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Contributions to a reassessment of Costa Rican Zygopetalinae (Orchidaceae). The genus *Kefersteinia* RCHB.f.

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Abstract

A revision of the Costa Rican species pertaining to the genus *Kefersteinia* RCHB.f. is presented. Phylogenetic relationships of the genus are discussed. Ten species are accepted for Costa Rica and a key to the species is provided, together with references to the types and synonyms, a detailed description, etymology, general distribution and examined specimens in the study area, ecological notes, taxonomic discussion and a composite illustration for each taxon. A new species, *Kefersteinia endresii* PUPULIN, is described and illustrated. Lectotypes are selected for *Zygopetalum lacteum* RCHB.f., *Kefersteinia alba* SCHLTR., *K. microcharis* SCHLTR. and *K. parvilabris* SCHLTR.

Key words: Orchidaceae, Zygopetalinae, *Kefersteinia*, *Kefersteinia endresii*, Costa Rica, systematics, taxonomy

Introduction

Although the Zygopetalinae appear to be a natural group of the Orchidaceae, its division into several formal subgroups has proven to be difficult. Within the subtribe, delimitation of genera is particularly critical in the *Chondrorhyncha* alliance. Despite the presence in all the genera of the complex of a common variant in the seed type with respect to the *Maxillaria* type (DRESSLER 1981), vegetative and floral characters do not seem to correlate consistently enough to permit the definition of clear generic boundaries. Among the diagnostic characters REICHENBACH (1852) selected to define his concept of *Kefersteinia* were the lip continuous with the column foot, the semiterete column winged at the distal margins, the subulate rostellar tooth and the presence of a keel extending from the proximal margin of the stigma to the middle of the column. In his realignment of *Zygopetalum* HOOK., REICHENBACH (1861) reduced *Kefersteinia* to a sectional status, defined by the slender column, distally keeled under the stigma, and the cucullate lip. He also maintained *Chondrorhyncha* LINDL. as a separate genus on the basis of the column foot longer than in *Zygopetalum*, the lateral sepals connivent with the column foot, the laminar callus at the middle of the disc and the 3-dentate rostellum. Due to the limited consistency of the characters differentiating the genera within the alliance, ALLEN (1949) reduced *Kefersteinia* and *Warscewiczella* RCHB.f. to synonyms of a broad *Chondrorhyncha* concept, a point of view shared in part by FOLDATS (1970). FOWLIE (1966a) pointed out a close similarity between *Kefersteinia* and *Chondrorhyncha* on the basis of a set of common features (i.e. the presence of four pollinia in two unequal pairs, a bristle-like rostellum, the flowers without a chin, an obscure to

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absent claw, similar callus structure and transverse, slit-like stigma), which are distinctly different from the allied genera *Cochleanthes* RAF. and *Warscewiczella*. He distinguished *Kefersteinia* and *Chondrorhyncha* mainly by the attachment of the lateral sepals, that are obliquely inserted at the base of the column and broadly upswept in the latter genus, and the presence of a short tooth on the anterior portion of the column in most of *Kefersteinia* species. In his fundamental revision of the *Chondrorhyncha* alliance, GARAY (1969b) distinguished *Kefersteinia* by the column with a distinct vertical keel and the geniculate or replicate lip with a free plate-like basal callus, versus the ecarinate column with a prominent foot forming an acute mentum and the concave lip with a fleshy callus in center of disc of *Chondrorhyncha*. A similar approach was also followed by SENGHAS and GERLACH (1990, 1993) in their preliminary account on the genus and in their revision of the Huntleyinae, where they used the basal position of the callus to separate *Kefersteinia* (together with *Condroscaphe* (DRESSLER) SENGHAS & GERLACH) from the allied *Chondrorhyncha*, as well as by DRESSLER (1993) in his treatment of the genus for Costa Rica and Panama.

Vegetative architecture is rather constant within the genus. Plants of *Kefersteinia* are small epiphytes without pseudobulbs with 3-6 ligulate to oblong leaves arranged like a fan, articulated with the conduplicate basal sheaths. Although vegetative characters are not consistent enough for taxonomic determination at species-level, they are sometimes useful for field recognition. The leaves are distinctly linear-elliptic in *K. wercklei*, narrowly elliptic in *K. alba* and *K. lactea*, and widely oblong in *K. costaricensis, K. orbicularis, K. microcharis*, and *K. endresii*.

All the species present short, 1-flowered, suberect to pendent scapes emerging from the axils of the lower sheaths, usually producing few, but *K. retanae* is very distinctive in the production of as many as 20 simultaneous inflorescences.

With the notable exceptions of *K. endresii, K. mystacina, K. parvilabris* and *K. stevensonii*, all of which present peculiar lips, the general outline of the lip in *Kefersteinia* is somewhat rounded, ovate to obovate, and usually entire. However, in *K. graminea* (LINDL.) RCHB.f. (the type of the genus) and the allied Andean species, as well as in Central American *K. lactea* and its relatives which belong to the "Andean group" (DRESSLER 1983), the lamina of the lip folds back abruptly at the middle. In the mainly Mesoamerican *K. costaricensis* complex, on the other hand, the lip is straight or it is only curved or bent down at apex. *Kefersteinia excentrica*, *K. wercklei*, and *K. retanae*, with their concave lips provided with erect basal margins that fold toward the column, represent in my opinion a third distinct subset, to which the sectional name of *Umbonatae* SENGHAS & GERLACH should be reserved.

These complexes also reflect in callus morphology, and SENGHAS and GERLACH's (1993) reorganization of *Kefersteinia* into two sections based on the shape of the callus recognizes the existence in the genus of two main species-groups, whose distribution range also indicate close internal relationships. In the mainly Andean sect. *Kefersteinia* the callus is sessile, low and long, whereas in the Central American sect. *Umbonatae* (sensu SENGHAS & GERLACH 1993) the callus is short and very high, supported by a distinct stipe.

The column of *Kefersteinia* is normally semiterete and presents a short basal foot. On the ventral surface, under the narrow stigmatic slit, many species show a laminar plate

variously shaped, often produced basally into a pair of lateral, rounded to sharply definite teeth. A longitudinal keel crosses the plate in most of the species, extending from the stigmatic entrance to the base of the plate or sometimes just to the middle. In some species the ventral keel projects toward the base forming a distinct tooth (*K. costaricensis, K. endresii, K. excentrica, K. parvilabris, K. retanae*), sometimes very prominent (*K. orbicularis*), but the tooth is absent in other species (*K. alba, K. lactea, K. microcharis, K. wercklei*) and the column of *K. alba* has no ventral keel.

Pollinarium morphology has been considered relevant in the classification of the complex. *Kefersteinia* has an usually small pollinarium with narrowly oblanceolate to sublinear viscidium scarcely distinct from the reduced stipe. The viscidium generally curls after removal, a character associated with the placement of the pollinarium on the scape of the pollinator antenna (DRESSLER 1981; GERLACH 1994). The four pollinia, normally in two pairs of different size, are linear-oblong to narrowly obpyriform, in most species somewhat sigmoid in lateral view, but in *K. microcharis* SCHLTR. the shape of pollinia is rather obovoid.

Pollination of *Kefersteinia* is carried out by male euglossine bees of the genera *Euglossa* and *Eulaema* apparently looking for perfumes (VAN DER PIJL & DODSON 1966; DRESSLER 1968, 1983; GERLACH 1994), a pollination syndrome shared with other members of the Zygopetalinae like *Cochleanthes, Chondrorhyncha*, *Dichaea* LINDL., *Huntleya* LINDL., and *Warscewiczella* [although flowers of *Warscewiczella* also attract female eulaemas which probe the back-swept lateral sepals for food resources (ACKERMAN 1983)]. However, in *Cochleanthes* (i.e. *Cochleanthes aromatica*, VAN DER PIJL & DODSON 1966) and *Huntleya* the pollinarium is placed behind the head of the bee whereas the pollinarium of *Kefersteinia* is placed on the basal segment of the bee's antenna (DRESSLER 1981).

Molecular data (WHITTEN et al., in prep.; DRESSLER 2000) seem to show *Kefersteinia* as a natural group quite distinct within the complex, but the occurrence of recently described, intermediate forms within the complex shows tendencies in morphological variations that seem to bridge closely related genera and render the actual generic separation rather questionable (NEUDECKER & GERLACH 2000), and DRESSLER (2000) claims for better samples that may perhaps change this impression.

No single feature is consistent enough to be used to characterize *Kefersteinia* as a whole. The genus may be distinguished by a set of different characters, the combination of which define a rather natural and easily recognized group, although there is no sharp line in terms of key features between closely related genera in the complex. Plants of *Kefersteinia* are usually small (to 12-15 cm tall), without pseudobulbs, the leaves erect to arching, arranged as an open fan, contracted at the base into conduplicate petioles, the inflorescences one-flowered, patent to pendulous, the flowers small and resupinate, the lip usually smaller than tepals, from shallowly to deeply concave, the lateral lobes sometimes surrounding the column, the callus basal, mostly bilobed, pedicellate or sessile and laminar, rarely extending to the central portion of the lip lamina, the column semiterete with incumbent anther, the stigma narrow and transverse, mostly ventrally provided with a laminar plate and a central keel sometimes extending to the rear into a distinct tooth, the base of the column produced into a short foot.

Taxonomy

Kefersteinia RCHB.f., Bot. Zeit. (Berlin) 10: 633 (1852).
≡ *Zygopetalum* sect. *Kefersteinia* RCHB.f., Walp. Ann. Bot. Syst. 6: 657 (1861).
Type species: *Kefersteinia graminea* (LINDL.) RCHB.f.

Plants epiphytic, cespitose, small, without pseudobulbs. Leaves 3-6, arranged like a fan, ligulate to oblong, acute to abruptly acuminate, basally narrowing and articulate to the conduplicate petiole. Inflorescence a 1-flowered scape, suberect to pendulous, the peduncle slender, terete. Floral bracts cucullate, membranaceous. Flowers usually small, ringent to spreading, white to greenish-yellow to yellow, usually variously spotted and blotched with purple and brown. Dorsal sepal ovate to oblong, acute to apiculate, concave, dorsally carinate, sometimes reflexed at apex. Lateral sepals linear-elliptic to elliptic-lanceolate, often slightly falcate or laterally twisted, obtuse to acute or apiculate, concave toward the base, sometimes with subrevolute margins. Petals obliquely elliptic, smaller than sepals, acute to subapiculate, decurrent to the column foot, rarely deflexed, the margins sometimes subrevolute or slightly denticulate. Lip shortly clawed, pandurate to ovate, suborbicular or spathulate, rarely obscurely 3-lobed, acute to obtuse or emarginate, usually concave toward the base with the basal margins erect, the lamina sometimes folding back at the middle; callus basal or subbasal, fleshy, pedicellate or sessile and laminar, mostly bilobed, rarely 2-carinate. Column subterete, with a short foot, widened toward the apex from a narrow base, sometimes provided with short lateral wings, the ventral surface often forming a fleshy plate, basally protruding or not into basal teeth, generally provided with a longitudinal keel that in some cases projects at the rear into a distinct tooth; rostellum 3-dentate, the central tooth usually distinctly longer. Anther cap cucullate, subquadrate-subrhombic to triangular-ovate, often slightly compressed, 2- to 4-celled. Pollinia 4, in two pairs of different size, linear-oblong to obovoid, on a linear to ovate or obpyriform stipe, basally rounded or attenuate, sometimes folded along the margins; viscidium hyaline, rhombic to obtriangular-peltate, barely distinguishable from the stipe.

The genus includes today more than 50 species, distributed from southern Mexico to Bolivia and Guyana (SENGHAS & GERLACH 1990), with a main center of dispersion in South American Andes (with Colombia and Peru as the single countries with the highest number of species) and a second center in Costa Rica, where 10 species are recorded in the present paper.

In his treatment of the Orchidaceae for STANDLEY's Flora of Costa Rica, AMES (1937) reported 7 species of *Kefersteinia*, one of which, *Kefersteinia subquadrata* SCHLTR., is now best placed in the close related genus *Chaubardiella* GARAY (GARAY 1969). Of the remaining 6 species, *K. alba, K. microcharis*, and *K. wercklei* were at that time known only from the type collections. MORA-RETANA & GARCÍA (1992) listed 9 species, including *K. auriculata* DRESSLER (a species known to be endemic to Panama) and two hitherto inedited taxa, namely *K. excentrica* DRESSLER & MORA-RETANA and "*K. retaniana*" GERLACH, later published with the specific epithet *retanae* (GERLACH 1994). In his field guide to the orchids of Costa Rica and Panama, DRESSLER (1993) recognized 8 species, two of them still undescribed at the time of his publication. In the same year, DRESSLER and MORA-RETANA (1993) formally named one of this species (*K. excentrica*)

and GERLACH (1994) described with the name of *K. retanae* the species reported by DRESSLER as "*Zygopetalum umbonatum*" (although the latter name is actually referable to *K. wercklei* SCHLTR.). Eventually PUPULIN (2000: 25) added to the list his *K. orbicularis*.

Key to the Costa Rican species of *Kefersteinia*

1 Callus stipitate 2
1* Callus sessile, laminar or carinate 6
2 Lateral margins of the lip folded toward column 3
2* Lateral margins of lip not folded toward column 5
3 Lip entire or slightly subpandurate ..... 1. *K. wercklei*
3* Lip distinctly 3-lobed 4
4 Apex of lip retuse . ..... 2. *K. retanae*
4* Apex of lip acute ..... 3. *K. excentrica*
5 Lip orbicular, folded down at middle ..... 4. *K. orbicularis*
5* Lip obovate, not folded down at middle . ..... 5. *K. costaricensis*
6 Lip much shorter than sepals, more or less straight 7
6* Lip subequal to the sepals, abruptly bent down at middle 8
7 Lip pandurate; callus cushion-like ..... 6. *K. parvilabris*
7* Lip spathulate; callus of two keels reflexed distally ..... 7. *K. endresii*
8 Column oblong-elliptic; callus wider distally ..... 8. *K. microcharis*
8* Column with triangular wings at the middle; callus wider proximally 9
9 Column with a prominent ventral keel; lip ovate-oblong, entire ..... 9. *K. lactea*
9* Column without ventral keel; lip rhombic, 3-lobed ..... 10. *K. alba*

Species descriptions

1. ***Kefersteinia wercklei*** **SCHLTR.**, Repert. Sp. Nov. Beih. 19: 53 (1923); fig. 1.
≡ *Chondrorhyncha wercklei* (SCHLTR.) C.SCHWEINF., Amer. Orch. Soc. Bull 12: 386 (1944) Type: Costa Rica. Alajuela: San Ramón, La Palma, June 1921, C. Wercklé 120 (holotype, B, destroyed; lectotype, a drawing at AMES!).
= *Zygopetalum umbonatum* RCHB.f., Ms. at W-R.

