
Ficus Sect. Adenosperma

E. J. H. Corner

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FICUS SECT. ADENOSPERMA

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The structure, distribution and classification of the twenty species of sect. *Adenosperma* are reviewed. The section is centred on New Guinea where nineteen species occur and *F. megalophylla* persists as the pachycaul relic. The section relates with sect. *Sycocarpus* subsect. *Auriculisperma* of the Solomon Islands and connects with the origin of sect. *Ficus* through the Philippine species *F. pseudopalma* and *F. rivularis* along the *Sararanga*-front of the Melanesian Foreland. The most widespread species are among the most advanced. They show the usual trend in *Ficus* from the stout pachycaul with large multibracteate fig to the leptocaul with lanceolate leaf and small fig, along with the development of cauliflory and geocarpy. There is no evidence to suggest that the species evolved through vicariism, and the two series *Amphigenae* and *Hypogenae* run almost identical courses from Celebes to New Hebrides. Two new species are described from New Guinea, *F. pilulifera* and *F. suffruticosa*.

INTRODUCTION

In the preceding paper, the close alliance of *F. deltoidea* introduced the problems of minor speciation and geographical dispersal in *Ficus* (Corner 1969). Section *Adenosperma* serves the wider purpose of evolution from the pachycaul with multibracteate fig to the leptocaul state. The domain is enlarged from Celebes to New Hebrides with a massing of species in the central position of New Guinea and a small element in north Queensland, but none in New Caledonia, the Philippines and the Timor-arc. This distribution to the east of Wallace's line occupies a part of several of Croizat's tracks without fulfilling any, and thus serves as a test of their validity (Croizat 1968, f. 14, p. 120 and f. 44, p. 314).

The section consists of shrubs, small trees and large trees, buttressed and to 30 m high, several species of which are common and vigorous members of the lowland forest. The point needs emphasis. The rivers in the domain of *Adenosperma* could well be called *Adenosperma*-rivers because of the great abundance of *F. adenosperma* along their banks from the upper reaches of the tidal stretch to altitudes of 2400 m. The abundance of the species of *Adenosperma* has not been enumerated in forest records, presumably because of the impossibility of identification, but it is clear from the increasing number of collections that they make up a considerable part

of the second-class timber in this part of the world. I now recognize twenty species because two are added in this account to those enumerated in my check-list (Corner 1965).

The section is distinguished in the dioecious subgenus *Ficus* by the single stamen, the usually free tepals, the more or less gynobasic style of the female flower (less evident in the gall-flowers), the red or red-spotted ovary, the compressed seed with a distinct keel that is usually double at the base, and the generally sessile nature of the flowers; the flower, that is, is not usually pedicellate though the ovary may be stalked. The section aligns itself with the unistaminate sect. *Sycidium* and sect. *Sycocarpus*, both of which differ in the form of the seed, if not also in that of the flower. Thirteen species, described from the time of Blume onwards, have been distributed in various groups of *Ficus* and their uniformity was not realized until attention had been given to flower and seed (Corner 1958). There emerges one of the best characterized sections of the genus.

The species show evolution from the massive primary construction with large leaves in spiral phyllotaxis, persistent large stipules and multibracteate figs to the leptocaul with small, often paucicostate, distichous leaves, small caducous stipules, small figs without lateral bracts and small flowers with simpler tepals. The whole is a process of simplification or reduction, best described as neotenic because it is the result of less growth of the twig in its apical organization, of the leaf in its apical and intercalary growth, and correspondingly of the fig and its flowers in their development. The more primitive pachycaul species occur at the centre of massing in New Guinea, perhaps in eastern New Guinea, but this half may merely be the better explored. Hence I take New Guinea to be the source of the section, both series of which have evolved in almost exactly the same manner, with the same number of species and a similar dispersal. Some of the advanced species are widely distributed and the widest, covering the whole range of the section, is the very common, variable, and much simplified *F. adenosperma*. Next in wide distribution are *F. mollior*, which appears as the antecedent to *F. adenosperma* and in no way vicarious, and *F. erythrosperma*, which is the counterpart in ser. *Hypogonae*. Three groups of closely allied species show clearly the evolutionary trends in leptocauly; they are *F. megalophylla*–*F. saccata*–*F. ochrochlora*, *F. mollior*–*F. comitis*–*F. adenosperma*, and *F. funiculosa*–*F. trichocerasa*–*F. erythrosperma* (figure 4).

The section falls naturally into two series according to the position of the cystoliths on the leaf, on both sides in ser. *Amphigenae* or only on the underside in ser. *Hypogonae*. The difference is readily ascertained in dried leaves for the cystoliths appear under a lens as minute pimples. I have seen no intermediate. Each series has ten species which hang variously together in their own smaller groupings. The tepals tend to be lanceolate in ser. *Amphigenae* and spatulate in ser. *Hypogonae*, but there are exceptions as *F. arbuscula* in the first series and *F. pleioclada* and *F. tenella* in the second.

The pachycaul species have amphigenous cystoliths and I assume this to be the primitive arrangement. These structures are invaginated secretory hairs and their epidermal distribution would seem to have been primitively unrestricted on the lamina as on the petiole and twig.

HABIT

The *Terminalia* habit of branching predominates. It gives the broad spreading crowns of *F. austrina* on the seashores and of *F. adenosperma* by the rivers. The truly distichous habit of the main branches occurs in ser. *Amphigenae*. *F. endochaete* with lanceolate leaves has the habit of *Prunus*, much as in *F. celebensis*, and *F. umbonata* with broader leaf resembles *F. ampelas*. The habit is almost achieved in three species of ser. *Hypogenae*, namely *F. trichocerasa*, *F. tenella* and *F. erythrosperma*; they have the leaves laxly spiral on divaricating twigs. Possibly the intermediate stage in ser. *Amphigenae* is found in *F. comitis*.

In the Solomon Islands *F. verticillaris*, as a small forest tree, carries the *Terminalia* habit to one extreme of leptocauly (Corner 1967, f. 39). *F. arbuscula* carries it to another extreme as a shrub with elegant tiers of branches bearing lanceolate leaves. It grows on the stony beds of swift rivers in the Moluccas, New Guinea and New Britain. It is the *Ficus* rheophyte in this region as *F. ischnopoda* is in Indomalaya, *F. pyriformis* in Sinohimalaya, *F. macrostyla* in Borneo, *F. cataractorum* in New Caledonia, and *F. bambusaefolia* in Fiji, all of which belong to different regional groups of *Ficus* and show how the pachycaul ancestors have independently exploited the circumstances of their regions. The habit seems also to be facultative in *F. adenosperma* and *F. mollior*, both of which have narrow-leafed riparian forms.

The section enters the mountain *Nothofagus* forest of New Guinea with *F. saccata*, *F. casearioides* (of *Terminalia* habit), and the cherry-like *F. endochaete*. These species are so dissimilar that, in view of the gradual differentiation found in most alliances of *Ficus*, it is difficult to believe that there are not other species to be discovered.

The smallest species is *F. suffruticosa*, which resembles some of the small shrubby species of sect. *Sycocarpus* subser. *Axillares*. Conceivably it is the precociously fertile sapling (1 m high) of *F. subcuneata* but, since it was said to be common where it was found in western New Guinea, it seems to be specifically distinct and to represent how this ever-present neotenic trend occurs in the genus.

LEAF

The largest leaf occurs in *F. megalophylla* (figure 7), associated with the stoutest twig, persistent stipules and the large multibracteate fig. The species seems rare and is known by few collections from eastern New Guinea. *F. saccata*, which is more frequent, is a slight leptocaul advance (figure 6). Both belong in ser. *Amphigenae* and lead through *F. ochrochlora* (figure 11) to the taller leptocaul trees as *F. mollior*, *F. comitis* (figure 15) and *F. adenosperma* (Corner 1967, f. 38). This alliance gives about as close a graduation as conceivable between the rare and restricted pachycaul and the common leptocaul with its loftier habit, smaller parts, and greater adaptability. Thus, the subglabrous states of *F. mollior* (Corner 1967, f. 38) may easily be mistaken for *F. adenosperma* and it is difficult to decide whether v. *microlepis* (figure 20) is correctly placed under *F. adenosperma* or should be referred to *F. comitis*. The leaf-forms are paralleled exactly in other sections of *Ficus* but as a mark of advance, similar to that of subgen. *Urostigma* and *Pharmacosycea*, the leaves of *Adenosperma* are never dentate.

The large leaves have many transverse intercostal veins and this regular arrangement passes with declining intercalary growth to the vaguer intercostal display in such as *F. adenosperma*.

Ser. *Hypogenae*, without a pachycaul species, may have diverged at such an early leptocaul stage from ser. *Amphigenae* as that between *F. ochrochlora* and *F. mollior*. Thus *F. subcuneata*

(figure 23), *F. funiculosa* (figure 28) and *F. austrina* (Corner 1967, f. 40) are the states with large leaves in three alliances. There is the more or less glabrous alliance of *F. austrina*, *F. casearioides* and *F. pilulifera*, the simply hairy alliance of *F. subcuneata* and *F. suffruticosa*, and the remainder with undulate as well as straight hairs. *F. funiculosa* is the one species of the section in which the lamina becomes ovate-cordate. The general tendency is from obovate to lanceolate with short basal veins. The small, elliptic or lanceolate leaf accompanies in *Adenosperma* the advanced leptocaul habit, as in *F. endochaete* and *F. erythrosperma* (Corner 1967, f. 40). As mentioned in connexion with *F. deltoidea*, this arrangement is the usual outcome of neotenic simplification in Moraceae.

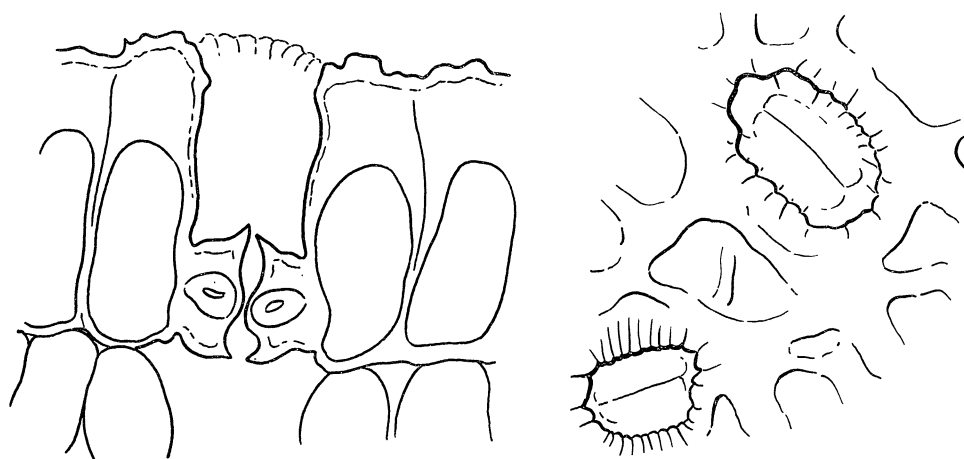


FIGURE 1. *F. verticillaris* v. *robusta*, stomata in section and surface view ($\times 500$).

In two species of ser. *Amphigenae* the stomata are sunken through the anticlinal lengthening of the epidermal cells (figure 1). They are *F. umbonata* and *F. verticillaris* v. *robusta*. The feature affords a certain distinction between sterile specimens of *F. umbonata* and *F. ampelas* (sect. *Sycidium*) and between *F. verticillaris* v. *robusta* and *F. smithii* (subgen. *Pharmacosyceae*), for these pairs of species may grow together and can easily be mistaken.

SYCONIA

The syconia are axillary, paired and multibracteate in *F. megalophylla*, *F. saccata* and *F. ochrochlora*, and they are sessile with 3–5 basal bracts (figures 6, 10, 11). In the leptocaul species the syconia become pedunculate with three basal bracts, and the lateral bracts are either few, small and scattered, or absent. These syconia may remain axillary, as appears to be the case in most species, but they become variously ramiflorous and cauliflorous in *F. mollior*, *F. comitis*, and *F. adenosperma* in ser. *Amphigenae* and in *F. pilulifera* (figure 22) in ser. *Hypogonae*. The cauliflory is so marked in this last species that it can easily be mistaken for a species of sect. *Sycocarpus* or one of the aberrant members of subgen. *Pharmacosyceae*, such as *F. racemigera* or *F. pritchardii*. The point emphasizes the astonishing parallelism in most groups of *Ficus* which follows from the general leptocaul trend, and it emphasizes the need for thorough study of the flowers, the seed and the microscopic structure of the leaf in order to follow these parallels. More attention, however, must be given to the cauliflorous habit in the field. Whereas *F. adenosperma* seems always to become truly cauliflorous, *F. comitis* may be merely ramiflorous, and

in *F. mollior* some trees are ramiflorous, others also cauliflorous while others, equally well grown, have only axillary figs. Young trees certainly start with axillary figs and through the persistent slow growth of the median (terminal) bud between the paired syconia on the fruiting side-branch the fascicles of syconia are built up, which persist on the trunk and branch or apparently on the trunk only in *F. pilulifera*. The inception of this habit in *F. theophrastoides* is figured in the account of the Solomon Islands figs (Corner 1967, f. 52).

Lastly there is the case of the very rare or local *F. pleioclada* which may be truly geocarpic. Its leafless cauliflorous twigs develop internodes 1–2 cm long and may extend along the ground for 150 cm from the base of the trunk. The geocarpic habit has been evolved in several series of the allied sect. *Sycocarpus* and sect. *Sycidium*, apparently by identical means, and it is the advance on the cauliflorous with relatively short and congested twigs, just as this is the advance on the ramiflorous and the axillary habit which distinguishes the more primitive, bistaminate sect. *Ficus*. *F. pleioclada* may be the parallel in *Adenosperma*.

The multibracteate syconium is often sessile without distinction between basal and lateral bracts, except that the lowest bracts are the smallest. This is the case in *F. dammaropsis* (sect. *Sycocarpus*) which is the best example of the primitive condition of the syconium. Then, as the lateral bracts become fewer and, often, smaller, they are spaced by internodal extension on the wall of the syconium. The spacing may start distally to the first few bracts at the base of the syconium, which thus come to be recognizable as basal bracts, and, as the effect increases, the body of the syconium comes to be made of the internodal extensions of the subsequent 5–8 bracts which become the peripheral bracts round the serried ostiolar bracts. This is the sequence in *Adenosperma* to which there is later added internodal extension below the first basal bract to give the peduncle with its distal collar of three basal bracts (that is, three nodes without internodal separation) and the more or less ebracteate body of the syconium. The effect is well shown in sect. *Sycocarpus*, for instance in *F. longibracteata*, *F. cynaroides* and *F. salomonensis* (Corner 1967, f. 44, 50, 56–58).

This seems to have been the general manner of evolution of the simple fig having a stalk (peduncle), collar and body with only ostiolar bracts, as in the typical case of *F. carica*. It is the ubiquitous consequence of the restrictive evolution of the syconium to fewer and fewer, more precise elements of construction. The simple fig which predominates in all sections of *Ficus* is another of the parallelisms of the genus; it stems from the generic heritage of the multibracteate inflorescence. The collar is refined to three, not five to eight, basal bracts as the minimal state of radial (not distichous) phyllotaxis. The internodal expansion of the body allows the intercalary multiplication of the flowers, while accentuating the closed orifice and its interlocking bracts, because this is a peripheral expansion and hyponastic incurvature. The evolution of the syconium comes to be the restriction of internodal extension to the first and the fourth internodes; that is to say when the phyllotaxis rises to $\frac{1}{3}$ and to $\frac{2}{5}$. The syconium is not a partial dilation with desultory squamation (Croizat 1968), but a precision of phyllotaxis.

It seems clear, nevertheless, from many groups of *Ficus* that the pedunculate syconium without lateral bracts may become sessile again by failure of the peduncular internode. Whether this has happened in *Adenosperma* is not clear. It may be the case in *F. mollior* v. *sessilis* and *F. trichocerasa*, but they may have inherited the sessile state from the multibracteate fig.

I advanced this explanation of the syconium in my first paper on *Ficus* (Corner 1933). It depends on the homology between the bract and the leaf of which there can be no doubt because transitions from leaf to bud-scale and from bud-scale to bract can be found in many

species of *Ficus*, particularly the cauliflorous in which the bracteate twigs may eventually become leafy at the tip. The bract may be considered stipular. Actually it is merely the leaf-primordium that has been arrested at such an early stage in development that, on maturing, it does not form the tripartite structure of lamina and two stipules. As I have mentioned under *F. deltoidea*, there is no call for a mass of assumptions in order to derive the syconium from a branch of a *Pourouma*-inflorescence and then to truncate it or evert it and turn it into a one-flowered capitulum, as Croizat imagines for *Dorstenia*, *Artocarpus* and *Antiaris* respectively. It is not that these genera have departed from blastophagy by eversion, but that a discoid multibracteate inflorescence, such as that of the ancestor of *Antiaropsis*, closed up with blastophagy to end with the little one-seeded syconia of the *F. deltoidea*-complex. I find the classical homology of bracts and flowers in Moraceae a sure guide to the variety of inflorescences.

PERIANTH

The tepals are free in most species but they are more or less united in *F. megalophylla*, *F. casearioides* v. *gamosepala* and *F. pleioclada*. The entirely gamophyllous perianth, saccate or cupular, is the character of the allied sect. *Sycocarpus* and does not occur in *Adenosperma* where the gamophyllous tendency is probably another parallel, as in many other groups of the genus. Nevertheless, this tendency may bear on the problem of *F. indigofera* of the Solomon Islands which I have referred to sect. *Sycocarpus* subsect. *Auriculisperma* in spite of its more or less lobed perianth (Corner 1967, f. 55). The matter is taken up on p. 326 in connexion with *F. rivularis*.

