STUDIES OF PACIFIC ISLAND PLANTS, XVII[1]

THE GENUS GENIOSTOMA (LOGANIACEAE) IN THE NEW HEBRIDES, FIJI, SAMOA, AND TONGA

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Introduction

Specimens of *Geniostoma*, an essentially tropical Old World genus of woody flowering plants of the family Loganiaceae, have been accumulating in world herbaria, including that of the U.S. National Museum, over a period of several decades, during which no serious attempt to understand relationships within the genus has been made. Specific identifications have usually proved difficult, and the genus as a whole is in need of a complete systematic revision. Primarily in order to facilitate an understanding of the Fijian specimens, which are now reasonably abundant in herbaria, we have undertaken a regional revision within a small portion of the generic range, extending from the New Hebrides eastward to Samoa. It has been customary to throw together a large part of the Pacific *Geniostomata* under the name *G. rupestre* J. R. & G. Forst., in spite of the fact that Gilg & Benedict (in Bot. Jahrb. 56: 542. 1921) considered it a local endemic of the New Hebrides. Only in New Caledonia, Samoa, and to a lesser extent in Micronesia have studies of *Geniostoma* progressed to a point where identifications can be made with any degree of assurance. For the Malaysian region in the broad sense there exist no dependable treatments, a situation that one may hope to see corrected as work on the Flora Malesiana progresses.

As is so often the case in "difficult" genera, the older descriptions are mostly inadequate for an understanding of the identity of species. Fortunately we have been able to see types or isotypes of most taxa thought to occur in our region. Especially valuable for study has been type material of *G. rupestre*, the type species of the genus. *Geniostoma* has in general been correctly understood and delimited,

[1] This paper, based on research partially supported by a grant from the National Science Foundation, continues the series under the same title by the first author. The place of publication of nos. X-XIV in the series was noted in connection with no. XV, in Contr. U.S. Nat. Herb. 30: 523-575. 1953. No. XVI was published in Journ. Arnold Arb. 34: 97-124. 1953.

but we believe that concepts of some of its species have been unreasonably broad. Sixteen species are now believed to occur between the New Hebrides and Samoa, of which six are here described as new. The other species of our region are redescribed on the basis of available material and older descriptions, and we append notes on distributions, local names, and relationships.

In the course of this study the pertinent herbarium material of several institutions has been examined and is here cited, with the indicated abbreviations: Arnold Arboretum of Harvard University (A); Bernice P. Bishop Museum (Bish); British Museum (BM); Gray Herbarium of Harvard University (GH); Royal Botanic Gardens, Kew (K); New York Botanical Garden (NY); University of California at Berkeley (UC); and U.S. National Herbarium (US). We are indebted to the administrators of these herbaria for the opportunity of studying specimens under their care.

HISTORICAL SKETCH

The genus was described by J. R. & G. Forster in their "Characteres Generum," in 1776, as was also their type species, *G. rupestre*, and was based upon material obtained by them on the island of Tanna, in the New Hebrides, during Cook's second voyage. The generic name is formed from the Greek words *genias* (beard) and *stoma* (mouth) and of course should be treated as neuter (cf. Int. Code Bot. Nomencl. Rec. 75A. 1956); when necessary we have corrected epithets given a feminine form. Additional species of *Geniostoma* were described in the early part of the nineteenth century from the Mascarene Islands, Java, Sumatra, the Philippines, New Zealand, Australia, and the Marianas Islands. For the most part, however, specimens obtained in Polynesia and Melanesia were identified with *G. rupestre*. In 1880 H. Baillon (in Bull. Soc. Linn. Paris 1: 247–248) published a list of New Caledonian species of the genus. Various other species described in *Geniostoma*, including those from the New World, were later shown to belong to other genera; the Hawaiian species, for instance, have been removed to the closely related genus *Labordia* Gaud. The first treatment of the genus that was relatively broad in regard to geography and in addition was acute and analytical was that of T. Valeton (in Bull. Inst. Bot. Buitenz. 12: 1–28. 1902), who studied the species of the vicinity of Buitenzorg and also some of those from more distant regions. Although he did not attempt a monographic revision, he employed a number of new criteria in his specific distinctions and was apparently the first to recognize the sexual dimorphism of several of the species. During the present century the number of putative species has substantially increased and now approaches 100, but the arrangement of the species within the genus has been neg-

lected. There almost certainly remain undescribed species in New Guinea and the other large islands of Malaysia and Melanesia. In Micronesia, and in the Society Islands and Polynesia generally, most or all of the species may have been discovered. According to A. Guillaumin (Fl. Anal. Syn. Nouv.-Caléd. 285. 1948), none of the New Caledonian species occur outside that area except for *G. rupestre*. As in other genera, the islands between Fiji and New Guinea have disclosed fewer *Geniostomata* than might be anticipated, indicating the need of further field work there.

CRITERIA OF USE IN SPECIFIC DELIMITATION

Among vegetative features of *Geniostoma*, the unusual nature of the stipules of two Fijian species, *G. macrophyllum* and *G. stipulare*, deserves mention. In these species the stipules are large, adnate to the margins of the petioles and forming foliaceous sheaths that are soon disrupted, leaving traces of tissue or obvious linear scars on the petiole. Both of these species are further distinguished by several other significant characters; they have cauline or ramuline inflorescences and leaves large for the genus. Their relationship may possibly be with *G. caulocarpum* K. Schum., of New Guinea. With the exception of *G. macrophyllum* and *G. stipulare*, the species treated by us have intrapetiolar stipules of a type more characteristic of the genus, forming a short sheath scarcely exceeding 2 mm. in length.

Certain species of our region are characterized by having markedly quadrangular or even 4-winged branchlets; the Samoan *G. fleischmannii* has the branchlets narrowly alate, as do some species of New Caledonia. *Geniostoma insulare* has its branchlets at least in the ultimate internodes sharply quadrangular. However, most of our species have essentially terete branchlets, which in the juvenile internodes may be compressed or subquadrangular.

Other vegetative characters of potential taxonomic usefulness include the kind and degree of pubescence and the size and shape of leaf-blades. Pubescence of the vegetative parts in general is limited to the innovations, although in certain species it is persistent; in the Fijian *G. calcicola*, for instance, a short, dense indument covers both surfaces of the leaf-blades, a character noted otherwise among species of the vicinity only in *G. crassifolium* Benth., of the Isle of Pines. Leaf-size and shape are characters at best of secondary importance. The leaf-blades may be fairly consistently large (in *G. macrophyllum* and *G. stipulare*) or small (in *G. stenocarpum*), but in most species-complexes the range of size is too great to be of taxonomic value. In leaf-shape there is a somewhat wider array of types and perhaps a slightly greater taxonomic value, but, as Valeton cautioned in 1902,

leaf-shape alone is not dependable in *Geniostoma* and must be used in conjunction with other characters.

One species of our area, the Samoan *G. biseriale*, has essentially sessile leaves that at once distinguish it from others of the region. Other species with similarly subsessile leaves are *G. sessile* Kanehira (Palau), *G. rapense* F. Br. (Rapa), and *G. clavatum* J. W. Moore (Raiatea), but they are diverse in other respects and obviously do not form a natural species group.

The basic structural unit of the inflorescence is a dichasium, generally of the cymose type; this is much modified, and finds its extreme diversity in the multiflowered, glomerate, cauline inflorescences of *G. macrophyllum*, which may bear up to 200 flowers, these basically organized in congested triflorous dichasia. At the other extreme may be mentioned the highly reduced, simple cyme of *G. calcicola*, with its 5 flowers on moderately long pedicels. In some New Caledonian species the inflorescence is reduced to a single flower. The most common type of inflorescence in the genus is a moderately open, compound dichasium with perhaps 5 to 30 flowers, those of the distal axes generally in triflorous dichasia, but those lower on any inflorescence-branchlet sometimes irregular, single, or paired. The inflorescences in leaf-axils (characteristic of most species) may consist of a single cyme but frequently are fasciculate (usually at the first node of the peduncle but sometimes in the axil itself) in pairs or sometimes in threes. In discussing the inflorescence of *Geniostoma*, Valeton discerns a racemose and a paniculate type, which he terms bostryx and cyme. According to Rickett (in Bull. Torrey Bot. Club 82: 430. 1955), these are but modifications of the dichasium. The verticillaster described by Valeton seems also a modification of the dichasium, with an obsolete or absent peduncle and fasciculate rachises. Corymbose panicles, according to Valeton present in *G. avene* Valeton and *G. australianum* F. v. Muell., are also basically dichasial. The main rachis is branched into opposite laterals, which are subtended by bracts, each node thus being bibracteate; on the irregular (not triflorous) branchlets there may be single unpaired bracts, or a pair of bracts without branchlets in their axils. In most inflorescences the calyces are subtended by bracteoles. In general, the nature of the inflorescence is diagnostic for only a few unusual species (e.g. in our area *G. gracile*, *G. macrophyllum*, *G. insulare*, and perhaps *G. calcicola*), but still it provides a valuable supplementary character in delimiting taxa.

The pioneering work of Valeton in *Geniostoma* has elucidated the incipient and actual sexual dimorphism in various species and has explained the diverse types of gynoecia. Dimorphism is expressed in some species by a considerable difference in stylar length, and in addition by the form and pubescence of the stamens. In general,

it would appear that flowers with long styles are those with fertile anthers, while those having short styles have sterile anthers. In the species of our area, however, marked dimorphism is not obvious, and short-styled flowers frequently appear to have fertile anthers. The close approach to dioecism that Valeton discussed in relation to certain Javanese species is lacking in the Fijian-Samoan area, at least as far as can be ascertained from gross microscopic observations. However, in certain cases, e.g. in *G. vitiense*, there is a fairly marked heterostyly, accompanied by anther differences. Stylar length is thus seen to be a character related to sexual dimorphism, and as such it is hardly appropriate for use in specific distinctions. In this regard, one may wonder whether the species from Saipan described as *G. longistylum* by Gilg is merely a long-styled form of *G. micranthum* DC. or *G. hoeferi* Gilg & Benedict; students of Micronesian species should review *Geniostoma* with this in mind.

The presence or absence of trichomes on the anthers, found to be of some use in the species discussed by Valeton, is apparently of little or no consequence in our species. The shriveled thecae of the sterile anthers mentioned by Valeton are not obvious in specimens from our region; at least we have noted no anthers that appear to be sterile, although of course it is possible that non-fertile pollen or reduced fertility exist in some cases. In respect to floral dioecism in the species of our area, there seems to be little or no sterilization of the gynoecia. Incipient tendencies seem to be toward hermaphrodite vs. pistillate individuals, but these tendencies are of no present taxonomic use.

Significant specific differences are found in the venation of the corolla, although these differences are difficult to express verbally without resorting to lengthy and complex phrases. We have included an illustration for each species here treated (Plate 1) showing the corolla split between two lobes and flattened out (two lobes are omitted from each sketch for brevity). In one basic type of corolla-venation, illustrated by *G. confertiflorum*, *G. clavigerum*, and *G. uninervium*, each corolla-lobe is supplied by a single main nerve, which may produce a few lateral branches, but these are so few or so inconspicuous that the impression of a one-nerved lobe is given. A second type of venation is more complex and could be described as somewhat candelabriform. In this type the main central nerve supplying each lobe has one or more laterally produced pairs of branches, these either subparallel or arcuately ascending and in turn usually laterally branched. Among our species the nerves anastomose and form reticulations only in *G. dictyoneurum*, in other species being free in the lobes. Whether the main vein supplying each lobe sends out its first branches high or low in the corolla provides a character of some

use. A division into three veins at or near the base of the corolla-tube frequently occurs in such species as *G. rupestre* and *G. macgregorii;* elsewhere, as in *G. stenocarpum* and *G. insulare*, the main vein usually branches first near the summit of the corolla-tube or in its throat. However, there is no real consistency within species as to this venation-pattern, and it should be used with caution as a differentiating character, even though incipient trends are apparent. For the most part the venation is readily observed in corollas of relatively thin texture; in species with a more carnose corolla that organ must be boiled and the outer tissue separated with dissecting tools, the venation then being apparent. The venation of the calyx, which usually has three nerves ascending into each lobe, provides a less useful character in species differentiation.

In most species of *Geniostoma* in our area the corolla is glabrous without, but all species observed by us have an obvious indument in the throat. The trichomes of the corolla-throat are white, thin, and retrorse, but as they sometimes extend to the inner surface of the lobes they tend to become spreading or even ascending. The length of the corolla-throat trichomes provides a very useful and consistent character. Among our species these trichomes are either "short" (0.1–0.4 mm. long) or "long" (0.4–0.9 mm. long); while such a dimensional difference is not striking, there appear to be no species in which a decision is difficult. Of course detection and measurement of so minute a character are facilitated by adequate microscopic and micrometric equipment, but even with a hand lens one can usually decide whether the trichomes are "short" or "long."

Pubescence similar to that within the corolla-throat extends to the filaments; rarely the anthers also bear trichomes of the same type. The gynoecium in *Geniostoma* is characteristically glabrous, but one of our species, *G. macrophyllum*, differs strikingly in having its ovary copiously hirtellous on the distal surface. The style only rarely is weakly hirtellous. The stigmas form a globose or clavate to obovoid capitulum that is minutely papillate, with papillae essentially conical but sometimes so slender as to appear setulose. It may be added here that the radial nature of the stigma, with the papillae in marked radial groups as shown in the Forsters' plate (*t. 12*), has been noted in *G. vitiense*.

A marked and diagnostic character found in certain Malaysian species, that of mucronulate or apiculate anthers, is of less importance in our area. However, in some instances (e. g. in *G. samoense* var. *parviflorum*) there does appear to be a very minute mucro on the anther. There is also some indication that apiculation of the anthers may be correlated with incipient sexual dimorphism, as mentioned and illustrated under *G. vitiense* and *G. macgregorii*. However,

all of our species fundamentally have obtuse or merely acute anthers, unlike such species as *G. arboreum* (Bl.) Kuntze (=*G. haemospermum* Steudel) and *G. miquelianum* Koorders & Valeton as described by Valeton.

The capsules in our species are usually ellipsoid to ovoid or obovoid, briefly apiculate by the persistent base of the style. However, a tendency toward essentially globose capsules is seen in *G. insulare* f. *sphaerococcum* and *G. dictyoneurum*. The capsules are subtended by persistent calyces, and all of them dehisce into two recurved valves to expose the seminal mass. The degree of recurvature of the valves, mentioned by Valeton, seems to us of little or no diagnostic use.

In summarizing this discussion of specific criteria, we agree with earlier students of *Geniostoma* in finding none of them entirely satisfactory. In approximate order of usefulness in differentiating the species of our region may be mentioned: type of stipule, presence or absence of ovary-indument, length of trichomes of the corolla-throat, type and abundance of vegetative pubescence, position and type of inflorescence and number of flowers, corolla-venation, stigma-shape, capsule-shape, and terete vs. angled or winged branchets. Various combinations of these characters and others of lesser value permit the recognition of taxa that seem to possess stability. That our delimitation of taxa is somewhat subjective is obvious, but this is inevitable in a study where experimental methods are impracticable.

Systematic Treatment

Geniostoma J. R. & G. Forst. Char. Gen. 24. *t. 12*. 1776.

As presently known, *Geniostoma* is composed of about 95 species of trees and shrubs. It is exclusively Old World in distribution, occurring from the Mascarene Islands through Malaysia north to Kyushu (Japan) and the Marianas and East Caroline Islands, south to Australia and New Zealand, and east to the Society Islands. The species at the extreme north and south limits of the genus are *G. ligustrifolium* A. Cunn. (New Zealand), *G. petiolosum* C. Moore & F. v. Muell. (Lord Howe Island), and *G. glabrum* Matsumura (Japan). Many species are ecologically correlated with the coastal lowland vegetation of tropical islands, but increasing numbers are becoming known from the cool, wet forests of the high interiors of such large islands as New Guinea.

Characteristic features of the genus are the presence of stipules, the simple opposite leaves, the axillary or cauline dichasial inflorescences, the tubular 5-lobed calyx and corolla, the insertion of the 5 stamens on the corolla-tube near its throat, the bilocular ovary, the numerous anatropous or nearly amphitropous ovules, and the bivalved, capsular,

dehiscent fruits with seeds embedded in an eventually exposed pulpy mass. The persistence of the seed-mass between the valves of the dehisced capsule is noteworthy; the seeds remain on persistent funicles and are enclosed by the pulp, which dries to a thin pellicle; the placentation persists until at last the mass drops or is broken from the exocarp and then splits into two halves, corresponding to the contents of each locule of the ovary. The seeds are ovate-angulate, usually concave at the hilum and minutely papillate; the embryo, embedded in a small amount of smooth endosperm, is short-oblong, usually more than half the length of the seed, and very shortly divided at apex into two cotyledons.

Key to the Species

Stipules large, forming foliaceous sheaths 1–3.5 cm. long, adnate to margins of petioles and caducous, leaving obvious linear scars; leaves large for the genus, the blades often exceeding 30×15 cm. (but sometimes smaller); inflorescences borne on trunks or branches or defoliate branchlets; Fijian species.

Ovary copiously hirtellous on distal surface; corolla-lobes glabrous (except at base within); inflorescences cauline, glomerate to elongate (to 25 cm. long) and with as many as 200 flowers; leaves glabrous . . **1. G. macrophyllum**

Ovary glabrous; corolla-lobes densely hirtellous within; inflorescences ramuline, dichasial, 15–20-flowered; leaf-blades (as well as other young parts) copiously pubescent beneath at least on principal nerves, the trichomes predominantly 3-celled, about 0.5 mm. long . . . . . **2. G. stipulare**

Stipules intrapetiolar, small, forming inconspicuous sheaths no more than 2 mm. long, the petioles without obvious stipular scars; leaves comparatively small, the blades not exceeding 24×13 cm. and usually much smaller; inflorescences axillary or rarely on defoliate branchlets.

