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THE GENUS CLADOCOLEA (LORANTHACEAE)

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THE NEOTROPICAL GENUS *Struthanthus* (Loranthaceae) has never, in its existence of nearly a century and a half, been monographed or even surveyed in its entirety. Except for a few regional treatments of the genus, none of which extend north of Costa Rica, there has been little more than rather casual listing of species and the sporadic addition of what adds up to a great number of new names. Van Tieghem's work at the turn of the century added many new generic names to Loranthaceae in the Americas and elsewhere, and some of these genera are within what is now generally called *Struthanthus*. Little note has been taken of Van Tieghem's profusion of new genera except in rather isolated instances.

A scrutiny of materials in most of the major herbaria of Europe and North America has shown that the insights of Van Tieghem and his nomenclatural creations can by no means continue to be ignored. This fact is well illustrated by the present study. I have discovered that there exists, mostly in central and southern Mexico, a group of related mistletoes which are so unusual, especially in their inflorescence morphology, that generic status is fully deserved. The resultant genus, through the consistent use of accepted nomenclatural procedure, receives the name *Cladocolea* Van Tieghem. Although Van Tieghem correctly perceived some of the unusual structural features of this genus, I hasten to point out that my conception of the outlines of *Cladocolea* has little in common with Van Tieghem's. Be that as it may, the present work embodies a monographic treatment of *Cladocolea*.

In the original description of *Cladocolea* (Van Tieghem, 1895a) some unusual features were listed. The flowers, unlike those of *Struthanthus* and most others, are single and develop in axillary positions. The spikes are axillary and often appear to break through the cortex of the main stem, leaving an irregular craterlike rim. Van Tieghem erroneously described the flowers as hermaphroditic. While this condition exists in some other species, the species referred to by Van Tieghem are dioecious, although the flowers have rather large aborted organs of the opposite sex. Van Tieghem also failed to observe that the inflorescence of at least his type species, *C. andrieuxii*, was a determinate inflorescence, i.e., it ter-

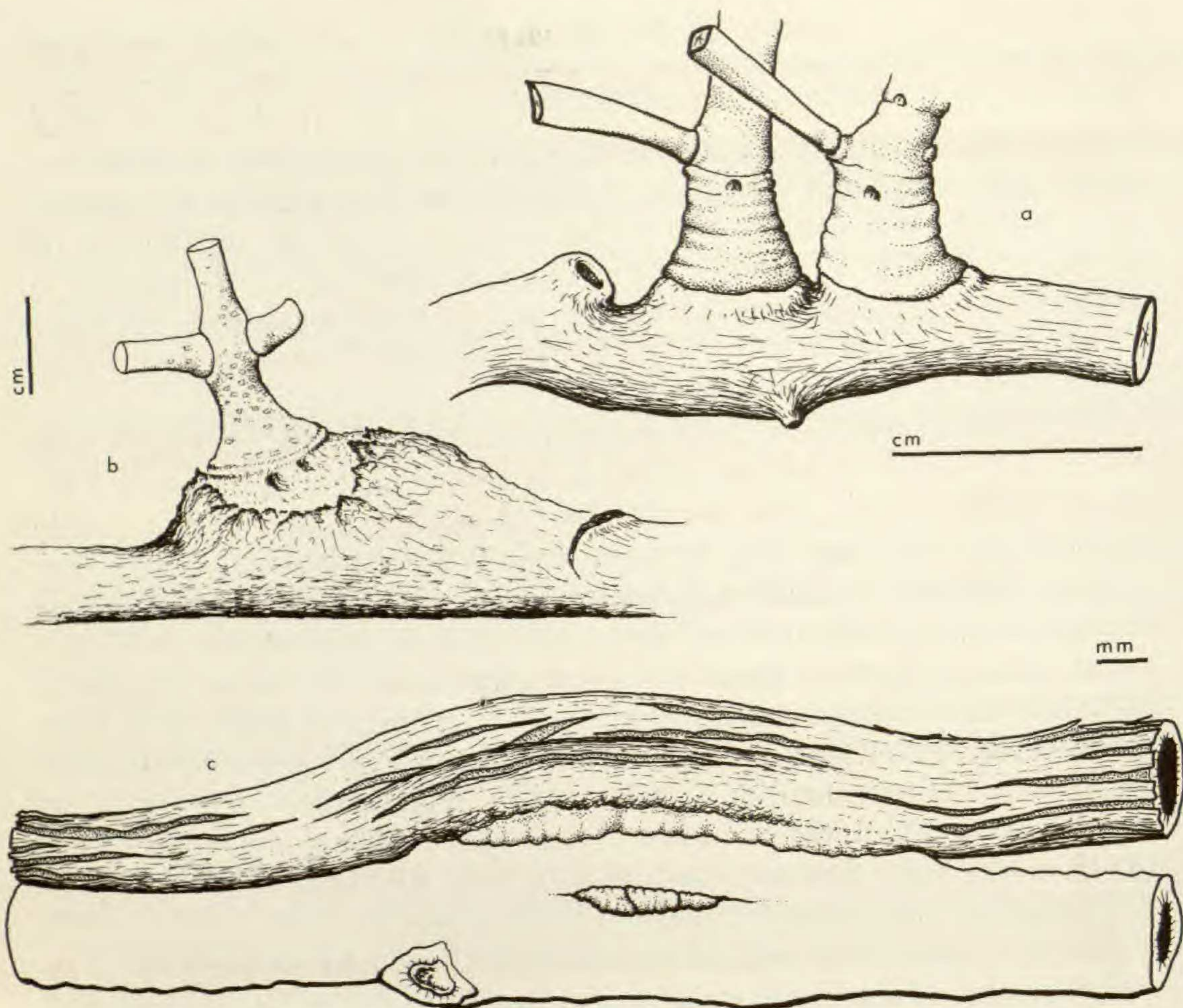


FIGURE 1. Some haustorial connections of *Cladocolea*: a, primary haustoria of two plants of *C. inconspicua* (*Hinds* 346, κ); b, primary haustorium of *C. loniceroides* (*Converse* 83, UBC); c, secondary haustorium of *C. pringlei* (*Pringle* 4697, P).

minated in a single flower. He did observe this condition in a second species, which, however, he assigned to *Loxania* Van Tieghem (Van Tieghem, 1895b). As will be seen below, nearly every species in the present treatment is characterized by determinate inflorescences. The existence of determinate inflorescences in Loranthaceae is an important fact which was not even known to Eichler (1878).

As no member of *Cladocolea* has been studied in the field, we know nothing of its germination. From mature fruits of several species it appears that the seedling is always dicotyledonous and green, surrounded by a whitish endosperm and some viscous tissue. The haustorial (radicular) pole of the embryo seems little differentiated in comparison to embryos of *Struthanthus*, *Phthirusa*, and *Oryctanthus*. A rather exceptional embryo is present in *C. inconspicua* (see FIGURE 19c).

In most mistletoe collections only a few twigs are gathered, and the base of the plant is left behind. This is rather unfortunate, as the presence or absence of basal epicortical roots is an important character. In only five species has the base of the plant been seen (*Cladocolea gracilis*,

C. inconspicua, *C. inorna*, *C. loniceroides*, and *C. oligantha*), and in all but the first species epicortical roots were lacking, the primary haustorium being a simple, graftlike union (FIGURE 1a & b). It should be noted, however, that none of these four species have such roots from the branches, while both basal and cauline epicortical roots characterize *C. gracilis*. Stem roots with secondary haustoria have been observed in a number of species (*C. archeri*, *C. gracilis*, *G. grahami*, *C. harlingii*, *C. mcvaughii*, *C. pringlei*, and *C. tehuacanensis*; FIGURE 1c). It is quite possible that many if not all of the latter group also develop epicortical roots from the base of the plant, as does *C. gracilis*.

Cladocolea stems show little variation in shape. In one species (*C. inconspicua*) there is a tendency toward flattened stems, but in others stems are normally terete. The leaves may be strictly paired or completely alternate, or they may vary between these two situations.

Many species of *Cladocolea* share an unusual feature in that lateral branches, either vegetative or flowering, seem to be endogenous. They break through cortical tissues of the mother stem, leaving an irregular craterlike rim of dead cortical tissue around the base of the lateral branch. This feature was observed by Van Tieghem both in the type species of *Cladocolea*, *C. andrieuxii*, and in the plants he called *Loxania* (Van Tieghem, 1895a & b). Earlier a similar observation had been made by Eichler (1878, p. 551) for *Psittacanthus*, in which the condition is not nearly as obvious as in *Cladocolea*.

The situation is illustrated in FIGURE 2 for *Cladocolea microphylla*. The leaf base of a young, leafy shoot is surrounded by a cushion consisting of papillar hairs. These hairs seem to grow together or coalesce in the axillary area, forming a hard cushion. When the axillary shoot develops, this cushion cracks open and the first leaves emerge. The more mature stem, then, is invested by a black or brownish calluslike growth. This condition and the associated branching pattern are strikingly similar to those in the quite unrelated genus *Myzodendron* of the Myzodendraceae (Kuijt, 1969, figs. 3-25). It may be mentioned that this situation in some *Cladocolea* species is not only difficult to recognize but indeed often very deceptive as well. In *C. glauca*, for example, the leaves visible along older branches are not primary leaves but rather secondary ones attached to the base of short lateral inflorescences.

There are two general branching habits in the genus, the sympodial and the percurrent, which may give a strikingly different appearance to otherwise closely related species, such as *Cladocolea microphylla* and *C. loniceroides*.

The distribution of inflorescences provides further systematic distinctions. In the percurrent species, such as *Cladocolea loniceroides*, there is a gradual, sequential appearance of inflorescences. In many others, however, inflorescences are limited to year-old growth, which at that time has dropped its leaves. This condition is well illustrated in *C. microphylla* (FIGURE 25a & b). In two remarkable cases (*C. dimorpha* and *C. oligantha*) current growth produces one type of inflorescence and year-old

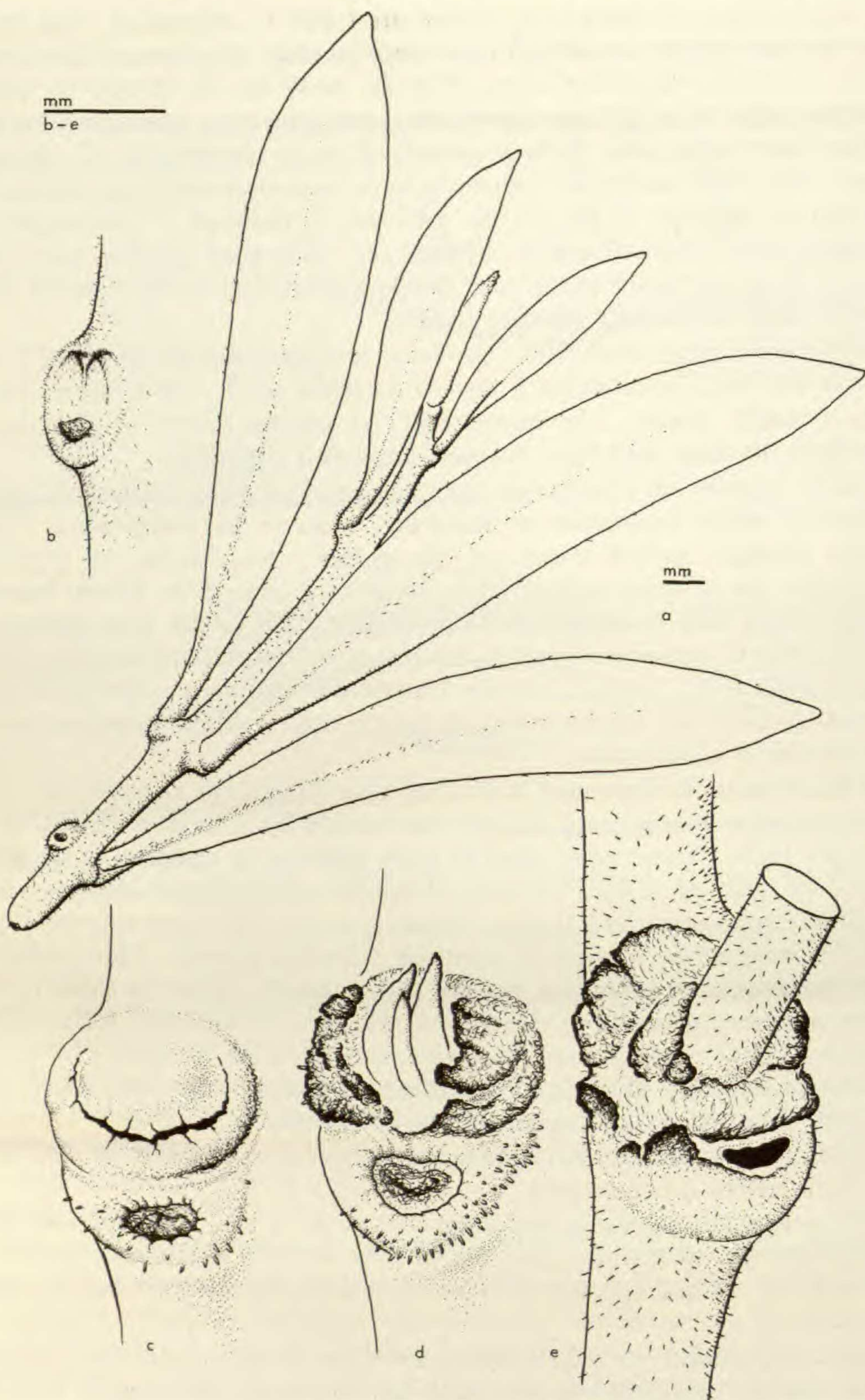


FIGURE 2. Emergence of lateral shoots in *Cladocolea microphylla* (Troll 593, M): a, expanding innovation; b, young axillary cushion above leaf scar; c, mature axillary cushion rupturing, leaf scar below; d, young leaves of the axillary shoot or inflorescence emerging from the axillary cushion, which has cracked wide open; e, a blackish-brown craterlike formation has developed around the base of the lateral shoot.

growth a quite different type. These are the only instances known to me of inflorescence dimorphism in the Loranthaceae. It is important to note that this dimorphism is not related to sex distribution.

The flower of *Cladocolea* may have four, five, or six petals, each of which bears a stamen or its aborted remnant fused with the abaxial surface. As in other Loranthaceae, a small calyculus crowns the ovary. In a number of species the stamens are all inserted at the same height. Monomorphic stamens are also known from the unrelated American genera *Desmaria* and *Tristerix* (Barlow & Wiens, 1973), but in most there is a clear dimorphism. Most species are dioecious, but several have hermaphroditic flowers. A high degree of correlation exists between tetramerous flowers, hermaphroditic flowers, straight styles, and monomorphic stamens (TABLE 1). This correlation is so strong that it is perhaps not too adventurous to speak of a constellation of primitive characters, the

TABLE 1. Correlation of tetramery with hermaphroditic flowers, straight styles, and monomorphic stamens.*

	PETAL NUMBER	FLOWERS ♂/♀ OR ♂	STYLE STRAIGHT	STAMENS MONOMORPHIC
<i>C. archeri</i>	4(5)	♂	+	-
<i>C. clandestina</i>	4	♂	+	+
<i>C. coyucaae</i>	4	?	-	+
<i>C. dimorpha</i>	4	?	-	+
<i>C. harlingii</i>	4	♂	+	+
<i>C. inconspicua</i>	4	♂	+	+
<i>C. inorna</i>	4	♂	+	+
<i>C. oligantha</i>	4	♂/♀	+	+
<i>C. roraimensis</i>	4	?	?	-

* All *Cladocolea* species having tetramerous flowers, hermaphroditic flowers, or monomorphic stamens are included in this list.

more so since the dioecism and stamen dimorphism of all other known *Cladocolea* species must surely be regarded as derivative conditions. It is particularly interesting that all four South American species are present among this possibly primitive group of species (*C. archeri*, *C. clandestina*, *C. harlingii*, and *C. roraimensis*).

The contorted or sometimes geniculate style of many Mexican species is a very peculiar feature which does not appear to occur elsewhere in Loranthaceae except in *Struthanthus* (see below). In some species the style is merely somewhat undulating in its middle or upper portion. The style of the staminate flower tends to be much straighter than that of the pistillate flower. The extreme is illustrated in the pistillate flower of *Cladocolea pedicellata*, where a great many twists occur. In at least some species (for example, the pistillate flower of *C. glauca*), these convolutions effectively double the total length of the style. Such contorted styles show no evidence

of later straightening, as they fall off after anthesis still in the original condition. The biological significance of these peculiar styles is unknown. The same feature is seen in several Mexican species of *Struthanthus* and the possibility of intrageneric affinities in these areas cannot be excluded. One of the early Mexican genera of Loranthaceae, *Spirostylis* Presl, was based on this stylar feature (Kuijt, in press).

Pollen has not been studied adequately in *Cladocolea*. It tends to be of the rounded, smooth tricolporate type typical of many Loranthaceae. In a number of species, however, a triradiate groove has been noted, as in *C. grahami* (FIGURE 13c), sometimes with a triangular central prominence.

The systematic position of *Cladocolea* with regard to other genera of small-flowered Loranthaceae, particularly *Struthanthus*, is a complex one, which may not be amenable to a completely satisfactory solution. This difficulty becomes clear when considering *C. harlingii*. There is little question that it must be assigned to *Cladocolea*; in its single, ebracteolate lateral flowers, determinate inflorescence, monomorphic stamens, and hermaphroditic flowers it agrees with a number of other *Cladocolea* species and with no known *Struthanthus* species. Yet its remarkable similarity in habit and mode of parasitism with *Struthanthus orbicularis* (H.B.K.) Blume (Kuijt, 1964) leaves one with a strong feeling that these similarities are more than superficial. This feeling is reinforced by the discovery of an as yet undescribed species from Peru, also of the same habit, which is characterized by an inflorescence with triads in its lower portion and by single flowers (including a terminal flower) in its upper part. This species represents the perfect intermediate between *C. harlingii* and *S. orbicularis*, and a position in either *Cladocolea* or *Struthanthus* would therefore seem justified for the Peruvian plant.

However, this is not the only "bridge" between the two genera. *Struthanthus polystachyus* (Ruiz & Pavón) Blume is paired in almost precisely the same way with *Cladocolea archeri* (see discussion under that species). At least one Mexican *Struthanthus* species, probably undescribed, also has an intermediate inflorescence. Inflorescence and floral details of some other Mexican *Struthanthus* species strongly suggest even further, possibly older, intergeneric connections. The unique stylar convolutions in some representatives of both genera thus assume additional evolutionary meaning and may yet be useful as an index of affinity.

It is clear that if the above suggestions are substantiated, *Struthanthus* as it is currently recognized becomes a polyphyletic entity; its several component units traceable back to separate branches of a *Cladocolea*-like group. The indeterminate, triad-bearing inflorescence of *Struthanthus* has been derived along various independent paths from determinate, *Cladocolea*-like inflorescences. These guiding principles can scarcely be defended adequately within the context of the present monograph; in fact, it is unlikely that such a defense can be made without a monographic treatment of *Struthanthus* itself.

If the postulated evolutionary relationships between the two genera are

even partly correct, the precise delimitation of *Cladocolea* and *Struthanthus* becomes somewhat arbitrary, at least where "bridging" species are located. In groping for the most useful separation, I am suggesting that *Cladocolea* be restricted to species with determinate inflorescences and single lateral, ebracteolate flowers, or obvious derivatives thereof, such as the species where the "inflorescence" is reduced to a single apical flower (for example, *C. clandestina* and *C. inconspicua*). *Struthanthus* is thus characterized by triads and (usually) an indeterminate inflorescence. Where difficulties arise (in species with mixed inflorescences), the situations should be individually evaluated.

The genus *Ixocactus* (Kuijt, 1967) may also be visualized as a derivative of *Cladocolea*-like ancestors. Indeed, in general habit its only species, *I. hutchisonii* Kuijt, is close to several *Cladocolea* species. The uniqueness of its quadricolpate, spinulose pollen, however, guarantees its survival as a separate genus.

With respect to the internal taxonomic structure of *Cladocolea*, it is first necessary to deal with Van Tieghem's division of the genus into two subgenera: subg. EUCLADOCOLEA, characterized by the presence of foliage leaves on the lower part of the spike (*C. andrieuxii*), and subg. STACHYCOLEA, in which such foliage leaves are absent (*C. tehuacanensis*, *C. grahami*, and *C. oerstedii*, the latter being a *Struthanthus*). The species added in the present work, including the two species which Van Tieghem placed in his new genus *Loxania*, render Van Tieghem's subgeneric dichotomy obsolete.

The genus as presently constituted, however, does not allow for a simple, convincing subdivision. It is possible, nevertheless, to define several groups of species which show strong affinities among themselves. It has been mentioned above that there is a very high degree of correlation between tetramery, monomorphic stamens, and hermaphroditic flowers. The nine species thus characterized (TABLE 1) undoubtedly form a closely related cluster. It is further possible to say that the three most closely related species of this group are *C. inconspicua*, *C. inorna*, and *C. clandestina*, notwithstanding the surprising geographical isolation in Brazil of *C. clandestina*.

Those species with expanded leaves on the inflorescences, either at the base or as floral bracts above, also seem to form a natural group. This is particularly convincing with *Cladocolea loniceroides* and *C. microphylla* (which have often been confused with each other), the rare *C. hintonii*, and *C. gracilis*. *Cladocolea andrieuxii* is also a member of this group. The relationships of these species to *C. pedicellata* are uncertain, the affinity with *C. glauca* and *C. tehuacanensis* being fairly remote.

A third species cluster consists of *Cladocolea grahami*, *C. mcvaughii*, and *C. pringlei*. These species undoubtedly form a natural group, but are rather distant from other *Cladocolea* species.

VERNACULAR NAMES. Only two vernacular names have been recorded by collectors: "sileno" and "malojo" (*Mexia* 321, 970), both applied to

Cladocolea inconspicua. It would be surprising, however, if the common Latin American appellation "matapalo" were not used for at least some of these mistletoes.

HOSTS. A tabulation of hosts that have been recorded is provided at the end of this paper. While several *Cladocolea* species are known only from *Quercus*, this should not mislead the reader into reaching conclusions with regard to host specificity. The possibility always exists that other ecological factors quite unrelated to hosts limit a mistletoe species to a zone or area where oaks are predominant. It is only when many collections are provided with such information that tentative ideas of this sort may be formulated. Thus it is clear that *C. loniceroides* has little host specificity; conversely, the fact that 13 out of 14 collections of *C. microphylla* are on oaks is suggestive of a very limited host range.

ACKNOWLEDGMENTS

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Cladocolea Van Tieghem, Bull. Soc. Bot. France 42: 166–168. 1895.

Loxania Van Tieghem, Bull. Soc. Bot. France 42: 386–389. 1895.

Phthirusa Martius, Flora 13(7): 110. 1830, not Eichler, Flora Brasil. 5(2): 52–67. 1868.¹

Loranthus L. p.p., *Oryctanthus* Eichler p.p., *Phthirusa* Eichler p.p., *Struthanthus* Martius p.p.

TYPE SPECIES: *Cladocolea andrieuxii* Van Tieghem, Bull. Soc. Bot. France 42: 166–168. 1895.

Erect or scandent parasitic shrubs, glabrous or short-pubescent; lateral branches (including inflorescences) often emerging in a pseudo-endogenous fashion; epicortical roots may occur on stems or at the base of the plant, or are absent. Leaves decussate, alternate, or irregularly arranged, simple, with pinnate venation, sometimes reduced to scales. Plants dioecious or with flowers hermaphroditic; in the former case aborted organs of the opposite sex usually present. Inflorescence normally a determinate spike, capitulum, dichasium, or raceme, in some species having undergone loss of the terminal flower or having been reduced to a single flower with one pair of bracts; lateral flowers ebracteolate, single in the axils of squamate (sometimes caducous) or foliaceous bracts. Flowers pale green

¹ See KUIJT, JOB. Proposal for the conservation of the generic name *Phthirusa* Eichler (1868) over *Phthirusa* Martius (1830) and *Passowia* Karsten (1852). Taxon (in press).

to pale yellow, sessile or pedicellate, 4-, 5-, or 6-partite; stamens fused with perianth members, dimorphic or monomorphic, with 4 thecae; pollen rounded-triangular, sometimes with triradiate groove and included triangular prominence, otherwise smooth; style often contorted or geniculate, especially in upper portion. Fruit a one-seeded berry with endosperm; embryo dicotyledonous, elongate, or globular, the haustorial disk weakly developed.

The genus *Cladocolea* is distinguished from *Dendropemon*, *Oryctanthus*, *Phthirusa*, and *Struthanthus* by the terminal flowers (determinate inflorescences) and by its lack of any bracteoles; from *Ixocactus* mostly by the unique pollen grain of the latter; and from *Struthanthus* and *Phthirusa* by its single, ebracteolate lateral flowers. The genus, however, shows clearly definable affinities with a number of *Struthanthus* species, such as *S. orbicularis* (H.B.K.) Blume, *S. polystachyus* (Ruiz & Pavón) Blume, possibly *S. johnstonii* Standley & Steyermark, and several as yet undescribed *Struthanthus* species.

Geographically *Cladocolea* is concentrated north of the Isthmus of Tehuantepec. One species, *C. oligantha*, is known from Mexico, as well as from Guatemala and Panama, and is likely to occur in intermediate areas also. Four species, three of which have previously been placed in other genera, are found in rather separate stations in South America, all but *C. clandestina* at high elevations (*C. archeri*, *C. harlingii*, and *C. roraimensis*). It is of considerable interest, furthermore, that all species occurring south of Mexico belong to the apparently primitive group delineated in the introduction.

KEY TO SPECIES OF CLADOCOLEA

1. Inflorescences absent, the flowers occurring singly, axillary to leaves on main stem.
 2. Calyculus fimbriate, style conical; known from Brazil. 3. *C. clandestina*.
 2. Calyculus not fimbriate, style straight, not conical; known from Mexico.
 3. Stem cylindrical even when young; anthers without connectival horn; most leaves acicular, some narrowly oblanceolate. 14. *C. inorna*.
 3. Young stems somewhat compressed; connectival horn of anther prominent; leaves obovate to oblanceolate, never acicular. 13. *C. inconspicua*.
1. Inflorescences present.
 4. Inflorescence subtended by several pairs of acute scale leaves.
 5. Petiole 8 mm. long or more; leaf apex obtuse; known only from Mt. Roraima. 21. *C. roraimensis*.
 5. Petiole 5 mm. long or less; leaf apex acute, even-attenuate; known from Ecuador, Colombia, and Peru. 2. *C. archeri*.
 4. Inflorescences not so subtended.
 6. Inflorescences in leaf axils of current growth, but sometimes also on older growth.
 7. Inflorescences on current growth simple dichasia.

8. Bracts on primary inflorescences caducous, small; secondary inflorescences with basal foliage leaves only; dioecious. 18. *C. oligantha*.
8. Bracts on primary inflorescences persistent, as large as the flowers; secondary inflorescences with foliage leaves along axis; flowers probably hermaphroditic. 6. *C. dimorpha*.
7. Inflorescences on current growth more than 3-flowered.
9. Leaves at least 10 times as long as wide. 5. *C. cupulata*.
9. Leaves no more than 5 times as long as wide.
10. Flowers pedicellate. 10. *C. harlingii*.
10. Flowers sessile.
11. Plants with at least the young growth pubescent, puberulent, or with short, stiff epidermal hairs.
12. Plants sparsely branched, sympodial.
13. Flowers 4-partite, style contorted or geniculate. 4. *C. coyucaae*.
13. Flowers 5-partite, style nearly straight. 22. *C. stricta*.
12. Plants profusely branched, not sympodial. 15. *C. loniceroides*.
11. Plants with even the young growth always glabrous.
14. Flowers nearly perpendicular on inflorescence axis, widely spaced. 16. *C. mcvaughii*.
14. Flowers differently arranged.
15. Leaves approximately twice as long as wide. 12. *C. hondurensis*.
15. Leaves more than 3 times as long as wide.
16. Spikes always determinate; staminate buds obovate; fruit 10 mm. long or more. 9. *C. grahami*.
16. Spikes determinate or indeterminate; staminate buds obovate; fruit about 5 mm. long. 20. *C. pringlei*.
6. Inflorescences not occurring on current growth; mature inflorescences present only on leafless, older internodes.
17. Mature leaves linear. 8. *C. gracilis*.
17. Mature leaves not linear.
18. Young growth finely puberulent.
19. Spikes with 0-3 foliage leaves on lower half of peduncle. 11. *C. hintonii*.
19. Spikes with involucre foliage leaves near tip of inflorescence. 17. *C. microphylla*.
18. Young growth glabrous.
20. Stems grooved or ridged when young. 1. *C. andrieuxii*.
20. Stems always terete.
21. Leaves at least 6 cm. long. 9. *C. grahami*.
21. Leaves less than 5 cm. long.
22. Flowers sessile along a slender, elongate inflorescence rachis. 23. *C. tehuacanensis*.
22. Flowers pedicellate or, if sessile, on a short, crowded inflorescence rachis.

23. Flowers short- or long-pedicellate, rarely sessile; twigs rather straight and stout; buds 6 mm. or more long, acute.
 19. *C. pedicellata*.
23. Flowers sessile; twigs often voluble, slender; buds 5 mm. long or less, more or less rounded. 7. *C. glauca*.

1. *Cladocolea andrieuxii* Van Tieghem, Bull. Soc. Bot. France 42: 167. 1895. FIGURES 3 & 4.

Oryctanthus andrieuxii (Van Tieghem) Engler in Engler & Prantl, Nat. Pflanzenfam., Nachtr. zu III: 135. 1897.

Struthanthus alni Bartlett, Proc. Am. Acad. 44: 630. 1909.

TYPE: *Andrieux 345* (see below).

Plant dioecious, completely glabrous, dark and shiny when dry, with sympodial growth; stems somewhat grooved or ridged; stem craters conspicuous. Leaves alternate, with primary leaves only on current year's growth, up to 3.5×1.5 cm., more usually 3×1 cm., lanceolate-oblan- ceolate, somewhat rounded to acute at apex, the base tapering into a petiole 2–4 mm. long; the pinnate venation clearly visible above. In- florescences only on year-old wood, consisting of a short spike with about 2 leaves below, the 5 or 6 sessile flowers crowded at the tip, bracts ca- ducous, one flower in a terminal position. Staminate flowers nearly 10 mm. long in bud, the bud pointed; petals 6; anthers nearly sessile, dimorphic, upper series attached above middle of petal, lower series attached about $\frac{1}{3}$ the distance from the base; anthers 2–2.5 mm. long, lacking a con- spicuous connective; filament cushion absent below the anther, an even ridge taking its place; pollen lacking triradiate groove, glabrous; ovary 2×2 mm.; style only slightly undulant, reaching to base of upper an- thers, where slightly contorted; stigma not differentiated; nectary well de- veloped, glabrous. Pistillate flowers $7-8 \times 1.5$ mm., 6-merous; sta- minodia very slender and inconspicuous; ovary 2 mm. long, calyculus irregularly dentate; petals sometimes with tufts of hairs on incurved tips; style ranging from nearly straight to strongly convolute in middle region; stigma capitate, with somewhat angular, papillar surface; nectary well developed, more or less smooth. Fruit 9×5 mm., ellipsoid, smooth; embryo dicotyledonous, half the length of the fruit.

There is no sign of any epicortical roots, but the base of the plant has not yet been seen.