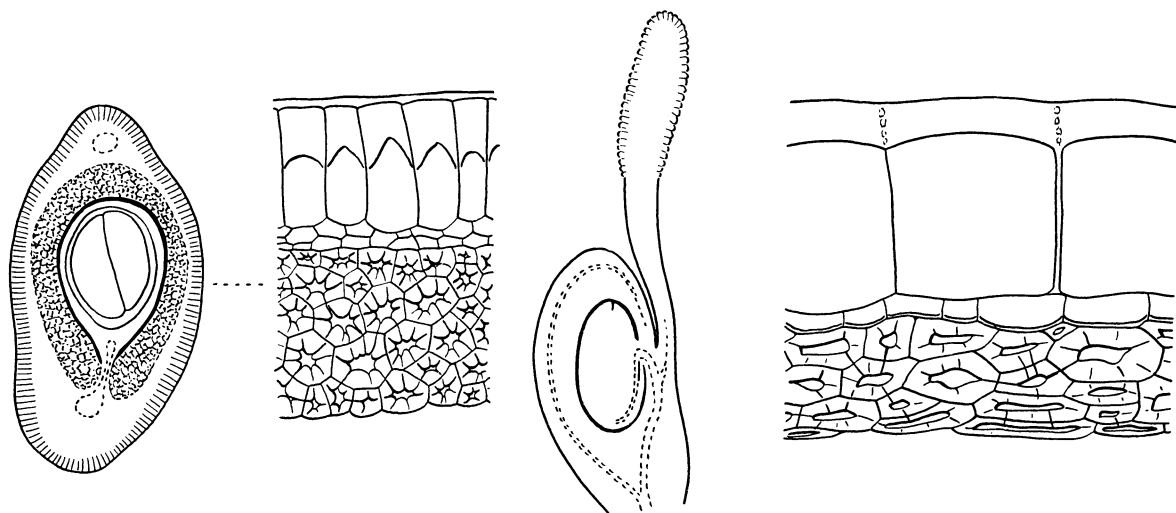


FIGURE 2. Left *F. verticillaris* v. *robusta*, section of the mature drupe through the hilum ($\times 25$) and part of the pericarp enlarged to show the epidermal cells with thick red-brown walls and the woody endocarp ($\times 220$). Centre, *F. trichocerasa*, young ovary with vascular bundles ($\times 25$). Right, *F. megalophylla*, section of the pericarp ($\times 220$).

SEED

The distinctive form of the seed has the double basal keel. It appears to be the result of the close proximity of the placental vascular bundle with the endocarp at the base of the fruit, but it is also connected with the gynobasic position of the style (figure 2). In *F. megalophylla*, *F. austrina*, and *F. verticillaris*, however, the seed lacks the double basal keel. Such seeds approach

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closely to the plump seeds of subsect. *Auriculisperma* ser. *Theophrastoides*, while the more auriculiform seeds approach those of ser. *Cynaroides*. In size the seeds vary 1–2.5 mm long and 0.4–0.9 mm wide in the narrow diameter.

DISTRIBUTION

The main fact is the restriction of *Adenosperma* to the arc Celebes to New Hebrides (table 1). I have concluded that this has resulted from the relatively late origin of the section in New Guinea whence, in its outward spread, it missed the connexions with Borneo, the Philippines and Fiji. I wrote 'it is impossible to believe that *F. adenosperma*, *F. erythrosperma* and *F. subcuneata*,

TABLE 1. THE DISTRIBUTION OF SECT. *Adenosperma*

	Cel.	Mol.	N.G.	N.Br.	Sol.	N.H.	Q.	collections
Amphigenae								
<i>F. megalophylla</i>	.	.	—	.	.	.	.	6
<i>F. saccata</i>	.	.	—	.	.	.	.	6
<i>F. ochrochlora</i>	.	.	—	.	.	.	.	10
<i>F. endochaete</i>	.	.	—	.	.	.	.	14
<i>F. umbonata</i>	.	—	—	.	.	.	.	6
<i>F. mollior</i>	.	—	—	—	—	.	—	65
<i>F. comitis</i>	.	.	—	.	.	.	.	17
<i>F. arbuscula</i>	.	—	—	—	.	.	.	24
<i>F. verticillaris</i>	.	.	.	.	—	.	.	35
<i>F. adenosperma</i>	—	—	—	—	—	—	—	ca. 200
(subtotal 10)	1	4	9	3	3	1	2	383)
Hypogenaе								
<i>F. austrina</i>	.	—	—	.	—	—	.	18
<i>F. casearioides</i>	.	—	—	.	.	.	.	33
<i>F. pilulifera</i>	.	.	—	.	.	.	.	1
<i>F. subcuneata</i>	—	—	—	—	.	.	.	26
<i>F. suffruticosa</i>	.	.	—	.	.	.	.	1
<i>F. pleioclada</i>	.	.	—	.	.	.	.	2
<i>F. tenella</i>	.	.	—	.	.	.	.	4
<i>F. funiculosa</i>	.	.	—	—	.	.	.	18
<i>F. trichocerasa</i>	.	.	—	.	.	.	.	48
<i>F. erythrosperma</i>	—	—	—	—	—	?	.	ca. 100
(subtotal 10)	2	4	10	3	2	1	.	251)
total 20	3	8	19	6	5	2	2	633
endemics	0	0	8	0	1	0	0	

Cel. Celebes; Mol. Moluccas; N.G. New Guinea; N.Br. New Britain; Sol. Solomon Is.; N.H. New Hebrides; Q. Queensland.

which reach Celebes and which, as large subcanopy trees and river-bank pioneers, compete there and in New Guinea with such as *F. melinocarpa*, *F. variegata* and *F. congesta*, could not have survived with them also in Borneo and the Philippines, if they had caught the land-connexions' (Corner 1958, p. 31). I enlarged on this in my account of the Solomon Islands figs (Corner 1967, p. 50). I have now given the evidence in detail that the primitive pachycaul species are restricted and relatively rare in New Guinea and that the most widespread are the advanced leptocaul species with reduced leaf and fig. There is no evidence that an ancestral species extended over the whole range and developed vicariously into the modern; all but one

occur in New Guinea and this disproves the explanation by vicariism. Moreover, concerning the three close alliances beginning respectively with *F. megalophylla*, *F. mollior* and *F. funiculosa*, their species grow together in the same forests. *F. suffruticosa* occurs in *F. subcuneata* country, *F. pilulifera* in that of *F. casearioides*. I do not doubt that all differ in their physiology and, thus, in ecology, as they do in structure, but they are not vicarious in the geographical sense any more than the coastal *F. austrina* can be considered vicarious with its inland ally *F. casearioides*. At present one can only read the events without understanding their causation; one can follow the modifications in structure and distribution, but there is no knowledge how speciation has been initiated.

Instead of the vicariism which Croizat proposes, I see a progressive structural and ecological evolution from the ancestral pachycaul of limited ecological ability in the early state of New Guinea, whereby the evolving species spread through the lowland and mountain forests into neighbouring lands. But very advanced leptocaul species, as *F. endochaete*, *F. pilulifera*, *F. suffruticosa* and *F. verticillaris*, have also limited distribution, as with the advanced varieties of *F. oleaefolia* in Borneo. I suppose that they were among the latest to evolve and were unable to escape from their territories. This would seem the natural explanation for the high mountain *F. endochaete*, isolated by large tracts of lowland forest. Sea-barriers appear to have restricted *F. verticillaris* to the Solomon Islands where it is so abundant. Little is known of the special means of dispersal in this section. Some species with greenish yellow figs (*F. mollior*, *F. adenosperma*, *F. austrina*) are distributed by fruit-bats and tree-marsupials. *F. subcuneata* and *F. verticillaris* with red figs may have other agents. All such facts bear on the expanding ecological evolution.

In support of my view, there is the close affinity between *Adenosperma* and *Auriculisperma*. This group appears to have originated on the Melanesian Foreland, as an earlier land-mass than the Solomons Archipelago. Vicariism may be advanced here to explain why *Adenosperma* went for New Guinea and *Auriculisperma* for the Solomons, but this reduces vicariism merely to divergence at a parting of the ways and removes its character of regional replacement of an originally widespread ancestor. There is no evidence that the ancestor of these two groups occupied the whole region from Celebes to Fiji, and certainly none to suppose that they occupy a track emanating from a source of *Ficus* in the Indian Ocean as Gondwanaland (Croizat 1968, f. 14, p. 120).

Ficus pseudopalma AND *Ficus rivularis*

These Philippine species differ from the rest of sect. *Ficus* and from each other markedly enough to require separate taxonomic series. *F. pseudopalma* (ser. *Pseudopalmeae*) connects as a pachycaul with *F. dammaropsis* of New Guinea, with subsect. *Auriculisperma* and, so, with sect. *Adenosperma*. It connects, also, with the ancestry of the *F. deltoidea*-complex. It has the free tepals of sect. *Ficus*.

F. rivularis (ser. *Rivulares*) is an advanced leptocaul shrub with lanceolate leaves, distinguished in sect. *Ficus* by the gamophyllous perianth with distinct tepal lobes, the compressed auriculi-form seed, and the more or less gynobasic style in the female flower (figure 3). The perianth, intermediate between that of sect. *Ficus* and sect. *Sycocarpus*, is the same as in the problematic *F. indigofera* of subsect. *Auriculisperma* (Corner 1967, f. 53–55). Their seeds are similar but there are too many other differences to ally them closely; thus, *F. rivularis* has a red perianth and white ovary with gynobasic style, two stamens, and hypogenous cystoliths while *F. indigofera*

FIGUS SECT. *ADENOSPERMA*

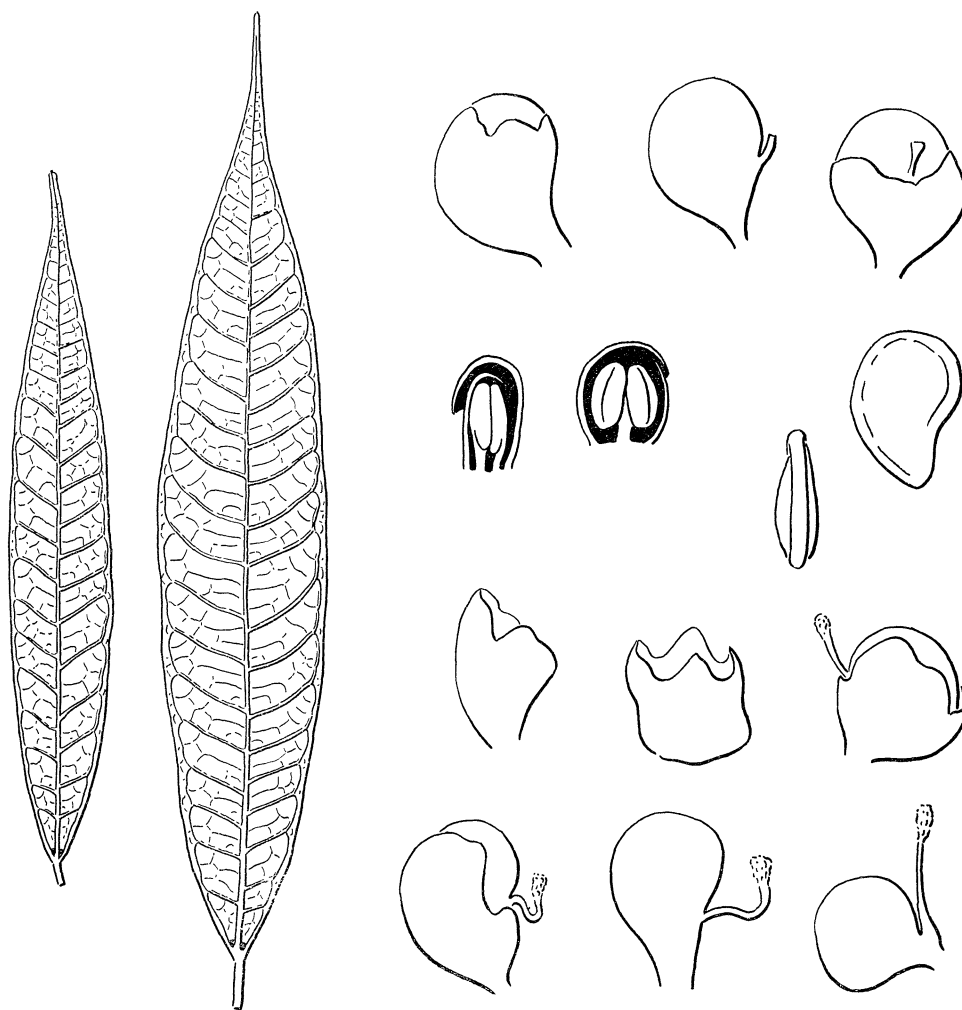


FIGURE 3. *F. rivularis* (sect. *Ficus*). Leaves PNH 2270 (left) and Bur. Sc. 28875 ($\times \frac{1}{2}$); male and gall-flowers (Bur. Sc. 76850), female flowers and seeds (Bur. Sc. 78576) ($\times 10$).

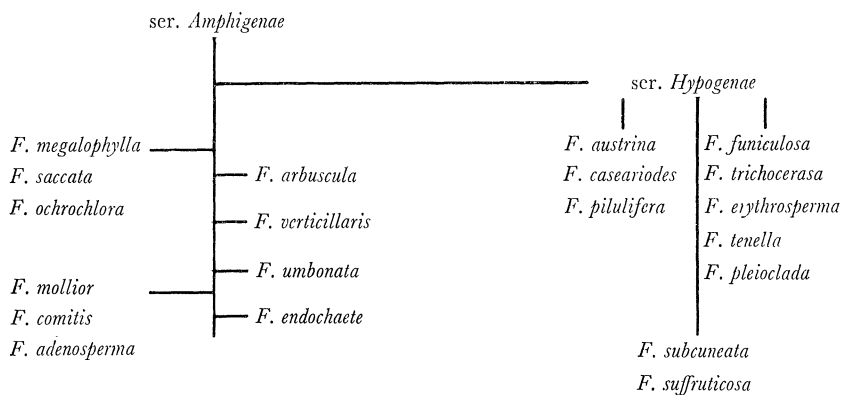


FIGURE 4. Specific affinity in sect. *Adenosperma*.

has a white perianth and red ovary not gynobasic, one stamen, and amphigenous cystoliths. In perianth, style and seed *F. rivularis* agrees with *Adenosperma*. It appears as a relic, fitting no section, of the ancestral line of sect. *Ficus* from which those to *Auriculisperma* and *Adenosperma* diverged. Its relic nature is shown by its advancement to the lanceolate leaf, more pronounced than in *Antiaropsis* (Corner 1969, f. 7).

Here is the interplay of characters, which Croizat emphasizes, along an ancient track. It is the *Sararanga*-front of the Melanesian Foreland abutting on the Solomons, the north coast of New Guinea, and Luzon (van Steenis & van Balgooy 1966; Corner 1967, p. 56). On this front there impinge, also, *F. pseudopalma* with its additive interplay and *Antiaropsis* as the relic precursor of *Ficus*. I am guided by these facts to see the origin of sect. *Ficus*, *Adenosperma* and

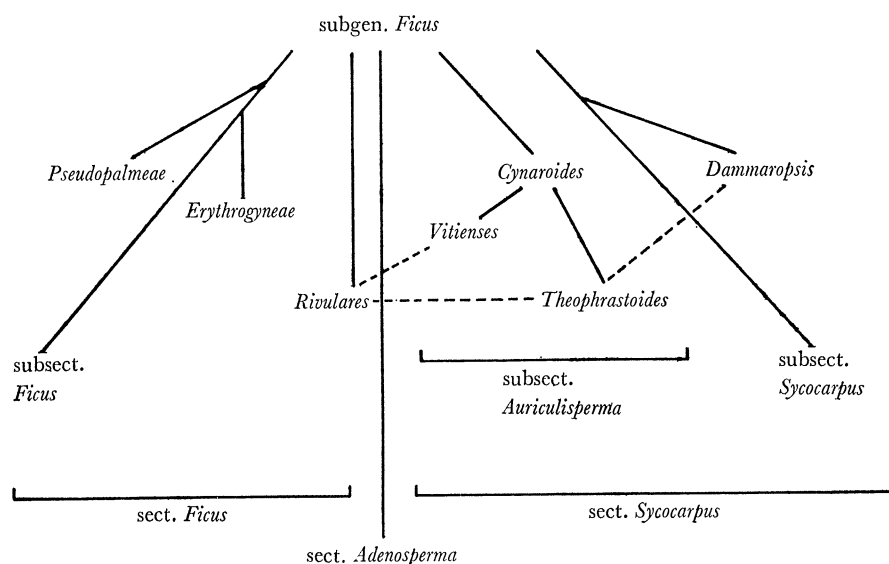


FIGURE 5. The relationships between sect. *Ficus*, *Adenosperma* and *Sycocarpus*.

