M: ovary and disk, × 7.5; P: cross section of ovary, × 15; Q: gynoecium × 2.5; R: fruit, × 2.5; T: upper part of the flower (vertical section) showing the arrangement of the stamens and staminodes in relation to the stigma, × 4; U: longitudinal part of the calyx showing venation, × 3.75.

PLATE 7

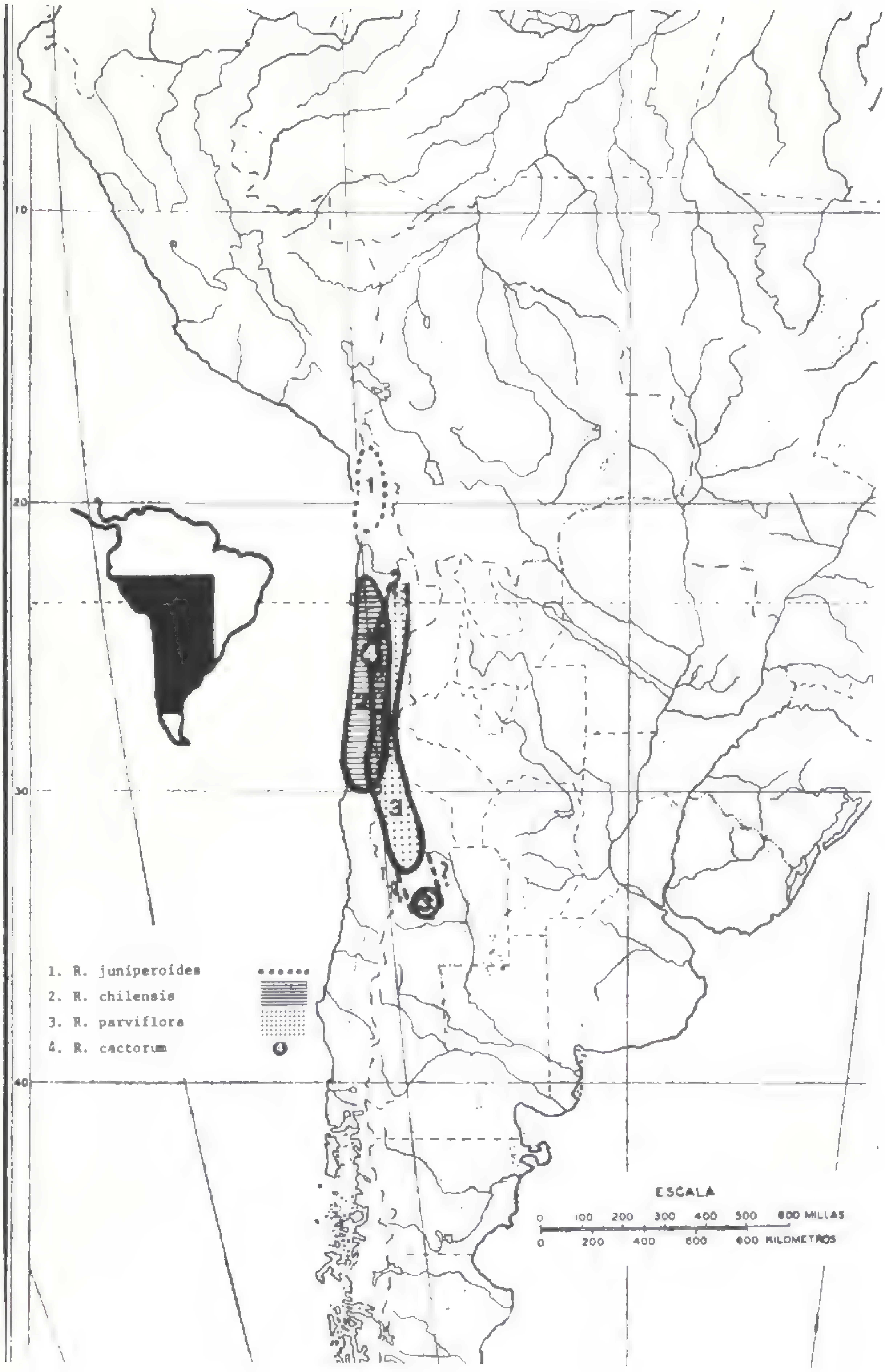
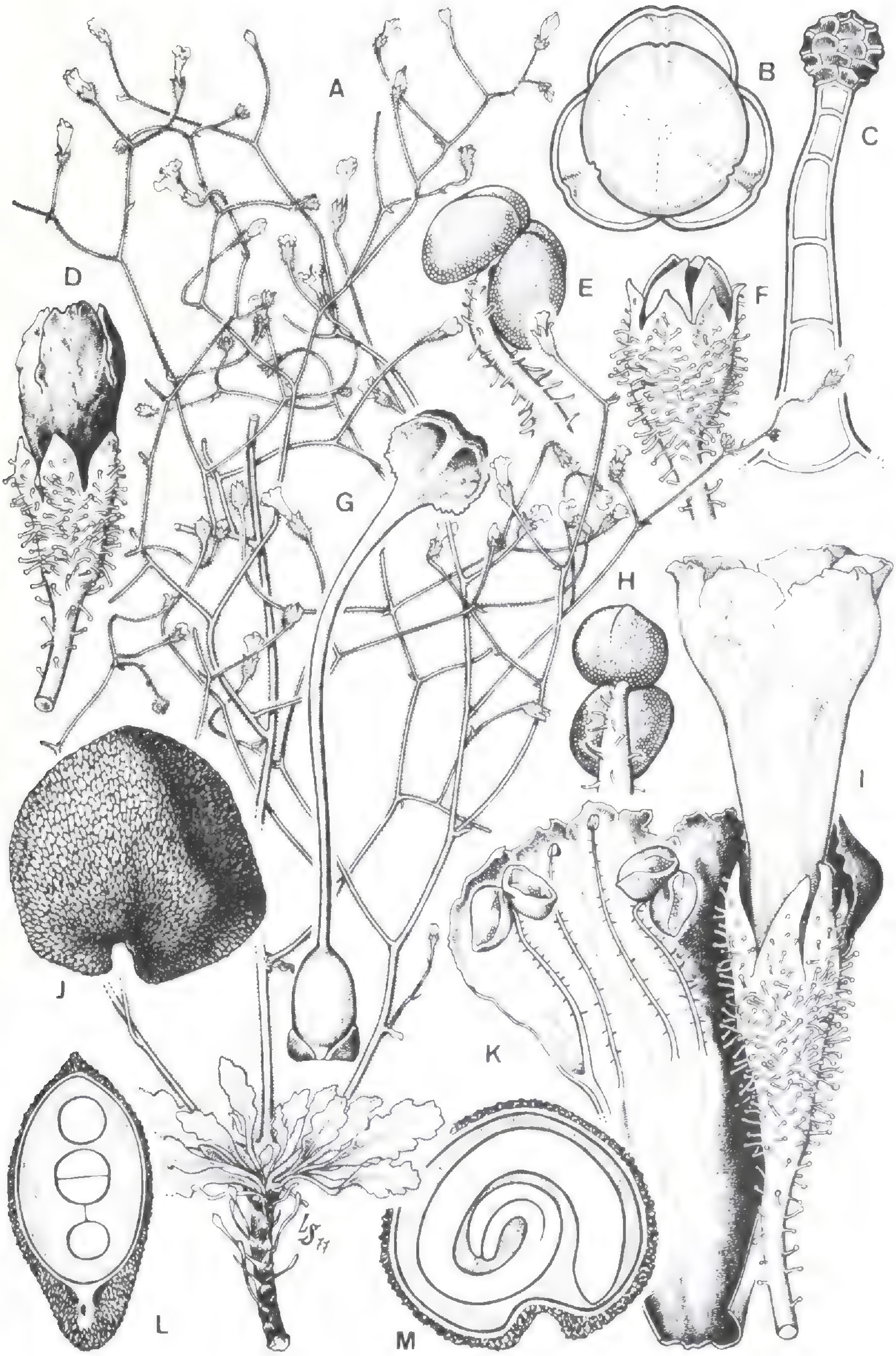


Plate 7. Geographical distribution of the species of *Reyesia*.

Plate 8. *Reyesia parviflora* (K, I: LIL 35324; the others from *J. H. Hunziker 4874*). A: habit, × 0,88; B: pollen tetrad, × 352; C: calyx hair, × 132; D: flower bud, × 7; E, H: anther (ventral and basal views), × 18; F: fruit, × 3.9; G: gynoecium, × 13.2; I: flower, × 10.5; J, L, M: lateral view, cross section and longitudinal section of seed, × 26.4; K: expanded corolla (internal view), × 10.5.

PLATE 8



BOTANICAL MUSEUM LEAFLETS VOL. 27, NO. 1 2
JANUARY–FEBRUARY 1979.

THE IDENTITY OF AMAZONIAN AND TRUJILLO COCA

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In the course of preparing a taxonomic treatment of the cultivated species of *Erythroxylum*[2], it has become necessary to make some nomenclatural additions and changes.

The cultivated coca plants of South America are generally considered to belong to two species of *Erythroxylum: E. Coca* Lam., which includes so-called Bolivian or Huánuco coca, and *E. novogranatense* (Morris) Hieron., which is Colombian coca (Plowman, 1979a). Both of these species have one distinct cultivated variety. Since they were first recognized, these varieties have been the source of considerable taxonomic confusion and misinterpretation in both the botanical and pharmaceutical literature.

The coca which is typical of the Amazon basin, known as Amazonian coca, is a variety of *Erythroxylum Coca*. Trujillo coca, which is grown primarily on the north coast of Peru, is a variety of *E. novogranatense*. Both of these varieties will be discussed in greater detail in separate papers now in preparation. My intention here is to identify these cultivated taxa with correct scientific names, descriptions and with the designation of types. In view of the current broad interest in coca and its derivatives, it is essential to stabilize the names of the plants without further delay.

AMAZONIAN COCA

Erythroxylum Coca is the most important commercial species of coca, furnishing by far the greatest portion of the world's

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[2]Botanists have not been consistent in the spelling of the generic name of coca. For a discussion of the correct orthography of *Erythroxylum*, see Plowman (1976).

supply of coca leaves and cocaine. This species is native to the *montaña* region of the eastern Andes, extending from Ecuador south to Bolivia. It is cultivated mostly between 500 and 1500 m. elevation in an area characterized by a favorable tropical environment with high rainfall, moderate temperatures, and well drained, mineral-rich soils.

A distinct variety of *Erythroxylum Coca* is also found in South America but has been largely ignored by both botanists and anthropologists. This is the coca of the Amazon valley, which continues to be cultivated today on a small scale by a number of Indian tribes in the western Amazon of Brazil, Colombia and Peru. The history, cultivation, method of use and alkaloid chemistry of Amazonian coca was discussed recently in a paper read before the 43rd International Congress of Americanists (Plowman, 1979b).

Amazonian coca is readily distinguished from typical *Erythroxylum Coca* (*E. Coca* var. *Coca*) of the Andean foothills. The Amazonian variety grows typically as a tall, spindly shrub with long, weak branches and relatively large, elliptical leaves. The leave are usually blunt or rounded at the apex in contrast to *montaña* coca which usually has more or less pointed leaves. The parallel longitudinal lines found on the leaf undersides and usually considered characteristic of *E. Coca* are often faint or even lacking in the Amazonian variety. Furthermore, the flowers of Amazonian coca have a shorter, thicker pedicel and a markedly denticulate staminal tube.

Erythroxylum Coca is a self-incompatible, distylous species with both long-styled (pin) and short-styled (thrum) morphs, which occur in approximately equal numbers (Plowman, unpublished data; Ganders, 1979). However, most populations of Amazonian coca contain only the short-styled morphs, with the exception of one or two collections from the easternmost Amazon in Brazil. The occurrence of only short-styled morphs in the Amazonian variety results from the fact that the plants are propagated vegetatively by cuttings, in contrast to Andean coca which is grown mainly from seeds. In Amazonia, entire plantations may be based on a single short-styled clone.

Since only one stylar form is present in Amazonian coca, there is, under field conditions, no fertilization in this obligately outcrossing species. As a result, Amazonian coca rarely if ever produces viable seed. Even though fruits may be formed, at times in abundance, the seeds are devoid of embryos and/or endosperm and will not germinate.

Amazonian coca appears to cross readily with long-styled morphs of its Andean counterpart. Experimental reciprocal crosses in the greenhouse produced normal offspring. These plants have not yet reached flowering size, so their degree of fertility cannot be reported at this time.

Amazonian coca is apparently known only in cultivation and is incapable of competing with the dense secondary vegetation which grows up after cultivated plots are abandoned. In this feature, it further differs from Andean *E. Coca*, which frequently escapes and forms a component of the forest understory in forested areas around coca plantations (Plowman, 1979a).

Amazonian coca also differs in the manner of preparation of the leaves for chewing. The leaves are always toasted to dryness and pulverized in a mortar and pestle. The resulting powder is then mixed with the ashes of leaves of *Cecropia* or *Pourouma* species (Moraceae).

Martius made the first collections of Amazonian coca during his sojourn in the Brazilian Amazon in 1819–1820. He described in detail the unique preparation and use of the plant (Spix & Martius, 1831) and later published a description and illustration of Amazonian coca under the name *Erythroxylum Coca* Lam., since he considered it to be the same as the Peruvian plant described by earlier authors (Martius, 1843).

There has been only one other attempt to name Amazonian coca scientifically; and this was the result of an unfortunate error in identification. In the 1870's, a variety of coca was introduced from Europe into cultivation on the island of Java. In 1890, this plant, which became known in the trade as "Java coca", was described as a new variety by the Dutch botanist Burck working at the Botanical Gardens at Bogor (Buitenzorg). Burck named the plant *Erythroxylum Coca* var. *Spruceanum* commemorating Richard Spruce, the famous English botanist who made extensive plant collections in the Amazon region in the mid-19th century.

In 1889, Morris a botanist at the Royal Botanic Gardens at

Kew, published an article[3] in which he described another new variety of coca, *Erythroxylum Coca* var. *novogranatense,* which is the basionym of *E. novogranatense*. In his article, Morris also discussed the relationships of other cultivated coca plants and remarked that specimens of Java coca "corresponded exactly" to herbarium specimens of coca at Kew collected by Richard Spruce on the Rio Negro in 1851[4]. On the basis of this statement, Burck injudiciously chose the name "Spruceanum" for Java coca.

The resemblance of Java coca to Spruce's original collection, which I have studied at Kew, is entirely superficial. Morris's identification was based merely on the variable characters of leaf shape and the lack of the characteristic parallel lines on the underside of the leaves. Spruce's collection at Kew is labeled "No. 73, 'Ipadú', sitio on the Rio Janaurí (affluent of the Rio Negro)", and clearly represents Amazonian coca as delimited here. This herbarium specimen also serves as a voucher for the first of two samples of coca powder which Spruce sent to the Kew Museum (Spruce, 1853a).

The holotype of *Erythroxylum Coca* var. *Spruceanum* Burck is a specimen preserved at the Herbarium Bogoriense in Bogor, Indonesia. Isotypes are found in the Institute for Systematic Botany in Utrecht, and at the Rijksherbarium in Leiden. All of these specimens belong to *Erythroxylum novogranatense,* and the name *E. Coca* var. *Spruceanum* is placed in synonymy with it. This identification agrees with the treatment of Payens who revised *Erythroxylum* for the Flora Malesiana in 1958. Even though Burck indirectly cited the Spruce collection as a paratype, this specimen must be excluded from the type material of *E. Coca* var. *Spruceanum,* since it belongs to a different species and does not conform to the type.

I would here like to name Amazonian coca as *Erythroxylum coca* var. *ipadu,* after the widely used Brazilian name of the plant, and offer the following description:

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[3]Morris' original article of 1889 was unsigned and was erroneously attributed by Burck and others to Dr. Thiselton Dyer, then Director at Kew.

[4]Although Morris reported the date of Spruce's coca collections as 1854, Spruce began his studies and collections of coca as early as 1851, as reported two years later in a letter to Sir William Hooker (Spruce, 1853b).

Erythroxylum Coca var. **Ipadu** Plowman var. nov.

Ab Erythroxylo Coca typico ramis fortiter erectis virgatis, ramentis paucis vel nullis, foliis apice rotundatis, lineis abaxialibus obscuris, pedicellis brevioribus, stamineo urceolo valde 10-denticulato, stigma promienti, ovato-oblonga differt.

TYPE: **PERU**: Dept. Loreto: Prov. Maynas. Río Ampiyacu, Puca Urquillo and vicinity, approx. lat. 3°05′, long. 71°55′. Cultivated shrub 2.5 m tall in open coca plantation in jungle clearing, interplanted with *yuca* and fruit trees. Branches slender, erect, then arching, leaves mostly near the tips, bright green. Flowers cream. N.v. *jibína* (Witoto). 5 Apr 1977. *T. Plowman, R. E. Schultes & O. Tovar 6663* (holotype, ECON; isotypes, F 1824462, GH, K, MO, S, U, US, USM).

Slender shrub to 3 m. tall. Single trunk to 2 cm. in diameter. Bark light greyish brown with fine longitudinal cracks. Branches strongly erect, spindly, sometimes arching over with age. Branchlets straight, not knobby at the nodes, light yellowish green becoming reddish brown, with lenticular or elongated lenticels. Ramenta[5] inconspicuous, sparse or sometimes absent, if present found only at the base of new shoots. Leaves present mostly at the branch tips, the blade elliptic to broadly elliptic or elliptic-ovate, apically obtuse to rounded, basally obtuse to acute, sometimes briefly attenuate, 35–115 mm long, 20–42 mm wide, firmly membranaceous, dark to medium green above, pale glaucous green beneath, dull to somewhat shiny above, dull beneath, midrib yellowish green, with an acute adaxial ridge, lateral nerves often prominulous above, abaxial longitudinal lines obscure or wanting, central panel often faint or concolorous. Petiole 2–4 mm. long. Flowers in axils of past season's growth, usually on naked stems but sometimes axillary in subterminal leaf axils, 1–5(6) per node, scattered or sometimes crowded, creamy white to yellowish throughout, odorless. Pedicel short, thickened distally, 2–4 mm long, to 1.5 mm in diameter. Lamina of petals spreading, sometimes suberect and not fully opening, incurved at apex. Margin of staminal cup markedly 10-denticulate, the

[5]The term "ramenta" was first used by Martius (1843) for the persistent, often congested, scale-like structures which frequently cover the twigs of *Erythroxylum* species. Morphologically, ramenta are simply stipules which are produced without accompanying leaves.

teeth short, triangular. Short-styled flowers predominant, style short 1.5 2 mm. long, stigma large, ovate-oblong, 1 mm long, 0.5 mm broad, bright yellowish green. Drupe 7 8 mm long, 4 6 mm in diameter, embryo and endosperm usually aborted. Chromosome number n = 12.

ETYMOLOGY: This variety is named for the Brazilian vernacular name of Amazonian coca.

COMMON NAMES: *idapú, ypadú* (Amazonian Brazil), *coca* (Amazonian Peru), *jibína* (Witoto, Peru), *ípi* (Bora, Peru), *pátu* (Cubeo, Colombia), *botô* (Makú, Brazil).

DISTRIBUTION: Cultivated in the Amazon basin of Peru, Columbia and Brazil, along the Amazon River and its major tributaries.

SPECIMENS STUDIED:

BRAZIL: AMAZONAS: Basin of Rio Iça, near San Antonio, "padu" or "coca", Dec 1935, *Krukoff 7645* (NY); Rio Purús basin, Rio Uneiuxi, Makú Indian village, 300 km above mouth, "botô" (Makú), 23 Oct 1971, *Prance et al. 15572* (ECON, INPA, K, NY, U, US); Rio Juruá, Marary, Sep 1900, *Ule 5039* (K, L); Rio Solimões, Tefé, Lago de Tejé, Mujeira, "padu", 13 Jul 1973, *Lleras et al. P16681* (GH); Tefé, "padu", "ipadu", 16 Jul 1972, *PLK & Urbana 12231* (INPA); Tefé, Fazenda Experimental, 20 Feb 1973, *PLK & Marilene 12553* (INPA); "prope Ega et São Paulo d'Olivença", 1819–1820, *Martius s.n.* (M); "in sylvis Japurensibus", "ypadu", 1819, *Martius S.N.* (M); Ilha Parauary, 20 Oct 1874, *Traill 77* (K); Rio Negro, Providentia, "ipadú", Jul 1888, *Prinzessin Therese von Bayern s.n.* (M); Rio Negro, Cucuí, 7.5.1973, *Silva et al. 1310* (F); Rio Janauarí, "paidú", *Spruce 73* (K): Manaus, igarapé do Buião, "ipadu", 5-7-1958, *Coêlho s.n.* (F). *PARÁ:* Belém, "ipadu", Sep–Oct 1961, *Pires 51919* (NY, US). [Belém, São Jozé to the Arsenal, 1828 1830], *Burchell 9588* (K); Belém, Botanical Garden, Museu Goeldi, 15 May 1908, *Baker 70* (A, BO, GH, LE, MO, NY, US); Rio Guamá, Apr 1899, *E. Poisson s.n.* (P); Santarem, May 1929, *Dahlgren & Sella 36* (F).

COLOMBIA: PUTUMAYO: Río Putumayo, entre Puerto Asís y Puerto Leguísamo, 300–400 m, 14–15 Oct 1954, *García-Barriga et al. 18713* (COL). AMAZONAS: Leticia, camino a Tarapacá, km. 17, 18 Jul 1965, *Lozano & Ospina 488* (COL); Tikuna village, km. 12 on trail from Leticia to La Pedrera, 14 Apr 1975, *Cabrera 3367*(COL). Río Igaraparaná, La Chorrera, 180 m, 6 Jun 1942, *Schultes 3899*(ECON); Ro Igaraparaná, "kudu jibina" (Witoto), 1 Mar 1974, *Idrobo 6859* (COL, ECON); Río Igaraparaná, 15 km. abajo de La Chor-

rera, "jibina", 12 Feb 1974, *Idrobo 6775* (COL). VAUPÉS: Río Piraparaná, Raudal, 4 Sep 1952, *Schultes & Cabrera 17169* (A, COL, ECON, F): Río Piraparaná, San Miguel, environs of Catholic mission, 23 Oct 1976, "cañea patu", "hokquhe", 23 Oct 1976, *Davis 119* (ECON, F), "ñaa k kwahe" (Barasana), *Davis 120n* (ECON, F); Río Apoporis, Soratama, Raudal Jirijirimo, below mouth of Kananarí, 900 m, 21 Jan 1952, *Schultes & Cabrera 14979* (ECON): Río Apoporis, Jino-Gojé, entre los Ríos Piraparaná y Popeyaká, alt. 250 m, 3–11 Sep 1952, *García-Barriga 14453* (ECON); Rio Kanarí, "pa-toó" (Kabuyayi), 6-8-1951, *Schultes & Cabrera 13415* (F); Río Kananarí, Cerro Isibukuri, 250–750 m, 13 Jun 1951, *Schultes & Cabrera 12419* (AAH, F, GH). Río Kubiyú, 2 hrs. upriver from confluence with Río Vaupés, "hokɨ pátu" (Cubeo), 9 Apr 1975, *Davis 10* (ECON, GH, K, MO, P, US), "kárika pátu" (Cubeo), *Davis 11* (ECON, F, MO, US) "pátu", *Davis 12* (F), "wehkí pátu", *Davis 13* (ECON, F, MO, NY, S, U); same locality, 12 Apr 1975, "kárika pátu", *Davis 18* (ECON, F, US); *"hokɨ pátu"*, *Davis 19* (ECON, F, K, NY, MO, US), "wehki pátu", *Davis 20* (ECON, US); lower Río Kubiyú, 1 Apr 1975, *Zarucchi et al. 1145* (ECON, F). Bocas del Carurú, Casa Álvarez, 240 m, 25 Sep 1939, *Cuatrecasas 7012* (F).
PERU: LORETO: Prov. Maynas: Río Napo, Negro Urco, 1 mile downriver, "jíbe" (Witoto), 17 Aug 1966, *Martin 1318* (ECON); Mishuyacu, near Iquitos, Apr 1930, *Klug 1117* (F, NY, US); Iquitos, alt. 120 m, "coca", 10 Oct 1929, *Ll. Williams 3551* (F); Morona Vieja, mouth of Quebrada Versalles, 11 km. N.O. de Iquitos, 17 Aug 1966, *Torres 167* (ECON, F); road from Iquitos to Río Nanay, 12 Jun 1966, *Martin 1001* (ECON); Río Nanay, road to Picuruyacu, near house of José Piña, 4 Aug 1966, *Martin 1209* (ECON). Río Ampiyacu, 24 Sep 1972, *Croat 20864* (DUKE, F, K); Pebas, Río Amazonas, 18 Apr 1977, *Plowman et al. 6922* (ECON, F, K), *Plowman et al. 6923* (ECON, F, MO), *Plowman et al. 6924* (ECON, F, US); Brillo Nuevo, Río Yaguasyacu, affluent of Río Ampiyacu, "ípi" (Bora), 12 Apr 1977, *Plowman et al. 6748* (ECON, F, K, NCU, USM), *Plowman et al. 6750* (ECON, F, USM), "huangana coca", *Plowman et al. 6802* (ECON, F, GH, K, USM), "mojarra coca", "tsɨ-paa" (Bora), 1 May 1977, *Plowman et al. 7136* (ECON, F, K, NCU, USM), "pelejo coca", "daa-llímɨ̈" (Bora), *Plowman et al. 7137* (ECON, USM); Florida, Río Putumayo, mouth of Río Zubineta, alt. 200 m, Mar–Apr 1931, *Klug 2002* (A, F, GH, MO, NY).

TRUJILLO COCA

Trujillo[6] coca is a variety of coca cultivated on the desert coast of Peru and in the adjacent arid valley of the Río Marañón. This plant has been grown there for at least 3000 years and is ecologically well adapted to its desert habitat, which both ancient and modern farmers watered with complex irrigation systems (Plow-

[6]The older spelling of the Spanish name Trujillo is "Truxillo" and is often encountered in the earlier literature. "Trujillo" is the correct form.

man, 1979a). Archeological and ethnohistorical evidence demonstrates that Trujillo coca was once cultivated in most if not all the coastal river valleys of Peru (Rostworowski, 1973).

In the pharmaceutical trade, Trujillo coca has also been referred to as "small-leaved" or "Peruvian" coca to distinguish it from "Bolivian" or "Huánuco" coca (referring to the species *Erythroxylum Coca*). Even in pre-Conquest Peru, Trujillo coca was recognized as a distinct variety and was called "tupa" coca, meaning "royal" or "noble" coca, to distinguish it from "mamox" coca, which was the name applied to the "large leaved" coca grown on the eastern slopes of the Andes, i.e. *E. Coca* (Rostworowski, 1973; Plowman, 1979a).

Trujillo coca is still cultivated on a small scale, especially in the region around Trujillo on the north coast of Peru. It constitutes less than 5% of the total coca production in Peru but is the principal variety used in the beverage industry owing to its high content of essential oils and flavors.

The identity of Trujillo coca became the object of much debate and confusion when the leaf first appeared in world pharmaceutical markets in the 1880's. The controversy centered on the botanical identification of the sundry commercial varieties of coca and involved a number of prominent botanists and pharmacists of the day, including E. R. Squibb, E. M. Holmes, D. Morris, W. Burck and H. H. Rusby. The history of this controversy is long and complicated and resembles the early attempts to identify the botanical sources of quinine and curare.

Much of the difficulty in identifying commercial coca leaves stemmed from the lack of experience of early workers with the plants in the field. Instead, they were attempting to describe and name samples of dried leaves encountered in commerce or isolated living plants of unknown provenience, cultivated in conservatories and experimental gardens.

My purpose here is not to elaborate all the intriguing details in the history of the identification of coca. This will be treated in depth in a separate paper which is in preparation. However, it is necessary to describe the events which have obfuscated the identification of Trujillo coca, in order to clarify its present taxonomic position and correct name.

As early as 1889, Trujillo coca was associated with *Erythroxy-*

lum novogranatense (as *E. Coca* var. *novogranatense*) by Morris at Kew, who stated that his new variety approached "very nearly (although not so coriaceous) as what are known in commerce as Truxillo leaves". In 1900, H. H. Rusby, then Professor at the New York College of Pharmacy, described Trujillo coca as a new species, *Erythroxylum truxillense.* He asserted that this coca differed from both *E. Coca* of Lamarck and from *E. Coca* var. *novogranatense* of Morris (which Rusby erroneously wrote as "neo-granatense"). Neither Rusby nor his English-speaking contemporaries were aware that Hieronymus, working in Berlin, had made the correct combination *Erythroxylum novogranatense* in 1895 in identifying the Colombian coca collections of F. C. Lehmann.

In his rambling and confused paper of 1900, Rusby discussed several different kinds of coca, both wild and cultivated, which he had encountered both in his extensive travels in South America and in the pharmaceutical trade. Rusby departed from acceptable taxonomic procedures, even then in common practice, of describing plants clearly and concisely and of citing specific collections as types or otherwise authentic specimens. He described his *E. truxillense* casually and in prose discourse. His brief description of the "Trujillo" or "small green leaf which we get directly from Peru" was given as follows: "It is mostly from 3 × 1-1/4 to 4 × 1-1/2 cm. It is obovate, with narrowed base, mostly acute or acutish at the apex and minutely apiculate. In commercial leaves the lateral lines are commonly faint or even wanting". He also provided an illustration of this leaf in his Fig. 14.

Rusby did not cite a type specimen of commercial Trujillo coca. However, his intention was to describe the Trujillo leaf found in the New York pharmaceutical trade, and a specimen of this material should be designated as a lectotype. No such specimens are preserved today at the New York Botanical Garden where the best set of Rusby's herbarium is deposited. However, an appropriate specimen has been discovered among Rusby's vast materia medica collection now housed at the Harvard Botanical Museum. This entire collection was transferred to Harvard in 1973 "on indefinite loan from the New York Botanical Garden."

In 1979, Susan Marie Rossi began at the Botanical Museum the task of curating and re-cataloguing Rusby's collections of medicinal plant products, contained largely in glass jars. She recovered, among other coca specimens, a jar labeled "No. 2684, *Erythroxylon truxillense* Rusby, Truxillo coca, small coca, native of Peru and cultivated. The commercial drug presented by E. Merck & Co., New York City." This specimen corresponds to a listing in Rusby's catalogue (1921) of plant products included in the now defunct Economic Museum of the New York Botanical Garden. The provenience of this specimen is confirmed by the occasional presence in the sample of leaves of *pacay, Inga Feuillei* D. C. This leguminous tree, a native of Peru, is commonly planted as a shade tree in plantations of Trujillo coca and its leaves often appear as a contaminant of commercial Trujillo leaf. This sample, identified by Rusby, is the most appropriate of Rusby's collections to serve as the lectotype of his species *E. truxillense.*

In addition to his cursory description of *Erythroxylum truxillense,* Rusby created further confusion by describing a living plant which he found in flower at the conservatory of the New York Botanical Garden in August, 1900. He knew nothing of the origin of this plant but likened it to his *E. truxillense,* but not without some reservations. He provided a brief description of it and stated that this plant was "unquestionably the same thing which Dr. Burck speaks of as Java coca and for which he proposes the name *E. Coca Spruceanum.*"

Rusby made an herbarium specimen of this living plant and deposited it at the New York Botanical Garden herbarium labeled *E. truxillense* Rusby. The following year (1901), he provided further descriptive details of the plant and published a line drawing of it (Rusby 1901, fig. 2). From both the specimen and the drawing, it is certain that this plant represents typical Colombian coca, *E. novogranatense* var. *novogranatense.*

It is likely that the living plant which Rusby confused with Trujillo coca was derived from progeny of the "Kew Plant" originally named by Morris, in spite of Rusby's contention that his plant did not match Morris's *E. Coca* var. *novogranatense.* We now know that *E. novogranatense* is at least partially self-compatible (Plowman, unpublished data; Ganders, 1979) and spontaneously produces prodigious amounts of seed. Seeds of the original "Kew Plant" were sent out to conservatories and botanical gardens throughout the world, and it is likely that some of them found their way to the New York Botanical Garden.

In short, the specimen which Rusby collected in cultivation must be excluded as a type of *Erythroxylum truxillense.* It was misconstrued by Rusby as being identical with the Trujillo leaves of commerce. In spite of his extensive field experience with coca in South America dating from 1885, Rusby never visited Trujillo and never saw or collected Trujillo coca in the field. Since this plant is grown only in a limited area in South America and is not cultivated in other countries, it is understandable that Rusby failed to recognize the subtle differences between the dried leaves of commerce and the living specimen of *E. novogranatense* in the greenhouse.

Most botanists since the time of Rusby have agreed that the cultivated coca plants belong to two closely related species of *E. Coca* and *E. novogranatense* (Schulz, 1907; Payens, 1958; Towle, 1961; Gentner, 1972; Machado, 1972; Plowman, 1979a). Until recently Trujillo coca was generally included within *E. novogranatense.* But no botanists had ever studied Trujillo coca in the field or had examined herbarium specimens collected in Peru. The only exception to this were studies of archeological coca leaves from coastal Peru, which certainly represent Trujillo coca (Harms, 1922; Griffiths, 1930; Towle, 1961; Plowman, 1979a).

The first documented herbarium specimens of Trujillo coca which I have found in major herbaria are those collected by Augusto Weberbauer in 1914 in the Province of Pataz in Peru, along the upper Río Marañón. These were originally identified as *Erythroxylum Coca.* No further specimens of Trujillo coca were made until the 1960's when interested botanists began to sample the local varieties of coca. From these recent collections, it is finally possible to assess intelligently the taxonomic status of Trujillo coca.

From herbarium studies, transplant experiments, chemical analyses and anatomical studies, it may be affirmed that Trujillo coca is in fact best placed in the species *E. novogranatense.* However, it differs from the typical form of this species sufficiently to justify treating it as a distinct variety within *E. novogranatense.*

Disjunct populations of Trujillo coca have recently been discovered in northwestern Ecuador and adjacent Colombia, where it is occasionally grown as a medicinal dooryard plant. These populations are of great interest because of their geographical isolation from plants in coastal Peru and because of their proximity to areas where typical Colombian coca is grown. Furthermore, they are growing in wet, montane habitat which is ecologically very different from the arid Peruvian coast. Continuing efforts by police authorities to annihilate coca in Ecuador now threaten these last remnant populations with extinction before they can be fully studied and before their possible role in the evolutionary history of coca can be properly assessed.

In 1972, Machado, in his treatment of the Peruvian species of *Erythroxylum,* attempted to reduce Rusby's *E. truxillense* to a variety of *E. novogranatense,* making the new combination *E. novogranatense* var. *truxillense.* Lamentably, this combination was not validly published, a fact which I overlooked in previous publications (Holmstedt et al., 1977; Plowman et al., 1978; Plowman, 1979a). Article 33.2 of the International Code of Botanical Nomenclature (Stafleu et al., 1978) plainly states that new combinations made on or after Jan. 1, 1953, must be accompanied by clear indication of the basionym (in this case, *E. truxillense* Rusby) and a full and direct reference given to its author and the original publication with page or plate reference and date. Machado (1972) neglected to include either the basionym or the original reference to Rusby's publication.

I would therefore like to validate the combination *Erythroxylum novogranatense* var. *truxillense* here. I also append a new description of the variety and designation of the lectotype. It should also be noted that Machado's new species *Erythroxylum Hardinii,* published in 1969, is placed in synonymy with *E. novogranatense* var. *truxillense* on the basis of its morphology, leaf venation and anatomy.

Erythroxylum novogranatense var. **truxillense** (Rusby) Plowman, *comb. nov.*

Erythroxylum truxillense Rusby, Druggists Circular & Chemical Gazette 44: 220. t. 14. 1900. 45: 49. 1901.

LECTOTYPE: "Truxillo coca, small coca. Native of **Peru** and cultivated." The commercial drug presented by E. Merck & Co., New York City. Accession No. 2684, Economic Museum of the New York Botanical Garden, no date. Specimen of dried leaves in a glass jar. (lectotype, ECON; isolectotypes consisting of small samples of this collection deposited at F, NY, USM).

Erythroxylum Hardinii E. Machado, Anales Ci. (Lima) 7(1–2): 14. 1969.

TYPE: **PERU:** Dept. San Martín, "Quebrada cerca de Crisnejas y el pueblo de Uchiza. Aparentamente en el lugar y sitios alendaños se cultivo hace mucho tiempo." 15 Feb 1965, *E. Machado 1256* (holotype, US 2803917; photograph of holotype, F, neg. 55486; isotypes, MOL, NCSC).

Shrub to 3 m. tall, usually with multiple trunks reaching 4 cm. in diameter. Bark greyish brown with transverse and longitudinal cracks. Branches relatively dense, erect and spreading, straight or bending with age, light reddish to greyish brown, becoming longitudinally fissured. Branchlets straight, slender, not markedly zigzag in extension growth, nodes scarcely knobby, usually as thick as the internodes, stems mostly smooth but sometimes minutely scaly-ramentaceous, light green becoming reddish or greyish brown, lenticels punctate or rarely lenticular, usually not breaking the surface. Internodes alternatively extended 6–20 mm. long, or shortened during ramenta production, 1–3 mm. long. Ramenta often present but short, occurring mainly at the base of new shoots or on slow-growing short shoots, inconspicuous. Stipules scarcely diverging from axis, membranaceous, pale green, turning light brown with age and disintegrating, keels in young stipules entire or rarely minutely fimbriate towards apex. Leaves usually persisting on the branches, weakly distichous, blade plane, narrowly elliptic to oblong-lanceolate, sometimes elliptic, apically acute to obtuse or rounded, basally acute to attenuate, 20–65 mm. long, 10–25 mm. wide, membranaceous, medium to light green above, pale green to glaucous green beneath, midrib flat adaxially or with only a slight medial ridge, pale green, often drying whitish beneath, lateral nerves and veinlets usually obscure above, rarely prominulous, abaxial longitudinal lines and central panel usually inconspicuous or obscure. Petiole 1–5 mm. long. Flowers in axils of previous season's growth, often near the tips of the branchlets or sometimes among the persisting leaves, usually 1–3(10) per node, scattered, if congested then only briefly, with a strong, foetid odor resembling raw pumpkin. Pedicels long, 3–11 mm. long, median length 9 mm. Petals fugaceous or sometimes persisting, appearing rotate, 3.5–5 mm. long, 2–3 mm. wide, the lamina subcymbiform or the midrib depressed above, yellowish green to cream, ligule creamy white. Staminal cup half the length to equaling the calyx. Drupe ovoid to ellipsoid, sometimes fusiform, obtuse to acute at apex, 10–13 mm. long, 4–7 mm. in diameter. Whole plant, especially the leaves, suffused with odor of wintergreen (methyl salicylate). Chromosome number $2n = 24$.

ETYMOLOGY: The variety is named for the city of Trujillo in northern Peru, near the area of primary cultivation and from which the leaves are exported.

COMMON NAMES: *coca de Trujillo, tupa* (Peru): *coca* (Ecuador).

DISTRIBUTION: Cultivated in northern Peru on the western slopes of the Andes and in the valley of the Alto Río Marañón. Disjunct populations known from northwestern Ecuador and adjacent Colombia.

SPECIMENS STUDIED:

COLOMBIA: NARIÑO: Río San Juan, across river from Maldonado, 2000 m., "coca", 26 Jan 1977, *Boeke 854* (F); Tumaco, 9 May 1926, *O.F. Cook 98* (US).
ECUADOR: CARCHI: Maldonado, 1450–1650 m., "coca", 2 June 1978, *Madison et al. 4920* (F, SEL); Environs of Chical, 12 km. below Maldonado, along Río San Juan, 1200 m., "coca", 25 May 1978, *Madison et al. 4447* (F, NCU, SEL).
PERU: AMAZONAS: Prov. Chachapoyas: Río Utcubamba, km. 6 from La Caclid, 1600 m., 25 Feb 1976, *Plowman 5563* (ECON, F, USM), *Plowman 5564* (ECON, F, K, USM), *Plowman 5565* (ECON, F, NCU, RB, USM). Yumbay, above Balsas near Hornopampa, alt. 1100 m, 27 Feb 1976, *Plowman 5583* (ECON, F, K, NCU, US, USM), *Plowman 5587* (ECON, F, USM), *Plowman 5588* (ECON, F, NCU, USM), *Plowman 5589* (ECON, F, USM), *Plowman 5590* (ECON, F, K, USM).
Prov. Contumaza: Dist. Simbrón, Fundo Farrat, 8 Jan 1966, *Machado 2960*

(NCSC), *Machado 2961* (MOL), *Machado 2962* (MOL), *Machado 2963* (NCSC). DEPT. HUÁNUCO: PROV. LEONCIO PRADO: Pumahuasi, Fundo "Villa Gloria", Experimental planting of Ing. Rodolfo Collantes, 830 m., "coca de Trujillo", 6 Apr 1976, *Plowman 5828* (ECON, F, K, USM), 19 Jul 1967 *Machado 1051* (NCSC), *Machado 1201* (NCSC), *Machado 1214* (NCSC), *Machado 1239* (NCSC); 20 Jul 1967, *Machado 2573* (NCSC).

LA LIBERTAD: Prov. Bolíar: Laderas del Río Marañón, Mar 1965, *Machado 2989* (MOL). Prov. Otuzco: Hacienda Collambay, between Simbal and La Cuesta, 800 m., 2 Sep 1973, *López & Sagástegui 7999* (GH): 850 m., 3 Mar 1976, *Plowman 5603* (ECON, F, UPS, USM), *Plowman 5604* (ECON, F, USM), *Plowman 5605* (ECON, F, USM), *Plowman 5606* (B, ECON, F, USM, VT), *Plowman 5607* (ECON, F, USM), *Plowman 5608* (ECON, F, USM), *Plowman 5609* (ECON, USM), *Plowman 5610* (ECON, F, USM), *Plowman 5611* (ECON, F, USM), *Plowman 5612* (ECON, F, K, NCU, USM), *Plowman 5613* (ECON, F, K, USM), *Plowman 5614* (ECON, F, U), *Plowman 5616* (ECON, F). PROV. PATAZ: Río Marañón, abajo de Pataz, 1400 m, 18 Aug 1914, *Weberbauer 7079* (MOL); Cerca del Río Marañón, 18 Feb 1965, *Machado 2987* (NCSC); Cerca de Tayabamba, orillas del Río Marañón, 2 Mar 1965, *Machado 2934* (MOL), *Machado 2935* (MOL); Cerca de Huancaspata, orillas del Río Marañón, 15 Jan 1966, *Machado 2929* (MOL); Prov. Trujillo: Laderas de la Vertiente Occidental, Mar 1965, *Machado 1248* (NCSC); Hacienda del Sr. Lopez, 1965, *Machado 1018* (NCSC); Simbal, El Sacramento, 580 m, 3 Mar 1976, *Plowman 5600* (ECON, F, USM), *Plowman 5601* (ECON), F, USM), *Plowman 5602* (ECON, USM), 17 Apr 1967, *Ferreyra s.n.* (ECON, USM), 16 Apr 1967, *Ferreyra s.n.* (USM); Simbal, La Banda, 500 600 m, "tupa", 17 Apr 1967, *Ferreyra s.n.* (ECON, USM); Simbal, San Lorenzo, 500–600 m, "tupa", 16 Apr 1967, *Ferreyra s.n.* (ECON, USM); Simbal, Las Animas, "tupa", "Coca de Trujillo", 17 Apr 1967, *Ferreyra s.n.* (ECON, USM); Simbal, Fundo de Rosario Gutierrez, "tupa", 17 Apr 1967, *Ferreyra s.n.* (ECON, F, USM); Simbal, 4 Mar 1976, *Plowman 5618* (ECON, F, USM); 3 km. from Simbal, "tupa", 16 Apr 1967, *Ferreyra s.n.* (ECON, USM).

LIMA: Lima, Universidad Nacional Agraria de La Molina, Jardín Botánico, 6 Apr 1975, *Plowman 5209* (BH, ECON, F), 6 Feb 1976, *Plowman 5388* (BH, COL, ECON).

ACKNOWLEDGMENTS

Part of the research reported in this paper was conducted at the Botanical Museum of Harvard University under a contract with the U. S. Department of Agriculture (No. 12 14 1001–230). Post-doctoral fellowship support was also received from the Katharine A. Atkins Fund at Harvard University. Field work on Amazonian coca was carried out as part of Phase VII of the Alpha Helix Amazon Expedition 1976–1977 and was funded by the National Science Foundation Grant No. 76–80874.

I am particularly grateful to Professor R. E. Schultes of

Harvard University for his continuing encouragement and support of coca research and for providing access to the H. H. Rusby collections. I would like to thank Susan Marie Rossi for her long hours spent in searching for Rusby's invaluable coca collections. Drs. Ramon Ferreyra and Oscar Tovar of the Museo Nacional de Historia Natural in Lima graciously gave valuable advice and assistance in field work. I also wish to thank the curators of the herbaria (cited according to the standard abbreviations of Holmgren and Keuken, Index Herbariorum, 1974) who kindly supplied herbarium specimens on loan for this study.

REFERENCES

Burck, W., 1890. Opmerkingen over de onder den Naam van *Erythroxylon Coca* in nederlansch Indie gecultiveerde gewassen. Teysmannia 1: 385-398, 449-464. t. 1-3.

Ganders, F. R., 1979. Heterostyly in *Erythroxylum Coca* (Erythroxylaceae). J. Linn. Soc. Bot. 78: 11-20.

Gentner, W. A., 1972. The Genus *Erythroxylum* in Colombia. Cespedesia 1: 481-554.

Griffiths, C. O., 1930. Examination of coca leaves found in a pre-Incan grave. J. Pharm. Pharmcol. 3: 52-58.

Harms, H. von, 1922. Übersicht der bisher in altperuanischen Gräbern gefundenen Pflanzenreste. Festschrift Eduard Seler. Stuttgart. p. 180.

Hieronymus, G., 1895. Plantae Lehmannianae in Guatemala, Costarica, Colombia et Ecuador collectae. Bot. Jahrb. Syst. 20, Beibl. 49: 35.

Holmstedt, B., E. Jäätmaa, K. Leander & T. Plowman, 1977. Determination of cocaine in South American species of *Erythroxylum* using mass fragmentography. Phytochemistry 16: 1753-1755.

Machado, E., 1969. Erythroxylaceae Novae II. Anales Ci. (Lima) 7(1-2): 14-17.

Machado, E., 1972. El género *Erythroxylon* en el Perú. Raymondiana 5: 5-101.

Martius, C. F. P. von, 1843. Beiträge zur Kenntnis der Gattung *Erythroxylon*. Abh. Akad. München 3: 367-369. t. 6.

Morris, D., 1889. Coca. Bull. Misc. Inform. (Kew) 25: 1-13.

Payens, J. P. D. W., 1958. Erythroxylaceae. Flora Malesiana 5: 543-552.

Plowman, T., 1976. Orthography of *Erythroxylum* (Erythroxylaceae). Taxon 25: 141-144.

Plowman, T., L. Rüdenberg & C. W. Greene, 1978. Chromosome numbers in neotropical *Erythroxylum* (Erythroxylaceae). Bot. Mus. Leafl. Harvard Univ. 26: 203-209.

Plowman, T., 1979a. Botanical Perspectives on Coca. J. Psyched. Drugs 11: 103-117.

Plowman, T., 1979b. Amazonian Coca. Paper presented before the 43rd International Congress of Americanists, Aug. 15, 1979, Vancouver, Canada.

Rostworowski de Diez Canseco, M., 1973. Plantaciones prehispánicas de coca en la vertiente del Pacífico. Revista Mus. Nac. (Lima) 39: 193 224.

Rusby, H. H., 1900. The botanical origin of coca leaves. Druggists Circilar & Chemical Gazette, November: 220–223.

Rusby, H. H., 1901. More concerning Truxillo coca leaves. Druggists Circular & Chemical Gazette, March: 47–49.

Rusby, H. H., 1921. Guide to the Economic Museum of the New York Botanical Garden. Bull. New York Bot. Gard. 11 (41): 1–138.

Schulz, O. E., 1907. Erythroxylaceae. In A. Engler, ed. Das Pflanzenreich 4 (134): 1 164.

Spix, J. B. von & C. F. P. von Martius, 1831. Reise in Brailien. München. 3: 1169, 1180.

Spruce, R., 1853a. Journal of a Voyage up the Amazon and Rio Negro. J. Bot. Kew Gard. Misc. 5: 212.

Spruce, R., 1953b. Botanical objects communicated to the Kew Museum from the Amazon River, in 1851 and 1852. J. Bot. Kew Gard. Misc. 5: 240.

Stafleu, F. A., et al., 1978. International Code of Botanical Nomenclature. IAPT Regnum Vegetabile 97. Utrecht.

Towle, M. A., 1961. The Ethnobotany of Pre-Colombian Peru. Wenner-Gren Foundation. New York.

PLATE 9

Plate 9. *Erythroxylum Coca* var. *Ipadu*. Original specimen of Richard Spruce (no. 73), collected on the Rio Janauarí, affluent of the Rio Negro, Brazil. From the Royal Botanic Gardens, Kew.

PLATE 10

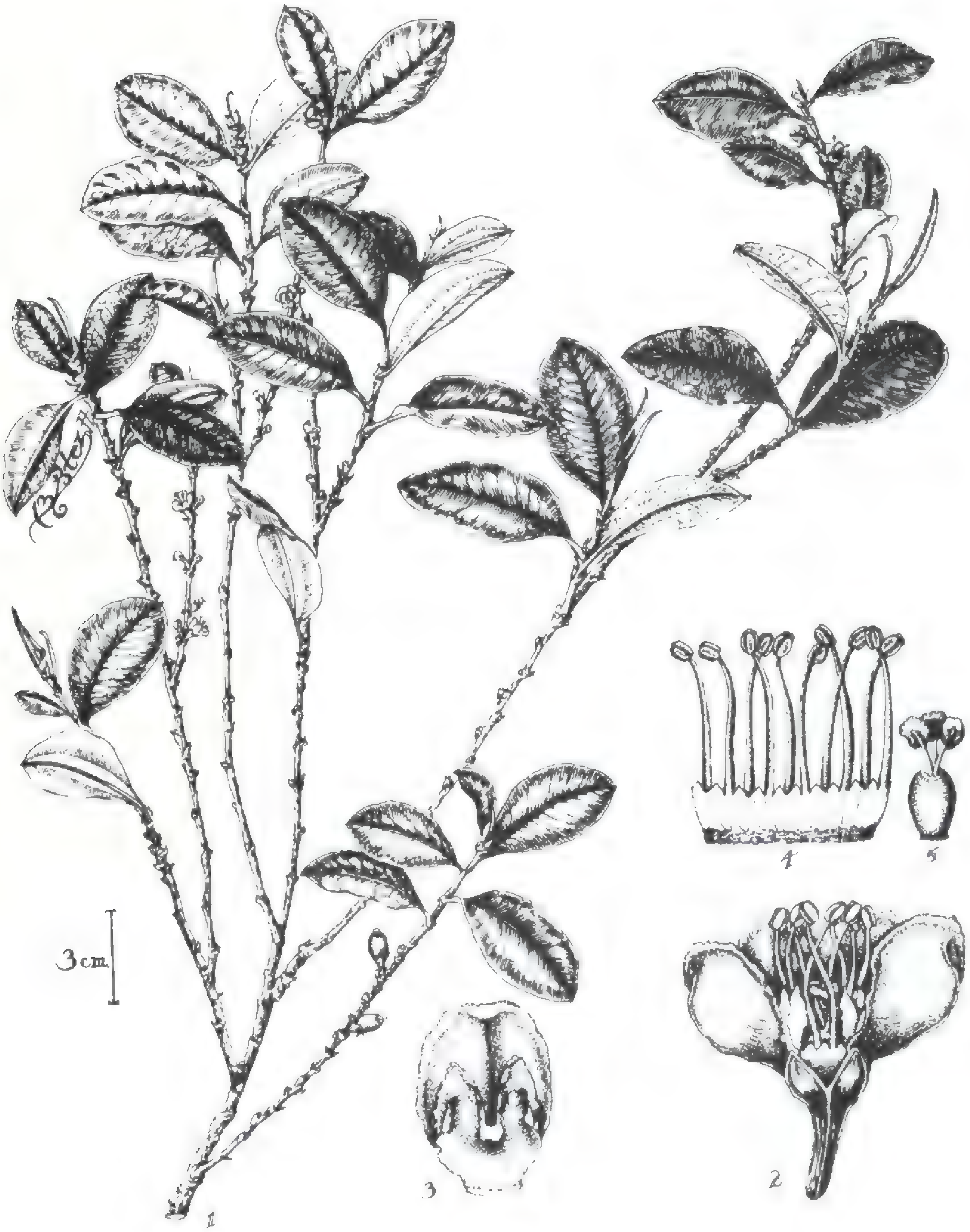

Plate 10. *Erythroxylum Coca* var. *Ipadu*. 1, Habit of plant. 2, flower with one petal removed. 3, petal showing ligule, adaxial view. 4, androecium, staminal tube opened up showing denticular margin. 5, gynoecium, showing large ovoid-oblong stigma. Drawing by L. T. Bates.

PLATE 11

Plate 11. *Erythroxylum Coca* var. *Ipadu.* Habit of plants in cultivation, Brillo Nuevo, Río Yaguasyacu, affluent of Río Ampiyacu, Prov. Maynas, Dept. Loreto, Peru. Photograph by R. E. Schultes.

PLATE 12

ERYTHROXYLUM novogranatense *var.* truxillense

(Rusby) Plowman

Plate 12. *Erythroxylum novogranatense* var. *truxillense*. 1, habit of plant, with flowers and fruits. 2, stipule, abaxial view. 3, flower, lateral view. 4, flower with petals and one sepal removed. Drawing by L. T. Bates.

PLATE 13

Plate 13. *Erythroxylum novogranatense* var. *truxillense*. Flowering branch of Trujillo coca at Collambay, Dept. La Libertad, Peru (*Plowman 5606*). Photograph by T. Plowman.

PLATE 14

Plate 14. *Erythroxylum novogranatense* var. *truxillense*. Plantation of Trujillo coca showing the use of *pacay* (*Inga Feuillei*) as a shade tree. Simbal, Dept. La Libertad, Peru (*Plowman 5600*). Photograph by T. Plowman.

PLATE 15

Plate 15. *Erythroxylum novogranatense* var. *truxillense*. Holotype of *Erythroxylum Hardinii* E. Machado from Crisnejas, near Uchiza, Dept. San Martin, Peru. Preserved at U. S. National Herbarium, Field Museum type neg. 55486.

BOTANICAL MUSEUM LEAFLETS
HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS, MARCH-APRIL 1979 VOL. 27, NO. 3-4

MONOPTERYX ANGUSTIFOLIA and ERISMA JAPURA:

Their Use by Indigenous Peoples in the Northwestern Amazon[1]

DARNA L. DUFOUR* AND JAMES L. ZARUCCHI**

The collection of wild vegetable foods is an integral part of the subsistence pattern of indigenous peoples in the tropical forest of South America. The role of these foods in the indigenous diet ranges from trail snacks and emergency foods to important sources of nutrients. Outstanding examples are palm fruits, palm hearts and Brazil nuts.

This paper is focused on two wild vegetable foods collected in the northwestern Amazon, the seeds of *Monopteryx angustifolia* Spruce ex Bentham and *Erisma Japura* Spruce ex Warming. Ethnobotanical information on these species is meager, but they are seasonally important food resources in the northwestern Amazon. The seeds of both are collected in large quantities, can be stored for long periods of time, and are available during the rainy season when animal protein is not particularly abundant.

[1] A preliminary draft of this paper, entitled "Vegetable Protein in the Diet of Indians in the Northwestern Amazon" by Darna L. Dufour, was presented at the sixth annual meeting of the Canadian Association for Physical Anthropology, Niagara-on-the-Lake, Ontario, November 1978.

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Botanical Museum Leaflets (USPS 404-990) Published monthly except during July and August by the Botanical Museum, Harvard University, Cambridge, Massachusetts 02138. Subscription: $25.00 a year, net, postpaid. Orders should be directed to Secretary of Publications at the above address. Second-Class Postage Paid at Boston, Massachusetts.

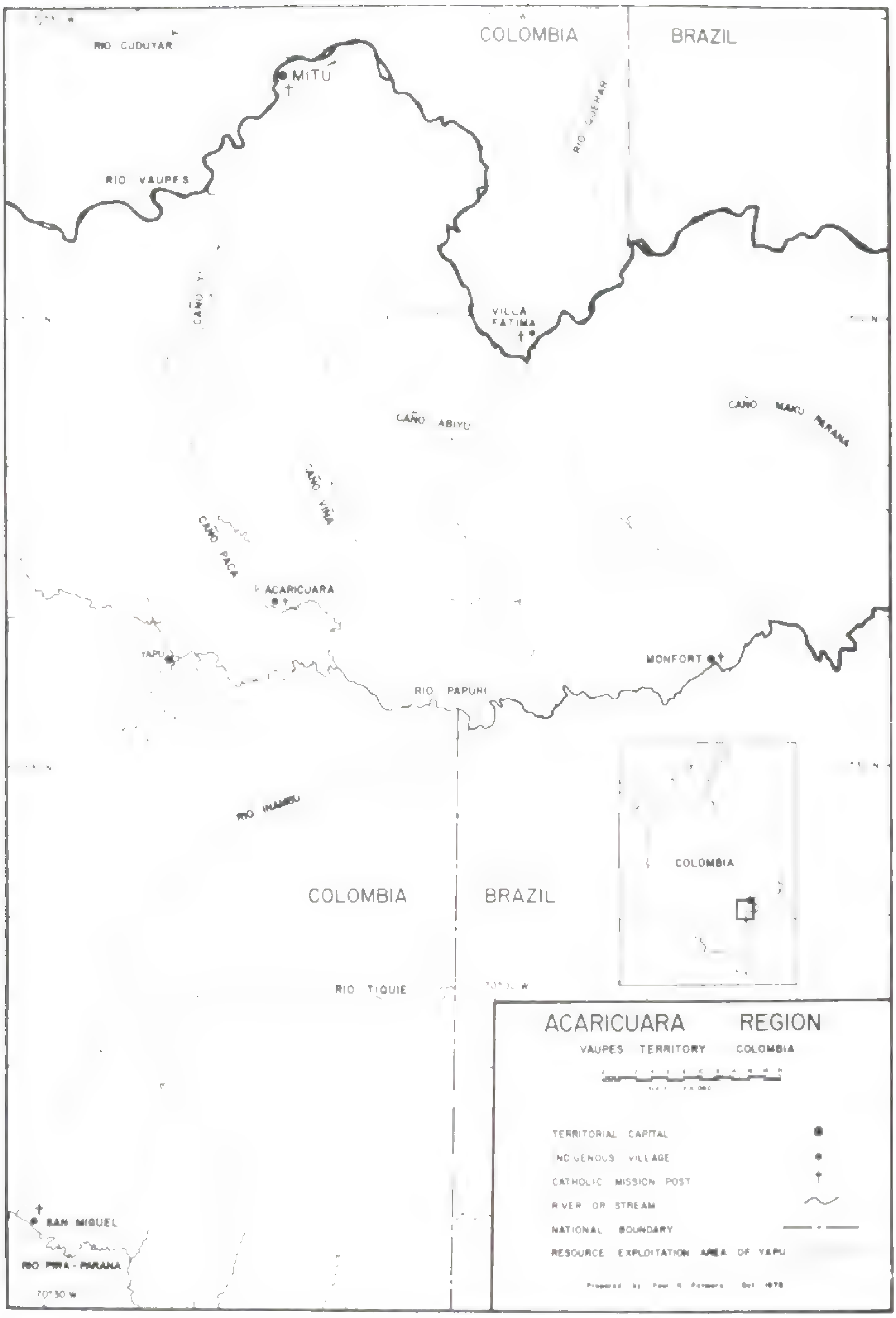


Figure 1. Map of the eastern Vaupés showing location of Yapú fieldsite.

The observations presented here are based on field work by the senior author with Tatuyo Indians living in the headwaters of the Papurí River at the village of Yapú, Vaupés, Colombia (figure 1).[2]

The Tatuyo[3] are root crop horticulturists relying on bitter manioc, *Manihot esculenta,* as a caloric staple. Dietary animal protein is obtained from fish, and to a lesser extent from game. Insects and other invertebrates are minor sources of protein. The availability of animal protein shows a distinct pattern of seasonal variation. In general, fish and game are more abundant in the dry season and less so at the height of the rainy season.

A wide variety of fruits, nuts and other vegetable products are collected and make important contributions to the diet. In addition to *Erisma* and *Monopteryx,* these include *Caryocar* spp., *Caryodendron orinocense, Euterpe* spp., *Hevea* spp., *Inga* spp., *Jessenia Bataua, Mauritia flexuosa, Micrandra* spp. and *Poraqueiba sericea.*

The upper Papurí area is transitional humid to very humid tropical forest with patches of caatinga and savanna vegetation. The terrain is predominantly rolling plain with occasional hilly uplands breaking the monotony of the skyline. Mean annual temperature is relatively high at about 26° C. and rainfall abundant at 340 cm. yr[4]. Seasonal differences in temperature and rainfall are not well marked. There is, however, a dry season of slightly less rainfall and slightly higher mean daily temperature from November to February. The rainy season begins in March and reaches a maximum in July.

Both *Monopteryx angustifolia* and *Erisma Japura* are common in virgin forest of the upper Papurí but not evenly dispersed

[2] The field work in the upper Papurí region was done by the senior author between 1976 and 1978. The research was carried out in collaboration with the Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá, and supported in part by an SSRC Dissertation Fellowship and NSF Grant BNS 75-20169.

[3] Tatuyo is the Spanish name for one of the linguistically distinct, exogamous groups of Tukanoan Indians in the northwest Amazon. In this paper, we refer to the inhabitants of the village of Yapú as Tatuyo. This is somewhat of an oversimplification, as there are other language groups represented in the village as well. However, the core of the village is Tatuyo, and the site of the village is within their traditional territory.

[4] General ecological and meteorological data from Instituto Geográfico "Augustín Codazzi" (1979:104). Bogotá, Colombia.

within it. *Monopteryx* is encountered most frequently on the banks of rivers, in areas not generally subject to inundation, and along small forest streams. *Erisma* is generally found away from the rivers on *terra firma.*

ERISMA, in the Vochysiaceae, is a genus of neotropical trees containing about sixteen species (Stafleu, 1954). The species are distributed from the Guianas to the Amazon basin. The genus is characterized by the fruits (see plates 16 and 17) which usually contain large wing-shaped calyx lobes. It was first described by Rudge in 1805 based on a collection by Martin from French Guiana.

The description of *Erisma Japura* Spruce ex Warming is based upon a large forest tree collected by Richard Spruce at Panuré [Ipanoré] on the Rio Uaupés, Brazil. Stafleu (1954) notes that the original material, *Spruce 2613*, consists of two separate collections: November 1852 (flowering) and February 1853 (fruiting). The specific epithet is derived from the local name for the tree. Spruce notes that "the kernels are pleasant eating", and that a "Japurá-butter" was made by the natives. Other species of *Erisma,* notably *E. calcaratum* and *E. uncinatum,* have been reported as sources of "Jaboty butter" or "Jaboty tallow" (Eckey 1954:562).

MONOPTERYX is a genus in the Leguminosae, tribe Sophoreae, which was described in 1862 by Spruce in Bentham's treatment of the family in Martius, *Flora Brasiliensis.* Spruce considered the genus to contain two species, *M. angustifolia* and *M. Uaucu,* both found in the northwest Amazon basin and upper Orinoco River area. Two flowering collections made by Spruce in the 1850's were the basis for the genus. Pittier in 1915 described *M. Jahnii* and provided a revised, although inaccurate, description of the genus. *Monopteryx Jahnii* is a synonym for *Fissicalyx Fendleri* Bentham (V. E. Rudd, pers. comm.).

Both *M. angustifolia* and *M. Uaucu* are large forest trees with characteristic buttresses. Spruce (1908:20) referred to these buttresses by the native word "sapopemas" [sapo, a root; pema, flat]. He gave the following account of *M. angustifolia* (1908: 335): "The trunk of this tree is 4 feet thick and 80 feet high. It has racemes of rose-coloured papilionaceous flowers. It grew on the rocky banks of the cataracts".

Recently a third species in the genus, *M. inpae,* has been described by Dr. William Rodrigues from the region of Manaus, Amazonas, Brazil. (Rodrigues, 1975).

METHODS OF DATA COLLECTION

The data were gathered as part of an energy flow study of the village of Yapú. All foods brought into the village were routinely weighed on a spring scale, capacity 30 kg. The edible portion was determined as percent edible by weight, using a scale accurate to ± 1 g.

Collections of all important food plants were made in the general area of the village. Voucher specimens are deposited in the herbarium of the Instituto de Ciencias Naturales, Bogotá, Colombia (COL); a duplicate set is deposited in the Economic Herbarium of Oakes Ames, Botanical Museum of Harvard University, Cambridge, Massachusetts (ECON).

Foods of unknown nutrient composition were prepared in the field for later biochemical analysis in Bogotá. Indigenous methods of preservation, such as drying, smoking, and fermenting, were used when possible. In other cases, benzoic acid was used as a preservative at a concentration of 3% by weight.

Dietary surveys were conducted on randomly chosen subjects. The method used was a 24-hour weighed dietary survey. The observer accompanied each subject for a 24-hour period and weighed all food portions on a 500 g. capacity dietary scale accurate to 1 g. Food eaten at a site where the dietary scale was not available was weighed on a 16 oz. spring scale or carefully estimated from a table of mean weights of food portions.

OBSERVATIONS ON THE UPPER PAPURÍ

Erisma Japura is known in Tatuyo as "batí" and in Lingua Geral as "yapurá"[5]. Its pale yellow flowers appear in the dry

[5] The name "japurá" by Spruce (1908:399) is probably a variant of the pronunciation or spelling of "yapurá" as the glide y in Latin America alternates with the fricative zz (Pers. comm. Arthur P. Sorensen, Jr.).

season, and the fruits are ready for collection toward the middle of the rainy season[6]. The fruits are winged and roughly oblong in shape. The average weight per fruit is 14 g., most of which is the woody pericarp. The edible portion of the fruit is nut-like, reminiscent of a large cashew in color and texture and, when fresh, accounts for about 24% of the total fruit weight (see plate 20).

The fruits are gathered from the forest floor complete with woody pericarp. The Tatuyo are selective in their gathering and avoid malformed, worm-infested and sprouted fruits. In a sample gathered by the author, it was found that about 20% were deemed inedible by Tatuyo standards. The trees are dispersed in the forest surrounding the village, but there are well-known areas which have a somewhat higher frequency of trees than others.

Monopteryx angustifolia is referred to by the Tatuyo as "jimio" and by neighboring Tukano speakers as "simio". The tree flowers toward the end of the dry season in January and February and, like *Erisma Japura,* fruits toward the middle of the rainy season in May and June[7]. The fruit is a long flattened pod, approximately 18–20 cm. long with an average weight of over 50 g. (plate 21). The pod is cracked open by the heat of the sun, allowing the seed to fall free to the ground. In the forest during the heat of the day, one can hear the characteristic crack of the pod, followed by the sound of the pod and seed falling through the leaves overhead.

The pulse is a large flattened disk measuring approximately 4.5 × 3.5 × 1 cm., with an average weight of about 7 g. The seed coat is usually slipped off as the seed is collected. Sprouted seeds, with sprouts of up to 3 or 4 cm., are acceptable and frequently collected toward the end of the harvest season.

As is also true of *Erisma,* the trees are not uniformly distrib-

[6] Flowers were collected in January 1977. Fruits were collected from a different tree in late April 1977. In 1978, the Tatuyo said that the trees were not going to flower, and the first flowers located appeared in mid March.

[7] Fruits were collected in April 1977. A late-fruiting tree was spotted the first of August. As was the case with *Erisma,* the Tatuyo said that the trees were not going to flower in 1978. However, a flowering tree was located on March 21, 1978.

uted in the forest, and the location of prime collecting sites is well known by the Tatuyo.

SEED COLLECTION

In 1977, the harvest of *Erisma* and *Monopteryx* overlapped during an eight-week period toward the middle of the rainy season. Women collected small amounts of seeds as they traveled to and from their cultivated plots; and, during the height of the harvest, both men and women devoted entire working days to seed collection. Figure 2 shows the cumulative collection rates for both seeds from April 12 through June 12, 1977. The total amount of *Erisma* collected was 1311 kg. Considering that this seed has an edible portion of about 24%, this represents some 314 kg. of edible food. A total of 723 kg. of *Monopteryx* seed was collected during the same period. This is considered to be 100% edible as collected. During a period of intensified collection in the fifth week, some 310 kg. of *Erisma* fruits and 180 kg. of *Monopteryx* seeds were gathered by the men of the village as part of a traditional "Yuruparí" ritual[8].

SEED UTILIZATION AND STORAGE

Erisma. During the harvest season, small quantities of *Erisma* seeds are eaten raw or toasted. They have a pleasant although occasionally bitter taste. Eaten raw, they leave a thin film of wax-like fat on the roof of the mouth.

Collected in quantity, *Erisma* seeds are cooked and prepared for storage in the form of a "butter", referred to below as "batí-butter". The method of preparation is as follows: the fruits are boiled in water until the inner seed is cooked and the woody pericarp softened. The outer shell, or pericarp, is then easily removed, taking with it the thin skin covering the seed. The

[8] "Yurupari" is used here as a general term for a type of dance festival communal ritual common in the northwest Amazon involving the use of sacred trumpets and the exchange of forest fruits. Wallace (1889:241), who traveled the Vaupés River in the 1850's, was the first to describe these rites. A recent analysis of this ritual among the neighboring Barasana is provided by Hugh-Jones (1974).

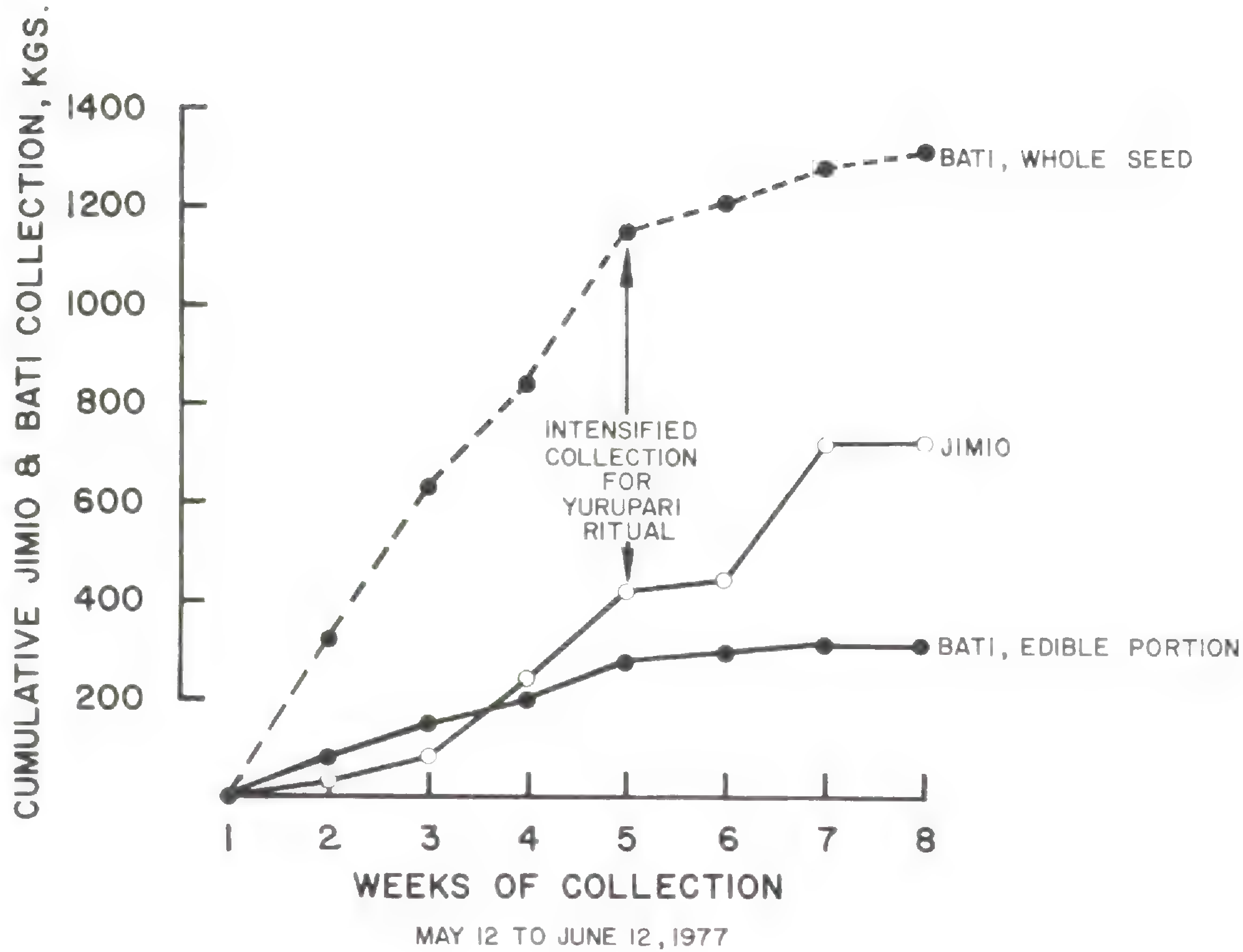


Figure 2. Cumulative collection rates for "jimio" (**Monopteryx angustifolia**) and "bati" (**Erisma Japura**) during the 1977 harvest at Yapú.

peeled seeds are washed thoroughly in a basket. Once washed, the seeds are reboiled until very soft (about 45 minutes) and then, while still hot, either pressed through a basket sieve or crushed to a butter-like consistency with a mortar and pestle. The crushing of the seeds is done quickly so that they are still warm when buried in a leaf-lined pit in the ground.

Storage pits used for batí-butter are dug neatly into the house floors in areas free from ants and other insects. The pits are about 30 cm. in diameter and of sufficient depth to allow the stored food to be covered with 6 to 8 cm. of soil. A typical pit is approximately 60 cm. deep. Once dug, the pit is carefully lined with the juvenile leaves of a tree tentatively identified as *Clathrotropis macrocarpa* (Leguminosae). This leaf, known in Tatuyo as "miapu", is commonly used to package food. The leaves are placed against the sides of the pit with the lower surface of the leaf toward the pit wall, petiole up, and the pointed apex bent to cover the pit floor. Additional leaves are bent in the pit to cover the pit floor thoroughly. When complete, the leaf-lining is 3-, or 4-leaves deep at all points and prepared in such a way that the inner leaves are lower in the pit than the outer ones. The batí-butter is placed in the pit and compacted. The leaves are then wrapped over it in a systematic manner, beginning with the inner leaves and finishing with the outermost ones. When complete, the entire leaf packet is covered with soil.

An estimated 85% of the *Erisma* collected in the period of observation was prepared as batí-butter and stored in leaf-lined pits in house floors. According to the Tatuyo, this butter can be stored for up to a year if proper care is exercised in changing the leaf-lining periodically and in securing insect-free storage pits. Under such anaerobic conditions, the butter ferments, developing a sharp taste and an odor not unlike a strong cheese. This odor is no doubt what Spruce referred to in his note on the Kew specimen: ". . . People who can get over its vile smell (which is never lost) find it exceedingly savoury."[9] The Tatuyo do indeed relish the strong flavor it attains after prolonged storage. Batí-butter, either fresh or fermented, is prepared by cooking it with water into a thick dip or adding it to "puné", a fish and manioc

[9] From Stafleu, 1954:474.

porridge[10]. As stored supplies of batí-butter decrease after the harvest, they become increasingly precious as food. It is then that women dig up portions of their supply for special occasions and as gifts.

One further use of batí-butter should be mentioned. The Tatuyo occasionally prepare a paste of batí-butter, charcoal, and the larvae of an unidentified species of wasp, which they use as a fish poison. The paste is fashioned into pellets which the fisherman throws into the stream as both bait and poison for "boteka" (*Leporinus alternus*[11]), a much sought-after river fish.

In the latter part of the rainy season, in late August and September, the Tatuyo collect Lepidoptera larvae and pupae known as "batiya" (family: Noctuidae[12]) in great abundance from *Erisma* trees further downstream on the Río Papurí and in the area of Acaricuara[13]. The larvae are collected as they descend from the canopy to pupate in the forest floor. According to informants, these trees are identical in flower and fruit to the collections made at Yapú and are assumed to be *Erisma Japura.*

Monopteryx. During their harvest, *Monopteryx* seeds are occasionally eaten peeled and roasted, although they have an exceedingly bitter taste. The vast majority of the harvest, however, is prepared for consumption as follows: the flexible seed coats are removed if this was not already done when the seeds were collected. Each seed is then split neatly in half and the remaining paper-thin integument peeled off with the aid of a knife or fingernails. This peeling is tedious and is most often done by groups of women in the early evening. The split pulses are then softened by boiling in water for a considerable period of

[10] Porridges of fish and manioc starch are very common dishes in the northwest Amazon. They are referred to in Spanish as "muñica". The general term in Tatuyo is "puné".

[11] Determined by Germán Galvis V., Unidad Ictiología, Sección Zoologia, Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá. A voucher specimen is deposited at the same institution.

[12] Determined by D. M. Weisman of the Insect Identification and Beneficial Insect Introduction Institute of the United States Department of Agriculture.

[13] The traditional spelling is Wacaricuara, but current usage is now Acaricuara.

time, up to three or more hours. As the pulses boil, a small quantity of a light green oily substance is liberated, forming a scum on the sides of the pot. The cooked pulses are edible but still very bitter. To remove the bitter taste, they are soaked in the river for two days. This soaking is done by emptying the cooked pulses into a large, loosely woven basket and placing the basket in the river so that the water circulates through it.

Prepared pulses are eaten plain or as "jimio janique", a drink made by adding mashed pulses to the boiled liquid removed from freshly grated manioc (*Manihot esculenta*).

Prepared pulses not destined for immediate consumption are mashed and buried in leaf-lined pits in much the same way as described above for batí-butter. Generally, however, the leaves of *Phenakospermum guyanense* (Musaceae) are used to form the leaf packet, and the pulses are not heated prior to burial. If proper care is exercised, *Monopteryx* can be stored in this manner for about six months. Under such anaerobic storage conditions, *Monopteryx* ferments, developing a sharp, pleasant taste. In the fermented state, it is occasionally eaten plain but most often prepared as "jimio janique". An estimated 50 to 75% of the total amount of *Monopteryx* seed collected during the 1977 harvest was stored for periods of time in the ground.

COMPOSITION OF SEEDS AND SEED PRODUCTS

In order to determine the composition of *Monopteryx* and *Erisma* seeds, samples of freshly cooked seed were prepared as for eating and preserved with benzoic acid. Duplicate samples of each were stored in leaf-lined pits as described above, until just prior to shipment, at which time they were removed to sterile glass jars and sealed with paraffin wax. The fermentation time of the pit-stored samples was four to six weeks. The results of food composition analyses of "jimio" and "batí" are shown in Table 1. The analyses were done on partially dry material by the Instituto Colombiano Agropecuario in Bogotá.

As indicated in Table 1, *Erisma* seed is high in fat (70.5g./100g.), and food energy (768 kcal. 100g.). Fermentation increases the fat content (to 80.1g. 100g.) and the energy value (to

TABLE 1
COMPOSITION OF BATI-BUTTER AND JIMIO, 100 GRAMS EDIBLE PORTION

Food	Moisture[a.] %	Food Energy kcal.	(MJ)	Protein g.	Fat g.	Carbohydrate Total g.	Carbohydrate Fiber g.	Ash g.
Bati-butter (*Erisma Japura*)								
Fresh cooked	(64) 2.3	768	(3.2)	9.4	70.5	13.3	1.8	4.5
Cooked, fermented	(54) 2.5	850	(3.6)	9.9	80.6	5.8	1.3	1.2
Jimio (*Monopteryx angustifolia*)								
Fresh cooked	(78) 5.7	554	(2.3)	12.6	23.2	53.0	3.4	5.5
Cooked, fermented	(76) 3.1	579	(2.4)	17.5	26.6	51.7	2.9	1.1
Nuts and oil seeds[b.]	3.7	596	(2.5)	17.0	54.3	21.7	3.7	3.3
Pulses[c.]	11.3	354	(1.5)	25.4	5.0	55.0	5.5	3.3

a. Value in parentheses is the percent moisture of food as prepared for eating. Analysis was done on partially dry material.

b. Mean value for 8 nuts and oil seeds. See note 14.

c. Mean value of 6 cultivated pulses. See note 15.

850kcal./100g.). In comparison with average values for eight cultivated nuts and oil seeds[14], batí-butter is considerably higher in fat and calories and lower in protein. On a dry weight basis, the values for batí-butter are similar to those for pecans (*Carya illinoensis*) (Wu Lueng and Flores, 1961:68–71).

Monopteryx is moderately high in fat (23.2g/100g) and protein (12.6g./100g.). In a fermented state, it is slightly higher in protein (17.5g./100g.) and food energy (579 kcal./100g.). In comparison with average values for six cultivated pulses, *Monopteryx* is relatively high in fat and low in protein[15].

The protein values reported here are for crude protein only. Although it is a question of much interest, the biological value of *Monopteryx* protein is not currently known. The oil composition of both *Monopteryx* and *Erisma* seeds is also of interest. The oil of *Monopteryx angustifolia* is not well known, but it has all the properties of a good edible oil (Mors and Rizzini 1966:27). Little is known of the oil of *Erisma Japura*, but two closely related species, *E. calcaratum* and *E. uncinatum*, have been shown to have oils of good quality (Pesce 1941:91–94).

CONSUMPTION PATTERNS

The consumption of *Monopteryx angustifolia* and *Erisma Japura* was measured during the 1977 May–June harvest period in the village of Yapú. The 24-hour weighed dietary survey method was used to record food intakes on a sample of eighteen adults. During the survey period, *Monopteryx* seeds were consumed freshly prepared as the main part of a meal and as a beverage. *Erisma* seeds were also eaten freshly cooked as the principal dish in a meal and, in two instances, as a dip made of fermented batí-butter.

In terms of the total food intake, the two seeds accounted for

[14] Values shown are the average values for the following eight nuts and oil seeds: *Anacardium occidentale*, *Bertholletia excelsa*, *Corylus* spp., *Helianthus annuus*, *Pinus cembroides*, *Prunus Amygdalus*, *Sesamum indicum*, and *Terminalia Catappa* (Wu Lueng and Flores, 1961:68–71).

[15] The values shown are the average values for the following six cultivated pulses: *Cicer arietinum*, *Glycine Max*, *Phaseolus vulgaris*, *Pisum sativum*, *Lens* spp., and *Vicia Faba* (Wu Lueng and Flores, 1961:66–68).

about 9% of the mean daily caloric intake and about 10% of the protein intake. Of the two seeds, *Monopteryx* was consumed more frequently and in larger quantities. It accounted for about 70% of the total caloric and over 80% of the protein contribution of the two seeds.

There is a general tendency among the Tatuyo to use vegetable products gathered from the wild in order to supplement meals in which there is little or no animal protein. This pattern was clear in the consumption of fresh *Monopteryx* seed. Only six out of the eighteen adults surveyed during the dietary study consumed fresh cooked *Monopteryx* seeds as part of a meal. In all of those meals, animal protein was not only absent but unavailable in the household. The exception was one meal containing a small amount of roasted insects contributing less than 1 g. of animal protein. The mean per capita intake of these individuals, five women and one man, was about 300 g. of fresh cooked seed, giving them an average intake of about 370 kcal. (1.5 MJ) and 9 g. crude vegetable protein.

The highest consumption of *Monopteryx* in this group of six was one woman whose intake over a 24-hour period was 548 g. of fresh seed, and an additional 57 g. as "jimio janique", making the daily total 605 g. of fresh seed. The seed provided her with about 750 kcal. (3.1 MJ) and 17 g. vegetable protein. She explicitly stated that she was eating "jimio" because there was no fish or meat available.

The use of *Monopteryx* seed as a beverage (jimio janique) tends to be reserved for days of low animal protein availability. This is especially true of stored supplies of fermented "jimio" after the harvest. This investigator's carefully stored supply, set aside early in the harvest specifically for biochemical analysis, proved to be no exception. One dreary rainy morning when we had breakfasted without fish or meat, the family with whom we were living dug up the sample of fermented "jimio" and prepared it as "jimio janique" so that we would not be hungry.

Like *Monopteryx*, fresh *Erisma* seed is also consumed at meals in which there is little or no animal protein available. The dietary survey data, however, indicate a much lower consumption of these seeds. The mean per capita intake of the five out of the eighteen adults in the dietary survey who consumed freshly cooked *Erisma* seed was 44 g. This provided them with approximately 125 kcal. (0.5 MJ) and 1.5 g. crude vegetable protein. Since both *Erisma* seed and batí-butter are very high in fat, they are more important as sources of calories than of vegetable protein.

The ability of the Tatuyo to store both *Monopteryx* and *Erisma* in a fermented state extends their availability. The harvest period lasts into the mid-rainy season when neither hunting nor fishing is very productive. Stored supplies of both seeds are important food resources at the height of the rainy season in July, when animal protein of almost any kind is difficult to obtain.

Stored supplies of "jimio" in the village were almost all exhausted by late August, two months after the harvest. One household held a supply for two additional months. Batí-butter is eaten in smaller amounts than "jimio" and stored supplies were stretched to at least six months in many households. Much of the batí-butter, however, was eaten during the height of the rainy season, even though it was explicitly stated by the Tatuyo that it was being saved to eat with fish porridge in October when fish are more abundant.

Our purpose here has been to describe and illustrate the use of two little-known food plants in the diet of indigenous peoples in the northwestern Amazon. By doing so, we suggest that closer attention be paid to collected vegetable foods. Although the caloric staple of these people is provided by cultivation, and animal protein is obtained from wild fauna, gathered vegetable foods are important supplementary nutritional resources.

ACKNOWLEDGMENTS

We are indebted to Dr. Polidoro Pinto E., Director of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá, and to the specialists at this institute for their generous hospitality and technical assistance. We would also like to thank Drs. V. E. Rudd, R. S. Cowan, and J. J. Wurdack for their assistance in verifying plant determinations; Dr. Gerardo Pérez Gómez, Departamento de Química, Universidad Nacional de Colombia, for his help with the biochemical analyses; Dr. Lloyd Knutson, Chairman of the Insect Identification and Beneficial Insect Introduction Institute, United States Department of Agriculture, Beltsville, Maryland, for his cooperation in the identification of insect specimens; and to Dr. Arthur P. Sorensen, Jr. for reading a draft of the manuscript.

In particular, the senior author would like to express her gratitude to Dr. Gonzalo Correal U., Sección de Antropología, Universidad Nacional de Colombia, for his support and supervision during the field project, and to her husband, Paul N. Patmore, who provided immeasurable help in the field study.

REFERENCES

Eckey, E. W. 1954. VEGETABLE FATS AND OILS. Reinhold Publishing Corp., New York.

Hugh-Jones, S. 1974. MALE INITIATION AND COSMOLOGY AMONG THE BARASANA INDIANS OF THE VAUPÉS AREA OF COLOMBIA. Ph.D. Dissertation, University of Cambridge, Cambridge, England.

Instituto Geográfico "Agustín Codazzi". 1970. ATLAS BÁSICO DE COLOMBIA. Banco de la República, Bogotá, Colombia.

Mors, W. B. and C. T. Rizzini. 1966. USEFUL PLANTS OF BRAZIL. Holden-Day Inc., San Francisco.

Pesce, C. 1941. OLEAGINOSAS DA AMAZONIA. Revista da Veterinaria, Belém, Pará, Brazil.

Pittier, H. 1915. On the characters and relationships of the genus Monopteryx Spruce. *Bull. Torrey Bot. Club 42*: 623-627.

Rodrigues, W. A. 1975. Contribuição para o estudo do gênero **Monopteryx** Spr. ex Benth. (Leguminosae) da Amazônia. *Acta Amazonica 5*(2): 153-155.

Spruce, R. in G. Bentham. 1862. in Martius, FLORA BRASILIENSIS *15*(1): 307 t. 122.

Spruce, R. in E. Warming. 1875. in Martius, FLORA BRASILIENSIS **13**(2): 109 t. 21 fig. 1.

Spruce, R. 1908. NOTES OF A BOTANIST ON THE AMAZON AND ANDES. 2 Vols. A. R. Wallace, editor, Macmillan and Co., Ltd., London.

Stafleu, F. A. 1954. A Monograph of the Vochysiaceae IV. Erisma. *Acta Bot. Neerl. 3*(4):459-480.

Wallace, A. R. 1889. A NARRATIVE OF TRAVELS ON THE AMAZON AND RIO NEGRO. Second edition. Ward, Lock and Co., London.

Wu Lueng, W. and M. Flores. 1961. TABLA DE COMPOSICIÓN DE ALIMENTOS PARA USO EN AMERICA LATINA. Instituto de Nutrición de Centro America y Panamá and Interdepartmental Committee on Nutrition for National Defense, U.S. Government Printing Office, Washington, D. C.

PLATE 16

Plate 16. Illustration of **Erisma Japura** Spruce ex Warming from Martius, FLORA BRASILIENSIS.

PLATE 17

Plate 17. Fruit of **Erisma Japura** Spruce ex Warming.

PLATE 18

Plate 18. Illustration of **Monopteryx angustifolia** Spruce ex Bentham from Martius, FLORA BRASILIENSIS.

PLATE 19

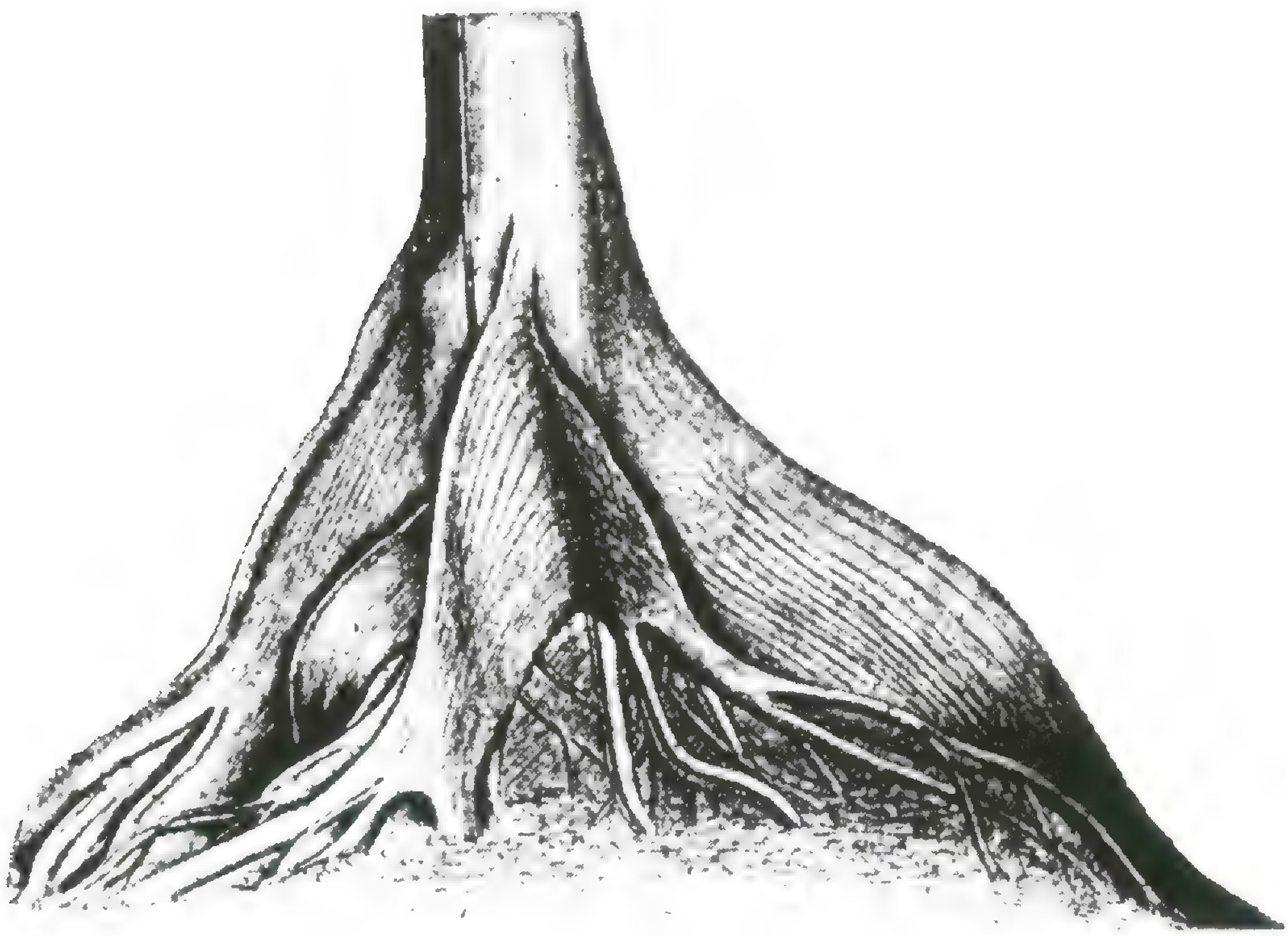


Plate 19. Buttresses of **Monopteryx angustifolia** Spruce ex Bentham from Spruce's NOTES OF A BOTANIST ON THE AMAZON AND ANDES, page 335.

PLATE 20

Plate 20. Freshly harvested leaves and fruits of **Erisma Japura.** One fruit toward the center of the group is split open to show the edible kernel. Photograph by Paul N. Patmore.

PLATE 21

Plate 21. Seeds and fruits of **Monopteryx angustifolia** Spruce ex Bentham. One pod has been opened to demonstrate the relative size and position of the seed. Photograph by Paul N. Patmore.

PLATE 22

Plate 22. Baskets of **Erisma Japura** and **Monopteryx angustifolia** gathered in preparation for the Yuruparí ceremony. Photograph by Paul N. Patmore.

Botanical Museum Leaflets
March–April 1979 Vol. 27, No. 3–4

STUDIES IN THE GENUS MICRANDRA II*

Miscellaneous Taxonomic and Economic Notes

Richard Evans Schultes

During the course of monographic studies on the euphorbiaceous genus *Hevea,* source of most natural rubber of commerce, related genera—*Micrandra* (including *Cunuria*), *Vaupesia* and *Joannesia*—have been investigated in the field and herbarium. Sundry notes of interest from the viewpoints of taxonomy, floristics or economic value of these genera have accumulated. The following notes concerning various species of *Micrandra* are offered towards an eventual monographic treatment of the genus.

Little is known about the commercial value of the latex of *Micrandra.* It has therefore seemed appropriate to publish a short survey of the possible utilitarian importance of the genus based upon studies of the literature, field work and significant notes on herbarium specimens.

During my taxonomic studies, numerous herbarium collections have turned up which, for one reason or another, merit special citing. Amongst these specimens are those of the late Paul H. Allen who worked in the Colombian Vaupés on rubber in the early 1940's during the shortage of this commodity due to the war emergency. Allen's collections are notable because of his extremely detailed field notes.

This study has been assisted by a grant from the Cabot Foundation of Harvard University.

UTILIZATION OF MICRANDRA AS A SOURCE OF RUBBER

As a source of commercial rubber, *Micrandra* is of very secondary, if any real, importance. That rubber is produced from these trees at the present time is doubtful, but an appreciable amount from several species may have found its way into

*The first contribution in this series appeared in *Bot. Mus Leafl., Harvard Univ.* 15(1952)201–222.

commerce in the past, especially during periods of feverish need to increase production.

To judge from the literature, one might assume that *Micrandra* had enjoyed a relatively major role in the world rubber supply. Most literature reports of the exploitation of *Micrandra* for rubber are either without foundation or else are erroneous repetitions of one or more of the earlier botanical explorers who noted this exploitation as an isolated observation not connected with a critical economic study of the industry as a whole.

In the earlier literature, it seems that there are but two reports on *Micrandra* by field botanists with first hand experience and whose statements should, for this reason, carry greater weight than most other literature references. Richard Spruce, who collected the type material of the genus *Micrandra* (including *Cunuria*) in the Rio Negro basin of Amazonian Brazil, failed to mention the utilization of *Micrandra* latex in commercial rubber production, an industry which, during his sojourn in the region (1851 1854), was beginning its great development on the basis of seringa or *Hevea*. In his posthumously published notes, he wrote (Spruce, R.: [ed. A. R. Wallace] "Notes of a botanist on the Amazon and Andes" 1 (1908) 508): "On the Vaupés, I met with two trees (*2427, 2479 hb.*) of a genus apparently not far removed from *Siphonia* [*Hevea*], which yield pure rubber and are also called by the Indians *xeringui* . . ." E. Ule, who carried out extensive surveys on rubber plants in the Amazon regions in the early years of the present century, stated (Ule, E.: "Veranlassung und Verlauf von Ules Expedition nach den Kautschukgebieten des Amazonenstromes" in Tropenpflanz. Beih. 6 (1905) 1) that, although *Micrandra* produces a good rubber, the trees are seldom exploited because the latex cannot be mixed with that of *Hevea* and because it is too troublesome for the rubber tappers to cut it to the exclusion of *Hevea*. In another report on his rubber studies, Ule (Ule, E.: "Die Kautschukpflanzen der Amazonas Expedition und ihre Bedeutung für die Pflanzengeographie" in Engler Bot. Jahrb. 35 (1905) 670) reported merely that *Micrandra siphonioides* is found to be frequent in the rubber forests of the Rio Negro and elsewhere.

From these two references, apparently, has stemmed a flood of reports, occasionally highly misleading, in both popular and technical literature. Some include *Micrandra* in lists of rubber-yielding species. While this is strictly correct, the unfortunate impression is often given that *Micrandra* should be counted amongst the commercial sources or rubber (Clouth, F.: "Rubber, gutta-percha and balata" (1903) 30; Walle, P.: "Au pays de l'or noir, le caoutchouc de Brésil," ed. 2 (1912) 124; Carneiro, A. J. de Souza: "Rubber in Brazil" (1913) 8; Ferguson, Jr. ed. 3: "All about rubber and gutta-percha" (1899) iii, clxxxiv). This last source states that it grows along the most "steamy valleys" of the Amazon and is indiscriminately cut by the natives "to furnish Pará rubber"! Others definitely assert that *Micrandra*-rubber was actively exploited and entered into commerce either alone or as an adulterant of *Hevea*-rubber (Morris, D.: "Plantes produisant le caoutchouc du commerce" in Bull. Soc. Etudes Colon. no. 5 (1899) 178; Ehrhardt, K.: "Die geographisch Verbreitung der für die Industrie wichtigen Kautschuk- und Guttaperchapflanzen" (1903) 26; Seeligmann, T., G. Lamy-Torrilhon & H. Falconnet: "Indian rubber and gutta-percha," ed. 2 (1910) 15; Ramondt, A. S.: "Caoutchouc, guttah-pertja en balata (1907) 6). Still others quite correctly assert that rubber from *Micrandra* is said to enter the trade, passing as a grade of Pará rubber (*Hevea*), but that no precise information on this point can be cited to substantiate the report (Warburg, O.: "Les plantes à caoutchouc et leur culture" (1902) 21, 48; Jumelle H.: "Les plantes à caoutchouc et à gutta" (1903) 60; Reintgen, P.: "Die Geographie der Kautschukpflanzen" (1905) 25; Schidrowitz, P.: "Rubber" (1911) 33; ed. 2 (1916) 33; Brown, H.: "Rubber, its sources, cultivation and preparation" (1914) 33). Occasionally, a report will credit *Micrandra* with producing in the *Hevea*-rubber districts of the Amazon the most highly esteemed grade of rubber (Pontio, M.: "Analysis du caoutchouc et de la gutta-percha" (no date) 8).

During my twelve-year study of lacticiferous plants in the Amazon Valley—especially in northwestern Brazil and southeastern Colombia—I saw no evidence of exploitation of *Micrandra* trees for their rubber. This was true even in areas where *Micrandra* was extremely abundant and easily accessible. Furthermore, I saw no evidence, such as scars on the bark, that such exploitation had been carried on in the past, although former workers may well have felled the trees for ringing and would, therefore, have left no traces.

The period of my field work (1941–1953) coincided with a renaissance of the wild rubber industry with high prices due to the world shortage of the commodity during and immediately after the war. I paid very special attention to *Micrandra*, since I was collecting material for a monographic study of *Hevea* and its relatives, such as *Micrandra*. Had any tapping of *Micrandra* been under way or had it formerly been carried out in the northwest Amazon, I believe that some indication of it could not have escaped my ken. The late Dr. Adolfo Ducke, much of whose half century of botanical exploration in the Amazon of Brazil was dedicated to the study of latex-yielding trees, failed to mention on any of his field labels or in his writings the use of *Micrandra* as a commercial source of rubber. It would seem, therefore, that we are wholly justified in assuming that *Micrandra* is not now, and probably has not in the past been, exploited in either the Colombian or the Brazilian sectors of the Amazon basin as a major source of rubber.

Fortunately, however, we now have definite and reliable information concerning the former use of *Micrandra* as a rubber tree. It appears that *Micrandra* was tapped in Venezuela, in localities where the trees abound and where rubber-yielding species of *Hevea* are lacking. Two reports from field technicians to Mr. Oliver E. Nelson, Special Representative of the Rubber Development Corporation in Caracas, give valuable information on *Micrandra* in Venezuela. Copies of these reports are preserved in the National Archives in Washington, D. C. and in the Botanical Museum of Harvard University.

On May 4, 1943, Mr. Harry J. Fuller, writing on his exploratory trip to the Paragua-Caurá area of southern Venezuela, stated:

> Caracas to Ciudad Bolivar by air, thence to La Paragua on the Paragua River by truck, thence by boat up the Paragua River. First *Micrandra* at the Auraima rapids. Río Oris enters the Paragua at Auraima and was ascended for some distance. Thick stands of *Micrandra*. Continued up Paragua. Numerous small caños enter the Paragua. *Micrandra* much more numerous on these caños than on banks of Paragua itself. Two days above the Oris reached Río Torono. About 300 yards wide at confluence. A half day up the

Torona is an abundance of *Micrandra*. Established camp and started experiments.

Expt. I. 2 men with machetes tapped 10 trees in 3½ hours, on one side up to 7 ft. 475 grams of rubber after 3 weeks air drying. Men walked a total of 350 yds. Fuller thinks that tapping to 20 or 30 ft. with spurs for climbing would make it possible for one man to produce 1 to 1½ kilos per day.

Expt. II. Two Indians tapped 8 trees in 3 hours to a height of 5½ ft. 350 kg. rubber after 3 weeks air drying.

Expt. III. 75-foot tree felled. Diam. 19 in. at 3 ft. Two men made transverse cuts on trunk with machetes at 3-inch intervals, extending about 2/3 circumference. Cuts extended to main branches, about 45 ft. from ground. Three hours required. Less than 1 kg. rubber (after air drying) collected next day.

Continued up Paragua. Major rivers with large concentrations of *Micrandra* are: Río Carapo and its tributaries. Río Carúm and its tributaries. Río Marí which is only 1 km. from the Río Capapaipa, an important tributary of the Caurá. The best way of reaching the upper Caurá is by way of the Paragua and its tributary, the Marí, from which, by 1 km. portage, Caurá basin may be reached.

Micrandras grow close to rivers and caños, rarely at distances greater than 300–400 yds. Number of Micrandras increases as one ascends the Paragua. Not scattered but commonly grow in groups of 5 to 25 or 30 trees, possibly the offspring of a single seed, developing from root sprouts. Seldom found isolated. Individual trees in a group 10 to 50 yds. apart.

Fuller did not get into the upper Caurá but had reliable information that *Micrandra* was the only rubber tree there and is present in considerable quantity.

On July 8 of the same year, Mr. William O. Hansen, reporting on his studies of *Micrandra* in the Territorio Federal del Amazonas in Venezuela, had the following data to offer:

Rubber known locally by several names:
1. "Caucho de Gauca" because the Gauca or Guacamaya (macaw parrot) eats the fruit.
2. "Caucho de Invierno" (wet season rubber), because it yields best in the wet months.
3. "Arara Seringa" which seems to be the Portuguese or Yeral Indian equivalent for Caucho de Guaca. Reported used commonly in Brazil.
4. "Seringa Irarí." Used from Manáos north to the Colombian and Venezuelan borders wherever the Yeral Indian dialect is spoken. The word "Irarí" means unreal or imitation and is used to distinguish *Micrandra* from *Hevea,* the real rubber.

Micrandra is said to exist in most parts of the territory. In groups of 20 to 50. Mostly in low land flooded yearly. Reported along the Orinoco, Casiquiare, Guainía and Río Negro. The greatest concen-

> trations are reported in the areas around Maroa, San Carlos, the Desecho de San Miguel (Casiquiare) and the Caño de Guamí (Río Negro near Santa Rosa de Amanadona).
>
> Some of the men who worked rubber 1900 1914, said they exploited *Micrandra*. Trees felled and ring-tapped every 3 ft. Latex collected as tree scrap. After 2 to 3 weeks, when the leaves were wilted, trees ring-tapped again at 2 to 3 inch intervals and the latex collected in gourdes of leaves. A tree 3 ft. in diam. would give about 1 gal. latex. Fairly stable. Coagulate in 5 to 10 hours.
>
> Various tapping tests tried mostly with low yields. In a few cases fair yields were obtained. One tree 24" DBH gave 1 1/4 quarts latex at one tapping. This tree was just beginning to bud and other trees that gave good yields were just starting to grow.
>
> The latex coagulates rapidly on the addition of water.
>
> A native said that her father collected *Micrandra* rubber and always found a large lump of rubber at the base of the trees. Used a sharp stick to probe for the rubber. The lumps weighed 5 or 6 kg. each.
>
> Average yield about 150 gms. air dry scrap of lump per tree per day. An expert tapper with climbing equipment can tap about 10 trees per day.

It is interesting to note that the first of these reports does not mention exploitation but that the second maintains that *Micrandra* was exploited from 1900 to 1914. The trees were felled, ringed and the latex allowed to coagulate as scrap on the trees. This was undoubtedly the so-called *Caurá rubber* formerly exported from the Orinoco basin of Venezuela. Neither of these reports indicates that *Micrandra* was in production in the 1940's, and I have been unable to find any data which would support the belief that these trees were ever used to any extent during the recent war-shortage of rubber.

Unfortunately, I have been unable to find voucher herbarium specimens upon which these foregoing reports might have been based. In the Venezuelan region concerned two closely related species are known to occur: *Micrandra minor* and *M. siphonioides*.

Allen, who carried out surveys for the Rubber Reserve Corporation in Colombia at the same time, has recorded on voucher specimens exceedingly interesting notes concerning the type of rubber and its possible exploitation. All of his observations on *Micrandra* were made amongst the Tukano Indians on the Río Papurí, an affluent of the Río Vaupés, which forms part of the boundary between Brazil and Colombia. Of *Micrandra minor*, he reported (*Allen 3061*): "Latex pale yellow, seldom flowing freely, usually coagulating in the cuts in a manner reminiscent of *Castilla*. This scrap can be removed after an interval of about three days, usually being wound into balls. Tensile strength excellent, considerably better than weak fine *Hevea*. Some resin content." On a separate label (*Allen 3061*), Allen noted: "Coagulated latex has much higher tensile strength than the best Acre Hevea. Yield very variable, but averages less than a quarter pound from felled trees. Cannot be tapped daily as *Hevea*." He similarly states of *M. siphonioides*: "Latex pale yellow, seldom flowing freely, usually coagulating in the cuts in the manner reminiscent of some species of *Castilloa* [sic], being removed after an interval of about three days as scrap, which is wound into balls. Tensile strength excellent, being considerably better than Acre Fine Hevea."

Allen offered notes also on the latex of other species of *Micrandra*. Of *M. Spruceana*, he wrote: "Bark very thin . . . with scanty latex which coagulates with difficulty, producing a non-elastic gum." *Micrandra Sprucei*, he annotated, had: "Latex yellowish, scant, coagulating to a non-elastic gum." For *M. Rossiana*, he reported: "Latex very scanty, coagulating to a gummy non-elastic mass." Although Allen's notes suggest the possible exploitation along the Río Papurí of *M. minor* and *M. siphonioides*, there is every indication that the other three species which he collected could not be worked and gave too little rubber or rubber of no commercial value.

The latex of all species of *Micrandra* is white, or cream-coloured, except for some individuals of *M. Rossiana*, where it may often be yellowish. Ule's statement (Ule, E. in Tropenflanz. Beih. 6 (1905) 1) that *Micrandra* milk may be distinguished from that of *Hevea* by its orange colour must be an error, for of the thousands of trees which I examined only a few had even a slightly yellowish latex. It is usually thick and slow-flowing. In taste, it is somewhat sweet, quite unlike the burning and bitter taste of most *Hevea* latex. It coagulates slowly on the trees, remaining tacky and resinous for weeks. The addition of river-water causes *Micrandra* latex to coagulate; whether or not this is due to some mineral or organic constituent present in this impure water is not known. Most rubber tappers whom I questioned maintain that *Micrandra* latex cannot be mixed with that of the rubber-yielding species of *Hevea*, the acid-coagulation of which it prevents. This unexpected effect is brought about likewise if the latex of *Hevea nitida* Mart. ex Muell-Arg. be added to that of species, such as *H. guianensis* Aubl., which furnish good rubber (Schultes, R. E.: "The genus *Hevea* in Colombia" in Bot. Mus. Leafl., Harvard Univ. 12 (1945) 11; Seibert, R. J.: "A study of *Hevea* (with its economic aspects) in the Republic of Peru" in Ann. Mo. Bot. Gard. 34 (1947) 268).

In quantity (and perhaps also in quality of rubber), latex varies from tree to tree, but we do not yet have precise data on this phenomenon, as we do for some species of *Hevea*. *Micrandra minor*, growing along or very near water courses, yields much more latex than does *M. siphonioides*, an inhabitant of higher, well drained sandy savannahs situated well back from streams. The latex of the former species is thinner and freer flowing than that of the latter. For this reason, we might justifiably assume that, if *Micrandra* has ever been commercially exploited, it was *M. minor* which was cut usually in preference to *M. siphonioides*, especially so since it is a much more abundant tree and much more accessible by canoe along the river banks.

Little indeed is known about the rubber from *Micrandra*. According to Spruce, *Micrandra* yields "pure rubber." Ule, likewise, stated that *Micrandra* rubber is of good quality. Allen's visual evaluation of the rubber of *M. minor* and *M. siphonioides* likewise suggests that it is of good quality.

There is very little chemical information available on this rubber. Mr. A. V. McMullan of the United States Department of Agriculture reported (letter to R. E. Schultes, June 16, 1949) the following data after studying an air-dried specimen of rubber from *Micrandra minor* (*Schultes et Murça* Pires 9075a): "Resins (acetone extract) 3.78%; rubber hydrocarbon (benzene extract) 87.08%; insolubles 9.14%. Appeared to be somewhat softer and weaker than *brasiliensis*. This sample very difficult to enter solution which may indicate a high polymer rubber. Merits more study." Rubber from the leaves and bark of two trees of *M. Lopezii* were examined—*Schultes et López 9638:* (bark) Resins 5.40%, rubber hydrocarbons 2.06%, "excellent rubber, clear, strong and elastic"; (leaves) resins 13.93%, rubber hydrocarbons

0.18%, "typical leaf rubber". *Schultes et López 9663:* (bark) resins 4.24%, rubber hydrocarbons 0.83%, "sticky and weak, not near the quality of above sample"; (leaves) resins 13.65%, rubber hydrocarbons, 0.21%, "typical leaf rubber". For *M. Spruceana* (*Schultes et López 9641*), the following results were recorded for bark rubber: Resins 3.92%, rubber hydrocarbons 1.31%; "poor, soft, sticky." *Micrandra Sprucei* (*Schultes et López 9640*) gave the following data: (bark) Resins 5.63%, rubber hydrocarbons 5.51%, "poor, soft and sticky"; (leaves) resins 16.84%, rubber hydrocarbons 0.16%, "typical leaf rubber."

An analysis of specimens sent in from Venezuela (probably by one of the expeditions the reports of which are quoted above) had a rubber content of 85.74 (Polhamus, L. G.: "Rubber content of miscellaneous plants" U.S.D.A. Prod. Research Dept., No. 10 (1957) 22). The species from which the sample was taken is stated to have been *Micrandra siphonioides,* but this identification is open to some doubt. If the specimen were collected by either Fuller or Hansen who prepared the reports, its provenience was more probably *Micrandra minor:* the trees grew "in low land flooded annually" and "close to rivers . . . rarely at distances greater than 300–400 yards": this is precisely the habitat of *M. minor,* not of *M. siphonioides.*

A somewhat more complete chemical study appeared in 1956 (Wisniewski, A.: "Borrachas amazônicas pouco conhecidas" in Bol. Técn. Inst. Agron. Norte 31 (1956) 301) in which, nonetheless, the author confessed to a lack of knowledge of *Micrandra* rubber in general. Wisniewski's samples were air-dried. He had an average of five samples, and he compared *Micrandra* rubber to a piece of Acre Fina (the highest grade of rubber from *Hevea brasiliensis*) in the following summary:

	CR kg./cm.^{2}	**AM**	**Resin**
Micrandra	266	760	4.86
Acre Fina	210	805	2.53

Micrandra elata (*Didr.*) *Mueller-Argoviensis* in Linnaea 34 (1865)) 142.

Micrandra bracteosa Mueller-Argoviensis in Martius Fl. Bras. 11 (1873) 290.

Micrandra Glaziovii Pax in Engler Pflanzenr. iv, 147 1910 Euphorbiaceae-Jatropheae) 20.

Micrandra brownsbergensis Lanjouw, Euphorbiaceae of Surinam (1931) 34, t. 7, 8.

Micrandra santanderensis Croizat in Journ. Arn. Arb. 24 (1943) 169.

BRAZIL: São Paulo, Mogy das Cruzes, in forest. 1876–77. *A. Glaziou 1847a* (*M. Glaziovii* TYPUS). São Paulo, Araracuara. September 18, 1888. *Loefgren 920.* Bahía. *Martius s.n.* (*M. bracteosae* TYPUS). Rio Paraná. July 1834. *Riedel 23* (*M. elatae* TYPUS).

COLOMBIA: Departamento de Santander, Barranca Bermeja, between Sogomoso and Carare Rivers. Alt. 100 m. October 9, 1936. *O. Haught 2011.* —— Between Carare and Magdalena River, Puerto Berrio, Dorado Creek, 5 km. south of Raizubo. April 30, 1937. *Haught 2189* (*M. santanderensis* TYPUS).

FRENCH GUIANA: Montagne de Kaw. Alt. 250–270 m. "Tree 7 m. tall. Fls. pale green. Fruit green. Occasional in forest on bauxite." December 14, 1954. *R. S. Cowan 38815.*

PERU: Departamento del Loreto, Provincia de Maynas, Iquitos, Río Nanay, Picuruyacu. Alt. c. 150–180 m. "Sandy upland, partially disturbed forest. 20 m. Fr. green. Sap milky." September 24, 1975. *S. McDaniel et M. Rimachi Y. 20204.* —— Iquitos, Río Nanay, Carreterado Picuruyacu. Alt. c. 150–180 m. "Upland. 10 m. Sap white. Fr. black. *Shiringarana.*" March 16, 1976. *S. McDaniel, M. Rimachi Y. et J. Folsom 20533.*

SURINAM: Surinam River, Brownsberg Forest Reserve. Tree No. 1146. HBW No. 6687, October 31, 1924, FLORIS TYPUS; HBW No. 4267, February 24, 1919, FRUCTUS TYPUS.

It is clear that these four binomials are referable to the widely distributed *Micrandra elata.* Although the species is most abundant along the coastal regions of Brazil and the Guianas, it has appeared in the Magdalena Valley of Colombia (from which locality is was described as a distinct species) and has recently been found far inland in the Estado do Pará in Brazil and as far west as Iquitos, Peru. This representation of *Micrandra* in the Departamento de Santander in Colombia is the only record of the genus west of the Andes; it is undoubtedly a coastal intrusion that proceeded inland up the Magdalena Valley.

Micrandra bracteosa, described from material collected in Bahía, Brazil, was presumed to differ from *M. elata* by lacking glands at the base of the leaves or of having them only weakly developed and by having a panicle shorter than the leaves. Both are unreliable characters, and it seems advisable to treat *M. bracteosa* as a synonym of the widespread and variable *M. elata.*

The distinguishing characters between *Micrandra elata* and the Surinam material described as *M. brownsbergensis* are of a minor and inconstant nature. Lanjouw did not distinguish *M. brownsbergensis* from *M. elata* when he described the concept. He did distinguish it from the very distinct *M. siphonioides.* Thanks to the very active Dutch collectors in Surinam, there is a wealth of herbarium material from the Brownsberg Forest Reserve. Careful examination of this ample material fails to provide one with any major character of distinction. The leaves are occasionally larger than is expected in *M. elata* and there are often fewer secondary nerves, but these and other fine differences are too trivial to separate *M. brownsbergensis* even as a variety.

Perhaps the most interesting collections of *Micrandra* are those made in 1936 and 1937 by O. Haught in Colombia and described by Croizat as *M. santanderensis.* When these collections are viewed alone, they do look different; their distinction fades, however, when one has the whole series of collections from Colombia to southern Brazil along the coastal lowlands. Croizat stated that this species was distinct from all other known species because of its "differently colored foliage, but there are no floral differences. The conspicuously axillary tufts of hairs on the leaves of this new species are not found on *M. elata* Muell.-Arg. or . . . *M. siphonioides* Benth., to judge from the photographs of the type specimens . . ." *Haught 2189,* the type of *M. santanderensis,* is, indeed, a good match for the type of *M. brownsbergensis,* although its leaves are somewhat larger; in *Haught 2011,* however, the leaves are very similar in size, shape and colouration to those of the type of *M. brownsbergensis.*

We should point out the inexactness in several points of the drawing of *Micrandra elata* provided by Pax (loc. cit., t. 5). The illustration which is published with this text has been prepared after careful study of ample material assembled from European, American and South American herbaria and represents, we believe, a more accurate and complete record of the species.

The collections *McDaniel et Rimachi Y. 20204* and *McDaniel, Rimachi Y. et Folsom 20533* are noteworthy as being the first from Peru. They represent also the material collected far within the Amazon—some 2000 miles upstream on the Amazon—of this species which is usually found nearer the coastal areas.

Cowan 38815 represents the first collection of *Micrandra elata* from French Guiana.

Micrandra Lopezii *R. E. Schultes* var. **microcarpa** *R. E. Schultes* var. nov.

Arbor usque ad 25 pedes alta, a *Micrandra Lopezii* capsula semineque multo minoribus (valvis siccitate ad 20 mm. longis) principaliter differt.

BRAZIL: Estado do Amazonas, Rio Aiary Jabarú, Içana. "Caatinga. Arvore, 7 ms. 35 cms. Latex branco, coagulante rápido, espresso, forte e abundante." November 8, 1947. *Ricardo de Lemos Fróes 21364* (Typus in Herb. Instituto Agrónomico do Norte 16829).

In addition to the significant difference in size of the fruit (28 mm. long in dried condition in *Micrandra Lopezii*, 20 mm. or less in this new variety), the leaves appear to be generally subcuneate instead of conspicuously rounded or even strongly cordate at the base.

Micrandra Rossiana *R. E. Schultes* in Bot. Mus. Leafl., Harvard Univ. 15 (1952) 211.

COLOMBIA: Comisaría del Vaupés, Río Papurí, vicinity of Monfort Mission. Alt. c. 200 m. "Slender, infrequent trees averaging 25–30 m. in height and 50 cm. in diameter. Bark grey, thin and hard and difficult to tap. Latex very scanty, coagulating to a gummy, non-elastic mass. Small tri-spermate capsule, resembling that of the *arara-siringa* [*Micrandra siphonioides*] but considerably elongated. Not well known, one or two individuals hesitatingly advancing either *maha-wakpuh* or *buhawakpuh* [*Micrandra minor*] but it is doubtful if either would be generally recognized as applicable to this species." August 28, 1943. *P. H. Allen 3109*.

This collection of Allen was the first made in Colombian territory. The astuteness of Allen and his native informants in recognizing this as a different species is extraordinary. Later collections have shown that is is not a rare species in the northwest Amazon of Brazil and Colombia.

Micrandra Rossiana has been known from Brazil, Colombia and Venezuela. Intensive studies of *Micrandra* have indicated that the distribution of *M. Rossiana* is much wider and more abundant in the Colombian Vaupés—especially in the Río Apaporis and its affluents—than in any other area of the northwest Amazon.

Micrandra siphonioides *Bentham* in Hooker, Bot. Journ. 6 (1854) 371.

COLOMBIA: Comisaría del Vaupés, Río Papurí, Macú-Paraná. Alt. c. 200 m. "Trees averaging 25 m. in *manchas* but with numerous isolated specimens measuring 35 m. when felled. Average diameter about 75 cm above the often prominently developed buttresses, which in large specimens often extend upward for 3–4 m. from the ground. Flowers greenish yellow, on axillary new growth. Bark reddish brown, of varying thickness, that on the trunk often 2–3 cm. while on the buttresses it seldom exceeds 1 cm. Latex pale yellow, seldom flowing freely, usually coagulating in the cuts in the manner reminiscent of some species of Castilloa [sic], being removed after an interval of about three days as scrap, which is wound into balls. Tensile strength excellent, being considerably better than Acre Fine Hevea. Known locally as *arara siringa* or *buhawakpuh* (Tucano)." August 11, 1943. *P. H. Allen 3050.*—Same locality. "Tall trees, averaging 25 m. tall in *manchas* on margins of low sandy caatinga, but with numerous isolated specimens on clay ridges reaching 35 m. Average diameter about 75 cm. above the often prominently developed buttresses, which in old specimens often extend upward for 3–4 m. from the ground. Flowers greenish yellow, on axillary new growth. Bark reddish brown, of varying thickness, that on the trunk often 2–3 cm., while on the plank buttresses it seldom exceeds 1 cm. Latex pale yellow, seldom flowing freely, usually coagulating in the cuts in a manner reminiscent of Castilla. This scrap can be removed after an interval of about three days, usually being wound into balls. Tensile strength excellent, considerably better than weak fine Hevea. Some resin content. Known locally as *arara-siringa* (Geral) and *bu-ha-wak-puh* (Tucano). See pickled fruits, which resemble those of Hevea." August 15, 1943. *Allen 3061.*

Micrandra siphonioides is a very abundant species in the northwest Amazon. Seldom, however, have such detailed field notes been appended to voucher specimens. For this reason, it seems advisable to quote the notes on *Allen 3050* and *3061*. The collection *Allen 3061* has been identified erroneously as *M. minor* Benth.