Plant to about 10 cm tall, each shoot provided with 3-4 leaves and 2-3 acute, triangular bracts at the base. Roots flexuous, glabrous. Leaves cuneate-ligulate to lanceolate, acuminate, to 10 cm long, 0.8 cm wide, narrowing at the base into a conduplicate petiole 1.5 cm long. Inflorescences 1-2, each a slender, pendent to suberect, solitary flower; peduncle terete, slender, to 3 cm long, with 1-2 cucullate, oblong, acute bracts. Floral bracts cucullate, obtuse, membranaceous, to 5 mm long, about 4 mm wide. Ovary subclavate, terete, 8 mm long including the pedicel. Flowers rather small, the tepals not

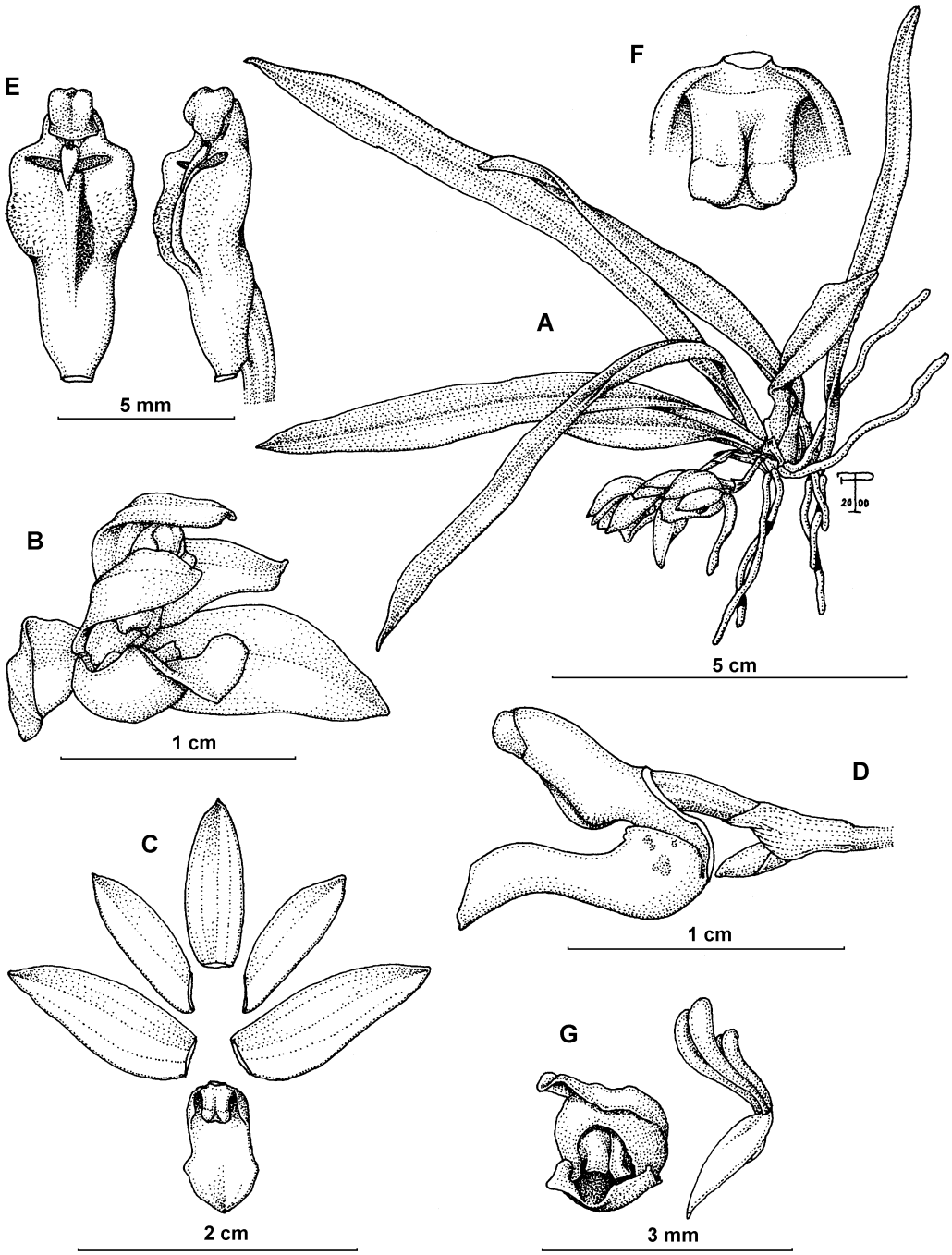


Fig. 1: *Kefersteinia wercklei* SCHLTR. A: habit; B: flower; C: dissected perianth; D: column and lip, lateral view; E: column, lateral and ventral three quarter views; F: callus; G: pollinarium and anther cap. Illustration voucher: Costa Rica. Santa Clara, 4 km West of Casamata, 1995, flowered in cultivation, 1996, M. Flores s.n. (USJ, photo! and drawings!).

spreading out completely, greenish white to cream, the petals sometimes with sparse red spots, the lip white with sparse rose blotches toward the base, sometimes spotted red toward the edges, the callus white. Dorsal sepal oblong-lanceolate, apiculate, concave, 12 mm long, 4.2 mm wide. Lateral sepals elliptic to elliptic-lanceolate, acute to obtuse, concave, 14.5 mm long, 5.3 mm wide. Petals obliquely elliptic to elliptic-lanceolate, acute, 11 mm long, 3.5 mm wide. Lip with a very short cuneate claw, ovate-oblong, subpandurate, obtuse, subapiculate, concave toward the base, curved sigmoidally, 9.5 mm long, 5.5 mm wide, the basal margins erect, the apical margins subcrenulate; callus basal, fleshy, clitelliform, truncate, bilobed and obscurely pulverulent at apex, sulcate along the middle, the groove dividing before reaching the apical notch, about 2.5 mm long, 2 mm wide. Column subterete, with a short foot, 8 mm long, 3.7 mm wide at the middle, from a narrow base, the ventral surface forming a subquadrate plate, basally protruding into two widely rounded keels, the margins pulverulent, provided with a low median, longitudinal keel. Anther cap cucullate, subquadrate, compressed, rounded at apex, 2-celled. Pollinia 4, linear-oblong, on a long, oblanceolate, acute stipe.

Derivation of name: in honor of the discoverer of the species, Carl Wercklé.

Distribution: Known only from Costa Rica.

Costa Rica: Alajuela: Atlantic rain forest, river shore slope between San Miguel de Sarapiquí and Río Toro, app. 600 to 650 m, Sept. 1988, C. Horich s.n. (Gerlach 1994, photo!); Santa Clara, 4 km west of Casamata, collected by M. Flores in 1995, flowered in cultivation, 1996, F. Pupulin 2450 (photo and drawings, USJ!); San Ramón, camino a los Potrerillos near the desmontes de los Carranzas, A.R. Endres s.n. (drawings, W-R!).

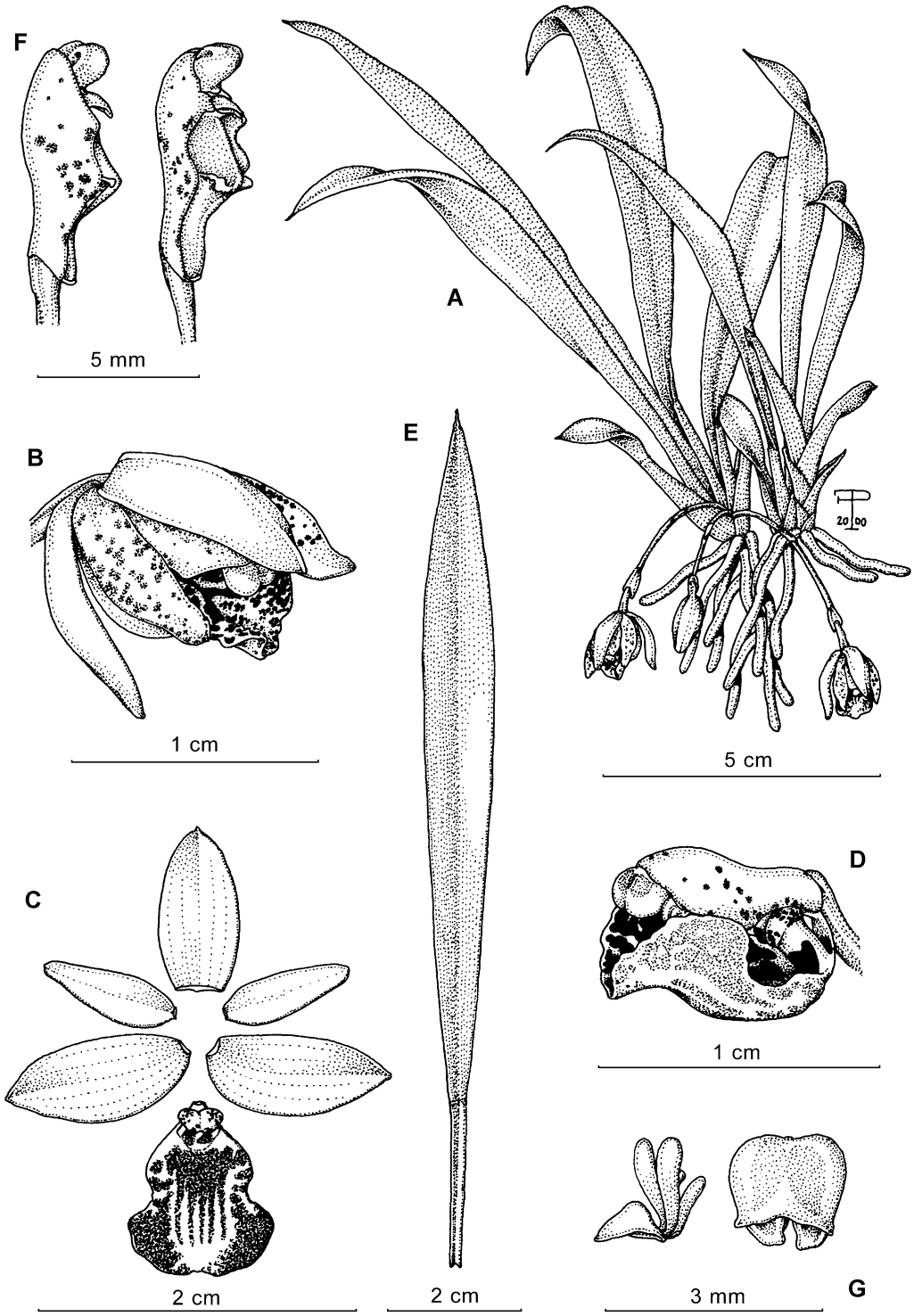
Habitat and ecology: Epiphytic in premontane wet forest of the Atlantic drainage of Cordillera de Tilarán in northern Costa Rica. Flowering June to November.

Discussion: An illustration and detailed description of *K. wercklei* were provided to REICHENBACH by A.R. ENDRES, based on a collection done near San Ramón (*Zygopetalum* n. 9, W-R 34708!), on which Reichenbach planned to published his *Zygopetalum umbonatum*. It is probable a flowered specimen was originally associated with ENDRES' material, on which the illustration of the habit intended for publication in Xenia Orchidaceae was prepared, together with a sketch by REICHENBACH of the lip and the pollinarium of the species (W-R 49841!). No actual specimen of this taxon is conserved in REICHENBACH 's herbarium, and *Zygopetalum umbonatum* was never published. Analytical drawings of the lip and pollinarium of *K. wercklei* were presented by SENGHAS and GERLACH (1993), and detailed photographs showing critical characters of the lip and the column of this species were published by GERLACH (1994).

2. ***Kefersteinia retanae*** **G.GERLACH ex C.O.MORALES**, Brenesia 52 ("1999"): 75 (2000); fig. 2.

   Type: Costa Rica. San José: Pérez Zeledón, Peña Blanca, 600 m, flowered in cultivation at Munich Botanical Garden, June 1992, prepared in the same date, G. Gerlach s.n. (holotype, USJ!; isotypes, M and Herb. Königer).