Sycocarpus along this front (figure 5). I am guided particularly by *Sararanga* to emphasize this front as a source of flowering plant evolution, because the inflorescence and habit of *Sararanga* are manifestly primitive in Pandanaceae. The family reaches Madagascar and Africa as *Pandanus*, but the bulk of *Pandanus* is in Malaysia and the west Pacific along with the third genus *Freycinetia* which extends westwards no farther than Ceylon. Somewhere in its eastern domain the family underwent the striking dichotomy into large seeds (one ovule per loculus) of *Pandanus*, as in palms, and the many very small seeds (many ovules per loculus) of *Freycinetia*, as in Cyclanthaceae. *Sararanga* locates this dichotomy on the Melanesian Foreland, but at an earlier date than the sections of *Ficus* because these sections do not extend to Africa and Madagascar, except that *F. palmata* (sect. *Ficus*) enters northeast Africa. Sect. *Ficus* has spread westwards in Malaysia and India, but is absent from Ceylon. Sect. *Sycocarpus* is feebly represented in India and has only *F. hispida* in Ceylon. *Adenosperma* has not crossed Wallace's Line.

Subgen. *Ficus* sect. *Adenosperma*

Corner, *Reinwardtia*, 4 (1958), 43

Trees or shrubs, not epiphytic, mostly with the leaves spirally arranged and with *Terminalia*-branching, distichous in a few species. Stipules paired, free or connate. Lamina entire,

symmetric, rarely scabrid, with two basal glands. Figs small to medium-size, axillary to cauliflorous or stoloniferous, mostly pedunculate with a collar of 3 basal bracts; body often with lateral bracts; internal bristles present or not; sclerotic cells usually in the fig-wall. Flowers mostly sessile. Tepals 3–6, red or pink, glabrous, free or somewhat gamophyllous. Male flowers ostiolar in 1 (–2) rings; stamen 1, not mucronate; no pistillode. Gall- and female flowers with dark red or red-spotted, sessile or stalked ovary; style strongly lateral to gynobasic, glabrous; stigma simple. Neuter flowers in one ring in place of the male in seed-figs. Seeds 1–2.5 mm long, strongly compressed, ovate-oblong to auriculiform in side-view, smooth, keeled, mostly with the keel double at the base of the seed, hilum not prominent; embryo straight. Hairs aseptate, smooth. Microscopic gland-hairs capitate, mostly 2-celled.

Species 20, Celebes, Moluccas, New Guinea, New Ireland, New Britain, Solomon Islands, New Hebrides, north Queensland.

Ser. *Amphigenae* Corner, l.c.

Cystoliths on both sides of the lamina. Species 10.

Ser. *Hypogonae* Corner, l.c.

Cystoliths only on the lower side of the lamina. Species 10.

In the following account the species are numbered in the sequence of my check-list, where keys to identification are given (Corner 1965). The two new species must be inserted in the key to ser. *Hypogonae*. Thus *F. pilulifera* comes immediately after *F. casearioides* as the contrast with cauliflorous figs, lanceolate leaves, and copious long internal bristles. *F. suffruticosa* comes in contrast with *F. subcuneata* as a shrub with shorter hairs and smaller figs.

Ser. *Amphigenae*

377. **F. *saccata*** Corner, *Gdns' Bull., Singapore* **18** (1960), 26 (figure 6).

Shrub or treelet up to 4 m high, sparingly branched, the leaves in rosettes; young leaves pink-veined beneath; branches with a pair of small stipules without lamina at the first and, sometimes, the second node. Glabrous except the petioles thinly clad with pale spreading hairs up to 1 mm long and the figs appressedly hairy. Twigs 5–7 mm thick, hollow, dark brown. Stipules 20–60 mm long and wide, ovate-saccate, apiculate, persistent, more or less joined, often splitting irregularly. Lamina 25–36 × 11–15 cm, obovate, shortly acuminate, attenuate gradually to the narrowly cordate base, membranous, entire, drying fuscous brownish, paler beneath, not scabrid; lateral veins 10–13 pairs, up to 7 regular intercostals slightly raised below; basal veins 3–4 pairs, short; 2 basal glands; petiole 20–50 mm long, concealed by the stipules. Figs sessile, concealed by the stipules, ripening olive or yellow-green; basal bracts 3, 5–7 mm long, ovate to oblong, firm, glabrous; body 20 mm wide (25–35 mm, living), finely appressedly brownish hairy, with several appressed or somewhat divergent, glabrous, brownish lateral bracts 4–6 mm long, rough with lenticels, the orifice surrounded by several prominent apical bracts 3–4 mm long; internal bristles copious, brownish; sclerotic cells very abundant. Gall- and female flowers 2–3 mm high, not filling the fig; tepals 4–6, about as long as the red, sessile or shortly stalked ovary; style red with white stigma. Seed 2–2.2 × 1.5 × 0.6–0.8 mm, slightly 2-keeled at the base; embryo straight.

Distr. Papua, Territory of New Guinea, in mountain forest 1000–2700 m.

Collections. Carr 14063, Papua, Lala River, type; Brass 30721, Mt. Wilhelm; NGF 12450, 12495, Morobe, Edie Creek; NGF 13969, Goroka, Asaro valley.

Locally this is not uncommon in the *Nothofagus* forest, but it is easily overlooked because the

figs are concealed in the congested rosettes of leaves. Comparison in the field with *F. megalophylla* is much needed.

378. *F. megalophylla* Diels, *Bot. Jahrb.* **67** (1935), 204 (figures 7–10).

Shrub or small tree up to 8 m high, fruiting at 2 m, sparingly branched; latex white, abundant; leaves spirally arranged in rosettes. Twigs and petioles closely villous with appressed or

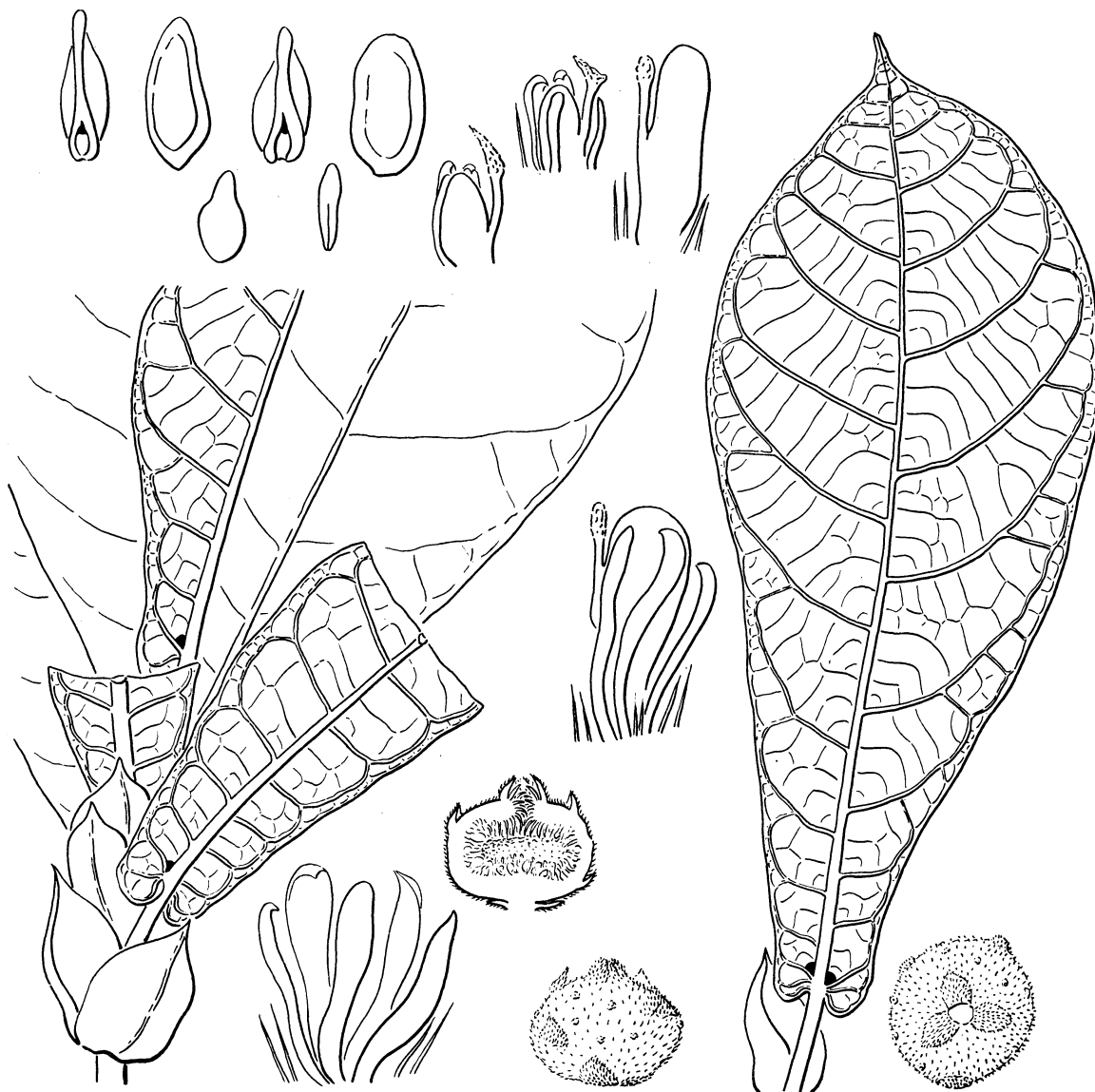


FIGURE 6. *F. saccata*. Apex of twig (left, NGF 12450) and leaf (Carr 14063) ($\times \frac{1}{2}$); female flowers, seeds and embryos (Carr 14063) ($\times 10$).

somewhat spreading, pale brown hairs up to 1.5 mm long, glabrescent; underside of the veins and veinlets shortly and softly white villous to thinly appressedly hairy. Twigs 7–12 mm thick, light brown. Stipules 35–50 \times 26–38 mm, broadly lanceolate, paired, persistent, glabrous or slightly puberulous. Lamina 27–45 \times 12–25 cm, broadly elliptic or obovate, shortly acuminate

FICUS SECT. *ADENOSPERMA*

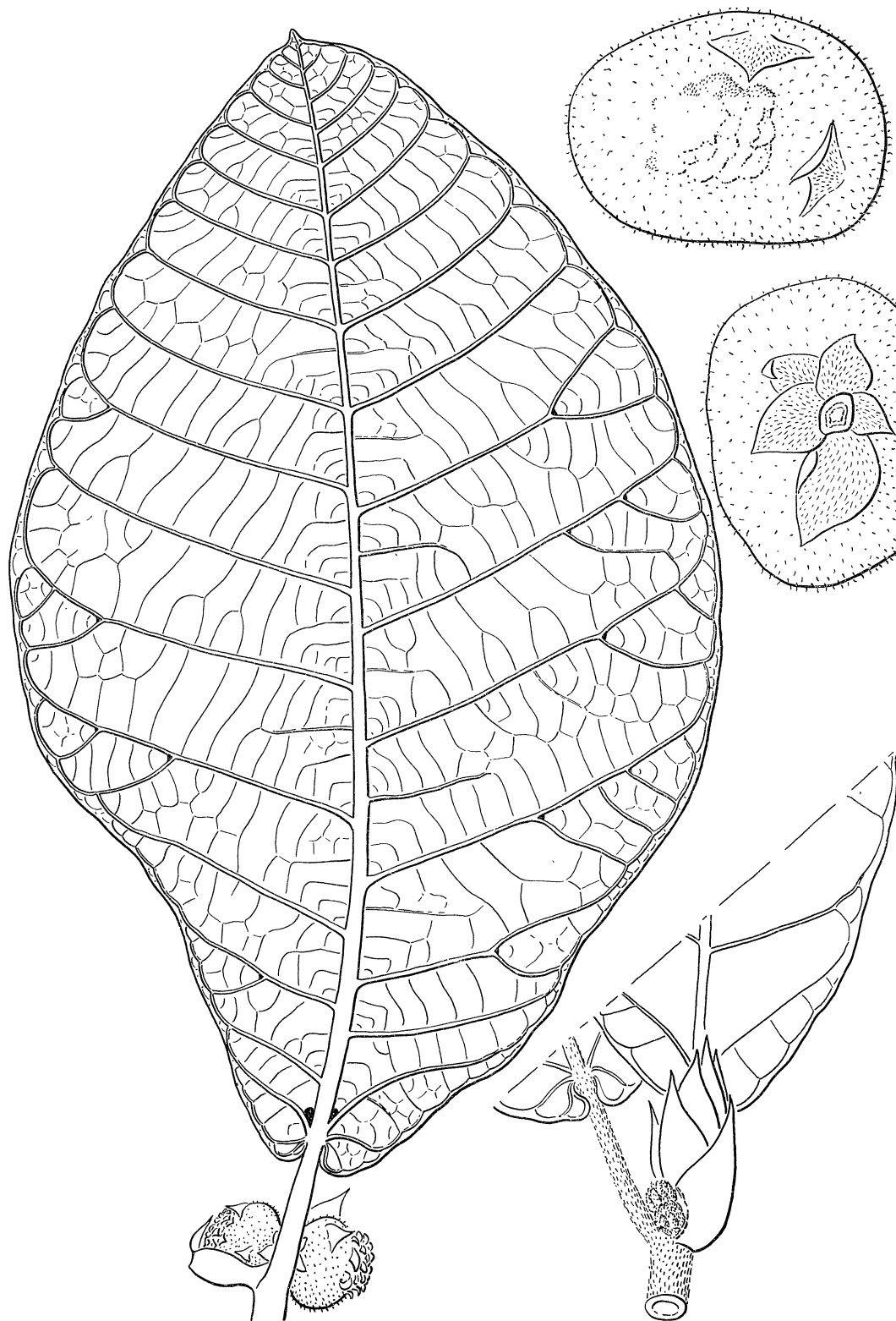


FIGURE 7. *F. megalophylla*. Leaf and twig ($\times \frac{1}{2}$), fig ($\times 2$), Hoogland 9100.

with the tip 4–10 mm long, base cordate-auricled to rounded subcordate or widely cuneate, entire, coriaceous, smooth, drying brown; lateral veins 7–15 pairs, strongly raised below, inarching near the margin, often subdichotomous with a small gland towards the margin; intercostals 3–9, regular, slightly raised below; basal veins 3–5 pairs, not or slightly elongate;

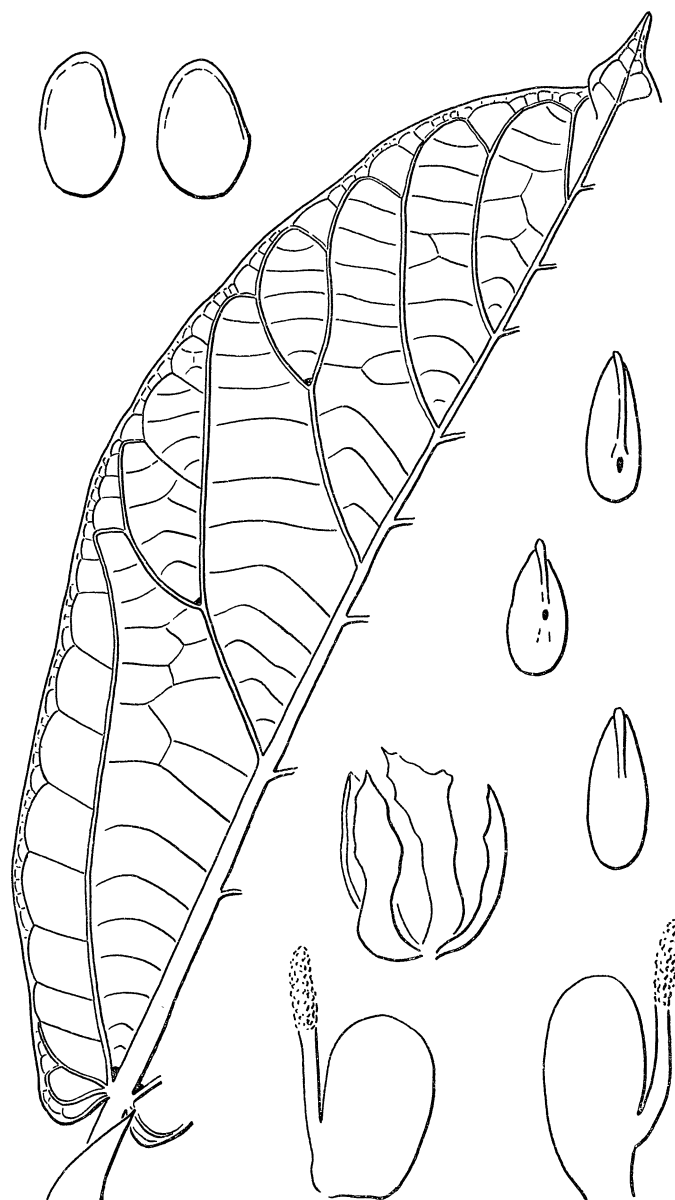


FIGURE 8. *F. megalophylla*. Leaf with elongate basal veins ($\times \frac{1}{2}$); female flowers and seeds ($\times 10$); Hoogland & Pullen 6196.

2 basal glands; petiole 18–60 \times 4–6 mm, soon glabrous. Figs paired, axillary, sessile, at first covered closely with imbricate, appressedly hairy lateral bracts, ripening dull purple; basal bracts 3–5, 4–13 \times 3–11 mm, appressedly hairy, ovate-lanceolate; body 20–35 mm wide, somewhat depressed-globose, thinly appressedly pale brown hairy, gall-figs with several appressed ovate-acute lateral bracts 4–10 \times 5–9 mm, often with recurved tips, seed-figs with few lateral

bracts, the apical bracts 5–7 mm long crowded round the apical rosette 12–18 mm wide; internal bristles frequent, up to 1 mm long, white, soft; fig-wall 3–4 mm thick, soft, without sclerotic cells. Tepals 3–4 (–5), pale red to whitish, ovate (male) to oblong-spathulate, free or extensively



FIGURE 9. *F. megalophylla*. Left, male and gall-flowers (Hoogland 9100); right, two gall-flowers and a perianth cut open (Clemens 4566) ($\times 10$).