Micrandra Spruceana (*Baillon*) *R. E. Schultes* in Bot. Mus. Leafl., Harvard Univ. 15 (1952) 217.

COLOMBIA: Comisaría del Vaupés, Río Papurí, Santa Teresita Mission. Alt. c. 200 m. "Tall trees, averaging 35 m. in height and 80 cm. in diameter above the conspicuously developed, nearly unique stilt buttresses which are produced to a height of 3–4 m. as laterally compressed board-like flanges which act as 'flying-buttresses' often high enough to allow a man to stand beneath them. Leaves simple, with two basal disk-like glands. Inflorescences of small green flowers from axillary new growth. Large tri-spermate seed capsule typical of Hevea. Bark very thin (6–8 mm.) with scanty latex which coagulates with difficulty, producing a non-elastic gum. Seeds collected for food. Known locally as *wak-puh* (Tucano)." August 15, 1943. *P. H. Allen 3063.*

PERU: Departamento de Loreto, Provincia de Maynas, Río Ampiyacu, Pebas and vicinity. April 10, 1977. *T. Plowman, R. E. Schultes et O. Tovar 6735.* — — Puca Urquillo and vicinity. "Tree 65 m. tall with large buttresses, forming interwoven props at base. Growing in upland primary forest. Latex white, sparse. Fruit green. Seeds brilliant, smooth, red-brown." April 27, 1977. *Plowman, Schultes et Tovar 6951.*

Although a very abundant element of the flora of the northwest Amazon, little has been known about the latex of *Micrandra Spruceana. Allen 3063* has an unusually detailed set of notes which have not hitherto been published.

The two Peruvian collections appear to be the first from Peru. They were made during Phase VII of the Alpha Helix Amazon Expedition 1976–1977.

Plowman, Schultes et Tovar 6951 is the voucher collection for Dragendorff spot test for alkaloids made in the Alpha Helix laboratory during the expedition: the species was found to be alkaloid-negative.

Micrandra Sprucei (*Muell.-Arg.*) *R. E. Schultes* in Bot. Mus. Leafl., Harvard Univ. 15 (1952) 218.

COLOMBIA: Comisaría del Vaupés, Río Papurí, vicinity of Piracuara Mission. Alt. c. 200 m. "Tall trees, slightly buttressed, averaging 30 m. in height and 60 cm. in diameter. Bark thin, averaging less than 1 cm. Latex yellowish, scant, coagulating to a non-elastic gum. Tri-spermate, Hevea-like capsule. Known locally as *wak-so'-ne-ne* (Tucano)." August 18, 1943. *P. H. Allen 3068.*

Little has been known of this curious caatinga species of *Micrandra.* The collection *Allen 3068* has been cited and its notes quoted in full because of their significance to our understanding of the genus.

VERNACULAR NAMES REPORTED FOR MICRANDRA

arara-seringa Río Vaupés, Brazil and Colombia *M. minor; M. siphonioides*
arvore de mammora Rio Paraná, Brazil *M. elata*
bartabalie balli (Arawak) Dutch Guiana *M. elata*
boo-ha'-wa-puch (Tukano) Río Vaupés, Colombia *M. Rossiana*
bo-wápuch (Tukano) Río Vaupés, Colombia *M. Rossiana*
bu-ha'-wak-puh (Tukano) Río Papurí, Colombia *M. Rossiana*
caucho Río Caurá, Venezuela *M. minor*
caucho de guaco Territorio Federal, Venezuela *M. minor* and or *M. siphonioides*
caucho de invierno Territorio Federal, Venezuela *M. Minor* and/or *M. siphonioides*
caucho kunudi (Maquiretare) Río Orinoco, Venezuela *M. siphonioides*
cauchorana Río Solimões, Brazil *M. minor; M. siphonioides*
caucho tomoro Río Caurá, Venezuela *M. siphonioides*
cunurí Amazonas, Brazil and Colombia *M. Spruceana*
cunurí da caatinga Amazonas, Brazil *M. Sprucei*
efacone (Witoto?) Río Igaraparaná, Colombia *M. minor*
huermega (Witoto) Río Igaraparaná, Colombia *M. minor*
ka-ro-a (Yukuna) Río Miritiparaná, Colombia *M. siphonioides*
koedi biosé balli (Arawak) Dutch Guiana *M. elata*
ko-no-ko (Miraña) Río Caquetá, Colombia *M. Spruceana*
ma-ha'-puch (Tukano) Río Vaupés, Colombia *M. minor*
ma-ha'-puh (Tukano) Río Vaupés, Colombia *M. minor*
ma-ha'-ree (Taiwano) Río Kananarí, Colombia *M. minor*
ma-ha-wa-he ("macaw seed") (Makuna) Río Piraparaná, Colombia *M. minor*
ma-ha'-wa-hö ("macaw seed") (Barasana) Río Piraparaná, Colombia *M. minor*

ma-há-wö-he ("macaw seed") (Makuna) Río Popeyacá, Colombia *M. siphonioides*

ma-há-wa-pö-kö (Barasana) Río Piraparaná, Colombia *M. Rossiana*

ma-há-wa-pö-kö (Gwanano) Río Vaupés, Colombia *M. Rossiana*

man-jé-ka (*man* = macaw) (Kubeo) Río Vaupés, Colombia *M. minor*

ma-poó-a (Tanimuka) Río Miritiparaná, Colombia *M. siphonioides*

moereidam (Karib) Dutch Guiana *M. elata*

momofi (Waika) Territorio do Roraima, Brazil *M. siphonioides*

ö-bai-me-ko (seringa de la sabola) (Miraña) Río Miritiparaná, Colombia *M. siphonioides*

paí-re (Puinave) Río Apaporis, Colombia *H. minor*

paí-root (Puinave) Río Apaporis, Colombia *H. minor*

peñ (Makú) Río Piraparaná, Colombia *M. Spruceana*

pý-root (Puinave) Río Apaporis, Colombia *M. minor*

seringá irari Rio Negro, Brazil *M. minor* and or *M. siphonioides*

seringarana Río Solimões, Brazil; Río Amazonas, Peru *M. minor; M. siphonioides; M. elata*

suru-wai-yek Bolivar, Venezuela *M. glabra*

topoeloe alomé (Karib) Dutch Guiana *M. elata*

wa-hö́ (Makuna) Río Piraparaná, Colombia *M. Spruceana*

wah-puch́ (Tukano) Río Vaupés, Colombia *M. Spruceana*

wakati-erwicheri (Bora?) Río Igaraparaná, Colombia *M. minor*

wa-so-né-né (Tukano) Río Vaupés, Colombia *M. Sprucei*

was-so-roo-re (Gwanano) Río Vaupés, Colombia *M. Sprucei*

wer-meger (Witoto) Río Igaraparaná, Colombia *M. minor; M siphonioides*

woo-sheeń (Puinave) Río Apaporis, Colombia *M. minor*

yé-cha (Yukuna) Río Miritiparaná, Colombia *M. Spruceana*

ye-ka (Kuripako) Río Guainía, Colombia *M. Spruceana*

PLATE 23

Plate 23. Flowering branch of *Micrandra siphonioides*. Río Apaporis, Comisaría del Vaupés, Colombia. Photograph: R. E. Schultes.

PLATE 24

Plate 24. Extensively buttressed roots are typical of *Micrandra Spruceana*. La Pedrera, Comisaría del Amazonas, Colombia. Photograph by R.E. Schultes.

PLATE 25

BOTANICAL MUSEUM LEAFLETS
HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS, MAY-JUNE 1979 VOL. 27, NOS. 5-6

ANCIENT GOLD PECTORALS FROM COLOMBIA: MUSHROOM EFFIGIES?[1]

RICHARD EVANS SCHULTES AND ALEC BRIGHT

I.

One of the most fascinating and enigmatic archaeological objects in the Americas is a certain type of anthropomorphic gold pectoral found in southern Panama and, most especially, in Colombia. Called "Darien pectorals," these ornaments are not confined to one region, although their greatest concentration seems to be in the Sinú country in northwestern Colombia, near the border with Panama's Darien Province. They are found also in the Quimbaya region of Colombia, farther south.

The dating of the Colombian gold objects and the styles of these objects are still rather indefinite, although archaeologists would generally place Sinú and Quimbaya goldwork in the late pre-Columbian centuries, most likely in the span of 1,000–1,500 A.D., but with the possibility of beginnings as early as 500 A.D.

Interestingly, one such "Darien pectoral" has been found as far north as Chichen Itzá in Yucatán, where it undoubtedly found its way as an item of long-distance trade, along with other lower Central American and Colombian gold artifacts. The Maya centre of Chichen Itzá—and its famed cenote of sacrifice,

[1] This paper is published in English in the *Botanical Museum Leaflets of Harvard University* and in Spanish in the *Boletín Museo del Oro* (Banco de la República) Ano 3, Bogotá, Colombia.

Botanical Museum Leaflets (USPS 404-990). Published monthly except during July and August by the Botanical Museum, Harvard University, Cambridge, Massachusetts 02138. Subscription: $25.00 a year, net, postpaid. Orders should be directed to Secretary of Publications at the above address. Second-Class Postage Paid at Boston, Massachusetts.

where such gold objects were thrown as offerings –was particularly active between 1,000 and 1,250 A.D. This, however, does not help in placing the manufacturing date of the object in question, as many of the other objects found in the Chichen Itzá cenote were clearly heirloom pieces (Willey, pers. comm.).

Although they vary slightly, these ornaments all follow a general plan. They are anthropomorphic, usually highly stylized. The most prominent feature is the pair of dome-shaped or rounded objects arranged side by side on the head. Lateral wing-like ornaments with spiral decorations made up of double spirals almost invariably frame the head of the pectoral. A flat face or mask, sometimes more or less natural but usually with complex filigree ornamentation, is discernible. Arms and hands hold two sticks or wands usually in an inverted V-shape. A frog or toad, sometimes very natural but usually extremely stylized, is almost always present immediately beneath the face: that is, on the chest.

These pectorals have been divided into two general types: "Darien pectorals" and "Darien-related pectorals." The former are the more typical, with most of the principal diagnostic features; the latter have very stylistic variations and fewer of the main diagnostic features, diverting in one or several ways from the basic morphological pattern of the Darien type.

Although a few specimens are to be found in private collections and in several museums, the greatest concentration of these gold pectorals is preserved in the Museo del Oro in Bogotá, Colombia. Thanks to the director, Dr. Luis Duque Gómez, we have had the opportunity of examining in great detail the Museum's collection of more than 150 specimens and of conferring with Mrs. Ana María Falchetti de Sáenz, whose meticulous research is embodied in her thesis entitled *The Goldwork of the Sinú Region, (Northern) Colombia* (Falchetti-Sáenz, 1976).

Because of the two dome-like objects on the head, these pectorals have popularly been called "telephone-bell gods." This term originated apparently from the description given by Dr. José Pérez de Barrada in 1954, when he mentioned "the semi-spherical buttons to which I have referred that remind one of the bells of old fashioned telephones or of a pair of mushrooms" (Pérez, 1954).

II.

Following the intense ethnomycological activities of Dr. R. Gordon Wasson (Wasson, 1962, 1968, 1972, 1979, 1980), his late wife Dr. Valentina P. Wasson (Wasson and Wasson, 1957), and the late Professor Roger Heim (Heim, 1967, 1978; Heim and Wasson, 1958) unveiling the ancient and the contemporary religious use of hallucinogenic mushrooms in southern Mexico, Pérez de Barrada wrote: "It would not be strange to reconsider with great reserve this casual attribution. It should be noted that these semi-spherical buttons are not fixed directly to the head but are attached by means of filaments soldered to the back of the piece . . . We know nothing about the ritual use of mushrooms amongst the Indians of Darien at the time of the discovery nor later, but if we remember, but keep it in mind, since no trace was found in the indigenous pharmacopoea of the Catios of the Golfo de Urabá, notwithstanding the excellent monograph by Father Severino Santa Teresa. On the other hand, the secrecy with which these Indians guard their knowledge of the properties of plants and their shamanistic ceremonies could have hidden a possible use of hallucinogenic mushrooms—a use which might be very ancient and which possibly existed in distinct forms. The bridge between Guatemala and Darien is difficult to establish but easy to suspect. Our suggestion that these buttons represent mushrooms is accepted by A. Emmerich" (Pérez, 1954).

This reference to Emmerich leads us directly to the second mention in the literature that these dome-like objects represent mushrooms. "It appears likely that the puzzling, hitherto unidentified hemi-spherical head dress ornaments in fact represent a pair of mushrooms, probably of hallucinogenic properties. It is significant that such mushroms are to this day traditionally counted, ceremonially used and consumed in pairs . . . the mushroom head dress ornaments were hammered out separately, riveted to short stems and then soldered to the body" (Emmerich, 1965).[2]

[2] In a note, Emmerich states: "I am indebted to Mrs. Mary U. Light for her original insight in identifying these ornaments as mushrooms."

A third consideration of the "telephone bell gods" as mushroom effigies was offered in 1974 by Professor Peter T. Furst. Referring to Emmerich, he reported:

"André Emmerich developed the interesting theory that the pairs of telephone bell-like, semi-spherical, hollow-stemmed ornaments surmounting the head dress of a certain class of conventionalized anthropomorphic gold pectorals in the Darién style from Colombia ("telephone gods") are in fact mushrooms. Emmerich demonstrated convincingly that over time these ornaments gradually changed position as the effigies themselves became more and more stylized. On early, more realistic pieces, the mushroom form is unmistakable, the semi-spherical caps being separated from the head dress by stems or stipes attached to the top of the head. Subsequently, the stipes became shorter and the caps were slightly inclined forward. Eventually, the stipes, though still present beneath the cap, disappeared altogether from view and the two caps faced forward like a pair of female breasts. By this time the human characters had also been stylized to the point of abstraction" (Furst, 1974, 1976).

III.

Our own studies of the many gold pectorals in the Museo del Oro and our familiarity with the complexities of magico-religious, shamanic or ceremonial use of hallucinogenic plants, together with consideration of the natural range of psilocybine-containing genera of mushrooms in the New World, lead us to the belief that this identification of the dome-shaped head dress ornaments is indeed correct and that, further, they strongly suggest the religious use in prehispanic Colombia of intoxicating mushrooms. This interpretation of the gold pectorals has already twice been supported (Schultes and Hofmann, 1979, 1980).

No other explanation of the possible significance of these domes has ever, so far as we know, been advanced. Significance they most certainly must have had. We are left, then, with the inescapable conclusion that they cannot represent anything else than mushroms.

In a number of the pectorals, the domes are elevated on a stipe. Furthermore, a few of the domes have a mammiform tip characteristic of some species of *Psilocybe,* and several have a design along the margin of the cap which could be interpreted as indicative of the scalloped edge of the cap of *Panaeolus sphinctrinus.* We have, in addition, several tangential arguments which have not hitherto been offered and which, we believe, lend weight to this interpretation.

As with the intoxications induced by many hallucinogens, levitation—the sensation of flying or soaring through the air and visiting distant places—is a commonly experienced psychic effect of psilocybine, the principal active constituent of species of *Panaeolus, Psilocybe* and *Stropharia* (Schultes and Hofmann, 1979; Brown, 1972).

In her long and involved chant during the Mazatec mushroom ceremony, for example, the famous shaman María Sabina repeatedly sings such descriptive phrases as "Whirling woman am I," "Look, I feel as though I'm going to the sky," "Woman like the big eagle am I," "Woman of space am I" (Halifax, 1979). Dr. Albert Hofmann, the chemist who first isolated psilocybine and psilocine from the sacred mushrooms and who elucidated their structures and synthesized them, mentions levitation amongst other symptoms produced by small doses of psilocybine: ". . . bodily relaxation and detachment from the environment . . . effects . . . associated with a pleasant feeling of extraordinary lightness, a bodily hovering" (Schultes and Hofmann, 1979, 1980). Wasson, the first to provide a detailed description of psilocybine-mushroom intoxication, reported specifically, amongst many other effects, the experience of levitation: ". . . the bemushroomed person is poised in space, a disembodied eye, invisible, incorporeal, seeing but not seen . . . your body lies in darkness, heavy as lead, but your spirit seems to soar . . . and with the speed of thought to travel where it listeth, in time and space . . ." (Schultes, 1973).

The Colombian gold pectorals almost invariably have two wings formed by spirals and arising at an angle lateral to the head dress ornaments. They vary somewhat in shape but always involve spiral filagree work. While occasionally abbreviated, they are usually elongated. We believe that these represent wings, the wings of a mythical bird, and are directly associated with levitation. Furthermore, we need not detail how frequently and how generally, not only in the Americas but in the Old World as well, are birds associated with hallucinogens, but several examples will suffice.

Amongst the Koryaks of Siberia, the culture hero, Big Raven, discovered the hallucinogenic mushroom *Amanita muscaria* from the spittle of the god Vihiyinin (Schultes and Hofmann, 1980). The mythical Thunder Bird carries the prayers of the peyote-eating Indians of the United States to heaven (LaBarre, 1938), and levitation is important in the Huichol peyote ritual in Mexico (Furst and Anguiano, 1977). In eastern Brazil, the Indians who drank *vinho de jurema (Mimosa hostilis)* flew all night carried on the back of a huge bird that skirted thundering rapids and showed its passengers the abodes of the dead (Gonçalves de Lima, 1946).

In several "Darien-related pectorals," the hands hold a bar on which are perched four birds. In one of the pectorals, the birds are movable. We suggest that, in these examples, too, the avian ornamentation indicates association with the flying sensation experienced in mushroom intoxication.

But there is an even more compelling argument for the hallucinogenic connection of the pectorals: the frog or toad. Almost all of the pectorals are ornamented with these amphibian figures. In some cases, the figure is realistic; in others, it is flat but easily discernible—with eyes, legs and a median dorsal band, indicating undoubtedly the coloured band on some of these animals. In most, however, it is highly stylized, their eyes and legs represented by circles of double spirals, the tail portion indicated by a flat triangular projection, and the snout represented occasionally by a knob-like protuberance.

This extraordinarily constant association of the frog or toad with the pectorals would seem to have deep significance. No other animals represent change and transition more sharply with their dramatic metamorphosis and fertility—passing from the egg to a wholly water-living, gill-breathing creature resembling a fish to a terrestrial, four-legged amphibian. Furthermore, certain frogs of the Dendrobatidae are frighteningly toxic—one species producing the most highly poisonous substance known (Daly and Myers, 1967; Daly and Witkop, 1971). For millenia and in widely separated parts of the globe, frogs and toads have been associated with origin myths, mysticism, rain and fecundity, the moon, magic and, especially, with intoxication from hallucinogenic agents (Wasson, 1980). This significance of the toad-frog motif has been emphasized by Furst (Furst, 1974, 1976) who succinctly states: "... there is clearly much more than only the 'obvious' connection with rain to account for the importance of the toad-frog motif in the indigenous symbolic system ..." (Furst, 1979).

Hallucinogenic constituents found in plants employed for their psychoactive properties have been isolated from frogs and toads. The alkaloid bufotenine, known from the leguminous tree *Anadenanthera peregrina* from which a highly psychoactive snuff is prepared in South America (Holmstedt and Lindgren, 1967), is present in the skin glands of *Bufo marinus* and other amphibians (Schultes and Holmstedt, 1968). The related and more potent hallucinogen, 5-methoxy-N, N-dimethyltryptamine, one of the active components of the snuff prepared in South America from several species of *Virola* trees (Schultes and Holmstedt, 1968), has recently been found in the North American desert toad, *Bufo alvarius* (Furst, 1974). Extremely toxic substances occur in the skin of some species of *Phyllobates* and *Dendrobates*, colourful amphibians of northwesternmost South America in the general region where the gold pectorals are found in greatest concentration. The venoms of some South American frogs and toads are employed in magical contexts, sometimes producing even ecstatic or hallucinogenic states. It was the Swedish anthropologist S. Henry Wassén who, many years ago, reviewed the literature and concluded "... that the ubiquitous frog/toad motif in South American mythology and art, including the great number of effigies of cast gold from prehispanic Colombia and Panama, was inseparable from the practical use of frog venom for blowgun dart poison (which in any event had a magical component) and from the widespread magico-religious beliefs and practices involving the toxins of different species of these amphibians" (Wassén, 1934). Frog poison—probably from a species of *Phyllobates* or *Dendrobates*—is used by hunters among the Amahuaca Indians of Amazonian Peru for inducing hallucinations: the poison is rubbed on self-inflicted cuts, inducing a violent illness, characterized by vomiting, diarrhoea, convulsions, unconsciousness. Supernatural expertness in the hunt results from the hallucinations which are interpreted as communication with forest spirits (Furst, 1974).

There can no longer be any doubt that the high place occupied in magico-religious spheres by frogs and toads must be attributed in great part to the toxic properties of some species. Although the potently poisonous South American species cannot be termed hallucinogenic in the usual sense of that word, their toxins do act upon the central nervous system with effects so unreal as to induce the Indian to ascribe supernatural powers to the animal and actually visual and other hallucinations may indeed accompany the violent intoxications caused by agents that can in no wise be considered true hallucinogens (Furst, 1974, 1976). For, as has been correctly pointed out: ". . . the massive assault on the system brought on by bufotenine-containing *Bufo* venom is of a very different order than the shift from one state of consciousness to another triggered by bufotenine-containing snuff" (Furst, 1974). Perhaps it may not be wholly coincidental that toads were so frequently added as an ingredient of the hallucinogenic witches brews of medieval Europe.

Whether as hallucinogen-inducing organisms, or as poisonous animals causing what might be termed pseudohallucination syndromes, these amphibians assumed—for this and other peculiarities—a significance in aboriginal mythology and magic, an exalted position amongst the peoples who created the Colombian gold work.

In almost every gold-working culture of Colombia, there are numerous examples of the toad-frog motif. There are hundreds of specimens in the Museo del Oro in Bogotá. These are especially abundant in the Tairona area of the Sierra Nevada de Santa Marta. From the surviving aboriginal groups of Indians still living in this region, it is known that the frog is considered a mythological being at the center of the cosmos (Reichel-Dolmatoff, 1963).

We believe that, especially when other characteristics of the gold pectorals (wings, birds, mushrooms) are taken into account, the constancy of the frog-toad motif on these artifacts must of necessity be interpreted as an indication that they played some role in a magico-religious system based on the hallucinatory experience. That no reference to the hallucinogenic use of mushrooms amongst the Indians of Colombia is found in the writings of the Spanish conquerors hardly argues against the possibility of such employment: the use and the cults connected with the mushrooms may well have died out between the dates of the latest gold pectorals and the 16th Century.

IV.

It would, of course, be a futile exercise to presume that the gold pectorals in question—or any other artifact, for that matter—represent the use of hallucinogenic mushrooms, unless mushrooms possessing psychotomimetic constituents actually do occur in the region where the artifacts were made and used.

Although the collection and study of mushrooms in Colombia is still in a very preliminary stage, psilocybine-containing species have been reported. Species of *Psilocybe* are known to be widely distributed in the world, and the field studies of Dr. Gastón Guzmán in 1964 and 1971 have indicated that hallucinogenic species of *Psilocybe* occur in Colombia (Guzmán and Varela, 1978). The localities are widely distributed throughout the nation and vary from the warm lowlands to *páramos* at high elevation. According to Guzmán, the following species of *Psilocybe* have been registered from Colombia: *P. antillarum* (Fr.) Quél., *P. argentina* (Speg.) Sing., *P. bullacea* (Bull. ex Fr.) Kumm., *P. columbia* Guzmán, *P. Pintonii* Guzmán and *P. subcubensis* Guzmán (which is occasionally considered to be a variant of *Stropharia cubensis*). A number of these mushrooms are presumably psilocybine-containing, since they are cyanescent and have a farinaceous odor and taste—indicative, according to Guzmán's experience, that they are hallucinogenic. Furthermore, *Panaeolus sphinctrinus* (Fr.) Bresadola, known as one of the hallucinogenic mushrooms of Mexico, has been collected in Colombia (Guzmán and Varela, 1978).

Guzmán writes in a letter: "I agree with you that the South American Indians used hallucinogenic species of *Psilocybe*. I reported 30 species from South America, but I think that there are more, but we need more explorations. Even I think that the

Indians from the Atlantic zone and not only those of the Andes used the hallucinogenic mushrooms." The recent field work of Dr. Kenneth Dumont has resulted in the registration from Colombia of other species of *Psilocybe,* a number of which may likewise be psilocybine-containing (Dumont, pers. comm.).

V.

Our studies of the Darien and Darien-related gold pectorals of Colombia have strengthened our belief that mushrooms perhaps enjoyed a widespread magico-religious place in aboriginal cultures from Mexico, through Central America and in the Andes south to Peru.

There are many pieces of evidence that may be interpreted as supporting such a belief. One manifestation of this cultural trait is provided by the numerous "mushroom stones" of Mexico, Guatemala and El Salvador, which have been extensively studied and documented (Borhegyi, 1957, 1961; Wasson, 1957; Rose, 1977). Four of these stone figures significantly have a frog-figure at their base (Wasson, 1980). Further south in Mexico and extending southeastward to El Salvador are various ceramic representations which have been interpreted as mushroom-related artifacts. From Colombia, there is one ceramic object from the area of greatest concentration of gold Darien pectorals which, although far less convincing than the gold objects, might be interpreted as representing a mushroom, since it has an undulating "cap" which occurs in some species of *Psilocybe.* There are, furthermore, numerous clay artifacts from Mexico with representations of mushrooms in contexts suggestive of their significance in magico-religious rituals (Borhegyi, 1963; Furst, 1974).

We might also mention at this point that several unusual "mushroom-like" ceramic pieces have been excavated at Araracuara in the Colombian Amazon (Herrera, pers. comm.).

Further to the south in the Andes, ceramic pots in the form of a human head with a mushroom-like protuberance from the forehead are frequent in the Mochica. This protuberance could not function as a handle: if the pot were filled with liquid, it would be too heavy to be supported by such a brittle handle. To the best of our knowledge, no functional explanation of this type of protuberance has been offered. They are all in shape very suggestive of mushrooms. One of the pots figured actually has painted flecks on the cap which might lead one to suspect that it represents *Amanita muscaria*, even though the species is believed not to have existed this far south in pre-Columbian times. These and other pottery artifacts, considered in detail by Furst (Furst, 1974), tend to support the belief that mushrooms were important in pre-Columbian art in more than one locality in the Andes of South America.

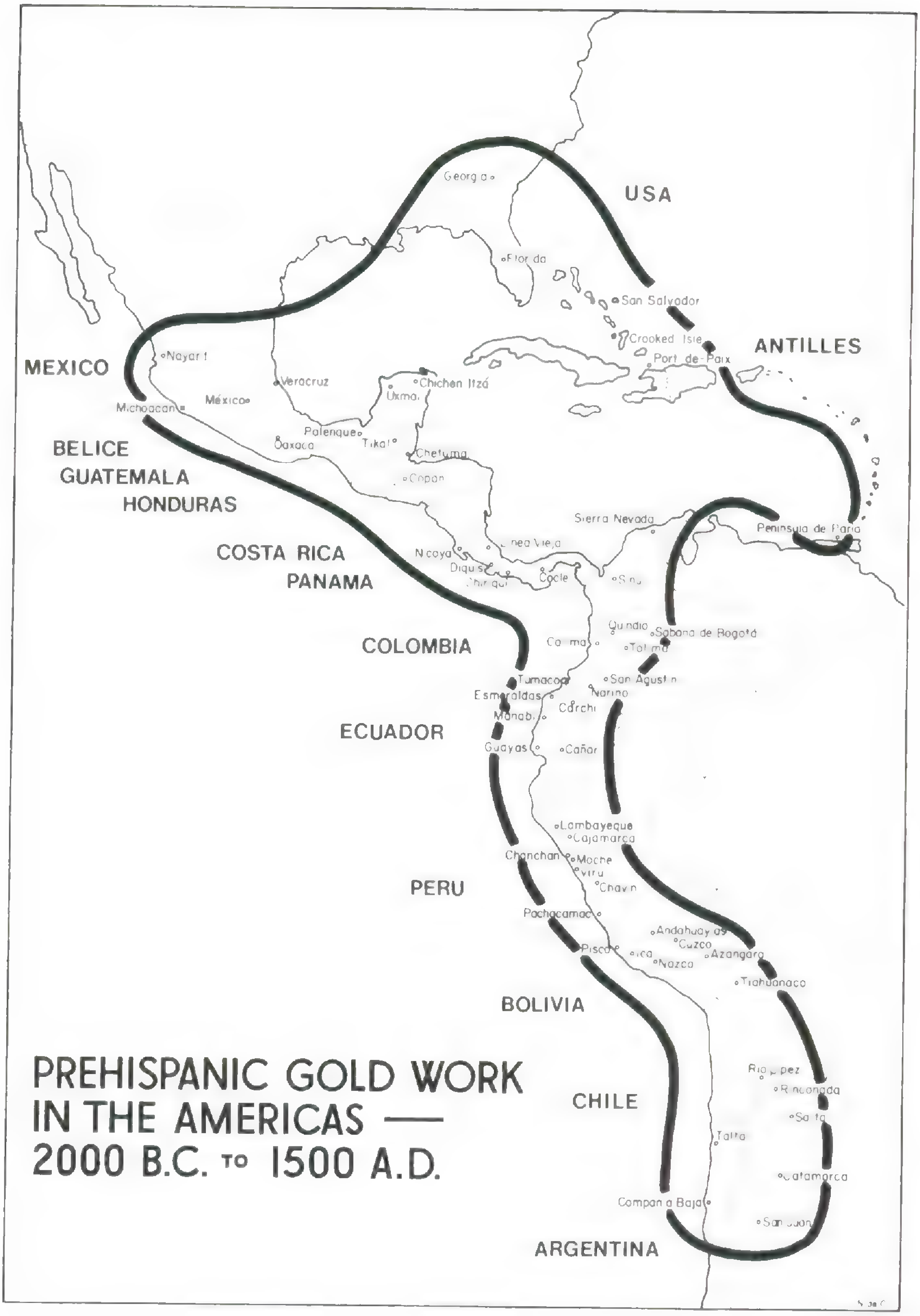
VI.

It has only recently been discovered that the fly agaric *Amanita muscaria*, has deep-rooted religious significance and is still ceremonically used by the Ojibway Indians living on Lake Superior in the United States (Wasson, 1979) and that Indians of the Mackensie River area of British Columbia, Canada, similarly employ this hallucinogen (Halifax, pers. comm.).

It is possibly significant that the Mackensie River area, being largely glacier-free in the Pleistocene, may have been one of the main routes taken by early man on his migrations from Siberia to the Americas.

Perhaps it may not be superfluous, in closing, to point out that from Asia ancient mythological ideas stemming from the use of hallucinogenic mushrooms and their concomitant associations are traceable in European witchcraft, in the cult of soma in the Indian subcontinent, in the use of fly agaric in Siberia and at least in two contemporary and unrelated and widely separated indigenous groups in North America.

In view of the recognized widespread magico-religious use of mushrooms in the New World, we believe that the interpretation of the Colombian "telephone bell gods," as mushroom-related artifacts, represents perhaps the most plausible explanation thus far advanced and that it may be of the utmost importance in our studies of the role of hallucinogens in aboriginal societies of the New World.


PREHISPANIC GOLD WORK
IN THE AMERICAS —
2000 B.C. TO 1500 A.D.
USA
ANTILLES
MEXICO
BELICE
GUATEMALA
HONDURAS
COSTA RICA
PANAMA
COLOMBIA
ECUADOR
PERU
BOLIVIA
CHILE
ARGENTINA
San Salvador
Crooked Isle
Port de Paix
Nayarit
Michoacan
México
Veracruz
Chichen Itzá
Uxmal
Palenque
Oaxaca
Tikal
Chetumal
Copan
Sierra Nevada
Peninsula de Paria
Nicoya
Diquis
Cocle
Quindio
Sabana de Bogotá
Tolima
San Agustin
Tumaco
Esmeraldas
Nariño
Manabi
Carchi
Guayas
Cañar
Lambayeque
Cajamarca
Chanchan
Moche
Viru
Chavin
Pachacamac
Andahuaylas
Cuzco
Azangaro
Pisco
Ica
Nazca
Tiahuanaco
Taltal
Compania Baja

ACKNOWLEDGMENTS

Permission to publish plates 23 to 33 has graciously been given by Dr. Luis Duque-Gomez, Director, Museo del Oro, Bogotá, Colombia. We gratefully acknowledge permission to publish plate 34 which has been granted by the Cleveland Museum of Art, Cleveland, Ohio (gift of Mr. and Mrs. R. Henry Norweb). We thank the director of the Peabody Museum, Harvard University, Prof. Clifford Lamberg-Karlovsky, for permission to reproduce plates 35 and 36 (Photograph by Hillel Burger).

REFERENCES

Borhegyi, S. F. De, "Mushroom stones of Middle America. A geographically and chronologically arranged distribution chart" in V. P. and R. G. Wasson, *Mushrooms, Russia and History*. Pantheon, New York 2 (1957) Appendix.

Borhegyi, S. F. De, "Miniature mushroom stones from Guatemala" in Am. Antiqu. 26(1961) 498–504.

Borhegyi, S. F. De, "Pre-Columbian pottery mushrooms from Mesoamerica" in Am. Antiqu. 28(1963) 328–338.

Brown, F. C. *Hallucinogenic Drugs*. Charles C. Thomas, Springfield, Ill. (1972) 80.

Daly, J. W. and C. W. Myers, "Toxicity of Panamanian poison frogs (*Dendrobates*): some biological and chemical aspects" in Science 156(1967) 970–1973.

Daly, J. W. and B. Witkop, "Chemistry and pharmacology of frog venoms" in W. Bucheri, E. E. Buckley and V. Deulofeu (Eds.) *Venomous Animals and their Venoms*. Academic Press, New York (1971) 497–519.

Dumont, K. Personal communication.

Emmerich, A. *Sweat of the Sun and Tears of the Moon*. University of Washington Press, Seattle, Wash. (1965).

Falchetti de Sáenz, A. M. *The Goldwork of the Sinú Region, (Northern) Colombia*. University of London (Unpubl. Thesis) (1976).

Falchetti de Sáenz, A. M., "Colgantes 'Darien'" in Bol. Mus. Oro 2(1979) 1–55.

Furst, P. T., "Hallucinogens in pre-Columbian art" in Spec. Publ. Mus. Texas Technical University 7(1974) 55–102.

Furst, P. T., *Hallucinogens and Culture*. Chandler and Sharp Publishers, San Francisco (1976).

Furst, P. T. and M. Anguiano, "'To fly as birds': myth and ritual as agents of enculturation among Huichol Indians of Mexico" in J. Wilbert (Ed.) *Enculturation in Latin America: an Anthology*. UCLA Latin American Center Publications, University of California, Los Angeles (1977) 95–181.

Gonçalves de Lima, O., "Observações sôbre o vinho da jurema utilizado pelos indios Pancarú de Tacaratú (Pernambuco)" in Arqu. Inst. Pesquisas Agron. 4(1946) 45–80.

Guzmán, G. and L. Varela, "Hongos de Colombia III" in Caldasia 12(1978) 309–338.

Guzmán-Huerta, G., *Estudio Taxonómico y Ecológico de los Hongos Neutrópicos Mexicanos.* Tésis Profesional, Instituto Politécnico Nacional, Ciencias Biológicas, Mexico (1959).

Halifax, J., *Shamanic Voices.* E. P. Dutton, New York (1979).

Halifax, J., Personal communication.

Harner, M. J., "Common themes in South American Indian yajé experiences" in M. J. Harner (Ed.) *Hallucinogens and Shamanism.* Oxford University Press, New York (1973) 155–175.

Heim, R., *Nouvelles Investigations sur les Champignons Hallucinogenes.* Museum National d'Histoire Naturelle, Paris (1967).

Heim, R., *Les Champignons Toxiques et Hallucinogènes* (Ed. 2) Société Nouvelle des Editions Boubée, Paris (1978).

Heim, R. and R. G. Wasson, *Les Champignons Hallucinogènes du Mexique.* Museum National d'Histoire Naturelle, Paris (1958).

Herrera, W. Personal communication.

Hofmann, A., *LSD-Mein Sorgenkind.* Klett-Cotta, Stuttgart (1979).

Holmstedt, B. and J.-E. Lindgren, "Chemical constituents and pharmacology of South American snuffs" in D. H. Efron (Ed.) *Ethnopharmacologic Search for Psychoactive Drugs,* Public Health Service Publ. No. 1645, U. S. Government Printing Office, Washington, D. C. (1967) 339–373.

LaBarre, W., *The Peyote Cult.* Yale University Publications in Anthropology, New Haven, Conn. (1938).

Pérez de Barradas, J., *Orfebrería Prehispánica de Colombía: Estilo Calima.* Gráficos Jura, Madrid (1954).

Reichel-Dolmatoff, G., "Apuntes etnográficos sobre los indios del alto Río Sinú" in Rev. Acad. Col. Cienc. Exact., Fís. Nat. 12, no. 45(1963) 29–40.

Rose, R. M., *Mushroom Stones of Mesoamerica.* Unpubl. Ph.D. Thesis, Harvard University, Cambridge, Mass. (1977).

Schultes, R.E., "An overview of hallucinogens in the Western Hemisphere" in P. T. Furst (Ed.) *Flesh of the Gods.* Praeger, New York (1972) 28.

Schultes, R. E., *Hallucinogenic Plants.* Golden Press, New York (1976).

Schultes, R. E. and A. Hofmann, *The Botany and Chemistry of Hallucinogens.* Ed. 2 Charles C. Thomas, Springfield, Ill. (1979).

Schultes, R. E. and A. Hofmann, *Plants of the Gods: Origins of Hallucinogenic Use.* McGraw Hill Co., New York (1980).

Schultes, R. E. and B. Holmstedt, "De plantis toxicariis e Mundo Novo tropicale commentationes II. The vegetal ingredients of the myristicaceous snuffs of the northwest Amazon" in Rhodora 70 (1968) 113–160.

Wassén, S. H., "The frog-motive among South American Indians" in Anthropos 29(1934) 319–370. "Part II. The frog in Indian mythology and imaginative world" Ibid., 613–658.

Wasson, R. G., "The hallucinogenic mushrooms of Mexico and psilocybine: a bibliography" in Bot. Mus. Leafl. Harvard Univ. 20(1962) 25–73.

Wasson, R. G., *Soma-Divine Mushroom of Immortality.* Harcourt, Brace and World, New York (1968).

Wasson, R. G., "The divine mushroom of immortality" in P. T. Furst (Ed.) *Flesh of the Gods.* Praeger Publishers, New York (1972) 185–200.

Wasson, R. G., "Traditional use in North America of *Amanita muscaria* for divinatory purposes" in Journ. Psyched. Drugs 11(1979) 25–28.

Wasson, R. G., *The Wondrous Mushroom: Mycolatry in Mesoamerica.* McGraw Hill, New York (1980).

Wasson, V. P. and R. G. Wasson, *Mushrooms, Russia and History.* Pantheon, New York (1957).

Willey, G. R., Personal communication.

PLATE 26

Plate 26–29 Colombian gold "mushroom" pectorals showing more or less realistic amphibian forms. Museo del Oro, Bogotá.

PLATE 27

PLATE 28

PLATE 29

PLATE 30

Plate 30-31 Colombian gold "mushroom" pectorals showing highly stylized amphibian forms. Museo del Oro, Bogotá.

PLATE 31

PLATE 32

Plate 32 33 Colombian gold "mushroom" pectorals showing four avian figures. Museo del Oro, Bogotá.

PLATE 33

PLATE 34

Plate 34–35. Views of the back of Colombian gold "mushroom" pectorals showing "stipes" of the mushroom-like domes. Museo del Oro, Bogotá.

PLATE 35

PLATE 36

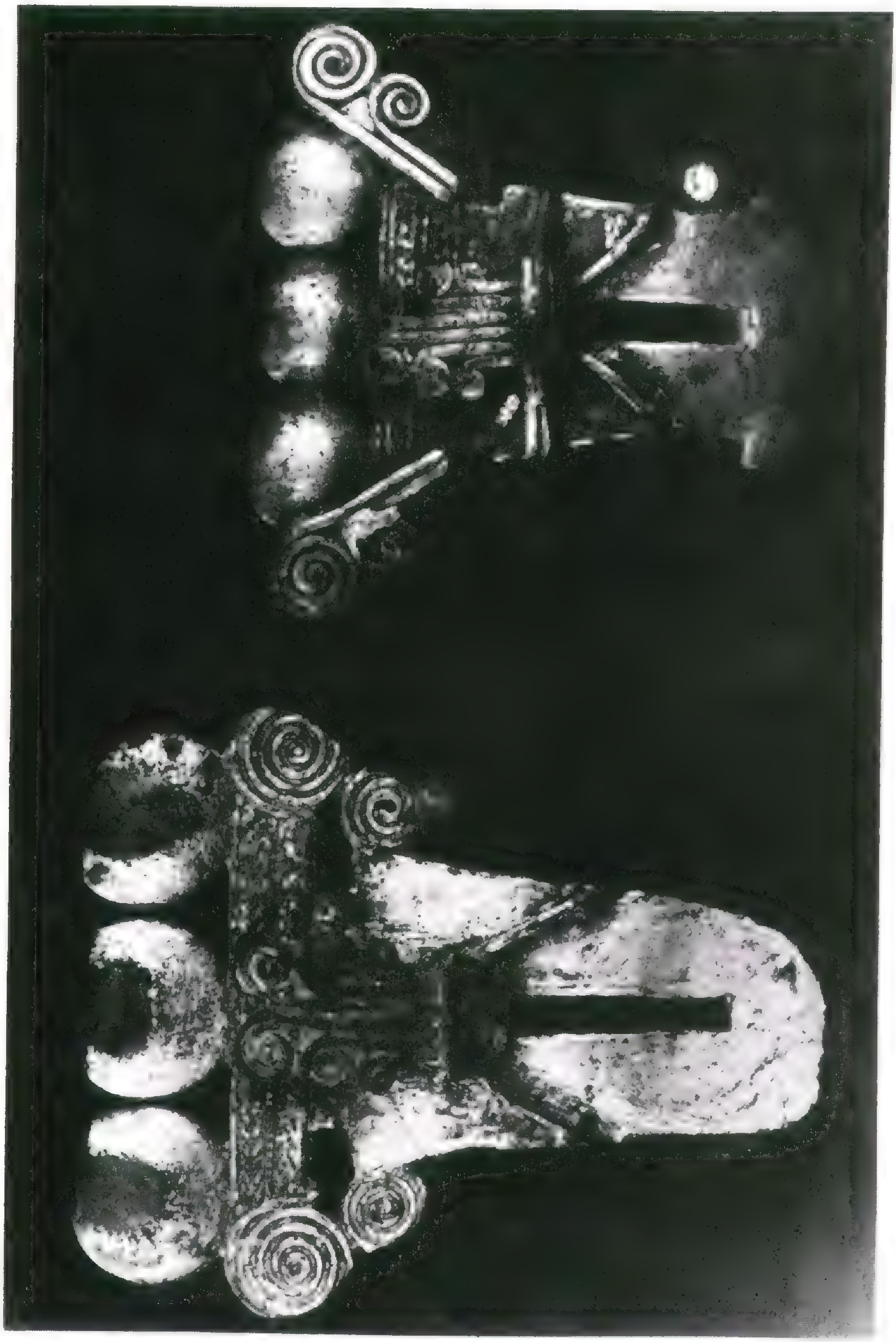


Plate 36 Two of the rare Colombian gold "mushroom" pectorals showing three (instead of two) dome-shaped objects at the top. Museo del Oro, Bogotá.

PLATE 37

Plate 37 Seated man, Colombian Quimbaya Culture, gold. Note the two mushroom-like objects on the head and the two bird (toucan?) beaks in place of legs.

PLATE 38

Plate 38 Pottery vessel in form of human head. Viru and Chicamac Valley, Peru, Early Intermediate Period (AD 200-500), Mochica IV. Note the mushroom-like object on the left side of the forehead and the trance-like expression of the face.

PLATE 39

Plate 39 Pottery vessel in form of human head. Viru and Chicamac Valley, Peru. Early Intermediate Period (AD 200 500), Mochica IV. Note the mushroom-like object at centre of the forehead.

BOTANICAL MUSEUM LEAFLETS VOL. 27, NO. 5-6
MAY-JUNE 1979.

DISCOVERY OF AN ANCIENT GUAYUSA PLANTATION IN COLOMBIA

RICHARD EVANS SCHULTES

I.

Ilex Guayusa Loes.* represents one of the caffeine yielding species of *Ilex* which is used, and has been from early times, as a stimulant, emetic and medicine (Schultes, 1972). It is also one of the most poorly understood species of the genus.

Loesener described *Ilex Guayusa* from sterile material as a "species nova atque dubia" (Loesener, 1901). Flowering material was not available to him in 1901. Nor has any flowering material, to the best of my knowledge, been collected until very recently. Notwithstanding the uncertainty that Loesener himself expressed concerning the validity of his species, *Ilex Guayusa* has always been accepted as a "good" species.

Actually, there have been very few specimens collected of this locally important plant. It is now apparently native to eastern Ecuador and adjacent Peru and Colombia. Although the English plant-explorer Richard Spruce was thoroughly familiar with guayusa, he seems never to have collected it during his assiduous collecting in Amazonian Peru and Ecuador 120 years ago (Schultes, 1978; Spruce, 1901).

There is in the herbarium at Kew an unidentified collection of *Ilex* made during the last century in Guilaguiza and Zamora, Ecuador (*E. C. Lehmann 5581*). I have studied the specimen, which has a few remnants of dried fruits still adhering to the twigs, and I believe that, while it may possibly represent *Ilex Guayusa,* it can be so determined only with strong reservation.

In 1939, Dr. Erik Asplund of the Riksmuseet in Stockholm made an excellent collection of *Ilex Guayusa* in Tena, Provincia Napo-Pastaza, Ecuador (*E. Asplund 9485*). This collection is sterile.

***Ilex guayusa** *Loesener* in Nov. Acta C. L. C. G. Nat. Cur. 78(1901)310.

Several significant collections, all from cultivated sources, were made by my former student, Dr. Homer V. Pinkley, in 1966 in eastern Ecuador (*H. V. Pinkley 199, 454, 455, 456*) at Dureno, Río Aguarico; Puerto Napo; between Tena and Archidona, Guayura, respectively. All are sterile. Notes on these collections, preserved in the Economic Herbarium of Oakes Ames in the Botanical Museum of Harvard University, state that the leaves are prepared as a tea drunk as a "health tonic" and amongst the Jivaro as an "emetic."

II.

Ilex Guayusa has, until recently, not been known from Colombia. Several collections are now available, however, and indicate that this tree is recognized and used medicinally and does grow in the lowland (more or less 2100 feet altitude) areas of the Putumayo on the eastern slopes of the Andes near the Ecuadorian frontier.

COLOMBIA: Comisaría del Putumayo, Valley of Sibundoy. "Obtained at a distance by a Sibundoy medicine man. Medicinal. *Guayusa.*" October 31, 1962. *M. L. Bristol 352-A2.* Comisaría del Putumayo, Pepino, near Mocoa. Alt. 680 m. "Cultivated." May 7, 1972. *R. E. Schultes 26359.* Comisaría del Putumayo, Río Mocoa, Alto Afán, near Mocoa. Alt. 700 m. May 8, 1972. *Schultes 26360.*

The *Bristol* collection constitutes a few leaves purchased from a medicine man of the Kamsá Indian tribe in the highland Valley of Sibundoy (8500 feet altitude). *Ilex Guayusa,* of course, does not grow at this altitude, but the leaves are acquired by trade or purchase from lower, warmer regions. The two *Schultes* collections demonstrate for the first time that the species does indeed form part of the Colombian flora. These collections are preserved in the Economic Herbarium of Oakes Ames, Harvard Botanical Museum, and in the Herbario Nacional de Colombia in Bogotá.

III.

It is suspected that guayusa was formerly employed over a far greater area than today (Schultes, 1972).

We know that the Jesuits exploited *Ilex Guayusa* as a medicine over three centuries ago in the Río Marañon of Peru. Padre Juan Lorenzo Lucero wrote in 1682 that the Jivaro Indians "... put together these evil herbs [*Banisteriopsis, Brugmansia* and other narcotics] with guañusa and tobacco, also invented by the devil, and allow them to boil until the small remaining quantity of juice becomes the quintescence of evil, and the faith of those who drink it is rewarded by the devil with the fruit of malediction, and always to the great misfortune of many ..." (Jiménez, 1889). Later, in 1738, an Italian missionary wrote that the priests employed it as a stomach tonic. At the same time, in 1739, Padre Andrés de Zarate reported that one product of the Jesuit missions was "guayusa." The Jesuits exported guayusa from their missions and sold the leaves in Quito (five leaves for half a real) as a medicine (Figueroa, 1904).

When the Jesuits were expelled from Ecuador in 1766, the business which they had established with guayusa as a cure of venereal disease fell apart. This did not affect, however, the use of *Ilex Guayusa* amongst the Jivaro and Kanelo of the Ríos Napo and Pastaza; these natives continued to cultivate it.

It was at this time, in 1857, that Spruce encountered guayusa extensively under cultivation amongst these same natives at Antombós, near Baños, in Ecuador. Spruce's report (Spruce, 1908) is a most detailed record of guayusa and deserves, therefore, to be quoted in full. I am unable to explain why Spruce failed to make herbarium specimens of *Ilex Guayusa,* unless his reason for neglecting this task was absence of flowers or fruits on the trees which he found. He wrote: "Instead of Cupána or Guaraná [*Paullinia Cupana* HBK.], the Zaparos and Jibaros, who inhabit the eastern side of the Equatorial Andes, have Guayúsa, a plant of very similar properties, but used by them in a totally different way. The Guayúsa is a true Holly [*Ilex*], allied to the maté or Paraguay tea (*Ilex paraguayensis*), but with much larger leaves. I was unable to find it in flower or fruit, and cannot say if it be a described species. The tree is planted near villages, and small clumps of it in the forest on the ascent of the Cordillera indicate deserted Indian sites. The highest point at which I have seen it is at about 5000 feet above the sea, in the gorge of the Pastasa below Baños, on an ancient site called Antombós, a little above a modern cane-farm of the same name.

There, in 1857, was a group of Guayusa trees, supposed to date from before the Conquest, that is, to be considerably over 300 years old. They were not unlike old Holly trees in England, except that the shining leaves were much larger, thinner and unarmed.

"When I travelled overland through the forest of Canelos, and my coffee gave out, I made tea of guayúsa leaves, and found it very palatable. The Jibaros make the infusion so strong that it becomes positively emetic. The guayúsa-pot, carefully covered up, is kept simmering on the fire all night, and when the Indian wakes up in the morning he drinks enough guayúsa to make him vomit, his notion being that if any food remain undigested on the stomach, that organ should be aided to free itself of the encumbrance. Mothers give a strong draught of it, and a feather to tickle the throat with, to male children of very tender age. I rather think its use is tabooed to females of all ages, like caapi on the Uaupés."

An hitherto apparently unpublished Spruce note on guayúsa, preserved at Kew, in a letter to the "Agent of Ecuador Land Company (Mr. G. P. Pritchett) in a reply to enquiries about the feasibility of forming a colony of Europeans in Forests of Canelos (written at Baños, Dec. 1857)" gives additional information on guayúsa and would seem to support the suspicion that the centre of distribution of the plant was the eastern slopes of the Ecuadorian Andes (Schultes, 1978). "I am not sure that the Guayúsa, which the wild Inds plant near their houses might not successfully compete in the English market against the inferior sorts of Tea. This is the leaf of a sort of holly, perfectly difft from the Maté or Paraguay Tea, tho somewhat allied to it, and it has much the same aromatic flavour without the bitterness of Chinese tea. I have used it for weeks of thogt instead of tea, & I believe you have drunk [?] some."

Although the centre of use of *Ilex Guayusa* in the 18th Century appears to have been the eastern Andean slopes of Ecuador and northern Peru, the plant was recorded from Colombia, somewhat to the north of this area.

A missionary, Padre Juan Serra (Serra, 1956), who worked in the Putumayo-Caquetá region of Colombia from 1756 to 1767, wrote that guayusa was used by the head Franciscan priest, Padre José Berrutieta, at Santa Rosa. In view of the extraordinary detail of Padre Serra's report, it may be worth transcribing it here in full.

"The day after the arrival of the President [head priest], I saw strings being hung out in the patio and hanging from them bundles of leaves. I went into the kitchen and asked their purpose. A woman answered: 'Father, this is guayusa. The President drinks it twice a day, and we have hung it in the sun to dry.' I told her that I would like to try it, and she said that she would give me some in the afternoon. Later . . . I tasted it; but as it was already sweetened, I did not drink more, but told her: 'I do not like it sweet, but unsweetened, in order to discover its true taste.' Later, they brought me more, and I drank a whole cupful. It has the color of dark honey, and five leaves are enough to make a chocolate pot full of its juice. Its taste is like tea but finer and more pleasant. When I drank it, I began to sweat and expectorate so much that I was obliged to change my habit, and within half an hour coughed enough phlegm to fill a large cup. These effects seemed to me to be very good. I went to the President and asked him about guayusa. He said that the beverage was excellent for the treatment of venereal diseases, that it . . . cleansed the blood and improved the digestion and appetite, because, when taken in the morning, one does not feel hunger until the afternoon. It strengthened the body and removed all impurities through perspiration and phlegm. All these effects are true, and I have experienced them many times. Father Berrutieta told me also that guayusa taken with honey caused women to become fertile, and, if the honey was that of the bee called *apate,* the woman, if married, would become pregnant immediately. This fact is well known and proven in Quito and the highlands. The Jesuits brought the plant from their mission and sold it in Quito at five leaves for a half real. I asked him where it might be found, and he told me that in the village of La Concepción, Fr. José Garvo had a big tree, but in Pueblo Viejo, the first town one reaches from here, about four days distant, there is a grove of more than one league in area, entirely of guayusa trees. I at once wrote the name of the village and the name of the tree, in order not to forget them, in order that I might provide myself with supplies for my journey and destination."

When Padre Serra arrived at Pueblo Viejo in December, 1756, he ". . . asked the . . . Mayor about Guayusa. He said that there was a great deal, and that if I so wished he would have some brought, because it grew in the forest somewhat outside the town. I told him that I wanted to go there myself and see the guayusa trees. He said that I could not go, that the mountain growth of brush was dense, but I insisted, and he assigned to me three Indians, each with a machete . . . We took with us two *saparos* or baskets . . . We arrived at the guayusa grove, which is on a plain. The guayusa tree is the most beautiful and luxuriant tree that I have ever seen. It grows to be rather large in girth, so much so that three men could not encircle it, and tall in proportion, with a heavy crown. The trunk is ash-color, like the trunk of the poplar, the leaf a gentle and delightful green. So much so that, seeing it, I considered the hardship of the journey well worth while. From the first tree I came to, I took some leaves and began to eat them to find out their taste. I found that it was very agreeable, somewhat similar to tea, but finer and more pleasant. Seeing that there were many seedlings in the field, while the Indians gathered leaves . . . I . . . cut six internodes of bamboo, and, with the machete, took out eighteen seedlings with roots, placing three in each internode with earth from the same place. I took them with me and, in each village of the Putumayo, I planted three guayusa trees, and they all grew, so that, at the end of three years, they were giving many leaves. In this way, all the priests were provided with guayusa for their own consumption." When Padre Serra finished his stay in Colombia and went to Peru, he took half a hundredweight of guayusa leaves with him, as well as a supply to display in Bogotá and Popayán.

That guayusa was well known in the Colombian Putumayo in those years is attested also by the reports of several Franciscan missionaries who had a mission on the Río Putumayo slightly downstream from its confluence with the Río Sucumbíos (Cuervo, 1894; Zawadzky, 1947). "Among the medicinal plants cultivated by our missionaries . . . for the relief of the poor Indians and themselves, the guayusa tree is outstanding. A description of this tree is being sent, at his request, to Don Pedro de Valencia, treasurer of the Royal Mint at Popayán. Its leaves, which are the most valued part of the plant, are eagerly sought in various parts of New Granada by those acquainted with its beneficial properties as a purgative and an aid to digestion."

About a century later, Padre Manuel María Albís (Albís, 1936) wrote about his trips to the Macaguaje Indians along the Ríos Mecaya, Senseya and Caucaya, in the same Putumayo-Caquetá area of Colombia. Of guayusa, he reported that "it is hot and used in poisonings; the burned leaves, when mixed with barley and honey, are given to women suffering amenorrhoea; when boiled and mixed with *yoco,* a caffein-containing liana [*Paullinia Yoco* R. E. Schult. et Killip] the preparation is used to cure dysentery; the liquid is used for stomach aches."

Patiño (Patiño, 1968) insinuates that guayusa "grows both wild and cultivated." Pinkley (pers. comm.) also believes that the species may grow in a truly wild state, although he has never encountered it outside of cultivation. Except for the vague statement by Padre Serra that "it grew in the forest," I find no evidence in the literature to suggest its occurrence in an undoubtedly wild state. All references indicate that guayusa, when not planted, grows as an escape or vestige of former plantings around abandoned human habitation sites. Patiño further intimates that, since guayusa, according to early reports, grew so prolifically in the Colombian Putumayo-Caquetá region; that since Padre Serra's experiments in guayusa propagation were so easily successful; and that since, in Pueblo Viejo, there was a grove "more than a league in size" -- guayusa might be still found in the area. Although I once doubted that any vestiges of these ancient plantings still exist in the Putumayo, Patiño's suspicion has proven to be correct.

IV.

In May, 1972, together with Dr. Andrew T. Weil of the Botanical Museum of Harvard University and Mr. Enrique Hernández of the Universidad de Nariño, I was able to make two collections in southern Colombia. Both are sterile, but both are extremely interesting from the point of view of history and of economic botany.

The first (*Schultes 26359*) was from a small bushy shrub cultivated in the dooryard of a *curandera* who lived in Pepino, a small town near Mocoa. She regularly pruned the bush, selling the leaves to Indian medicine men in the nearby highland village of Sibundoy and to the public herb market in the city of Pasto. They are valued medicinally as a "tonic." The source of the collection *Bristol 352-A2* was undoubtedly this bush, since our questioning always elicited the same answer: that this *curandera* was the only source of guayusa leaves for export in the whole Mocoa area.

The *curandera* informed us that the original material for her bush came from "large and ancient trees" in the very old town of Pueblo Viejo near Mocoa. Pueblo Viejo is now a very tiny and poor hamlet completely off the main highway and, in 1972 at least, accessible only on foot.

We decided to make the trip. Upon arrival, we began to enquire about guayusa. Few people knew the plant, but the school teacher found that several of the school children were aware of the location of a number of large trees. They agreed to guide us. A walk of an hour and a half over rude and abandoned, muddy mule trails brought us to Alto Afán. There we were rewarded by finding tall trees of great age which, from their manner of growth, indicated definitely former cultivation. The trees were sterile, but the natives maintained that they did flower and that the flowers were "tiny and greenish white."

The eldest farmers living in Alto Afán—some of them apparently of great age—assured us that the trees were large and old when they were children.

We have not the slightest doubt that these trees are vestiges of the guayusa plantations described by Padre Serra, who encountered a grove in Pueblo Viejo "of more than one league in area" some 200 years ago.

BIBLIOGRAPHY

Albis, M. M. *Memorias de un Viajero* (1854). Rev. Popayan, 26, no. 163–165 (1936) 28–32.

Cuervo, A. B. *Colección de Documentos Inéditos sobre la Geografía y la Historia de Colombia* IV. Secc. 2a. *Geografía-Viajes-Misiones-Limites. Casanare y el Caquetá durante la Colonia* (1894). [Quoted in Patiño, 1968].

Figueroa, F. *Relación de las misiones de la Compania de Jesús en el país de los magnas.* Colección de Libros y Documentos Referentes a la Historia de América (1904) 406 [Quoted in Patiño, 1968].

Jiménez de la Espada, M. *Noticias auténticas del famoso río Marañon y misión apostólica de la Compania de Jesús de la provincia de Quito . . .*" (1889) 13, 373, 626 [Quoted in Patiñno, 1968].

Loesener, L. E. T. "Monographia Aquifoliacearum" in Nov. Acta C. L. C. G. Nat. Cur. 78 (1901) 310.

Patiño, V. M. "Guayusa, a neglected stimulant from the eastern Andean foothills" in Econ. Bot. 22 (1968) 311 316.

Schultes, R. E. "*Ilex Guayusa* from 500 A.D. to the present" in Etnolog. Stud. 32 (1972) 115-138.

Schultes, R. E. "Richard Spruce and the potential for European settlement of the Amazon: an unpublished letter" in Bot. Journ. Linn. Soc. 77 (1978) 131–139.

Serra, Juan de Santa Gertrudis. *Maravillas del Peru* 1, pt. 1, 2 (1956) 28, 29; 2, pt. 3, 4. Biblioteca Presidencia la República, Lima. [Quoted in Patiño].

Spruce, R. *Notes of a Botanist on the Amazon and Andes* [Ed. A. R. Wallace] Macmillan, London 2 (1908) 453 454.

Zawadzky C., A. *Viajes misioneros del R. P. Fr. Fernando* de Jesús Lrrea, franascano, 1770–1773 (1947). [Quoted in Patiño].

PLATE 40

Plate 40. One of the large, old trees of *Ilex Guayusa* in Alto Afán, Pueblo Viejo, Putumayo, Colombia. Photograph: R. E. Schultes.

PLATE 41

Plate 41. The present inhabitants of Pueblo Viejo know that the leaves of *Ilex Guayusa* have presumed medicinal value, but they apparently do not use the plant. One of the trees in the ancient abandoned guayusa plantation in Alto Afán, Pueblo Viejo, Putumayo, Colombia. Photograph: R. E. Schultes.

Botanical Museum Leaflets Vol. 27, No. 5-6
May-June 1979

THE FLOWERS OF ILEX GUAYUSA

Melvin Shemluck*

In 1901, Theodor Loesener described a new species of holly from sterile material collected in 1898 by Warsczewic in eastern Peru. Loesener named the holly *Ilex Guayusa*, because the Indians of eastern Colombia, Ecuador, and Peru used its leaves to prepare a medicinal and beverage tea called *guayusa* (or *huayusa*).

Although the plant is well known to local people, few botanists have collected it, and it is poorly represented in the world's herbaria. The great English plant-explorer, Richard Spruce, did not collect guayusa, although he was well acquainted with it and even employed it as a substitute for tea when his supply of the latter ran out (Schultes: "Richard Spruce and the potential for European settlement of the Amazon: an unpublished letter" in Bot. Journ. Linn. Soc. 77 (1978) 131-139). It is so poorly represented in herbaria that a major United States institution mounted leaves from a commercially prepared wreath as their sole representative of the species.

Two reasons can be offered for this poor representation. One is that guayusa, a cultivated plant, has been poorly collected by researchers interested in more academic botanical problems connected with the wild flora. Another reason, the more conceivable, is that *Ilex Guayusa* could not be found in flower: botanists are hesitant, given the time and weight constraints of collecting expeditions, to collect non-flowering or non-fruiting material. Consequently, it has been those botanists interested in economically important species who have collected most of the specimens of this plant.

The absence of flowers and fruit has led some botanists to speculate that guayusa is an asexually reproduced cultigen which has lost its flowering ability through years of selection and vegetative propagation by man. Like many other cultivated

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plants, it seems to grow only in association with human habitation, either presently or in the past (Schultes: "Discovery of an ancient guayusa plantation in Colombia" in Bot. Mus. Leafl. Harvard Univ. 27 (1979) 143).

The view that this plant has been in association with man for a long period of time is also reinforced by speculation that *Ilex Guayusa* may possibly represent only a cultivated variant of *I. paraguariensis.* It was, in fact, Loesener himself who, in describing guayusa, first pointed out the possible relationships between *L. Guayusa* and *I. paraguariensis:* "Species ob flores adhuc ignotos valde dubia. Sed si re vera de Ilice agitur, species *I. paraguariensis* St. Hil. et *I. nitidae* (Vahl) Maxim. sine dubio affinis. Folia maiora et acutius acuminata quam in affinibus." *I. paraguariensis*, known as *yerba maté* or *Paraguay tea,* grows wild in the mountains of southern Brazil, Paraguay and Argentina; it is also cultivated in these countries.

My interest in *Ilex Guayusa* was sparked by a conversation with Prof. Richard Evans Schultes of the Botanical Museum of Harvard University in 1979. I was preparing an ethnobotanical expedition to Ecuador, and he suggested that a search for guayusa flowers be included in my plans. Prof. Schultes told me of the plant's meager taxonomic representation, its interesting use as a caffeine-containing plant used as a snuff in ancient Bolivia (Schultes: "*Ilex Guayusa* from 500 AD to the present" in Etnolog. Stud. 32 (1972) 115 138) and its importance as a medicinal and ritual tea amongst contemporary Indians in Ecuador (Villavicencio, M.: *Geografiá de la República del Ecuador* (1858) 371 374; Patiño, M.: Guayusa a neglected stimulant from the eastern Andean foothills" in Econ. Bot. 22 (1968) 311–316).

Soon after arriving in Quito in August 1979, I discovered that the question of guayusa's ability to flower had been answered by a collection in the herbarium at the Universidad Central of that city. On October 4, 1975, an expedition led by Ing. Agr. Alberto Ortega, Professor of Botany at this university, discovered flowers on a tree growing near a market in Sacua, Ecuador. Thanks to Ing. Ortega, I have examined this material. It consists entirely of staminate flowers. This collection represents the first flowers of *Ilex Guayusa* ever collected by botanists: the original material collected by Warsczewicz 77 years earlier was sterile—as are all subsequent collections.

Just one week after examining the specimen at the Universidad Central, I was also able to locate flowering material of guayusa. With Mr. Fred Ness of the University of New Mexico, I found a small tree in the tiny village of Rió Chicó, ten kilometers south of Puyo, Ecuador. Rió Chicó is inhabited by people known variously as the Canelos Quechua, Sacha Runa or Puyo Runo. The village stands at an altitude of approximately 1000 meters, similar to that of Ortega's collection. Nevertheless, flowering was occuring two months earlier.

The tree, growing next to the school master's house, did not belong to any single local family but was used by all members of the immediate community. My guide and informant, Sr. Rafael Santi, told me that guayusa tea is used before and after drinking the hallucinogen called *ayahuasca (Banisteriopsis Caapi).* Drinking the tea kills the bitter taste of the ayahuasca, and its use afterwards prevents hangovers. In addition, it gives a person strength to cope with the powerful hallucinogen. Guayusa is also used by local people as a coffee substitute and for stomach trouble, and it is reputedly an aphrodisiac. In Puyo, numerous grocery stores sell "leis" of folded and strung leaves for local consumption.

The tree was 30 feet tall, with a diameter of about 10 inches at breast height. It had whitish bark on all stems older than three years. After waiting for three weeks, I was able to collect specimens with about one third of the flowers open. Sr. Santi told me that the tree produced seeds, but at the time I could verify only that abundant pollen was being released. I located two other guayusa trees growing several hundred meters outside of the same village, but they were not in flower. These trees were approximately 12 feet in height and had the appearance of large shrubs. I was told by several residents that these trees flowered many months later, in the early part of the year.

I examined the flowers and found them all to be staminate. Numerous flowers and buds were cross-sectioned, and only two tiny vestigial locules could be found in the cushion-shaped gynoecium. No hint of ovules or placental tissue exists. I can offer no reasonable explanation for my guide's asserting that this tree produced seeds, especially since this man is a very astute observer and would not mistake other floral parts for seeds. It is of note, however, that one flower amongst the 60 to 80 examined did resemble the pistillate form of *Ilex paraguariensis.* This one flower possessed a gynoecium slightly constricted into four carpel regions, each bearing a stigma-like structure directly upon it, and it did produce pollen.

With the discovery of flowers, questions about the natural history of *Ilex Guayusa* can be explored. It is interesting that, upon cursory examination, flower morphology and leaf shape are very much like those of *I. paraguariensis*. In contrast, however, guayusa attains heights of 75 feet, while *I. paraguariensis* is a shrub or small tree growing only to 24 feet. Additionally, guayusa leaves are usually much larger. Guayusa is apparently dioecious and may well be accommodated in the reproductive pattern of the genus. However, little more can be said with certainty, and fundamental questions concerning sexual reproduction and lack of vernal synchronization of trees in the same area must be answered.

In conclusion, the next logical step is to search for pistillate flowers of guayusa and to determine whether or not they produce viable seeds. Furthermore, field data on all species of *Ilex* in the New World tropics are needed in order to evaluate effectively the taxonomic position of this species. It is to be hoped that the historical difficulty in finding flowering material will not hinder future studies and that 77 years need not pass before the reproductive biology of this interesting economic plant is more fully understood.

Ilex Guayusa *Loesener emend. Shemluck*

Arbor magna, robusta, usque ad 75 ped. alta sed praecipue in cultura usualiter minor. Rami glabri vel subglabri, frequenter minute et longitudinaliter delicate striolati. Folia magna, glabra, supra vulgo nitidula viridiaque, subtus pallida, interstitis saepisime 1.5–3 cm. longis dissita; stipulis conspicuis inaequaliter subulato-deltoideis, cinereis, usque ad 1.8 mm. longis, basiń 1mm. latis; petioli glabri, plus minusve rugulosi, plerumque

1–1.2 cm. longi; lamina chartacea vel submembranacea, oblonga vel elliptico—oblonga (interdum subovato-lanceolata), margine leviter recurvata, crenato-serrata, base acuta vel subcuneato—obtusa, apice manifeste acuminata, vulgo 9–12 cm. (sed saepe usque ad 21 cm.) longa et 4–5 cm. (sed frequenter usque ad 7.5 cm.) lata, nervis lateralibus 8 ad 10, in angulis 45–60° dispositis, apicem versus curvis, marginem versus reticulatis, supra inconspicuis et subtus prominentibus. Inflorescentiae imperfectae in axillis fasciculatae, cymosae, pedunculo plus minusve 5–9 mm. longo, sparsissime piloso. Flores staminati parvi, albo-virides gemmis 1.5–2 mm. in diametro; pedicelli minute strigosi, plerumque 5 mm. longi; bracteoli brunnei, granulosi, subulati, usque ad 1mm. longi; calyx crateriformis, lobis 4, brunneis extus marginem versus albidis, dense granulosis, triangularibus, apice obtusulis, plerumque 1–1.4 mm. longis, 1.2–2 mm. latis; petalis plerumque 4, basin conspicue connatis, toto 3.5–4 mm. longis, membranaceis viridulis sed marginem versus albis, extus pilosulis, intus in lineis minutissime papilosis, rotundato-obtongis, 3 mm. longis, base 2.5 mm. latis; stamina plerumque 4 (saepe 5), petalis base adnata, filamentis 1.5 mm. longis, antheris 1.5 mm. longis; ovario rudimentario pulvinato; 1–1.5 mm. in diametro, glabro. Flores pistillati ignoti.

ECUADOR: Provincia de Pastaza, Río Chicó, affluent of Río Pastaza. Village of Río Chicó and vicinity. alt. c. 1000 m. 31 August 1979. *M. Shemluck 236.* –Same tree 25 August 1979, 1979 *M. Shemluck et F. Ness 221.*

EXPLANATION OF PLATE 42.

1. Flowering branch, about 1/2 natural size.
2. Inflorescence (with incipient branch distally), about 1 1/2 natural size.
3. Single staminate flower, about 6 times natural size.
4. Variant, uncommon form of pistil in pollen-bearing staminate flower, about 10 times natural size.
5. Bud, about 5 times natural size. Drawn by E. W. Smith

Botanical Museum Leaflets Vol. 27, No. 5-6.
May June 1979

CHEMICAL TEST FOR SILICA DETERMINATIONS AS AN ARCHAEOLOGICAL FEATURE IN ETHNOBOTANY

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Silica determinations of archaeological soils and ethnobotanical materials have consisted primarily of visual and microscopic identifications based on morphological measurements of diatoms of sediment cores and of plant opal or phytoliths in the absence of other botanical evidence.

Bacillariophyceae, or diatoms, are unicellular algae characterized by a cell wall of silica, and classified on the basis of cell wall markings. Species are specific in their requirements and their relative abundance is useful in determining past environmental conditions.

Phytoliths are opalline silica bodies found in the epidermal cells of certain plant groups. Unlike the silicification process in petrified wood, phytolith deposition produces distinct types associated with specific genera.

Chemical analysis of archaeological soils and materials offers not only further substantiation for ethnobotanical identifications, but also affords the possible mapping of a distinct archaeological zone consisting of silica deposition indicative of the past presence of standing or running waters, or of agricultural sites.

A gravimetric determination of silica (as SiO_2) can be measured as loss on volatilization by means of hydrofluoric acid, after dehydration by use of both hydrochloric and perchloric acid.

PROCEDURE

1. Preparation of Samples

A. Samples should be stored and tested in non-borosilicate containers, such as those of polyethylene, plastics or rubber.

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B. Samples should be previously unprepared or unprocessed: that is, they should not have undergone any other type of analysis that involves acid digestion as sample preparation (such as in pollen analysis).

C. Samples should be reduced to particulates either with a porcelian mortar and pestle, or a metallic grinder.

D. At all times samples should be protected against atmospheric dust and any other contaminant.

2. Preparation of Reagents

A. All reagents and distilled water should be stored in non-borosilicate containers (see 1.,A) and protected from contamination (see 1.,D).

B. Distilled water should be known to be low in silica.

C. HYDROCHLORIC ACID (1:1): prepare HCL (1:1) by adding equal volumes of HCL and distilled water.

D. HYDROCHLORIC ACID (1:50): prepare HCL (1:50) by diluting one volume of HCL with fifty volume of distilled water.

E. SULFURIC ACID (1:1): prepare H_2SO_4 (1:1) by adding equal volumes of H_2SO_4 and distilled water.

F. HYDROFLUORIC ACID (1:1): prepare HF (1:1) by adding equal volumes of HF and distilled water.

G. PERCHLORIC ACID (7:3): prepare $HCLO_4$ (7:3) by diluting seven volumes of $HCLO_4$ with three volumes of distilled water. (Perchloric acid is explosive in the presence of organic matter; exercise due caution).

3. Preparation of Blanks

A. Prepare a reagent blank of five milliliters of distilled water.

B. Run test procedure as in 4, including additions of acids, evaporations and ignitions, on this reagent blank.

4. Test[1]

A. dehydration

[1] This test eliminates interferences due to tannin, color and turbidity.

1. Place 5 gms. of pulverized materials to be tested in a platinum or acid-leached glazed porcelain evaporating dish.
2. To this sample, add 5 ml. of HCL (1:1) to form a slurry. Stir or mix to expose as much surface area of the sample as possible to the HCL.
3. Evaporate over a water bath or other suitable heating apparatus.
4. During this evaporation, add 5 ml. of HCL (1:1) at three appropriately spaced intervals.
5. Add 5 ml. $HCLO_4$ (7:3), and proceed to total evaporation.
6. After evaporation to dryness, place the dish in an oven (110° C) or other suitable apparatus to bake for forty minutes.
7. Remove evaporating dish and allow to cool until moderately warm.
8. Add to residue in dish, 5 ml. HCL (1:1), and 50 ml. distilled water to form a slurry. Stir with porcelain spatula or other suitable apparatus (no glass).
9. Pass this heated mixture through an ashless, quantitative grade filter paper by means of vacuum filtration.
10. Wash evaporating dish with small amounts of HCL (1:50), and pass this through the same filter.
11. Pass 50 ml. of hot distilled water in 10 ml. increments also through the residue on the filter.
12. Set aside this filter with residue.
13. Place the filtrate (see 9) and washings (see 10, 11) in the original evaporating dish, in portions if necessary, and evaporate to dryness as in 6.
14. Repeat steps 7 through 12.
15. Place the two filters with residue (see 12), in a tared covered platinum crucible and place the crucible in a drying oven (110° C) for forty minutes.
16. After drying, remove the covered crucible from the drying oven; place in a muffle furnace, and ignite to 1000° C for fifteen minutes.
17. Remove the crucible from the muffle furnace and cool in a dessicator; weigh and repeat step 16, until cooled crucible demonstrates a constant weight.
18. Record this constant weight.

B. VOLATILIZATION

1. Add small amount of distilled water to moisten residue in crucible.
2. Add 0.2 ml. of H_2SO_4 (1:1).
3. Add 10 ml. HF (1:1).
4. Slowly evaporate to dryness. Do not use oven; avoid loss by spattering.
5. After evaporating to dryness, place in a muffle furnace, and ignite to 1000°C for fifteen minutes.
6. Remove the crucible from the muffle furnace and cool in a dessicator; weigh and repeat step 5 until cooled crucible demonstrates a constant weight.
7. Record this constant weight.

5. CALCULATIONS

A. Subtract values of reagent blanks (see 3., A., B.) from weights after evaporation (see 4., A., 18), and after volatilization (see 4., B., 7).
B. Subtract the corrected weight of the crucible after volatilization (4., B., 7) from the corresponding corrected weight after evaporation and before volatilization (4., A., 18).
C. The difference X, in milligrams, is the loss on volatilization and represents silica.
D. Mg. SiO_2= X = loss on volatilization.

6. EVALUATION OF RESULTS

Compared to lower levels in surrounding soil or material, significantly high levels of silica in association with the presence of diatoms, indicates past environmental conditions of either standing or running water; and in the presence of certain phytoliths indicates past grasslands rather than woodlands, and more specifically, in accordance with the phytolith classification scheme suggested by D. M. Pearsall, supports the identification of the presence of maize in archaeological contents.

This procedure was developed in the Ethnobotanical Laboratory of the Botanical Museum of Harvard University with the support and encouragement of Professor Richard Evans Schultes, Director of the Museum. I thank Professor Schultes and the Museum staff for their contribution to this project, and in particular, Professor Elso S. Barghoorn, Lillian Hanscom, Publications Secretary, and Wesley Wong, Librarian.

SELECTED BIBLIOGRAPHY

1. Dimbleby, G. W., *Plants and Archaeology*, Humanities Press, Inc., New York, 1967.
2. Helbaek, H., 'Palaeo-Ethnobotany': in *Science in Archaeology*, (Eds. D. Brothwell and E. Higgs), Thames and Hudson, Bristol, 1963.
3. Leo, R. F. and Barghoorn, E. S., "Silicification of Wood", in *Bot. Mus. Leafl.*, Harvard Univ., Vol. 25, #1, December 7, 1976.
4. Pearsall, D. M., "Phytolith Analyses of Archaeological Soils; Evidence for Maize Cultivation in Formative Ecuador": in *Science*, Vol. 199, January 13, 1978.

BOTANICAL MUSEUM LEAFLETS
HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS, SEPT.-NOV. 1979 VOL. 27. NO. 7-9

SYSTEMATICS OF THE GENUS STELIS SW.

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In preparing the manuscript for the second volume of the "Orchids of Ecuador" which includes the genera of the *Pleurothallidinae*, I had the opportunity to look at the genus *Stelis* critically again after some 23 years. Namely, in 1957, as a privileged recipient of a Guggenheim Fellowship for Canadians which allowed me to spend a year in the Orchid Herbarium of Oakes Ames at Harvard University, I had prepared a critical study of the genus *Stelis*. Although the interest in this unpublished, book-length monograph has been fairly constant throughout the years by both professionals and amateurs alike, the chances for its publication grew slimmer for financial reasons as the years went by. The present synopsis is based essentially on that manuscript, but the position of each species has been re-evaluated. Consequently the internal structure of the genus is quite different from my classification published in 1956 (Canadian Journ. Bot. 34: 346-359). In that paper I also have covered in sufficient details the historical background of the genus including the infrageneric classifications. These aspects, therefore, are not repeated here.

In this synopsis the systematics of the genus are completely revised and brought in line with the articles of the International Code of Botanical Nomenclature. The key to the sections has been expanded to include the 22 alliances into which the genus is now divided.

In revising the genus it became apparent that about 32 species share in common a special character which cannot be accomo-

Botanical Museum Leaflets (USPS 404-990). Published monthly except during July and August by the Botanical Museum, Harvard University, Cambridge, Massachusetts 02138. Subscription: $25.00 a year, net, postpaid. Orders should be directed to Secretary of Publications at the above address. Second-Class Postage Paid at Boston, Massachusetts.

dated within the circumscription of the genus *Stelis*. Here I refer to those species in which the flowers have a single stigma as opposed to the two stigmata in the genus *Stelis*. For these species the generic name *Apatostelis* is proposed here.

In recent years a lot of attention has been focused on the whole group of *Pleurothallidinae*, resulting in the publication of a number of new genera. As an introduction to the *Pleurothallidinae* a key to all genera within this subtribe is given here. Attention must be called to the fact that the following generic names are excluded for various reasons: *Luerella* Braas differs from *Masdevallia* solely in the character of the petals which are calliferous externally in the former; *Pabstiella* Brieger differs from *Pleurothallis* only in the prominent columnfoot; *Garayella* Brieger is based on the same type as *Chamelophyton* Garay; *Dubois-Reymondia* Karst., recently resurrected by Brieger, had been reduced already in 1859 to a synonym of *Pleurothallis* by Lindley due to lack of differentiating characters; *Restrepiopsis* Luer is a recent segregate of *Restrepiella* Garay, yet both genera have the same circumscription; *Octandrorchis* Brieger is only an *Octomeria* with connate lateral sepals; *Steliopsis* Brieger is not validly published the obscure description in German and the photograph of the general habit of the plant leave little doubt that it is referable to *Stelis Allenii* L.O.Wms.

I would like to call special attention to the genus *Specklinia* Lindl. which I recognize only as a subgenus of *Pleurothallis*. It certainly deserves a recognition at the generic level as it is evident from the "Key to Genera" provided on subsequent pages. Such a step, however, will require some 800 nomenclatorial transfers.

STUDY OF FLORAL DETAILS.

The flowers of most *Stelis* species are very small to minute and commonly are of a rather fleshy texture. The conventional method of preparing herbarium specimens through drying and pressing, frequently damages the intricate floral structures. Therefore, care must be taken in preparation for examination. There are two simple methods available: 1, boiling the dried flowers for about one minute, after which the flowers should be dissected submerged in water: 2, placing the dry flowers in concentrated ammonia for about 30 minutes, then washing in cold running water for 5–10 minutes, after which they should be dissected submerged in water. If drawings are to be prepared, they should be made from the submerged flowers and floral parts. If the flowers are exposed to air on open slides, they will desiccate very rapidly and become distorted. Most of the *Stelis* drawings published by Schlechter show such distortions. The plates attached to this paper were prepared from flowers submerged in water.

It should be mentioned that the advantage of using the ammonia method is that after the flowers have been washed thoroughly in running water, they can be transferred to FAA or alcohol and can be stored indefinitely. Such material will not differ substantially from actual live material preserved in liquid in the field.

TYPIFICATION OF THE GENUS.

When Swartz established the genus *Stelis,* he explicitly stated that its characters are those given for *Humboldtia* Ruiz & Pavón. At the same time he also noted that the generic name of *Humboldtia* was previously used by Vahl. Therefore, *Stelis* is merely a new name for *Humboldtia* Ruiz & Pavón, and the lectotype for it must be chosen from among the eleven specific epithets provided by Ruiz and Pavón in their *Systema Vegetabilium.* There are five *Humboldtia* species which are definitely referable to *Stelis,* and of these only *Humboldtia purpurea* exhibits the characters depicted by Ruiz and Pavón on plate 27 for *Humboldtia;* these drawings are part of the original protologue. The holotype of *Humboldtia purpurea* is in the herbarium of Jardin Botanico, Madrid; duplicates are in the Reichenbach Herbarium, Vienna, and in the Willdenow Herbarium, Berlin.

The generic name *Stelis* was conserved in 1905, although, as Stafleu has shown in Taxon 8:258,1959, the conservation was superfluous at that time. In 1929, *Epidendrum ophioglossoides* Jacq. was selected as the lectotype by Green in Prop. Brit. Bot. p. 100, and this typification was conserved in 1930. Unfortunately, *Epidendrum ophioglossoides* is based on Plumier's polynomial of 1703, as well as on Plumier's drawing of it published subsequently by Burmann in 1759. A closer examination of Plumier's drawing reveals at once that it is referable to the genus *Pleurothallis* R.Br. as it is understood today, and is conspecific with *Pleurothallis floribunda* (Lindl.)Lindl. Therefore, a retypification of *Stelis* is necessary to prevent a mass transfer of some 1,000 specific epithets from *Pleurothallis* which is inevitable if the old typification is maintained.

In using this reasoning, Garay and Sweet in the Journal of the Arnold Arboretum 53: 528, 1972 have selected *Humboldtia purpurea* Ruiz & Pavón as a new lectotype.

ACKNOWLEDGMENTS

My special thanks and appreciation are recorded here to the John Simon Guggenheim Memorial Foundation for their Canadian Fellowship awarded to me in 1957 for the purpose of a monographic revision of the genus *Stelis*. This same foundation has also provided extra financial help toward the preparation of the illustrations published for the first time in this paper.

The financial help in the form of a grant from the American Orchid Society's Fund for Education and Research and the contribution of Mr. Fritz Hamer of El Salvador, both of which helped to defray in part the publication costs of this paper, are here gratefully acknowledged.

KEY TO THE GENERA OF THE SUBTRIBE PLEUROTHALLIDINAE

1.	Pollinia 2	2
1a.	Pollinia 4 or 6 or 8	23
2.	Lip firmly adnate to column	3
2a.	Lip movably articulate with column	5
3.	Flowers fleshy; lip adnate to base of column at a right angle	**Crocodeilanthe**
3a.	Flowers membranaceous; lip parallel with column	4
4.	Column cylindric to clavate; stigma in front of column facing lip	**Lepanthes**
4a.	Column trumpet-shaped; stigma terminal in center of obliquely truncate column	**Salpistele**
5.	Flowers not resupinate, i.e. lateral sepals and lip uppermost	6

5a. Flowers resupinate, i.e. lateral sepals and lip lowermost 8
6. Lateral sepals in natural position connivent with dorsal sepal to tip, but free between themselves to middle, forming a slanted, eye-like opening on top of flower . . . . **Andreettaea**
6a. All three sepals are free at tip 7
7. Sepals ringent; lateral sepals with cushion-like thickening at tip; petals adnate to base of column; lip of simple construction, entire in front, commonly arcuate . . . . **Scaphosepalum**
7a. Dorsal sepal at a right angle with the lateral sepals; petals adnate laterally near apex of the long, channelled column-foot; lip intricately sculptured, 2-lobed in front, basally with an overhanging, large, fleshy callus . . . **Acostaea**
8. All three sepals connate at tip, forming a window-like opening at least on one side between dorsal and a lateral sepal . . . . **Cryptophoranthus**
8a. All three sepals free at apex, if connivent, is due to imperfect separation in anthesis 9
9. Dorsal sepal variously connate with lateral sepals 10
9a. Dorsal sepal free from lateral sepals 19
10. Stigmata 2, terminal, one on each side of rostellum . . . . **Stelis**
10a. Stigma 1, on top or face of column under rostellum 11
11. Sepals united into a 3-lobed synsepal, i.e. lateral sepals free from one another almost to base, but highly connate with dorsal sepal . . . . **Physothallis**
11a. Sepals never form a 3-lobed synsepal 12
12. Rostellum arrect; anther dorsally reclined; lip sensitively hinged under free tip of column-foot **Porroglossum**
12a. Rostellum porrect or recurved; anther incumbent; lip non-sensitively articulate at tip of column-foot . . . 13
13. Petals adnate laterally to column-foot; lateral sepals with a thickened fold or transverse callus . . . . . **Dryadella**
13a. Petals adnate at base of column; lateral sepals without a thickened fold or transverse callus 14
14. Lip segmented into a hypochile and epichile; petals crested or calliferous at apex . . . . **Dracula**

14a. Lip not segmented; petals unadorned or with marginal or intramarginal callosity 15
15. Column erect, footless or with an oblique base; rostellum large, sensitive, i.e. when pollinia removed, it bends over and hides the stigma .... **Apatostelis**
15a. Column arcuate with a prominent foot; rostellum neither sensitive nor hides the stigma 16
16. Petals unadorned, membranaceous 17
16a. Petals fleshy, always with callosities at or near margin .... **Masdevallia** (Luerella)
17. Plants rhizomatous, repent; peduncle almost none, 1- to 2-flowered; flowers sessile .... **Phloeophila** (Geocalpa)
17a. Plants aggregate; peduncle manifest, 1- to many-flowered; flowers pedicellate 18
18. Sepals always united into a distinct sepaline tube; base of lip free from column-foot .... **Physosiphon**
18a. Sepals shallowly connate, ringent; base of lip clasping column-foot .... **Triaristella**
19. Stigma or stigmata terminal; rostellum prominent; anther more or less reclining; column without wings or auricles 20
19a. Stigma on face of column; rostellum short; anther inclined; column with distinct wings or auricles 21
20. Sigmata 2, one on each side of rostellum; column very short, dilated toward apex, without a foot; secondary stem with muricate, hirsute (lepanthiform) sheaths .... **Lepanthopsis**
20a. Stigmata confluent, 1, transversely elliptic or reniform, often protruding on both sides of rostellum; column short to elongate, dilated toward the pedestal-like column-foot; secondary stem with glabrous sheaths .. **Pleurothallis (Subgen. Pleurothallis)**
21. Column sessile, footless, consists of a large conspicuous cucullate clinandrium; inflorescence always terminal .... **Platystele**

21a. Column more or less elongate with a distinct foot; clinandrium less conspicuous than the whole columnar structure; inflorescence rarely lateral 22

22. Lip originating beneath the free apex of the column-foot; petals calliferous to carinate .... **Rodrigoa**

22a. Lip originating at adnate apex of column-foot; petals neither calliferous nor carinate .... **Pleurothallis (Subgen. Specklinia)**

23. Pollinia 4 24

23a. Pollinia 6 or 8 27

24. Secondary stems elongated, prominently caespitose or aggregated; peduncle commonly shorter than leaves 25

24a. Secondary stems very short, hardly any, on distinct rhizome; peduncle commonly longer than leaves .... **Barbosella**

25. Sepals fleshy, coriaceous, partially united to form a flask-shaped base, free above .... **Dresslerella**

25a. Sepals rather thin in texture, free 26

26. Inflorescence sessile; foot of column short, as narrow as the column itself; petals with a distinct, broad blade .... **Restrepiella** (Restrepiopsis)

26a. Inflorescence pedunculate; foot of column distinctly expanded at base, pedestal-like; petals always linear-filiform with a clavate tip .... **Restrepia**

27. Column short, footless; stigmata 2; lip inconspicuous; secondary stems remote on ascending, caulescent rhizome .... **Brachionidium** (Yolanda)

27a. Column elongate with distinct foot; stigma 1; lip conspicuous; secondary stems caespitose or approximate or alternate on decumbent rhizome 28

28 Pollinia 6; secondary stem very short, distichously alternating on rhizome .... **Chamelophyton** (Garayella)

28a. Pollinia 8; secondary stem well-developed, elongate 29

29. Flowers aggregate, sessile; sepals and petals more or less similar .... **Octomeria** (Octandrorchis)

29a. Flowers on long, slender peduncles; sepals and petals dissimilar .... **Pleurothallopsis**

STELIS* Swartz

in Schrader's Journal für die Botanik 2 (4):239, t.II, Fig. 3, a g, 1799; Fl. Ind. Occid. 3: 1549, 1998, 1804; in K. Vetensk. Acad. Nya Handl. Stockh. 21: 248, 1800; in Schrd. N. Journ. 1: 97, 1805; Spreng., Anleit. I., 1:288, 1802; Syst. 3: 730, 1826; Gen. 2: 669, 1831; Willd., Sp. Pl. 4: 138, 1805; Pers., Syn. 2: 524, 1807; R. Brown in Ait. Hort. Kew. ed. 2, 5:210, 1813; Kunth in Humb. & Bonpl., Nov. Gen. et Sp. Pl. 1:361, 1816; Presl, Rel. Haenk. 1: 103, 1827; Lindl., Gen. and Sp. Orch. Pl. 11, 1830; in Bot. Reg. 28: Misc. p. 68, 1842; Folia Orch. Stelis 1858; Poepp. & Endl., Nov. Gen. ac Sp. Pl. 1: 46, 1836; Endlich., Gen. Pl. 188, 1836; Reichenbach fil. in Walp. Ann. Bot. Syst. 3: 524, 1852; ibid. 6: 198, 1861; Griseb., Fl. Brit. W. Ind. Isl. 611, 1864; Bentham in Journ. Linn. Soc. Bot. 18: 292, 1881; in Benth. & Hook., Gen. Pl. 3: 490, 1883; Hemsley in Gard. Chron. n.s. 12: 108, 1879; ibid. n.s. 16: 136, 1881; in Godman & Salvin, Biol. Centr. -Amer. Bot. 3: 203, 1883; Barb. Rodr., Gen. et. Sp. Orch. Nov. 2:82, 1882; Pfitzer in Engl. & Prantl. Die Natürl. Pflanzenfam. 2(6): 138, 1888; in Engl., Bot. Jahrb. 19: 20, 1894; Stein, Orchideenbuch 568, 1892; Kerch., Le Livre des Orchidées 263, 1894; Cogniaux in Mart., Fl. Bras. 3(4): 342, 1896; in Urb., Symb. Antill. 6: 385, 1910; Porsch in Denkschr. Akad. Wissensch. Wien 79 (1): 104, 1908; Fawc. & Rendle, Fl. Jamaica 1: 50, 1910; Schlechter, Die Orchideen 175: 1914; ed. 2, 171, 1927; Lemée, Dict. Descr. & Syn. Gen. Pl. Phanerog. 6: 271, 1935; Ames in Field Mus. Bot. Ser. 18(1): 295, 1938; Acuña in Bol. Tec. No. 60. Esta. Agron. Cuba 116, 1939; Stehlé, Fl. Descr. Antill. Franc. 1: 180, 1939; Pittier et al, Cat. Fl. Venez. 1: 203; 1945; León, Fl. Cuba 1: 365, 1946; L. O. Williams in Ann. Mo. Bot. Gard. 33: 55, 1946; in Ceiba 2: 75, 1951; Hoehne, Iconogr. Orch. Brasil 204, 1949;

*ETYMOLOGIA: Stelis, vox graeca, significat viscum quod arbori innascitur, quae natura huius generis est." Swartz *loc.cit.*

Ames & Correll in Fieldiana 26: 155, 1952; Foldats in Anal. Univ. Central Venez. 33: 271, 1953; in Lasser, Fl. Venez. 15: 43, 1970; Hodge in Amer. Orch. Soc. Bull. 23: 38, 1954; Garay in Can. Journ. Bot. 34: 346, 1956; C. Schweinf. in Fieldiana 30: 163, 1958; Schultes, Native Orch. Trinidad & Tobago 69, 1970; Garay & Sweet in Howard, Fl. Lesser Antill., Orch. 90, 1974; Hamer, Orch. El Salvador 2: 339, 1974; Pabst & Dungs, Orch. Brasil. 1: 150, 1975.

Syn.: **Humboldtia** Ruiz & Pavón,Fl. Peruv. Chil. Prodr. 121, 1794, non Vahl no. 3518, 1794.
Dialissa Lindl. in Ann. & Mag. Nat. Hist. 15: 107, 1845.

Sepala inter se aequalia vel subaequalia, vulgo patentia, breviter vel alte connata, interdum urceolum formantia, raro omnia in synsepalum conniventia; textura sive tenuis sive carnosa. Petala vulgo carnosa, quam sepala multoties breviora, lata, apice plus minusve incrassata. Labellum concavum, carnosum. Calli disci nunc transversi, bipartiti, nunc, integri sic basali, nunc lamelliformes six lateraliter oblique inserti. Columna abbreviata, vulgo apoda, sursum dilatata, valde carnosa, bibrachiata; clinandrium prominens; stigmata 2, in brachiis distinctae, laterales; rostellum valde productum; anthera terminalis, opercularis, incumbens; pollinia 2, cerea, apice saepius visco parco connexa.

Herbae epiphyticae vel saxicolae. Caules caespitosi vel repentes, interdum proliferi, unifoliati, non pseudobulbosi. Folium coriaceum, basi saepe in petiolum contractum. Racemi elongati, nunquam uniflori; bractae alternae, saepe distichae, nunc imbricatae. Flores parvi vel minuti, saepissime secundi.

LECTOTYPUS: **Humboldtia purpurea** Ruiz & Pavón

KEY TO INFRAGENERIC CATEGORIES AND ALLIANCES WITHIN CATEGORIES.

1. Sepals flabellate, i.e., lateral sepals free almost to base, but fused half way with dorsal sepal into a 3-lobed synsepal .... **SUBGENUS NEXIPOUS**

1a. Sepals never flabellate 2

2. Flowers in natural position either urceolate or ventricose, i.e., the three sepals highly connate with one another forming an inflated base .... **SUBGENUS DIALISSA**

2a. Flowers in natural position either bilabiate, i.e., lateral sepals forming a variously connate synsepal, or stellate, i.e. all three sepals free, together forming a triangle in outline 3

3. Flowers stellate; sepals either radially or bilaterally symmetrical .... **SUBGENUS STELLATA**

A. Column with a prominent foot **SECTION PEDALES**

AA. Column footless .... B

B. Disc of lip either with a protruding transverse ridge or convex, cushion-like C

BB. Disc of lip either flat to concave or deeply excavate .... F

C. Lip viewed from side commonly triangular to replicate-triangular in outline; disc viewed either from above or from front, always with a well-defined, transverse ridge .... **SECTION DISTICHAE**

a. Bracts well-developed, longer than pedicellate ovary, often distichous, and/or imbricating .... **1. S. disticha alliance**

aa. Bracts small to inconspicuous .... b

b. Column elongate, much surpassing the petals in length .... **2. S. columnaris alliance**

bb. Column short, as long as, or shorter than petals c

c. Sepals form an equilateral triangle in outline .... **3. S. purpurascens alliance**

cc. Sepals form an inequilateral triangle in outline .... **4. S. elatior alliance**

CC. Lip viewed from side never triangular in outline; disc cushion-like without a well-defined, transverse ridge .... D

D. Lip longer than wide .... **SECTION RHOMBOIDEAE**

a. Lip ovate-rhombic in outline, widest near base .... **5. S. rhomboidea alliance** aa. Lip from a long-cuneate base obovate-rhombic to subquadrate-oblong, widest near apex .... **6. S. Fendleri alliance**

DD. Lip as wide as or wider than long .... E

E. Lip with an incurved, filiform tooth in middle of anterior margin .... SECTION MONOSTACHYAE

EE. Lip either broadly apiculate or entire in front .... SECTION ISOCHILAE

a. Disc of lip with a longitudinal, fleshy, ridge-like callus in center .... **7. S. ascendens alliance**

aa. Disc of lip with a longitudinal groove in center .... **8. S. apiculata alliance**

F. Lip flat to concave, part of which with a longitudinal, somewhat incrassate disc .... G

FF. Lip deeply excavate, navicular to cymbiform .... SECTION CHASMOSTELIS

a. Secondary stem distinct for size of plant, elongate .... b

aa. Secondary stem indistinct for size of plant, very short; lip linear-oblong, navicular, mostly hidden by a large plate .... **9. S. microchila alliance**

b. Lip triangular-hastate without a distinct basal plate .... **10. S. Porpax alliance**

bb. Lip ovate to elliptic or subglobose with a distinct transverse plate at base c

c. Lip ovate to elliptic to subnavicular .... **11. S. despectans alliance**

cc. Lip subglobose-cymbiform .... **12. S. angustifolia alliance**

G. Dorsal sepal much longer than lateral sepals .... SECTION LABIATAE

a. Petals mucronate; plants caespitose, often proliferous .... **13. S. triseta alliance**

aa Petals mucronate; plants caespitose, often proliferous .... **13. S. triseta alliance**

GG. Dorsal sepal hardly different from lateral sepals .... SECTION CONCAVE

a. Lip entire or short apiculate in front ..... b aa. Lip 3-lobed .... **15. S. aprica alliance**

b. Callus of lip with a longitudinal, central groove c

bb. Callus of lip with a longitudinal, rather obscure ridge in center ..... **16. S. gutturosa alliance**

c. Secondary stems caespitose, densely approximate .... **17. S. oblonga alliance**

cc. Secondary stems produced on a rhizome .... d

d. Secondary stems approximate on an ascending rhizome .... **18. S. pusilla alliance**

dd. Secondary stems remote on a horizontal rhizome .... **19. S. scansor alliance**

3a. Flower bilabiate; lateral sepals for the most part connate, but in nature usually connivent to a bifid apex .... **SUBGENUS STELIS**

a. Plants caespitose .... b

aa. Plants rhizomatous **20. S. tenuicaulis alliance**

b. Petals rather thin, cuneate flabellate, longer than wide .... **21. S. globiflora alliance**

bb. Petals fleshy, transverse, always wider than long .... **22. S. purpurea alliance**

c. Flowers rather large; dorsal sepal 6–12 mm. long .... **22a. S. purpurea group**

cc. Flowers rather small; dorsal sepal 2–4(5) mm. long .... **22b. S. aviceps group**

INFRAGENERIC CATEGORIES

Subgenus **Nexipous** Garay, *subgen. nov.*

Typus: *Stelis nexipous* Garay

Flores flabellatae, i.e. sepala lateralia inter se fere usque ad basem libera, sed cum sepalo postico alte connata, synsepalum, 3-lobum formantia.

Subgenus **Dialissa** (Lindl.) Garay in Can. Journ. Bot. 34: 351, 1956.

Basionym: Genus *Dialissa* Lindl. in Ann. Mag. Nat. Hist. 15: 107, 1845.

Syn.: *Stelis* Sect. *Dialissa* (Lindl.) Lindl., Folia Orch. Stelis 2, 1858.

Typus: *Dialissa pulchella* Lindl.

Flores seu urceolatae seu ventricosae, i.e., sepala inter se alte connata, superne semiaperta, infra ventricoso-inflata.

Subgenus **Stellata** Garay, *subgen. nov.*

Typus: *Epidendrum trigoniflorum* Sw.

Syn.: *Stelis* Subgenus *Eustelis* Lindl. ex Cogn. in Mart., Fl. Bras. 3(4):355, 1896.

Stelis Subgenus *Stelis* Sw. ex Garay in Can. Journ. Bot. 34:350,1956.

Typus: *Epidendrum trigoniflorum* Sw.

Flores stellatae, i.e., sepala similia, inter se seu bilateraliter seu radialiter symmetrica.

Section **Pedales** Garay, *sect. nov.*

Typus: *Humboldtia lanceolata* Ruiz & Pav.

Syn.: *Stelis-Trivalves* Rchb.f. in Walp.Ann. 6: 199,1861. *Nomen.*

Lectotypus: *Stelis major* Rchb.f.

Flores stellatae; columna in pedem longum, prominentem producta.

Section **Distichae** Lindl. ex Cogn. in Mart.,Fl. Bras. 3(4) : 343, 1896.

Lectotypus: *Stelis disticha* Poepp. & Endl., *in hoc loco.*

Syn.: *Stelis* Sect. *Eustelis* Lindl., Folia Orch. Stelis 2, 1858.

Stelis Sect. *Papulosae* Garay in Can.Journ. Bot. 34: 351, 1956.

Lectotypus: *Epidendrum trigoniflorum* Sw., *in hoc loco.*

Stelis Sect. *Fissae* Garay in Can.Journ.Bot.34:351,1956.

Lectotypus: *Stelis papaquerensis* Rchb.f., *in hoc loco.*

Flores stellatae; labellum a latere visum in ambitu triangulare vel replicato-triangulare; discus semper distincte transverseque carinatus.

Section **Rhomboideae** Garay, *sect.nov.*

Typus: *Stelis rhomboidea* Garay

Flores stellatae; labellum in ambitu rhombeum, longius quam latius, a latere visu nunquam triangulare; discus obscure vel non-carinatus.

Section **Monostachyae** Lindl. ex Cogn. in Mart., Fl.Bras. 3(4):344, 1896.
Lectotypus: *Stelis argentata* Lindl., *in hoc loco*.

Flores stellatae; labellum a latere visum nunquam triangulare, latius quam longius vel aequilatum, antice in medio dentiferum.

Section **Isochilae** Garay, *sect. nov.*
Typus: *Stelis apiculata* Lindl.

Flores stellatae; labellum a latere visum nunquam triangulare, subaequilongum et latum; discus convexus, pulvinatus.

Section **Chasmostelis** Schltr. in Fedde, Rep. Beih. 19: 18, 1923.
Typus: *Stelis despectans* Schltr.

Flores stellatae; labellum valde excavatum, naviculare vel cymbiforme.

Section **Labiatae** Lindl., Folia Orch. Stelis 2, 1858.
Lectotypus: *Stelis brevilabris* Lindl., *in hoc loco.*

Flores stellatae; sepalum posticum quam sepala lateralia longius; labellum vulgo 3-lobum, dimidio inferiore incrassatum, planum vel plus minusve concavum.

Section **Concavae** Garay in Can.Journ.Bot. 34: 351, 1956.
Lectotypus: *Humboldtia oblonga* Ruiz & Pav.

Syn.: *Stelis* Sect. *Distinctae* Garay in Can.Journ. Bot. 34: 351, 1956.

Lectotypus: *Stelis aprica* Lindl.

Flores stellatae; sepala similia, i.e., sepalum posticum a sepalis lateralibus haud diversum; labellum sive integrum sive trilobum vel apiculatum, dimidio inferiore vulgo incrassatum, planum vel plus-minusve concavum.

Subgenus **Stelis**

Syn.: Genus *Humboldtia* Ruiz & Pav., Fl.Peru. & Chile., Prodr. 121, 1794, non Vahl 1794.

Stelis Sect. *Humboldtia* (Ruiz & Pav.) Pers.,Syn.Pl. 2: 524, 1807.

Lectotypus: *Humboldtia purpurea* Ruiz & Pav.

Stelis Sect. *Disepalae* Rchb.f. in Bonpl. 3: 70, 1855, *Nomen.*

Lectotypus: *Stelis melanoxantha* Rchb.f.

Stelis Subgen. *Inaequales* Garay in Can.Journ.Bot. 34: 351, 1956.

Stelis Sect. *Valvae* Garay in Can. Journ.Bot. 34: 351,1956. Typus: *Humboldtia purpurea* Ruiz & Pav.

Flores bilabiatae. Sepalum posticum a sepalis lateralibus valde diversum. Sepala lateralia inter se pro parte connata, in natura saepissime usque ad apicem conniventia.

ABBREVIATIONS

Roman numerals I to XI which appear under each illustration are designating subgenera or sections. Arabic numerals represent alliances within sections. The habit of plant whether caespitose or rhizomatous is represented by a small "c" or "r" respectively.

SUBGENERA AND SECTIONS

I = Subgen. Nexipous
II = Subgen. Dialissa
III = Sect. Pedales
IV = Sect. Distichae, 1–4
V = Sect. Rhomboideae, 5–6
VI = Sect. Monostachyae
VII = Sect. Isochilae, 7–8
VIII = Sect. Chasmostelis, 9–12
IX = Sect. Labiatae, 13–14
X = Sect. Concavae, 15–19
XI = Subgen. Stelis, 20–22

ALLIANCES AND GROUPS

1 = S. disticha alliance
2 = S. columnaris alliance
3 = S. purpurascens alliance
4 = S. elatior alliance
5 = S. rhomboidea alliance
6 = S. Fendleri alliance

7 = S. ascendens alliance
8 = S. apiculata alliance
9 = S. microchila alliance
10 = S. Porpax alliance
11 = S. despectans alliance
12 = S. angustifolia alliance
13 = S. triseta alliance
14 = S. brevilabris alliance
15 = S. aprica alliance
16 = S. gutturosa alliance
17 = S. oblonga alliance
18 = S. pusilla alliance
19 = S. scansor alliance
20 = S. tenuicaulis alliance
21 = S. globiflora alliance
22a = S. purpurea group
22b = S. aviceps group

columnaris 2
despectans 11
disticha 1
elatior 4
Fendleri 6
globiflora 21
gutturosa 16
microchila 9
oblonga 17
Porpax 10
purpurascens 3
purpurea 22a
pusilla 18
rhomboidea 5
scansor 19
tenuicaulis 20
triseta 13

NEW TAXA

Stelis aperta Garay, *sp. nov.* I.

Epiphytica, caespitosa, usque ad 50 cm. alta; radicibus filiformibus, glabris; caulibus secundariis erectis, vaginis ternis, infundibuliformibus, pro maxima parte obtectis, usque ad 13 cm. longis; folio coriaceo oblongo-ligulato, acuto, basin subpetiolato-conduplicato, usque ad 11 cm. longo, 1.5 cm. lato; inflorescentia singula, erecta, satis dense multiflora, usque at 38 cm. longa; bracteis oblique ovato-cucullatis, acutis, usque ad 3 mm. longis; floribus apertis, ut videtur secundis, intus minutissime papillosis; sepalis lateralibus oblique ovatis, obtusis, 3-nerviis, inter se liberis sed cum sepalo postico alte connatis, usque ad 5.5 mm. longis, 5 mm. latis; sepalo postico ovato-triangulo, obtuso, usque ad 3+3 mm. longo, 4 mm. lato; petalis carnosis, 3-nerviis, transverse rhombeo-ellipticis, usque ad 1 mm. longis, 1.5 mm. latis; labello ovato-elliptico, leviter concavo, obtuso, disco basin et supra apicem calloso-incrassato donato, usque ad 1.5 mm. longo, 2 mm. lato; columna erecta, sursum paululo expansa, usque ad 2 mm alta; ovario pedicellato ca. 3mm. longo.

Ecuador: without precise locality. Lehmann 21! (W).
Type in Reichenbach Herbarium no. 65889.

Stelis steganopus Garay, *sp. nov.* I.

Epiphytica, caespitosa, usque ad 19 cm. alta; radicibus filiformibus, flexuosis glabris; caulibus secundariis erectis, vaginis ternis pro maxima parte obtectis, usque ad 8 cm. longis; folio satis coriaceo, lineari-oblongo, obtuso, basin in petiolum, 1 cm. longum attenuato, petiolo incluso usque ad 11 cm. longo, 1.3 cm. lato, vulgo angustiori; inflorescentiis succedaneis, 1 3, suberectis vel paulo arcuatis, foliis aequilongis vel paulo brevioribus, satis dense multifloris; bracteis oblique ovato-cucullatis, acutis, adpressis, usque ad 2 mm. longis; floribus atropurpureis, nutantibus, intus minute papillosis; sepalis lateralibus inter se liberis, sed sepalo postico alte connatis, inde synsepalum formantibus, oblique ovatis, obtusis, usque ad 4.5 mm. longis, 3 mm. latis; sepalo postico ovato-elliptico, obtuso usque ad 2.5 + 2 mm. longo, 3 mm. lato; petalis minutissimis, transverse ellipticis, obtusis, 3-nerviis, dimidio superiori incrassatis, usque ad 0.5 mm. longis, 1 mm. latis; labello satis membranaceo, cuneato-elliptico, acuto vel subapiculato, disco basin callo V-formi, satis prominenti ornato, toto labello 2 mm. longo, 1.2 mm. lato; columna humili, sursum paulo dilatata, usque ad 1 mm. alta; ovario pedicellato 2 mm. longo.

Ecuador: Morona-Santiago, Cordillera Cutucú, S.W. of Río Itzintza. Camp E-1299! (NY) Type!

Stelis calyculata Garay, *sp. nov.* II.

Epiphytica, caespitosa, usque ad 15 cm. alta; radicibus filiformibus, flexuosis, glabris; caulibus secundariis approximatis, erectis vel oblique ascendentibus, vaginis 3, imbricantibus pro maxima parte obtectis, usque ad 3 cm. longis; folio oblanceolato-oblongo, subacuto vel obtuso, basin in petiolum, 1 cm. longum cuneatim contracto, petiolo incluso usque ad 5 cm. longo, 1 cm. lato; inflorescentia singula, erecta, gracili, laxe multiflora, usque ad 13 cm. longa; bracteis oblique infundibuliformibus, 1 mm. longis; floribus secundis, glabris; sepalis inter se alte connatis, urceolatis; sepalo postico elliptico, obtuso, 4 + 2 mm. longo, 2.5 mm. lato; sepalis lateralibus oblique ovato-triangularibus, obtusis, usque ad 4 + 2 mm. longis, 2.5 mm. latis; petalis subquadrato-obovatis, apice valde retusis, satis concavis, extus sub apice tumidis, uninerviis, usque ad 1.2 mm. longis, 0.8 mm. latis; labello carnoso, obovato-cymbiformi, basi subgloboso, antice acuto; disco basin callo bipartito, transverso donato; toto labello usque ad 1.2 mm. longo, 0.8 mm. lato; columna humili, cylindrica, 1 mm. alta; ovario pedicellato 2 mm longo.

Ecuador: Bolívar, Hacienda Talahua. Penland & Summers 612! (AMES) Type!

Stelis Schlechterana Garay, *nom. nov.* IV-c-1
Basionym: *Stelis mirabilis* Schltr. in Fedde, Rep. Beih. 27: 32, 1924.

Stelis hirsuta Garay, *sp. nov.* IV-r-3
Basionym: *Stelis Jamesonii* var. *parviflora* Garay in Can. Journ.Bot. 34: 352, 1956.

Stelis antennata Garay, *sp. nov.* V-r-6

Epiphytica, rhizomatosa, usque ad 13 cm. alta; rhizomate gracili, ascendenti; radicibus filiformibus, flexuosia, glabris; caulibus secundariis primum ascendentibus, deinde suberectis, satis gracilibus, vaginis costatis, imbricantibus omnino obtectis, usque ad 7 cm. longis; folio obovato-elliptico, obtuso, basi in petiolum, usque ad 13 mm. longum abrupte contracto, petiolo incluso usque ad 5 cm. longo, 1.2 cm. lato; inflorescentia singula, arcuata, laxe pluriflora, usque ad 10 cm. longa; pedunculo gracili, usque ad 5 cm. longo; floribus purpureis, ut videtur secundis, glabris; sepalo postico ovato-triangulari, acuto vel subacuminato, 3-nervio, usque ad 4 mm. longo, 2 mm. lato; sepalis lateralibus patentibus, oblique ovatis, acutis vel subacuminatis, 3 -nerviis, usque ad 4 mm. longis, 1.8 mm. latis; petalis carnosis, rhombeis, apice longe aristatis, 3-nerviis, usque ad 3 mm. longis, 2 mm. latis; labello cuneato-subquadrato, cochleari, antice subtruncato, obtuso; disco usque ad medium incrassato-papilloso; toto labello 2 mm. longo, 1.5 mm. lato; columna humili, 2 mm. alta; ovario cylindrico, 2 mm. longo; pedicello 5 mm. longo.

Bolivia: Sailapatá, 3000 m. alt. Cardenas 3288! (AMES) Type!

Stelis calceolaris Garay, sp. nov. VIII-c-10

Epiphytica, caespitosa, usque ad 25 cm. alta; radicibus filiformibus, flexuosis, glabris; caulibus secundariis approximatis, erectis, foliis aequilongis, vaginis 3-nis, omnino obtectis, usque ad 7.5 cm. longis; folio coriaceo, lineari-oblanceolato, obtuso, basin in petiolum usque ad 1 cm. longum sensim angustato, petiolo incluso usque ad 7 cm. longo, 1 cm. lato; inflorescentia singula, erecta, satis dense multiflora, usque ad 22 cm. longa; bracteis infundibuliformibus, truncatis, 2 mm. longis; floribus ut videtur purpurascentibus, secundis, glabris; sepalis inter se simillimis, pantentibus, ovato-ellipticis, acutis vel obtusis, 3-nerviis, usque ad 3.5 mm. longis, 3 mm. latis; petalis carnosis, cuneato-subrotundis, 1.5 mm. longis latisque, raro paululo latioribus; labello carnoso, cochleato-naviculari, basin callo transverso donato, usque ad 2 mm. longo, 1.7 mm. lato; columna humili brachiis paululo divaricatis, 2 mm. longis; ovario pedicellato usque ad 4 mm. longo.

Colombia: Depto. Cundinamarca, Bogotá. Karsten s.n.! (LE) Type!

Stelis bractescens Garay, *nom. nov.* XI-c-22a
Basionym: *Stelis bracteata* Schltr. in Fedde, Rep. Beih. 27:26, 1924, not Schltr. 1923.

Stelis robustior Garay, *nom. nov.* XI-c-22a
Basionym: *Stelis robusta* Schltr. in Fedde, Rep. Beih. 27: 38, 1924, not Schltr. 1918.

Apatoselis Garay, *gen.nov.*
Syn.: *Stelis* Sect. *Eustelis—Polystachyae* Lindl., Folia Orch. Stelis 2, 1858.
Stelis Sect. *Polystachyae* (Lindl.) Cogn. in Mart. Fl. Bras. 3(4): 343, 1896.

EYMOLOGY: *apate* = deceit, fraud and *Stelis* = generic name. The name is given to emphasize the general appearance of the flowers resembling those of the genus Stelis, yet having a very different columnar structure.

Sepala inter se libera vel plus minusve connata. Petala quam sepala breviore. Labellum carnosum, basi columnae adnatum, saepe breviter tenuiterque unguiculatum. Columna cylindrica, apoda vel basin breviter decurrentia; clinandrium prominens, vulgo 3-lobatum; stigmata sub rostello confluentia, inde singulum; anthera terminalis, incumbens; pollinia 2, apice visco parco connexa.

Herbae epiphyticae vel saxicolae; caulibus caespitosis vel ex rhizomate ascendentibus, non pseudobulbosis; foliis singulis, saepe petiolatis; inflorescentiis vulgo racemosis, rare subcapitatis; floribus satis parvis.

TYPUS: *Stelis hylophila* Rchb.f.

KEY TO ALLIANCES

1. Dorsal sepal much longer than the connivent lateral sepals .... 1. **A. glossula alliance**
1a. Dorsal sepal more or less the same length as the divergent lateral sepals 2
2. Lip viewed from side triangular to replicate-triangular in outline; disc always with a well-defined, transverse ridge .... 2. **A. crescentiicola alliance**
2a. Lip viewed from side never triangular in outline 3
3. Lip 3-lobed; lateral lobes incrassate, calliferous .... 3. **A. chamaestelis alliance**
3a. Lip entire 4
4. Lip wider than long .... 4 **A. hirtella alliance**
4a. Lip as long as, or longer than wide 5
5. Apical part of lip concave, excavate, thin 6
5a. Apical part of lip convex-thickened, fleshy, never excavate .... 5. **A. ciliaris alliance**

6. Inflorescence with conspicuously developed bracts; lip with prominent V-shaped callus from base to middle
   .... 6. **A. montana alliance**

6a. Inflorescence with inconspicuous bracts; lip without V-shaped callus, basal half fleshy, thickened, callus-like . 7

7. Inflorescences commonly more than one, rarely exceed subtending leaf, usually much shorter; lip ovate-oblong to subquadrate in outline .... 7. **A. hylophila alliance**

7a. Inflorescence always one, commonly much longer than subtending leaf, rarely subequal to it; lip from a trapezoid base rhomboid .... 8. **A. rubens alliance**

The Arabic number which appears after each nomenclatorial transfer designates its position among the alliances in the genus.

Apatostelis alata (Lindl.) Garay, *comb. nov.* —7.
Basionym: *Stelis alata* Lindl., Folia Orch. Stelis 18, 1858.
Syn.: *Stelis tenuilabris* Lindl., Folia Orch. Stelis 4, 1858.
Stelis canaliculata Rchb.f. in Gard. Chron. 1718, 1872.
Stelis myriantha Schltr. in Fedde, Rep. Beih. 7:90, 1920.

Apatostelis atrorubens (L.O.Wms.) Garay, *comb. nov.* —3.
Basionym: *Stelis atrorubens* L.O.Wms. in Ann. Mo. Bot. Gard. 29: 239, 1942.

Apatostelis braccata (Rchb.f. & Warsc.) Garay, *comb. nov.* —7.
Basionym: *Stelis braccata* Rchb.f.& Warsc. in Bonpl. 2: 114, 1854.

Apatostelis chamaestelis (Rchb.f.) Garay, *comb. nov.* —3.
Basionym: *Pleurothallis chamaestelis* Rchb.f. in Linnaea 22: 825,1850.
Syn.: *Stelis florea* Lindl., Folia Orch. Stelis 5, 1858.
Stelis chamaestelis (Rchb.f.) Garay & Dunsterv., Venez. Orch.Ill. 4:292, 1966.
Stelis Umbriae Schltr. in Fedde, Rep. Beih. 27:40, 1924.
Stelis Lasallei Foldats in Act. Bot. Venez. 3:406, 1968.

Apatostelis ciliaris (Lindl.) Garay, *comb. nov.* —5.
Basionym: *Stelis ciliaris* Lindl. in Hook., Comp. Bot. Mag. 2:353,1837.
Syn.: *Stelis atropurpurea* Hook. in Bot. Mag. 69: t. 3975, 1842.
Stelis confusa Schltr. in Beih. Bot. Centralbl. 36(2): 386, 1918.
Stelis micrantha var. *atropurpurea* (Hook.) Josst, Orchid. 38, 1851.

Apatostelis Corae (Foldats) Garay, *comb. nov.* —6.
Basionym: *Stelis Corae* Foldats in Act. Bot. Venez. 3:401, 1968.

Apatostelis costaricensis (Rchb.f.) Garay, *comb. nov.* —7.
Basionym: *Stelis costaricensis* Rchb.f. in Bonpl. 3: 225, 1855.
Stelis minutiflora A. & S., Sched. Orch. 8: 18, 1925.

Apatostelis crescentiicola (Schltr.) Garay, *comb. nov.* —2.
Basionym: *Stelis crescentiicola* Schltr. in Fedde, Rep. 16: 442, 1920.
Syn.: *Stelis Isthmii* Schltr. in Fedde, Rep. Beih. 17:16, 1922.
Stelis praemorsa Schltr. in Fedde, Rep. Beih. 17, 17, 1922.

Apatostelis glossula (Rchb.f.) Garay, *comb. nov.* —1.
Basionym: *Stelis glossula* Rchb.f in Gard. Chron. 1373, 1870.

Apatostelis gracilifolia (C. Schweinf.) Garay, *comb. nov.* —2.
Basionym: *Stelis gracilifolia* C. Schweinf. in Bot. Mus. Leafl. 17:38, 1955.

Apatostelis grossilabris (Rchb.f.) Garay, *comb. nov.* —7.
Basionym: *Stelis grossilabris* Rchb.f. in Gard.Chron. n.s. 16: 717, 1881.
Syn.: *Stelis Covilleana* Schltr. ex Knuth in Fedde, Rep. Beih. 43: 226,1927. *Nomen.*
Stelis Pittieri Schltr. ex Knuth in Fedde, Rep. Beih. 43: 227, 1927. *Nomen.*

Apatostelis hirtella Garay, *nom. nov.* —4.
Basionym: *Stelis hirta* Lindl., Folia Orch. Stelis 3, 1858, not J.E.Sm. 1816.