Plant to about 10 cm tall, each shoot provided with 2-3 leaves and 3-5 basal cataphylls, these foliaceous or not. Roots flexuous, glabrous. Leaves linear to narrowly oblanceolate, acute, minutely apiculate, to 13 (17) cm long, 1.1-1.4 cm wide, narrowing at the


F
5 mm
A
5 cm
B
1 cm
E
2 cm
C
2 cm
D
1 cm
3 mm
G

base into a conduplicate petiole 2 cm long. Inflorescences many, each a slender, pendent, solitary flower; peduncle terete, slender, to 4 cm long, with 2-3 conic-infundibuliform, membranous bracts. Floral bracts peltate, obtuse, 4 mm long, about 3.5 mm wide. Ovary subclavate, slightly winged, 7 mm long including the pedicel. Flowers small for the genus, the tepals not spreading out completely, greenish yellow, translucent, the petals with sparse purple spots, the lip white spotted and blotched with dark purple along nerves and the margins, the callus pale yellow spotted purple. Dorsal sepal elliptic, apiculate, concave, 10 mm long, 4-5 mm wide. Lateral sepals elliptic to elliptic-lanceolate, slightly falcate, acute, concave, 12 mm long, 3 mm wide. Petals obliquely elliptic-lanceolate, acute, 12 mm long, 4-5 mm wide. Lip with a short cuneate claw, obovate-pandurate, retuse, concave, 11 mm long, 9 mm wide, the margins upcurved; callus subbasal, pedicellate, peltate-obreniform, bilobed, about 3 mm high, 3 mm wide, 2 mm long. Column elongate, with a short foot, 7 mm long, 5 mm wide at the middle, from a narrow base, the ventral surface forming a transversely elliptic plate, basally protruding into a transverse keel, the margins obscurely lacerate, provided with a median longitudinal keel projecting into an obtuse tooth. Anther cap cucullate, subquadrate, slightly compressed, rounded at apex, 4-celled. Pollinia 4, linear-oblong to narrowly obpyriform, on a rather large, folded stipe; viscidium hyaline, obtriangular.

Derivation of name: Named in honor of Dora Emilia Mora de Retana, pre-eminent Costa Rican orchidologist.

Distribution: Known only from Costa Rica.

Costa Rica: San José: Pérez Zeledón, Peña Blanca, 510 m, collected by J. Cambronero, 6 May 2000, F. Pupulin 2456 (USJ!); same locality, about 500 m, collected by J. Cambronero, 1994, cultivated at San Isidro de Pérez Zéldon by Giselle Fonseca, F. Pupulin 2578 (USJ!); same locality, J. Cambronero sub F. Pupulin 708 (drawings, USJ!).

Habitat and ecology: Epiphytic in premontane and lower montane wet forest of Cordillera de Talamanca in southern Costa Rica, at 500-600 m elevation. Flowering from May to November.

Discussion: The ringent, yellowish flowers heavily spotted with purple and the obovate-pandurate lip with retuse apex and the margins upcurved easily distinguish *K. retanae* from its close relatives, namely *K. wercklei* and *K. excentrica*. *Kefersteinia retanae* is the most floriferous species of the genus in Costa Rica, and a single growth may bear up to 20 flowers. At the type locality a specimen was observed with 42 flowers simultaneously opened (J. CAMBRONERO, pers. comm.). Although vegetative features are usually not consistent enough to distinguish species within *Kefersteinia*, the linear to narrowly oblanceolate leaves of *K. retanae* are a good character for field recognition. As noted by GRAYUM *et al.* (1996) *K. retanae* was not validly published at the time of the original description (GERLACH 1994) because only locality data were provided to designate the holotype (GREUTER *et al.* 1994), and the name has been validated by MORALES (1999).

Fig. 2: *Kefersteinia retanae* G.GERLACH ex C.O.MORALES. A: habit; B: flower; C: dissected perianth; D: column and lip, lateral view; E: leaf; F: column, lateral and ventral three quarter views; G: pollinarium and anther cap. Illustration voucher: Costa Rica. San José: Pérez Zeledón, Peñas Blancas de San Isidro, 620 m, 1994, J. Cambronero s.n. (USJ, drawings!).

3. ***Kefersteinia excentrica*** **Dressler & Mora-Retana**, Orquídea (Méx.) 13: 261 (1993); Fig. 3.

Type: Costa Rica. Cartago: La Selva, camino a Taus, en la misma ruta al Refugio de Fauna Silvestre Tapantí, 1300-1400 m, 9 nov. 1984, *R.L. Dressler & D.E. Mora-Retana 163* (holotype, USJ!; isotypes, FLAS, USJ!).

Plant to about 15 cm tall, each shoot provided with 4-5 leaves. Roots flexuous, glabrous. Leaves oblanceolate to narrowly elliptic, acute to acuminate, the margins of the lamina slightly recurved, 8.5-15 cm long, 1.1-1.5 cm wide. Inflorescences 1-4, each a slender, pendent, solitary flower; peduncle terete, to 5 cm long, with membranaceous, triangular bracts. Ovary clavate, to 17 mm long including the pedicel. Flowers rather small, the tepals not completely spreading, pale green with purple spots and blotches, the petals withish, densely spotted with purple, the lip white spotted with purple especially toward the apex; lip apex sometimes solid red. Dorsal sepal elliptic or lanceolate-elliptic, acute, carinate, concave, 12-13 mm long, 5-6 mm wide. Lateral sepals elliptic to lanceolate-elliptic, slightly subfalcate, apiculate, 15-17 mm long, 5-6 mm wide. Petals obliquely elliptic, the margins slightly denticulate, acute, 12-14 mm long, 4-5 mm wide. Lip with a short cuneate claw, 3-lobed, pandurate, apiculate, 13 mm long, 10 mm wide, twisted along its longitudinal axis after anthesis; lateral lobes rounded, suberect; midlobe subflabellate, the lamina provided with 5 low, longitudinal keels, the lateral margins dentate; callus bilobed, low, 4.0 mm wide, about 2 mm long. Column elongate, with a short foot, 10 mm long, 4 mm wide at the middle, from a narrow base, the ventral surface forming a subquadrate plate below stigma, the corners basally protruding in two short teeth, provided with a weak median keel on and below the plate projecting at the rear into a low tooth. Anther cap cucullate, subquadrate, 2-celled. Pollinia 4, linear-oblong, on a slender, obovate stipe; viscidium peltate.

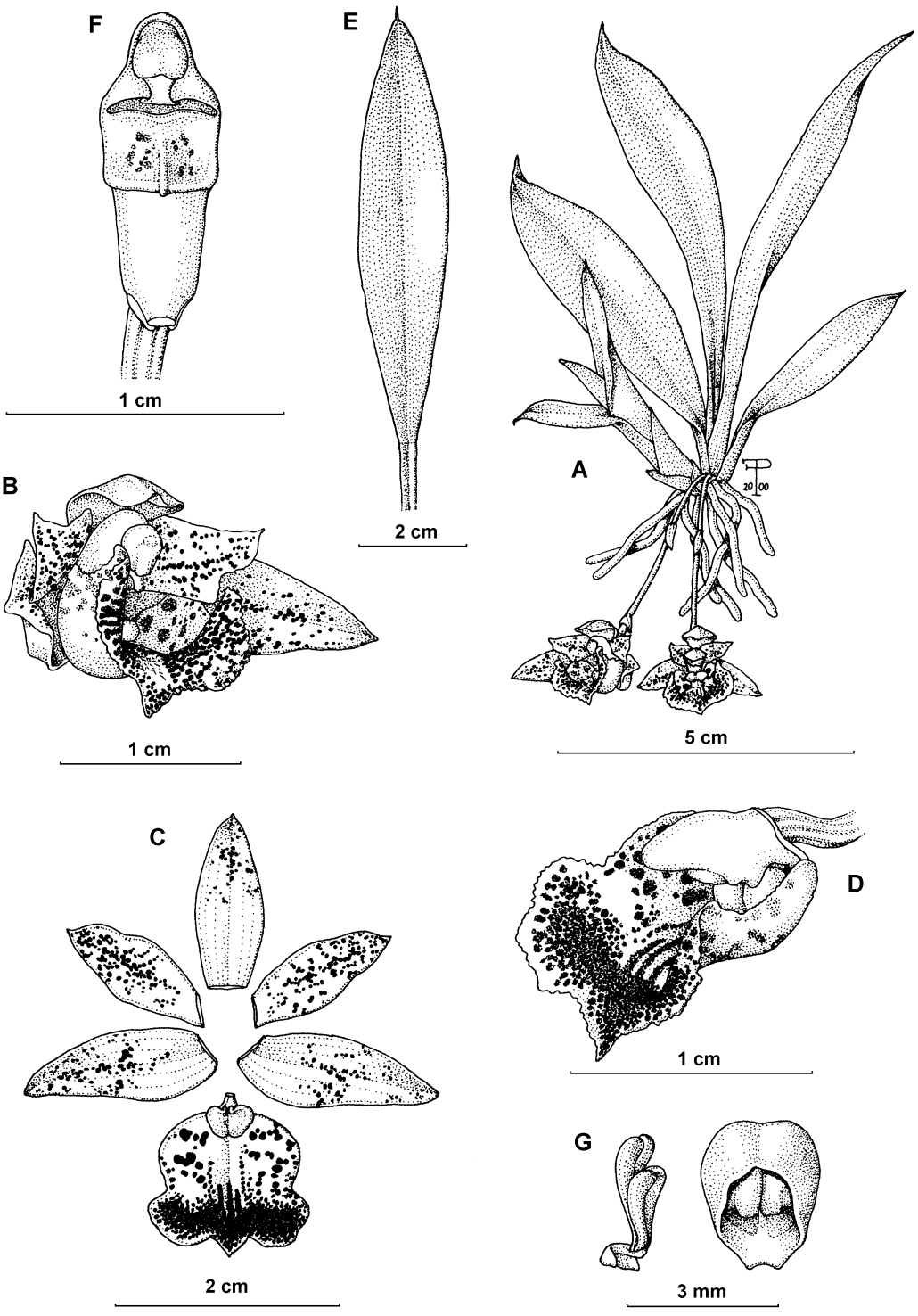
Derivation of name: from the Latin excentricus, "off-center," in allusion to the position of the lip not balanced in the center.

Distribution: Costa Rica and Panama.

Costa Rica. Alajuela: San Ramón, camino a Cataratas, Junio 1990, D.E. Mora-Retana s.n. (USJ!). San Ramón, Cataratas de San Ramón, camino a la Reserva Forestal, Julio 1990, D.E. Mora-Retana s.n. (paratype, USJ!). San Ramón, Reserva Biológica A.M. Brenes, ca. 900 m, flowered 22 Dec. 1999, M. Freiberg sub M. Blanco 1054 (USJ!). Reserva Biológica A.M. Brenes, collected by M. Freiberg, flowered in cultivation at Jardín Botánico Lankester, 17 June 2000, F. Pupulin 2424 (USJ). Same locality, M. Freiberg s.n. (SEL, drawings!); Reserva Biológica Monteverde, trail to Peñas Blancas, near the Refuge Alemán, 10°17'96"N 84°44'83"W, 16 April 2000, flowered in cultivation at Jardín Botánico Lankester, 19 December 2000, F. Pupulin & M. L. Spadari 2280 (USJ, FAA Coll.!). Cartago: Orosi, Selva, camino a Taus, 9 Nov. 1984, M. Blanco 1053 (USJ!); La Selva, camino a Taus, without collector, Sept. 1984, flowered in cultivation at Jardín Botánico Lankester, 16 Dec. 2000, F. Pupulin 2736 (USJ, FAA Coll.!).

Habitat and ecology: Epiphytic in wet premontane forest between 1200 and 1500 meters altitude, usually on mossy tree trunks in rather shady sites. Flowering from December to March.

Fig. 3: *Kefersteinia excentrica* Dressler & Mora-Retana. A: habit; B: flower; C: dissected perianth; D: column and lip, three quarter view; E: leaf; F: column, ventral view; G: pollinarium and anther cap. Illustration voucher: Costa Rica. Alajuela: San Ramón, Reserva Biológica A.M. Brenes, collected by M. Freiberg, flowered in cultivation at Jardín Botánico Lankester, 17 June 2000, F. Pupulin 2424 (USJ).


F
1 cm
E
2 cm
A
5 cm
B
1 cm
C
2 cm
D
1 cm
G
3 mm

Discussion: One of the most distinctive characters of *K. excentrica* is the off-center position of the lip, that usually rotates of some 30 degrees along its longitudinal axis, most commonly towards the left. Although this is the normal condition for the species, flowers of *K. excentrica* usually present at anthesis the lip in the regular symmetric position, and in floriferous specimens it is not uncommon to see both kinds of placement of lip at the same time in the same plant (pers. obs.). On the other hand, the off-center position of the lip is not restricted to *K. excentrica*, and it may be sometimes observed also in *K. parvilabris* (e.g., Costa Rica: Cartago, Taus, Camino a Tapantí, Dressler & Mora s.n., USJ spirit coll.!). DRESSLER (1981: 248) reported that pollinaria of *Kefersteinia* are placed on the scape, or the basal segment of the antenna, of the euglossine bees that are responsible of its pollination, and GERLACH (1994) associated pollination of *K. costaricensis* with visits of male *Euglossa deceptrix*, an euglossine bee searching for perfumes. The presence of a prominent projection on the ventral surface of the column and DRESSLER's observation about the placement of the pollinarium may suggest that the off-center position of the lip actually forces the pollinators to enter the flower along its margin.

4. ***Kefersteinia costaricensis*** **SCHLTR.**, Beih. Bot. Centralbl. 36: 413 (1918); fig. 4.

≡ *Chondrorhyncha costaricensis* (SCHLTR.) ALLEN, Ann. Missouri Bot. Gard. 36: 86 (1949).

Type: Costa Rica: colline vers le Rio Chirripó, 300 m, Jan. 1900, H. Pittier 16058 (holotype, B; destroyed; lectotype, a drawing of the holotype at AMES, photo!).

Plant to about 10 cm tall, each shoot provided with 3-5 leaves. Roots flexuous, glabrous. Leaves elliptic to elliptic-oblanceolate, acute, 6-11 cm long, 1.7-2.5 cm wide, the margins of the lamina narrowing toward the base into a short conduplicate petiole about 1 cm long. Inflorescences 1-3, each a slender, pendent, solitary flower; peduncle terete, to 4 cm long, with membranaceous, triangular-ovate bracts. Ovary clavate, to 17 mm long including the pedicel, subtended by 2 cucullate bracts 3 mm long. Flowers rather small, spreading, the sepals greenish white to cream, the petals withish, densely spotted with purple, the lip white, spotted with purple, the callus white, spotted purple. Dorsal sepal elliptic to elliptic-ovate, acute, carinate, concave, 10-11 mm long, 5-6 mm wide. Lateral sepals obliquely elliptic-lanceolate, slightly subfalcate, acute to apiculate, 11-13 mm long, 6-8 mm wide. Petals obliquely elliptic-oblong, adnate to the column foot, acute, 9-11 mm long, 6-7 mm wide. Lip with a short linear claw, obovate when spread, obtuse, apiculate, deeply concave at the base, the distal margins slightly crenulate, 13 mm long, 10-11 mm wide; callus at the base of the lamina, fleshy, stalked, subreniform, bilobed, 6.0 mm wide, about 5 mm long, 2.5 mm high. Column elongate, stout, with a short foot, 10 mm long, 4.5 mm wide at the middle, from a narrow base, the ventral surface forming a transversely rectangular plate below stigma, protruding basally in two short teeth, provided with a prominent median keel on the plate projecting at the rear into a triangular tooth. Anther cap cucullate, triangular-ovate, 2-celled. Pollinia 4, linear-oblong, on a slender, ovate stipe; viscidium peltate.