Leaves obviously petiolate, the petioles normally at least 4 mm. long, the blades various at base (acute or attenuate to rounded) but not cordate.

Corolla-venation comparatively simple, each lobe supplied by a single nerve with a few short faint laterals, or essentially unbranched; trichomes of the corolla-throat obvious, 0.6–0.7 mm. long; Fijian species.

Stigma oblong-clavate, obovoid, or ellipsoid; each corolla-lobe supplied by a faint nerve with 1 or 2 usually unbranched laterals on each side.

Leaves comparatively large, the petioles 9–20 mm. long, the blades usually 10–23×5–12 cm.; inflorescences 5–11-flowered; corolla-lobes with a single pair of faint lateral nerves arising from the midnerve . . . . . **3. G. confertiflorum**

Leaves smaller, the petioles 5–9 mm. long, the blades 3–8×1–3.6 cm.; inflorescences 3–5 (rarely to 9)-flowered; corolla-lobes with 2 pairs of lateral nerves arising from the midnerve . . **4. G. clavigerum**

Stigma globose; each corolla-lobe supplied by a single dark relatively conspicuous nerve with brief and obscure (or usually without) laterals; petioles 5–9 mm. long, the leaf-blades ovate, usually about 10–12×3–5 cm . . . . . **5. G. uninervium**

Corolla-venation comparatively complex, each lobe supplied by a nerve that produces in the corolla-tube (or at its base) one or several pairs of obvious lateral nerves, these ascending together into the lobe and usually rebranched.

Trichomes of the corolla-throat short, 0.1–0.4 mm. long.
Indument of young parts of plant copious, although minute, composed of setulose trichomes 0.05–0.2 mm. long, these obvious on the young branchlets, petioles, and often on ventral surfaces of leaf-blades, especially on costae; inflorescence-branches similarly pilose; Fiji to Tonga and Niue . . . . . **6. G. vitiense**
Indument lacking throughout (except within corolla).
Inflorescences elongate, with branchlets and pedicels 7–17 mm. long, 3–7-flowered; corolla-lobes glabrous and smooth, each supplied by a nerve that branches high in the tube or in the throat; stigma clavate-obovoid; capsules ellipsoid, 5–9×4–7 mm.; Samoa. **7. G. gracile**
Inflorescences comparatively compact, with branchlets and pedicels 2–6 mm. long, 5–15(–20)-flowered; corolla-lobes pilose proximally or pustulose within, each supplied by nerves diverging in lower part of tube or at its base; stigma globose; capsules narrower, 7–13×3–4.5 mm.; Fiji and Tonga . . . . . **8. G. macgregorii**
Trichomes of the corolla-throat comparatively long, 0.4–0.9 mm. long.
Leaf-blades puberulent on both surfaces (hairs obvious, about 0.3 mm. long), elliptic, 3.5–5×1.5–2.5 cm., rounded at apex; Fiji. **9. G. calcicola**
Leaf-blades glabrous, or pilose only on the ventral costae, variously shaped but most often acute to acuminate at apex.
Corolla-venation complex, each lobe supplied by a nerve branched in lower portion of tube, the branches rising into the lobe and there forming a reticulum of short veinlets; leaf-blades thin in texture, ovate, 7–12×3.5–7 cm., usually rounded at base and apex; Fiji . . . . . **10. G. dictyoneurum**
Corolla-venation not reticulate, the veinlets in the lobes free.
Flowers comparatively large, the corolla 4.5–5 mm. long, each lobe supplied by a dichotomous main nerve with several laterals; leaf-blades oblanceolate or narrowly elliptic, 4–12×1.5–3.5 cm.; branchlets quadrangular and narrowly winged distally; Samoa . . . . . **11. G. fleischmannii**
Flowers comparatively small, the corolla 2.5–3.5 mm. long, each lobe supplied by a single main nerve with 1 or 2 pairs of laterals; branchlets not winged.
Leaf-blades lanceolate or narrowly ovate, 4–7.5×1.2–2.7 cm.; each corolla-lobe supplied by a nerve divided in the throat; Fiji . . . . . **12. G. stenocarpum**
Leaf-blades various in shape, usually exceeding 8×3 cm.
Inflorescence-axes minutely puberulent with trichomes no more than 0.03 mm. long; vegetative parts glabrous; leaf-blades ovate to broadly ovate, 8–18×4–9 cm. (often smaller in var. *parviflorum*); Samoa . . **13. G. samoense**
Inflorescence-axes glabrous (or, if puberulent in some forms of no. 15, then the young vegetative parts also puberulent).
Leaf-blades acuminate or obviously cuspidate at apex; each corolla-lobe supplied by a nerve usually branching at or near base of tube; New Hebrides and Santa Cruz Islands, and perhaps westward . . . . **14. G. rupestre**

Leaf-blades rounded to obtuse (or sometimes broadly acute or bluntly cuspidate) at apex; each corolla-lobe supplied by a nerve usually branching in upper part of tube; Fiji to Samoa, Tonga, and Niue . . . . . **15. G. insulare**

Leaves subsessile, the petioles 2 mm. long or less, the blades subauriculate, cordate, or subcordate at base; plant glabrous throughout except for the usual corolla-throat trichomes, these 0.3–0.4 mm. long; Samoa.

16. G. biseriale

1. Geniostoma macrophyllum Gillespie in Bishop Mus. Bull. 91: 25, *fig. 28*. 1932.

PLATE 1, FIGURE 1; PLATE 2, FIGURES 1–3

Small tree to 10 m. high, glabrous throughout except for some floral parts, the trunk to 25 cm. in diameter; branchlets stout, distally 4–8 mm. in diameter and compressed-quadrangular, becoming terete and up to 2 cm. in diameter; stipules forming a foliaceous sheath up to 15 mm. long, distally acute, laterally united with the alate petiole-margin; leaves large for the genus, the petioles broadly alate, not distinct from the blade, the blades chartaceous, ovate to elliptic or sometimes obovate, 22–55 cm. long, 9–25 cm. broad, gradually decurrent at base and produced laterally along the petiole into a broad decurrent wing, obtuse to bluntly cuspidate at apex, entire at margin, the costa stout, conspicuous, sulcate above, prominently elevated beneath, the secondary nerves 11–20 pairs, arcuate-ascending, irregularly anastomosing near margin, slightly sulcate above, raised beneath, the veinlets prominulent on both surfaces; inflorescences cauline on old wood, often near base of trunk, variable in size and shape, when young somewhat glomerate, at length more or less pendent on elongated branching woody axes bearing numerous congested triflorous dichasia, sometimes up to 25 cm. long and bearing as many as 200 flowers, freely branching, with deltoid, acute, inconspicuous bracts and small ultimate bracteoles less than 1 mm. long; flowers subsessile in congested groups of 3; calyx cupuliform, about 2 mm. in diameter, lobed to the middle, the lobes deltoid-ovate, acute, 1–3 (–5)-nerved, the nerves free; corolla 3–3.3 mm. long, divided to middle, the tube 1.5–1.7 mm. long, pilose at throat, the trichomes about 0.6 mm. long, dispersed in a uniform band around throat down to middle of tube, the lobes deltoid-ovate, about 1.5× 1.5 mm., glabrous without and within except at extreme base at throat, the venation comparatively simple, each corolla-lobe supplied by a single usually 3-branched vein, the branches arising midway in the tube; stamens with short glabrous or sparsely ventrally barbate filaments about 0.3 mm. long, the anthers broadly ovoid, about 0.5 mm. long, sparsely hirtellous at base, acute at apex; ovary depressed-globose, conspicuously flattened distally, about 0.6 mm. high and 1.6 mm. in diameter, laterally glabrous but copiously hirtellous on distal surface with erect hairs about 0.2 mm. long, the style gla-

brous, 0.4–0.5 mm. long, the stigma depressed-globose, papillate, about 0.5 mm. broad; capsules glabrous, ovoid-ellipsoid, apiculate by the stylar remnant, 8–11 mm. long.

TYPE LOCALITY: Near Nasinu, Naitasiri Province, Viti Levu, Fiji; the type is *Gillespie* 3638, cited below.

DISTRIBUTION: Endemic to Fiji, and known thus far only from Viti Levu, Vanua Levu, and Ovalau, as a slender tree 3–10 m. high, with a trunk 4–10 (–25) cm. in diameter, occurring in wet forests at altitudes from near sea level to 850 m. The inflorescences, which consist of dense many-flowered glomerate or elongate irregular dichasia, are borne on the trunk, often less than a meter from the ground. The corolla is noted as greenish white, within hirtellous with whitish hairs; other floral parts are whitish. The capsule at maturity is black, with orange seeds. No local names or uses are indicated.

FIJI: VITI LEVU: Mba: Hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, *Smith* 6168 (A, Bish, K, US). Serua: Hills along coastal road, *Greenwood* 976A (A). Namosi: Hills east of Wainikoroiluva River near Namuamua, *Smith* 8899 (US); hills bordering Wainavindrau Creek, near Wainimakutu, *Smith* 8552 (US); hills east of Navua River, *Greenwood* 976 (A). Naitasiri: Near Viria, *Parks* 20461 (Bish, UC); along Tamavua-Sawani road, *Setchell & Parks* 15071 (Bish); near Nasinu, *Gillespie* 3638 (Bish type, GH, UC); near Suva Pumping Station, *Degener & Ordonez* 13746 (A, Bish, K, NY). Naitasiri or Rewa (near border): Mt. Kombalevu, *Parks* 20317 (Bish, UC, US); near Tamavua, *Jeoward* 65 (K); woods near Tamavua, *Gillespie* 2109 (Bish). Rewa: Slopes of Mt. Korombamba, *Gillespie* 2297 (Bish); Suva Ditch Trail, *Bryan* 370 (A, Bish); Princes Road, *Meebold* 16791 (Bish); Central Road, Suva, *Tothill* 613 (Bish, K), 617 (K). VITI LEVU, without locality, *Parks* 20870 (Bish, UC). VANUA LEVU: Thakaundrove: Southern slope of Korotini Range, below Navitho Pass, *Smith* 573 (Bish, GH, K, NY, UC, US). OVALAU: Near summit of main range west of Levuka, *Gillespie* 4449 (Bish, UC); Mt. Tana Lailai, near Levuka, *Graeffe* in 1864 (K).

Geniostoma macrophyllum, together with the new species *G. stipulare*, is isolated in relation to the other species of our area in gross and obvious features as well as in technical characters. These two species exhibit certain vegetative characteristics in common: unusually large leaves; enlarged, petiolar stipules; and cauliflory or ramuliflory. In particular, the nature of the stipules, which in both species are adnate to the margins of the petiole and in *G. macrophyllum* united to the basal part of the blade also, marks these species as amply distinct from their Fijiian congeners, and indeed from most of the other Pacific species which have been the subject of our attention.

Geniostoma macrophyllum is abruptly distinct from *G. stipulare*, and displays very little intraspecific variation of consequence. Only one specimen (*Jeoward* 65) is unusual, in that its leaves are markedly obovate and more or less cuspidate at apex, and in addition, the branches of the inflorescence are excessively elongated; yet the

flowers are indistinguishable from those of the other cited specimens of *G. macrophyllum*.

The phenomenon of cauliflory is more marked in *G. macrophyllum* than in other species of the genus, with the exception of *G. caulocarpum* K. Schum., of New Guinea, the inflorescences often appearing close to the ground on the main trunk. In *G. stipulare* the inflorescences are mostly ramuline, and in addition are fewer-flowered and more strictly cymose. In all other Fijian *Geniostomata*, the inflorescences are either strictly axillary among the leaves, or both axillary and ramuline on juvenile branches.

While we believe that the two species here discussed form a distinct section within *Geniostoma*, we refrain from proposing a formal name, since this should follow a monographic study of the entire genus.

2. Geniostoma stipulare Smith & Stone, sp. nov.

PLATE 1, FIGURE 2; PLATE 2, FIGURES 4–9

Arbor parva ad 5 m. alta, innovationibus et ramulis atque stipulis foliorum petiolis et laminis subtus rufo-pilosis, pilis 3-cellularibus circiter 0.5 mm. longis; ramulis subteretibus vel subcompressis apicem versus 2–5 mm. diametro; stipulis gemmam circumcludentibus per margines petiolorum fere ad basim laminae adnatis anguste oblongis, 1–3.5 cm. longis, caducis; foliis magnitudine disparibus, petiolis 1.5–4.5 cm. longis supra sulcatis subtus rotundatis, laminis ovatis ellipticis vel obovatis, 6.5–34 cm. longis, 3–18 cm. latis, basi cuneato-decurrentibus, apice acuminato-cuspidatis, margine integris, nervis majoribus subtus copiose et areolis sparsius pilosis, costa supra leviter sulcata subtus valde elevata, nervis secundariis utrinsecus 8–15 utrinque paullo elevatis, venulis subtus prominulis; inflorescentiis secus ramos vel ramulos defoliatos enatis conferto-glomeratis sub-sessilibus dichasialibus 15–20-floris, pedunculo ad 1 mm. longo, pedicellis 1–6 mm. longis, bracteolis forma et textura calycis lobis similibus; floribus (videtur pistillatis) in dichasiis congestis trifloris dispositis; calyce cupuliformi, lobis orbiculari-ovatis 1–1.5 mm. longis paulo latioribus 3–5-nervatis; corolla 4.5–5.2 mm. longa ad medium lobata, tubo lobisque extus glabris, tubo intus basi glabro faucibus pilis albis circiter 0.8 mm. longis hirtello, lobis ovatis intus praeter apicem dense hirtellis, nervatio comparate multiplice, corollae quoque loba nervis 3 e basi tubi in lobam adscendentibus praedita, quoque nervo laterali faucibus semel diviso; staminibus in speciminibus nostris forsan abortivis, filamentis deltoideo-ligulatis circiter 0.8 mm. longis pilosis, antheris lanceolato-oblongis apice acutis circiter 1.3 mm. longis et 0.5 mm. latis basi breviter hirtellis, thecis fortasse sterilibus; ovario glabro depresso-globoso 1–1.6 mm. alto 2.5–3 mm. lato, stylo filiformi 2.5–3.5 mm. longo, stigmate globoso diametro

circiter 1.1 mm. papilloso; capsula ovoidea 9-10 mm. longa circiter 4 mm. lata apice apiculata.

Type in the U.S. National Herbarium, Nos. 2192146 and 2336118, collected among hills east of the Navua River, near Nukusere, Province of Serua, Viti Levu, Fiji, alt. 100–200 m., November 2, 1953, by A. C. Smith (No. 9148). Duplicates to be distributed.

ADDITIONAL SPECIMENS EXAMINED:

FIJI: VITI LEVU: Naitasiri or Namosi: Mt. Naitarandamu, near summit, *Gillespie* 3364 (Bish, UC). VANUA LEVU: Thakaundrove: Mt. Ndikeva, in forest on eastern buttress, *Smith* 1860 (Bish, GH, K, NY, UC, US).

DISTRIBUTION: The few specimens known of this species indicate that it is a Fijian endemic restricted to Viti Levu and Vanua Levu. It is a shrub or small, slender tree up to 5 m. high, with relatively large leaves, for the genus, which are sparsely but rather uniformly pubescent on the lower surfaces; it has ramuline inflorescences consisting of congested, subsessile dichasia. The corolla and other floral organs are white, except for the stigma, which is pale yellow.

LOCAL NAME: On the label of *Smith* 1860 the common name is given as *muskarimba*, but this is questionable, since the name often refers to members of the genus *Cyrtandra* (Gesneriaceae), some species of which in fact resemble *G. stipulare* in foliage and superficially in fruit.

This new species, while varying considerably in the size of its leaves, sometimes attains a leaf-size approaching or equalling that of *G. macrophyllum*—two or three times larger than the leaves of most other Fijian *Geniostomata*. However, the pubescence of the leaves and of the inner surfaces of the corolla-lobes, the glabrous ovary, the pilose filaments, the relatively large flowers, and the unusual stipules effectively characterize this species. The inflorescences are noteworthy in that they are borne on older branches, being much contracted dichasia bearing relatively few flowers.

That the relationship of *G. stipulare* is to *G. macrophyllum* is indicated by the large, petiolar stipules and the position of the inflorescences. Together they form a somewhat isolated group; nonetheless, they are nearly as distinct from each other as they both are from their other Fijian congeners. Even the type of trichome that *G. stipulare* produces is distinct; it is usually a three-celled hair, the cells being elongate, and on drying it becomes flattened, the cells then seeming oriented in different planes. These peculiar trichomes, however, are limited to the leaves and innovations; those of the corolla-throat are of the more ordinary type, cylindric and apparently nonseptate.

At mature branchlet-nodes the stipules are lacking, but their occurrence is indicated by the long scars that are left, one on each margin of the petiole, from the base to a point definitely below the blade, but about three-fourths as long as the petiole. Apparently the stipules

are split by the expansive growth of the young leaves, and the remnants are caducous.

There is possibly a third undescribed species of *Geniostoma* of this relationship present in Fiji as yet represented only by a few fragments which are mounted, together with a leaf of *G. macrophyllum*, on a single sheet (*Degener* 14027, from Vanua Levu, in the herbarium of the Arnold Arboretum). If the remaining leaf, which manifestly does not represent *G. macrophyllum*, and the inflorescences do in fact belong together as representing one plant, there seems little doubt that an undescribed species still awaits adequate collecting. The leaf, which is hirtellous beneath with the same three-celled type of trichome found in *G. stipulare*, is as large as those of the type of that species, with a long slender petiole displaying the two linear stipular scars also characteristic of *G. stipulare* (terminating before the base of the blade), but the blade is basally auriculate. The inflorescences, which are greatly elongated and appear to be cauline, bear numerous small congested flowers like those of *G. macrophyllum*. However, they exhibit glabrous ovaries and decidedly mucronulate anthers, in the former character differing from *G. macrophyllum*, and in the latter from *G. stipulare*.