Apatostelis hylophila (Rchb.f.) Garay, *comb. nov.* —7.
Basionym: *Stelis hylophila* Rchb.f. in Bonpl. 3:241, 1855.
Syn.: *Stelis reflexa* Lindl., Folia Orch. Stelis 3, 1858.
Stelis recurvula Schltr. in Fedde, Rep. Beih. 9: 68, 1921.
Stelis Gonzaleziana C. Schweinf. in Rev. Acad. Colomb. Cienc. 5: 349, 1943.

Apatostelis inaequalis (Ames) Garay, *comb. nov.* —1.
Basionym: *Stelis inaequalis* Ames, Sched. Orch. 4: 12, 1923.

Apatostelis Jimenezii (Schltr.) Garay, *comb. nov.* —5.
Basionym: *Stelis Jimenezii* Schltr., in Beih. Bot. Centralbl. 36(2):389,1918.
Syn.: *Stelis fimbriata* Baker in Ann. Mo.Bot. Gard. 55:68, 1968.
Stelis gratiosa Luer in Selbyana 5:192, 1979.

Apatostelis latipetala (Ames) Garay, *comb. nov.* —2.
Basionym: *Stelis latipetala* Ames in Bot.Mus.Leafl. 3:53, 1935.

Apatostelis Leinigii (Pabst) Garay, *comb. nov.* —2.
Basionym: *Stelis Leinigii* Pabst in Orquidea 29: 7, 1967.

Apatostelis magnipetala (Schltr.) Garay, *comb. nov.* —7.
Basionym: *Stelis magnipetala* Schltr. in Fedde, Rep. Beih. 27:31, 1924.

Apatostelis minimiflora (Schltr.) Garay, *comb. nov.* —7.
Basionym: *Stelis minimiflora* Schltr. in Fedde, Rep. Beih. 27: 31, 1924.

Apatostelis minuta (C. Schweinf.) Garay, *comb. nov.* —7.
Basionym: *Stelis minuta* C.Schweinf. in Bot.Mus.Leafl. 10: 120,1942.

Apatostelis montana (L.O.Wms.) Garay, *comb. nov.* —6,
Basionym: *Stelis montana* L.O.Wms. in Ann. Mo. Bot. Gard. 27: 272, 1940.

Apatostelis muscosa (Lindl.) Garay, *comb. nov.* —7.
Basionym: *Stelis muscosa* Lindl., Folia Orch. Stelis 7, 1858.

Apatostelis oxypetala (Schltr.) Garay, *comb. nov.* —8.
Basionym: *Stelis oxypetala* Schltr. in Fedde, Rep. 15:203, 1918.

Apatostelis pendulispica (Ames) Garay, *comb. nov.* —2.
Basionym: *Stelis pendulispica* Ames in Bot.Mus.Leafl. 2: 85, 1934.

Aptostelis persimilis (Ames) Garay, *comb. nov.* —8.
Basionym: *Stelis persimilis* Ames in Bot.Mus.Leafl. 2: 14, 1934.

Apatostelis pleistantha (Schltr.) Garay, *comb. nov.* —7.
Basionym: *Stelis pleistantha* Schltr. in Fedde, Rep. Beih. 27: 36, 1924.

Apatostelis rubens (Schltr.) Garay, *comb. nov.* —8.
Basionym: *Stelis rubens* Schltr. in Fedde, Rep. 8; 564, 1910.
Syn.: *Stelis Liebmannii* Rchb.f. ex Hemsl. in Gard. Chron. n.s. 12:108, 1879.
Stelis Tuerckheimii Schltr. in Fedde, Rep. 8: 564, 1910.

Apatostelis rufobrunnea (Lindl.) Garay, *comb. nov.* —8.
Basionym: *Pleurothallis rufobrunnea* Lindl.,Folia Orch. Pleuroth. 36, 1859.
Syn.: *Stelis rufobrunnea* (Lindl.) L.O.Wms. in Bot.Mus. Leafl. 7: 188, 1939.

Apatostelis Skutchii (Ames) Garay, *comb. nov.* —8.
Basionym: *Stelis Skutchii* Ames in Bot.Mus.Leafl. 6: 17, 1938.

Apatostelis Standleyi (Ames) Garay, *comb. nov.* —8.
Basionym: *Stelis Standleyi* Ames, Sched. Orch. 9: 21, 1925.

Apatostelis Tonduziana (Schltr.) Garay, *comb. nov.* —8.
Basionym: *Stelis Tonduziana* Schltr. in Beih. Bot. Centralbl. 36(2):393, 1918.
Syn.: *Stelis mirabilis* Schltr. in Fedde, Rep. Beih. 19: 96, 1923.

Apatostelis umbelliformis (Hespenh. & Dressler) Garay, *comb. nov.* —2.
Basionym: *Stelis umbelliformis* Hespenh. & Dressler in Orquideologia 6: 21, 1971.

INDEX TO SPECIES OF STELIS

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carnosula var. concolor Cogn.	= Stelis grandiflora Lindl.
carnosula var. parvifolia Cogn.	= Stelis grandiflora Lindl.
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caudata D.Don	= Bulbophyllum odoratissimum Lindl.
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citrina Schltr.	= Stelis pusilla Schltr.
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concaviflora C. Schweinf.	= Subgen. Dialissa
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conmixta Schltr.	= Sect. Distichae c-3
connata Presl	= Subgen. Stelis c-22b
contorta (Ruiz & Pav.) Pers.	= Restrepia sp.
convallarioides Garay	= Stelis vulcanica Schltr.
Cooperi Schltr.	= Sect. Monostachyae c

Corae Foldats	= Apatostelis Corae (Foldats) Garay
cordata (Ruiz & Pav.) Willd.	= Pleurothallis cordata (Ruiz & Pav.) Lindl.
cordibractea Schltr.	= Stelis maxima Lindl.
coriifolia Lindl.	= Sect. Distichae c-1
costaricensis Rchb.f.	= Apatostelis costaricensis (Rchb.f.) Garay
costaricensis Schltr.	= Stelis microchila Schltr.
coturcoënsis Schltr.	= Stelis chachapoyensis Rchb.f.
Covilleana Schltr. ex Knuth	= Apatostelis grossilabris (Rchb.f.) Garay
crassifolia Lindl.	= Stelis aprica Lindl.
crassilabia Schltr.	= Sect. Distichae c-3
crescentiicola Schltr.	= Apatostelis crescentiicola (Schltr.) Garay
cryptochila Garay	= Stelis aviceps Lindl.
crystallina Ames	= Sect. Chasmostelis c-11
cubensis Schltr.	= Stelis gutturosa Rchb.f.
cucullata Ames	= Sect. Distichae c-3
cuculligera Schltr.	= Sect. Distichae c-1
cuencana Schltr.	= Sect. Chasmostelis c-12
cundinamarcae Schltr.	= Sect. Distichae c-4
cuprea Lindl. ex Lemée	= *nom. illeg.*
cupuligera Rchb.f.	= Subgen. Stelis c-22a
curvata Schltr.	= Stelis purpurascens Rich. & Gal.
curvicarina C. Schweinf.	= Subgen. Stelis c-22b
cuspidata Ames	= Sect. Concavae c-15.
cuspidilabia Schltr.	= Stelis catharinensis Lindl.
cycloglossa Schltr.	= Sect. Isochilae c-8
cyclopetala Schltr.	= Sect. Chasmostelis c-10
cymbiformis Lindl.	= Stelis humilis Lindl.
dactyloptera Rchb.f.	= Subgen. Stelis c-21
dazae Garay	= Sect. Isochilae c-8
decipiens Schltr.	= Stelis aviceps Lindl.
densiflora Lindl.	= Stelis cupuligera Rchb.f.
depauperata Lindl.	= Subgen. Dialissa
deregularis Barb.Rodr.	= Physosiphon spiralis Lindl.
despectans Schltr.	= Sect. Chasmostelis c-11.
Desportesii Urb.	= Stelis minutiflora (Hoffmsegg.) Rchb.f. ex Hoffmsegg
Dialissa Rchb.f.	= Subgen. Dialissa
diaphana Schltr.	= Stelis fraterna Lindl.
diffusa C. Schweinf.	= Sect. Monostachyae c
discolor Rchb.f.	= Sect. Rhomboideae r-5
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dolichopus Schltr.	= Sect. Isochilae c-8
domingensis Cogn.	= Stelis gutturosa Rchb.f.
drosophila Barb.Rodr.	= Stelis intermedia Poepp. & Endl.

dubia Lindl.	= Subgen. Stelis c-22a
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dupliciformis C. Schweinf.	= Subgen. Stelis r-20
Dusenii Garay	= Stelis intermedia Poepp. & Endl.
Dussii Cogn.	= Sect. Monostachyae c
ecallosa Garay	= Subgen. Stelis c-22a
effusa Schltr.	= Sect. Distichae c-3
Ekmanii Shltr.	= Sect. Distichae c-3
elatior Lindl.	= Sect. Distichae c-4
elegantula Schltr.	= Sect. Isochilae c-8
elliptica Ames & Schweinf.	= Stelis tridentata Lindl.
elongata H.B.K.	= Sect. Labiatae r-14
endocharis Rchb.f.	= Stelis purpurea (Ruiz & Pav.) Willd.
Endresii Rchb.f.	= Stelis argentata Lindl.
epilithica Garay	= Stelis papaquerensis Rchb.f.
eublepharis Rchb.f.	= Sect. Pedales c
eublepharis var. glabriflora C. Schweinf.	= Stelis loxensis Lindl.
Eugenii Schltr.	= Subgen. Stelis c-22b
euspatha Rchb.f.	= Sect. Chasmostelis c-12
exilipes Schltr.	= Subgen. Stelis c-22b
eximia Ames	= Stelis superbiens Lindl.
fasciculiflora Regel	= Pleurothallis obovata Lindl.
Fendleri Lindl.	= Sect. Rhomboideae c-6
filiformis Lindl.	= Sect. Rhomboideae c-6
Filomenoi Schltr.	= Sect. Isochilae r-7
fimbriata Baker	= Apatostelis Jimenezii (Schltr.) Garay
fissa Lindl.	= Stelis oblonga (Ruiz & Pav.)Willd.
flacca Rchb.f.	= Subgen Stelis c-22b
flavida Focke	= Pleurothallis pruinosa Lindl.
flexa Schltr.	= Sect. Distichae r-4
flexuosa Lindl.	= Sect. Concavae c-17
florea Lindl.	= Apatostelis chamaestelis (Rchb.f.) Garay
floribunda H.B.K.	= Stelis oblonga (Ruiz & Pav.)Willd.
foliosa Hook.	= Polystachya foliosa (Hook.) Rchb.f.
foveata Lindl.	= Sect. Distichae c-1
fractiflexa Ames & Schweinf.	= Stelis Wercklei Schltr.
fragrans Schltr.	= Stelis pauciflora Lindl.
fraterna Lindl.	= Sect. Distichae c-4
fruticulus Schltr.	= Stelis purpurea (Ruiz & Pav.) Willd.
fulva Schltr.	= Stelis purpurascens Rich. & Gal.
furfuracea Lehm. & Krzl.	= Sect. Concavae c-17
gemma Garay	= Sect. Distichae c-3

genychila Garay	= Sect. Distichae c-4
gigas Barb.Rodr.	= Sect. Distichae c-4
gladiata Lindl.	= Sect. Distichae c-4
glandulosa Ames	= Stelis leucopogon Rchb.f.
globiflora Rchb.f.	= Subgen. Stelis c-21
glomerosa Luer	= Subgen. Dialissa
glossula Rchb.f.	= Apatostelis glossula (Rchb.f.) Garay
glumacea Lindl.	= Stelis ochreata Lindl.
gonatoglossa Rchb.f. ex Huenecke	= *nomen nudum*
Gonzaleziana C. Schweinf.	= Apatostelis hylophila (Rchb.f.) Garay
gracilifolia C.Schweinf.	= Apatostelis gracilifolia (C. Schweinf.) Garay
gracilis Ames	= Sect. Distichae c-4
gracilispica C. Schweinf.	= Subgen. Stelis r-20
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grandibracteata C. Schweinf.	= Sect. Chasmostelis r-12
grandiflora Lindl.	= Sect. Distichae c-3
grandiflora var Tweediana Lindl.	= Stelis papaquerensis Rchb.f.
grandis Rchb.f.	= Stelis Lindenii Lindl.
gratiosa Luer	= Apatostelis Jimenezii (Schltr.) Garay
grossilabris Rchb.f.	= Apatostelis grossilabris (Rchb.f.) Garay
guatemalensis Schltr.	= Sect. Concavae c-15
guianensis Rolfe	= Sect. Isochilae c-8
guttifera Porsch	= Stelis fraterna Lindl.
gutturosa Rchb.f.	= Sect. Concavae c-16
gymnopoda Schltr. ex Mansf.	= Stelis Schmidtchenii Schltr.
Hallii Lindl.	= Sect. Distichae c-4
Hallii var. atra (Lindl.) Garay & C. Schweinf.	= Stelis atra Lindl.
Hallii var. minor C. Schweinf.	= Stelis Hallii Lindl.
hemicardia Rchb.f.	= Stelis purpurea (Ruiz & Pav.) Willd.
Hennisiana Schltr.	= Sect. Monostachyae c
herbiola Lindl.	= Stelis pusilla H.B.K.
Herzogii Schltr.	= Sect. Concavae c-17
heterosepala Schltr.	= Stelis aviceps Lindl.
Heylidyana H.C.Focke	= Stelis argentata Lindl.
hians Schltr.	= Stelis velutina Lindl.
hirsuta Garay	= Sect. Distichae r-3
hirta Lindl. 1858	= Apatostelis hirtella Garay
hirta J.E.Sm.	= Bulbophyllum hirtum (J.E.Sm.) Lindl.
Hoehnei Schltr.	= Stelis Ruprechtiana Rchb.f.
Hoppii Schltr.	= Sect. Distichae c-3
huancabambae Krzl.	= Stelis purpurea (Ruiz & Pav.) Willd.

Huebneri Schltr.	= Stelis yauaperyensis Barb. Rodr.
humilis Lindl.	= Sect. Chasmostelis c-12
hylophia Rchb.f.	= Apatostelis hylophila (Rchb.f.) Garay
hymenantha Schltr.	= Stelis catharinensis Lindl.
iminapensis Rchb.f.	= Sect. Concavae c-17
inaequalis Ames	= Apatostelis inaequalis (Ames) Garay
inaequisepala Hoehne & Schltr.	= Stelis fraterna Lindl.
insignis Ames	= Stelis oblonga (Ruiz & Pav.) Willd.
intermedia Poepp. & Endl.	= Sect. Distichae c-4
inversa Schltr.	= Stelis brevilabris Lindl.
Isthmii Schltr.	= Apatostelis crescentiicola (Schltr.) Garay
itatiayae Schltr.	= Sect. Monostachyae c
Iwatsuhae Hashimoto	= Sect. Distichae c-4
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Jamesonii var. parviflora Garay	= Stelis hirsuta Garay
Jenssenii Urb.	= Sect. Distichae c-4
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Johnsonii Ames	= Sect. Distichae c-4
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lanata Lindl.	= Sect. Chasmostelis r-12
lancea Lindl.	= Sect. Distichae r-4
lanceolata (Ruiz & Pav.) Willd.	= Sect. Pedales r
lancilabris Rchb.f.	= Platystele lancilabris(Rchb.f.) Schltr.
Langlassei Schltr.	= Sect. Labiatae c-13
Lankesteri Ames	= Subgen. Stelis c-22a
lasallei Foldats	= Apatostelis chamaestelis (Rchb.f.) Garay
latipetala Ames	= Apatostelis latipetala (Ames) Garay
latisepala C. Schweinf.	= Sect. Distichae c-3
laxa Schltr.	= Sect. Distichae r-4
Leinigii Pabst	= Apatostelis Leinigii (Pabst) Garay
lentiginosa Lindl.	= Sect. Rhomboideae r-6
leptophylla Schltr.	= Stelis Cooperi Schltr.
leucopogon Rchb.f.	= Sect. Monostachyae c
Liebmannii Rchb.f. ex Hemsl.	= Apatostelis rubens (Schltr.) Garay
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Lindleyana Cogn.	= Sect. Distichae c-1

Lindleyana var. carnosior C. Schweinf. = Stelis Lindleyana Cogn.
littoralis Barb.Rodr. = Stelis argentata Lindl.
lloënsis Schltr. = Sect. Concavae r-18
lobata Rchb.f. = Stelis elongata H.B.K.
Loëfgrenii Cogn. = Sect. Monostachyae r
longicuspis Schltr. = Stelis pardipes Rch.b.f.
longipetiolata Ames = Sect. Distichae c-3
longiracemosa Schltr. = Sect. Concavae c-17
loxensis Lindl. = Sect. Distichae r-1
lutea Lindl. = Sect. Distichae c-3

macra Schltr. = Sect. Chasmostelis c-10
macrantha Rolfe = Subgen. Stelis c-22a
macrocarpa H.B.K. = Stelis lanceolata (Ruiz & Pav.) Willd.
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macropoda Schltr. = Subgen. Stelis r-20
mcrostachya Lodd. ex W. Baxt. = *nomen nudum*
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major Rchb.f. = Sect. Pedales c
Mandoniana Schltr. = Stelis purpurascens Rich. & Gal.
maxima Lindl. = Subgen. Stelis c-22a
Maxonii Schltr. = Sect. Distichae c-3
magahybos Schltr. = Sect. Distichae c-4
megantha Barb.Rodr. = Sect. Distichae c-3
megistantha Schltr. = Sect. Distichae c-4
melanoxantha Rchb.f. = Subgen. Stelis c-22a
melicoides Schltr. = Stelis elongata H.B.K.
mesohybos Schltr. = Sect. Distichae c-4
micragrostis Schltr. = Sect. Chasmostelis c-11
micrantha Barb.Rodr. = Stelis aprica Lindl.
micrantha (Sw.)Sw. = Sect. Distichae c-3
micrantha var. atropurpurea (Hook.) Josst = Apatostelis ciliaris (Lindl) Garay
microcaulis Barb.Rodr. = Stelis caespitosa Lindl.
microchila Schltr. = Sect. Chasmostelis c-9
microglossa Rchb.f. = Stelis minutiflora (Hoffmsegg.) Rchb.f. ex Hoffmsegg.
microphylla Hoehne & Schltr. = Stelis parvifolia Garay
microphylla Lindl. = Stelis pusilla H.B.K.
microstigma Rchb.f. = Stelis parvula Lindl.
microtantha Schltr. = Stelis intermedia Poepp. & Endl.
microtis Rchb.f. = Stelis parvula Lindl.
Miersii Lindl. = Stelis minutiflora (Hofmsegg) Rchb.f. ex Hoffmsegg.
Millei Schltr. = Stelis lamellata Lindl.
minimiflora Schltr. = Apatostelis minimiflora (Schltr.) Garay

minuta C. Schweinf.	= Apatostelis minuta (C. Schweinf.) Garay
minutiflora Ames & Schweinf.	= Apatostelis costaricensis (Rchb.f.) Garay
minutiflora (Hossmsegg) Rchb.f. ex Hoffmsegg.	= Section Concavae c-16
Miqueliana Lindl. *Sphalm*	= Pleurothallis Miqueliana Lindl.
mirabilis Schltr. 1923	= Apatostelis Tonduziana (Schltr.) Garay
mirabilis Schltr. 1924	= Stelis Schlechterana Garay
mocoana Schltr.	= Sect. Distichae c-3
modesta Barb.Rodr.	= Sect. Distichae c-4
mononeura Lindl.	= Sect. Chasmostelis c-12
montana L.O.Wms.	= Apatostelis montana (L.O.Wms.) Garay
mucronata Lindl.	= Stelis biserrula Lindl.
mucronata Porsch	= Stelis pauciflora Lindl.
mucronipetala Schltr.	= Stelis pardipes Rchb.f.
muscifera Lindl.	= Sect. Distichae c-1
muscosa Lindl.	= Apatostelis muscosa (Lindl.)Garay
myriantha Lindl.	= Stelis pusilla H.B.K.
myriantha Schltr.	= Apatostelis alata (Lindl.)Garay
nana Lindl.	= Subgen. Stelis c-22a
nanegalensis Lindl.	= Sect. Distichae c-4
navicularis Garay	= Sect. Chasmostelis c-12
naviculigera Schltr.	= Sect. Distichae r-3
nephropetala Schltr.	= Sect. Isochilae c-8
nexipous Garay	= Subgen. Nexipous
nitens Rchb.f.	= Sect. Isochilae c-8
Norae Foldats	= Sect. Rhomboideae c-6
nubis Ames	= Sect. Distichae c-4
nutans Lindl.	= Subgen. Stelis c-22b
nutantiflora Schltr.	= Stelis despectans Schltr.
obliquipetala (Ames & Schweinf.) L.O.Wms.	= Physosiphon obliquipetalus Ames & Schweinf.
oblonga (Ruiz & Pav.) Willd.	= Sect. Concavae c-17
oblongifolia Lindl.	= Sect. Distichae c-3
obovata C. Schweinf.	= Stelis Maderoi Schltr.
obscurata Rchb.f.	= Stelis parvula Lindl.
ochreata Lindl.	= Sect. Distichae c-1
odoratissima J.E.Sm.	= Bulbophyllum odoratissimum (J.E.Sm.) Lindl.
oligantha Barb.Rodr.	= Sect. Isochilae c-8
oligoblephara Schltr.	= Sect. Distichae c-4
omalosantha Barb.Rodr.	= Stelis pauciflora Lindl.
ophioglossoides (Jacq.)Sw.	= Pleurothallis ophioglossoides (Jacq.) Garay & Sweet
Ottonis Schltr.	= Stelis gigas Barb.Rodr.
ovalifolia Focke	= Platystele ovalifolia (Focke) Garay & Dunsterv.

ovatilabia Schltr.	= Sect. Chasmostelis c-10
oxypetala Schltr.	= Apatostelis oxypetala (Schltr.) Garay
oxysepala Schltr.	= Sect. Isochilae c-8
pachyphylla Schltr.	= Stelis purpurea (Ruiz & Pav.) Willd.
pachypus Lehm. & Krzl.	= Pleurothallis pachypus (Lehm. & Krzl.) Garay
pachystachya Lindl.	= Sect. Isochilae c-8
pachystele Schltr.	= Stelis purpurea (Ruiz & Pav.) Willd.
palmeiraënsis Barb.Rodr.	= Sect. Chasmostelis c-10
panamensis Schltr.	= Sect. Distichae c-4
papaquerensis Rchb.f.	= Sect. Distichae c-4
papillosa Garay	= Stelis atroviolacea Rchb.f.
paraënsis Barb.Rodr.	= *Incerta sedis*
parahybunensis Barb.Rodr.	= Stelis fraterna Lindl.
pardipes Rchb.f.	= Sect. Labiatae c-13
parvibracteata Ames	= Stelis leucopogon Rchb.f.
parviflora (Ruiz & Pav.) Pers.	= Sect. Chasmostelis c-12
parvifolia Garay	= Sect. Distichae c-3
parvilabris Lindl.	= Subgen. Stelis c-22b
·**parvula** Lindl.	= Sect. Distichae c-3
pastoënsis Schltr.	= Stelis oblongifolia Lindl.
patula Schltr.	= Stelis guatemalensis Schltr.
pauciflora Lindl.	= Sect. Monostachyae c
pauloënsis Hoehne & Schltr.	= Sect. Monostachyae c
peliochyla Barb.Rodr.	= Sect. Distichae c-4
pelliata Rchb.f. ex Huenecke	= Stelis Bangii Schltr.
penduliflora Barb.Rodr.	= Stelis fraterna Lindl.
pendulispica Ames	= Apatostelis pendulispica (Ames) Garay
pentodonta Rchb.f.	= Stelis alba H.B.K.
perlaxa Schltr.	= Stelis concinna Lindl.
perparva C. Schweinf.	= Subgen. Stelis c-22b
perplexa Ames	= Sect. Distichae c-3
perpusilla Cogn.	= *Incerta sedis*
perpusilliflora Cogn.	= Sect. Concavae c-15
persimilis Ames	= Apatostelis persimilis (Ames) Garay
peterostele Hoehne & Schltr.	= Stelis papaquerensis Rchb.f.
petiolaris Schltr.	= Sect. Distichae c-3
petropolitana Rchb.f.	= Stelis intermedia Poepp. & Endl.
petropolitana var. latifolia Hoehne	= Stelis Ruprechtiana Rchb.f.
phaeantha Schltr.	= Stelis purpurea (Ruiz & Pav.) Willd.
phaeomelana Schltr.	= Stelis gigas Barb.Rodr.
philargyrus Rchb.f.	= Sect. Monostachyae c

piestopus Schltr.	= Stelis tricardium Lindl.
pilostylis Schltr.	= Stelis discolor Rchb.f.
piperina Lindl.	= Sect. Labiatae r-14
Pittieri Schltr. ex Knuth	= Apatostelis grossilabris (Rchb.f.) Garay
planipetala Ames	= Sect. Chasmostelis c-12
platycardia Schltr.	= Stelis parvula Lindl.
platystachya Garay & Dunsterv.	= Sect. Distichae c-3
pleistantha Schltr.	= Apatostelis pleistantha (Schltr.) Garay
pleurothalloides Ames	= Stelis furfuracea Lehm. & Krzl.
plurispicata Barb. Rodr.	= Stelis papaquerensis Rchb.f.
polybotrya Lindl.	= Sect. Concavae c-17
polycarpa Schltr.	= Stelis aviceps Lindl.
polyclada Lindl.	= Stelis pusilla H.B.K.
polystachya Cogn. 1909	= Stelis trigoniflora (Sw.)Garay
polystachya (Ruiz & Pav.) Willd.	= Pleurothallis sp.
popayanensis Lehm. & Krzl.	= Sect. Pedales c
Porpax Rchb.f.	= Sect. Chasmostelis c-10
Porschiana Schltr.	= Sect. Distichae c-4
Porschiana var. minor Schltr.	= Stelis papaquerensis Rchb.f.
Powellii Schltr.	= Sect. Distichae c-1
praemorsa Schltr.	= Apatostelis crescentiicola (Schltr.) Garay
praesecta Schltr.	= Stelis propinqua Ames
propinqua Ames	= Sect. Monostachyae c
prorepens Schltr.	= Sect. Concavae r-19
pterostele Hoehne & Schltr.	= Stelis papaquerensis Rchb.f.
pterostylis Schltr.	= Stelis pugiunculi Lindl.
puberula Barb.Rodr.	= Stelis fraterna Lindl.
pugiunculi Lindl.	= Sect. labiatae c-13.
pulchella H.B.K.	= Pleurothallis pulchella (H.B.K.) Lindl.
punoënsis C. Schweinf.	= Stelis dupliciformis C. Schweinf.
Purdiaei Lindl.	= Sect. Distichae c-3
purpurascens Rich. & Gal.	= Sect. Distichae c-3
purpurea (Ruiz & Pav.) Willd.	= Subgen. Stelis c-22a
Purpusii Schltr.	= Stelis purpurescens Rich. & Gal.
pusilla H.B.K.	= Sect. Concavae r-18
pygmaea Cogn.	= Sect. Monostachyae c
quinquenervia C.Schweinf.	= Sect. Distichae c-3
Rabei Foldats	= Sect. Chasmostelis c-10
racemiflora Lodd. ex W. Baxt.	= Pleurothallis quadrifida (Llave & Lex.)Lindl.
racemosa J.E.Sm.	= Sunipia racemosa (J.E.Sm.) Tang & Wang
ramonensis Schltr.	= Stelis parvula Lindl.

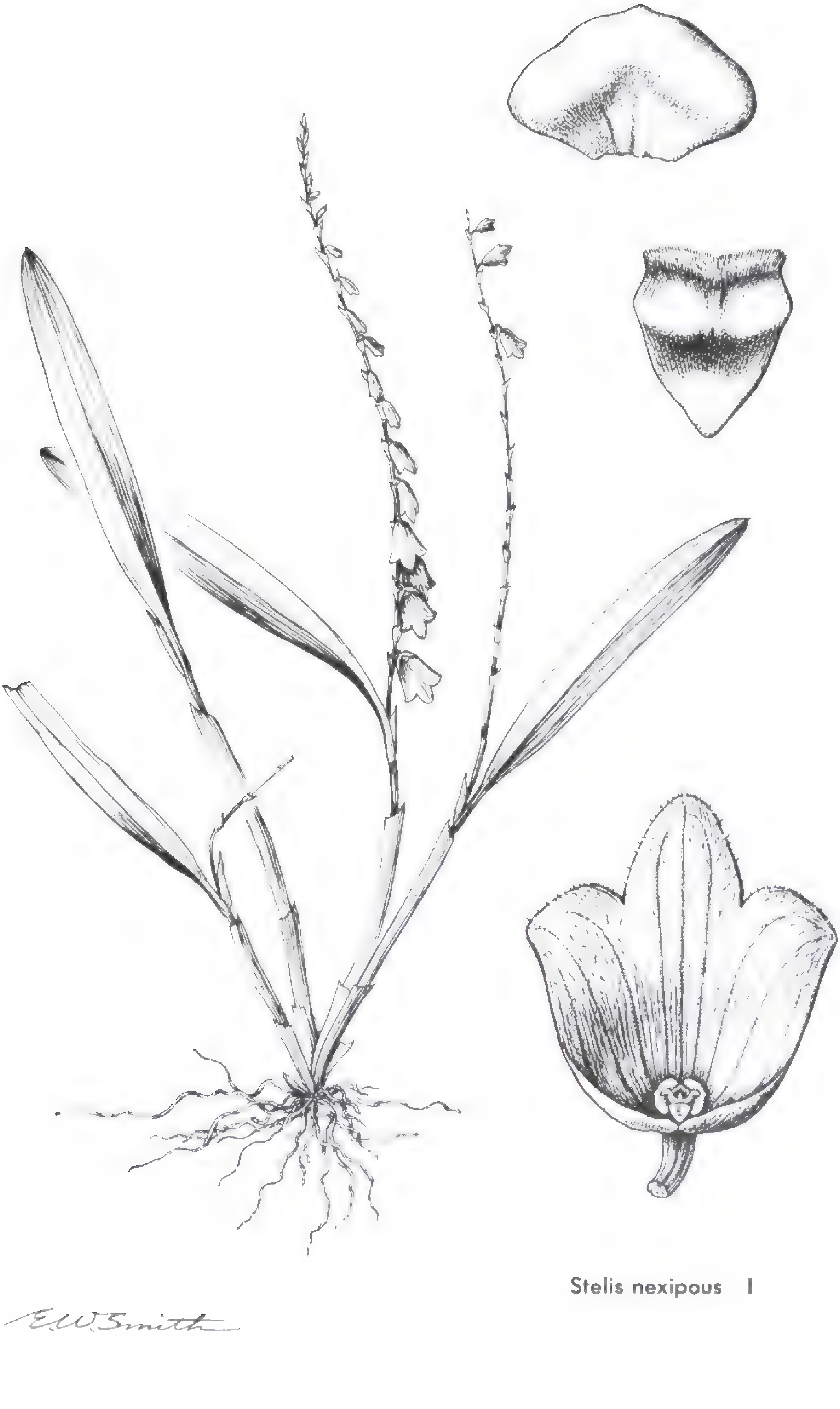
recurvula Schltr.	= Apatostelis hylophila (Rchb.f.) Garay
reflexa Lindl.	= Apatostelis hylophila (Rchb.f.) Garay
reflexisepala Garay	= Stelis papaquerensis Rchb.f.
Reitzii Garay	= Sect. Monostachyae c
repens Cogn.	= Sect. Concavae r-15
revoluta (Ruiz & Pav.)Willd.	= Pleurothallis revoluta (Ruiz & Pav.) Garay
rhizomatosa Schltr.	= Stelis trichorrhachis Rchb.f.
rhodochila Schltr.	= Stelis parvula Lindl.
rhombilabia C. Schweinf.	= Subgen. Stelis c-22b
rhomboglossa Schltr.	= Subgen. Stelis c-22b
rhomboidea Garay	= Sect. Rhomboideae r-5
rhynchanthera Lehm. & Krzl.	= Stelis lanceolata (Ruiz & Pav.) Willd.
ringens Schltr.	= Subgen. Stelis c-22a
robusta Schltr. 1918	= Stelis tristyla Lindl.
robusta Schltr. 1924	= Stelis robustior Garay
robustior Garay	= Subgen. Stelis c-22a
Rodriguesii Cogn.	= Stelis aprica Lindl.
rubens Schltr.	= Apatostelis rubens (Schltr.) Garay
rubens var. oxypetala (Schltr.) Ames	= Apatostelis oxypetala (Schltr.) Garay
rufobrunnea (Lindl.) L.O.Wms.	= Apatostelis rufobrunnea (Lindl.) Garay
Ruprechtiana Rchb.f.	= Sect. Distichae c-1
Ruprechtiana var. latifolia Cogn.	= Stelis Ruprechtiana Rchb.f.
Ruprechtiana var. major Cogn.	= Stelis Ruprechtiana Rchb.f.
Rusbyi Rolfe	= Stelis connata Presl
Sanchoi Ames	= Sect. Distichae c-3
sanguinea Garay	= Subgen. Stelis c-22a
sanluisensis Foldats	= Sect. Chasmostelis c-12
santiagoënsis Mansf.	= Sect. Distichae c-4
sarcodantha Schltr.	= Stelis aemula Schltr.
saxicola Schltr.	= Stelis truncata Lindl.
scabrida Lindl.	= Sect. Distichae c-3
scandens Rolfe 1907	= Sect. Distichae r-1
scandens Schltr. 1924	= Stelis dazae Garay
scansor Rchb.f.	= Sect. Concavae r-19
Schenckii Schltr.	= Sect. Distichae c-3
Schlechterana Garay	= Sect. Distichae c-1
Schmidtchenii Schltr.	Sect. Distichae c-3
Schnitteri Schltr.	Sect. Isochilae c-8
Schomburgkii Fawc. & Rendle	- Sect. Concavae c-17
seleniglossa Schltr.	- Stelis catharinensis Lindl.
serra Lindl.	= Sect Concavae c-17
sesquipedalis Lindl.	= Stelis lanceolata (Ruiz & Pav.) Willd.

setacea Lindl.	= Sect. Chasmostelis r-12
simacoënsis Schltr.	= Stelis virens Schltr.
simula Schltr.	= Stelis crassilabia Schltr.
Skutchii Ames	= Apatostelis Skutchii (Ames) Garay
smaragdina Barb.Rodr.	= Stelis papaquerensis Rchb.f.
Sodiroi Schltr.	= Stelis discolor Rchb.f.
spathulata Poepp. & Endl.	= Sect. Concavae r-15
sphaerochila LIndl.	= Stelis humilis Lindl.
spiralis (Ruiz & Pav.) Pers.	= Pleurothallis spiralis (Ruiz & Pav.) Lindl.
Standleyi Ames	= Apatostelis Standleyi (Ames) Garay
steganopous Garay	= Subgen. Nexipous
stenophylla Rchb.f.	= Sect. Chasmostelis c-10
Steyermarkii Foldats	= Stelis iminapensis Rchb.f.
Storkii Ames	= Sect. Rhomboideae c-6
striolata Lindl.	= Subgen. Stelis r-20
suaveolens Lehm. & Krzl.	= Subgen. Dialissa
subinconspicua Schltr.	= Stelis micragrostis Schltr.
superbiens Lindl.	= Sect. Monostachyae c
superposita Schltr.	= Stelis oblongifolia Lindl.
synsepala Cogn.	= Sect. Distichae c-4
tachirensis Foldats	= Stelis stenophylla Rchb.f.
tenuicaulis Lindl.	= Subgen. Stelis r-20
tenuilabris Lindl.	= Apatostelis alata (Lindl.) Garay
tenuipetala Garay	= Sect. Chasmostelis c-10
tenuis Schltr.	= Stelis pusilla H.B.K.
tenuissima Schltr.	= Sect. Rhomboideae c-6
Tessmanii Mansf.	= Stelis nana Lindl.
thecoglossa Rchb.f.	= Sect. Distichae c-3
thermophila Schltr.	= Sect. Distichae c-1
Tippenhaueri Urb.	= Stelis gutturosa Rchb.f.
Toepfferana Rchb.f.	= Stelis scabrida Lindl.
tolimensis Schltr.	= Sect. Distichae c-3
Tonduziana Schltr.	= Apatostelis Tonduziana (Schltr.) Garay
transversalis Ames	= Sect. Distichae c-4
Trianaei Schltr.	Stelis scansor Rchb.f.
triangulabia Ames	= Sect. Distichae c-3
triangularis Barb.Rodr.	= Sect. Distichae C-3
triangularis var **longipedunculata** Cogn.	= Sect. Distichae c-3
trianguliflora Schltr.	Stelis muscifera Lindl.
triangulisepala C. Schweinf.	= Sect. Distichae c-4
triaristata Luer	= Sect. Distichae c-4
tricardium Lindl.	= Sect. Distichae c-3
trichorrachis Rchb.f.	= Sect. Monostachyae r
tricuspis Schltr.	= Sect. Concavae r-15
tridactylon Luer	= Sect. Distichae c-4

tridentata Lindl.	= Sect. Monostachyae r
trigoniflora (Sw.) Garay	= Sect. Distichae c-3
trinitatis Ames	= Stelis muscifera Lindl.
trinitensis Ames ex Broadw.	= Stelis muscifera Lindl.
triplicata Lindl.	= Sect. Distichae c-1
triseta Lindl.	= Sect. Labiatae c-13.
triseta var. pardipes (Rchb.f.)C. Schweinf.	= Stelis pardipes Rchb.f.
tristyla Lindl.	= Sect. Distichae c-3
triura Lindl.	= Lepanthes triura (Lindl.) Schltr.
truncata Lindl.	= Subgen. Stelis c-22a
tubata Lodd.	= Physosiphon tubatus (Lodd.) Rchb.f.
Tuerckheimii Schltr.	= Apatostelis rubens (Schltr.) Garay
Tweediana (Lindl.)Lindl.	= Stelis papaquerensis Rchb.f.
umbelliformis Hespenh. & Dressler	Apatostelis umbelliformis (Hespenh. & Dressler) Garay
Umbriae Schltr.	= Apatostelis chamaestelis (Rchb.f.) Garay
uninervia C. Schweinf.	= Stelis macra Schltr.
vagans Ames	– Stelis prorepens Schltr.
vagans Schltr. 1930	Stelis pardipes Rchb.f.
velutina Lindl.	= Subgen. Dialissa
venezuelensis Foldats	= Sect. Distichae c-4
verecunda Schltr.	= Sect. Distichae c-3
vestita Ames	= Sect. Distichae c-4
vinosa Barb.Rodr.	= Stelis fraterna Lindl.
vinosa var. angustifolia Cogn.	= Stelis fraterna Lindl.
vinosa var. longifolia Cogn.	= Stelis fraterna Lindl.
violacea Garay	= Subgen. Stelis c-22b
violascens Schltr.	= Stelis propinqua Ames
virens Schltr.	= Sect. Rhomboideae c-6
virgulata Schltr.	= Subgen. Stelis c-22a
viridi-brunnea Lehm. & Krzl.	= Stelis major Rchb.f.
viridipurpurea Lindl.	= Stelis fraterna Lindl.
vittata Lindl.	= Stelis Jamesonii Lindl.
vulcani Rchb.f.	= Subgen. Dialissa
vulcanica Schltr.	= Sect. Monostachyae c
Walteri Schltr.	= Sect. Concavae c-17
Weberbaueri Schltr.	= Sect. Distichae c-4
Wercklei Schltr. (as Werklei)	= Sect. Distichae c-3
Werneri Schltr.	= Sect. Distichae c-3
Wettsteiniana Schltr.	= Stelis pauciflora Lindl.
Williamsii Ames	= Sect. Distichae c-3
xantantha Schltr.	= Stelis iminapensis Rchb.f.
yauaperyensis Barb.Rodr.	= Sect. Monostachyae c
yungasensis Schltr.	= Stelis connata Presl
zonata Rchb.f.	= Sect. Distichae c-3