Derivation of name: named from the country where the species was originally discovered.

Distribution: Nicaragua, Costa Rica and Panama.

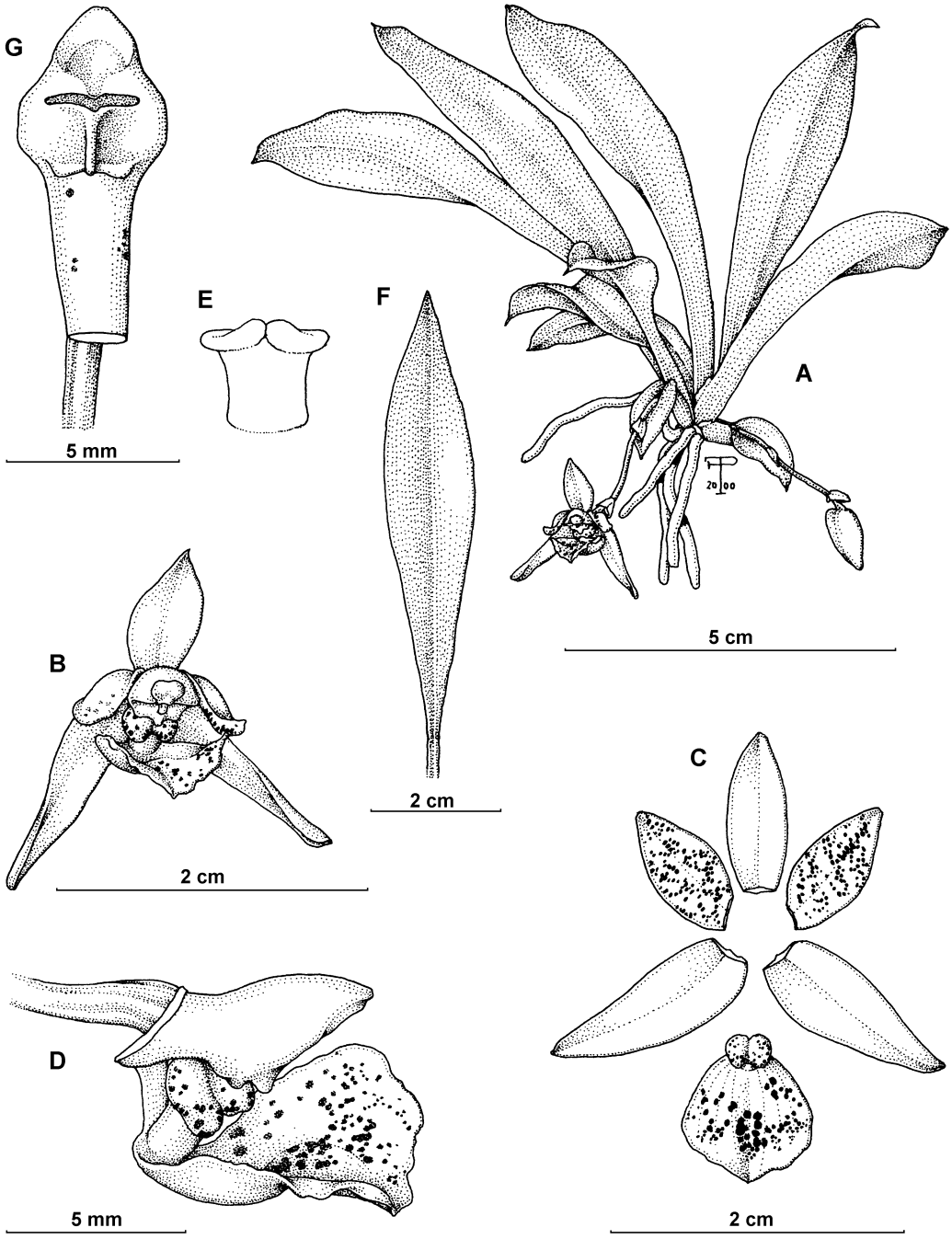


Fig. 4: *Kefersteinia costaricensis* SCHLTR. A: habit; B: flower; C: dissected perianth; D: column and lip, lateral view; E: callus, frontal view; F: leaf; G: column, ventral view. Illustration voucher: Costa Rica. Heredia: Puerto Viejo de sarapiqui, Finca La Selva, 25 March 1991, R.L. Dressler & D.E. Mora-Retana s.n. (USJ).

Costa Rica. Alajuela: Reserva de San Ramón, Río San Lorencito, Fila Pavas, 800 m, 2-6 Sep. 1986, I.A. Chacón, M. Chacón & V. Mora 2241 (CR!); Cataratas de San Ramón, cultivado en casa de doña Amparo de Zeledón, 19 Aug. 1936, A. de Zeledón (Serie de varios colectores 363)(CR!); Cataratas de San Ramón, cultivada en San José, 1935, M. Quirós Calvo 618 (CR!); Reserva Biológica Monteverde. Río Peñas Blancas. Quebrada Gemelas, 10°19'N 84°43'W, 800 m, 10 Sept. 1989, E. Bello 1218 (CR!); San Carlos, Río Segundo, Dec. 1961, C.H. Lankester 1795 (CR!). Cartago: Santa Teresita de Turrialba, Sept. 1991, D.E. Mora-Retana & R.L. Dressler s.n. (USJ!); same locality, collected by R.L. Dressler & D.E. Mora-Retana, 16 Sept. 1991, flowered in cultivation at Jardín Botánico Lankester, 15 Dec. 2000, F. Pupulin 2735 (USJ, FAA Coll.!); Turrialba, a orillas del Río Pejibaye, 25 March 1992, R.L. Dressler & D.E. Mora-Retana s.n. (USJ !); Turrialba, Palomo de Santa Teresita, collected by R.L. Dressler & D.E. Mora-Retana, 19 Sept. 1991, flowered in cultivation at Jardín Botánico Lankester, 12 Dec. 2000, F. Pupulin 2733 (USJ, FAA coll.!). Pacuare, La Suiza, Platanillo de Turrialba, toward Moravia de Chirripó, collected by O. Ureña, Oct. 1999, flowered in cultivation at Cartago, 15 Nov. 2000, F. Pupulin 2582 (USJ, FAA coll.!); La Selva, 25 March 1991, R.L. Dressler & D.E. Mora-Retana s.n. (USJ!); Pacuare, Jan., Endres 297 (W!); San Carlos, Vara de Robles, El Guarco, collected by M. Flores, May 1997, flowered in cult., Nov. 2000, F. Pupulin 2580 (USJ!); Reventazón, C.H. Lankester 362 (AMES). Guanacaste: Reserva Biológica Monteverde, al lado de carril en bosque maduro del Pantano Chomogo, 1600-1620 m, 20 May 1977, V.J. Dryer 1364 (CR!); Guanacaste: 600-700 m, 10.30N 84.55W, 25 Jan. 1926, P.C. Standley & J. Valerio 46009 (AMES). Heredia: Puerto Viejo de Sarapiquí, Finca La Selva, flowered June 2000, M. Blanco 907 (USJ!). Heredia: 10.30N, 84.00W, 13 July 1993, R.L. Dressler 6150 (MO). Puntarenas: Cantón de Osa. Fila Costeña, Fila Cruces, cabeceras del Río Piedras Blancas; cerro Anguciana, faldas al Oeste, 08°49'02"N, 83°11'25"W, 800-900 m, 9 Dec. 1993, B. Hammel, R. Aguilar & M. Grayum 19249 (CR!); Golfito. Peninsula across bay, west from the town of Golfito (generally west of Playa Cacao), 08°38'00"N, 83°11'15"W, 20-200 m, 29 Jan. 1992, H. Schmidt 611 (INB!). Without definite locality: Cultivated in garden in San José, 17 March 1978, C. Todzia 208 (CR!); 19 Aug. 1926, C.H. Lankester 362 (AMES).

Habitat and ecology: This is the most widespread and common *Kefersteinia* species in Costa Rica, where it is usually found on large and shaded branches of tropical rain forests at 20-1600 m elevation. Flowers of *K. costaricensis* are apparently pollinated by male *Euglossa deceptrix* (GERLACH 1994) looking for perfumes.

Discussion: The fleshy lip with plane or only slightly undulate margins, and the short tooth well apart from the stigma formed by the keel under the column easily distinguish *K. costaricensis* from other Mesoamerican *Kefersteinia* species with stipitate callus. In the drawing from the holotype published by MANSFELD (1931) as well as in the record of type at AMES (no. 24761) the adaxial view of the callus shows it 3-scutellate as defined by SCHLECHTER in the protologue (SCHLECHTER 1918), but the frontal view of the same organ perfectly agrees with Costa Rican material of this species, and MORA and ATWOOD (1993) suggested this may be due to the poorly hydrated flower on which the original description and illustration were done. In REICHENBACH's herbarium is kept a drawing by ENDRES of a plant of *K. costaricensis* from Pacuar (*Endres 297*, W-R 10208!) in which the stalked callus presents 4 low keels. Forms with unspotted petals and with completely white flowers also exist in Costa Rica (*F. Pupulin 2580*, USJ!, and *2582*, USJ, FAA collection!).

5. ***Kefersteinia orbicularis*** **PUPULIN**, Lindleyana 15: 21 (2000); fig.5.

Type: Costa Rica. San José: Dota, crest of Cerro Nara, 1100 m, epiphytic in disturbed primary forest, 15 Jan. 1999, F. Pupulin, D. Castelfranco & L. Spadari 1170 (holotype, USJ!; isotype, SEL-spirit!).

Plant to about 10 cm tall, each shoot provided with 2-3 leaves and 2-4 basal cataphylls, foliaceous or not. Roots flexuous, glabrous. Leaves obovate elliptic, acute to obscurely

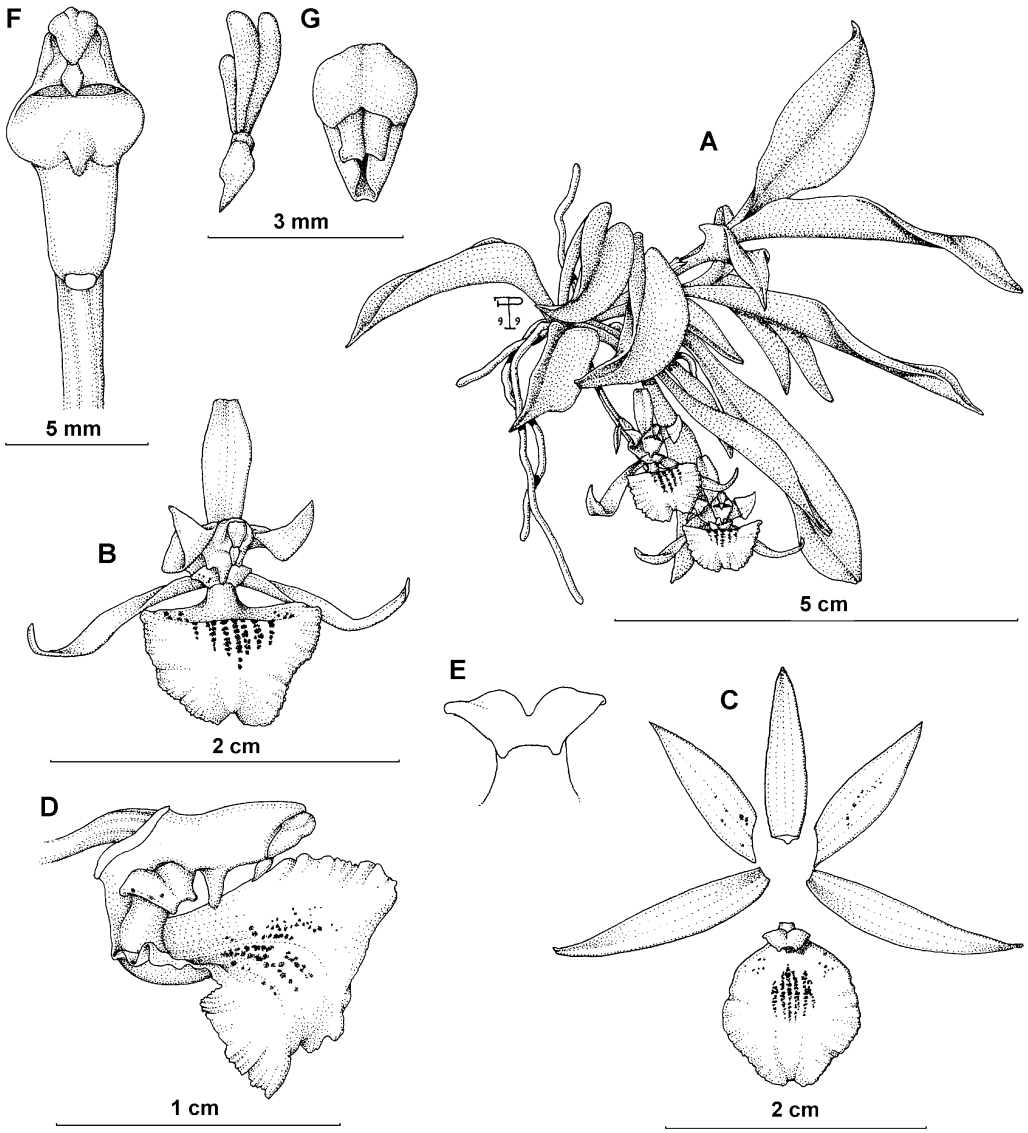


Fig. 5: *Kefersteinia orbicularis* PUPULIN. A: habit; B: flower; C: dissected perianth; D: column and lip, three quarter view; E: callus, frontal view; F: column, ventral view; G: pollinarium and anther cap. Illustration voucher: Costa Rica. San José: Dota, crest of Cerro Nara, 1100 m, epiphytic in disturbed primary forest, 15 Jan. 1999, F. Pupulin, D. Castelfranco & L. Spadari 1170 (USJ). Drawn from the holotype.

