

Epiphytes That Strangulate Palms

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Especially in the evergreen tropical forests with heavy rainfall, the various plant communities strikingly demonstrate their struggle for existence by competing with each other. As the primary problem of the plants under such environments is receiving adequate sunlight, different species undergo various modifications in their habits in order to win over their neighbours. A sturdy-stemmed tall tree, for instance, is surpassed by a slender-stemmed, fast-growing liana which twines over and expands its leafy surface over the foliage canopy of the former.

In mixed plant communities, some plants may cooperate with each other for their mutual benefit, both existing as active partners. This phenomenon is referred to as symbiosis, and the participants are known as symbionts. In lichens for example, the algae and the fungi live in mutual partnership. Some plants, on the other hand, are parasitic and depend on their host plants completely or partially for their nourishment. *Cassytha*, *Cuscuta*, *Orobanche* and *Rafflesia* may be examples of complete or holoparasites. *Loranthus*, *Viscum*, and *Santalum* are examples of partial or hemiparasites.

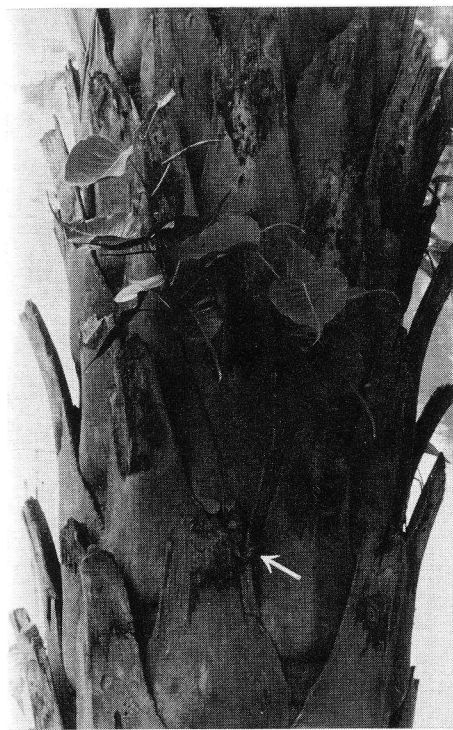
A third category of plants which is relevant to the present study is the epiphytes which grow on other plants, but never derive food from them. They usually absorb moisture from the atmosphere by means of special aerial roots. But the roots of a few other epiphytes as the ones illustrated in this article reach the soil in course of time and absorb

from it moisture as well as minerals. The epiphytes that abound the tropical rain forests are mostly from the families Orchidaceae, Piperaceae, Bromeliaceae, Araceae and a few genera of Urticaceae, Loranthaceae and Cactaceae. Among the non-flowering plants, the most important ones are the lichens, and the illustration by Hodge (1956) of lichens on the trunk of a palm is particularly impressive. Various algae, mosses and ferns are also often found to be epiphytic on other plants.

Palms, being primarily tropical dwellers, are not spared by epiphytes, although fortunately they are not hospitable to major plant parasites. In India, two species of *Ficus*, *F. religiosa* and *F. bengalensis* are the most common epiphytes among the angiosperms. They start as epiphytes on the palm trunks, but eventually when their roots reach the soil they grow into massive trees. These fast-growing epiphytes very soon envelop the palms, cast shadow on their crown and eventually kill them by strangulation. In the course of time, it is hard to find any trace of the original palm as the territory is fully occupied by the *Ficus*. In the following pages a few examples of *Ficus* species strangulating palms as well as three members of Araceae epiphytic on palm trunks are reported.

Ficus religiosa

As its name suggests, *Ficus religiosa* is a sacred tree to most Indians and Southeast Asians. It was while meditating under one such tree that Lord



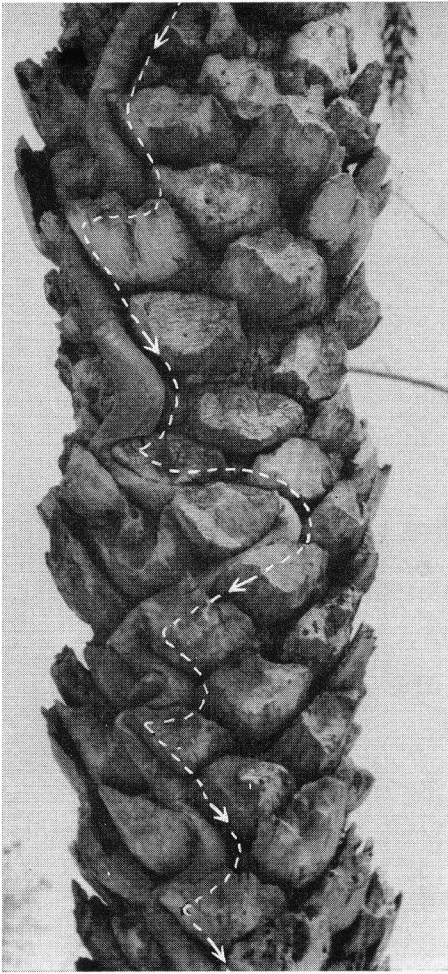
1. A young *Ficus religiosa* seedling springing from a leaf axil of *Phoenix sylvestris*. The arrow indicates the foot of the *Ficus*.