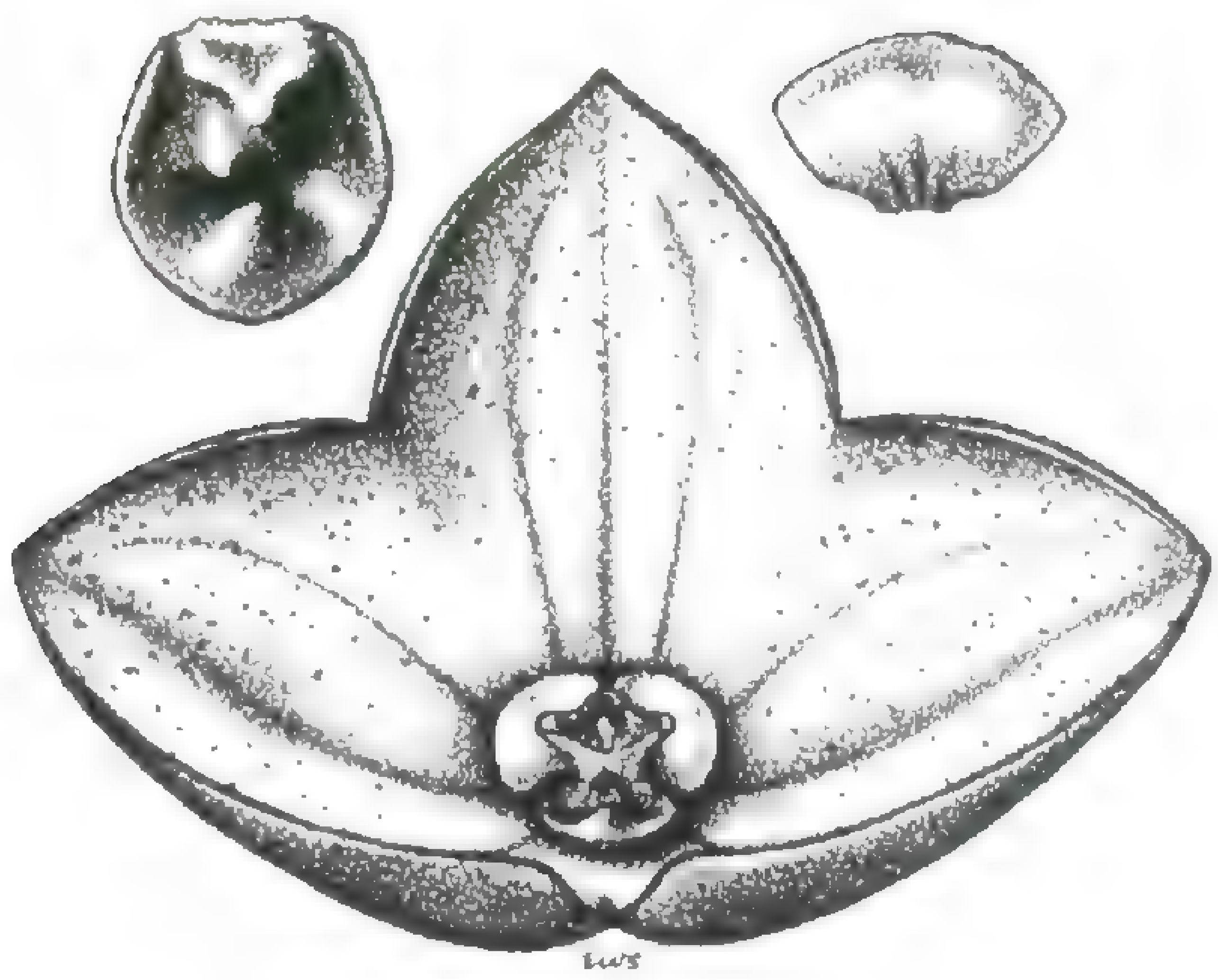
PLATES

PLATE 43

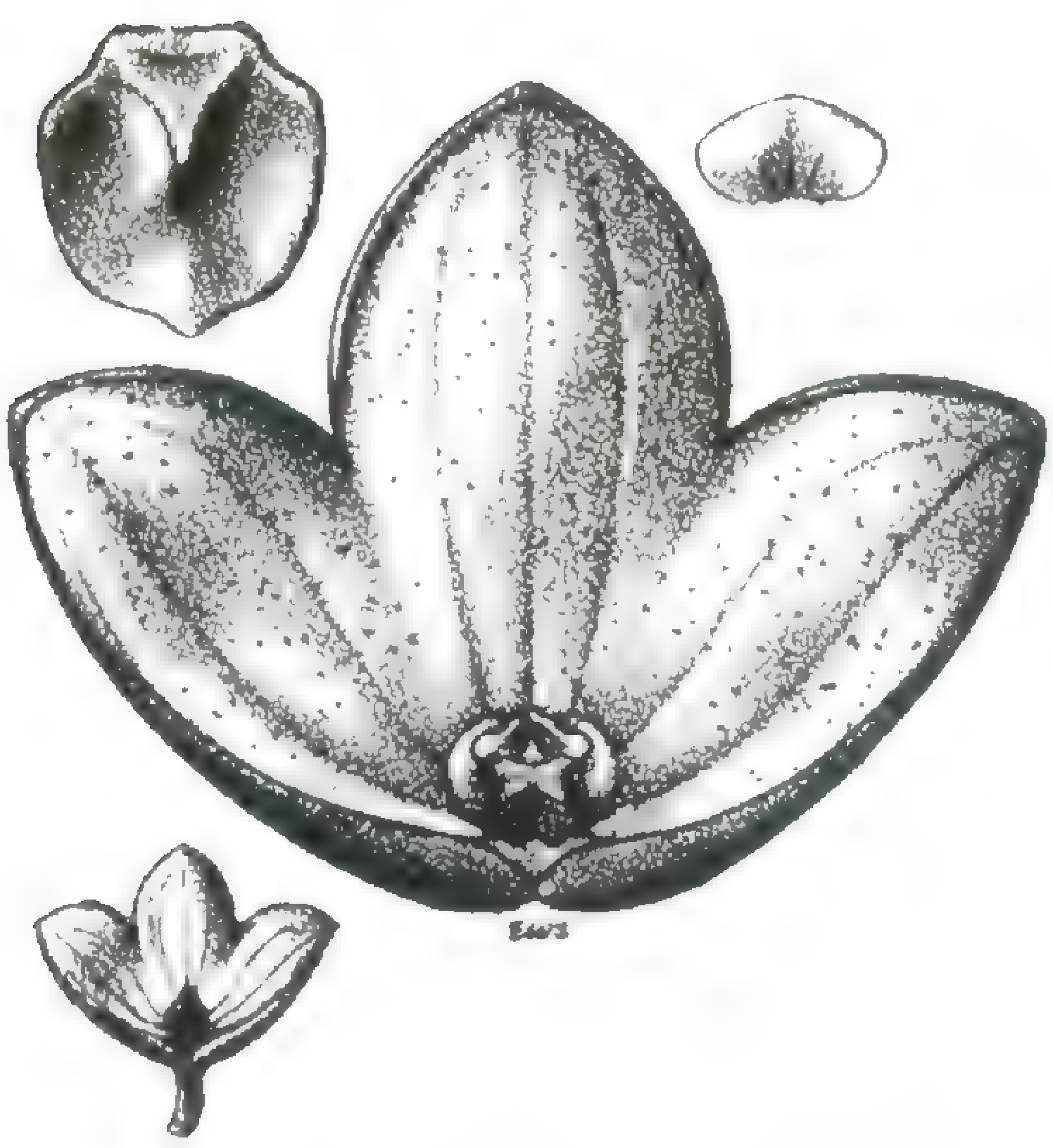


Stelis nexipous I

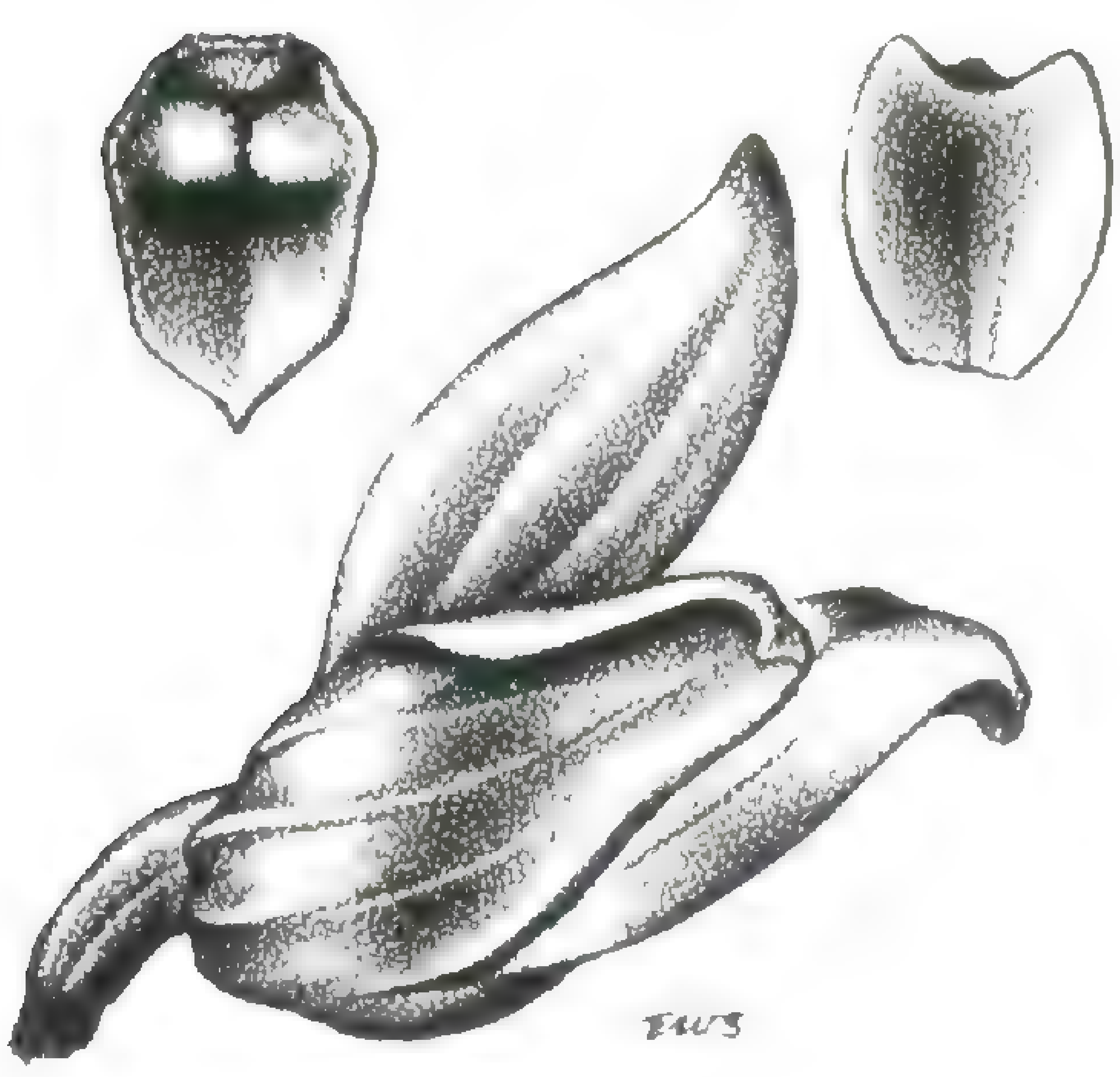
PLATE 44



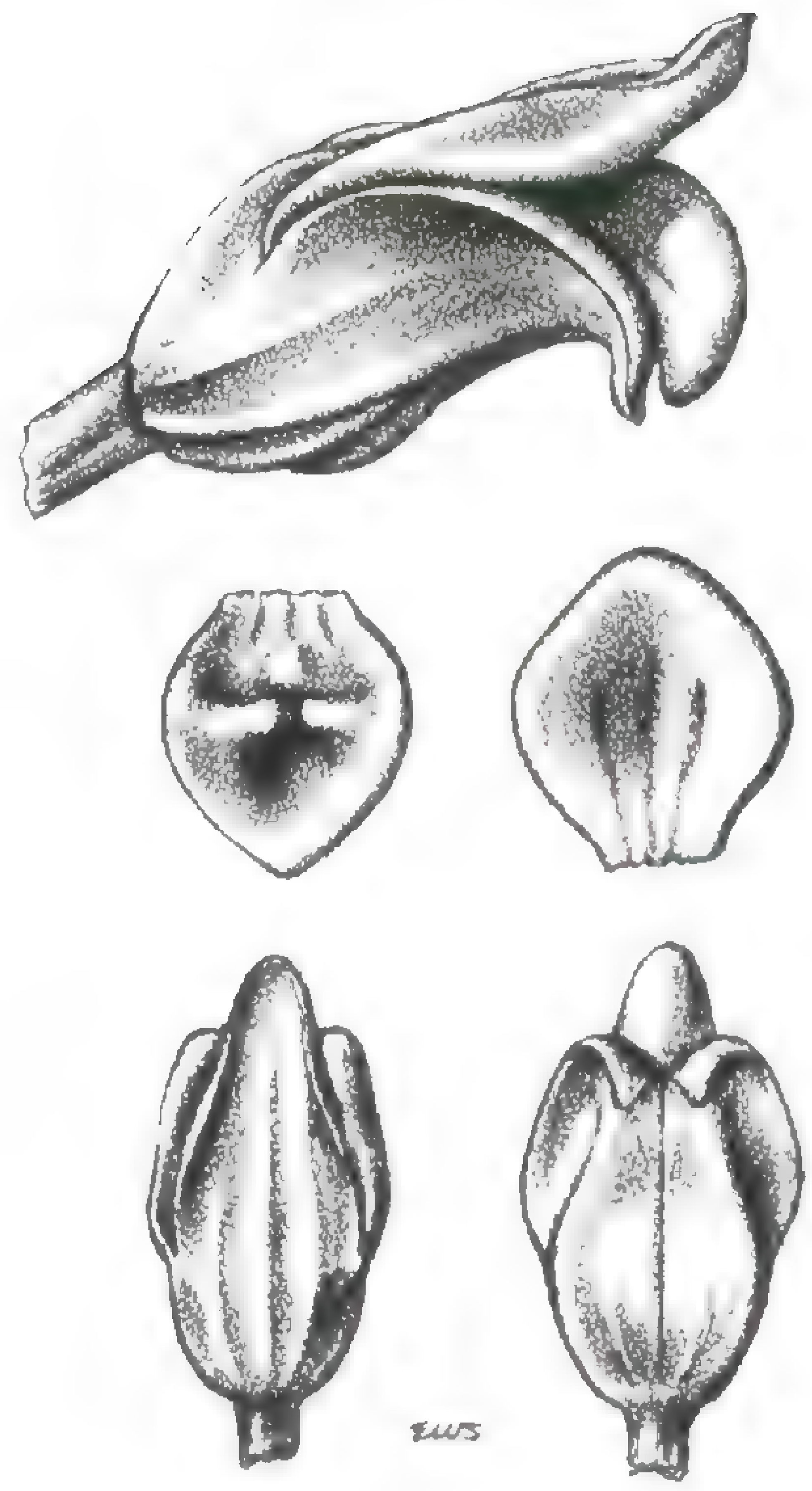
Stelis aperta I



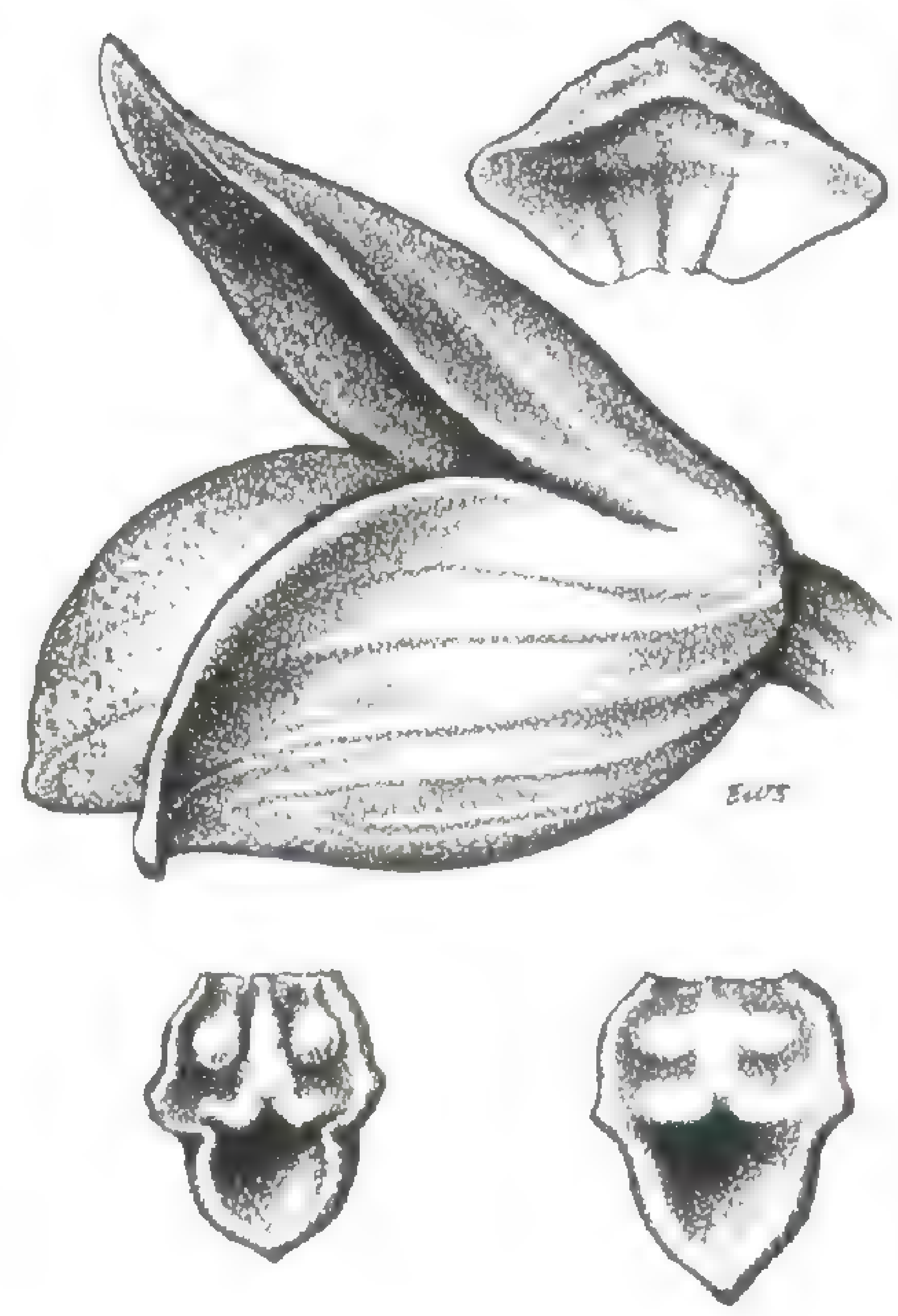
Stelis steganopus I



Stelis calyculata II

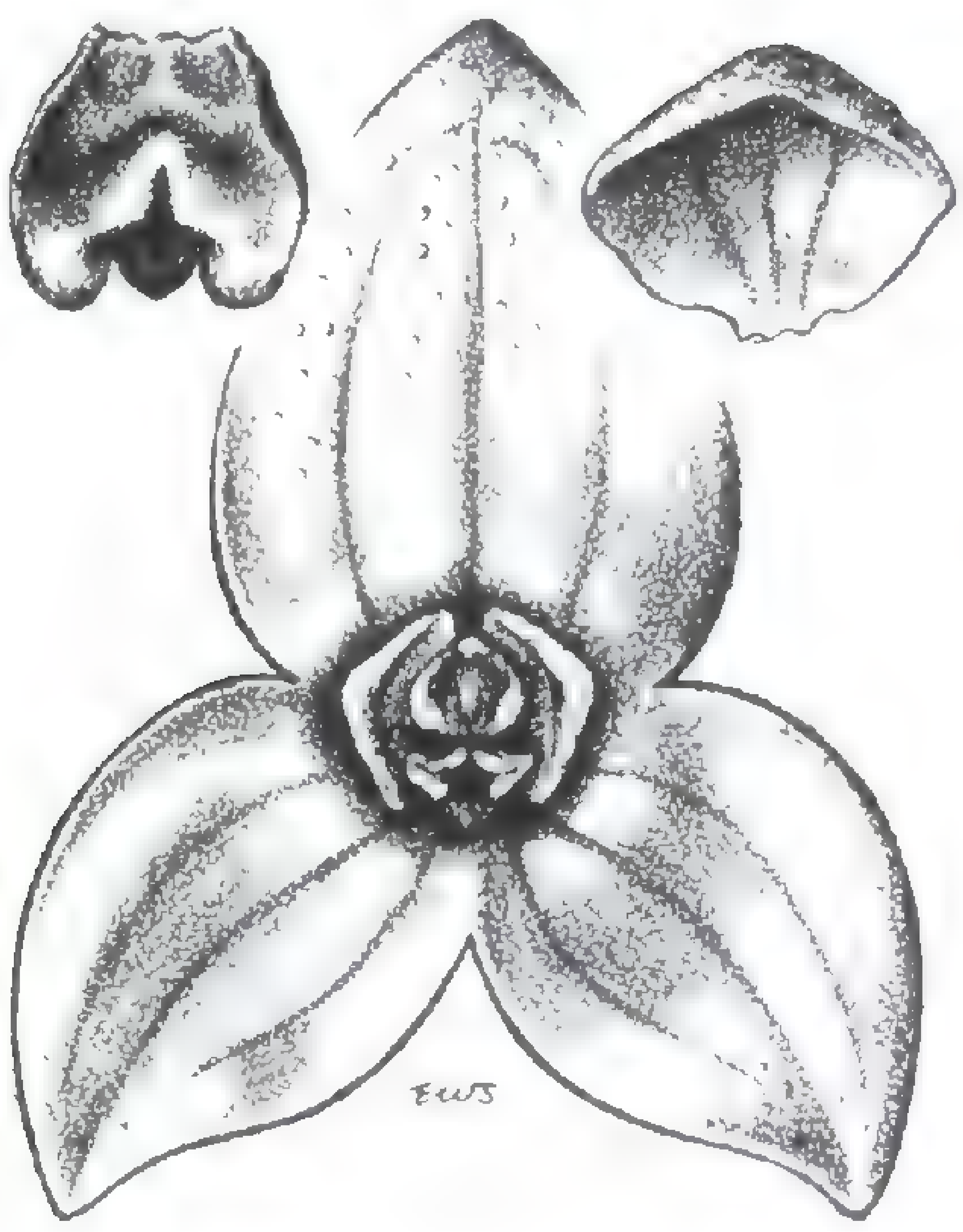


Stelis Dialissa II

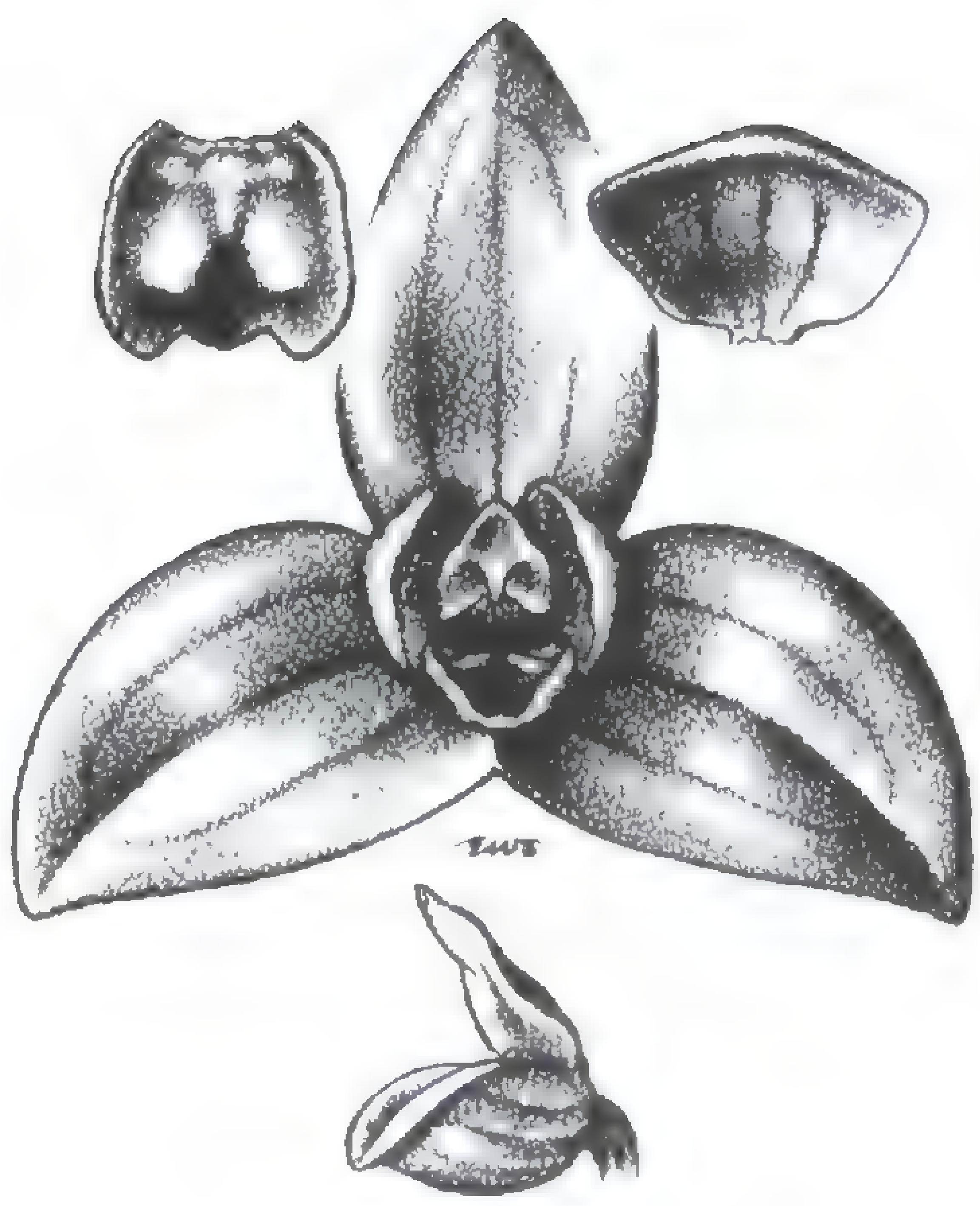


Stelis velutina II

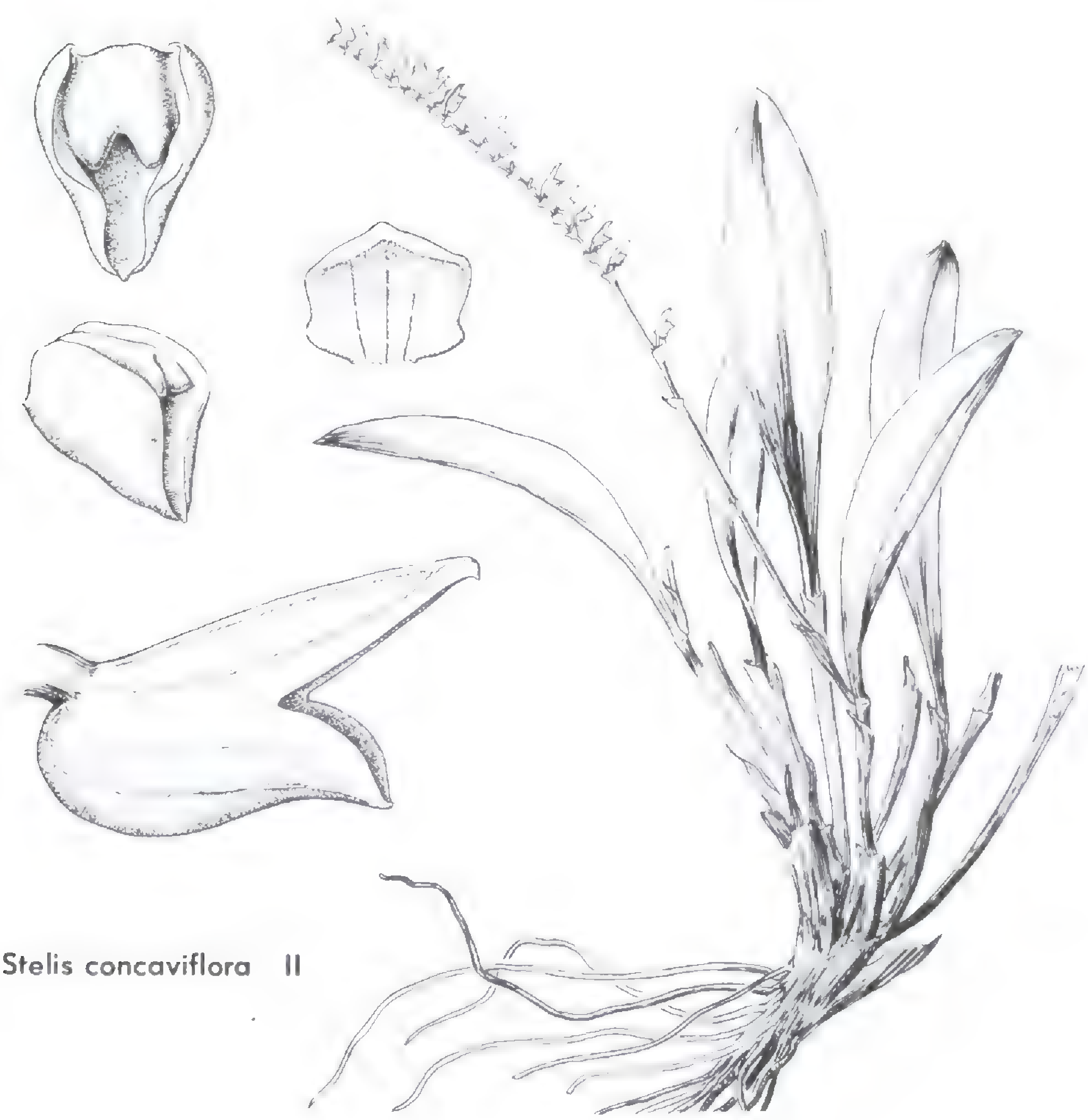
PLATE 45



Stelis suaveolens II

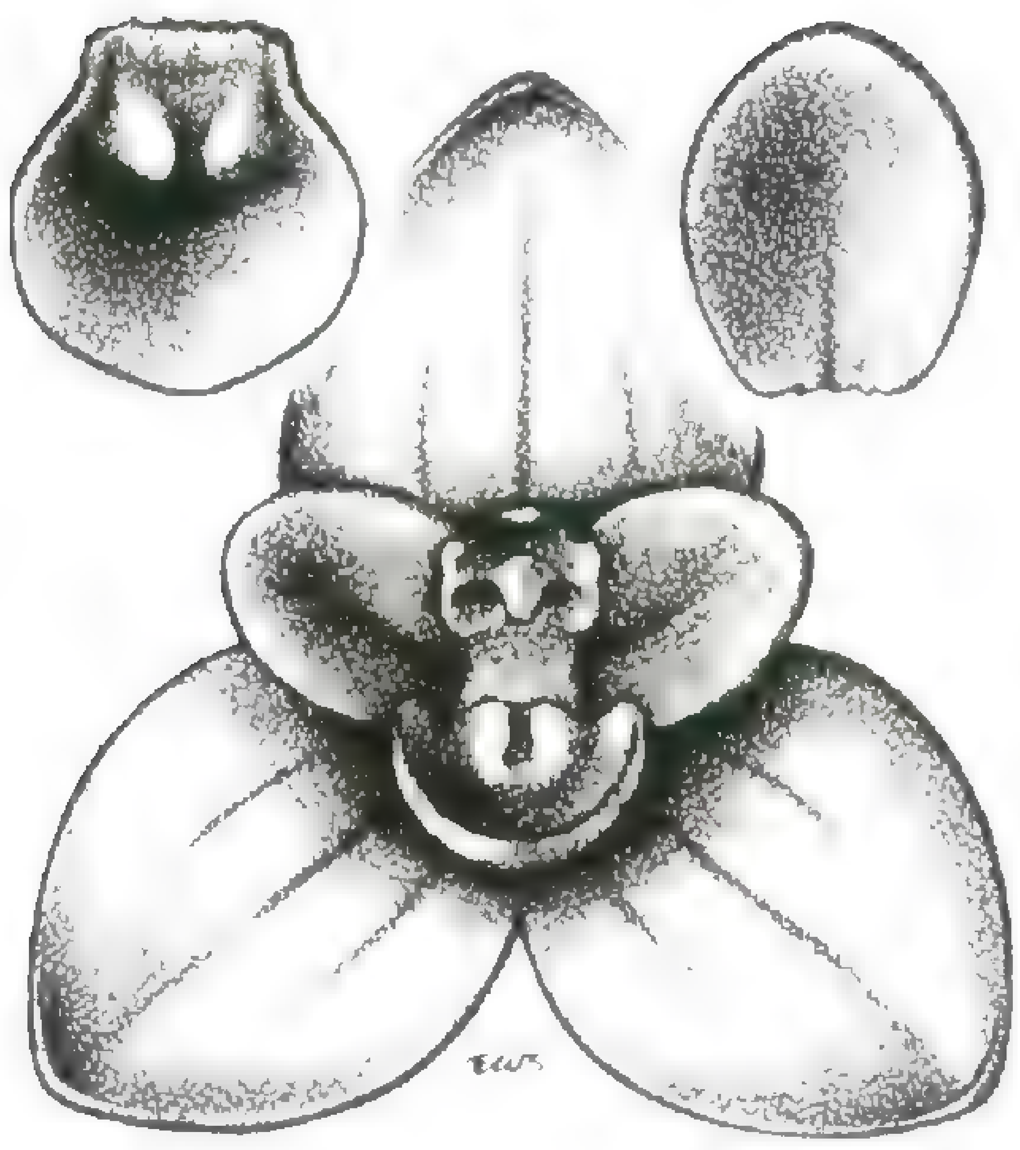


Stelis vulcani II

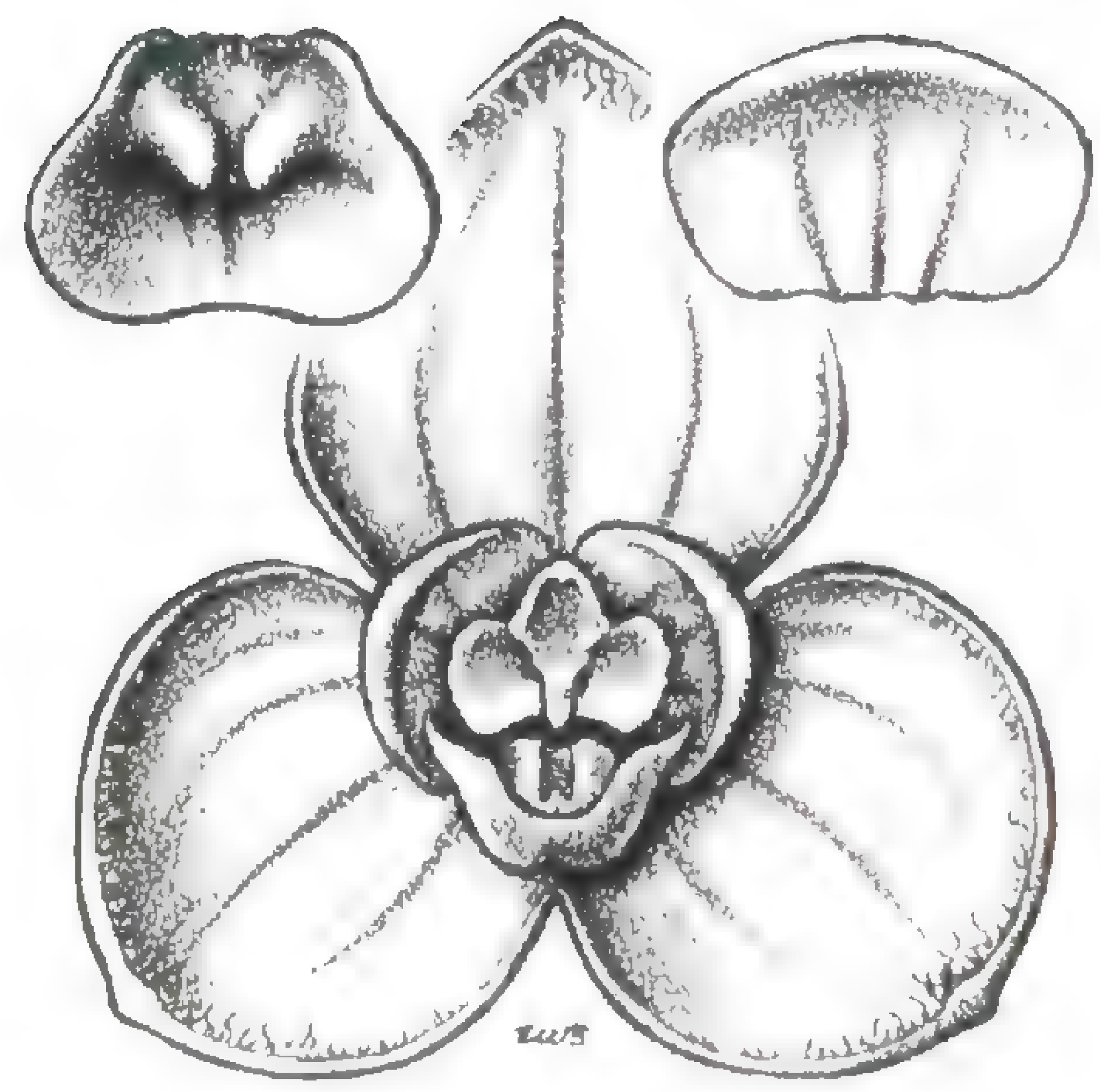


Stelis concaviflora II

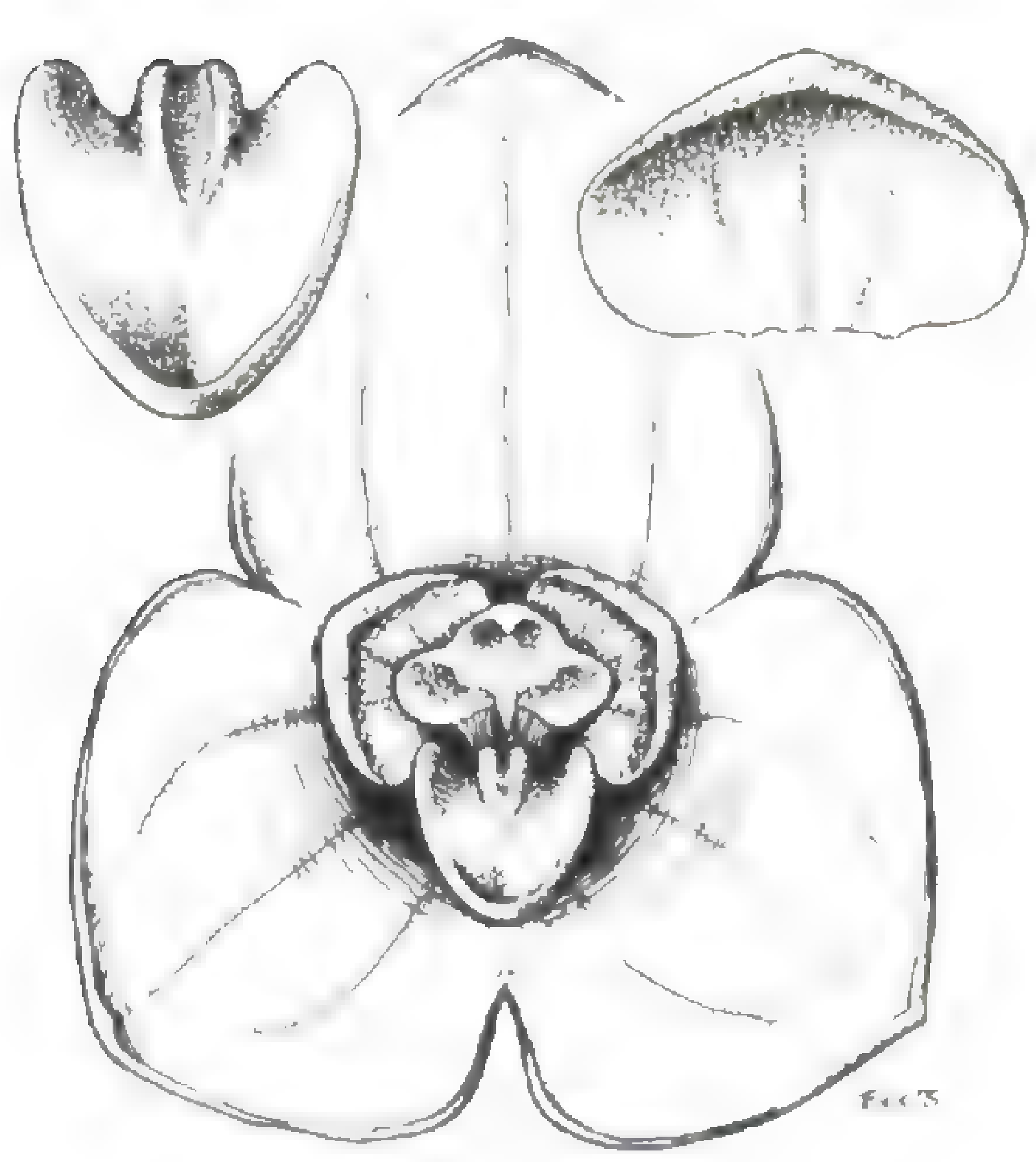
PLATE 46



Stelis popayanensis III

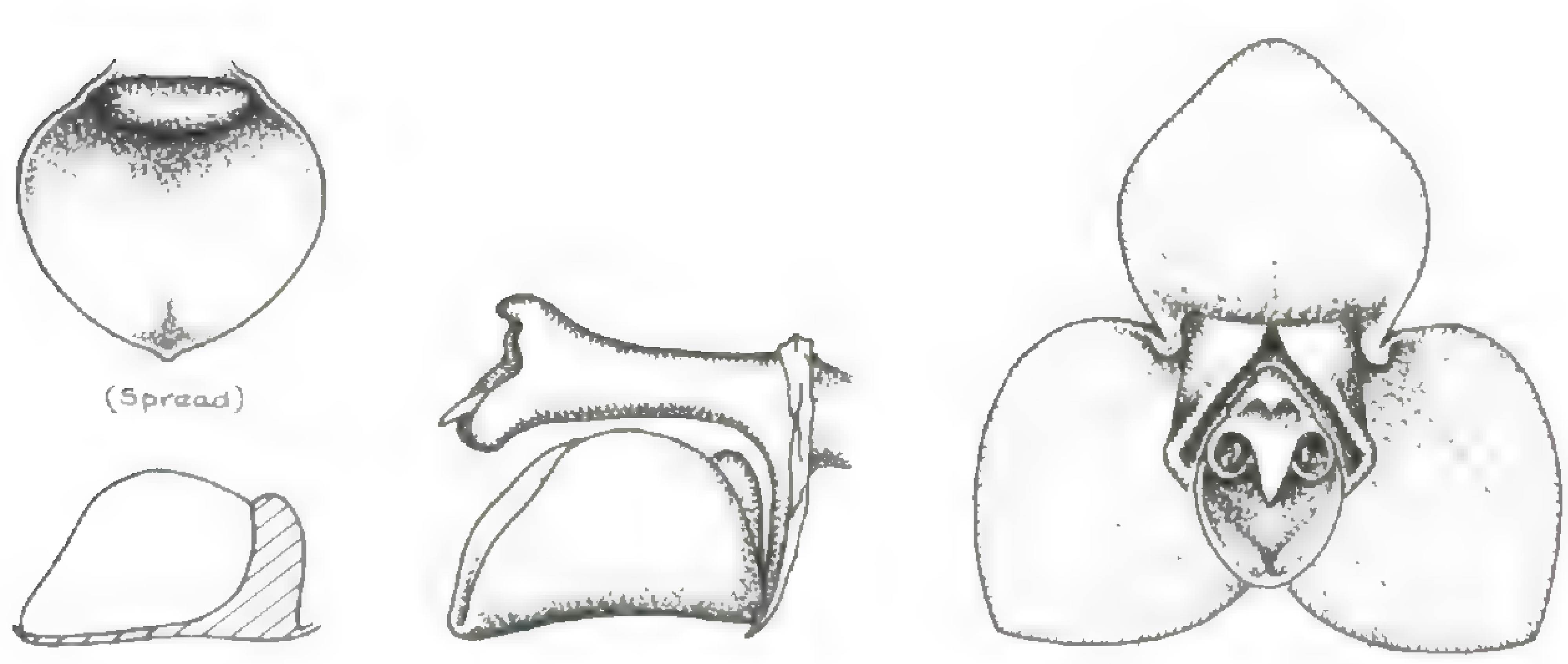


Stelis major III



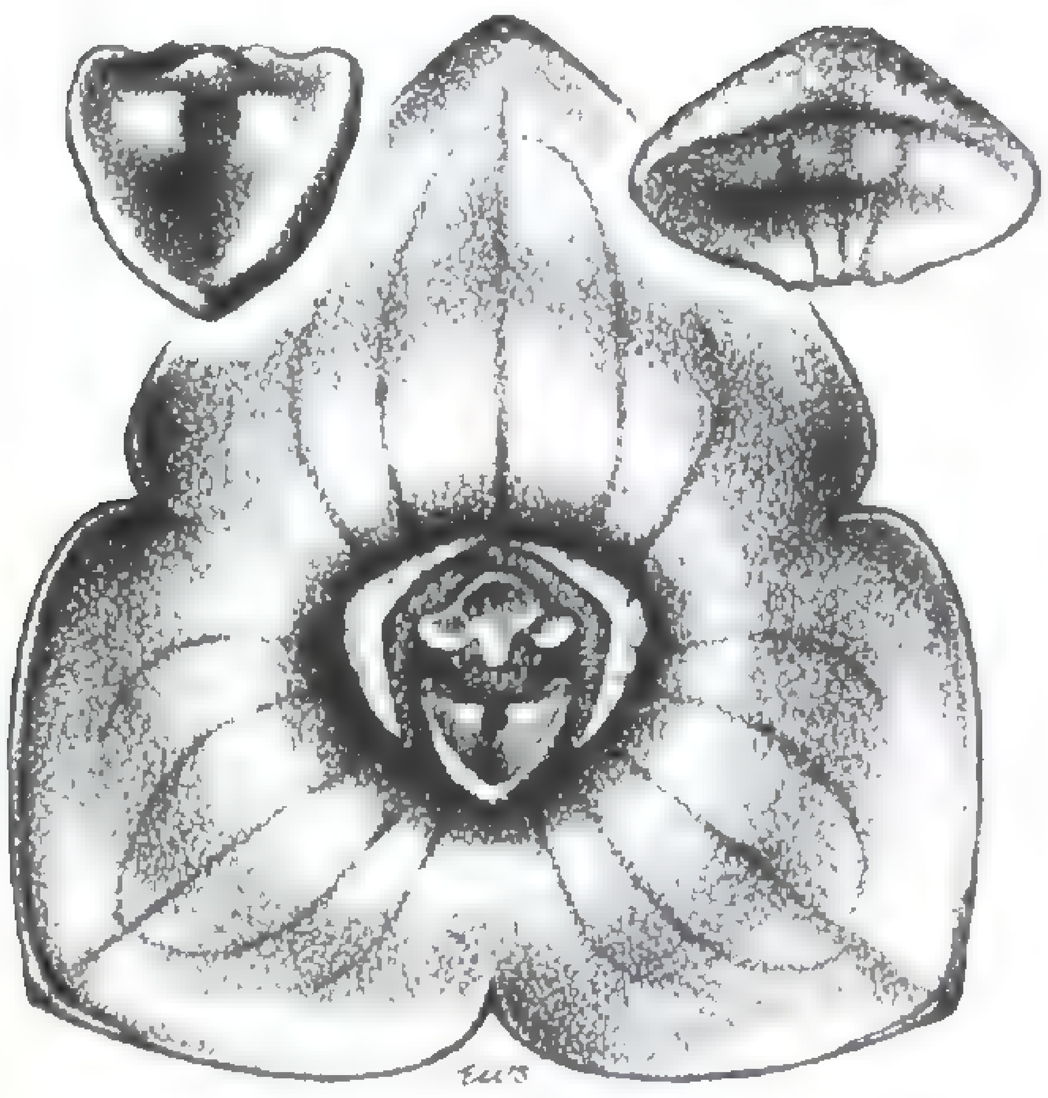
Stelis lanceolata III

Stelis eublepharis III

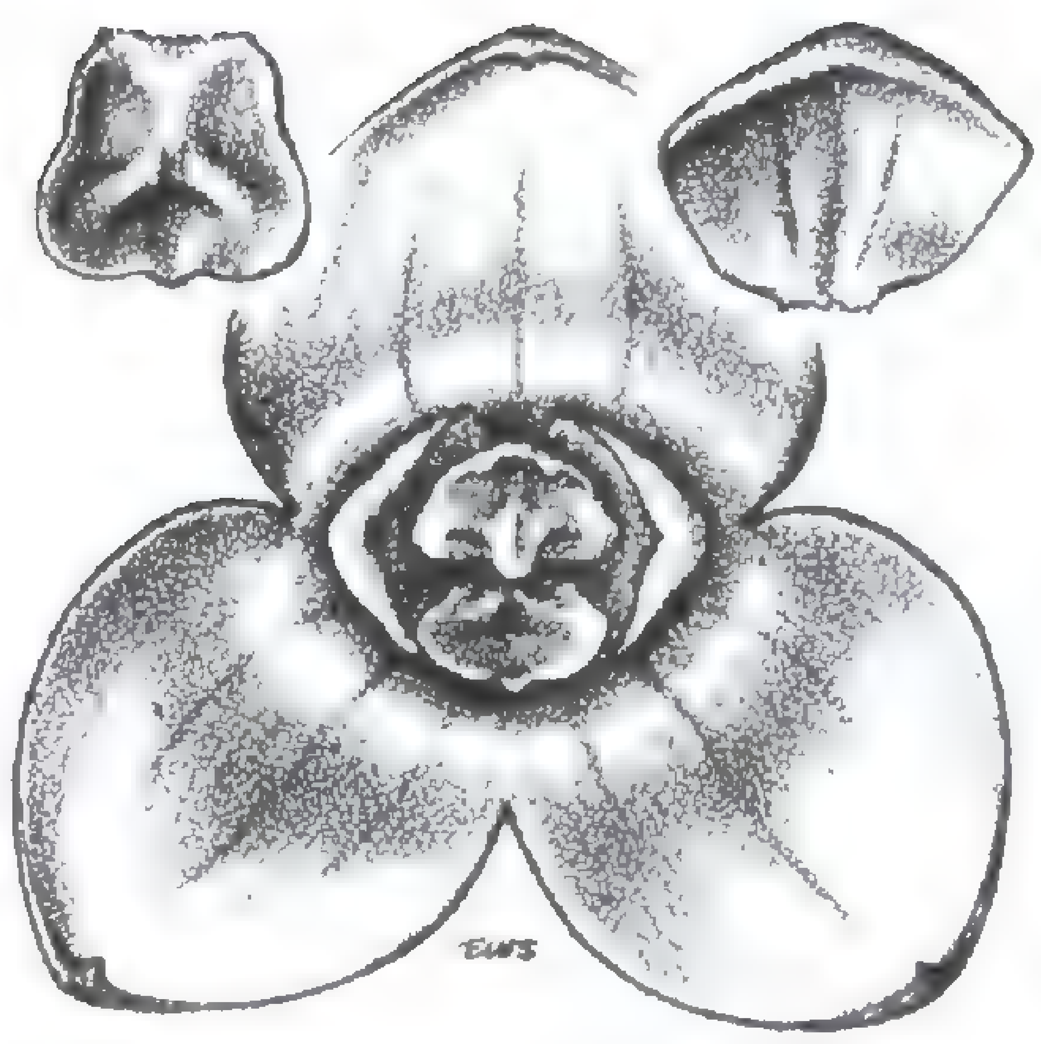


Stelis Dunstervilleorum III

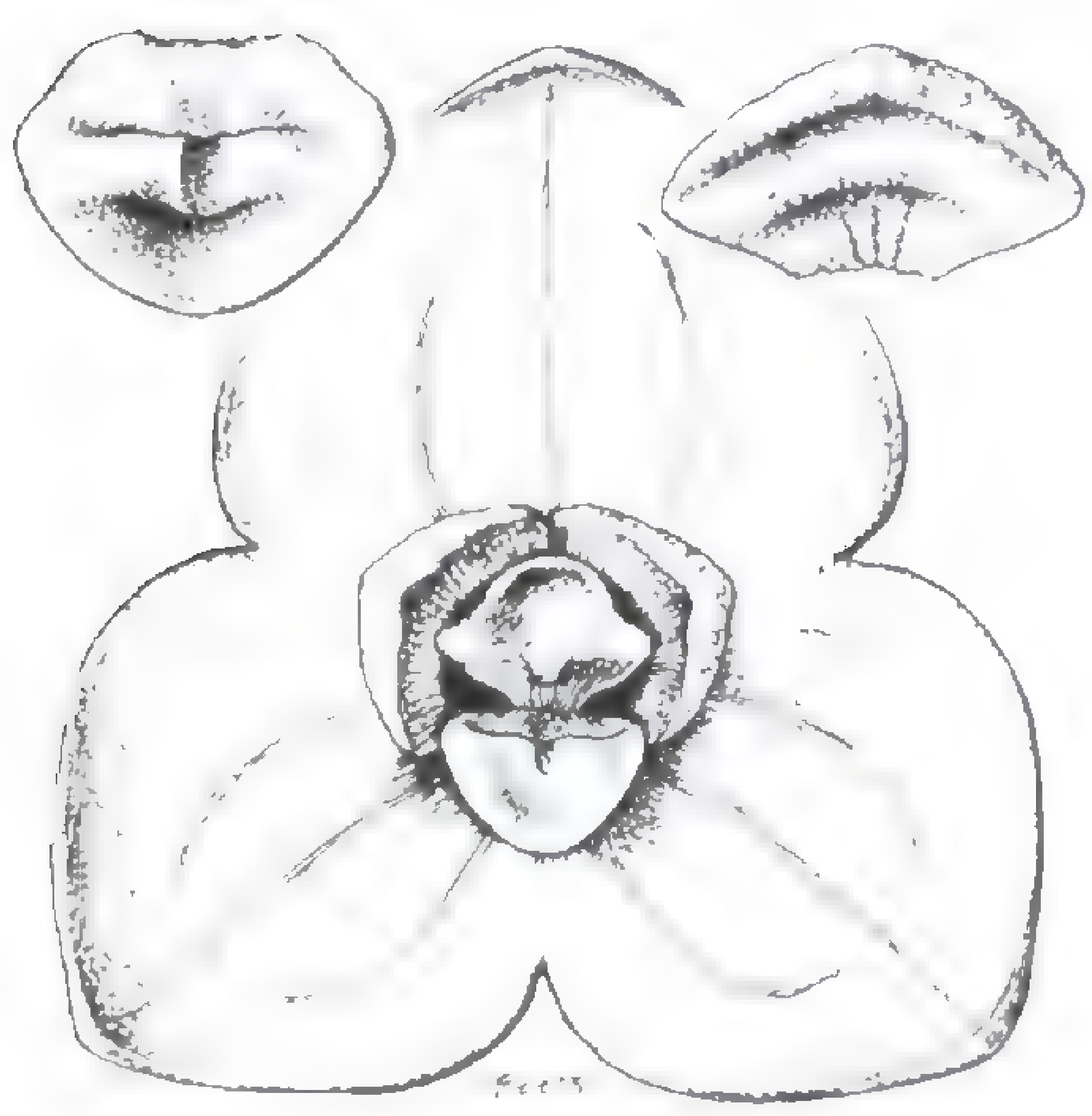
PLATE 47



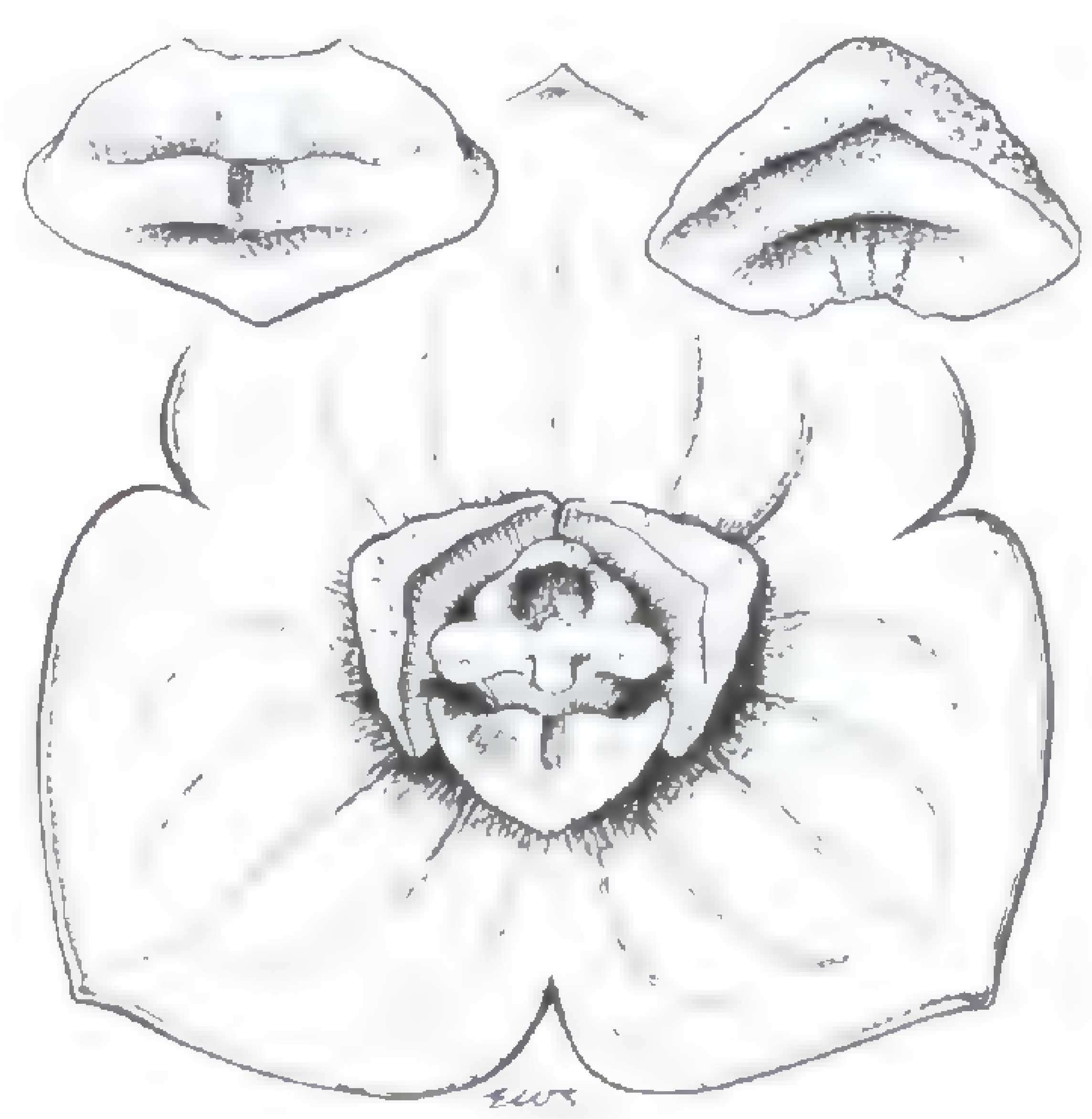
Stelis Bangii IV-c-1



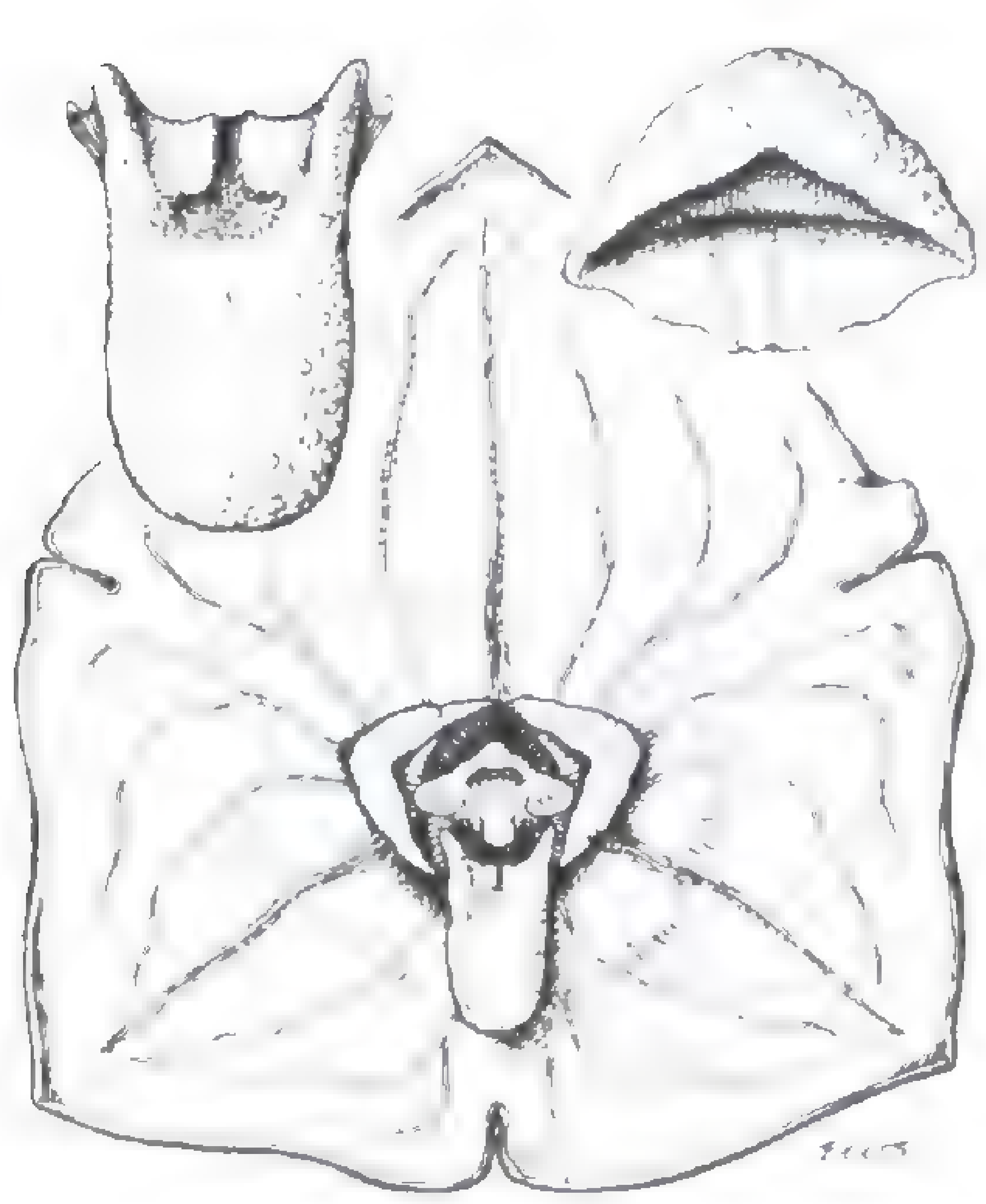
Stelis foveata IV-c-1



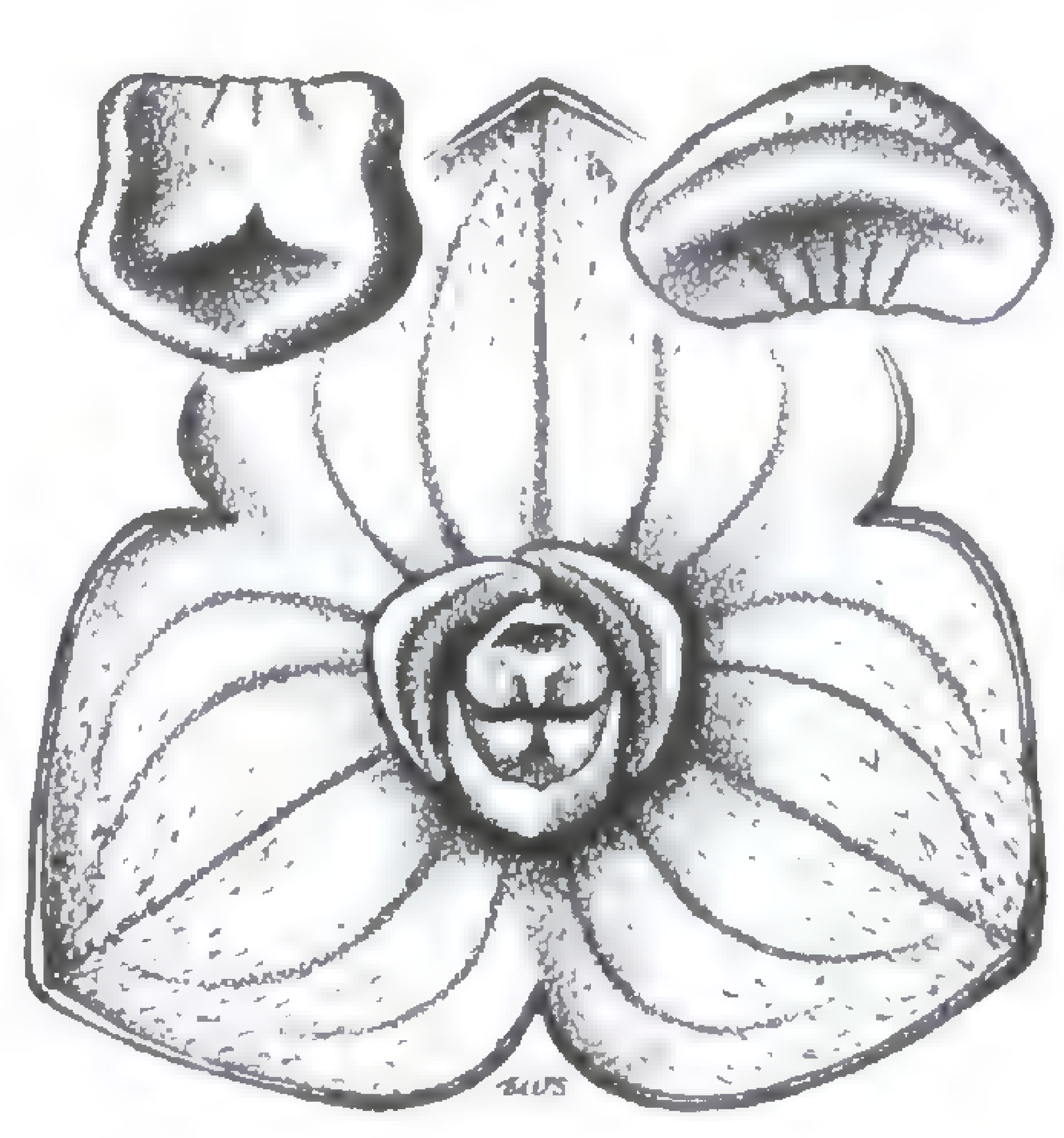
Stelis Lindleyana IV-c-1



Stelis muscifera IV-c-1

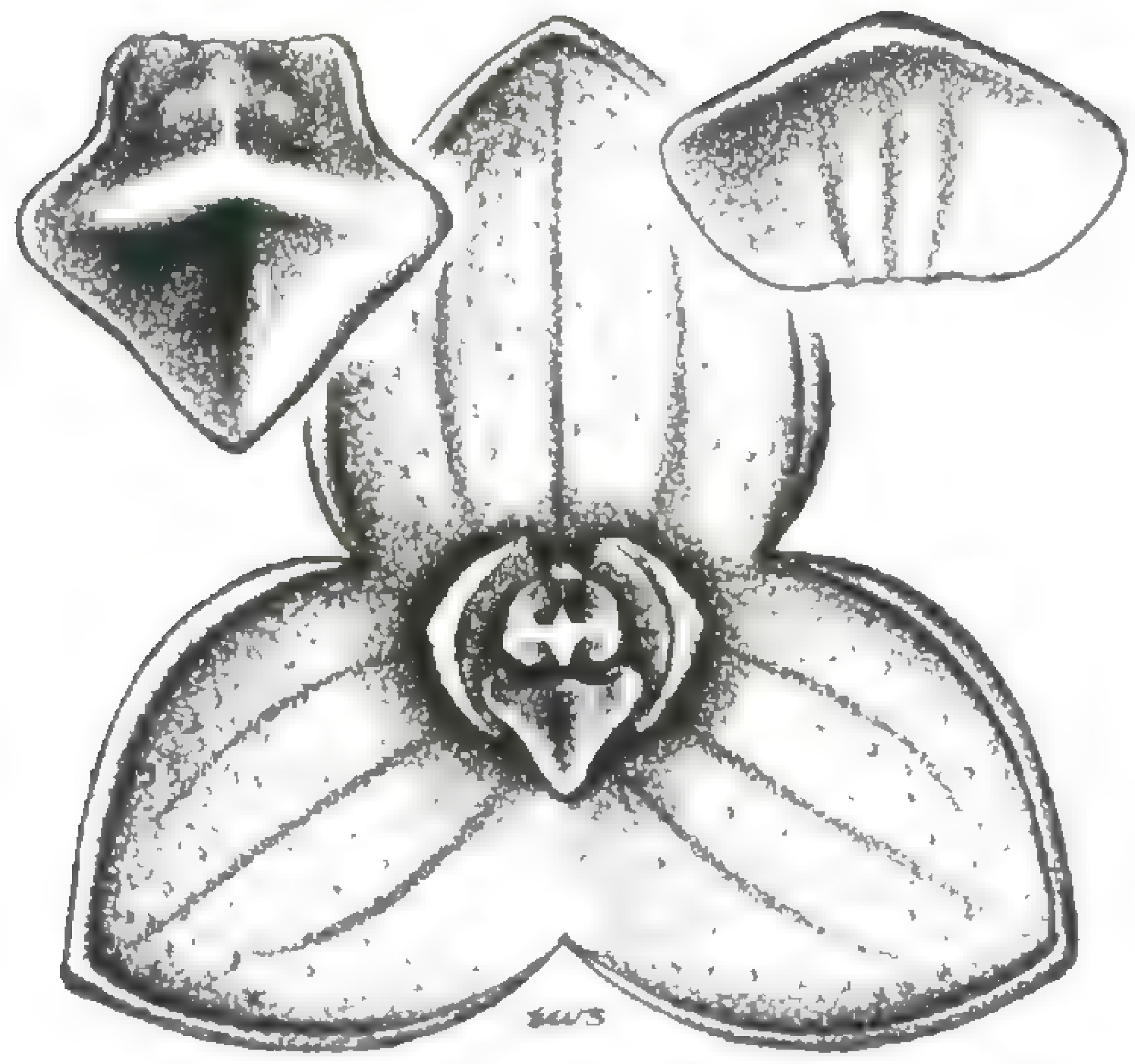


Stelis triplicata IV-c-1

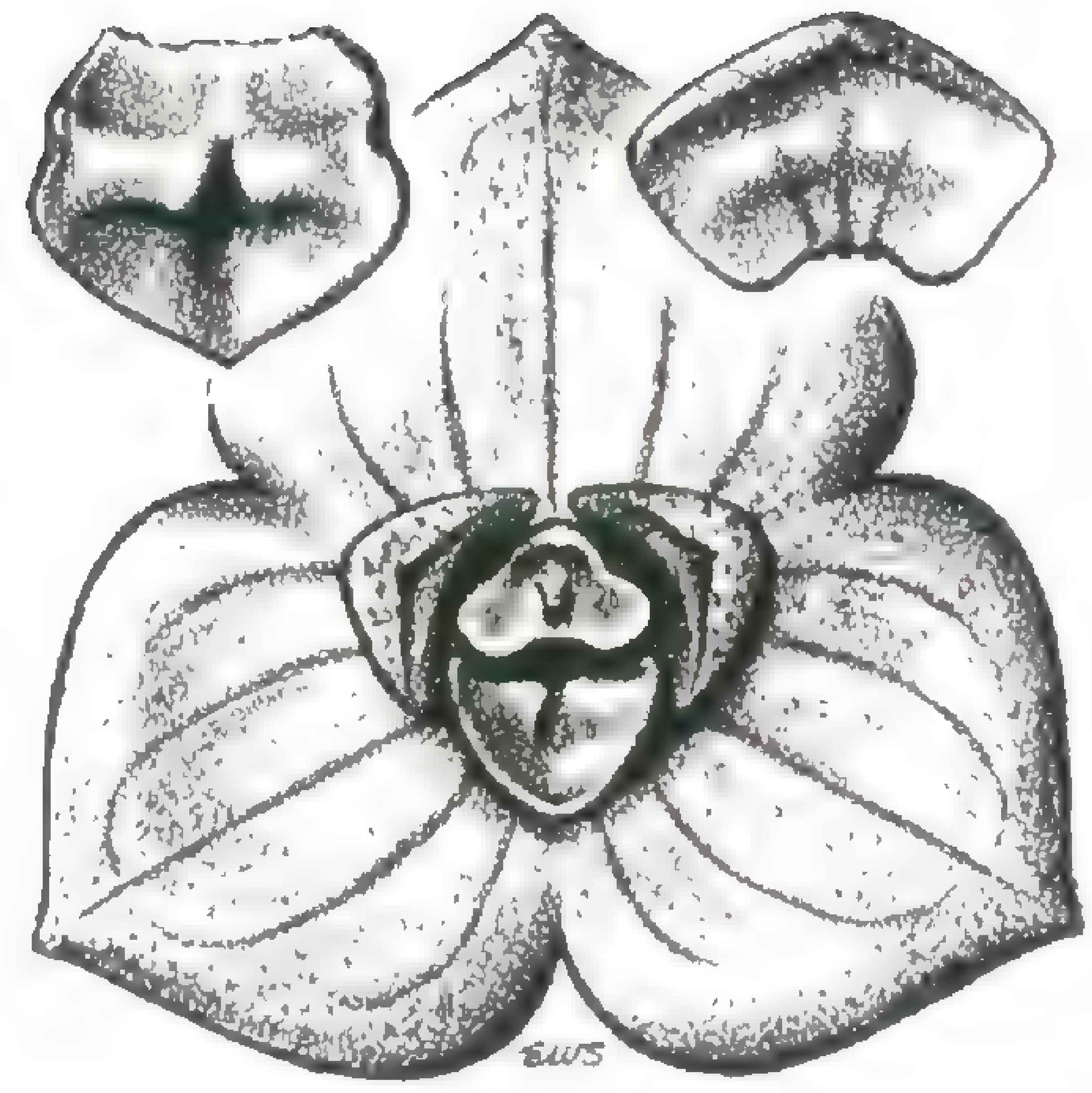


Stelis acuifera IV-c-1

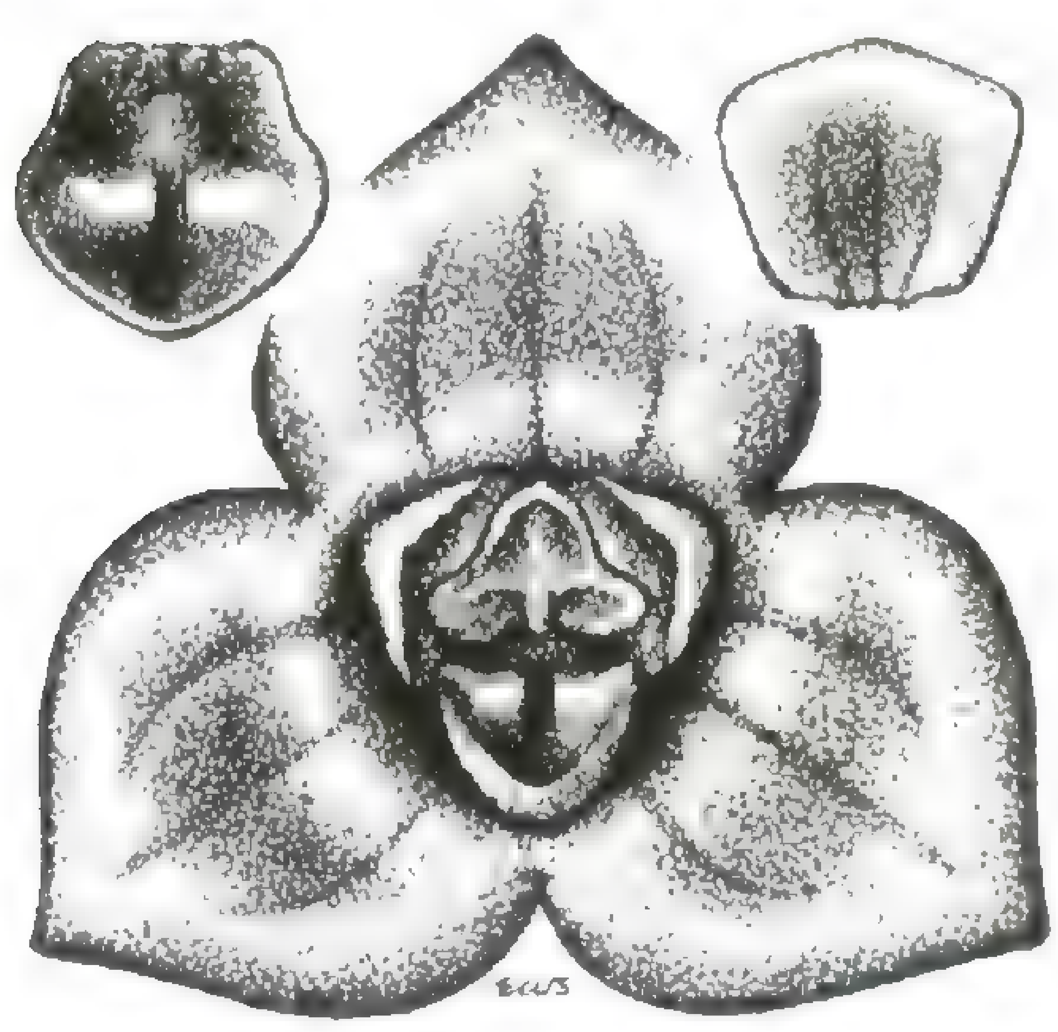
PLATE 48



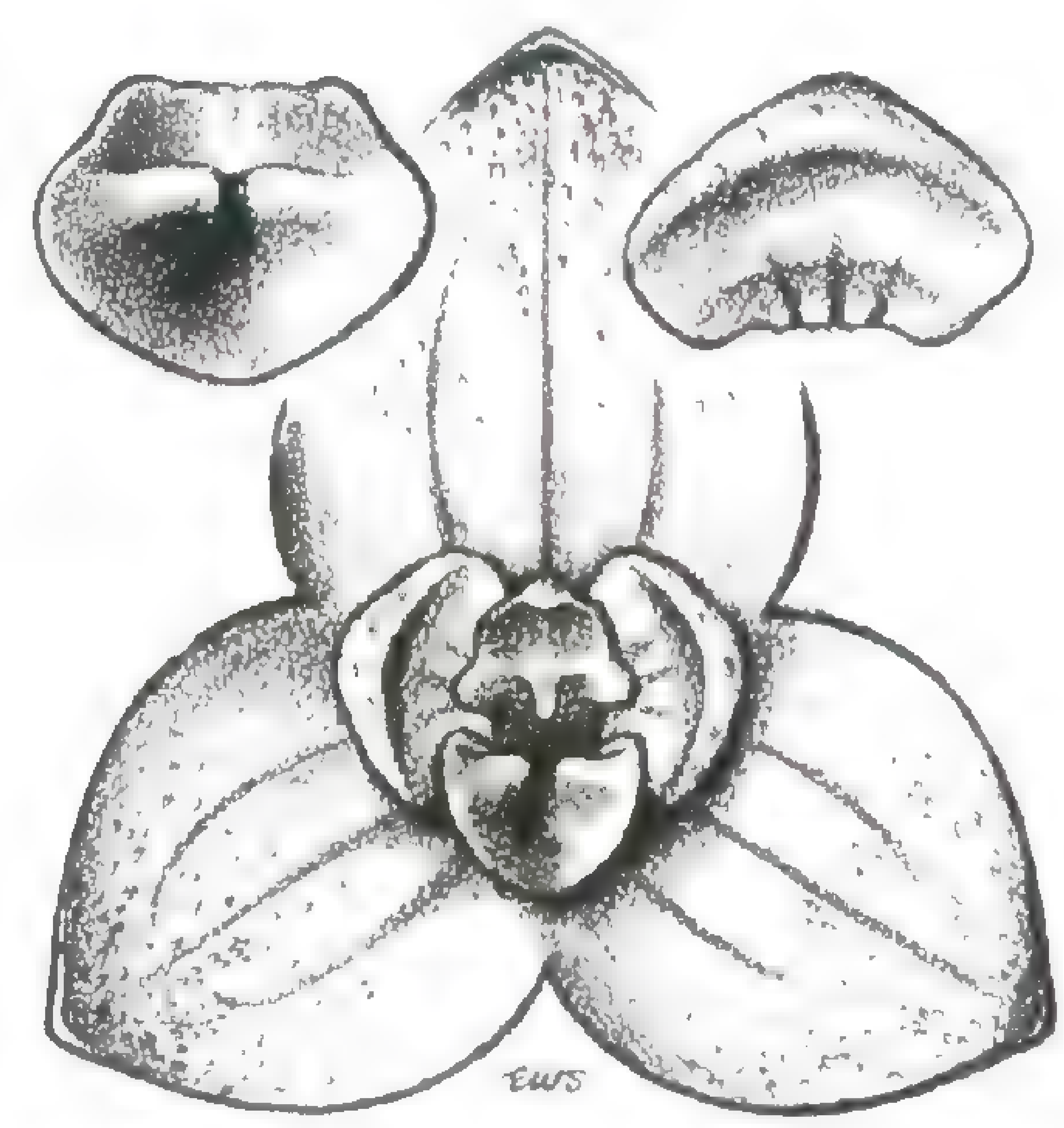
Stelis chachapoyensis IV-c-1



Stelis ochreata IV-c-1



Stelis attenuata IV-c-1

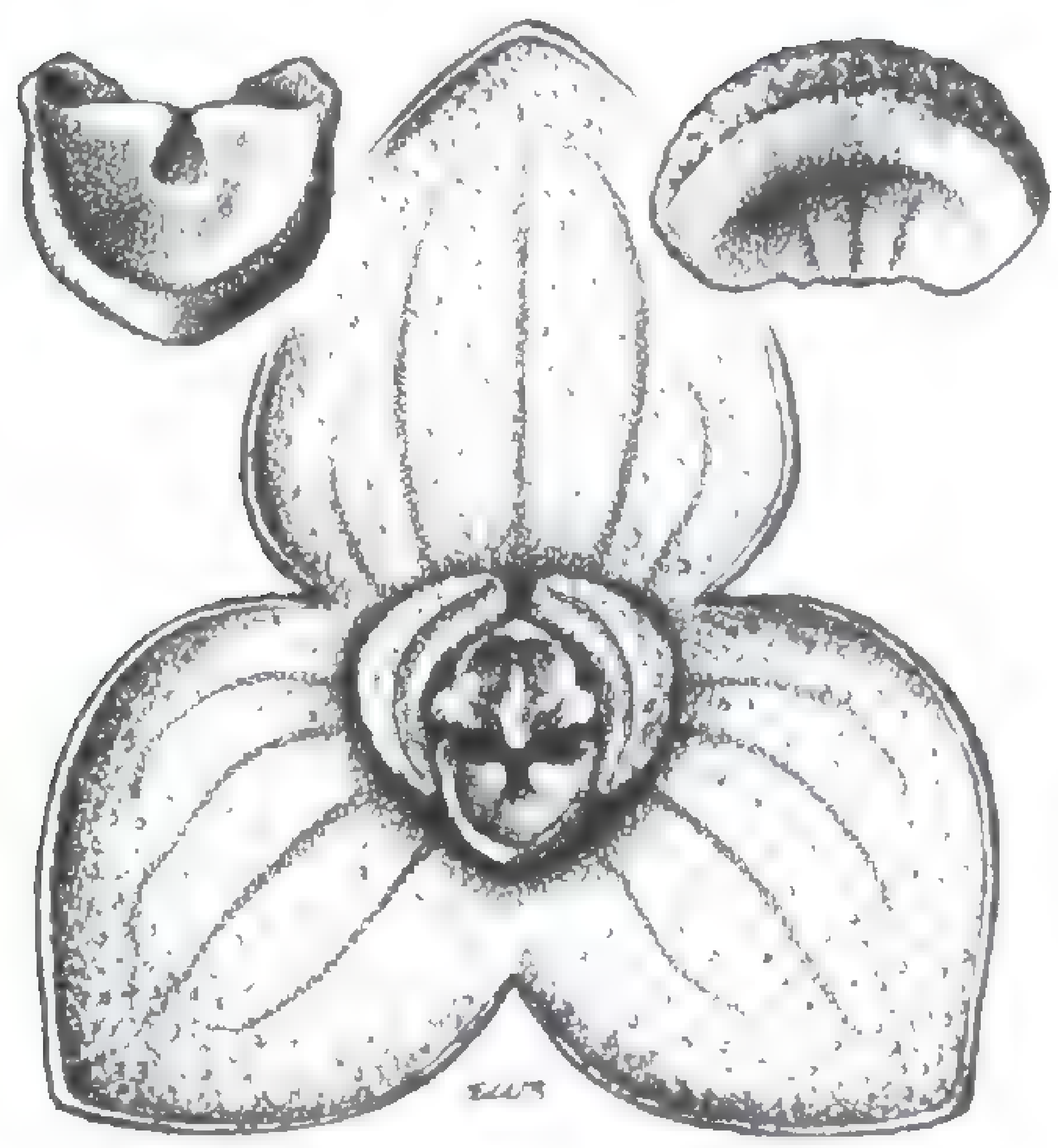


Stelis loxensis IV-r-1

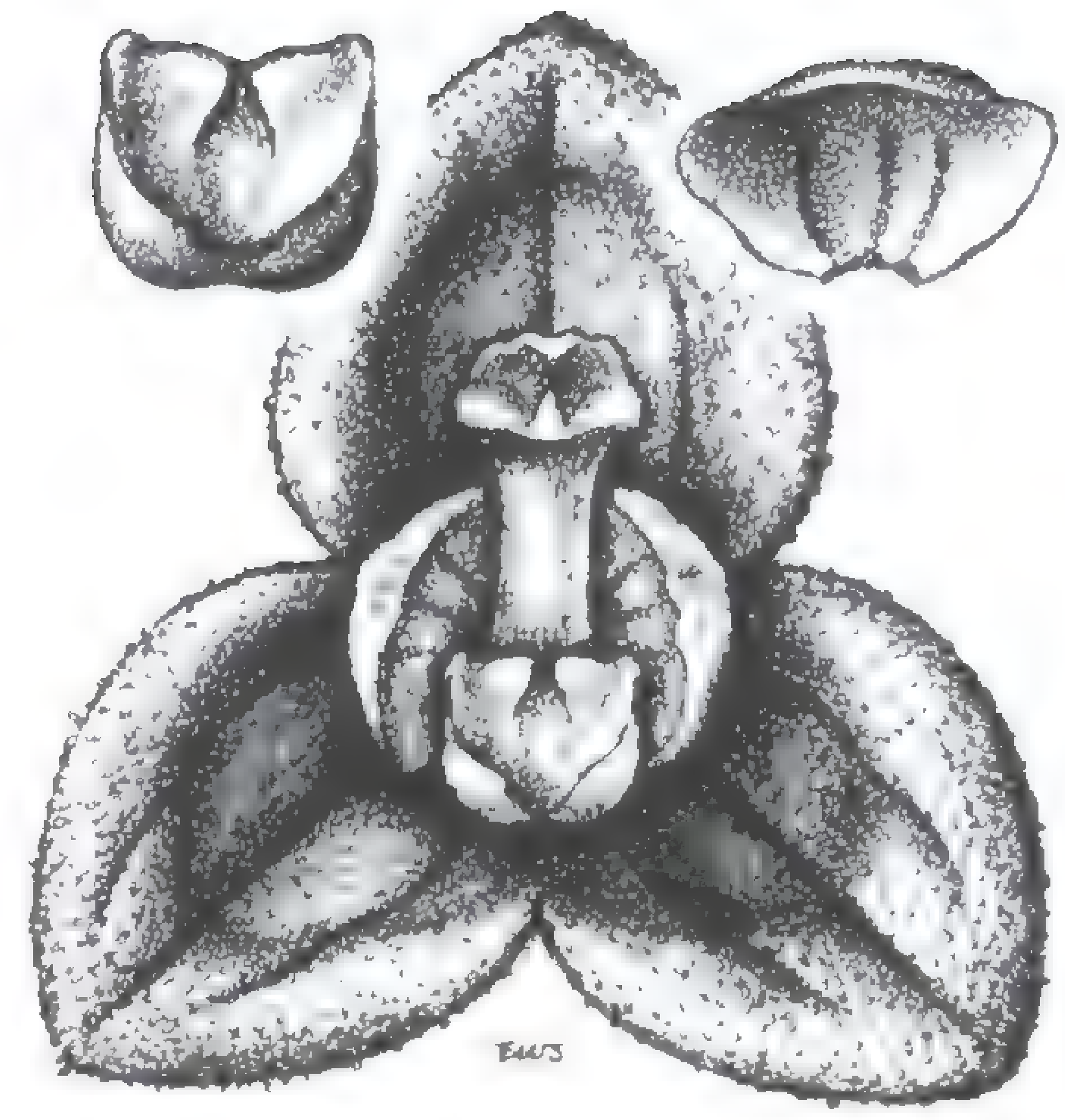
Stelis Powellii IV-c-1

Stelis carnosiflora IV-c-1

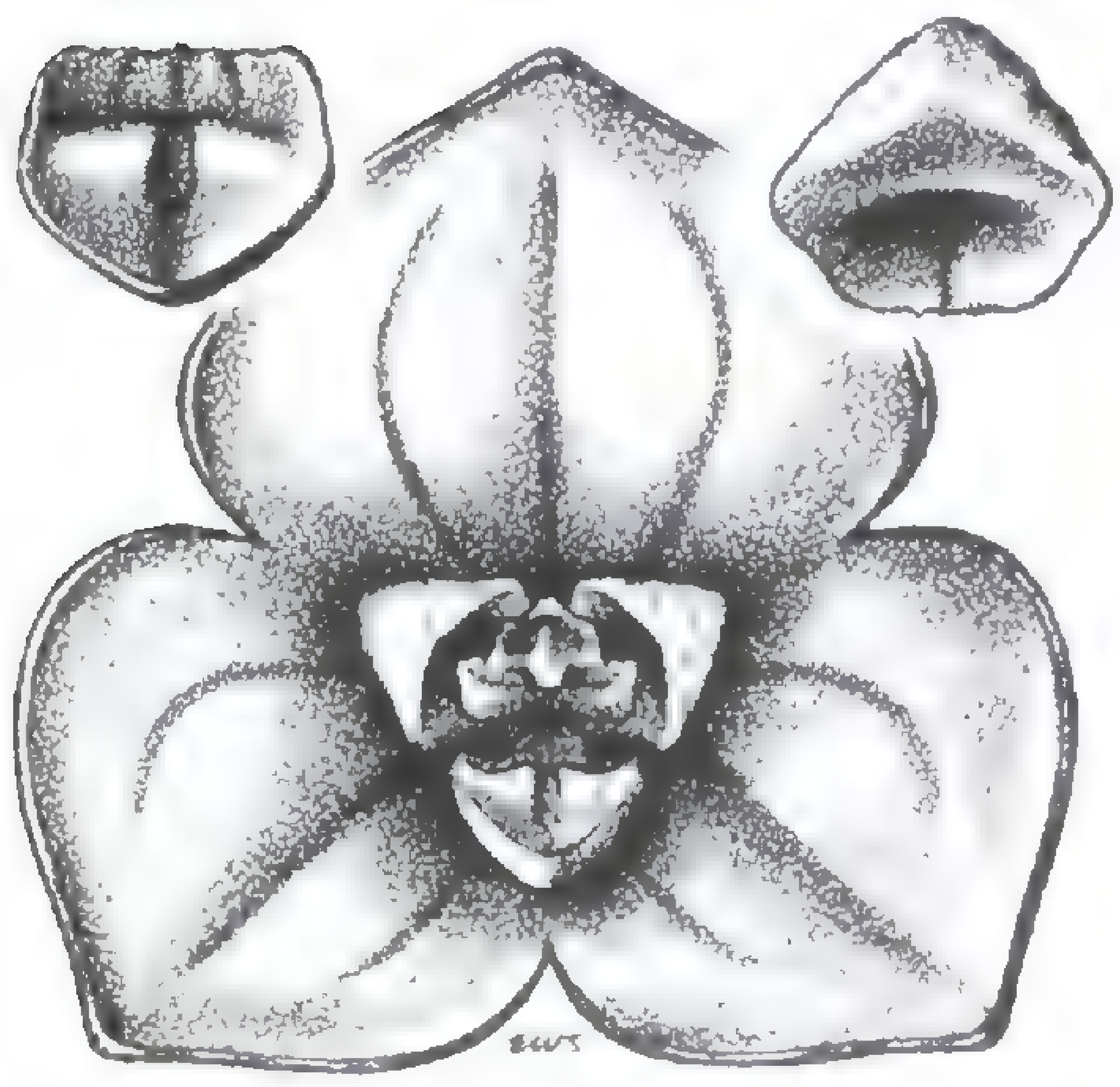
PLATE 49



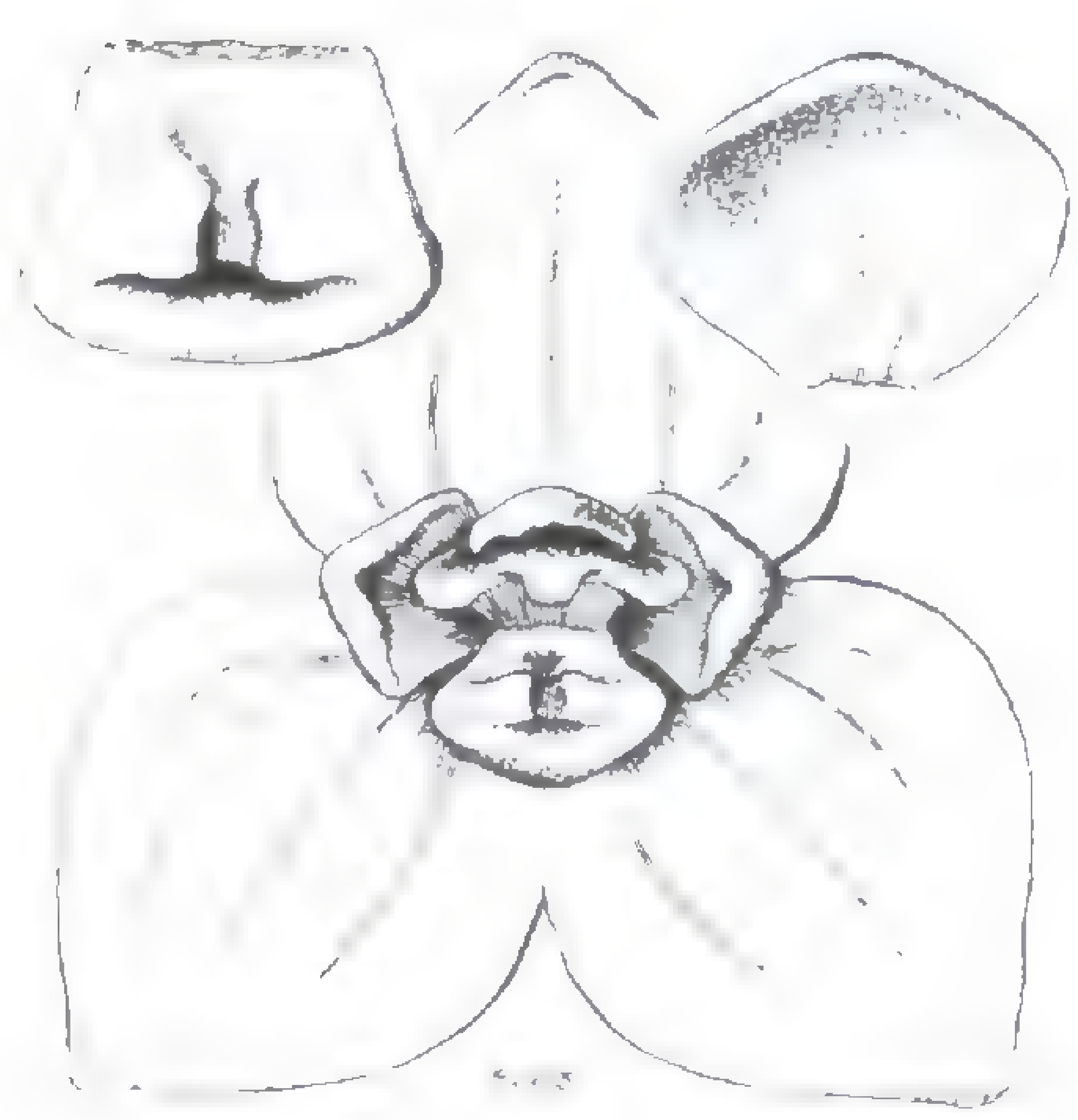
Stelis scandens IV-r-1



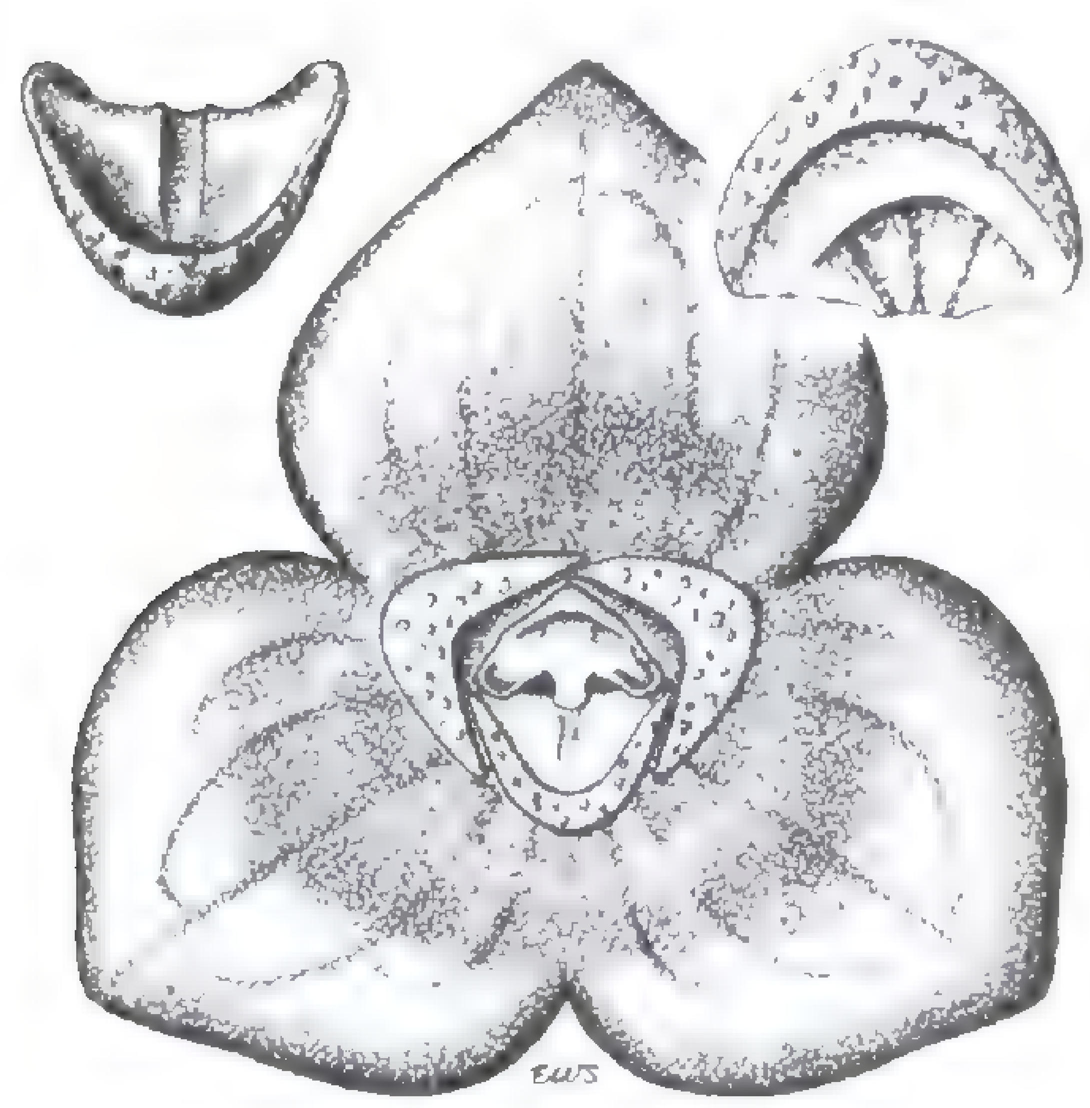
Stelis columnaris IV-r-2



Stelis latisepala IV-c-3



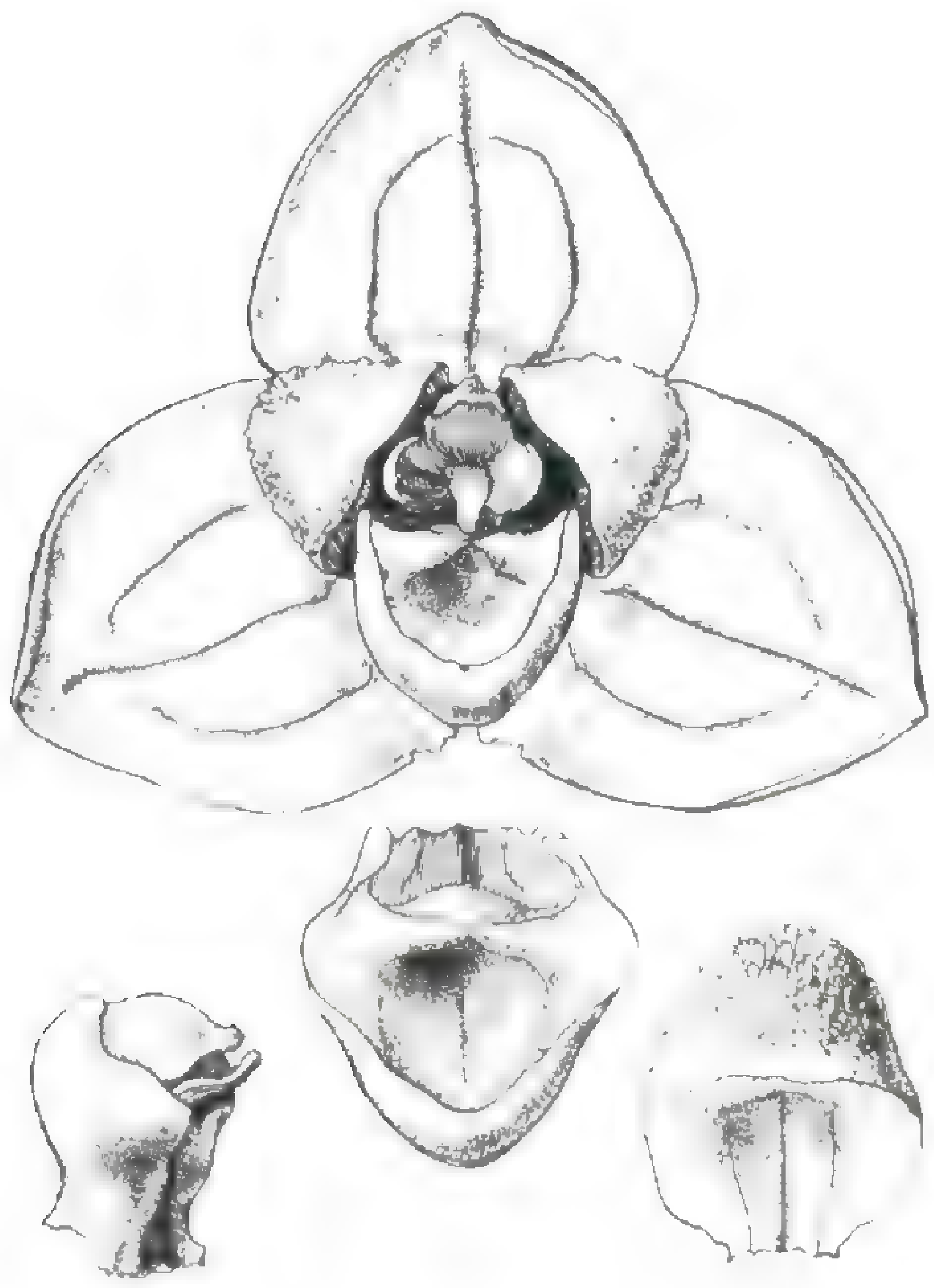
Stelis lutea IV-c-3



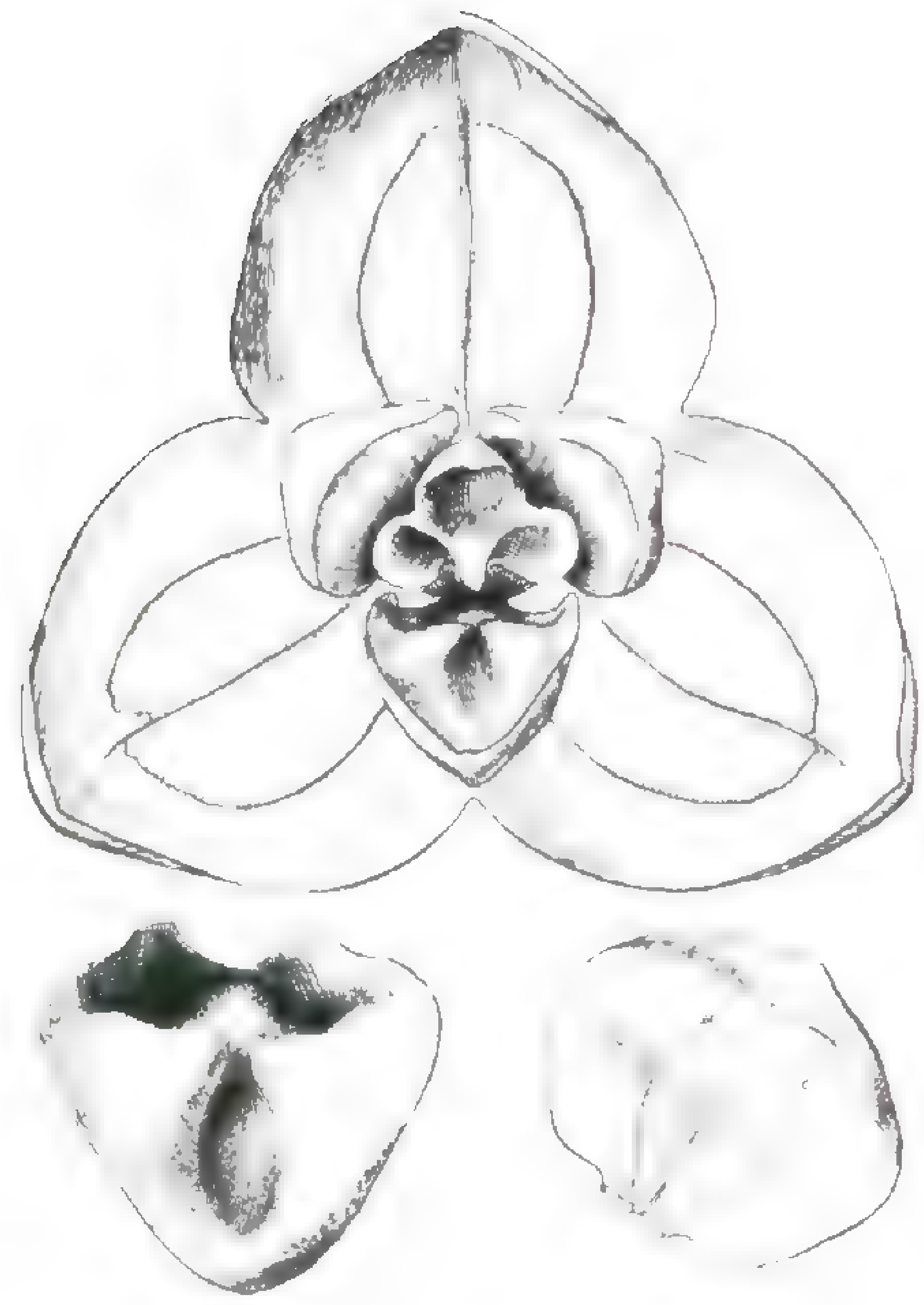
Stelis zonata IV-c-3

Stelis crassilabia IV-c-3

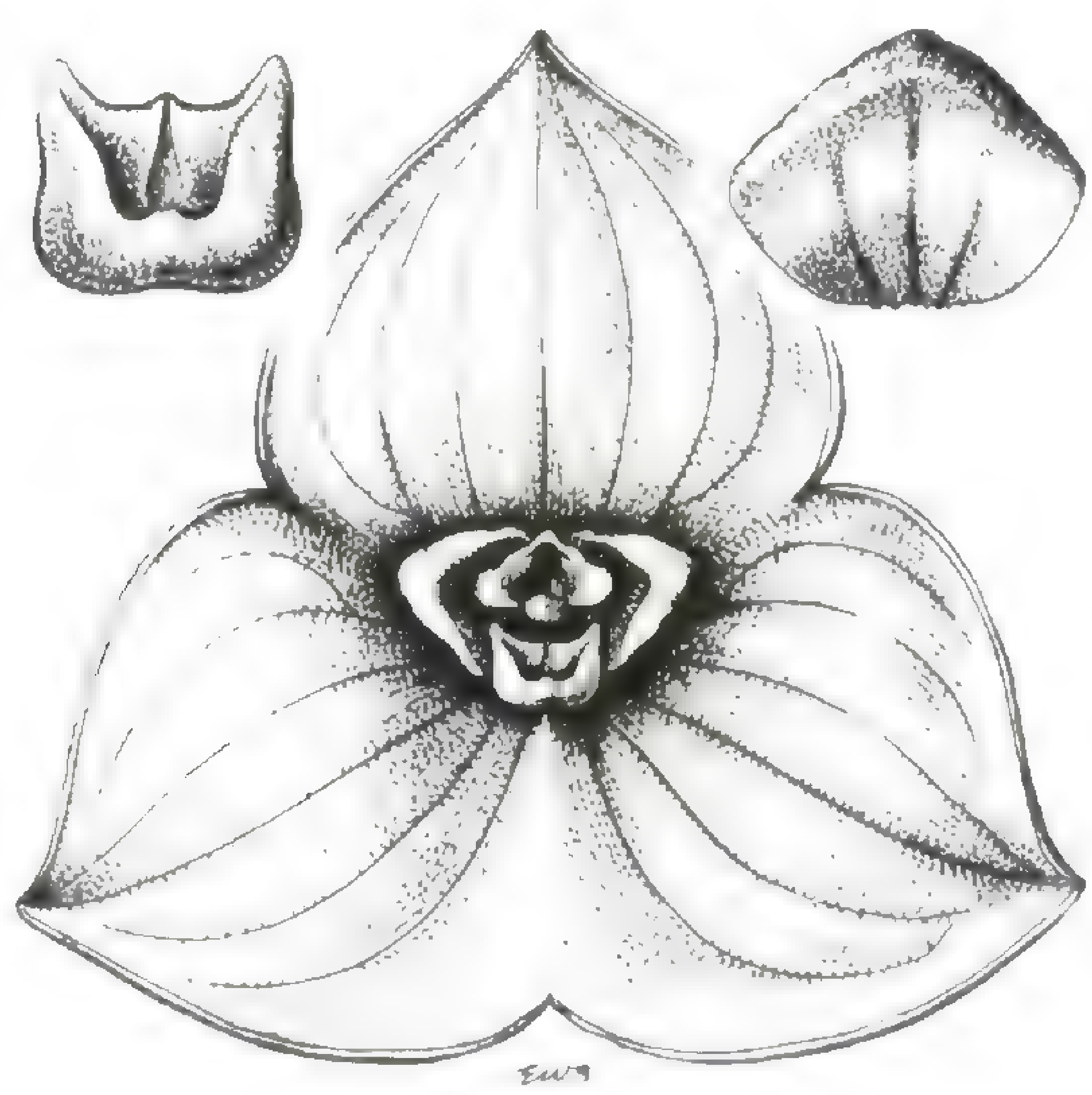
PLATE 50



Stelis Alfredii IV-c-3

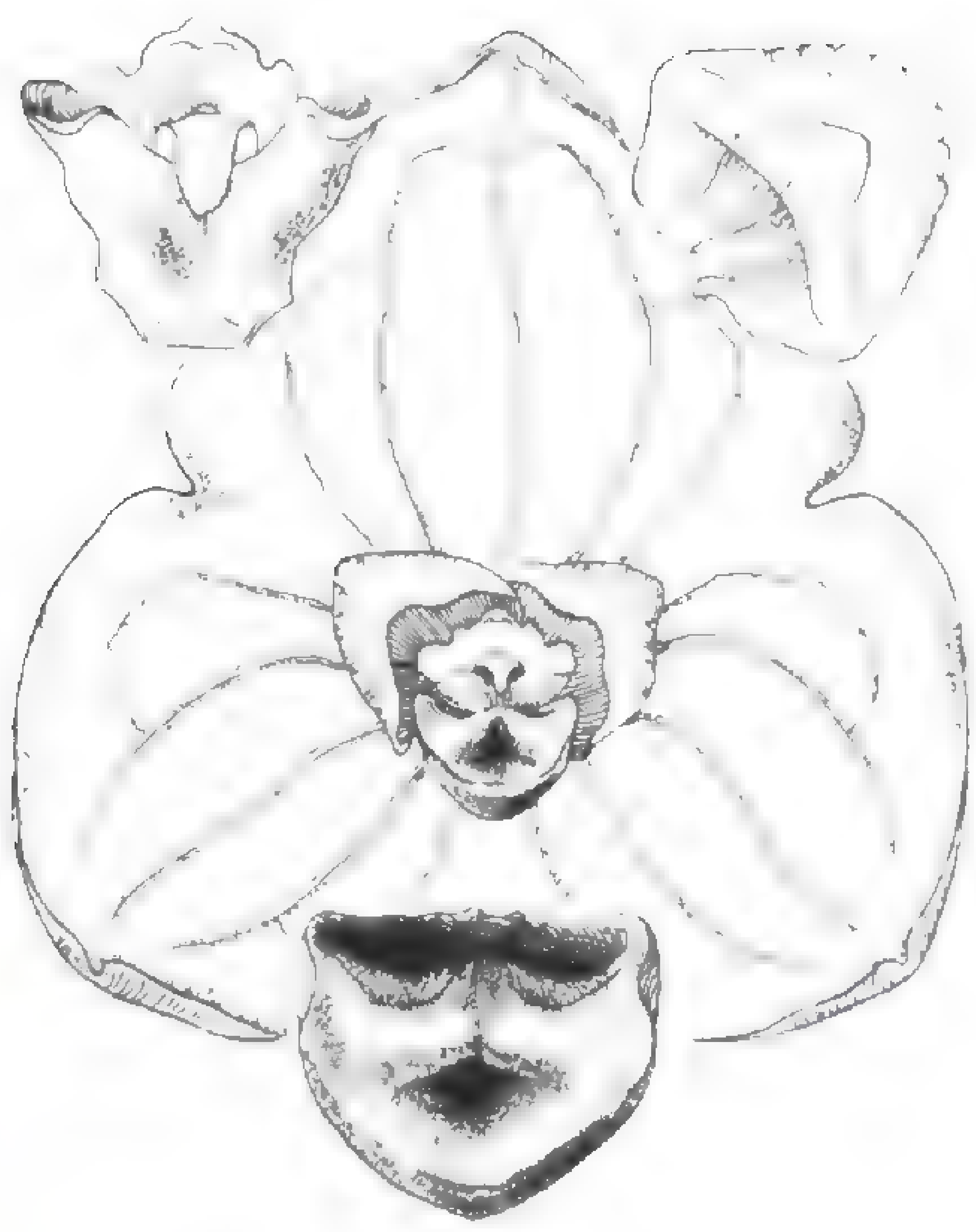


Stelis bidentata IV-c-3

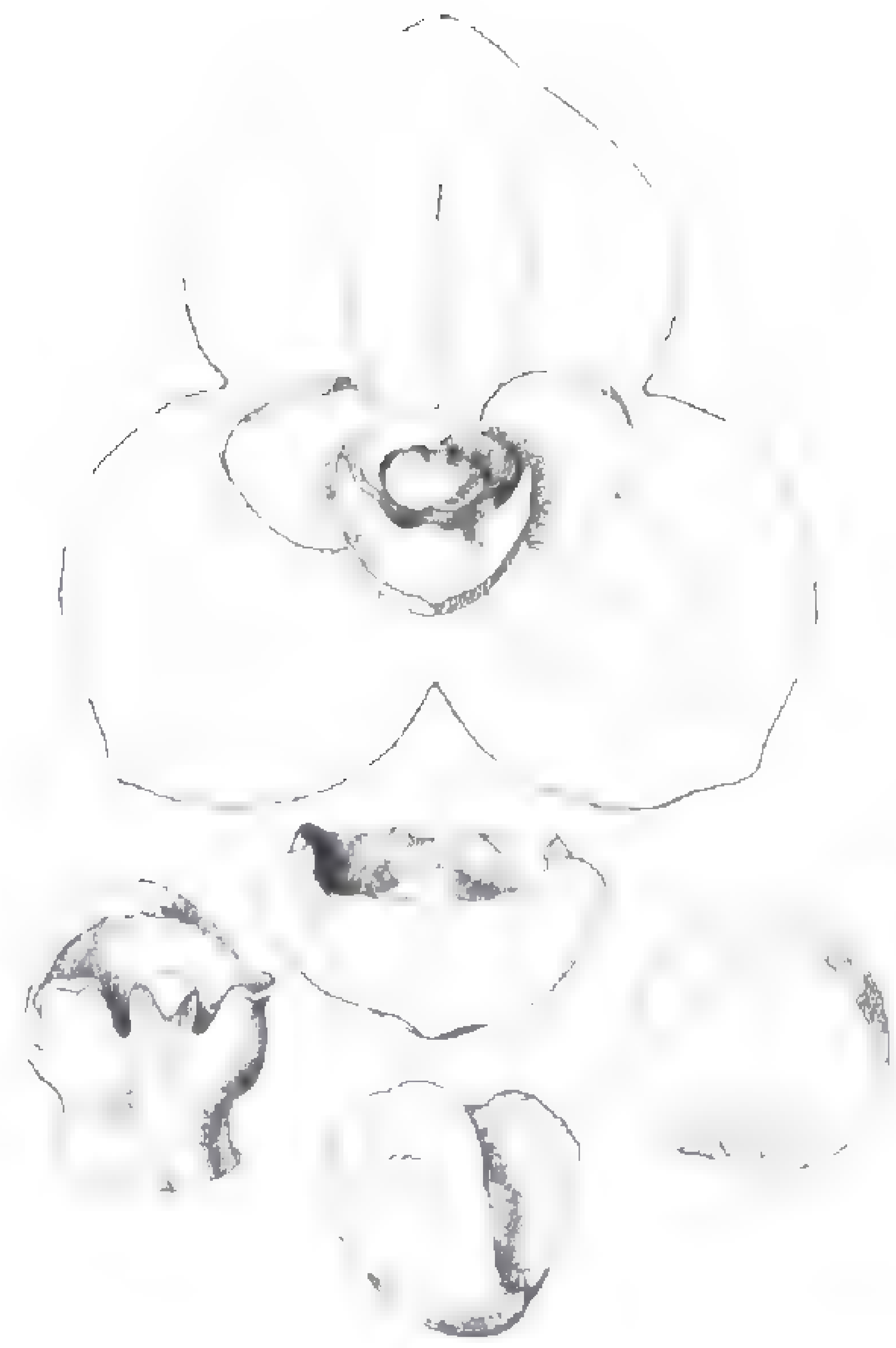


Stelis gemma Garay IV-c-3

PLATE 51

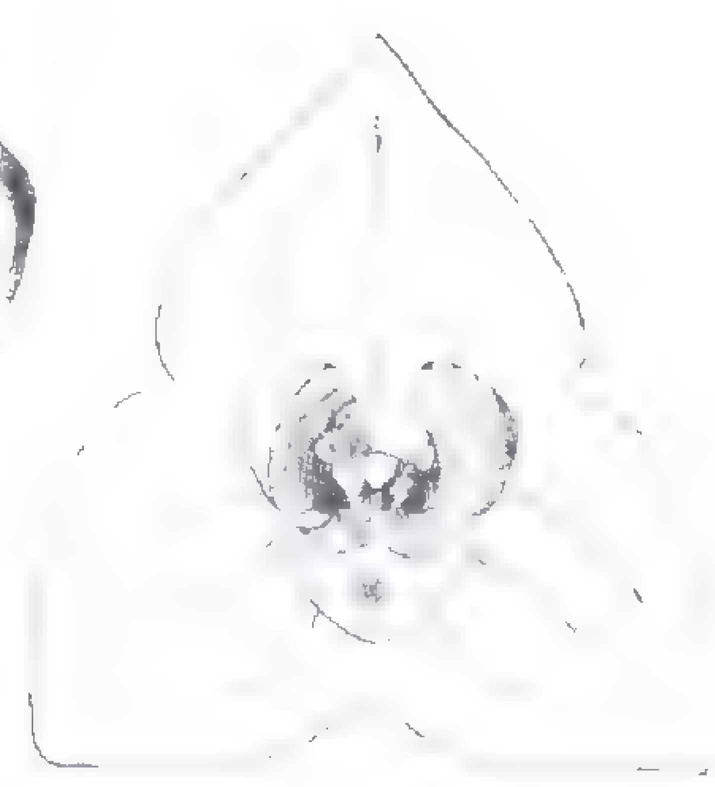


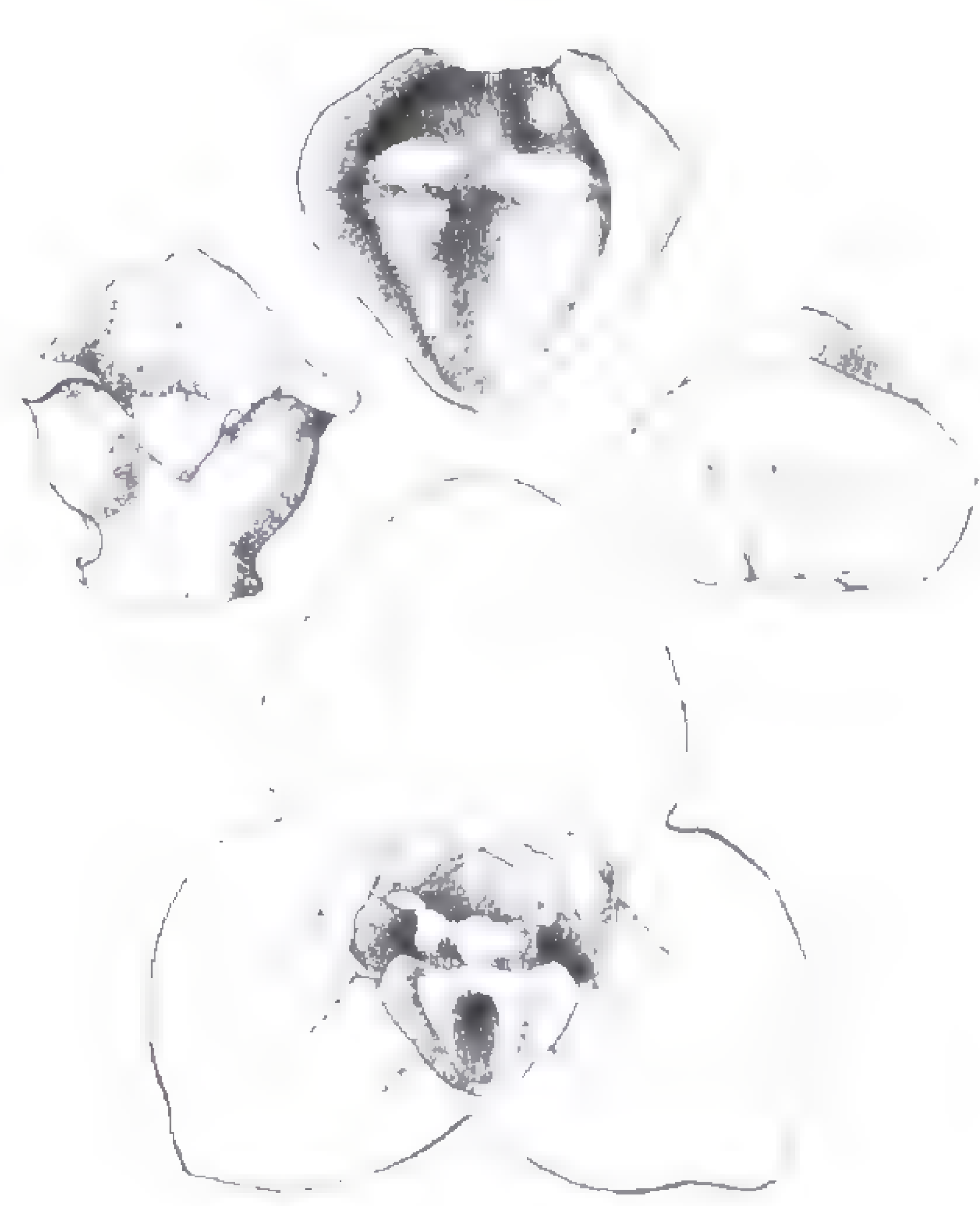
Stelis conmixta IV-c-3



Stelis longipetiolata IV-c-3

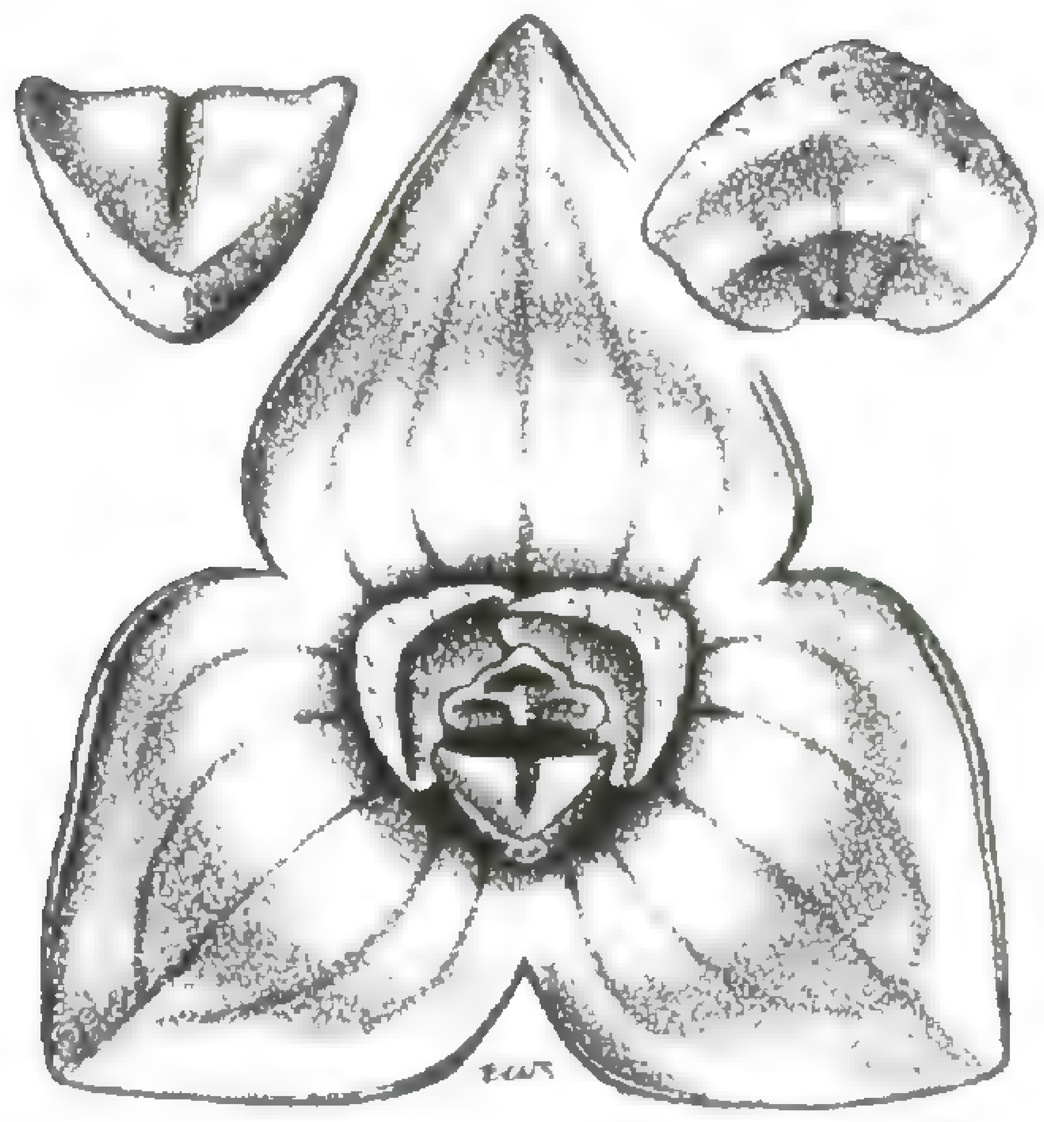
Stelis perplexa IV-c-3



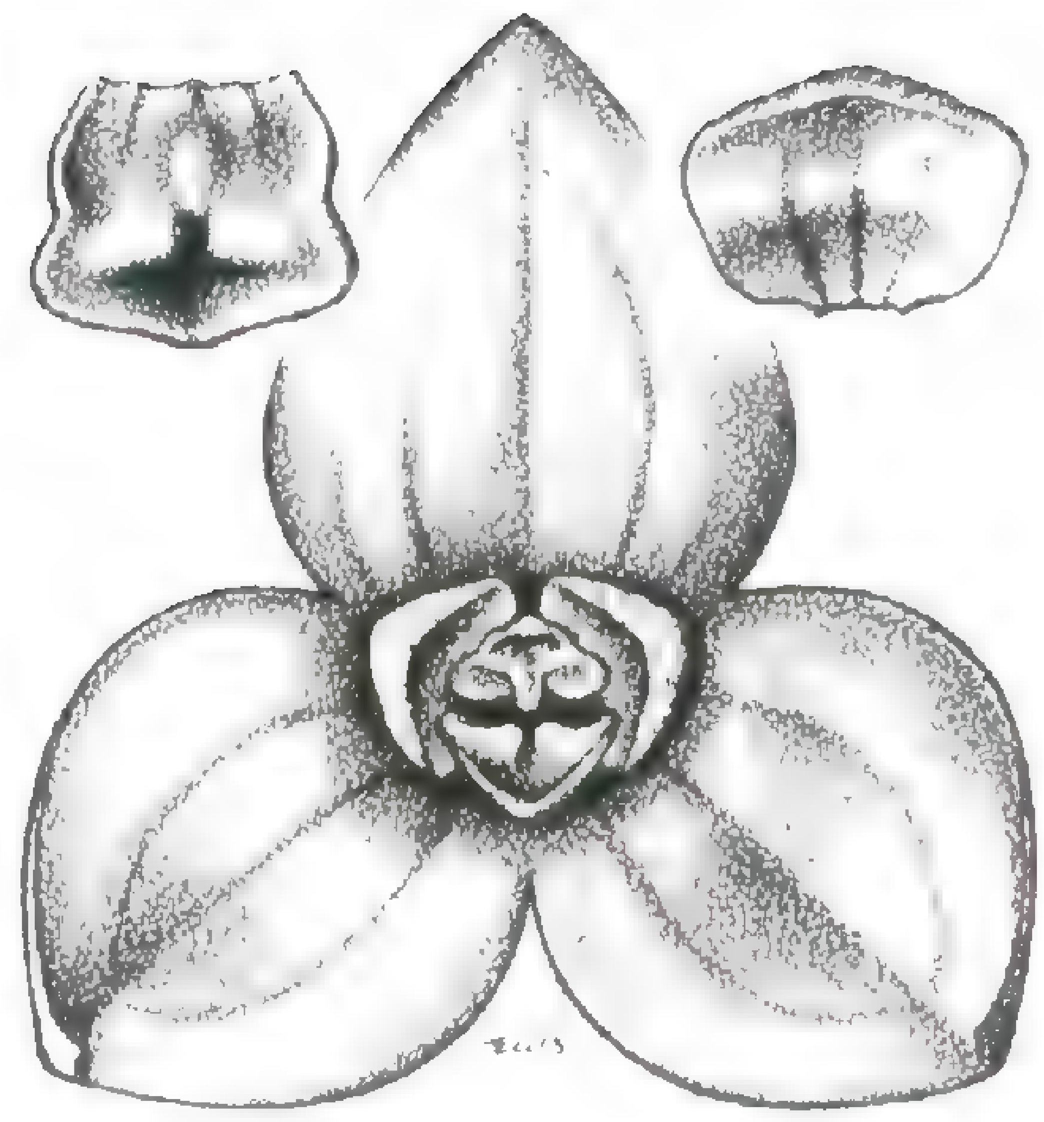


Stelis parvula IV-c-3

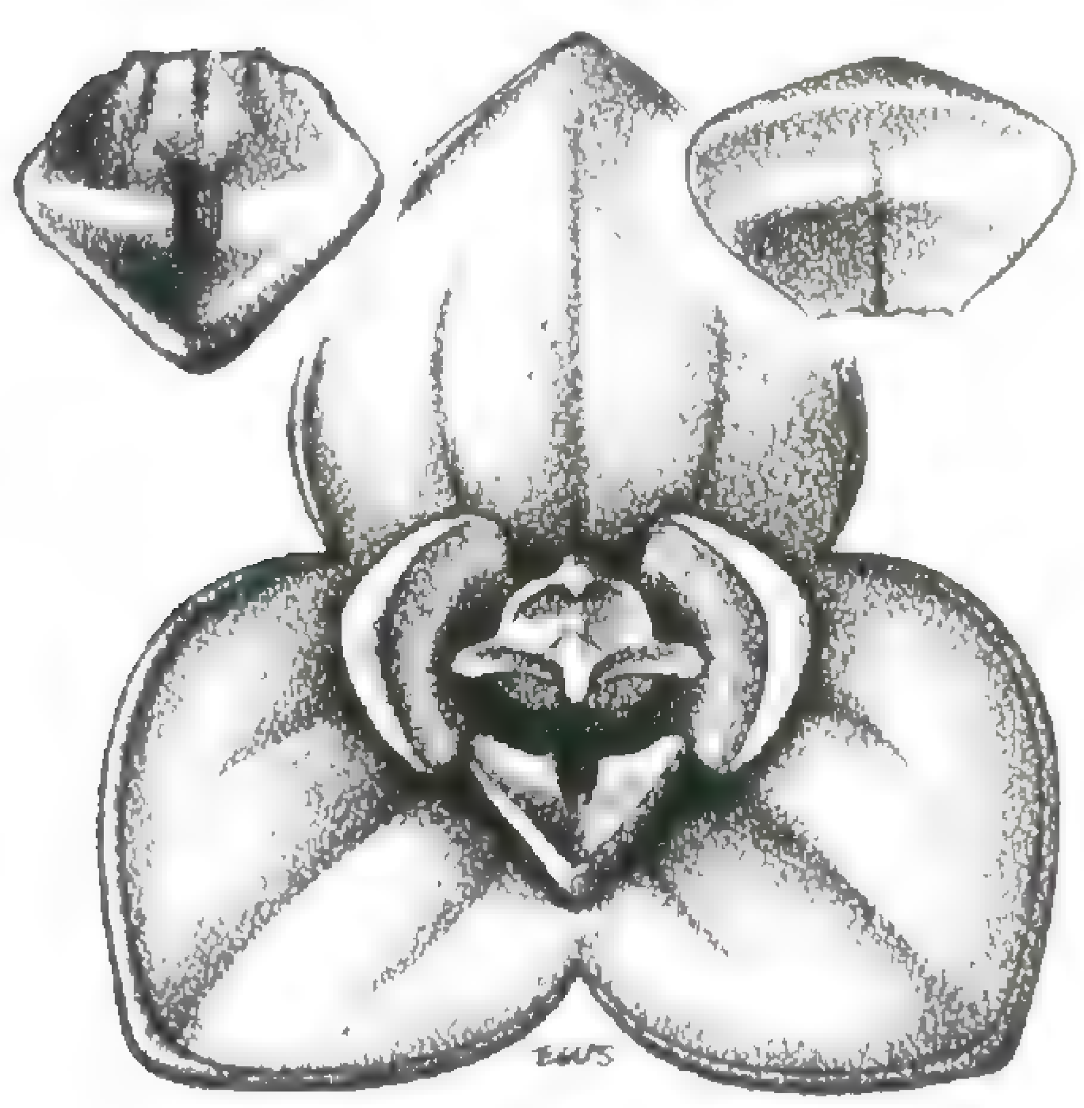
PLATE 52



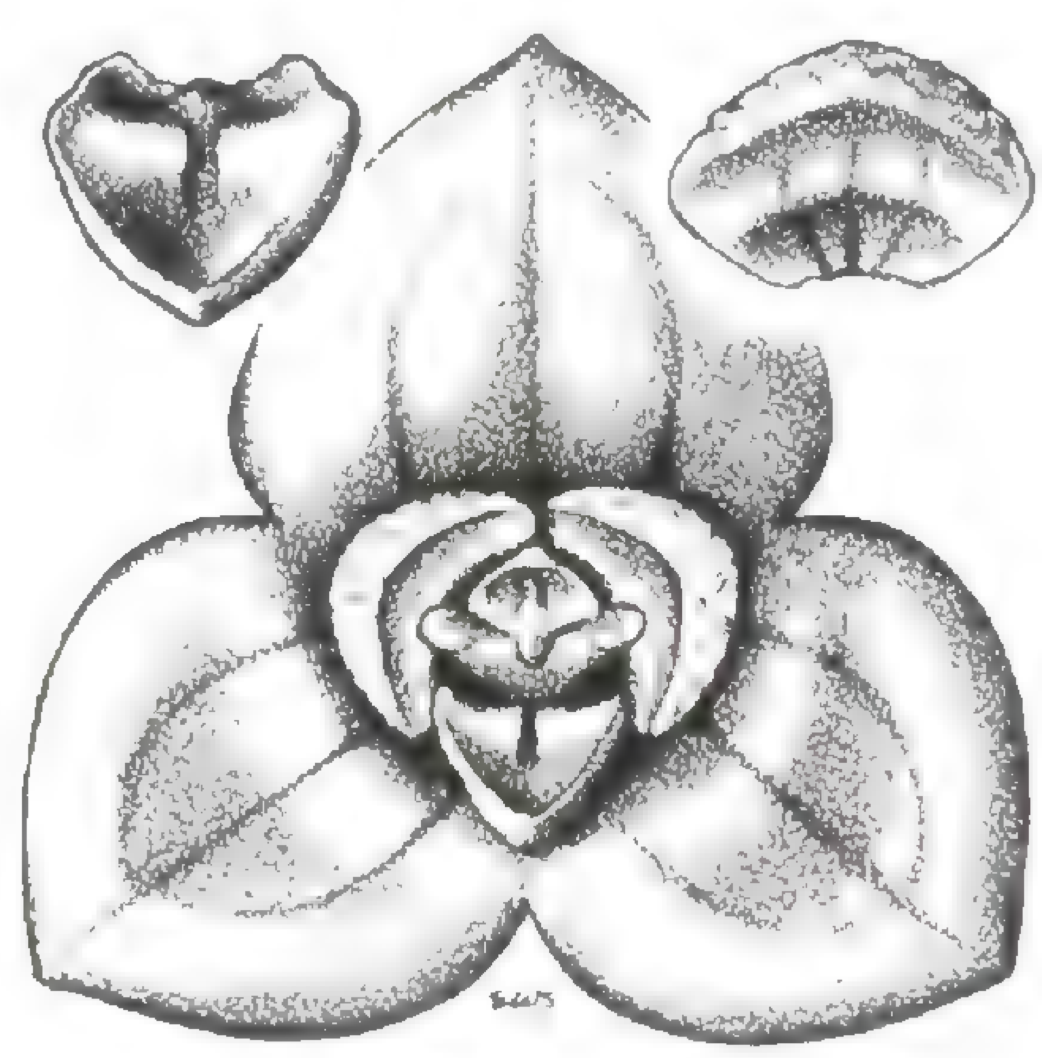
Stelis megantha IV-c-3



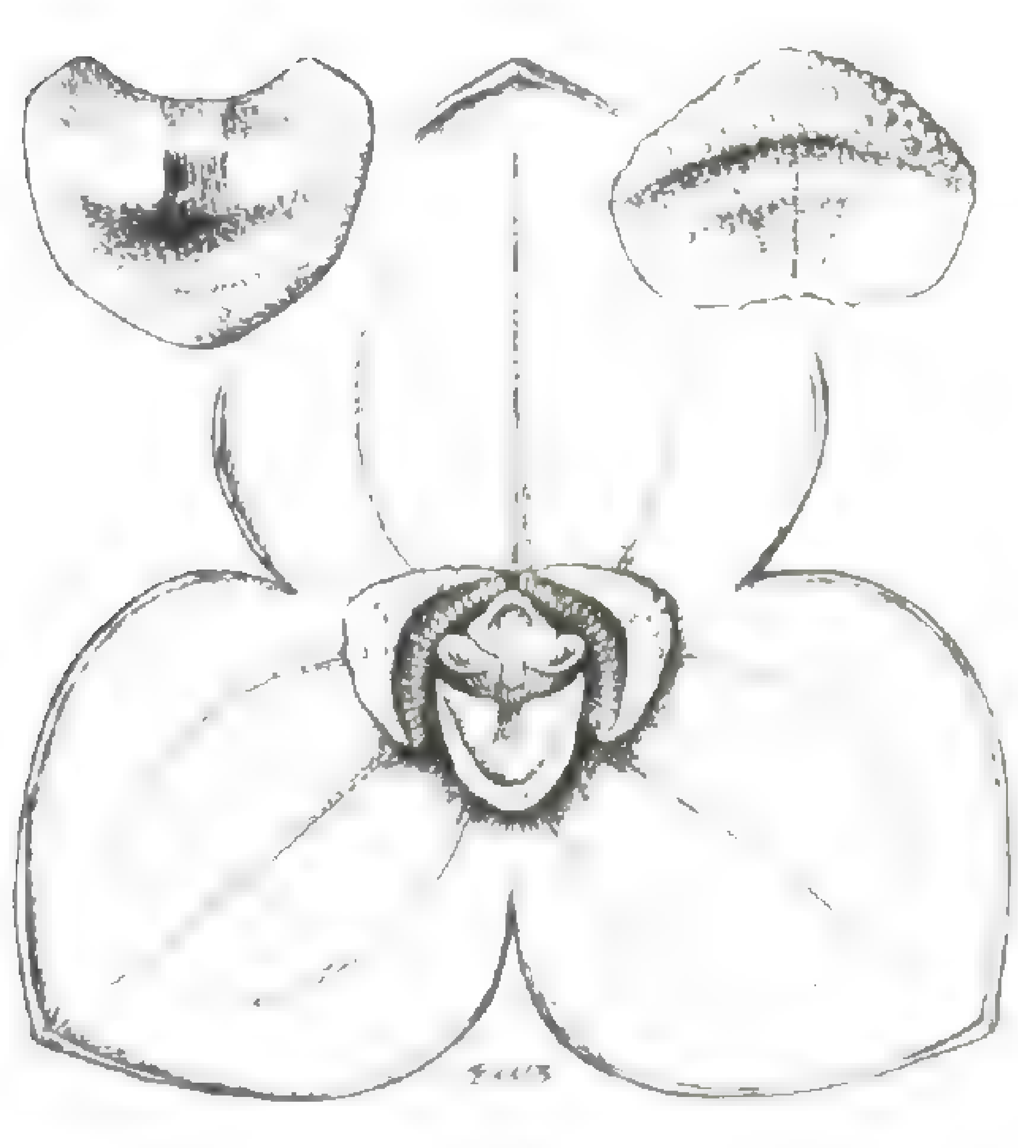
Stelis micrantha IV-c-3



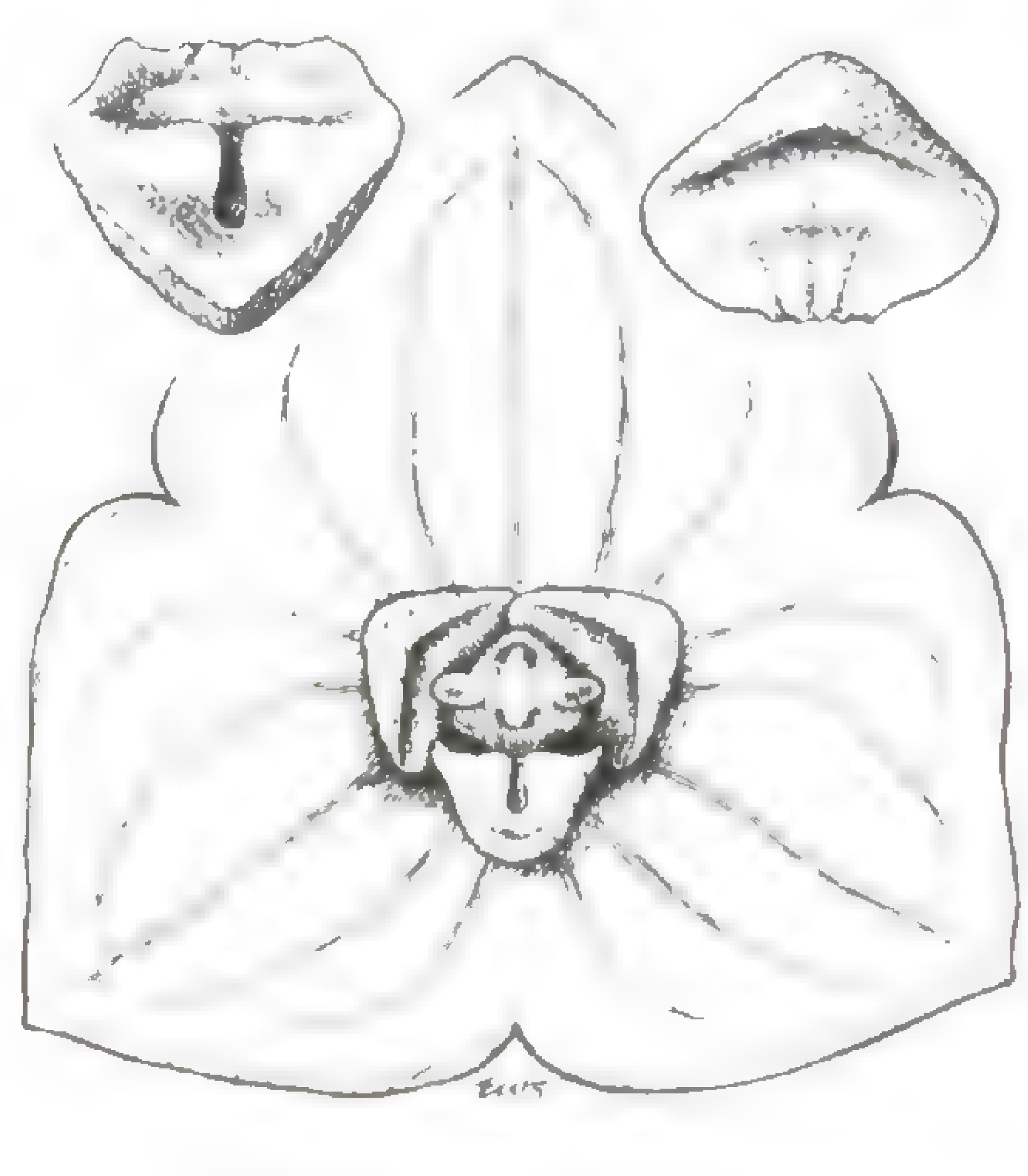
Stelis parvifolia IV-c-3



Stelis trigoniflora IV-c-3



Stelis scabrida IV-c-3



Stelis tristyla IV-c-3

PLATE 53

[S. Purpusii]

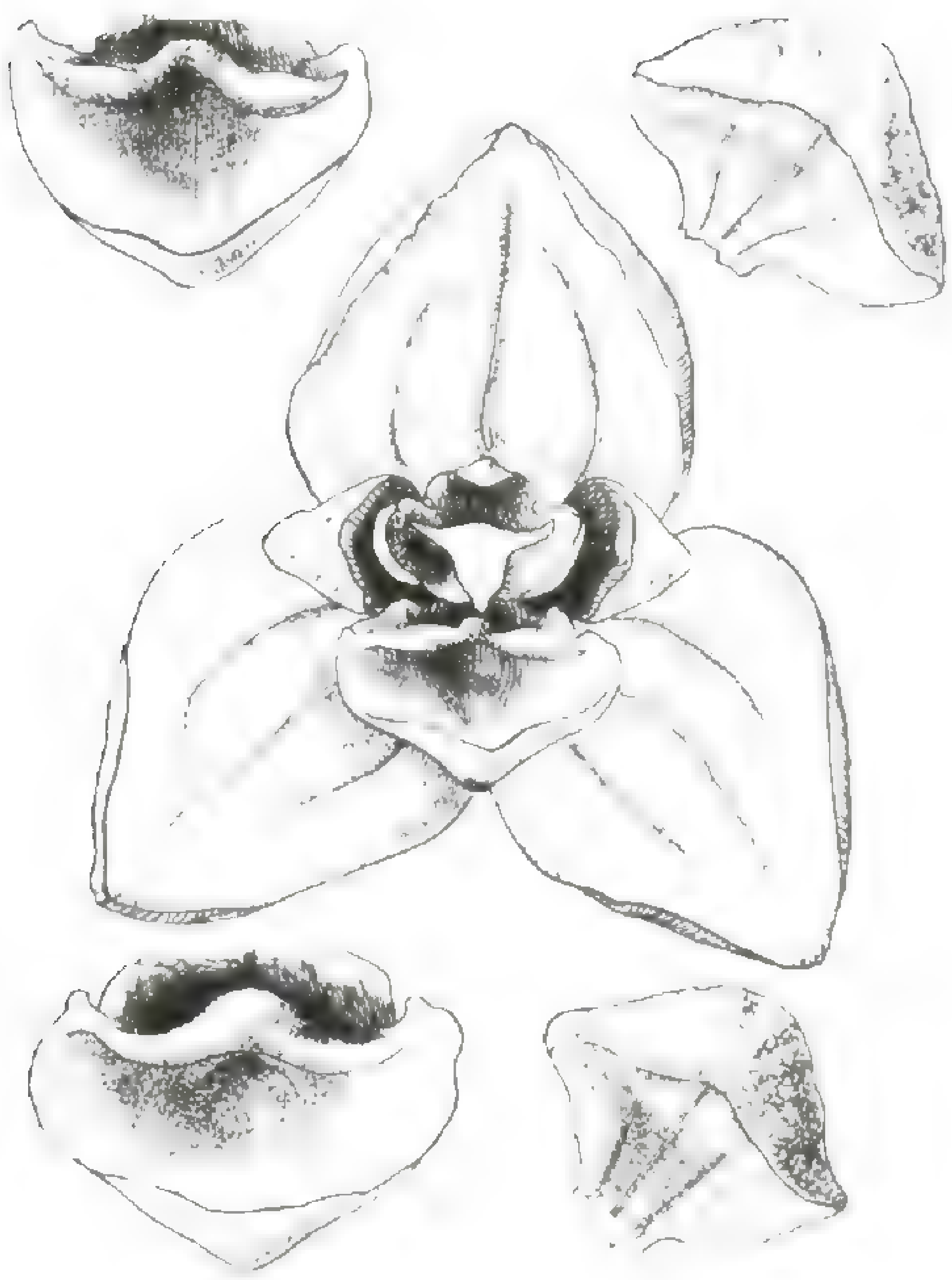
[S. Alfaroi]

Stelis purpurascens IV-c-3

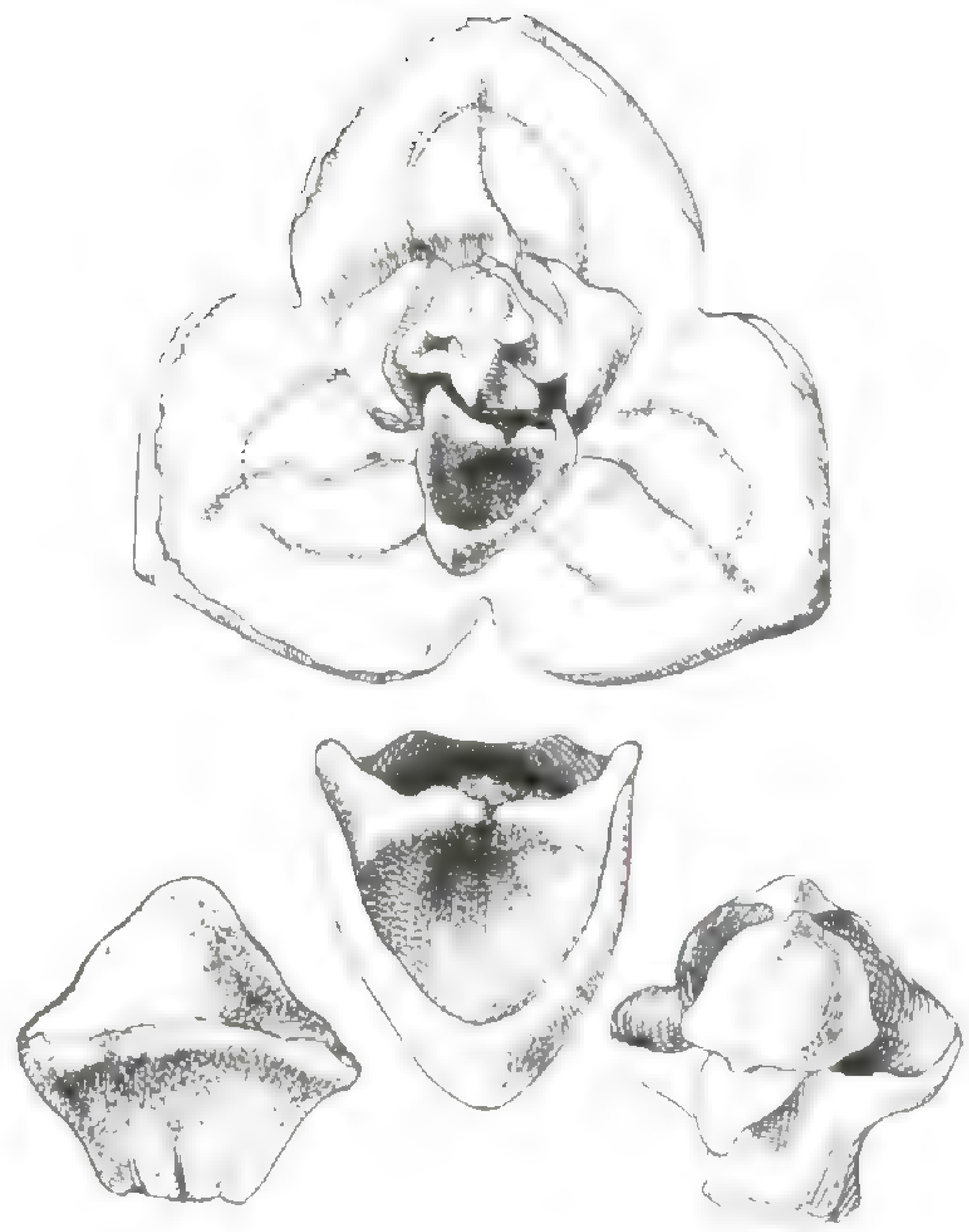
Stelis Sanchoi IV-c-3

Stelis triangulabia IV-c-3

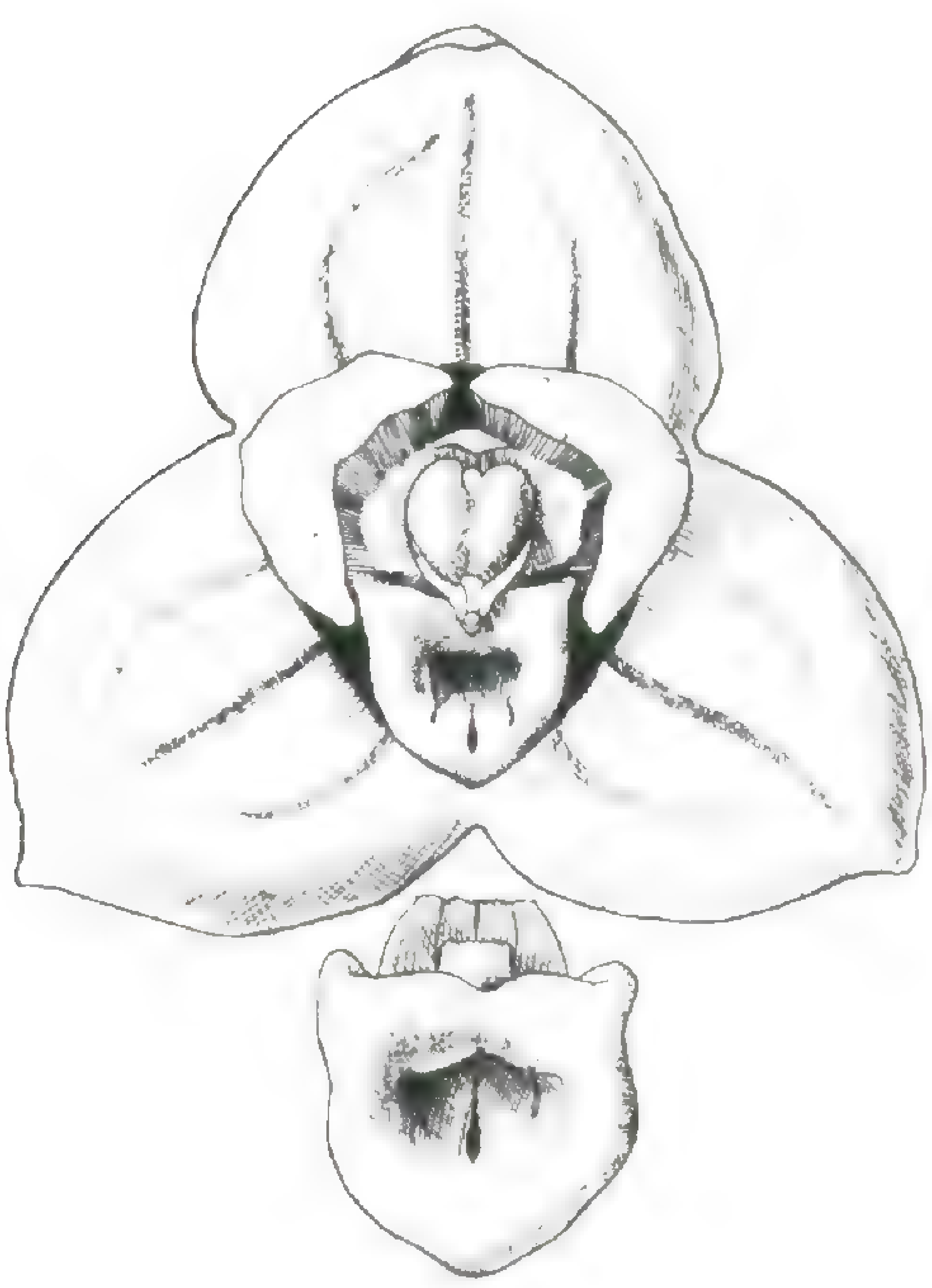
PLATE 54



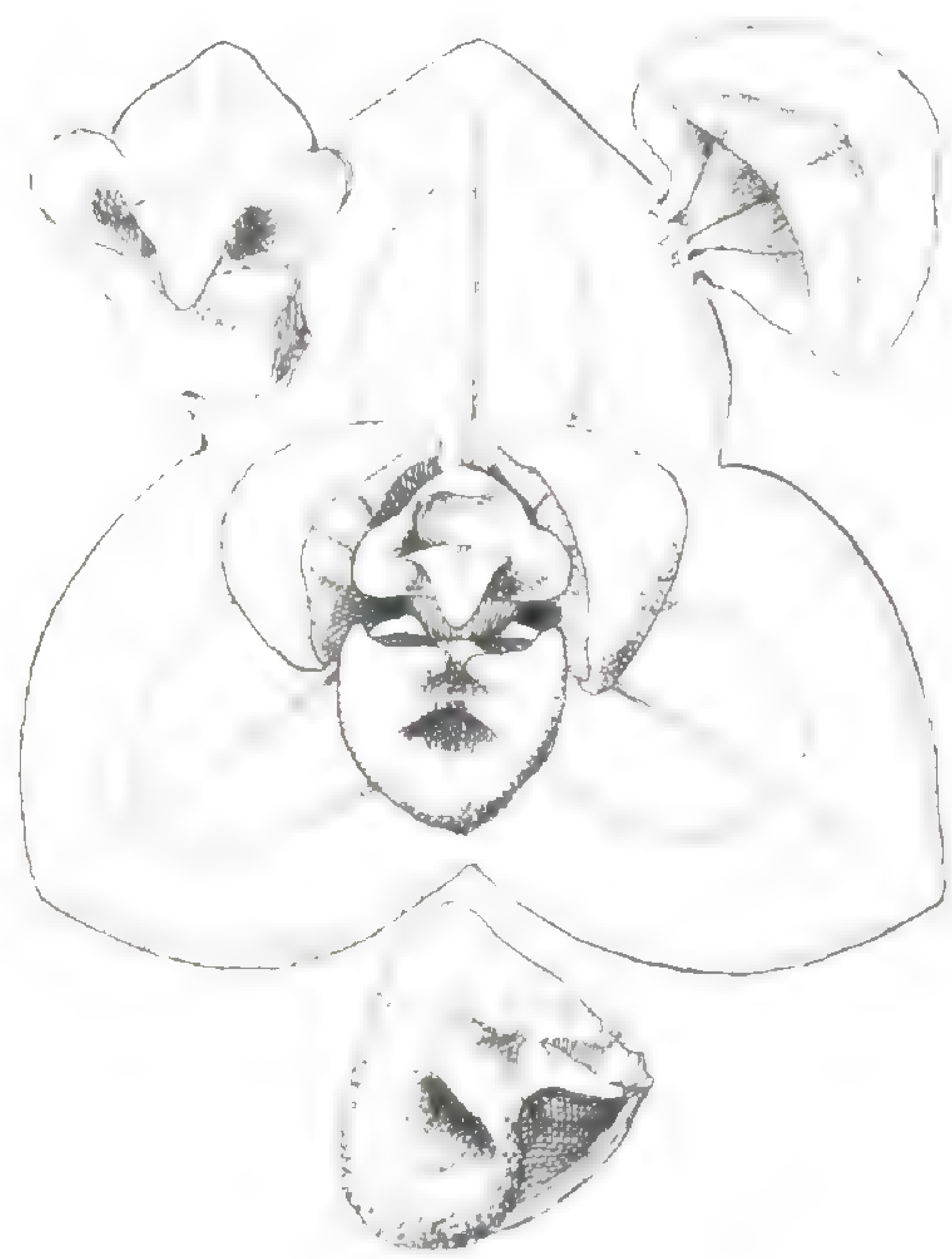
Stelis thecoglossa IV-c-3



[S. coiloglossa]



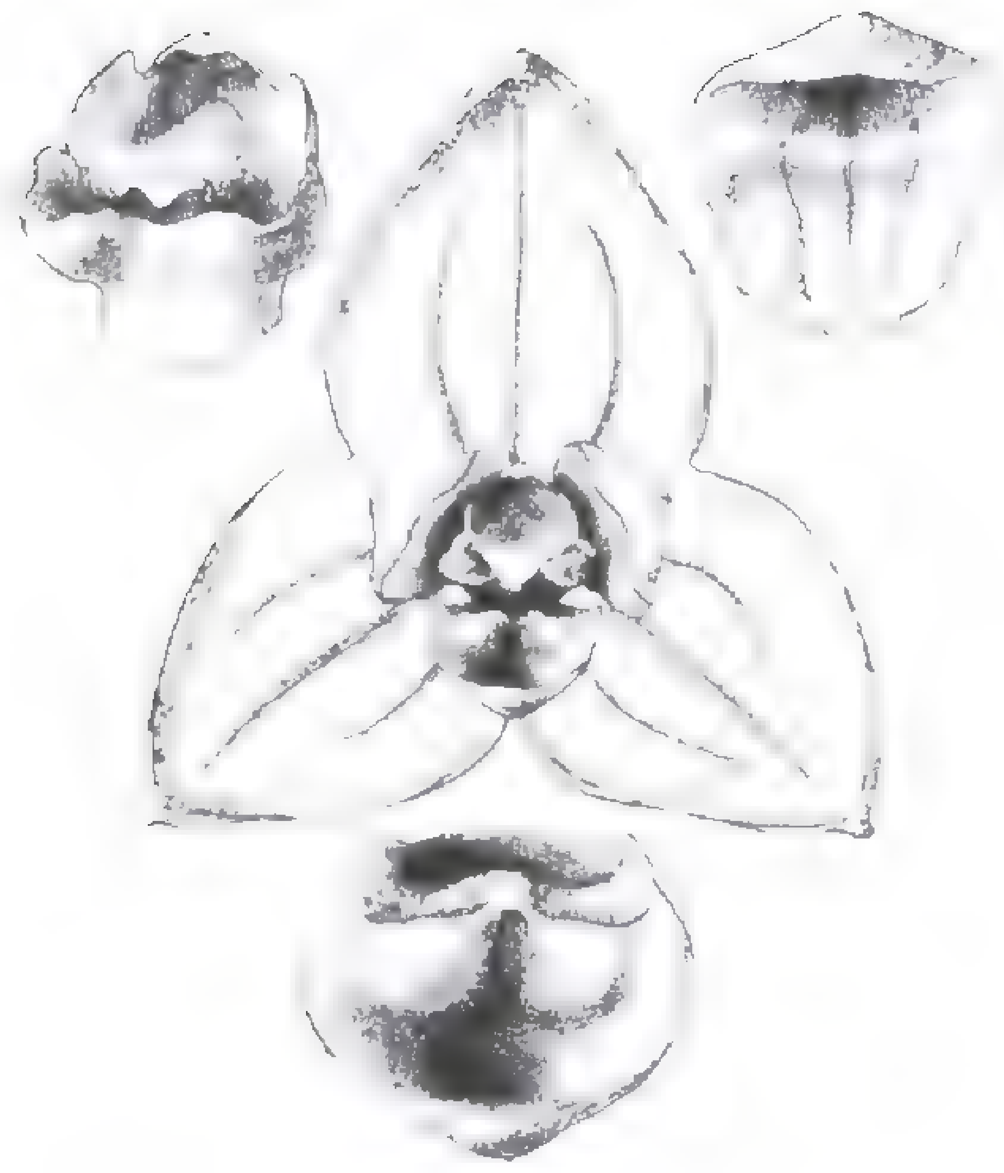
Stelis Wercklei IV-c-3



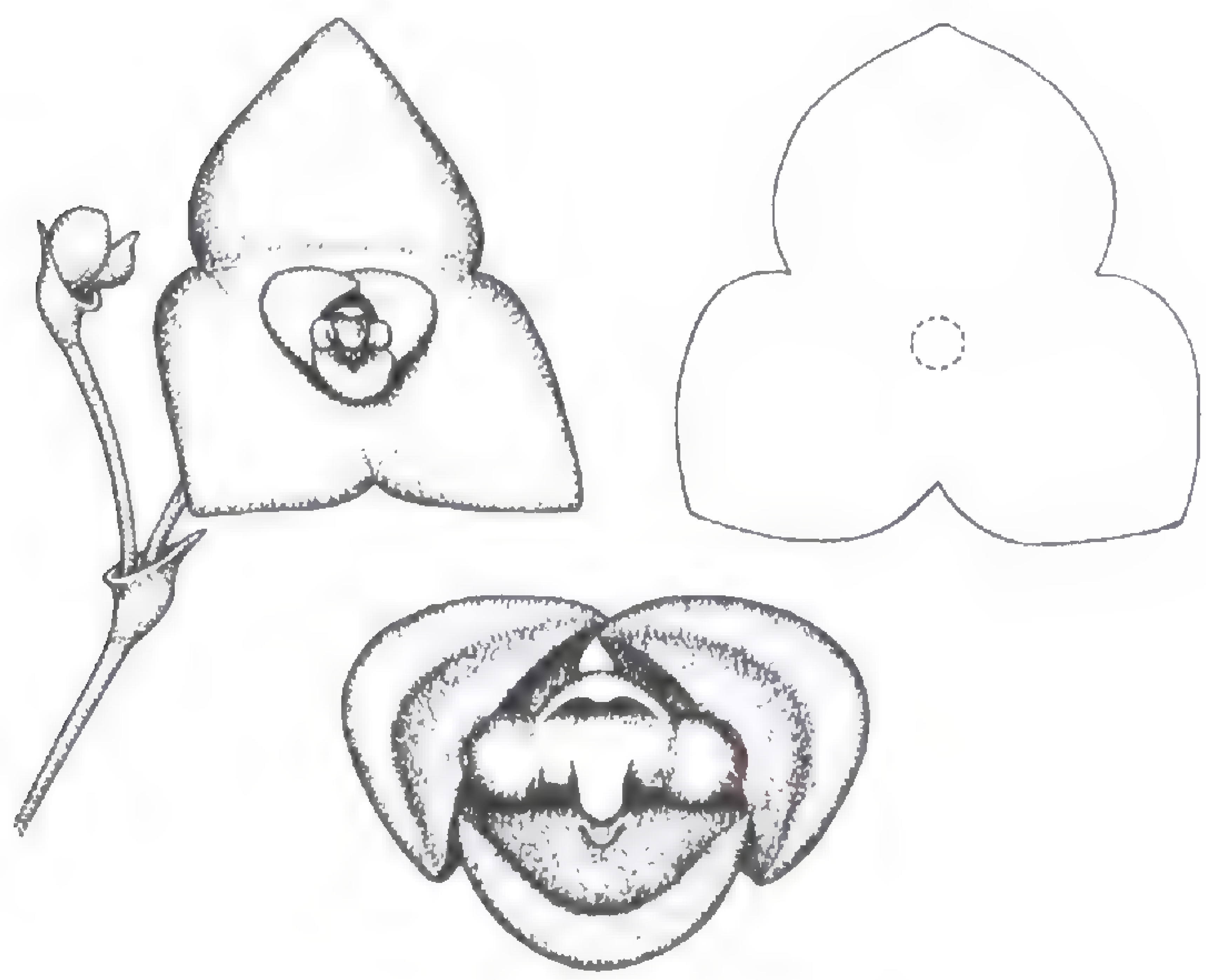
[S. fractiflexa]

PLATE 55

Stelis Williamsii IV-c-3



Stelis cucullata IV-c-3



Stelis tolimensis IV-c-3

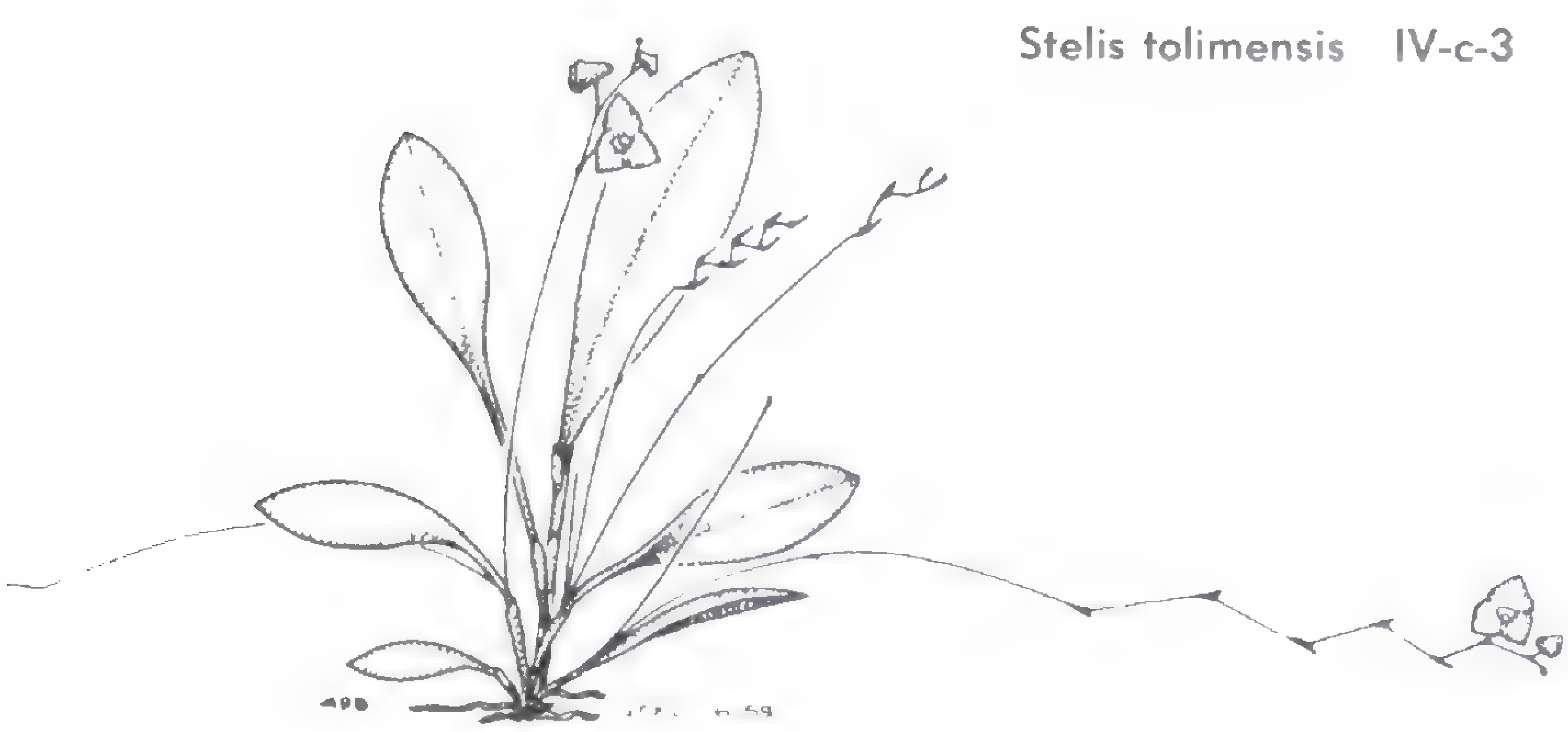
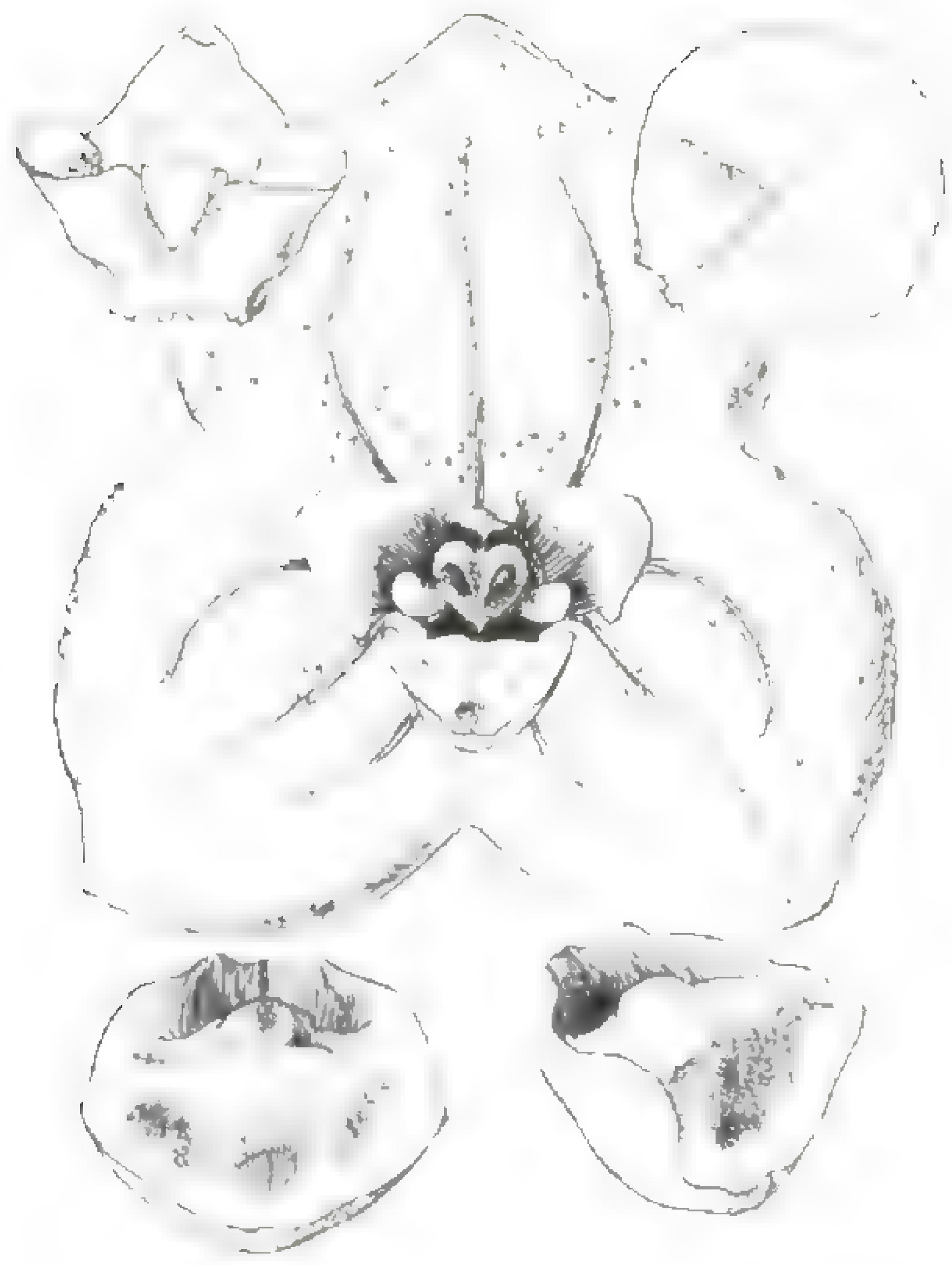
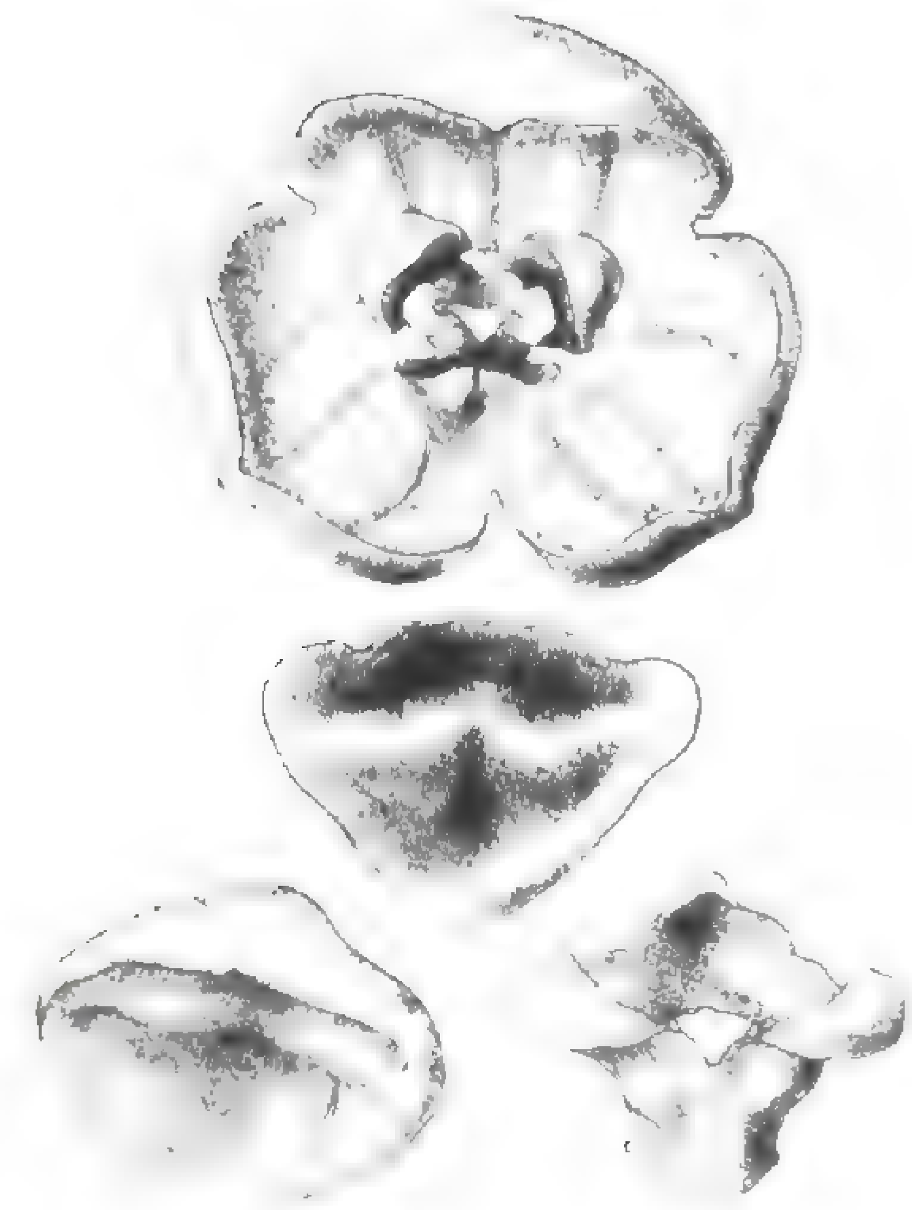


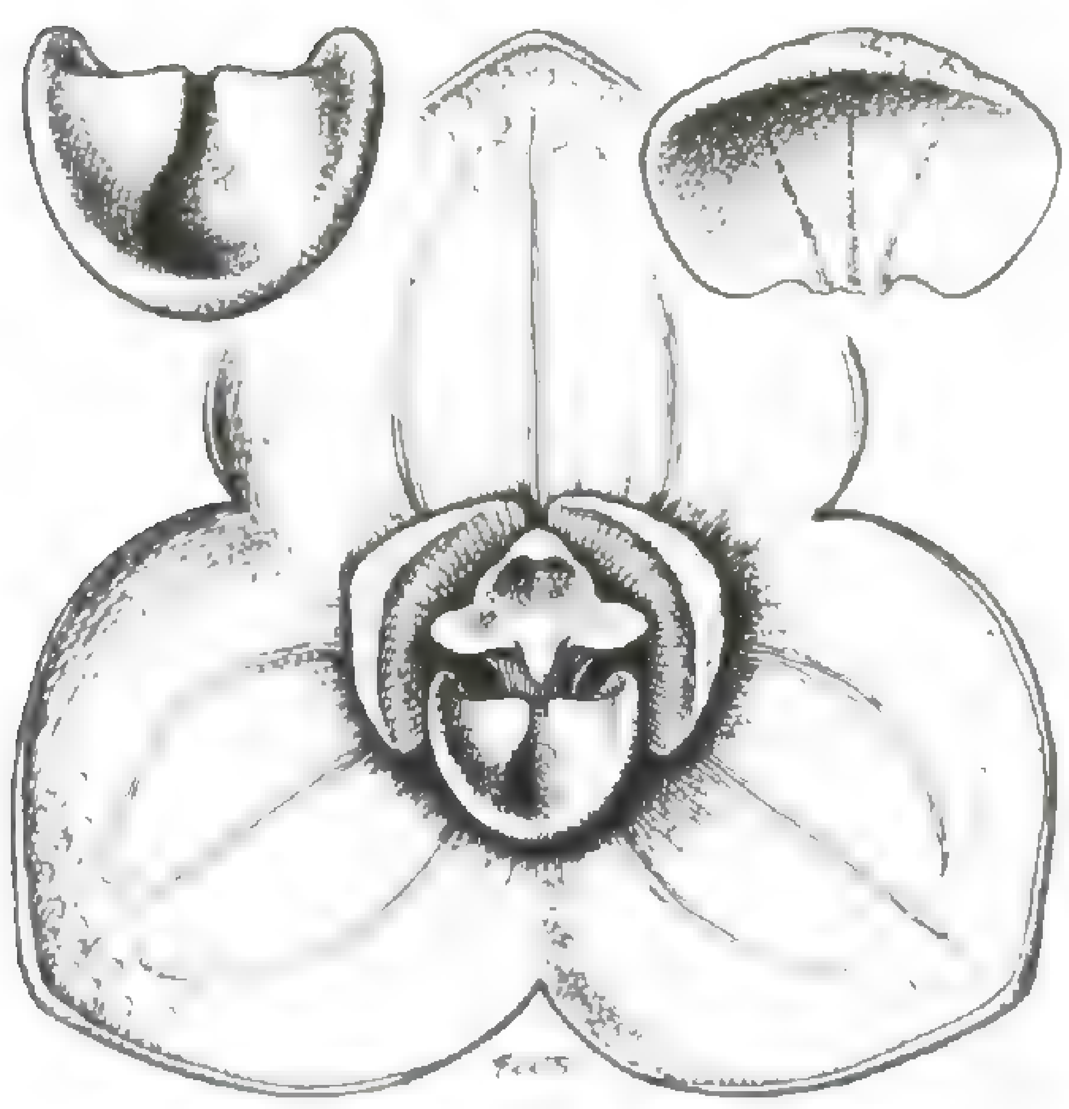
PLATE 56



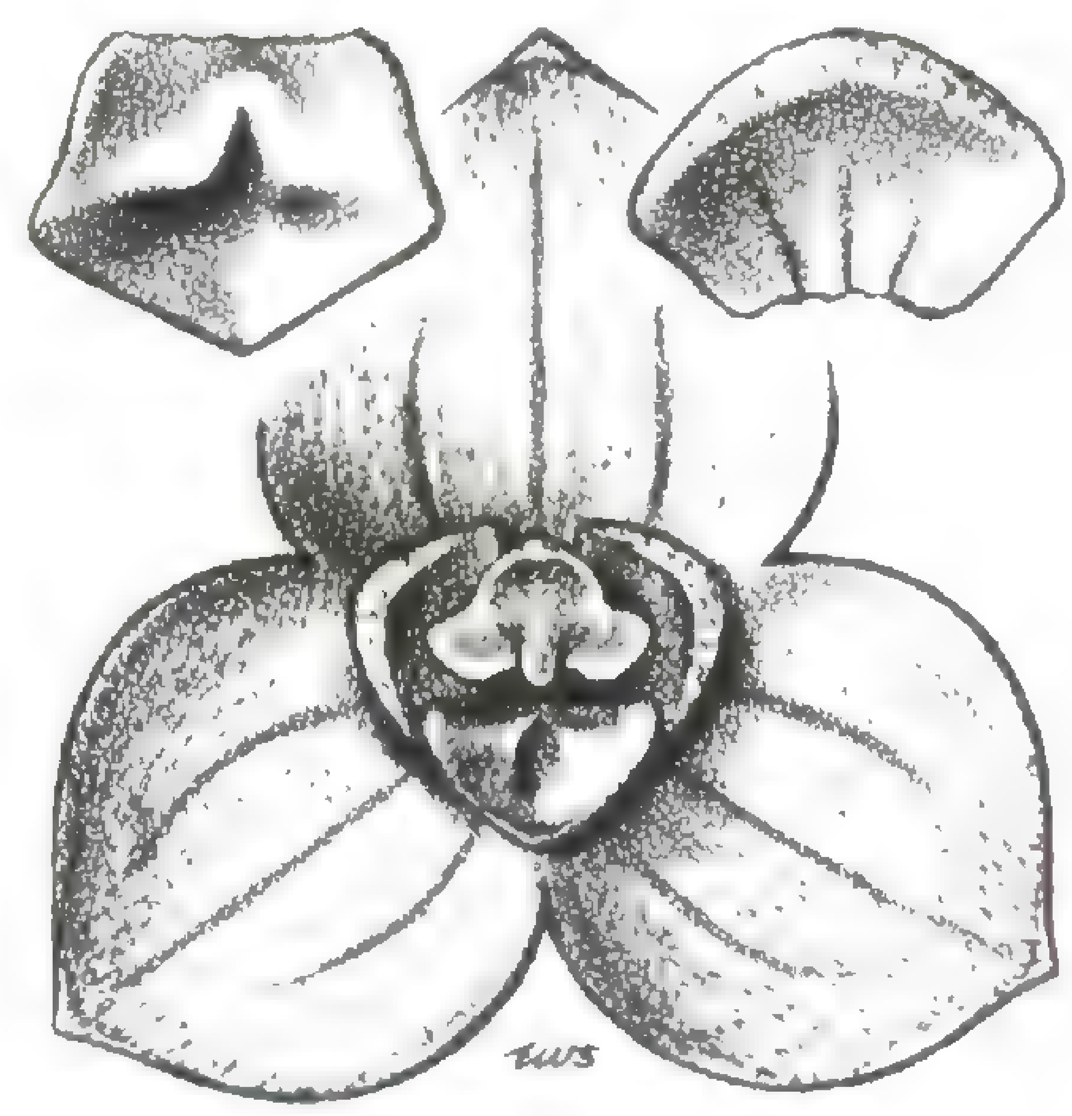
Stelis aemula IV-c-3



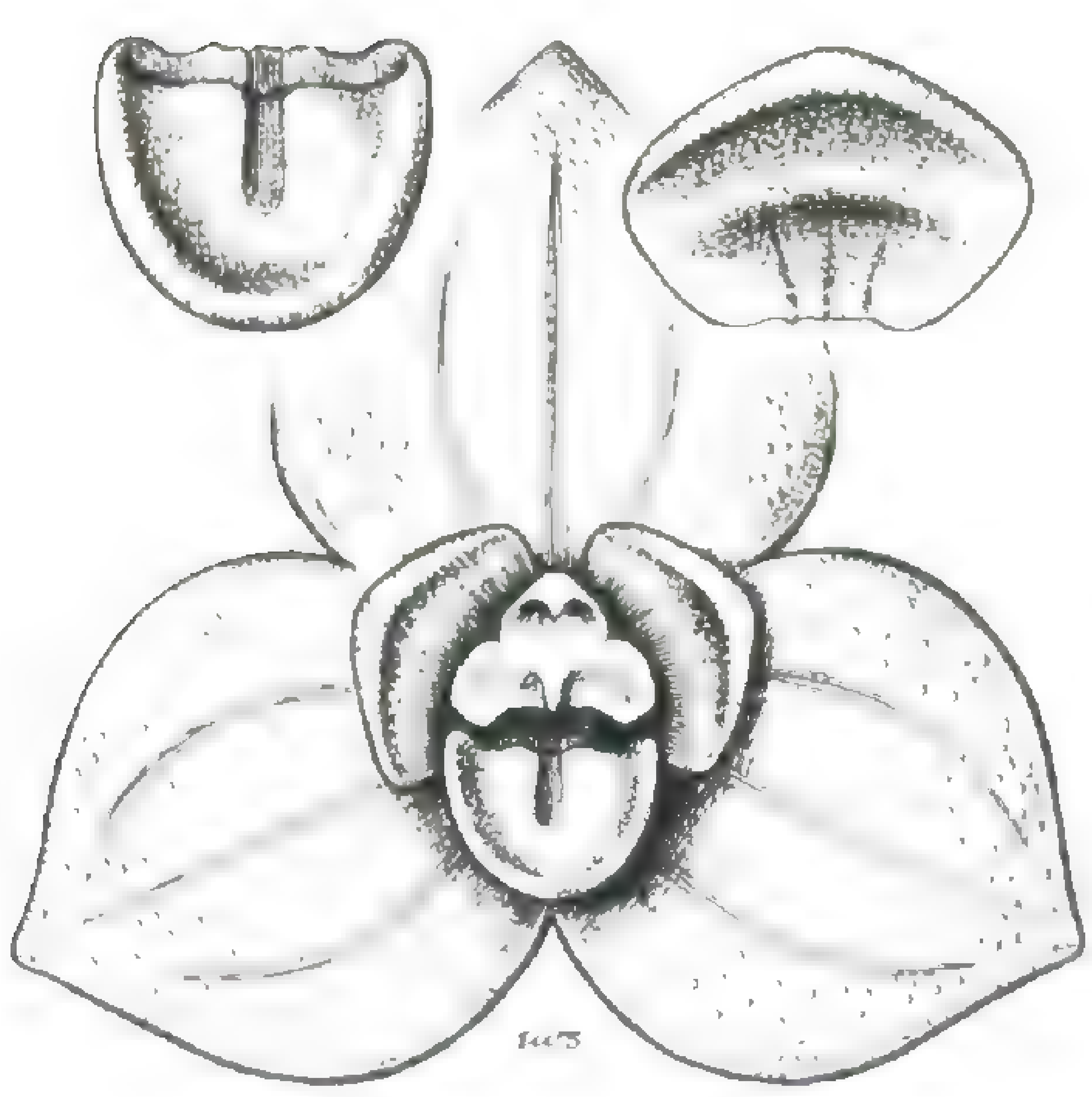
[S. sarcodantha]