C. andrieuxii is the type species of *Cladocolea* Van Tieghem.

Mexico. GUERRERO: Chichihualco, Cerro de Pastilla, near Camotla, on *Quer- cus*, 2300 m., *Rzedowski 16436* (MICH). OAXACA: Mt. S. Felipe, on *Quercus*,

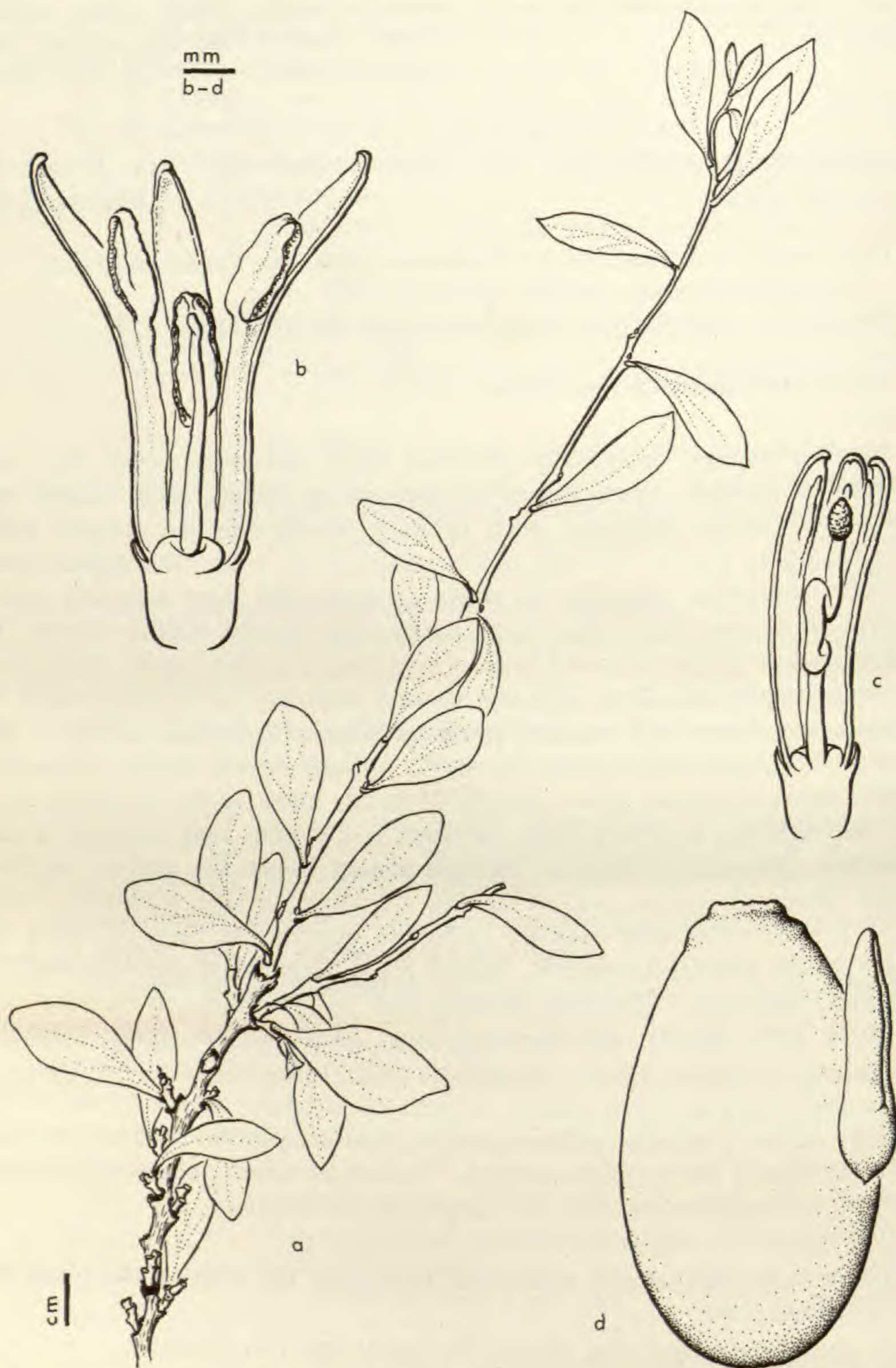


FIGURE 3. *Cladocolea andrieuxii*: a, habit, pistillate plant? (*Andrieux 345, K*); b, staminate flower, longitudinal section (*Pringle 10244, SMU*); c, pistillate flower, longitudinal section (*Pringle 10244, SMU*); d, fruit and embryo (*Camp 2609, NY*).

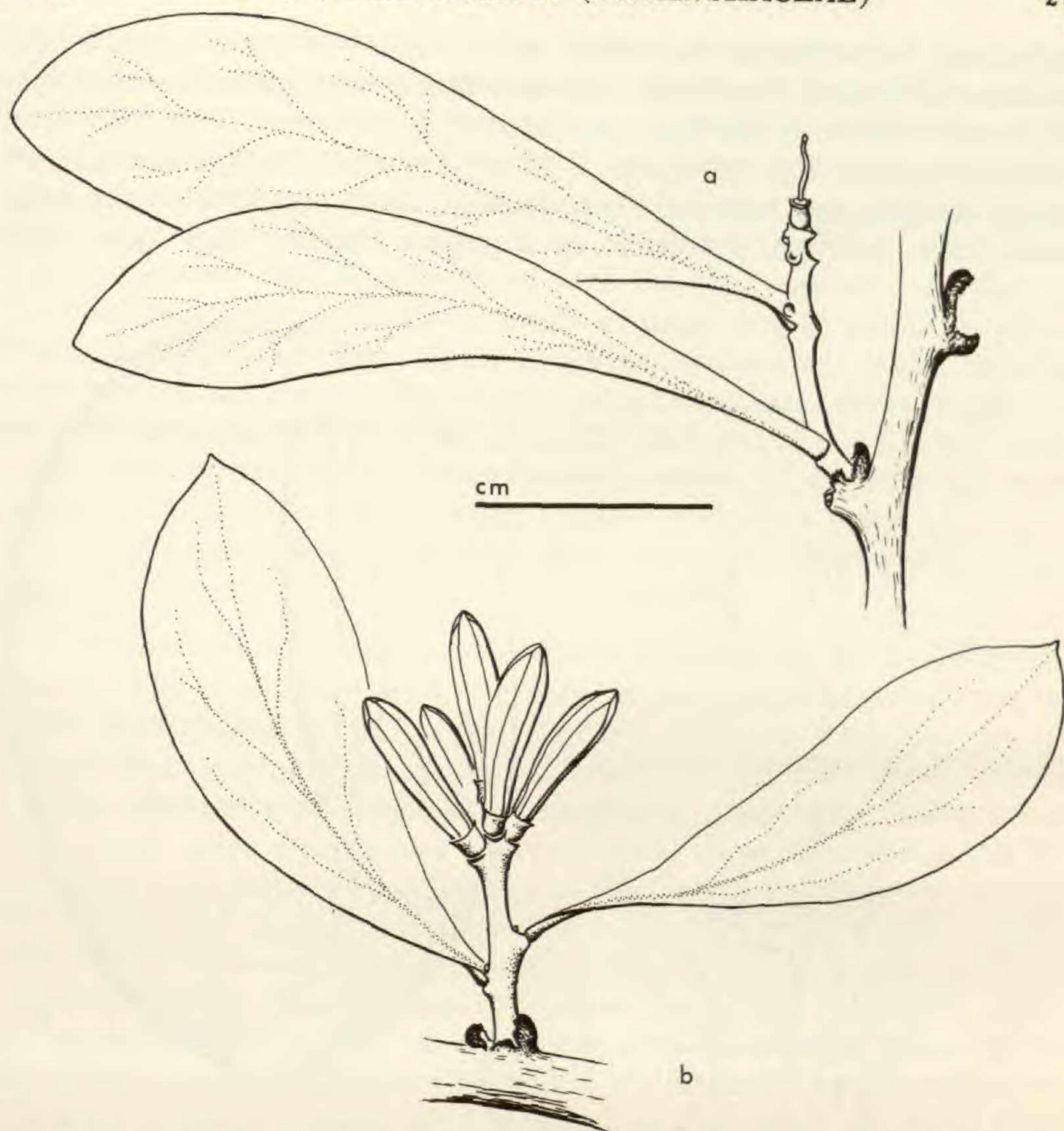


FIGURE 4. *Cladocolea andrieuxii*: a, inflorescence, pistillate? (*Andrieux 345*, G); b, inflorescence, staminate? (*Pringle 10244*, SMU).

*Andrieux 345*² (P, holotype of *C. andrieuxii*; G, K, M, isotypes); Cerro de San Felipe N of Oaxaca, on *Alnus*, Camp 2609 (NY); summit ridge, Sierra de San Felipe above city of Oaxaca, on *Alnus jorullensis* var. *exigua*, 10,000 ft., *Pringle 10244* (GH, holotype of *Struthanthus alni*; CAS, MICH, UC, US, UT, isotypes).

2. *Cladocolea archeri* (A. C. Smith) Kuijt, comb. nov. FIGURE 5.

Oryctanthus archeri A. C. Smith, Bull. Torrey Bot. Club 59: 516, 517. 1932.

TYPE: *Archer 1521* (see below).

Rather large, glabrous plant strikingly similar to *Struthanthus polystachyus* (Ruiz & Pavón) Blume, with apparently sympodial growth;

²There is some confusion concerning *Andrieux 344*, which appears to be a mixed collection. It is accompanied by the same data as *Andrieux 345*. At K and P the specimen clearly belongs to the present species, but at M it would seem to be *C. tehuacanensis* instead (as, in fact, indicated by an annotation to that effect in Van Tieghem's hand). *Andrieux 344* is not mentioned in Van Tieghem's note on *C. andrieuxii*.

stems long and straight, branching only from older wood, angular and smooth when young, becoming stout and terete, with numerous conspicuous, round lenticels of uniform size; internodes 4.5–8 cm.; stem roots rare. Leaves decussate, the leaf blade 3–10 × 2–5 cm., ovate, somewhat attenuate at apex and rounded to truncate at base; petiole 4–8 mm. long, canaliculate; midvein prominent as a groove, running into apex, with

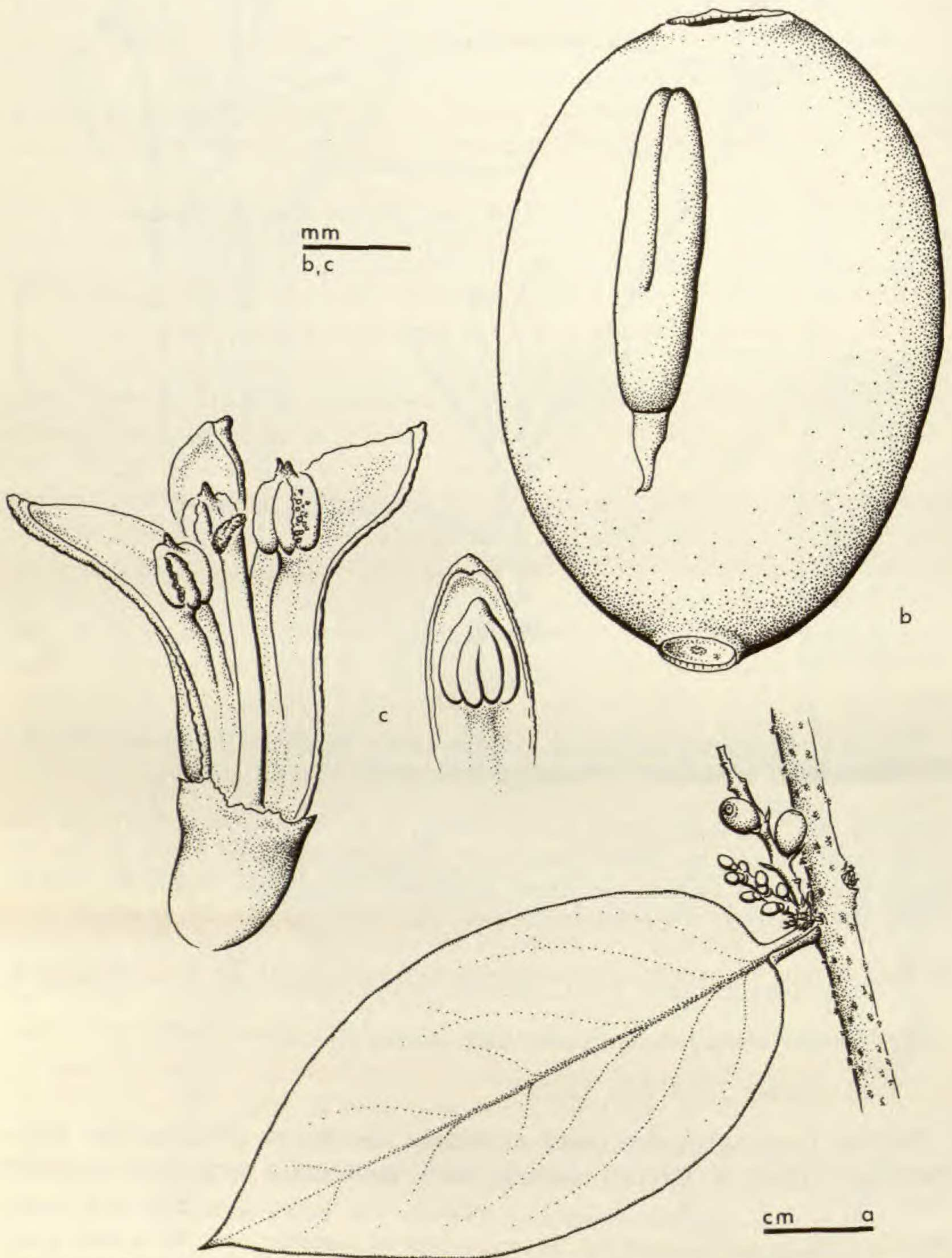


FIGURE 5. *Cladocolea archeri*: a, portion of twig with two inflorescences of different ages (*Archer 1521*, us); b, fruit and embryo of same collection; c, anther and flower, two petals removed (*Dodson & Thien 1852*, UBC).

regular and prominent lateral veins. Inflorescence subtended by several pairs of small, chartaceous scale leaves, several per leaf axil; each inflorescence with ca. 5 pairs of ebracteolate, sessile flowers and one terminal one; floral bracts acute, up to nearly 3 mm. long, naviculate, mostly caducous but some persisting. Flowers yellow-green, hermaphroditic, the mature bud nearly 6 mm. long, blunt; petals 4.5 mm. long, 4(5), each with one anther, the filament fused with its petal; anthers attached at two different heights, both above middle of petal, but all similar in shape, having 4 pollen sacs with blunt, projecting connective; pollen smooth, somewhat 3-lobed but lacking evident surface markings; ovary 1.5×1.5 mm., with irregularly denticulate calyculus; style straight and rather stout, 3 mm. long; stigma weakly differentiated, oblique. Fruit "rose red when young, becoming blue with a greyish bloom" (collector's notes, type specimen), 4×6 mm., ovoid, with blunt apex; embryo dicotyledonous, 3 mm. long.

Assignment of this species to *Cladocolea* is logical but by no means inevitable. The closest relative of *C. archeri*, in fact, would seem to be *Struthanthus polystachyus*. The general similarity between these two species survives closer scrutiny. Except for *C. roraimensis*, no other known species of either *Cladocolea* or *Struthanthus* have basal, chartaceous inflorescence bracts; fruit color changes are identical; and, most importantly, the inflorescence of *S. polystachyus* has two or four paired single flowers (rather than triads) and a single, terminal flower (Kuijt, 1964). Indeed, the relationship of these two species is so close that it is tempting to postulate a derivation of the dioecious one (*S. polystachyus*) from *C. archeri*, which has hermaphroditic flowers. A completely parallel situation exists in the relationship between another *Cladocolea*, *C. harlingii*, and *Struthanthus orbicularis* (H.B.K.) Blume and its immediate relatives. It is worth mentioning that in both instances the *Cladocolea* species involved has hermaphroditic flowers and is very localized geographically, while the corresponding *Struthanthus* species is dioecious and widely distributed. *S. orbicularis* ranges from Brazil and Peru through all Central American republics to southern Mexico, while *S. polystachyus* is more cordilleran, ranging from northern Peru to Costa Rica (Kuijt, 1964).

If the relationships are as sketched above, it can be seen that no completely satisfactory assignment at the generic level may be possible at this time. Both *Cladocolea archeri* and *Struthanthus polystachyus* might be included in either *Cladocolea* or *Struthanthus*. A third possibility, which has much to recommend it from the point of view of the recognition of natural affinities, is the establishment of a separate genus to include both species, i.e., the genus *Peristethium*, which Van Tieghem (Bull. Soc. Bot. France 42: 175. 1895) erected for *S. polystachyus* (*S. leptostachyus* (H.B.K.) G. Don). Such an arrangement, however, would not only belie the affinities which *C. archeri* shows to the remainder of *Cladocolea*, but it would also, to be consistent, necessitate the creation of a similarly new genus for *C. harlingii* and its close relatives in *Struthanthus*. The effect would be to split *Struthanthus* into units which, while perhaps represent-

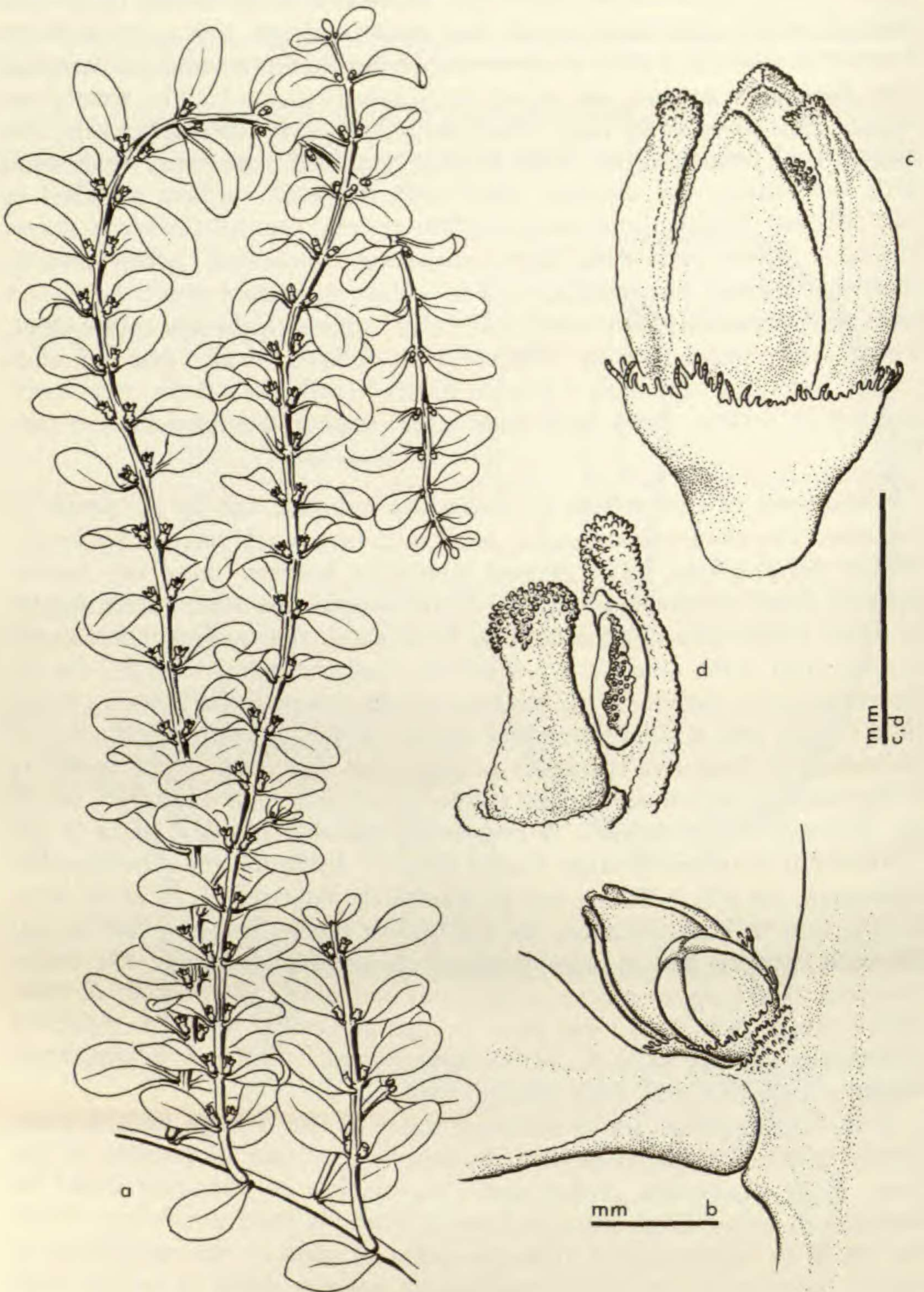


FIGURE 6. *Cladocolea clandestina* (Martius s.n., M): a, habit, redrawn from Eichler, *Flora Brasil.* 5(2): pl. 18. 1868; b, axillary group of flowers; c, mature flower; d, style and anther-bearing petal.

ing the most natural groups possible, could nevertheless not always be adequately distinguished from each other. At any rate, as *Struthanthus* has never been monographed, such action is at present quite premature, and

the inclusion of *C. archeri* in *Cladocolea* would seem to be the most reasonable alternative.

Ecuador. PROV. IMBABURA: Lita, 500 m., *Acosta Solis 12200* (F); PROV. TUNGURAHUA: Chaupi, 2400 m., *Dodson & Thien 1852* (UBC, UC). Colombia. DEPT. ANTIOQUIA: La Sierra, 18 km. N of Medellín, on *Tournefortia fuliginosa*, 2000 m., *Archer 1058* (US), *Archer 1521* (US, holotype, *Oryctanthus archeri*); Cordillera Central, near Porcesito, Río Medellín Valley, 1100 m., *Hodge 6842* (US). DEPT. VALLE: Cordillera Occidental, Hoya del Río Digua, La Elsa, ravine La Cristalina, 1000–1150 m., *Cuatrecasas 15244* (F, UC); Cordillera Occidental, Hoya del Río Cali, Quebradahondo, arriba de La Glorieta, camino a Miralindo, 2100–2250 m., *Cuatrecasas 18430* (F); Cordillera Central, shores of Río Bugalagrande, Calamar, 1680 m., *Cuatrecasas 20506* (F). Peru. DEPT. HUANUCO: SW slope of Río Llulla Pichis watershed, ascent of Cerro del Sira, below summit, on Melastomataceae, 2100 m., elfin forest, *Dudley 13450* (F).

3. *Cladocolea clandestina* (Martius) Kuijt, comb. nov. FIGURE 6.

Loranthus clandestinus Martius in Schultes & Schultes, Syst. Veg. 7: 96. 1829.
Phthirusa clandestina (Martius) Martius, Flora 13: 110. 1830.

TYPE: *Martius* (see below).

Young leafy stems quadrangular, smooth, green; older stems terete, developing longitudinal lenticels which are often in long series. Leaves regularly decussate, 2.5 × 1.5 cm. or slightly smaller, obovate to broadly elliptical, with rounded apex and acute base; petiole ca. 1 × 1 mm.; venation pinnate but obscure, with two large lateral veins at base of blade. Inflorescence with flowers single or in threes (two laterals in axils of scale leaves beneath primary, median flower), in the axils of foliage leaves, margin and back of scale leaves covered with short hairs. Flowers 2 × 1 mm., calyculus glabrous but with fringed margin, the projecting hairs mottled with brown; petals 4, slightly more than 1 mm. long, each with papillate tip but otherwise glabrous; anthers on extremely short filaments, less than 1 mm. long, placed at uniform heights on the middle of the petal; petals differing only slightly in width, otherwise both petals and stamens monomorphic; anther connective projecting slightly; pollen broadly triangular, smooth, with very faint triradiate marking; style 1 mm. long, somewhat quadrangular, base very heavy; stigma very conspicuously papillate, dark-colored; nectary rather smooth. Fruit 2 × 4 mm., ellipsoid, dark-colored(?).

This species is the type species of *Phthirusa* Martius, a generic name recently superseded by *Phthirusa* Eichler (Kuijt, in press). Its affinities are clearly with *Cladocolea inconspicua*, as already suggested by Eichler (1868, p. 67).

There is no real evidence for the floral dimorphism described by Eichler; the two "forms" described by Eichler may represent two stages in maturity.

Brazil. PROV. RIO DE JANEIRO: *Glaziou 1429* (F), *Martius* (M, holotype of *Lo-*

ranthus clandestinus; this specimen very faithfully drawn in Eichler, *Flora Brasil.* 5(2): *pl.* 18. 1868).³

4. *Cladocolea coyuca* Kuijt, sp. nov.

FIGURES 7 & 8.

TYPE: *Hinton 3958* (see below).

Gracilis, dioecia?, parce ramosa, sympodialis; caules ut videtur sine radicibus, teretes, juveniles breviter albo-pubescentes, vetustiores lenticellis manifestis vel fissuris epidermalibus longis. Folia alterna, solum in innovationibus vertentibus, oblanceolata, basi longe attenuata, 35×8 mm. Inflorescentiae singulares in axillis foliarum ad ramos novos, subsessiles vel pedunculis ad 10 mm. longis; flores 5–7, ad apicem congesti, foliis squamiformibus parvis suffulti; ca. 3 mm. longi, tetrameri; antherae monomorphicae vel submonomorphicae connectivum obtusum. Stylus medio semel conspicue contortus. Fructus ca. 5×3 mm.

Plant possibly dioecious, slender, sparsely branched, with sympodial growth; twigs straight, terete, apparently rootless, the young growth with very short, stiff, white epidermal hairs; year-old stems with longitudinal or roundish lenticels or long epidermal cracks. Leaves alternate, occurring only on current growth, up to 35×8 mm., oblanceolate with fairly blunt apiculate apex and long, tapering base; petiole very short or lacking; venation pinnate, the midrib running into apex. Inflorescence one per leaf axil on current growth, only occasional on year-old growth, leafless, peduncles as long as 10 mm. but sometimes much shorter, rarely nearly lacking; flowers 5–7, crowded at apex, subtended by small scale leaves, either paired or alternate, terminal flower always present. Flowers about 3 mm. long, 4-merous; anthers monomorphic or nearly so, 4-loculate, nearly sessile; filament buttress thick, the free upper part continuing in an extremely slender, short filament; connective blunt; ovary 1×1 mm., somewhat frayed at calyculus; style with a single, prominent contortion in the middle; stigma well differentiated, capitate, with papillar surface, sometimes lobed, reaching above pollen sacs. Fruit 5×3 mm., somewhat obovate, smooth; embryo ca. 3 mm. long, clavate, cotyledons 2 mm. long.

I am not completely satisfied that *Hinton 4777* is the staminate plant of this species or even that the species is dioecious. *Hinton 3958* is a fruit-bearing plant, and its flowers have apparently fully matured anthers; yet I have not been able to find pollen. *Hinton 6688* is also fruit-bearing but has clearly degenerate anthers. As these conditions at least theoretically could coexist in one species, and as some very striking and close similarities exist between these specimens, they are treated together provisionally.

Mexico. GUERRERO. Distr. Coyuca: Coyuca, on a chirimo, *Hinton 5554* (K,

³ The following material is cited in Rizzini, *Rodriguésia* 28–29: 130. 1956. PROV. RIO DE JANEIRO: Tijuca, *Brade 10461*; Corrocado, *Schwacke 1411*; PROV. ALAGOAS: Maceió, *Gardner 1322*.

Two further collections, by Mikan and Riedel, both from Prov. Rio de Janeiro, are cited by Eichler (*loc. cit.*) but have not been seen.

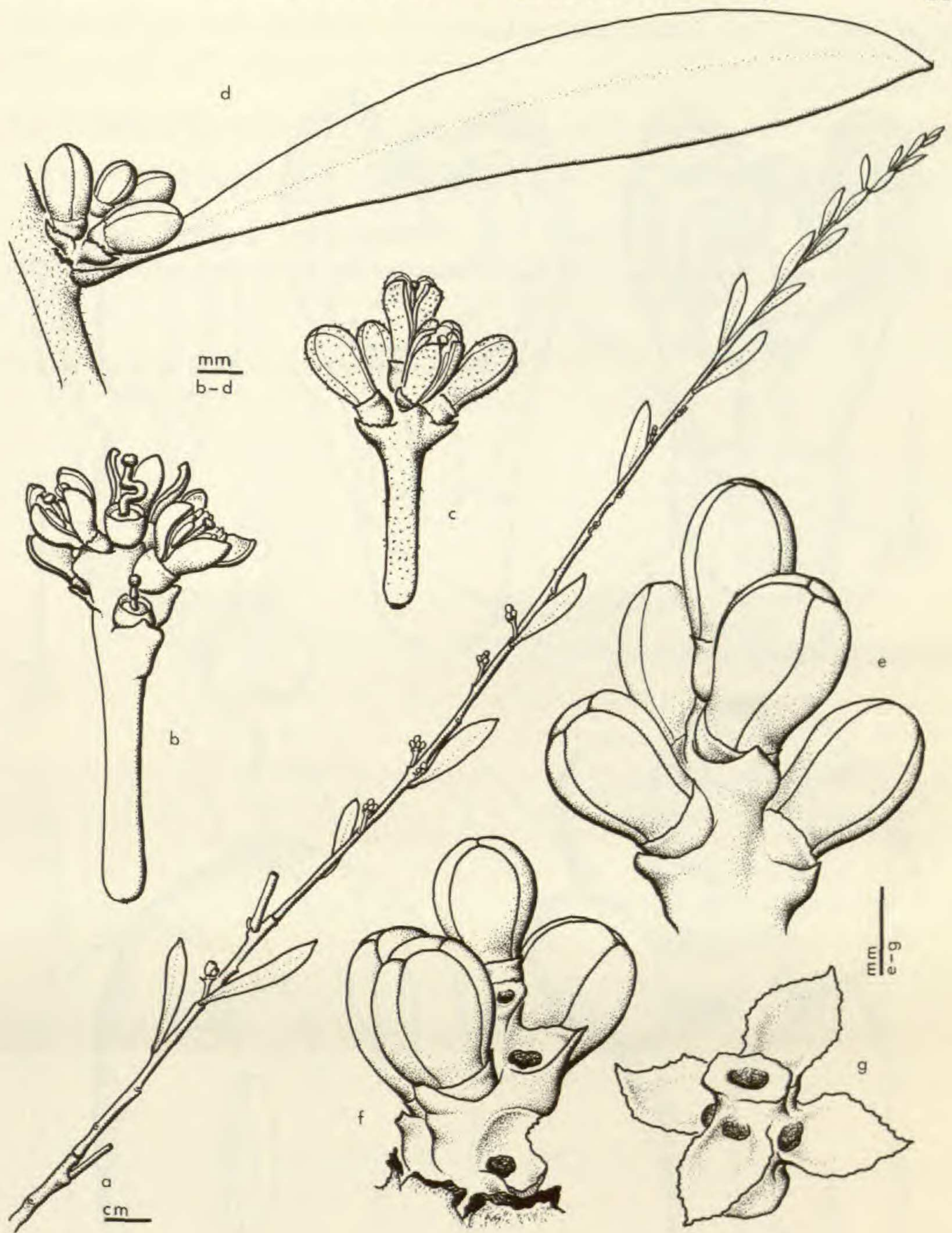


FIGURE 7. *Cladocolea coyucae*: a, habit (*Hinton 3958*, K); b, inflorescence, same collection; c, inflorescence, pistillate (*Hinton 6688*, K); d, inflorescence of sessile type (*Hinton 4777*, G); e-g, inflorescence details of same collection.