3. Geniostoma confertiflorum Smith & Stone, sp. nov.

PLATE 1, FIGURE 3; PLATE 2, FIGURES 15, 16

Arbor parva 3–10 m. alta praeter corollae partem interiorem ubique glabra, ramulis apicem versus compressis et 2–5 mm. diametro demum teretibus; stipulis intrapetiolaribus in vagina rotundata circiter 1.5 mm. longa apice minute mucronulata conjunctis; foliis magnitudine moderatis, petiolis anguste alatis 9–20 mm. longis, laminis ellipticis vel ovatis, 7–24 cm. longis, 3–13 cm. latis, vulgo 10–23 × 5–12 cm., basi cuneatis vel rotundatis et decurrentibus, apice acuminatis, margine integris, costa supra sulcata subtus elevata, nervis secundariis utrinsecus 8–12 subtus prominulis, venulis obscuris; inflorescentiis axillaribus dichasialibus 5–11-floris, pedunculo communo subnullo haud 1 mm. longo, rhachidibus primariis 1–3 mm. longis bibracteolatis, bracteolis circiter 0.6 mm. longis, pedicellis 2–3 mm. longis in calycem dilatatis; floribus visis videtur hermaphroditis; calyce cupuliformi circiter 2.5 mm. longo, lobis ovatis circiter 1.5 mm. longis 3–5-nervatis; corolla 4–4.7 mm. longa extus glabra, tubo 2–2.4 mm. longo intus basim versus glabro faucibus pilis albis circiter 0.6 mm. longis hirtello, lobis ovatis 2–2.3 mm. longis erectis vel subpatentibus intus praeter basim glabris, nervatio simplice, corollae quoque loba nervo unico subobscuro per tubum ad lobam adscendente praedita, quoque nervo venulum unicum subsimplicem inconspicuum faucibus ferente; staminium filamentis deltoideo-ligulatis 0.3–0.4 mm. longis, antheris anguste

ovoideis circiter 1 mm. longis ubique glabris apice minute apiculatis vel subretusis; ovario depresso-globoso glabro diametro circiter 1 mm., stylo 1–1.3 mm. longo, stigmate oblongo-clavato 1–1.3 mm. longo minute papilloso; capsula late ellipsoidea 7–9 mm. longa apice apiculata, seminibus circiter 1 mm. longis cumulo pulposo flavo-aurantiaco immersis.

Type in the U.S. National Herbarium, No. 2191173, collected in hills north of Wainavindrau Creek, between the Korombasambasanga Range and Mt. Naitarandamu, Province of Namosi, Viti Levu, Fiji, alt. 250–450 m., September 14, 1953, by A. C. Smith (No. 8488). Duplicates to be distributed.

ADDITIONAL SPECIMENS EXAMINED:

FIJI: VITI LEVU: Serua: Mbuyombuyo, near Namboutini, *Tambualewa* 15593 (A, Bish, K, NY, UC, US); hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith* 9240 (US). Naitasiri: Near Tamavua, *Gillespie* 2059 (Bish, NY, UC, US); near Nasinu, *Gillespie* 3637 (Bish, UC, US). Rewa: Near Lami, *Gillespie* 2317 (Bish, UC); Central Road, Suva, *Tothill* 611 (K). OVALAU: Summit of Mt. Ndelaiovalau and adjacent ridge, *Smith* 7381 (US), 7621 (US). NGAU: Slopes of Mt. Ndelaitho, on northern spur toward Navukailangi, *Smith* 7878 (US); hills east of Herald Bay, inland from Sawaieke, *Smith* 7744 (US).

DISTRIBUTION: Endemic to Fiji, thus far known from Viti Levu, Ovalau, and Ngau. The species is noted as arborescent, becoming 3 to 10 m. high, with a trunk up to 5 cm. in diameter; the flowers are white or pale greenish, with the anthers and stigmas sometimes pale yellow. The seeds are noted as yellow. The habitat is in woods or forest, often on ridges or in rocky areas, at elevations from near sea level to 626 m. No local names have been recorded.

This new species, as well as the next one, *G. clavigerum*, is characterized by its clavate stigma; in other Fijian species the stigma is globose or subglobose. In addition, both these species and a third, *G. uninervium*, are similar in that the nervation of their corolla-lobes is relatively simple, consisting of a sparsely or almost unbranched single central nerve.

Of the specimens cited, those from Ngau (*Smith* 7744, 7878) and one from Viti Levu (*Gillespie* 2317) exhibit rather large leaf-blades, which are thin in the former but coriaceous in the latter. Other specimens display considerably smaller leaves, which in respect to size differ little from those of the other Fijian species. Also, an unusual condition is present in *Gillespie* 2059, of which the styles are minutely and sparsely hirtellous rather than glabrous. However, with this one exception, the floral characters of all the specimens agree in size, pilosity, shape, and other characters.

Geniostoma confertiflorum is a species not closely related to those often confused with *G. rupestre*, and it is nearly as well marked a species as *G. macrophyllum* or *G. stipulare*. In superficial characters, such as the average size and shape of the leaves, however, it resembles such

species as *G. rupestre*, *G. macgregorii*, and perhaps glabrate forms of *G. vitiense*—all species of a different group, with globose stigmas and complex corolla-venation. More significantly, *G. confertiflorum* is similar in general appearance to *G. clavigerum* and to *G. uninervium*. The following new species, *G. clavigerum*, differs from *G. confertiflorum* chiefly in its small chartaceous leaves, but also in corolla-venation. From *G. uninervium* the present new species is more easily distinguished by the fainter corolla-venation.

4. Geniostoma clavigerum Smith & Stone, sp. nov.

PLATE 1, FIGURE 4

Arbor parva ad 10 m. alta praeter corollae partem interiorem omnino glabra, ramulis subteretibus apicem versus 1–2 mm. diametro; stipulis intrapetiolaribus in vagina rotundata 1–1.5 mm. alta conjunctis; foliis comparative parvis, petiolis 5–9 mm. longis non alatis, laminis chartaceis ovatis vel elliptico-ovatis, 3–8 cm. longis, 1–3.6 cm. latis, basi obtuso-cuneatis, apice acutis vel subacuminatis, margine integris, costa supra paulo sulcata subtus elevata, nervis secundariis utrinsecus 5–9 utrinque prominulis, venulis obscuris; inflorescentiis axillaribus dichasialibus 3–5 (–9)-floris, pedunculo communo ad 1 mm. longo apice bibracteato, axibus secundariis 1–5 mm. longis ad nodos bibracteatis, pedicellis 1–5 mm. longis infra calycem dilatatis et bracteolatis, bracteis bracteolisque anguste ovatis 0.4–1 mm. longis; floribus (visis videtur hermaphroditis) in dichasiis trifloris dispositis; calyce cupuliformi, lobis ovatis 1–1.5 mm. longis acutis minute ciliolatis 3–5-nervatis; corolla breviter tubulosa extus glabra 4–5 mm. longa, tubo 2–2.5 mm. longo intus basim versus glabro faucibus pilis albis reflexis circiter 0.6 mm. longis hirtello, lobis erectis vel subpatentibus glabris vel basi parce pilosis, nervatio subsimplice, corollae quoque loba nervo unico inconspicuo per tubum adscendente et fere faucibus cum nervulis utrinque 2 lateralibus praedita, nervulis in lobas adscendentibus haud vel obscure ramulosis; staminium filamentis ligulatis, antheris anguste ovoideis circiter 1 mm. longis; ovario depresso-globoso diametro circiter 1 mm., stylo filiformi 1–1.2 mm. longo, stigmate clavato obovoideo vel ellipsoideo circiter 1 mm. longo papilloso; capsula ellipsoidea vel ovoidea 9–10 mm. longa apiculata.

Type in the herbarium of the Bernice P. Bishop Museum, collected on slopes near the base of Mt. Nanggaranambuluta [Lomalangi], near Nandarivatu, Province of Mba, Viti Levu, Fiji, alt. 1,050 meters, in November 1927, by J. W. Gillespie (No. 3916). Duplicate at UC.

ADDITIONAL SPECIMENS EXAMINED:

FIJI: VITI LEVU: Mba: Tholo-i-Nandarivatu, *Gibbs* 724 (BM, K); Mt. Nanggaranambuluta [Lomalangi], *Gillespie* 3782 (Bish, UC), 4334 (Bish, NY, UC).

DISTRIBUTION: Endemic to Fiji, known only from northern Viti Levu, in the elevated area near Nandarivatu at about 1,000 m. or

somewhat higher. Records indicate the species as a small tree 4–10 m. high, with white odorless flowers, occurring in dense wet forests.

Geniostoma clavigerum is very close to the preceding, *G. confertiflorum*, and appears to be a smaller-leaved, smaller-cymed plant. The more complex corolla-venation distinguishes the species, but the smaller leaves and fewer-flowered cymes also appear to be constant. The relatively large flowers and clavate stigmas (whence the name), as well as the corolla-venation, are features which distinguish this species from its other Fijian congeners.

5. Geniostoma uninervium Smith & Stone, sp. nov.

PLATE 1, FIGURE 5; PLATE 2, FIGURES 10–14

Arbor parva ad 10 m. alta praeter corollae partem interiorem ubique glabra vel innovationibus ramulis junioribus stipulis petiolis laminae costisque dorso minute rufo-puberula mox glabrata, ramulis subteretibus vel leviter compressis apicem versus 1–2 mm. diametro; stipulis intrapetiolaribus in vagina rotundata 1–1.5 mm. alta conjunctis; foliis magnitudine moderatis, petiolis 5–9 mm. longis non alatis, laminis chartaceis ovatis, 4.5–15.5 cm. longis, 2–7 cm. latis, plerumque 10–12×3–5 cm., basi rotundatis vel obtuse cuneatis et paulo decurrentibus, apice acuminatis, costa supra leviter sulcata subtus elevata, nervis secundariis utrinsecus 5–9 utrinque prominulis, venulis subobscuris; inflorescentiis axillaribus coarctatis dichasialibus 3–9-floris, pedunculo obsoleto haud 1 mm. longo apice bibracteato axes 1–3 principales gerente, axibus 1–3 mm. longis apice bibracteatis 1–3-floris, pedicellis 2–4 mm. longis plerumque ebracteolatis infra calycem haud dilatatis; calyce cupuliformi, lobis deltoideis circiter 1.5×1.5 mm. minute ciliolatis 3-nervatis, nervo medio fusco lateralibus pallidis; corolla circiter 4 mm. longa urceolata fere ad medium lobata, tubo intus basim versus glabro faucibus pilis albis 0.6–0.7 mm. longis hirtello, lobis demum reflexis, nervatio simplice, corollae quoque loba nervo unico fusco conspicuo lateraliter haud ramuloso praedita; staminium filamentis deltoideo-ligulatis circiter 0.4 mm. longis pilosis, antheris glabris anguste ovatis circiter 0.7 mm. longis minute apiculatis; ovario subgloboso circiter 1.2 mm. diametro apice depresso, stylo filiformi circiter 1 mm. longo, stigmate globoso papilloso circiter 0.7 mm. diametro; capsula ellipsoidea vel obovoidea circiter 10 mm. longa.

Type in the U.S. National Herbarium, No. 2191135, collected in hills north of Wainavindrau Creek, between the Korombasambasanga Range and Mt. Naitarandamu, Province of Namosi, Viti Levu, Fiji, alt. 250–450 m., September 11, 1953, by A. C. Smith (No. 8437). Duplicates to be distributed.

ADDITIONAL SPECIMENS EXAMINED:

FIJI: VITI LEVU: Namosi: Trail between Nanggarawai and Saliandrau, *Gillespie* 3217 (Bish, US). Tailevu: Hills east of Wainimbuka River in vicinity of Ndakui-

vuna, *Smith* 7099 (US). Rewa: Southeastern slope of Mt. Korombamba, *Gillespie* 2295 (A, Bish, UC, US). VANUA LEVU: Thakaundrove: Mt. Mariko, *Smith* 461 (Bish, GH, K, NY, UC, US). OVALAU: Hills west of Lovoni valley, on ridge south of Mt. Korolevu, *Smith* 7527 (US). TAVEUNI: Summit of Uluingalau, *Smith* 896 (Bish, GH, K, NY, UC, US).

DISTRIBUTION: Endemic to Fiji; known thus far from Viti Levu, Vanua Levu, Ovalau, and Taveuni. The plant is arborescent, becoming 5–10 m. high, and occurs at elevations of 100 to 1,200 m. in dense forest or thickets. The corolla and filaments are white or greenish white and the anthers white or yellow.

LOCAL NAMES: "*Mboimboinda*" or "*kavikaloa*" (*Smith* 7099). The former name is a rather general one for species of *Geniostoma* and refers to the characteristic foetid odor.

The relationships of this species are apparently with the two preceding ones, all three sharing a relatively simple pattern of nervation of the corolla-lobes. *Geniostoma uninervium* differs from both *G. confertiflorum* and *G. clavigerum* in its globose stigmas and also in the darker corolla-venation. In the simplicity of this venation it differs from all its Fijian congeners.

6. Geniostoma vitiense Gilg & Benedict in Bot. Jahrb. 56: 542. 1921; A. C. Sm. in Sargentia 1: 97. 1942; Yuncker in Bishop Mus. Bull. 220: 216. 1959.

PLATE 1, FIGURE 6; PLATE 2, FIGURES 21–23; PLATE 3, FIGURES 12–15

Geniostoma crassifolium var. *glaberrimum* Benth. in Journ. Linn. Soc. Bot. 1: 97. 1857.

Geniostoma rupestre var. *puberulum* A. Gray in Proc. Amer. Acad. 4: 33, *nomen*. 1859, in Bonplandia 10: 37, *nomen*. 1862.

Geniostoma rupestre sensu Seem. Fl. Vit. 164. 1866; non J. R. & G. Forst.

Shrub or tree to 12 m. high, the innovations and all young vegetative parts densely pubescent with stiffly erect rufous or cinereous setulose trichomes 0.05–0.2 mm. long, these forming a close and fairly persistent indument on the branchlets, petioles, and ventral side of the costa, and often also on the ventral surface of the blade, the leaves and branches finally glabrate; branchlets somewhat compressed-quadrangular and 1–4 mm. in diameter distally, becoming at length terete; stipules intrapetiolar, forming a short subtruncate sheath 1–1.5 mm. long, soon caducous; leaves petiolate, the petioles 3–10 mm. long, exalate, the blades chartaceous to subcoriaceous, ovate to narrowly ovate or lanceolate-ovate, 2.5–15 cm. long, 1–6.5 cm. broad, commonly about 10×4 cm., subtruncate to nearly subcordate or rounded or broadly acute at base, broadly or narrowly acute to somewhat attenuate or slightly acuminate at apex, entire, glabrous above, pubescent beneath at least on the midrib when young, usually also on veinlets and surfaces, at last glabrate, the costa shallowly sulcate above, raised beneath, the lateral nerves 5–12 per side, commonly 6–8, slightly raised on both surfaces; inflorescences axillary

among the leaves, dichasial, commonly 5–15-flowered, all axes and bracts pubescent or in fruit somewhat glabrate, the peduncle 1–3 mm. long, bibracteate at summit with lanceolate bracts 1.5–2 mm. long, the major axes 2–6 mm. long, bibracteate at nodes, the pedicels 3–6 mm. long, bracteolate or bibracteolate and slightly flared into calyx; flowers borne in triflorous (or irregular) dichasia, slightly sexually dimorphic and apparently gynodioecious, heterostyled; calyx cupuliform, glabrous, the lobes deltoid-ovate, acute or slightly acuminate, 3–5-nerved, marginally ciliolate, about 0.8 mm. long and broad; corolla short-tubular, with spreading or reflexed lobes, glabrous externally, 2.8–3.3 mm. long, the tube half as long, glabrous within at base but above closely pilose around the throat with pale retrorse trichomes 0.2–0.4 mm. long, the lobes glabrous within except at the extreme base with a few trichomes along the veins, ovate, the nervation relatively complex, each lobe supplied by a branching system of nerves consisting of a central main nerve entering the base of the tube and producing 1 or commonly 2 pairs of lateral veins in the upper part of the tube or throat or near the base of the lobe, each lateral vein usually branched once or twice (or rarely thrice), producing brief lateral veinlets, these occasionally obscurely forked near their apices, all ascending in the lobe; stamens inserted at the throat, the filaments deltoid-ligulate, 0.3–0.4 mm. long, retrorse-pilose with trichomes like those of the corolla-throat, the anthers in short-styled flowers narrowly deltoid, about 0.8 mm. long, devoid of pollen, minutely apiculate at apex, the connective pilose at base, the thecae pilose with shorter trichomes at base, the anthers in long-styled flowers fertile, oblong-ovate, 0.8–0.9 mm. long, minutely retuse at apex, the connective glabrous, the thecae basally sparsely hirtellous or glabrous; ovary glabrous, in short-styled flowers large, subglobose, about 1.2 mm. in diameter, the style obsolete or to 0.3 mm. long; the ovary in long-styled flowers smaller, subglobose, about 0.9 mm. in diameter, the style 0.8–0.9 mm. long; stigma papillate, globose, about 0.8 mm. in diameter; capsule ellipsoid, apiculate, 5–9.5 mm. long, 3.5–4.5 mm. broad.

TYPE LOCALITY: Fiji, without precise locality; the type is *Seemann* 301, presumably the specimen deposited in the Berlin herbarium and subsequently destroyed. However, isotypes are available at Kew and the British Museum and are cited below.

DISTRIBUTION: Fiji, Tonga, and Niue, of general occurrence from near sea level to 600 m. altitude in dry forests, secondary forests, open hilly country, or near streams. The species has been recorded as shrubby but also as a tree up to 12 m. high, with a trunk 8 cm. in diameter and curved, pendent branches. The greenish white

flowers produce a markedly foetid odor, which accounts for the Fijian name.