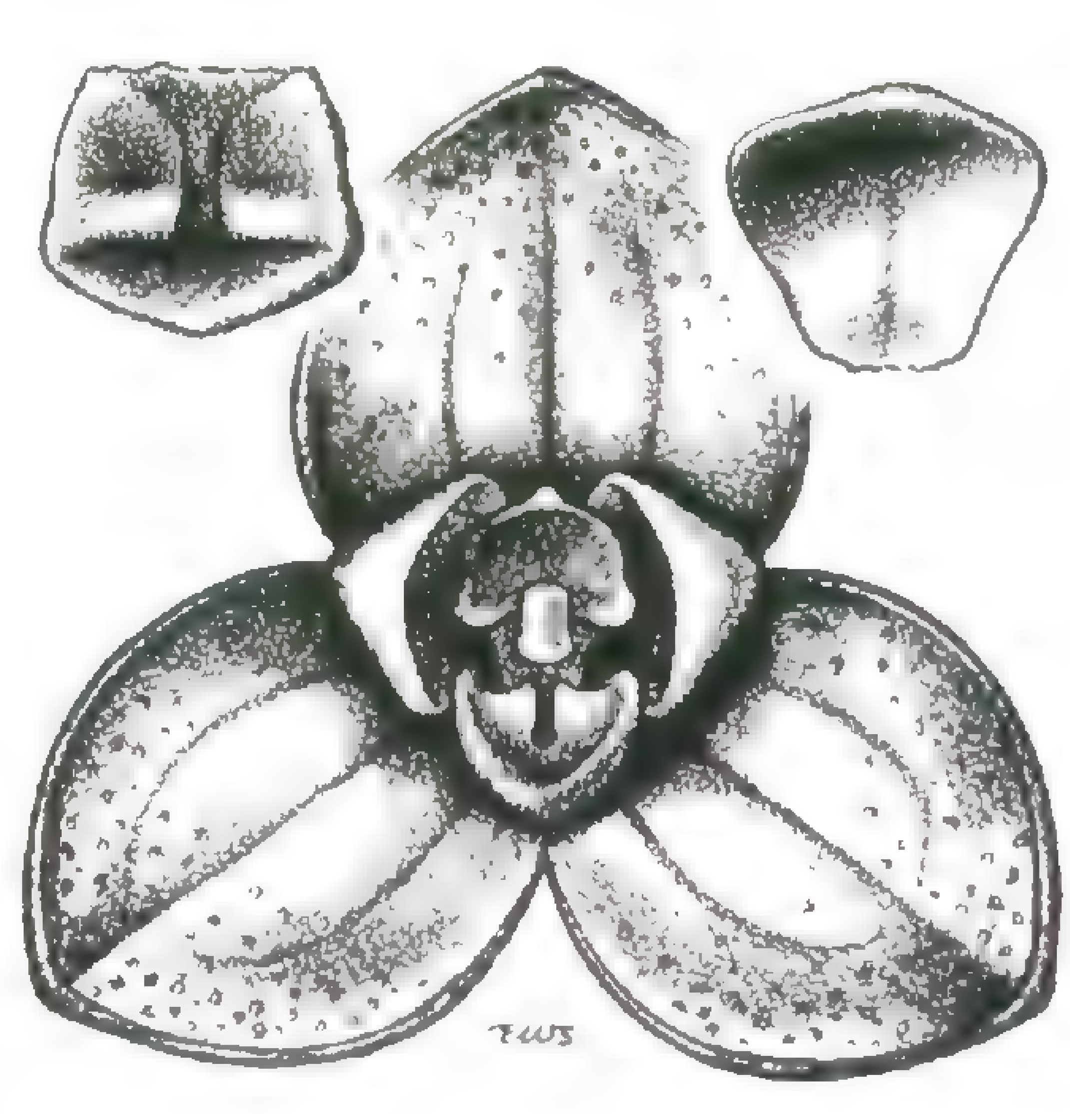
Stelis Ekmanii IV-c-3



Stelis oblongifolia IV-c-3



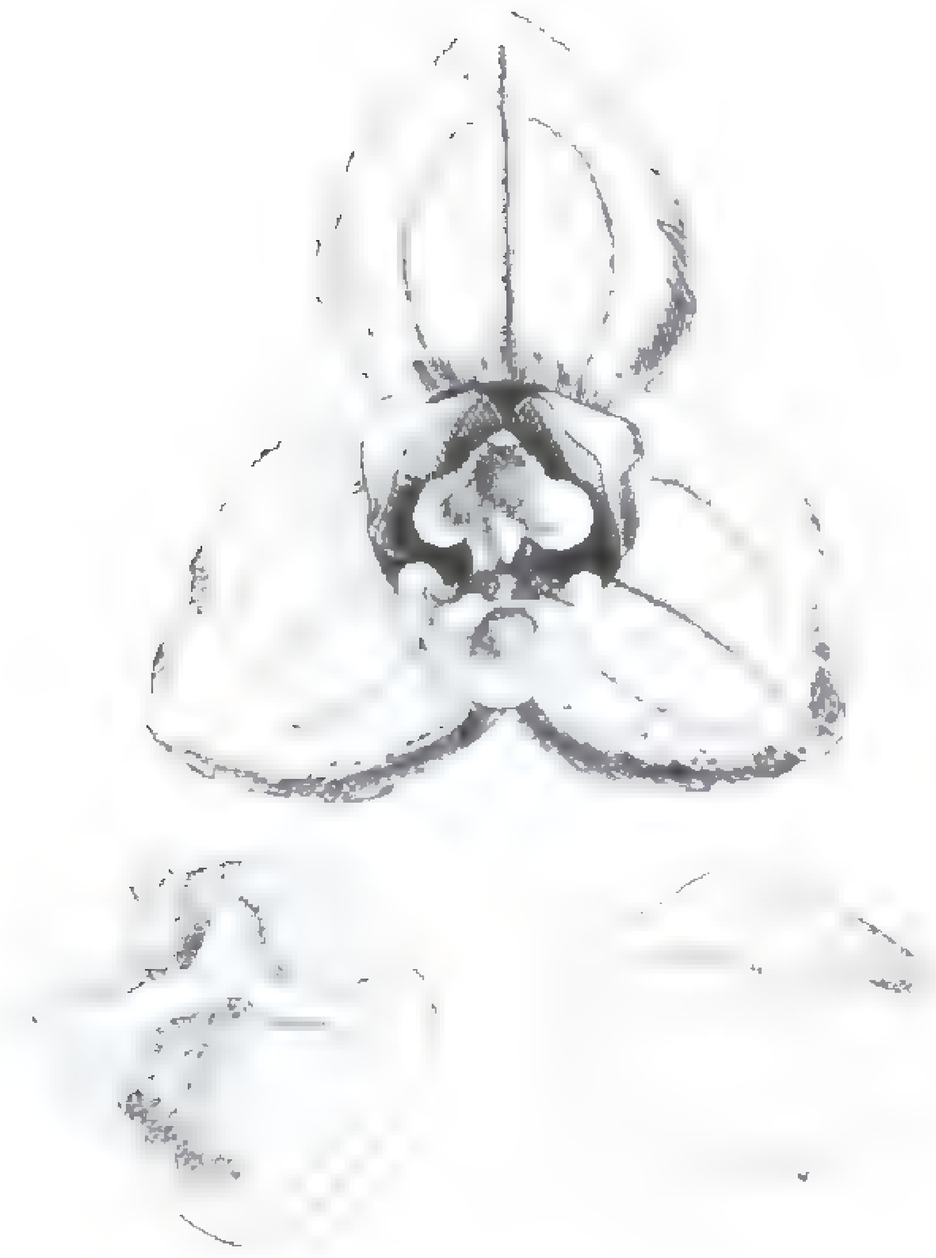
Stelis caespitosa IV-c-3



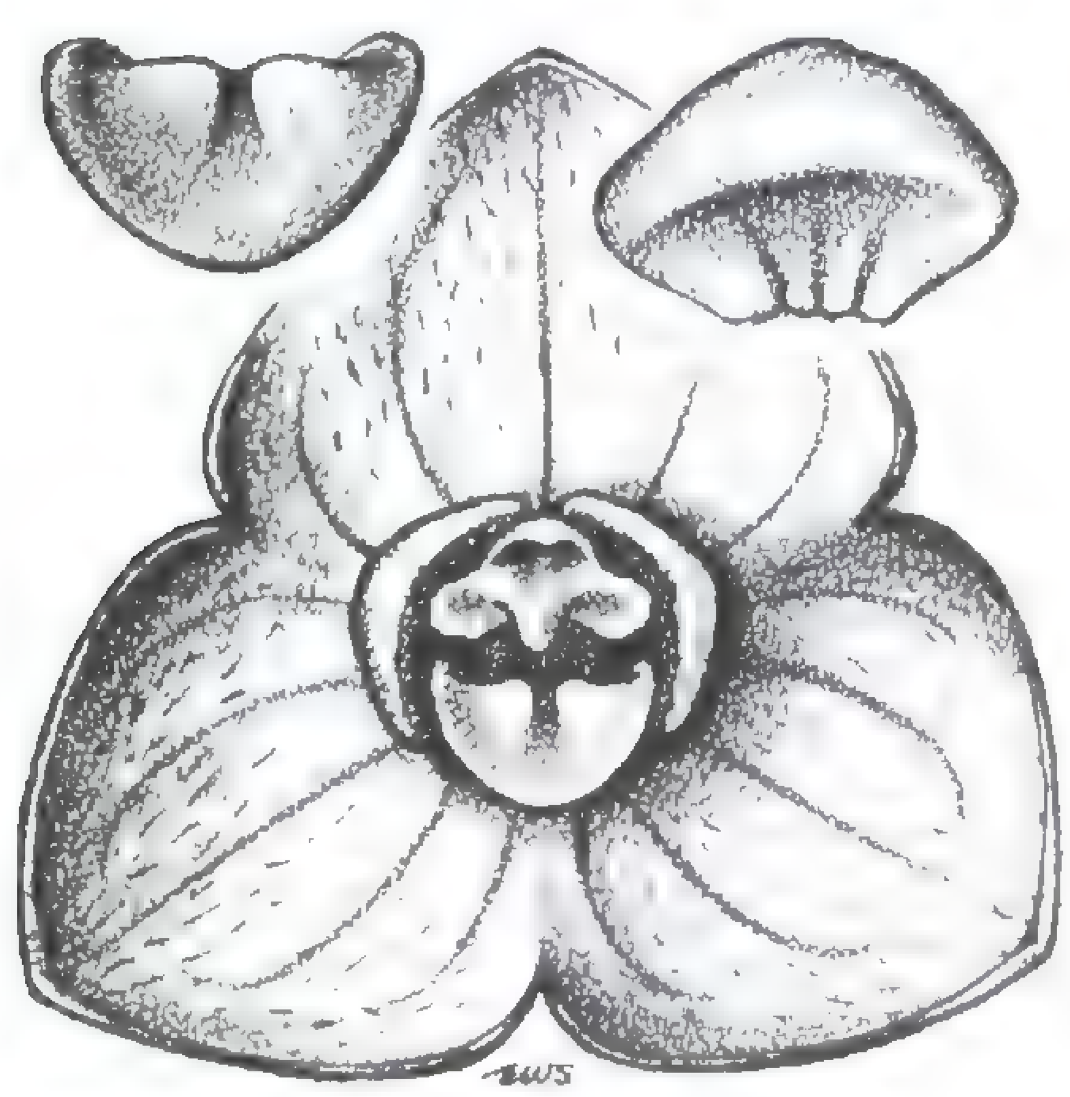
Stelis capillaris IV-c-3

PLATE 57

Stelis chihobensis IV-c-3

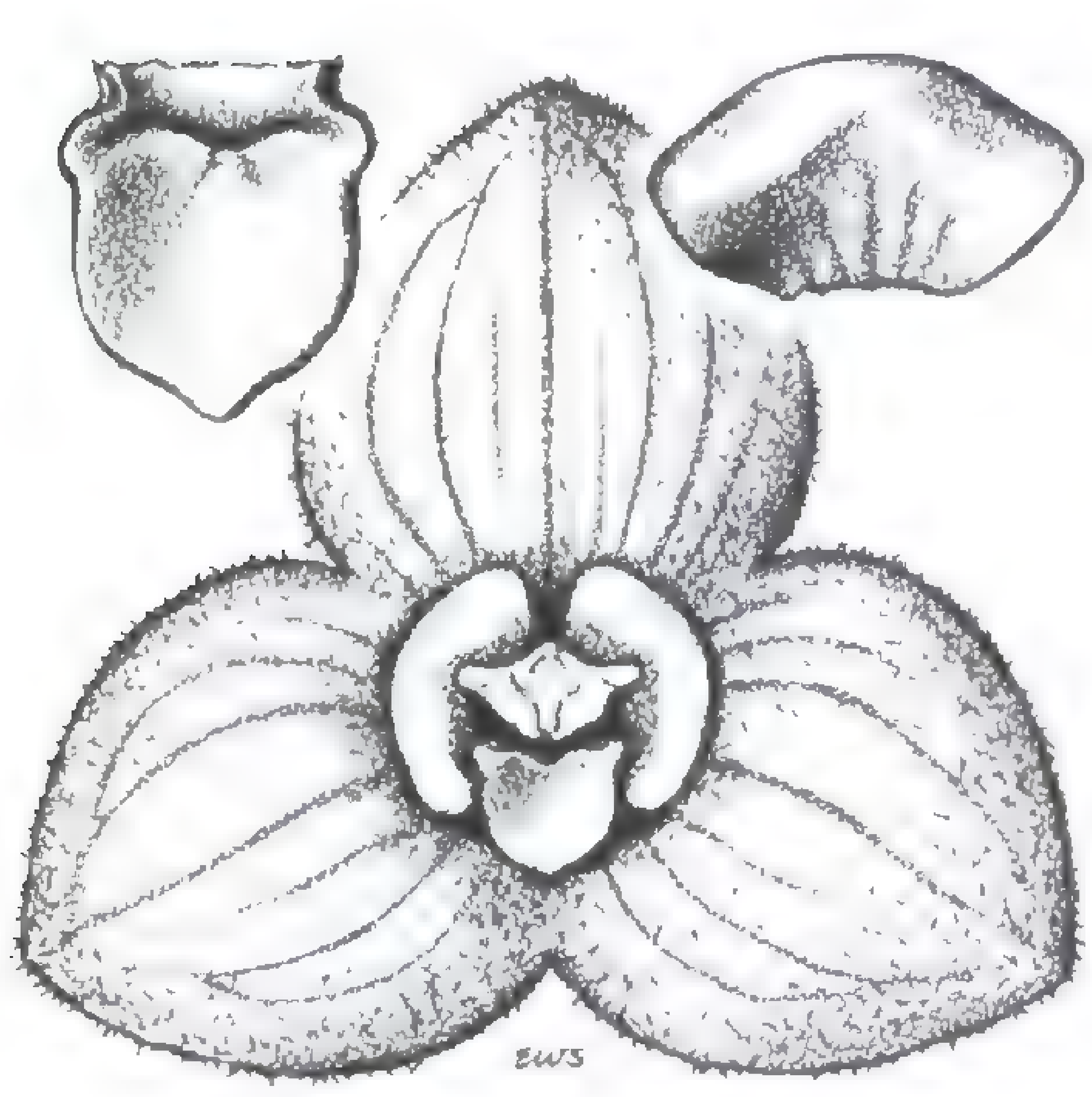


Stelis Maxonii IV-c-3

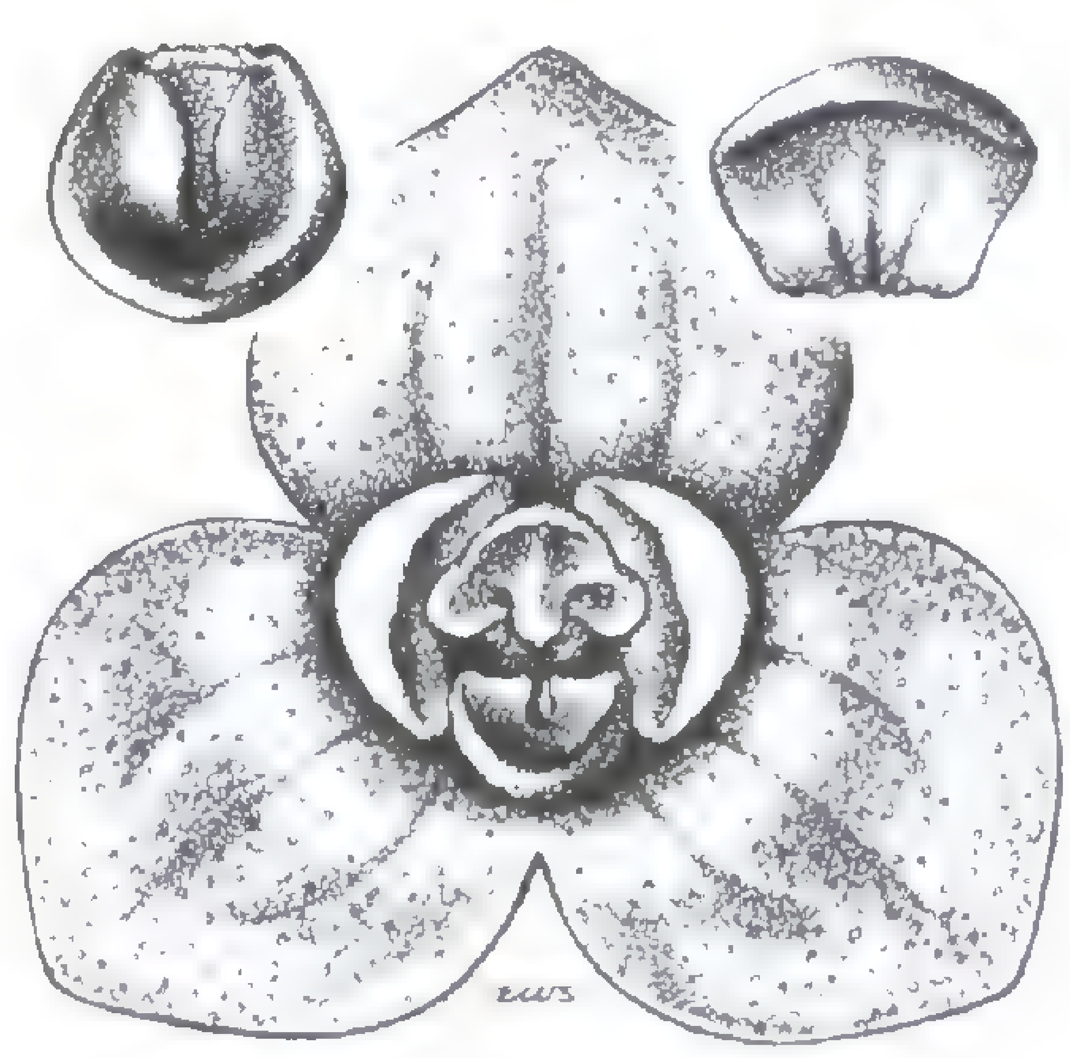


Stelis Purdiei IV-c-3

Stelis effusa IV-c-3

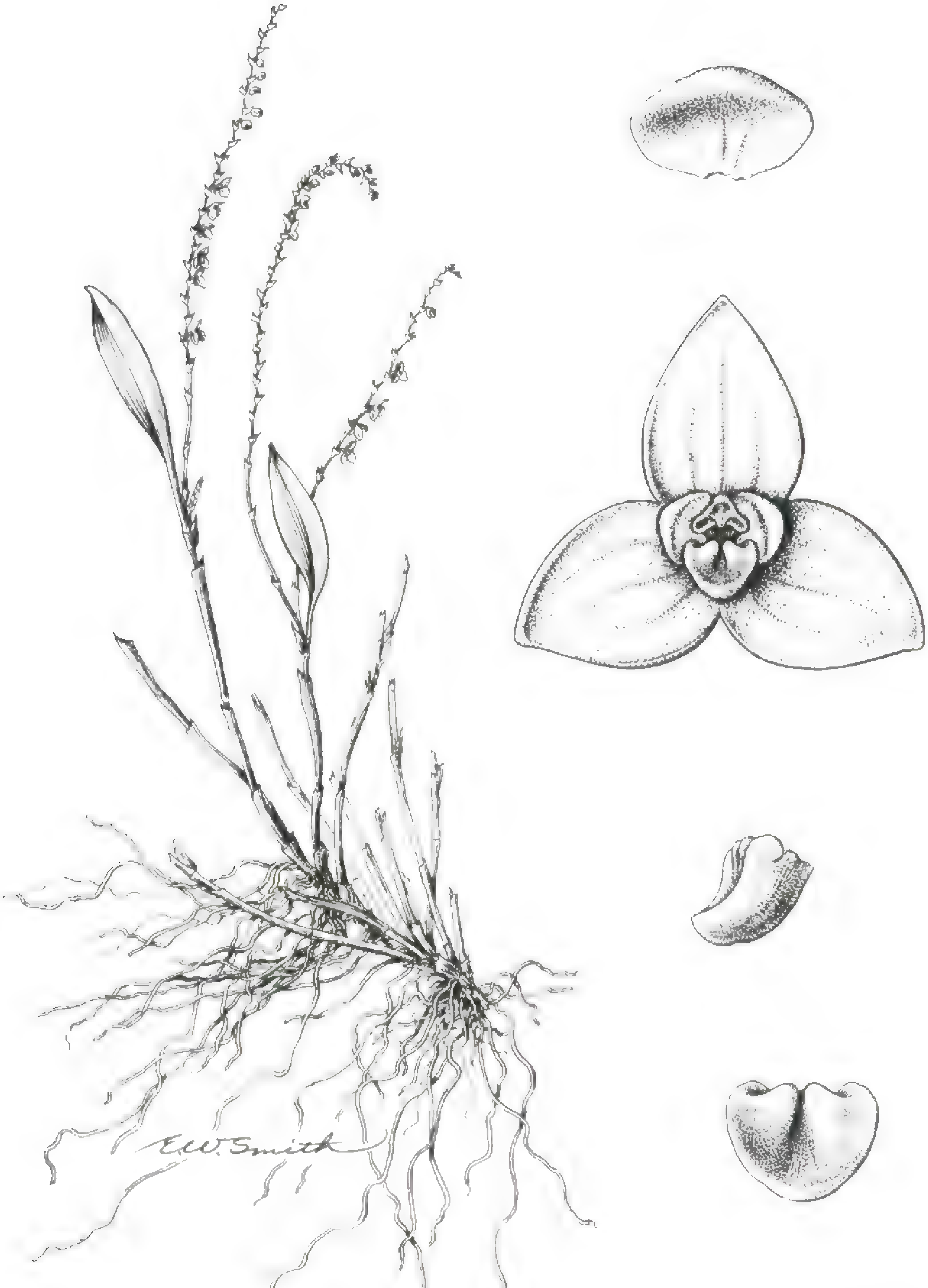


Stelis quinquenervia IV-c-3



Stelis platystachya IV-c-3

PLATE 58



IV-r-3

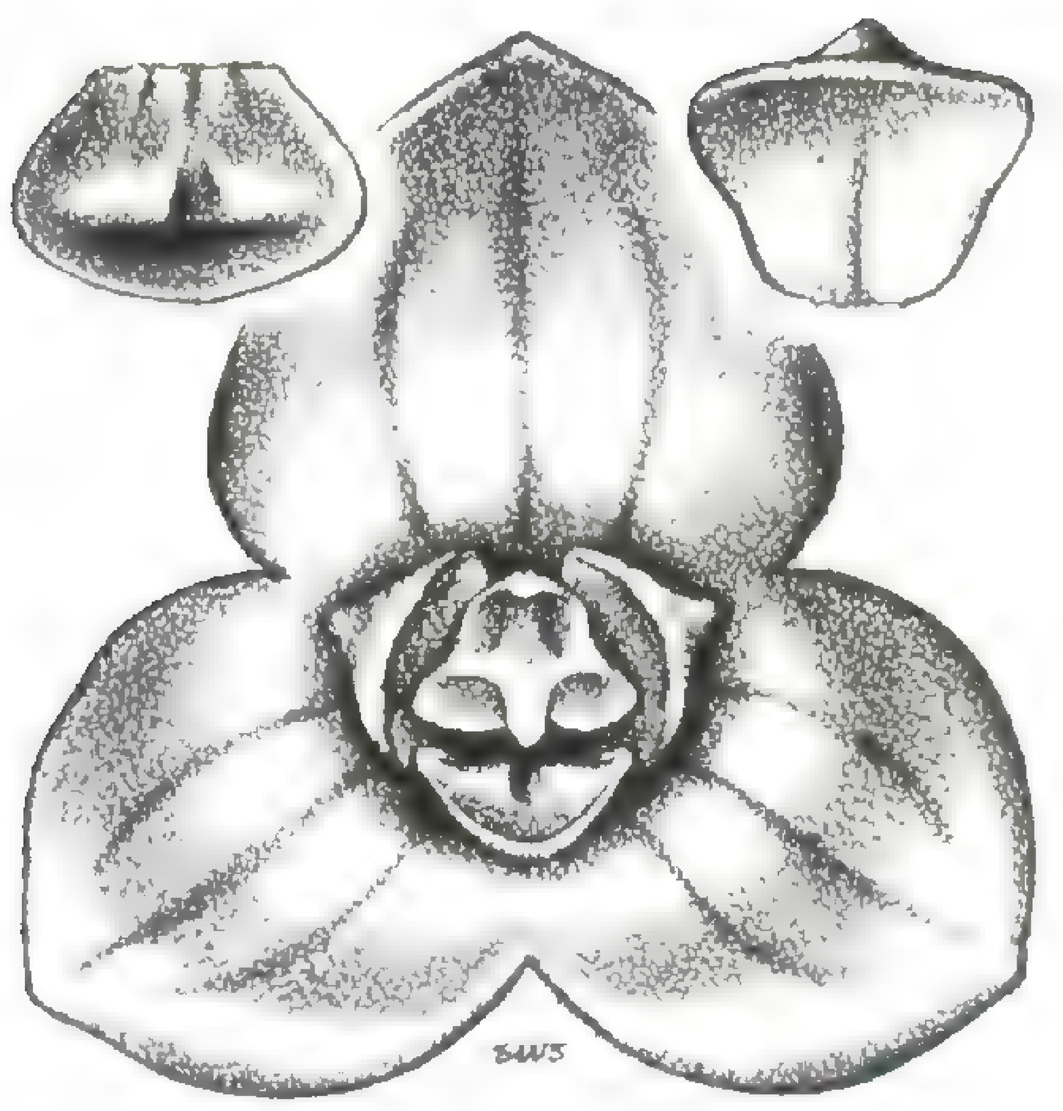
STELIS *affinis C. Schweinf.*

PLATE 59

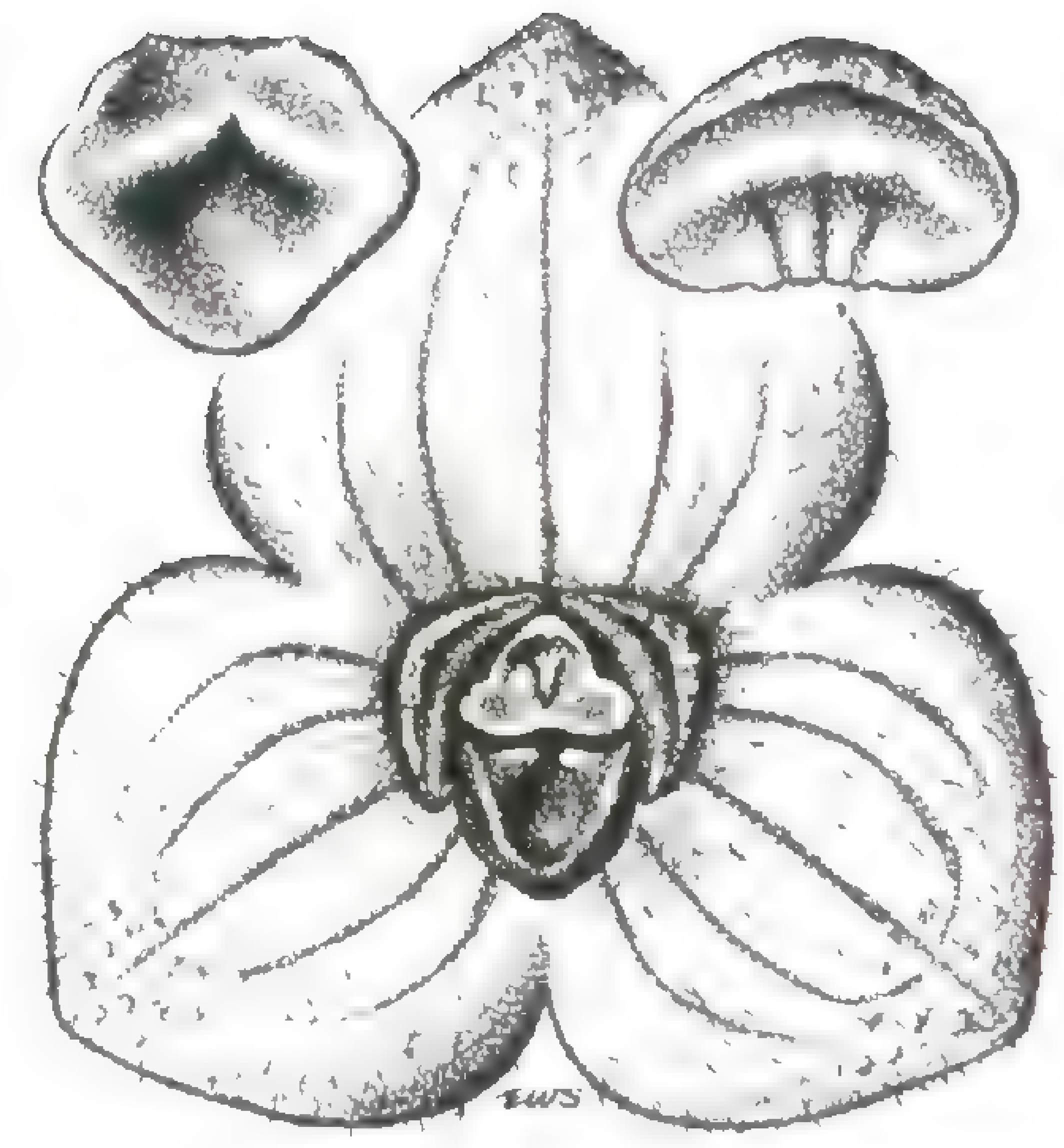
STELIS *breviracema* *C. Schweinfurth*

IV-r-3

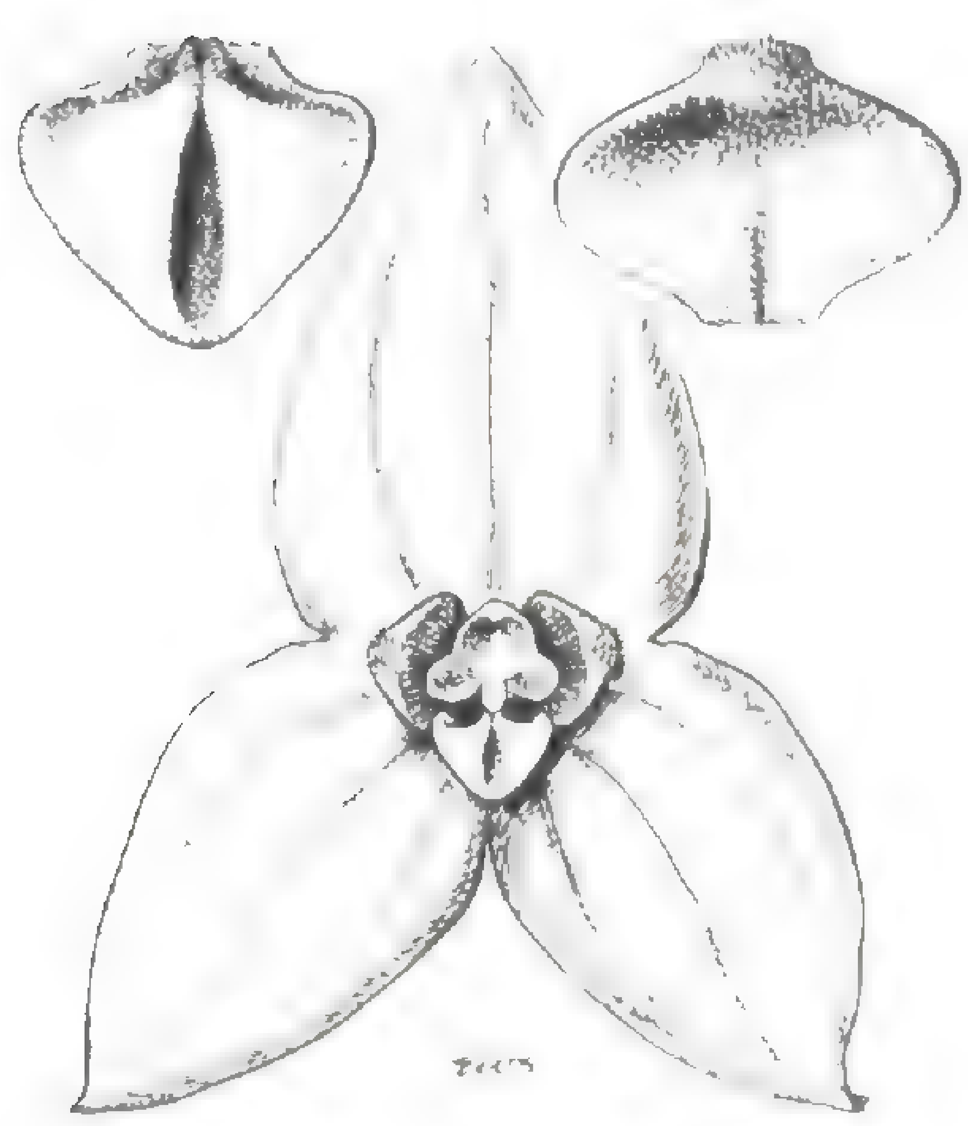
PLATE 60



Stelis naviculigera IV-r-3

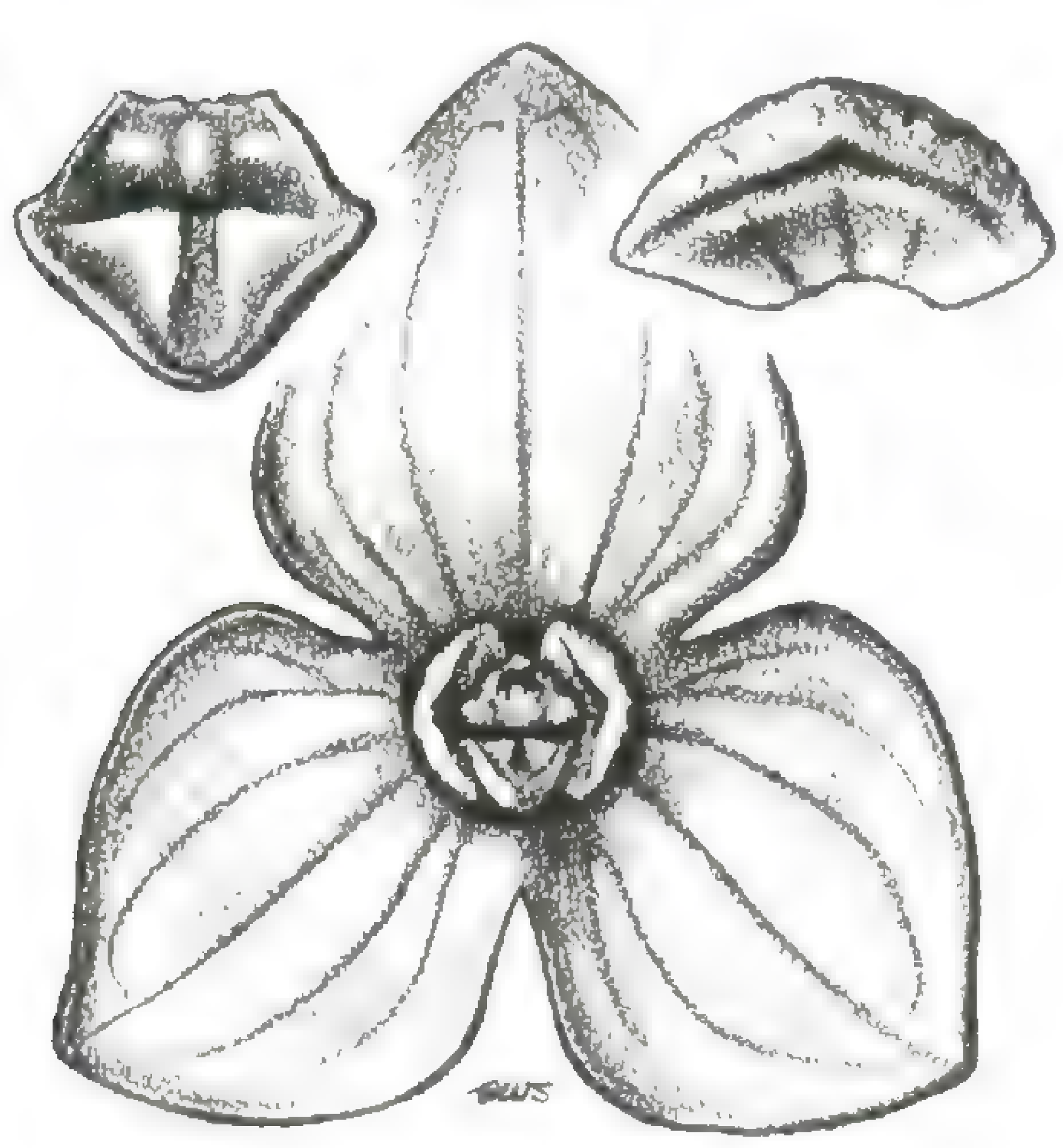


Stelis Lindenii IV-r-3

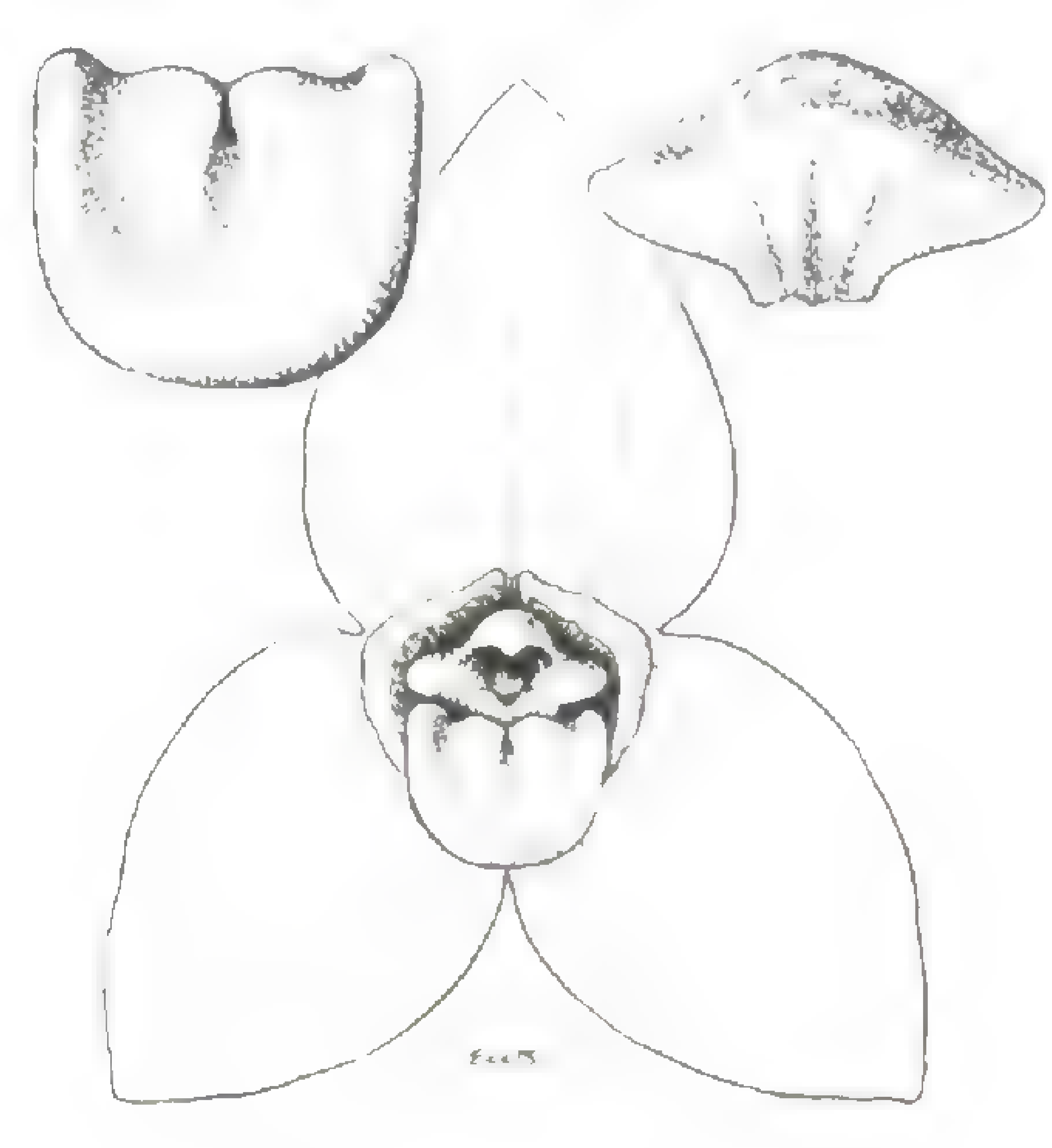


Stelis santiagoënsis IV-r-4

Stelis gracilis IV-c-4



Stelis nanegalensis IV-c-4



Stelis elatior IV-c-4

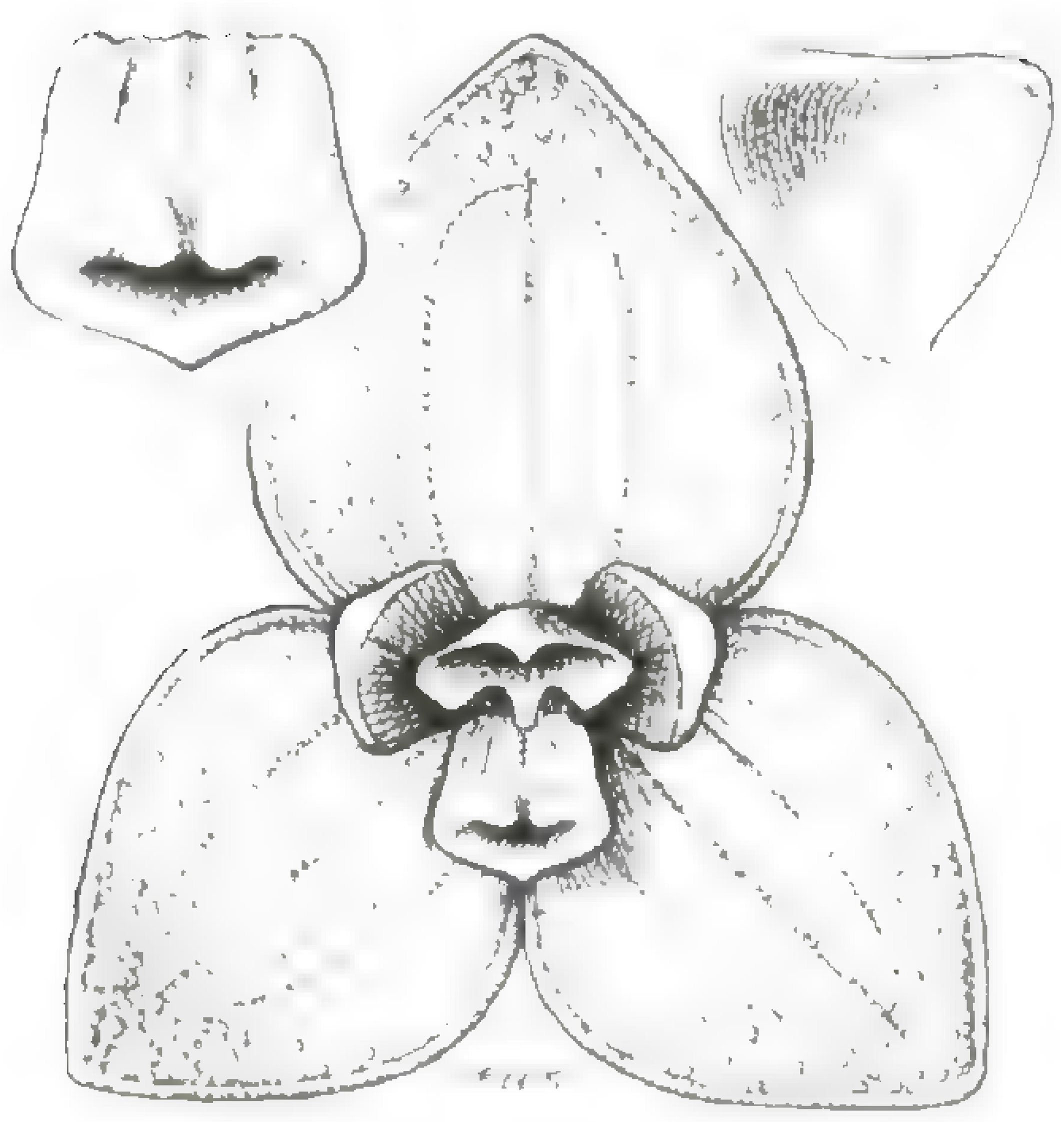
PLATE 61

Stelis transversalis IV-c-4

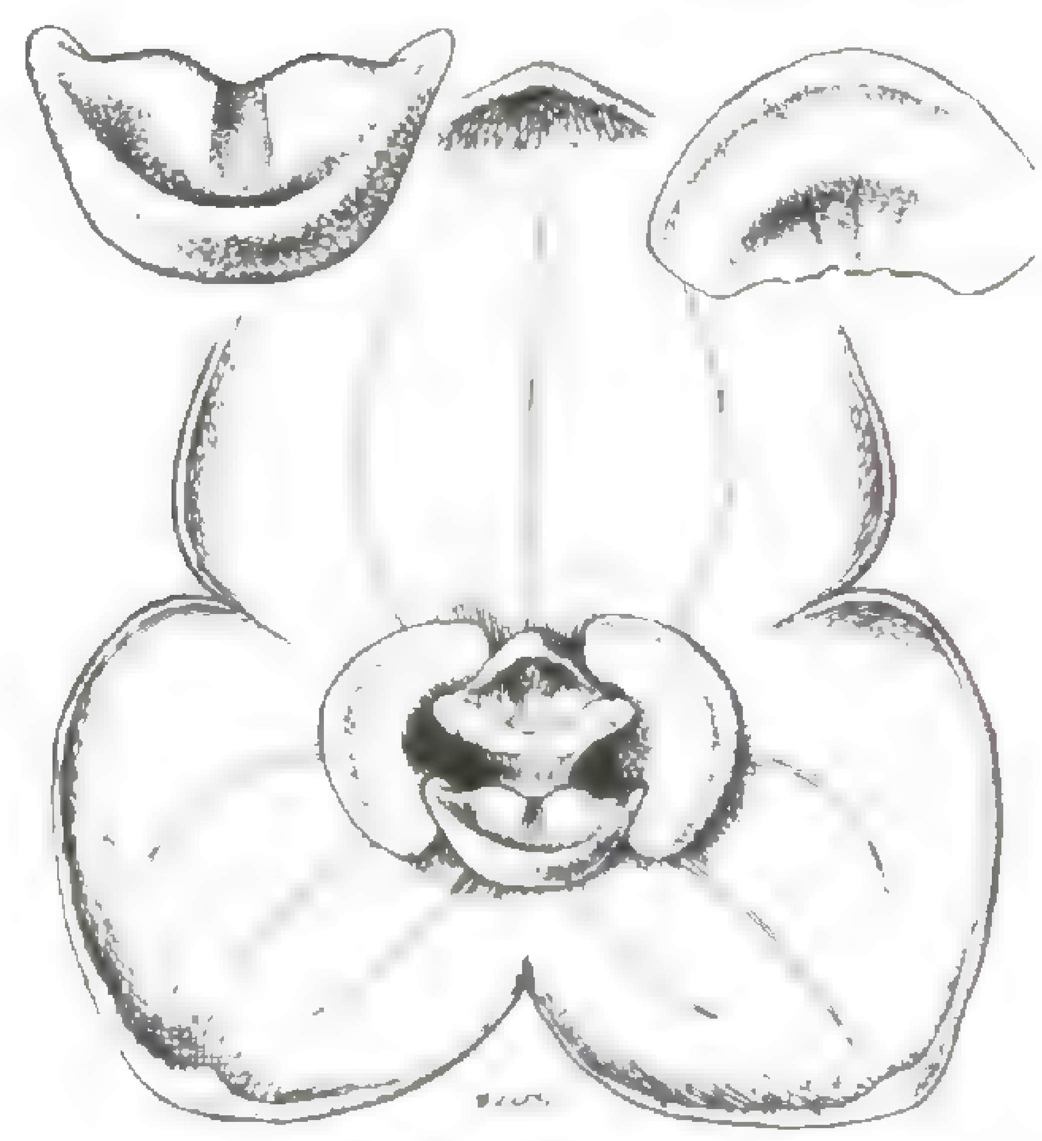
PLATE 62

Stelis Johnsonii IV-c-4

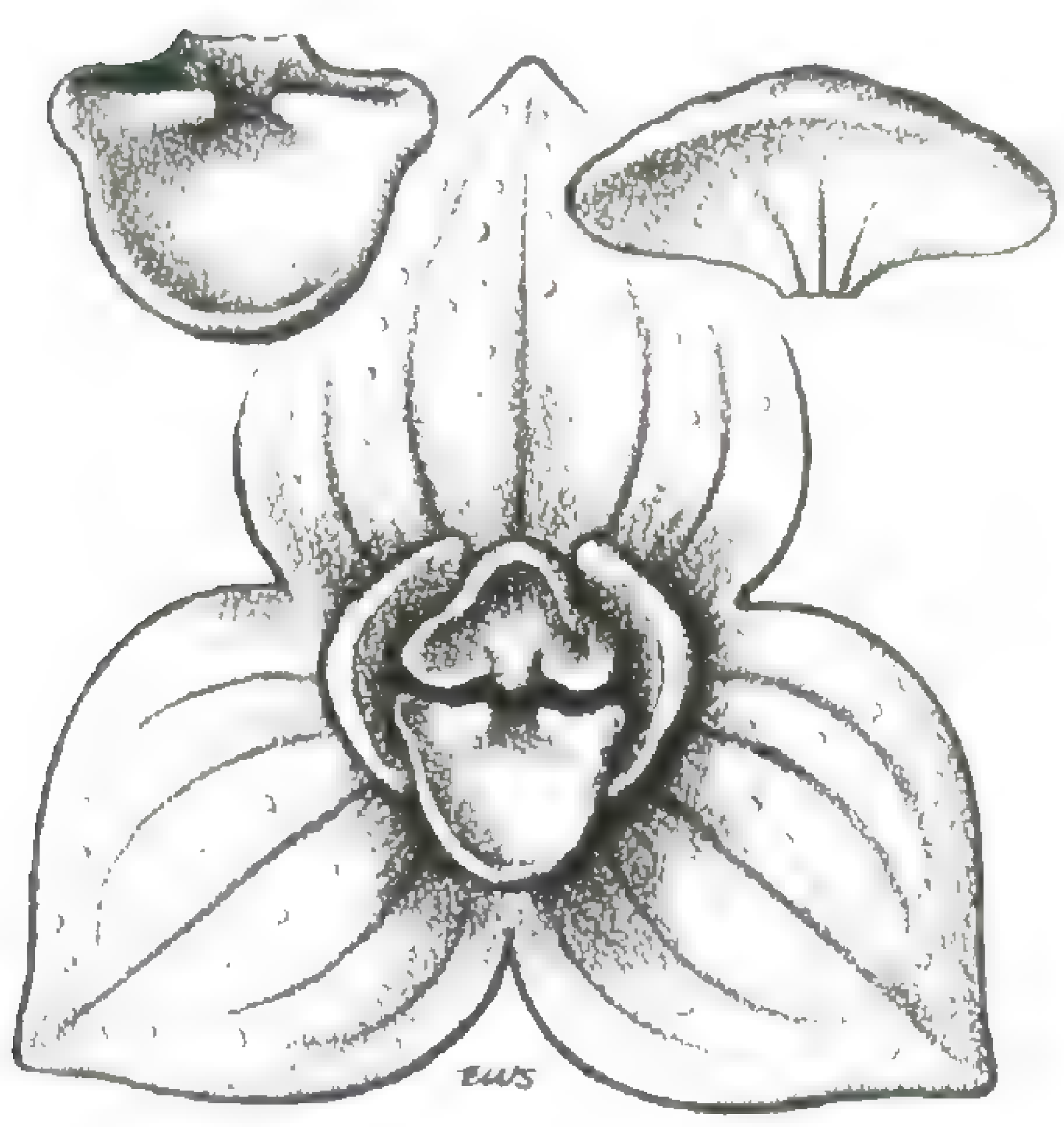
Stelis nubis IV-c-4



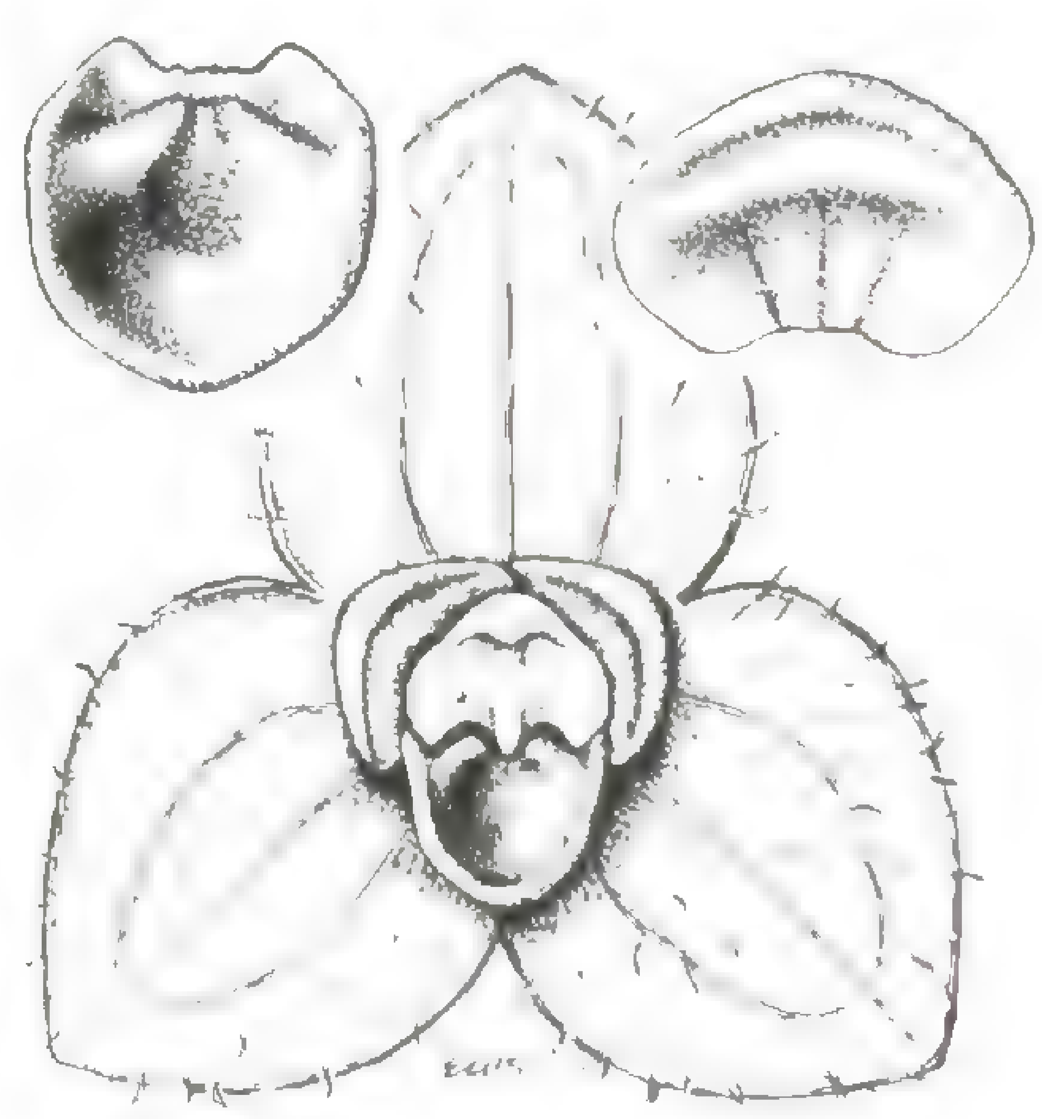
Stelis intermedia IV-c-4



Stelis gladiata IV-c-4

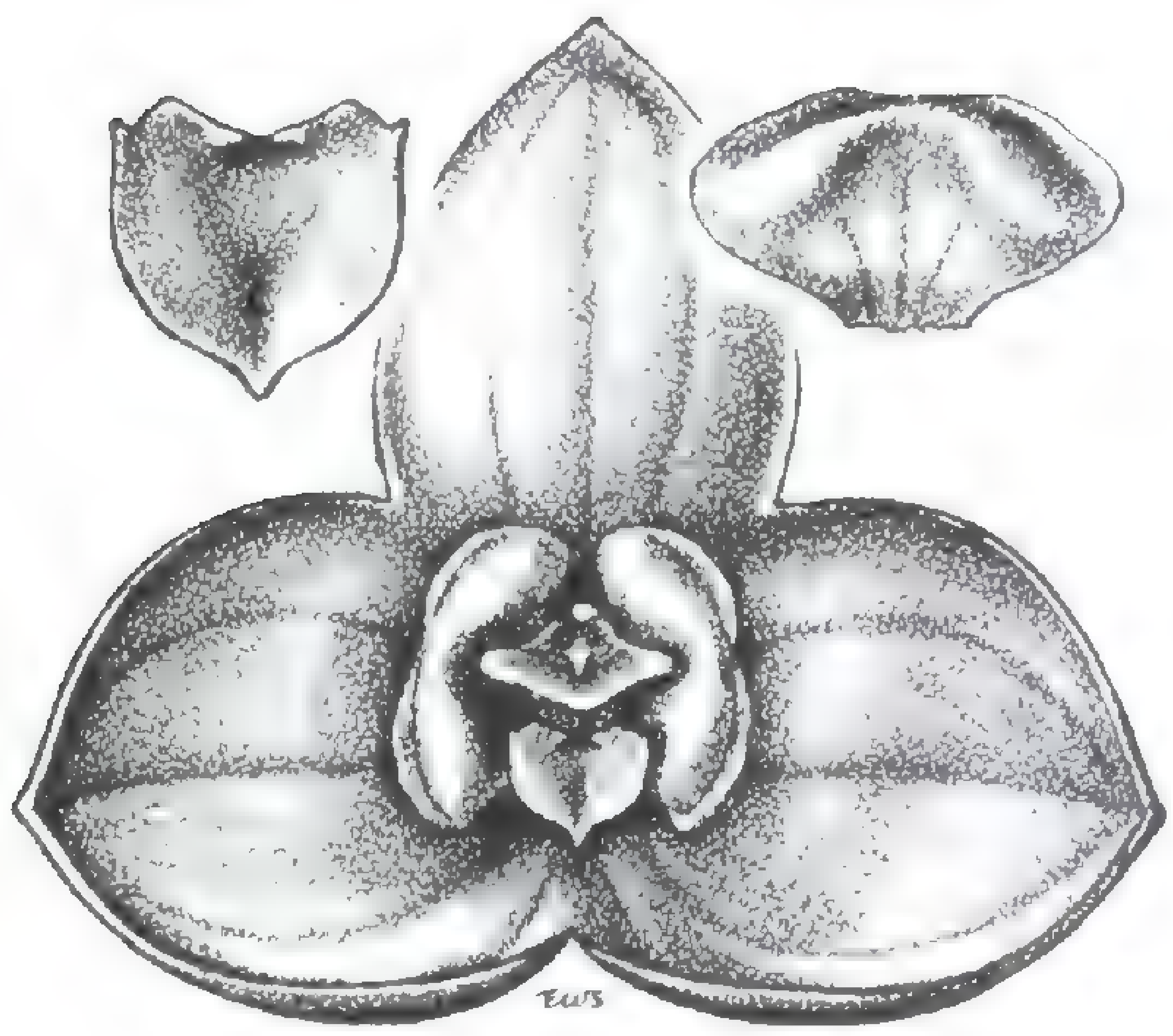


Stelis gigas IV-c-4

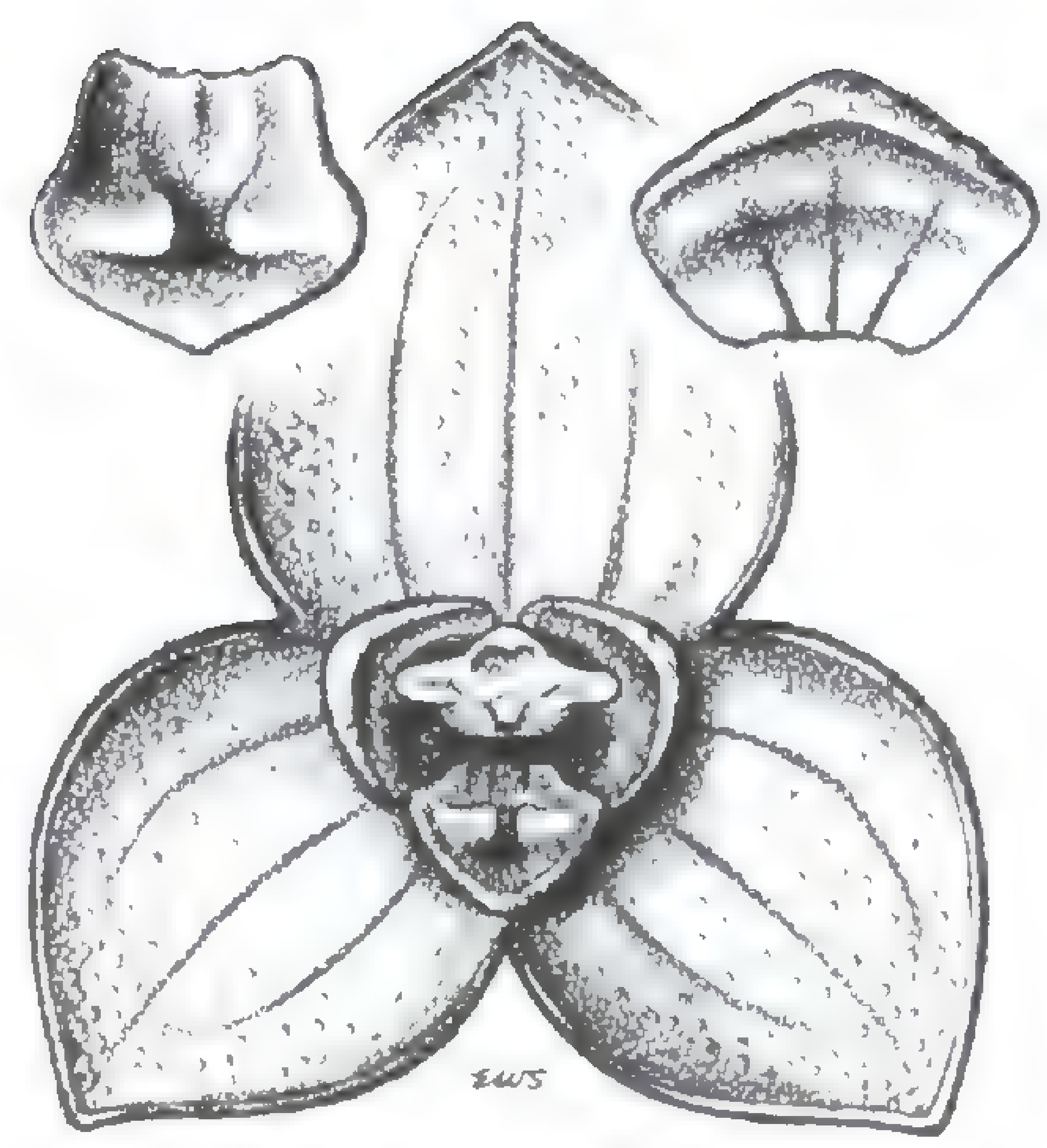


Stelis atroviolacea IV-c-4

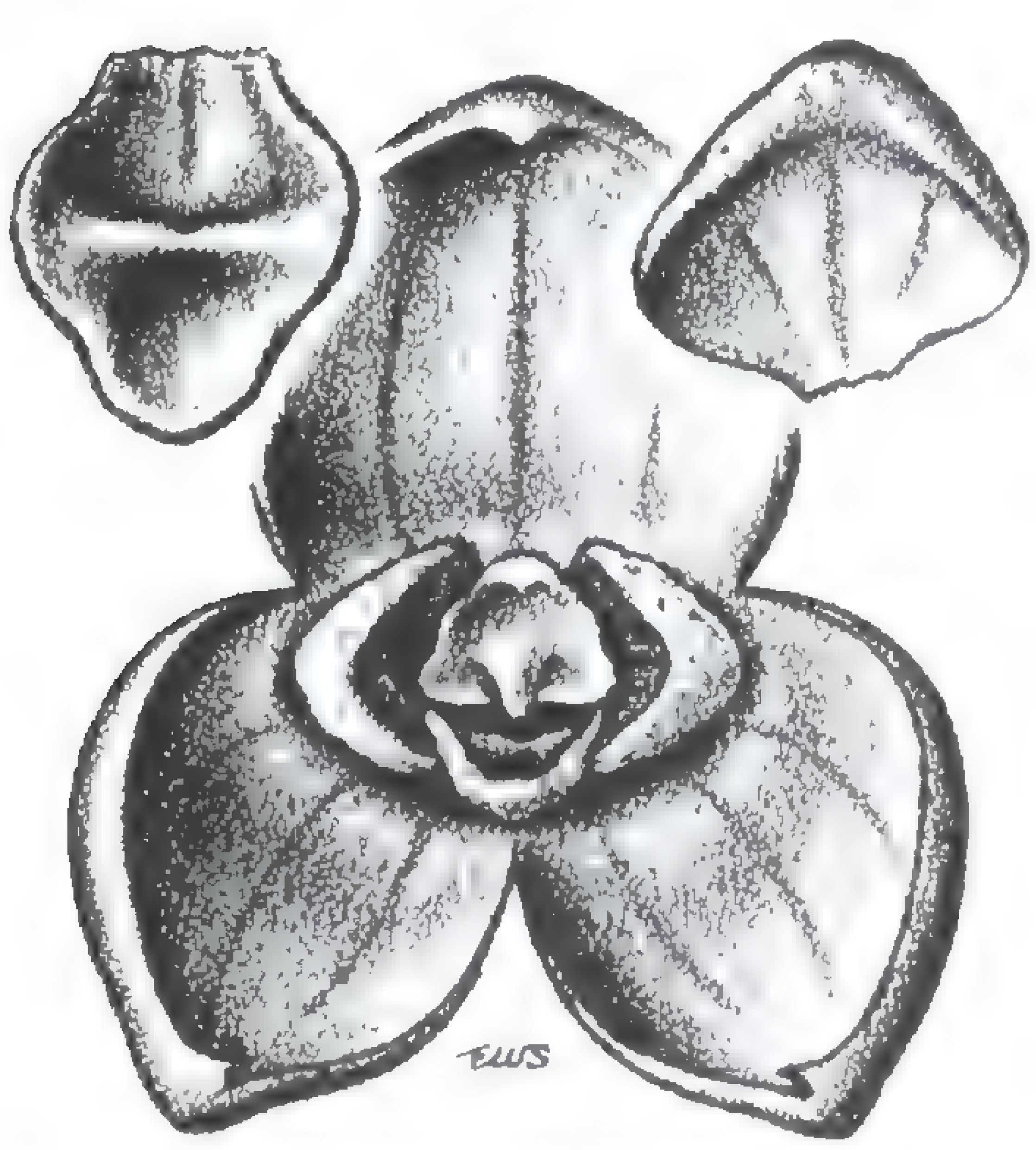
PLATE 63



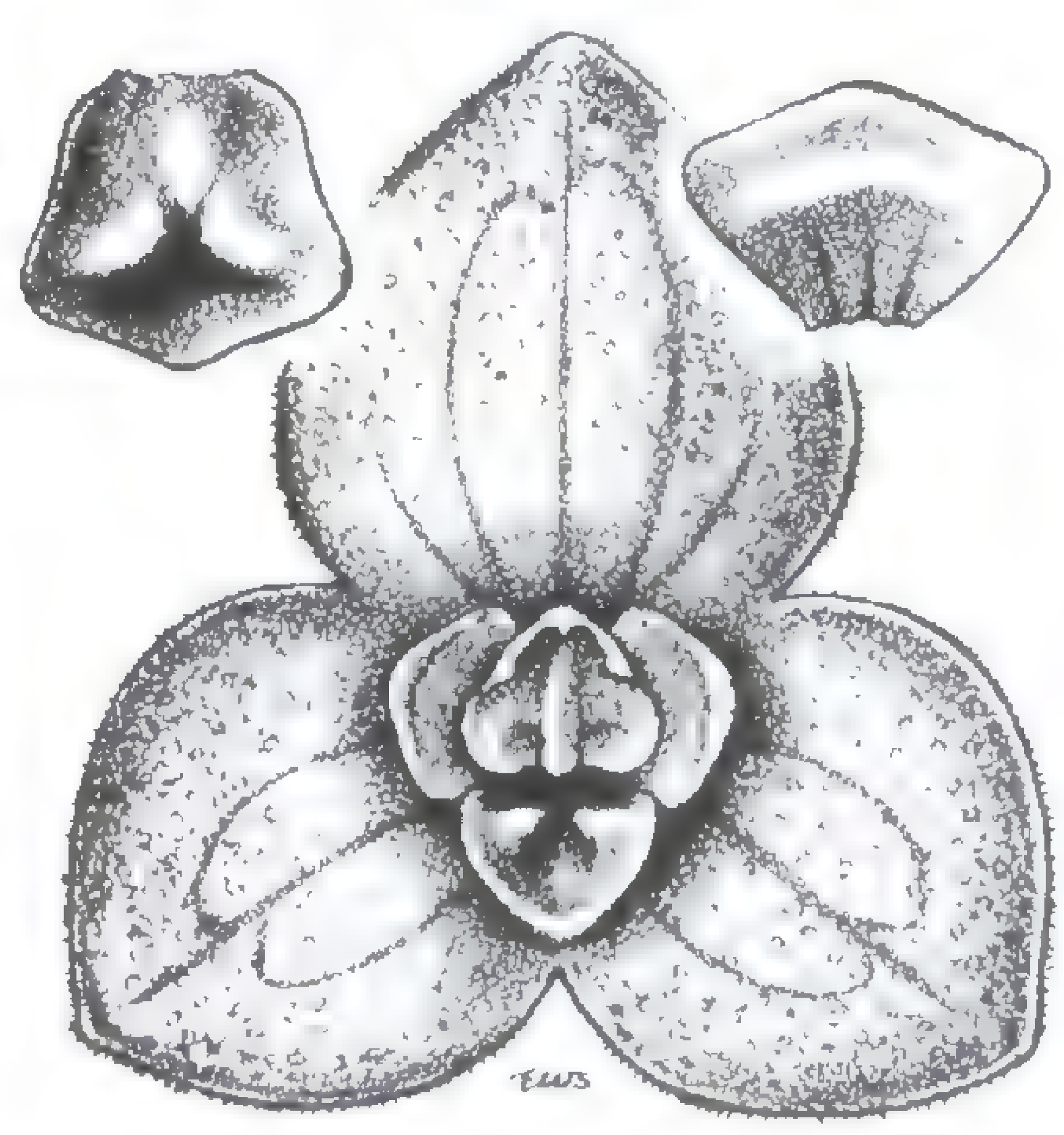
Stelis genychila   IV-c-4



Stelis lancea   IV-r-4

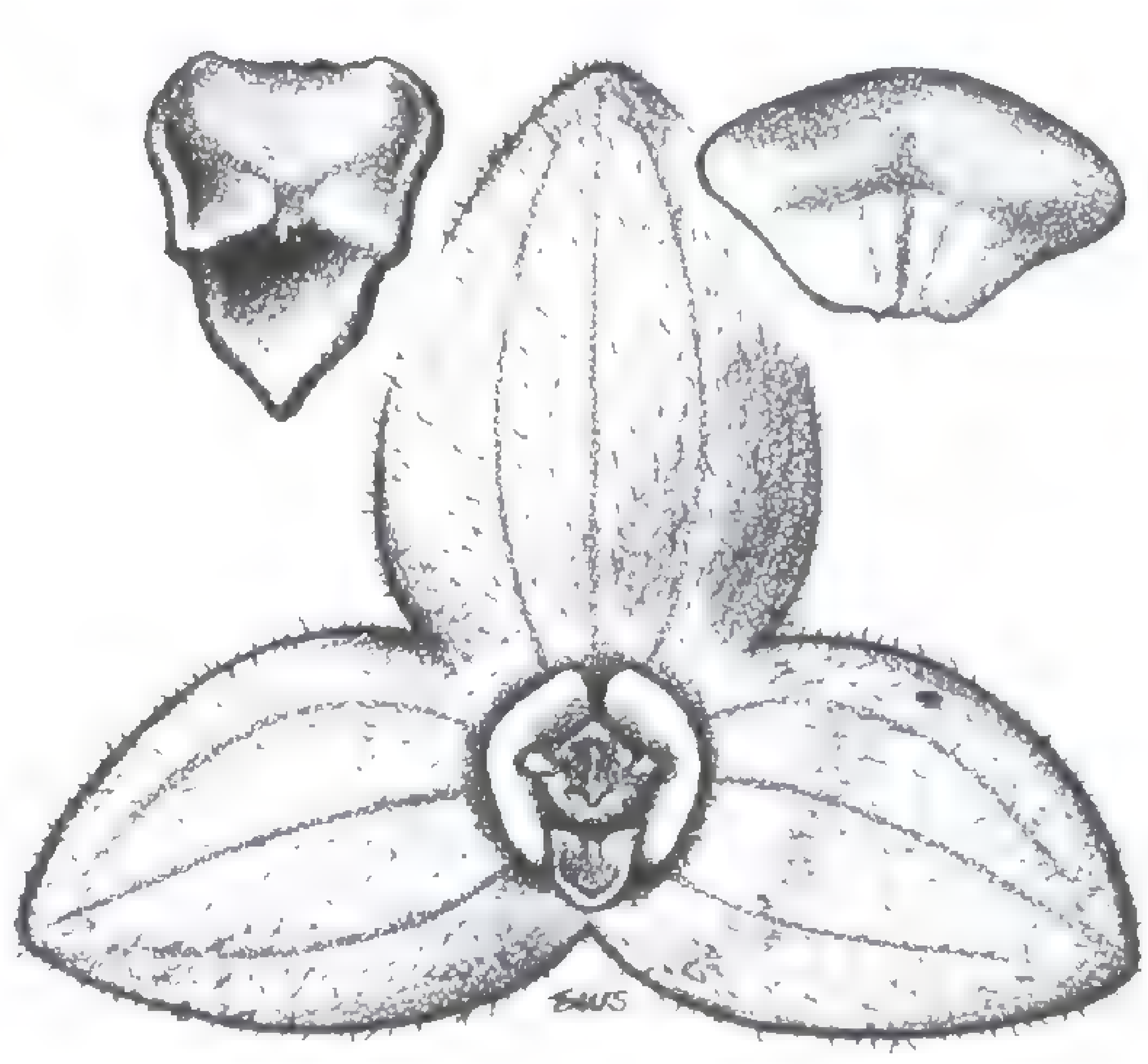


Stelis laxa   IV-r-4



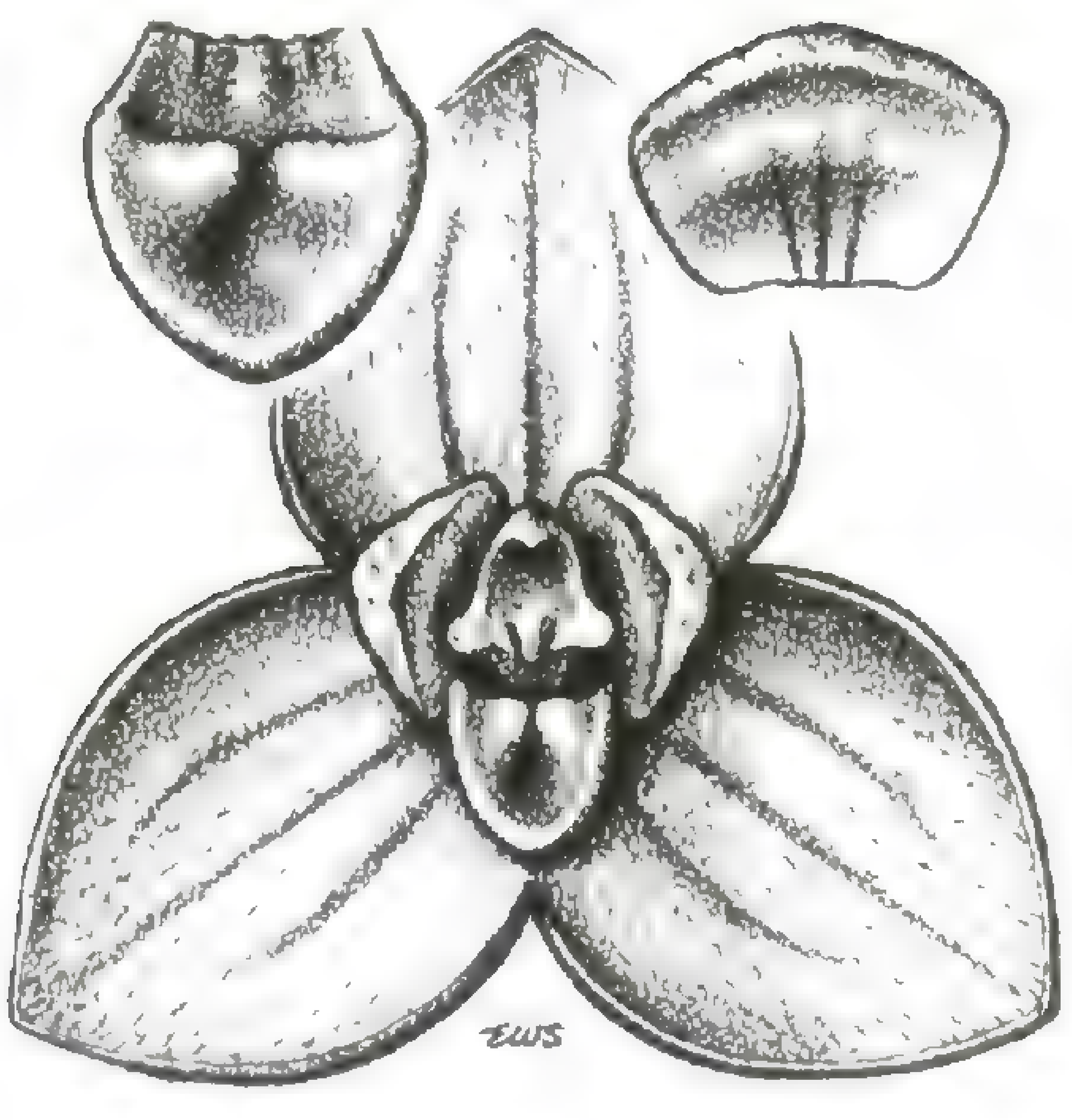
Stelis Weberbaueri   IV-c-4

Stelis vestita   IV-c-4

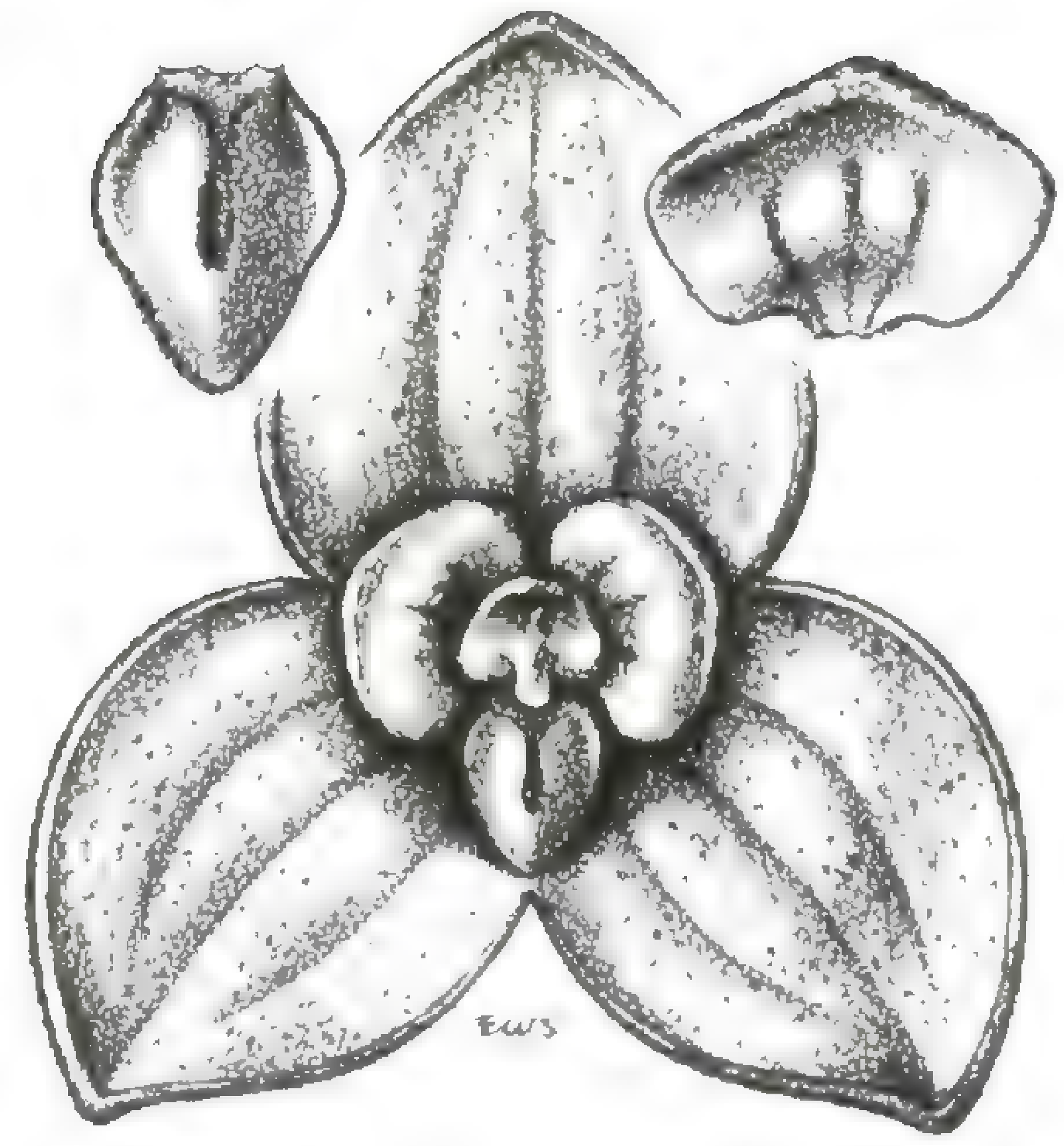


Stelis juninensis   IV-c-4

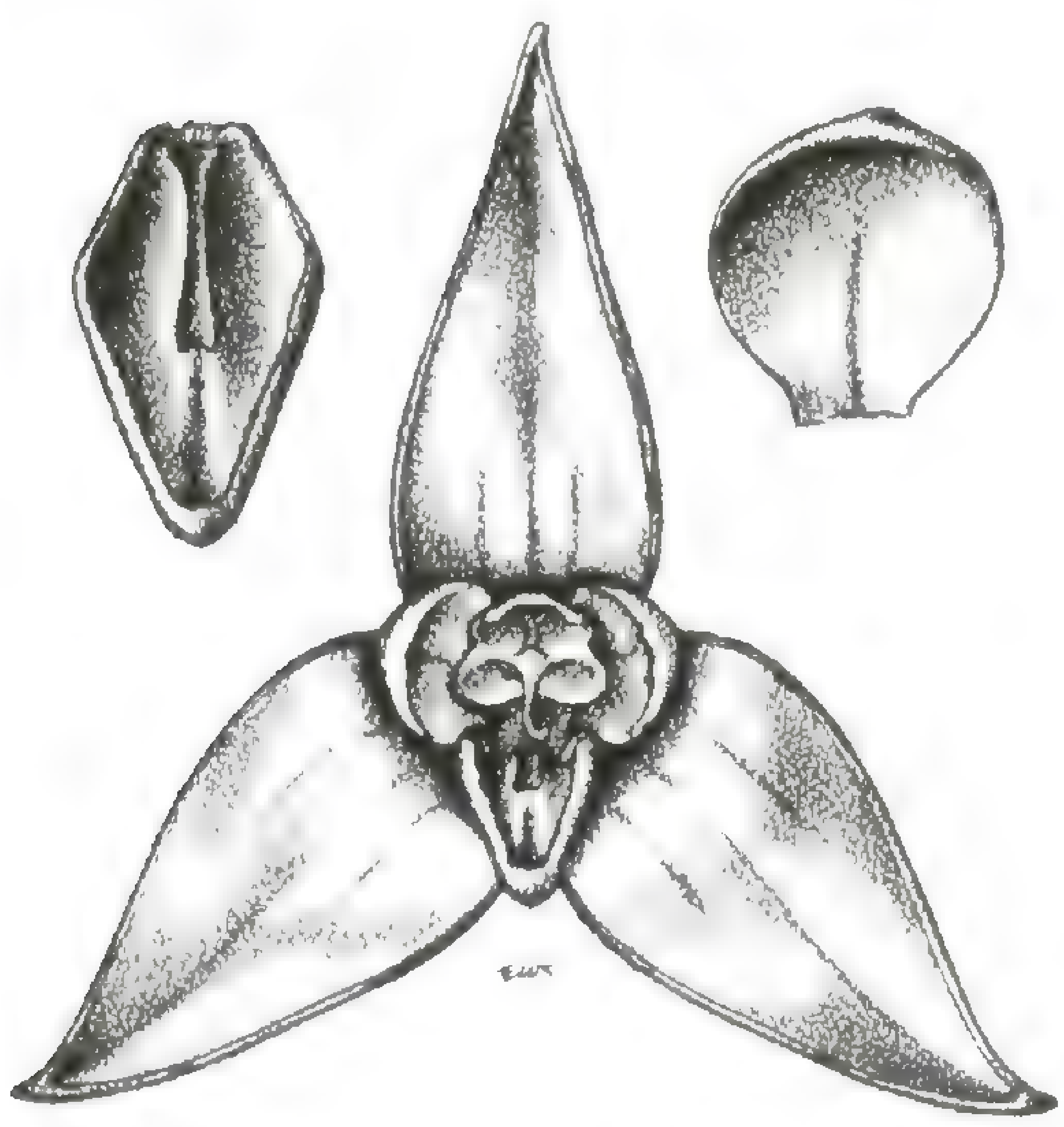
PLATE 64



Stelis flexa IV-r-4

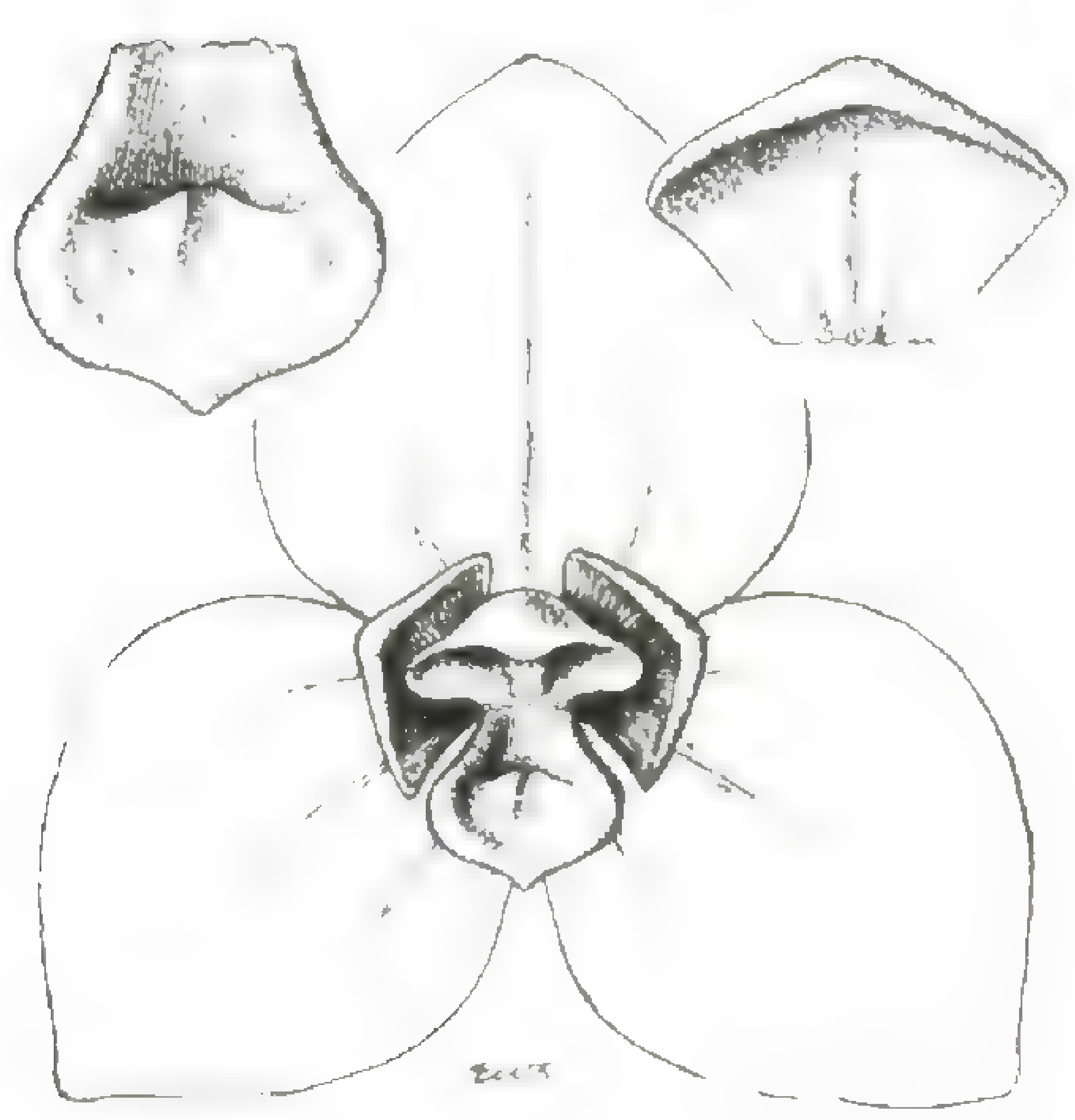


Stelis discolor V-r-5

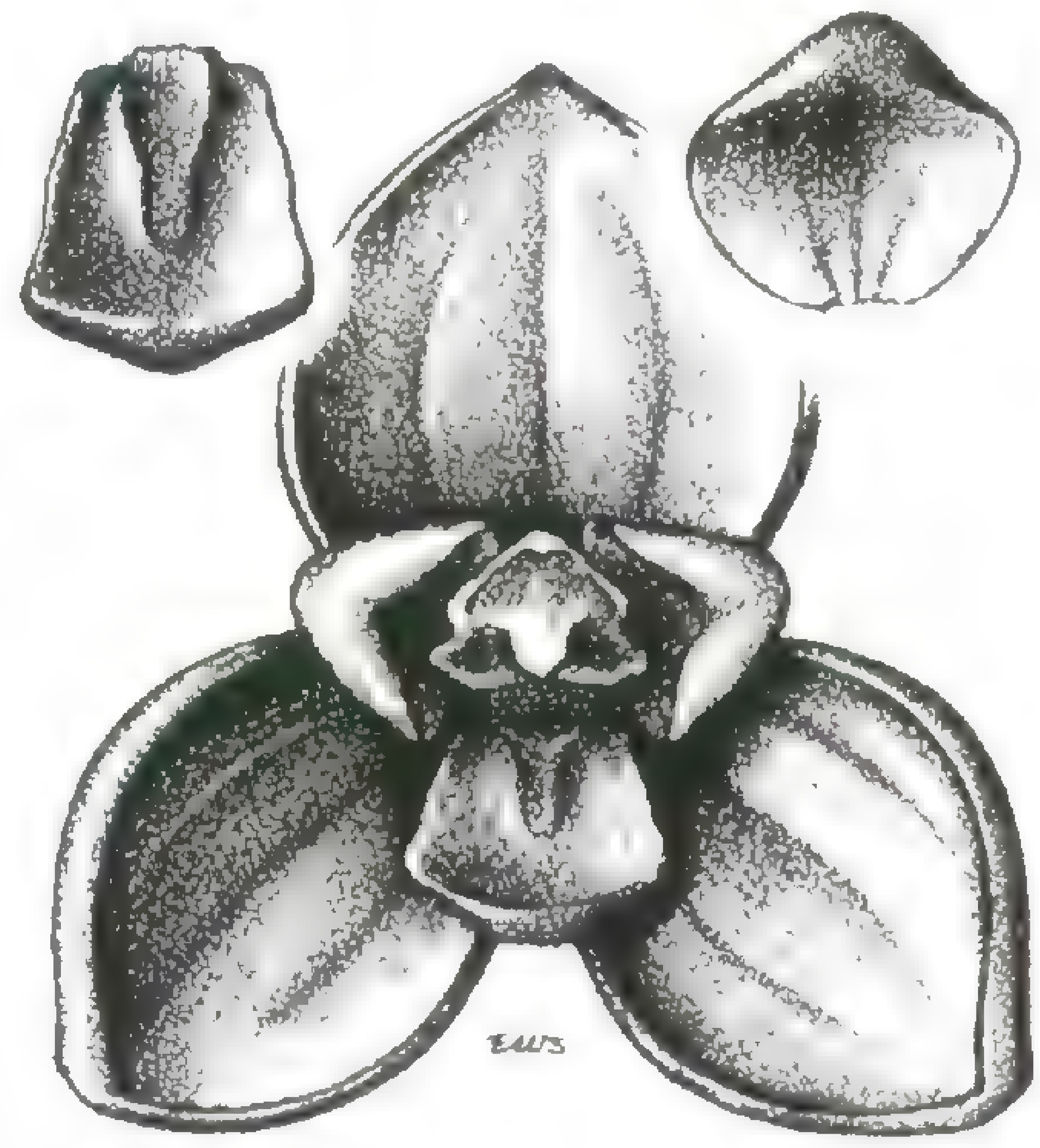


Stelis rhomboidea V-r-5

Stelis tenuissima V-c-6

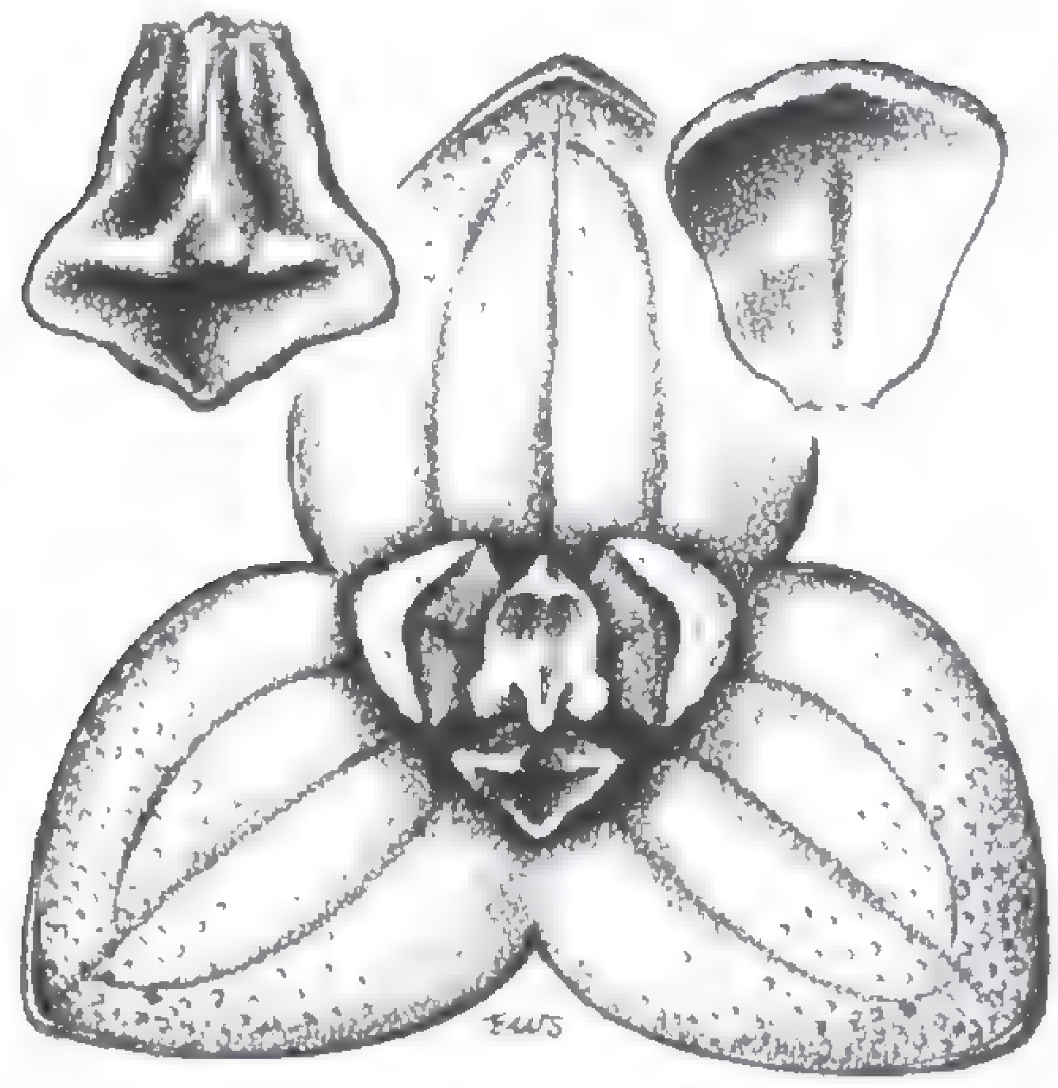


Stelis Fendleri V-c-6

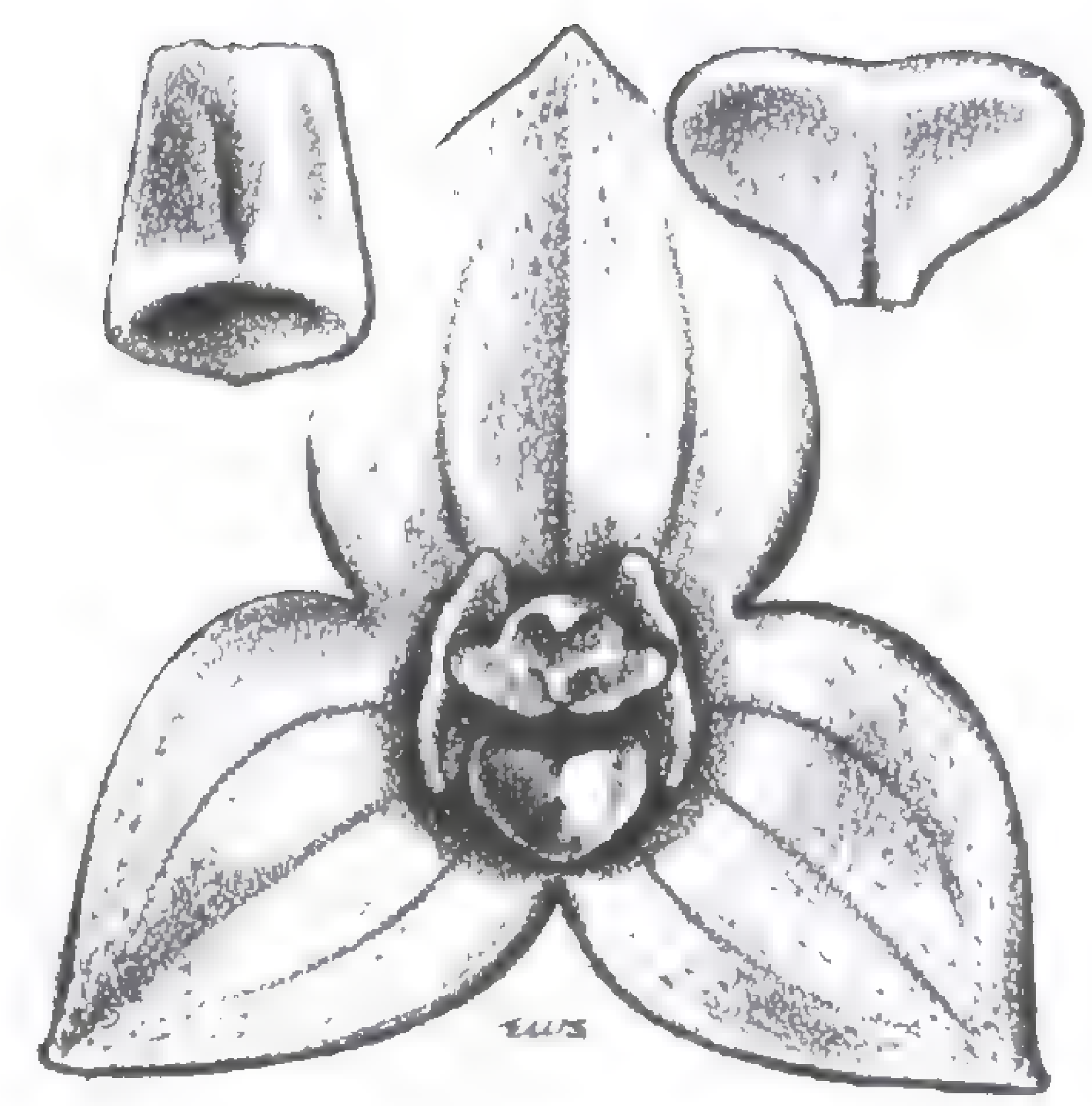


Stelis Maderoi V-c-6

PLATE 65

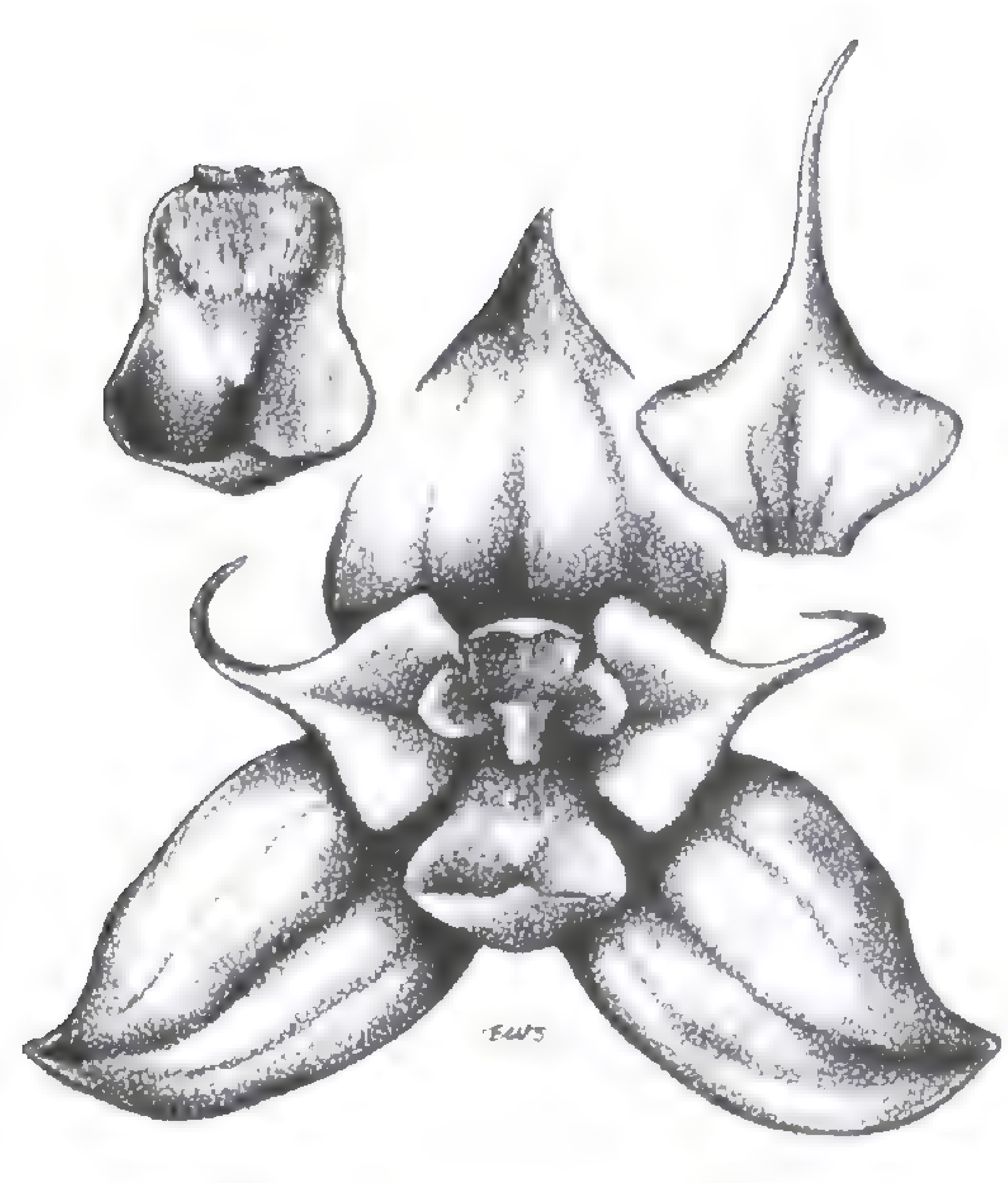


Stelis filiformis V-c-6



Stelis virens V-c-6

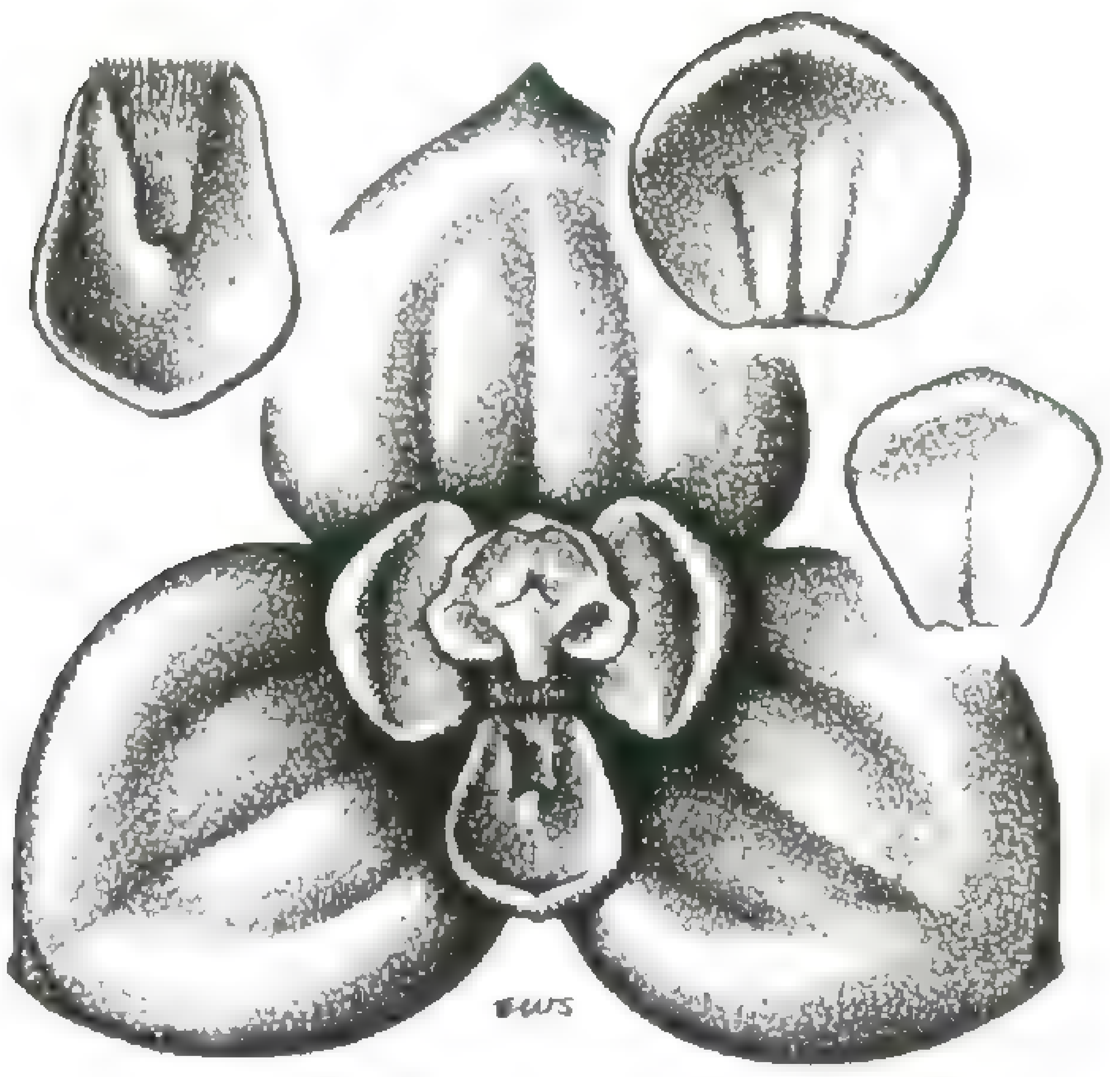
Stelis Storkii V-c-6



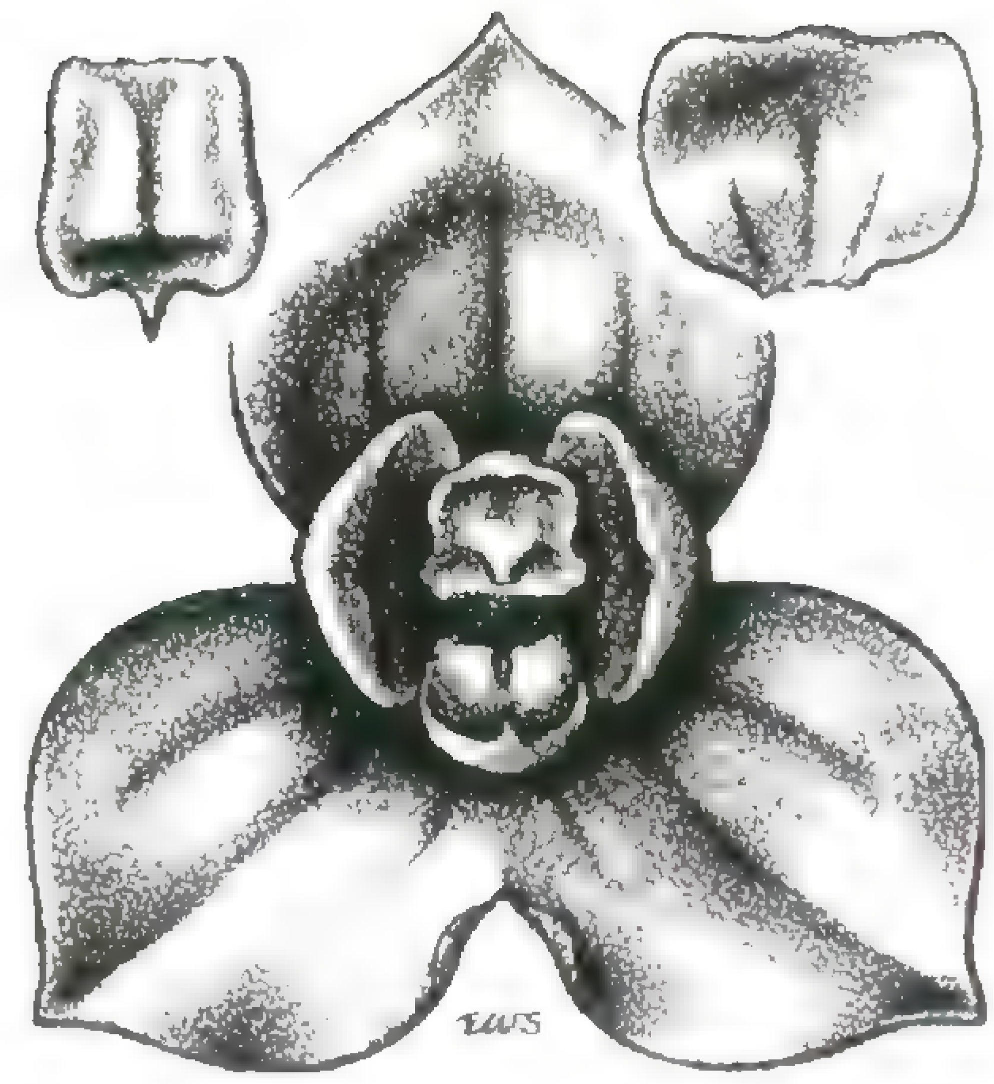
Stelis antennata V-r-6

Stelis cleistogama V-c-6

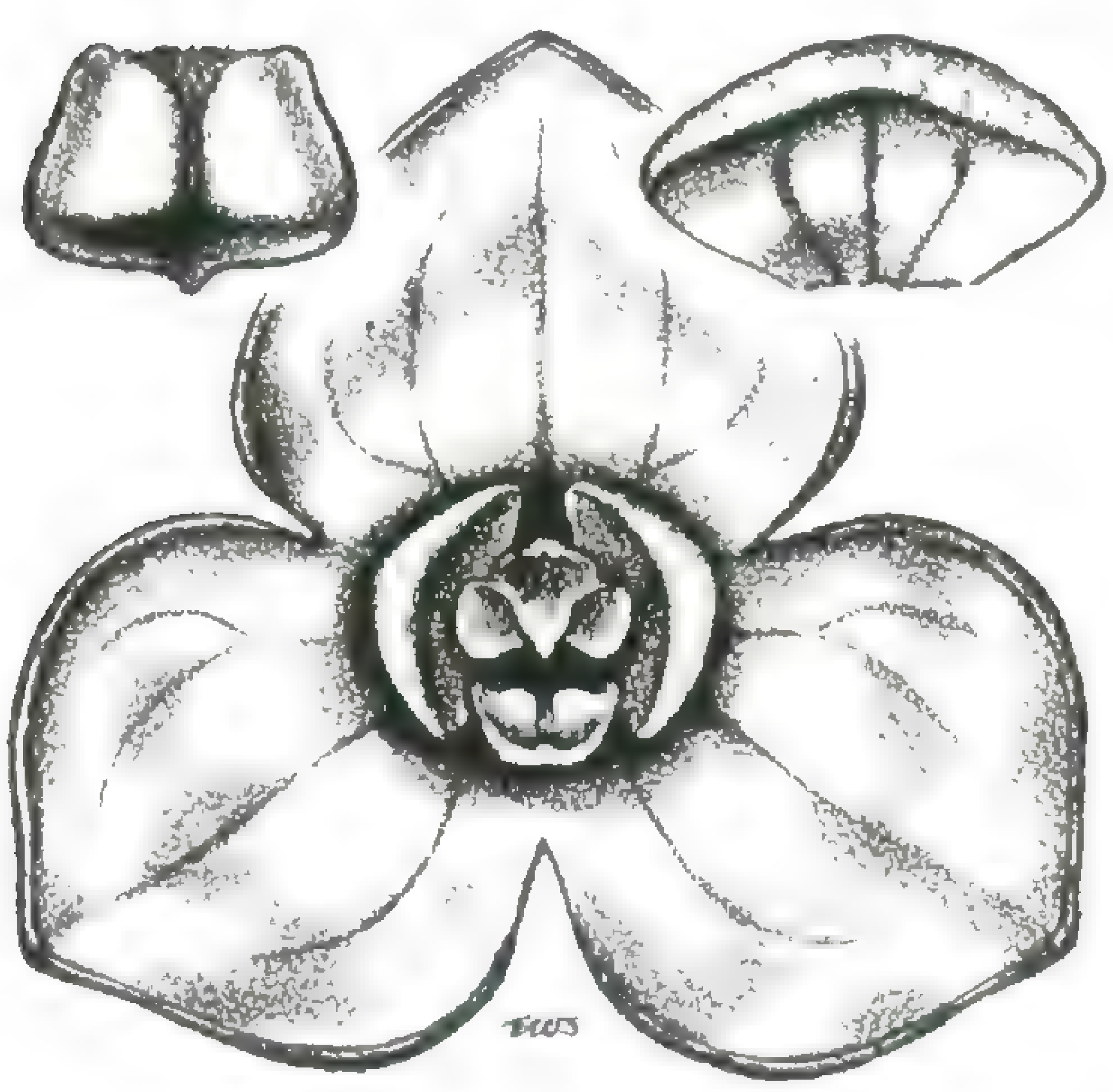
PLATE 66



Stelis lentiginosa V-r-6

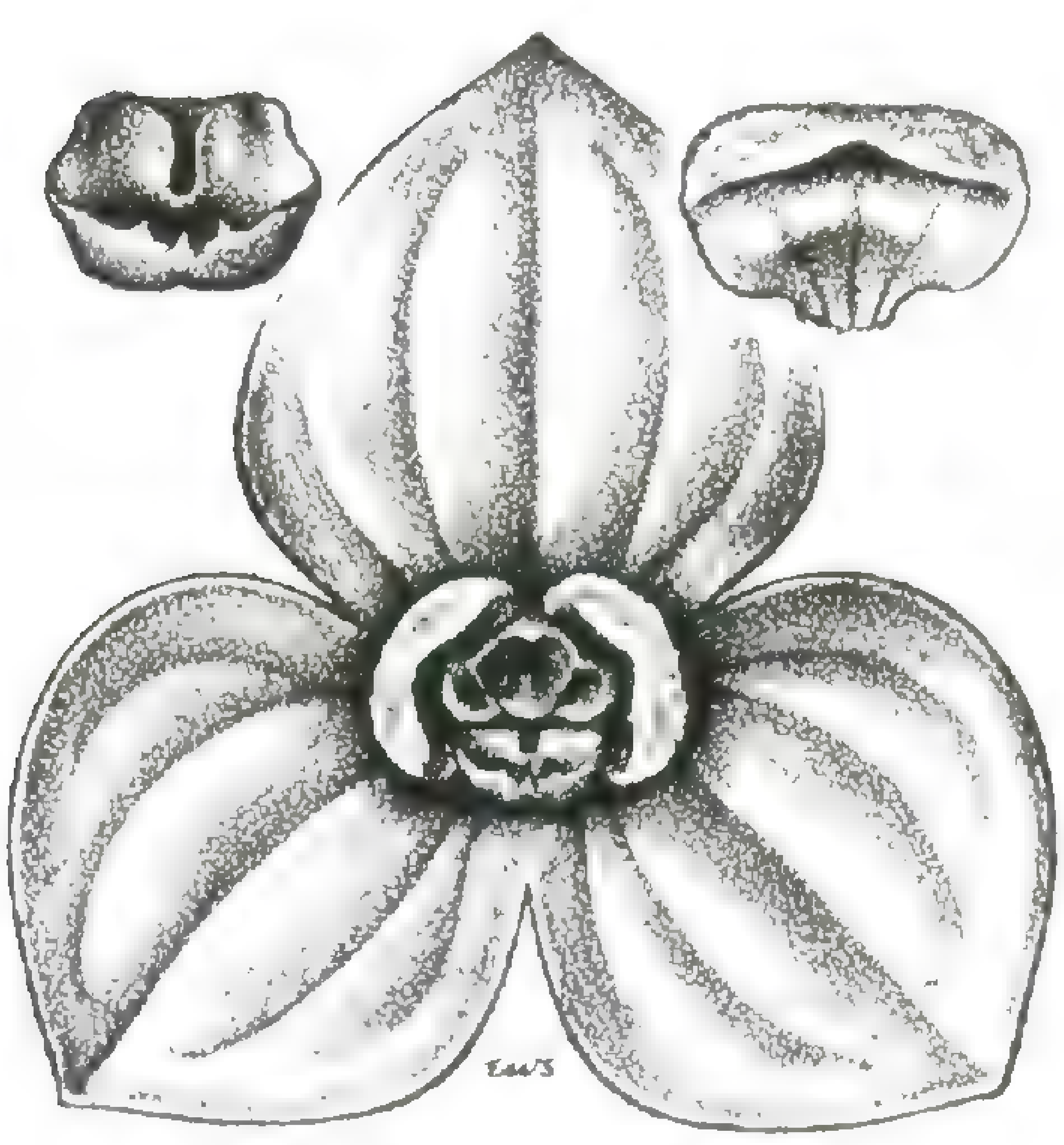


Stelis pygmaea VI



Stelis Dussii VI

Stelis propinqua VI



Stelis vulcanica VI

Stelis Cooperi VI

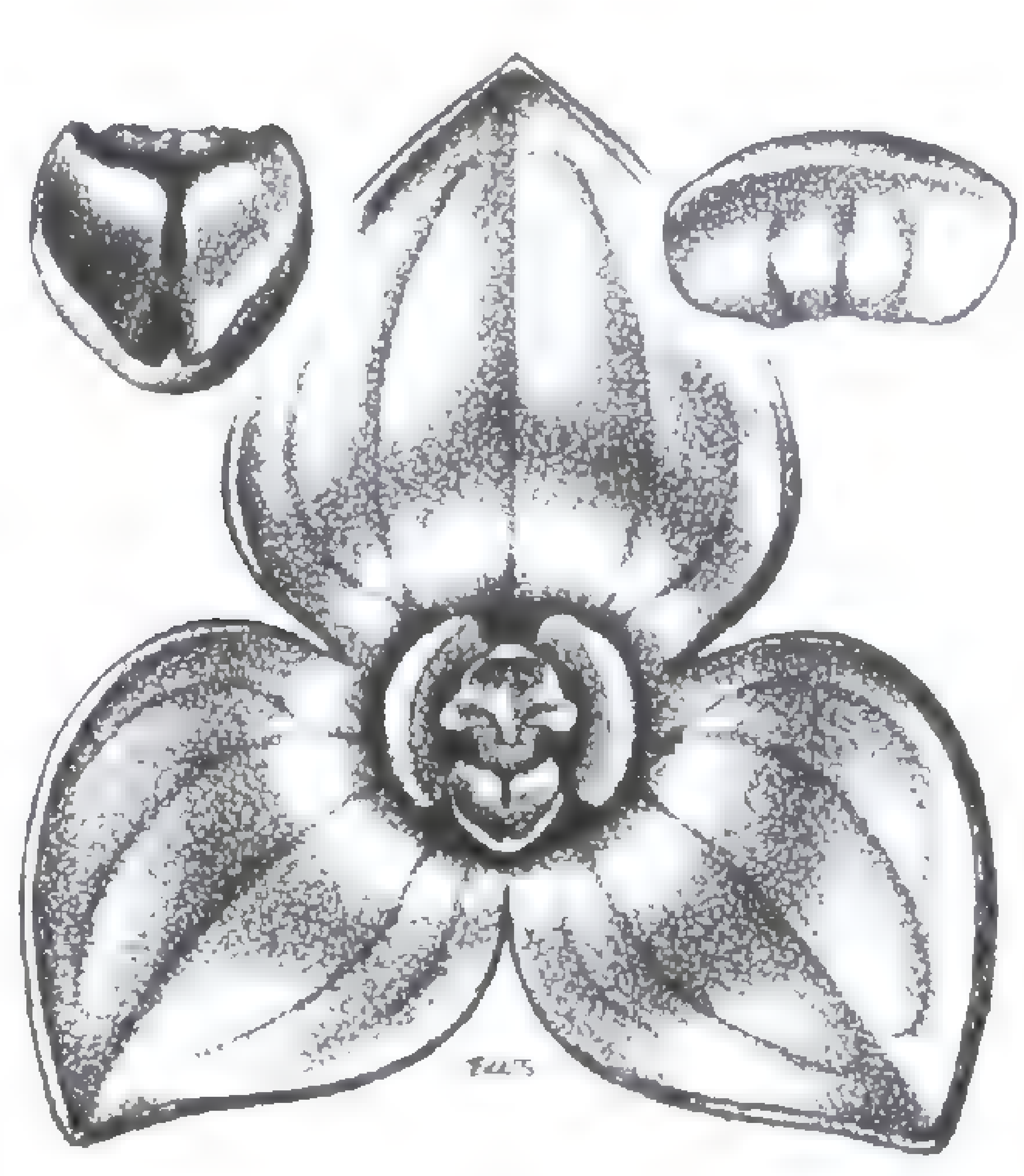
PLATE 67

Stelis superbiens VI

Stelis leucopogon VI

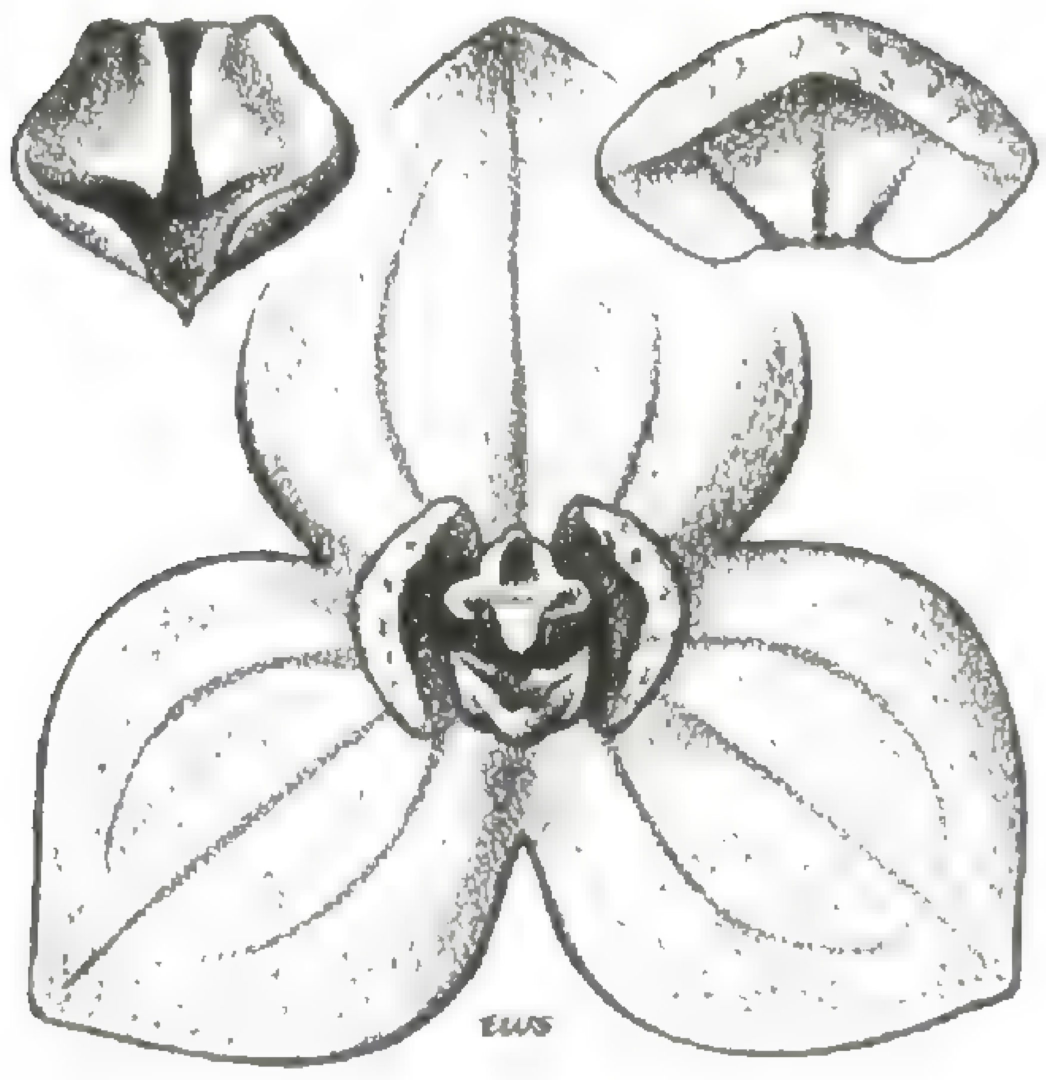
Stelis diffusa VI

Stelis argentata VI

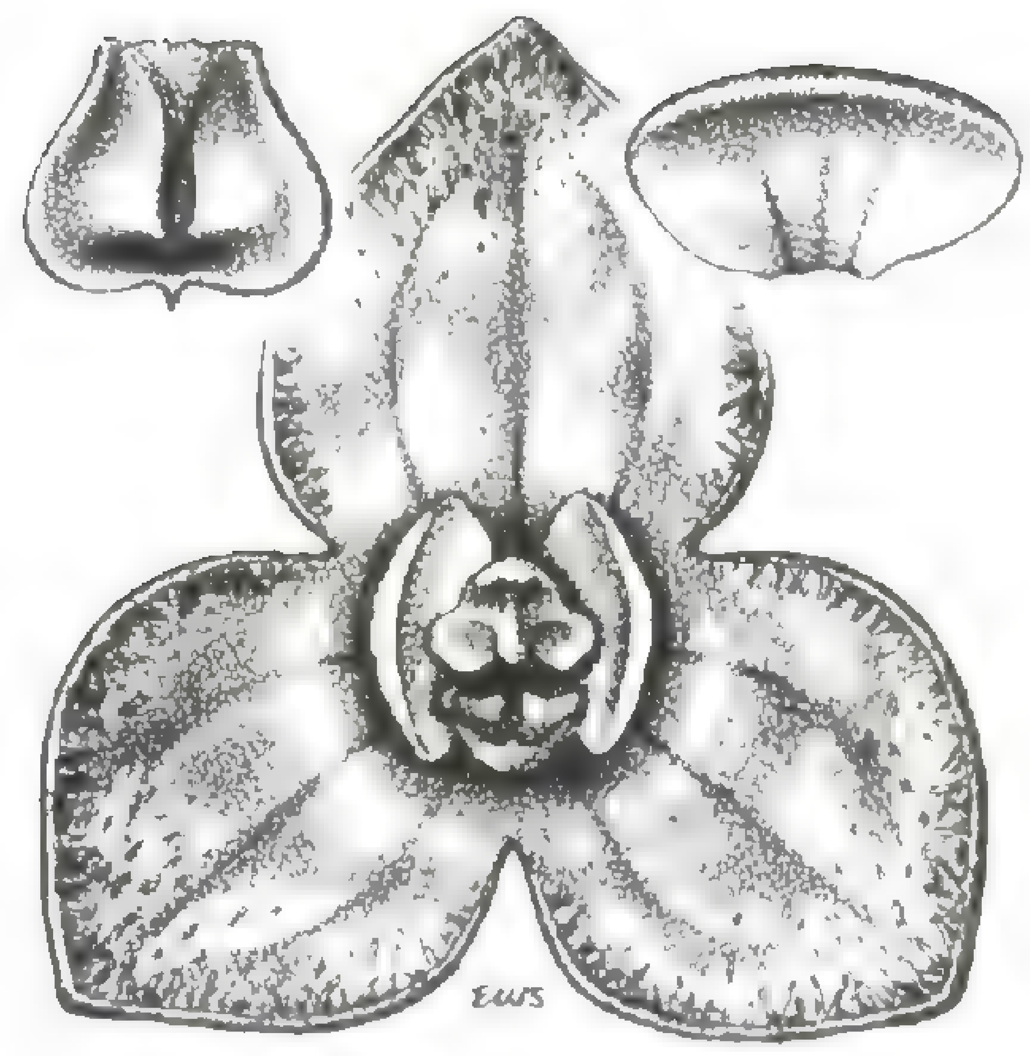


Stelis itatiayae VI

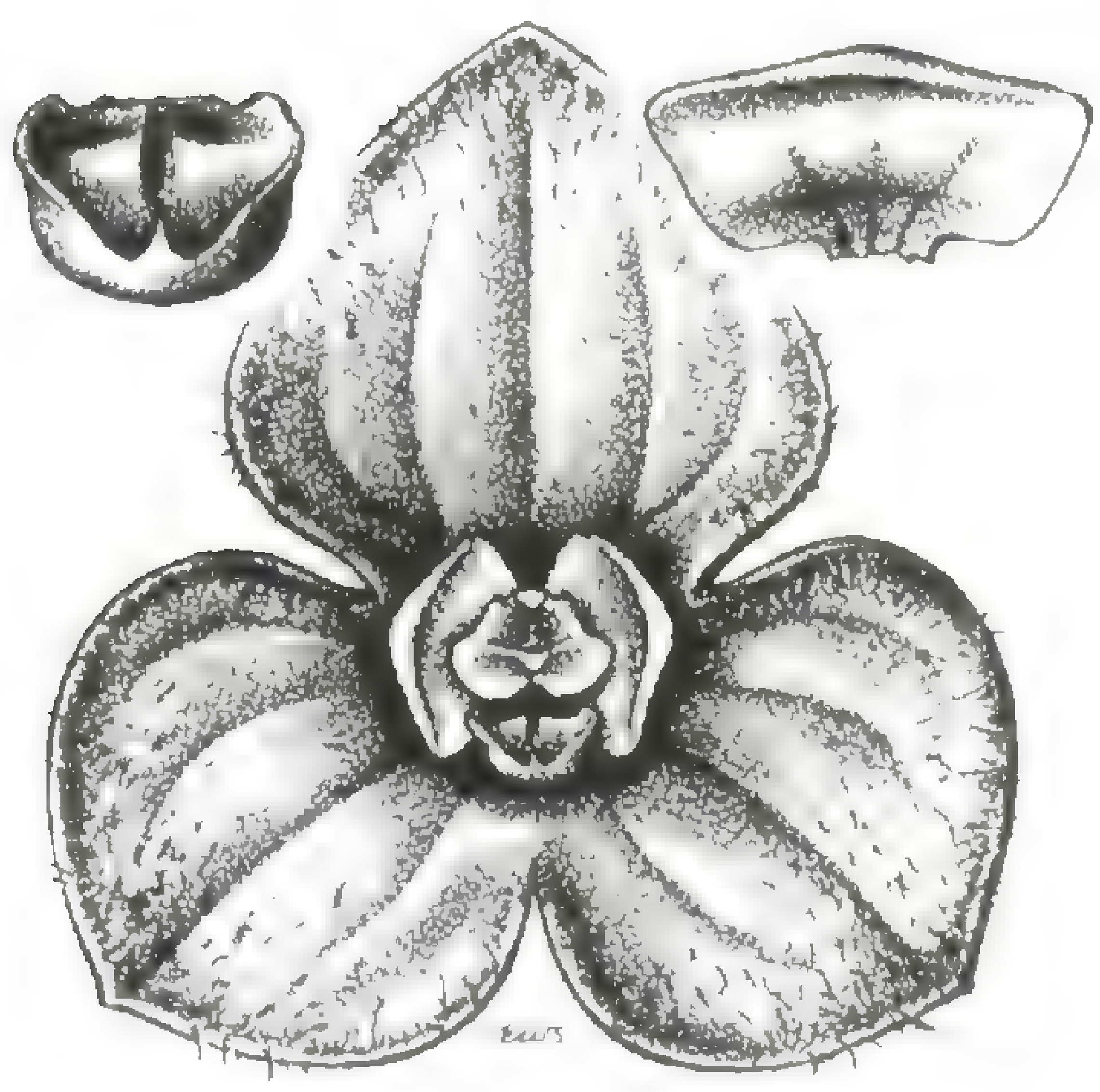
PLATE 68



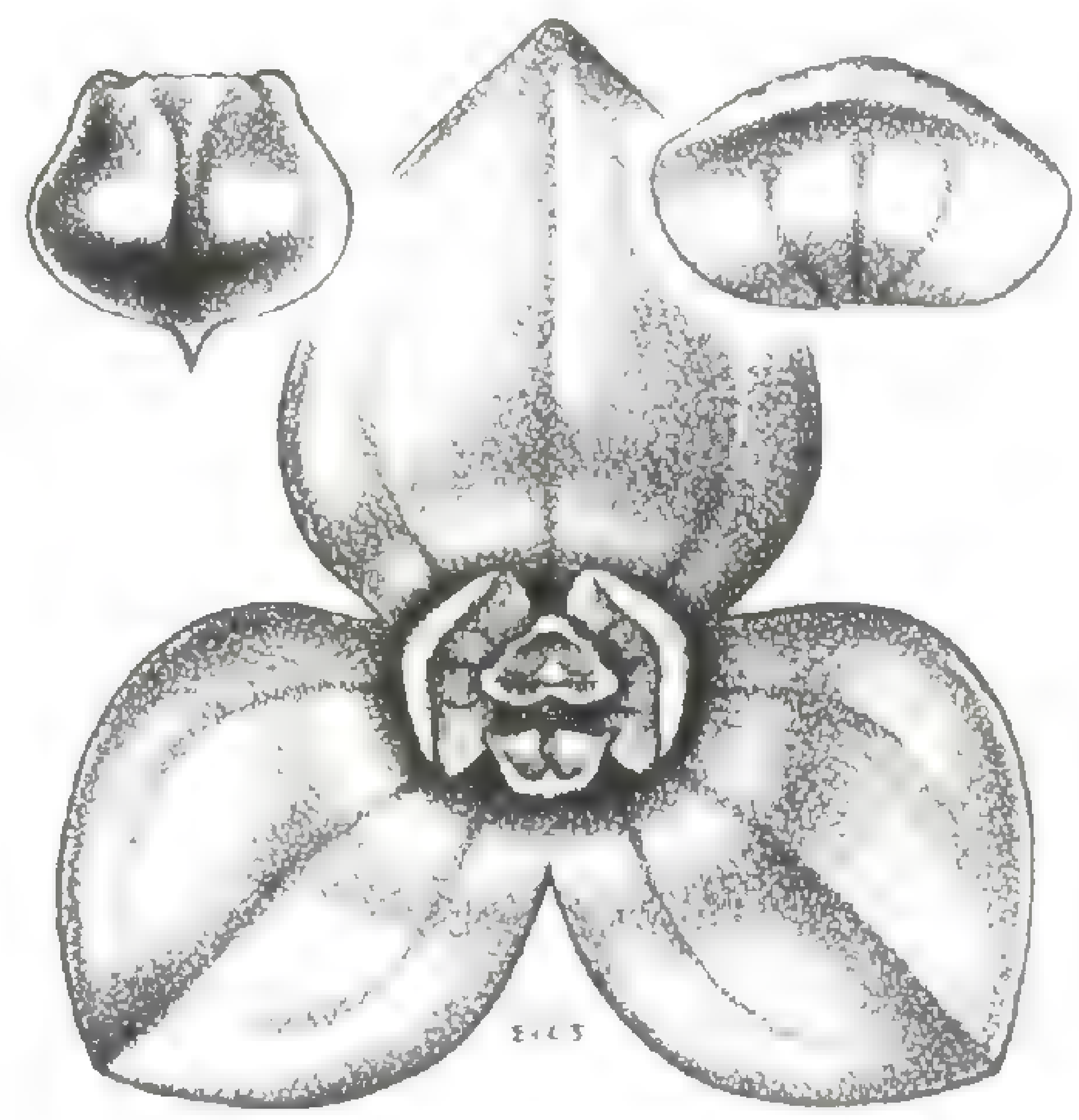