retuse, the margins of the lamina slightly undulate, to 6.0 cm long, 1.1-1.4 cm wide, narrowing at the base into a conduplicate petiole. Inflorescences 1-5, each a slender, pendent, solitary flower; peduncle terete, to 4 cm long, with 1-2 infundibuliform bracts. Floral bracts infundibuliform, ovate, acute, 4.5 mm long, about 3.5 mm wide. Ovary cla-

vate, 8 mm long including the pedicel. Flowers rather large for the genus, the tepals spreading out, white to pale greenish white, translucent, the petals with sparse purple spots at the base, the lip white spotted with dark purple along the midrib and toward the base, the callus white to yellow. Dorsal sepal elliptic-lanceolate, apiculate, reflexed at apex, 13.0 mm long, 3-3.5 mm wide. Lateral sepals narrowly elliptic to linear-elliptic, slightly falcate, laterally twisted, acute, concave, 17 mm long, 3 mm wide. Petals obliquely elliptic-lanceolate, acute, 12 mm long, 4 mm wide. Lip with a short cuneate claw, entire, orbicular to widely obovate, retuse, concave at the base, 13 mm long, 11 mm wide, the lamina folding back at the middle, the lateral margins crisped; callus subbasal, pedicellate, obreniform, peltate, bilobed, 2.5 mm high, 4.0 mm wide, 1.4 mm long. Column elongate, with a short foot, 10 mm long, 5 mm wide at the middle, from a narrow base, the ventral surface forming a transversely elliptic plate, basally protruding in two short velutine teeth, provided with a median keel projecting into an elongate tooth, apically velutine. Anther cap cucullate, obovate, 4-celled. Pollinia 4, narrowly obpyriform, on a slender, linear, folded stipe; viscidium hyaline, rhombic.

Derivation of name: from the Latin orbicular, "circular," in allusion to the circular shape of the lip.

Distribution: known only from Costa Rica.

Costa Rica. San José: Dota, crest of Cerro Nara, 1100 m, 15 Jan. 1999, F. Pupulin, D. Castelfranco & L. Spadari 1126 (Herb. Pupulin), 1127 (USJ!), and 1171 (SEL!). Same locality, 910 m, 20 Feb. 2000, F. Pupulin, D. Castelfranco, L. Spadari & K. McFarland 2066 (USJ!), 2067 (Herb. Pupulin!), and 2068 (SEL!). Same locality, about 1000 m, 20 Feb. 2000, F. Pupulin, D. Castelfranco, L. Spadari & K. McFarland 2095 (USJ!) and 2106 (Herb. Pupulin!). Pérez Zeledón, Las Nubes de Quizarrá, Nov. 1989, flowered in cultivation May 1990, F. Pupulin 23 (SEL!). Los Altos de San Juan, near San Isidro del General, 1000 ft., Horich H62CR44 (LA, photo!). Platanar de Pérez Zeledón, 400-600 m, 20 March 1993, without collector (USJ, drawing!).

Habitat and ecology: Epiphytic in premontane wet forest and cloud forest in southern and central Pacific Costa Rica on mossy branches in the understory of disturbed primary vegetation. Flowering from February to May.

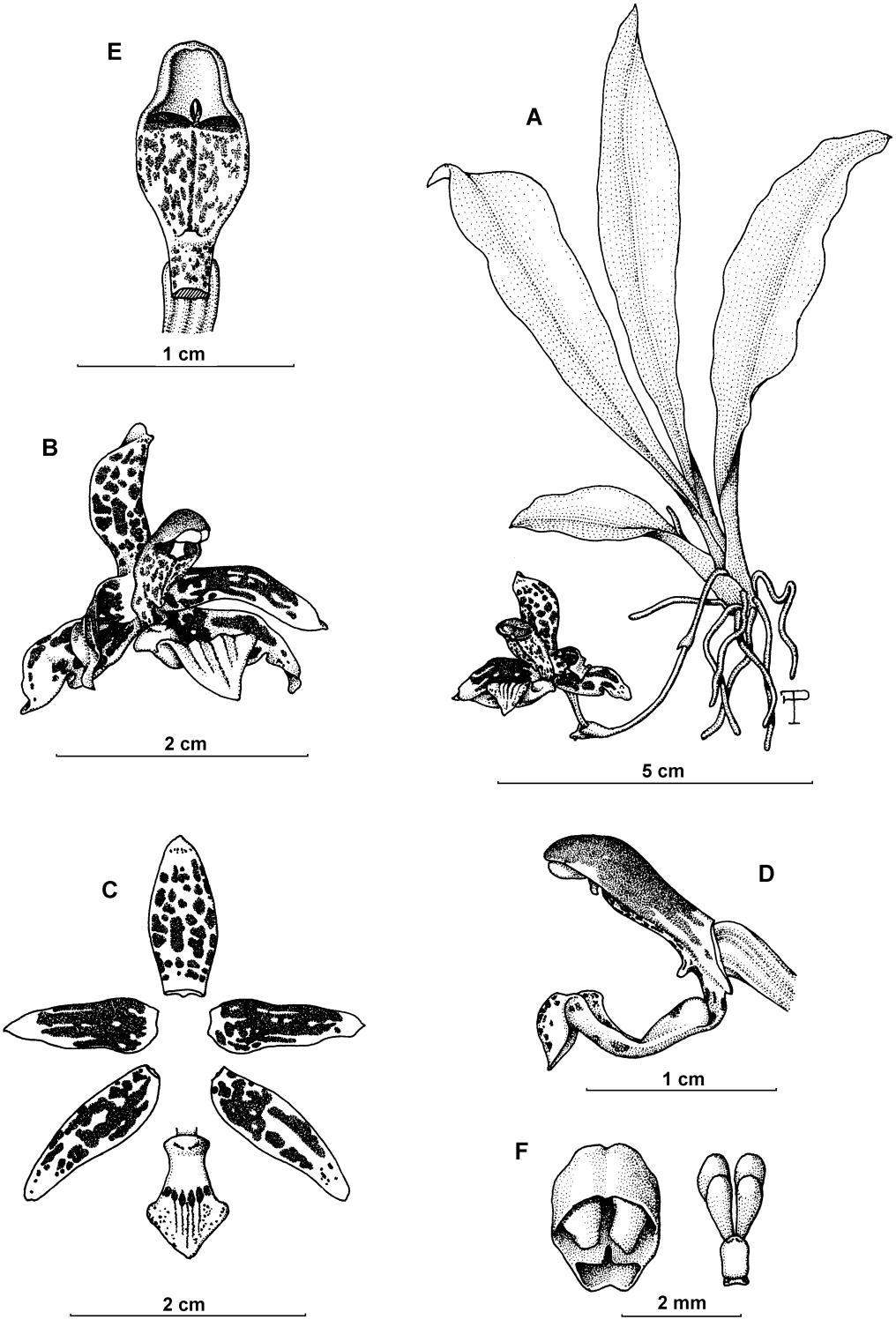
Discussion: *Kefersteinia orbicularis* closely resembles *K. costaricensis*, but the larger size of its flowers, the crisped margins of the lip, the different shaped callus and column and the peculiar arrangement of the lateral sepals easily distinguish the two species.

6. ***Kefersteinia parvilabris*** **SCHLTR.**, Repert. Sp. Nov. Beih. 19: 52 (1923); fig. 6.

≡ *Chondrorrhyncha parvilabris* (SCHLTR.) L.O.WILLIAMS, Ceiba 5: 195 (1956).
Type: Costa Rica. San Jerónimo, Jan. 1922, C. Wercklé 116 (holotype, B, destroyed; lectotype, selected here, AMES 31623!, drawings of the holotype).

= *Kefersteinia deflexipetala* FOWLIE, Orch. Dig. 30: 117 (1966).
Type: Costa Rica. Cartago: Cedral de Orosi, 1400 m, Horich H64CR13 (holotype, LA, not seen).

Fig. 6: *Kefersteinia parvilabris* SCHLTR. A: habit; B: flower; C: dissected perianth; D: column and lip, lateral view; E: column, ventral view; F: anther cap and pollinarium. Illustration voucher: Costa Rica. Cartago: Tres Equis, 750 m, F. Pupulin s.n. (USJ!).


E
1 cm
A
5 cm
B
2 cm
C
2 cm
D
1 cm
F
2 mm

Plant to about 12 cm tall, each shoot provided with 4-6 leaves, and 2-5 acute, triangular bracts at the base. Roots flexuous, glabrous. Leaves cuneate-oblong, subacuminate, somewhat undulate along the margins, to 12 cm long, 2.3-3.1 cm wide, narrowing at the base into a conduplicate petiole 1.5 cm long. Inflorescences 1-2, each a slender, prostrate to pendent, solitary flower from the axils of the larger basal bracts; peduncle terete, slender to subfiliform, to 5 cm long, with 2-3 imbricating, cucullate, oblong, acute bracts. Floral bracts double, the outer one cucullate, orbicular, apiculate, membranaceous, to 6 mm long, about 5 mm wide; the inner one cuneate-oblong, acute, shorter and narrower. Ovary subclavate, terete, to 11 mm long including the pedicel. Flowers rather small, the tepals patent, greenish yellow densely striped and spotted with purplish black, the petals somewhat darker than sepals, the lip with black claw and the lamina whitish, suffused with lilac, densely spotted with purplish black, the callus white. Dorsal sepal lanceolate, acute, the apex incurved, the margins subrevolute, 13.5 mm long, 6 mm wide. Lateral sepals narrowly lanceolate, acute to subobtuse, concave toward the base, the margins subrevolute, 15 mm long, 4.8 mm wide. Petals obliquely ovate-lanceolate, acuminate, the margins subrevolute, deflexed toward the column, 13.5 mm long, 5 mm wide. Lip from a very short, cuneate claw, oblong-rhombic, subpandurate, apiculate, with 2-4 low longitudinal carines, slightly concave toward the base, the apex reflexed, 11.5 mm long, 7 mm wide, provided at the base with two small, triangular auricles; callus basal, fleshy, transversely oblong, sometimes 3-gibbous, obscurely tomentose. Column semiterete, slightly convex at apex, with a short foot, 12 mm long, 5 mm wide at the middle, from a cuneate base, the ventral surface provided with a low median, longitudinal keel, basally protruding into a short velutine tooth. Anther cap cucullate, subquadrate, compressed, retuse at apex, 2-celled. Pollinia 4, obpyriform, on a subquadrate, rounded stipe.

Derivation of name: from the Latin parvus, "little", and labium, "lip", in reference to the proportionately small and narrow lip of the species.

Distribution: Costa Rica to Colombia.

Costa Rica. Alajuela: Reserva de San Ramón, on the slopes of a little cerro North to Station, 1100 m, 16 Aug. 1991, M. Germani 20 (USJ!). San Ramón, Cataratas, 1869-70, A.R. Endres s.n. [Zygopetalum N. 8] (drawings, W-R 2212!). Cartago: Paraíso, Finca La Selva, camino a Taus, 1984, D.E. Mora-Retana s.n. (USJ!); Taus, Agosto 1989, D.E. Mora-Retana s.n. (USJ!). Táus, camino a Tapantí, D.E. Mora-Retana s.n. (USJ!); Tres Equis, 750 m, Oct. 1989, F. Pupulin s.n. (USJ!); El Alto de Las Varas, near Turrialba, 600 m, Horich H62CR49 (LA); vicinity of Pejibaye, 900 meters, Standley & Valerio 47026 (AMES). Heredia: shores of Laguna del Congo, NW of Cariblanco, 700 m, Horich H62CR50 (LA).

Habitat and ecology: Epiphytic in premontane and lower montane wet forests, in shady conditions at 600-1400 m. Flowering from January to June.