MICH, NY, US); Santa Barbara, *Hinton 6688* (K, MICH, NY, UC, US). MEXICO. Distr. Temascaltepec: Bejucos, on a guaje, 610 m., *Hinton 3958* (K, holotype of *C. coyucae*; MICH, NY, UC, US, isotypes); Bejucos, on a brazil, *Hinton 4777* (F, G, K, MICH, NY, P, S, UC, US, W). MICHOACÁN: Tancitaro region, arid slopes above Apatzingán, on *Thevetia*, 2000 ft., *Leavenworth & Hoogstraal 1513*⁴ (F,

⁴The Leavenworth and Hoogstraal specimen is sterile, and it is assigned to *C. coyucae* on the basis of vegetative similarity only. The Purpus collection is a broad-leaved plant with hermaphroditic flowers, and its placement here is provisional.

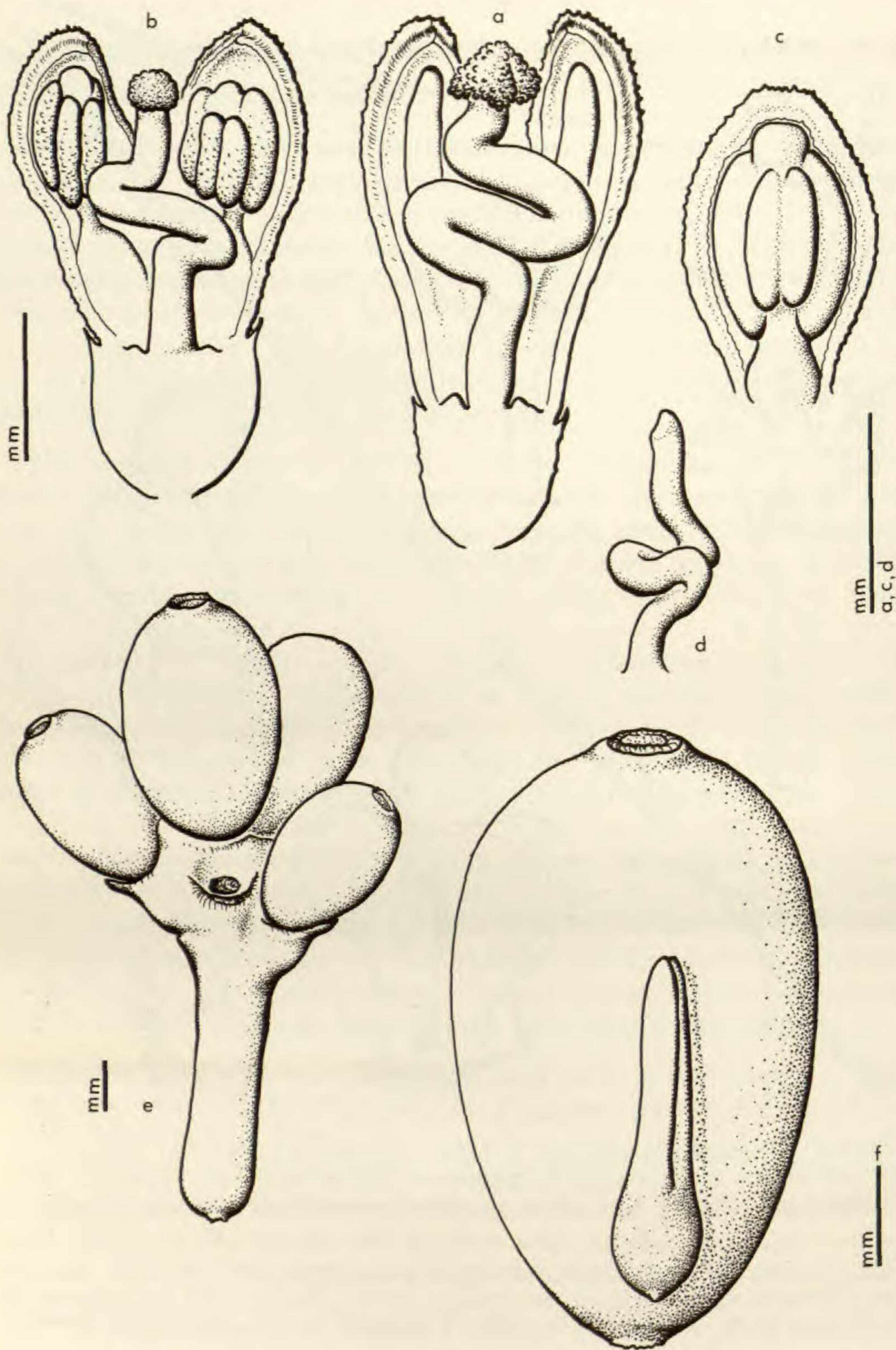


FIGURE 8. *Cladocolea coyuca*: a, pistillate flower, longitudinal section (*Hinton 6688, K*); b, staminate or hermaphroditic flower, longitudinal section (*Hinton 3958, K*); c, stamen and subtending petal (*Hinton 4777, G*); d, style of same collection; e, mature infructescence (*Hinton 3958, K*); f, fruit and embryo (*Hinton 5554, K*).

GH, MICH, MO, NY). PUEBLA: Coxcatlán, on *Heliocarpus*, *Purpus* 4191 (BM, F, UC).

5. *Cladocolea cupulata* Kuijt, sp. nov.

FIGURE 9.

TYPE: *McVaugh* 21127 (see below).

Dioecia, pendula, sympodialis; rami vetustiores scabri. Folia decussata, pendula, coriacea, taeniata vel falcata, ad 140×10 mm., apice

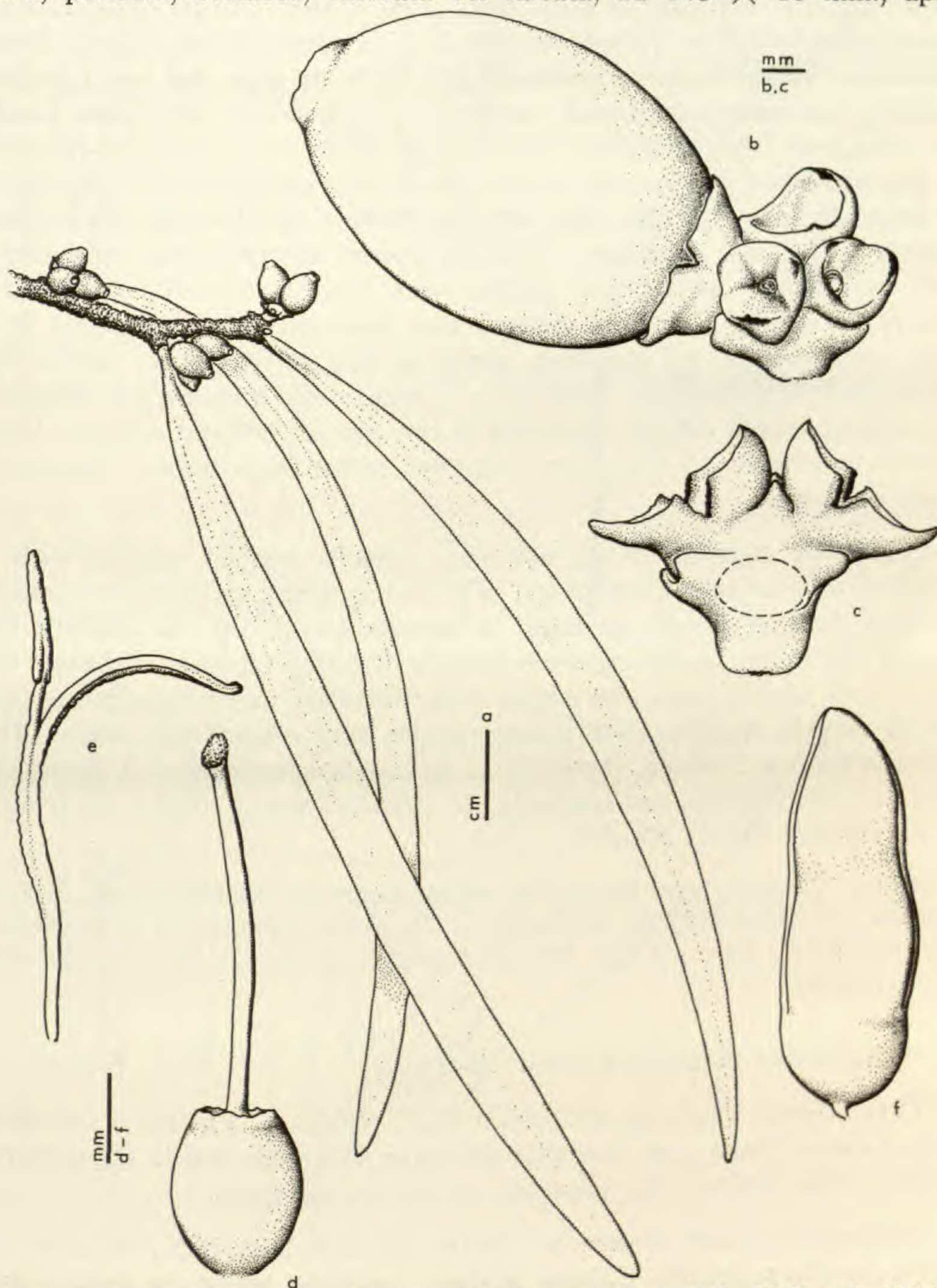


FIGURE 9. *Cladocolea cupulata* (a, *McVaugh* 21127; b-f, *McVaugh* 23273; both MICH): a, habit, pistillate plant in fruit; b, infructescence, three fruits removed; c, same, all fruits removed and lowest cupule cut away (broken line); d, gynoecium; e, petal and aborted anther; f, mature embryo.

basique acuta. Inflorescentia pistillata brevis validaque, axis 3–5 mm. longa, floribus binis ad quaternis, structuris cupulatis insidentibus. Flos femineus fere 8 mm. longus; stylus rectus, 4.5 mm. longus; stigma capitatum; staminodia magna. Fructus ovoideus, 10×7 mm., cupula accreta suffultus.

A dioecious, pendent, rather coarse mistletoe 50–70 cm. long, with sympodial growth; older branches terete with rough, gray and cinnamon-brown surface; no basal or stem roots seen; craters conspicuous. Leaves opposite, up to 140×10 mm., rather thick, pendent, ribbon-shaped, often somewhat falcate, tapering gradually into an acute apex and base; petiole lacking; leaf margin thickened; venation obscure except for several parallel veins near base. Pistillate inflorescence short and stout, 1–3 per axil of persistent leaf on year-old growth, developing only after full expansion of branches; axis 3–5 mm. long with 2–4 flowers, each flower in a cuplike structure, the cups decussate. Pistillate flowers nearly 8 mm. long, probably hexamerous; petals very slender, with large staminodia which have clearly discernible filaments; ovary 2 mm. long, calyculus somewhat dentate; style straight, 4.5 mm. long, almost as long as the petals; stigma capitate, well differentiated. Fruit 10×7 mm., ovoid, smooth, the enlarged, subtending cupule usually rupturing in two places; embryo 4.5 mm. long, the two cotyledons 3.5×1.5 mm., very flat, rather blunt-tipped. Staminate plant unknown.

Cladocolea cupulata is an extremely clearly marked species with a puzzling inflorescence morphology. The peduncle is a saddlelike structure, holding the four flowers in bays. I have not been able to identify the bracts which one would expect below the flowers; however, between the upper two cupules and alternating with them are two triangular organs which may be leaflike. The young cupules may consist of a bract. The inflorescence as a whole, therefore, is an indeterminate one. A staminate plant is unfortunately not available. *C. cupulata* would seem to be related to *C. grahami* and *C. pringlei*.

Mexico. JALISCO: pine forests on rolling mountain summits 6 mi. NW of Cuautla, on *Pinus*, 1700 m., *McVaugh* 21127 (MICH, holotype of *C. cupulata*), pine-oak forest, hills 7–8 km. NW of Cuautla, on *Pinus*, 1850 m., *McVaugh* 23273 (MICH).

6. *Cladocolea dimorpha* Kuijt, sp. nov.

FIGURE 10.

TYPE: *Smith, Peterson, & Tejeda* 4127. **Mexico.** PUEBLA: Tehuacan area, Leucho Diego, S of Coxcatlán on Cerro Ajuereado and in the adjacent valley, 1000–1800 m. (G, holotype; F, NY, US, isotypes).

Sympodialis, caules teretes, ut videtur sine radicibus, recti, juveniles capillis brevibus remotis. Folia alterna, primaria solum in innovationibus vertentibus, 20×30 mm. vel minora, lanceolata, apex acutus, apiculo parvo; folia secundaria paulo minora, solum ad ramos anniculos. Inflorescentiae primariae permanentes orientes ad innovationes vertentes,

singulae axillares, simpliciter dichasiales; flores sessiles, laterales bracteis persistentibus; inflorescentiae secundariae ad ramos anniculos; folia bina ad quaterna ad partem inferiorem pedunculi, flores 3–5 in capitulum par-



FIGURE 10. *Cladocolea dimorpha* (Smith, Peterson, & Tejada 4127, G): a, diagrammatic representation of the distribution of primary inflorescences (current growth) and secondary inflorescences (year-old growth); b, primary inflorescence and axillant leaf; c, secondary inflorescence, with leaf scar below; d, flower, longitudinal section.

vum congesti. Flos 3×1 mm.; petala 4; antherae petalaeque monomorpha. Stylus ipsum supra antheras acute contortus, praeterea plus minusve rectus.

A branched plant at least 40 cm. long, with sympodial growth; stems terete, straight, with widely spaced, short hairs when young, but from second season smooth, light brown, and with many lenticels; apparently without roots. Leaves alternate; primary leaves only on current growth, 20×30 mm. or less, glabrous but with somewhat granular surface, narrowly lanceolate, the apex acute with small tooth and the base narrow and tapering; discrete petiole absent; secondary leaves along year-old stems, similar but smaller, more oblanceolate, and with more rounded apex. Inflorescences of two types: (1) primary, developing continuously on current growth, one in the axil of all except the first several leaves of a twig, being simple dichasia of 3 sessile flowers, the 2 lateral flowers each subtended by a slightly shorter lanceolate bract, and (2) secondary, on year-old growth only, leaving craters; 2-4 leaves on lower part, one often at very base, the 3 to 5 flowers in a small capitulum, the lowest flowers subtended by foliar or smaller bracts. Flowers 3×1 mm. in bud; anthers and petals monomorphic, the 4 petals seemingly sessile but attached nearly half-way up the anther by a very short and slender filament; filament cushion or ridge below anther; pollen sacs 4, the inner ones half the size of the outer ones; connective not extended; pollen trilobate, lacking obvious triradiate groove or triangle; ovary ca. $\frac{2}{3}$ mm. long, calyculus slightly dentate; style reaching to above the anthers, more or less straight up to that point but then bent sharply; stigma well developed, capitate, minutely papillate; nectary ring smooth.

Although no fruits are present on the single known collection, the well differentiated style, stigma, and anthers suggest that the flowers of *Cladocolea dimorpha* are hermaphroditic. If this is true, a degree of affinity to *C. inconspicua* and *C. inorna* would seem to be indicated; both of these species also have 4-partite flowers with monomorphic stamens, as does *C. dimorpha*. The only other *Cladocolea* with dimorphic inflorescences is *C. oligantha*, where the differences are less striking than in *C. dimorpha*.

7. *Cladocolea glauca* Kuijt, sp. nov.

FIGURE 11.

TYPE: *Arsène* 1749/2 (see below).

Tenuis, volubilis, glabra, dioecia; rami vetustiores radices gerentes. Folia primaria glauca, lanceolata, ad 25×7 mm.; folia secundaria bina in inflorescentia, oblanceolata-obovata. Inflorescentia ad ramos anniculos, spicam breviter pedunculatam, vulgo solitariam efformans; bractae caducae. Flores in inflorescentia ca. 6, 5 mm. longi, hexameri; stamina dimorpha; stylus florum pistillatorum valde flexuosus. Fructus 4×5 mm.

Dioecious, slender, completely glabrous plants with voluble twigs; bark light brown, smooth, later peeling off in long, gray patches revealing brown,

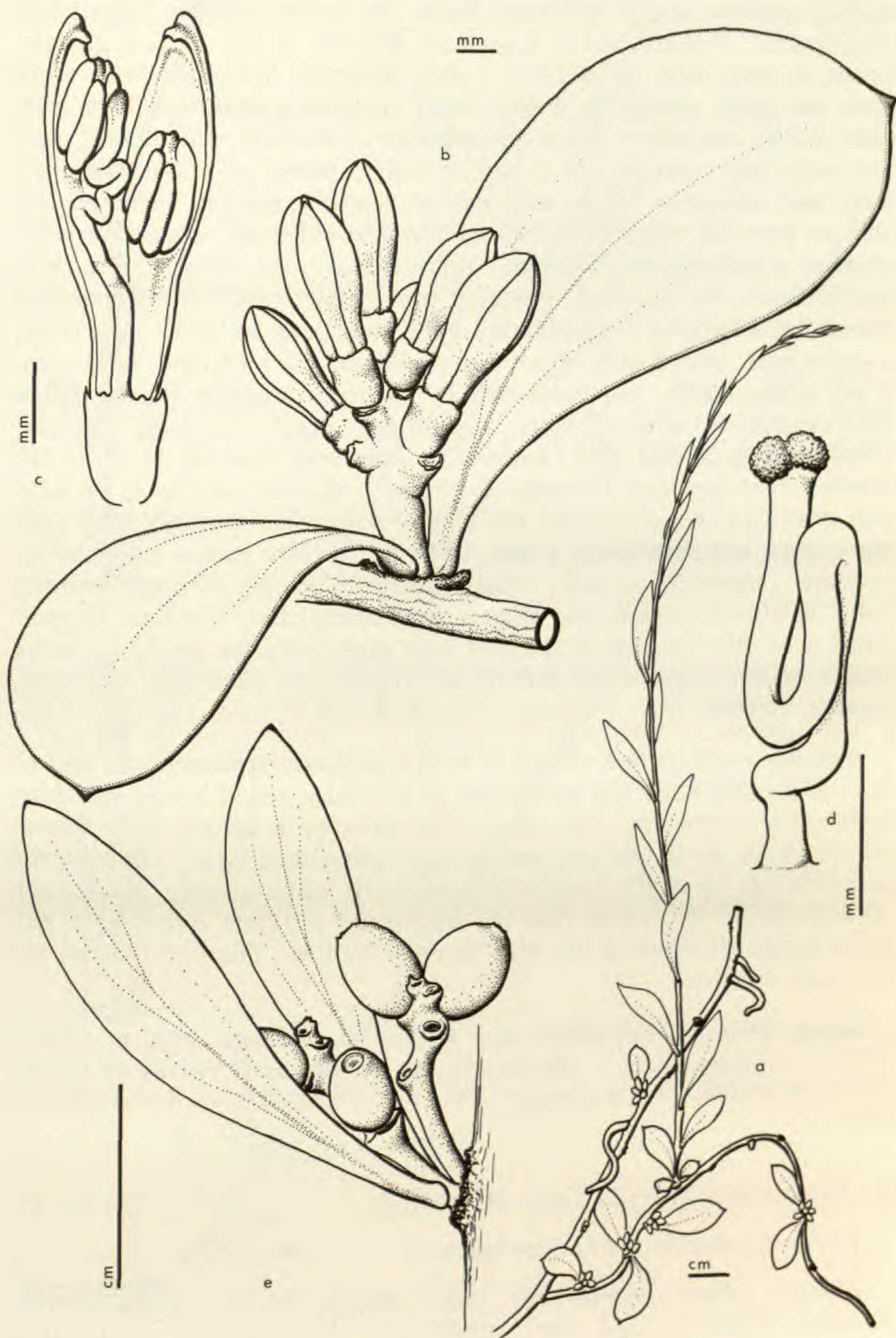


FIGURE 11. *Cladocolea glauca*: a, habit, staminate plant (*Arsène 1749/2*, BM); b, inflorescence, same collection; c, staminate flower, longitudinal section, same collection; d, style of pistillate flower (*Nicolas s.n.*, BM); e, two infructescences, one leafless, same collection.

reticulate, subdermal tissue; some stem roots on year-old and older growth; axillary cushions nearly indistinguishable, but craters on older twigs fairly conspicuous. Primary leaves apparently dropped at end of first growing season or soon after, up to 25×7 mm., glaucous, lanceolate, with acute apex and base; petiole ca. 2 mm. long; venation pinnate but only mid-vein visible; secondary leaves oblanceolate to obovate, with obtuse apex and acute base; petiole 1×1 mm., usually 2 leaves per spike; both primary and secondary leaves with narrow, leathery margin. Inflorescences only on year-old wood and (few) on two-year-old wood: staminate inflorescence a pedunculate (1–2 mm.) spike, solitary, the foliage leaves completely basal and seemingly emerging from crater; pistillate inflorescence resembling staminate, but peduncles up to 5 mm. long, at least 1 mm. thick, a superposed, second spike sometimes developing; in both cases flowers ca. 6 per spike, sessile, and subtended by caducous scalelike bracts, spikes determinate. Staminate flowers: mature bud ca. 5 mm. long, obovate; petals 6, with hooded apex; anthers 1.5 mm. long, inserted $\frac{1}{2}$ or $\frac{2}{3}$ the distance from the base (stamens dimorphic), filament very short or lacking; connective not projecting, the 2 outer pollen sacs slightly longer than the 2 inner ones; the ovary 1 mm. thick and slightly longer, calyculus irregularly dentate to smooth; style reaching to middle of upper anthers, distal half much convoluted; stigma not differentiated. Pistillate flowers: petals 6, 3 mm. long; style doubled back upon itself for nearly its entire length; stigma capitate, well differentiated, papillate. Fruit ca. 4×5 mm., smooth, ellipsoid.

A rather small species related to both *Cladocolea tehuacanensis* and *C. pedicellata*, differing from the former in its fleshy, broad leaves and short spikes and flowers, and from most of the latter in its sessile, small flowers which are obtuse in bud and have a much convoluted style. The material available, as in many *Cladocolea* species, is unfortunately inadequate. Thus I cannot be certain that the superposed pistillate spikes have any foliar leaves; it seems to me that they are leafless. The fruits drawn are not quite mature.

Mexico. PUEBLA: Huejotzingo, near Puebla, on *Crataegus*, 2900 m., *Arsène* 1749(2) (US, holotype of *C. glauca*; BM, GH, NY, isotypes); vicinity of Puebla, Cerro Tepoxuchil, 2330 m., *Arsène* 2268 (US); Tepoxuchil, on *Acacia*, *Nicolas* (BM).

8. *Cladocolea gracilis* Kuijt, sp. nov.

FIGURE 12.

TYPE: *Rzedowski* 17518 (see below).

Dioecia, glabra, sympodialis; rami tenues, teretes. Folia alterna, linearia, $10-20 \times 1-2$ mm., impetiolata. Inflorescentia determinata, ad partes anniculos vel vetustiores, basi foliis ca. 6; pistillata axi gracilissima attenuata, fructifera ad 20 mm. longa, floribus 3–4; staminata brevior, floribus ad 6. Flos hexamerus, ca. 5 mm. longus; stylus floris pistillati valde convolutus, staminati subrectus. Staminodia floris pistillati lori-

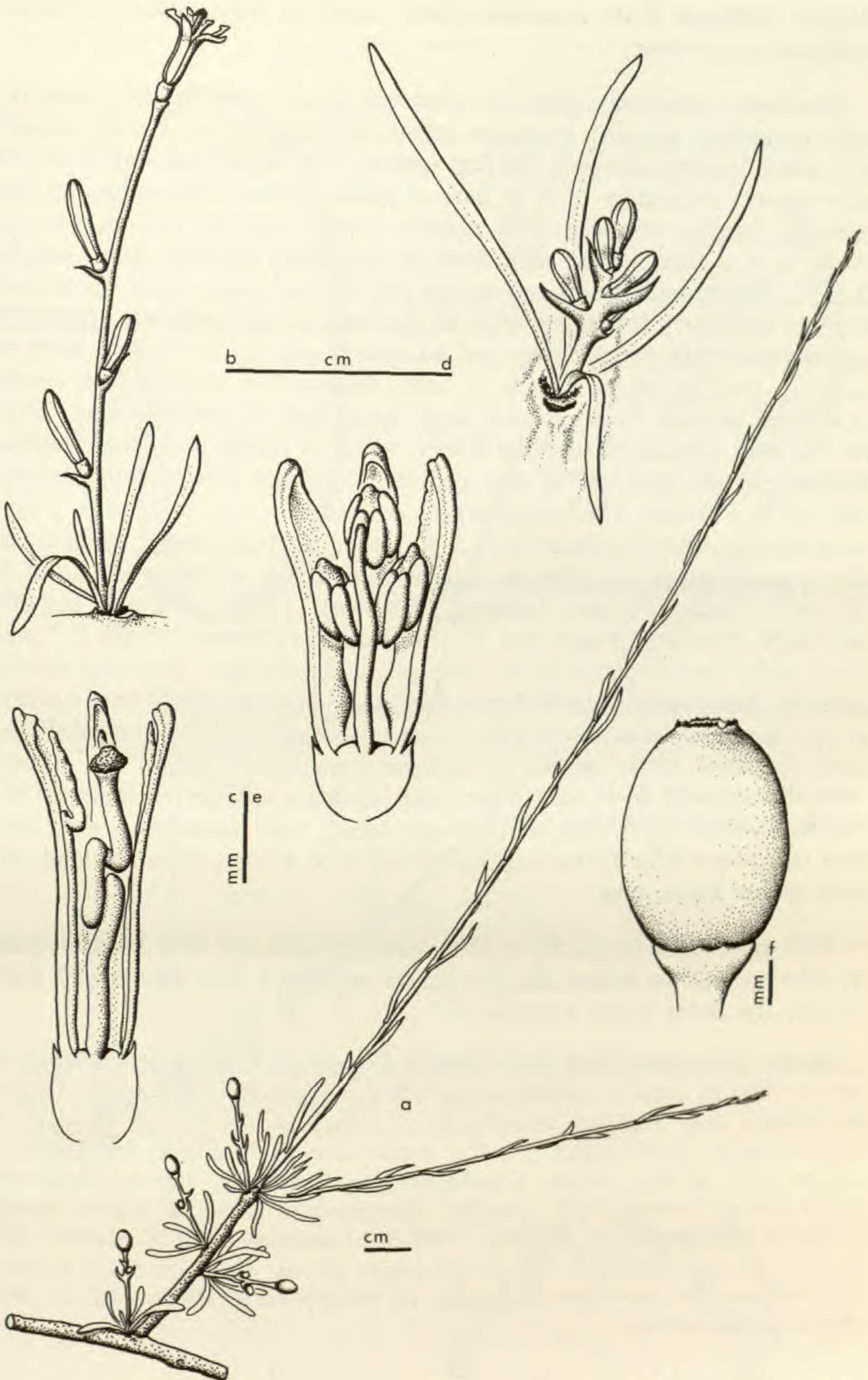


FIGURE 12. *Cladocolea gracilis*: a, habit, pistillate plant (*Rzedowski 17518*, MICH); b, pistillate inflorescence (*Rzedowski 22618*, MICH); c, pistillate flower, longitudinal section, same collection; d, staminate inflorescence, same collection; e, staminate flower, same collection; f, fruit (*Rzedowski 17518*, MICH).

formia; antherae floris staminati planis duobus, inaequalibus. Fructus ovoideus, 6×4 mm.

Dioecious, completely glabrous mistletoe about 1 m. in size, pendent, with sympodial growth; branches rather straight, terete, brown, dotted with small lenticels above in the first season, with occasional stem roots on older growth and larger roots at base of plant; craters discernible but not striking. Leaves alternate, with primary leaves only on current growth, $10\text{--}20 \times 1\text{--}2$ mm., linear, with acute or somewhat rounded apex; petiole absent. Inflorescences on one-year-old growth and older, with up to half a dozen secondary leaves crowded at the base of the peduncle: pistillate inflorescence with very slender and elongated axis up to 15 mm. long at anthesis, reaching up to 20 mm. in fruit; flowers 3–4, ebracteolate, sessile in axils of acicular bracts spaced along upper half of inflorescence, except for the very prominent terminal flower, which is sessile in a small cuplike structure at the tip of a 2–4 mm. pedicel; staminate inflorescence shorter, with up to 6 flowers, the bracts larger, sometimes almost foliaceous. Staminate flowers yellow, hexamerous, 4.5×1 mm., the bud oblong; anthers sessile or nearly so, at two different heights, both above middle of petal but of the same shape; filament buttress prominent; pollen trilobate, smooth, with faint triradiate groove but no triangular prominence; ovary 0.5 mm. long; style more or less straight; stigma undifferentiated. Pistillate flowers greenish, hexamerous, nearly 5 mm. long, very slender; petals very narrow, ca. 3.5 mm. long, staminodia narrow, strap-shaped, reaching the petal tips, their filaments often twisted at anthesis; ovary less than 1×1 mm., calyculus smooth; style ca. 2.5 mm. long, strongly convoluted in upper $\frac{2}{3}$; stigma capitate, somewhat pointed and lobed, with tubercular, dark surface reaching nearly to the petal tips. Fruit 6×4 mm., smooth, ovoid, but with rather blunt apex.

This extraordinary species at first sight reminds one of a larch because of its very narrow leaves and its clearly separated long shoots and short shoots, the latter being reproductive.

Mexico. GUERRERO: road above Canyon de Zopilote 8 km. E of Xochipala on way to Filo del Caballo from Milpillas, 850 m., *Breedlove 35998* (CAS); Canyon de Zopilote, near Milpillas, municipality of Zumpango del Río, on *Randia*, 750 m., *Rzedowski 22618* (MICH). JALISCO: municipality of Tecalitlán, near Gallardo, 10 km. NW of Tepalcatepec (Michoacán), on *Colubrina*, 500 m., *Rzedowski 17518* (MICH, holotype of *C. gracilis*). MICHOACÁN: Tancitaro region, municipality of Apatzingán, La Majada, 1200 ft., *Leavenworth & Hoogstraal 1410* (F, MO); old lava flow 4 mi. NW of Apatzingán, 300 m., *McVaugh 17937* (MICH); Tepalcatepec, flat areas near settlement, on *Podopterus mexicanus*, 400 m., *Rzedowski 16623* (MICH).

9. *Cladocolea grahami* (Bentham) Van Tieghem, Bull. Soc. Bot. France 42: 167. 1895. FIGURES 13 & 14.

Loranthus grahami Bentham, Plantae Hartweg. 62, 63. 1845.