LOCAL NAMES AND USE: Commonly known in Fiji as *mboimboinda*, but also with the following recorded names: *mbatimara* (*Smith* 8966), *mbatimboni* (*Smith* 8405). In Tonga, recorded names are *faifailunga* and *fifilunga*, and on Lifuka (Yuncker), *te'e pilo a Maui*. On Niue, the names *tete* and *teatea* have been recorded by Yuncker. One record of a medicinal use is given, from the Yasawa Group, Fiji, by St. John, where some part of the plant is used as a remedy for stomach-ache.

FIJI: YASAWA GROUP: WAYA: Olo Creek, north of Yalombi, in woods, *St. John* 18018 (Bish, US). VITI LEVU: Mba: North of Lomolomo, *Degener & Ordonez* 13650 (A, Bish, K, NY, UC, US); north of Natalau, *Degener* 15003 (A, Bish, K, NY, UC, US); mountains near Lautoka, *Greenwood* 1237 (A, UC, US); Nandarivatu, *Gibbs* 555 in part, as to pubescent specimen only (BM). Nandronga & Navosa: Near Kalaro, *H. B. R. Parham* 208A (BM); hillsides above Tholo Levu, Nokonoko District, *H. B. R. Parham* 246 (BM). Serua: Hills west of Waivunu Creek between Ngaloa and Korovou, *Smith* 9215 (US), 9274 (US); hills between Navua River and Wainiyavu Creek, near Namuamua, *Smith* 8966 (US); hills east of Navua River near Nukusere, *Smith* 9100 (US). Ra: Vicinity of Rewasa, near Waileka, *Degener* 15461 (A, Bish, K, NY, US). Namosi: Valley of Wainambua Creek, south of Mt. Naitarandamu, *Smith* 8767 (US); hills north of Wainavindrau Creek, between Korombasambasanga Range and Mt. Naitarandamu, *Smith* 8405 (US); near Namosi, in valley of Waindina, *Gillespie* 2619 (Bish, UC). Naitasiri: Near Korosuli, on Wainimala River, *Horne* 978 (K); near Viria, *Meebold* 16499 (K); along Navutu-Nanduna track, *B. E. Parham* 3011 (A); Tholo-i-Suva, *Parks* 20890 (Bish, UC, US); woods near Nasinu, *Gillespie* 3493 (Bish, UC, NY). Naitasiri or Rewa, on border: Mt. Kombalevu, *Parks* 20293A (Bish, US), 20330 (Bish, UC, US). Rewa: Near Suva, *Jeoward* 100 (K). Viti Levu, without precise locality: *Graeffe* 1371 (K). VANUA LEVU: Mbua: Rukuruku Bay, *H. B. R. Parham* 5 (GH). Mathuata: Seanggangga Plateau, in drainage of Korovuli River, near Natua, *Smith* 6642 (A, Bish, K, NY, US); Lambasa, *Greenwood* 490 (K); summit ridge of Mt. Numbuiloa, east of Lambasa, *Smith* 6507 (A, Bish, K, NY, US); Navukuru, south of Lambasa, *Gressitt* 2483 (US). Thakaundrove: Eastern drainage of Yanawai River, *Degener & Ordonez* 14104 (A, Bish, K, NY, UC, US); hills south of Nakula valley, *Smith* 326 (Bish, GH, K, NY, UC, US); Maravu, near Salt Lake, *Degener & Ordonez* 14233 (A, Bish, K, NY, UC, US). Vanua Levu, without precise locality: *U.S. Expl. Exped.* (source of the name *G. rupestre* var. *puberulum*, GH, K, NY, US); *Horne* 614 (K); *Guppy* in 1899 (K); *Tothill* F456 (K). TAVEUNI: Near Waiyevo, *Gillespie* 4634 (Bish); near Wairiki, *Gillespie* 4400.2 (Bish, NY, UC, US). OVALAU: *Milne* 270 (K, type of *G. crassifolium* var. *glaberrimum*); Port Kinnaird, *Seemann* 300 (BM, K). NGAU: Shore of Herald Bay near Sawaieke, *Smith* 8000 (US). Fiji, without definite locality: *Seemann* 301 (isotypes, BM, K, fragment at GH).

TONGA: VAVA'U: *Home* in 1846 (BM); *Barclay* 338A (BM); *Crosby* 229 (K); Talau Hill, *MacDaniels* 1092 (Bish); near upper rim of seaside cliff above Ha'alaufuli on northeastern part of island, *Yuncker* 16101 (US). "Vavau and Lifuka": *Harvey* in 1855 (GH, K). LIFUKA: *Yuncker* 15787 (US). Tonga, without definite locality, "*Capt. Cook*" (BM).

NIUE: East of Alofi village, *Yuncker* 9625 (A, Bish, US), 10092 (Bish, US); near Mutalau village, *Yuncker* 9696 (A, Bish, UC, US).

Geniostoma vitiense was correctly segregated from the inclusive concept of *G. rupestre* by Gilg and Benedict in 1921, but it appears to have been cited since only in the two publications indicated by us above. It is a well marked species, immediately distinguishable from most of its congeners by its close, harsh indument, and more technically by the very short rather dense trichomes of the corolla-throat. Some specimens exhibit a tendency toward glabrescence, while others have harsh persistent indument even on mature parts. The intrapetiolar stipules, the leaves of variable size, and the candelabriform venation of the corolla-lobes are commonplace characters in the genus, but the short trichomes of the corolla-throat and the vegetative pubescence are good distinguishing characters. The leaf-blades, while quite variable, are generally more or less ovate or ovate-lanceolate, often rather broadly rounded or subtruncate at base, and usually acute rather than acuminate at apex. The puberulent dichasial axes are another distinguishing feature of *G. vitiense*, hardly unique, but among the other Fijian species present only in *G. calcicola*, perhaps in *G. insulare*, and sometimes in *G. stenocarpum*.

The sexual dimorphism of the flowers of this species, as yet not very strongly differentiated morphologically, is quite possibly complete in respect to pollen abortion within the anther. As noted in the description, slight divergences in pubescence and in the form of anther exist between the "pistillate" and "perfect" flowers, as well as in the gynoecia. As far as can be made out from the specimens examined, the "perfect" flowers are constant on any one individual, while other individuals produce "pistillate" flowers; thus an incipient, if not an actual, gynodioecism is present. However, sterilization of the staminate organs has not, apparently, been accompanied by sterilization of the pistillate organs in other individuals; and fruits are to be found on both "pistillate" and "perfect" individuals. There may, of course, be some difference in the degree of fertility between these sexual forms, but it is not apparent. The same phenomenon was reported by Valeton for several species of Malaysia. In our area, it is probably common in other species, and definite indications of it have been seen in *G. macgregorii*, while in some species the flowers appear to be all strictly hermaphrodite (as in *G. macrophyllum*). A more intensive study of this problem, carried out in the field, would probably yield some useful information. Perhaps associated with this phenomenon is that of odor; the malodorous flowers of *G. vitiense* and of certain other species are possibly the hermaphrodite rather than the perfect flowers, or vice versa. The odor is such that it probably attracts flies as pollinating vectors. Scentless, or at least not foetid, flowers are known in such species as *G. clavigerum* and perhaps *G. macgregorii*. Such a difference, if it is associated with a difference in the mode of pollination, could be taxonomically significant.

7. **Geniostoma gracile** Rechinger in Rep. Sp. Nov. 6: 325. 1909, in Denkschr. Akad. Wiss. Wien 85: 328. *t. 11*. 1910; Gilg & Benedict in Bot. Jahrb. 56: 544. 1921: Christophersen in Bishop Mus. Bull. 128: 75, pro parte, as to *MacDaniels* 1121 only. 1935.

PLATE 1, FIGURE 7; PLATE 3, FIGURES 9–11

Shrub or small tree with drooping branches, glabrous throughout except for some floral parts, with slender subterete branchlets distally subcompressed and 1–2 mm. thick; stipules intrapetiolar, forming a gently rounded sheath about 1 mm. high; leaves petiolate, the petioles slender, 4–7 mm. long, the blades thin-chartaceous, lanceolate-ovate to elliptic-ovate, relatively narrow, (1.5–) 4–13 cm. long, 1–4.5 cm. broad, rounded to subcuneate and briefly decurrent at base, long-attenuate and sharply acuminate at apex, entire, the costa sulcate above, raised beneath, the lateral nerves 4–10 per side, slightly raised on both surfaces, the veinlets smooth, mostly plane and subevident or obscure; inflorescences axillary among the leaves, dichasial, 3–7 (usually 5–)-flowered, the axes slender and notably elongate, the peduncle 1–7 mm. long, the axes and pedicels 7–17 mm. long, with short bracts about 1 mm. long, the pedicels slightly flared into the calyx; flowers externally glabrous; calyx cupuliform, the lobes deltoid-ovate, acute, 0.7–1 mm. long, 1-nerved to obscurely 3-nerved; corolla about 3.5 mm. long, tubular, divided to middle into suberect or patent deltoid-ovate lobes, the tube closely pubescent within, at throat with pale reflexed trichomes about 0.3 mm. long, those nearer the base of the tube shorter, about 0.1 mm. long, the tube pilose within on the proximal third or half, glabrous distally, the venation relatively complex, that of each corolla-lobe derived from a single central vein ascending from below the tube up to the throat, there producing one or usually two pairs of ascending laterals, these in turn branched laterally once, twice, or even thrice, in the lobe, all the branches ascending and not anastomosing; stamens inserted at throat on short retrorsely pilose deltoid-ligulate filaments about 0.2–0.3 mm. long, the anthers narrowly deltoid-oblong, bluntly tipped, about 0.8×0.35 mm., glabrous; ovary subglobose, about 1 mm. in diameter, narrowed into the filiform glabrous style, this about 1–1.4 mm. long, the stigma clavate-obovoid and subbilobate, papillate, about 0.8–0.9 mm. broad and 1 mm. long; capsule ellipsoid, apiculate, 5–9 mm. long, 4–7 mm. broad.

TYPE LOCALITY: Upolu, Samoa; cited syntypes are *Rechinger* 948 and 1475, of the former of which duplicates are cited below.

DISTRIBUTION: Endemic to Samoa; known only from Savaii and Upolu. The plant is shrubby or becoming a small tree, occurring from near sea level to about 500 m. altitude, in forest or shrubby vegetation. The flowers are white.

LOCAL NAME: *Taipoipo*, according to Gilg & Benedict, who probably derived their information from labels on one of Rechinger's specimens.

SAMOA: SAVAII: Coastal thickets, *Reinecke* 532 (K). UPOLU: Above U'umapu [Utumapu] ("Utmapu" of Rechinger and Gilg & Benedict), *Rechinger* 948 (isosyntype, BM, US); Vaea, *MacDaniels* 1121 (Bish).

In contrast to Christophersen, who cited a large suite of specimens under this species, we find that only the few specimens cited above represent the species as typified by an isosyntype. Most of the specimens cited by Christophersen under *G. gracile* are here treated as *G. samoense* var. *parviflorum*, a variety imperfectly known to Gilg & Benedict and apparently to Christophersen, and sustained by us as a distinct entity, although the type has not been seen and was presumably destroyed along with the type material of *G. gracile*, *G. vitiense*, and many other species at Berlin. *Geniostoma gracile* appears to be related to *G. macgregorii* and *G. vitiense*, species which also exhibit the very short corolla-throat trichomes characteristic of *G. gracile*. In the narrow, sharply acuminate leaf-blades and the unusually elongate cymose dichasia, *G. gracile* differs from its Fijian relatives and also from most other Samoan *Geniostomata*. However, specimens of *G. samoense* var. *parviflorum* sometimes bear dichasia almost as elongated as those of *G. gracile*; the former appears to be a population commonly found at rather high elevations, and of course it differs from *G. gracile* in its long corolla-throat trichomes.

8. Geniostoma macgregorii (Horne ex Baker) Smith & Stone, comb. nov.

PLATE 1, FIGURE 8; PLATE 2, FIGURES 17–19

Plectronia macgregori Horne, A Year in Fiji, 266, *nomen*. 1881; Horne ex Baker in Journ. Linn. Soc. Bot. 20: 363. 1883.

Geniostoma rupestre sensu auct. quoad plantas vitienses, pro parte.

Shrub or small tree to 10 m. high, glabrous throughout except for some floral parts; branchlets slender, subterete or slightly compressed and 1–3 mm. in diameter distally; stipules intrapetiolar, forming a subtruncate or gently rounded (or in youngest state, somewhat deltoid) sheath 1–1.5 mm. high; leaves glabrous, petiolate, the petioles 4–16 mm. long, slender, proximally exalate, the blades thick-membranous, chartaceous, or subcoriaceous, when juvenile subglossy, later dull, ovate to elliptic-ovate or oblong-ovate or sublanceolate, 3–16 cm. long, 1–6 cm. broad, commonly about 10×3.5 cm., attenuate, acute, or somewhat rounded at base, briefly decurrent on the petiole, attenuate and acuminate at apex, often very narrowly so or even caudate, entire, the costa sulcate above, slightly elevated beneath, the lateral nerves 5–10 per side, slightly raised on both surfaces, the veinlets evident or obscure, plane; inflorescences axillary among the leaves, dichasial, usually 5–15-flowered, rarely to 20-flowered, all the axes glabrous, the peduncle stout, flattened, 1–4 mm. long, bibracteate at summit with lanceolate bracts 1–1.5 mm. long, the major axes slender, 2–6 mm. long, bibracteate at nodes, the pedicels 2–6 mm. long, slender,

flared and bracteolate below the calyx; flowers borne in triflorous (or near the peduncle uni- or biflorous) dichasia, glabrous externally; calyx cupuliform, the lobes deltoid-ovate, 1–3 (rarely 5–)-nerved, about 1 mm. long, as broad or nearly as broad; corolla short-tubular, slightly urceolate, with reflexed lobes, 3–4 mm. long, divided to middle, the tube glabrous within basally, above to throat and on base of lobes closely pilosulous with short retrorse trichomes 0.1–0.25 mm. long, the lobes ovate, basally pilosulous like the throat, distally merely pustulous with pustules 0.05 mm. high, at the extreme apex glabrous, the venation relatively complex, each corolla-lobe supplied by three main nerves entering the tube already distinct, or diverging in the lower part of tube, ascending to throat and into the lobe, producing 2–4 short ascending (rarely forked) lateral nerves; stamens inserted at throat, the filaments deltoid-ligulate, about 0.4 mm. long, closely pilosulous with short retrorse trichomes like those of the throat, the anthers narrowly oblong-deltoid, about 0.8 mm. long, acute, glabrous; ovary glabrous, subglobose, about 1.4 mm. high and 1.8 mm. broad, the style glabrous, filiform, 1.2–1.5 mm. long in long-styled flowers, 0.7–0.9 mm. long in short-styled flowers, the stigma globose; capsule narrowly ellipsoid or narrowly ovoid, 7–13 mm. long, 3–4.5 mm. broad.

TYPE LOCALITY: Ovalau, Fiji; the type is *Horne* 261, cited below.

DISTRIBUTION: Known only from Fiji and Tonga. The plant is a slender shrub or small tree 3–10 m. high, bearing flowers with a greenish white or pale green corolla and a white stigma; the fruit is green without, the inner pulp orange. The habitat is noted as dense or open forest, or near the margins of forest, from near sea level to 900 m. altitude, mostly between 50 and 200 m. altitude.

LOCAL NAMES: Very rarely noted, although numerous specimens are at hand; *mboimboinda* on a few specimens from Vanua Levu; Graeffe's collection from Ovalau bears the name *mbatimbona*. Three collectors note that the foetid odor common to *G. vitiense* is not present, and indeed one states "odorless" (*Greenwood* 541A); another states that there is an odor, but not a foetid one (rather, says the Tothill label, a "horsy" scent). These data, in conjunction with the rare usage of the name *mboimboinda*, may indicate that the plants are scentless or at least not malodorous.

FIJI: VITI LEVU: Mba: Mt. Evans, *Greenwood* 388 (K); near Lautoka, *Greenwood* 49 (K); northern slopes of Mt. Namendre, east of Mt. Koromba ("Pickering Peak"), *Smith* 4554 (A, Bish, K, NY, US). Nandronga & Navosa: Near Mbelo and Vatukarasa, *Degener* 15296 (A, K, NY). Serua: Hills west of Waivunu Creek, between Ngaloa and Korovou, *Smith* 9318 (US), 9469 (US); vicinity of Ngaloa, *Degener* 15071 (A, Bish, K, NY, UC, US); near Vatutavathe, *Degener* 15206 (A, Bish, K, NY, UC, US); hills between Wainiggere and Waisese Creeks, between Ngaloa and Wainiyambia, *Smith* 9357 (US). Namosi: Coastal hills, *Greenwood* 541A (A). Tailevu: Uthunivanua, *McKee* 2817 (US). Naitasiri:

Near Viria, on Rewa River, *Meebold* 16507 (Bish); woods beyond Tamavua, Gillespie 2151 (Bish), 2170 (A, Bish, NY, UC, US); Wainimbuku River area, on ridge near Nasinu river, *Shradha Nand* [Fiji Dept. Agric. No.] 7358 (US); near Nasinu, *Gillespie* 3528 (Bish, NY, UC); Suva Pumping Station, *Degener & Ordonez* 13757 (A, US). Rewa: Near Naikorokoro River west of Suva, *Meebold* 21943 (Bish); Mt. Korombamba, *H. B. R. Parham* 84 (BM); southeastern slopes of Mt. Korombamba, *Gillespie* 2230 (Bish, UC); summit of Mt. Korombamba, *Gillespie* 2395 (Bish, UC); lower slopes of Mt. Korombamba, *Vaughan* 3327 (BM, K); near Suva, *Tothill* 477 (Bish, K), 623 (K), *Meebold* 16436 (K), 21387 (BM, NY); Central Road, Suva, *Tothill* 625 (Bish); mouth of Rewa River, *Guppy* in 1899 (K). KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith* 132 (Bish, GH, K, NY, UC, US). VANUA LEVU: Mathuata: Hills near Lambasa, *Greenwood* 511 (K), 541 (K); southern slope of Mt. Numbuiloa east of Lambasa, *Smith* 6398 (A, Bish, K, NY, US), 6576 (A, Bish, K, US). Thakaundrove: Southwestern slope of Mt. Mbatini, *Smith* 668 (Bish, GH, K, NY, UC, US). OVALAU: *Graeffe* 1612 (K); vicinity of Levuka, *Horne* 96A (GH, K); "mountains of Ovalau," *Horne* 261 (GH, K type). KORO: *Tothill* 612 (Bish in part, K). MATUKU: *Milne* 128 (K), 128 bis (K). KAMBARA: Central wooded basin, *Bryan* 504 (Bish). Fiji Islands, without definite locality, *U. S. Expl. Exped.* (US).