Buddha attained Divine Wisdom, and the tree in many Indian languages is known as the Tree of Wisdom. It is a tremendous task for the devout Buddhists to preserve the original tree under which Lord Buddha meditated a little less than twenty-five centuries ago. The Hindus also consider this tree very sacred, and in practically every temple there is a *F. religiosa* tree. The religious sentiment is so powerful in India that this tree provides dwelling places to many on public road-sides. Devotees plant a tree on a public road-side and erect a small stone image under it and offer prayers to it. As the tree expands, the area of the place of worship also widens sufficient for a family to live in. Gradually a small

tea shop or the like may spring on one side of the temple, a source of income for the inmates of the house. No one dares to disturb such houses. Though this tree is a great nuisance and even a potent danger to houses, Hindus and Buddhists do not venture to fell them or even lop their shoots. But when it is unavoidable, the pious people call in Muslim laborers to do the job. Mostly on account of this attitude many palms are allowed to be killed by the *Ficus*.

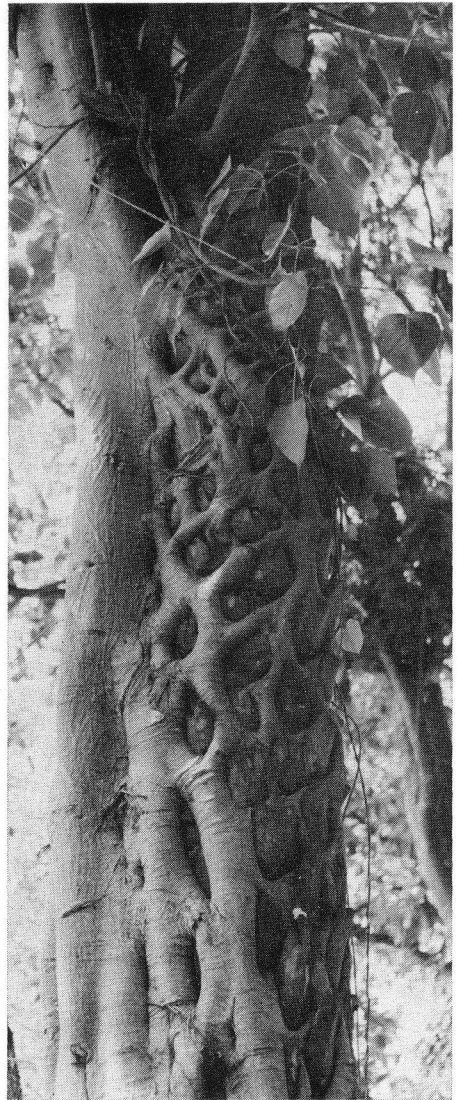
In Fig. 1 is seen the trunk of a *Phoenix sylvestris* having numerous persistent leaf bases. From the axil of a leaf base, a young *F. religiosa* seedling springs up. *Ficus religiosa* and a number of other *Ficus* species thrive excellently in Bengal, fruiting during the warmer months. The ripe fleshy fruits are enjoyed by many species of birds, especially the common crows and mynas feasting on them. The numerous small hard seeds swallowed by the birds pass out unharmed along with the droppings. There is good chance of these seeds getting deposited within the leaf axils of palms as the birds often prefer to perch on palms. Monsoon immediately follows the fruiting season and the seeds start germinating. The decaying leaf bases as well as the dust and humus materials deposited at these leaf axils by wind form an excellent medium for the seedlings to get established. The closely packed leaf bases function as efficient insulation material against desiccation, and so the *Ficus* seedlings get sufficient moisture even when none of their roots reached the soil.

After getting established thus, the *Ficus* seedling in its attempt to expand itself quickly sends downwards one or two primary roots so as to reach the soil for extra nourishment. The problem of descent over the rugged surface of the stem is not an easy job which may amount to getting out of a complicated



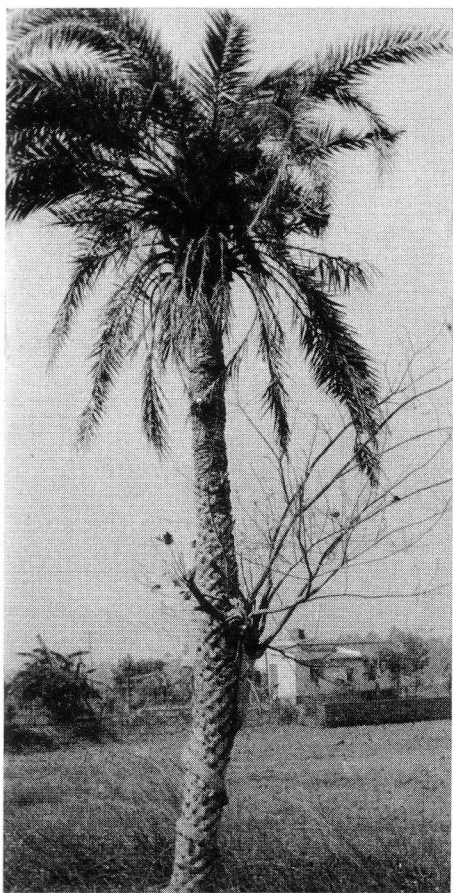
2. The descent of a *Ficus* root between the leaf bases of *Phoenix sylvestris*.