Discussion: The yellow flowers densely blotched with purplish red and the deflexed petals easily distinguish *K. parvilabris* from the other Costa Rican species of the genus. The lip of *K. parvilabris* is rather variable regarding the general outline and the presence of longitudinal keels on the distal portion of the lamina (fig. 7), but the drawings from SCHLECHTER's herbarium kept at AMES leave no doubts about the identity of the species. The diagnostic characters used by FOWLIE (1966b) to define his concept of *K. deflexipetala*, i.e. the abruptly deflexed position of the petals and the laterally contracted lip with a verrucose callus, proved to be indistinguishable from *K. parvilabris* (GARAY 1969; MORA & ATWOOD 1992), and an examination of the drawing from the holotype confirmed such an interpretation. Some 25 years before his formal description

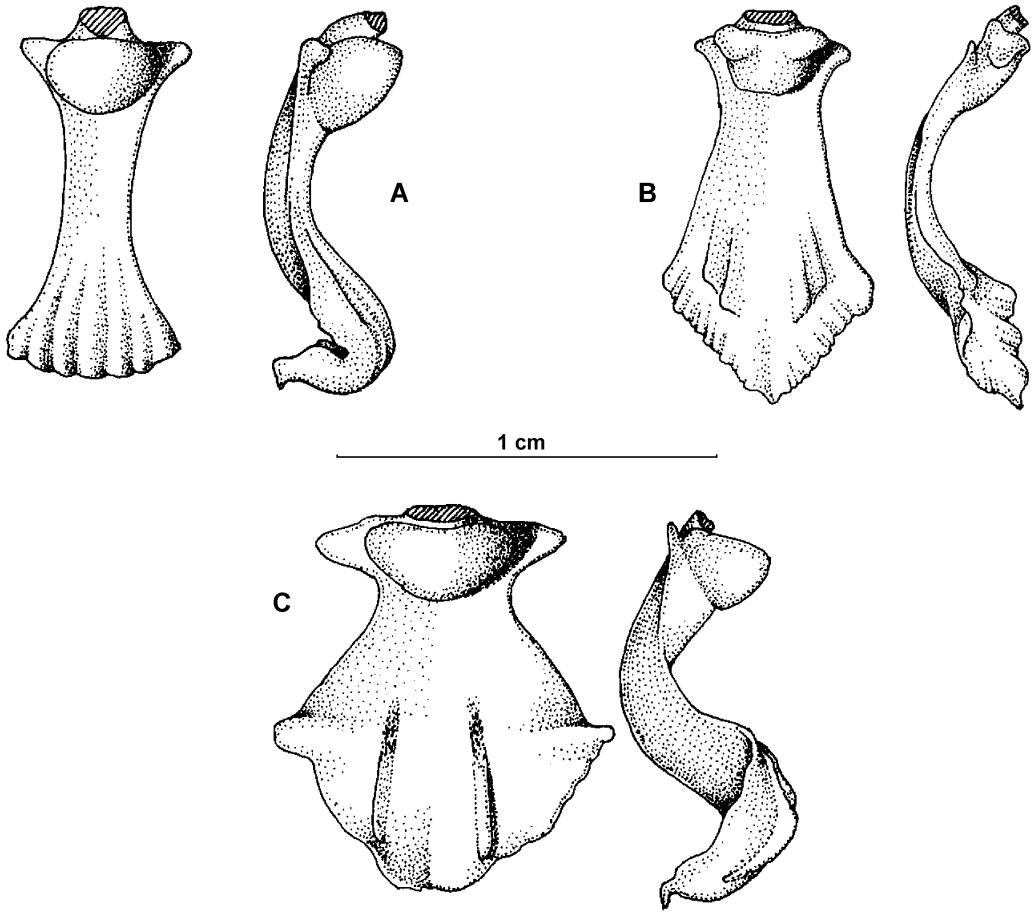


Fig. 7: Variability in lips of *Kefersteinia parvilabris* SCHLTR.: ventral and lateral views of the lip. A: Costa Rica, without definite locality; B: Costa Rica. Cartago: Turrialba, La Suiza; C: Costa Rica. Cartago: Turrialba, Taus. Bar = 1 cm. Drawn from living specimens cultivated at Jardín Botánico Lankester, Universidad de Costa Rica.

by SCHLECHTER, *K. parvilabris* was illustrated and described by A.R. ENDRES, who sent to REICHENBACH material based on a Costa Rican collection from Cataratas de San Ramón (W-R 2212!), erroneously identified in Vienna as *Zygopetalum lacteum* by REICHENBACH *filius*.

7. ***Kefersteinia endresii* PUPULIN, sp.n.**

Diagnosis: Inter species generis Kefersteiniae labello perparvo callo pulverulento duabus carinis parallelis inflatis antice abrupte reflexis apice geminatis recavis differt.

Type: Costa Rica: without definite locality, A. Endres s.n. (holotype, W-R 18048!); (fig. 8).

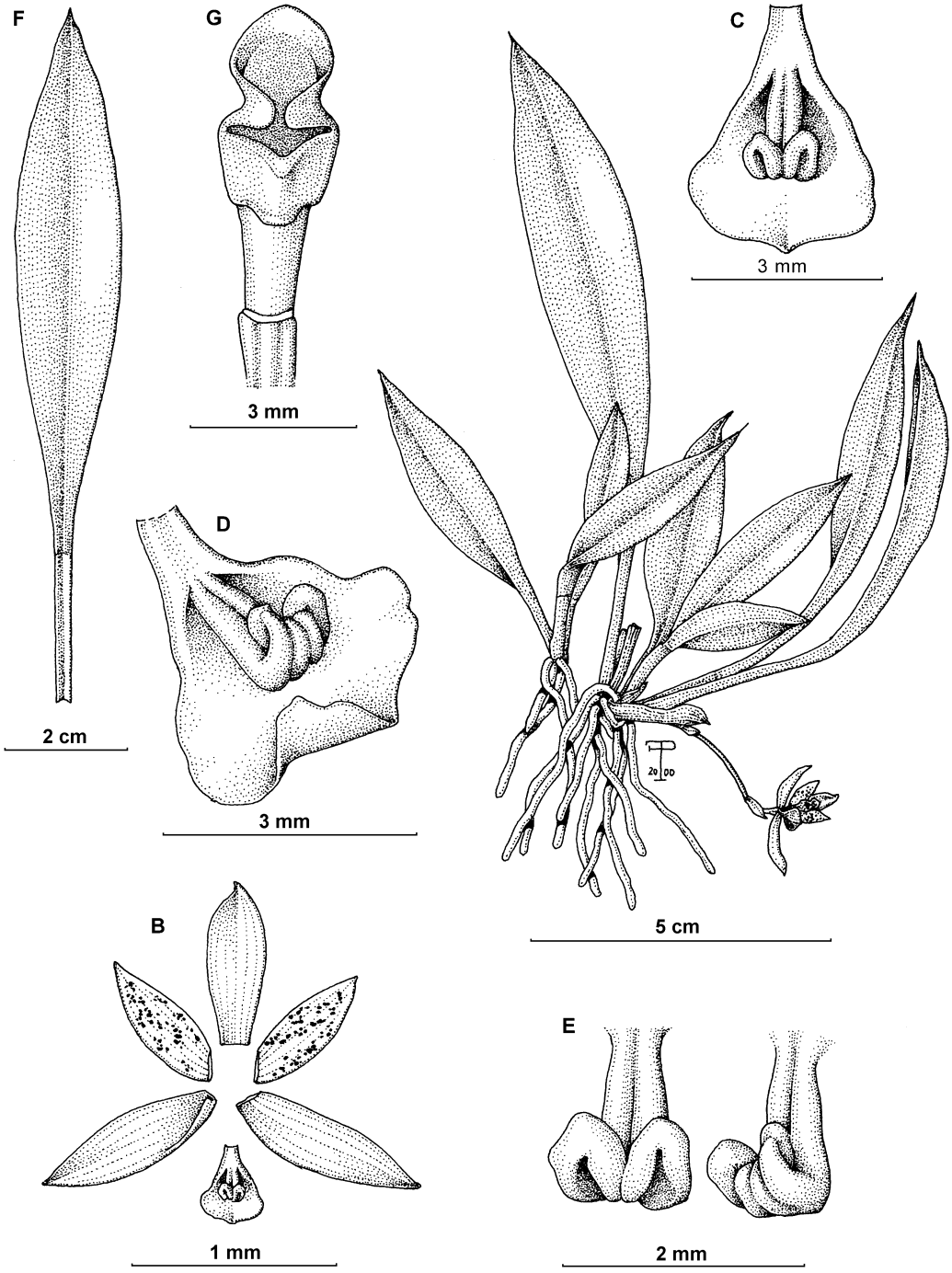


Fig. 8: *Kefersteinia endresii* PUPULIN. A: habit; B: dissected flower; C: lip, adaxial view; D: lip, three quarter view; E: callus, frontal and lateral views; F: leaf; G: column, ventral view. Illustration voucher: Costa Rica. Without definite locality, Endres s.n. (W-R). Drawn from the holotype.

Plant epiphytic, erect, cespitose, to about 12 cm tall, each shoot provided with 3 leaves. Roots flexuous, glabrous. Leaves oblanceolate to narrowly elliptic, acute to acuminate, 5.4-12 cm long, 0.9-1.8 cm wide, the margins of the lamina narrowing toward the base into a distinct conduplicate petiole to 2.5 cm long. Inflorescence a slender, pendent, solitary flower; peduncle terete, to about 3 cm long, with membranaceous, ovate bracts. Ovary clavate, to 7 mm long including the pedicel. Flowers small, the tepals spreading out, the membranous sepals apparently pale greenish white, translucent, the petals sparsely spotted with purple, the lip apparently dark, may be purple, the callus darker. Dorsal sepal elliptic to elliptic-oblong, obtuse, dorsally carinate toward the apex, 8 mm long, 3 mm wide. Lateral sepals narrowly elliptic to lanceolate-elliptic, slightly subfalcate, acute, concave, conduplicate toward the base, 10 mm long, 3 mm wide. Petals obliquely elliptic, acute, 7.5 mm long, 2.5 mm wide. Lip very small, from a short cuneate claw, obpyriform-spathulate, obscurely 3-lobed, obtuse, apiculate, 4 mm long, 3 mm wide; callus extending from the base to about the half of the lamina, two inflate pulverulent keels distally abruptly reflexed, abaxially concave toward the apex to form a 4-lobed tip, 1.5 mm long, 1.2 mm wide. Column elongate, with a short foot, 6 mm long, 2.5 mm wide at the middle, from a narrow base, the ventral surface forming a trapezoidal plate below stigma, the corners basally protruding in two rounded teeth, provided with a distinct median keel on the plate projecting from the stigma to the rear into a high, rounded tooth. Anther cap cucullate, subquadrate, compressed, retuse at apex, 2-celled. Pollinia 4, obpyriform, on a subquadrate stipe.

Derivation of name: named in honor of A.R. Endres, who originally collected this species and illustrated hundreds of Costa Rican orchids in great detail.

Distribution: only known from Costa Rica.

Costa Rica. Without specific locality.

Habitat and ecology: Not known.

Discussion: For the shape and the color of sepals and petals, *K. endresii* seems to be referable to the *K. costaricensis* complex, characterized by the membranous and translucent sepals and the petals variously spotted with purple, whereas the small size of its lip is reminiscent of *K. parvilabris* SCHLTR. However, the callus on the lip of *K. endresii* is totally different from the stalked callus of the species close to *K. costaricensis* as well as from the rounded cushion of *K. parvilabris*, and it has apparently no close relatives within the genus. The species is known only by a single collection done in Costa Rica by ENDRES in the nineteenth century, without definite locality, and it has not been collected subsequently. Unfortunately, neither description nor illustration were provided by ENDRES of the living plant.

8. ***Kefersteinia microcharis*** **SCHLTR.**, Repert. Sp. Nov. Beih. 19: 300 (1923); fig. 9.

≡ *Chondrorhyncha microcharis* (SCHLTR.) L.O.WILLIAMS, Ceiba 5: 194 (1956).
Type: Costa Rica. Umgebung von San Ramon, im Jahre 1921, G. Acosta s.n. (holotype, B, destroyed; lectotype, selected here, AMES 40556!, drawings from the holotype).

Plant to 13 cm tall, each shoot provided with 3-5 leaves and 1-2 acute, triangular bracts at the base. Roots flexuous, glabrous. Leaves articulate with the conduplicate basal sheaths provided with scarious margins, ligulate to oblanceolate, abruptly acute, 5-13

cm long, 1.5-2.1 cm wide, the margins of the lamina narrowing toward the base into a conduplicate petiole to about 1 cm long. Inflorescences 1-2, each a slender, patent to pendulous, solitary flower; peduncle terete, to 3.2 cm long, with membranaceous, ovate, apiculate bracts. Ovary clavate, to 15 mm long including the pedicel, subtended by 2 cucullate, ovate, acute bracts to 5 mm long. Flowers spreading, the sepals and petals white, the lip white, sparsely spotted with purple at the base, the callus white, spotted purple. Dorsal sepal elliptic to widely lanceolate, obtuse, concave, 13 mm long, 6 mm wide. Lateral sepals lanceolate to elliptic, obtuse, concave, 13 mm long, 7 mm wide. Petals obliquely widely elliptic, subacute to obtuse, slightly concave towards the apex, 13 mm long, 7.2 mm wide. Lip with a very short cuneate claw, widely ovate when spread, emarginate, shortly apiculate, the distal margins strongly crenulate, 14 mm long, 15.8 mm wide, the distal portion reflexed; callus at the base of the lamina, bilobed, obovate, broadened at apex, the basal margins somewhat elevated, about 4 mm long, 3.3 mm wide. Column elongate, semiterete, oblong from a narrow base, with a short foot, 9 mm long, 3.5 mm wide at the middle, the ventral surface provided with a distinct, rounded, median longitudinal keel extending from the stigma to the apex of the column foot. Anther cap cucullate, subrhombic, 2-celled. Pollinia 4, obovoid, on a linear stipe rounded at the base.

Derivation of name: From the Greek words *micro*, "small", and charis, "grace", in allusion to the grace of the small flower of this species.