Stelis philargyrus VI



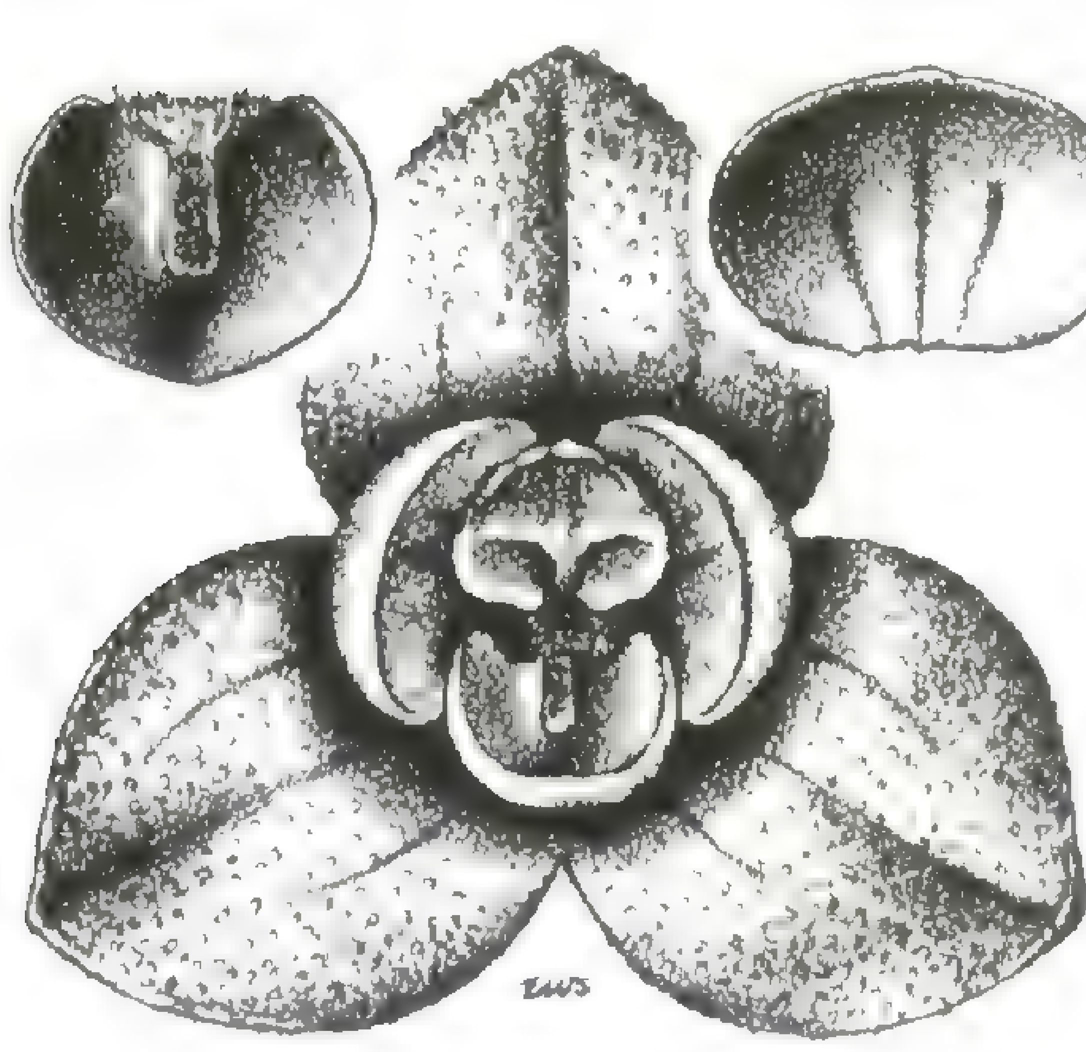
Stelis pauciflora VI



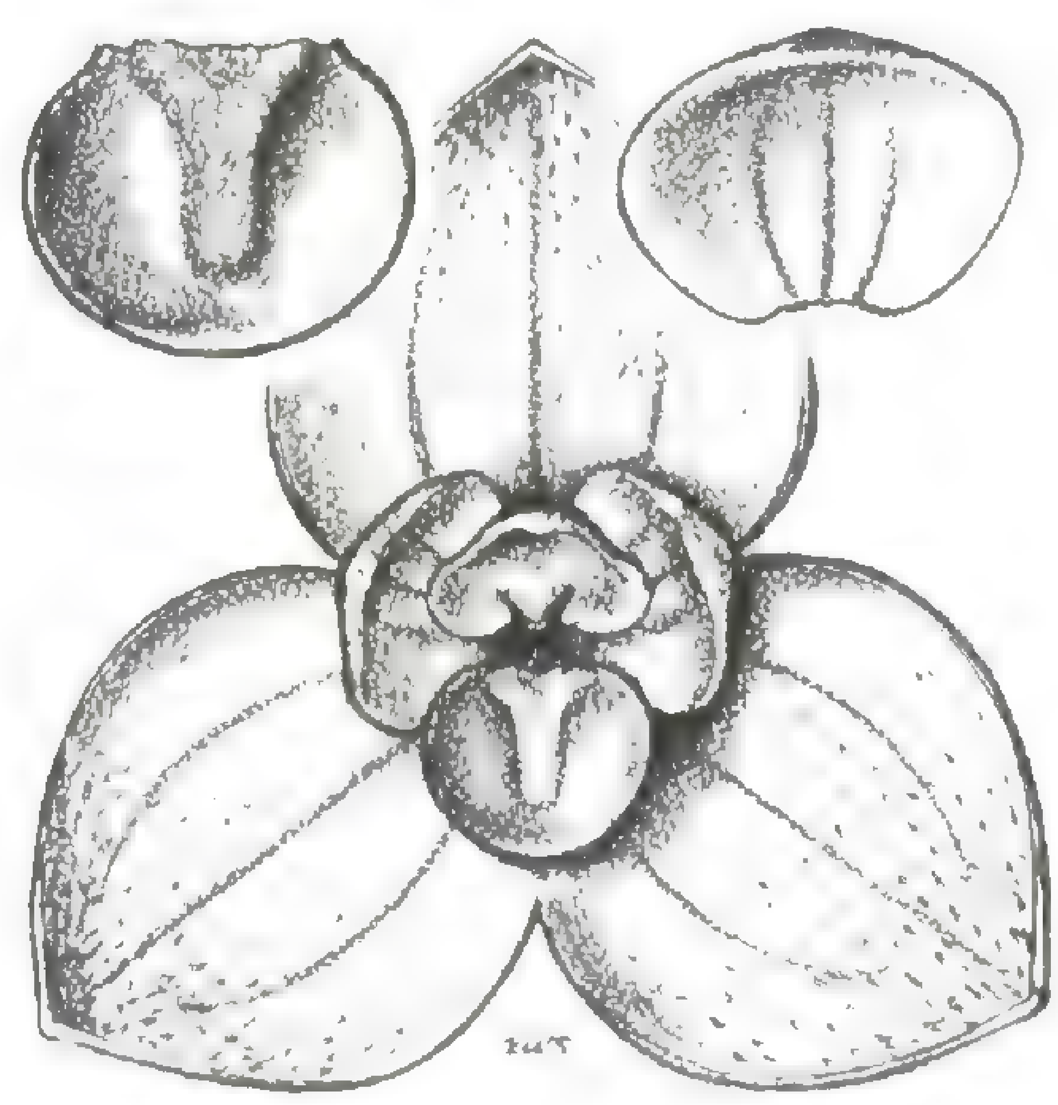
Stelis tridentata VI



Stelis trichorrachis VI

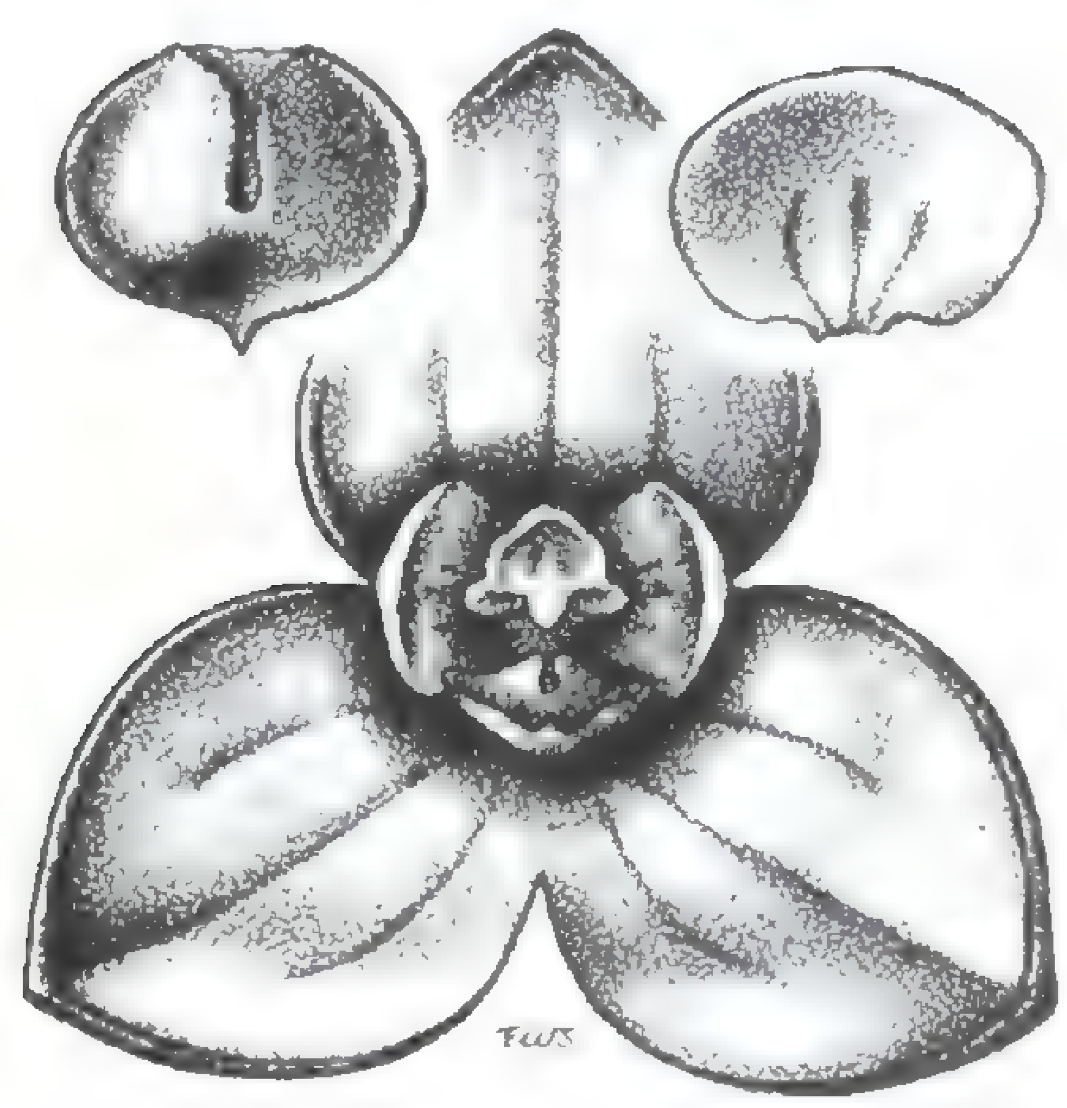


Stelis ascendens VII-r-7

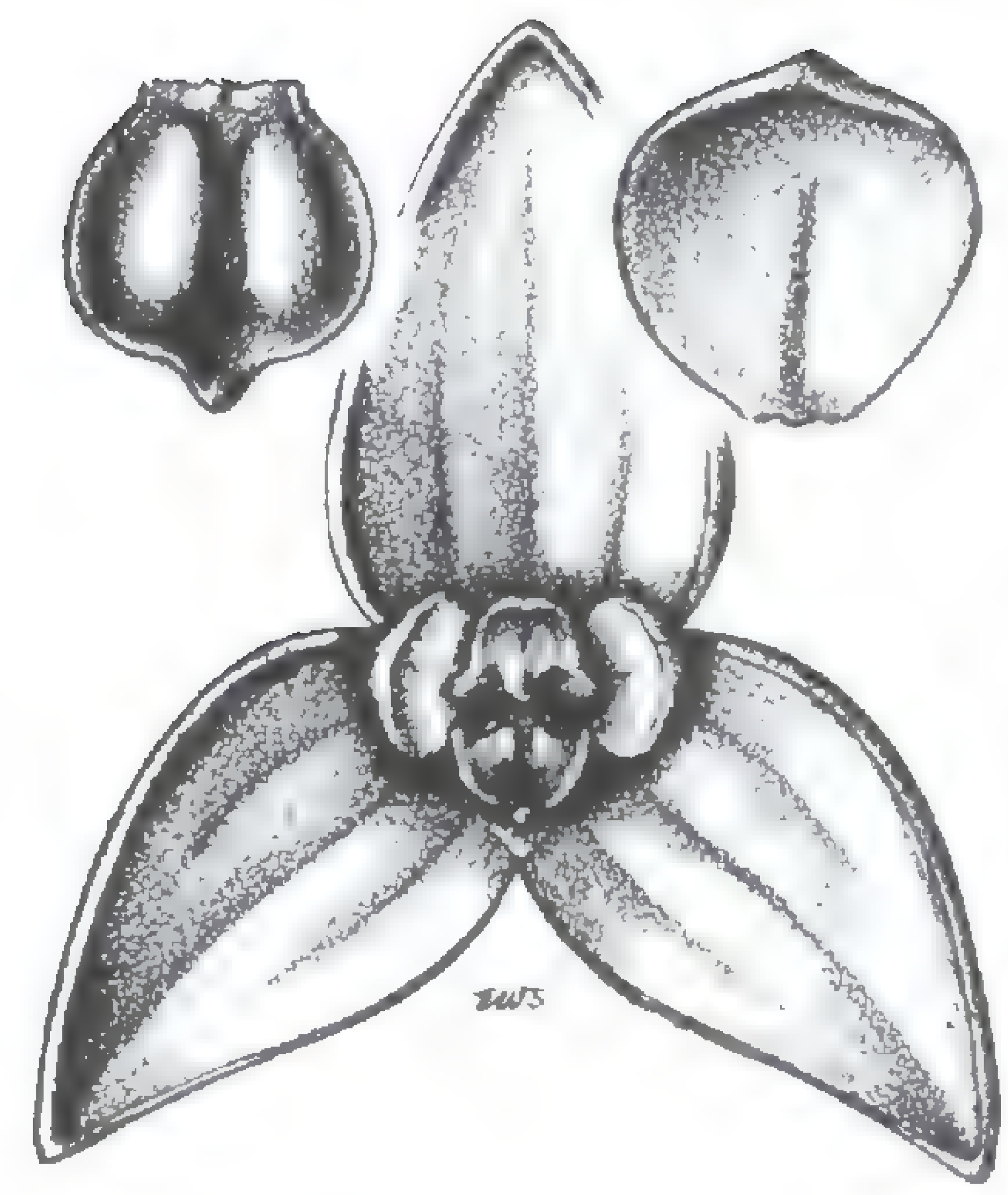


Stelis Jamesonii VII-r-7

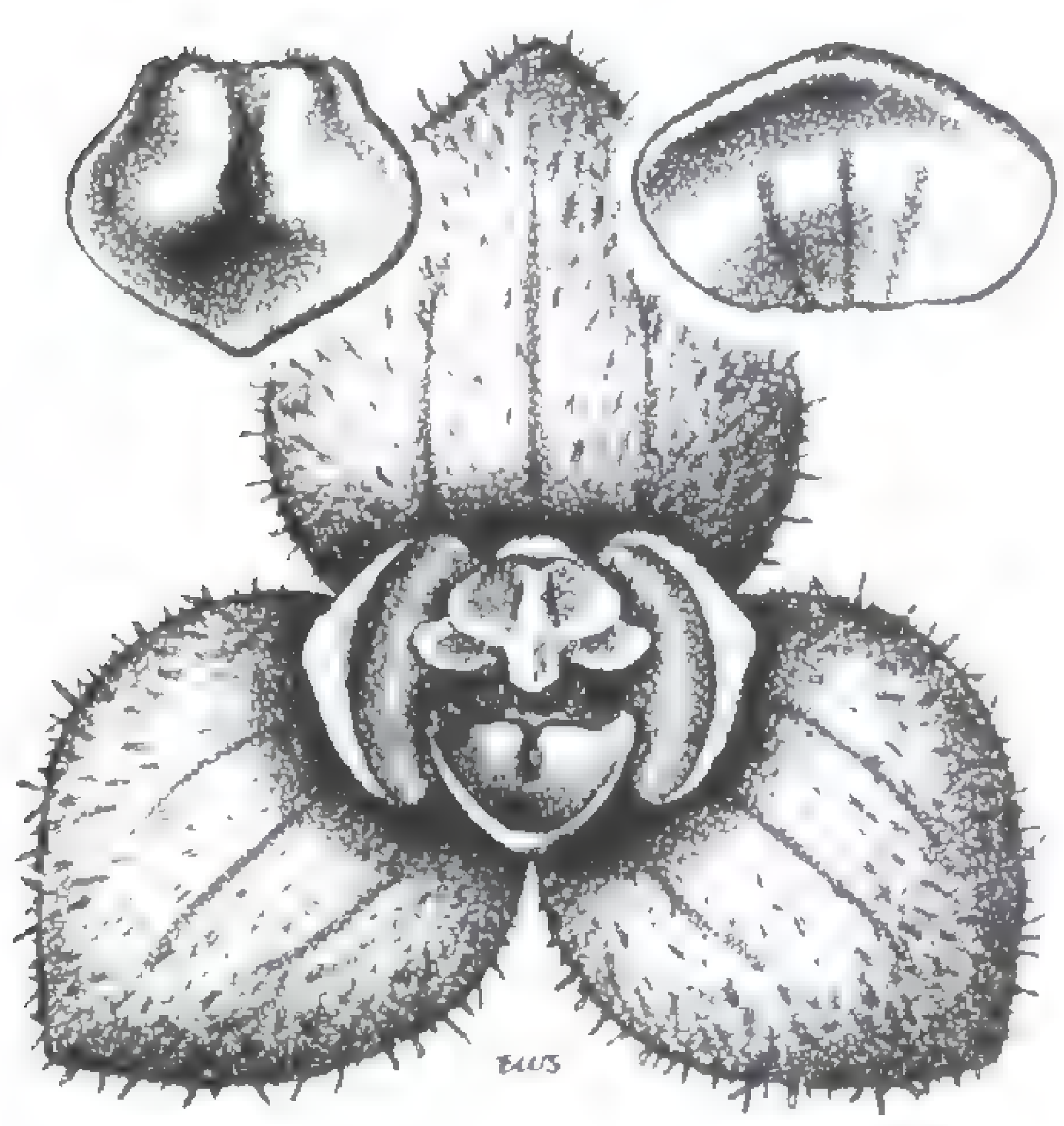
PLATE 69



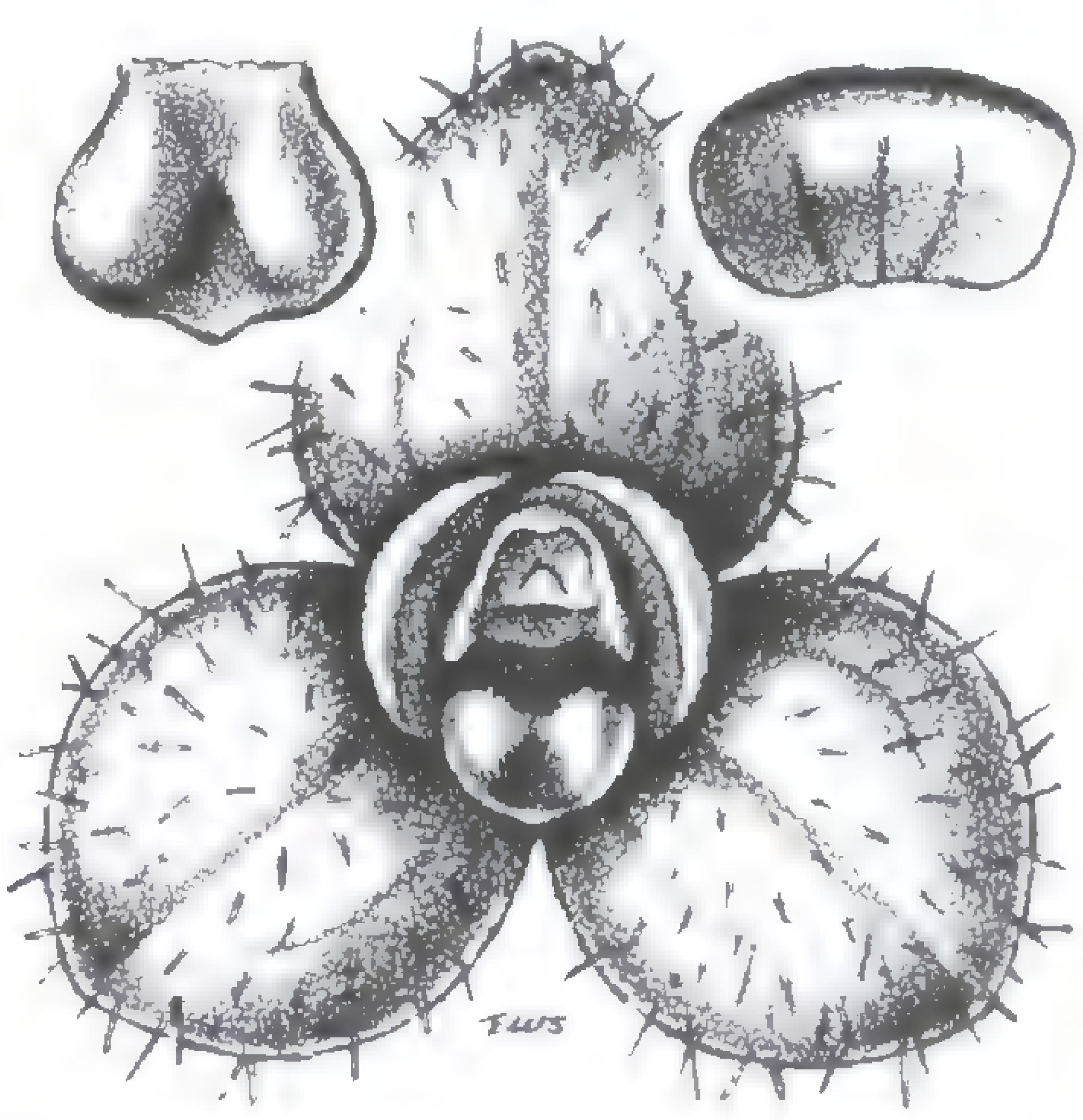
Stelis guianensis VII-c-8



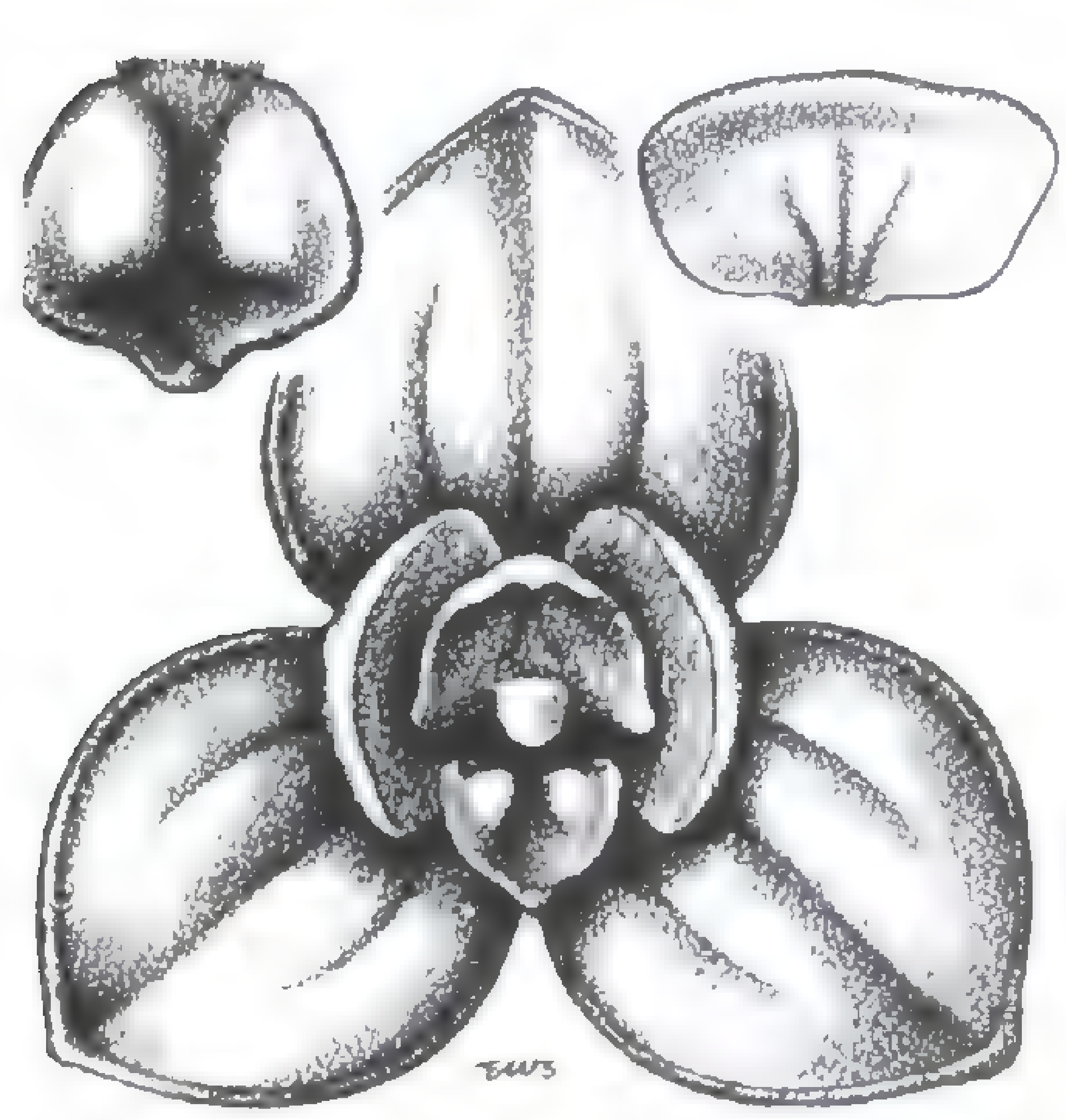
Stelis nitens VII-c-8



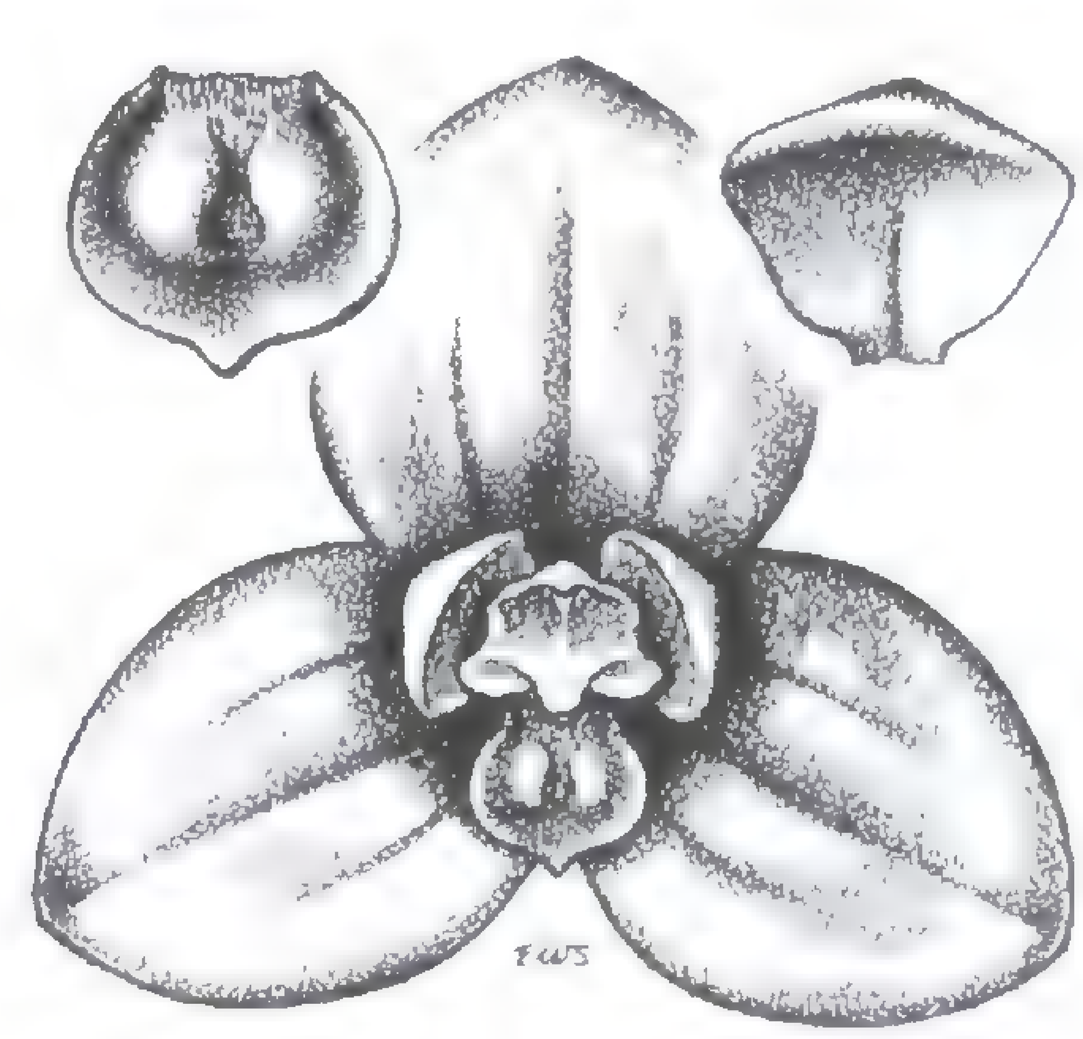
Stelis colombiana VII-c-8



Stelis pachystachya VII-c-8



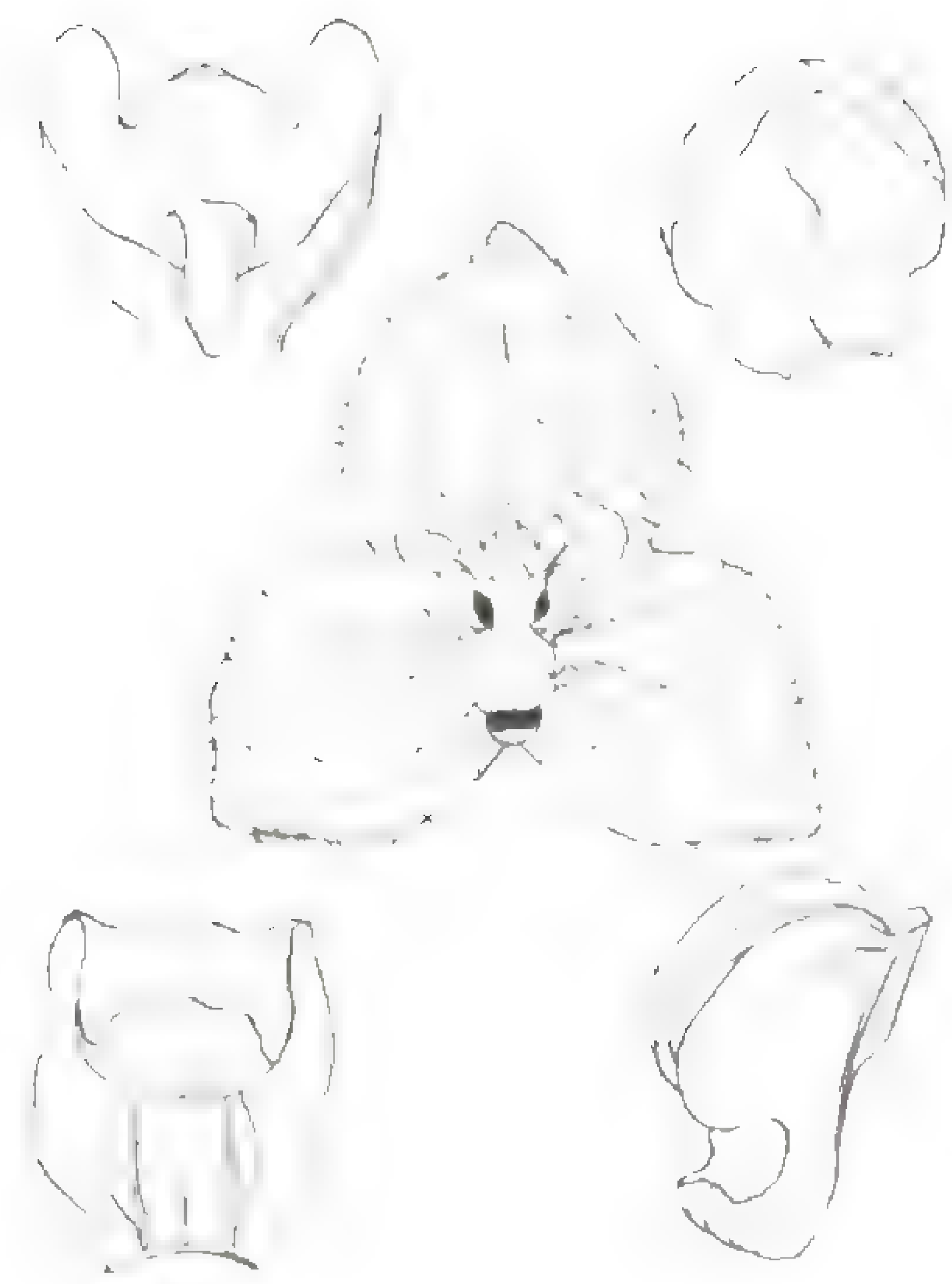
Stelis chabreana VII-r-8



Stelis apiculata VII-r-8

PLATE 70

Stelis michrochila VII-c-9



Stelis barbata VIII-c-9

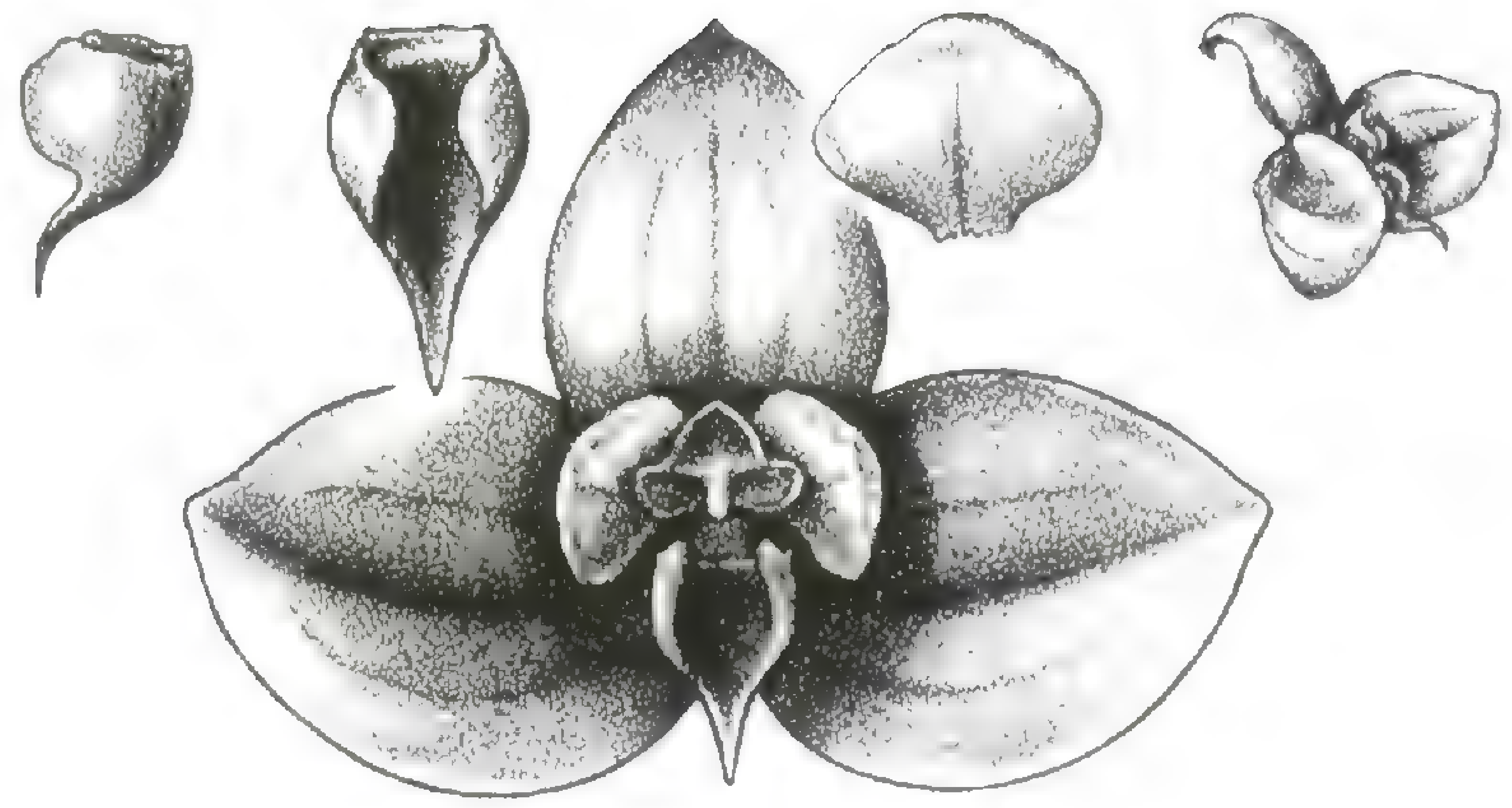
Stelis ovatilabia VIII-c-10

PLATE 71

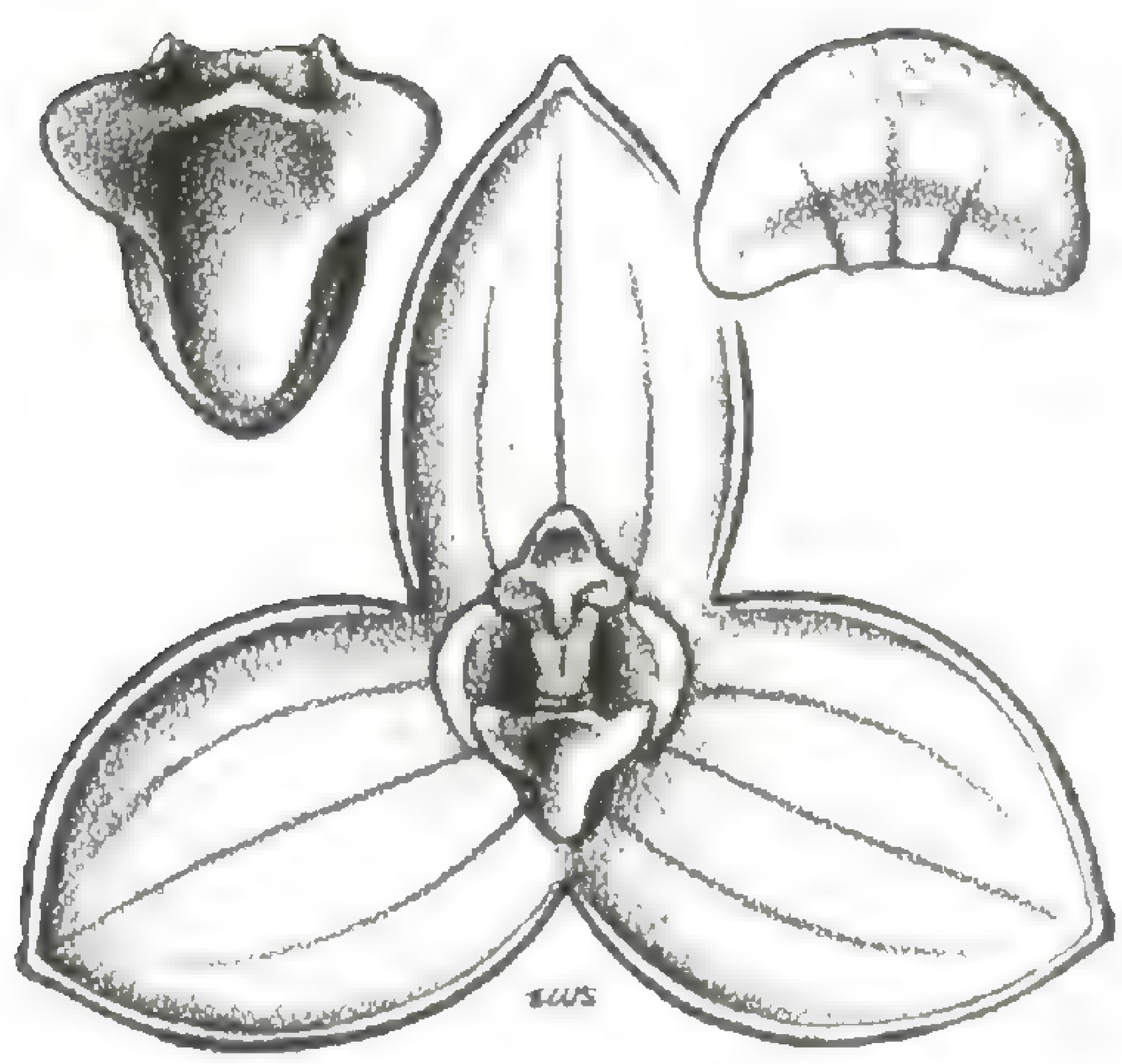
Stelis macra VIII-c-10

Stelis cyclopetala VIII-c-10

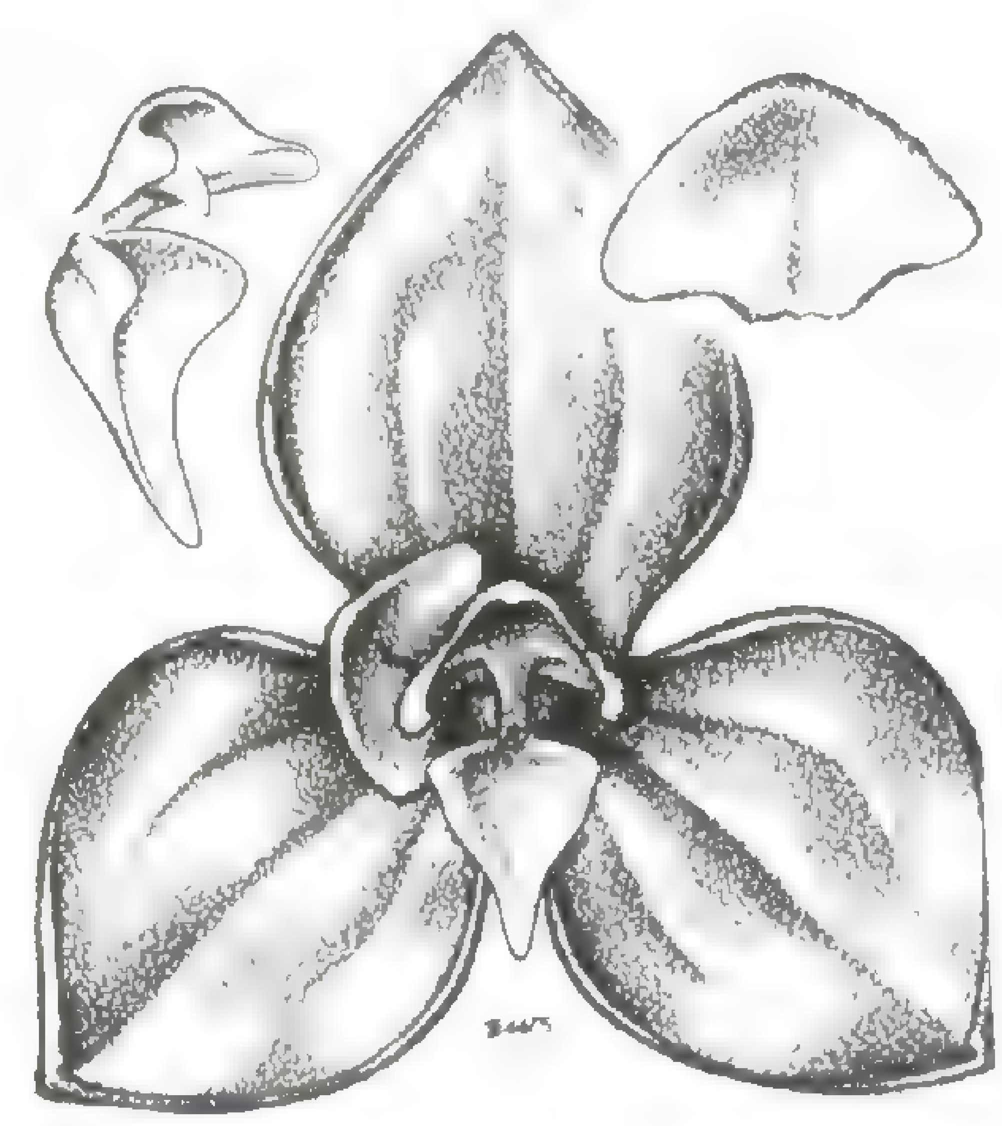
PLATE 72



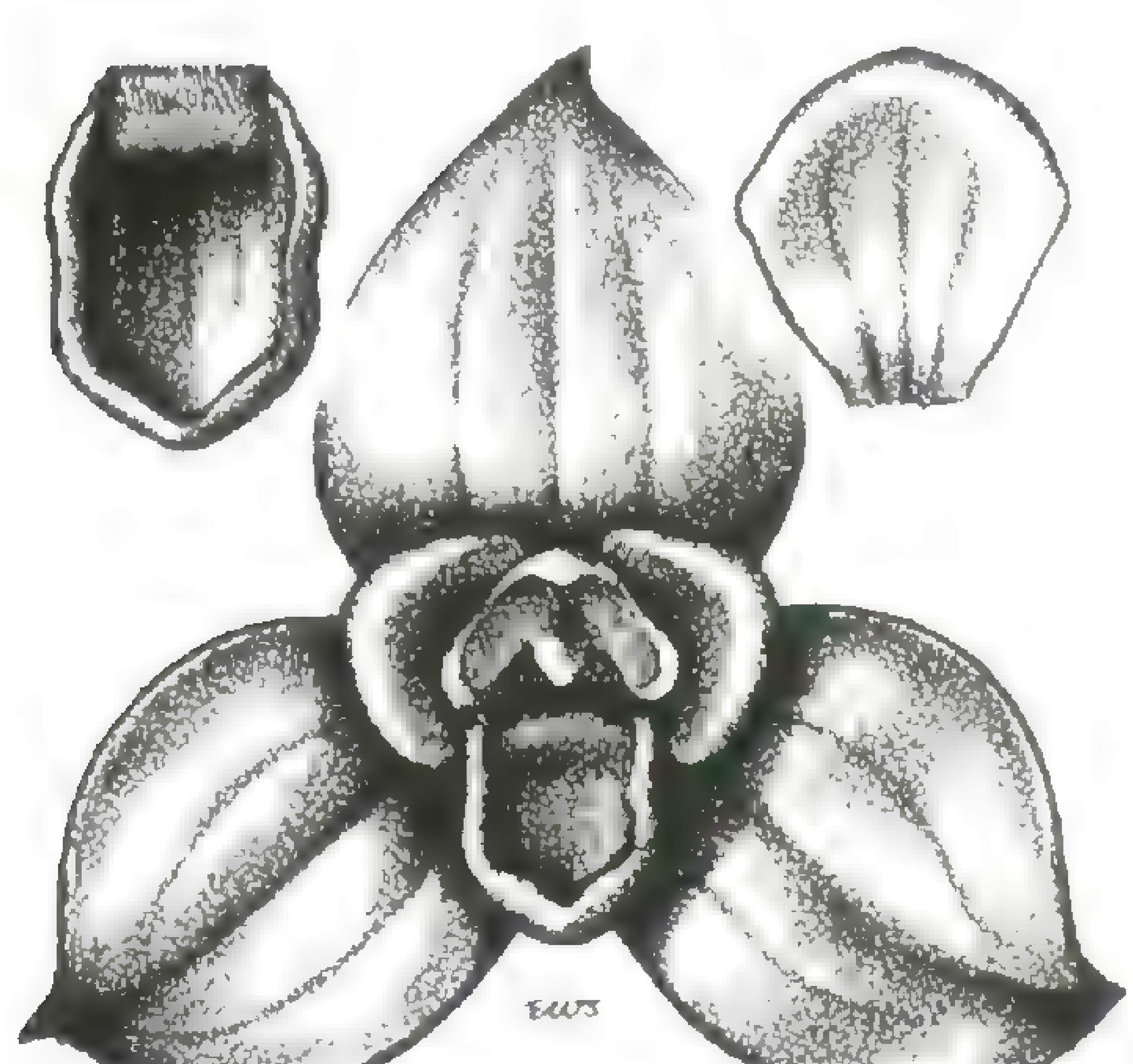
Stelis tenuipetala VIII-c-10



Stelis stenophylla VIII-c-10



Stelis Porpax VIII-c-10



Stelis calceolaris VIII-c-10

Stelis despectans VIII-c-11

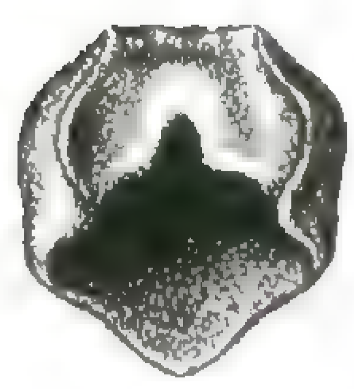
PLATE 73

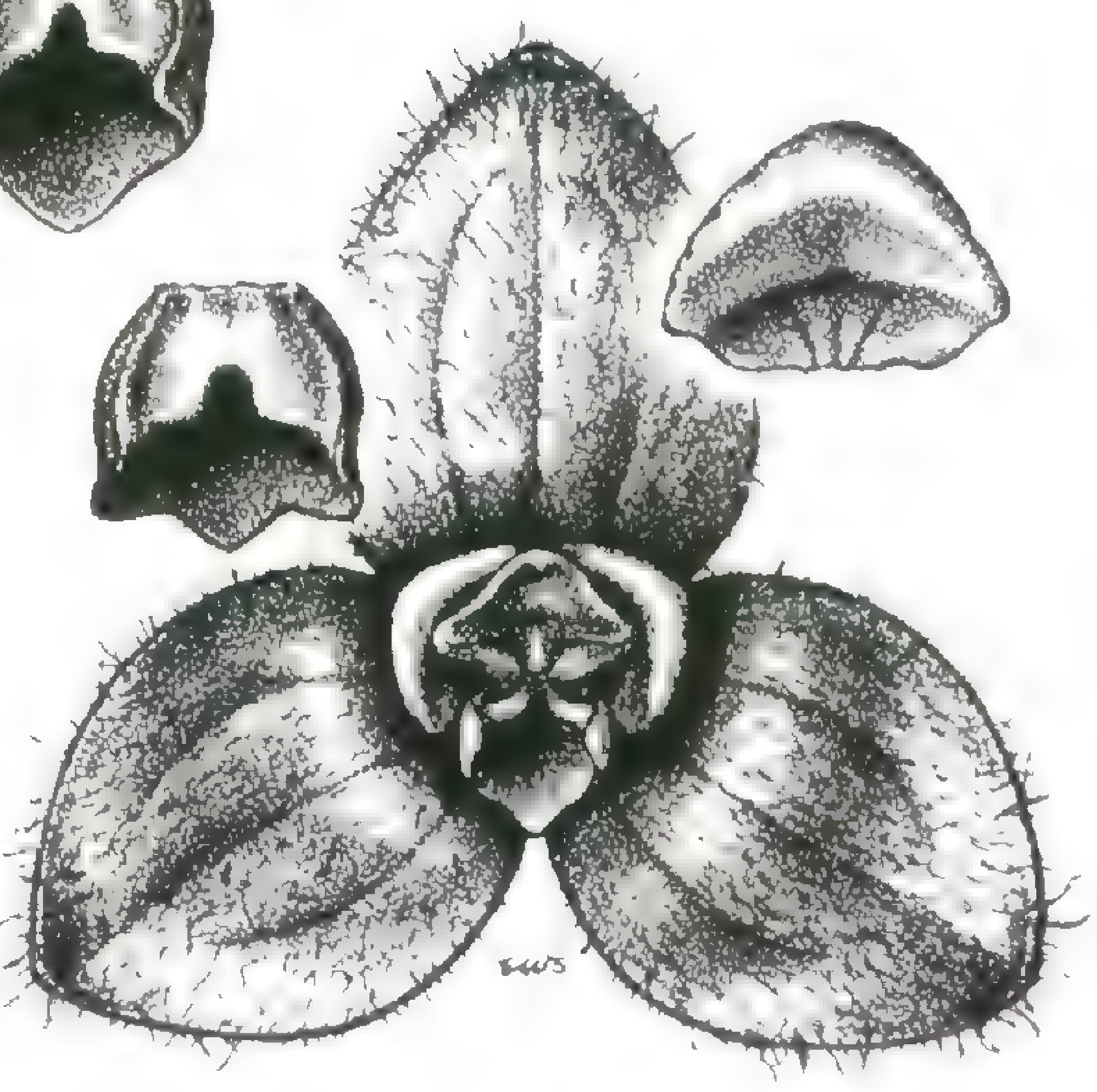
Stelis crystallina VIII-c-11

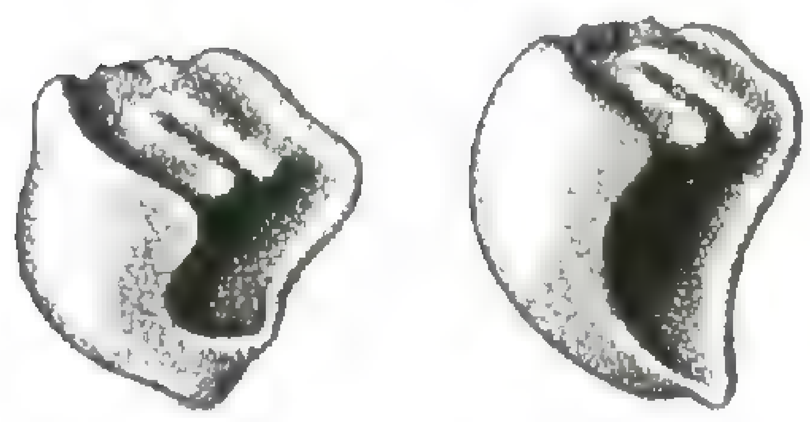
PLATE 74

Stelis lanata VIII-r-12

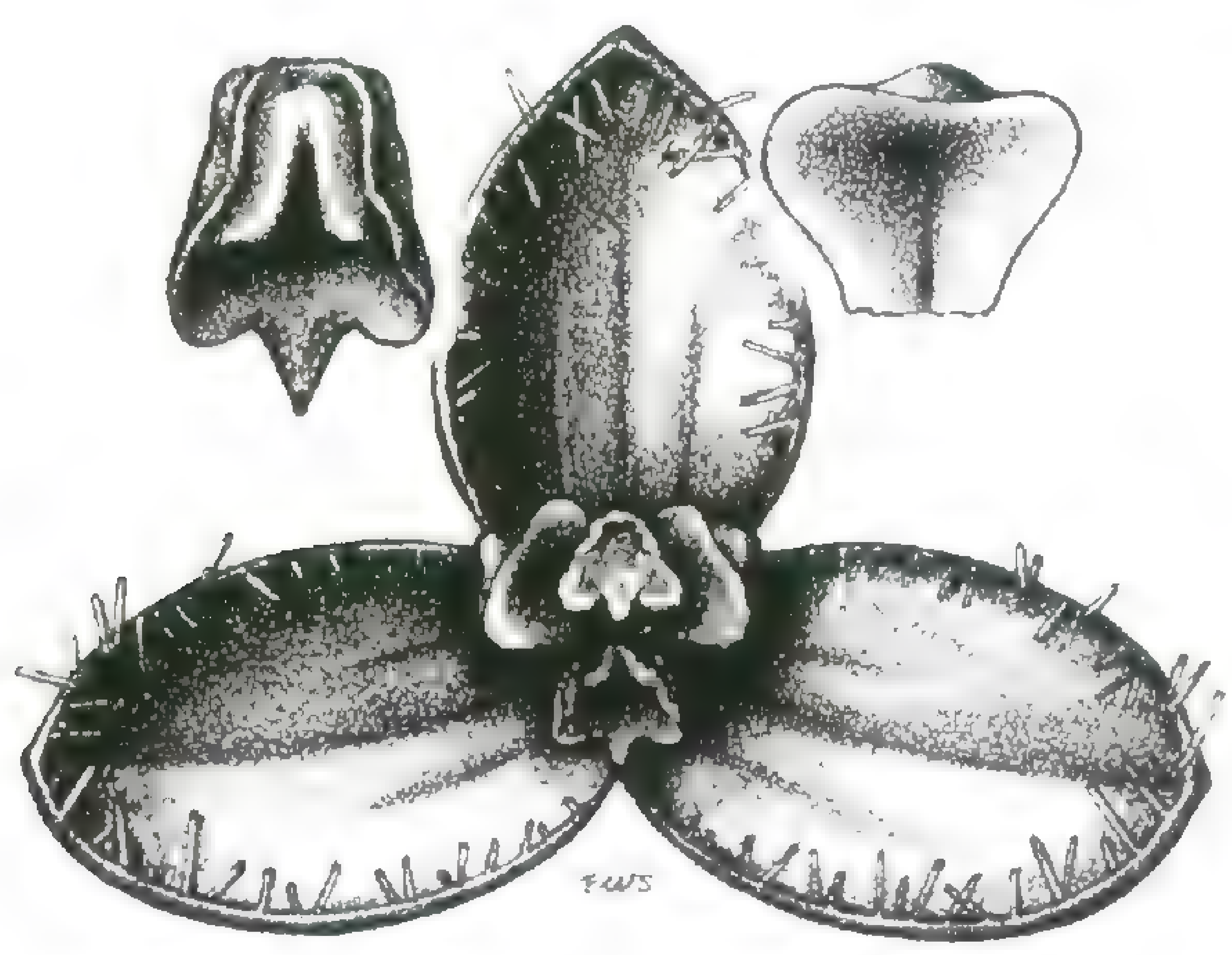
Stelis angustifolia VIII-c-12



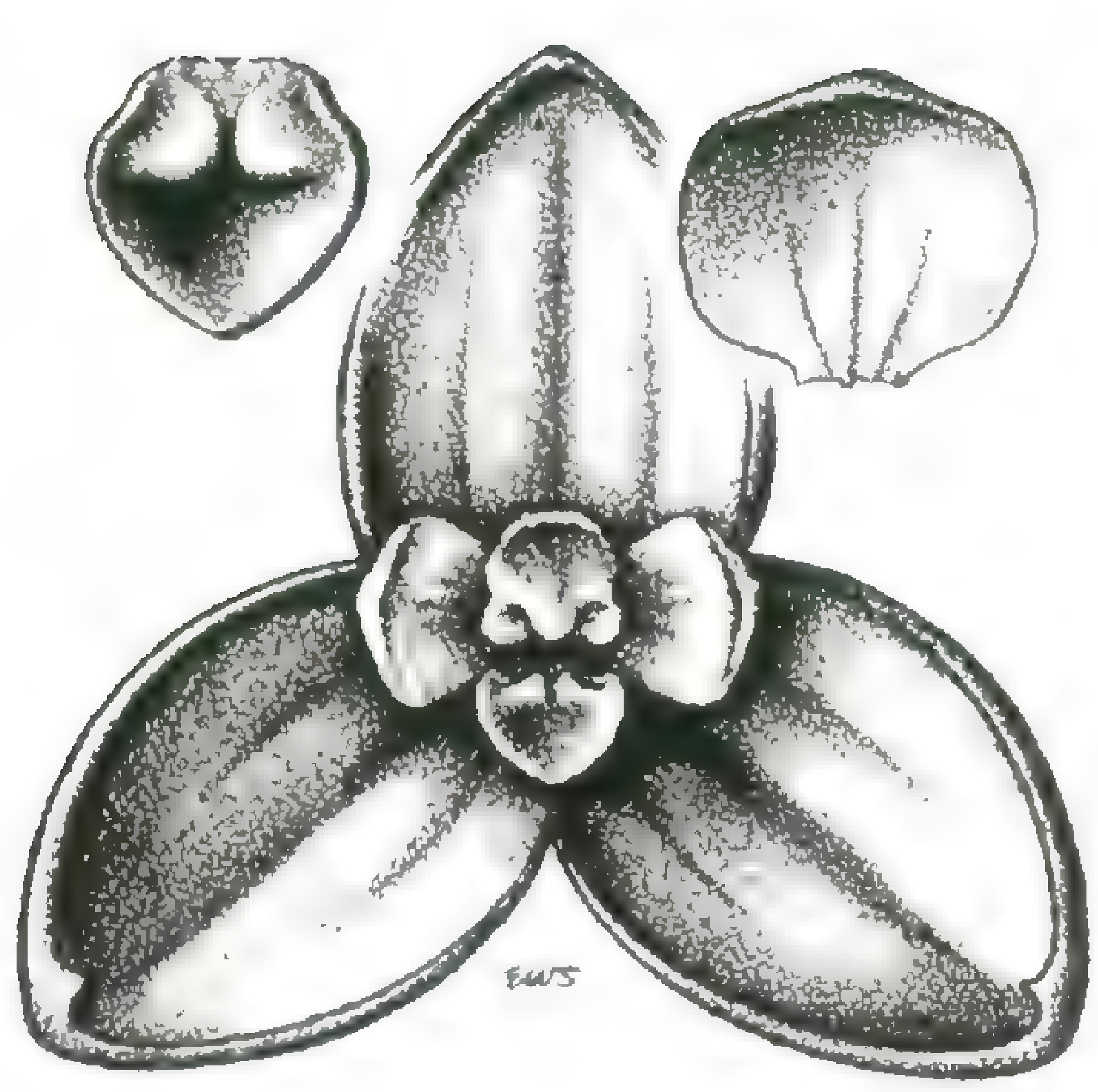




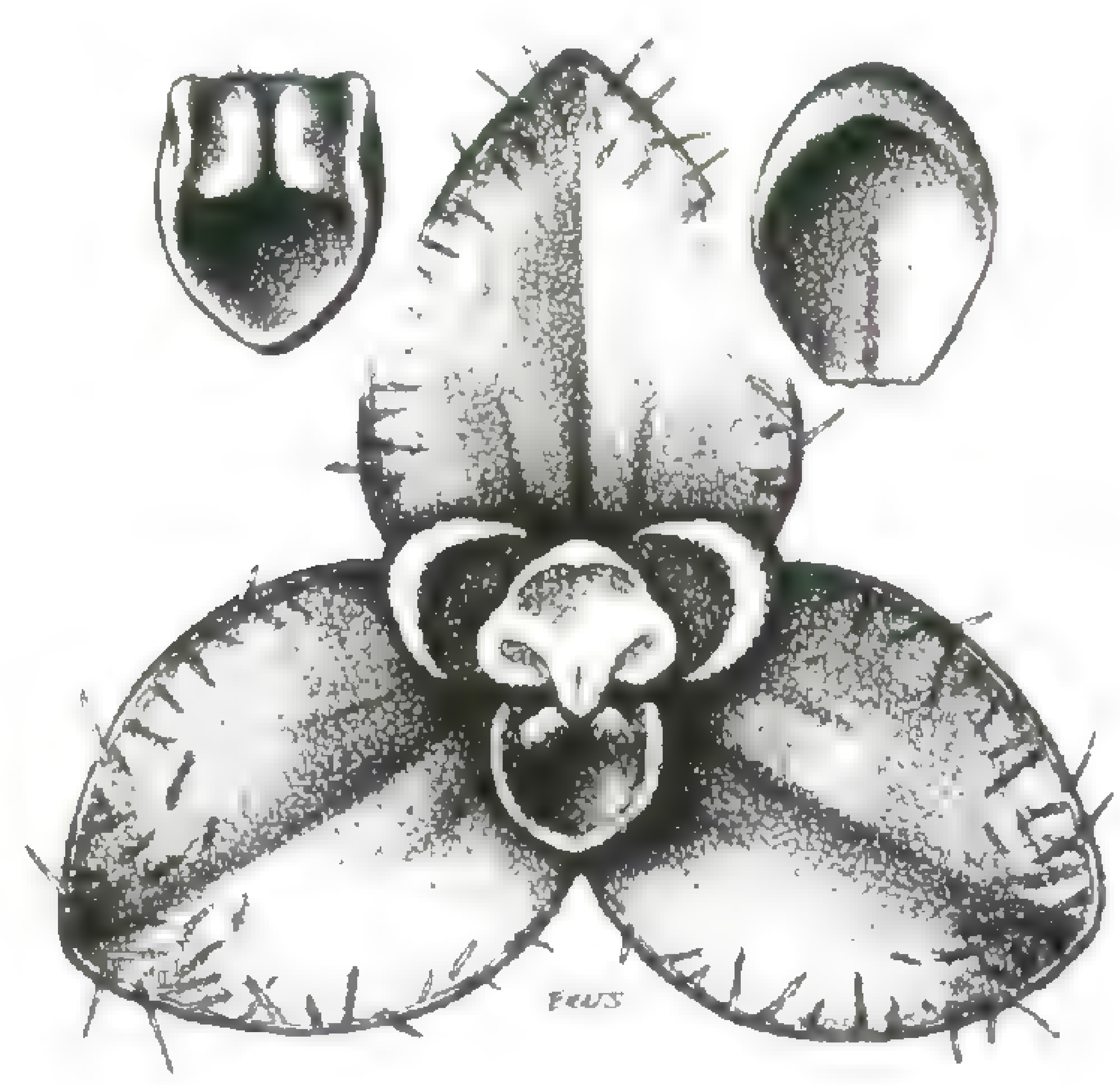
Stelis humilis VIII-c-12



Stelis euspatha VIII-c-12



Stelis parviflora VIII-c-12

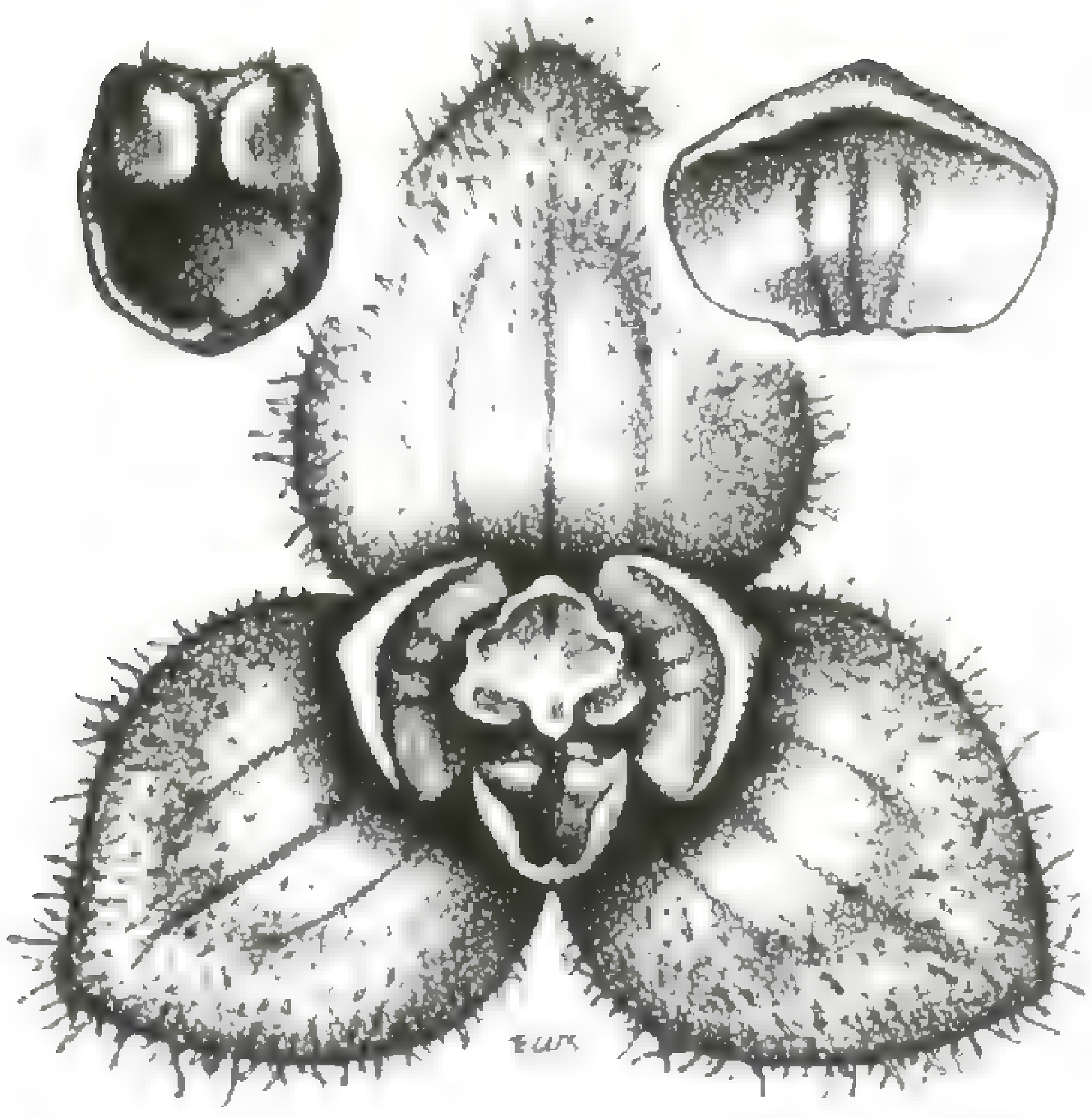


Stelis mononeura VIII-c-12

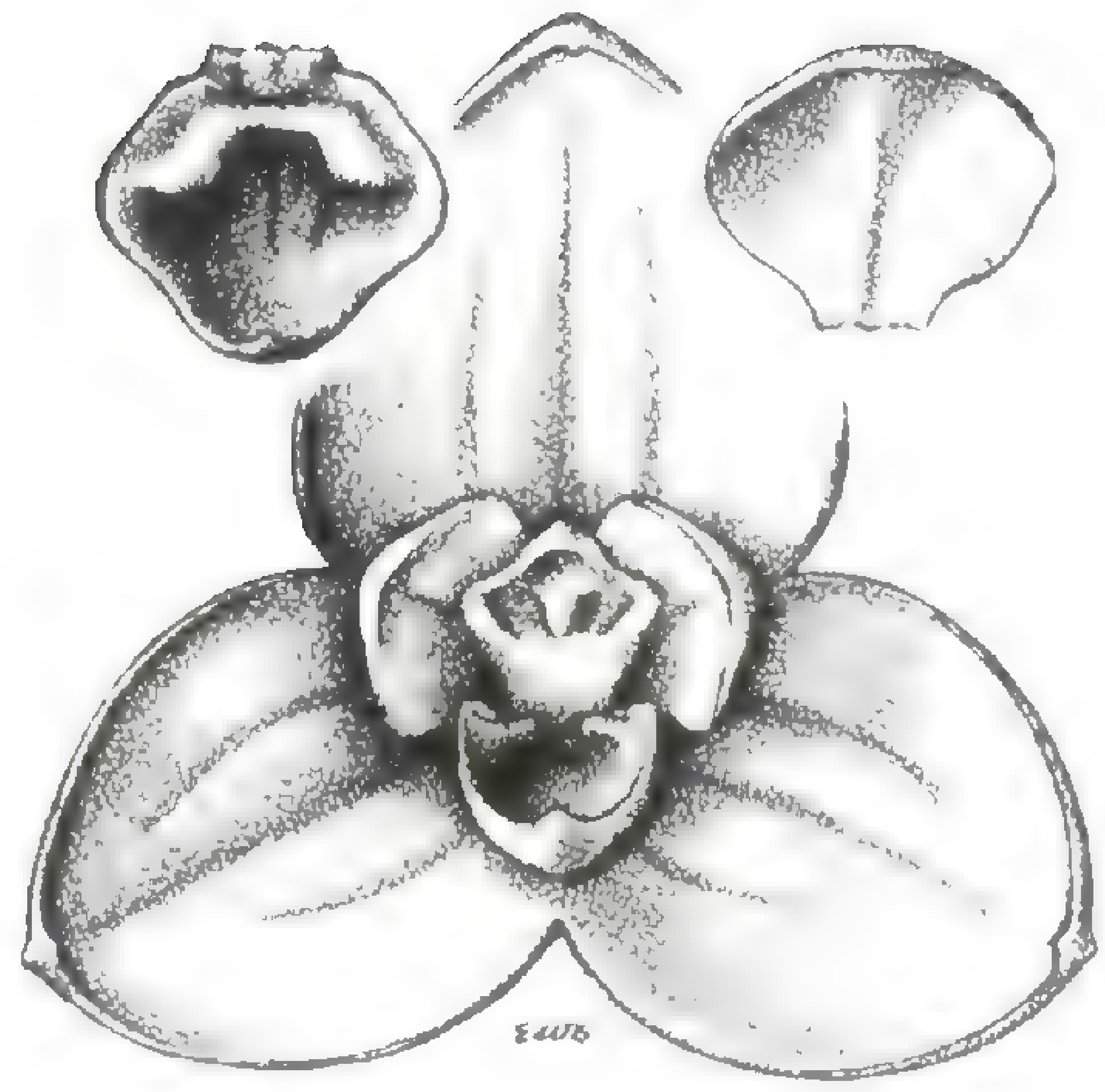
PLATE 75

Stelis planipetala VIII-c-12

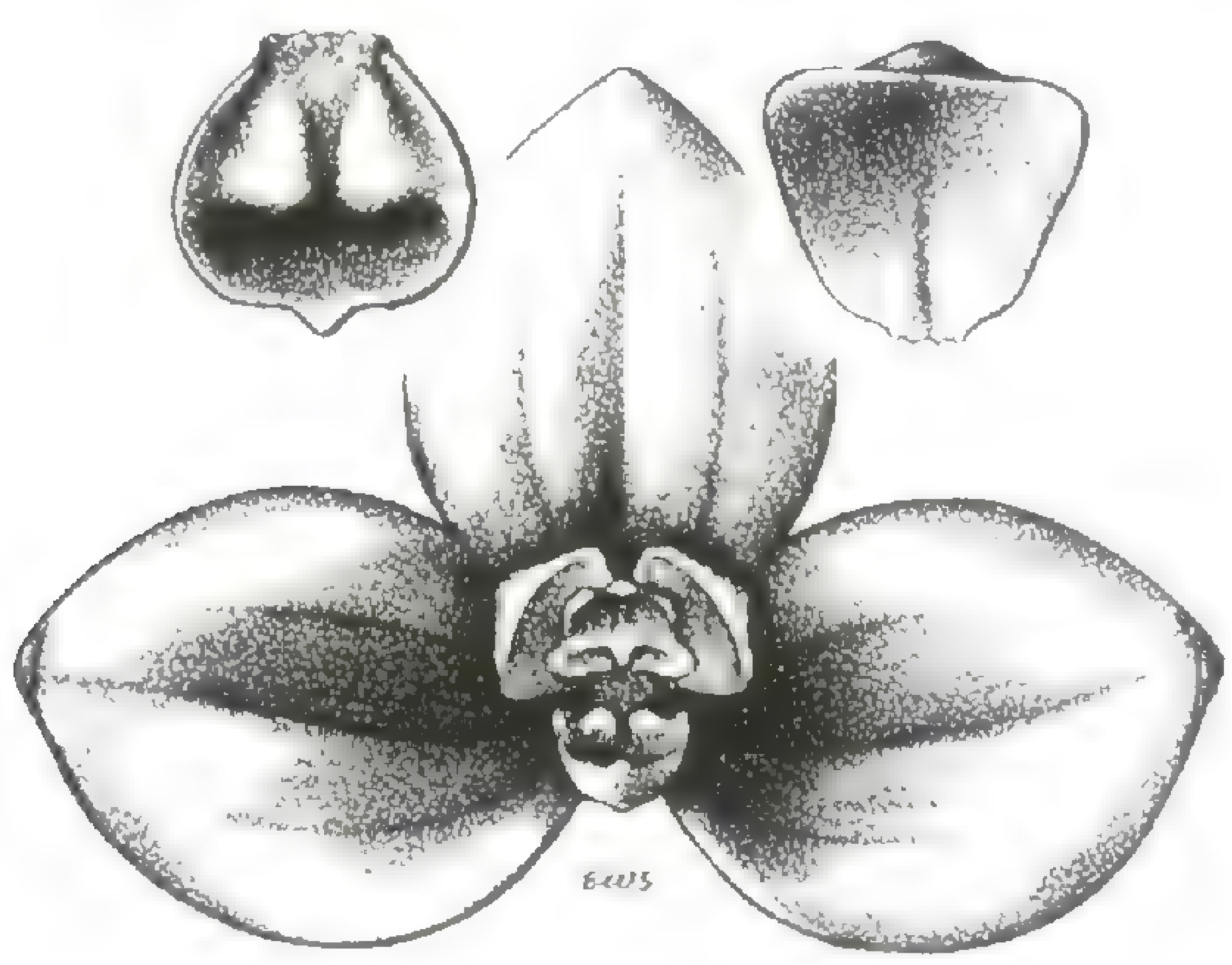
PLATE 76



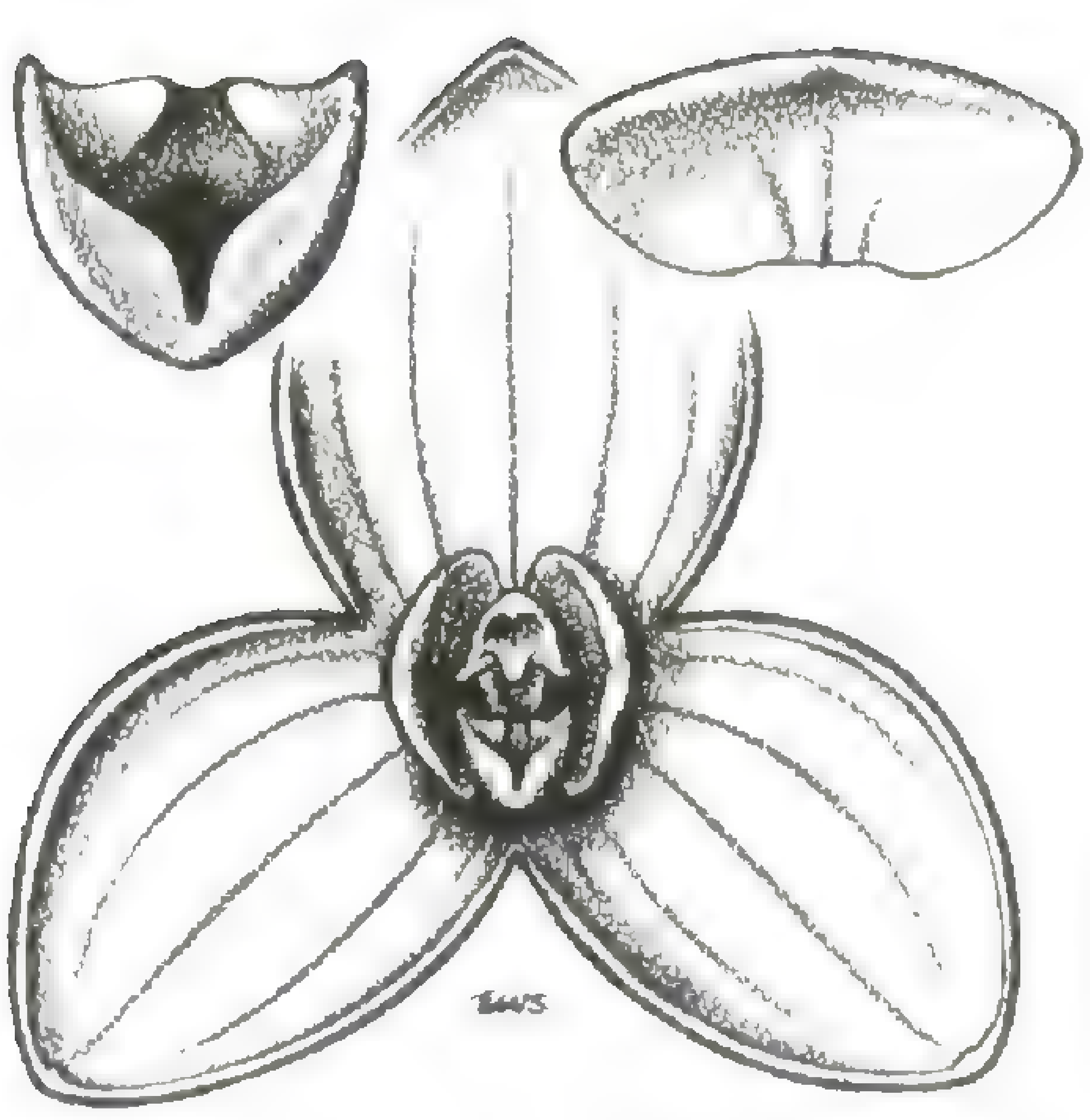
Stelis navicularis VIII-c-12



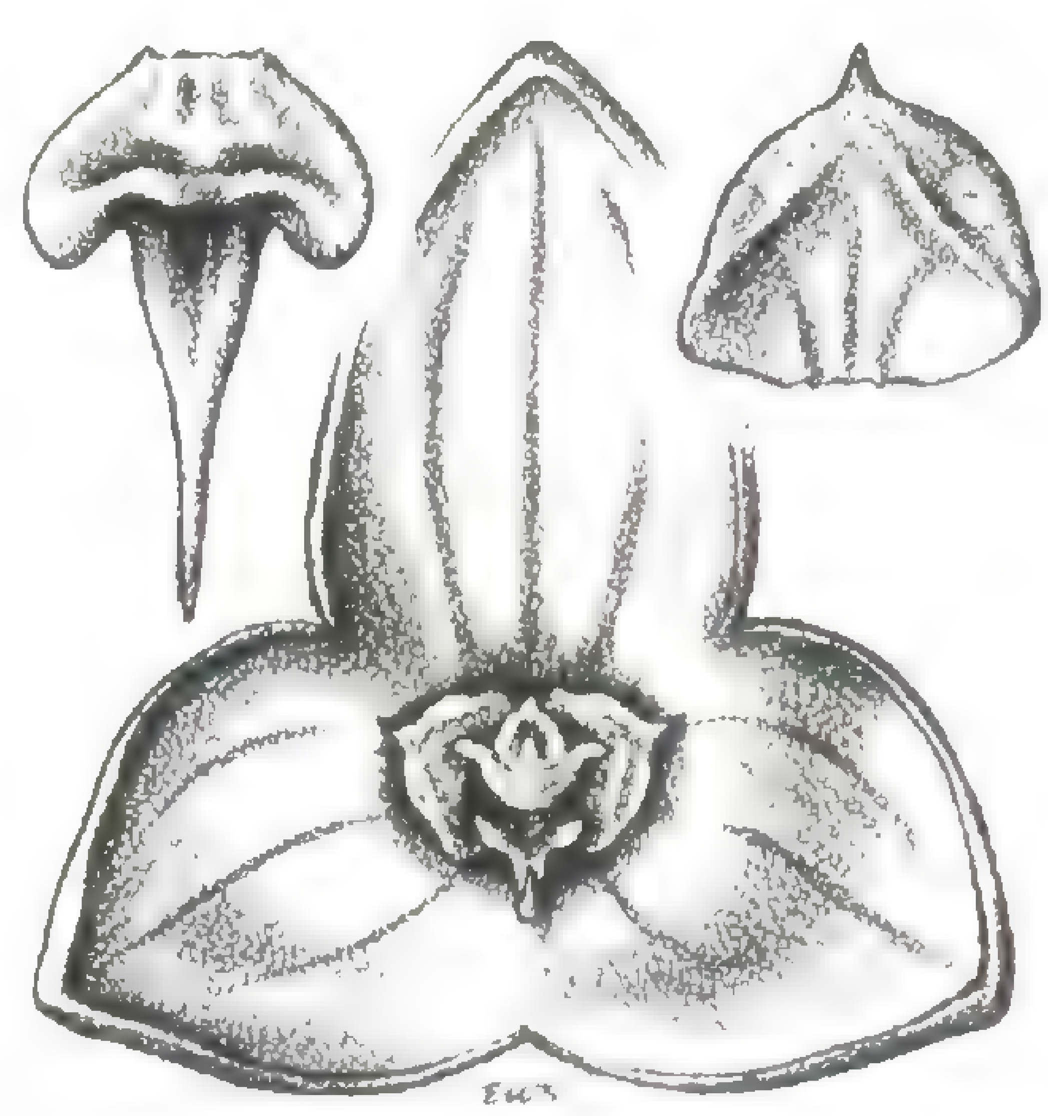
Stelis campanulifera VIII-r-12



Stelis lamellata VIII-r-12



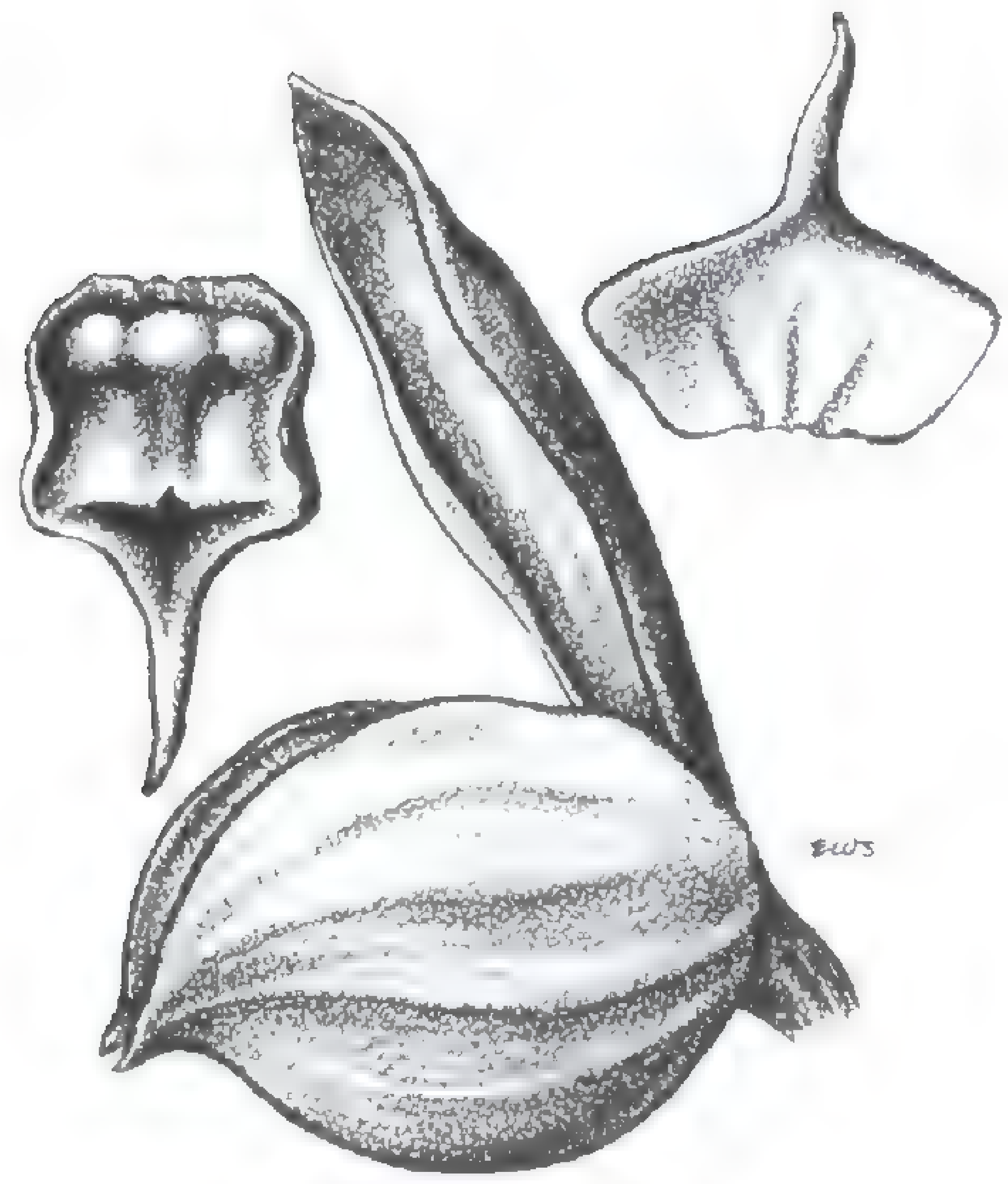
Stelis setacea VIII-r-12



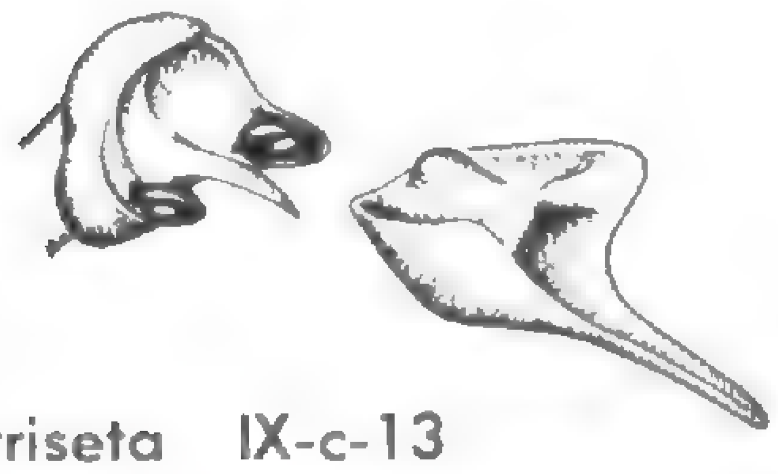
Stelis pugiunculi IX-c-13

PLATE 77

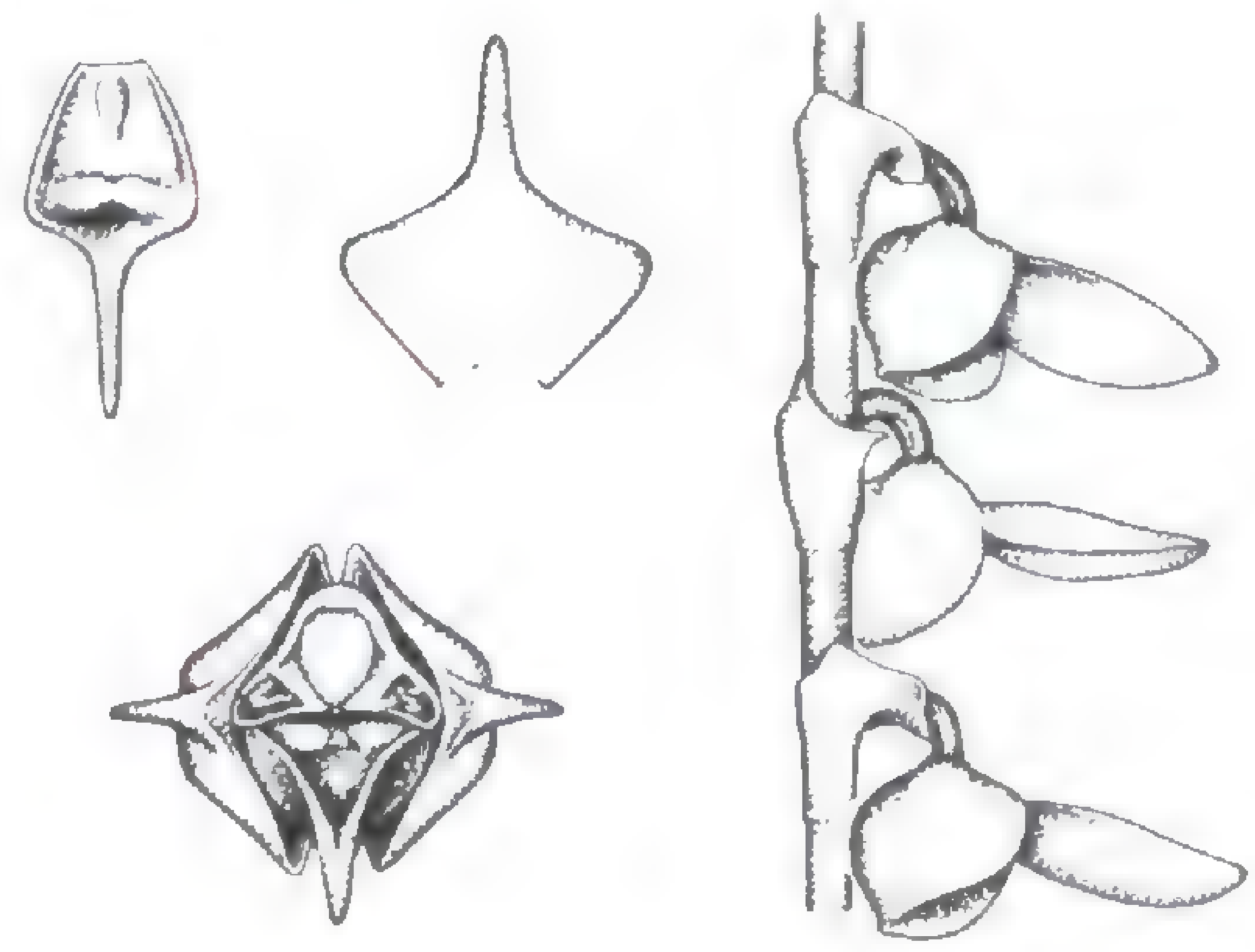
Stelis pardipes IX-c-13

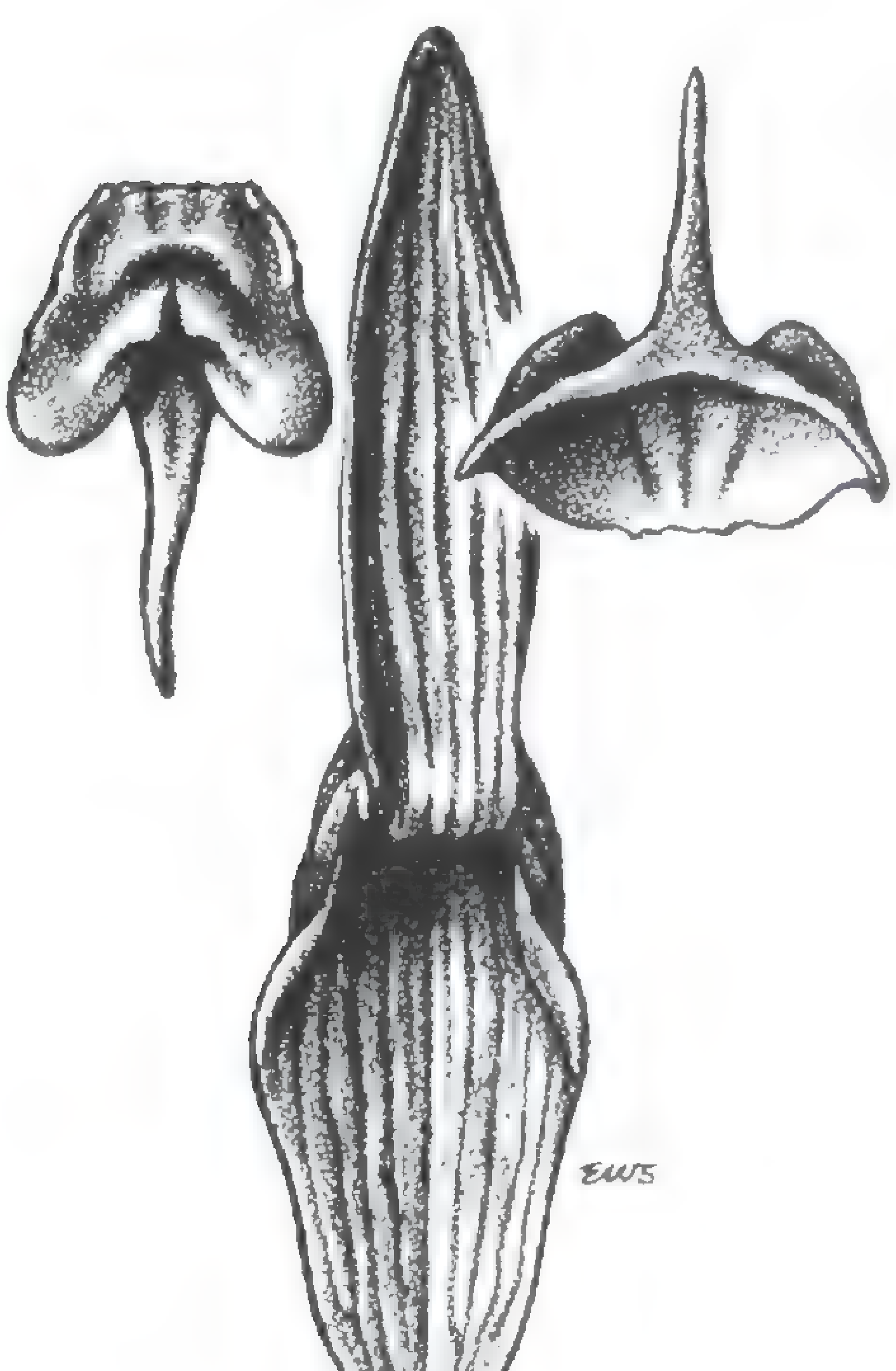


Stelis bicornis IX-c-13

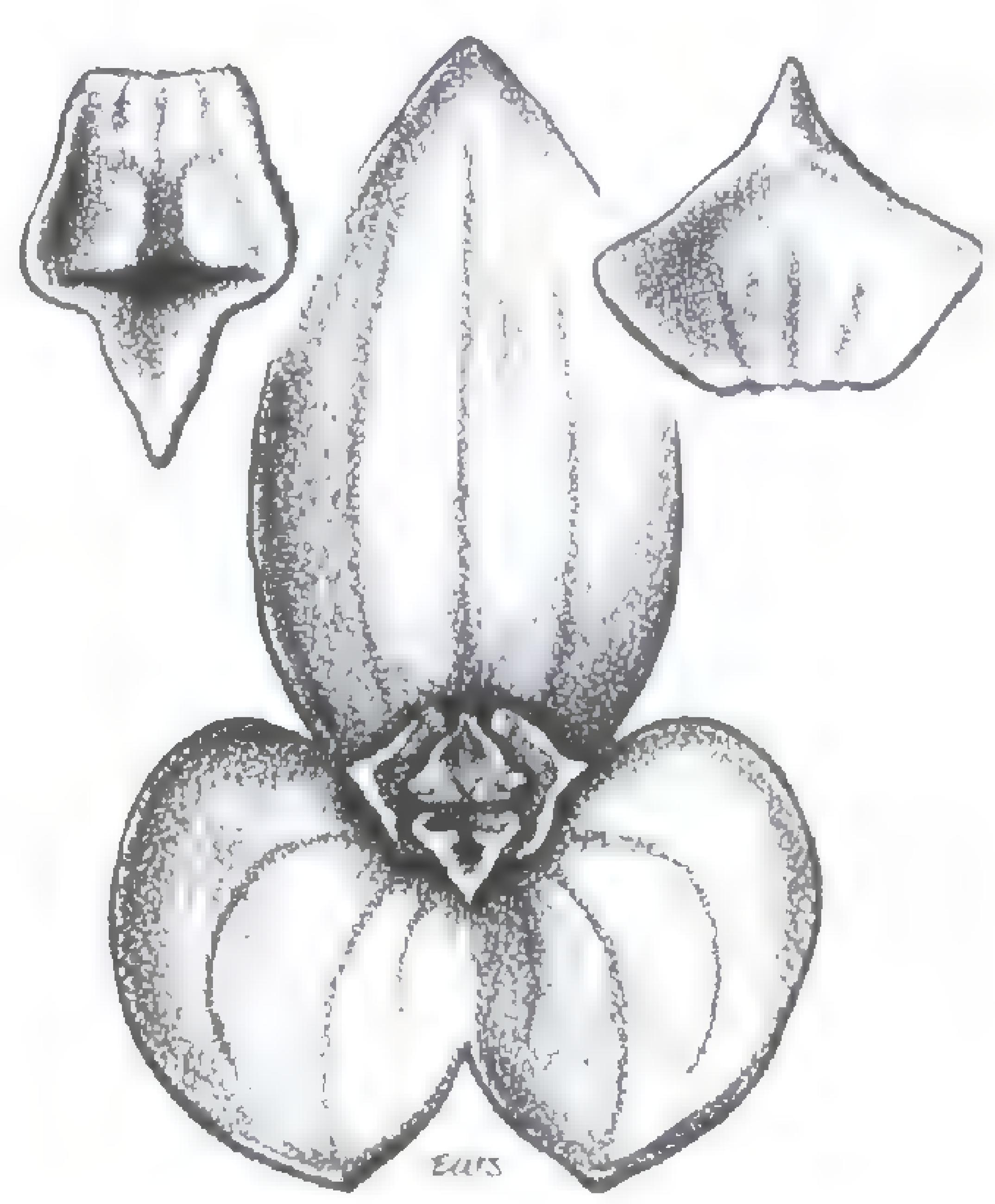


Stelis triseta IX-c-13



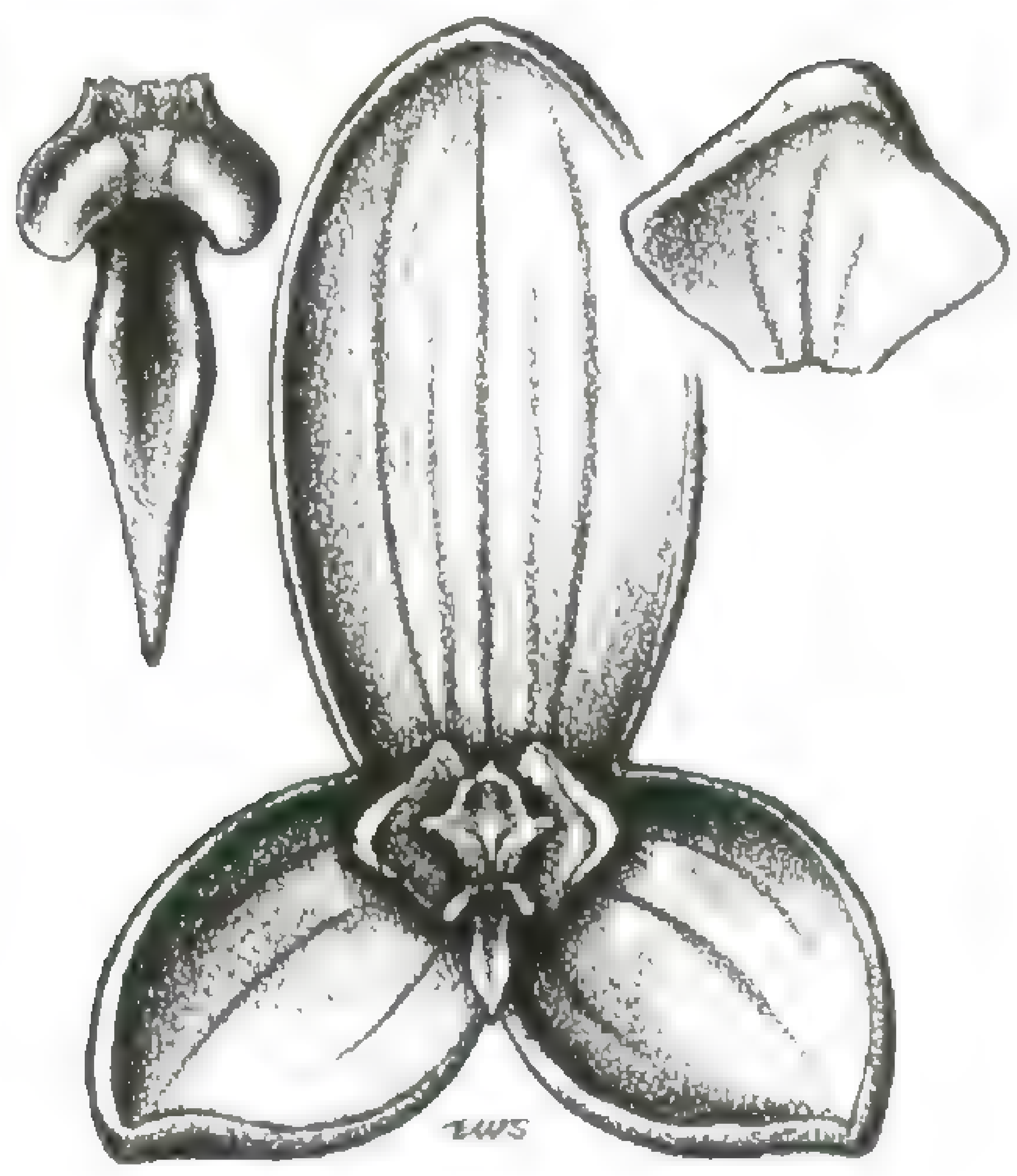


Stelis Langlassei IX-c-13

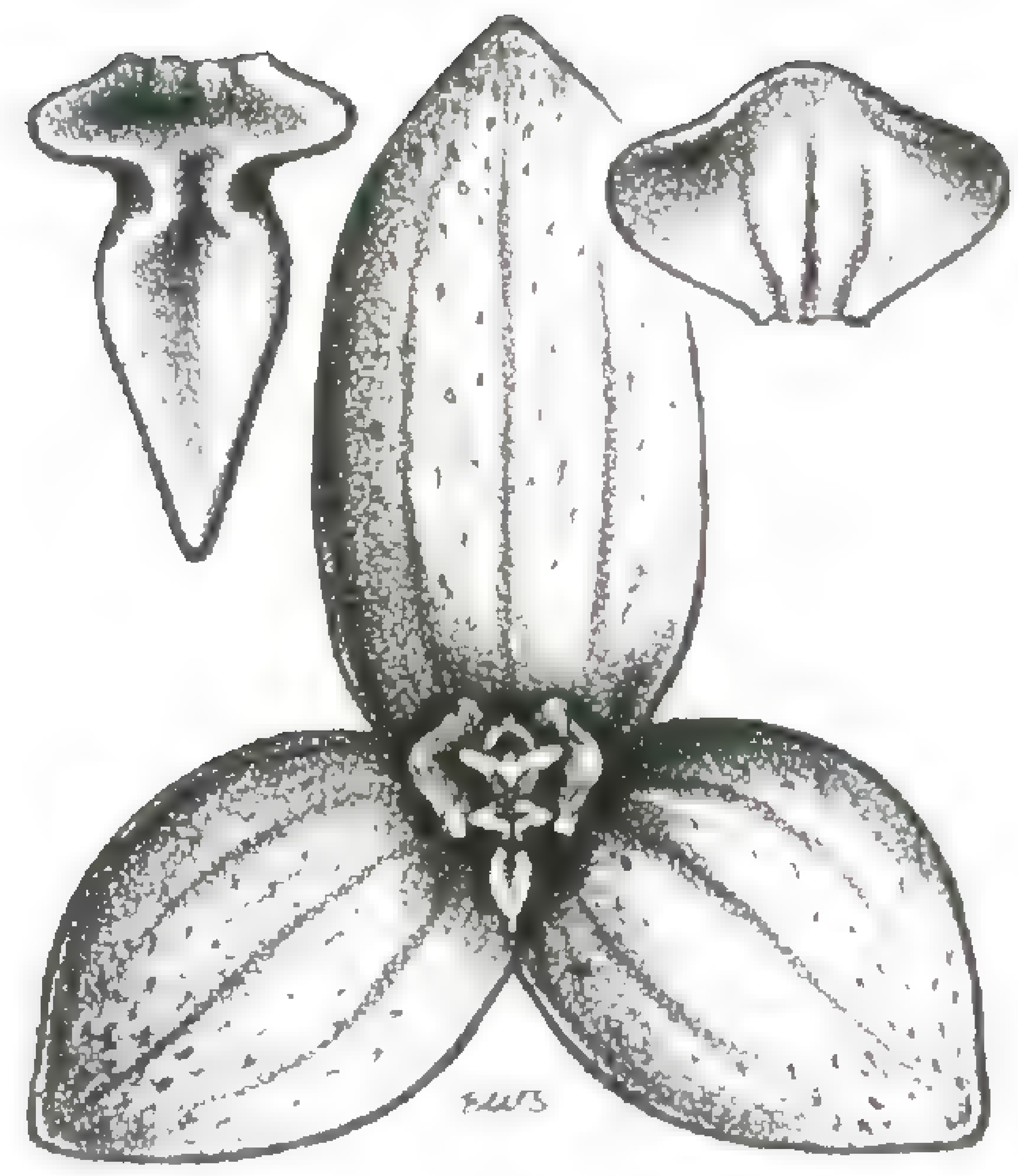


Stelis biserrula IX-c-13

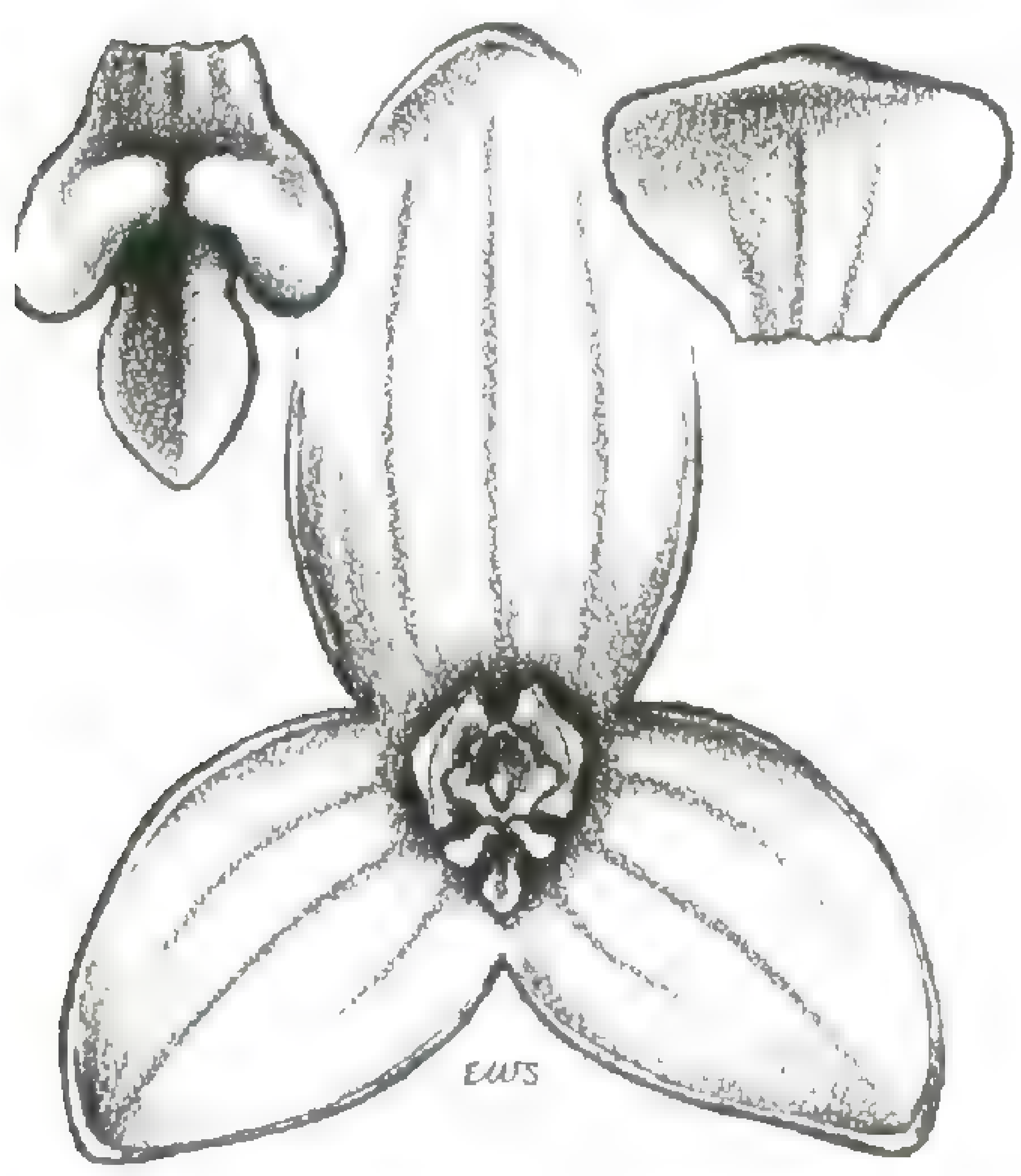
PLATE 78



Stelis piperina IX-r-14

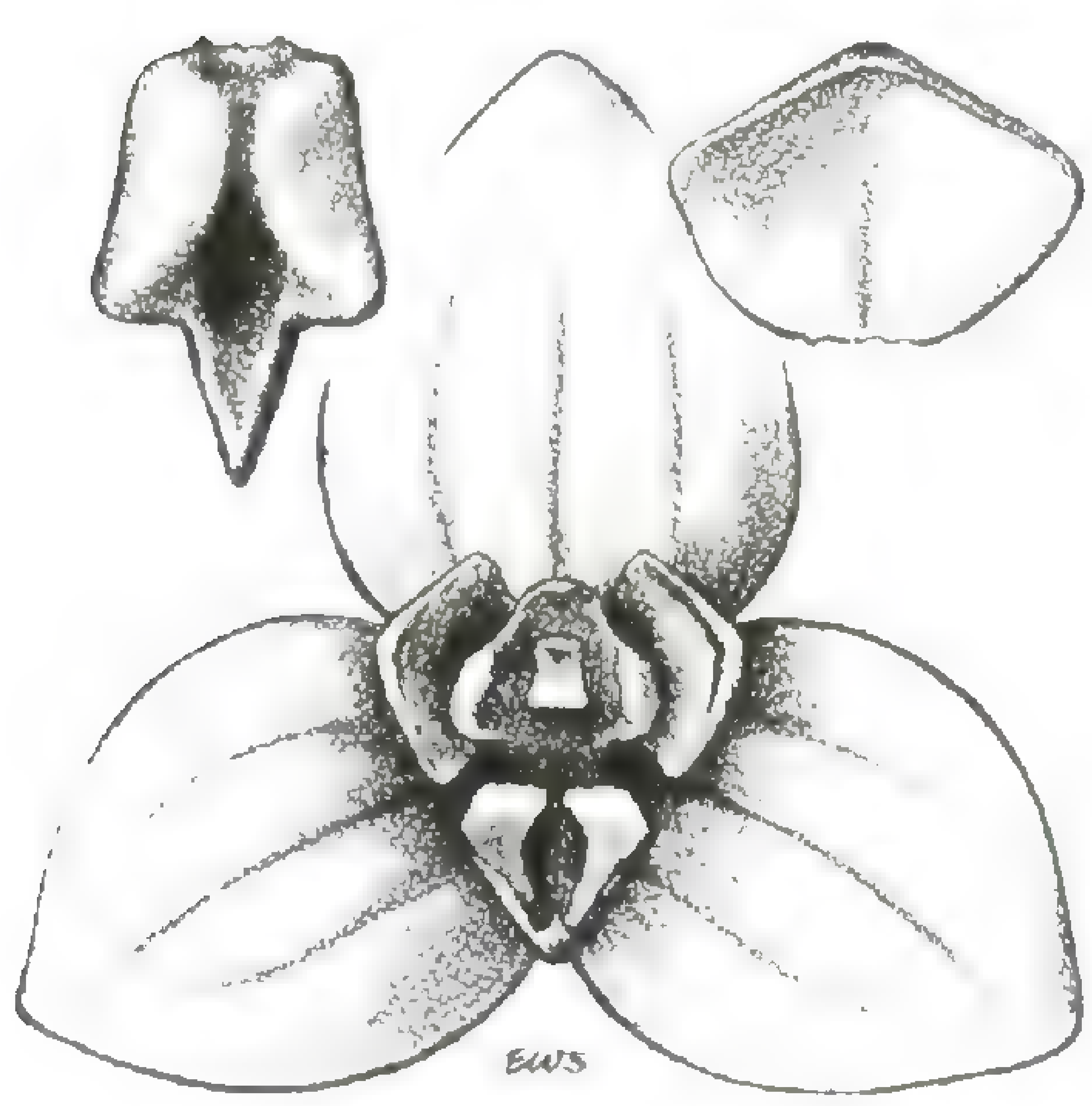


Stelis elongata IX-r-14

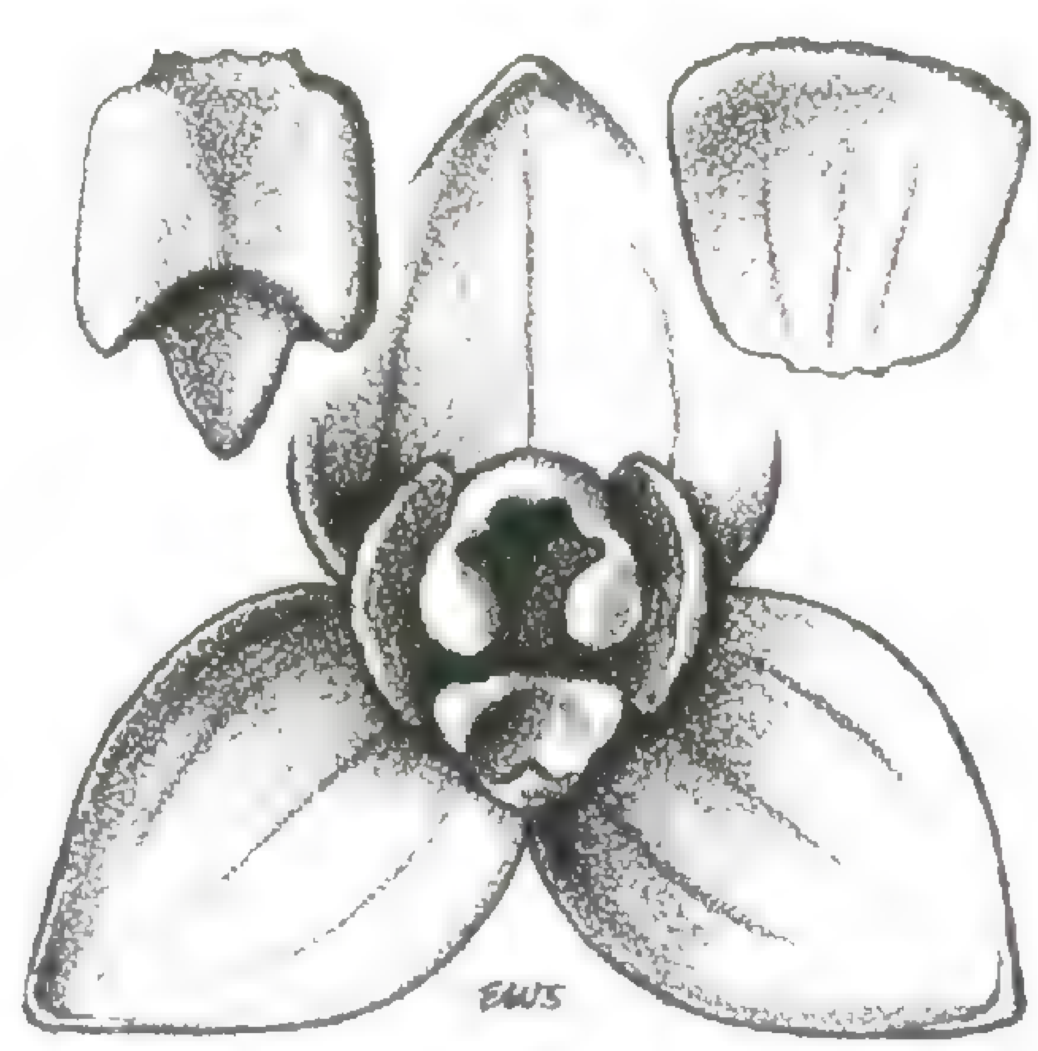


Stelis brevilabris IX-r-14

Stelis cuspidata X-c-15



Stelis aprica X-c-15

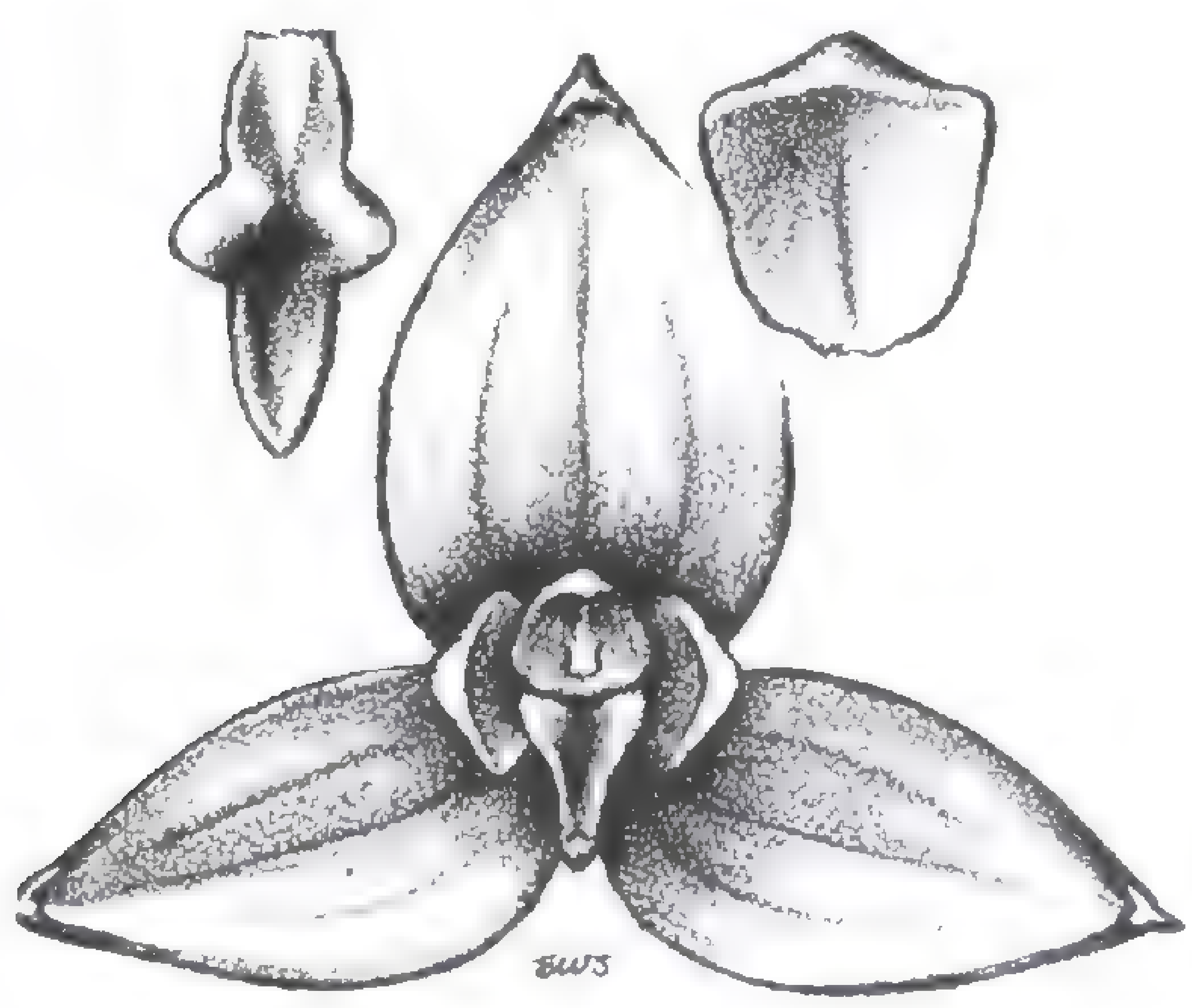


Stelis perpusilliflora X-c-15

PLATE 79

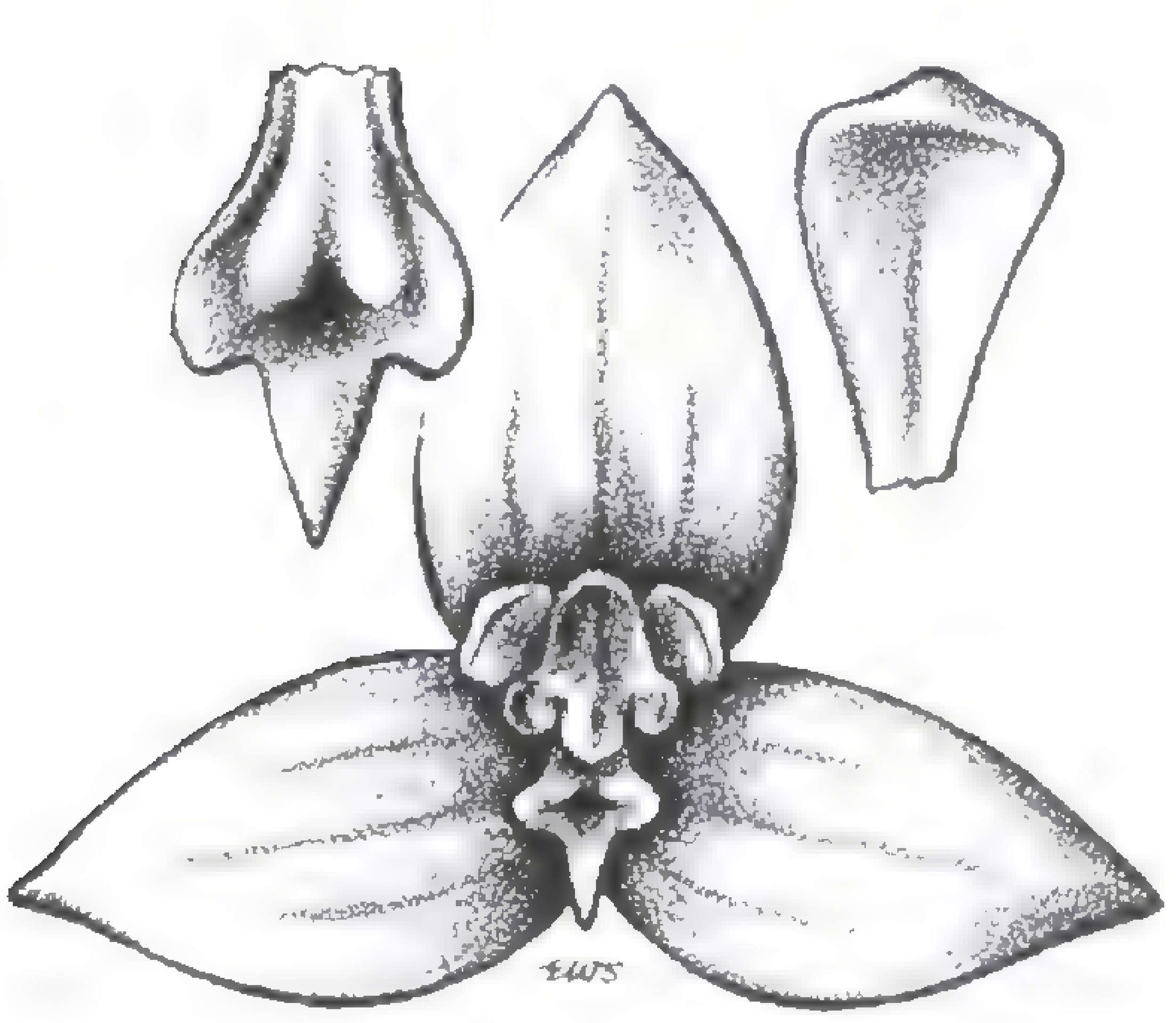
Stelis catharinensis X-c-15

Stelis guatemalensis X-c-15



Stelis repens X-r-15

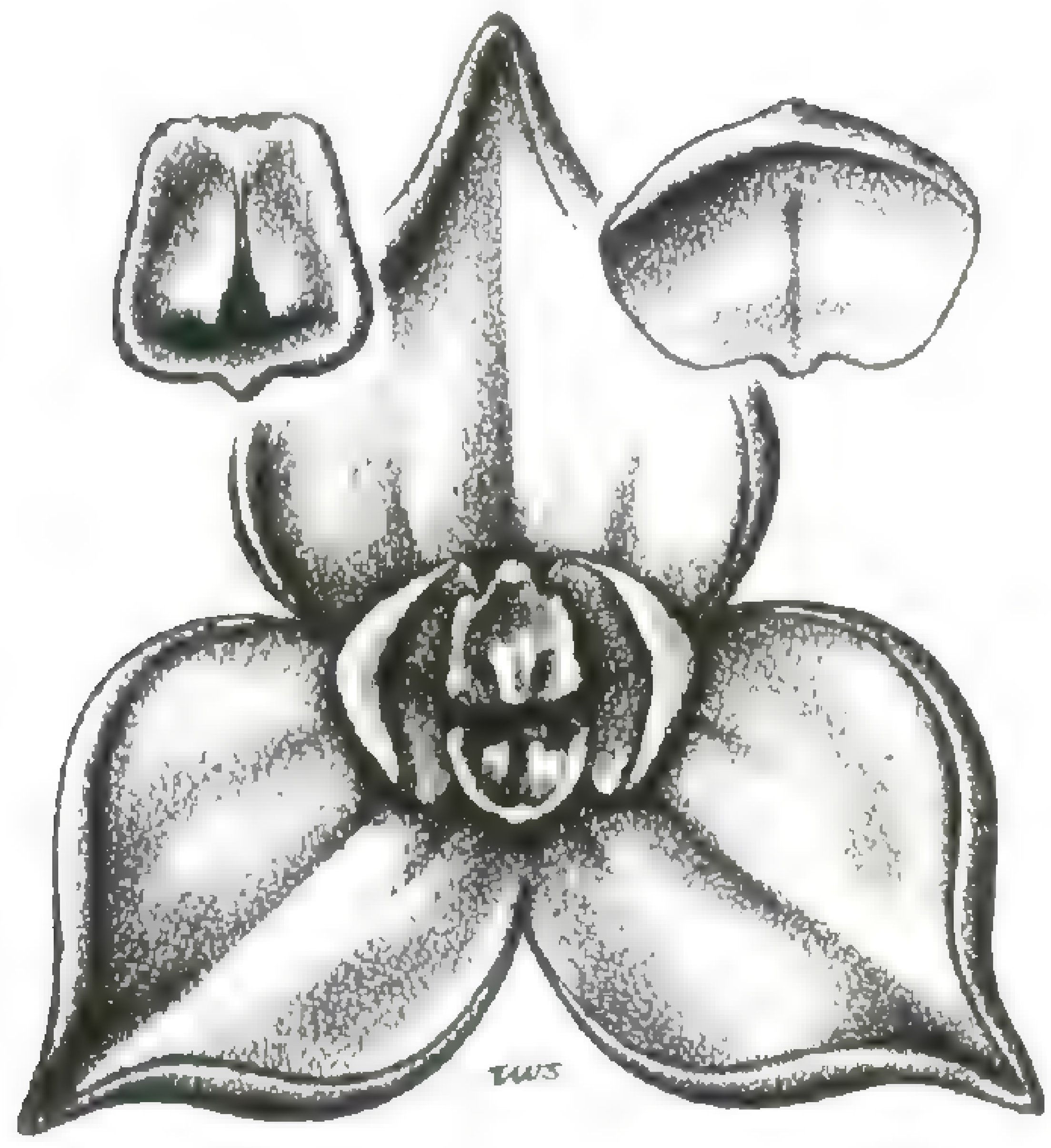
[S. patula]