maze. The root being slender and delicate to begin with, in its attempt to protect itself from desiccation and damage from insect pests, descends through the narrow spaces available between successive leaf bases. The leaves of *Phoenix sylvestris* are arranged spirally on the trunk, and so the leaf bases do not provide a vertical passage. Thus, the roots struggle, and prompted by the gravitational attraction, they make zig-zag

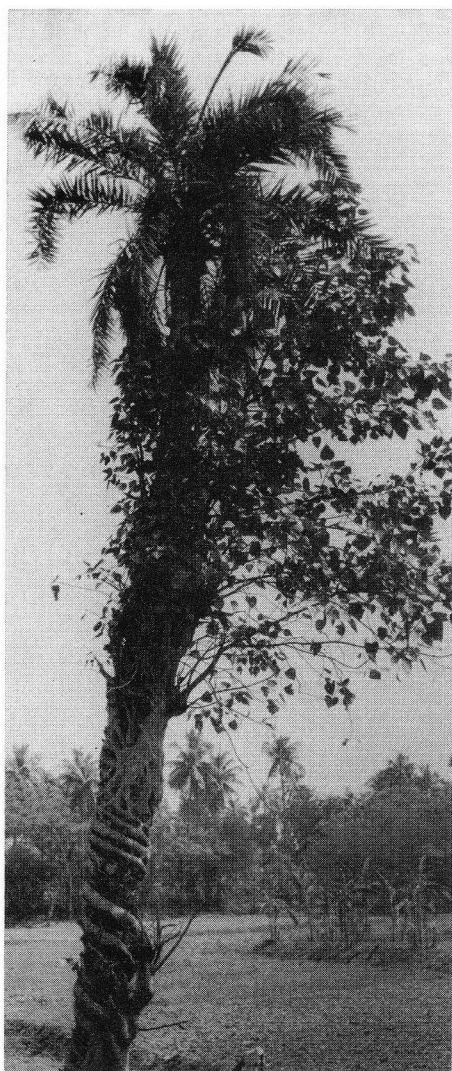


3. The main "root-stem" of *Ficus religiosa* showing a network.

movements between leaf bases and eventually reach the soil after producing long but essential root-lengths. A closer view of one such root on a palm trunk is seen in Fig. 2. The dotted white line indicates the direction of the root's descent.



4. A three-year-old *Ficus religiosa* epiphytic on a *Phoenix*.



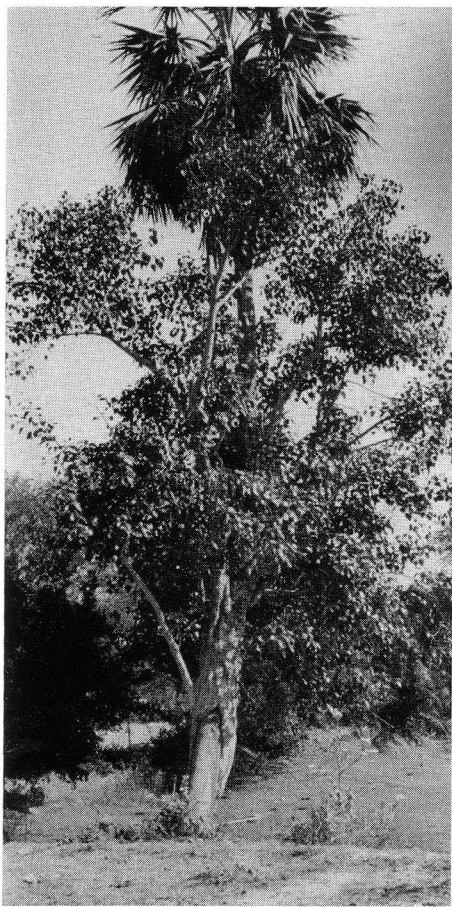
5. Main roots of a *Ficus* descending around a *Phoenix* stem in counter-clockwise fashion.

The next course of action of the *Ficus* is depicted in Fig. 3. One or more roots penetrate the soil while their aerial portions rapidly increase in girth eccentrically, expanding towards the periphery, the only direction available for expansion. Thus they bulge outside the crevices of leaf bases. Very soon, more or less a vertical "root-stem" is formed as is clear from Fig. 3. At this stage, several lateral roots are produced slantingly at all heights which in turn produce further orders of rootlets slantingly

forming rectangular islands between them. This pattern is inevitable because of the peculiar arrangement of the leaves. The tips of leaf bases enclosed within the cells await their turn to be completely covered by the rapidly expanding root-mat of the epiphyte. Co-



6. A single root of a *Ficus* descending a *Phoenix* trunk in clockwise fashion.



7. A massive *Ficus religiosa* enveloping a *Borassus flabellifer*.

alescing of rootlets or fusion of parts of rootlets at intervals are peculiar with *Ficus* sp. The rootlets get firmly sealed to each other in a criss-cross pattern and finally coalesce into a single hollow cylinder around the palm. Usually the seeds of *Ficus* get deposited in leaf axils at fairly high levels, and so the newly formed tubular stem of the epiphyte covers a great height of the palm trunk. As the "stem" gets thus fortified, the shoot of the epiphyte enlarges speedily and progressively annihilates the host.