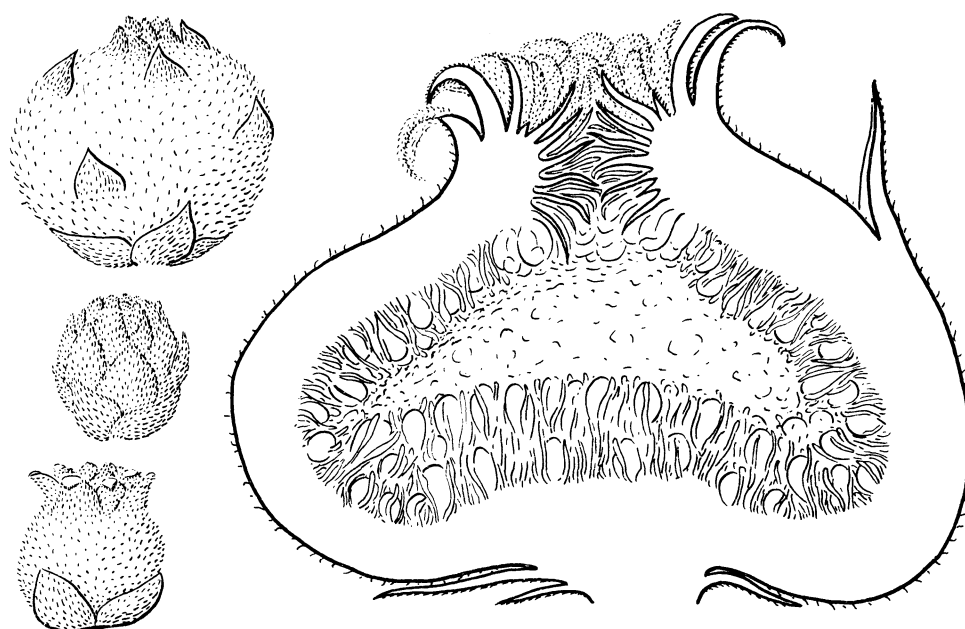


FIGURE 10. *F. megalophylla*. Left, three figs of Clemens 4566 ($\times 2$); right, section of the gall-fig of Hoogland 9100 ($\times 3$).

gamophyllous (Clemens 4566) in the flowers with stalked ovaries. Male flowers in 1–2 rings; stamen with a tuft of hairs at the base. Gall- and female flowers with the tepals equal to the ovary or shorter (Clemens 4566); ovary dark red. Seed 1.8–2.1 \times 1–1.2 \times 0.8–0.9 mm, somewhat flattened, scarcely keeled.

Distr. Territory of New Guinea, in mountain forest 900–1900 m.

Collections. Clemens 4566, Morobe, Ogerammung, and 8960, Morobe, Samansing; Hoogland and Pullen 6196, West Highlands, Togoba; Hoogland 9100, Morobe, Mt. Rawlinson; Ledermann 9447, Sepik, Etappenburg, type; Schlechter 17124, Kani mountains, syntype.

The type and syntype appear no longer to exist. I have identified the species from Clemens 4566 which was named by Diels. Ledermann described the plant as a small tree 6–8 m high, Schlechter as a high tree with stalked figs, which seems different. Further Diels gives the stipules as 10 cm long, the lamina as 40–60 × 18–28 cm with the petiole 10–12 cm long. Two or more species may be confused under this name, but I have not seen another fig from New Guinea to agree with Diels's description.

F. megalophylla, as I understand it, has much in common with *F. theophrastoides* (subsect. *Auriculisperma*). One day when the scientific importance of these pachycaul relics is appreciated, these species may be grown in a botanical garden and cross-pollination may be tried.

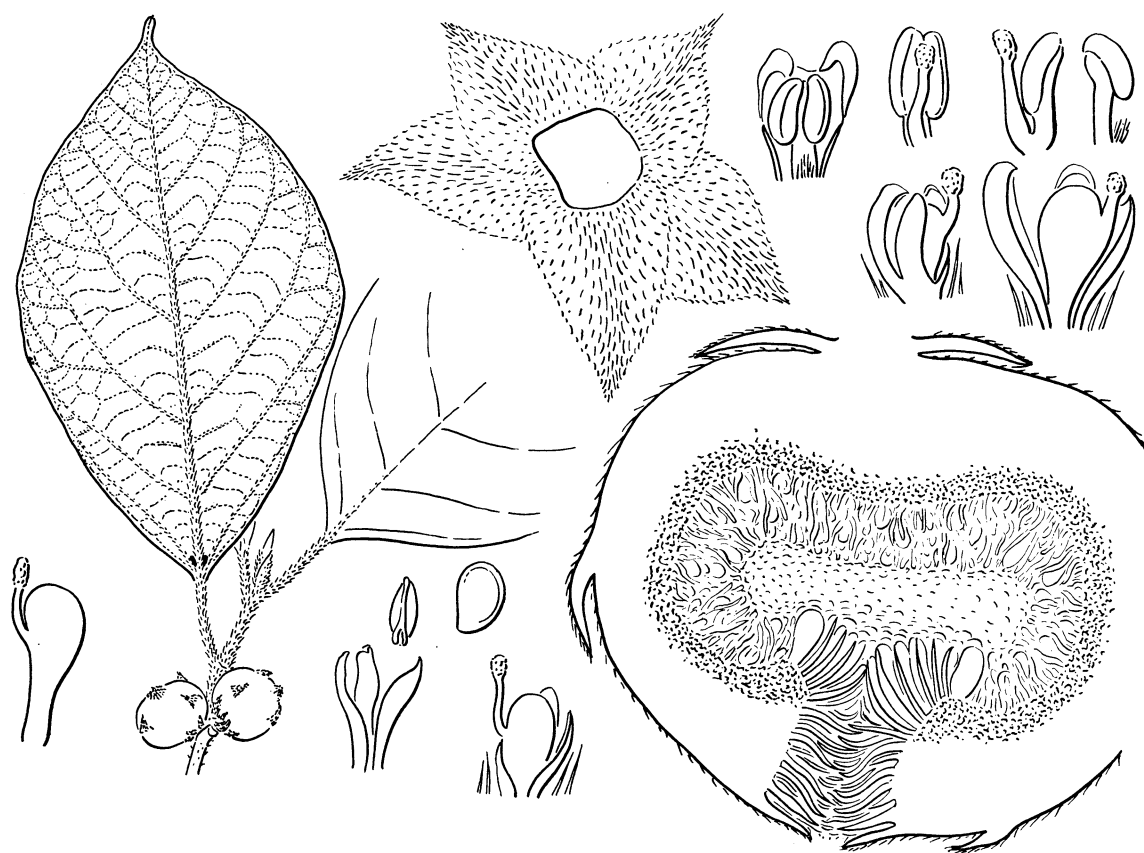


FIGURE 11. *F. ochrochlora*. Twig ($\times \frac{1}{2}$), fig in section and basal bracts ($\times 3$), male and gall-flowers ($\times 10$), Carr 12946; female flowers and seeds ($\times 10$), Boden-Kloss s.n.

379. ***F. ochrochlora*** Ridl., *Trans. Linn. Soc. Lond. (Bot.)* **2**, 9 (1916), 148 (figure 11).

Tree up to 10 m high, branches spreading, leaves spirally arranged but laxly to almost subdistichous. Twigs, petioles, undersides of the veins, stipules and figs fulvous tomentose with appressed and spreading straight hairs 1–2 mm long, the veinlets brownish velutinate beneath. Twigs 3 mm thick, chocolate brown, slowly glabrescent. Stipules up to 18 mm long,

caducous. Lamina 11–16 × 5.5–9 cm, elliptic, subrhombic to obovate, shortly acuminate with a tip up to 12 mm long, base narrowly cuneate, membranous, entire, smooth, drying brown; lateral veins 6–8 pairs, ascending; intercostal up to 8, regular, slightly raised beneath; basal veins 1–2 pairs, short; 1–2 basal glands; petiole 15–25 mm long, slowly glabrescent. Figs axillary and on the twigs behind the leaves, paired, sessile; basal bracts 3–5, 5–9 mm long, ovate-lanceolate, acuminate, appressedly hairy; body 15 mm wide (22 × 25 mm, living), subglobose or depressed, glabrescent, with several scattered lateral bracts shorter towards the orifice, often mucronate, the orifice closed by many acute apical bracts somewhat erect in the dried fig; internal bristles abundant, yellowish, long or short; sclerotic cells sparse to abundant as a layer 0.8 mm thick. Tepals 3, reddish pink, free or gamophyllous rather extensively, especially in the male flower, spatulate, about as long as the ovary. Male flowers in one ring, rarely with a tuft of hairs at the base of the stamen or with a minute pistillode. Ovary dark red. Seed 1 mm long, slightly keeled.

Distr. New Guinea, apparently mainly along river-banks in lowland forest.

Collections. Brass 5337, Papua Central Division; Brass 6954 and 7287, Palmer River; Boden-Kloss s.n., Wollaston Expedition 1912–13, type; BW 11443, west New Guinea; Carr 12946, Papua; Corner s.n., Lae; Kalkmann 4042, west New Guinea (1200 m); Kanehira & Hatusima 11882, west New Guinea; Pulle 248, west New Guinea; Schodde 3103, Territory of New Guinea.

This species is hairy as *F. mollior* and the leaf is similar but the fig is larger, sessile, and supplied with larger, more numerous basal bracts, and the figs appear not to become cauliflorous. Thus it effects the gradual transition from *F. megalophylla* to *F. mollior*. Collections are few because the trees seem often to be sterile.

380. **F. endochaete** Summerh., *J. Arn. Arb.* **22** (1941), 94 (figure 12).

Tree up to 16 m high, the leaves distichous, pendent and rusty beneath (living); bark dark brown, inner bark purplish. Twigs and petioles tomentose with light fawn brown or ferruginous, spreading or appressed hairs 1–2 mm long, with minute undulate hairs, slowly glabrescent; underside of the main veins appressedly hairy, upper side of the lamina sparsely. Twigs 1.5 mm thick. Stipules up to 18 mm long, fulvous sericeous along the keel. Lamina 7–15 × 1.5–3.8 cm, lanceolate, acuminate or nearly caudate, the tip 15–30 mm long, base slightly unequal, cuneate on one side, rounded on the other, entire, subcoriaceous, smooth, drying brown; lateral veins 10–16 pairs, oblique; intercostal 1–3, slightly raised below; basal veins 1 pair, short, with one basal gland (on the narrow side); petiole 3–15 mm long. Figs solitary or paired, axillary, wholly finely villous with short brown appressed or spreading hairs and pallid undulate hairs, the body glabrescent; peduncle 10–12 mm long, slender; basal bracts 3, 1.5 mm long, ovate-lanceolate, not always distinct; body 8–12 mm wide, subglobose, with 0–5 scattered lateral bracts, the orifice with 5 slightly umbonate peripheral bracts and several small internal bracts; internal bristles abundant, brown, 1 mm long; sclerotic cells abundant in the gall-fig. Tepals 3–4, red, free, lanceolate to spatulate, shorter than the gall-ovary. Male flowers in one ring, stamen with a few hairs at the base of the filament. Ovaries sessile or substipitate, red or with red margin, or red at the base. Seed 1.5–1.9 mm long, with a double basal keel.

Distr. Territory of New Guinea, in *Nothofagus* forest 1800–2600 m.

Collections. Brass 4913 (type), 10988, 11316, 30598, 30833; Brass & Verstegeh 10493;

Hoogland & Pullen 6160; NGF 5163, 11299, 24734, 32086; Pullen 373, 490; Robbins 665, 784.

This is a very distinct species, recognized from the brown hairy, lanceolate, distichous leaves. Possibly others of its alliance remain to be discovered.

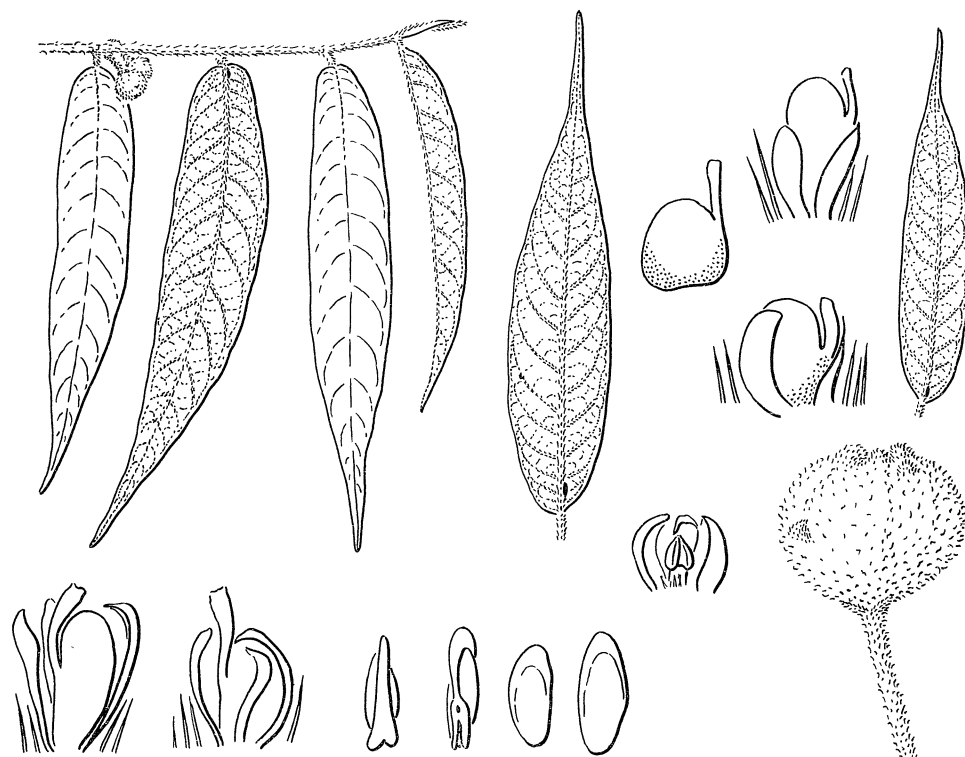


FIGURE 12. *F. endochaete*. Twig ($\times \frac{1}{2}$), NGF 24734; two leaves ($\times \frac{1}{2}$), fig ($\times 2$), male and gall-flowers ($\times 10$), NGF 5163; female flower and seeds ($\times 10$), Robbins 784.

381. ***F. umbonata*** Reinw. ex Bl., *Bijdr.* (1825), 454 (figure 13).

Shrub or tree up to 10 m high; bark grey, smooth; latex white; wood hard. Leaves distichous. Twigs, petioles and figs thinly puberulous with stiff white spreading hairs less than 0.5 mm long, the underside of the veins thinly puberulous to glabrous. Twigs 1.5–2 mm thick, greyish brown. Stipules up to 8 mm long, caducous, more or less glabrous. Lamina 5–14 \times 1.8–5.8 cm, elliptic, slightly asymmetric, subacute to shortly acuminate, base cuneate and often slightly asymmetric, entire, stiffly subcoriaceous, scabrid on both sides, drying brown; lateral veins (4–) 6–9 pairs; intercostals 2–5, slightly raised below, finely brown areolate beneath; basal nerves 1 pair, not or slightly elongate, without basal glands; petiole 7–14 \times 2 mm, scabrid. Figs axillary, paired, scabridulous; peduncle 2–6 mm long; basal bracts 3, small, more or less in a collar; body 10 mm wide, obconic, lateral bracts 0–3, 1–2 mm long, scattered, with 5–6 slight ridges towards the 5–6 umbonate peripheral bracts round the orifice; internal bristles none; sclerotic cells abundant. Tepals 3, reddish, free or shortly gamophyllous, ovate-lanceolate to spatulate, shorter than the ovary. Male flowers in one ring. Ovary reddish or red-spotted, sessile or stalked. Seed ?. Stomata deeply sunken.

Distr. Moluccas (Obi, Nuffa Laut), west New Guinea (Sorong), in lowland forest and as a shrub in rocky terrain, locally common.

FICUS SECT. ADENOSPERMA

337

Collections. Moluccas, Reinwardt 1452 (type), NIFS bb. 23785; New Guinea, Pleyte 928, v. Royen 4091, Teysmann 6647, Warburg 20849.

This species, distinguished by the distichous scabrid leaves, must resemble *F. ampelas*, for which reason, perhaps, it has been so little collected.



FIGURE 13. *F. umbonata*. Leaves (left to right), Reinwardt 1452 (two leaves), Pleyte 928, NIFS bb 23785 ($\times \frac{1}{2}$); leaf and fig (right), v. Royen 4091 ($\times 1$); male and gall-flowers, Reinwardt 1452 ($\times 10$).

382. **F. mollior** F. Muell. ex Benth., *Fl. Austral.* 6 (1873), 173; Corner, *Phil. Trans. Roy. Soc. B*, 253 (1967), 115, f. 38.

This common lowland species is described under the Solomon Islands figs. It is very variable in hairiness, leaf-shape, and size, and the position and size of the figs. Thus I recognize two varieties and one form. Thinly hairy plants with short hairs, less than 1 mm long, approach *F. adenosperma* but have the more numerous intercostals. The figs in some collections are 15–20 mm wide, in others 10–12 mm. They commonly become ramiflorous and in many trees are cauliflorous, but in others that are equally well grown they remain axillary. How much this variation, included under v. *mollior*, depends on the age of the tree or its habitat remains to be determined. Var. *sessilis* seems to approach *F. ochrochlora*.