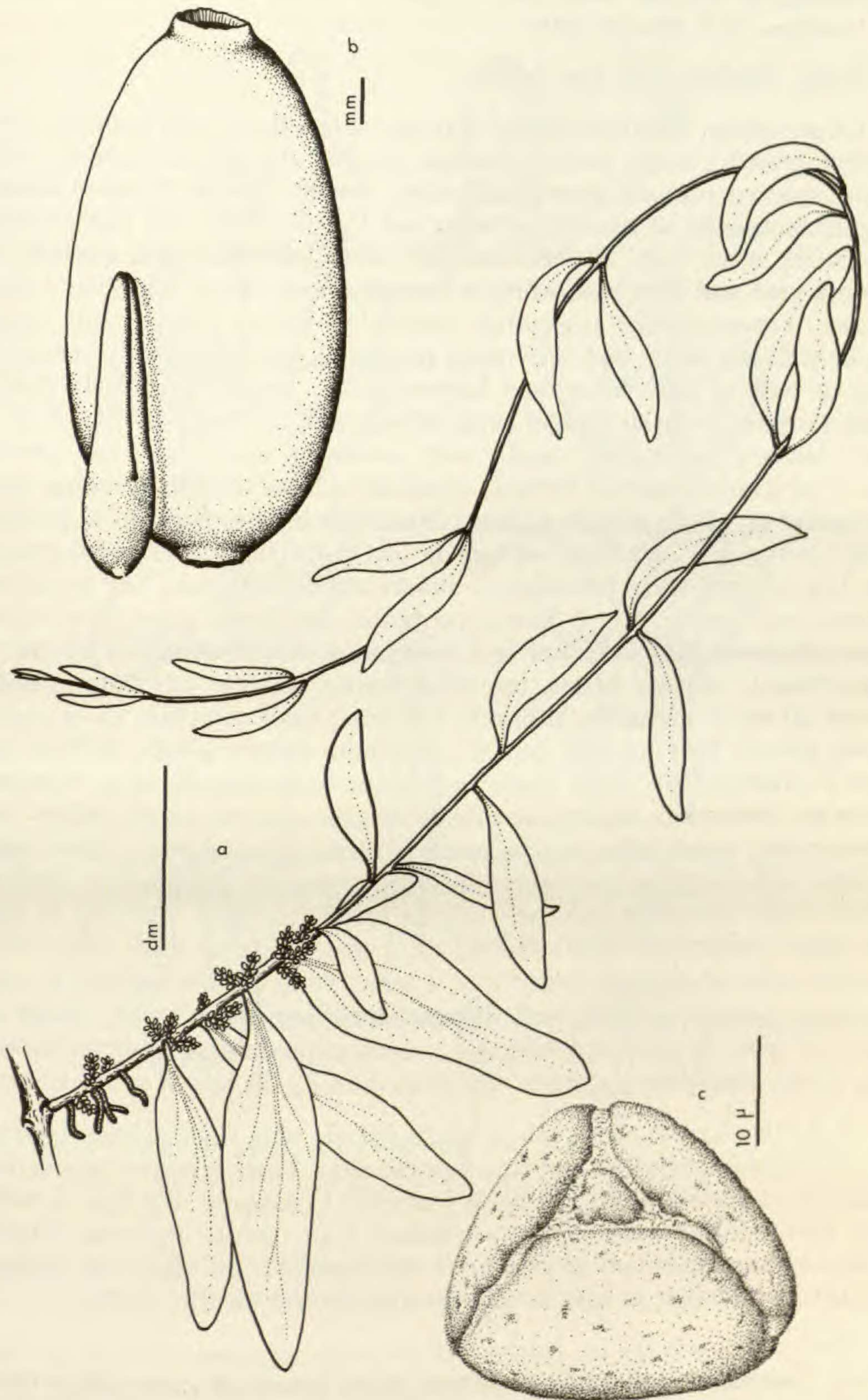


FIGURE 13. *Cladocolea grahami*: a, habit, staminate plant (Pringle 6987, P); b, fruit and embryo (Graham 235, K); c, pollen grain (Pringle 6987, G).

Struthanthus grahami (Bentham) Standley, Contr. U. S. Natl. Herb. 20(6): 212. 1919.

Oryctanthus grahami (Bentham) Engler in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 16b: 174. 1935.

TYPE: *Graham 235* (see below).

Large, coarse, dioecious plants, glabrous throughout, with possibly sympodial growth; stems terete, chestnut brown, straight or voluble, with stem roots on year-old growth and older; young, voluble shoots originating subterminally or laterally, growing out for 40–50 cm., not immediately producing stem roots or inflorescences; stem epidermis first smooth, in second year and later exfoliating in irregular, long strips, revealing a fine, brown, honeycomblike subdermal cellular structure; older stems sometimes with low ridges and with round lenticels; craters extremely conspicuous at base of innovations and inflorescences. Leaves irregularly decussate to quite irregular, yellow-green when fresh, $7 \times 2(-4)$ to 14×3 cm., leathery, lanceolate, usually with attenuate apex and base; petiole ca. 5×2 mm.; margin distinct; venation pinnate, midrib reaching apex or nearly so, often multiple at base. Staminate inflorescence up to 20 mm. long, peduncle 5 mm., first solitary in leaf axils, later in crowded groups of 4–6 per leaf axil; inflorescence bracts mostly caducous but persistent above, very small; 10–12 flowers per spike, the lowest paired, the upper ones alternate, and one flower in a terminal position, subtended by one or sometimes 2 unequal bracts, the other flowers oblique; pistillate inflorescence up to 15 mm. long, peduncle 1–2 mm., basic structure as in staminate, flowers 7–11, usually paired. Staminate flowers sessile, $4-7 \times 2-3$ mm., 6-merous, the buds ovate; calyculus with smooth edge; stamens strongly dimorphic; anthers at middle or near apex of petals, with 4 approximately equal pollen sacs; connective terminating in a very short cone; pollen with triradiate groove and included triangular prominence (FIGURE 13c); style somewhat undulate; stigma undifferentiated, reaching to base of upper anthers. Pistillate flowers ca. 5 mm. long; petals 6, with strap-shaped aborted anthers; ovary 1×1 mm.; style much contorted in mid-portion; stigma capitate, well differentiated, somewhat lobed. Fruit ca. 12×6 mm., dark-colored, ellipsoid, calyculus prominent; embryo clavate, ca. 7 mm. long, dicotyledonous, the cotyledons $\frac{2}{3}$ the length of the embryo.

A striking species which can be confused only with *Cladocolea pringlei* or *C. mcvaughii*, and with these only superficially. There seems to be a certain amount of variation in some floral features. Commonly, the tips of petals are held together in the bud by a papillate crest. In one instance (FIGURE 14f), a remarkable tuft of long hairs was observed just above the anthers, a tuft very similar to that in santalaceous flowers (Kuijt, 1969).

Mexico. *Graham 235* (K, holotype of *Loranthus grahami*). GUERRERO. Distr. Mina: Laguna, on oak, 1860 m., *Hinton 10149* (GH, K, MO, NY, US). JALISCO: NW slopes of Nevado de Colima, above Jazmín, 3 mi. below El Isote, on *Quercus*, 2500–2700 m., *McVaugh 10143* (MICH). MEXICO. Distr. Temascaltepec: Nanchititla, on oak, *Hinton 3107* (GH, K, MICH, NY, US); Pantoja, on oak, 1500

m., *Hinton 3550* (GH, K, MICH, US); Cumbre-Trojas, *Hinton 9021* (GH, K, MICH, US). MICHOACÁN: 8–10 mi. NW of Ciudad Hidalgo, a few mi. N of village of San Pedro Aguaro, on *Quercus*, 2500–2700 m., *McVaugh 9999* (MICH). MORELOS:

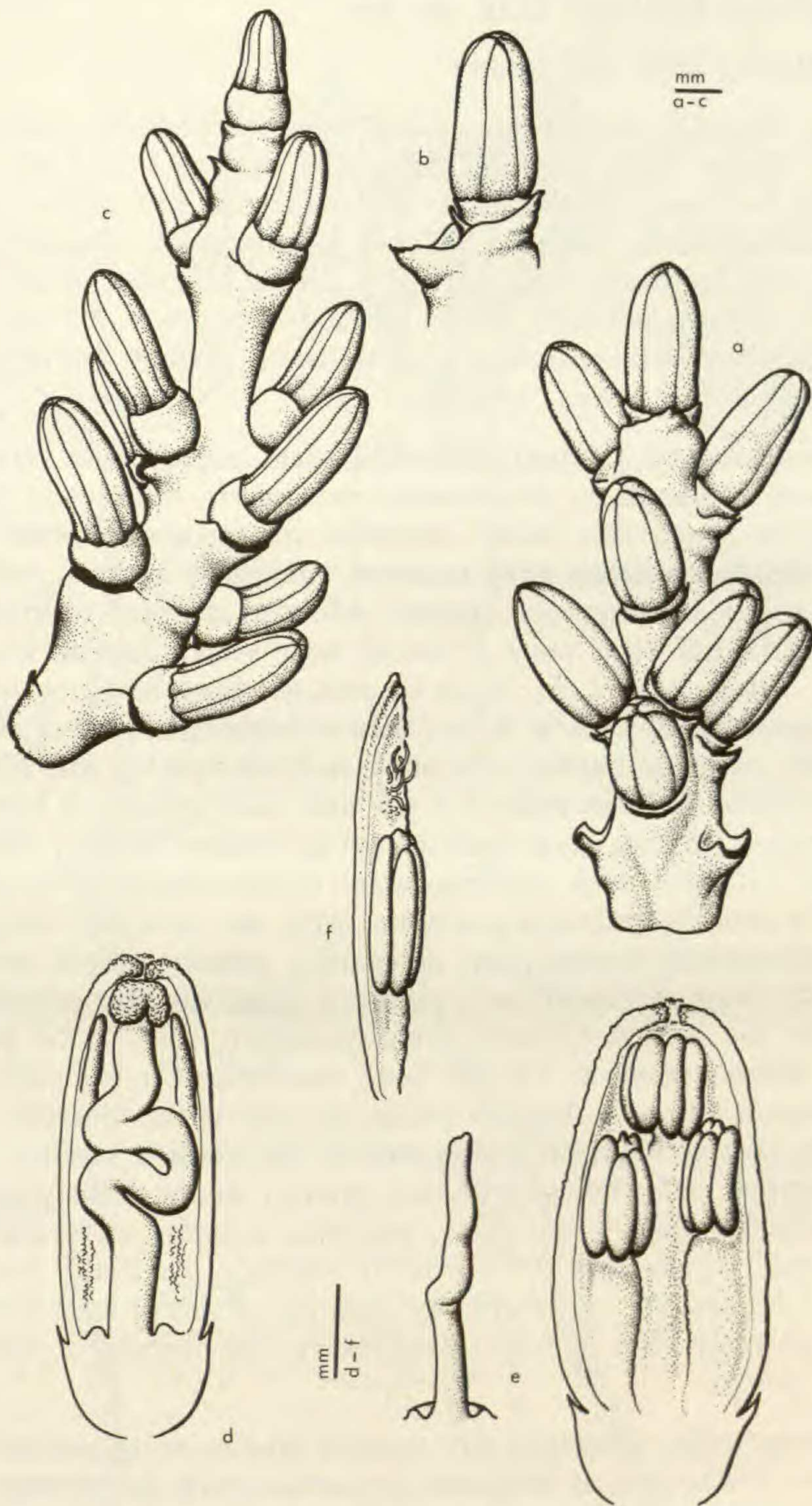


FIGURE 14. *Cladocolea grahami*: a, staminate inflorescence (*Pringle 6987, G*); b, terminal flower of another inflorescence, same collection; c, pistillate inflorescence (*Graham 235, K*); d, pistillate flower, longitudinal section, same collection; e, staminate flower and style, longitudinal section (*Pringle 6987, G*); f, petal and stamen, showing tuft of hairs above anther (*Hinton 3550, K*).

Sierra de Tepoxtlán, on oak, 7500 ft., *Pringle 6987* (BR, C, F, G, GH, GOET, K, M, NY, P, PR, S, UC, US).

10. *Cladocolea harlingii* Kuijt, sp. nov.

FIGURE 15.

TYPE: *Harling 6094* (see below).

Scandens, flexuosa, ramosissima, glabra, haud sympodialis; caules quadrangulares, virides. Folia juvenilia prehensilia, matura 3×1 cm., obovata; petiolus 4–5 mm., canaliculatus. Inflorescentiae pro axilla 1–4; axis tenuis, quadrangularis; flores ca. 15 pro inflorescentia, singulares, pedicellis ca. 1 mm. insidentes, unus terminalis, reliqui laterales, omnes bractea caduca sub pedicello subtenti. Flores bisexuales; petala 4, 2.5 mm. longa; antherae petalaeque monomorphica; stylus rectus, planum antherarum superans. Fructus 4×2 mm., ovoideus.

A sinuous, scandent, profusely branching plant, superficially very similar to, but much smaller than, *Struthanthus orbicularis*, completely glabrous, branching not sympodial; stems somewhat quadrangular, green; young leaves on slender branches stiffly recurved, prehensile as in *S. orbicularis*, i.e., the petioles swelling upon contact, allowing the leaf to grasp other objects; epicortical stem roots produced near such grasping leaves and elsewhere. Leaves 3×1 cm., blade lanceolate with acute base and apex; leaves occasionally up to 5×3 cm., then obovate; petiole 4–5 mm. long, canaliculate; venation pinnate, the single midvein running into apex, very prominent below. Inflorescences 1–4 per axil, one primary, 2 lateral, and one superposed, lacking basal scale leaves or evident craters; axis rather slender, ca. 0.5 mm. thick, quadrangular; flowers single, on 1 mm. long pedicels, in about 7 decussate pairs, and with one terminal, short-stalked flower (inflorescence development acropetal), equally spaced along axis, each lateral flower subtended by a caducous bract, the scar remaining evident below the pedicel. Flowers hermaphroditic, said to be yellowish-green or orange; petals 4, 2.5 mm. long, monomorphic, pointed; anthers also monomorphic, $\frac{1}{2}$ as long as petals, on very slight filament buttress, apparently lacking filament; pollen sacs 4, the inner 2 smaller than the outer 2; pollen with obvious triradiate groove; ovary slightly more than 1 mm. long, less than 1 mm. wide, calyculus smooth; style straight and rather stout; stigma well differentiated, capitate, papillate, reaching to just above the anthers; nectary fleshy, glabrous. Fruit at least 4×2 mm., ovate, apparently dark in color, the nectary ring forming a conspicuous "button" at apex.

This remarkable, geographically isolated species must undoubtedly be counted to *Cladocolea*, as indicated by inflorescence morphology, hermaphroditic 4-merous flowers, and monomorphic anthers. Paradoxically, its nearest relative (possibly its derivative) would seem to be *Struthanthus orbicularis*, as shown partly by general appearance, but particularly by the unique mode of parasitism in both mistletoes, where young leaves are used as grappling hooks to capture new host branches.

Ecuador. PROV. LOJA: road from Loja to La Tuna, km. 13-34, 1600-2600 m., *Dodson & Thien 1507* (UBC, UC, US); 16 km. S of Loja, lower than Cajanuma, 2000-2200 m., *Espinosa 16366* (NY); Cariamanga, road to Gonzanamá, 1700 m., *Harling 6015* (s); San Pedro, 2200 m., *Harling 6094* (s, holotype of *C. harlingii*);

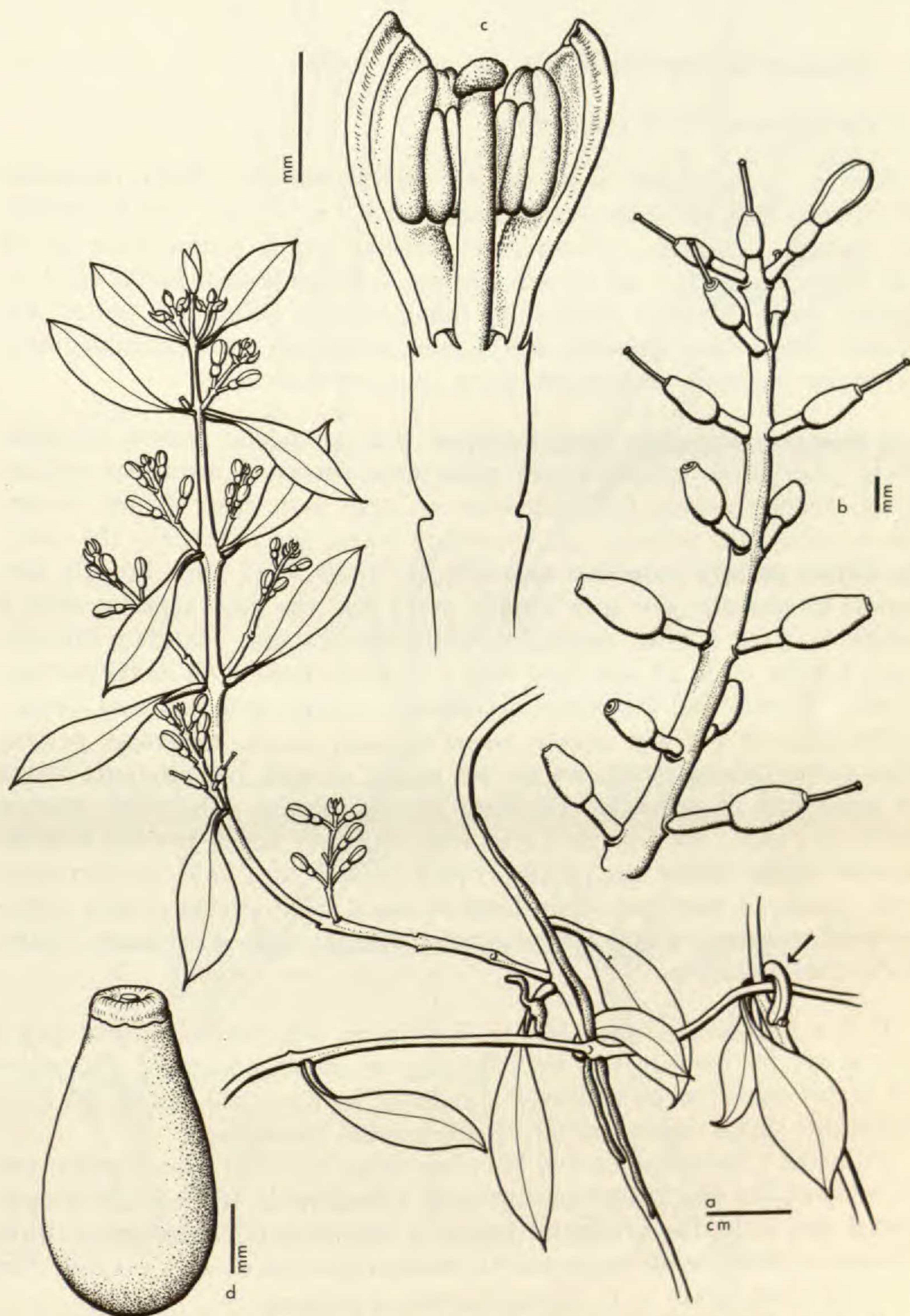


FIGURE 15. *Cladocolea harlingii* (*Harling 6094*, s): a, habit, showing prehensile petiole (arrow), epicortical stem roots, and flowering branch; b, inflorescence with young fruits; c, flower, longitudinal section; d, mature fruit.

Cerro Villonaco, 7–12 km. W of Loja, 8000–9000 ft., *Sparre 16295* (s); Cariamanga, 7210 ft., *Townsend a-27* (us); 46 km. SE of Cariamanga, 1750 m., *Wiens 3800* (UT); 70 km. SE of Pinas, 1500 m., *Wiens 3781* (UT); 28 km. S of Catamayo on road to Macara, on Compositae, 2020 m., *Wiens 3792* (UT); Cerro Villonaco, 7–12 km. W of Loja, 8000–9000 ft., *Wiggins 10964* (UT).

11. *Cladocolea hintonii* Kuijt, sp. nov.

FIGURE 16.

TYPE: *Hinton 10148* (see below).

Dioecia, sympodialis; rami teretes, recti, puberuli. Folia decussata vel alterna; folia primaria secundariaque ad 20×12 mm., late lanceolata vel obovata, puberula. Inflorescentia pistillata spica pedunculata ad 25 mm. longa; flores 3–5, ad apicem sessiles; folia secundaria nulla vel 1–3, alterna, parte inferiore pedunculi; inflorescentiae solum ad partes aniculos. Flores dense puberuli, 4×1 mm., hexameri; petala anguste linearia; stylus tenuis, 3 mm. longus, parte exteriori convolutus.

A dioecious, relatively small mistletoe with sympodial growth, straight, terete, puberulent branches, and puberulent leaves; innovations subterminal, slender; craters fairly obvious; no stem roots seen. Leaves decussate to alternate; primary and secondary leaves approximately the same, the former perhaps somewhat narrower, up to 20×12 mm., broadly lanceolate to obovate, the apex usually acute and the base tapering into a petiole ca. 2×1 mm.; venation pinnate but obscure. Pistillate inflorescence a spike up to 25 mm. long with 3–5 sessile flowers on distal portion, usually alternate but sometimes subopposite, always with terminal flower; spikes only on year-old growth where primary leaves no longer persist, some spikes lacking foliage leaves, but nearly all with 1–3 alternate leaves on lower half of peduncle. Pistillate flowers densely puberulent, mature bud 4×1 mm.; the 6 petals 3 mm. long, narrowly linear, bearing a small, aborted anther above the middle; ovary ca. 1.5×1 mm. or narrower; style slender, 3 mm. long, convoluted in distal half; stigma clearly differentiated, somewhat lobed and tubercular; nectary with short hairs. Staminate plant unknown.

It is a pleasure to honor Mr. G. B. Hinton, who seems to have had a special eye for mistletoes in his collecting in southern Mexico. The major set of his mistletoe collections is deposited at Kew and forms the most significant single source, by far, in the present monograph.

Although *Cladocolea hintonii* has clear affinities with *C. loniceroides* and *C. microphylla*, the distinctions are very considerable. *C. hintonii* is sympodial and lacks the involucre leaves or bracts of *C. loniceroides*, while the latter difference also separates it consistently from *C. microphylla*. The fruit and male plant of *C. hintonii* await description.

Mexico. GUERRERO: Distr. Mina, Laguna, on oak, 1860 m., *Hinton 10148* (K, holotype of *C. hintonii*), 1800 m., *Hinton 10151* (NY).

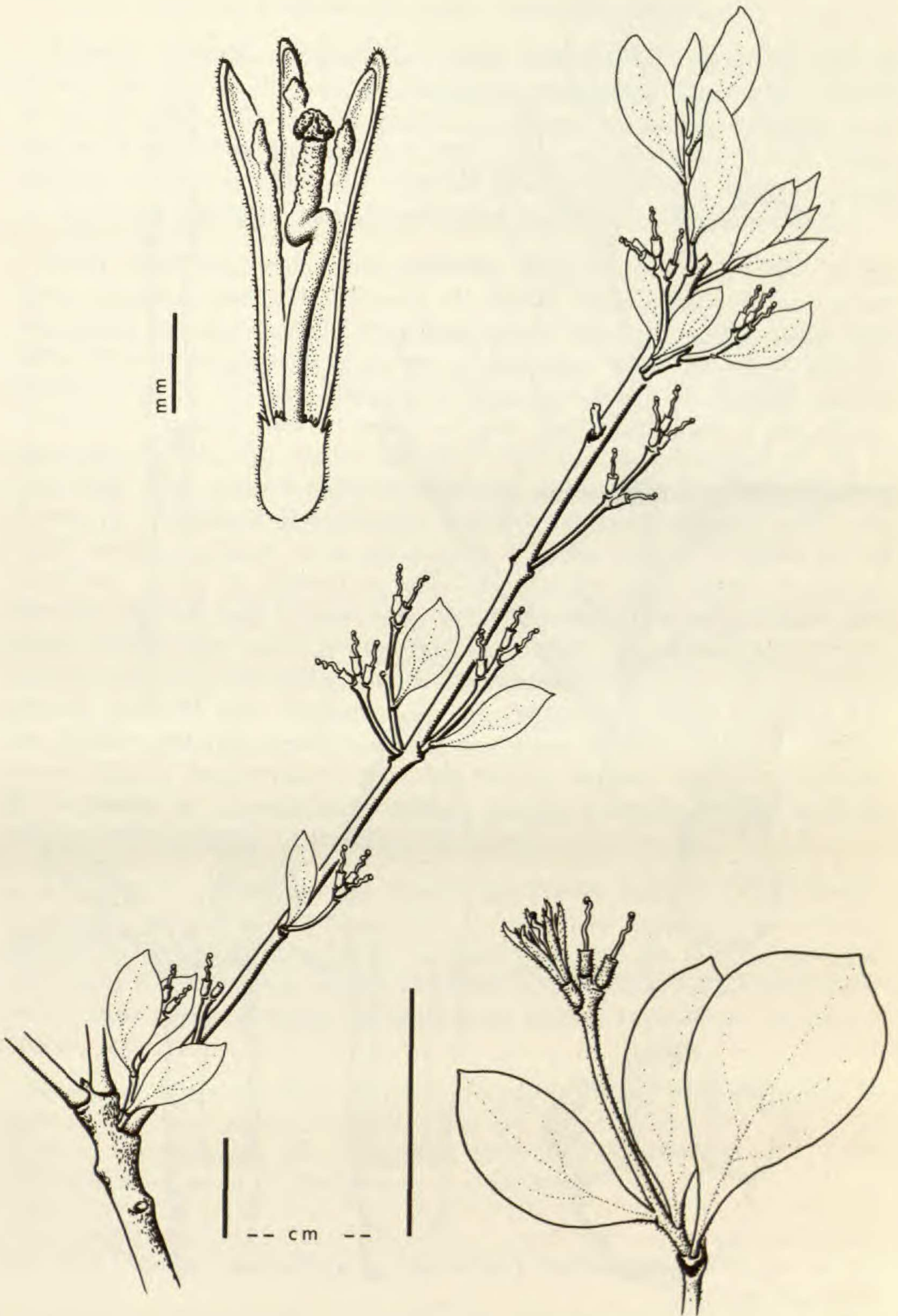


FIGURE 16. *Cladocolea hintonii*, pistillate plant (*Hinton 10148*, κ): habit, inflorescence, and sectioned flower.

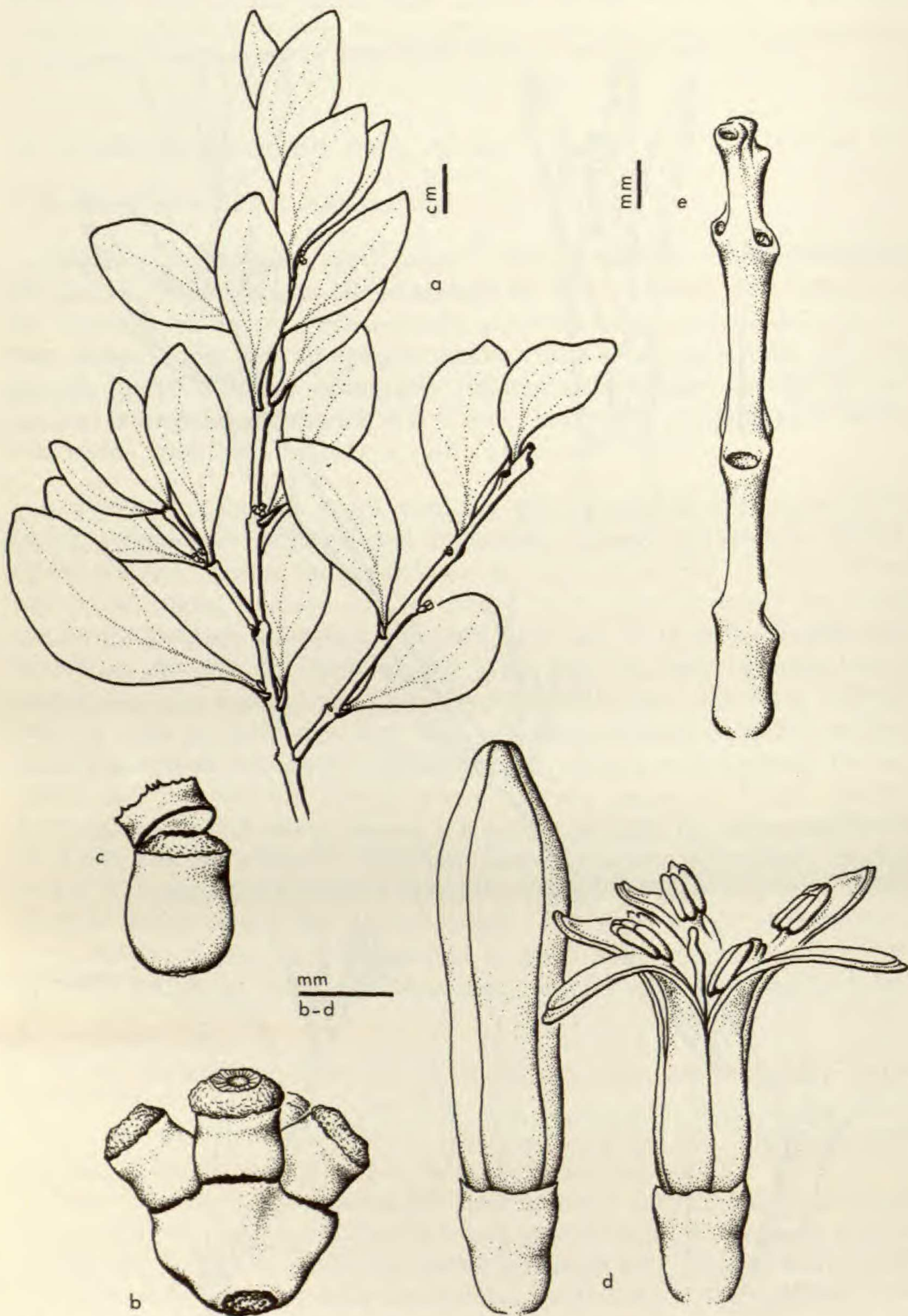


FIGURE 17. *Cladocolea hondurensis*: a, habit (Yuncker, Dawson, & Youse 6220, K); b, very young fruit on nearly sessile inflorescence, same collection; c, same, showing circumscissile calyculus; d, staminate flower and bud (Molina & Molina 13922, F); e, inflorescence axis, same collection.

12. *Cladocolea hondurensis* Kuijt, sp. nov.

FIGURE 17.

TYPE: *Yuncker, Dawson, & Youse 6220* (see below).

Dioecia, glabra, sympodialis. Folia irregulariter decussata vel alterna, subcoriacea, obovata vel lanceolata, rotundata, basi acuta; lamina 40×25 mm. Inflorescentia pistillata axillaris, subsessilis, solitaria, floribus ca. 4 sessilibus geminatis. Inflorescentia staminata ad 15 mm. longa, floribus sessilibus, decussatis, paribus ca. 4; flos 6 mm. longus; petala 5; antherae biseriatae, sacculi polliniferi quaterni; stylus fere rectus.

Plant dioecious, leafy, and glabrous, with sympodial growth; young stems straight, somewhat grooved or ridged; craters conspicuous around vegetative laterals, scarcely so around spikes; no stem roots or basal roots seen. Leaves irregularly decussate to alternate, rather leathery, the leaf blade ca. 40×25 mm., obovate to lanceolate, the apex rounded and the acute base tapering into a petiole 4–5 mm. long and at least 1 mm. thick; venation pinnate but rather obscure. Staminate inflorescence up to 15 mm. long, with about 4 pairs of decussate, sessile flowers, lacking terminal flower(?). Pistillate inflorescence axillary, on year-old wood only, virtually sessile, solitary, with apparently 4 sessile flowers arranged in two decussate pairs, the flowers in axils of caducous scale leaves. Staminate flowers: mature bud 6 mm. long; petals 5; anthers at two heights, just above middle and near tip of petals, each with 4 equal pollen sacs; connective scarcely protruding; pollen smooth, trilobate, with faint triradiate groove; ovary 1 mm.; calyculus smooth; style more or less straight; stigma undifferentiated, nearly reaching the upper anthers. Pistillate flowers: ovary slightly longer than 1 mm., the flaring, dentate calyculus apparently deciduous in circumscissile fashion, leaving a rough, circular scar; no other pistillate flower or fruit details known.