Figures 4 and 5 demonstrate this phenomenon. The epiphyte in Fig. 4 is about three years old and had shed its leaves at the time of photographing it. The *Ficus* in Fig. 5 is about eight years old and has firmly established itself, many of its roots having penetrated the soil. Its leafy shoots have grown sufficient to reach the level of the palm's crown. Within a couple of years the *Ficus* is bound to overpower the *Phoenix*.

In Fig. 6 what appears like an anaconda stifling a helpless victim is nothing but a *Ficus religiosa* in the process of finessing and strangulating a *Phoenix sylvestris* palm. The development of a single but prominent root of *Ficus* is very striking as it grips the stem in clockwise direction. The taproot or the primary aerial root starting from the base of the epiphyte descends left-handedly. At some level before reaching the ground, this root changed its direction, but very soon got back to the original course before reaching the ground. The leaves on a trunk are arranged in clockwise or counterclockwise fashion. As the leaf spirals provide distinct and continuous spiralling channels between them, following this course is much less of an obstacle for the roots. The expansion of the root takes place vertically and after some time the entire root envelops the stem. In some palms, the epiphytes emit more than one main root, each following the channel between two leaf spirals as seen in Fig. 5. Here coalescing of roots can take place quickly unlike the case in the specimen of Fig. 6. Another difference noticed between the roots of these two plants is the opposing directions they chose to grow downwards.

Three instances of *Ficus religiosa* epiphytic on *Borassus flabellifer* are described below. *Ficus* thrives more on *Phoenix sylvestris* than on *Borassus flabellifer*. In the latter species, the stem is more or less devoid of persistent



8. A closer view of "windowed" sheathing roots of *Ficus religiosa*.

leaf bases as compared to that of *Phoenix*. So there are fewer chances of the epiphyte getting established on these trunks. Moreover, the root system of *Borassus* is much harder and closely-set than that of *Phoenix*, and it could be a tough struggle for the *Ficus* roots to penetrate the hard root-matting of *Borassus*. In addition, the trunk as well as the crown of *Borassus* are much sturdier than those of *Phoenix*.

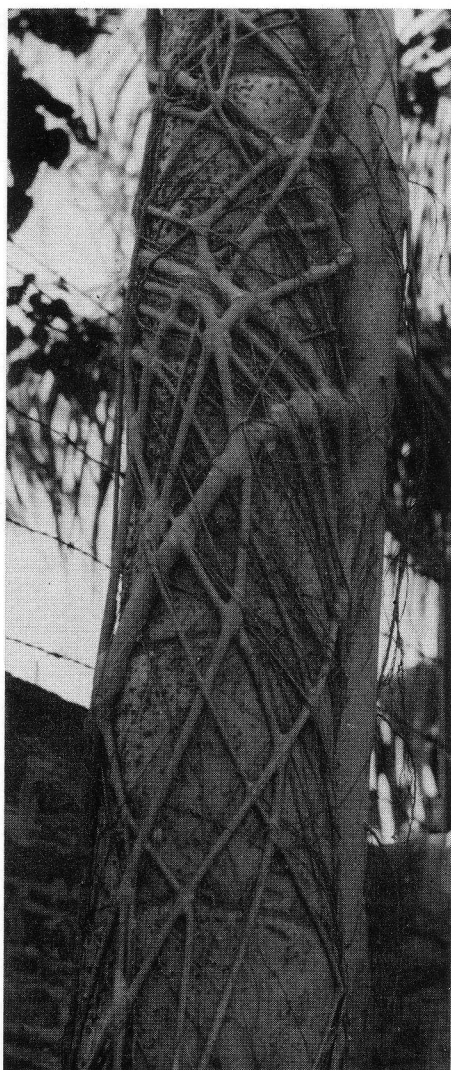
The massive epiphyte, *Ficus religiosa* in Fig. 7 has surrounded the *Borassus* trunk all around excepting at the base where the stem is partially visible. The palm seems to be little affected by the epiphyte as it continues to produce a good number of fruits each year. Also the trunk has not diminished in girth. Figure 8 is a closer view of the base of another *Borassus* gripped firmly by *F.*

religiosa. As the roots expand rapidly, the "windows" through which the palm trunk is visible will be soon covered up. This *Borassus* is also not seriously harmed by a massive epiphyte.