TONGA: VAVA'U: Near Neiafu, *Setchell* 15656 (UC).

This species, frequent in Fiji, was described in very general terms by Baker (and not at all by Horne); it provides not the only illustration of confusion between *Geniostoma* and *Plectronia* (i.e. *Canthium*, Rubiaceae), as evidenced by *G. niinoanense* Kanehira (=*Canthium barbatum* (Forst. f.) Seem. var. *korrorense* (Valeton) Fosberg, the variety based on *Plectronia korrorensis* Valeton). However, there is no question as to the identity of Horne's specimen, and therefore his specific epithet, corrected in accordance with Rec. 73C of the International Code of Botanical Nomenclature, must be used.

Although material here cited has generally been previously identified as *G. rupestre*, it is less closely related to that species than it is to *G. vitiense*, even though the pubescence of the latter gives a superficial impression of difference that is not entirely warranted. The short trichomes of the corolla-throat are a constant feature of *G. macgregorii* and serve to distinguish it at once from the New Hebridean *G. rupestre*. From *G. vitiense*, *G. macgregorii* differs in being glabrous and in having its leaf-blades relatively more narrow (in most specimens) and usually long-acuminate; in floral characters the two are very similar. The remarks on sexual dimorphism given under *G. vitiense* also apply here.

Only the single specimen cited above from Tonga carries the known distribution of *G. macgregorii* beyond Fiji; this specimen, while not entirely typical, cannot be referred to any other species occurring in Tonga and we believe it to be correctly placed here. Outside of our area, *G. batanense* Merr., of the Philippines, is somewhat similar in general aspect to *G. macgregorii*, but it has externally puberulent flowers and a setulose style.

9. Geniostoma calcicola A. C. Sm. in Sargentia 1: 99. 1942.

PLATE 1, FIGURE 9; PLATE 2, FIGURE 24

Geniostoma sp. A. C. Sm. in Bishop Mus. Bull. 141: 125. 1936.

Scandent shrub to 50 cm. high, with slender terete fusco-cinereous branchlets at first densely short-setose with pale, conic-tapered, several-celled setae; stipules intrapetiolar, forming a short broadly ovate sheath; leaves densely puberulent, petiolate, the petioles 3–5 mm. long, the blades chartaceous, elliptic or oblong-elliptic, 3.5–5 cm. long, 1.5–2.5 cm. broad, obtuse at base, rounded or slightly emarginate or minutely mucronulate at apex, entire, with slightly recurved margins, pilose on both surfaces, the trichomes about 0.3 mm. long, the costa shallowly sulcate above, raised beneath, the lateral nerves 4–6 per side, shallowly sulcate above, slightly raised beneath, the veinlets obscure; inflorescences axillary, dichasial, slender, open, 5 (rarely 9–)-flowered, the peduncle 1 mm. long, the pedicels 2–5 mm. long, the nodes bibracteate, the flowers bracteolate just below the calyx, all the axes sparingly setulose; flowers borne on relatively long slender pedicels scarcely flared at apex; calyx cupuliform, glabrous except for the ciliolate margin, the lobes acute, ovate-deltoid, 1.2–1.5 mm. long, 1–3-nerved; corolla short-tubular, 3.5–4 mm. long, glabrous externally, the tube about 2.5 mm. in diameter, glabrous within at base, pilose at throat with white trichomes about 0.8 mm. long sparsely but uniformly disposed around throat, the lobes about 1.5 mm. long, ovate, reflexed, glabrous except at extreme base, the venation pinnate, each corolla-lobe supplied by one main nerve branched just below the lobe or sometimes toward base of tube into 2 main lateral nerves, all ascending into the lobe and there unbranched or with a few short free laterals; stamens inserted at throat, the filaments ligulate, about 0.4 mm. long, sparsely pilose, the anthers oblong, basally cordate, apically obtuse, about 1 mm. long; ovary glabrous, depressed-subglobose, about 1.3 mm. in diameter, the style filiform, about 1 mm. long, glabrous, the stigma subglobose to somewhat obcordate, about 0.8 mm. in diameter, papillate; capsule unknown.

TYPE LOCALITY: Fulanga, Fiji; the type is *Smith* 1116, cited below.

DISTRIBUTION: Known only from the type collection, collected on cliff face in limestone formation; the corolla is white. The other specimens tentatively referred to *G. calcicola* in the original publication are now accounted for under *G. insulare*.

FIJI: FULANGA: Near Monothaki, near sea level, *Smith* 1116 (Bish, GH type, K, NY, UC, US).

Although the occurrence of this species on other islands of Lau may be suspected, at present we do not have a single collection other than

the type referable to it. Its closest relatives are *G. crassifolium* Benth., of the Isle of Pines, and *G. insulare*, described below. Relationships among the three species may be indicated in the following key:

Leaf-blades puberulent on both surfaces.
  Ovary and style hirtellous, the style 0.3–0.5 mm. long, the stigma clavate; anthers about 1.2 mm. long; dichasia closely hirtellous; leaf-blades up to 7×4 cm . . . . . **G. crassifolium**
  Ovary and style glabrous, the style 0.8–1 mm. long, the stigma obovoid or subglobose; anthers about 0.9 mm. long; dichasia sparsely hirtellous; leaf-blades up to 5×2.5 cm . . . . . **G. calcicola**
Leaf-blades glabrous or puberulent only beneath . . . . . **G. insulare**

Reference of Tongan plants to *G. calcicola* in Yuncker's *Plants of Tonga* (in Bishop Mus. Bull. 220:215. 1959) was based, we now believe, on too inclusive a concept, and these plants are now cited under *G. insulare*.

10. Geniostoma dictyoneurum Smith & Stone, sp. nov.

PLATE 1, FIGURE 10

Arbor gracilis ad 7 m. alta praeter corollae partem interiorem omnino glabra, ramulis gracilibus apicem versus 1–2 mm. diametro et subteretibus vel obscure quadrangularibus; stipulis intrapetiolaribus in vagina rotundata vel subtruncata 1–1.3 mm. alta conjunctis; foliis magnitudine moderatis, petiolis 8–12 mm. longis, laminis membranaceis vel tenuiter chartaceis ovatis, 7–12 cm. longis, 3.5–7 cm. latis, basi rotundatis vel subtruncatis et in petiolum subito cuneato-decurrentibus, apice rotundatis, margine integris, costa supra sulcata subtus conspicue elevata, nervis lateralibus utrinsecus 4–10 utrinque prominulis, venulis obscuris; inflorescentiis axillaribus vel ramulis paulo infra folia enatis dichasialibus, pedunculo crasso 1–2 mm. longo apice bibracteato axes 1–3 principales graciles nodis bibracteatos 4–6 mm. longos gerente, bracteis 0.5–1 mm. longis, axibus 3–9-floris, floribus 1–3 in dichasiis dispositis, pedicellis gracilibus 1–3 mm. longis infra calycem dilatatis et bracteola calycem adpressa ornatis; calyce cupuliformi, lobis deltoideis 0.6–0.8 mm. longis minute ciliolatis uninervatis vel interdum inconspicue 3-nervatis; corolla circiter 4 mm. longa ad medium lobata, tubo faucibus pilis circiter 0.5 mm. longis hirtello, lobis ovatis basim versus interdum parce hirtellis, nervatio intricato, corollae quoque loba nervis 3 e basi tubi in lobam adscendentibus praedita, quoque nervo venulis lateralibus pluribus tenuibus in reticulum laxum conjunctis ornato; staminium filamentis ad 0.2 mm. longis copiose hirtellis, antheris anguste deltoideo-ovoideis circiter 0.9×0.4 mm. apice acutis basi haud parce hirtellis; ovario depresso-globoso circiter 0.8 mm. lato, stylo filiformi ad 0.5 mm. longo, stigmate

subgloboso papilloso circiter 0.5 mm. lato; capsula subglobosa vel ate ovoidea, 5–6 mm. longa, 4.5–5.5 mm. lata, apice apiculata.

Type in the U.S. National Herbarium, No. 2190641, collected among the hills east of Herald Bay, inland from Sawaieke, Ngau, Fiji, alt. 300–450 m., June 18, 1953, by A. C. Smith (No. 7814). Duplicates to be distributed.

ADDITIONAL SPECIMENS EXAMINED:

FIJI: KORO: Rocky thicket at sea level on east coast, *Smith* 1037 (Bish, GH, K, NY, UC, US).

DISTRIBUTION: Endemic to Fiji, and known only from Ngau and Koro. The plant is recorded as a slender tree 5–7 m. high, growing in forest from sea level to 450 m. altitude, the flowers with corolla and filaments pale green or white, the anthers white.

LOCAL NAME: *Mboimboinda* (Koro).

Geniostoma dictyoneurum, as the name implies, exhibits anastomosing venation of the corolla-lobes, a character found very rarely in other species. The leaf-blades are rather broadly ovate, apically blunt or rounded, noticeably thin-membranous, and relatively large for the genus, with 4–10 lateral nerves on each side of the midrib. The pilosity of the corolla inner surface is densest on the filaments; on the corolla-throat it is sparser and covers a narrower band. In this respect there exists a certain resemblance to specimens of *G. vitiense*, which occasionally shows a similar variability in corolla-indument. The completely glabrous vegetative parts of the present species readily distinguish it from *G. vitiense*. A resemblance to *G. macgregorii* may also be noted, but the long corolla-throat hairs of *G. dictyoneurum*, and of course the anastomosing corolla-lobe venation, quickly differentiate it. Perhaps the closest relative of *G. dictyoneurum* is *G. insulare*, at least the form with subglobose capsules; in *G. dictyoneurum* the capsules are also regularly sphaeroidal rather than elongated.

11. Geniostoma fleischmannii Rechinger in Rep. Sp. Nov. 7: 17, as *G. fleischmanni*. 1909, in Denkschr. Akad. Wiss. Wien 85: 329. *t. 10*. 1910; Gilg & Benedict in Bot. Jahrb. 56: 545. 1921; Christophersen in Bishop Mus. Bull. 128: 175, as *G. fleischmanni*. 1935. PLATE 1, FIGURE 11

Shrub or small tree 3–4 m. high, glabrous throughout except for some floral parts; branchlets slender, gray-brown, markedly quadrangular and narrowly winged, distally 1–3 mm. thick; stipules intrapetiolar, forming a truncate sheath about 1 mm. long; leaves glabrous, petiolate, the petioles 2–7 mm. long, the blades oblanceolate or narrowly elliptic, 4–12 cm. long, 1.5–3.5 cm. broad, attenuate-decurrent or sometimes acute and decurrent at base, acute to acuminate at apex, the costa shallowly sulcate above, slightly raised beneath, the lateral nerves 6–12 but usually 9 or 10 per side, slightly raised on both surfaces, the veinlets obscure; inflorescences axillary among the leaves,

dichasial, usually 5–10-flowered, the peduncle flattened, subobsolete or to 1.5 mm. long, the axes and pedicels 4–9 mm. long, bracteate with bracts to 1.5 mm. long, the pedicels bracteolate and flared just below calyx; flowers slenderly pedicellate; calyx cupuliform, the lobes deltoid, about 1 mm. long and 0.8 mm. broad, 1–3-nerved; corolla 4.5–5 mm. long, the tube 2.5–2.7 mm. long, glabrous without, glabrous within at the extreme base but retrorse-pilose above to throat with trichomes 0.7–0.9 mm. long, the lobes 1.9–2.3 mm. long, glabrous distally, deltoid-ovate, the venation complex, each lobe supplied by one main nerve, this usually narrowly divaricate in the tube, ascending and branching into the lobe, producing 2–4 ascending lateral branch-nerves, these occasionally briefly branched; stamens inserted at throat, with short pilose filaments 0.3–0.5 mm. long, the anthers deltoid, blunt-tipped, about 0.7 mm. long; ovary glabrous, about 1.5 mm. high and 1.8 mm. broad, the style filiform, glabrous, about 1 mm. long, the stigma subglobose, subbilobate, about 0.9 mm. in diameter; capsule ellipsoid, 7–8 mm. long, about 4 mm. broad, short-apiculate.

TYPE LOCALITY: Savaii, Samoa; the type is *Rechinger* 1648, presumably deposited at Berlin and subsequently destroyed. We have seen no isotypes, but the species is very well illustrated and easily recognized.

DISTRIBUTION: Endemic to Samoa; apparently known only from Savaii. It is said to be a shrubby species becoming a small tree 4 m. high, with markedly 4-angled branchlets and with white flowers, occurring at high elevations (1030 m. according to Christophersen & Hume), or in "sunny openings near Asau" (Rechinger).

SAMOA: SAVAII: Forest above **Matavanu**, *Christophersen & Hume* 2124 (Bish, NY, UC, US).

Characters that amply distinguish *G. fleischmannii* from other Samoan species, and in combination from its congeners throughout the Pacific, are its relatively large corollas, its candelabriform corolla-lobe venation of an unusual type (consisting of a dichotomous main nerve with several laterals rather than being 3 or 5-nerved), its long, narrow, usually oblanceolate leaf-blades, and its 4-winged branchlets.

12. Geniostoma stenocarpum A. C. Sm. in Sargentia 1: 98. 1942.

PLATE 1, FIGURE 12; PLATE 3, FIGURES 7, 8

Shrub or small tree to 4 m. high, with at first often minutely pubescent but soon glabrate slender subterete branchlets; stipules intrapetiolar, forming a short rounded sheath; leaves petiolate, the petioles 2–6 mm. long, the blades lanceolate or narrowly ovate, 4–7.5 cm. long, 1.2–2.7 cm. broad, attenuate and decurrent or merely acute at base, or very rarely subtruncate, narrowly acute to slightly

acuminate at apex, entire, the costa slightly sulcate above, raised beneath, the lateral nerves 4–7 per side, prominulent, the veinlets mostly obscure; inflorescences glabrous or sometimes at first minutely pubescent and soon glabrate, axillary among the leaves, 5–12(–18)-flowered, dichasial, compound dichasial, or often irregular, the peduncle 1 mm. long or less, the major axes 3–6 mm. long, the nodes bibracteate (sometimes with only 1 or with no bract), the pedicels 2–5 mm. long, bracteolate, the bracteoles about 0.5 mm. long; calyx cupuliform, the lobes deltoid-ovate, acute or short-acuminate, 1–3-nerved, the margins ciliolate; corolla short-tubular, 2.5–3.5 mm. long, glabrous externally, divided to middle, the tube glabrous within basally, sparsely hirtellous at throat with trichomes about 0.4 mm. long, similarly hirtellous in a narrow median horizontal band and on filaments (but glabrous between filaments in upper portion), the lobes ovate, glabrous, the venation relatively complex, each corolla-lobe supplied by 3 nerves with several lateral branches in the lobe, derived from a single main nerve entering the tube and producing two main lateral nerves in the throat; stamens inserted at throat, the filaments narrowly deltoid-ligulate, about 0.6 mm. long, pilose, the anthers glabrous except at extreme base, obtuse or with a minute mucronulate apex, ovate-oblong, 0.8–0.9 mm. long; ovary glabrous, subglobose, about 1 mm. in diameter, the style filiform, glabrous, short to nearly obsolete, 0.3–0.7 mm. long, the stigma subglobose, about 0.5 mm. in diameter, papillate; capsule ellipsoid, 7–10 mm. long, 2.5–3.5 mm. wide, apiculate by the stylar remnant, subtended basally by the persistent calyx.

TYPE LOCALITY: Nandarivatu, Viti Levu, Fiji; the type, *Degener & Ordonez* 13591, is cited below.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu, where it appears quite frequent at middle elevations. It has been recorded as a shrub or small tree up to 4 m. high, occurring in or on borders of dense forest at elevations up to 1150 m. and only rarely as low as 150 m.; the flowers are greenish or white.

LOCAL NAMES: *Mbati-mbati* (*Gillespie* 3170); *mbuimbuita* (*Smith* 4993, 6020); *mbatimara* (*Smith* 5062).

FIJI: VITI LEVU: Mba: Nandarivatu and vicinity, *Gibbs* 555, pro parte (BM), *Tothill* 626 (K), *Gillespie* 3170 (Bish), 4280 (Bish, UC), *Degener & Ordonez* 13591 (A type, Bish, K, NY, UC, US), 13592 (A, Bish, K, NY, UC, US), 14314 (A, Bish, K, NY, UC, US); slopes of escarpment north of Nandarivatu, *Smith* 6020 (A, Bish, K, NY, US); Mt. Ndelaiyoö, on escarpment west of Nandarivatu, *Smith* 5062 (A, Bish, K, NY, US); ridge between Mt. Nanggaranambuluta and Mt. Namama, east of Nandarivatu, *Smith* 4993 (A, Bish, K, NY, US); slopes of Mt. Tomanivi [Mt. Victoria], *Smith* 5226 (A, Bish, K, NY, US); hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, *Smith* 6152 (A, Bish, K, NY, US). Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Rewasau, *Smith* 5394 (A, Bish, K, NY, US). Serua: Banks of Navua River, at Namata Rapids, *Gillespie* 2941 (Bish, UC).