This species, although very imperfectly known, may be rather distantly related to *Cladocolea mcvaughii*. In superficial appearance it reminds one of an *Antidaphne*, or even *C. andrieuxii*, but the few inflorescences seen leave no doubt that we are concerned with a distinct species of *Cladocolea*. Indeterminate spikes are also known from *C. cupulata*, *C. mcvaughii*, and *C. pringlei*.

Honduras. DEPT. LA PAZ: Cordillera Guajiquiro, 5 km. from Sabanetas, on *Quercus*, 2100 m., *Molina & Molina 13922* (F). DEPT. COMAYAGUA: hills above plains of Siguatepeque, near El Achote, 1350 m., *Yuncker, Dawson, & Youse 6220* (GH, holotype of *C. hondurensis*; F, K, isotypes).

13. *Cladocolea inconspicua* (Bentham) Kuijt, comb. nov.

FIGURES 1a, 18, 19.

Loranthus inconspicuus Bentham, Bot. Voy. Sulphur. 102. 1844 [1845].

Phthirusa inconspicua (Bentham) Eichler in Martius, Fl. Brasil. 5(2): 67. 1868.

Struthanthus inconspicuus (Bentham) Standley, Contr. U. S. Natl. Herb. 20: 212. 1919.

TYPE: *Hinds 346* (see below).

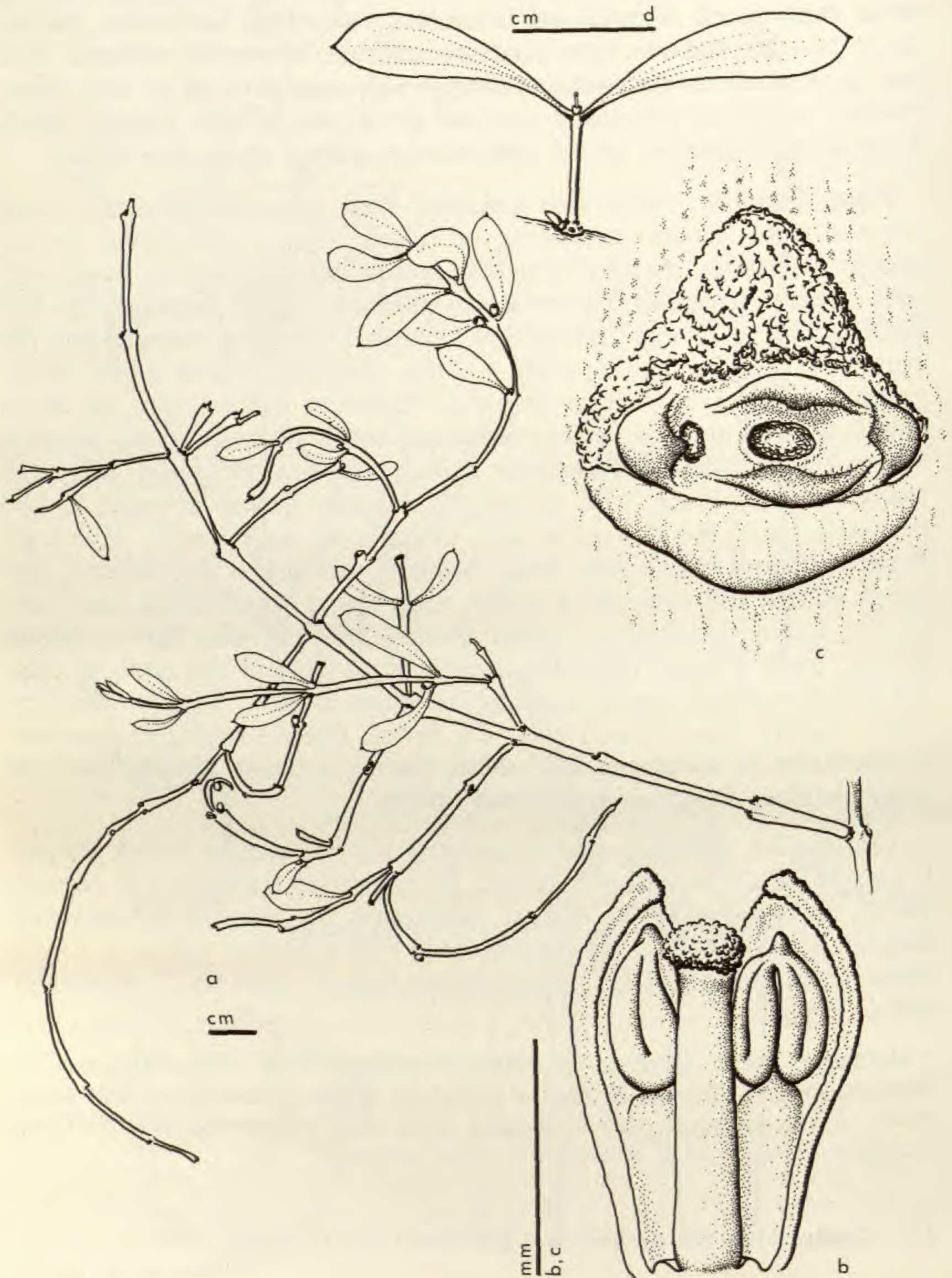


FIGURE 18. *Cladocolea inconspicua*: a, habit (*Hinds 346*, κ); b, flower, longitudinal section (*Ortega 632*, κ); c, axillary cushion, bracts, and flower scars (*Palmer 531*, BM); d, lateral branch with two leaves and single, terminal flower (*Wiens 2494*, WTU).

Plant a small, much branched, stiff mistletoe with simple graftlike haustoria lacking any sign of other roots (FIGURE 1a), with sympodial growth, each twig with up to 12 internodes, more commonly with about 6, the lateral branches paired; stems somewhat compressed ancipitally when young, becoming terete in age, then with irregular, longitudinal cracks; young stems greenish-gray, essentially glabrous but for papillar bulges of epidermal cells; stomata (and other epidermal cells) in regular longitudinal files, the guard cells transversely oriented; axillary cushions distinct (FIGURE 18c), triangular, light brown and somewhat hairy, on young twigs only, but craters scarcely discernible. Leaves decussate, up to 22×9 mm., usually much smaller, glabrous, oblanceolate to obovate, with rounded to acute or mucronate apex, often with callose "nail," the latter a remnant of the densely hairy scalelike tip visible in young, expanding leaves, tapering at base into a petiole 2–3 mm. long; midvein running into the apex, sometimes with 2 additional veins standing out. Flowers hermaphroditic, occurring singly in the axils of foliage leaves, sometimes followed by 2 more developing in the axils of the paired scale leaves of the first flower; each flower sessile but subtended by 2 minute scale leaves with white-hairy margins and papillate dorsal surfaces; some older nodes showing evidence of further flower production. Mature bud 2.5 mm. long; petals 4, rarely 3; anthers 1 mm. long, monomorphic on very short filaments attached at the middle of the petal with conspicuous buttresses below, connective projecting well above the 4 pollen sacs; pollen smooth, with three rather bulbous lobes, each with a circular, shallow depression; ovary 1 mm.; style straight; stigma just above anthers, well differentiated, papillate; nectary smooth. Fruit 2×3 mm., red, smooth, broadly ellipsoid; embryo nearly spherical but for the 2 cotyledons, 1.5×1 mm.

It is indeed tempting to compare *Cladocolea inconspicua* with the remarkable *Ixocactus* (Kuijt, *Brittonia* 19: 62–67. 1967), which is similar in general appearance, though leafless. *Ixocactus*, however, has a pollen grain which is unique not only in Loranthaceae but also in the Santalales in general; it also has dimorphic anthers, each of which has only 2 pollen sacs, and a conical, short style. The closest relatives of *C. inconspicua* are *C. inorna* and *C. clandestina*.

It is of some interest that an occasional flower develops in a terminal position, between two normal foliage leaves, on a small lateral branch one internode long (FIGURE 18d). The occurrence of such "inflorescences" lends support to the contention that single, axillary flowers represent the final stage in reduction from a several-flowered, determinate inflorescence.

Mexico. Between Tepic and Mazatlán, *Gregg 1116* (MO). GUERRERO: Acapulco and vicinity, *Palmer 531* (BM, F, GH, K, MO, NY, UC, US). NAYARIT: near Mexcaltitlán, *Ortega 6162* (GH, UC, US). SINALOA: vicinity of Culiacán, Yerba Buena, *Brandegge* (UC); Culiacán, *Brandegge* (UC); above Cofradia, NE of Imala, 450 m., *Breedlove 35588* (CAS); vicinity of Labradas, on *Croton niveus*, *Ferris & Mexía 5166* (CAS); Imala, on *Zanthoxylum*, *Gentry 4996* (GH, MICH, NY); Capadero, Sierra Tacuichamona, on *Mimosa palmeri*, *Gentry 5636* (GH, NY); Culiacán and vicinity, 150–500 ft., *Gentry 7056* (CAS, F, GH, MICH, NY, UC, US); San

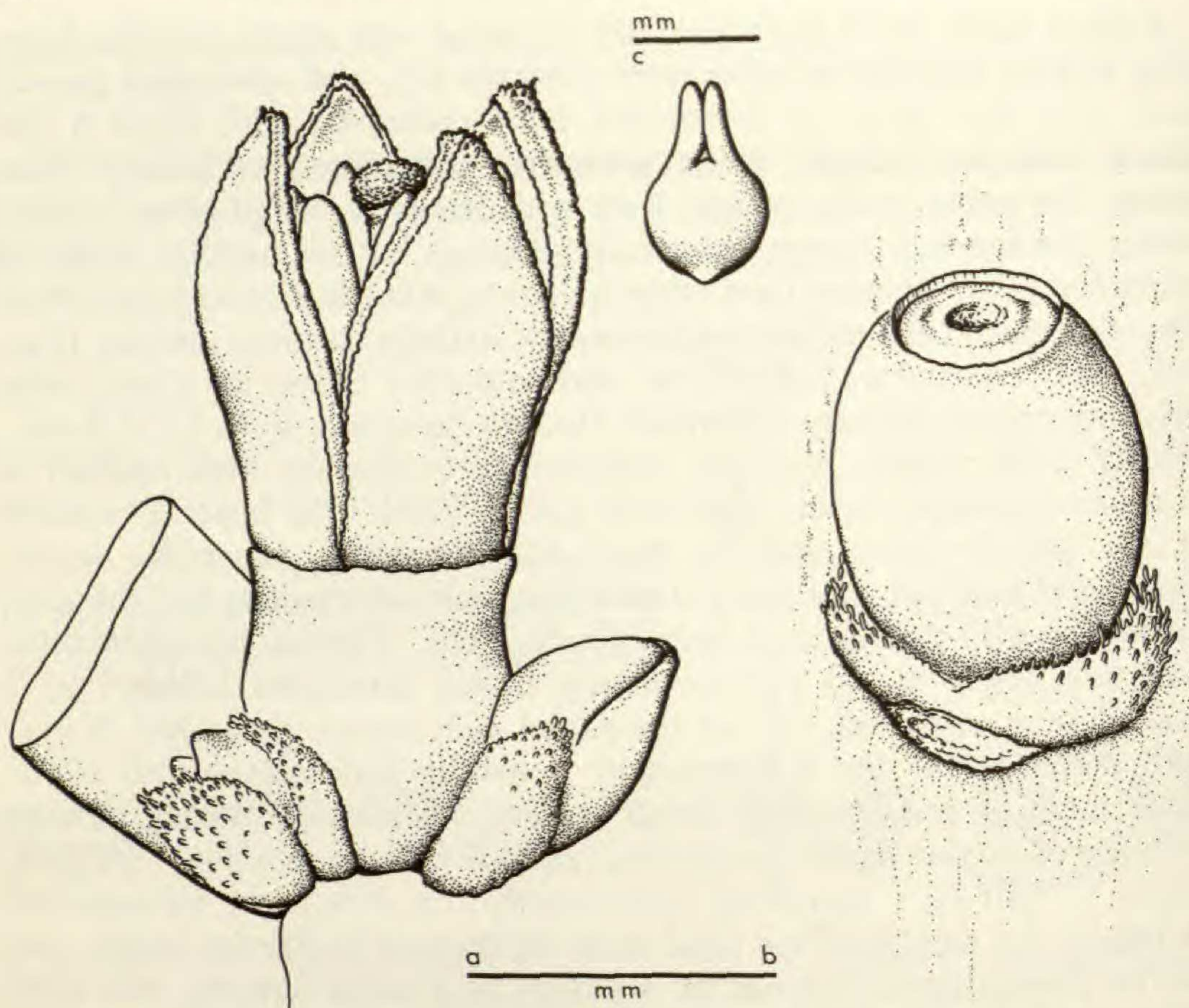


FIGURE 19. *Cladocolea inconspicua*: a, flower with two lateral flower buds (Ortega 632, K); b, mature fruit (Palmer 531, BM); c, embryo, same collection.

Blas, *Hinds* 346 (K, holotype of *Loranthus inconspicuus*); "La Noria" foothills, wooded N slope S of village, 800 ft., *Mexia* 321 (C, CAS, MO, UC); trail from Los Labrados to Marisma, 5 m., *Mexia* 970 (CAS, F, GH, MO, NY, UC, US); San Ignacio, San Agustín, 185 m., Ortega 632 (F, K); Culiacán, Palmer 1796 (GH, US); vicinity of Mazatlán, on *Randia*, Rose, Standley, & Russell 13746 (US); ca. 40 mi. N of Mazatlán on Mex. route 15, thorn forest, sea level, Wiens 2494 (CAS, UC, US, UT; voucher, $n = 8$).

14. *Cladocolea inorna* (Robins. & Greenm.) Kuijt, comb. nov.

FIGURE 20.

Loranthus inornus Robinson & Greenman, Am. Jour. Sci. 50: 163, 164. 1895.
Struthanthus inornus (Robins. & Greenm.) Standley, Contr. U. S. Natl. Herb. 20(6): 212. 1919.

TYPE: L. C. Smith 122 (see below).

Extremely slender, brittle, profusely branching mistletoe, 56–60 cm. in size, with sympodial branching (no lateral branches formed within each season); stems terete, glabrous, gray-green, with fine longitudinal ridges when dry, apparently lacking both stem roots and basal roots. Leaves irregularly alternate-decussate, the former arrangement predominating, gray-green, the largest leaves up to 15×3 mm., oblanceolate, with acute

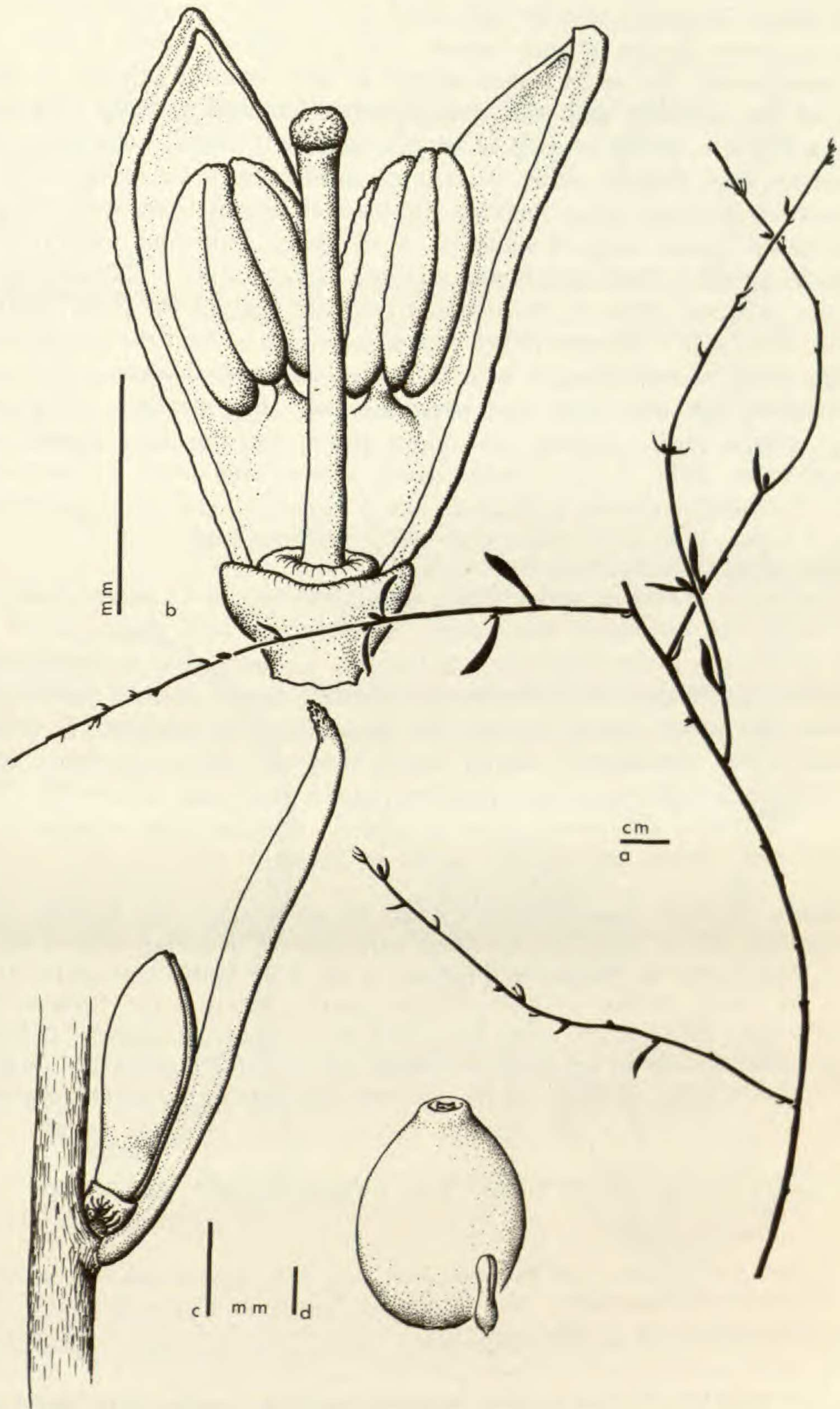


FIGURE 20. *Cladocolea inorna*: a, habit, b, flower with two petals removed, and c, axillary flower bud (all from *Smith 122, GH*); d, fruit and embryo (*McVaugh & Koelz 1019, MICH*).

base and acute, sclerotic, and papillate apex; petiole indistinct or absent; most leaves, however, acicular and about 5×1 mm.; youngest leaves, at least on lower portion of each branch, with a fringe of brownish hairs, as on scale leaves; the scale leaves several at very base of laterals, 1 mm. long or less, sclerotic and with reddish-brown lacinate margins. Flowers hermaphroditic, sessile in axils of leaves, commonly single, sometimes followed by later flowers, either in axils of subtending scale leaves or in a superposed position, often flanking the base of lateral branches. Mature buds acute, 3 mm. long, of which ca. $\frac{1}{6}$ is ovary; calyculus more or less smooth; petals 4; both petals and stamens monomorphic; filament short, slender, attached about $\frac{1}{3}$ the distance from the base of the petal; anther 1 mm. long, with 4 elongate pollen sacs which reach beyond the connective; pollen either of two types or with two faces, one with 3 obscure, circular depressions, the other with faint triradiate line; style straight, 2–2.5 mm. long; stigma small, capitate, just above anther tips; nectary smooth, inconspicuous. Fruit 5×3.5 mm., ovoid, smooth and black at maturity, calyculus not prominent; endosperm nearly spherical, embryo dicotyledonous, 1.5 mm. long, both endosperm and cotyledons pink.

Cladocolea inorna is undoubtedly closely related to *C. inconspicua*, as Robinson and Greenman recognized. At the same time there cannot be any question as to the distinctness of the two. *C. inorna* has predominantly alternate leaves that are lanceolate to acicular; terete, smooth stems; and pollen sacs which extend beyond the connective. In contrast, *C. inconspicua* shows consistently paired leaves that are elliptic-obovate; compressed stems with a papillate epidermis; and a projecting connective. Several other minor differences could be added. Another close relative is *C. clandestina*, which, surprisingly, grows in Brazil.

Mexico. JALISCO: mountainsides 6.5 mi. NE of Autlán, near highway pass, on legumes, 925 m., *McVaugh & Koelz 1019* (MICH); N-facing slope 2 mi. W of Autlán, *Wilbur & Wilbur 1666* (MICH); 8 mi. S of Autlán toward La Resolana, on *Cassia*, *Wilbur & Wilbur 2400* (MICH). MICHOACÁN: between Río Tepalcatepec and Arteaga, along highway S from "Cuatro Caminos," 3 km. S of Nueva Italia and 30 km. E of Apatzingán, 225 m., *McVaugh 22521*⁴ (MICH). OAXACA: Cuicatlán, 2000 ft., *Smith 122* (GH, holotype of *Loranthus inornus*).

15. *Cladocolea loniceroides* (Van Tieghem) Kuijt, comb. nov.

FIGURES 1b, 21, 22.⁵

Loxania loniceroides Van Tieghem, Bull. Soc. Bot. France 42: 387. 1895.

Struthanthus loniceroides (Van Tieghem) Engler in Engler & Prantl, Nat. Pflanzenfam. ed. 2. 16b: 173. 1935.

⁴The collection *McVaugh 22521* is added provisionally only, as it shows some significant differences (densely puberulent; leaves obovate, up to 10 mm. wide, with truncate, mucronate apex; fruit red at maturity) and may, when further material becomes available, warrant nomenclatural distinction.

⁵See also Calderón & Rzedowski, Cact. y Sucul. Mex. 17: fig. 59. 1972.

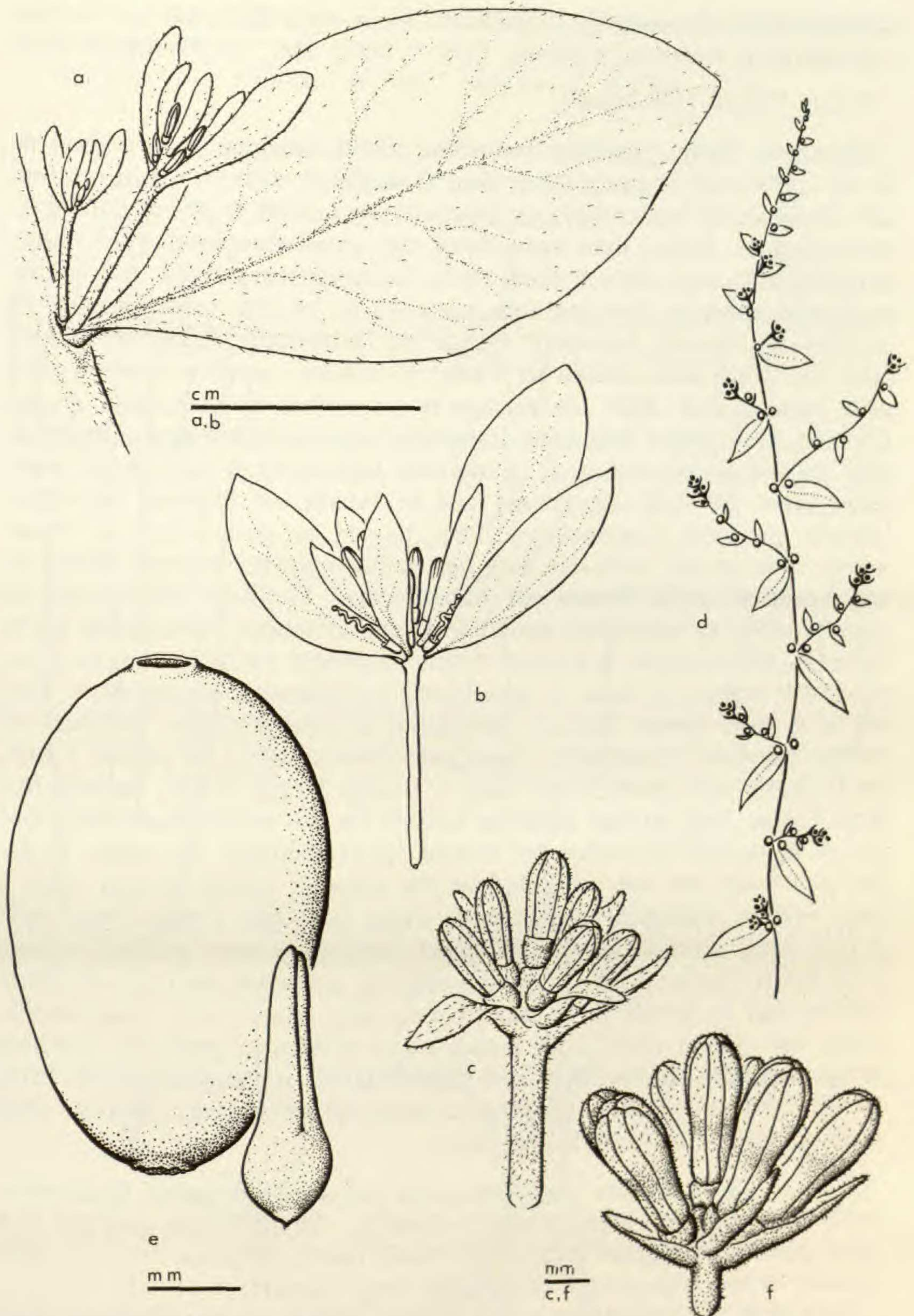


FIGURE 21. *Cladocolea loniceroides*: a, pistillate inflorescences and leaf (*Hinton* 3796, G); b, pistillate inflorescence, large-bracted type (*Hinton* 4112, K); c, pistillate inflorescence, small-bracted type (*Pavón*, s.n., P); d, diagrammatic representation of a complex flowering branch, staminate (*Hinton* 10458, K), black dots = flowers, small circles = young inflorescences; e, fruit and embryo (*Hinton* 3152, K); f, staminate inflorescence, small-bracted type (*Hinton* 3840, K).

Struthanthus hunnewellii I. M. Johnston, Contr. Gray Herb. 95: 53, 54. 1931.
Struthanthus mexicanus Calderón, Cact. y. Sucul. Mex. 17: 99–102. 1972.

TYPE: *Pavón* (see below).

Dioecious, leafy, profusely branching plants reaching 2 to several m. in size, pubescent or finely puberulent throughout, with growth percurrent and continuously branching, only exceptionally tending to sympodial habit; stems slender, terete, light tan-colored, not exfoliating even when older; plants lacking stem roots or basal roots; craters inconspicuous. Leaves decussate to alternate, soft and thin, up to 35×15 mm. (more usually 25×10 mm.), broadly lanceolate with acute (sometimes slightly attenuate) apex and acute base; petiole very short or lacking; venation pinnate, midvein running into apex. Inflorescences sometimes in compound groups (FIGURE 21d), where they show transitions between larger lateral branches and individual inflorescences. Staminate inflorescences one or 2, sometimes more per axil, superposed and/or lateral, or flanking vegetative laterals; peduncle 1–several mm. long, topped by an involucre of bracts 4 mm. long or less, each one with one axillary flower, terminal flower always present; 6–10 flowers per inflorescence. Pistillate inflorescence in same position as staminate; peduncle 3 mm. or longer, occasionally up to 15 mm. long, slender; involucral bracts extremely variable, ranging from squamate organs or linear 4 mm. bracts to foliaceous organs more than 10×5 mm. (outer bracts), decreasing in size inwardly; numbers of flowers same as in staminate. Staminate flowers said to be yellow, 4 mm. long; petals more than 3 mm. long, 6 (rarely 5) per flower; anthers less than 1 mm. long, at two different heights on the petals, dorsifixed more or less in middle of anther by slender, short filament; the inner 2 pollen sacs lower but not smaller than the outer 2; pollen smooth, with a faint central, triangular prominence; ovary less than 1 mm. long; style 3 mm. long, straight except for slight undulation near anthers; stigma little differentiated; base of style invested by pubescent nectary. Pistillate flowers said to be white, at least 3 mm. long; staminodia strap-shaped; ovary less than 1 mm.; style contorted in middle or upper $\frac{2}{3}$, reaching to tip of petals; stigma fairly well differentiated; nectary pubescent. Fruit ca. 5×3 mm., obovoid, glabrous, turning red at maturity; embryo dark green, clavate, the 2 cotyledons linear.

This seems to be the most commonly collected species of *Cladocolea*, even though its geographic range is limited. The holotype at Paris is a small pistillate specimen with rather small bracts (FIGURE 21c). *C. loniceroides* is the type species of *Loxania* Van Tieghem.

Several of the collections at MICH from Jalisco are very delicate in all structural details and have only squamate floral bracts. The main characteristics of *Cladocolea loniceroides* apply, however, and the specimens are here included. Also unusual is the Guerrero collection *McVaugh 150*, which, besides having squamate bracts, has leaves that are nearly orbicular. A further questionable specimen is *Rzedowski 16372*. It has extremely fine branches and foliage, squamate inflorescence bracts, and, in apparent

contrast to other collections of *C. loniceroides*, secondary haustoria from a thick basal root.

"Attracts large numbers of bees" (*Wilbur & Wilbur 1838*).

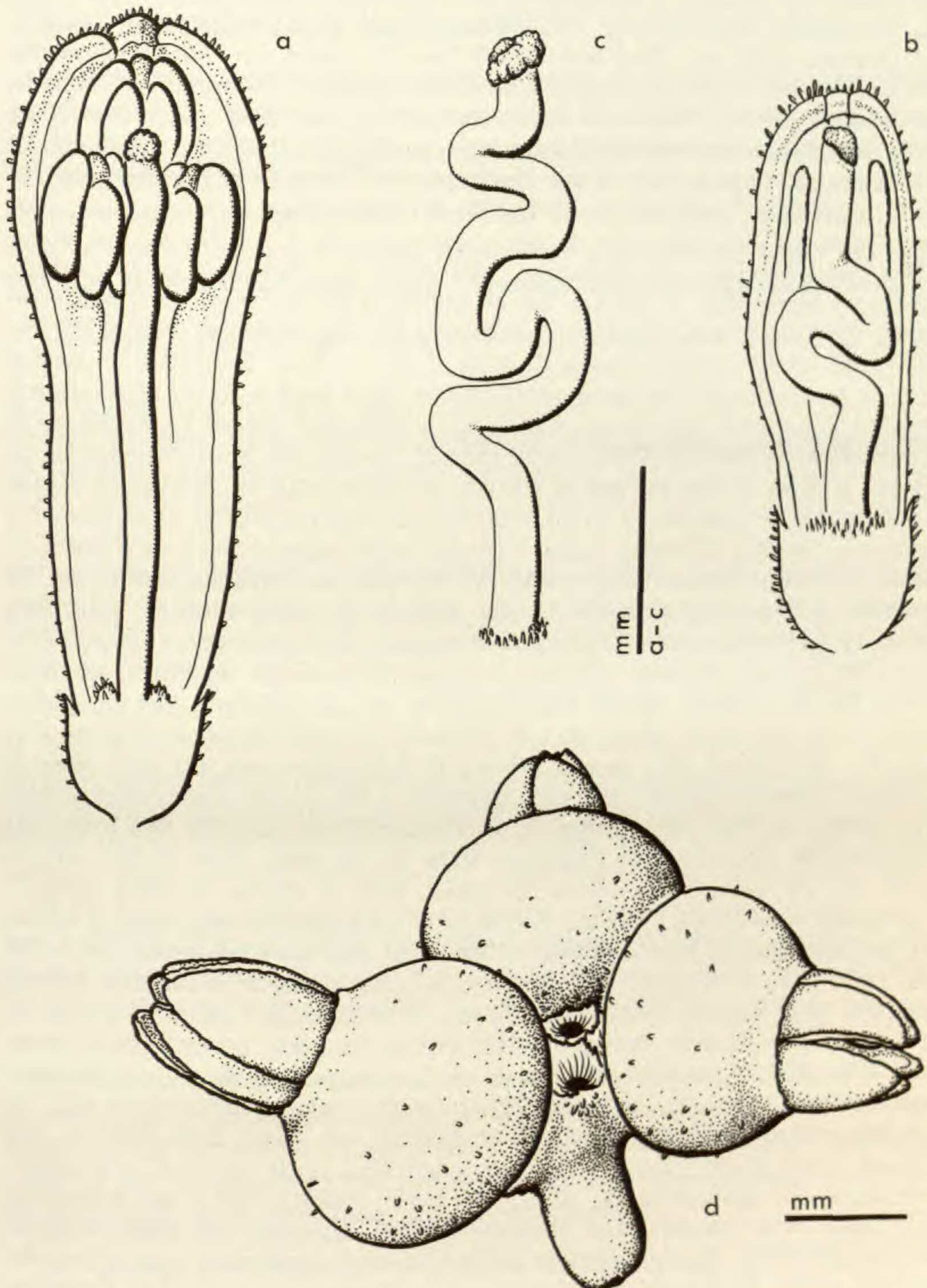


FIGURE 22. *Cladocolea loniceroides*: a, staminate flower, longitudinal section (*Hinton 3840*, K); b, pistillate flower, longitudinal section (*Pavón s.n.*, P); c, style of pistillate flower (*Hinton 4112*, K); d, insect galls resembling small fruits on staminate plant (*Hinton 10689*, K).