In Fig. 9, there are three *Borassus* palms infested by *F. religiosa*. The trunk of the palm at the right end which is not clearly visible is indicated by the arrow. These palms are growing on a roadside near the Calcutta airport. The lower trunk of the palm on the left has been completely covered by the roots of the *Ficus*. However, the shoot has not expanded as much as it could because of its being pruned periodically to avoid obstructing the telegraph and power lines. The palm at the extreme right is also fully engulfed by the epiphyte. However, the middle palm is covered only by a stump (marked X) of the *Ficus* as



9. Three *Borassus* stems partially covered by *Ficus religiosa*.

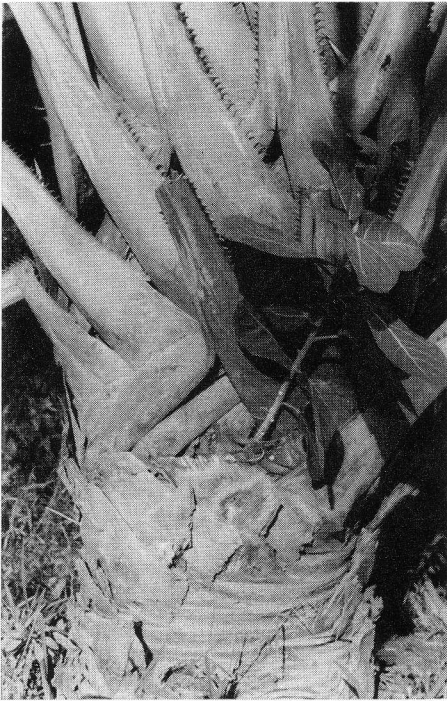


10. A reticulate root-matting of *Ficus religiosa* on the trunk of *Caryota urens*.

most of the original plant was destroyed by a serious attack of the lac insect (*Lacciferus lacca*).

In Fig. 10 is seen the lower part of the trunk of *Caryota urens* that was growing at the premises of the Indian Statistical Institute, Calcutta. Since the stem of *Caryota* is smooth, having no persistent leaf base, the epiphyte should have had its access to the palm through the axil of a living or drying leaf. Soon a few roots must have twined around the stem and supported the shoot even when the supporting palm leaf had fallen. I noticed this tree only at a very late stage

when the epiphyte struck many roots into the soil and the palm was about to be fatally damaged. The epiphyte's enormous foliage engulfed the entire palm crown. Though the *Caryota* was growing very close to an open farmyard manure pit with plentiful nutrients avail-



11. A seedling of *Ficus bengalensis* growing from a *Corypha elata* leaf axil.

able, the palm was not allowed by the epiphyte to produce even the first terminal spadix. The root-matting of the epiphyte has an impressive look (Fig. 10). The fusion at junctions of rootlets moving one across the other resembles welding together of thin and thick metallic rods in a tubular mantle. The *Ficus* has established itself into a large tree after the palm died.

Ficus bengalensis

Being a native tree, *Ficus bengalensis* (the common banyan) thrives luxuriently in Bengal (Northeastern India). The great banyan tree growing at the Indian Botanic Garden, Calcutta, with its 1100 or more proproots that function as "stems" and straggling to about 1500 feet along the circumference is perhaps



12. *Ficus bengalensis* "embracing" a *Phoenix sylvestris*.

the largest living *F. bengalensis*. This tree is honoured especially in literature as a benevolent protector of all who go under its shade, and adopted as the Emblem of Madhya Pradesh, a state in central India as well as the State Bank of India. It is worth mentioning that it is

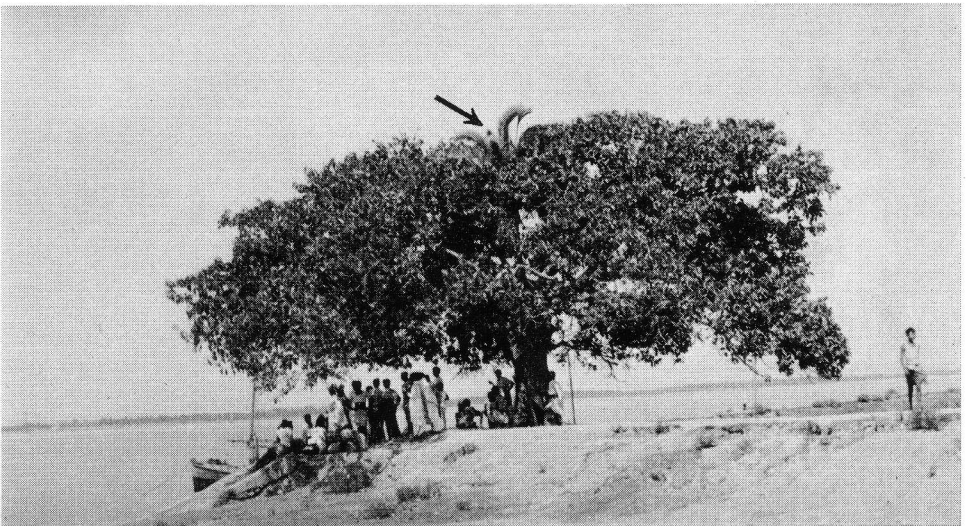


also the emblem of our Indian Statistical Institute. However, to many species of trees including palms, the banyan is not a good neighbor. In Bengal and to a lesser degree in other parts of India, this tree starts its development as an epiphyte, the way *F. religiosa* generally grows, on other trees. In addition to many species of dicotyledonous trees that are strangulated, the banyan also causes death to some palms, though not as often as *F. religiosa*.