KEY TO THE VARIETIES OF *F. mollior*

- Figs pedunculate
 Figs closely hairy at first, subglobose.....v. *mollior*
 Figs glabrous, obconic or pyriform.....v. *pseudocovellia*
- Figs sessile, axillary or ramiflorous.....v. *sessilis*
 Lamina elliptic to obovate, up to 10 cm wide.....f. *sessilis*
 Lamina lanceolate, up to 3.5 cm wide; stipules persistent.....f. *riparia*

Var. **mollior**

Distr. Amboina, New Guinea, New Britain and New Ireland, Solomon Islands, north Queensland, lowland and mountain forest to 1800 m, often on river-sides and behind mangrove.

Var. **pseudocovellia** Corner, *Gdns' Bull., Singapore* **18** (1960), 27.

Figs glabrous, cauliflorous and ramiflorous, the body more or less pyriform.

Distr. West New Guinea (Versteeg 46, Mamberamo, small tree up to 5 m).

Superficially this resembles species of sect. *Sycocarpus* (*Covellia*), but the perianth and seeds are those of *Adenosperma* and the glands occur in the axils of the basal veins of the leaf.

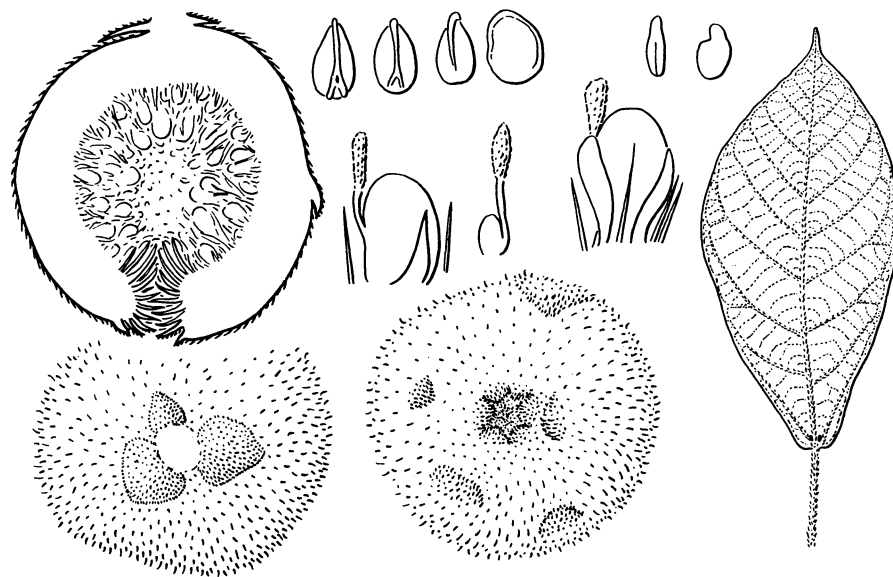


FIGURE 14. *F. mollior* v. *sessilis*. Leaf ($\times \frac{1}{2}$), figs ($\times 3$), female flowers, seeds and embryos ($\times 10$); Carr 12360.

Var. **sessilis** Corner, *Gdns' Bull., Singapore* **18** (1960), 27 (figure 14).

Fig more or less sessile; basal bracts 3, 1–2.5 mm long; seed distinctly keeled; ? not cauliflorous.

Distr. Papua, especially in the d'Entrecasteaux and Louisiade Islands.

Collections. Brass 26014, 27320, 28069, 28349, 28526; Carr. 12360 (type); NGF 13533, 15408; Lister Turner 88.

There are evidently transitions to the normal state of v. *mollior*. Compare *F. pleioclada*.

Forma **riparia** Corner, *Gdns' Bull., Singapore* **18** (1960), 27.

Lamina 6–10 \times 2–3.5 cm, lanceolate, acute or subacuminate; petiole 5–15 mm; stipules persistent. Fig sessile, axillary.

Distr. West New Guinea, riverside shrub locally common (Pleyte 517, Sorong).

This is clearly a riparian form similar to that of *F. adenosperma*, but typically hairy and with numerous intercostals.

383. **F. comitis** King, *J. As. Soc. Beng.* **56** (1887) 63; *Ann. R. bot. Gdns., Calc.* **1** (1888) 156, pl. 197 (figure 15).

Small to medium-size tree; leaves spirally arranged; latex cream-buff. Glabrous or the undersides of the veins and the figs thinly appressedly puberulous. Twigs 2–3 mm thick, dark chocolate brown, hollow. Stipules up to 15 mm long, caducous. Lamina 12–28 \times 5.5–14 cm, elliptic, suddenly acuminate, the tip up to 15 mm long, narrowed to the widely cuneate base, membranous to subcoriaceous, smooth, drying fuscous brown; lateral veins 8–13 pairs at a wide

angle; intercostals up to 8, slightly raised below; basal nerves 1–2 pairs, not or shortly elongate; basal glands 2; petiole 20–85 mm, dark brown as the twigs. Figs paired and in clusters of 3–6 in the leaf-axils and on the twigs below the leaves, thinly appressedly hairy, soon glabrous; peduncle 2–4 mm long; basal bracts 3, small, in a collar or scattered; pedicel 2–4 mm long; body 6–8 mm wide, subglobose, with 0–2 small lateral bracts, the orifice plane and closed by several small bracts; internal bristles abundant, white to pale brown, up to 0.8 mm long; gall-figs with a thin layer of sclerotic cells, especially round the bases of the flowers, few or

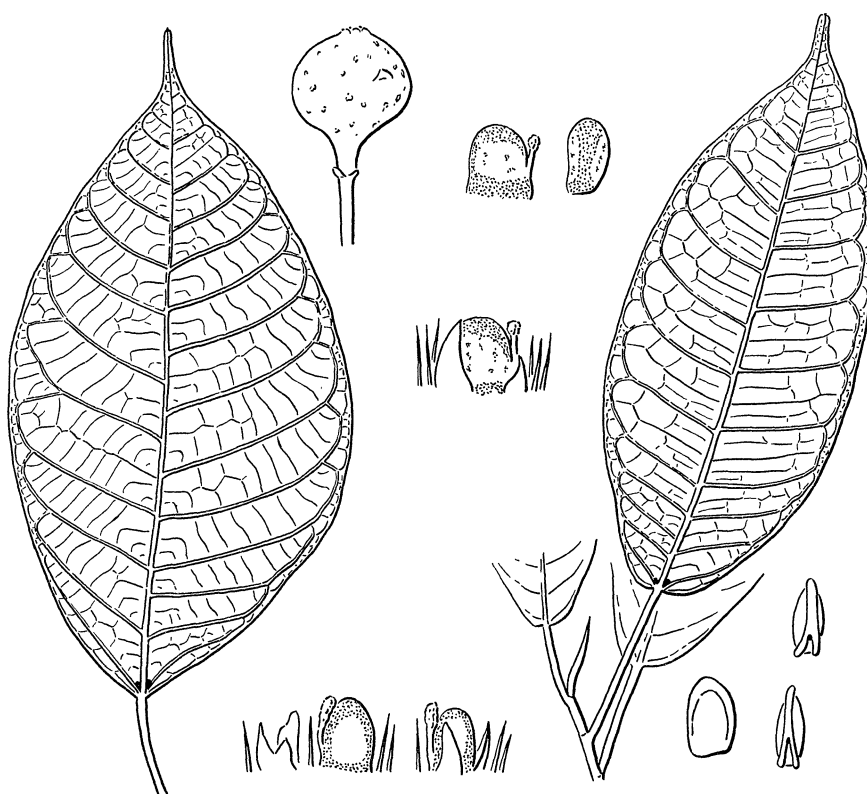


FIGURE 15. *F. comitis*. Leaf (left) ($\times \frac{1}{2}$), fig ($\times 2$), Pulle 97; twig ($\times \frac{1}{2}$), Corner s.n.; gall-flowers (upper centre) ($\times 10$), Pulle 227; female flowers and seeds (below) ($\times 10$), NFG 13518.

none in the seed-figs. Tepals 3, reddish, free, shorter than or equalling the ovary. Male flowers in one ring. Ovary dark red with pale yellow or red-spotted sides. Seed 2–2.2 mm long, with double basal keel.

Distr. New Guinea, in lowland forest up to 1100 m, riverside, locally common.

The description suggests a large-leaved, glabrous state of *F. adenosperma*, but comparison of many wild trees, even growing together, has shown me that they are distinct. Compare, nevertheless, *F. adenosperma* v. *microlepis*.

384. *F. arbuscula* K. Schum. et Laut, *Fl. Schutzgeb.* (1901), p. 273 (figures 16, 17).

Shrub or small tree up to 6 m, flat-topped with *Terminalia*-branching, the leaves in rosettes. Glabrous or the young figs more or less appressedly puberulous. Twigs 2–4 mm thick, dark brown. Stipules 6–18 mm long, caducous to more or less persistent. Lamina 3–13 \times 0.8–5 cm, narrowly elliptic to lanceolate or lanceolate-obovate, subacute to subacuminate, base cuneate

or narrowly rounded, entire, subcoriaceous, drying greyish above and usually greyish white beneath, yellow-green beneath when living; lateral veins 6–13 pairs; intercostals 0–4, vague, scarcely raised below; basal veins 1–2 pairs, short; basal glands 2; petiole 3–30 mm long. Figs axillary, paired or solitary; peduncle 8–16 mm; basal bracts 3, 1.5 mm long; pedicel 0–2 mm long; body 12–25 mm wide (up to 35 mm, living), globose or depressed, with three equatorial lateral bracts and several smaller bracts towards the plane orifice; internal bristles sparse to abundant, short, whitish; sclerotic cells none or in a thin layer in the seed-figs. Tepals 4–5, red, spatulate or lanceolate, equal to or exceeding the gall-ovary, shorter than

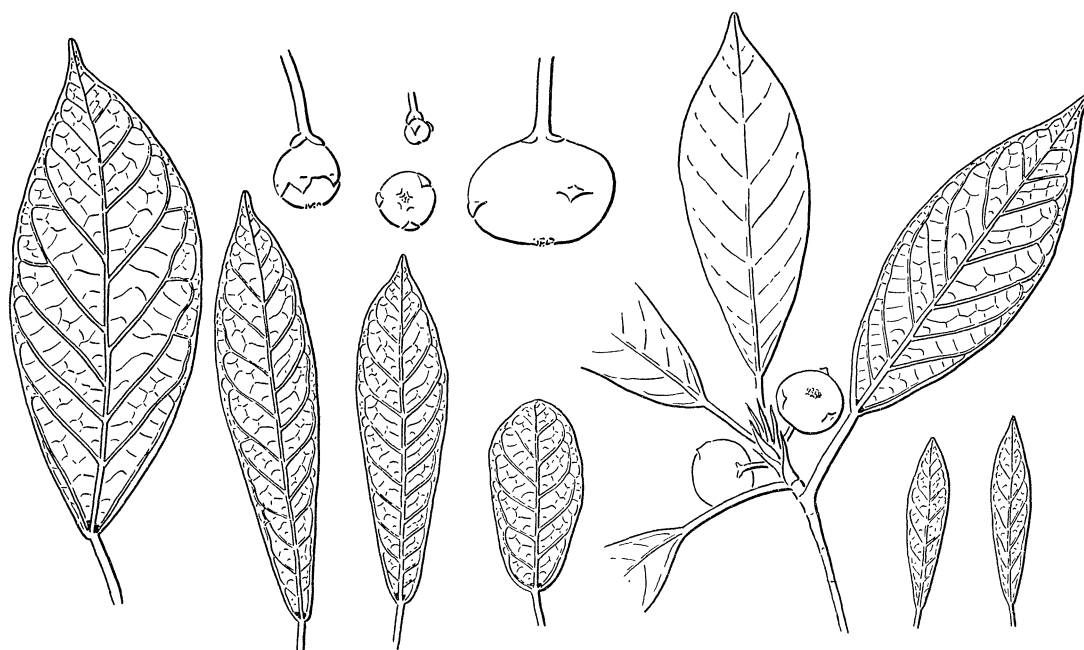


FIGURE 16. *F. arbuscula*. Leaves (left to right), NGF 26488, Kostermans 869, Beguin 2075, v. Leeuwen 10352 and (extreme right) Pulle 122 ($\times \frac{1}{2}$); twig ($\times \frac{1}{2}$), NGF 21826; figs ($\times 1$), Ledermann 8182.

the seed-ovary. Male flowers in one ring. Ovaries sessile or shortly stalked, dark red. Seed 1.6–2.3 \times 1–1.2 \times 0.8–0.9 mm, rather strongly keeled. Leaf with the upper hypodermis 2–3 cells thick.

Distr. Moluccas (Halmahera, Morotai), New Guinea, New Britain; stream or riverside shrub in the flood-zone, mainly of rocky stream-beds, locally common, but also on limestone hills.

This elegant bush is one of the dwarfs of the section. The leaves vary in width and in length of petiole, probably in accordance with the swiftness of the stream or the degree of inundation. The larger fig with its median belt of lateral bracts and the tougher leaves drying whitish beneath distinguish it from riverside *F. adenosperma*, which is also much larger in habit.

Though several collections have been made, one of the latest being from New Britain where it grows in river-gravel under *Eucalyptus deglupta*, there is still much to be learnt. Five collections (Pulle 122, Eyma 5458, Bw 15209, and Boden-Kloss s.n. from west New Guinea, and Brass 6949 from Papua) differ in having the leaves not whitish beneath on drying, smaller figs 10–12 mm wide with the lateral bracts scattered on the body, short peduncles 3–5 mm long, and the

cystoliths very sparse on the underside of the lamina. They suggest a shrubby variety of *F. verticillaris* of the Solomons or a distinct species. Such riparian plants are notoriously difficult to place from herbarium-material and need elucidation in the field. BW 15209 was described as a bush up to 1.5 m high, very common in young secondary growth on limestone hills in the Vogelkop peninsula.



FIGURE 17. *F. arbuscula*. Female flowers and seeds of Rodatz & Klink (type, left), Kostermans 869 (upper centre), v. Leeuwen 10352 (upper right); male and gall-flowers of Lam 1285 (lower centre and right); ($\times 10$).

385. *F. verticillaris* Corner, *Gdns' Bull., Singapore* **18** (1950), 27; *Phil. Trans. Roy. Soc. B*, **253** (1967), 116, f. 39 (figures 1, 2).

I have described this under the Solomon Islands figs. It is the most slender species of the section, but retains the *Terminalia* habit.

386. *F. adenosperma* Miq., *Ann. Mus. Bot. Ludg. Bat.* **3** (1867), 233, 296; Corner, *Phil. Trans. Roy. Soc. B*, **253** (1967), 117, f. 38.

I have described this under the Solomon Islands figs. It is the commonest species of the section and the most widely spread, but it seems to occur in Queensland only as v. *glabra*. It is particularly abundant in flood-damaged and deforested areas by rivers. High altitude forms have small leaves and a compact habit. By swift rivers the leaves become more lanceolate. Four varieties can be recognized but there are intermediates which seem in no way limited geographically or ecologically, unless v. *microlepis* occurs only in New Guinea. Thus the species occupies a big track but does seem to be differentiating vicariously.

KEY TO THE VARIETIES OF *F. adenosperma*

Glabrous or minutely appressedly white puberulous; leaf-base cuneate.

Figs with several small lateral bracts, mostly on the twigs below the leaves, often on short burrs... v. *microlepis*

Figs without lateral bracts, peduncle varying short or none..... v. *glabra*

Distinctly brown hairy.

Hairs spreading, especially at the nodes; figs mostly without lateral bracts; leaf-base broadly cuneate to shallowly cordate..... v. *chaetophora*

Hairs more or less appressed; figs mostly with lateral bracts..... v. *adenosperma*

Var. **adenosperma** (figures 18, 19).

Distr. Celebes, Moluccas, Tanimba Isl., Aru Isl., New Guinea, New Ireland, New Britain, Solomon Isl., New Hebrides; lowland and mountain forest up to 2500 m, chiefly by rivers and streams, often in thickets on sandbanks and islands.

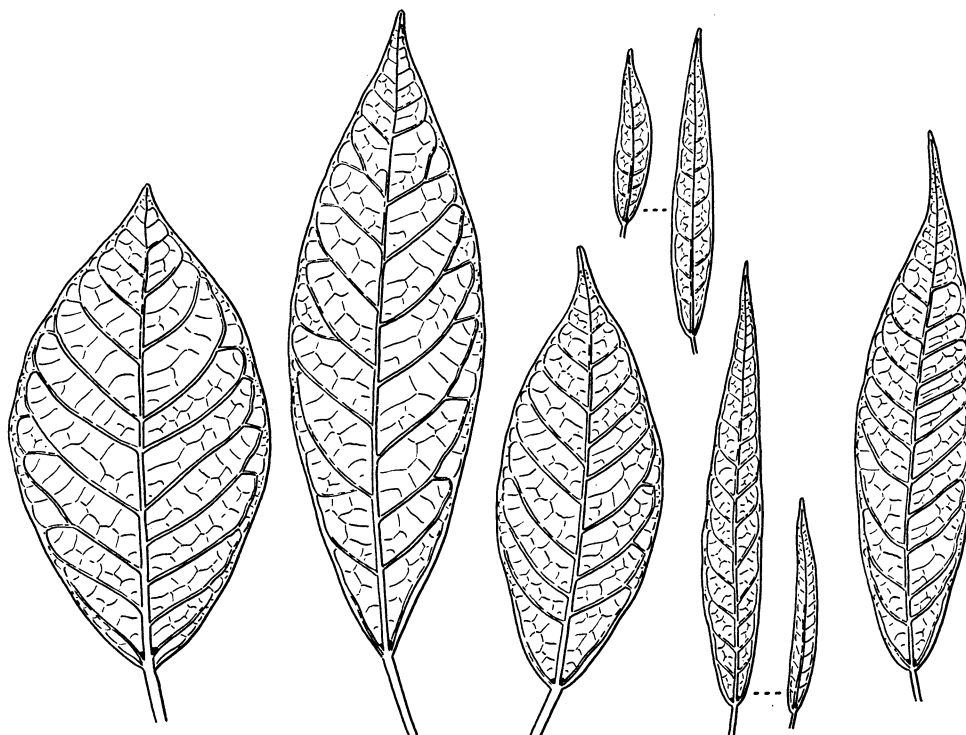


FIGURE 18. *F. adenosperma*. Three broad leaves of v. *adenosperma* (left to right), Labillardière s.n. (Amboina), Lam 2721, Elbert 2799; lanceolate leaves of f. *angustifolia*, Bloembergen 4499 (upper two), van Steenis 10419 (lower two), Rant 34 (right) ($\times \frac{1}{2}$).