Mexico. *Pavón* (P, holotype of *Loxania loniceroides*); *Sessé, Mociño, Castillo, & Maldonado* 927, 4957 (F). GUERRERO. Distr. Mina: Manchón, on oak, *Hinton* 10458 (K, MO, NY, US); Aguazarca-Filo, on oak, *Hinton* 10500 (GH, K, US); Pilas, 1600 m., *Hinton* 10689 (K, WTU); 2 km. NE of Campamento El Gallo, estribaciones suroccidentales del Cerro Teotepec, on *Alnus*, 2650 m., *McVaugh* 150 (MICH); Chichihualco, near Camotla, Campo de Aviación, 2250 m., *Rzedowski* 16372 (MICH); Chichihualco, Cerro de la Pastilla, near Camotla, on *Quercus*, 2300 m., *Rzedowski* 16437 (MICH); same, on *Ostrya virginiana*, *Rzedowski* 16451 (MICH); Puerto Chico, Chichihualco, 10 km. W of Camotla, on *Alnus*, 2500 m., *Rzedowski* 18000 (MICH); 16 km. E of Aserradero Aqua Fria, Tlacotepec, on road to Chilpancingo, on *Populus*, 2400 m., *Rzedowski & McVaugh* 270 (CAS, MICH); below Omiltemi, on *Ostrya*, 6400 ft., *Sharp* 441572 (GH); vicinity of Omiltemi, ca. 60 km. W of Chilpancingo, on Compositae, 2000 m., *Tillett* 637-153 (GH, US). JALISCO: mountains N of Autlán, 3-5 mi. above Mina San Francisco, on Malvaceae, 1500-1650 m., *McVaugh* 19918 (MICH); Sierra de Manantlán, 25-30 km. SE of Autlán, 8-10 km. E of La Cumbre between El Chante and Cuzalapa, on *Eupatorium mairetianum*, 2000-2250 m., *McVaugh* 23159 (MICH); Sierra de Halo, 7 mi. SSW of Tecalitlán, on lumber road to San Isidro, on *Baccharis*, 2000-2200 m., *McVaugh & Koelz* 1129 (MICH); wooded slopes S of road above pass 10 mi. S of Autlán toward La Resolana, on Compositae, *Wilbur & Wilbur* 1420 (MICH); mountains E of Mamantlán ca. 15 km. SSE of Autlán by way of Chante, on *Alnus*, 8300 ft., *Wilbur & Wilbur* 1838 (MICH); Pacific slopes 10 mi. S of Autlán, 5200 ft., *Wilbur & Wilbur* 2162 (MICH). MEXICO: Tiloxtoc, below Valle de Bravo, edge of river, on *Salix*, *Converse* 83 (UBC); Mexico City, corner of Marsella and Nápoles streets, on *Ligustrum*, *Gimate Leyva* (MICH); 4 km. SSE of Luvianos, 1500 m., *Roe, Roe, Mori, & Rzedowski* (UT); Distr. Temascaltepec: Temascaltepec, 1750 m., *Hinton* 636 (K, US); Bejucos, 610 m., on brazil, *Hinton* 930 (K, MICH, NY, US); Acatitlán, on a cirian, *Hinton* 3152 (K, MICH, NY, US); Calera, 770 m., *Hinton* 3796 (G, GH, K, MICH, NY, S, UC, US); Rincón, 1960 m., on peach, *Hinton* 3840 (K, NY, US); Nanchititla, on oak, *Hinton* 4112 (K, MICH, NY, UC, US); same on "espino," *Hinton* 4115 (K, NY, US); Telpintla, 1840 m., on peach, *Hinton* 4255 (K, MICH, MO, NY, US); 10 km. S of Temascaltepec, *Moreno* 164 (CAS, US). MICHOACÁN: km. 150 S of Zitácuaro, 8600 ft., on *Alnus*, *Barr & Barr* 64-553 (CAS, US); El Salto S of Morelia, on *Alnus*, *Barr & Dennis* 64-304A (UC); S. Torricillas, Coalcomán, 2400 m., *Hinton* 15022 (GH, MO, NY, US); road N of San Felipe Los Alzati to San Cristóbal, 12 km. N of Zitácuaro, on *Alnus*, 2300-2500 m., *Iltis, Iltis, & Koeppen* 318 (MICH); S-facing slopes of mountains between Río del Salto and La Polvilla, ca. 18 mi. E of Morelia, 7200-8000 ft., on leguminous tree, *King & Soderstrom* 5105 (MICH, NY, SMU, UC, US); steep mountain sides NW of Aguililla 6-7 km. S of Aserradero Dos Aguas, on *Baccharis* and *Vernonia*, 2000 m., *McVaugh* 22732 (MICH); near summits 8-12 km. SW of Aserradero Dos Aguas, nearly W of Aguililla, on *Alnus*, 2250-2400 m., *McVaugh* 22791 (MICH); 3-6 km. S of Aserradero Dos Aguas, nearly W of Aguililla, on *Baccharis*, 2000-2100 m., *McVaugh* 24662 (MICH); same, on *Rumfordia*, *McVaugh* 24681 (MICH); Las Manzanillas, near Zitácuaro, on *Alnus*, 2150 m., *Rzedowski* 28122 (ENCB, holotype of *Struthanthus mexicanus*; CAS, MICH, isotypes); same, *Rzedowski* 28123 (CAS, MICH). MORELOS: woods N of Cuernavaca, on *Alnus*, 2100 m., *Hunnewell* 11854 (GH, holotype of *Struthanthus hunnewellii*); Cuernavaca, on *Quercus*, *Kenoyer* A-501 (MICH); km. 59 of Mexico City — Cuernavaca road, *Lundell & Lundell* 12328 (MICH, NY, UC, US); ca. 6 mi. N of edge of Cuernavaca on old road to Mexico City, on *Alnus*, 6500 ft., *Mickel*

1678 (NY, UBC); lava beds near Cuernavaca, on *Solanum refractum*, 5000 ft., Pringle 7362 (F, US); 10 km. N of Cuernavaca (km. 65), on *Alnus*, Rzedowski 18481 (CAS, US). OAXACA: road between Juquila and Napala, Nelson 2421 (US).

16. *Cladocolea mcvaughii* Kujit, sp. nov.

FIGURE 23.

TYPE: *McVaugh 15008* (see below).

Dioecia, sympodialis, glabra, caulibus rectis vel sat volubilibus, interdum radicibus. Folia alterna vel decussata, 50–100 × 30–30 mm., lanceolata, basi apiceque saepe aliquantum attenuata. Inflorescentiae pistillatae 10–20 mm. longae, floribus 8–12, staminatae ad 35 mm. longae, floribus 10–14, ut videtur, indeterminatae; flores sat remoti. Flores pistillati 4 × 1 mm., staminati 5–6 × 1.5 mm., hexameri, stylus pistillatorum valde convolutus, staminatorum fere rectus. Stamina staminodiaque dimorphica.

Dioecious, completely glabrous mistletoe, with sympodial growth; stems straight or voluble, terete, light cinnamon-brown when young, becoming gray-brown with age and often crowded with small, transverse lenticels; craters obvious; stem roots occasional on older growth. Leaves alternate to decussate, 50–100 × 20–30 mm., lanceolate, acute to rounded or sometimes slightly attenuate at apex, acute at base, tapering into a dorsiventrally flattened petiole 5–10 mm. long, 1–3 mm. wide; leaf margins smooth, not brown or callose; venation obscurely pinnate, lower midrib never multiple. Inflorescences developing axially after branches fully expanded(?), also on previous year's growth. Staminate inflorescence seen only axillary to foliage leaves (midsummer), one per axil, up to 35 mm. long, only sometimes terminating in a (bracteate) flower; flowers 10–14, widely spaced or paired along upper $\frac{3}{4}$ of inflorescence, nearly perpendicular to axis; bracts mostly persistent, acute. Pistillate inflorescence 10–20 mm. long at anthesis, 1–several per axil, axis 1.5 mm. thick, the 8–12 flowers mostly paired but often irregularly so, terminal flower often but not always lacking, when present, subtended by small scale leaves with acute, caducous tip. Staminate flowers light yellowish green, hexamerous, 5–6 × 1.5 mm.; anthers 0.5 mm. wide, dimorphic, attached to petals at middle and $\frac{2}{3}$ the distance from the base, 1 mm. long; pollen smooth, trilobate with triradiate groove and triangular prominence. Pistillate flowers yellow-green, 4 × 1 mm., hexamerous, the petals narrow, strap-shaped and provided with pale yellow staminodia at two slightly different levels, attached at and slightly above the middle; ovary 1 mm.; style much convoluted along its entire length; stigma well differentiated, obliquely capitate, reaching $\frac{3}{4}$ the length of the petals. Fruits not seen, infructescence axis elongating up to 40 mm. long before fruits mature.

This species is reminiscent of *Cladocolea grahami* and *C. pringlei*, with which *C. mcvaughii* undoubtedly has affinities. It can be distinguished from them on the basis of the elongated (and, in the pistillate, elongating) inflorescence axis; the orientation and shape of the staminate buds; and the lack of the "multiple vein" character typical of the leaves of *C. gra-*

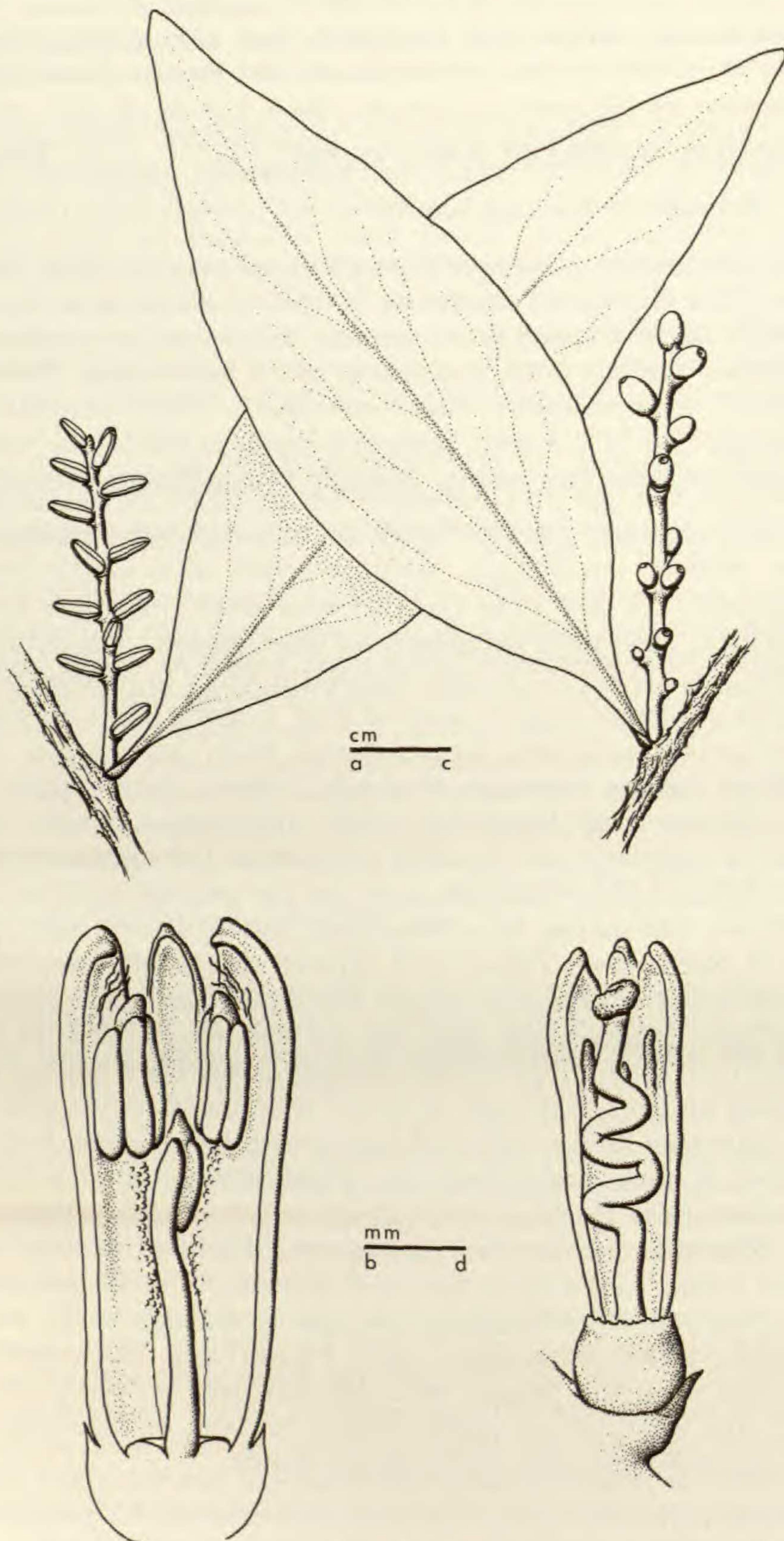


FIGURE 23. *Cladocolea mcvaughii*: a & b, staminate inflorescence and flower, the latter in longitudinal section (*McVaugh 15008*, MICH); c, pistillate inflorescence (*Rzedowski 17404*, MICH); d, pistillate flower in longitudinal section (*McVaugh 12193*, MICH).

hami and *C. pringlei*. One of the most consistent vegetative distinctions is the smooth leaf margin, which in the above two species is invariably brown, and callose or corklike.

It is a pleasure to name this species after Dr. Rogers McVaugh of the University of Michigan, long-time student of the flora of Jalisco (one of the most crucial *Cladocolea* areas) and collector of some of the most important material not only of the species named for him, but also of several other species of *Cladocolea*.

Mexico. JALISCO: oak-pine forest near summit of pass 7–8 mi. NW of Los Volcanes, along road between Ayutla and Mascoto, on *Quercus*, 1800–1900 m., *McVaugh 12193* (MICH); near summits, Sierra del Cuale, SW of Talpa de Alende, SW of Piedra Rajada, on *Quercus*, 1800–2250 m., *McVaugh 14353* (MICH); Sierra del Halo, near lumber road leading to San Isidro, 2–5 mi. from Colima highway 7 mi. SSW of Tecalitlán, on *Quercus*, 1400–1500 m., *McVaugh 15008* (MICH, holotype of *C. mcvaughii*); same, but 13–16 mi. from Colima highway, on *Quercus*, 2000–2200 m., *McVaugh & Koelz 1211* (MICH); municipality of Jilotlán, Sierra del Coral, on *Quercus*, 1400 m., *Rzedowski 16635* (MICH); Llano Verde, near Los Corales, municipality of Tecalitlán, Sierra de Los Corales, on *Quercus macrophylla*, *Rzedowski 17404* (MICH). MEXICO: W of Toluca, hills W of Jordana, on *Quercus*, *Gregg 722b* (MO); 2 km. NW of Nanchititla, municipality of Tejupilco, on *Quercus*, 1900 m., *Rzedowski 22120* (MICH). NAYARIT: 3 km. W of Mazatlán, on *Quercus aristata*, 800 m., *Rzedowski 17914* (MICH). SINALOA: Pacific Coast Highway, on Highway 40 near Porterillos, on *Quercus*, 4600 ft., *Wiens 4415* (UT).

17. *Cladocolea microphylla* (H.B.K.) Kuijt, comb. nov.

FIGURES 2, 24, 25.

Loranthus microphyllus H.B.K., Nov. Gen. Sp. Pl. 3: 439 (*quarto ed.*), pl. 300. 1820.

Phthirusa microphylla (H.B.K.) Blume, in Schultes & Schultes, Syst. Veg. 7(2): 1730. 1830.

Struthanthus microphyllus (H.B.K.) G. Don, Gen. Hist. Dichlam. Pl. 3: 413. 1834.

Loxania microphylla (H.B.K.) Van Tieghem, Bull. Soc. Bot. France 42: 387. 1895.

TYPE: *Bonpland* (see below).

Plant dioecious, white-puberulent, half a meter or more in size, with sympodial growth; stems terete, straight, primary leaves only on current growth, year-old growth often with many reddish-brown lenticels; craters very obvious, also reddish-brown; stem and basal roots absent. Leaves alternate to decussate, mostly the former, 5–30 × 2–10 mm., lanceolate, acute at apex and base; petiole 2 mm. or less; leaf margin and base puberulent. Inflorescences only on year-old growth (rarely a few on older twigs), one (pistillate) or 1–2 (staminate) per axil, the latter in a superposed position where it occurs; peduncle 2–12 mm. (rarely nearly lacking), terminated by capitulum with several foliar involucre bracts which subtend the lowest flowers; upper flowers with minute bracts or (the ter-

minal flower) ebracteate; flowers usually about 6; some individuals consistently with 1-2 leaves on lower peduncle, these leaves lacking flowers. Staminate flowers pale yellow to orange, 3-4 × 1-2 mm. in bud, 6-partite; anthers with 4 pollen sacs, the inner 2 somewhat lower than the outer 2;

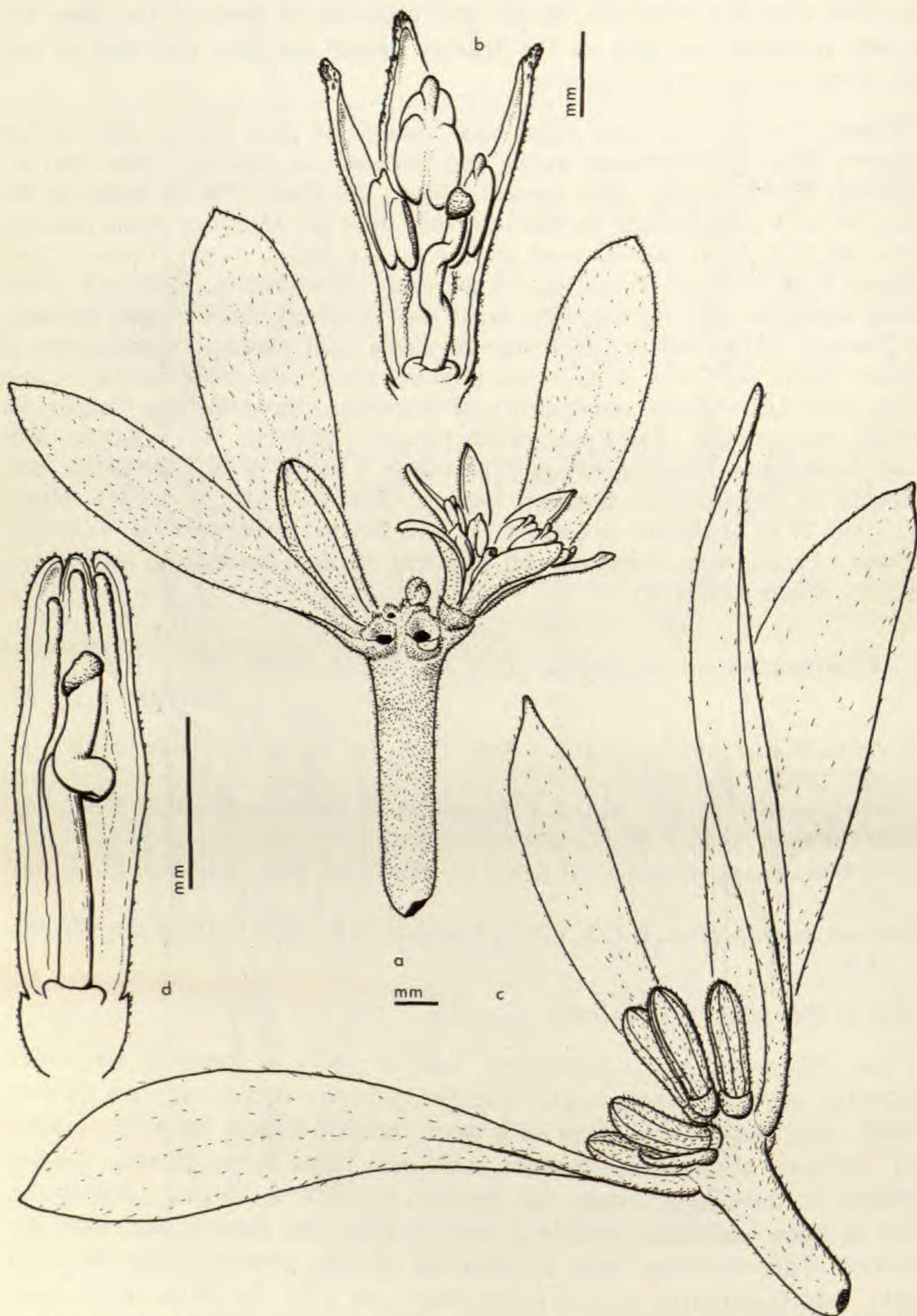


FIGURE 24. *Cladocolea microphylla*: a & b, inflorescence and longitudinal view of staminate flower (*Pringle 4369*, M); c, pistillate inflorescence, d, pistillate flower in longitudinal section (both from *Troll 593*, M).

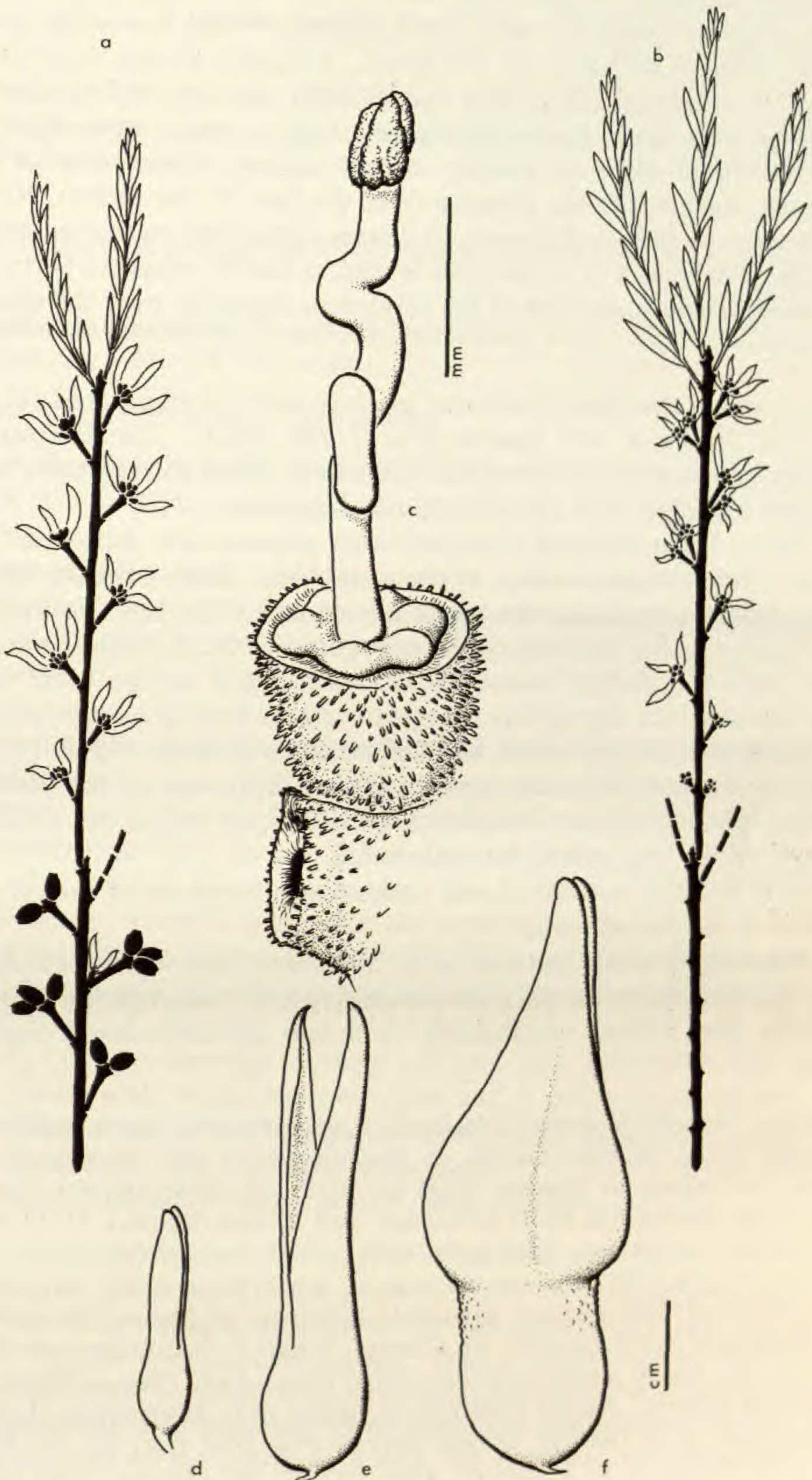


FIGURE 25. *Cladocolea microphylla*: a & b, diagrammatic representation of branching pattern of pistillate (*Troll 593, M*) and staminate (*Pringle 4369, M*) plants respectively; c, gynoecium, pistillate flower with highly convoluted style (*Frye & Frye 2601, SMU*); d-f, stages in embryo development (*Troll 593, M*).

the anthers dimorphic, upper ones above, lower ones at or slightly below middle of petal; ovary 0.5 mm.; style slightly twisted in middle; stigma capitate, situated half-way up the flower. Pistillate flowers greenish-yellow, 4–5 × 1 mm.; petals 6, very narrow, with very slender inconspicuous staminodia near tips; ovary slightly less than 1 mm.; style slightly or much convoluted above the middle; stigma capitate, often somewhat lobed and acute, reaching $\frac{3}{4}$ the distance from the base of the flower. Nectary in both types of flowers glabrous; all flowers puberulent on ovary and back of petals. Fruit ca. 7 × 4 mm., an orange to scarlet, ellipsoid berry; embryo dicotyledonous, the tips of the cotyledons emerging from the spherical endosperm.

This is one of the three *Cladocolea* species previously illustrated (H.B.K., Nov. Gen. Sp. Pl. 3: 439 (*quarto ed.*) *pl.* 300. 1820). The illustration is generally accurate but gives no hint of the long shoots with primary leaves. The type specimen is in exceedingly poor condition.

As far as I can discover, flowering takes place in late spring and early summer. Innovations develop at the same time. Both primary and secondary leaves remain on the plant all summer. By late November or early December the first inflorescences begin to break through the cushions in the axils of primary leaves. All leaves are still on the plant at this time, but they are apparently dropped more or less simultaneously with the resumption of vegetative and inflorescence growth (April ?); none remain at the next flowering season. Mature fruits are on the plant during the flowering season, but they may well ripen earlier, as a full year seems a rather long period for maturation.

A more detailed and illustrated account of emergence of lateral shoots is given in the introduction.

The species is often confused with *Cladocolea loniceroides*, which, however, does not share the peculiar periodicity of *C. microphylla* and seems to flower more or less continuously. The two are nevertheless closely related.

Mexico. "Nouvelle Espagne," Moricand (G, possibly an isotype instead); "Nova Hispania," Sessé, Mociño, Castillo, & Maldonado 926 (F). JALISCO: N slopes, Nevado de Colima, on *Quercus*, 2400 m., McVaugh 10146 (MICH); Sierra del Halo, 5 km. toward San Isidro on lumber road, Colima highway 11–12 km. SW of Tecalitlán, on *Quercus*, McVaugh 24492 (MICH); base of Nevado de Colima, on oaks, Pringle 4369 (F, G, GH, GOET, K, M, MICH, NY, P, S, UC, US). MEXICO: 5 km. WSW of Villa Victoria, on road to Zitácuaro, on *Quercus mexicana*, 2550 m., Rzedowski 28127 (MICH); La Ciénaga, 4 km. S of Sultepec, on *Quercus*, 2350 m., Rzedowski 30389 (CAS, US), 30390 (CAS); Distr. Temascaltepec, Comunidad, on *Quercus*, Hinton 7689 (GH, K, MICH, US). MICHOACÁN: Lake Pátzcuaro, 3 km. W of Quiroga, on oak, Frye & Frye 2601 (GH, MO, NY, SMU, UC, WTU); ca. 18 mi. S of Pátzcuaro, 8900–9000 ft., on *Quercus*, King & Soderstrom 5196 (MICH, NY, SMU, UC, US, WTU); 6 mi. N of Tancitaro, mountain slope, on *Alnus*, 8500 ft., Leavenworth 340 (F, GH, MICH, MO, NY); "Cerritos de Agua," 3 mi. below lumber camp at Dos Aguas, nearly W of Aguililla, 2000–2100 m., McVaugh 17839 (MICH); Los Manzanillas, near Zitácuaro, on *Quercus*,

2150 m., *Rzedowski 28125, 28126* (CAS, MICH); Tangancicuaro, near Cerezos, base of Cerro Patambán, on *Quercus*, 2300 m., *Rzedowski & McVaugh 652* (MICH); Mil Cumbres between Morelia and Ciudad Hidalgo, 2400 m., on *Quercus*, *Troll 593* (G, M). MORELOS: Cuernavaca, *Bonpland* (P, holotype of *Loranthus microphyllus*); El Mirador, near road from Cuernavaca to Mexico City, 2000 m., *Williams 3820* (GH).

18. *Cladocolea oligantha* (Standley & Steyermark) Kuijt, comb. nov.
FIGURE 26.

Struthanthus oliganthus Standley & Steyermark, Contr. Field Mus. Nat. Hist. (Bot. Ser.) 23: 154, 155. 1944.

TYPE: *Steyermark 50672* (see below).

Plant dioecious, sparsely branched, completely glabrous, with sympodial growth; stems rather stout and straight, terete, first light colored, later dark brown and often with a sprinkling of rather large, transverse lenticels; one-year-old wood (bearing secondary inflorescences) with shrunken bark, as if cortex very fleshy; no basal or stem roots seen. Leaves alternate, 20–30(–45) × 8–10(–16) mm., lanceolate to oblanceolate, acute to rounded at apex, long-tapering at base into a petiole 2–4 mm. long and 0.5–2 mm. thick; midvein running into the apex, other veins often obscure, pinnate except for two large, basal lateral veins running half-way down the length of the blade. Inflorescences of two types: (1) primary, on current year's growth, being mostly single (rarely with a superposed inflorescence), axillary, simple dichasia on peduncles 4–5(–10) × 1 mm.; bracts of 2 lateral flowers caducous; the 3 flowers in one plane, and (2) secondary, developing on year-old growth, bearing one or 2 smallish but normal foliage leaves at the very base, deceptively like primary leaves; flowers 4–6, one of which is terminal, the others crowded nearby, spirally arranged. Flowers said to be reddish, ca. 5 × 2 mm. when in (clavate) bud, tetramerous; anthers 1.5 mm. long, inserted in the middle of the petals, with projecting connective and 4 pollen sacs; stamens and petals monomorphic; style straight or nearly so, at least 4 mm. long; stigma inconspicuous. Fruit red, becoming black, 7 × 5 mm., ovoid, smooth; embryo dicotyledonous, nearly 4 mm. long, clavate.