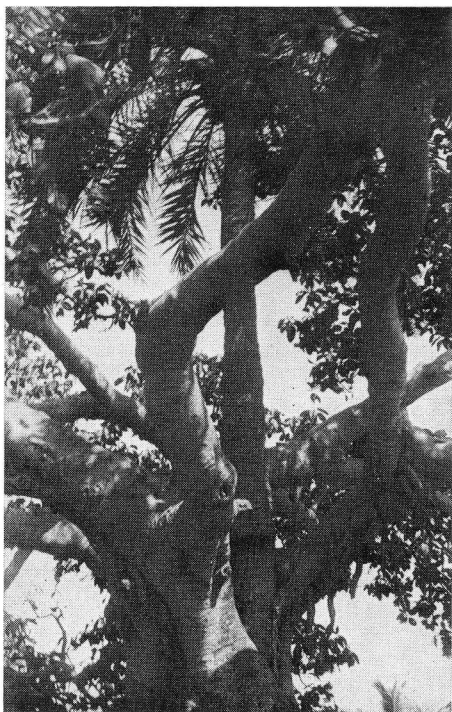
A young banyan seedling which survives exclusively as an epiphyte in the crown of a young *Corypha elata* palm is seen in Fig. 11. *Corypha* retains persistent leaf bases for a considerably long time after the withering away of the lamina. This tree is not inhabited by many epiphytes. Though the species is rare in India there are over a hundred individuals of this species growing at the Indian Botanic Garden, and practically

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13. An epiphytic banyan that has developed into a large tree.



14. The arrow points to the distal crown of a *Phoenix* which is about to be exterminated by a massive banyan.



15. Inner view of the host-epiphyte contact of the trees in Fig. 14.

all of them are free from such large epiphytes.

In Fig. 12, a middle-aged *Phoenix sylvestris* is covered with a banyan up to the base of the crown. Obviously the root tips have reached the soil and their aerial portions are in the process of spreading over the entire surface of the palm trunk. This palm is standing on the bank of river Hooghly (south of Calcutta) and the moisture has induced the several hanging roots visible in the illustration. The *F. bengalensis* enveloping the stem of *Borassus flabellifer* in Fig. 13 has developed into a full-grown tree. Yet its shoots are unable to suppress the palm crown. There is no trace of the palm trunk visible up to about fifteen feet from the ground as the *Ficus* has developed a tubular "stem" around it.

It looks as though the *Ficus* will not be able to win the race by overgrowing the *Borassus*. On the other hand it expands laterally.

An impressive view of how a *Ficus bengalensis*, starting as an epiphyte on a *Phoenix sylvestris*, encroaches on the latter leading to a stage of acute strangulation is seen in Fig. 14. This *Ficus* is capable of giving shelter to a hundred people and stands at a ferry point on the Hooghly river, 30 miles south of Calcutta. In Tamil literature, the banyan is eulogised as the tree growing out of a seed the size of an egg of a small fish, but spreading to such vast dimensions as to give shelter to a king and his huge army. The tree in Fig. 14 also started as an epiphyte on a *P. sylvestris* and the host tree just survives, its distal leaves being pointed to by the arrow mark. Considering its present height, the epiphyte must first have been established at the crown of the host when the latter was about half its height. The portion of the trunk below this has been completely encompassed by the banyan whose shoots at the beginning obviously concentrated on lateral development. Since the locality adjoins a wide river, there are strong winds, thereby height can be a decided disadvantage. The banyan has eventually spread out around the palm allowing a part of its crown to just peep out through its dense foliage as seen in Fig. 14. A view of the upper portion of the palm as visible from underneath the banyan showing some portion of its trunk is seen in Fig. 15. The palm is likely to be stifled to death in a couple of years. To support the above presumption, I present the photograph (Fig. 16) of a banyan which has killed its original host. The lower part of the stem of the host, *Phoenix sylvestris* which is clearly visible is not fully enveloped by the expanding roots of the foe. Within a radius of 50 miles from Calcutta I have



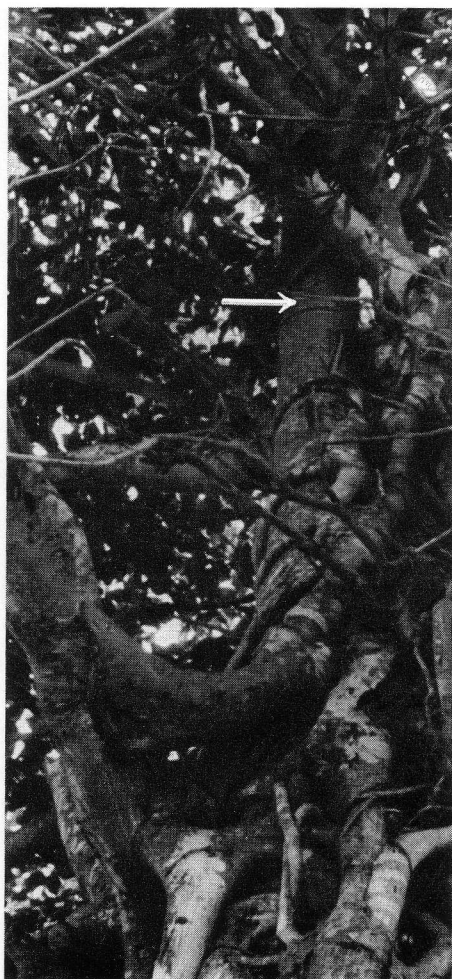
16. The epiphytic banyan stifled its host *Phoenix sylvestris*.