FIGURE 19. *F. adenosperma*. Female flowers and seeds, Mosely s.n. Admiralty Isl. (left), Forbes 3256 (right) ($\times 10$).

Forma **angustifolia** Corner, *Gdns' Bull.*, *Singapore* 18 (1960), 28.

Lamina 2–14 \times 0.5–3 cm, lanceolate, attenuate to the subacute apex; petiole 2–5 mm long; intercostals 0–1.

Distr. Celebes, Soeloe Isl.

Collections. Van Steenis 10419, Rant 34, Manos s.n. 1937 from Celebes; Bloembergen 4499 (type) from Soeloe Isl.

This riparian form parallels *F. mollior* v. *sessilis* f. *riparia*, *F. arbuscula* and *F. tenella*.

Var. **chaetophora** (Warb.) Corner, *Gdns' Bull., Singapore* **18** (1960), 28; *Phil. Trans. Roy. Soc. B*, **253** (1967) 118, f. 38.

Distr. New Guinea, New Ireland, New Britain, Solomons, New Hebrides.

Var. **glabra** Corner, *Gdns' Bull., Singapore* **18** (1960), 28; *Phil. Trans. Roy. Soc. B*, **263** (1967) 118. *Distr.* Key Isl., New Guinea, New Britain, Solomons, Queensland.

Var. **microlepis** Corner, *Gdns' Bull., Singapore* **18** (1960) 28 (figure 20).

Tree up to 30 m high, bole up to 10 m high and 70 cm thick, buttressed, with spreading crown; latex creamy, scant in the bark; bark red-brown, nearly smooth or thinly flaky; inner bark pinkish; wood pale, hard, heavy. Glabrous. Stipules 10–20 mm. Lamina 6.5–18 × 3.5–9 cm, subacute to subacuminate, base cuneate; 2–5 indistinct intercostals; petiole 12–35 mm.

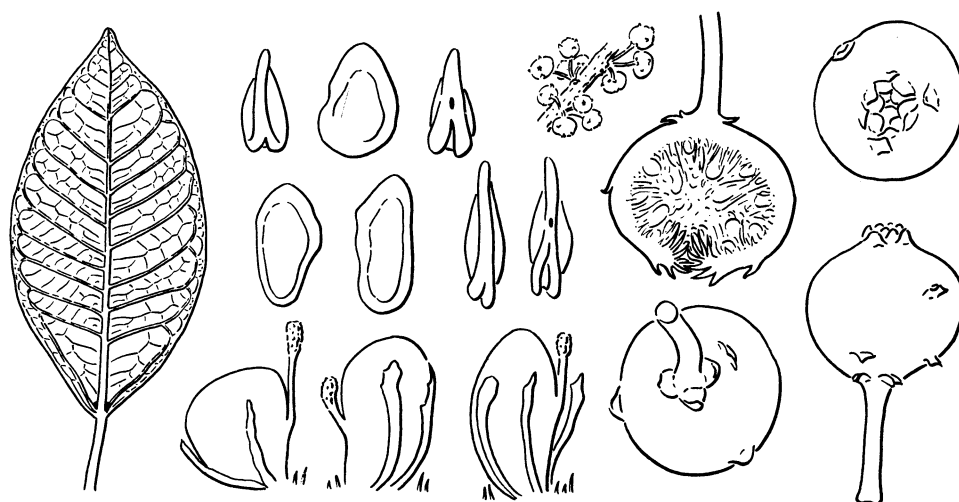


FIGURE 20. *F. adenosperma* v. *microlepis*. Leaf and fig-clusters ($\times \frac{1}{2}$), figs ($\times 4$), female flowers and seeds ($\times 10$); Hoogland 4451.

Figs in clusters of 2–3, axillary, mostly on the twigs below the leaves, eventually on short woody appressed burrs up to 5 mm long; peduncle 2–12 mm; basal bracts 1–1.5 mm, in a collar, persistent; pedicel 0–2.5 mm; body 6–7 mm wide, globose, with numerous small recurved or spreading lateral bracts, the orifice closed by a rosette, 2–3 mm wide, of suberect bracts; internal bristles minute, abundant; sclerotic cells abundant. Seed 1.5–2 × 1 × 0.6–0.7 mm, strongly compressed and keeled; embryo straight.

Distr. New Guinea, lowland and mountain forest up to 1100 m.

Collections. Brass 23822, BW 464 (=Schram 16), Clemens 10909, Hoogland 4451 (type), NGF 7861 and 23020.

This variety, which has not been studied in the field, comes between *F. comitis* and *F. adenosperma*.

Ser. Hypogenaе

387. *F. austrina* Corner, *Gdns' Bull., Singapore* 18 (1960), 29; *Phil. Trans. Roy. Soc. B*, 253 (1967), 118, f. 40.

Distr. Key Isl. (? Amboina), New Guinea (Ransiki), New Ireland, Solomon Isl., Vanua Levu (Banks Group); coastal.

I have described this under the Solomon Islands figs. Unlike other species of the section it is a coastal plant. Its distribution may have been from New Guinea where its ally *F. casearioides* is common, but there is only the one collection from west New Guinea. In the Solomons it is locally abundant. Superficially *F. austrina* mimics *F. pedunculosa* v. *segaarensis* (sect. *Ficus* ser. *Podosyceae*) and their distributions seem partially to overlap in Key Islands and New Guinea.

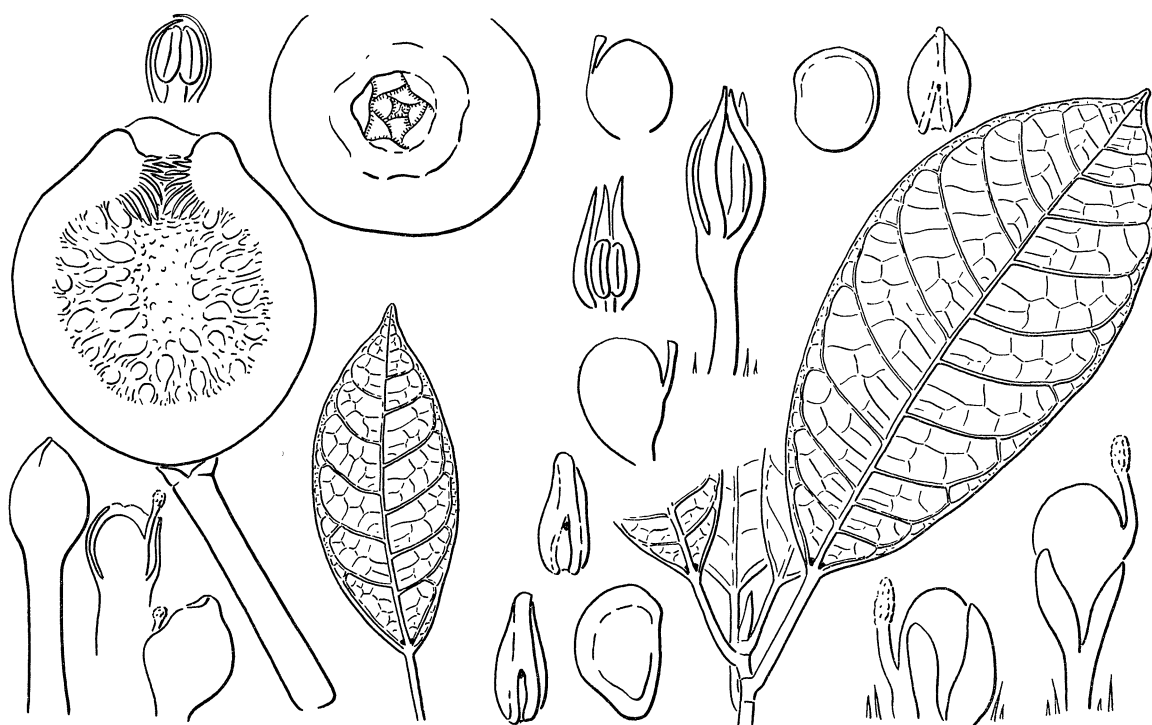


FIGURE 21. *F. casearioides*. Left v. *gamosepala*; leaf ($\times \frac{1}{2}$), Carr 15797; figs ($\times 3$), Carr 14548; male and gall-flowers ($\times 10$), Carr 13179. Right, v. *casearioides*; twig ($\times \frac{1}{2}$), Saunders 445; male, gall-flowers and 'gall-seeds' (above) ($\times 10$), Forbes 568; female flowers and seeds (below) ($\times 10$), Clemens 1350.

388. *F. casearioides* King, *J. As. Soc. Beng.* 55 (1887), 403 (figure 21).

Tree up to 26 m high; bark smooth, light brown, lenticels elongate in longitudinal rows; inner bark yellowish; wood pale, with parenchyma in bands; latex white (? scant); leaves spirally arranged. Glabrous or the young parts puberulous. Twigs 2–5 mm thick, pale cream or ochraceous, the epidermis scaling. Stipules up to 17 mm long, caducous. Lamina 7–18 \times 2.5–9 cm, ovate-elliptic to obovate or narrowly elliptic, tapered to each end, blunt to shortly or sub-acutely acuminate, base cuneate, thinly to rather thickly coriaceous-chartaceous, smooth, entire, drying brown; lateral veins 8–11 pairs, scarcely raised below; intercostals 3–6, spaced; basal veins 1 pair, short; basal glands 2; petiole 7–45 mm long. Figs paired, axillary, drying very hard; peduncle 10–20 mm long; basal bracts 3, 1 mm long, triangular-acute; pedicel

0–1.5 mm; body 11–12 mm, subglobose, the plane orifice 2 mm wide, without lateral bracts; internal bristles abundant, small to minute; sclerotic cells very abundant in the gall-figs, few or none in the seed-figs. Tepals 3–5, free or shortly gamophyllous, oblong-spathulate, red. Male flowers in one ring. Gall-flowers sessile or with a white glabrous pedicel up to 2.5 mm long; tepals longer than the dark red-brown, sessile or substipitate ovary, the endocarp crustaceous and seed-like. Female flowers similar but the tepals shorter than the ovary. Seed 1.5–1.7 × 1.2–1.5 × 0.8 mm, auriculiform, bluntly keeled.

Var. casearioides

Distr. Morotai, New Guinea, in forest up to 2300 m, locally common.

Collections. Morotai, Kostermans 1106, 900 m, common tree. New Guinea, BW 3809; Clemens 1165, 1350, 3599; Forbes 568 (type); Hartley 11998, 12097, 12249; Ledermann 9480, 12984; NGF 9324, 9779, 12420, 19488; Pullen 491; Robbins 130; Saunders 445; Vink 16563.

This was put originally in subgen. *Urostigma*, doubtless because the crustaceous endocarp of the gall-flowers was mistaken for that of the seed. In some collections, as Clemens 1165, the gall-figs are abnormally large and have an unusual insect in the flowers. The species can be mistaken for *F. subnervosa* (subgen. *Pharmacosycea*), *F. pedunculosa* (sect. *Ficus*) and *F. microdictya* (sect. *Sycocarpus*) with all of which it may grow; they are convergent glabrous species, among which the pale twigs distinguish *F. casearioides*.

Var. gamosepala Corner, *Gdns' Bull.*, *Singapore* **18** (1960), 29 (figure 21).

Perianth extensively gamophyllous with 2–4 obscure blunt lobes, red, in all the flowers. Lamina 4–15 × 1.7–7 cm; lateral veins 4–8 (–9), intercostals 0–3. Figs with short peduncles 6–12 mm, body 10 mm wide, orifice slightly depressed; internal bristles none or few and minute.

Distr. Ternate, New Guinea.

Collections. Ternate, Beguin 1527. New Guinea, Brass 23302, 24776; Carr 13179 (type), 14548, 15711, 15797, 15847; Hartley 11946; Hoogland 5857 (mixed with *F. microdictya*); Ledermann 13084; NGF 4309, 6784; Robbin 156.

Because of the gamophyllous perianth, this may be mistaken for sect. *Sycocarpus*. Compare, thus, *F. indigofera* (subsect. *Auriculisperma*) and, with two stamens, *F. rivularis*.

388 A. F. pilulifera sp.nov. (figure 22).

Abor parva ad 6 m alta, cauliflora, ut in *Terminalia* ramosa; cortice griseo levi; ligno duro. Ramuli petiolique primo pilis albidis v. brunneolis ad 1 mm longis appressis tenue vestiti, glabrescentes; lamina superne glabra, subtus sparsim appresse pilosa. Ramuli 2–3 mm crassi, pallide brunnei, dein albicantes. Stipulae 7–12 mm longae, caducae, tenue sericeae. Lamina 17–24 × 5–7.5 cm, lanceolato-elliptica, apice obtuso v. mucronato 10–12 mm longo subrostrata, basi attenuato-cordata, integra levis subcoriacea, sicco brunnea et superne nitida; costis lateralibus utrinsecus 12–14, subtus elevatis; intercostis 2–5; costis basalibus utrinsecus 1, brevibus; glandulis basalibus nullis; petiolo 12–35 mm longo. Ramuli cauliflori ad 13 cm longi, 3–4 mm crassi, sparsim ramosi, sine internodis, syconiis apices versus fasciculatis; pedunculo 5–8 × 1 mm, gracili; bracteis basalibus 3, 0.5–0.7 mm, ovato-acutis; corpore syconii 10 mm lato, subgloboso glabro, bracteis lateralibus nullis, apicalibus parvis; setis internis 1 mm longis, albidis, copiosis; cellulis scleroticis sparsis, vix valde induratis; Tepala (3–) 4 rubra libera, mascula spathulato-cucullata, feminea lanceolato-spathulata. Flores masculi ostiolares;

stamine uno, non mucronato. Flores cecidiophori sessiles; ovario fusco-rubro, sessili v. stipitato. Flores feminei ?. Cystolitha hypogena. Typus, T. G. Hartley 11096 (L), New Guinea, Morobe district, Busu River, 10 Jan. 1963.

I place this next to *F. casearioides*. It has the same pale twigs but differs in the longer lanceolate leaves with more numerous lateral veins, the cauliflorous habit and, as a detail, the copious internal bristles. The leaves are very like those of *F. subtrinervia* (subgen. *Pharmacosycea*) and, at



FIGURE 22. *F. pilulifera*. Leaf and fig-cluster ($\times \frac{1}{2}$); figs ($\times 2$); male and gall-flowers ($\times 10$); Hartley 11096.

first, I wondered if the figs had been mistakenly assigned to these dried twigs; however, the leaves of *F. subtrinervia* are subdistichous whereas those of *F. pilulifera* are set in compact rosettes; thus the habit of the two trees must be quite different.

F. pilulifera would seem to be rare because the Busu River, where it grew, is a well collected region.

389. **F. subcuneata** Miq., *Ann. Mus. Bot. Lugd. Bat.* 3 (1867), 235, 297 (figures 23, 24).