This is one of two *Cladocolea* species with dimorphic inflorescences, the other being *C. dimorpha*. In the present species the two inflorescences are deceptively alike except, of course, for the position of the associated leaves or leaflike organs. Occasionally, leafless inflorescences identical to primary ones may be found in superposed positions above secondary ones.

The staminate and pistillate flowers are also remarkably similar. The aborted stamens in the pistillate flower, for example, are unusually well differentiated.

Cladocolea oligantha is further noteworthy for being the only *Cladocolea* which occurs both north and south of the Isthmus of Tehuantepec.

Guatemala. DEPT. HUEHUETENANGO: rocky dry slopes above San Ildefonso

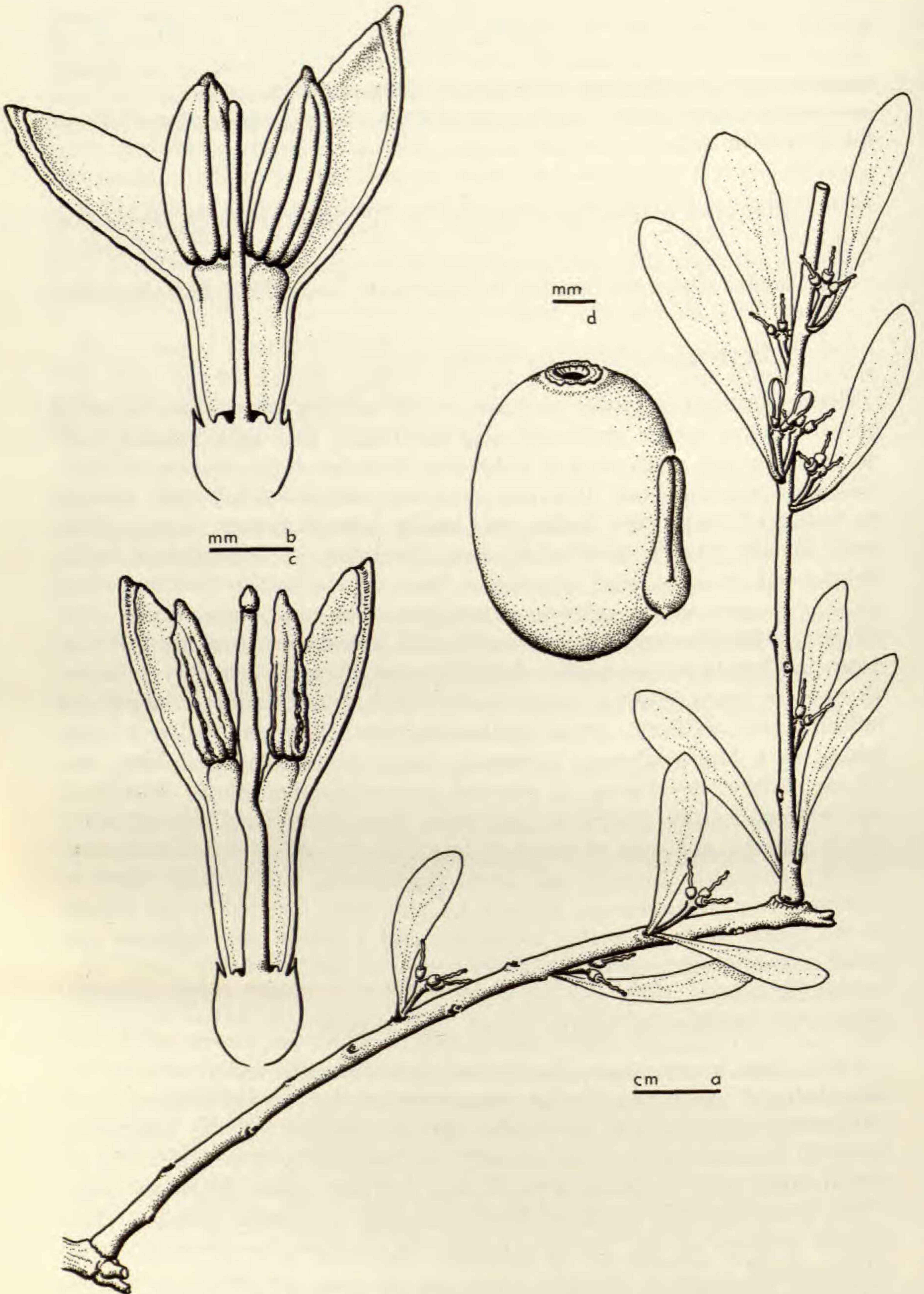


FIGURE 26. *Cladocolea oligantha*: a, habit, showing primary inflorescences (erect portion) and secondary inflorescences (lower, oblique portion) (*Hinton* 8146, K); b, staminate flower, same collection; c, pistillate flower (*Hinton* 4730, K); d, fruit and embryo (*Breedlove* 35995, CAS).

Ixtahuacán, 1600–1700 m., *Steyermark* 50672 (F, holotype of *Struthanthus oliganthus*; isotype at US); NW of Cuilco, Cerro Chiquihui above Carrizal, on copal, 1350–2300 m., *Steyermark* 50824 (F, US). MEXICO. COLIMA: Rancho Guerrero, *Jones* 423 (US). GUERRERO: road above Canyon del Zopilote, 8 km. E of Xochipala on way to Filo del Caballo from Milpillas, on *Lysiloma*, 850 m., *Breedlove* 35991 (CAS); 5 km. E of Xochipala, on *Bursera*, 1100 m., *Rzedowski* 18649 (CAS); E of Cerro Alquitrán, near Mazatlán, municipality of Chilpancingo, on *Bursera bipinnata*, 1500 m., *Rzedowski* 22674 (CAS, MICH); Distr. Coyuca, Pungarabato, on a copal, *Hinton* 8146 (K, US). JALISCO: near Chapala, *Rose & Painter* 7662 (US). MEXICO: Distr. Temascaltepec, Naranjo, on a cirian, 860 m., *Hinton* 4730 (K, MICH, NY, UC, US). OAXACA: Pan-Am. Highway between Oaxaca and Tuxtla Gutierrez, 12.5 km. E of Juchitán, on *Bursera*, 0–50 m., *McVaugh* 21853 (MICH). PUEBLA: 12 km. NW of Petlalcingo along Pan-Am. Highway on road to Acatlán, 1350 m., *Iltis & Koepfen* 1116 (MICH, US); 7 mi. SE of Izúcar de Matamoros, on *Bursera*, 4950 ft., *Webster, Miller, & Miller* 11446 (GH). Panama. PROV. PANAMA: vicinity of Las Lajas bridge, Panama National Highway, *Bartlett & Lasser* 16645 (MO); near beach at Nueva Gorgona, on *Bursera tomentosa*, *Duke* 4504 (GH, US).

19. *Cladocolea pedicellata* Kujit, sp. nov.

FIGURES 27 & 28.

TYPE: *Hinton* 4091 (see below).

Dioecia, glabra, sympodialis; caules sat validi; cortex badia, deinde cinereo-brunnea. Folia opposita vel decussata, oblanceolata vel obovata, subsessilia, rotundata, basi attenuata. Inflorescentiae binae in axillis, ad ramos anniculos et vetustiores; axis inflorescentiae pistillatae ad 20 mm. longa; pars inferior foliis 2–6 geminatis vel sparsis. Flores in racemo determinato, 7–9, pedicellis 4–7 mm. insidentes, saepe gracillimi; alabastra acuta, 6 mm. longa vel ultra, hexamera, calyculus extus expansus. Stylus gracilis, parte superiore valde contortus; stigma bene efformatum. Stamina dimorphica; antherae ad 2 mm. longae.

Plant dioecious, glabrous, with sympodial growth, the leafy long shoots developing during late summer, primary leaves being dropped before or staying on during anthesis; stems terete, stout, the bark shredding into strips later, becoming gray and smooth in age; craters evident; stem roots seen only on *Rzedowski* 24020 (CAS). Leaves alternate to decussate, up to 60 × 23 mm., lanceolate to oblanceolate or obovate, acute to rounded at apex, at base tapering into flat, short petiole. Inflorescences determinate, only on second season and older stems, one or rarely 2 per axil, consisting of 7–9 flowers on a stout or slender axis; secondary leaves somewhat smaller than primary ones, one or 2 pairs, the lateral flowers in the leaf axils (or slightly above) and in a terminal raceme; flowers with pedicels ranging from extremely slender, 4–7 mm. long, to stout and very short or occasionally (*Rzedowski* 16373) absent. Staminate flowers hexamerous, apparently variable in size, 6–12 mm. in length, narrowly acute to somewhat oblong and blunt; buds acute; stamens strongly dimorphic; anthers up to 2 mm. long, attached at or above middle of petals; pollen sacs 4, more or less equal; style straight or slightly undulating at tip;

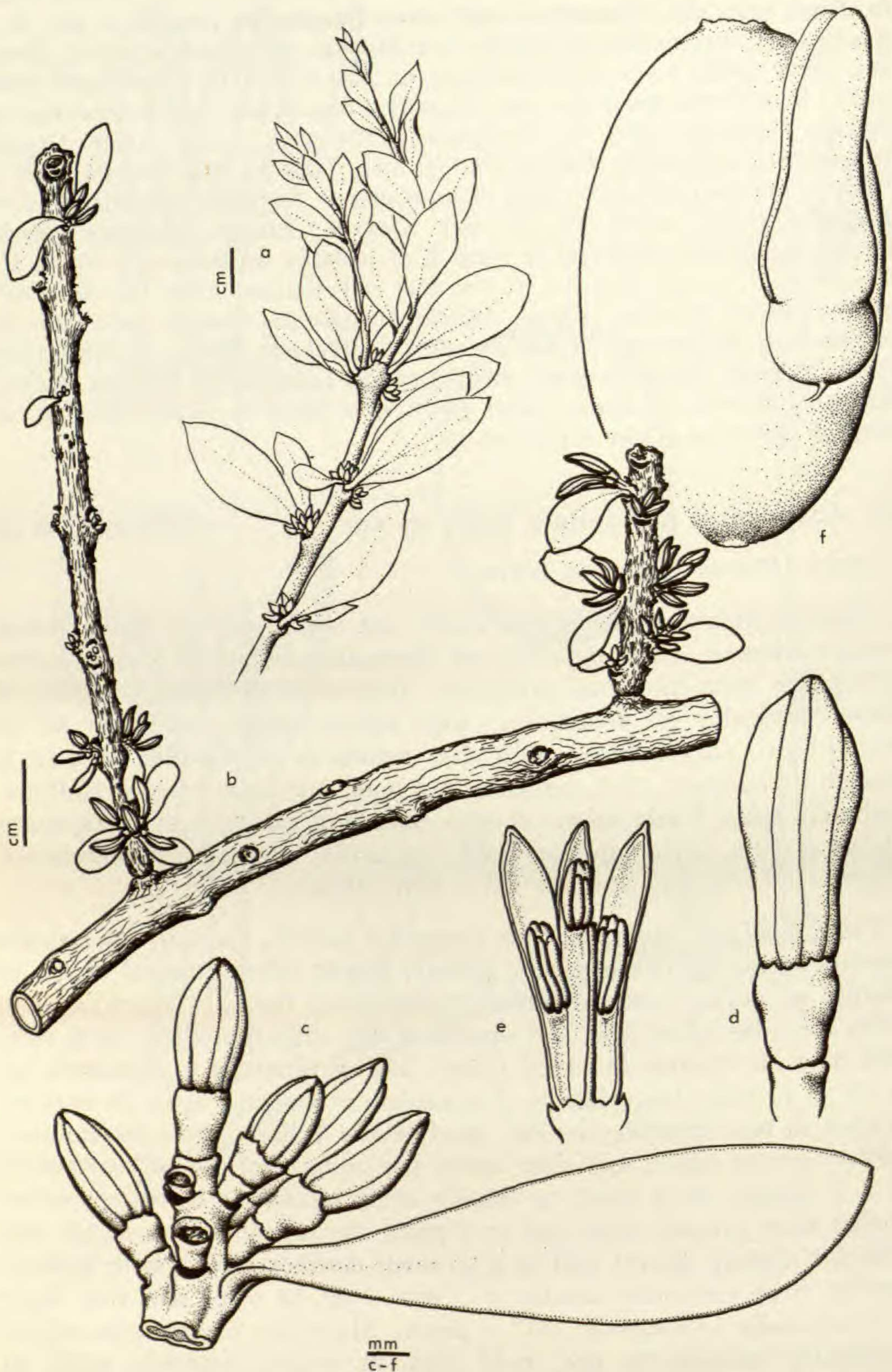


FIGURE 27. *Cladocolea pedicellata*: a, habit, probably staminate plant, primary leaves persisting (Rzedowski 16373, MICH); b, habit, staminate plant, primary leaves deciduous (Nicolas 5158/4, BM); c-e, same collection, inflorescence, bud, and longitudinal section of flower; f, fruit and embryo (Rzedowski 22359, MICH).

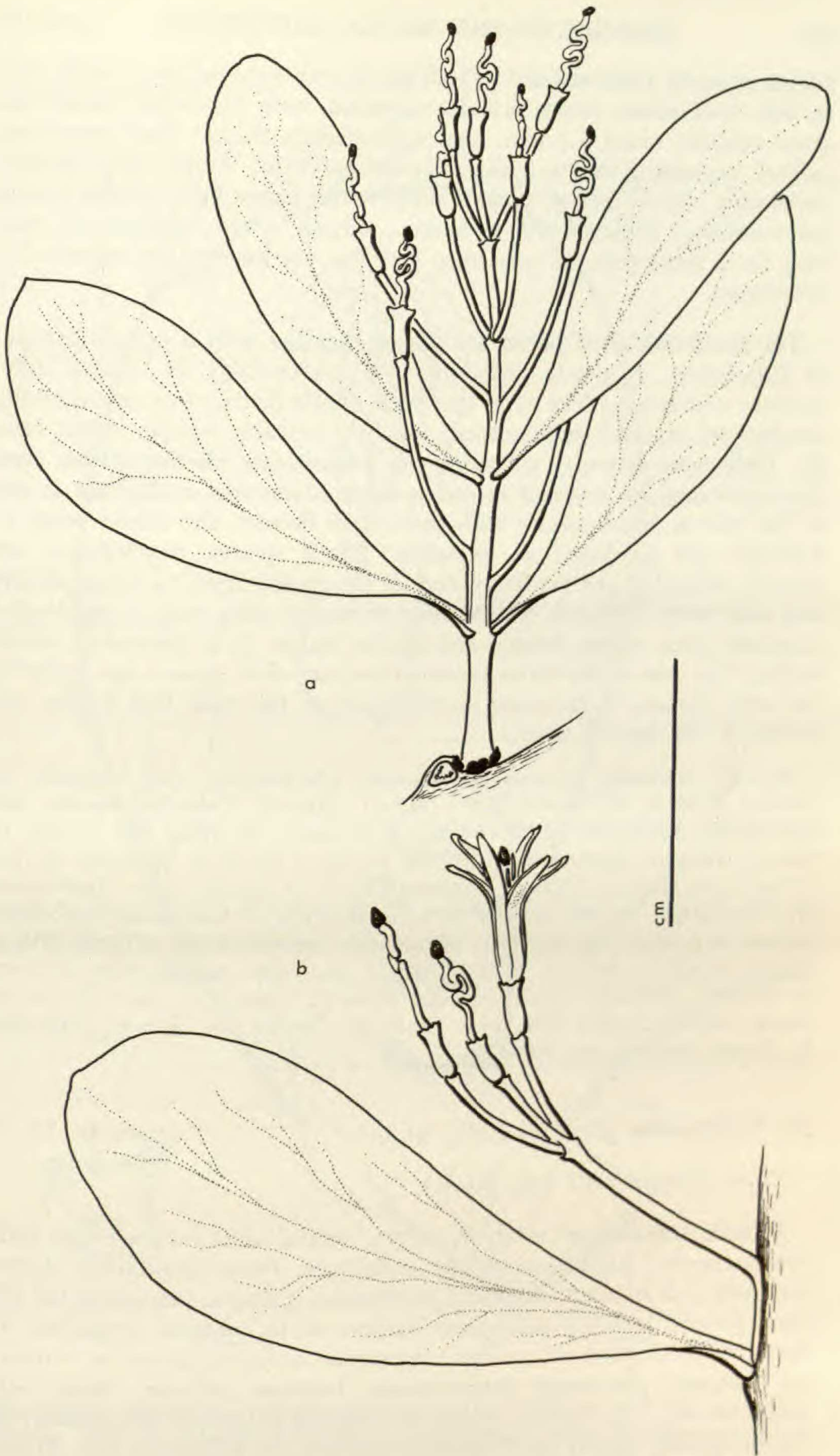


FIGURE 28. *Cladocolea pedicellata*, pistillate, long-pedicelled form (Hinton 4091, G): a, normal inflorescence; b, rare triad at base of otherwise normal inflorescence.

stigma scarcely differentiated. Pistillate flowers hexamerous, 6 mm. long in bud; bud acute; petals acicular, greenish, with dimorphic staminodia above middle; ovary 1.5 mm. long, only slightly thicker than supporting pedicel, expanding into a flaring, dentate calyculus above; style slender, undulating slightly below, greatly contorted in upper half; stigma clearly differentiated. Fruit ca. 12×6 mm., smooth, ovoid; embryo 8.5 mm. long, the 2 cotyledons 6.5 mm. long, very flat, the haustorium scarcely differentiated.

The specimens cited below are placed together with a certain amount of trepidation, as much variation exists, particularly in various inflorescence characters. The type specimen, in particular, has an unusually slender and graceful inflorescence, which is probably unique in the family. Only more extensive collecting can demonstrate whether all the cited specimens may be retained in one species. *Cladocolea pedicellata* is one of the two or three species with pedicellate flowers, the others being *C. harlingii* and (perhaps) *C. cupulata*. These species, nevertheless, are scarcely related to one another except at the generic level. A closer affinity may exist with *C. glauca*, which differs in having stem roots, more slender, scandent stems, sessile flowers, and smaller leaves. It is interesting, nevertheless, that one of the three known collections of *C. glauca* was made by the same person, in the same locality, and on the same host as one collection of the present species.

Mexico. GUERRERO: Campo de Aviación, Chichihualco, near Camotla, on *Quercus*, 2250 m., *Rzedowski 16373* (MICH). MEXICO: Cerro Sacremonte, near Amecameca, *Rzedowski 22359* (MICH); E of Cerro del Pino, near Ayotla, on *Quercus*, 2600 m., *Rzedowski 24020* (CAS, MICH); 5 km. E of Zoquipán, on road to Puebla, on *Quercus*, 2500 m., *Rzedowski 27330* (F, MICH); Distr. Temascaltepec, Nanchititla, on oak, *Hinton 4091* (K, holotype of *Cladocolea pedicellata*; isotypes at G, MICH, NY, UC, US). MICHOACÁN: wooded slopes 8–10 mi. NW of Ciudad Hidalgo, a few mi. N of village of San Pedro Aguaro, 2500–2700 m., on *Quercus*, *McVaugh 10000* (MICH). PUEBLA: Tepoxuchil, near Puebla, on *Acacia*, *Nicolas 5158/4* (BM, US); Cerro del Gavilán, on *Quercus*, 7000–8000 ft., *Purpus 4063* (F, UC, US).

20. *Cladocolea pringlei* Kuijt, sp. nov.

FIGURES 1c, 29, 30.

TYPE: *Pringle 4697* (see below).

Dioecia, scandens vel volubilis, glabra, sympodialiter ramosa; rami badii, deinde cinerei. Radices ad partes vetustiores. Folia irregulariter alternodecussata; ad annum secundum persistentia, coriacea, lanceolata vel obovata, $50\text{--}110 \times 7\text{--}15$ mm., apice basique acuta, margine squamosa. Inflorescentiae singulae vel paucae congregatae, axillares, ad partes vertentes vel juniores; plerumque determinatae; bractee caducae; flores 6–13. Alabastra ca. 5×2 mm.; petala 6; stamina petalaeque dimorphica; antherae sessiles. Stylus parte superiore paulum vel multum flexus. Fructus ovoideus, 5×3.5 mm.

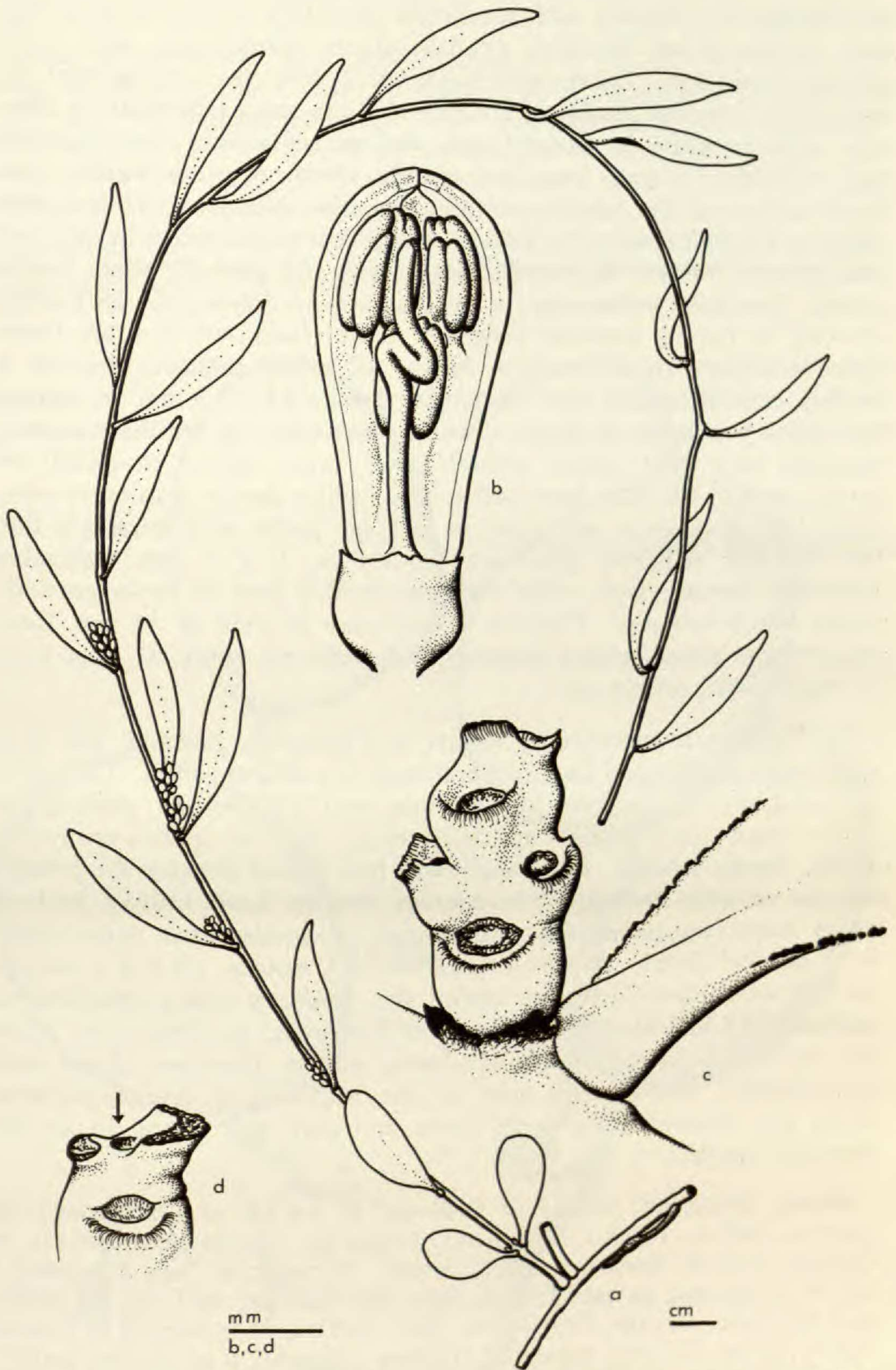


FIGURE 29. *Cladocolea pringlei*, staminate plant (*Pringle 4697*, G): a, habit; b, flower, with three petals removed; c, inflorescence, with all flowers removed to show terminal wedge; d, tip of a second inflorescence showing scar of terminal flower (arrow).

Plants dioecious, scandent to somewhat voluble, often 2 m. or more in size, completely glabrous, with apparently sympodial branching; branches first chestnut-brown, becoming grayish; craters conspicuous; stem roots on older stems only. Leaves sometimes paired, with their arrangement always quite irregular, leathery, 50–110 \times 7–15 mm., lanceolate to obovate, with an acute to rounded apex and an acute base often tapering into a petiole 3–8 mm. long; leaf margin brown, of scaly texture; the basal portion of the midrib multiple; venation pinnate. Inflorescences single or in small clusters, in axils of foliage leaves on current or very recent growth; mature infructescences on year-old growth, where leaves persist. Staminate inflorescence a spike with 6–13 flowers, the apex often aborting to form a terminal wedge of sterile tissue, but at other times spike terminated by a bracteate flower; all bracts caducous, leaving a swollen, crescent-shaped scar. Staminate flowers 5.5 \times 2 mm. in mature bud which is obovate in shape; petals 6, dimorphic, as are the stamens; filaments very short; upper anthers above, lower anthers at middle of petals; anthers 4-locular, inner pollen sacs slightly shorter than outer ones, connectival horn short and blunt or lacking; pollen with triradiate line and included triangular prominence; ovary ca. 1 \times 1 mm., calyculus somewhat dentate; style slightly to considerably bent in upper portion; stigma undifferentiated. Pistillate inflorescence in fruit ca. 13 mm. long, lowest fruits paired, others irregular, 5–8 fruits per spike, at least 5 \times 3.5 mm., ovoid, orange-red.

This species is superficially similar to *Cladocolea grahami*, but it is consistently smaller and has fruits and buds of a different form. The papillate petal tips of *C. grahami* have not been seen in *C. pringlei*, while spikes in the former species are always determinate. The two species are nevertheless closely related. Much confusion has existed between *C. pringlei* and the recently described *Struthanthus palmeri* Kuijt (1975), both of which have frequently been misidentified as *Struthanthus "spirostylis"* or *S. haenkei* (Presl) Engler, a synonym of *S. venetus* (H.B.K.) Blume. As with some other *Cladocolea* species, this similarity with a *Struthanthus* species might indicate true affinity. The Rzedowski specimen cited below has lanceolate, distinctly petiolate leaves and is, therefore, placed here provisionally. The same is true for the McVaugh & Koelz specimen, which has extraordinarily large leaves and may well belong to an undescribed species.

Mexico. GUERRERO: vicinity of Omiltemi, 60 km. W of Chilpancingo, on *Quercus*, 2000 m., *Tillett 637–146* (US); Campo de Aviación, near Camotla, on *Quercus*, 2250 m., *Rzedowski 16359* (MICH). MICHOACÁN: Lake Pátzcuaro, 3 km. W of Quiroga, on oak, *Frye & Frye 2600* (GH, MO, SMU, UC, US, WTU); near Pátzcuaro, on oaks, *Pringle 5058* (GH). OAXACA: mountains N of Oaxaca, end of road to TV relay station off Highway 190, 1 mi. S of 490 km. marker, on oak, 7400 ft., *Breckon & Breckon 803* (GH); Cerro de San Felipe N of Oaxaca, lower slopes, on *Quercus*, *Camp 2365* (NY); 15–18 km. WSW of Oaxaca, canyon of the Río Zavaleta near village of San Pablo Quatro Venados, on *Quercus*, *Camp 2550* (NY); Manzanar, E of Oaxaca, on road through San Au-

gustín toward Natividad, on *Quercus*, 7550 ft., *Carlson 1385* (F, MICH); Tecomatlán, Pueblo Viejo, Camino Montelobos, 3000 m., *Conzatti 1898* (F); Cuicatlán, Coyula a Cuyamecalco, 1800 m., *Conzatti & Gomez 2381* (2081?) (F); Cañada de San Gabriel, Etna., 2900 m., *Conzatti & Gonzalez 294* (GH); montañas de Mitla, Tlacolula, Cerro de Xaagá, 1850 m., *Conzatti & Ostlund 5178* (K); upper SW slopes of Cerro San Felipe, above San Felipe, 12–14 km. NNW of Oaxaca, on *Quercus*, 2400–2800 m., *Koeppen & Iltis 1242* (MICH); San Felipe, *Liebmann 3117* (c); foothills above Oaxaca, on oaks, 7000 ft., *Pringle 4697* (US, holotype of *Cladocolea pringlei*; isotypes at BR, G, GH, GOET, K, NY, P, PR, S, UC); Mt. Jayacatlán, *Smith 32* (GH); Distr. Nochixtlán, W of Huandilla, 2000 m., *Conzatti 1899* (F); Distr. Inguila, Plan de Minas, 1380 m., *Conzatti 4544* (US).

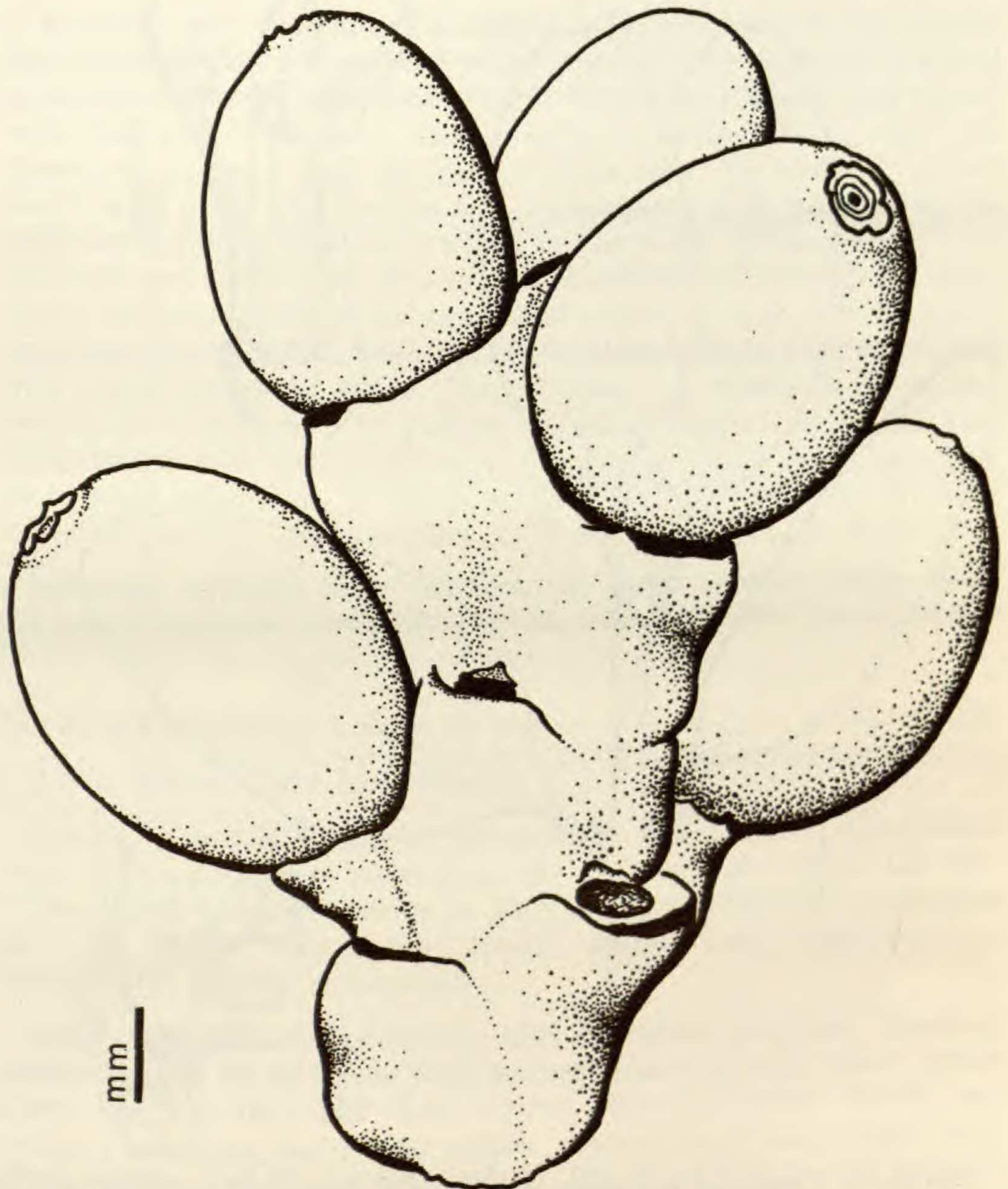


FIGURE 30. *Cladocolea pringlei*: inflorescence with nearly mature fruit (*Conzatti & Ostlund 5178*, K).