The available specimens fall into three fairly well marked forms that appear not significant enough to merit names: a narrow-leaved glabrous form, a narrow-leaved puberulent form, and a glabrous form with comparatively broad, ovate leaf-blades. The first of these includes the type collection and most of the cited specimens. Only three collections (*Degener* 14314 and *Gillespie* 2941 and 4280) show a marked and fairly persistent puberulence on the branchlets; a minute indument is frequent on the innovations but is usually soon lost. One puzzling specimen, *Smith* 6020, seems to have both glabrous and persistently puberulent branchlets on one tree. The third form, with leaf-blades ovate and rounded to subtruncate at base, is represented by *Gibbs* 555 and *Smith* 5394. Association of these three forms with particular habitats or altitudes does not at this time seem to be noteworthy.

The closest relationship of *G. stenocarpum* appears to be with *G. rupestre*, of the New Hebrides, and less notably with *G. insulare*. The small and predominantly lanceolate leaf-blades give a very distinct aspect to *G. stenocarpum*. Although corolla-lobe venation is not an entirely dependable criterion of relationship, in this respect *G. stenocarpum* is closer to *G. insulare* than to *G. rupestre*, in which the lobe-supplying nerve usually divides at or near the base of the corolla-tube.

The flowers of *G. stenocarpum* are noted as foetid only by Gibbs, whose No. 555 is a mixture with *G. vitiense*; her comment may apply to the latter species, which is reported by various collectors as having malodorous flowers.

13. Geniostoma samoense Reinecke in Bot. Jahrb. 25: 666. 1898; Rechinger in Denkschr. Akad. Wiss. Wien 85: 328. 1910; Gilg & Benedict in Bot. Jahrb. 56: 543. 1921; Setchell in Carnegie Inst. Publ. 341: 59. 1924.

PLATE 1, FIGURE 13

Small tree to 10 m. high or shrub, glabrous throughout except the axes of the inflorescence and some floral parts, or the innovations at first minutely pubescent, soon glabrate; branchlets distally 1–3 mm. in diameter, subterete or somewhat compressed-quadrangular, in age terete; stipules intrapetiolar, forming a subtruncate or gently rounded sheath 1–2 mm. high; leaves petiolate, the petioles 5–15 mm. long, exalate, the blades chartaceous, ovate to broadly ovate, 3–18 cm. long, 1.5–9 cm. broad, rounded or obtuse-cuneate and decurrent at base, obtuse to acuminate at apex, entire, the costa sulcate above, raised beneath, the lateral nerves 5–10 per side, slightly raised on both sides, the veinlets manifest or somewhat obscure, not raised; inflorescences axillary among the leaves, dischasial, the dichasia strict or often irregularly branching, 5–15-flowered, commonly 9-flowered, the peduncle about 1 mm. long and 0.7 mm. thick, bibrac-

teate at summit, the major axes 2–5 mm. long, the pedicels 1–3 mm. long, bibracteolate at nodes or sometimes irregularly 1- or 2-bracteolate, the bracteoles when opposite continuous across the node, sheathing, all the axes minutely puberulent with short blunt trichomes no more than 0.03 mm. in length; calyx 1.3–1.6 mm. long, the lobes equal in length to the tube, broadly deltoid, about 0.7 mm. long and 1 mm. wide, marginally ciliolate, 3-nerved (rarely obscurely so); corolla 2.5–3.3 mm. long, the tube 1.2–1.8 mm. long, glabrous without, glabrous within in the lower half, pilose in the upper half to the throat with white trichomes 0.45–0.7 mm. long, the lobes glabrous or pilose only at extreme base, the venation comparatively complex, each corolla-lobe supplied by 3 main nerves diverging near base of tube and branching laterally near throat, all ascending into the lobe, there with brief lateral branches or none; stamens inserted at throat, the filaments pilose, ligulate, about 0.3 mm. long, the anthers ovate, acute or obtuse, about 0.7 mm. long and 0.5 mm. broad; ovary glabrous, subglobose, about 1 mm. in diameter, the style about 0.2 mm. long, glabrous, the stigma depressed-globose or subglobose, papillate, 0.7–1 mm. in diameter; mature capsule ellipsoid-obovoid, briefly apiculate by the stylar remnant, the lobes dehiscent-recurved, 8–10 mm. long, 4–5 mm. broad; seeds ovoid with a concave hilum, the testa minutely papillate, about 0.06 mm. thick, the papillae no more than 0.015 mm. high, orange in life.

Geniostoma samoense is a species of the alliance of *G. rupestre*, differing chiefly in the puberulent dichasia, the relatively broader capsules, and the larger, broader, usually more obtuse leaf-blades. The venation of the corolla-lobes is very similar to that of *G. rupestre*, there being some variability within each species as to the height in the corolla-tube of the point of divergence of the three main nerves. The venation of the sepals is generally 3-nerved, although the two lateral nerves are sometimes short and obscure. The dichasia are distinctly but minutely puberulent with trichomes no more than 0.03 mm. long, which are usually persistent even on fruiting specimens.

Several specimens cited by Christophersen (in Bishop Mus. Bull. 128: 176. 1935) as *G. rupestre* are here referred to *G. samoense*, a species not considered by Christophersen in identifying his material. There is no indication that Christophersen believed Reinecke's species a synonym of *G. rupestre*, but this was possibly the case. We are satisfied that the two entities amply merit specific recognition.

The available material of *G. samoense* represents two varieties, which may be differentiated as follows:

Leaf-blades usually 8–18×4–9 cm., rounded at base, obtuse to obtusely acuminate at apex; anthers blunt at apex; stigma globose; plants of low elevations. **var. samoense**

Leaf-blades usually 3–11×1.5–4.5 cm., cuneate at base, long-acuminate at apex; anthers minutely mucronulate; stigma depressed; plants usually of mountain forests. . . . . var. **parviflorum**

13a. Geniostoma samoense var. **samoense**

PLATE 2, FIGURES 25, 27, 28; PLATE 3, FIGURES 1–4

Geniostoma rupestre var. *macrophyllum* A. Gray in Proc. Amer. Acad. 4: 33, *nomen*. 1859.

Leaf-blades large, relatively broad, rounded at base, obtuse to obtusely acuminate at apex, comparatively thin in texture; bracts 1–1.3 mm. long; anthers blunt at apex; stigma globose, the style short.

TYPE LOCALITY: Samoa; the precise locality and the identity of the holotype are uncertain, since Reinecke cited his own collection (275) from Upolu and three Graeffe specimens (245 and 1393 from Upolu, and 1613 from Savaii). Rather than designate a lectotype at this time we prefer to consider the four collections as syntypes; duplicates of two of them (Graeffe 1393 and 1613) have been seen and are cited below as isosyntypes.

DISTRIBUTION: On the basis of available material, this typical variety is seen to occur on several islands of Samoa and also on Uvea, Wallis Islands. It is recorded as a shrub or small tree, with white flowers; the seeds are brown, embedded in orange pulp. Habitats reported are swampy forest near the coast, thickets on rocky bluffs, near lava fields, or in *fau* (*Hibiscus tiliaceus*) forest, from altitudes of near sea level to 680 m. (summit of Mt. Fao).

LOCAL NAMES: *Taitai-ipu* (Christophersen); *taipoipo* (Reinecke, on Upolu); *fatimatao* (Powell, on Upolu); *laumafatifati* (Setchell, on Tutuila, and also Powell).

SAMOA: SAVAII: Matautu, *Vaupel* 222 (Bish, K, NY, US); between Letui and Aopo, *Christophersen* 906 (Bish); Matavanu lava field, *Christophersen & Hume* 1898 (Bish); Safotu-Manase, *Christophersen & Hume* 2451 (Bish, UC, US); near Salaeula, lava flow of 1905–1911, *Christophersen* 2467 (Bish, NY); without precise locality, *Graeffe* 1613 (K isosyntype). UPOLU: Summit of Mt. Fao, *Christophersen* 556 (Bish, NY, UC); without precise locality, Graeffe 18 (BM), 1393 (K isosyntype), 1614 (K). Tutuila or Upolu: *Powell* 257 (K). TUTUILA: Near Nuuli, *Setchell* 117 (Bish, UC); Breakers Point, *Seale* in 1929 (NY); Pango Pango harbor, *Diefenderfer* 29 (Bish); Pango Pango and vicinity, *Yuncker* 9336 (Bish), *Kuntze* 23007 (NY), *Meebold* 12646 (Bish, K), *Setchell* 264 (UC), *Collarino* (*Setchell* no.) 578 (UC). OFU: *Yuncker* 9453 (Bish, US), 9477 (Bish, UC, US). TAU: South of Siufaga, *Yuncker* 9005 (A, Bish, US); near Siufaga, *Yuncker* 9192 (Bish). Samoa, without locality, *Graeffe* s.n. (GH); *U.S. Expl. Exped.* (source of the name *G. rupestre* var. *macrophyllum*, GH, NY, US).

UVEA (Wallis Islands): Without other locality, *Graeffe* 42 (BM).

13b. Geniostoma samoense var. parviflorum Reinecke in Bot. Jahrb. 25: 666, as var. *parviflora*. 1898; Gilg & Benedict in Bot. Jahrb. 56: 544, as var. *parviflora*. 1921.

PLATE 2, FIGURE 26; PLATE 3, FIGURES 5, 6

Leaf-blades comparatively small, usually 3–11×1.5–4.5 cm., cuneate at base, long-acuminate at apex, pale beneath, with obvious venation; anthers minutely mucronulate with a tip about 0.1 mm. long; stigma depressed, about 0.7 mm. in diameter, broader than high.

TYPE LOCALITY: Upolu, Samoa; the type is *Reinecke* 555, which we have not seen. Gilg & Benedict mentioned the specimen (in 1921) as moldy and useless, but nevertheless they opined that it might represent a distinct species.

DISTRIBUTION: Samoa, known only from Savaii and Upolu; the material available to us is all from the former island. The variety is recorded as a small tree or shrub up to 10 m. high, with white flowers and green fruits. It usually occurs between 1,000 and 1,400 m. altitude, but on occasion as low as 200 m.

SAMOA: SAVAII: Matavanu crater, *Christophersen* 609 (Bish, US); Matavanu lava field, *Christophersen & Hume* 1878 (Bish, UC, NY); above Matavanu, *Christophersen & Hume* 2200 (Bish, NY); Letui, *Christophersen* 775 (Bish, UC, US); above Salailua, *Christophersen* 2675 (A, Bish, UC, US), 3118 (Bish, UC, NY); Siuvao-Auala, *Christophersen* 3375 (Bish).

Although there is a strong difference in general aspect between the two varieties here recognized, no significant floral characters appear to distinguish them. The flowers in both are about the same size, and why Reinecke selected the varietal epithet "*parviflora*" is not clear. His original description of the variety is not very helpful, but it seems definitely to refer to the small-leaved form with long-acuminate leaf-apices.

14. Geniostoma rupestre J. R. & G. Forst. Char. Gen. 24. *t. 12*. 1776, Beschr. Gatt. Pfl. *t. II, f. 12*. 1779; Willd. Sp. Pl. 1: 998. 1797; Spreng. Pl. Min. Cog. 1: 18. 1813, Syst. Veg. 1: 588. 1825; Endl. Gen. Pl. 576. 1838; DC. Prodr. 9: 26. 1845; Benth. in Journ. Linn. Soc. Bot. 1: 97. 1857; F. v. Muell. Contr. Phytog. New Hebr. 13. 1873; Gilg & Benedict in Bot. Jahrb. 56: 542. 1921; Guillaumin in Bull. Soc. Bot. Fr. 72: 701. 1927, in op. cit. 76: 299. 1929, in Journ. Arnold Arb. 13: 22. 1932, in Journ. Linn. Soc. Bot. 51: 557. 1938.

PLATE 1, FIGURE 14

Geniostoma "densiflora" sensu Guillaumin in Bull. Mus. Hist. Nat. [Paris] II. 9: 295. 1937, non Baillon (1880).

Shrub or small tree to 10 m. high, glabrous throughout except for some floral parts, the branchlets slender, subterete or somewhat compressed-quadrangular, 1–2 mm. in diameter distally; stipules intrapetiolar, forming a subtruncate or obtusely deltoid sheath 1–1.5 mm. high; leaves glabrous, petiolate, the petioles slender, 5–10 mm. long, the blades thin-chartaceous to subcoriaceous, ovate to elliptic-ovate,

often rather narrowly so, 3–14 cm. long, 1–4 cm. broad, acute and decurrent or rarely somewhat rounded at base, acuminate or obviously cuspidate at apex, entire, the costa sulcate above, raised beneath, the lateral nerves 5–9 per side, slightly raised on both surfaces, the veinlets plane, mostly obscure; inflorescences axillary among the leaves, dichasial, 5–15-flowered, glabrous, the peduncle short, flattened, 1–2 mm. long, bibracteate at apex, the bracts lanceolate, to 1.5 mm. long, the axes slender, 2–5 mm. long, bibracteate at nodes, the pedicels 2–5 mm. long, slightly flared and bracteolate below calyx; flowers externally glabrous, borne in triflorous (or irregular) dichasia; calyx cupuliform, the lobes deltoid-ovate, 0.7–1 mm. long, 3-nerved; corolla 2.5–3 mm. long, short-tubular, slightly urceolate, with reflexed (?) lobes, divided to middle, the tube glabrous within at base, sparsely pilose above and around throat with white reflexed trichomes 0.5–0.8 mm. long, these also on filaments, the lobes glabrous distally within, sparsely pilose with similar trichomes toward extreme base along nerves, the venation comparatively complex, each lobe supplied by a central nerve producing a lateral branch on each side near base of tube or sometimes higher, the branches ascending into the lobe and there often with brief lateral branches, occasionally the lobe supplied by two equal (or very rarely by three equal) veins ascending distinct from base of tube; stamens inserted at throat, the filaments deltoid-ligulate, 0.3–0.4 mm. long, pilose, the anthers narrowly oblong-deltoid, about 0.8 mm. long, minutely apiculate at apex, distally or entirely glabrous; ovary glabrous, subglobose, 0.6–0.7 mm. in diameter, the style filiform, glabrous, 0.6–0.7 mm. long, the stigma globose or subglobose, about 0.5 mm. in diameter, capsule 7–10 mm. long, 3–4 mm. broad.

TYPE LOCALITY: Tanna, New Hebrides; type collected by J. R. & G. Forster on Cook's second voyage, cited below.

DISTRIBUTION: Known with certainty from the New Hebrides (several islands) and the Santa Cruz Islands; also reported from New Caledonia, as discussed below. The specimens available to us are noted as shrubs or small trees to 10 m. high; the flowers are said to emit a strong foetid odor that attracts flies. Adequate altitudinal data are not available, but presumably *G. rupestre* is a lowland species.

SANTA CRUZ ISLANDS: VANIKORO: *Kajewski* 650 (A, UC, US).

NEW HEBRIDES: ESPIRITU SANTO: Mt. Tabwemanana, in open grassland, *I. & Z. Baker* (Oxford Univ. Exped.) 29 (BM). AMBRYM: Mt. Touo, *de la Rüe* (2nd Voy.) in 1935–36 (A). ERROMANGA: Wuppenbu (?), *Cheesman* 20 (K). TANNA: *J. R. & G. Forster* 103 (BM type, K); "*Herb. Pallas*" (coll. Forster?) (BM); *W. Anderson* in 1774 (BM). ANEITYUM: Anelgahaut Bay, *Kajewski* 728 (A, Bish, NY, US).

Geniostoma rupestre has been the traditional "catch-all" for Pacific specimens of the genus, even though Gilg & Benedict in 1921 expressed the opinion that it was a local species limited to the New Hebrides. They apparently had access to some portion of the original Forster material from Tanna. At this time we cannot be certain as to the precise identity of the several New Caledonian sheets referred to *G. rupestre* by Guillaumin, but it is quite probable that the range of the species does extend to that island and perhaps also to the Solomons. However, on the basis of existing material we feel assured that it does not occur east of the New Hebrides.

Since *G. rupestre* is the type species of the genus, some importance is attached to the Forster material, fortunately preserved in good condition. The four specimens cited above from Tanna are so similar in all respects that one may believe them to be parts of the same Forster collection. As holotype we designate the British Museum sheet that is clearly labeled as a Forster collection; previously none of these sheets has been so designated.

Among the species with comparatively long corolla-throat trichomes, *G. rupestre* is readily distinguished from its only close allies, for instance *G. samoense* and *G. insulare*, by its glabrous habit and usually acuminate leaf-blades. A closer superficial resemblance exists between *G. rupestre* and the Fijian *G. macgregorii*, but the indument of the corolla in these two species is uniformly and strikingly different, even though this character is not obvious upon superficial examination.