Tree up to 30 m high, fruiting at 6 m; bark greyish brown to reddish or orange brown; inner bark pink; wood light orange, darkening on exposure; latex white; leaves glossy, spirally arranged in *Terminalia*-branching, young leaves pinkish fawn. Twigs, petioles, underside of main veins and figs strigose-villous with pale fulvous to rusty, rather stiff, spreading hairs 1.5–3 mm long on twigs and petioles, but whitish and 1–1.5 mm long on young plants; the smaller veins thinly hairy with similar, shorter or subundulate hairs, but no undercoat of flexuous hairs. Twigs 2.5–4 mm thick, fuscous brown. Stipules up to 22 mm long, fulvous

strigose or only along the midrib, varying appressedly hairy, caducous. Lamina 12–20 × 4.5–9 cm (up to 26 × 9 cm in saplings), obovate with the acuminate tip up to 15 mm long, caudate with the tip up to 20 mm in saplings, narrowed to the rounded cuneate or narrowly subcordate base, entire, membranous subcoriaceous, not scabrid, drying dark fuscous brown; lateral veins (7–) 9–13 (–16) pairs, distinctly raised below, with up to 10 intercostals slightly

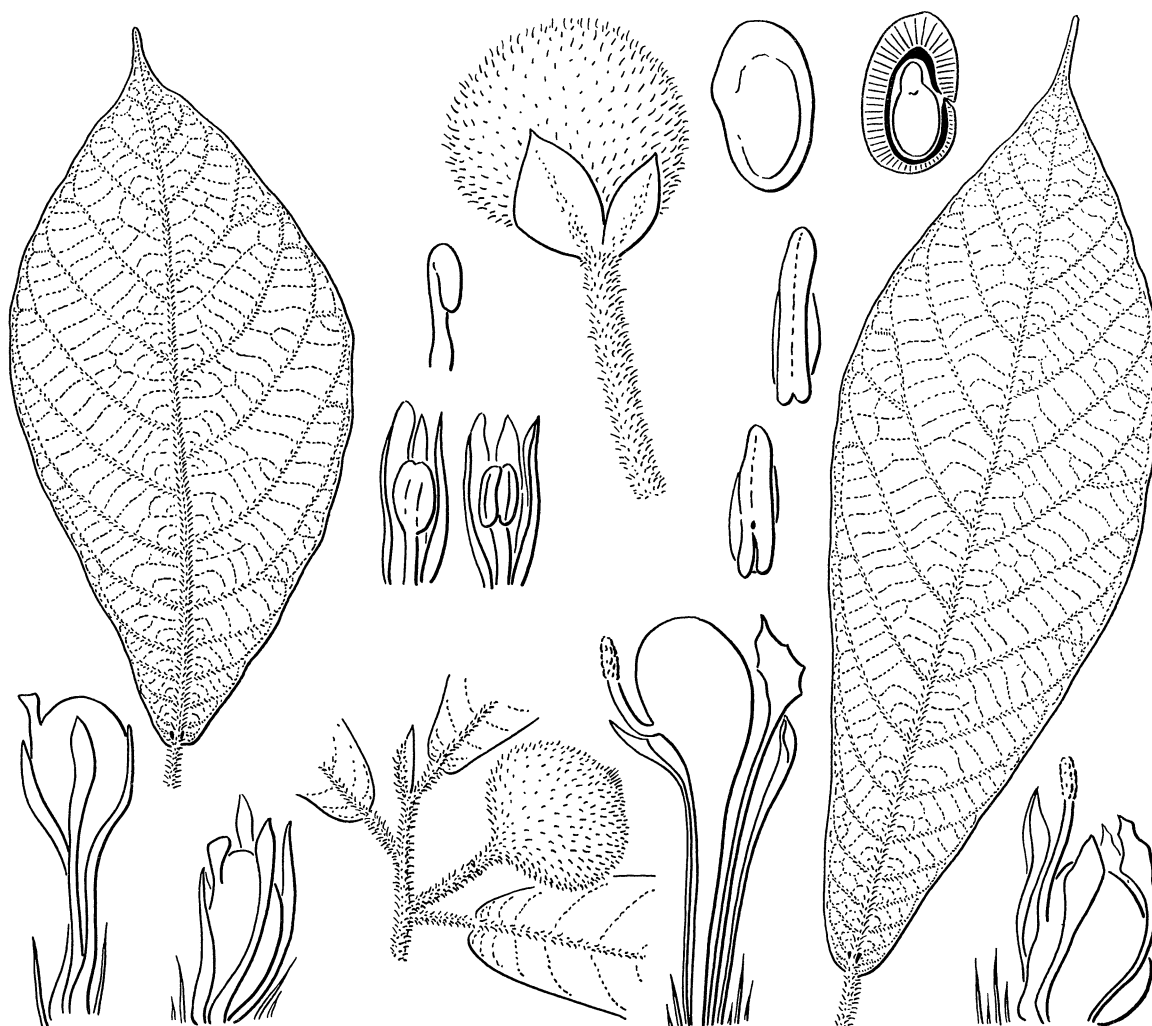


FIGURE 23. *F. subcuneata*. Leaves and twig ($\times \frac{1}{2}$), Carr 16314 (left), NGF 12484 (centre), Hoogland 3949 (right); young fig with basal bracts ($\times 3$), Hoogland 3949; male and gall-flowers (lower left) ($\times 10$), Kostermans 1409; female flowers (lower right) and seeds ($\times 10$), Hoogland 3949.

raised below; areolae glabrous; basal veins 1–3 pairs, short; basal glands 2, small, often absent; petiole 5–20 mm long. Figs axillary, solitary, occasionally paired, varying cauliflorous (Hoogland 4394), glabrescent except round the orifice, ripening scarlet; peduncles 5–24 mm long; basal bracts 3, 6–8 × 4–5 mm, glabrous or thinly hairy on the midline, early caducous; pedicel 1–12 mm long; body 18–25 × 24–30 mm (30 × 40 mm, living), depressed globose without lateral bracts, orifice plane and closed by several apical bracts in a small rosette 3–4 mm wide; internal bristles up to 1 mm long, white, abundant; fig-wall thick, without sclerotic cells. Tepals 4–6, narrowly stalked-spathulate, free, red. Male flowers in one ring; filament red. Gall-flowers

sessile; tepals as long as the shorter ovaries, not as long as the stalked ovaries; ovary dark red. Female flowers sessile; tepals as long as or longer than the ovary; ovary red-brown with whitish, red-speckled sides. Seed 2–2.5 × 1.3 × 0.6 mm, auriculiform, bluntly keeled, embryo straight.

Distr. Celebes, Moluccas (Ceram, Halmahera, Morotai), New Guinea, New Britain; in lowland and mountain rain-forest up to 1200 m alt., often by rivers, locally common.

This is a large characteristic tree, but in the herbarium it can be mistaken for a species of sect. *Sycocarpus*, and the leaf and fig resemble those of the climber *F. odoardi*. The following species may be only a juvenile form.

389 A. *F. suffruticosa* sp.nov. (figure 25).

Frutex 1 m alt., latices pauco, foliis spiraliter instructis. Ramuli petiolique stipulaeque, costae subtus, et receptacula pilis ad 1 mm longis brunneolis patentibus setosi, pilis undulatis nullis. Ramuli 1.5–2 mm crassi, fusco-brunnei. Stipulae 11–13 mm longae, caducae, marginibus

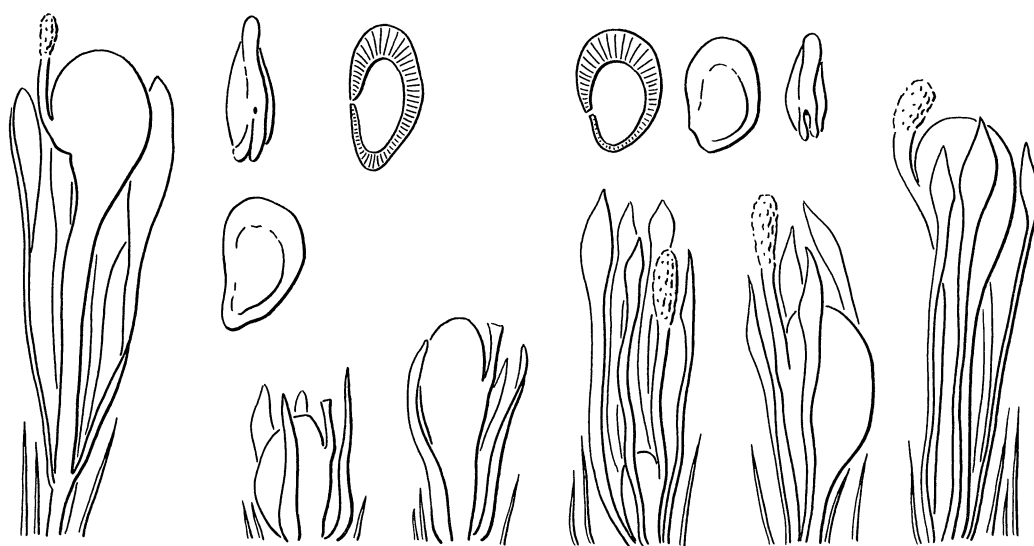


FIGURE 24. *F. subcuneata*. Left, shortly pedicellate female flower and seeds from stipitate ovaries, Clemens 3270; lower centre, gall-flowers, de Vriese s.n. (Ceram); right, female flowers and seeds from sessile ovaries, Carr 16314 ($\times 10$).

glabris. Lamina ad 17 × 5.7 cm, anguste obovato-elliptica, apice mucronato ad 10 mm longo acuminata, basi anguste subcuneata, integra subcoriacea, sicco fusco-brunnea, haud scabrida, subtus villosa; costis lateralibus utrinsecus 11–14, obliquis, subtus elevatis; intercostis 4–7, areolis glabris; costis basalibus utrinsecus 1–3 brevibus; petiolo 7–15 mm longo. Receptacula axillaria, saepe solitaria; pedunculo 10–15 × 0.5 mm, gracili hirsuto; bracteis basalibus 2.5–3.5 mm longis, ovato-acutis pilosis caducis; corpore receptaculi ad 7 mm lato (multo immaturo), subgloboso strigoso, saepe subpedicellato, bracteis lateralibus nullis, apicalibus erectis 1 mm longis; setis internis ad 1 mm longis, brunneolis copiosis; cellulis scleroticis ? nullis. Tepala 3 libera rubra spathulata. Flores sessiles, masculi ostiolares, stamine uno; cecidiophori ovario sessili rubro. Cystolitha hypogena. Typus, BW 10771 (L), West New Guinea, south Manokwari, Mt. Krabo, 3 Sept. 1960.

This plant was said to be rather common as a shrub in primary forest on stony clay soil.

It agrees essentially with *F. subcuneata*, but is more slender and has smaller basal bracts. It suggests a precociously fertile sapling, but whether this or a distinct species it has special interest in showing how the tree-form, characteristic of ser. *Hypogonae*, may be reduced.

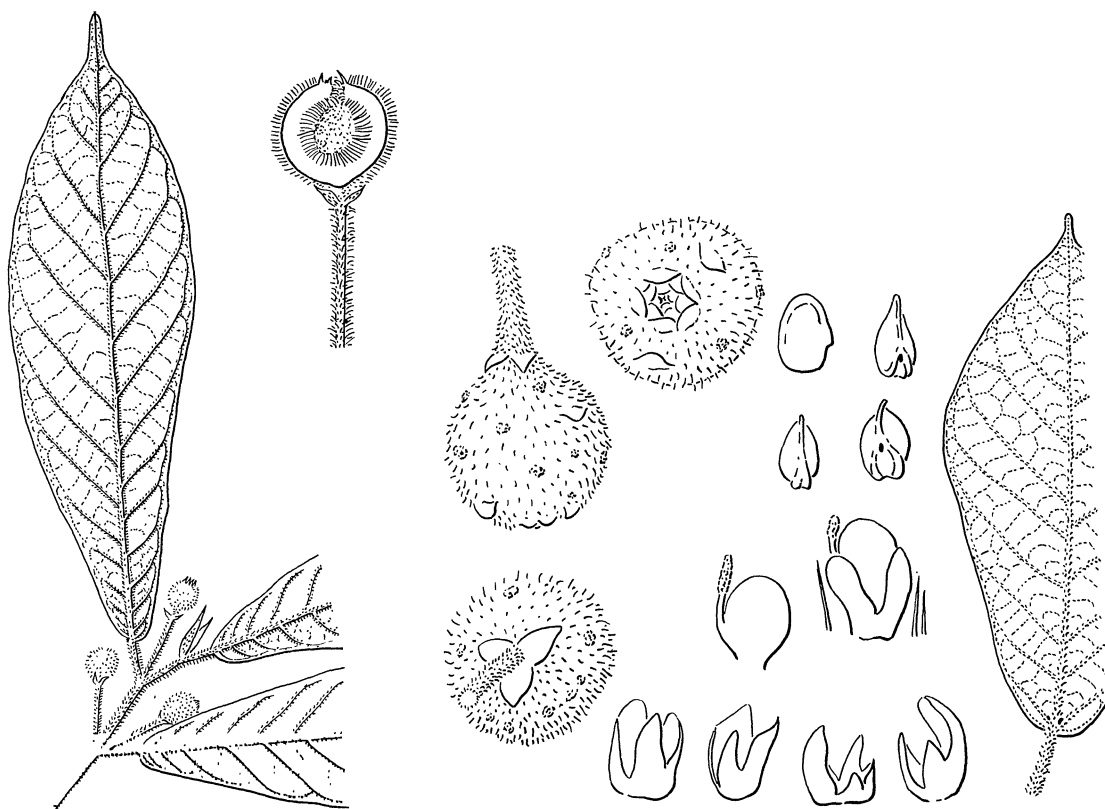


FIGURE 25

FIGURE 25. *F. suffruticosa*. Twig ($\times \frac{1}{2}$), fig ($\times 2$); BW 10771.

FIGURE 26

FIGURE 26. *F. pleioclada*. Leaf ($\times \frac{1}{2}$), figs ($\times 4$), female flowers and seeds ($\times 10$); Ledermann 13054.

390. *F. pleioclada* Diels, *Bot. Jahrb.* **67** (1935), 216 (figure 26).

Tree 10–25 m; bark fuscous to reddish brown. Twigs, petioles and underside of the veins pale fulvous villous with spreading, oblique, straight and subundulate hairs 1–1.5 mm long, 0–1 mm on the veins, shorter and puberulous-villous on the veinlets; upper side of lamina soon glabrous or villosulous along the main veins. Twigs 3–4 mm thick, fuscous; foliage spiral-ascending. Stipules up to 15 mm long, glabrous except the ciliolate edge, caducous. Lamina up to 20 × 10 cm, elliptic to obovate, shortly acuminate, base rounded subcuneate, symmetric entire, thinly coriaceous, smooth, villous beneath, drying pale drab or greyish brownish; lateral veins 9–11 pairs, raised rather strongly beneath; intercostals 3–8, rather lax, raised beneath; basal veins 2 pairs, short, with 2 slight basal glands; petiole 12–35 × 2.5–3 mm, villous. Figs cauliflorous, perhaps geocarpic, on slender branching leafless twigs up to 150 cm long from the base of the trunk, lying on the ground, the clustered branches shortly villous towards the ends (1–2 mm wide), at the base glabrous and thickening up to 8 mm, internodes 4–20 mm long; peduncles 3–5 × 1 mm, slender, villous-hispid, then glabrescent; basal bracts 3, 1–1.5 mm long, subtriangular, glabrous; body 7–8 mm wide, subglobose or ellipsoid, with 2–3 small appressed glabrous lateral bracts, tuberculate with small lenticels, thinly villous, glabrescent,

the orifice plane, closed by 3–4 small glabrous apical bracts, these eventually spreading to show the internal bracts; internal bristles rather sparse, up to 1 mm long, yellowish; sclerotic cells in a thick layer in the wall of the seed-fig. Female flowers sessile; tepals 3–4, gamophyllous shortly, with spatulate to lanceolate, obtuse to subacute lobes, reddish; ovary sessile or substipitate, dark red; style strongly lateral. Seed 1.1–1.3 mm long, compressed, with two narrow basal keels.

Distr. Territory of New Guinea (Sepik, Felspitze); mossy forest, 1500 m.

Collections. Ledermann 12654 (type), 13054.

The indumentum and leaves recall *F. subcuneata*, but the small figs on long cauliflorous twigs, much as in *F. ribes*, are very different. I cannot fit these fruits to any other species and I assume that they have been rightly associated with the leaves. Thus the species, which appears either very rare or overlooked, is the only more or less geocarpic species in *Adenosperma*.

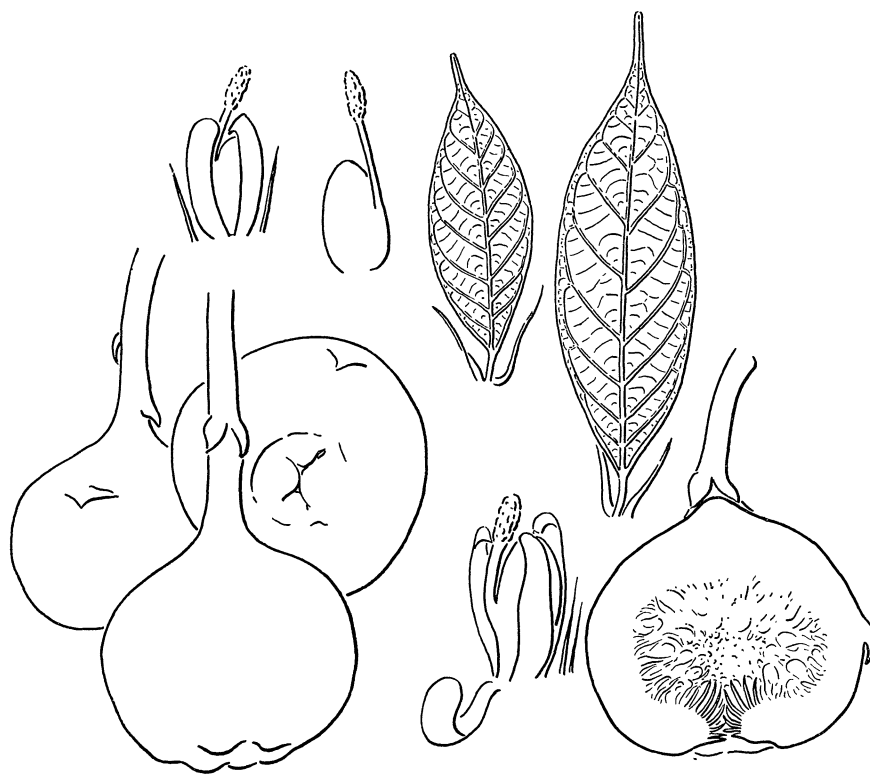


FIGURE 27. *F. tenella*. Leaves ($\times \frac{1}{2}$), figs ($\times 3$), female flowers and seeds ($\times 10$); Carr 14639.

391. ***F. tenella*** Corner, *Gdns' Bull., Singapore* **18** (1960), 30 (figure 27).