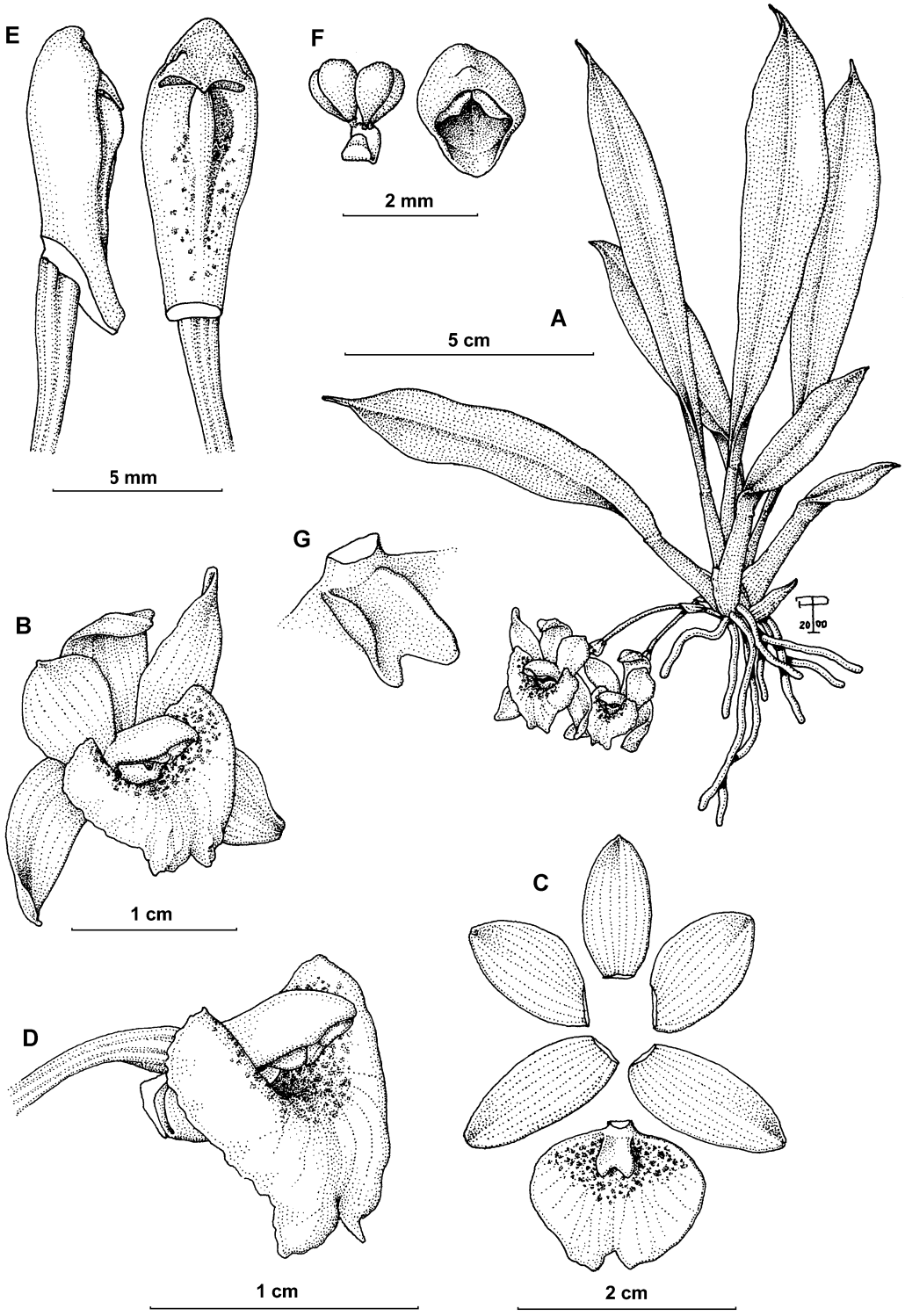
Distribution: Only known from Costa Rica.

Costa Rica. Heredia: Sarapiquí, Cariblanco, 700-800 m, 8 May 1992, F. Pupulin 252 (USJ! and USJ FAA collection!); below la Laguna de la Hondura towards Veintisiete, 750 m, J.A. Fowlie F62CR31 (LA); shore of la Laguna del Cerro Congo, NW of Cariblanco, 750 m, J.A. Fowlie F62CR32 (photo, LA!). Without locality (drawing, USJ!).

Habitat and ecology: Epiphytic in premontane and lower montane wet forests on the Atlantic drainage of Cordillera de Tilarán and Cordillera Central, usually in shady conditions. Flowering from April to June.

Discussion: FOWLIE (1966b) accepted *K. microcharis* as a species distinct from his concept of *K. lactea* (including *K. alba*), on the basis of the callus appressed to the base of lip *versus* on a short stalk, short triangular wings on the column absent versus present, and the heavier substance and the slightly larger flowers of *K. microcharis*. According to the protologue (SCHLECHTER 1923), *K. microcharis* presents a subreniform, widely ovate lip and a rhombic callus; the semiterete column has no lateral wings and shows a short abaxial keel. In the brief note accompanying the original description, Schlechter also pointed out that the new species presents much more crenulate margins of the lip that any other Central American *Kefersteinia* species. SCHLECHTER's drawing of the holotype at AMES clearly illustrates the subreniform lip, the callus wider in the distal portion and the oblong column without wings that distinguish *K. microcharis* from the closely allied species of the *K. lactea* complex, and it is therefore designated here as the type.

Fig. 9: *Kefersteinia microcharis* SCHLTR. A: habit; B: flower; C: dissected perianth; D: column and lip, three quarter view; E: column, lateral and ventral view; F: pollinarium and anther cap; G: callus. Illustration voucher: Costa Rica. Heredia: Sarapiquí, Cariblanco, 700-800 m, 8 May 1992, F. Pupulin 252 (USJ! and USJ, FAA Collection!).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9. ***Kefersteinia lactea*** **(RCHB.f.) SCHLTR.**, Repert. Spec. Nov. Regni Veg. Beih. 19: 228 (1923); fig. 10.

≡ *Zygopetalum lacteum* RCHB.f., Gard. Chron. 1290 (1872).
≡ *Chondrorhyncha lactea* (RCHB.f.) L.O.WILLIAMS., Caldasia 5: 16 (1942).
Type: Costa Rica [?]. Chiriquí, cultivated by Linden (lectotype, selected here, W-R 49620!, a flower into a pocket and the drawing at top left of the type sheet).

Plant to 12 cm tall, each shoot provided with 3-4 leaves and 1-2 acute, triangular bracts at the base. Roots flexuous, glabrous. Leaves articulate with the conduplicate basal sheaths, narrowly elliptic, abruptly acute, 4-11 cm long, 1.2-1.5 cm wide, the margins of the lamina narrowing toward the base into a conduplicate petiole to 2 cm long. Inflorescences 1-2, each a slender, patent to pendulous, solitary flower; peduncle terete, to 2.3 cm long, with membranaceous, ovate, acute bracts. Ovary subclavate, to 12 mm long including the pedicel, subtended by 2 cucullate, ovate, acute bracts to 3.5 mm long. Flowers spreading, the sepals and petals white, the lip white sparsely spotted with purple at the base, the callus white, spotted purple. Dorsal sepal linear-elliptic to elliptic, obtuse, apiculate, 10 mm long, 4.5 mm wide. Lateral sepals lanceolate to elliptic, subacute, concave toward the apex, 12 mm long, 4 mm wide. Petals obliquely widely elliptic to oblanceolate, subacute, apiculate, slightly concave towards the apex, 11 mm long, 5 mm wide. Lip widely ovate from a cuneate base, emarginate, the distal margins crenulate, 12 mm long, 12 mm wide, the distal portion reflexed; callus at the base of the lamina, bilobed, ovate, broadened at the base, the basal margins elevated, 3.5 mm long, 2.5 mm wide. Column elongate, semiterete from a narrow base, with a short foot, 9 mm long, 4.2 mm wide at the middle, with a pair of narrow, triangular wings just above the middle, the ventral surface provided with a distinct, semicircular, median longitudinal keel extending from the stigma to about the middle of column. Anther cap cucullate, ovoid, 2-celled. Pollinia 4, narrowly obpyriform, on a obtriangular stipe attenuate at the base.

Derivation of name: from the Latin lacteus, "milky," in allusion to the milk white color of the flower.

Distribution: Costa Rica and Panama.

Costa Rica. Alajuela: San Ramón, camino a los Potrerillos, July-August, Endres 98 (W-R 14705!); San Pedro de San Ramón, bois humides, 1150 m, July 1921, A.M. Brenes 85 (B, destroyed; AMES); San Carlos, Río Cuarto, orilla de laguna Río Cuarto, 1 Oct. 1978, R.A. Ocampo S. 2089 (CR!). Cartago: Taus, Agosto 1989, D.E. Mora-Retana s.n. (USJ!); Reventazón, C.H. Lankester (AMES, photo!). Heredia: Río del Angel Gulch, above Cariblanco, 800 m, Horich H62CR44.5 (LA). Guanacaste: La Tejona, north of Tilarán, Standley & Valerio 46009 (AMES). Puntarenas: Zona Sur, Dec. 1989, F. Pupulin s.n. (USJ!). San José: Pérez Zeledón, Las Nubes de Quizarrá, 1100 m, in deep shade in secondary forest along a stream, April 1989, F. Pupulin 9 (USJ!). Tarrazú. Trocha entre Cerro Nara y Llanos de Santa María, 09°32'35"N 84°00'50"W, 700-800 m, 20 Ago. 1997, O. Valverde & A. Estrada 172 (CR!); San Jose, Horich 59.733-1 (MO). Without specific locality, Endres 334 (W-R 49620); Endres s.n. [1868] (W-R 44599!); Endres s.n. (W-R 33240!).

Habitat and ecology: A widespread but not common epiphyte of the premontane and lower montane rain forests from both Atlantic and Pacific drainage in central and southern Costa Rica, at 700-1200 m elevation, usually in shaded and wet spots. Flowering February to August.

Discussion: The interpretation of REICHENBACH's concept of *Zygopetalum lacteum* is somewhat difficult. The protologue is apparently based on four collections REICHENBACH received at different times, namely a collection from Chiriquí by WALLIS, a Costa Rican

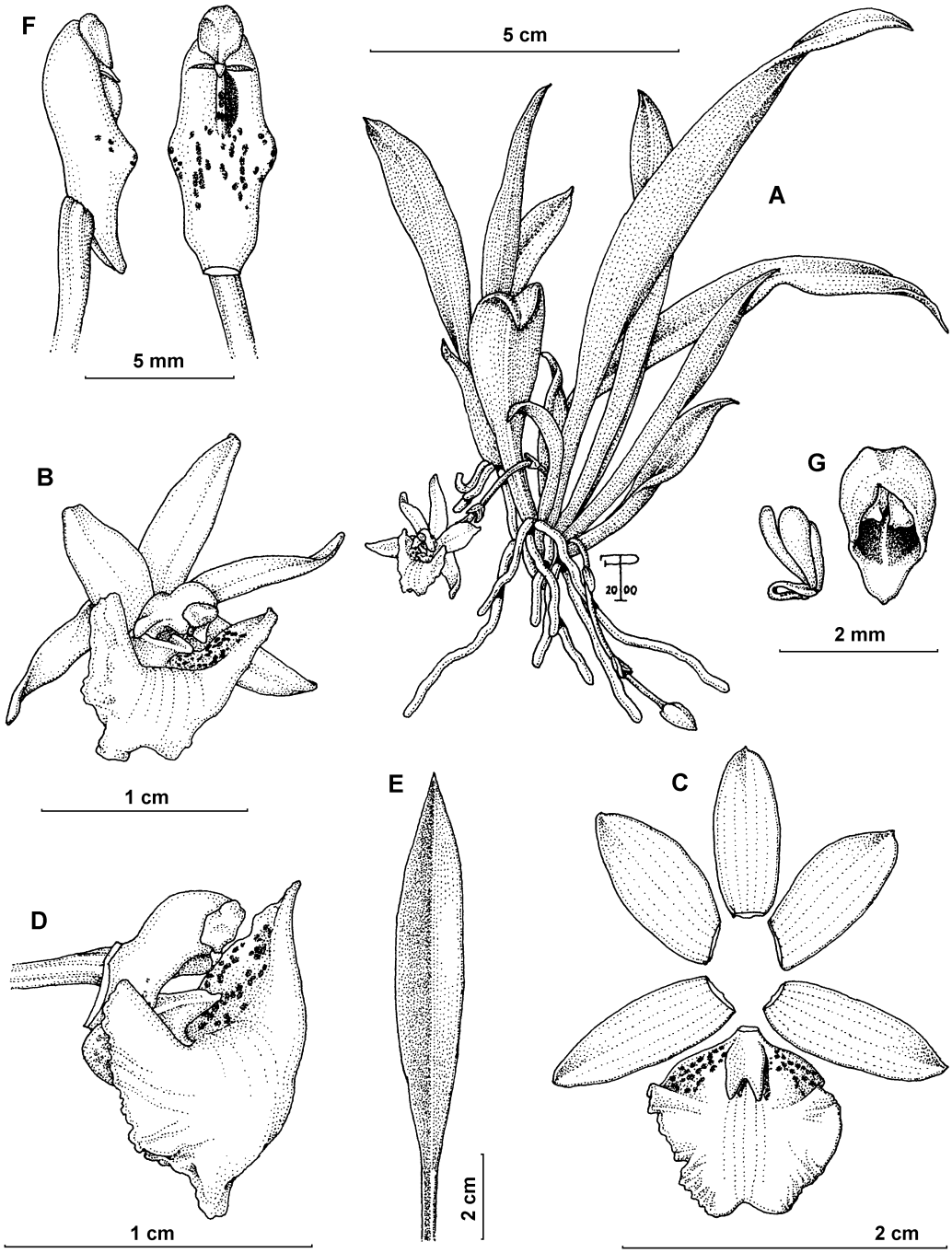


Fig. 10: *Kefersteinia lactea* (RCHB.f.) SCHLTR. A: habit; B: flower; C: dissected perianth; D: column and lip, three quarter view; E: leaf; F: column, lateral and ventral view; G: pollinarium and anther cap. Illustration voucher: Costa Rica. Cartago: Turrialba, Taus, 1989, flowered in cultivation at Jardín Botánico Lankester, 27 June 2000, F. Pupulin 2431 (USJ).