21. *Cladocolea roraimensis* (Steyermark) Kuijt, comb. nov.

FIGURE 31.

Phthirusa roraimensis Steyermark, Fieldiana Bot. 28: 224, 225. 1956.TYPE: *Steyermark 58943* (see below).

A rigid, glabrous, sympodial plant; stems somewhat succulent, 2–5 mm. thick, bark smooth, internodes rather short (1–3 cm.); no stem roots seen. Leaves decussate, olive-green to bronze, very coriaceous, 40–50 × 10–25 mm., elliptic to ovate or obovate, with apex obtuse or more commonly

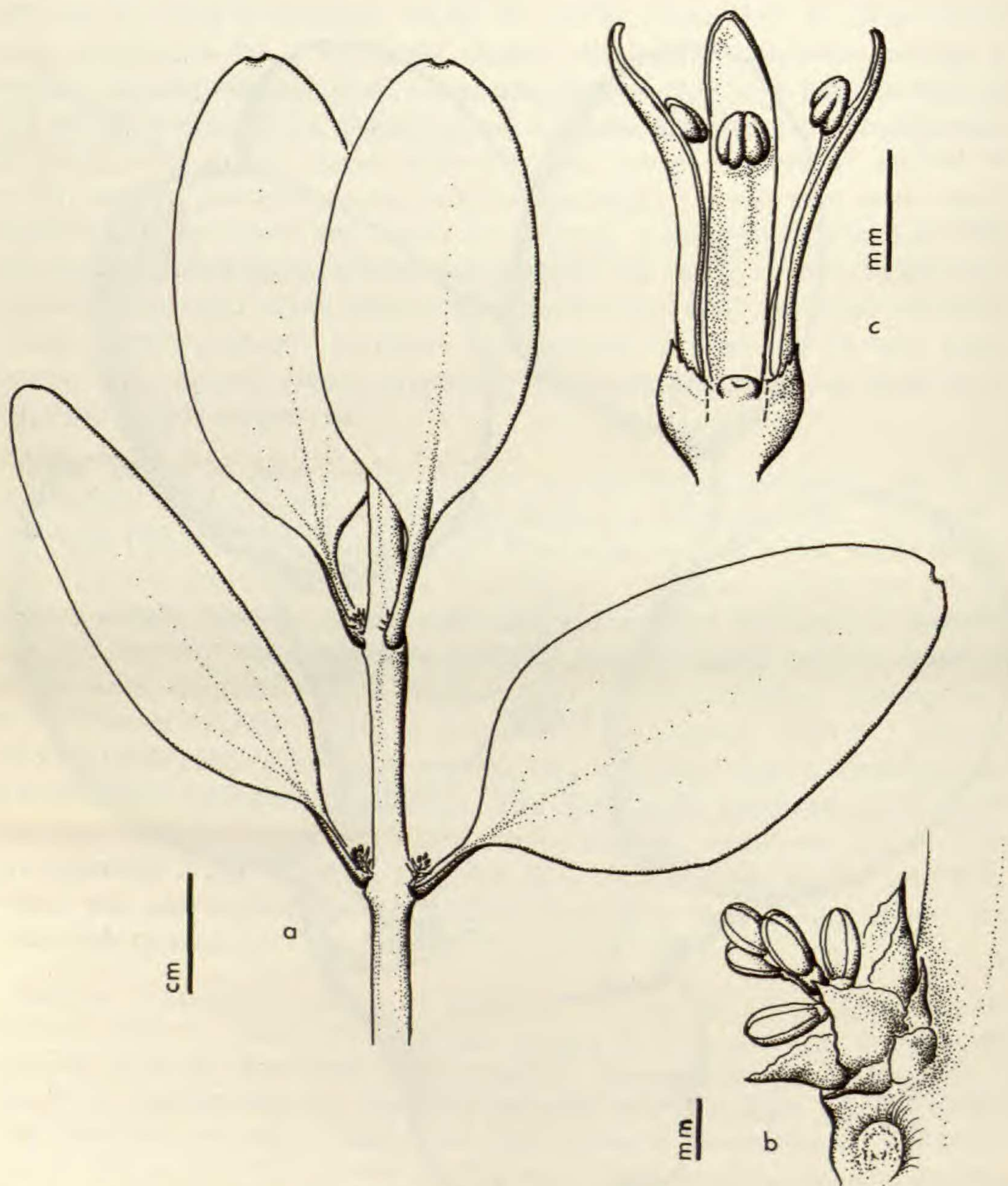


FIGURE 31. *Cladocolea roraimensis* (*Steyermark 58965*, US): a, habit, reconstructed; b, immature inflorescence, leaf scar below; c, mature flower, one petal removed to show central cushion and absence of style.

emarginate through loss of a caducous brown nail-like tip ca. 1×1 mm., and base obtuse to acute; petiole ca. 10 mm. long, strongly canaliculate; venation obscure. Much of the mesophyll differentiated into sclereids with many, bulbous arms. Inflorescences one per axil, subtended by several pairs of acute, chartaceous bracts 1–2 mm. long; flowers paired, sessile, ebracteolate, inflorescence terminated by a single, sessile flower; floral bracts caducous; flowers 7 or 9 per inflorescence, yellowish; calyculus prominently 2-dentate; petals 4, 4 mm. long, with a sessile anther above the middle in dimorphic arrangement; pollen smooth, rounded-triangular, with little or no evidence of triradiate grooves; style not seen. Fruit said to be dull blue-green, oblong-ovoid, 7×5 mm., the fruiting axis elongating to ca. 12 mm.

Although only two rather inadequate collections exist of this species, the *Cladocolea*-like inflorescence of the material fully warrants transferal of this species to the genus treated here. It is of some interest that Steyermark indicated "*Phthirusa*" *clandestina* as a possible relative, since that species is presently also included in *Cladocolea*. However, *C. archeri* would seem to be much nearer to *C. roraimensis*, as is indicated by the chartaceous inflorescence bracts which, in *Cladocolea*, are known only from the latter two species. All flowers seen, in contrast to Steyermark's statements, are tetramerous. The apparent absence of a style, even in young, unopened flowers, is very surprising. In its place is found a minute cushion with a small central depression. The "floribus. . . dioicis" in the original description is presumed to indicate unisexual flowers. As in all other Loranthaceae with unisexual flowers, the sexes are likely to be segregated on separate individuals. If this is so, the type is staminate and the other collection pistillate. Unfortunately, no flowers are present on the latter.

Venezuela. BOLÍVAR: Mount Roraima, SW slopes between Rondón Camp and base of sandstone bluffs, 2040–2255 m., *Steyermark* 58943 (F, holotype of *Phthirusa roraimensis*); same, *Steyermark* 58965 (F, US).

22. *Cladocolea stricta* Kujit, sp. nov.

FIGURE 32.

TYPE: *Hinton* 10176 (see below).

Dioecia, sympodialis, folia et rami puberuli, rami teretes. Folia alterna, solum in innovationibus vertentibus, 15×7 mm. vel minora, late lanceolata. Inflorescentiae staminatae singulae in axillis foliarum, pedunculis ad 2 mm. longis; flores 5–6 ad apicem congesti, foliis squamiformibus. Stylus rectus, stamina dimorphica.

Plant dioecious, short-pubescent, with sympodial branching; branches terete, straight, up to 25 cm. long for one season's growth, leaves rather dense, but occurring only along current season's growth; branch pubescence persisting into second season; craters conspicuous around base of innovations (which are subterminal), less so around base of inflorescences. Leaves consistently alternate, 15×7 mm. or smaller, broadly lanceolate, with acute apex and base, slightly apiculate; petiole 1 mm. or

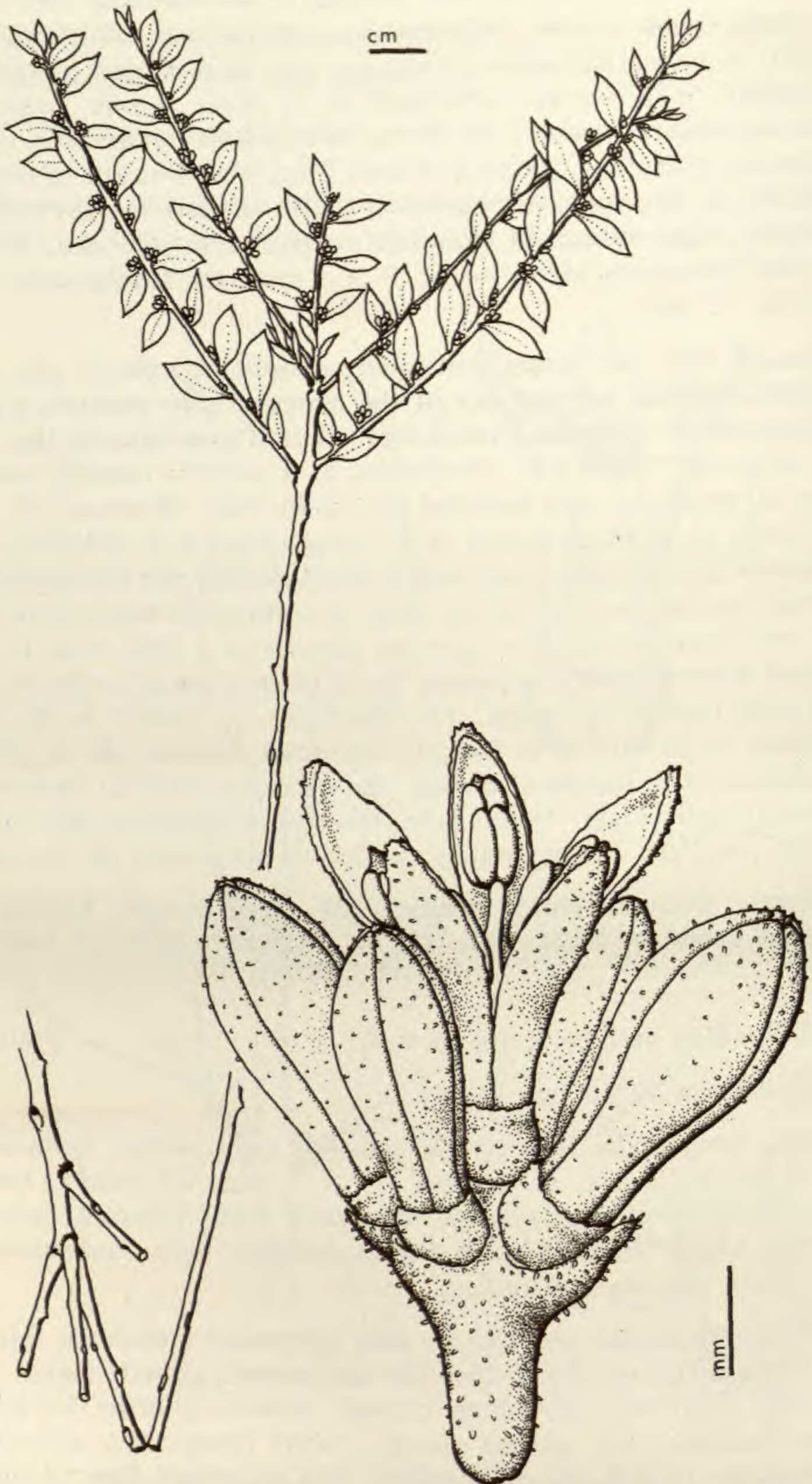


FIGURE 32. *Cladocolea stricta*, staminate plant (*Hinton 10176*, K): habit and inflorescence.

less; blade rather fleshy, with only the midvein visible, running into apex. Staminate inflorescence solitary in the axils of leaves, being a small, determinate 5–6-flowered capitulum with squamate, persistent bracts and a peduncle ca. 2 mm. long, both bracts and peduncle short-pubescent. Staminate flowers 4 mm. long in bud, including the ovary, commonly 5-merous, sometimes 4-merous or very rarely 6-merous; calyculus and tips of petals short-pubescent; petals and stamens dimorphic; anthers 1 mm. long, attached at or above the middle of the petal; filament 0.5 mm., basifixed, with elongate filament buttress; pollen smooth, without evident grooves; ovary 1×1 mm.; style straight, reaching to middle of upper anthers; stigma completely undifferentiated; nectary somewhat pubescent. Pistillate plants not known.

It is with some hesitation that I give this single collection specific status. However, the differences from *Cladocolea microphylla* and *C. loniceroides*, its closest relatives, seem to be such as to make it impossible to do otherwise. *C. stricta* differs from *C. microphylla* in its absence of foliar bracts; its single inflorescence, which, furthermore, is borne in the axil of a persistent leaf; the fact that it flowers along current growth; its 4–5-partite flowers; and by its straight style, at least in the staminate flower. From *C. loniceroides* it differs in the same features (except the flowering along current growth) and, additionally, in its sympodial branching and very rigid, sparse habit.

Mexico. GUERRERO: Distr. Mina, Armenia, on *Salix*, 2340 m., Hinton 10176 (K, holotype of *Cladocolea stricta*).

23. *Cladocolea tehuacanensis* (Oliver) Van Tieghem, Bull. Soc. Bot. France 42: 167. 1895. FIGURE 33.

Loranthus tehuacanensis Oliver, Naturhist. Foren. Kjoeb., Vidensk. Meddel. 1864: 171. 1865.

Oryctanthus tehuacanensis (Oliver) Engler in Engler & Prantl, Nat. Pflanzenfam., Nachtr. zu III: 135. 1897.

TYPE: *Liebmann 3129* (see below).

Plant dioecious, slender, sparsely branched, completely glabrous throughout, sympodial, without branching in a single season; youngest twigs very attenuate and whiplike, bearing narrowly lanceolate (immature?) leaves; stems somewhat sinuous, terete, light brown, with fine longitudinal lines, later with small, rounded lenticels; craters rather conspicuous; stem roots abundant locally but seen only on fruiting twigs. Leaves alternate throughout, secondary leaves one (rarely 2) per spike, at the very base of the spike, seemingly emerging from the crater, rather thin, up to 35×7 mm., lanceolate-oblongate, with rounded apex and tapering at base into the 1×5 mm. petiole; venation pinnate, midrib not reaching apex. Pistillate inflorescences on year-old wood, not on current growth, one or 2 per axil, up to 30 mm. long, axis somewhat compressed in dried plants only, leafless above crater, the flowers subtended by "shoulders" on which leaf

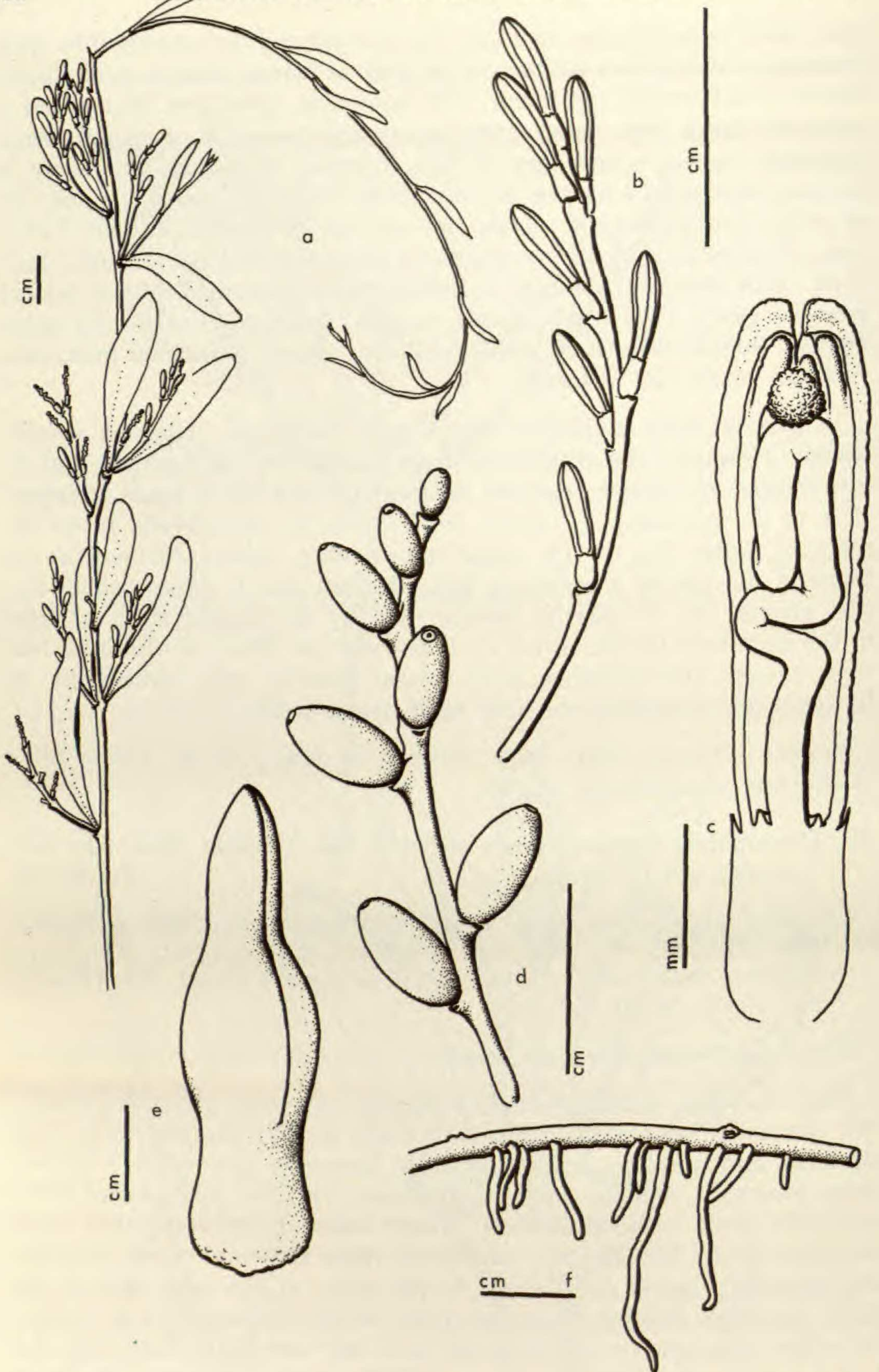


FIGURE 33. *Cladocolea tehuacanensis*, pistillate plant: a, habit (*Liebmann 3129, c*); b, inflorescence, same collection; c, pistillate flower, longitudinal section, same collection; d, infructescence (*Liebmann s.n.*, presumably 3129, p); e, embryo, same collection; f, roots growing from stem (*Liebmann 3130, c*).

scales are not recognizable; flowers 5–8 per spike, one of which is terminal, in irregular, paired to alternate arrangements. Pistillate flowers: mature bud 5×1 mm., somewhat clavate in shape; calyculus smooth except for one or more teeth; petals 5 or 6, very narrow, slightly more than 3 mm. long, with very small staminodia reaching tip of petal, showing a slight but distinct dimorphism; ovary 1.5 mm. long; style highly convoluted in upper $\frac{2}{3}$; stigma just below petal tips, capitate, well differentiated, with papillar surface; nectary smooth. Fruit at least 7×3 mm., ellipsoid, dark-colored; embryo dicotyledonous, slightly more than 5 mm. long, $\frac{2}{3}$ of which is cotyledons, the radicular end rather blunt. Staminate plant unknown.

There is some unfortunate confusion in the very sparse collections of this species. In Copenhagen three sheets exist, each labelled "6. *Loranthus Tehuacanensis* Oliv." Two of these sheets bear the Liebmann number 3129 but have different collection dates (May and December, 1841; the latter is considered the holotype). The third sheet bears the number 3130 and was also collected in December, 1841, in Tehuacán. The two unnumbered Liebmann sheets at Paris, dated Dec. 1841, are presumed to be 3129.

Mexico. "In monte Felipe, prope Oaxacam Julio. Parasitica," *Andrieux* 344 (M; at K and P this number is *C. andrieuxii*); Tehuacán, *Liebmann* 3129 (c, holotype of *Loranthus tehuacanensis*; isotype at P); same, *Liebmann* 3130 (c).

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INDEX TO COLLECTIONS CITED

Numbers in parentheses refer to species as treated in the text.

- | | |
|-------------------------------|--|
| Acosta Solis 12200 (2) | Bartlett & Lasser 16645 (18) |
| Andrieux 344 (1, 23), 345 (1) | Bonpland <i>s.n.</i> (17) |
| Archer 1058 (2), 1521 (2) | Brade 10461 (3) |
| Arsène 1749/2 (7), 2268 (7) | Brandegge <i>s.n.</i> (13) |
| Barr & Barr 64–553 (15) | Breckon & Breckon 803 (20) |
| Barr & Dennis 64–304A (15) | Breedlove 35588 (13), 35991 (18),
35998 (8) |

- Camp 2365 (20), 2550 (20), 2609 (1)
 Carlson 1385 (20)
 Converse 83 (15)
 Conzatti 1898 (20), 1899 (20), 4544 (20)
 Conzatti & Gómez 2381 (2081?) (20)
 Conzatti & Gonzalez 294 (20)
 Conzatti & Ostlund 5178 (20)
 Cuatrecasas 15244 (2), 18430 (2), 20506 (2)
- Dodson & Thien 1507 (10), 1852 (2)
 Dudley 13450 (2)
 Duke 4504 (18)
- Espinosa 16366 (10)
- Ferris & Mexía 5166 (13)
 Frye & Frye 2600 (20), 2601 (17)
- Gardner 1322 (3)
 Gentry 4996 (13), 5636 (13), 7056 (13)
 Gimete Leyva *s.n.* (15)
 Glaziou 1429 (3)
 Graham 235 (9)
 Gregg 722*b* (16), 1116 (13)
- Harling 6015 (10), 6094 (10)
 Hinds 346 (13)
 Hinton 636 (15), 930 (15), 3107 (9), 3152 (15), 3550 (9), 3796 (15), 3840 (15), 3958 (4), 4091 (19), 4112 (15), 4115 (15), 4255 (15), 4730 (18), 4777 (4), 5554 (4), 6688 (4), 7689 (17), 8146 (18), 9021 (9), 10148 (11), 10149 (9), 10151 (11), 10176 (22), 10458 (15), 10500 (15), 10689 (15), 15022 (15)
 Hodge 6842 (2)
 Hunnewell 11854 (15)
- Iltis, Iltis, & Koeppen 318 (15)
 Iltis & Koeppen 1116 (18)
- Jones 423 (18)
- Kenoyer A-501 (15)
 King & Soderstrom 5105 (15), 5196 (17)
 Koeppen & Iltis 1242 (20)
- Leavenworth 340 (17)
 Leavenworth & Hoogstraal 1410 (8), 1513 (4)
 Liebmann 3117 (20), 3120 (23), 3129 (23)
 Lundell & Lundell 12328 (15)
- Martius *s.n.* (3)
 McVaugh 150 (15), 9999 (9), 10000 (19), 10143 (9), 10146 (17), 12193 (16), 14353 (16), 15008 (16), 17839 (17), 17937 (8), 19918 (15), 21127 (5), 21853 (18), 22521 (14), 22732 (15), 22791 (15), 23159 (15), 23273 (5), 24492 (17), 24662 (15), 24681 (15)
 McVaugh & Koelz 1019 (14), 1129 (15), 1211 (16)
 Mexía 321 (13), 970 (13)
 Mickel 1678 (15)
 Mikan *s.n.* (3)
 Molina & Molina 13922 (12)
 Moreno 164 (15)
 Moricand *s.n.* (17)
- Nelson 2421 (15)
 Nicolas *s.n.* (7), 5158/4 (19)
- Ortega 632 (13), 6162 (13)
- Palmer 531 (13), 1796 (13)
 Pavón *s.n.* (15)
 Pringle 4369 (17), 4697 (20), 5058 (20), 6987 (9), 7362 (15), 10244 (1)
 Purpus 4063 (19), 4191 (4)
- Riedel *s.n.* (3)
 Roe, Roe, Mori, & Rzedowski *s.n.* (15)
 Rose & Painter 7662 (18)
 Rose, Standley, & Russell 13746 (13)
 Rzedowski 16359 (20), 16372 (15), 16373 (19), 16436 (1), 16437 (15), 16451 (15), 16623 (8), 16635 (16), 17404 (16), 17518 (8), 17914 (16), 18000 (15), 18481 (15), 18649 (18), 22120 (16), 22359 (19), 22618 (8), 22674 (18), 24020 (19), 27330 (19), 28122 (15), 28123 (15), 28125 (17), 28126 (17), 30389 (17), 30390 (17)
 Rzedowski & McVaugh 270 (15), 652 (17)

Schwacke 1411 (3)	Troll 593 (17)
Sessé, Mociño, Castillo, & Maldonado 926 (17), 927 (15), 4957 (15)	Webster, Miller, & Miller 11446 (18)
Sharp 441572 (15)	Wiens 2494 (13), 3781 (10), 3792 (10), 3800 (10), 4415 (16)
Smith 32 (20), 122 (14)	Wiggins 10964 (10)
Smith, Peterson, & Tejeda 4127 (6)	Wilbur & Wilbur 1420 (15), 1666 (14), 1838 (15), 2162 (15), 2400 (14)
Sparre 16295 (10)	Williams 3820 (17)
Steyermark 50672 (18), 50824 (18), 58943 (21), 58965 (21)	
Tillett 637-146 (20), 637-153 (15)	Yuncker, Dawson, & Youse 6220 (12)
Townsend a-27 (10)	

RECORDED HOSTS OF CLADOCOLEA

Number of records in parentheses

<i>C. andrieuxii</i> :	<i>Alnus jorullensis</i> (1) <i>Alnus</i> (1) <i>Quercus</i> (2)
<i>C. archeri</i> :	<i>Tournefortia fuliginosa</i> (1) Melastomataceae (1)
<i>C. clandestina</i> :	?
<i>C. coyuca</i> :	? <i>Thevetia</i> (1) <i>Heliocarpus</i> (1)
<i>C. cupulata</i> :	<i>Pinus</i> (2)
<i>C. dimorpha</i> :	?
<i>C. glauca</i> :	<i>Acacia</i> (1) <i>Crataegus</i> (1)
<i>C. gracilis</i> :	<i>Colubrina</i> (1) <i>Podopterus mexicanus</i> (1) <i>Randia</i> (1)
<i>C. grahami</i> :	<i>Quercus</i> (7)
<i>C. harlingii</i> :	Compositae (1)
<i>C. hintonii</i> :	<i>Quercus</i> (1)
<i>C. hondurensis</i> :	<i>Quercus</i> (1)
<i>C. inconspicua</i> :	<i>Croton niveus</i> (1) <i>Mimosa palmeri</i> (1) <i>Randia</i> (1) <i>Zanthoxylum</i> (1)
<i>C. inorna</i> :	<i>Cassia</i> (1) Leguminosae (1)
<i>C. loniceroides</i> :	<i>Alnus</i> (11) <i>Baccharis</i> (3) <i>Eupatorium mairetianum</i> (1) <i>Ligustrum</i> (1) <i>Ostrya virginiana</i> (1) <i>Ostrya</i> (1) <i>Populus</i> (1) <i>Prunus persica</i> (2) <i>Quercus</i> (4) <i>Rumfordia</i> (1)

	<i>Salix</i> (1)
	<i>Solanum refractum</i> (1)
	<i>Vernonia</i> (1)
	Compositae (2)
	Leguminosae (1)
	Malvaceae (1)
<i>C. mcvaughii</i> :	<i>Quercus aristata</i> (1)
	<i>Quercus macrophylla</i> (1)
	<i>Quercus</i> (9)
<i>C. microphylla</i> :	<i>Alnus</i> (1)
	<i>Quercus</i> (13)
<i>C. oligantha</i> :	<i>Bursera bipinnata</i> (2)
	<i>Bursera tomentosa</i> (1)
	<i>Bursera</i> (3)
	<i>Lysiloma</i> (1)
<i>C. pedicellata</i> :	<i>Acacia</i> (1)
	<i>Quercus</i> (4)
<i>C. pringlei</i> :	<i>Quercus</i> (9)
<i>C. stricta</i> :	<i>Salix</i> (1)
<i>C. tehuacanensis</i> :	?

INDEX TO ACCEPTED NAMES AND TO SYNONYMS

The numbers refer to the corresponding species in the text.

Cladocolea

<i>andrieuxii</i> = 1
<i>archeri</i> = 2
<i>clandestina</i> = 3
<i>coyucae</i> = 4
<i>cupulata</i> = 5
<i>dimorpha</i> = 6
<i>glauca</i> = 7
<i>gracilis</i> = 8
<i>grahami</i> = 9
<i>harlingii</i> = 10
<i>hintonii</i> = 11
<i>hondurensis</i> = 12
<i>inconspicua</i> = 13
<i>inorna</i> = 14
<i>loniceroides</i> = 15
<i>mcvaughii</i> = 16
<i>microphylla</i> = 17
<i>oerstedii</i> = <i>Struthanthus</i>
<i>oligantha</i> = 18
<i>pedicellata</i> = 19
<i>pringlei</i> = 20
<i>roraimensis</i> = 21
<i>stricta</i> = 22
<i>tehuacanensis</i> = 23

Loranthus

<i>clandestinus</i> = 3

grahami = 9

inconspicuus = 13

inornus = 14

microphyllus = 17

oerstedii = *Struthanthus*

tehuacanensis = 23

Loxania

loniceroides = 15

microphylla = 17

Oryctanthus

andrieuxii = 1

archeri = 2

grahami = 9

oerstedii = *Struthanthus*

tehuacanensis = 23

Phthirusa

clandestina = 3

inconspicua = 13

microphylla = 17

oligantha = *Dendropemon*

roraimensis = 21

Struthanthus

alni = 1

grahami = 9

Struthanthus (*cont'd*)*hunnewellii* = 15*inconspicuus* = 13*inornus* = 14*loniceroides* = 15*mexicanus* = 15*microphyllus* = 17*oliganthus* = 18

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