15. Geniostoma insulare Smith & Stone, sp. nov. PLATE 1, FIGURE 15

Frutex vel arbor gracilis ad 5 m. nonnunquam ad 15 m. alta praeter corollae partem interiorem demum glabra, vel innovationibus ramulis petiolis foliorum costa subtus inflorescentiae axibusque arcte puberulis (pilis patentibus rufis circiter 0.1 mm. longis), ramulis juventute saepe quadrangularibus 1–3 mm. crassis demum subteretibus glabrisque; stipulis intrapetiolaribus in vagina 1–1.5 mm. alta rotundata vel obtusa conjunctis; foliis plerumque comparative parvis, petiolis 3–9 (–11) mm. longis complanatis superne subalatis, laminis chartaceis vel subcoriaceis, ovatis vel ellipticis interdum elliptico-obovatis raro obovatis, 2–12 cm. longis, 1–7 cm. latis, vulgo circiter 5×2.5 cm., basi rotundatis subtruncatis obtusis vel late acutis et plus minusve decurrentibus, apice rotundatis vel acutis interdum minute mucronatis vel cuspidatis vel retusis, margine integris, costa supra sulcata subtus elevata, nervis lateralibus supra saepe subdepressis subtus prominulis, venulis subobscuris; inflorescentiis axillaribus dichasialibus 5–15-floris, pedunculo 1–3 mm. longo, axibus pedicellisque 2–5 (–7) mm. longis interdum puberulis, bracteis inconspicuis; calyce cupuliformi, lobis

deltoideo-ovatis circiter 1×1.3 mm. 1–3 (–5)-nervatis; corolla breviter tubulosa 3–3.5 mm. longa fere ad medium lobata, tubo faucibus pilis pallidis retrorsis 0.4–0.8 mm. longis hirtello, lobis deltoideo-ovatis circiter 1.5 mm. longis latisque supra basim glabris, nervatio subintricato, corollae quoque loba nervo unico cum nervis lateralibus 2 plus minusve tubi medio ornato praedita, nervis 3 subparallelibus vel curvatis in lobam adscendentibus et ibi venulas breves laterales paucas gerentibus; staminium filamentis ad 0.2 mm. longis pilosis, antheris deltoideis circiter 0.8 mm. longis apice acutis vel minute mucronulatis; ovario subgloboso 0.7–0.9 mm. diametro, stylo ad 0.6 mm. longo, stigmate subclavato-obovoideo inconspicue bilobato papilloso 0.7–0.9 mm. longo; capsula ellipsoidea vel sphaeroidea, 5–14 mm. longa, 3–5.5 mm. lata, apiculata, seminibus ovoideis circiter 1.2× 0.7 mm. minute papillosis.

The species here described as new appears to be the most abundant *Geniostoma* in Tonga, and in some forms it occurs more sparingly in both Fiji and Samoa. Specimens which we now refer here have been variously identified in herbaria as *G. rupestre*, *G. vitiense*, and *G. calcicola*. Of these species, *G. insulare* is most closely allied to *G. rupestre*, from which it differs in its quite dissimilar foliage, the leaf-blades being most often rounded to obtuse at apex and only occasionally broadly acute or bluntly cuspidate. In general the veins supplying corolla-lobes branch high in the tube rather than near or at the base as is frequent in *G. rupestre*, but this character is not entirely dependable. Our var. *tongense* of the new species, in its closely but harshly puberulent vegetative parts, suggests *G. calcicola*, which we now believe to be represented only by the type collection from Fulanga, Fiji. However, *G. insulare* never has its foliar indument extending to both surfaces of the leaf-blades, this being limited even in var. *tongense* to the ventral costae and a few of the laterals. The complex involving *G. insulare*, *G. rupestre*, and *G. calciola* is not satisfactorily understood from available material and the present solution is admittedly provisional, pending further observation or experiment. Two varieties, one of which has three quite distinct forms, are distinguished as follows:

Vegetative parts glabrous . . . . . **var. insulare**
Leaf-blades elliptic or ovate, rarely somewhat obovate, rounded or merely acute at base and apex, not cuspidate.
Capsules ellipsoid, comparatively narrow; Tonga and Fiji . . . **f. insulare**
Capsules sphaeroid; Fiji . . . . . **f. sphaerococcum**
Leaf-blades mostly obovate, gradually decurrent at base, rounded or broadly acute and cuspidate at apex; Samoa . . . . . **f. cuspidatum**
Vegetative parts (innovations, branchlets, petioles, and usually leaf-blades on ventral costae) puberulent; Tonga and Niue . . . . . **var. tongense**

15a. Geniostoma insulare var. insulare

Varietas typica; partibus vegetativis glabris; foliorum laminis plerumque ellipticis vel ovatis raro subobovatis, basi obtusis vel rotundatis interdum subdecurrentibus, apice rotundatis vel obscure mucronatis vel late acutis; capsulis ellipsoideis vel sphaeroideis.

15a (1). Geniostoma insulare var. insulare forma insulare

Geniostoma rupestre var. *ellipticum* A. Gray in Proc. Amer. Acad. 4: 33, *nomen*. 1859.

Forma typica; foliorum laminis plerumque ellipticis vel ovatis; capsulis ellipsoideis.

Type in the herbarium of the University of California, No. 296979, collected at edge of mangrove swamp near Nukualofa, Tongatabu, Tonga, near sea level, June–August, 1926, by W. A. Setchell & H. E. Parks (No. 15334). Duplicates at Bish, GH, US.

ADDITIONAL SPECIMENS EXAMINED:

TONGA: HA'ABAI GROUP: KAO: *Yuncker* 15900 (US). NOMUKA: Seaside thicket, *Yuncker* 15821 (US). NIUATOPUTAPU: Summit of range east of Vaipoa, *Hürlimann* 366 (US). TAFAHI: Path to the Piu 'o Tafahi, *Hürlimann* 432 (US). TONGATABU GROUP: TONGATABU: Peninsula west of Hofoa, *Hurlimann* 83 (US); Vahe Ha'ake, *Setchell & Parks* 15357 (UC); near Ha'atafu, *Setchell & Parks* 15575 (UC); below Ha'akame village, *Yuncker* 15284 (US); near Niutoua, *Yuncker* 15111 (US); without precise locality, *U.S. Expl. Exped.* (source of the name *G. rupestre* var. *ellipticum*, GH, NY), *Lister* in 1889 (K), *Setchell & Parks* 15231 (UC), 15247 (UC). Tonga, without further locality: *D. Nelson* (BM).

FIJI: VANUA LEVU: Mathuata: Seangganga Plateau, in drainage of Korovuli River, near Natua, *Smith* 6868 (A, Bish, K, US). Thakaundrove: Maravu, near Salt Lake, *Degener & Ordonez* 14170 (A, Bish, K). FULANGA: Limestone formation on lagoon cliff, *Smith* 1203 (Bish, GH, K, NY, UC, US).

DISTRIBUTION: Tonga and Fiji; the plant is recorded as a low shrub or slender tree not much exceeding 3 m. in height, usually occurring in thickets near sea level or in xerophilous or fog forest upward to 500 m., frequently on limestone; the flowers are white or greenish white.

LOCAL NAMES AND USE: *Te'e pilo a Maui* (recorded by various collectors in Tonga); *faefaelunga* (Niuatoputapu); *mbitimbiti* (Fulanga). Hürlimann indicates that the plant is used in Tongan medicine.

As the nomenclaturally typical form and variety of *G. insulare* we have indicated the population with glabrous habit, prevailingly elliptic or ovate leaf-blades, and ellipsoid capsules.

15a (2). Geniostoma insulare var. insulare forma sphaerococcum Smith & Stone, f. nov. PLATE 2, FIGURE 20

Forma foliorum laminis ovatis acutis saepe basi rotundatis vel subtruncatis; e forma typica capsulis sphaeroideis distinguitur.

Type in the U.S. National Herbarium, No. 1674613, collected in hills above Namalata and Ngaloa Bays, Kandavu, Fiji, alt. 200–400 m., October 14, 1933, by A. C. Smith (No. 112). Duplicates at Bish, GH, K, NY, UC.

ADDITIONAL SPECIMENS EXAMINED:

FIJI: VITI LEVU: Naitasiri: Woods near Tamavua, *Gillespie* 3610 in part (NY); near road beyond Nasinu, *Gillespie* 3610 in part (Bish, UC). OVALAU: Northwest of Levuka, *Gillespie* 4566 (Bish, NY, UC). KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith* 71 (Bish, GH, K, NY, UC, US); without precise locality, *Tothill* 614 (K). VANUA MBALAVU: Nambavatu, *Tothill* 615 (K). FULANGA: Limestone formation, *Smith* 1142 (Bish, GH, K, NY, UC, US). Fiji, without further locality: *U.S. Expl. Exped.* (US).

DISTRIBUTION: Fiji, known from the several islands mentioned above, where it occurs as a tree 5–15 m. high from sea level up to 400 m. alt., often in rocky formations or on limestone.

LOCAL NAME: *Mboimboinda* (Kandavu, Fulanga).

The cited specimens differ from the typical form of our var. *insulare* primarily in having consistently globose or sphaeroidal capsules; the leaf-blades also tend to be slightly different in shape, being predominantly ovate and rounded or nearly truncate at base. However, the indicated nomenclatural position seems best to show the relationship within *Geniostoma* of this puzzling population, on the basis of available material. In form the capsules suggest those of *G. dictyoneurum*, described above, from which *G. insulare* differs in the free veinlets of its corolla-lobes and in the smaller, more coriaceous, and usually more acute leaf-blades.

15a (3). Geniostoma insulare var. insulare forma **cuspidatum** Smith & Stone, *f.* nov.

Forma foliorum laminis plerumque obovatis interdum ellipticis apice cuspidatis et capsulis late ellipsoideis e forma typica differt.

Type in the herbarium of the Bernice P. Bishop Museum, collected on the summit of Mt. Fao, Upolu, Samoa, alt. 680 m., September 6, 1929, by Erling Christophersen (No. 569). Duplicate at UC.

ADDITIONAL SPECIMENS EXAMINED:

SAMOA: SAVAII: Near Salaeula, *Christophersen* 2467 (Bish). TAU: Near summit of main range, *Garber* 755 (Bish). Samoa, without further locality: *U.S. Expl. Exped.* (US), *Whitmee* in 1876–77 (GH).

Distribution: Known only from the few scattered cited Samoan collections, at altitudes up to 680 m.; the plants are said to be shrubs or trees up to 5 m. high.

Although the cited Samoan material seems clearly to belong to the typical variety of *G. insulare*, it represents a local variant which, at least for the present, seems worthy of formal recognition.

15b. Geniostoma insulare var. **tongense** Smith & Stone, var. nov.

Planta e varietate typica partibus vegetativis et inflorescentiae ramulis arcte puberulis distinguitur; ramulis demum glabratis; foliorum laminis ex ovatis ellipticis utroque subacutis interdum subrotundatis; capsulis ellipsoideis.

Type in the herbarium of the University of California, No. 297257, collected on the plateau on Eua, Tonga, in June or July, 1926, by H.E. Parks (No. 16261). Duplicates at Bish, GH, US.

ADDITIONAL SPECIMENS EXAMINED:

TONGA: VAVA'U GROUP: VAVA'U: Coastal cliff above Leimatua, *Yuncker* 16057 (US). TONGATABU GROUP: EUA: Above Honuma, *Yuncker* 15505 (US); above Fuai, *Yuncker* 15379 (US), *Hürlimann* 190 (US); cliffs at Likio, *Parks* 16097 (UC), 16395 (UC); terrace north of Vaingana Creek, *Hürlimann* 275 (US); without precise locality, *Lister* in 1889 (K), *Cartwright* in 1889 (K).

NIUE: Rocks near Alofi, *Yuncker* 10152 (Bish).

DISTRIBUTION: Tonga and Niue; the variety is recorded as a shrub or as a small tree approaching 5 m. in height and with a trunk 5–18 cm. in diameter, occurring in the forests of level places or along limestone cliffs, elevations of sea level up to 240 m. having been indicated; the flowers are white or greenish, with a disagreeable odor.

LOCAL NAME: *Te'e pilo a Maui* has been recorded in Tonga, as for var. *insulare*.

As implied in our discussion of the species as a whole, these conspicuously puberulent individuals from Tonga and Niue comprise a population of *G. insulare* that seems worthy of varietal recognition.

16. Geniostoma biseriale Rechinger in Rep. Sp. Nov. 6: 325. 1909, in Denkschr. Akad. Wiss. Wien 85: 329. *t. 9, f. 2.* 1910; Christophersen in Bishop Mus. Bull. 128: 175. 1935.

PLATE 1, FIGURE 16

Shrub or small tree 2–4 m. high, glabrous throughout except for some floral parts, with slender pale gray-brown subterete or obscurely quadrangular branchlets, these distally about 2 mm. thick; stipules intrapetiolar, forming a short subtruncate sheath 1–1.2 mm. long; leaves subsessile, the petioles at most 2 mm. long, the blades oblong-elliptic or narrower and lanceolate-elliptic (rarely slightly lanceolate-ovate), subauriculate, cordate, or subcordate at base, acuminate at apex, 6–15 cm. long, 2–6 cm. broad, the costa sulcate above, raised beneath, the lateral nerves 7–12 per side, slightly raised on both surfaces, the veinlets obscure; inflorescences axillary among the leaves, dichasial, 5–10-flowered, the peduncle 1–2 mm. long, the axes and pedicels glabrous, 1–3 mm. long, bracteate, the flowers glabrous externally; calyx cupuliform, the lobes 0.8–1 mm. long, deltoid-ovate; corolla short-tubular, 3.5–4.2 mm. long, lobed nearly to middle, the tube glabrous basally within, at throat sparsely pilose with trichomes 0.3–0.4 mm. long, the lobes deltoid-ovate, glabrous distally, the venation complex, that of each lobe derived from a single central main nerve producing 1 or 2 pairs of lateral branches in the tube, these in turn producing 1 or 2 lateral branches, all ascending into the lobe; stamens inserted at throat, the filaments about 0.2 mm. long, the anthers narrowly deltoid-oblong, 0.6–0.8 mm. long; ovary glabrous,

depressed-globose, about 0.7 mm. high and 0.9 mm. broad, the style slender, glabrous, 1.5–2 mm. long, the stigma (in our specimens poorly preserved) apparently obovoid, about 0.7 mm. long; capsule ellipsoid, 7–8 mm. long, 2–4 mm. broad, apiculate.

TYPE LOCALITY: Upolu, Samoa, in forest near Tiavi, at 700 m. alt.; the type is *Rechinger* 446, presumably deposited in the Berlin Herbarium and subsequently destroyed. The cited illustration is excellent and permits adequate understanding of the concept.

DISTRIBUTION: Endemic to Samoa, and thus far known from few collections from Savaii and Upolu, occurring in forest between 400 and 1500 m. alt.; it is said to be a shrub or small tree up to 4 m. high, with white flowers.

SAMOA: SAVAII: Papa'afu, crater-rim, *Christophersen* 2727 (Bish, UC, NY); above Sili, *Christophersen* 3152 (Bish, UC, NY). UPOLU: Ridge above Malololelei, *Christophersen* 11 (Bish, US).

Geniostoma biseriale is readily distinguished from other species of our region by its essentially sessile leaves, of which the petioles do not exceed 2 mm. in length, the blades being proportionately unusually narrow, prevailingly cordate or even subauriculate at base. The indument of the corolla-throat is short, suggesting that the closest relatives of *G. biseriale* may be *G. gracile* and *G. macgregorii*, but the relationship is not close.

Excluded Species

Geniostoma microphyllum Seem. in Bonplandia 10: 37, nomen. 1862, Fl. Vit. 164. 1866.

FIJI: VITI LEVU: Namosi (?): "Navua River," *Seemann* 304 (BM, GH, K type); Rewa: Summit of Central Road, Suva, *Tothill* 611 (K).

This taxon is not a *Geniostoma*, but appears to be rubiaceous. We judge it to be a juvenile form of a *Psychotria*, probably of a lianoid species, suggestive of *P. serpens* L. The Seemann specimen was mentioned by A. Gray (in Proc. Amer. Acad. 5: 320. 1862), who stated that the specimen, first labeled as a *Gaertnera*, was a new *Geniostoma*. The nature of the stipules, the leaf structure, and the apparent climbing habit (adventitious roots appearing at the nodes of the stem) exclude this plant from *Geniostoma*. We hope to be able to state more precisely the identity of this puzzling plant, but are not prepared to do so at this time.