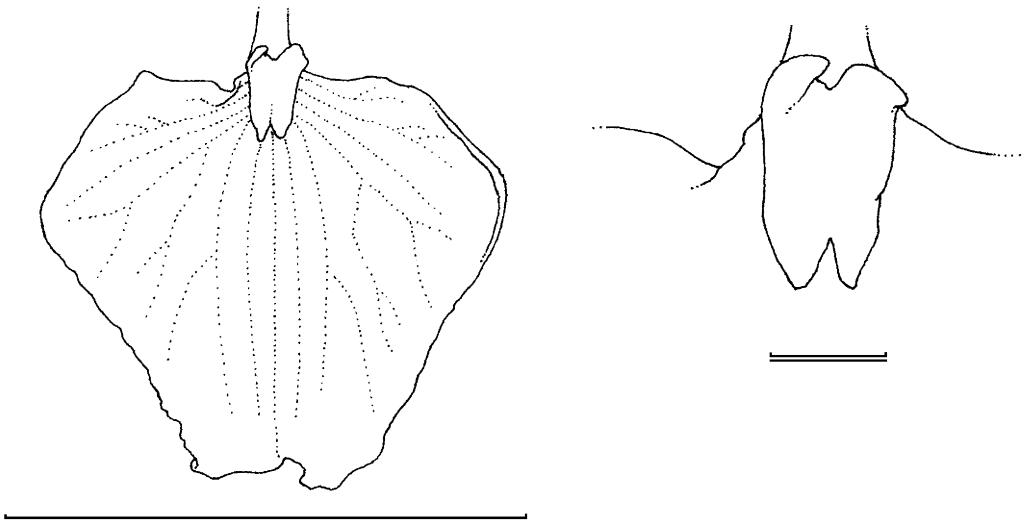


Fig. 11: *Kefersteinia lactea*. Lip and callus from the flower of the lectotype of *Zygopetalum lacteum* RCHB.f. Illustration voucher: Chiriquí, without collector (W-R). Bar = 1 cm. Double bar = 1 mm. Drawn from the type.

collection by ENDRES, a specimen cultivated by LINDEN from Chiriquí and another cultivated specimen, without definite locality, flowered by Veitch (Reichenbach, 1872). Seemingly, REICHENBACH planned to publish the new species after correspondence with A.R. ENDRES, who sent him his different sketches and tentative descriptions based on Costa Rican collections done around 1868 (W-R 44590!, 14705!, 33240!) with the proposed name of "*Zygopetalum lacteum* ENDR. & RCHB.f". Although the manuscript protologue by REICHENBACH expressly indicates the co-authorship of the new species with ENDRES, the name of the collector was eventually deleted before publication. The type material of *Zygopetalum lacteum* kept in Vienna well reflects the wide concept REICHENBACH had of this species. The type sheet (W-R 49620!) consists of three sketches of different flowers and a single flower in a packet. The drawing accompanying the original description shows an elliptic column, whereas both the drawings from Endres 334 and from a specimen collected in Chiriquí (supposedly drawn from a plant flowered by LINDEN, as indicated by a leaflet at the bottom right of the type sheet in REICHENBACH's handwriting) on the same sheet present triangular wings above the middle of the column that seem to met better the protologue ("columna medio dilatata, nunc angulata"). The outline of the lip is suborbicular in the drawing accompanying the manuscript protologue, it is obovate-subtrilobate in Endres 334, and widely ovate in the Chiriquí specimen. Also the shape of the lip callus, that has been considered critical to distinguish species in the so-called *K. lactea* complex, is rather variable in the material associated with the type. Two of the specimens apparently present a callus wider in the frontal portion, a character used by DRESSLER (1993) to separate *K. lactea* from its relatives, but in the only flower conserved with the type material the callus is lyre-shaped and it presents at the base the two triangular lobes that probably correspond to the "laciniae" cited in the original protologue (fig. 11). The same is true for two other specimens

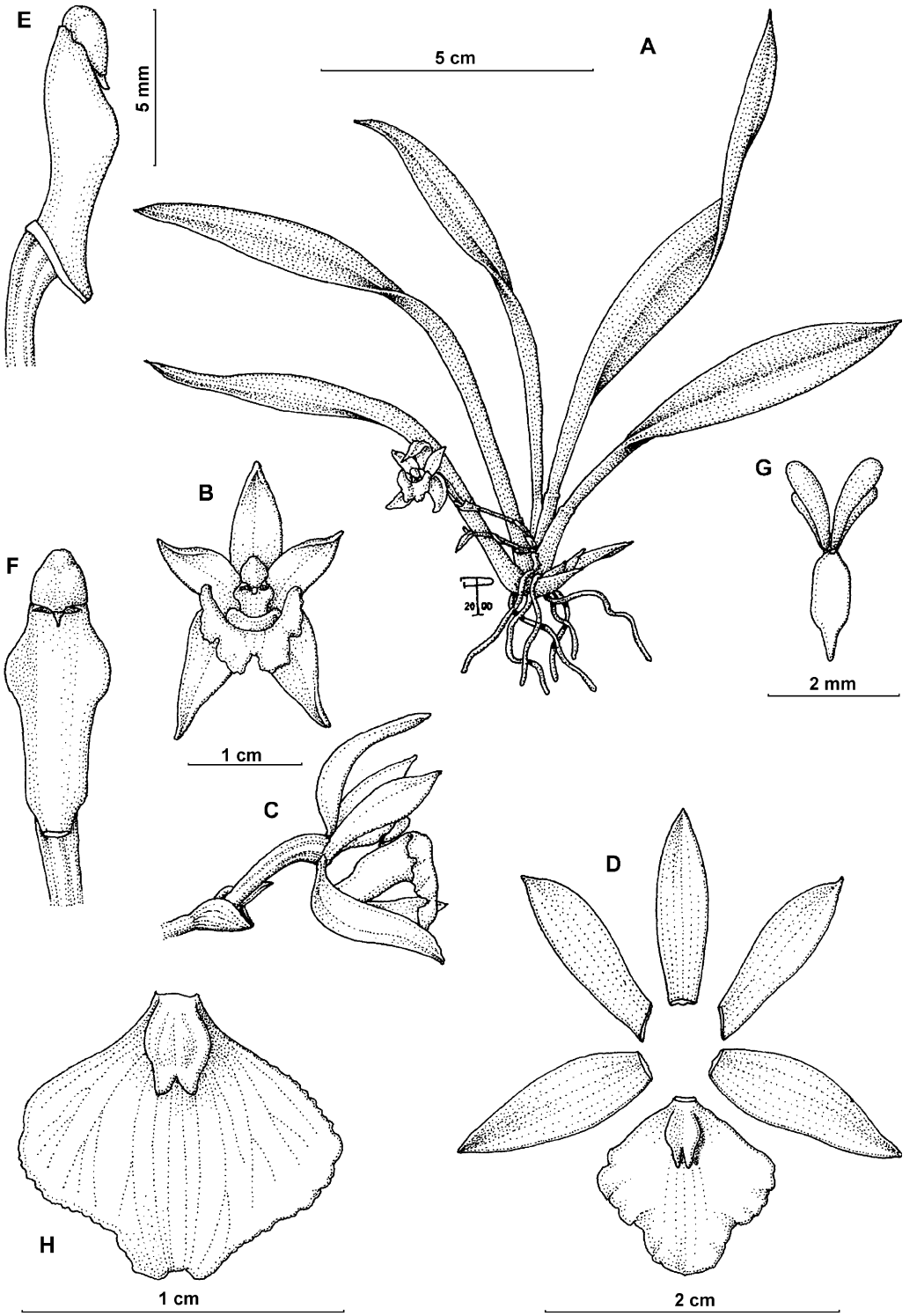
at W collected by ENDRES in Costa Rica (W-R 14705! and W-R 44599!), both of which were determined by REICHENBACH as *Zygopetalum lacteum*. Although ATWOOD (1989) noted that a drawing of a flower from a paratype of *K. lactea* (Endres 334) kept at the herbarium of OAKES AMES (AMES 21763, photo!) does not show the wings of the column, the tracings made by SCHLECHTER under the label Endres 334 mixed up the sketches of two different specimens studied by REICHENBACH. Actually, Endres 334 clearly shows both the small wings at the middle of the column and the abaxial keel.

The resolution of the true identity of *Zygopetalum lacteum* is particularly critical because this is the oldest name published in the *Kefersteinia lactea* complex, and firm application of names to the other Mesoamerican taxa of this group closely depends on typification of REICHENBACH's concept. No one of the flower and sketches of the paratypes of *Z. lacteum* at W totally agrees with the protologue for one or more characters, and paradoxically the sketch REICHENBACH traced on the same leaflet of the manuscript description is the least close to the protologue, presenting no wings on the column nor triangular lobes at the base of the lip. Accepting this drawing as the type of *Z. lacteum* would have as consequences the reduction of *Kefersteinia microcharis* SCHLTR. in synonymy under *K. lactea* and the necessity to publish a new name for the material commonly collected and cultivated in Costa Rica and Panama under the name *K. lactea*. For this reason I propose to typify *Zygopetalum lacteum* RCHB.f. choosing as the lectotype for this species the only preserved flower on the type sheet and REICHENBACH's sketch at top left of the same sheet, likely representing the same flower: Chiriquí, without collector, flowered in cultivation by LINDEN. The lectotype substantially agrees with the protologue, with the exception of the lip outline, and closely matches other Costa Rican collections determined by REICHENBACH himself as *Z. lacteum*.

10. ***Kefersteinia alba*** **SCHLTR.**, Repert. Spec. Nov. Beih. 19: 228 (1923); (fig. 12).

Type: Costa Rica. Alajuela: San Pedro de San Ramón, 1075 m, July 1922, A.M. Brenes 284 (holotype, B, destroyed; lectotype, selected here, AMES 31624!, drawings from the holotype).

Plant to 12 cm tall, each shoot provided with 5-6 leaves. Roots flexuous, glabrous. Leaves narrowly elliptic to linear, acute, 6-15 cm long, 0.7-1.5 cm wide, the margins of the lamina narrowing toward the base into a conduplicate petiole about 1.5 cm long. Inflorescences 1-2, each a slender, patent to erect, solitary flower; peduncle terete, to 2.5 cm long, with membranaceous, triangular-ovate bracts. Ovary clavate, to 15 mm long including the pedicel, subtended by 2 cucullate bracts to 4 mm long. Flowers rather small, spreading, the sepals and petals white, the lip white sparsely spotted with purple at the base, the callus white. Dorsal sepal oblong to elliptic-oblong, subacute, apiculate, concave, 12-14 mm long, 4-5 mm wide. Lateral sepals obliquely ovate-lanceolate, acute to apiculate, concave, 13-15 mm long, 5-7 mm wide. Petals obliquely elliptic-oblong, acute to obtuse, somewhat apiculate, 12 mm long, 4 mm wide. Lip with a short cuneate claw, 3-lobed, widely rhombic to suborbicular when spread, obtuse to shortly emarginate, the distal margins crenulate, 12 mm long, 12 mm wide, the distal portion reflexed; callus at the base of the lamina, bilobed, lyre-shaped, broadened at the base, the basal margins elevated, about 5 mm long, 3 mm wide. Column elongate, semiterete from a narrow base, with a short foot, 10 mm long, 3.5 mm wide at the middle, with a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pair of narrow, triangular wings just above the middle. Anther cap cucullate, ovate, 2-celled. Pollinia 4, narrowly obpyriform, on a linear stipe attenuate at the base.

Derivation of name: from the Latin albus, "dull white", in reference to the color of the flower.

Distribution: Only known from Costa Rica.

Costa Rica. Without definite locality: a plant cultivated in the living collection of Marie Selby Botanical Gardens (SEL 114-76-19, voucher not preserved, drawing!).

Habitat and ecology: Epiphytic in premontane and lower montane rain forests, in semi-shade, at about 300-1000 m elevation. Flowering at least in July.

Discussion: Although FOWLIE (1966b) treated *K. alba* as a synonym of *K. lactea*, SCHLECHTER's drawings from the holotype at AMES clearly show the ligulate to narrowly elliptic leaves, the winged column without ventral keel, the rhombic, three-lobed lip and the lyre-shaped callus that are good diagnostic characters to distinguish *K. alba* from its close relatives. The species seems to be exceedingly rare, and the only other Costa Rican collection referable to this taxon is a plant collected in 1976 and flowered at Selby Gardens, on which the illustration intended for the *Icones Plantarum Tropicarum* was prepared (ATWOOD 1989). Unfortunately, no material was preserved at the time and the illustrated plant died in cultivation (DRESSLER, pers.comm.). Although in his description ATWOOD (1989) mentions the presence of a ventral keel on the upper half of the column, the published drawing of the ventral view of the column shows no trace of any keel. In his typification of SCHLECHTER's Costa Rican Orchidaceae based on collections by A.M. BRENES, BARRINGER (1986) did not selected any type for *K. alba*. However, the analytical drawings of the plant and flower at AMES are detailed enough to adequately distinguish the species, so they are designated here as the type.

Excluded species

Kefersteinia subquadrata SCHLTR., Repert. Sp. Nov. Beih. 19: 300 (1923).
= ***Chaubardiella subquadrata* (SCHLTR.) GARAY**, Orquideología 4: 149 (1969). *Stenia chasmatochila* FOWLIE, Orch. Dig.. 29: 347 (1965). *Chaubardiella chasmatochila* (FOWLIE) GARAY, Orquideología 4: 148 (1969).

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Fig. 12: *Kefersteinia alba* SCHLTR. A: habit; B: flower, frontal view; C: flower, lateral view; D: dissected perianth; E: column, lateral view; F: column, ventral view; G: pollinarium; H: lip. Illustration vouchers: A-G: Costa Rica. Without definite locality, collected in 1976, flowered in cultivation at Marie Selby Botanical Gardens (redrawn from ATWOOD 1989). H: Costa Rica. Alajuela: San Pedro de San Ramón, July 1922, A.M. Brenes 284 (redrawn from the lectotype at AMES).

friend Dario Castelfranco of Gaia Botanical Garden. M. Laura Spadari accompanied me in many of the field trips to the most remote areas of the country. The staff of Jardín Botánico Lankester, Universidad de Costa Rica, supported my work maintaining in cultivation and flowering most of the specimens collected and studied over the years; I am particularly indebted with Mario Blanco and Carlos O. Morales for their useful comments and with Günter Gerlach for his critical suggestions to the manuscript. Acknowledgements are extended to the curators and personnel of the following herbaria: AMES, CR, FLAS, M, MO, SEL, USJ, and W. I especially thank Gustavo Romero, John T. Atwood and Ernst Vitek for their help in providing me critical materials and their assistance during my visits to their institutions.

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