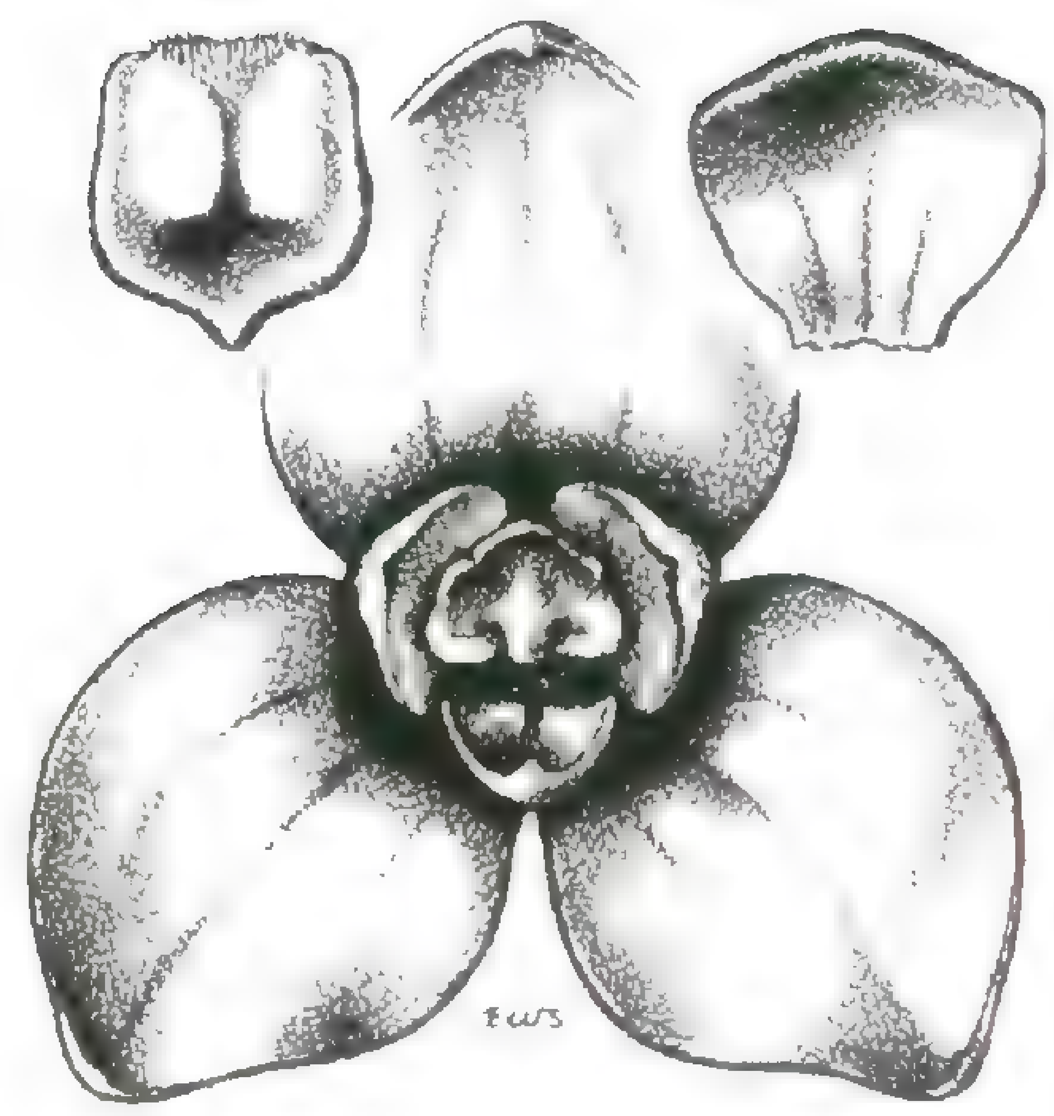
Stelis spathulata X-r-15

Stelis tricuspis X-r-15

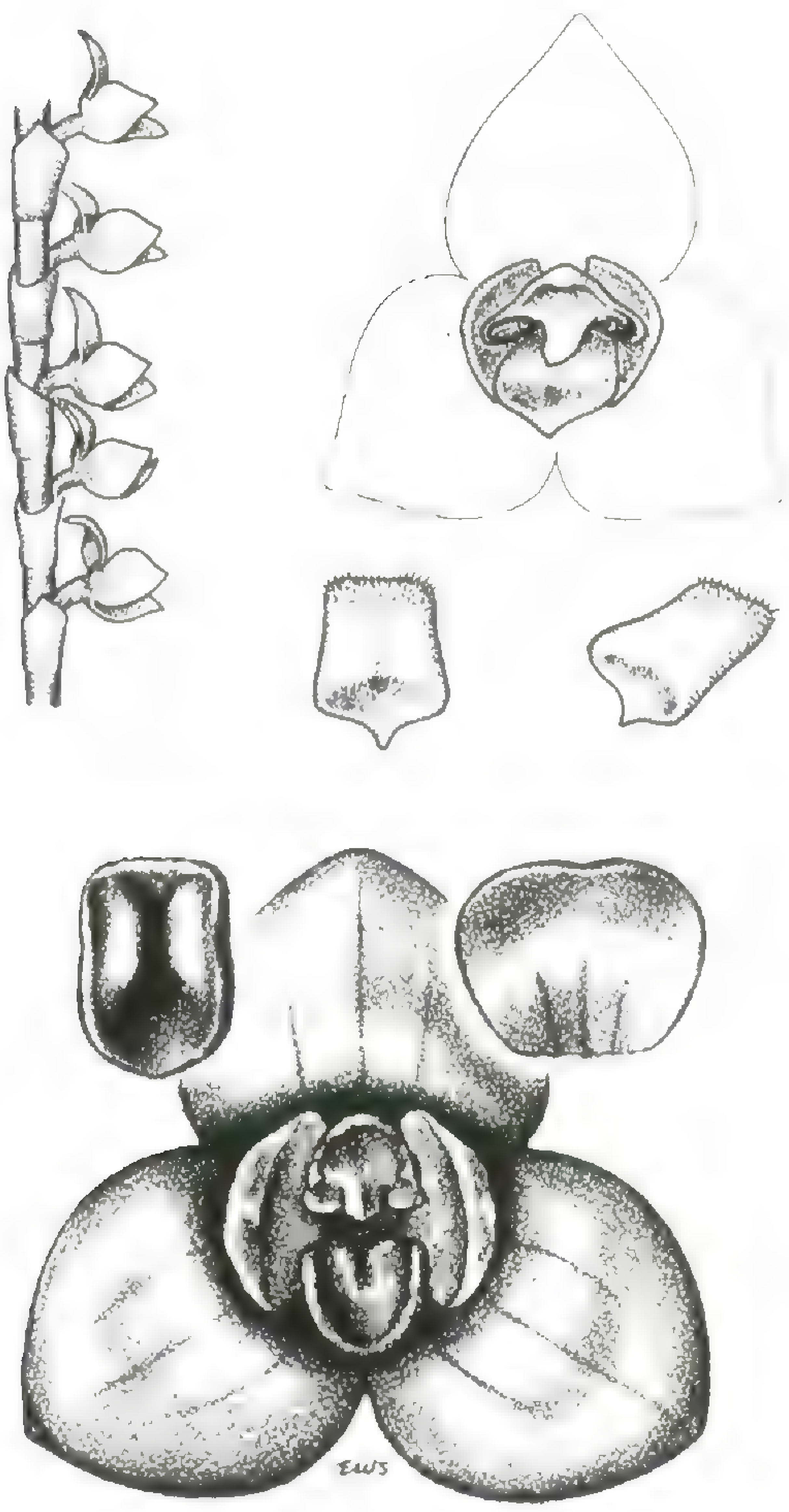
PLATE 80



Stelis flexuosa X-c-17



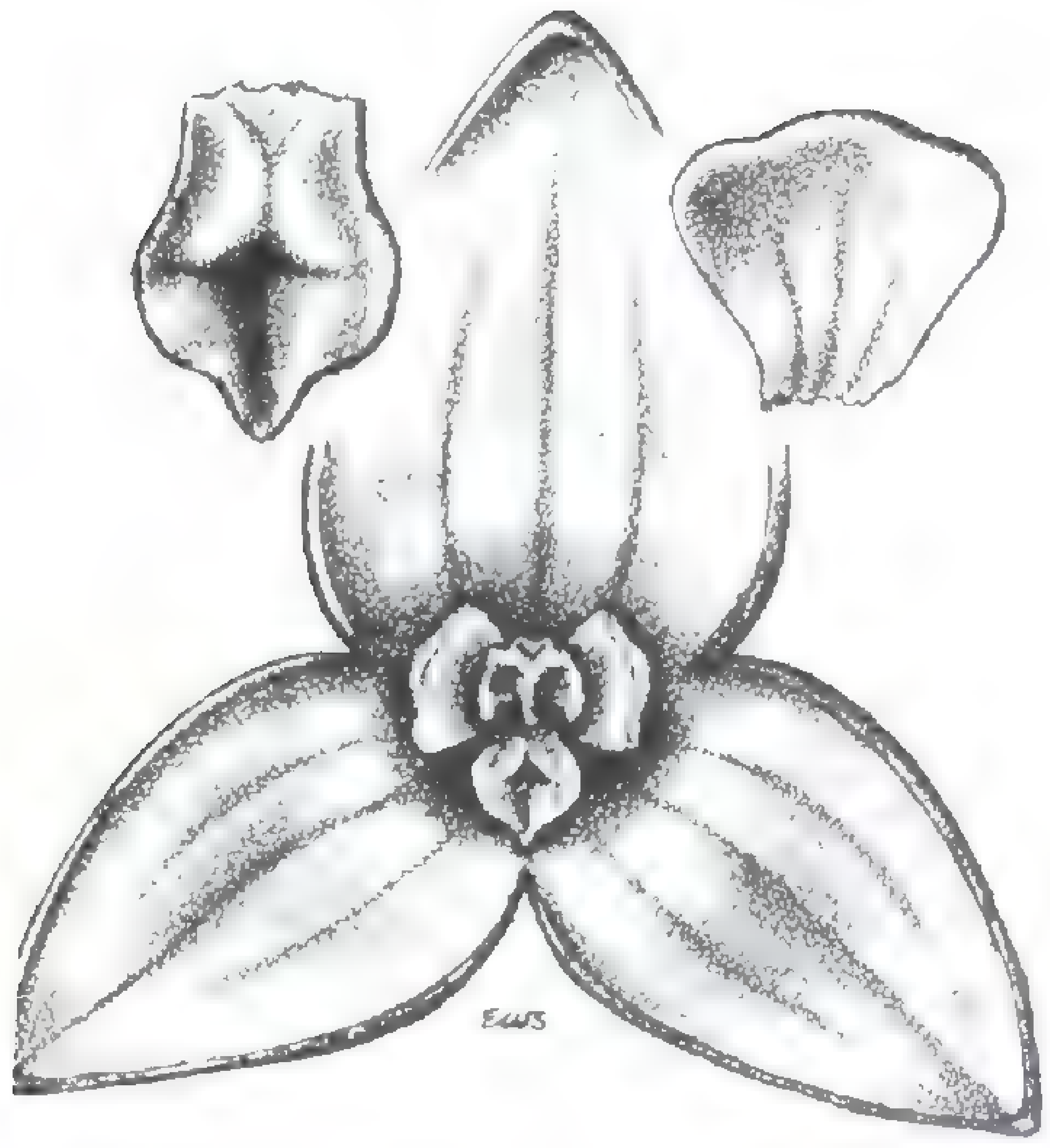
Stelis polybotra X-c-17



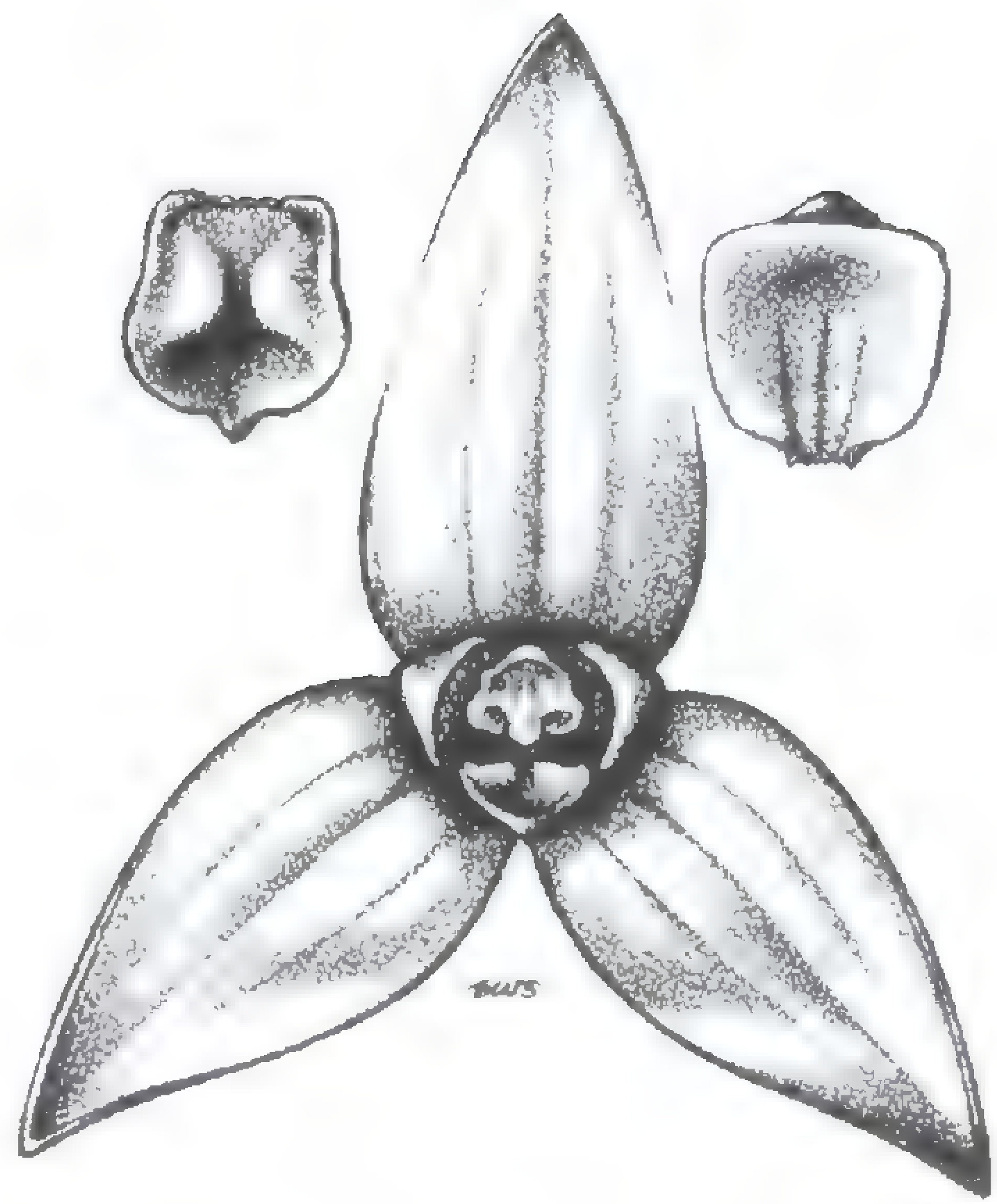
Stelis serra X-c-17

Stelis Schomburgkii X-c-17

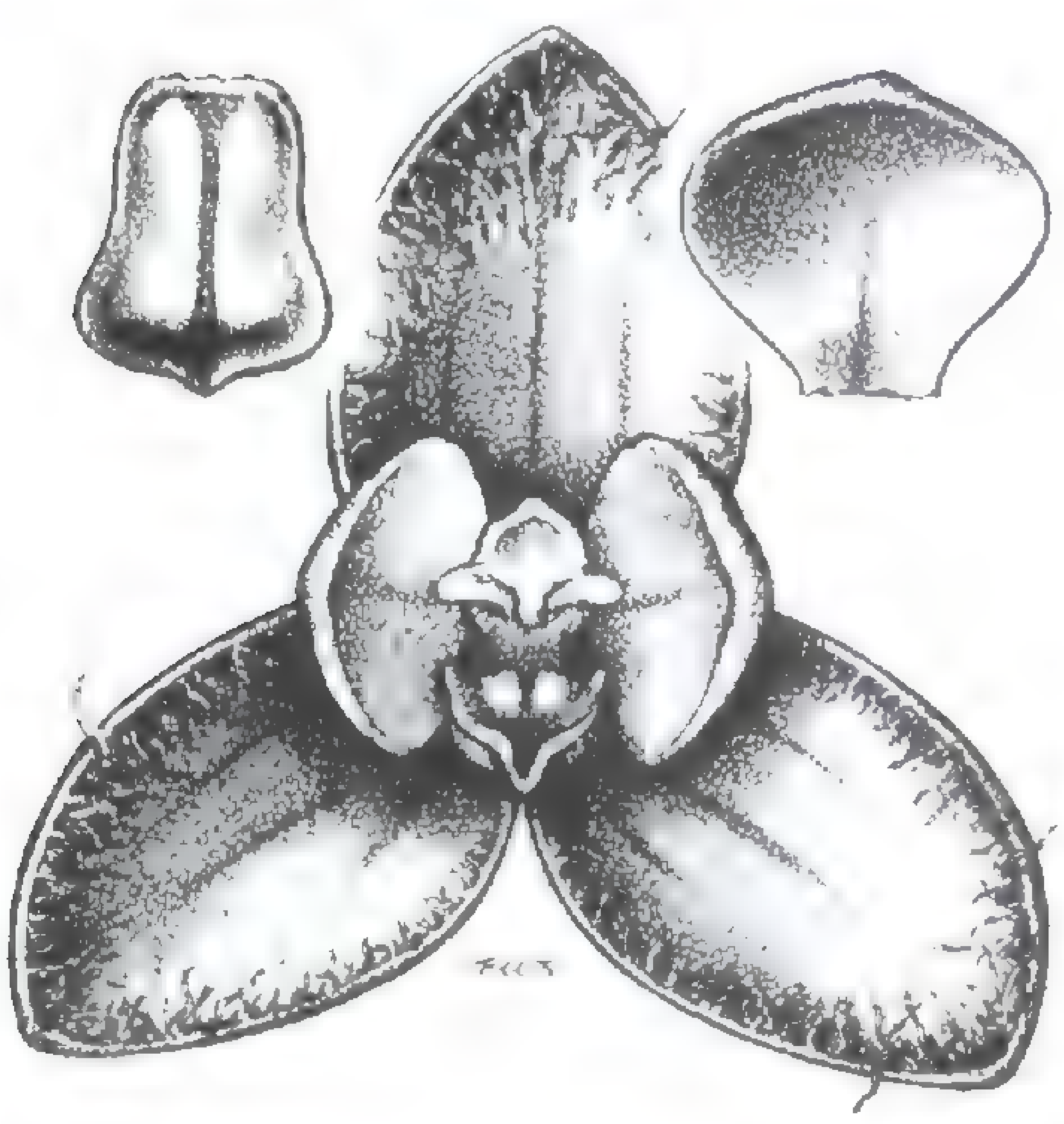
PLATE 81



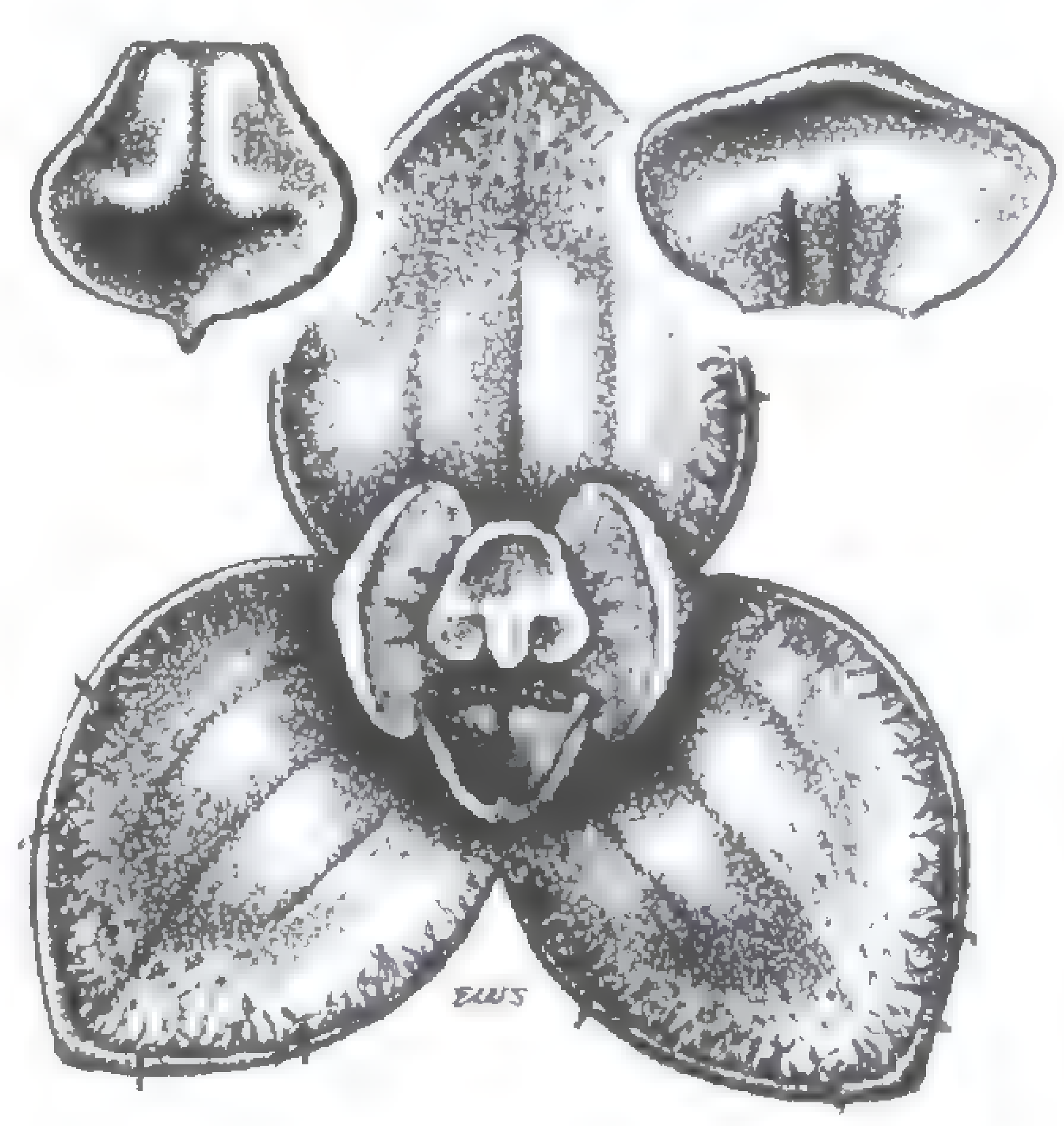
Stelis alba X-c-17



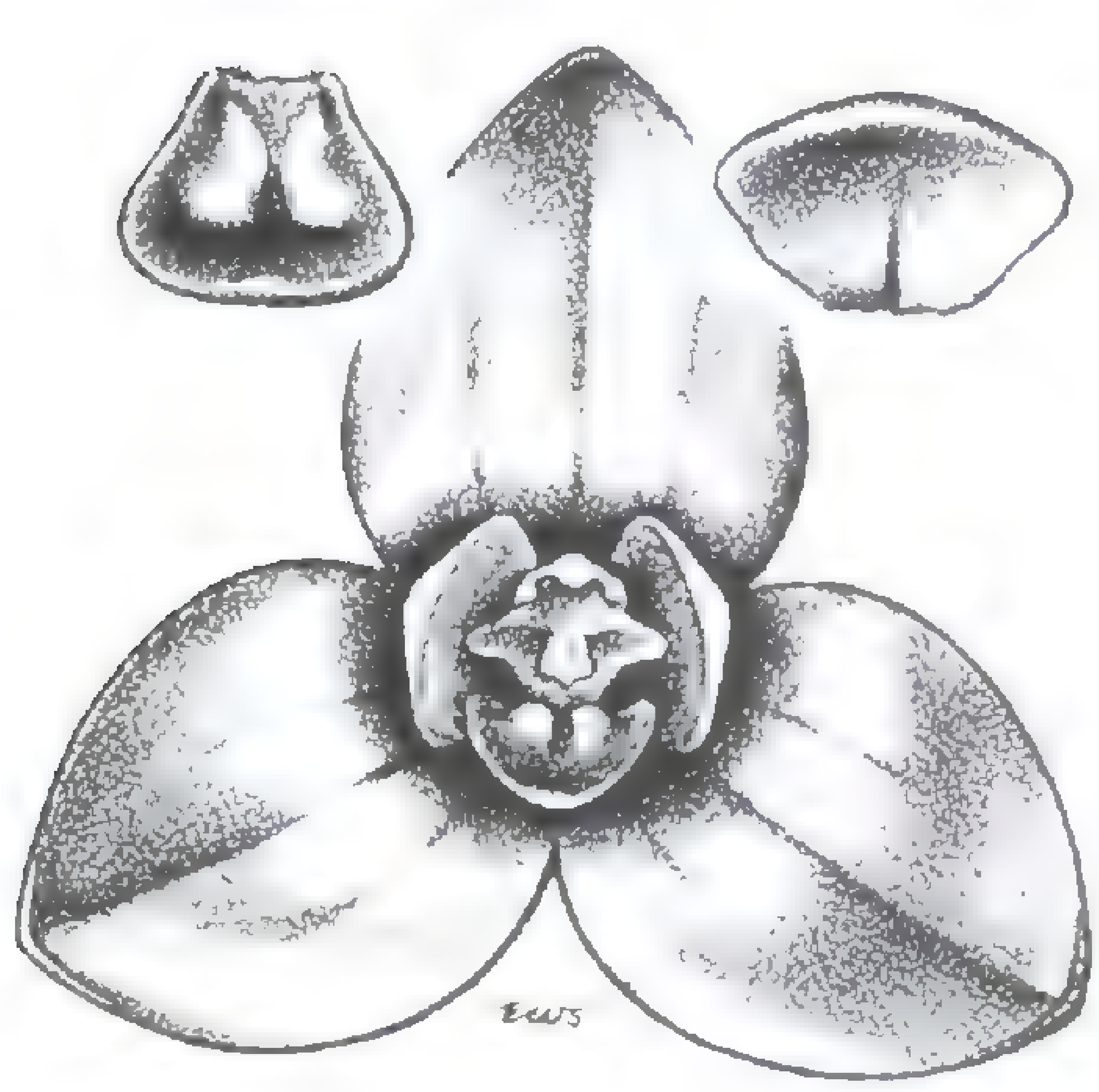
Stelis furfuracea X-c-17



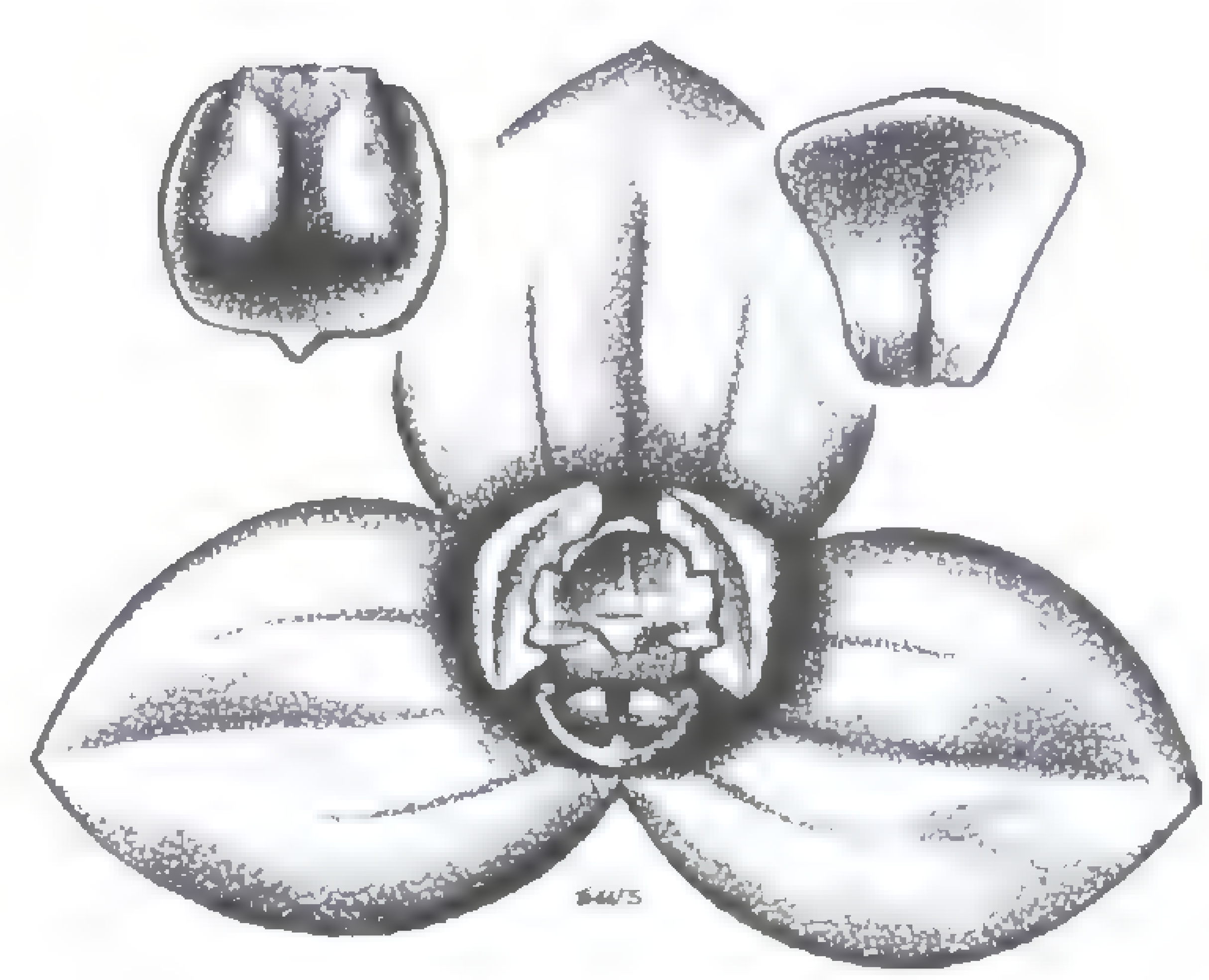
Stelis concinna X-c-17



Stelis oblonga X-c-17

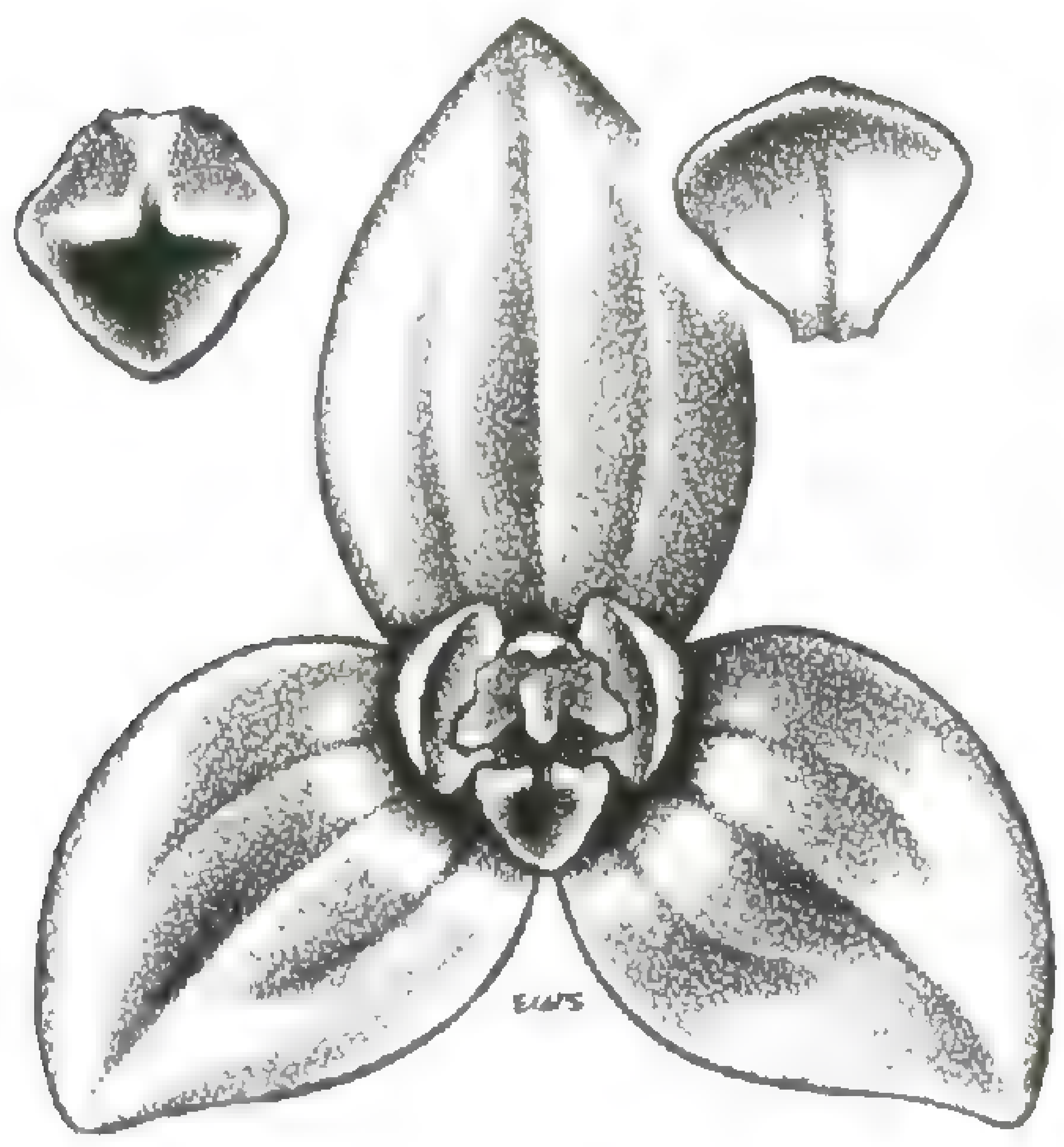


Stelis graminea X-r-18

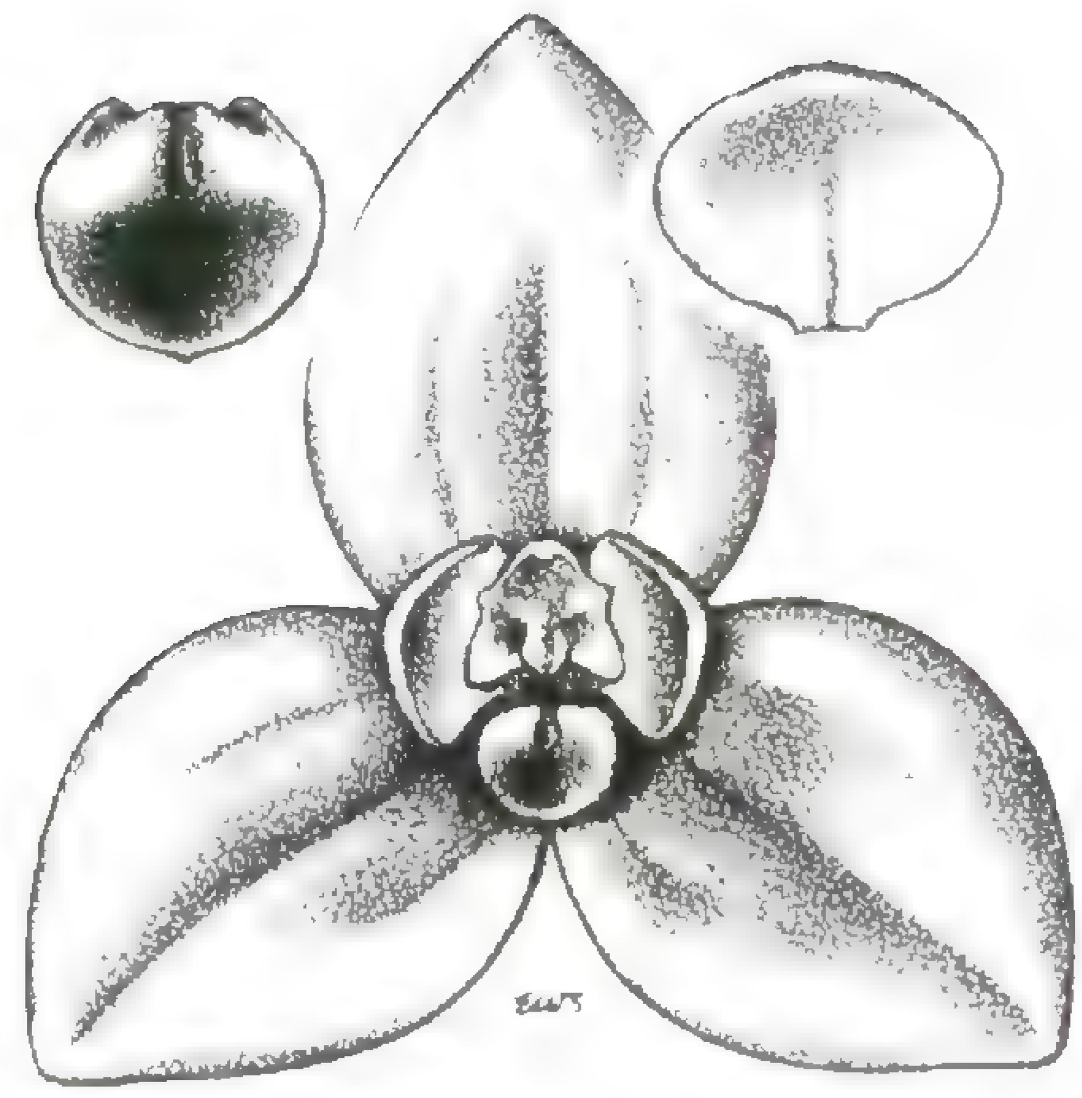


Stelis pusilla X-r-18

PLATE 82



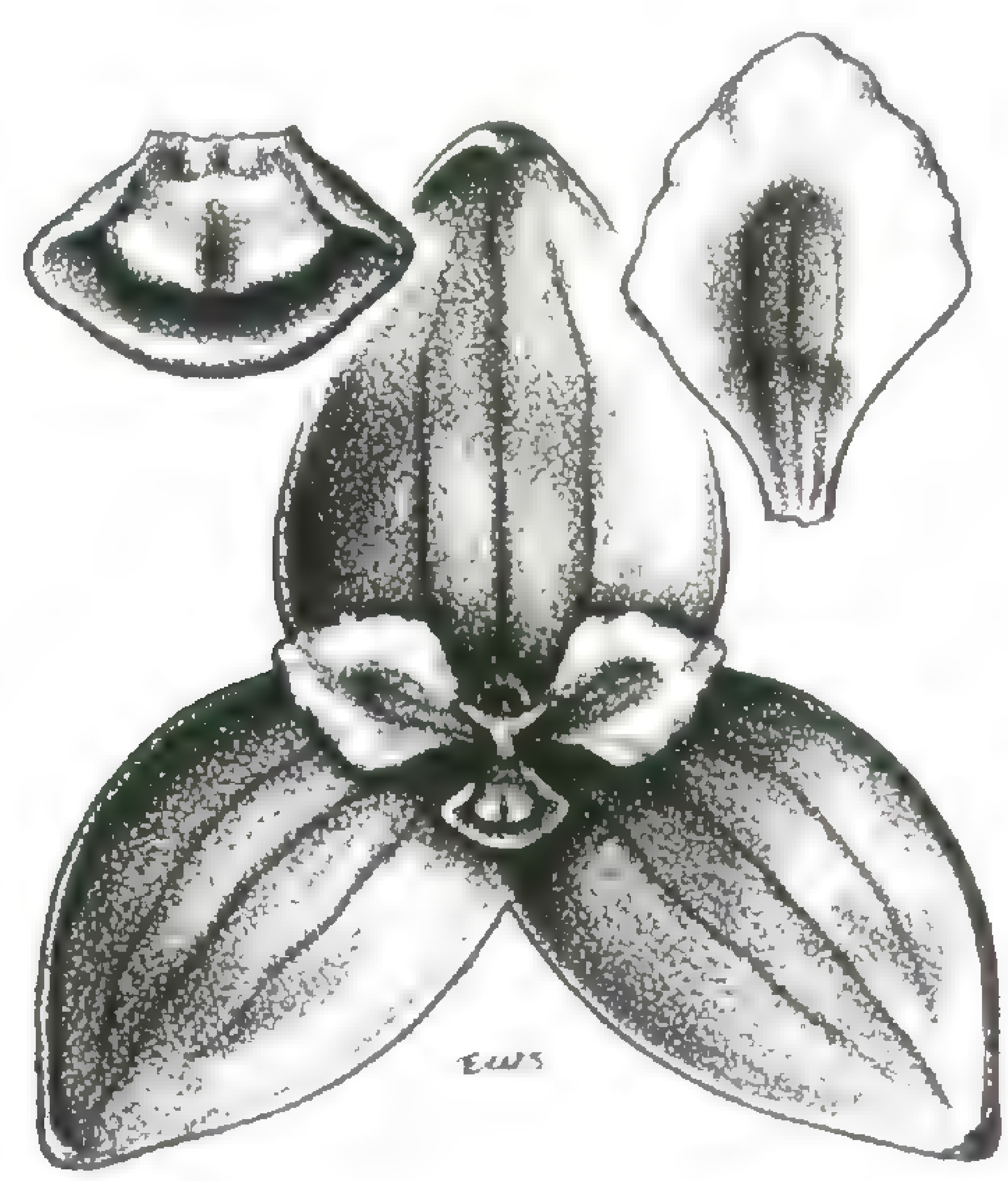
Stelis prorepens X-r-19



Stelis scansor X-r-19

Stelis dupliciformis XI-r-20

Stelis dactyloptera XI-c-21



Stelis globiflora XI-c-21

PLATE 83

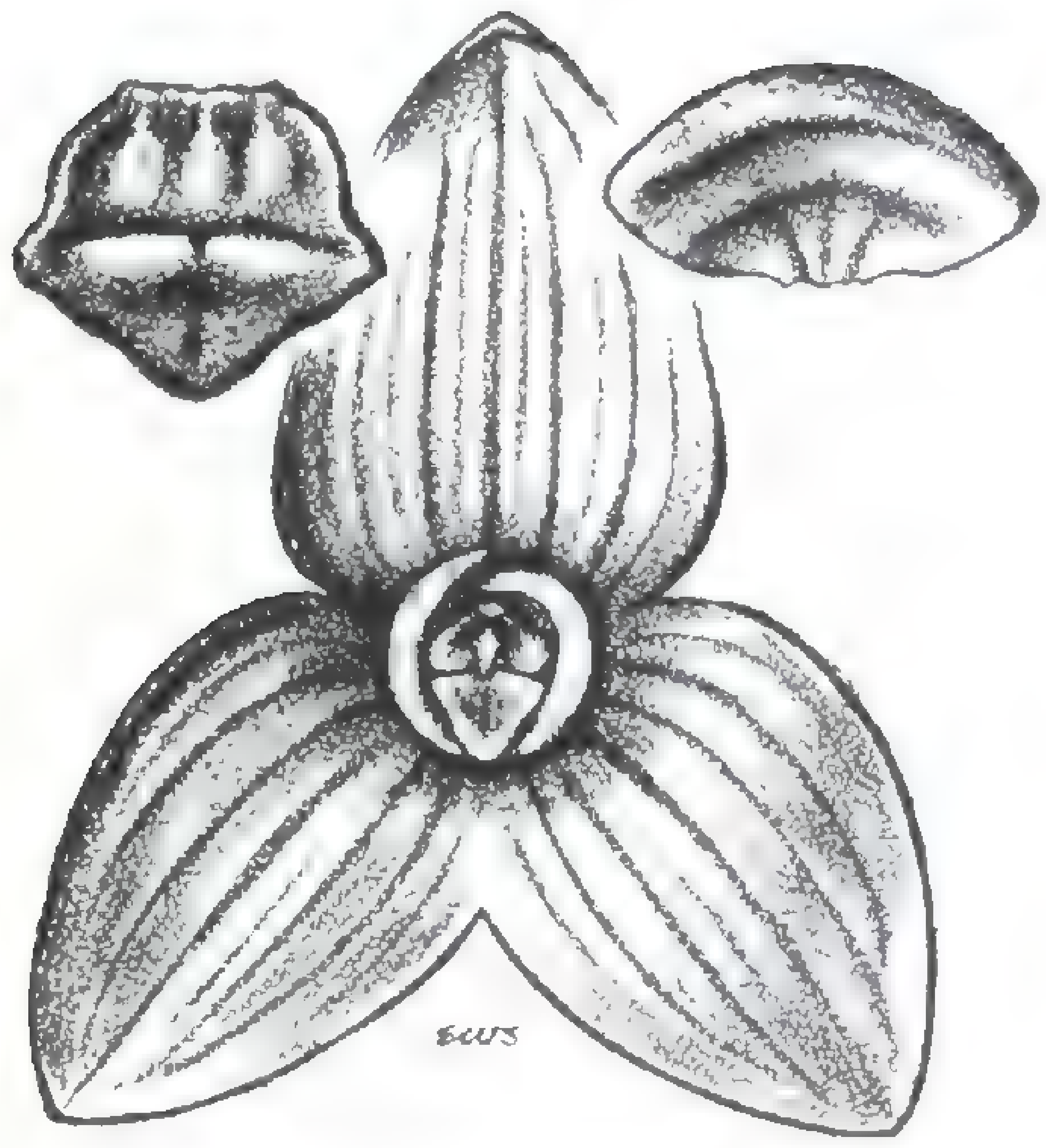
Stelis tenuicaulis XI-r-20

Stelis striolata XI-r-20

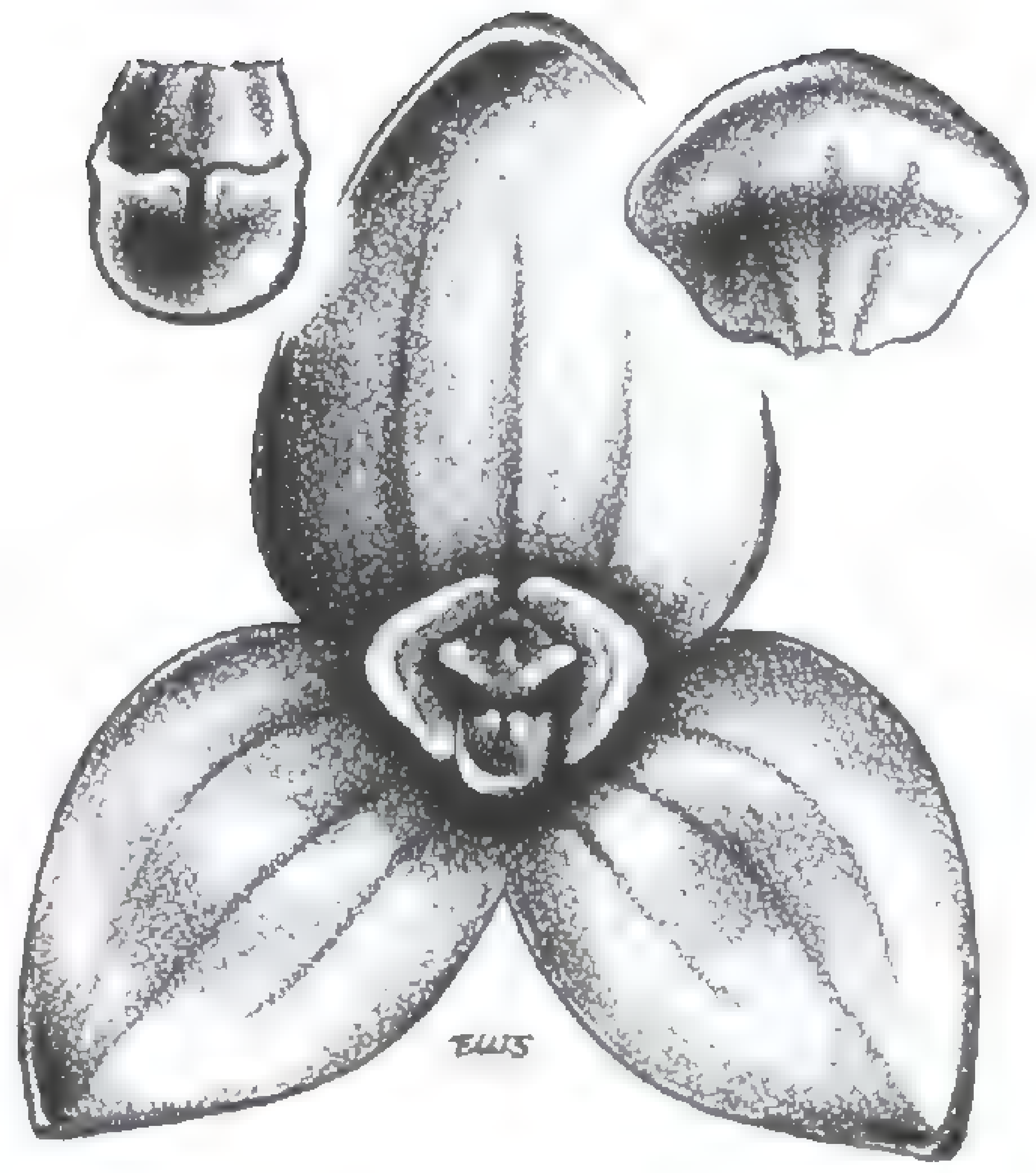
PLATE 84

Stelis gracilispica XI-r-20

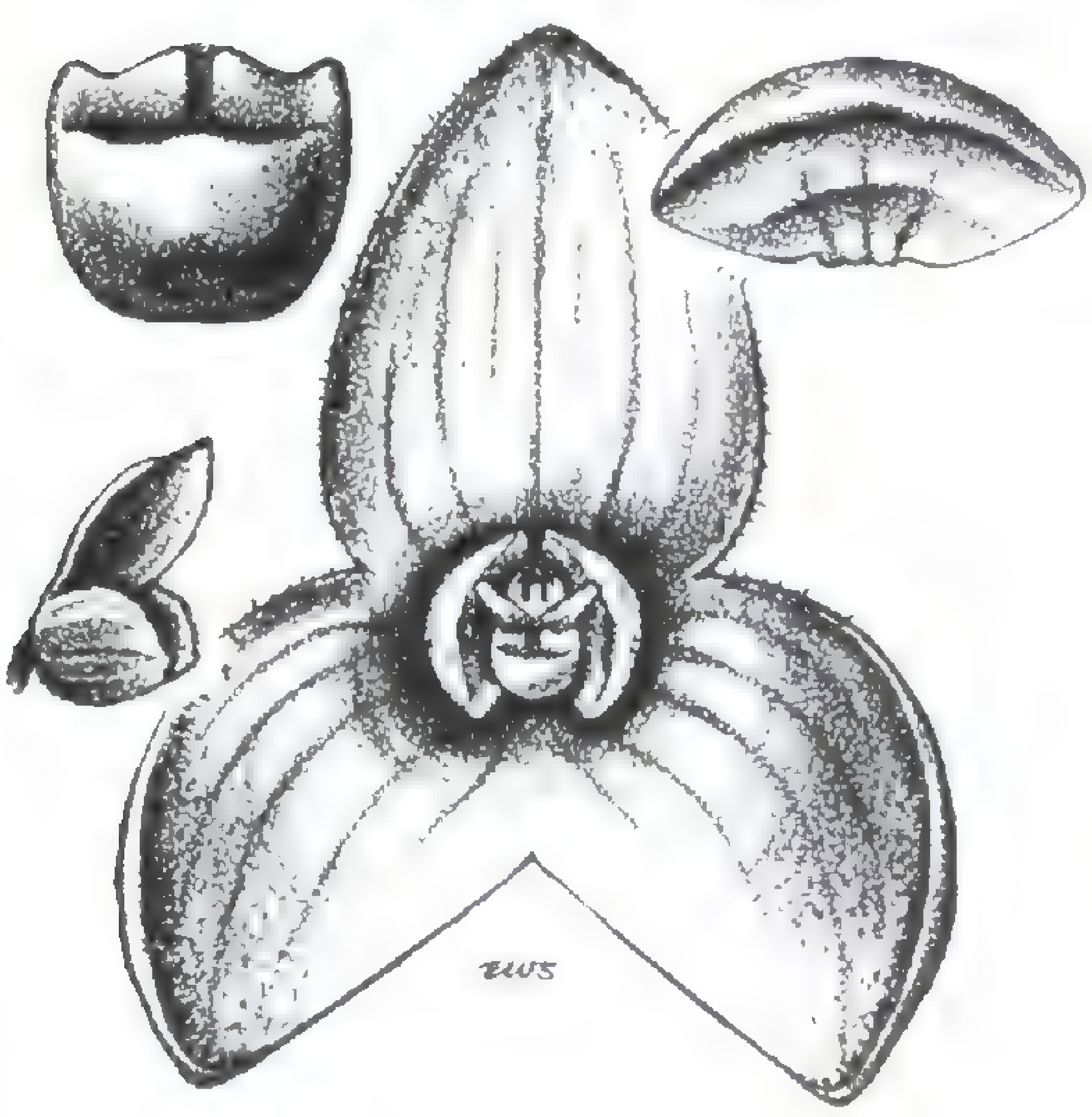
PLATE 85



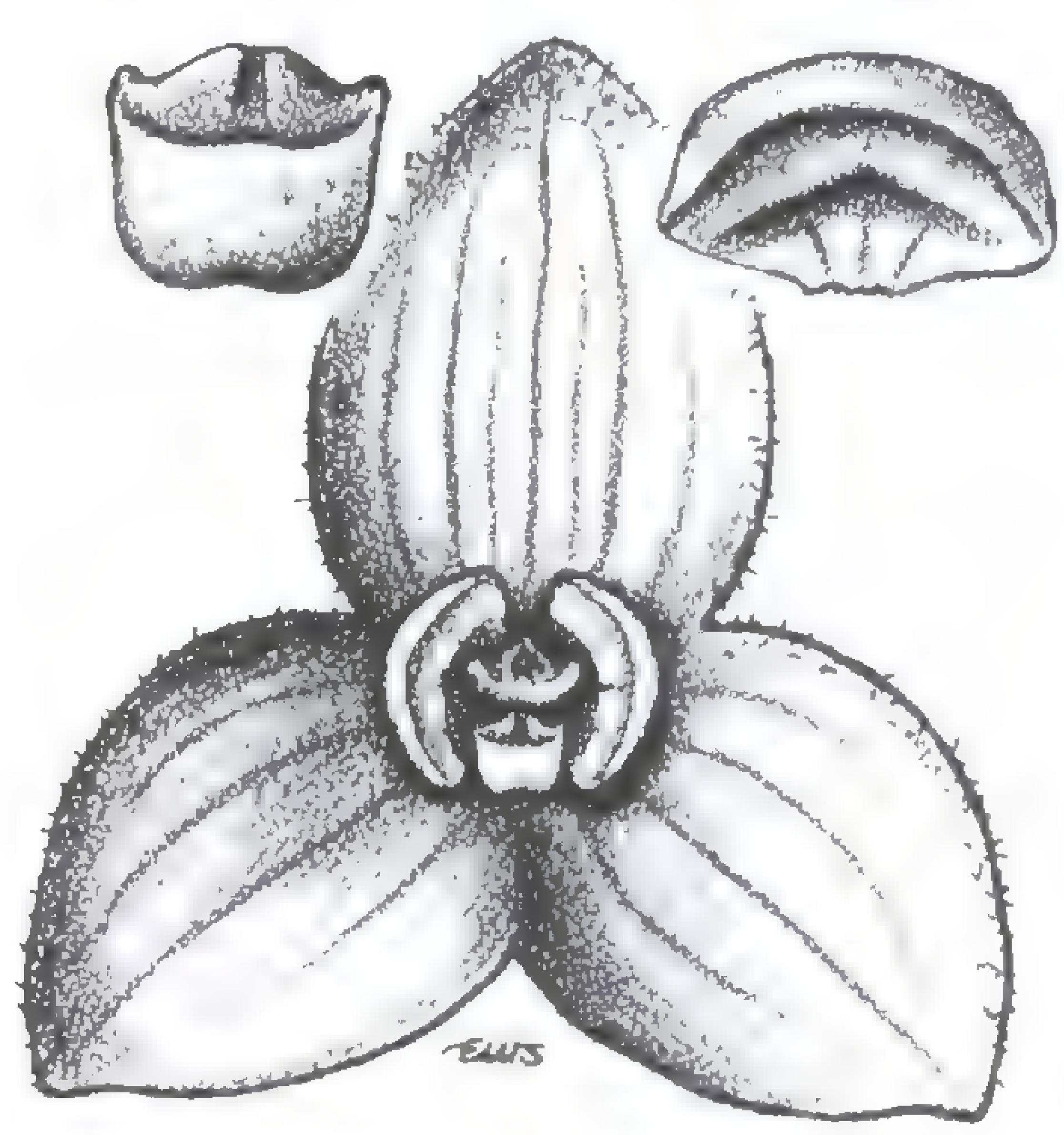
Stelis purpurea XI-c-22a



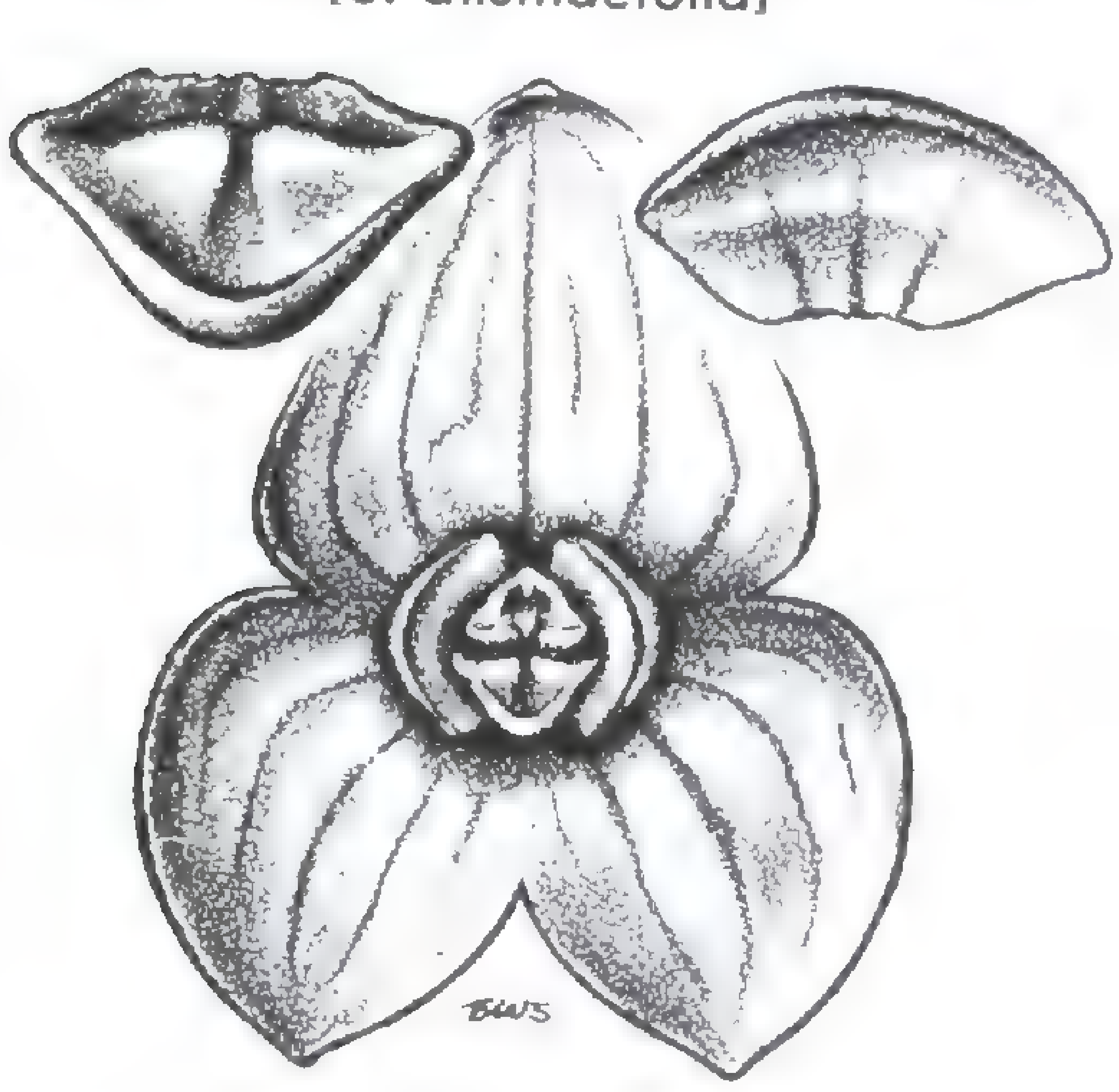
Stelis nutans XI-c-22b



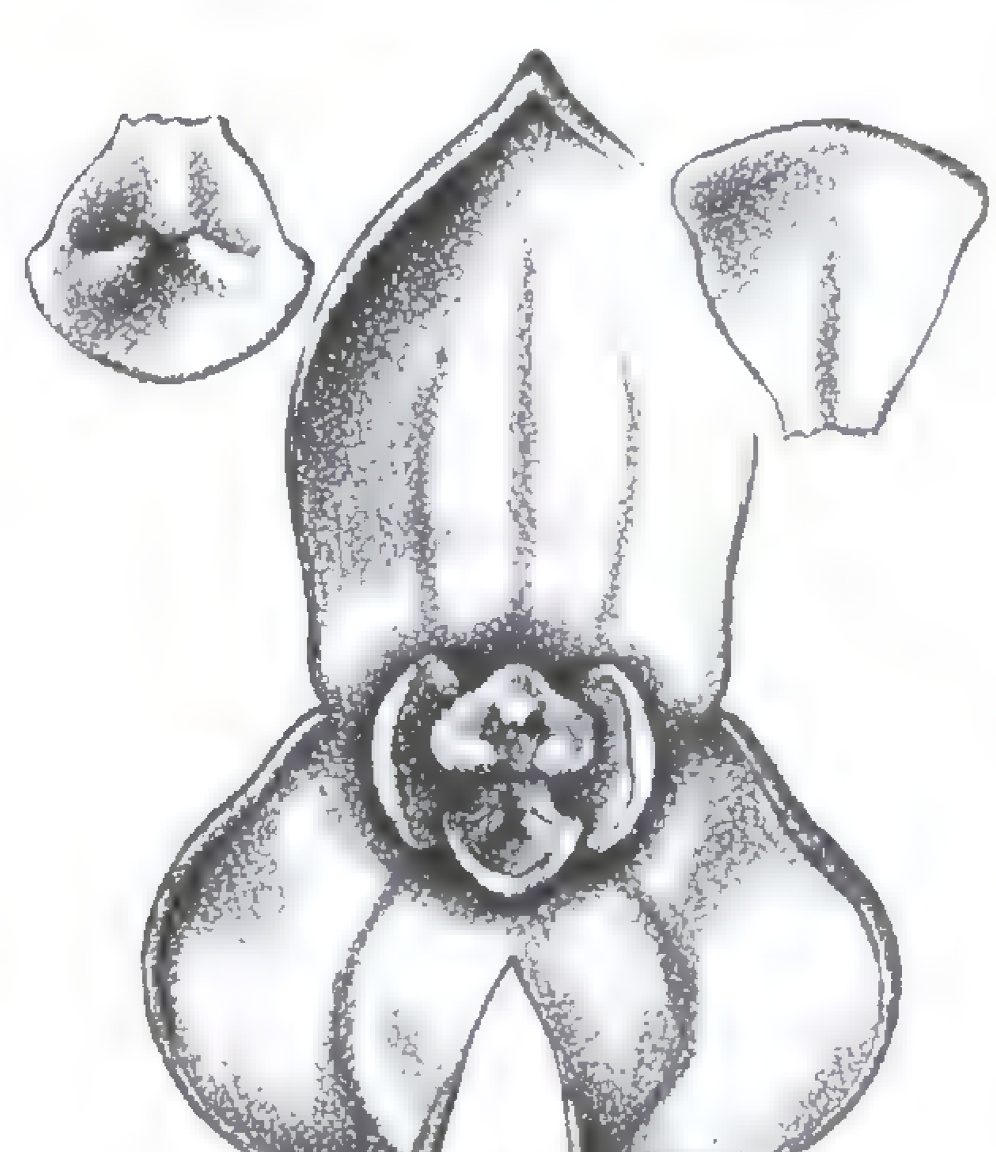
[S. alismaefolia]



Stelis flacca XI-c-22b

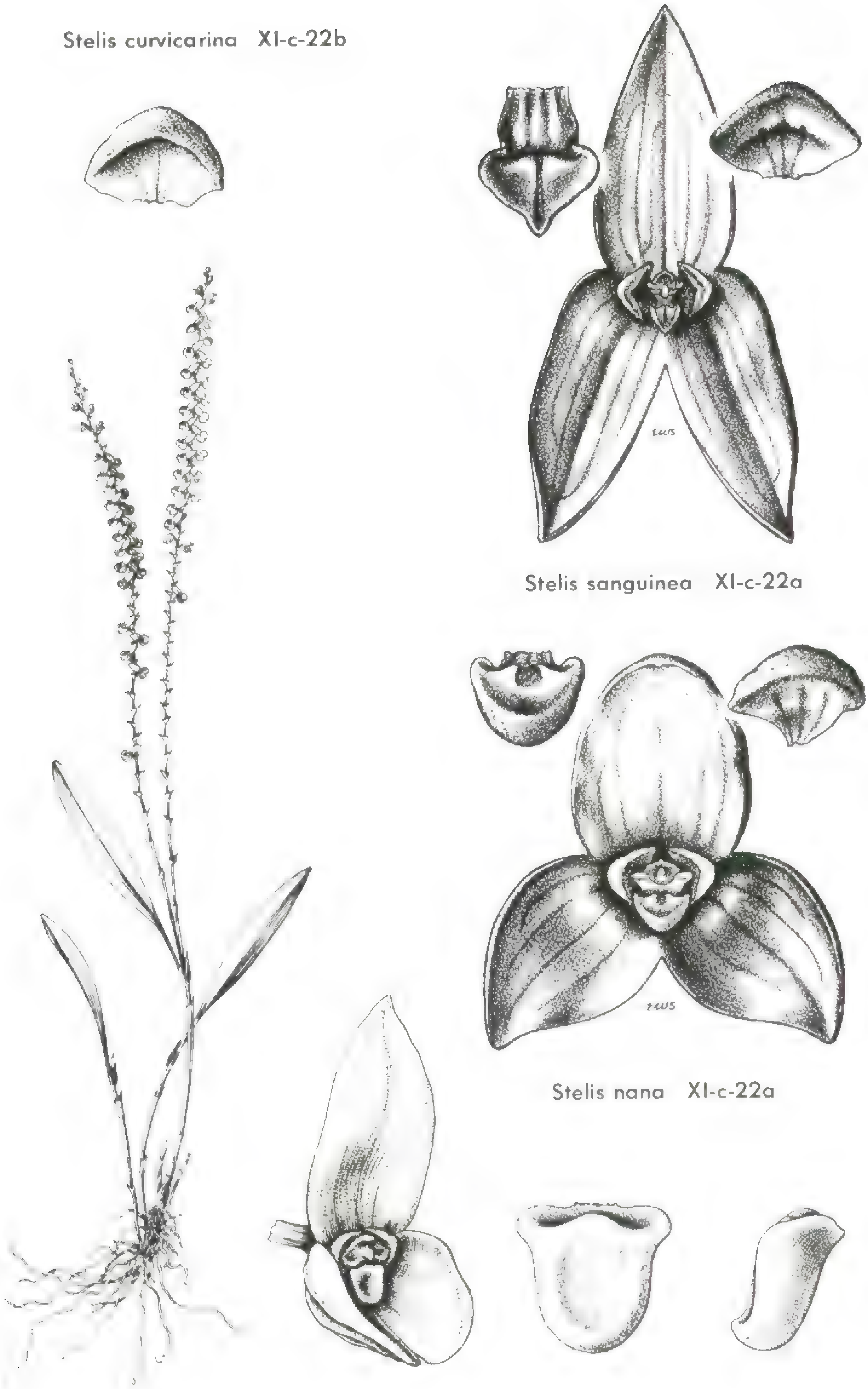


Stelis aviceps XI-c-22b



Stelis perparva XI-c-22b

PLATE 86

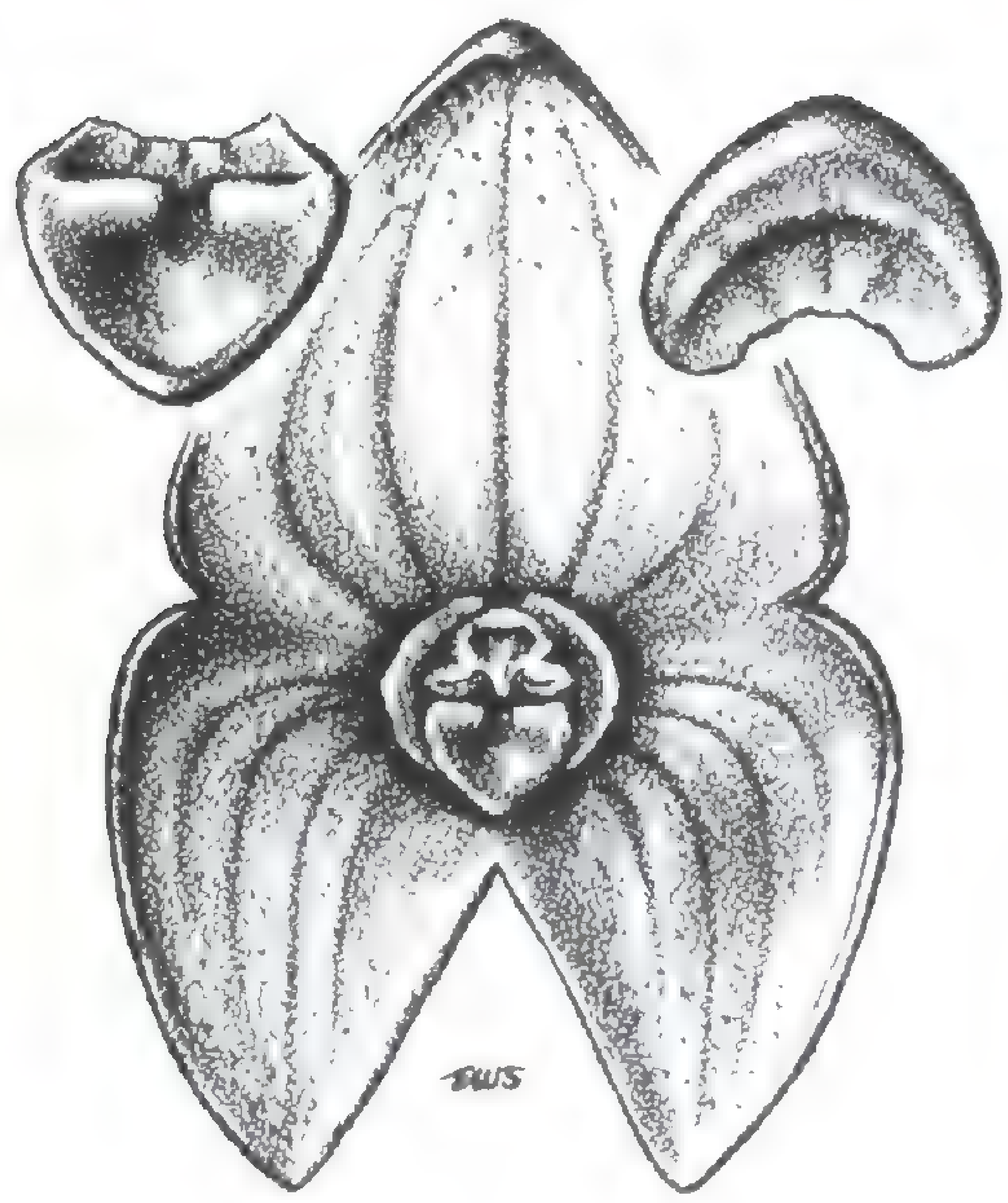


Stelis curvicarina XI-c-22b

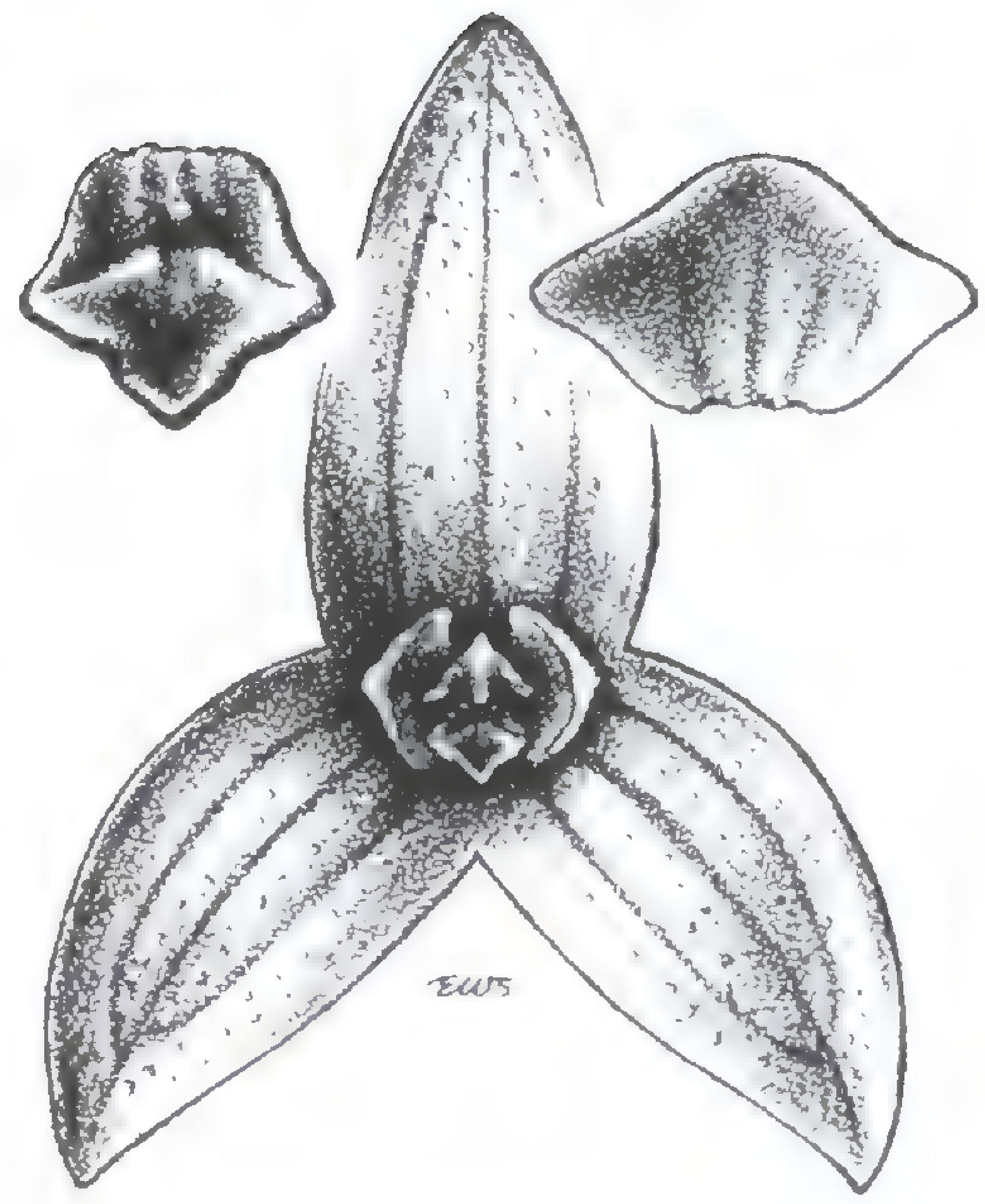
Stelis sanguinea XI-c-22a

Stelis nana XI-c-22a

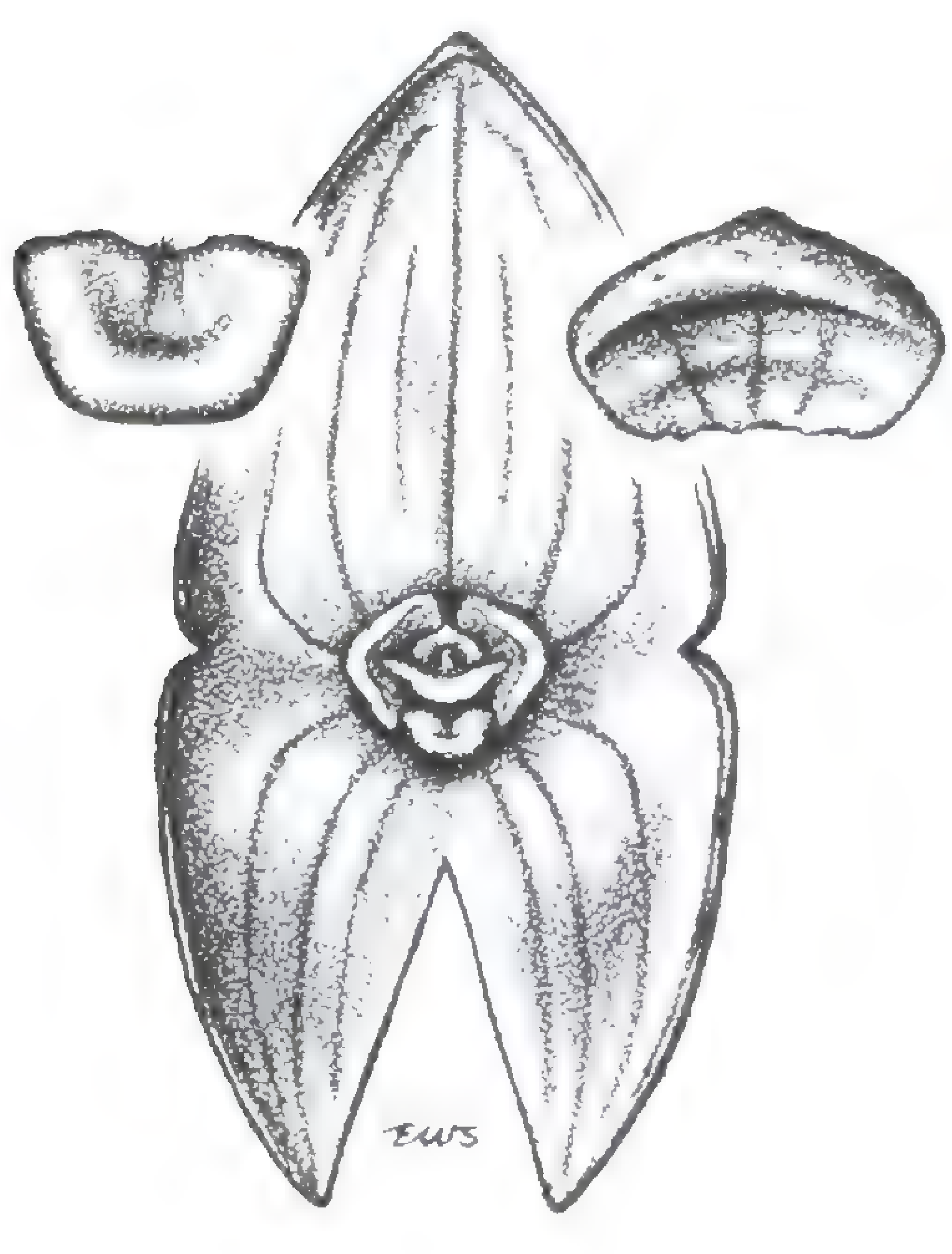
PLATE 87



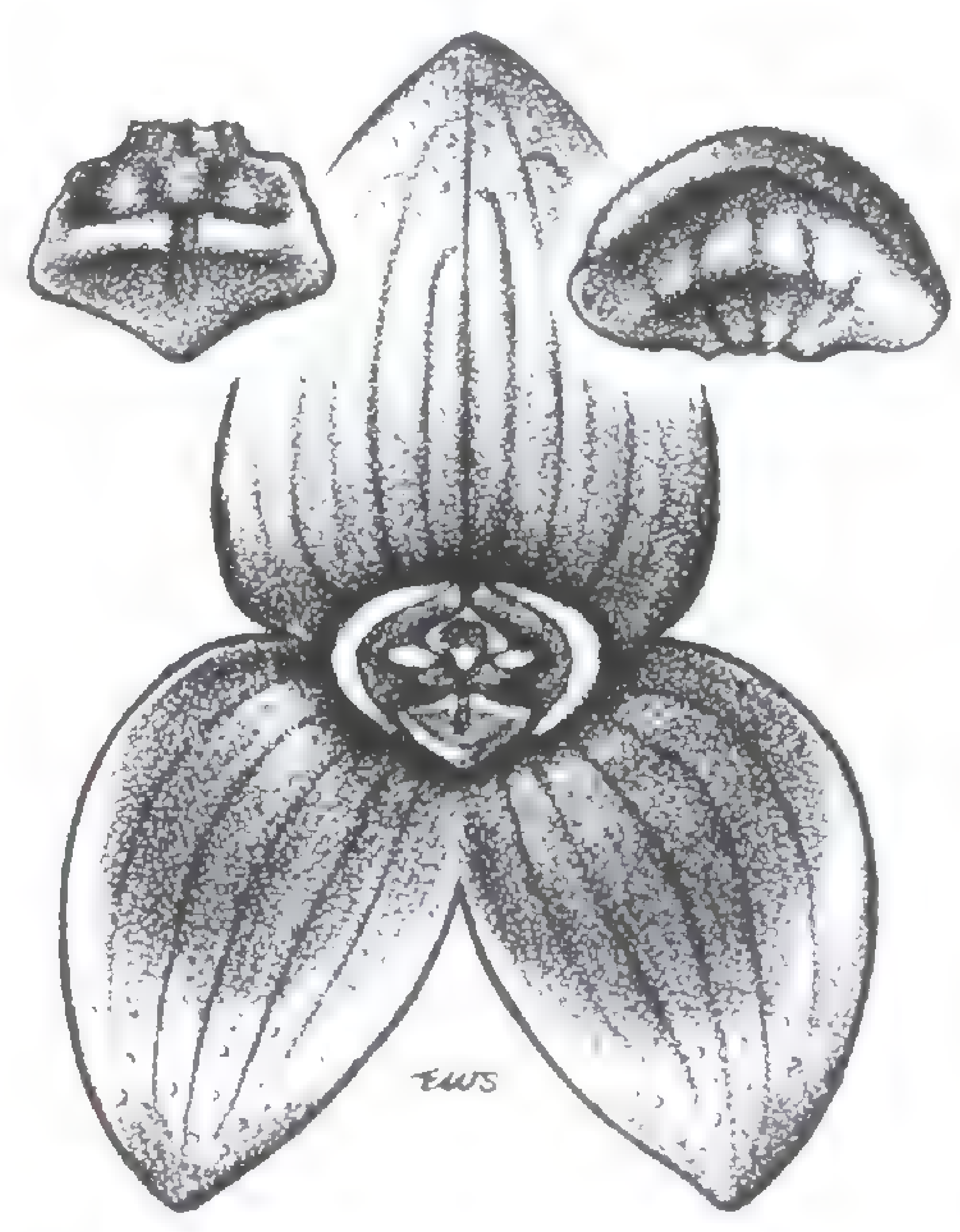
Stelis cupuligera XI-c-22a



Stelis Eugenii XI-c-22b

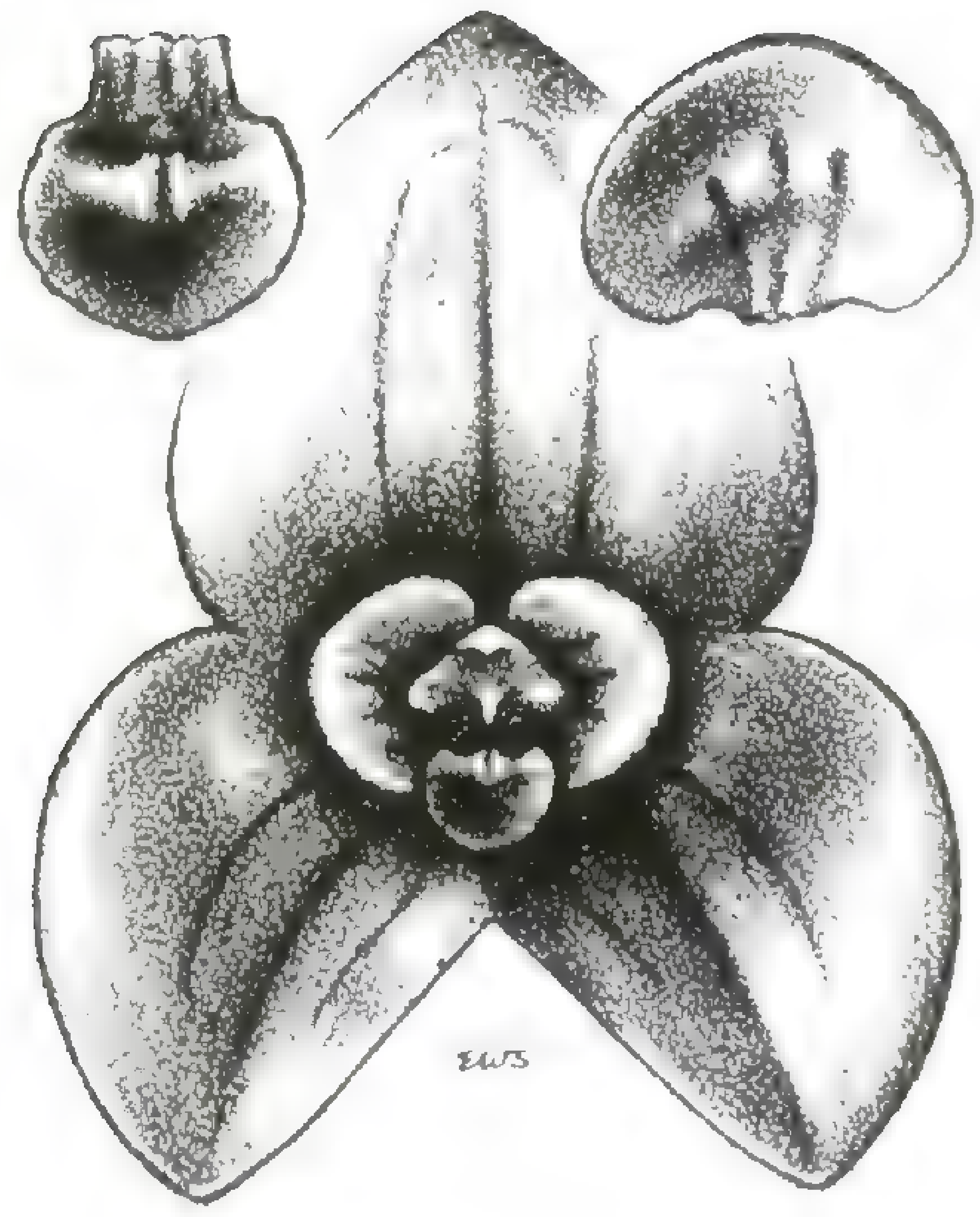


Stelis ecallosa XI-c-22a

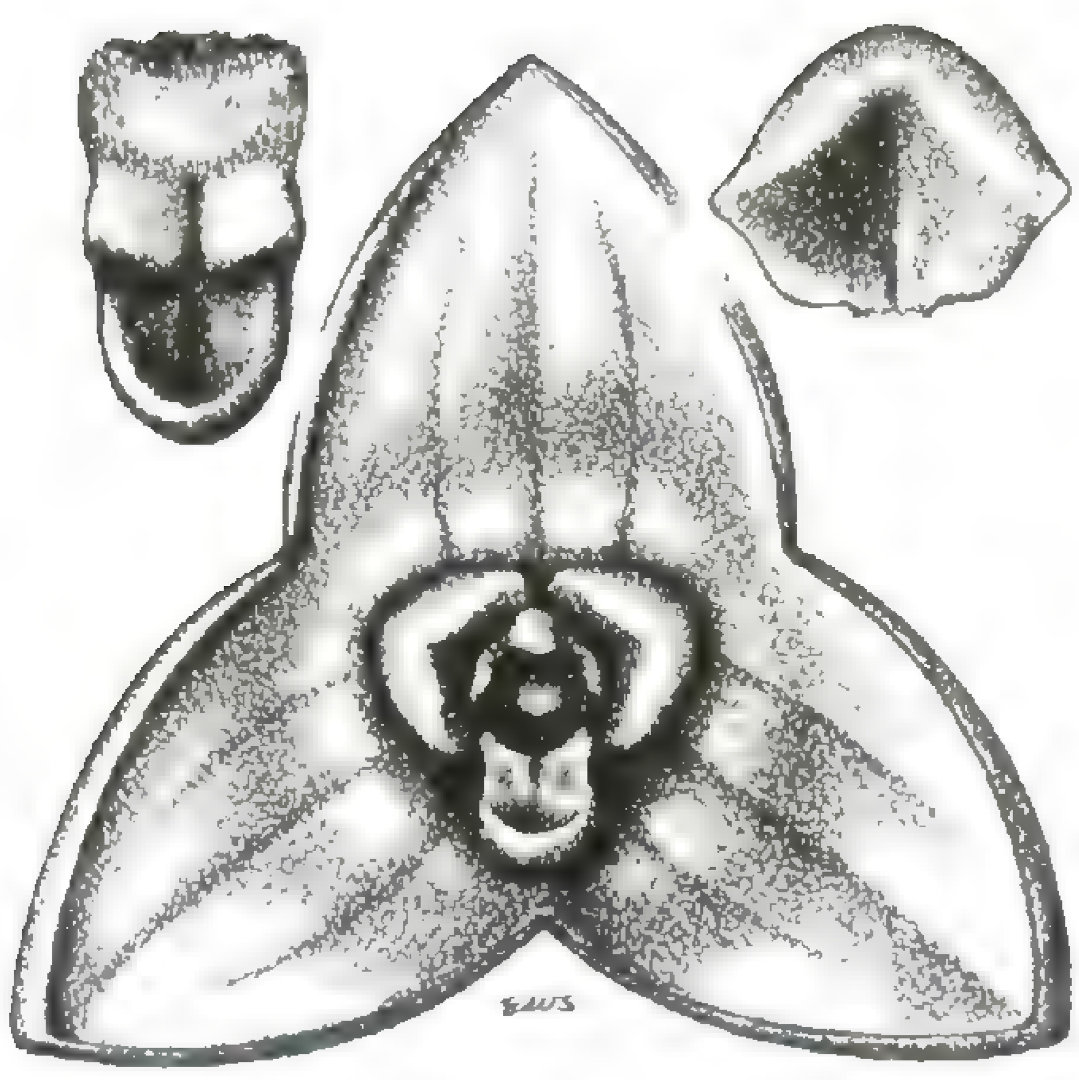


Stelis maxima XI-c-22a

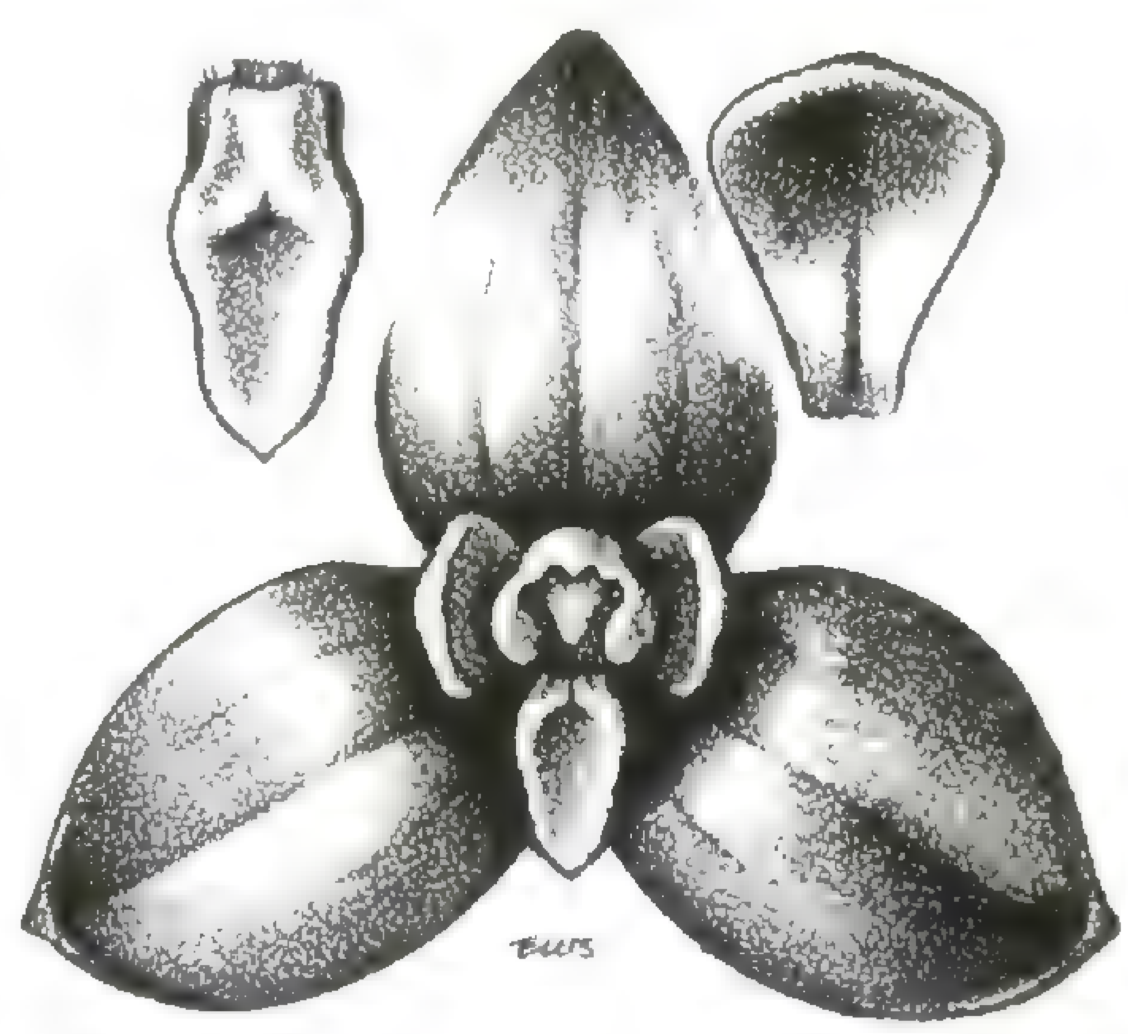
PLATE 88



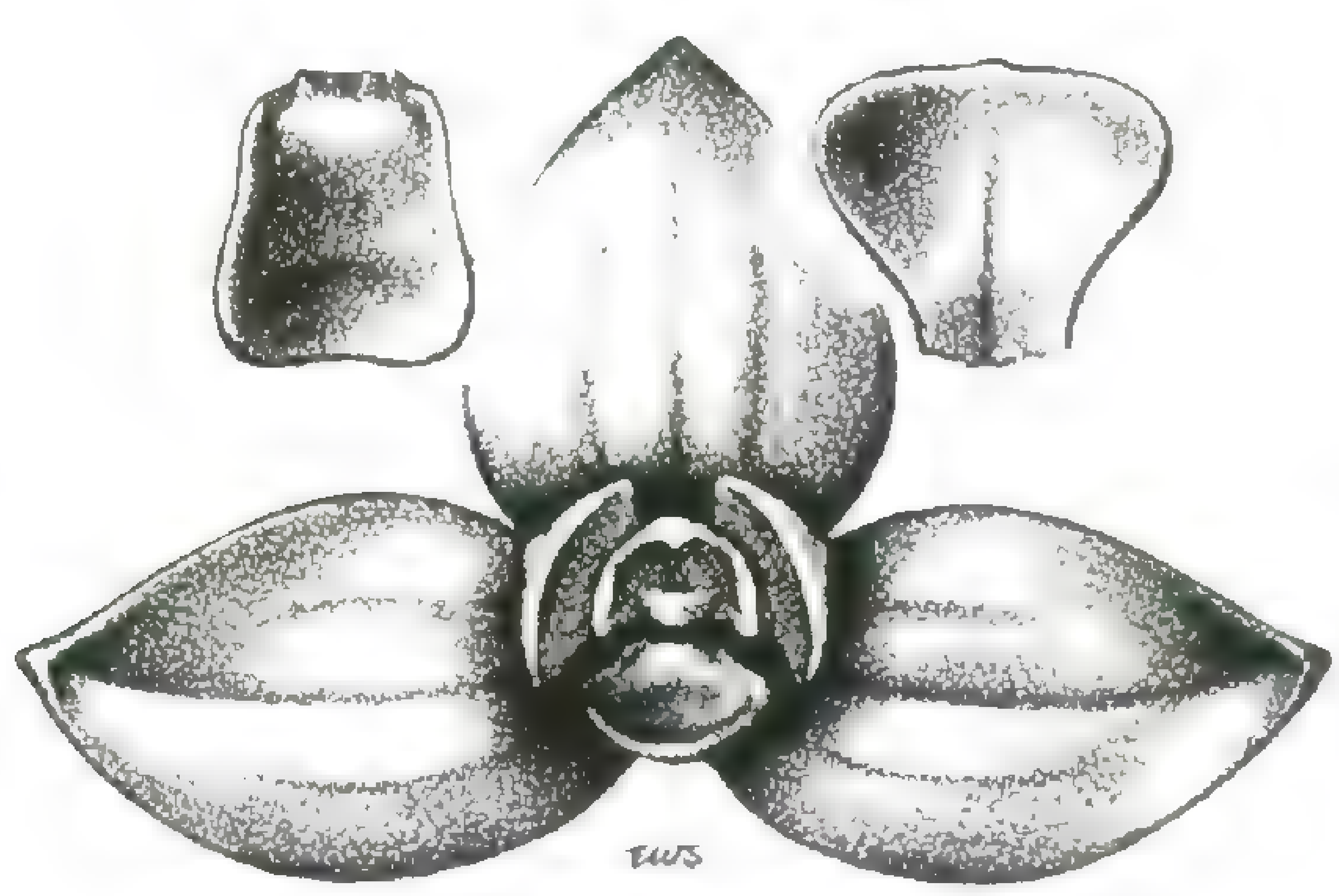
Stelis parvilabris XI-c-22b



Apatostelis atrorubens

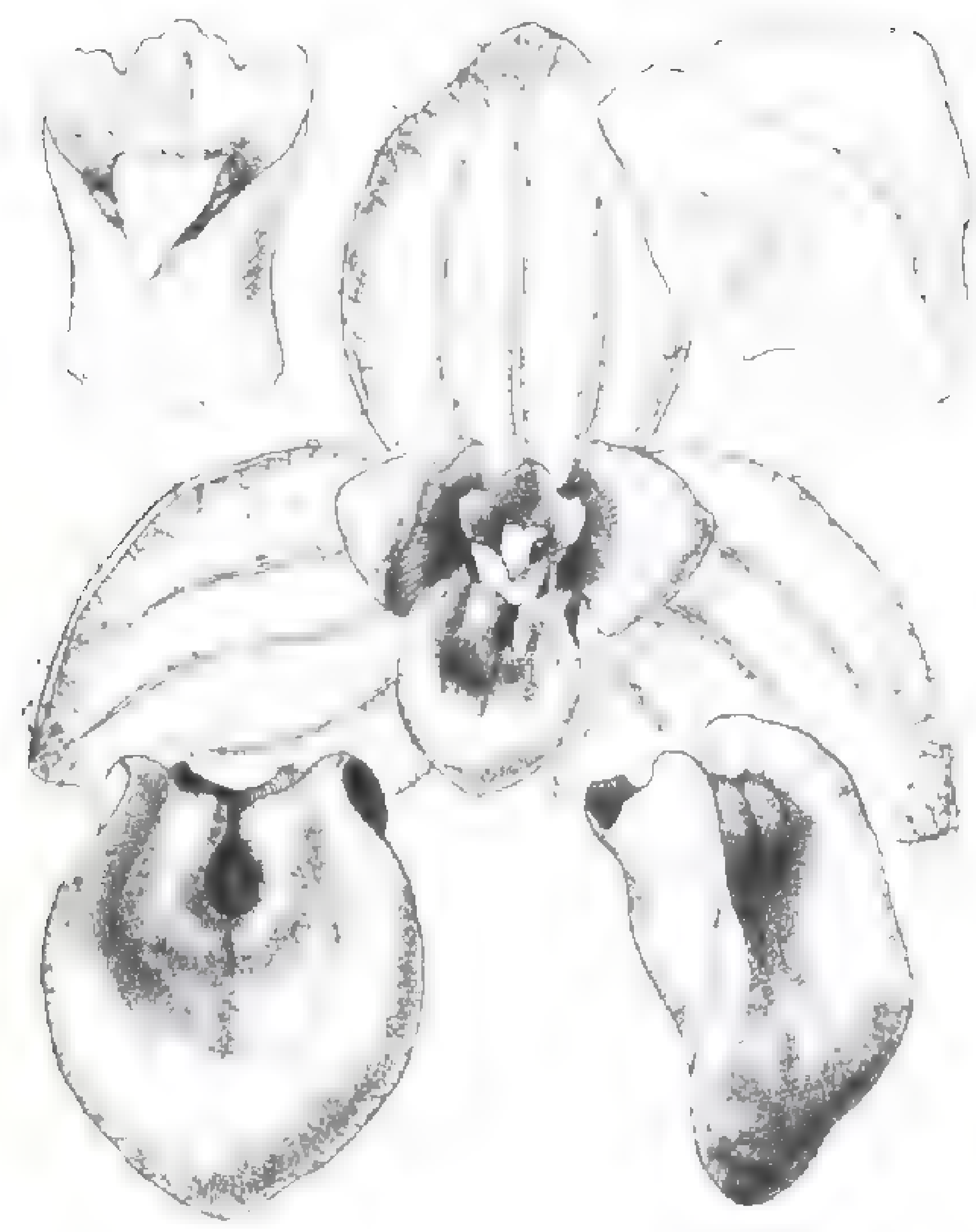


Apatostelis braccata

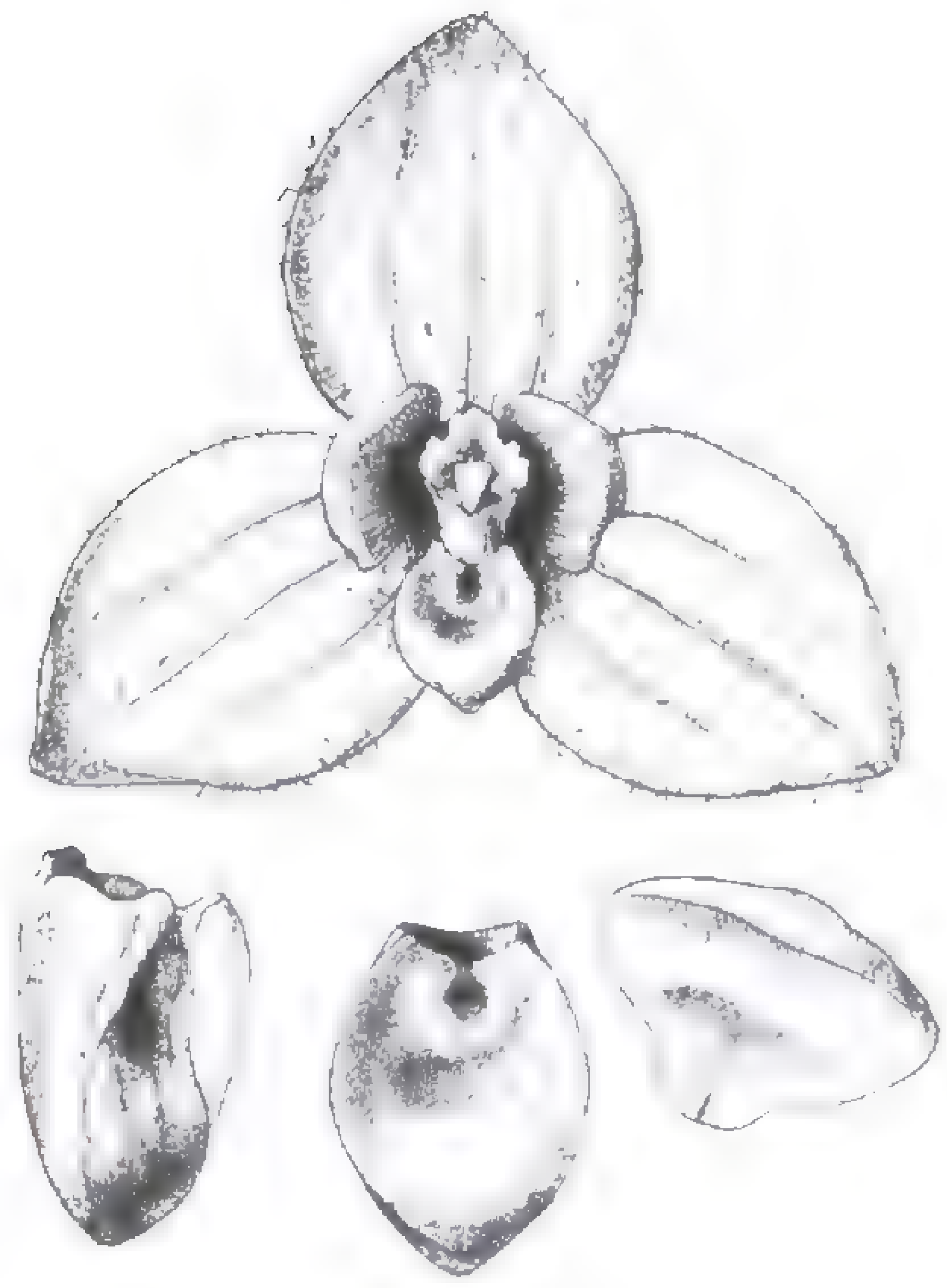


Apatostelis alata

PLATE 89



Apatostelis ciliaris



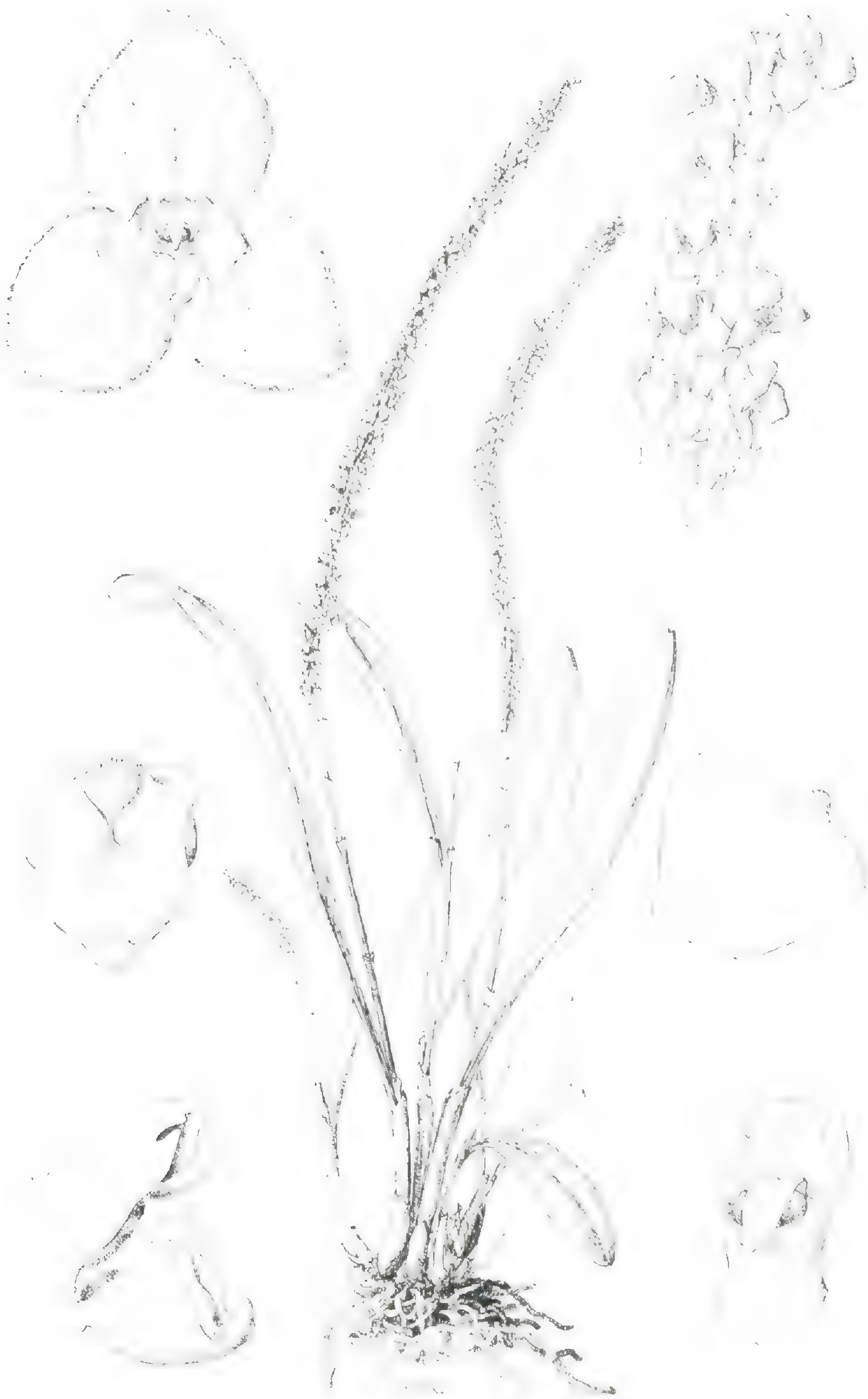
[S. confusa]