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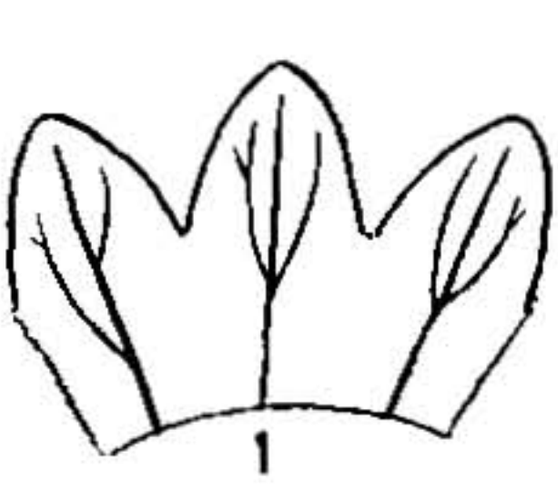
PLATES

PLATE 1

Corolla-lobe venation-patterns in *Geniostoma*. The types of venation of 16 species are shown, all × 5; each figure illustrates 3 lobes and the corresponding part of the corolla-tube. FIGURES 1, *G. macrophyllum;* 2, *G. stipulare;* 3, *G. confertiflorum;* 4, *G. clavigerum;* 5, *G. univervium;* 6, *G. vitiense;* 7, *G. gracile;* 8, *G. macgregorii;* 9, *G. calcicola;* 10, *G. dictyoneurum;* 11, *G. fleischmannii;* 12, *G. stenocarpum;* 13, *G. samoense;* 14, *G. rupestre;* 15, *G insulare;* 16, *G. biseriale.*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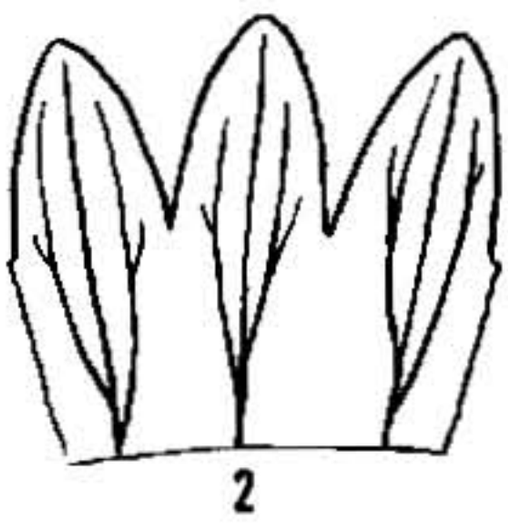
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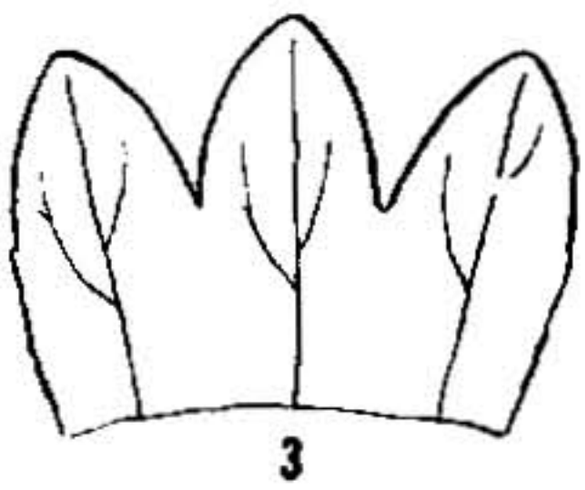
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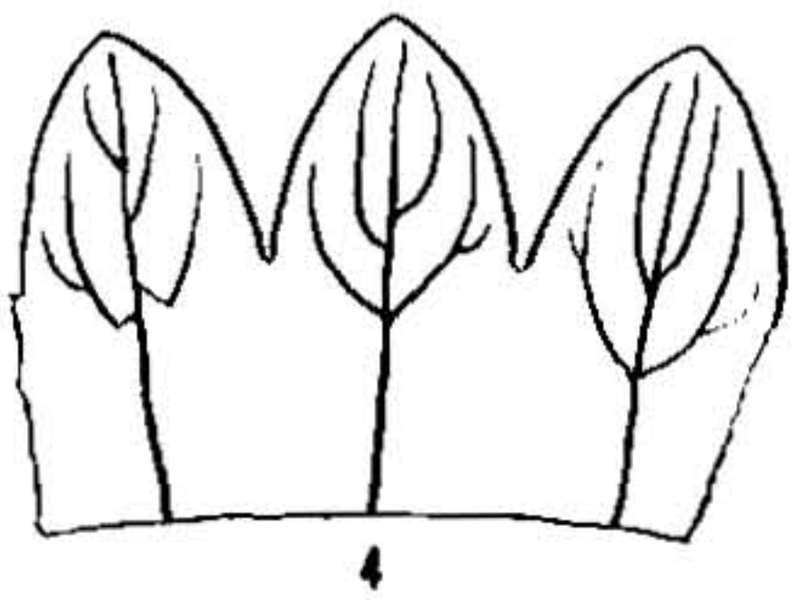
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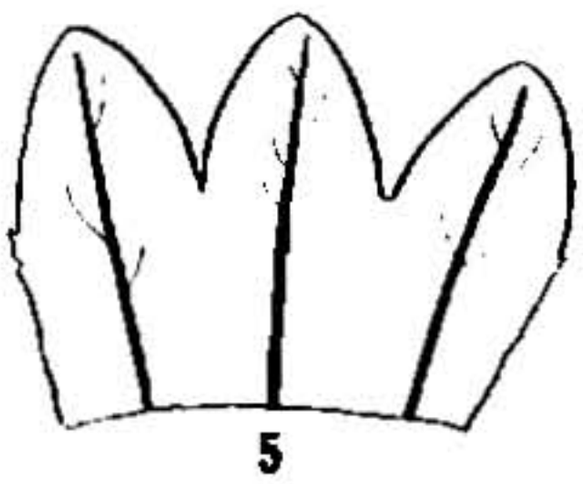
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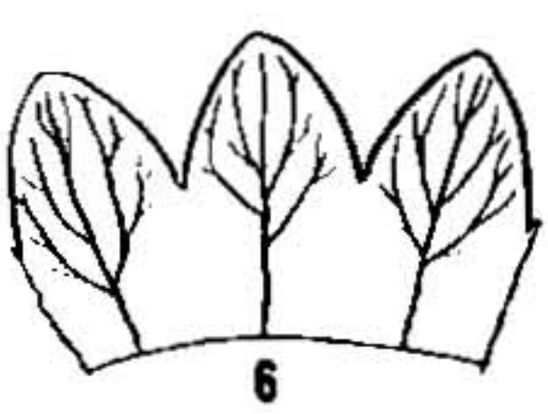
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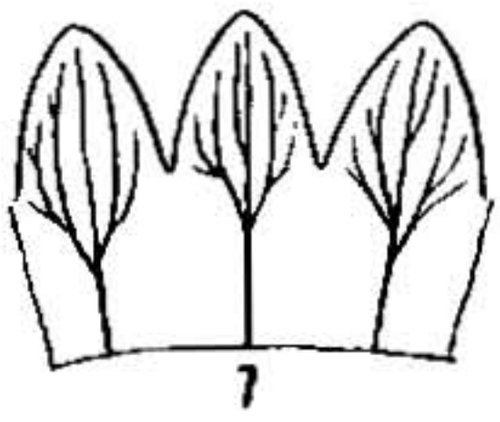
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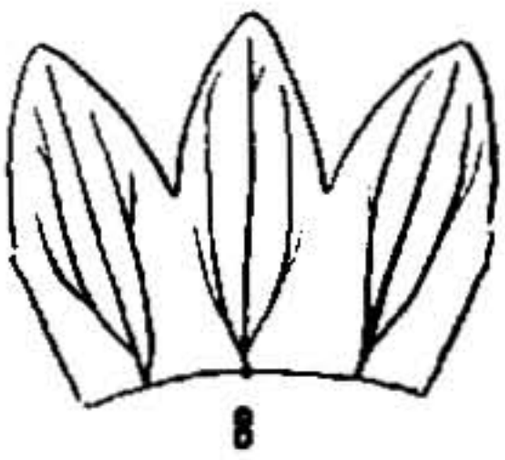
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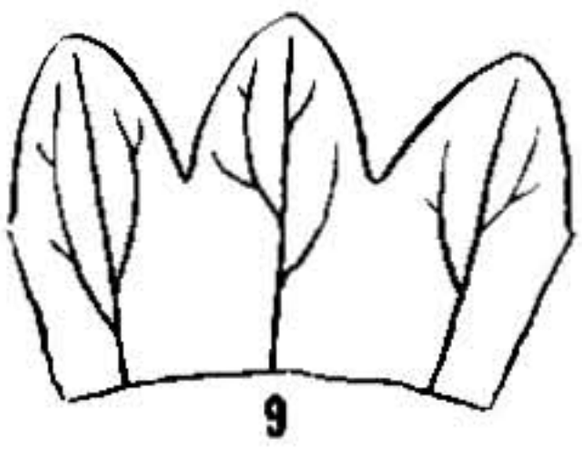
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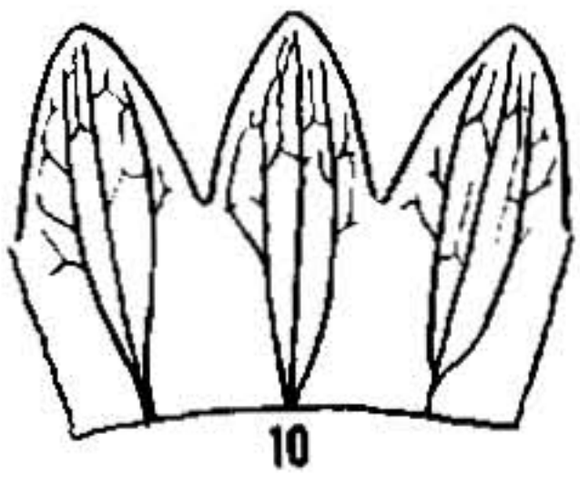
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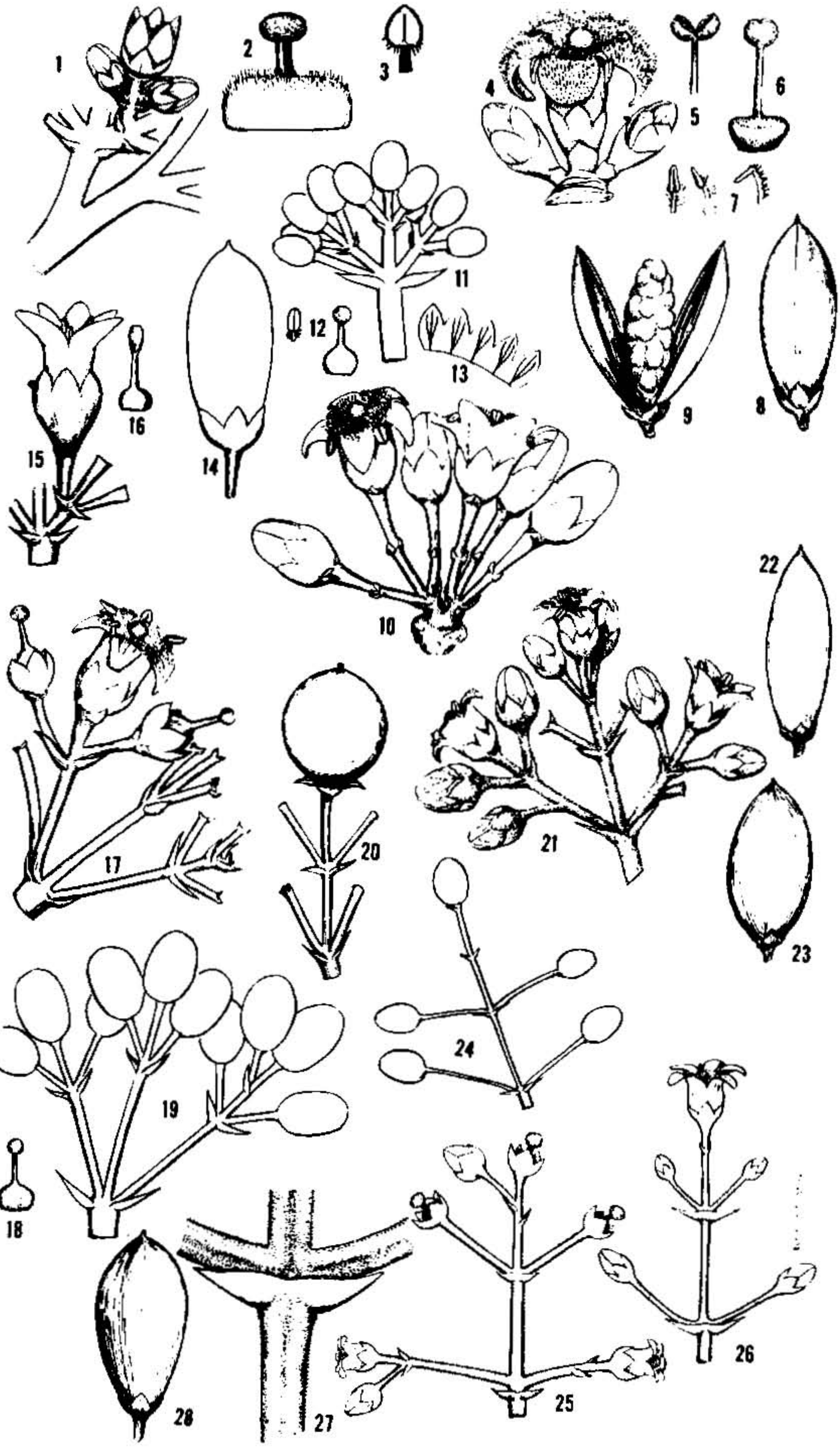
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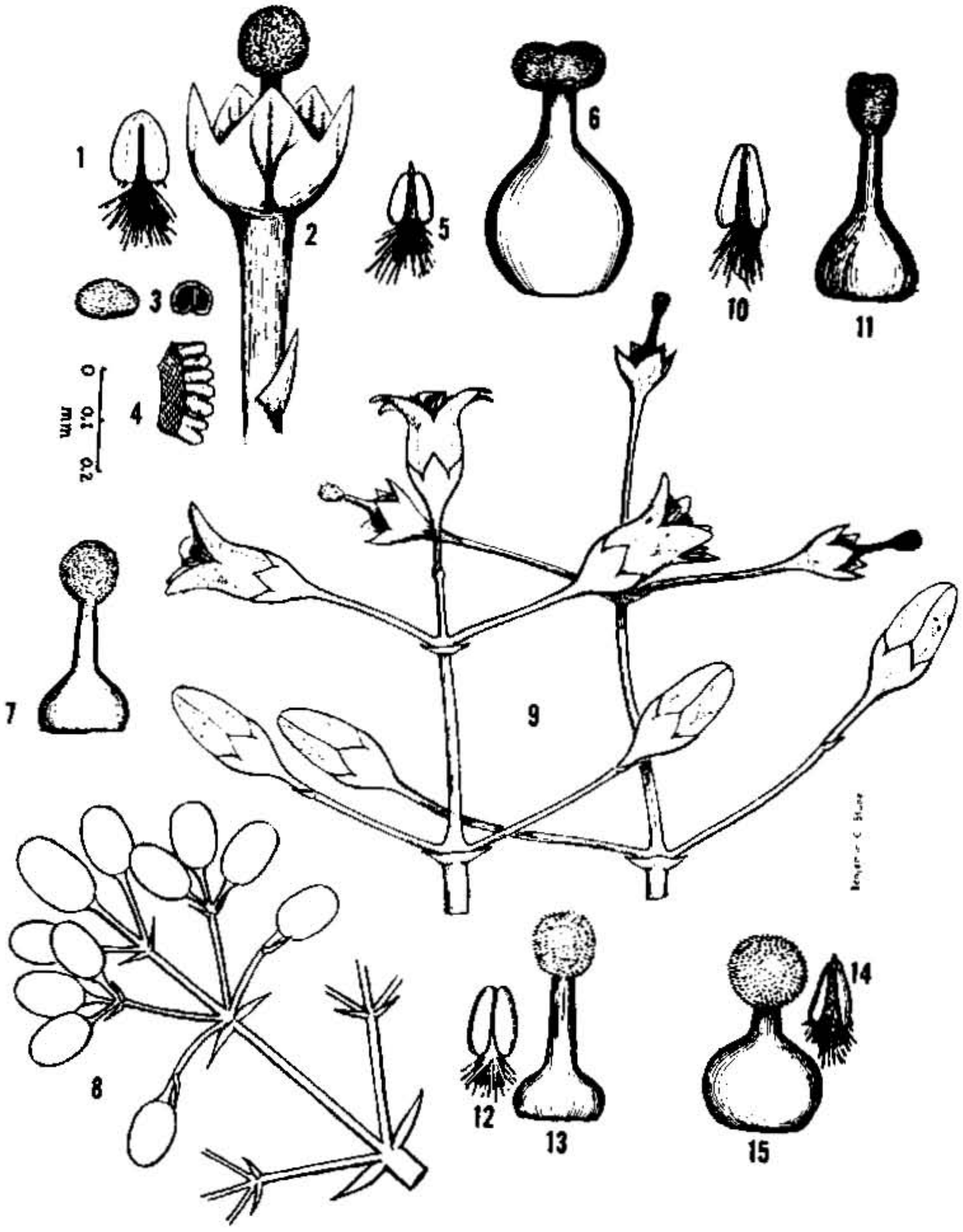
PLATE 2

Floral features of *Geniostoma*. FIGURES 1–3, *G. macrophyllum:* 1, portion of inflorescence, × 2.5; 2, gynoecium, × 10; 3, stamen, × 10. FIGURES 4–9, *G. stipulare:* 4, ultimate dichasium, × 5; 5, stigma, showing lobes, × 5; 6, gynoecium, × 5; 7, stamens, × 5; 8, capsule before dehiscence, × 2.5; 9, capsule after dehiscence, × 2.5. FIGURES 10–14, *G. uninervium:* 10, inflorescence with flowers, × 5; 11, schematic diagram of young inflorescence, × 5; 12, stamen and gynoecium, × 2.5; 13, calyx, showing venation, × 2.5; 14, capsule in outline, × 2.5. FIGURES 15, 16, *G. confertiflorum:* 15, portion of inflorescence with flower, × 2.5; 16, gynoecium, × 2.5. FIGURES 17–19, *G. macgregorii:* 17, part of inflorescence with flower and gynoecia, × 2.5; 18, gynoecium, × 2.5; 19, schematic diagram of inflorescence, × 2.5. FIGURE 20, *G. insulare* f. *sphaerococcum:* capsule and part of inflorescence, × 2.5. FIGURES 21–23, *G. vitiense:* 21, inflorescence, × 2.5; 22, 23, capsules, × 2.5. FIGURE 24, *G. calcicola:* schematic diagram of inflorescence, × 2.5. FIGURE 25, *G. samoense* var. *samoense:* inflorescence and flowers, × 2.5. FIGURE 26, *G. samoense* var. *parviflorum:* inflorescence and flowers, × 2.5. FIGURES 27, 28, *G. samoense* var. *samoense:* 27, greatly enlarged view of inflorescence-node with bract; 28, capsule, × 2.5.

PLATE 3

Floral features of *Geniostoma*. FIGURES 1–4. *G. samoense* var. *samoense:* 1, stamen, × 5; 2, flower past anthesis, with pedicel, × 5; 3, seed in side view and cross-section, × 10; 4, portion of wall of seed in cross-section, × 50. FIGURES 5, 6. *G. samoense* var. *parviflorum:* 5, stamen, × 5; 6, gynoecium, × 5. FIGURES 7, 8. *G. stenocarpum:* 7, gynoecium, × 5; 8, schematic diagram of inflorescence, × 2.5. FIGURES 9–11. *G. gracile:* 9, two inflorescences, one with flowers at anthesis, the other slightly later, × 2.5; 10, stamen, × 5; 11, gynoecium, × 5. FIGURES 12–15. *G. vitiense:* 12, 13, stamen and gynoecium from "long-styled" or hermaphrodite flower, × 5; 14, 15, stamen and gynoecium from "short-styled" or pistillate flower, × 5.



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