examined several huge *Ficus religiosa* and less frequently *F. bengalensis* trees showing some remnants of *P. sylvestris* trunk or a gap which would indicate the former position of the palm trunk within their "stems."

Another instance of *F. bengalensis* sapping a palm is seen in Fig. 17 where the victim is a delicate but elegant ornamental palm, *Livistona chinensis*, photographed at the premises of the Drug Research Institute, Lucknow (India). There



17. A *Livistona chinensis* under a banyan tree.



18. *Livistona rotundifolia* trunk entangled by the aerial roots of a banyan.

were many *L. chinensis* planted at this Institute along with several other flowering and shade trees, one being *F. bengalensis*. The latter has spread out its shoots and surpassed the expectation of the horticulturists. So much so that the banyan has shadowed and dwarfed many neighbouring trees. The several propoots hanging from the heavy banyan shoots are a great menace to other plants, one of the victims being a *Livistona chinensis* (Fig. 17) which has no chance of

escape from these "octopus tentacles." Not only have the aerial roots entangled the trunk, but also the crown has come entirely under the canopy of the banyan. In the present case, the killer of *L. chinensis* did not commence as an epiphyte, but as a neighbour with just the right to live as the other neighbours. In Fig. 18 is seen the lower portion of the trunk of a *Livistona rotundifolia*



19. *Philodendron* sp. climbing on a stem of *Caryota mitis*.

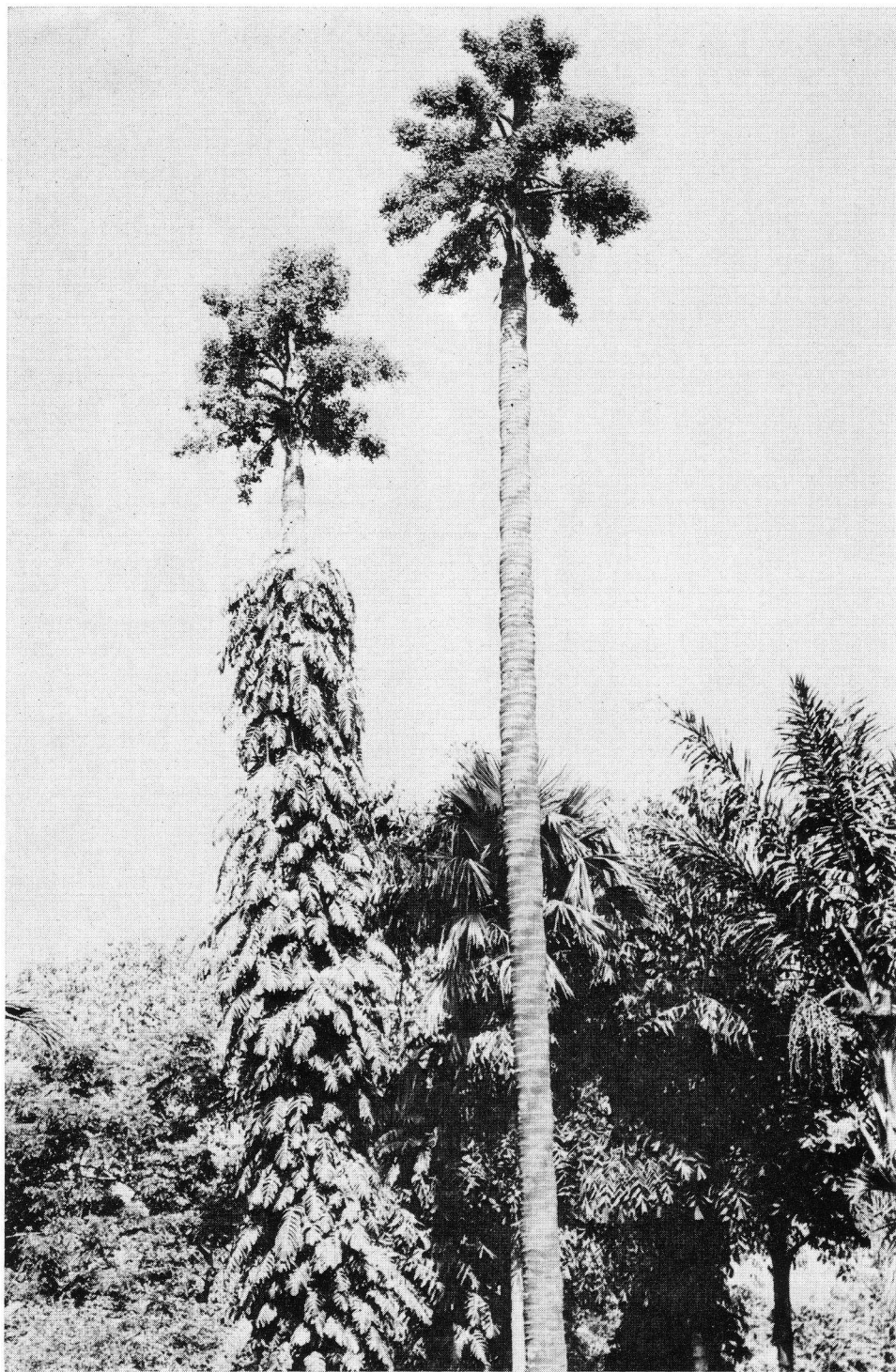
being completely overgrown by the aerial roots of *F. bengalensis* at the same Drug Research Institute. The redeeming feature in the present case is that the crown of the palm is well above the canopy of the banyan and looks as if it can never be overcome by the banyan.