Apatostelis glossula

Apatostelis inaequalis

Apatostelis montana

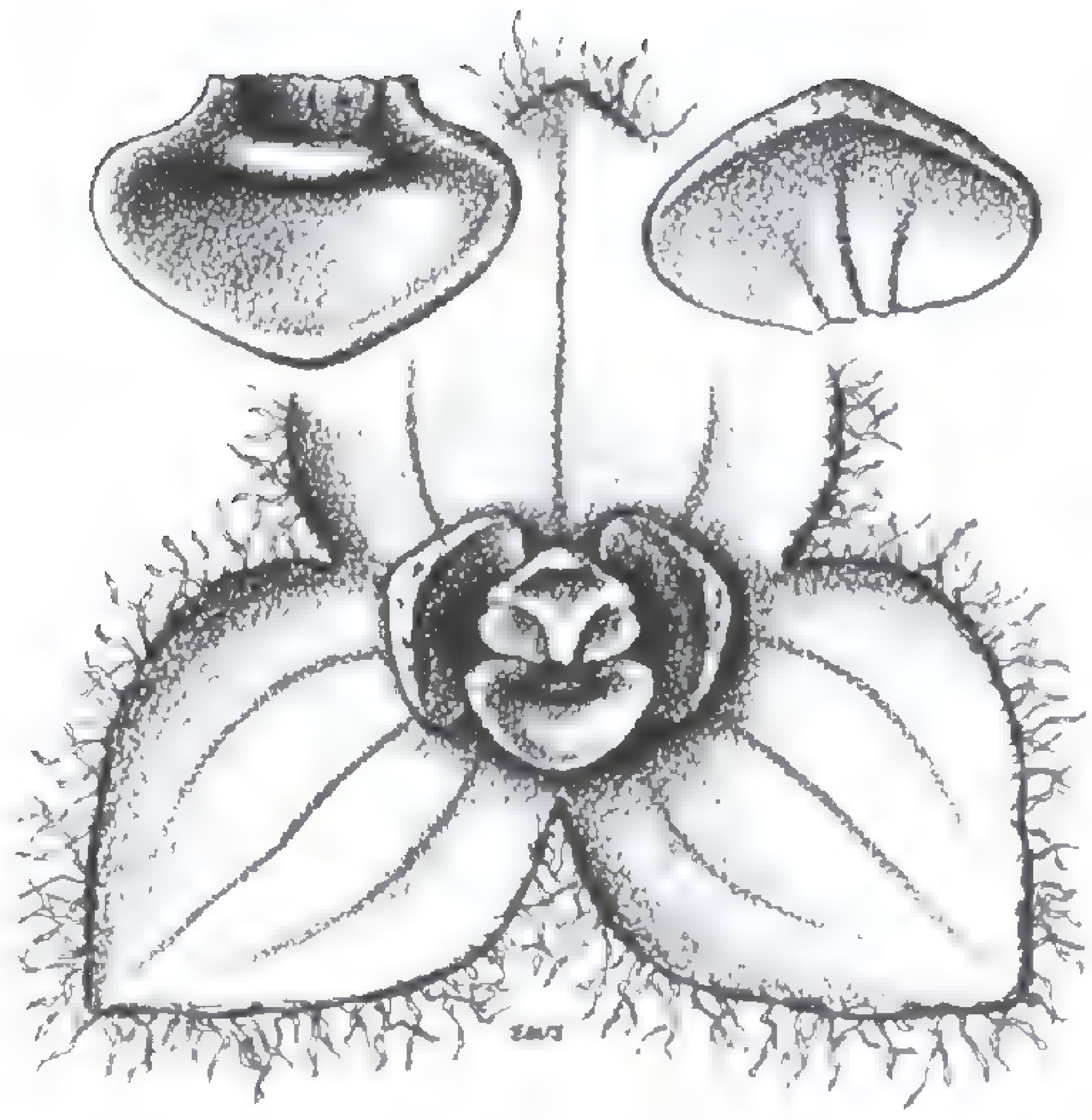
PLATE 90



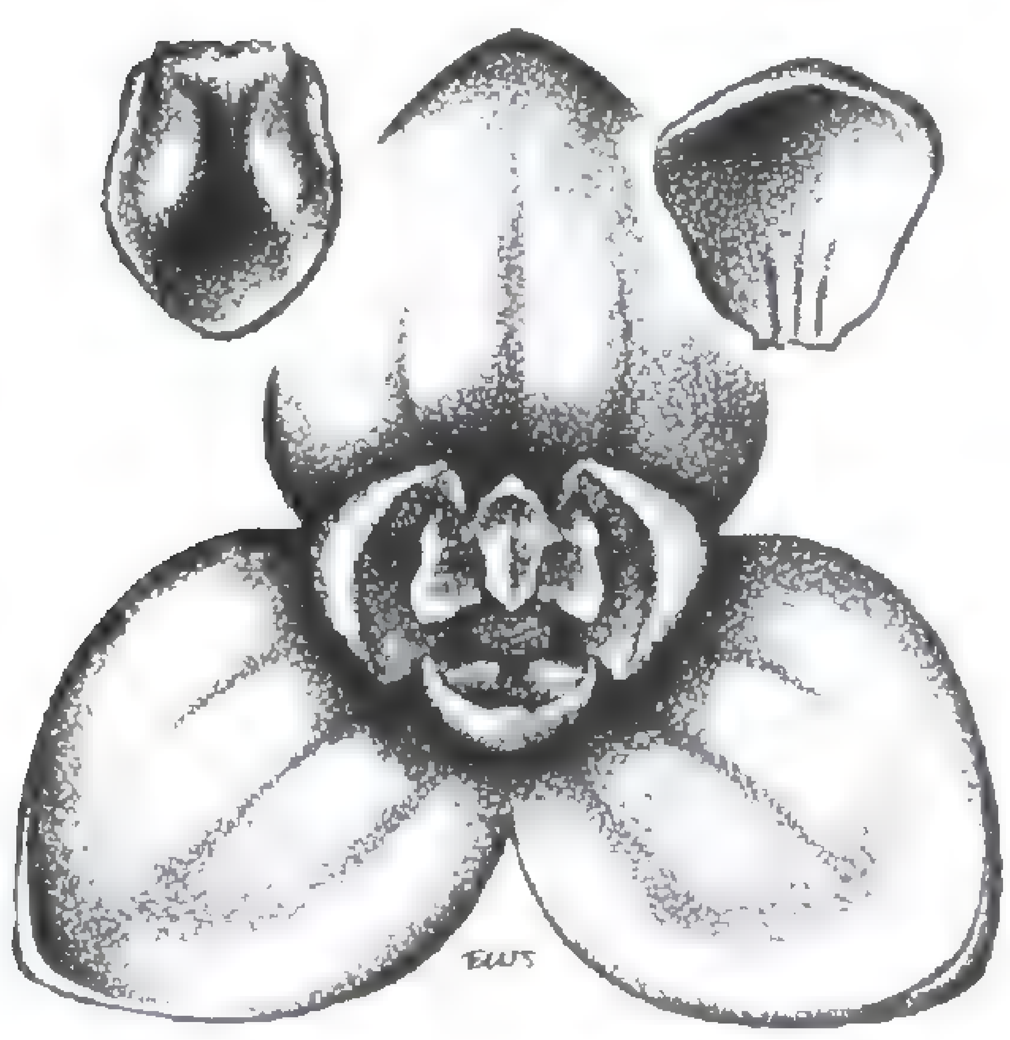
Apatostelis crescentiicola

PLATE 91

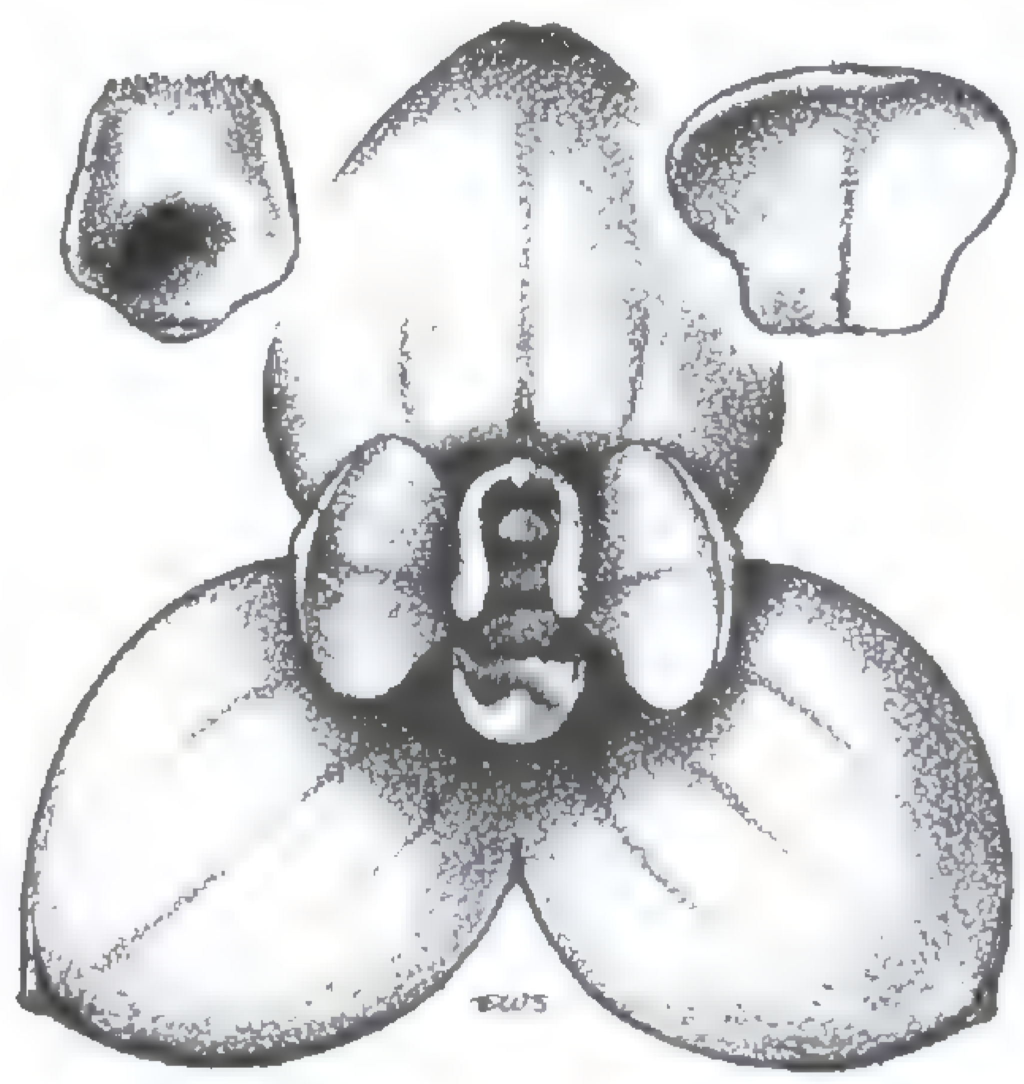
Apatostelis constaricensis



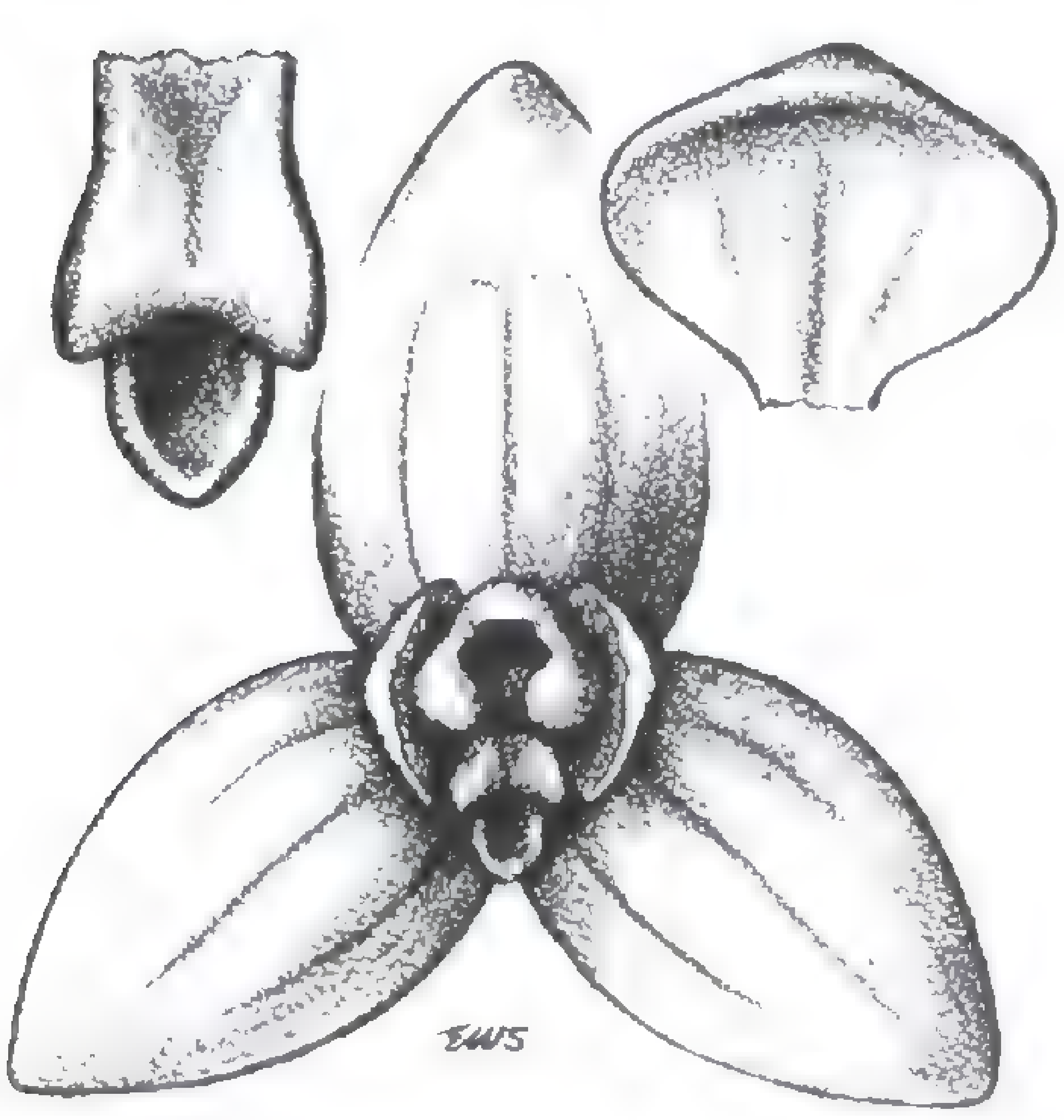
Apatostelis hirtella



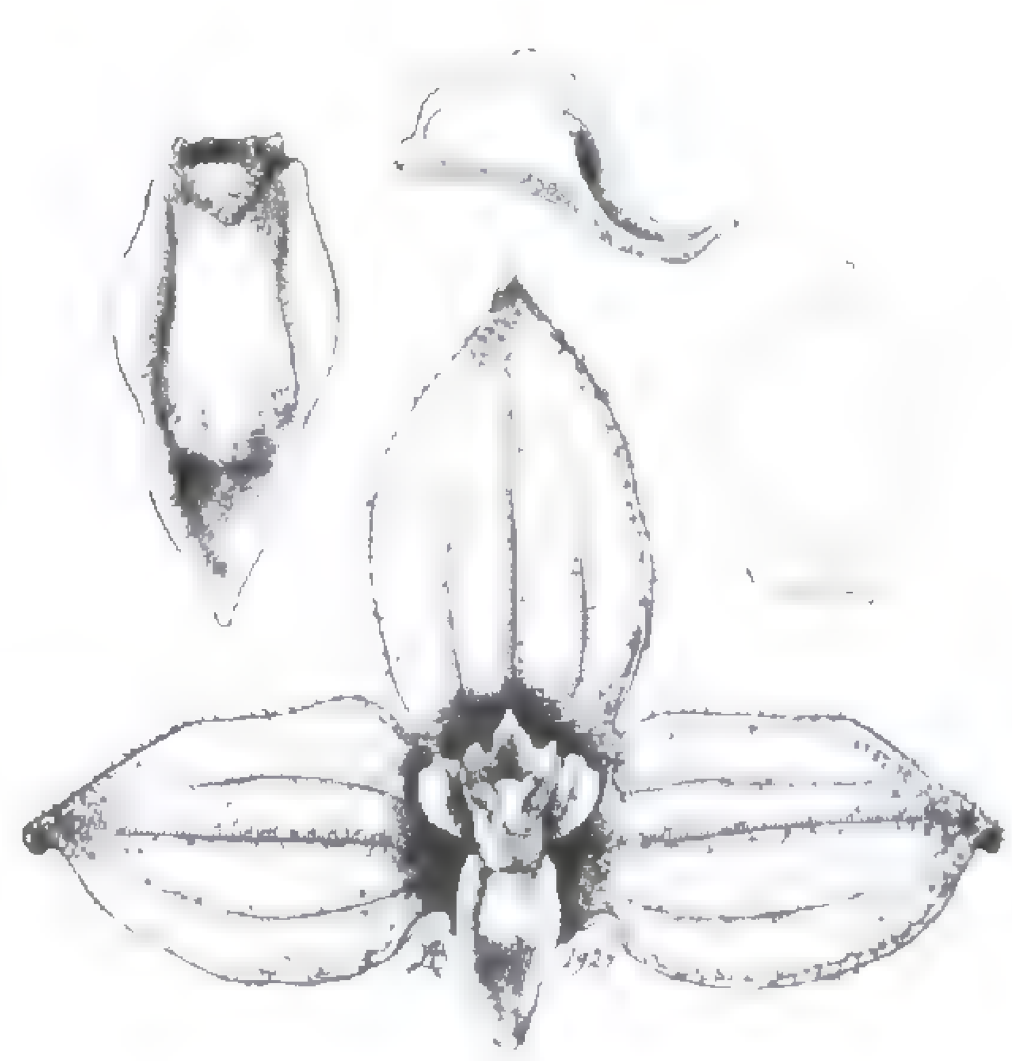
Apatostelis muscosa



Apatostelis hylophila



Apatostelis chamaestelis



Apatostelis oxypetala

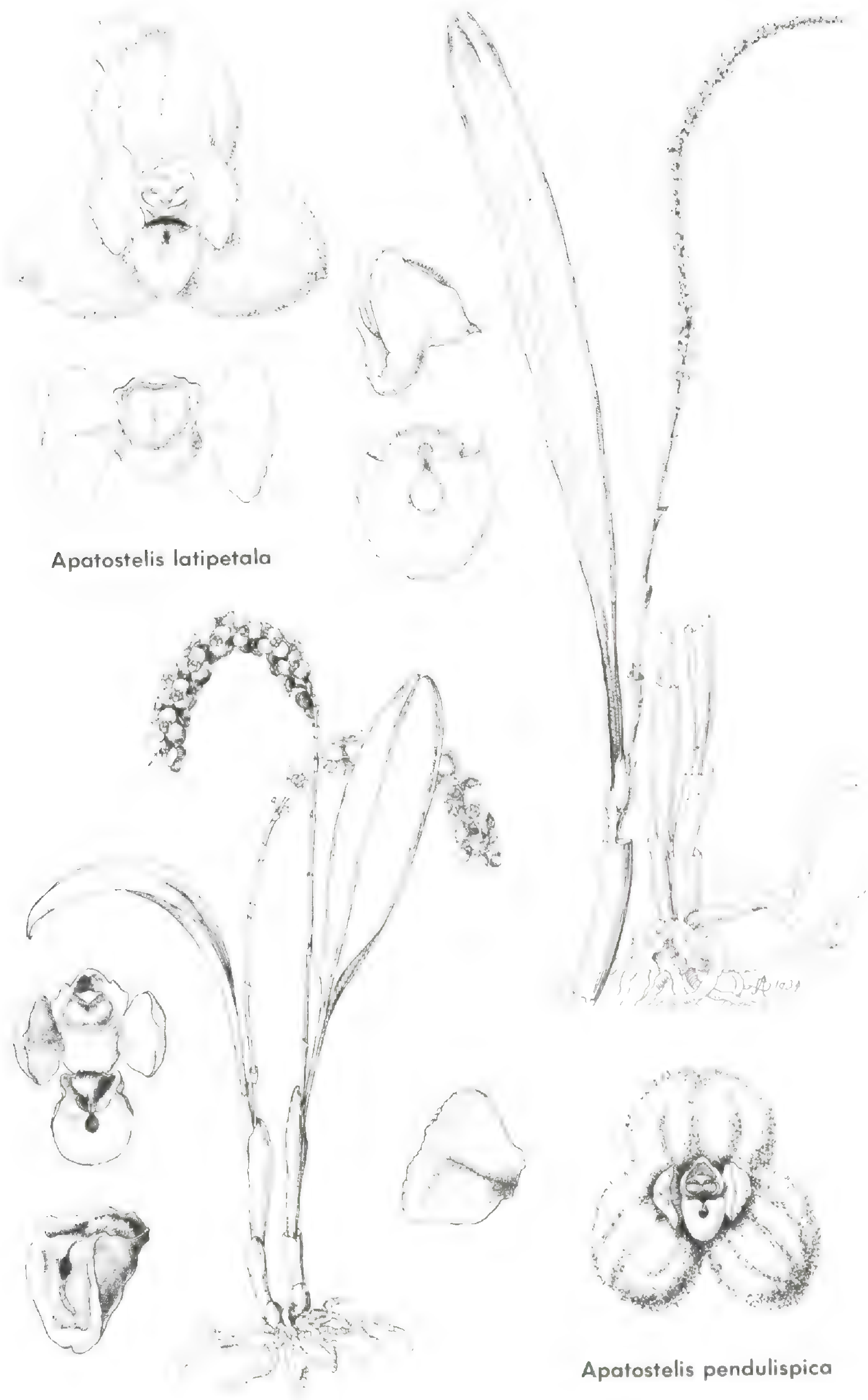
PLATE 92

Apatostelis inaequalis

Apatostelis glossula

PLATE 93

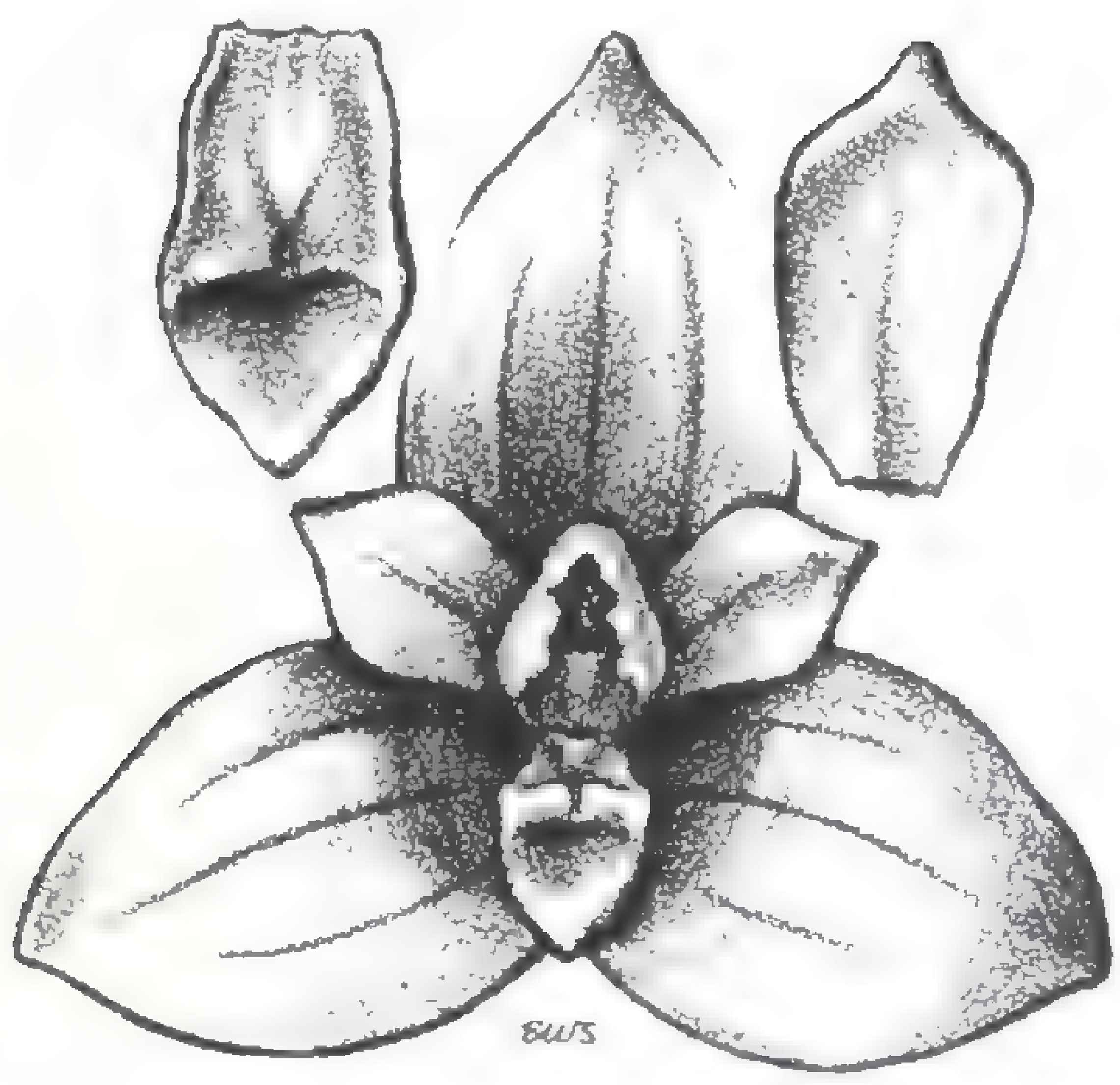
PLATE 94



Apatostelis latipetala

Apatostelis pendulispica

PLATE 95

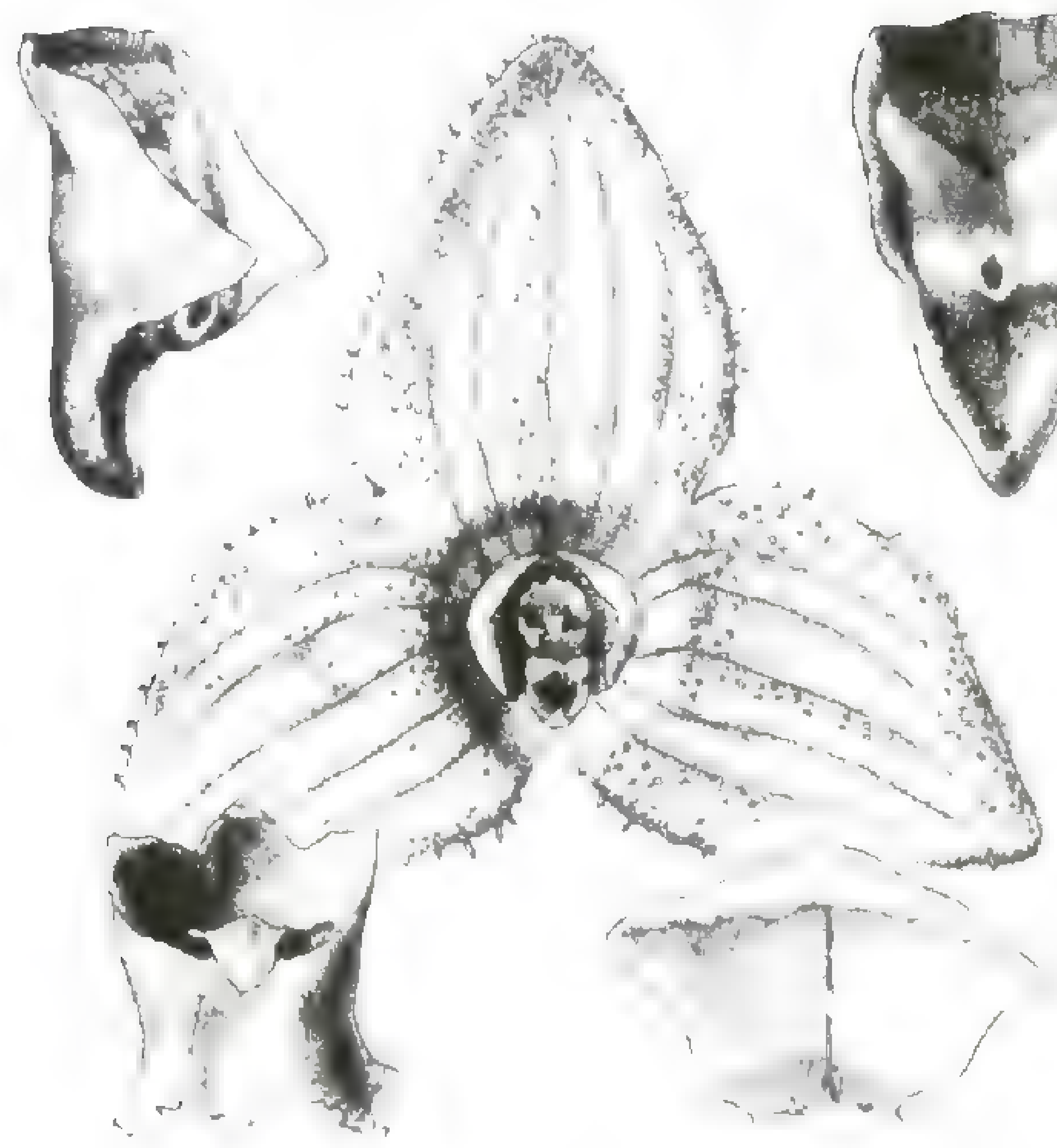


Apatostelis rufobrunnea

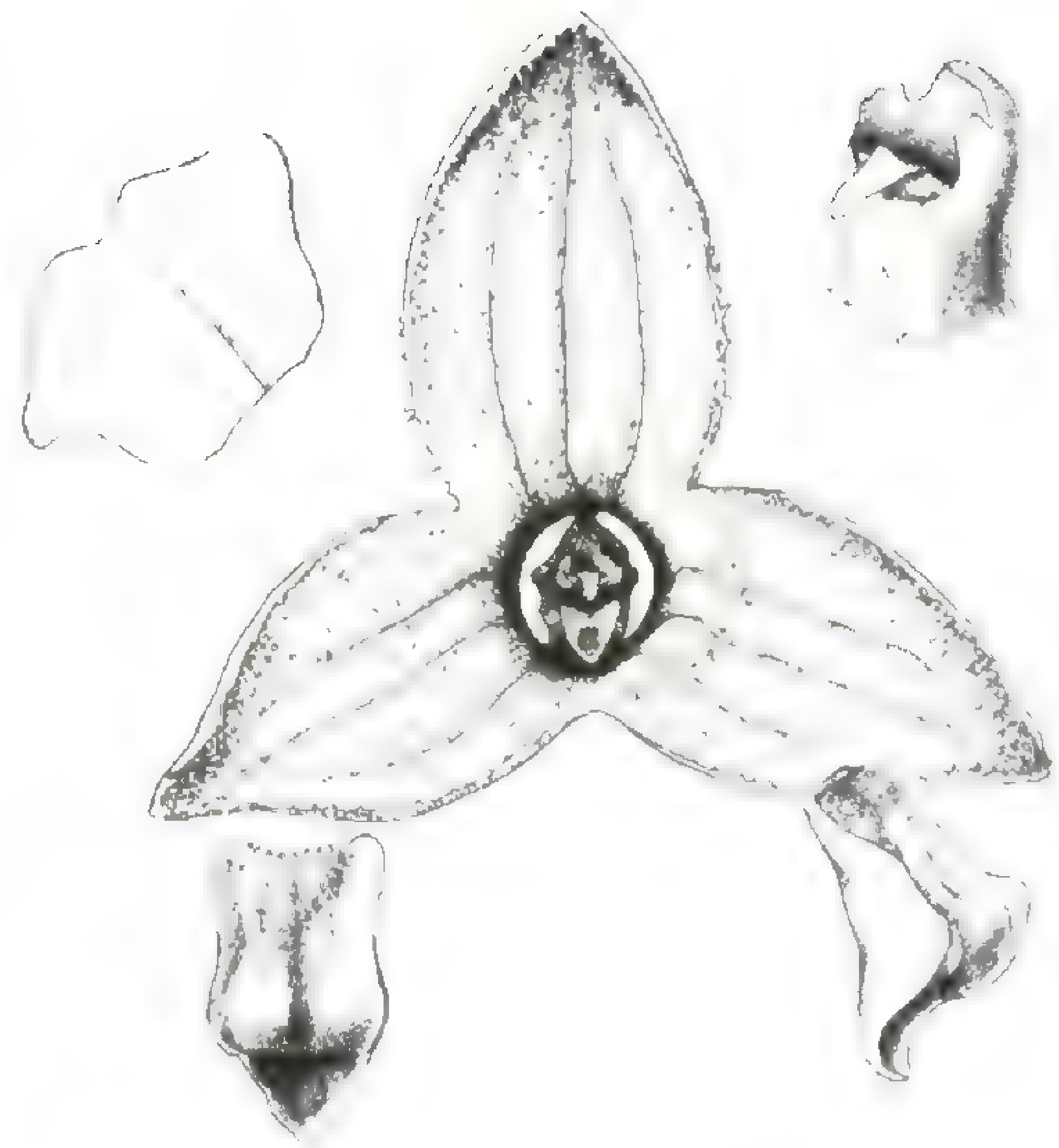
Apatostelis rubens

Apatostelis persimilis

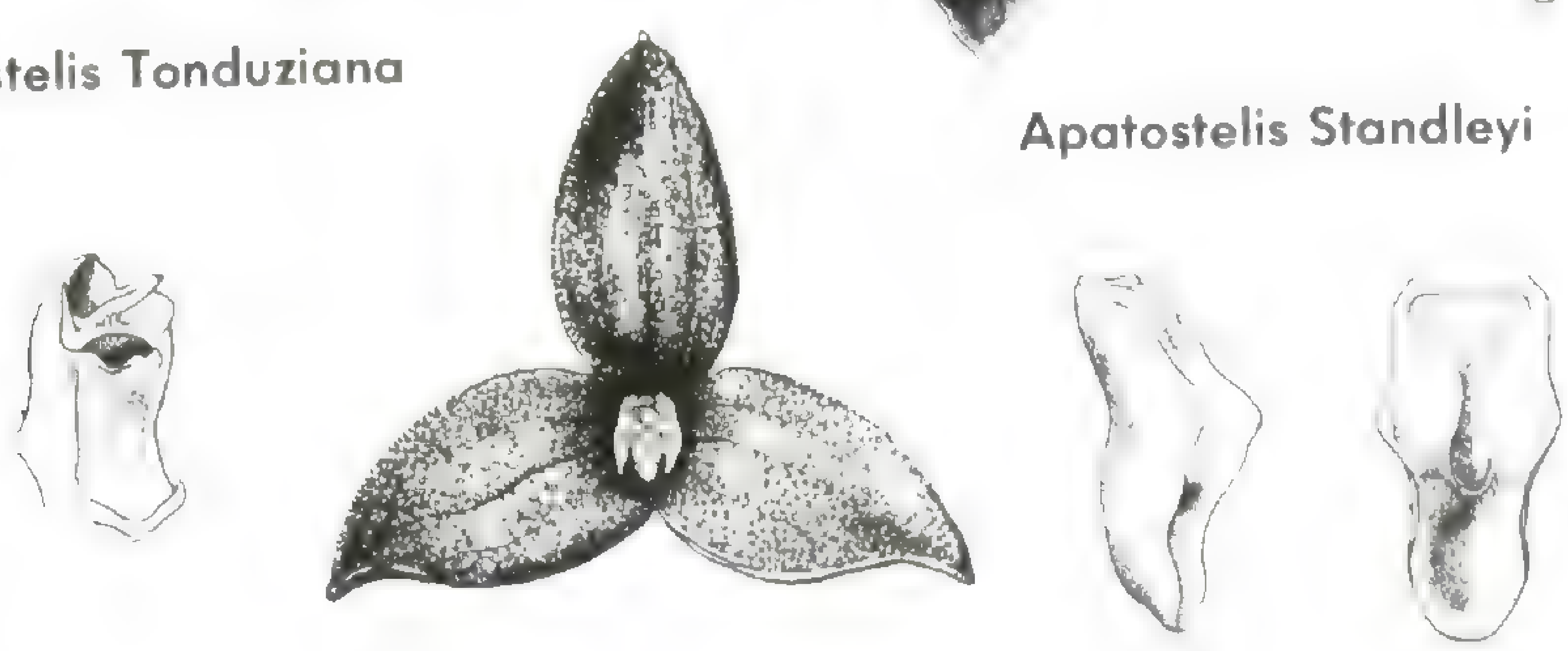
PLATE 96



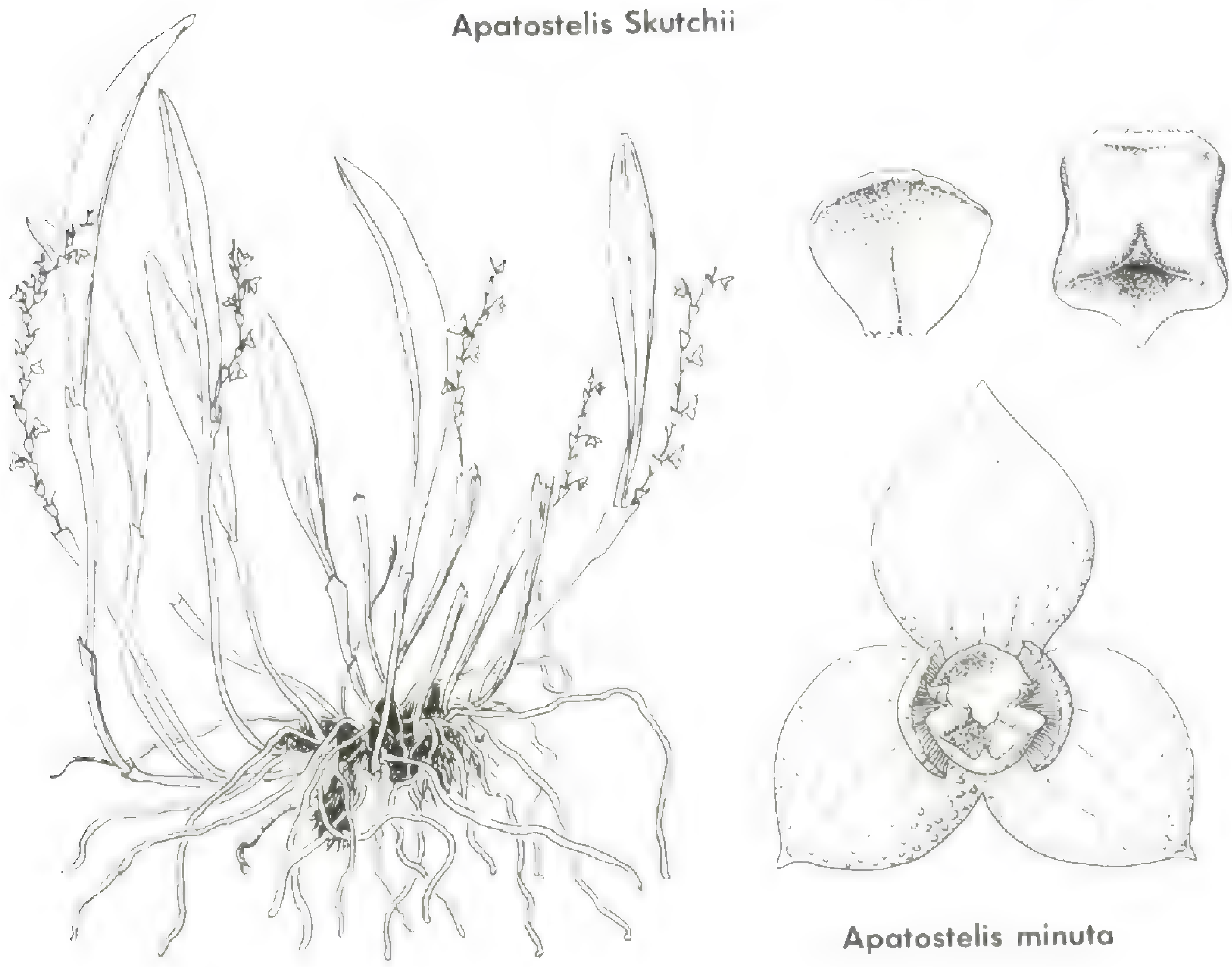
Apatostelis Tonduziana



Apatostelis Standleyi



Apatostelis Skutchii



Apatostelis minuta

PLATE 97

Apatostelis

minimiflora

BOTANICAL MUSEUM LEAFLETS
HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS, DECEMBER 31, 1979 VOL. 27, NO. 10

THE ETHNOBOTANY OF THE FLATHEAD INDIANS OF WESTERN MONTANA

JEFFREY A. HART

INTRODUCTION

Little thorough ethnobotanical research has been done with the Flathead Indians. This paper brings together information from the research of Malouf (1971), Stubbs (1966), Teit (1930) and Turney-High (1937), but more importantly uses as the main sources of its information living Flathead Indians whom I interviewed in the summer and fall of 1973 on the Flathead Indian Reservation in western Montana. As only the oldest tribal members remember native plants, their uses, names and cultural significance, time is running out to record this valuable information.

This paper has as its purpose the examination of some 110 species of plants used by the Flathead Indians, including descriptions of the methods used in collection, preparation and utilization for food, medicine, technology and religion, as well as phonetic descriptions of the Indian names for the plants.

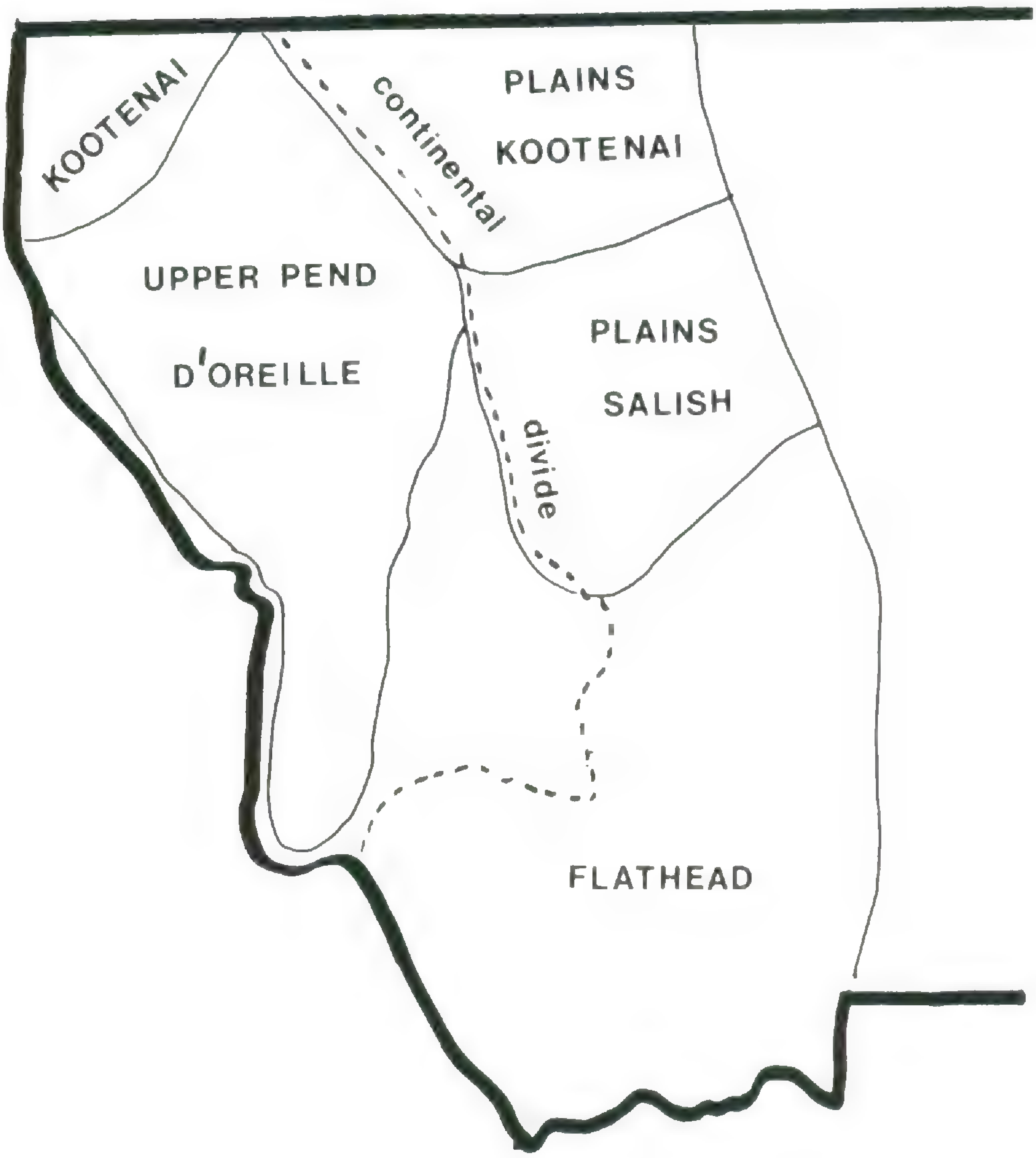
THE FLATHEAD INDIANS

The Flathead Indians occupy the southern half of the Flathead Indian Reservation in western Montana. They are members of the Salishan-speaking language group and are closely related to

Botanical Museum Leaflets (USPS 404-990) Published monthly except during July and August by the Botanical Museum, Harvard University, Cambridge, Massachusetts 02138. Subscription: $25.00 a year, net, postpaid. Orders should be directed to Secretary of Publications at the above address. Second-Class Postage Paid at Boston, Massachusetts

TRIBAL DISTRIBUTIONS IN WESTERN MONTANA

CIRCA 1730



Adapted from a map by Malouf, 1971

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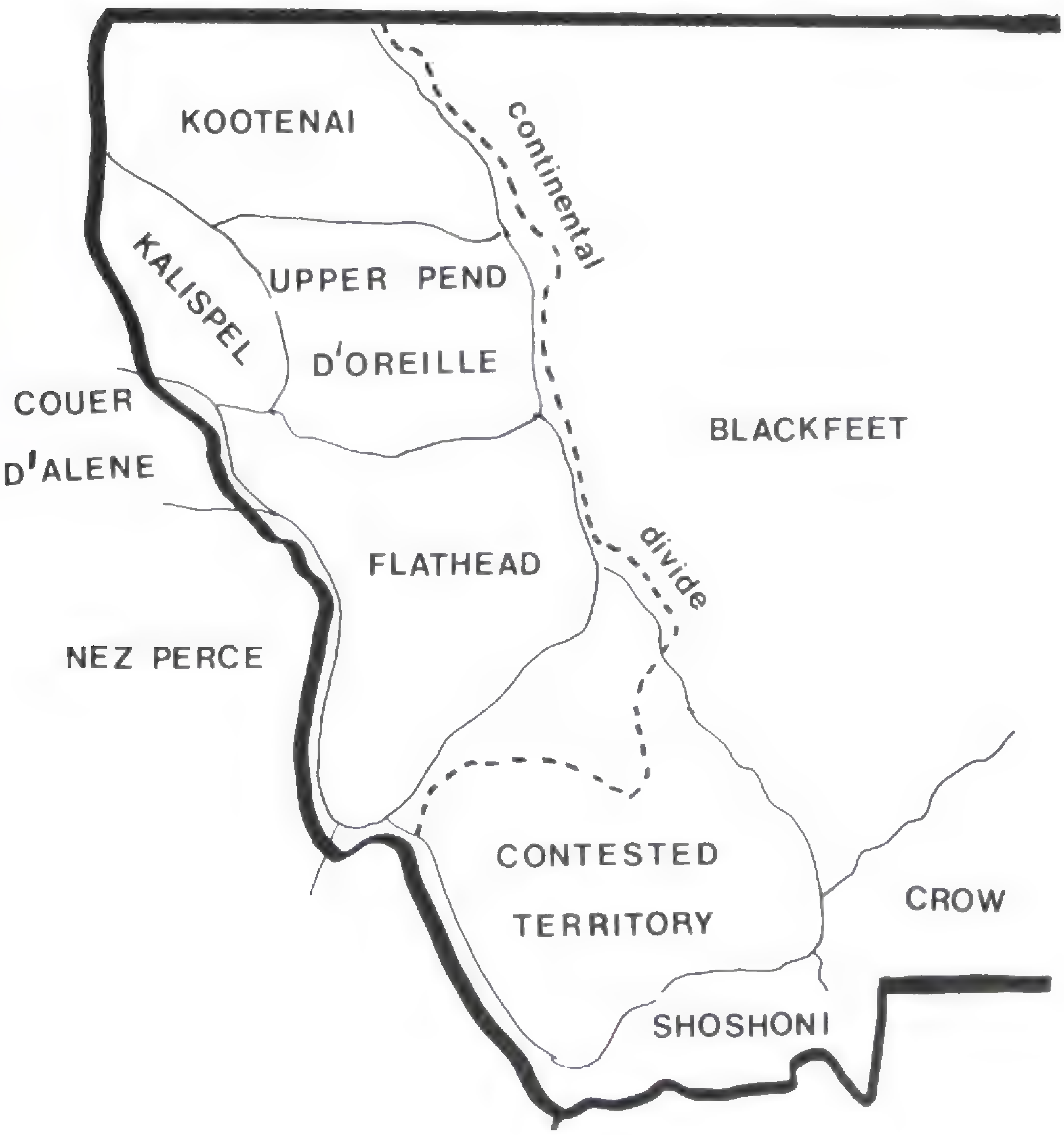
CIRCA 1855



Adapted from a map by Malouf, 1971

the Kalispel and Pend d'Oreille who also live on the same reservation. These distinctions, however, have become blurred in recent years, largely through intermarriage.

Though considered to be a plateau tribe, the Flatheads once were a plains people before the introduction of the horse. In about 1600 their territory was surrounded by the Rocky Mountains to the west and south; the Gallatin, Crazy and Little Belt Mountains to the east; and the Big Belt Mountains to the north. They were divided into 4 distinct bands, with one in Helana, two near Butte, and one in the Big Hole Valley (Teit, 1937).

In the 1700's, about the time that they acquired the horse, the Blackfeet, Crow and other tribes arrived from the east and pushed various tribes, then occupying the western fringes of the Plains, west and south. The Flathead retreated to the gentle Bitterroot Valley of western Montana. They continued hunting east of the continental divide for buffalo, but continued Blackfeet hostility required carefully planned expeditions, these often being accompanied by such friendly western tribes as Pend d'Orielle, Kootenai, Nez Perce and Shoshoni (Teit, 1930).

The original population of the Flatheads is difficult to estimate. Teit (1930) estimated the total population of the Flathead tribes at the time of the introduction of the horse as 15,000, but Fahey (1974) believed 4,000 to be a more realistic figure. The original population was greatly decimated due to diseases, especially a smallpox epidemic in the 1840's and to warfare. By 1909 the U. S. Department of Indian Affairs gave these estimates of the Salishan population: Flathead, 598; Pend d'Oreille 665; Kalispel 182; Spokane, 138. Due to considerable intermarriage with whites it is now difficult to give accurate estimates of the Indian population. Furthermore, most of the fertile land once possessed by Indians has passed to white ownership, resulting in further fragmentation and disintegration of Indian values and customs.

PLANTS USED BY THE FLATHEAD INDIANS

The following list of plants is arranged alphabetically in the categories of Fungi, Lichens, Bryophytes, Pteridophytes and their allies, Gymnosperms, and Angiosperms (Monocots and Dicots). Common names are given in parenthesis. When known, Flathead names are included, and where possible, with their translations. These have been recorded from Flathead Indians from the Flathead Indian Reservation in western Montana. This would not have been possible without the help of Dr. Anthony Mattina, Salishan linguist at the University of Montana, though I have modified the symbols for ease of typing. A key to the orthography used is given in Appendix II.

The list mostly describes plant species, their uses, and Flathead names. Abbreviated symbols to references are as follows: Ad (Adams, 1973); PB (Beaverhead, 1973); RD (Diettert, 1955); LP (Parker, 1973); AP (Pierre, 1973); JP (Pilko, 1973); MSS (Small Salmon, 1973); RS (Stubbs, 1966); T-H (Turney-High, 1937); AV (Vanderburg, 1973); CW (Woodcock, 1973). General methods of collection, preparation and the role of plants in Flathead culture are discussed in the section following the listings. Appendix I is an index to the scientific names of plants mentioned in the text. Appendix III provides a listing of general botanical words used.

FUNGI

The pileus of a species of *Armillaria, Collybia,* and *Russula* was removed and the cap was boiled in a rich broth or was fried for eating (RS). A species of another kind found growing on *Larix occidentalis* was placed on aching teeth for relief (PB), and the spores of a species of *Lycoperdon* were rubbed on eyelids and cheeks of infants to induce sleep (RS,AV).

LICHENS

Alectoria sp. — (Black tree moss)
Uncooked: shawtemqen (PB,AP,CW)
Cooked: sqwu?a (PB): 'baked'

This common species of black tree moss, actually a lichen, was soaked in water and then baked with camas or was baked separately. If baked separately, it was left in the fire pit only over one night. The resulting black, gelatinous material was either eaten with camas, or was sun dried, powdered and mixed with the sweet powder made from camas. A thick pasty substance was made by adding water, and was eaten more as a luxury food than as a staple (RS). Each family consumed about 25 pounds of this lichen each year (T-H).

Letharia vulpina (L.) Vain — (Wolf moss)
skwalyo (PB,AV)

A childbirth medicine was made from a species of tree "moss," very possibly *Letharia vulpina.* The expectant mother's body was rubbed with it (RS, AV).

A yellow "moss" found on *Pseudotsuga menziesii,* also probably *Letharia,* was used as a toothache medicine. It was soaked in hot water for ten to fifteen minutes and then placed in the area of the cavity or toothache. It was believed that this plant was poisonous, so the patient was warned not to swallow the saliva. In a short while the pain of the tooth would be alleviated, and after a few days the tooth would break apart into pieces (PB).

Sores and scabs were first washed and then this lichen was placed on the affected area as a poultice (AP, CW).

It was also used to dye feathers a yellow greenish color (PB).

BRYOPHYTA

Claopodium sp. — (Moss)

This absorbent moss was used to line cradle boards and as a padding inside baby diapers. Placed both fore and aft, the moss lining lasted about twelve hours, and then was washed and reused (PB).

PTERIDOPHYTA

Equisetum arvense L. — (Horsetail)
t́uxweń (Ad, PB, AP, AV, CW)

A tea made from the whole plant was used as a diuretic (Ad,PB).

GYMNOSPERMAE

Cupressaceae

Juniperus communis L. — (Common juniper)
ćiqćeqenlshp (PB)

Juniperus scopulorum Sarg. (Rocky Mountain juniper)
punlshp (Ad, PB, LP, AP, AV, CW)

A tea made from the boughs was drunk for colds, pneumonia, and fevers (Ad, AP, MSS, CW). It was believed that the tea made from the boughs having fleshy cones intact was stronger (Ad). It was also drunk as a general tonic (RD). A decoction applied externally to rheumatic and arthritic areas supposedly alleviated the pain, but did not cure it (PB).

The boughs were burned with charcoal in a can and held beneath the nose of a sick horse (PB). The boughs were also burned on stove tops as incense (Ad, PB, RS, AV) or were used as a body scent (PB).

Thuja plicata Donn. — (Western red cedar)
Wood: astkw (PB, AP, CW)
boughs: mselshp (PB, AP, AV, CW)

Baskets or bags were made from the bark. The strips of bark were woven into differently shaped baskets; a single, large piece of bark was shaped into a bag. The baskets were used primarily for berry picking, while the bag was used for storage (PB).

PINACEAE

Abies grandis (Dougl.) Forbes — (Grand fir)
quilcen (PB, MSS)

An infusion of the resin from the punctured bark blisters was sweetened and drunk for whooping cough (PB). The resin was also rubbed on the throat and chest for colds. An eyewash was made by boiling the bruised needles. The dried and finely pulverized needles were also used as a baby powder (RS).

Abies lasiocarpa (Hook.) Nutt. — (Subalpine fir)
maninlshp (Ad, PB, AP, MSS, CW)

The needles were dried, pounded into a powder, and mixed with grease or marrow; this was then rubbed on diseased or infected skin; if the diseased skin was open and runny, then this powder was sprinkled directly on the festering sore (PB).

For cuts, the hardened resin was pulverized, mixed with warmed lard, and then applied to the wound (MSS). A baby powder was made from the dried and pulverized needles (PB, RD, AV); it was used on baby rashes caused by excessive urination (PB). The needles were placed on the stove as an incense (Ad, PB, AV) or hung on walls to give rooms a pleasant aroma (AV). The pulverized needles were also used to scent shawls (AP, CW) or were used as a body scent (PB).

The finely powdered needles were also mixed in equal proportions with lard and applied to hair as an oil; it was noted to impart a fragrant evergreen scent and a greenish color to hair (Ad, PB). A mixture of the foliage or stems of *Abies lasiocarpa, Artemesia ludiviciana, Ceanothus velutinus, Ligusticum canbyi* and *Pterospora andromeda* was used to make a hair restorer (Ad).

Larix occidentalis Nutt. (Western larch)
Tree: caqwelsh (PB, AP, AV, CW)
Boughs: chchqwelshelshp (PB)
Hardened sap: sanćemćem (PB)

The hardened sap was collected from larch as well as from pine trees; it was chewed like gum (AP, RS, AV).

A sweet syrup was made from the sap: it was collected from hollowed-out portions of the trunk and then was allowed to remain there for some time so that natural evaporation would concentrate the sugars (AP, RS, CW). The gummy sap was also used to plaster hair in place (RS).

Pinus albicaulis Engelm. —(Whitebark pine)

The seeds were eaten (RD), and presumably were prepared as were the seeds of *Pinus monticola.*

Pinus contorta Dougl. — (Lodgepole pine)
qweqwelit (PB, AP, AV, CW)

A medicine for burns was made from this pine. The resin was heated in a can until it turned black. One part of bone marrow was added to four parts of heated resin and mixed until no longer sticky. This was then molded into flat cakes and placed on burns (PB).

A mixture of axle grease, Climax Chewing Tobacco and resin was applied to boils (PB). The pitch was chewed like gum. The sap and cambium from the peeled bark were eaten, though in small quantities as too much was thought to cause a bellyache. And the preferred tepee poles were fashioned from the slender trunks of this tree (AP, RS, CW).

Pinus monticola Dougl. — (White pine)

Green cones were put into a fire, removed after they had opened, and the roasted seeds eaten (RS).

Pinus ponderosa Dougl. — (Ponderosa pine)
sa?atkwlshp (Ad, PB, LP, JP, AV, CW)

Ponderosa pine had several medicinal uses. The warmed resin was placed on boils and a leaf of *Berberis repens* was placed over it until it broke (Ad). For dandruff, the pointed ends of the needles were jabbed into the scalp (MSS). The heated needles were placed on the abdomen of expectant mothers to help deliver the placenta (T-H). The pitch, heated and mixed with melted animal tallow, was applied with a piece of canvas for rheumatism and backache (RS).

The sap from ponderosa was preferred more than any other conifer. The bark was peeled in late April or early May when the sap was running. An incision made with a knife or axe prior to peeling was made to test the flow and sweetness of the sap. The rib bone of a buffalo or elk was used to peel the bark, as its natural flexibility and curavature facilitated its being worked under the bark. Once removed, the bark was scraped on the inside to remove the edible cambium and sap (RS).

The seeds were also eaten; they were prepared as were those of *Pinus monticola* (RS).

Pseudotsuga menziesii (Mirbel) Franco — (Douglas fir)
cq̓elshp (PB, AV)

A tea made from the needles was drunk for colds (RS). The rotten wood was used to smoke hides (AV).

TAXACEAE

Taxus brevifolia Nutt. — (Western yew)
ckwńcha (PB, LP) 'bow-wood'

The wood was used to make bows (PB, RD). Boiled sinew or muscle was used to varnish the well-seasoned wood to waterproof it and to prevent it from warping (PB).

ANGIOSPERMAE

Monocotyledonae

Cyperaceae

Scirpus acutus Muhl. — (Bulrush)
tkwtiń (PB)

The stems were used for tying tents together or for braiding mats or rugs (RD).

Gramineae

Elymus cinereus Scribn. & Merr. — (Ryegrass)
pspsnewlsh (PB); pa?pa?a (LP)

Young Indian boys once placed hawthorn points on these shoots; they were used as play spears to inflict pain on one another in preparation for warfare (PB).

Hierochloe odorata (L.) Beauv. — (Sweetgrass)
sx̲esesťiye?e (Ad, PB, AP, AV, CW)

The aromatic properties of sweetgrass were well known to the Flatheads. The blades were braided into three ply ropes and placed in suitcases with clothes to give them fragrance (AP, RS, CW); or the aroma was imparted to clothes by burning sweetgrass beneath them (RS). It was believed that this treatment would keep bugs away (AP, C W). Sweetgrass was also burned on stove tops as incense (Ad, AV).

An infusion of sweetgrass was drunk for colds, fevers (Ad, AV) and to alleviate sharp pains inside (PB). It was also mixed with the seeds of *Thalictrum occidentale* and made into a tea drunk for colds (RS).

Allium cernuum Roth — (Nodding onion)
qwliwye?e (PB, AP, MSS, AV, CW)

The bulbs of this common onion were frequently eaten. They were eaten raw or used for flavoring soups and meats, and apparently were not kept for winter use (Ad, RD, AP, JP, RS, CW).

Allium douglasii Hook. — (Douglas onion)
sehch (Ad)

These mild and sweet onions were known only from the Hot Springs area of the Flathead Indian Reservation. They were eaten fresh or were dried, though they didn't keep very long; they were sometimes eaten with *Alectoria* (RD).

Brodiaea douglasii Wats. — (Brodiaea)
silus (PB)

It was not clear that this species was eaten. PB believed the bulb edible, but AV thought it poisonous.

Camassia quamash (Pursh) Greene — (Camas)
Uncooked: sx̱we?li (Ad, LP, AP, JP, AV, CW)
Cooked: ?itx̱we?e (Ad, JP, AP, AV, CW)

After bitterroot, camas was the most important food plant to the Flathead Indians. RD claimed that the Bigsam family consumed bout 8 gallons of dried bulbs each year, though in earlier times a greater quantity was certainly consumed.

Camas bulbs were normally gathered just after the plant bloomed (RS, AV), from late June to early August, depending upon the elevation, and were found in moist meadows throughout the Northwest. Flatheads mostly gathered their camas from Camas Prairie (AP, JP RS, CW), Evaro Hill (JP), parts of the Bitterroot Valley (JP, RS), in the vicinity of Seeley Lake (RS), at Potomac (JP), in the Lower Jocko Canyon (Malouf, 1971), as well as several other sites. The bulbs found in Camas Prairie were noted for their sweetness, but were smaller than those found elsewhere (RS).

Camas bulbs were typically baked in a fire pit, which measured approximately one and one half feet deep by several feet wide. Rocks were placed on the burning wood, and after becoming thoroughly heated, were in turn covered by layers of various types of leafy vegetation, including ferns, grass, birch (*Betula*) branches with leaves intact, geranium (*Geranium*) tops, skunk cabbage (*Lysichitum americanum* Hulten & St. John) leaves, lupine (*Lupinus*), black tree lichen (*Alectoria*), willow (*Salix*), and bark from various kinds of trees. Cloth, canvas or burlap bags have been used in recent times in place of natural vegetation. If the vegetation was not moist, then water was poured on the leaves to produce a steam. This can also be done by pouring water down a hole made by leaving a stick in the pit and then removing it after the dirt had been spread on top. A fire was kindled on top of the dirt, and in one to three days the camas was ready to eat (AP, JP, RS, AV, CW).

The cooked camas, dark in color and sweet in taste, could be eaten immediately, dried and stored for future use, ground up with a stone pestle, or more recently ground with a meat grinder and made into small cakes. Flour, cream and sugar in recent times have been added (AP, JP, RS, AV, CW). Another dish was made by boiling camas down to make a syrup to which was added flour, or a sweet tasting beverage (RS).

Many researchers have speculated that a chemical change takes place during the cooking process of camas. Chestnut (1902) reported "while raw, the substance of the bulbs is crisp, white and very mucilaginous, but almost tasteless; when cooked, however, they are remarkably sweet, the long baking having evidently converted the mucilaginous substance into sugar." Konlande and Robinson (1972) did chemical analyses of the bulbs before and after cooking. Raw camas was found to contain 0.5 1.1% reducing sugar, while cooked camas was found to have 42.9% reducing sugar on a dry-weight basis.

Erythronium grandiflorum Pursh (Glacier lily)
max̱e?e (PB, JP)

The bulbs were recognized as being edible (PB, JP), though they were apparently not used very often.

Fritillaria pudica (Pursh) Spreng. — (Yellowbells)
q́awx̱e?e (PB, JP, AV, CW)

The corms were collected in May at about the same time as bitterroot, and were washed and often eaten with it (RD, AP, JP, AV, CW).

Veratrum viride Ait. — (Hellebore)
s̓teso?o (AP, JP, AV, CW): the name pertains to "sneeze"

The root was employed as a decongestant. Powder from the dried roots was sniffed into the nose, the resulting sneezing clearing up the nasal passages (AP, RS, AV, CW). As this medicine had a powerful reaction, it was not given to children (AV).

Xerophyllum tenax (Pursh) Nutt. — (Beargrass)
selchestiye? (PB, AP, AV, CW): pertains to bad or sore

The roots were boiled to make a decoction which was applied to the scalp; it was thought to act as a hair restorer (RD).

Zygadenus elegans Pursh — (Death camas)
i?westeń (PB, AP, AV, CW)

The bulbs were recognized as poisonous and were avoided (PB, RD, AV).

ORCHIDACEAE

Goodyera oblongifolia Raf. (Rattlesnake-plantain)
nche?eẃs (PB, AP, AV, CW): "to pry open or apart"

The epidermal layer of the leaf was peeled off; the leaf was then plastered on burns, cuts, boils and sores (PB, RD, AP, RS, R-H, AV, CW). It acted to draw the pus out (PB).

TYPHACEAE

Typha latifolia L. — (Cat-tail)
Leaves: p̓ishlshp (PB, AP, AV, CW): pertains to scrap
Inflorescence: sx̲estqe (PB): 'good head'

The leaves were used for weaving baskets for meat and fish, and for making mats for sweathouses (AP, CW).

Dicotyledonae

ACERACEAE

Acer glabrum Torr. — (Mountain maple)
sxu'tlula (PB, LP, AP, CW)

The branches were used to make arrow shafts, pipestems, and as framework in sweathouses (PB).

ANACARDIACEAE

Rhus glabra L. — (Smooth sumac)

An infusion of the leaves and branches was drunk for tuberculosis. The patient in this treatment could not use salt or sugar as it was believed to make him cough (RS). The fruit was known for its laxative properties (RS).

ASCLEPIADACEAE

Asclepias speciosa Torr. — (Showy milkweed)
senelshqew (Ad)

The milky sap was dried and used like chewing gum (Ad). The roots were either eaten fresh or were dried, pulverized, and made into a tea; this was taken for stomach ache (RD).

BERBERIDACEAE

Berberis repens Lindl. — (Mahonia)
Plant: sceselshp (PB)
Fruit: sćals (Ad, PB, AP, JP, CW)

RS claimed that the fruit was never used for food until sugar was made available in recent times. RD claimed that they were eaten fresh when ripe, however. The fruits could also be pounded and cooked into a jam (RD, AV), though much sugar was needed (AV). Dried, the fruit was saved for future use (RD).

As a medicine, the roots were cleaned, chewed or crushed, and placed on cuts with a clean cloth; this was changed three times a day. In about three days the cut was reputedly healed (PB).

A decoction made from the roots had several uses. It was drunk as a tea to alleviate coughing (AP, CW), to facilitate the delivery of the placenta of pregnant women, for venereal diseases, as a contraceptive (RS), and for rheumatism (AP, CW); it was also used as an eyewash (RD).

Betulaceae

Alnus incana (L.) Moench — (Alder)
ċhichteṅe (PB, MSS, AV)

An infusion of the bark was employed to dye moccasins yellow (MSS, AV), feathers reddish brown (PB), and human hair red (RS).

Betula occidentalis Hook — (Birch)
siċeqenelshp (AP, AV, CW)

Betula papyrifera Marsh — (Paper birch)
qwlshnalqw (AP, AV, CW)

The sap was drunk as a beverage (PB, RD), it was collected from hollowed-out cavities in trunks (PB).

Boraginaceae

Lithospermum ruderale Dougl. — (Stoneseed)
si?icqen (PB): pertains to head

An infusion from either the fresh or dried roots was drunk for pleurisy and similar ailments (RD), while the infusion of the foilage was drunk for diarrhea (RS).

CACTACEAE

Opuntia polyacantha Haw — (Prickley-pear cactus) sxweyeneʔe (PB, AP, JP, CW): 'sharp ear'

The stems were burned to remove the spines, then were washed and boiled; the resulting infusion was drunk for diarrhea (Ad). The crushed stems were placed directly on backaches (AP, CW), presumably after the spines had been removed.

CAPRIFOLIACEAE

Lonicera ciliosa (Pursh) DC — (Orange honeysuckle)

The plant was boiled to make a shampoo; it reputedly made hair grow longer (RS).

Lonicera involucrata (Rich.) Banks — (Bearberry)

The fruits were eaten to expel worms (Ad) or to act as a powerful laxative (RS).

Sambucus cerulea Raf. and **S. racemosa** L. — (Elderberry) Plant: ćkwik-alkshkw (PB, AP, CW) Fruit: ćkwikw (PB, AP, AV, CW)

An infusion of the bark was drunk by women to help deliver the placenta (PB). A flute was made from the stems (Ad, PB, RD). RD reported that the use of elderberry came only recently when sugar became available. For immediate consumption, the fruits were boiled and eaten (RS), for later use they were boiled and sun dried (RS, AV) or were canned or made into a jam (AV).

Symphoricarpos albus (L.) Blake — (Snowberry) Plant: stemtemnýa (PB, AP, AV, CW): pertains to corpse Fruit: stemtemnyalshq (PB)

Wood: stemtemnyalshkw (PB)
Leaves: stemtemnyelshp (PB)

The fruit or leaves were crushed and applied to wet sores (AV), chapped or injured skin (RD), or to scabs of cuts and burns to promote healing with no scarring (RS). An eyewash was made from this species and *Rosa* sp. mixed together. If one poked his eye when hunting, the fruit was chewed and the juice placed into the eye; at first the eye tightened up, but soon felt better (PB).

CELASTRACEAE

Pachistima myrsinites (Pursh) Raf. — (Mountain lover)
An infusion of the roots was drunk for syphilis (PB).

CHENOPODIACEAE

Chenopodium sp. — (Lamb's quarters)
Young plants were cooked as potherbs (RS).

COMPOSITAE

Achillea millefolium L. — (Yarrow)
nkwk̓wa (Ad, PB, AP, JP, MSS, AV, CW)

The leaves were mashed by chewing or by pulverizing in water, and then wound around cuts, bad bruises, and open wounds to stop bleeding and to act as a disinfectant (Ad, PB, RD, AP, MSS, AV, CW). The leaves and stems were boiled to make a bitter tea taken for colds (RD, RS). For toothache, the leaves were compressed on the particular tooth causing the pain (AP, CW). An infusion of the leaves was employed to wash aching backs and legs (Ad). The flower heads were rubbed in armpits as a deodorant (RS, AV).

Artemisia dracunculus L. — (Sage)
Swollen feet and legs were treated by placing them into the the hot infusion of this plant and by rubbing the boiled plant over the affected areas (Ad).

Artemisia ludoviciana Nutt. — (Prairie sage)
qepqepte (Ad, PB, AV)

Several uses were made of this plant: a decoction made from the leaves was used externally to wash bruises (PB); was placed in bath water along with a similar decoction from *Rosa woodsii* and used for itchiness (Ad); or was drunk as a bitter, strong-tasting tea for colds (RS) or the decoction was used to wash areas affected with poison ivy (AD).

The leaves of this sage and that of *Pseudotsuga menziesii* were placed in sweathouses as incense (Ad).

Hides were rubbed with the foilage of this plant before they were soaked; apparently this treatment prevented hides from souring (RS).

Artemisia tridentata Nutt. — (big sagebrush)
ṕuṕunelshp (PB, LP, AV, CW):
'stink plant'

An unfusion of this sage was drunk as a remedy for colds and pneumonia (RS).

Aster conspicuus Lindl. — (Showy aster)

An unfusion of the roots was drunk in the treatment of gonorrhea (PB).

Balsamorhiza sagittata (Pursh) Nutt. — (Arrowleaf balsamroot)
Plant: mtuchuẃe (Ad, PB, AP, JP, MSS, AV, CW)
Root: taeqwu (PB, AV)

The leaves were used as a poultice for swellings (MSS) or burns (AP, CW). An infusion of the roots was drunk for tuberculosis, whooping cough, to increase urinary flow, or as a physic (JP). The tough, woody roots were made palatable by baking in a fire pit for at least three days (RS).And the flowering stems were peeled and eaten raw (Ad, AP, JP, MSS, RS, CW) or were cooked as a green (Ad).

Circium spp. — (Thistle)
Edible kind: ćeqćiq (PB, MSS, AV): 'prickly'
Inedible kind: sqel̓temxwa (Ad, AV): 'its a kind of man'

The young stems were peeled and eaten raw (Ad, RD, AV). Two species were recognized, one considered edible and the other not. Years ago there was a taboo against picking too much thistle, as it was believed that it might become exterminated (PB). The roots were peeled and baked in a fire pit for two to three hours; they were not dried for later use (RS).

Grindelia squarrosa (Pursh) Dunal — (Gumweed)
telshisqa (PB, AP, AV, CW): 'it sticks to horses' hooves'

An infusion of the stems and leaves was drunk for colds, pneumonia, fever, whooping cough, tuberculosis, or just to perk one up (Ad, PB, AP, RS, CW). The sticky flower heads were rubbed on sore horses' hooves; it was believed to toughen them (RS, AV).

Matricaria matricarioides (Less) Porter (Pineapple weed)
n̲celceltxwqin (Ad, PB, AP, AV, CW): 'clustered heads'

An infusion of the entire plant was drunk for colds (Ad, AP, AV, CW), fevers (AP, CW), diarrhea (PB), upset stomach (Ad, PB), and by women at childbirth to give them energy and to build up their blood (RD) and to help deliver the placenta (RS). This tea was also blended with *Letharia vulpina* for the preceding medication, and was also drunk by young girls having menstrual cramps (RS).

The leaves were dried, powdered and sprinkled over fresh meat or fruit to keep bugs off, and sometimes the entire plant was used in alternate layers in parfleches with meat or berries (PB, RS).

Tanacetum vulgare L. — (Tansy)
The crushed leaves were used to poultice burns (RS).

CORNACEAE

Cornus stolonifera Michx. — (Red-osier dogwood)
Plant: schtxwe (AP, AV, CW)
Fruit: stechcxw (PB, AP, AV, CW)

The fruit, though apparently bitter, was eaten raw or was mixed with serviceberries (RD, AP, AV, CW). The branches were used in the construction of sweathouses (RD), and the inner bark was dried and smoked with tobacco (AP, AV, CW).

CRUCIFERAE

Rorrippa nasturtium-aquaticum (L.) Schinz & Thell. — (Watercress)
senkwa?letkw (AP, AV, CW): 'it's growing in the water'

Watercress was occasionally cooked as a potherb (RS, AV); it was also eaten raw (RS).

ELAEAGNACEAE

Shepherdia canadensis (L.) Nutt. — (Buffalo-berry)
Plant: sx̲usemnalshkw (PB, AP, CW): 'foam berry plant'
Fruit: sx̲wusem (Ad, PB, LP, JP, AP, AV, CW): 'foam berry'

"Foam berries," gathered in the middle of August, were placed in a bowl with water and beaten until foamy, and the resulting frothy dish was then eaten (Ad, AP, CW). It was bitter tasting, but was made more tasty by adding sugar (AV). The fruit was dried and saved for winter use (Ad, RS, AP, JP, AV, CW), but in recent times freezers have been used to preserve them (AP, CW). An eyewash was made by boiling the debarked branches (PB, AP, AV, CW).

Arctostaphylos uva-ursi (L.) Spreng. — (Kinnikinnick)
Plant: skwlselshp (PB, AP, JP, AV, CW): 'red plant'
Fruit: skwulis (PB, LP, AP, AV, CW): 'red?'

The fruit was eaten raw (RS), fried and eaten (RS, AV), or boiled with sugar and made into a broth (AP, CW). The dried berries were not dried and stored since other berries could have been gathered from the shrub at anytime during the winter, thus serving as a hedge against starvation (RS).

The powder from the pulverized fruit was sprinkled on liver as a condiment; it could also be mixed with lard for eating (RS).

The powder from the pulverized leaves was used on burns to help promote rapid healing (AP, RS, CW). A tea made from the leaves was drunk for colds and coughs (AP, CW). For earaches, smoke from the leaves was inhaled from a pipe and then blown into the aching ear with the detached pipestem (RS).

The leaves were dried in an oven or sweathouse (JP), and mixed with tobacco for smoking (Ad, PB, RD, AP, JP, RS, AV, CW). It was also smoked with the dried bark of red willow (probably *Cornus stolonifera*), or the dried roots of *Veratrum viride* or *Osmorhiza occidentale*.

Chimaphila umbellata (L.) Bart. (Prince's pine)
sch<u>x</u>el<u>x</u>elpu (Ad, PB, JP): 'eye brightener'

A decoction of the leaves was employed as an eyewash for sore eyes, especially due to heat, smoke, or perspiration (Ad, PB, JP). The leaves, after drying in a sweathouse, were smoked (PB).

Ledum glandulosum Nutt. — (Labrador Tea)
scht<u>x</u>we liti (PB, AP, AV, CW): 'mountain tea'

An infusion of the leaves and twigs was employed as an eyewash (Ad).

Pterospora andromedea Nutt. — (Pinedrops)
senchelep tapemis (Ad, PB): 'coyote's arrow'

A whitish growth (fungus?) found on the roots was used for toothache. It was put in the caries to alleviate the pain (PB). An infusion of the plant was mixed with several other species and used as a hair restorer. It was also boiled with *Clematis columbiana* to make a shampoo (RS).

Vaccinium globulare Tydb. — (Huckleberry)
Plant: steshlshqwlshp (PB, AP, CW): 'sweet plant'
Fruit: stsha (PB, LP, AP, AV, CW)

Huckleberries were the most important fruit gathered by the Flathead (RS). RD suggested that they were mostly eaten in season, but some were sun dried and saved for winter use (RS). In winter the dried huckleberries were boiled and eaten with various roots. They were not mixed with pemmican or meat (RS).

An infusion of the roots or stems was drunk for heart trouble (PB, AV); an infusion of the leaves was drunk for kidney trouble (AP, CW); and a decoction of the roots was applied to rheumatic and arthritic limbs (AV).

Vaccinium scoparium Leigberg — (Whortleberry)
Plant: siptkwalshkw (PB)
Fruit: sipt (PB, AP, AV, CW)

Although these small fruits were eaten fresh when found, they were seldom utlized (AP, RS, AV, CW).

GERANIACEAE

Geranium viscosissimum F. & M. (Sticky geranium)
t̓et̓eqenelshp (PB)

A decoction of the roots was rubbed on horses' sores, cuts, rope burns, and was apparently good for keeping wood ticks and flies off (Ad, AV, CW).

A horse's nose was held over a burning container of the shavings from the dried root mixed with charcoal; this helped to cure distemper, pneumonia, coughing, and running nose (RS, AV).

There seemed to be confusion regarding the correct identity of chechi. RS claimed it to be a species of *Geranium,* while Carlson (1973) claimed it to be a species of *Lomatium.* Some Flatheads claimed *Lomatium triternatum var. anomalum* to be the plant.

PB claimed the baked roots of *Geranium* were used as a poultice on wounds, cuts, or swellings. The scum resulting from boiling the roots was used externally for wart treatment, or the milky sap was directly applied from a fresh plant (RS, AV). The mashed root placed inside a buckskin or a piece of cloth of tightly bound around a woman's painful breast or for "milk fever" (RS).

Grossulariaceae

Ribes spp. — (Currants and gooseberries)
Currants (without thorns): steḿtu (AP, CW)
Gooseberries (with thorns): n̲te (PB, AP, AV, CW)

The fruits were eaten fresh, cooked, or sometimes were dried for future use (PB, RD, AP, RS, CW).

Hydrangeaceae

Philadelphus lewisii Pursh — (Mockorange)
wax̲elshp (PB, AP, JP, AV, CW)

Pipestems (RD, AV), bows (JP), combs (AV), and arrow shafts (AV) were made from the branches.

Labiatae

Mentha arvensis L. — (Mint)
x̲enx̲ene (Ad, PB, AP, AV, CW): pertains to 'cool'

An infusion of the plant was drunk for colds (RS, T-H), coughs (T-H), and if mixed with *Juniperus scopulorum* boughs, for fevers (Ad). The green leaves were also packed around aching teeth (RS). The crumbled and powdered leaves were employed as a flavoring ingredient in the absence of salt and pepper (RS).

The leaves were dried, powdered and sprinkled over fresh meat or fruit to keep insects off (PB, RS). The entire plant was commonly placed in houses for its pleasing aroma (PB, RS), on the floors of sweathouses (RD), or in suitcases with clothes (PB, RS).

Monarda fistulosa L. — (Horsemint)
tituẃi (Ad, PB, JP, AV, CW): 'little boys'

An infusion of the plant was drunk for colds (Ad, JP, TS, AV), fevers (Ad, PB, AP, RS, AV, CW), coughs (AP, RS, CW), to increase milk flow for nursing mothers (Ad), and as a general tonic (T-H).

The leaves were packed around aching teeth to bring relief (AP, CW). Dried bundles of plants were hung in rooms, presumably its pleasant odor brought relief to people having colds (RD). The dried and powdered leaves were sprinkled over fresh meat or fruit to keep insects off (PB, RS).

Nepeta cataria L. — (Catnip)

An infusion of the stems and leaves was drunk to induce perspiration to break fever (RS).

LEGUMINOSAE

Lupinus sp. — (Lupine)
nq́enaqete (JP, AV): 'stink plant'; t́et́eqenelp (PB): 'flattened'

PB claimed this plant to be poisonous, though JP stated that sheep were fond of it.

NYMPHACEAE

Nuphar variegatum Engelm. —(Pond lily)
kwenemlshp (Ad, PB, MSS): pertains to 'grab' and 'plant'

A medicinal tea made from the roots was drunk for venereal disease; it reputedly acted to open the urinary tract. The crushed roots were also applied to the affected parts (PB). This same decoction was mixed with bathwater for rheumatism (Ad) or was applied to bruises (PB). A poultice made from the peeled, washed and baked roots was applied to infected sores (RS). The boiled and crushed roots were placed on deep cuts of horses (PB).

PLANTAGINACEAE

Plantago major L. — (Plantain)
nlshemlshemqe?ene?e (AP, AV, CW): 'bears' ears'

The leaves were variously used as a poultice for cuts and sores: the leaves were softened in hot water and put on sores (RS, AV); crushed and placed on infected cuts (PB); or crushed and mixed with sugar and placed on cuts (AP, CW). It was believed that the pus would be drawn out with this application (AP, RS, CW).

POLEMONIACEAE

Gilia aggregata (Pursh) Spreng. — (Gilia)

The dried plants and those of *Lomatium simplex* were placed in perfume bags; they were believed to give off a pleasant aroma (RD).

PORTULACACEAE

Claytonia lanceolata Pursh — (Springbeauty)
skweńkwi (PB, AV)

The larger roots were the first of the roots to be gathered by the Flathead; they were available in the middle of April (RS). They were washed and boiled for eating (JP, RS, AV).

Lewisia rediviva Pursh — (Bitterroot)
spe̍tlem (Ad, PB, LP, AP, JP, AV, CW)

An even greater quantity of bitterroot than camas was eaten (RD), possibly because of the widespread abundance and ease of collecting it. Flathead women dug bitterroot in early May. Before digging, the First Roots Ceremony was performed (see discussion following the listing of plants). Digging was done just before the plant began to bloom, as the epidermal layer of the root slipped off more easily than if it had already bloomed. Once dug, the roots were peeled, washed, and dried in the sun. Sometimes the reddish inner core or stele which was believed to impart the bitter taste was removed, though sometimes it was left intact. In fact, some people actually preferred the smaller, more bitter tasting bitterroots of western Montana to the larger, blander varieties occurring farther west in the Nez Perce country of Idaho (JP, RS, AV). Bitterroots were once found in great quantities on the flats of what is now Missoula, Montana, the campus of the University of Montana, and the Bitterroot Valley (RS).

The common method of cooking bitterroot was steaming the roots for a few minutes on a lattice of small twigs above water in a kettle (AP, RS, CW). Dried bitterroots were boiled in water, sometimes with serviceberries or huckleberries (RS). A broth was also made by boiling the roots (AP, CW). Bitterroots were also sweetened with camas, but more recently sugar has been used (RS).

An infusion of the roots was drunk for heart trouble (RS, AV), pleurisy (RS), and by mothers to increase milk (PB, T-H, AV).

RANUNCULACEAE

Clematis columbiana (Nutt.) T. & G. — (Clematis)

The stems and leaves were boiled to make an infusion used as a hair restorer (RD, AV), or a shampoo (RS). A medicine made from this species and *C. ligusticifolia* was used for a type of itch and for sores, especially for around the neck (RD).

Clematis hirsutissima Pursh — (Sugarbowl)

An infusion of the entire plant was employed as an itch medicine; the affected areas were washed with the solution and rubbed with the boiled plant (RS, AV).

Clematis ligusticifolia Nutt. — (Clematis)

An infusion of the stems and leaves was employed as an eyewash, though it apparently didn't work very well (Ad). It was also used for itchiness and sores (RS, AV), or used as a hair restorer (RD).

Ranunculus glaberrimus Hook. — (Buttercup)
schiniyalmn (PB, AP, AV, CW)

The plant was crushed and placed within a piece of canvas or buckskin and applied as a poultice for burn blisters and open running sores (RS, AV). PB, however, recognized it to be poisonous and cautioned against such usage.

Thalictrum occidentale Gray — (Meadowrue)
pxwcu (AV): pertains to 'smell'

The dried seeds were boiled to make a tea for colds, chills, and fevers (RS, AV). Sometimes *Hierochloe odorata* was boiled with the seeds to make a more effective medication (RS).

The dried seeds were chewed until pulverized and were rubbed on the hair and body as a perfume (RS).

RHAMNACEAE

Ceanothus velutinus Dougl. — (Buckbrush)
kwelitčhiyelshp (Ad, PB, AP, AV, CW)

A salve made by mixing the dried and powdered leaves with lard or grease was applied to burns and sores (RD, RS). The leaves were also used alone as a poultice (AP, CW).

Rhamnus purshiana DC — (Cascara)
cheqwiqwisa (Ad): pertains to 'belch'

An infusion of the bark was drunk as a laxative (Ad, PB, AV). Some Flatheads believed that if the bark was whittled upward in making the tea, then it would act as an emetic, but if the bark was whittled in a downward fashion, then the medicine acted as a purgative (Ad, AV).

Amelanchier alnifolia Nutt. — (Serviceberry)
Plant: stqe (PB, LP, AP, AV, CW); siýeye?, for a different variety
Fruit: slshaq (PB, LP, AV)

Serviceberries constituted one of the most important foods of the Flathead Indians. Ripening in mid summer, they were normally sun dried and stored for future use (Ad, RS, AV). They were cooked with flour to make a gravy, or mixed with bitterroot, milk and sugar to make a tasty dish (Ad, AV). Some Indians preferred to mash the fruits and form small cakes to dry in the sun; powdered leaves of *Monarda fistulosa* and *Mentha arvensis* sprinkled over them acted to keep flies away (RS).

Serviceberry wood was used for lame horses. A sharpened stick was stuck deeply into the swollen ankle, whereafter blood and other serous matter drained out. The root of a yet unidentified plant was then used for medication (PB). The stems were employed in the manufacture of arrow shafts, though those of *Acer glabra* were preferred (PB).

Crataegus columbiana Howell — (Red hawthorn)
Plant: steḿqwpalqw (PB): pertains to 'round'; senćhelshpa (PB): 'coyote's tree'
Fruit: steḿoqw (PB)

Crataegus douglasii Lindl. — (Black hawthorn)
Plant: sxwe?sxwe?nchelshp (PB, AV): pertains to 'sharp'
Fruit: sxwe?ne (PB, AV)

The berries were pounded or ground and eaten raw or were cooked, or they were made into small round cakes and sun dried for later eating. They were often mixed with other fruits, like chokecherries. They constituted an especially important fruit in years when the serviceberry crop was poor; they could be gathered in the winter months, as some fruits remain on the bush all through the winter (RD, RS).

Fragaria virginiana Duchesne — (Strawberry)
Plant: senceshe?shtis (PB)
Fruit: q̓itq̓em (PB, AP, AV, CW)

The fruits were eaten only when fresh (AP, RS, AV, CW).

Geum triflorum Pursh — (Avens)

An infusion of the fresh or dried roots was drunk for chills (RD).

Prunus virginiana L.— (Chokecherry)
Plant: lshx̱lshxwalshkw (PB, AP, AV)
Fruit: lshx̱lsho (Ad, PB, LP, JP, AV, CW)

Chokecherries were the last fruits to be collected in late summer; in fact, freezing in early fall was believed to improve their taste and make them sweeter (RS).

Though sometimes eaten fresh (RS), chokecherries were usually prepared for later use. The individual chokecherries were pounded and pulverized with a pestle. Round cakes were made from the mashed fruit and placed in the sun to dry. These could be saved for winter use, in which case they would be soaked in water for eating (Ad, JP, RS). In recent times, meat grinders have been used to pulverize chokecherries (RS, AV). Chokecherries were often mixed with other fruits, such as those of *Berberis repens* and *Crataegus* spp.

An infusion of the bark and branches was drunk for diarrhea (PB, AP, CW). For intestinal worms, a tea made from the bark which was peeled downward was drunk; it acted as a purgative (if the bark was peeled upward, the medicine acted as an emetic) (RS).

A resin from the plant was warmed, strained, and when cool, used as eyedrops for sore eyes (PB, RS).

Rosa woodsii Lindl. — (Wild rose)
Plant: xweýe (PB): pertains to 'sharp'
Leaves: xweyelshp (PB)

Wood: xweypalschkw (PB, AP, AV)
Fruit: spiqalshqexwaye (AP, CW); se nqe pu (AV): pertains to anal itch

Rosehips were apparently never utilized very extensively by the Flatheads, at least before the introduction of sugar, after which it was used to make jellies (RS). It may be that the hips were used especially during severe winters as they remain on the bush all winter. An infusion of the petals, the bark, or the roots was used for sore eyes caused by excessive exposure to the sun (PB, RD, AP, RS, CW).

Rubus idaeus L. — (Raspberry)
Plant: lleclalshkw (AP, CW)
Fruit: llac (PV, AP, AV, CW)

Wild raspberries were of small economic importance. They were normally eaten fresh, though they were occasionally dried for winter use (RS). An infusion of the stems and leaves was drunk for diarrhea (RS).

Rubus leucodermis Dougl. —(Black raspberry)
Fruit: m̲cukw (AP, CW)

The fruits were certainly eaten, but like those of *Rubus idaeus*, were probably of minor economic importance.

Rubus parviflorus Nutt. — (Thimbleberry)
Plant: pulpelqenelshp (PB)
Fruit: pulpelqen (PB, AP, CW): pertains to 'easy' and 'head'

The fruits were eaten fresh (RD, AP, RS, CW); and probably were never gathered in sufficient quantity to store for winter eating.

Sorbus scopulina Greene — (Mountain ash)
smx̲e s?ilshis (PB): 'grizzly bear food'; tx̲wex̲wewe (AV, CW)

An infusion of the leaves and twigs was drunk for tuberculosis and coughs (PB, RD, AP, CW). An infusion of the fruit was drunk for vomiting of blood (RD), and eating the fruit was thought to alleviate tiredness, hunger, thirst and fatigue (PB).

RUBIACEAE

Galium boreale L. — (Bedstraw)

The seeds were considered edible, but were seldom utilized (RS).

SALICACEAE

Populus tremuloides Michx. — (Aspen)
m̓lm̓lte (PB, AP, AV, CW): pertains to 'shimmering leaves'

A tea made from the bark was drunk for ruptures (RS, AV).

Populus trichocarpa T. & G. — (Black cottonwood)
Plant: mulsh (PB, AP, AV, CW)
Cambium: ćek̓wye (PB): pertains to 'shiny' or 'bright'

The sap from cottonwood was valued more than that of any other tree. Only the young trees were peeled, as the bark from the older trees was difficult to remove. The thin, transparent strips of cambium were removed in a similar manner as was the cambium of ponderosa pine and chewed for its sweep sap (RS).

The leaves were used either fresh or were dried and employed as a poultice to draw pus out of wounds (AV) or used on boils (RS). Young cottonwood branches, roots of *Rosa woodsii* and *Potentilla glandulosa* were boiled to make a tea drunk for syphilis (RD).

Salix spp. — (Willow)
Plant: qewqewpulsh (AV): pertains to 'habitual mover'; ppu (PB, LP, AV)
Catkins: slshtitichi (AP, AV, CW): 'bitch dog'

The bark was employed in the treatment of cuts. In one medicinal preparation hot water was poured over the bark; the resulting solution was used to wash the wound, and the powder from the finely crushed bark was placed on the cut with a clean cloth; the bandage needed to be changed once a day; in two to four days the cut was heeled (PB). The bark was also chewed and put on cuts and abrasions directly (RS, AV).

An eyewash was made from a species found near Arlee; the bark, leaves, or young stem tips were used (RD, AV). The bark of a different species was chewed for diarrhea, dysentery and summer flu (RD, AV).

Branches were used in the construction of sweathouses, baskets, etc. (RS, AV). Bark from a species found in the Blackfoot valley was used to make rope used for horses (This could possibly be *Elaeagnus commutata*) (AV).

SAXIFRAGACEAE

Heuchera cylindrica Dougl. — (Alumroot)
cep̓cup̓ (PB): pertains to 'sticky'

An infusion of the root was drunk for stomach ache and diarrhea, or the root was chewed directly for immediate results (PB, RS, T-H). Of all the plants known for stomach ache and diarrhea, this was recognized to be the best remedy (PB).

SCROPHULARIACEAE

Besseya rubra (Dougl.) Rydb. — (Kitten-tails)
chechelshu (AV)

A strong tasting tea made from either the fresh or dried roots was drunk for colds (RS); it was also taken as a physic (RS, AV).

Castilleja sp. (Indian paintbrush)
sccmelt sce?ekw si? lshis (PB): 'children's flower food'

Indian children sucked the nectar from the flower (PB, RD, JP).

Verbascum thapsis L. — (Mullein)
chx̱elk̓wasqis (PB, LP): 'train's seeds'

The plant was boiled to make a shampoo which lathers like soap. It was thought to turn hair darker (RS). The plant is so named for the fact that it was first observed by the Flatheads along railroad tracks, its origin due to seeds falling out of the train (PB).

Cicuta douglasii (DC) Coult. & Rose (Water hemlock)
?inixw (AP, AV, CW): 'poisonous'

The root was recognized as poisonous (AP, AV, CW).

Heracleum lanatum Michx. — (Cow-parsnip)
x̲wte (PB, AP, AV, CW)

The dried and matured hollow stems were employed to make elk whistles (PB, RD, AP, AV, CW). The dried or fresh roots were utilized as a poultice used on swellings, especially of the feet (RD). For food, the young stalks were peeled and eaten raw (RD, AP, RS, AV, CW).

Ligusticum canbyi Coult. & Rose — (Lovage)
x̲asx̲es (Ad, PB, LP, MSS, AV): pertains to 'good'

This medicine is still popular today. Its favorite application is for colds and sore throats: the dried roots can be chewed (JP, RS, T-H), and infusion of the roots can be drunk (JP, RS, T-H, AV), or the leaves are smoked with tobacco for relief (JP, RS, AV). An infusion of the roots is also drunk for fevers (MSS).

The root was once chewed and rubbed on a person's body for seizures. Cigarettes mixed with this plant were then smoked; this supposedly calmed the person (Ad).

Lomatium cous (Wats.) Coult. & Rose — (Biscuit-root)
pchlu (PB, JP, AP, AV, CW)

The root was dug after the plant bloomed in the spring (RS). They were peeled and eaten raw, boiled (RS, AV), or pounded into small cakes and dried in the sun (JP, RS). The dried bricks or biscuits could be stored for a long time and were often carried on long hikes or marches (JP).

Lomatium macrocarpum (Nutt.) Coult. & Rose — (Desert parsley) ćhećhi (PB, JP, AP, AV, CW)

The young, fresh roots are bitter-tasting, but if allowed to dry become more palatable. Older roots are generally too fibrous and stringy to eat (RD).

Osmorhiza occidentalis (Nutt.) Torr. — (Sweet cicely) x̲wit (PB, AP, AV, CW)

An infusion of the roots was drunk for colds (AP, RS, CW), coughs and sore throats, or the root was chewed for similar results (PB).

Perideridia gairdneri (H. & A.) Math. — (Yampah) stlukwm (Ad, PB, AP, AV, CW)

The roots were gathered in July when the flowers were well developed (AP, RS, AV, CW). They were washed and eaten fresh (RS, AV) or could be boiled, mashed and made into little round cakes, and dried and stored for winter use (Ad, RS, AV).

URTICACEAE

Urtica dioica L. — (Nettles) cćax̲elshp (PB, AP, AV, CW): 'sting leaf'

An infusion of the leaves was drunk for fits (apparently epilepsy), insanity, or temper tantrums. For rheumatism, feet were soaked in this infusion (RS). Nettles were also used to swat aching backs in the sweathouse (AP, CW).

VIOLACEAE

Viola sp. — (Violet) m̲semsa? (PB, AV)

The roots were boiled into a tea and drunk for colds, flu, chills, and fevers (PB, T-H, RS, AV). A mild medicine, it was recommended for children (RS, AV). A poultice for mumps was made from the roots (PB).

THE ROLE OF PLANTS IN THE CULTURE OF THE FLATHEAD INDIANS

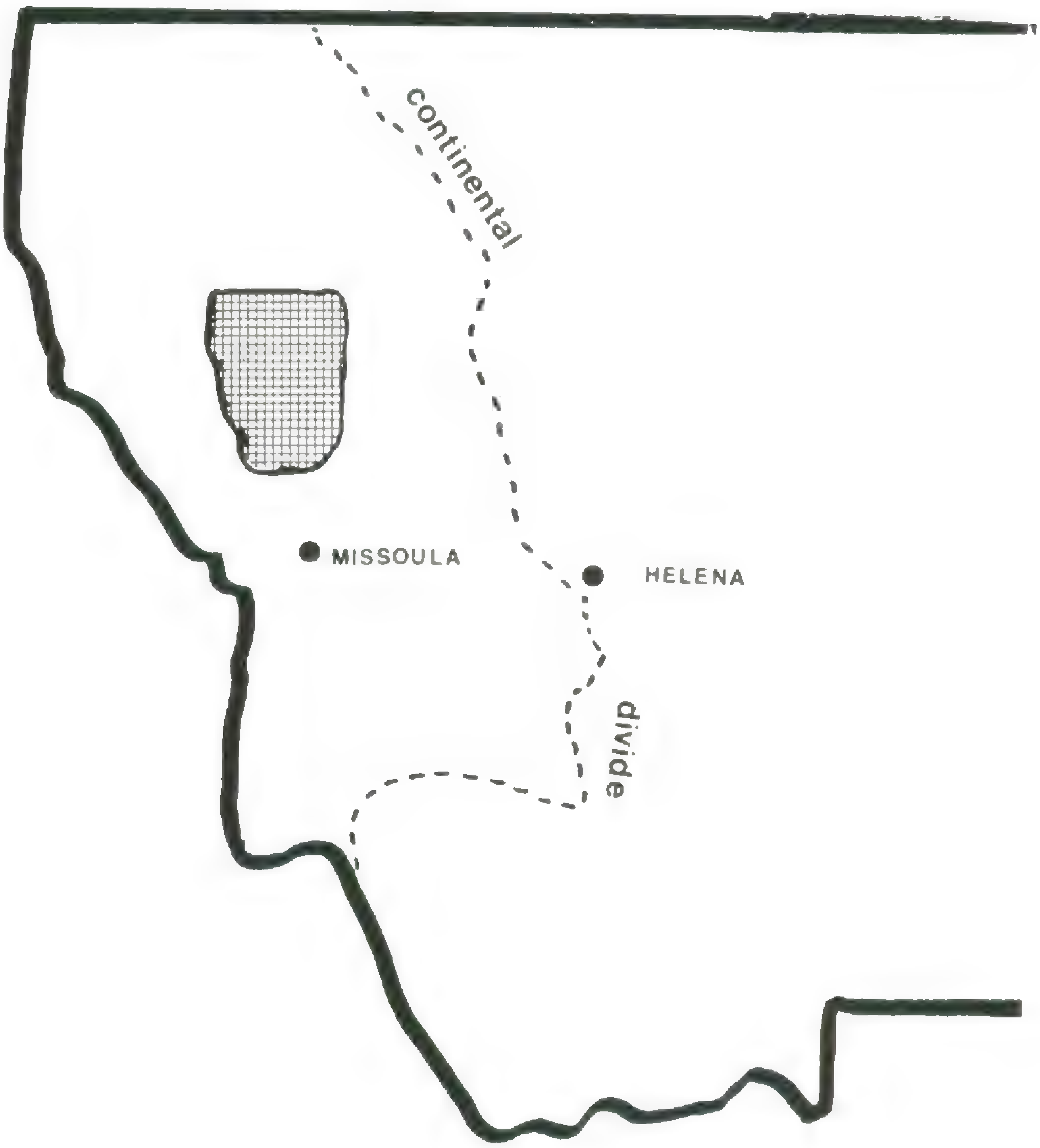
The Collection and Preparation of Food Plants

The Flathead food economy depended upon hunting, mostly of big game animals, fishing, and the collection of roots, berries and other food plants. As in most societies, the women were responsible for the collection and preparation of food plants, while the men did the hunting and fishing. When cooking camas, for example, men were forbidden to go near the cooking pits lest bad luck and famine overtake all (Turney-High, 1937). Murdock (1967) estimated that 40% of the Flathead diet came from hunting, 30% from fishing, and 30% from plants.

Roots and berries formed the most important kinds of vegetable foods. The most important plants furnishing berries included: serviceberries (*Amelanchier alnifolia*), huckleberries (*Vaccinium globulare*), and chokecherries (*Prunus virginiana*). Other berries of lesser importance included: kinnikinnick (*Arctostaphylos uva-ursi*), mahonia (*Berberis repens*), redosier dogwood (*Cornus stolonifera*), hawthorn (*Crataegus* spp.), strawberries (*Fragaria virginiana*), gooseberries and currants (*Ribes* spp.), rose hips (*Rosa woodsii*), raspberries (*Rubus ideaeus, R. leucodermis,* and *R. parviflorus*), elderberries (*Sambucus cerulea* and *S. racemosa*), buffalo-berries (*Shepherdia canadensis*), and whortle berry (*Vaccinium scoparium*). The most important root crops were camas (*Camassia quamash*), bitterroot (*Lewisia rediviva*), wild carrot (*Periderdia gairdneri*), and cous (*Lomatium cous*). Roots and bulbs of lesser importance included: wild onions (*Allium cernuum* and *A. douglasii*), balsamroot (*Balsamorhiza sagittata*), brodiaea (*Brodiaea douglasii*), thistle (*Cirsium* sp.), springbeauty (*Claytonia lanceolata*), glacier lily (*Erythronium grandiflorum*), yellowbell (*Fritillaria pudica*), dessert parsley (*Lomatium macrocarpum*), and cat-tail (*Typha latifolia*). The more important roots and berries were dried and stored for winter use, while those of lesser importance were more often eaten fresh, though in periods of food scarcity they were gathered in greater quantity.

Flathead women initiated the gathering season with the collection of bitterroot in early May. Before digging, the First Roots

FLATHEAD INDIAN RESERVATION



Ceremony was performed to insure an ample harvest of bitterroot as well as other plant foods. The gathering of food plants was coordinated with other subsistance activities. Teit (1930) summarized the annual Flathead food quest as follows: "In the springtime, digging certain roots, hunting and fishing on the nearer grounds; in early summer root digging and berrying, only a little hunting or root digging; in early fall (about September), the same occupations as in late summer; in late fall (October and November), root digging and hunting in the early part, and finally only hunting. In December they went into their camps and left them in March."

Flatheads usually gathered berries in cedar bark baskets, though sometimes bark from a young fir was used. These baskets measured about 18-20 inches by 8-10 inches in diameter and tapered from a round top to a pointed rectangular bottom. The seams were either sewn together with willow bark or were pierced and pinned together with small twigs, and then made waterproof with conifer pitch (Stubbs, 1966).

Teit (1930) claimed that in prehistoric times the Flatheads gathered roots in baskets, but after the introduction of the horse, roots were gathered in flat woven and often decorated containers which measured 2-3 feet long and 15-20 inches wide. They obtained these from the neighboring Nez Perce. Dried roots and berries were stored in rawhide bags (Stubbs, 1966).

Root crops were dug with digging sticks. The Flathead often used digging sticks of hawthorn or serviceberry with horn antler or wooden transverse handles. The points were fire-hardened and sharpened by burning and shaving or rubbing against rough stones. Wooden digging sticks proved impractical for camas which grows in heavy turf, in which case elk antler digging sticks were employed. These were probably similar to those used by the Kootenai which were about 15 inches long and contained the crotch of one prong which served as a handle. Wooden and elk horn antlers were replaced by iron digging sticks when the whites moved into the region (Malouf, 1971).

The Flatheads either boiled or baked their vegetal food. The hot pit method of baking is described in the section where camas is discussed. Turney-High (1937) described the method of boiling:

a hole one foot deep and wide was dug in the ground and lined with a permanent bag of bison skin. Stones heated red hot were placed into this container filled with water, to which the food was added for boiling. After the food was boiled the bag was removed and washed, and then hung to dry. Stubbs (1966) stated that wood boiling and utility pots were often used in permanent grounds. They made these by hollowing out large burls from pine, fir and larch tree trunks. Because these burls were pitchy they were resistant to decay. Food was boiled in them by the hot rock method. Left in the camps where they were made, wooden pots could be used on subsequent trips and lasted for many years.

The proportion of vegetal food used varied during the different periods of Flathead existence. With the introduction of the horse and the more extensive reliance on buffalo hunting east of the continental divide, the digging of roots and gathering of berries became of lesser importance as these tasks could not always be done while hunting buffalo. Though some of the old people remained in the camps in the Rocky Mountains and still collected roots and berries, there was a general tendency to neglect these foods. With the near extinction of the buffalo in the 1880s, the Flatheads depended more significantly on vegetal foods again (Teit, 1930).

Flatheads used other kinds of plants for food, though in lesser quantities. Pines (*Pinus albicaulis, P. monticola,* and *P. ponderosa*) furnished edible seeds. The leafy parts of various plants (*Balsamorhiza sagittata, Chenopodium* sp., *Heracleum lanatum, Rorripa nasturtium-aquaticum,* and *Cirsium* spp.) were eaten as greens. Gums, saps, and inner barks were collected from various trees for eating (*Larix occidentalis, Pinus contorta, P. ponderosa*, and *Populus trichocarpa*). Various mushrooms (such as species of *Armillaria, Collybia, Russula,* and *Lycoperdon*) were eaten. The black tree moss (*Alectoria*) was fire baked with camas. Nodding onion (*Allium cernuum*), kinnikinnick (*Arctostaphylos uva-ursi*) and mint (*Mentha arvensis*) furnished condiments, while beverages were made from birch (*Betula occidentalis*), camas (*Camassia quamash*), mint (*Mentha arvensis*), and horsemint (*Monarda fistulosa*).

Plants and Medicine

As with most Indians of North America, the Flatheads had two kinds of doctors: shamans and herb doctors. Shamans did not normally use plants to cure, but relied on magic and ritual to treat diseases stemming from supernatural causes; outward and visible shamanistic acts of curing included blowing and sucking noxious materials from the place affected, songs, etc. They were often called in when the naturalistic treatment of herb doctors did not work, and their work was considered more supplementary than antagonistic to that of the herb doctors. Some even learned to use herbal remedies (Turney-High, 1937).

For diseases stemming from naturalistic causes, doctors well-versed in herbal lore were called in. These were just as often women as men. In fact most everyone in the tribe was aware of the more common medicinal plants, and many were household remedies (Turney-High, 1937).

Flatheads used at least 67 species of plants for medicinal purposes. Plant medicines were administered in several ways, depending upon the illness. For cuts, burns, sores and other external problems, poultices from various plants and plant parts were employed. For fevers, colds, stomach aches, diarrhea and other internal problems, infusions made by boiling the plants or parts of plants were drunk.

Religion and Beliefs About Plants

As with most Indian tribes, the Flatheads had an animistic viewpoint of the world. Spirit beings were very important; that these were generally animals and not plants is probably because animals personified spirits more readily than plants. None-the-less, because plants figured significantly in the economics of living, especially food and medicine, they did enter into their religious and mythological world.

The spring search for food was initiated with the First Roots Ceremony, a ritual common throughout the plateau region. It was necessary before any woman was allowed to search for food. To fail to do so, it was believed, resulted in a scarcity of roots. It was a tribal affair, and when the tribe still had access to the

Bitterroot Valley, gathered at the "Dancing Place" just north of the present town of Hamilton, Montana. The ceremony was a prayer for the abundance of the two most important economic plants, camas and bitterroot. When all of the participants were assembled, the High Chief appointed 2 mature women to act as leaders and a number of other women as assistants. The group then went to a site where bitterroot was found. The senior woman raised her arm to the sun and prayed for success, security, good health, etc. Then the same prayer was made to the earth. Next the digging began, and when enough bitterroot had been dug, the women took the roots to the Chief's lodge where it was cooked. When the meal was ready the Chief prayed to the sun, then to the earth, and finally the food was distributed to the assembled people. Afterwards the Thanksgiving Dance started. With this sacred ceremony completed, anybody was free to collect bitterroot (Turney-High, 1937).

The camas dance was part of the Midwinter Festival which began at the New Year. It had a magical-religious motivation, being primarily a prayer in the dead of winter for an adequate supply of vegetable food in the spring. It was followed by the Blue Jay Dance. They were a favorite time for marrying and consisted of riotous joking and playing (Turney-High, 1937).

Medicine and religion were inseparable. This was certainly true with a Flathead method of discovering new medicines by means of dreams, though it it not denied that many medicines were borrowed and traded from other groups. Beaverhead (1973) stated that when a person was known to be sick a certain medicine man was called to doctor the patient. If the medicine did not seem to work then another medicine person was called in to cure the patient. During the night the medicine person would dream and be told to use a certain kind of plant. Then the next day he would find that plant and take it to the patient to use as a remedy. As a result the medicine would become well known to all members of the tribe.

Flathead Indians were required to placate certain spirits when they collected plants. Vanderburg (1973) claimed that when the huckleberry was collected for its medicinal use as a heart medicine it was required that the collector make a payment to the plant in the form of beads, etc. and to talk to the plant too. Many medicines required similar payment.

Coyote, leading culture hero and trickster of the Flatheads, figured in several plant uses and beliefs. Once Coyote was bound in ropes, for example, and nothing could be found to free him until a leafblade of a species of *Carex* was used to cut the rope. The dried stalks of *Pterosperma andromedea* were thought to be "Coyotes' arrows." Rosehips were often called "Coyotes' Berries" or "place of itching in the anus" because Coyote once ate the fruits and as a result his anus began to itch; he scratched so much that he eventually bled to death.

Plants and Technology

The Flatheads made many of their everyday items from plants. For tepee poles they used young trunks of lodgepole pine (*Pinus contorta*). Willow (*Salix* spp.) and red-osier dogwood (*Cornus stolonifera*) were used in the construction of sweathouses. Wood for bows came from shrubs like mockorange (*Philadelphus lewisii*) and yet (*Taxus brevifolia*), while the wood for arrows was fashioned from branches of maple (*Acer glabrum*), serviceberry (*Amelanchier alnifolia*), and mockorange (*Philadelphus lewisii*). Whistles were fashioned from the stems of cow-parsnip (*Heracleum lanatum*) and elderberry (*Sambucus* spp.). Baskets and bags were made from the bark of cedar (*Thuja plicata*). And Flatheads made dyes from alder (*Alnus incana*) and lichen (*Letharia vulpina*).

APPENDIX I.

Index to Scientific Names

Abies grandis (Dougl.) Forbes
A. lasiocarpa (Hook.) Nutt.
Acer glabrum Torr.
Achillea millefolium L.
Alectoria sp.
Allium cernuum Roth
A. douglasii Hook.

Alnus incana (L.) Moench
Amelanchier alnifolia Nutt.
Arctostaphylos uva-ursi (L.) Spreng.
Armillaria sp.
Artemesia dracunculus L.
A. ludoviciana Nutt.
A. tridentata Nutt.
Asclepias speciosa Torr.
Aster conspicuus Lindl.
Balsamorhiza sagittata (Pursh) Nutt.
Berberis repens Lindl.
Besseya rubra (Dougl.) Rydb.
Betula occidentalis Hook.
B. papyrifera Marsh.
Brodiaea douglasii Wats.
Camassia quamash (Pursh) Greene
Castilleja sp.
Ceanothus velutinus Dougl.
Chenopodium sp.
Chimaphyla umbellata (L.) Bart
Cicuta douglasii (DC) Coult. & Rose
Cirsium spp.
Claopodium
Claytonia lanceolata Pursh
Clematis columbiana (Nutt.) T. & G.
C. hirsutissima Pursh
C. ligusticifolia Nutt.
Collybia sp.
Cornus stolonifera Michx.
Crataegus columbiana Howell
C. douglasii (Nutt.) T. & G.
Elymus cinereus Scribn. & Merr.
Equisetum arvense L.
Erythronium grandiflorum Pursh
Fragaria virginiana Duchesne
Fritillaria pudica (Pursh) Spreng.
Galium boreale L.
Geranium viscosissimum F. & M.
Geum triflorum Pursh
Gilia aggregata (Pursh) Spreng.
Goodyera oblongifolia Raf.
Grindelia squarrosa (Pursh) Dunal
Heracleum lanatum Michx.
Heuchera cylindrica Dougl.
Hierochloe odorata (L.) Beauv.
Juniperus communis L.
J. scopulorum Sarg.
Larix occidentalis Nutt.
Ledum glandulosum Nutt.
Letharia vulpina (L.) Hue

Lewisia rediviva Pursh
Ligusticum canbyi Coult. & Rose
Lithospermum ruderale Dougl.
Lomatium cous (Wats.) Coult. & Rose
L. macrocarpum (Nutt.) Coult. & Rose
Lonicera ciliosa (Pursh) DC
L. involucrata (Rich.) Banks
Lupinus sp.
Lycoperdon sp.
Lysichitum americanum Hulten & St. John
Matricaria matricarioides (Less.) Porter
Mentha arvensis L.
Monarda fistulosa L.
Nepeta cataria L.
Nuphar variegatum Engelm.
Opuntia polyacantha Haw.
Osmorhiza occidentalis (Nutt.) Torr.
Pachistima myrsinites (Pursh) Raf.
Perideridia gairdneri (H. & A.) Math.
Philadelphus lewisii Pursh
Pinus albicaulis Engelm.
P. contorta Dougl.
P. monticola Dougl.
P. ponderosa Dougl.
Plantago major L.
Populus tremuloides Michx.
P. trichocarpa T. & G.
Prunus virginiana L.
Pseudotsuga menziesii (Mirbel) Franco
Pterospora andromedea Nutt.
Ranunculus glaberrimus Hook.
Rhamnus purshiana DC
Rhus glabra L.
Ribes spp.
Rorrippa nasturtium-aquaticum (L.) Schinz & Thell.
Rosa woodsii Lindl.
Rubus idaeus L.
R. leucodermis Dougl.
R. parviflorus Nutt.
Russula sp.
Salix spp.
Sambucus cerulea Raf.
S. racemosa L.
Scirpus acutus Muhl.
Shepherdia canadensis (L.) Nutt.
Sorbus scopulina Greene
Symphoricarpos albus (L.) Blake
Tanacetum vulgare L.
Taxus brevifolia Nutt.
Thalictrum occidentale Gray

Thuja plicata Donn.
Typha latifolia L.
Urtica dioica L.
Vaccinium globulare Rydb.
V. scoparium Leigberg
Veratrum viride Ait.
Verbascum thapsus L.
Viola sp.
Xerophyllum tenax (Pursh) Nutt.
Zigadenus elegans Pursh

APPENDIX II

Key to the Pronunciation of the Flathead Words

The Flathead language has sounds quite different from that of the English language. No attempt is made to give an exact allophony, as this would not enhance the main text. The following symbols give only an approximation to the true Flathead sounds. These have been adapted and simplified from Hart (1974). The interested reader should pursue this work for the exact allophony.

a	Similar to *a* in F*a*ther
B	Similar to English
c	Similar to *ts* in ca*ts*
c	Similar to *ts* in ca*ts*, but with a strongly exploding quality
ch	Similar to *ch* in *ch*urch
e	Similar to *a* in B*a*y or to *i* in b*i*rd
i	Similar to *ee* in b*ee*t
K	Similar to English
L	Similar to English
lsh	A friction sound similar to "sh" but produced farther back where l is produced
M	Similar to English
N	Similar to English
o	Similar to *o* in c*o*t
P	Similar to English
K	Similar to English
q	Similar to k, but the sound is produced farther back in the throat
S	Similar to English

sh Similar to *sh* in lu*sh*
T Similar to English
tl Produced together with "lh" as one sound
u Similar to *oo* in b*oo*t
x Similar to *ch* in ba*ch*
? The glottal stop is similar to *tt* in button (when the "t" sound is not produced)
ʹ The apostrophe is used above the symbol to represent sounds that are strongly exploded or glottalized.
— Symbols underlined indicate that the sound is produced relatively farther back in the mouth than the same symbol when not underlined.
w When w follows other symbols like constant k, x, and q, it indicates that the sound is produced by rounding the lips.

APPENDIX III

A List of General Botanical Terms

algae	senupule<u>x</u>we (Ad)
bush	?esťemp (Ad, LP, AP, CW): 'its bunched'
cone	schćić?e (Ad, LP, AP, CW)
ferns	chxwitlshp (AP, AV, CW)
	te<u>x</u>te<u>x</u>elshp (PB)
flowers	sće?ekw (Ad, LP, AP, AV, CW)
fruit	sṕqa<u>l</u>q (Ad, LP, AP, CW)
grass	supu?lexw (LP, AV)
leaves	picchlsh (Ad, LP, AV)
leaves (evergreen)	ćheme?e (Ad, LP)
moss	senkwespu (PB)
mushroom	peťleqine (PB, LP, JP, AP, AV, CW)
	s?itsh (AV)
plants	skwa?lu?lexw (Ad, LP, AV)
roots	so<u>x</u>wip (Ad, LP, AV)
seeds	senqechti (AP, CW)
tree, trees	?esshit (L), ?esćelćil (L)
tree bark	chi?lelxw (Ad, LP, AP, CW)
vines	ćhilyalalkw (Ad, PB, LP, JP, AV, CW)
weeds	chesupu?lexw (Ad, LP, AP, CW)

wood (dry)	xe?malqw (LP)
wood (green)	qelalqw (LP, AP, CW)
woods	nkwe (Ad, LP, AP, CW)

ACKNOWLEDGMENTS

I would like to offer my appreciation to the various institutions which made this study possible: the University of Montana Department of Botany, the University of Montana Native Studies Program, and the various organizations of the confederated Salish and Kootenai Tribes which encouraged this study.

Most importantly, history will appreciate the contributions made by various Flathead Indians. Pete Beaverhead, probably the most respected medicine man on the reservation, provided a great deal of wholly new information. Other informants included: Bob and Sophie Adams, Larry Parker, Annie Pierre, John Pilko, Mitch Small Salmon, and Christine Woodcock.

LITERATURE CITED

Adams, Bob and Sophie. 1973. Flathead Indian Reservation, Camas Prairie, Montana. Personal communication.

Beaverhead, Pete. 1973. Flathead Indian Reservation, Ronan, Montana. Personal communication.

Carlson, Barry. 1973. Department of Linguistics, University of Victoria, B. C. Personal communication and unpublished dictionary of the Spokane Idians.

Dietteret, R. 1955. Unpublished manuscript, University of Montana.

Fahey, John. 1974. *The Flathead Indians.* University of Oklahoma Press, Norman, Oklahoma.

Hitchock, C. Leo and Arthur Cronquist. 1973. *Flora of the Pacific Northwest.* University of Washington Press, Seattle, Washington.

Kolande, J. E. as J. R. K. Robson. 1972. The Nutritive value of cooked camas and consumed by Flathead Indians. *Ecology of Food and Nutrition,* Vol. 2.

Malouf, Richard T. 1971. *Camas and the Flathead Indians of Montana.* Unpublished manuscript, University of Michigan, Ann Arbor, Michigan.

Mattina, Anthony. 1973. Department of Anthropology, University of Montana, Missoula, Montana. Personal communication.

Murdock, George P. 1967. *Ethnographic Atlas.* Pittsburg; University of Pittsburgh Press.

Parker, Larry. 1973. Flathead Indian Reservation, Ronan, Montana. Personal communication.

Pierre, Annie. 1973. Flathead Indian Reservation, St. Ignatius, Montana. Personal communication.

Pilko, John. 1973. Flathead Indian Reservation, Camas Prairie, Montana. Personal communication.

Small Salmon, Mitch. 1973. Flathead Indian Reservation, Perma, Montana. Personal communication.

Stubbs, R. D. 1966. *An investigation of the Edible and Medicinal Plants Used by the Flathead Indians.* M. A. thesis, University of Montana, Missoula.

Woodcock, Christine. 1973. Flathead Indian Reservation, St. Ignatius, Montana. Personal communication.