Small tree up to 10 m high, horizontally branched, the leaves spirally arranged; latex white. Glabrous or the young parts thinly appressedly brown hairy, the hairs up to 1 mm long. Twigs 1.5–2.5 mm, fuscous brown, sometimes minutely scurfy with microscopic straight hairs. Stipules 10–30 mm, lanceolate, glabrous, persistent. Lamina 6–15 \times 1.5–3.7 cm, lanceolate-elliptic to narrowly obovate, acuminate or subcaudate with the tip up to 17 mm long, base narrowly cuneate, entire, membranous, drying fuscous brown; lateral veins 9–11 pairs; intercostals up to 7, rather faint; basal veins 1 pair, short, without basal glands; petiole 4–14 mm. Figs axillary, paired or solitary; pedicels up to 4 mm long, with 2–3 scattered lateral bracts,

sometimes set in a collar about the middle; body 6–9 mm wide (10–12 mm, living), subglobose, with 1–3 small lateral bracts, the orifice slightly sunken and closed by 3–4 flat apical bracts; internal bristles up to 1 mm long, copious; sclerotic cells none. Female flowers sessile: tepals 4, pale red, free, oblong, about as long as the dark red, sessile or substipitate ovary; style red, strongly gynobasic. Neuter flowers in a single ring round the orifice. Seed?

Distr. Papua (Boridi, Milne Bay District, Mt. Dayman, Misima Isl.); streamside in primary forest up to 1100 m alt.

This is near to *F. erythrosperma* and differs in the smaller size of all parts and in the persistent stipules. It is known from four collections of seed-plants, for two of which (Brass 23560, 27510) it is noted that it was a common small tree (4–10 m) on flood-banks of streams in the rain-forest. Hence it is an entity which must be recognized. It suggests the transition to a riverside bush as *F. suffruticosa* to *F. subcuneata*.

392. **F. funiculosa** Corner, *Gdns' Bull., Singapore* 18 (1960), 30 (figure 28).

Tree up to 25 m high, with heavy canopy; bole up to 8 m, 35 cm thick, buttressed; bark smooth or slightly flaky, brown to red-brown; inner bark pale orange as the wood; latex white; leaves spirally arranged, tending to subdistichous. All parts densely tomentose with white to fulvous, spreading or oblique, straight hairs 1–2 mm long, and with densely interwoven flexuous hairs as an undercoat; uppersides of the leaves soon glabrous, the lower sides slowly, the undersides of the veins appressedly hairy. Twigs 2.5–6 mm thick, becoming pale greyish buff or fuscous, the bark flaking off. Stipules 12–20 mm long, broadly lanceolate, connate, caducous. Lamina 9–23 × 6–18 cm, ovate to broadly elliptic, varying subobovate, shortly and rather bluntly acuminate with the tip up to 12 mm long, base shallowly cordate to rounded or widely cuneate, entire, smooth, subcoriaceous, drying light brown to fuscous brown; lateral veins 8–11 pairs, prominent beneath; intercostals 6–11, fairly regular, slightly raised beneath; basal veins 3–5 pairs, reaching $\frac{1}{4}$ – $\frac{1}{3}$ of the lamina in the leaves with a broad base; glands rather faint, usually two basal glands and often one at the forkings of the main lateral veins; petiole 15–45 × 2–4 mm. Figs axillary, solitary or paired, wholly densely tomentose, 'grey-green' (living); peduncles 4–12 × 2.5 mm, with 2 small blunt villous scattered lateral bracts 1–1.5 × 2–2.5 mm, rarely set in a collar; body 20–30 mm wide (up to 45 mm, living), becoming depressed globose, with 1–3 small scattered lateral bracts, the orifice closed by numerous small, slightly projecting apical bracts in a rosette 2.5–4 mm wide; fig-wall thick, 2 mm, without sclerotic cells or in the inner layer of the gall-figs; internal bristles 1–2.5 mm long, copious, soft, white to yellowish, subflexuous. Tepals 3–4, lanceolate, reddish. Male flowers in 2–3 rings; tepals spatulate. Gall-flowers sessile or shortly stalked; tepals almost as long as the ovary or longer; ovary sessile to long-stalked, reddish with white sides to wholly dark red. Female flowers sessile; tepals much shorter than the sessile or long-stalked ovary; ovary with broad red peripheral band and red-speckled sides. Seed 1.7–1.9 mm long, much flattened, auriculiform, bluntly keeled.

Distr. New Guinea, New Britain; in primary forest up to 1200 m alt., locally abundant in wet *Camptosperma* or *Octomeles* forest on alluvial soil, as a subcanopy tree.

This large tree appears to be the beginning of the subseries distinguished by the double indumentum and leading through *F. trichocerasa* to *F. erythrosperma* and *F. tenella*. Caution must be used in avoiding confusion with the large buttressed *F. semivestita* (sect. *Neomorpha*) and, in the herbarium, with the climber *F. odoardi*. It seems that all three may grow together.

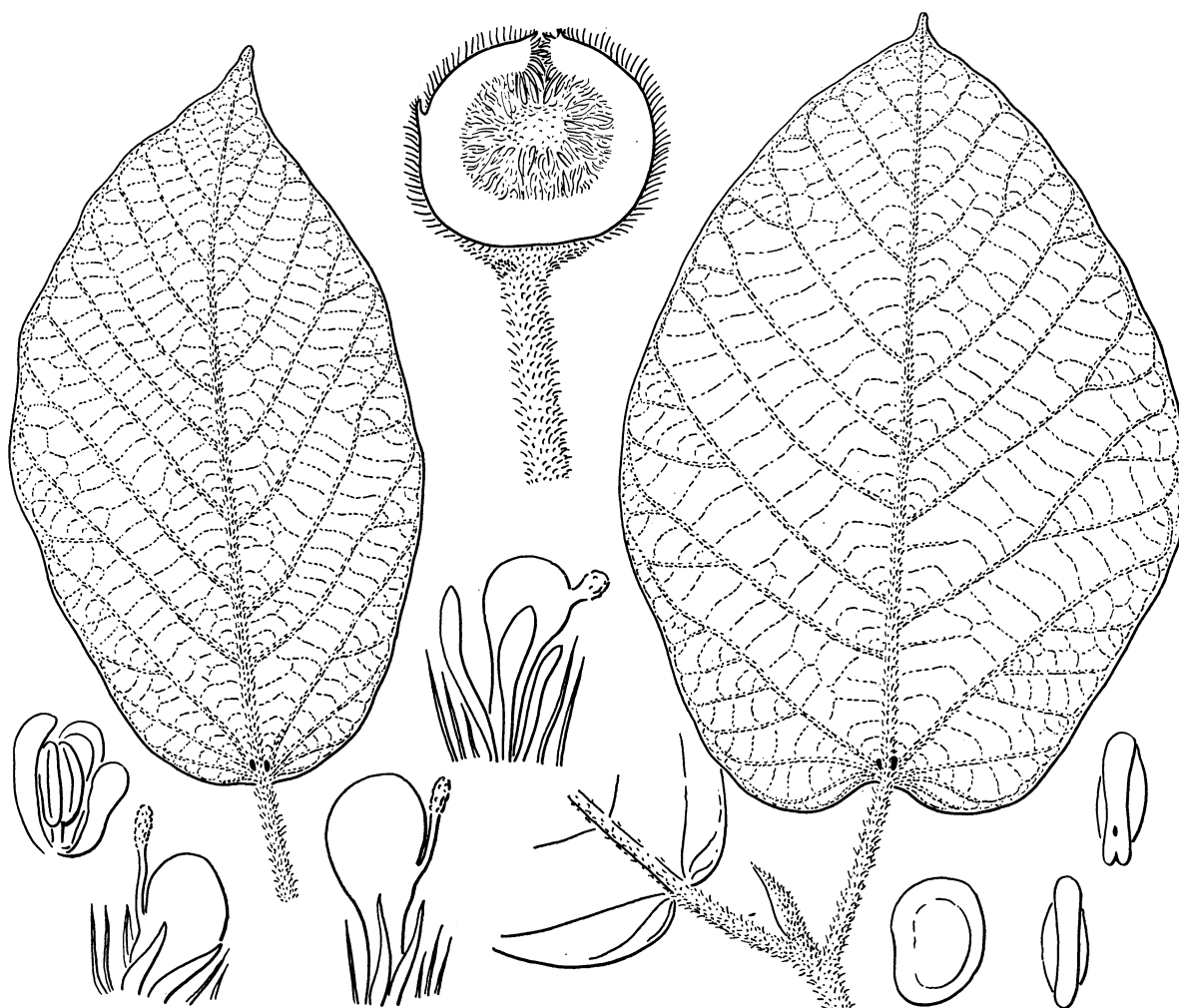


FIGURE 28. *F. funiculosa*. Leaf (Hoogland 3555) and twig (Brass 24106) ($\times \frac{1}{2}$); young fig (Hoogland 3555) ($\times 3$); male and gall-flowers (Hoogland 3555), female flowers and seeds (NGF 7031) ($\times 10$).

393. *F. trichocerasa* Diels, *Bot. Jahrb.* **67** (1935), 188 (figures 29, 30).

Tree up to 25 m high, fruiting at 3 m, without buttresses; bark dark brown, smooth, slightly transversely ridged; inner bark and wood pale straw-yellow; latex white. Leaves laxly spiral to subdistichous (? without *Terminalia*-branching). Twigs, petioles and figs villous-tomentose with spreading or appressed, fulvous hairs 1–3 (–5) mm long and with a close undercoat of minute undulate hairs, slowly glabrescent; leaves with similar indumentum when young but soon glabrescent except the undersides of the veins. Twigs 2.5–4 mm thick, light brown to dark chocolate. Stipules 10–25 mm long, villous or with glabrous sides, but glabrous on new shoots. Lamina 9–25 \times 4–12 cm, reducing to 4–10 \times 1.5–4 cm on tall trees, elliptic to subobovate, often slightly asymmetric, acuminate or shortly caudate with the tip 10–18 mm long, base cuneate, varying narrowly subcordate, entire, membranous to subcoriaceous, drying fuscous brown and often silvery beneath; lateral veins (7–) 9–12 pairs; intercostals 6–18, raised beneath; basal veins 2–4 pairs, short, with 2 basal glands; petiole 8–40 mm long. Figs axillary, often solitary, but becoming cauliflorous, densely and persistently fulvous tomentose, ripening red; peduncles 0–6 mm long, or up to 10 mm long with scattered bracts; basal bracts 2–3, 1.5–3 mm

long, in a collar or scattered, ovate-acute; body 12–15 mm wide (15–20 mm, living), subglobose, with several small subcrescentic lateral bracts more or less concealed by the tomentum, crowded towards the slightly sunken orifice; internal bristles up to 1 mm long, copious, white; sclerotic cells few to abundant in gall-figs, not in seed-figs. Tepals 3–4, reddish or red-speckled, free, spatulate, equal to or exceeding the ovaries. Male flowers in one ring. Gall- and female flowers

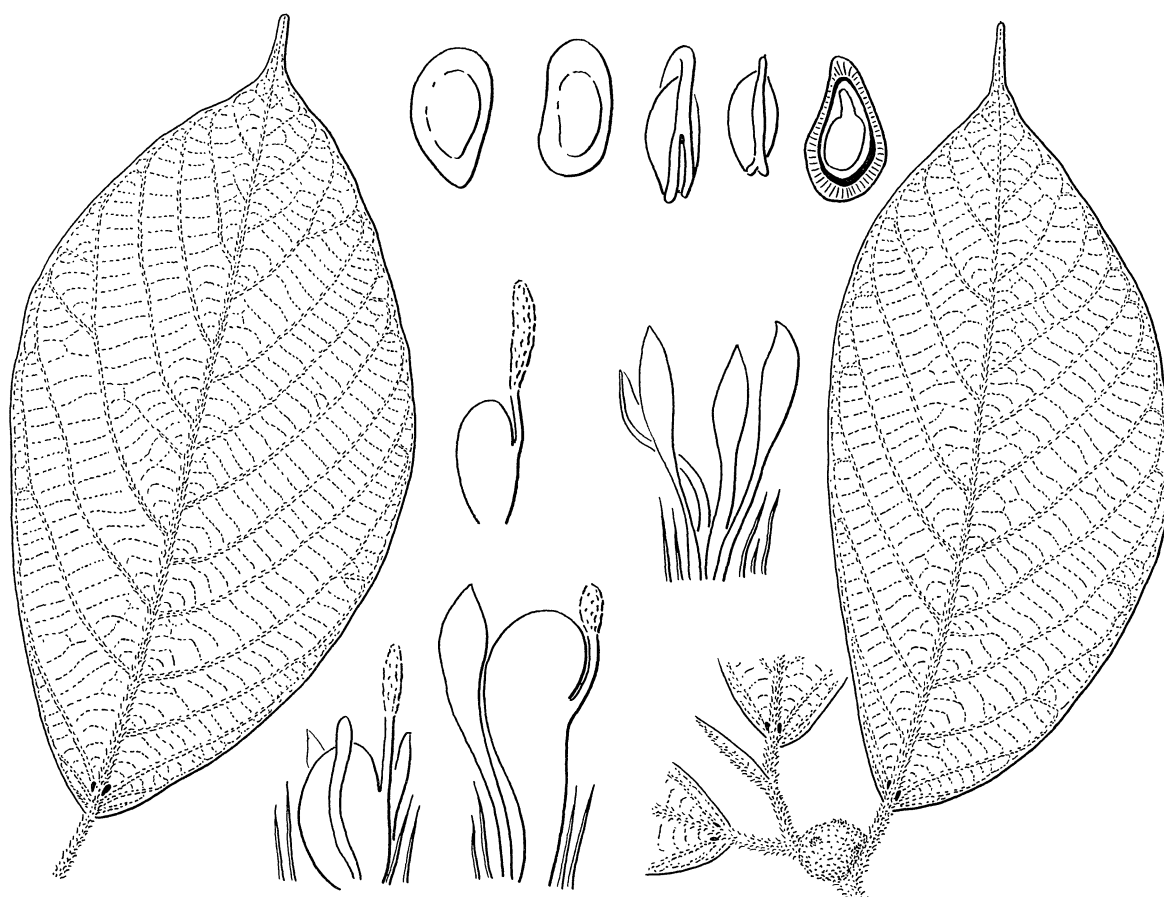


FIGURE 29. *F. trichocerasa*. Leaf (Carr 13212) and twig (Carr 15321) ($\times \frac{1}{2}$); female flowers and seeds (Carr 15321) ($\times 10$).

sessile or shortly pedicellate; ovary sessile or stalked, dull red or red speckled on the sides; style reddish. Seeds 1.6–1.9 mm long, compressed, rather strongly keeled, embryo almost straight.

Var. *trichocerasa*

Distr. New Guinea; rainforest up to 1800 alt., frequent.

This must not be mistaken for *F. glandulifera* v. *villosa* (sect. *Ficus*) with which it may grow.

Var. *glabristipula* Corner, *Gdns' Bull., Singapore* **18** (1960), 31.

Stipules glabrous or pilose along the keel with long, pale fawn hairs. Twigs, petioles and young leaves densely pilose with pale to bright tawny, appressed then spreading hairs 2–4 mm long, and with a tomentum of undulate hairs. Lamina becoming small, 8–11 \times 3.5–6 cm,

and rather stiffly coriaceous on old trees; intercostals up to 8, rather strongly raised beneath, often zig-zag. Fig-peduncle 2–5 mm long; sclerotic cells very abundant throughout the wall of the gall-figs, but as a thin layer in the inner part of the seed-figs; internal bristles often very few in the gall-figs. Gall-flowers sessile or with a thick whitish stalk up to 2 mm long, containing many sclerotic cells; ovary pale yellowish white.

Distr. Territory of New Guinea and Papua; lowland and mountain forest up to 2600 m alt.

Collections. Brass 23257, 27468, 28447; Carr 14162; Hoogland & Schodde 7350; NGF 13541, 17669, 29936.

The status of this variety needs inquiry in the field. The thickly sclerotic wall of the gall-figs with their pedicellate gall-flowers and white ovaries give the impression of belonging to



FIGURE 30. *F. trichocerasa*. Gall-figs ($\times 3$), gall-flowers ($\times 10$); Carr 13212.

subgen. *Pharmacosycea*, but the stigmas are simple and the trees are dioecious. The collection NGF 15408 (from Bulolo) suggests yet another variety with more or less persistent stipules and strong *Terminalia*-habit, the leaves in compact rosettes.

394. ***F. erythrosperma*** Miq., *Ann. Mus. Bot. Lugd. Bat.* **3** (1867), 226, 293; Corner, *Phil.*

Trans. Roy. Soc. B, **253** (1957), 120, f. 40.

Distr. North Celebes, Ceram, Ternate, Amboina, Key Isl., New Guinea, New Britain, New Ireland, Solomon Islands.

I have described this under the Solomon Islands figs. After *F. adenosperma* it seems to be the next commonest and widely spread species though it seems to be absent from New Hebrides and Queensland. It is a large buttressed tree like *F. funiculosa* but its small figs and narrow, almost distichous leaves show that it is much advanced, even on *F. trichocerasa*. It is common in the interior of the forest where *F. adenosperma* seldom penetrates. Possibly two forms have been confused. One is the common lowland tree with orange-brown to reddish bark and green young leaves which are thinly hairy and without the undercoat of undulate hairs. The other is a mountain tree with dull brown bark and red young leaves which are hairier and have the

undercoat of undulate hairs. In fig and flowers they seem identical. The lowland form leads to more reduced *F. tenella* while the mountain connects with *F. trichocerasa*. The ecology and taxonomy of these four species need to be studied in the forest.

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