Ficus aurea

Smith (1956) described with striking illustrations a *Sabal palmetto* being strangled by *Ficus aurea* which he observed at N. Wild Olive Avenue, Daytona Beach, U.S.A. which region is not the usual habitat of the killer *Ficus*. According to Smith, "birds deposit the fig seeds in the high boots of the palmettoes or on the branches of other trees, whence aerial roots descend to the ground and forms stems which gradually surround the host trunks and merge there. In time the host dies of strangulation, the trunk slowly decays and crumbles, and the woody fig enormously expands its own trunk to fill the vacated space, so that eventually no evidence of the murder remains."

Philodendron

Palms have several other epiphytes, man being responsible for some of them since palm trunks serve as ideal supports for ornamental creepers such as *Philodendron*, *Scindapsis*, *Pothos*, *Raphidophora* and the several species of orchids and cacti. Hodge (1959) published two most captivating pictures of palm trunks beset with ornamental plants. A species of *Echeveria*, which by nature is not epiphytic, planted on the trunk of a robust young *Phoenix* sp. growing in Mexico has a distinctive appearance. The other picture of Hodge shows orchids and ferns growing wild as epiphytes on the smooth trunk of a cultivated *Caryota* sp. There are several oil palms (*Elaeis guineensis*) in Malaysia bearing on their trunks several species of orchids and ferns as well as seedlings of the palms themselves. Though epiphytes usually stick to the trunks having persisting leaf bases or similar rough surfaces, in parts of Kerala State (India) even the smooth-stemmed coconut offers support to several species of orchids and other epiphytes.



20. *Raphidophora* sp. epiphytic on *Corypha elata*.

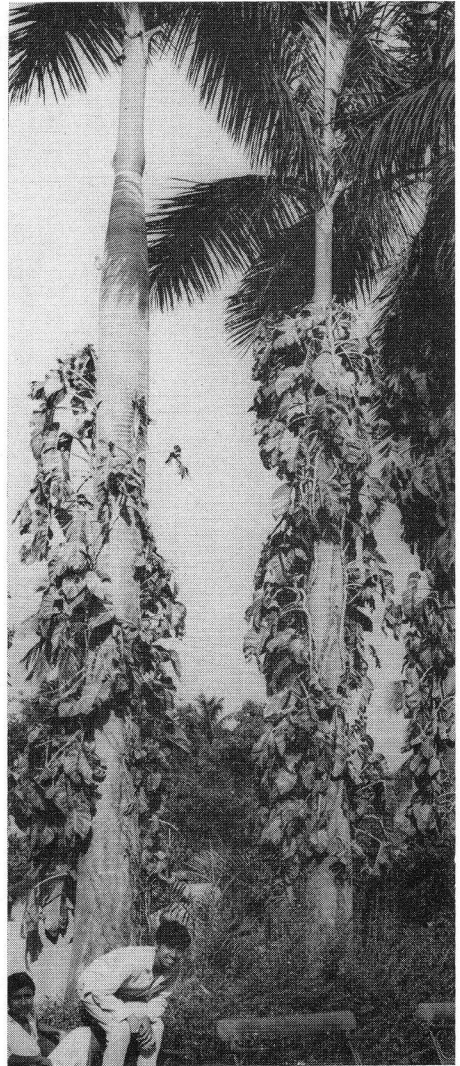
Caryota mitis is a smooth-stemmed clustering palm. Several such clumps are grown inside the Large Palm House of the Indian Botanic Garden, Calcutta. To enhance the beauty and to utilise the space more effectively, some of these palms are used as supports for the araceous epiphyte, *Philodendron* sp. as the one seen in Fig. 19. The several uniform roots that move downwards and cover the stem do not expand as those of *Ficus*. The leaves with deeply lobed lamina grow elegantly often obstructing the growth of the *Caryota* itself.

Raphidophora

Raphidophora sp. of the Araceae with its large, incised, dense leaves makes a good ornamental climber. Palm trunk forms ideal support for this species. At the Indian Botanic Garden, one will be able to see the view shown in Fig. 20 till about the end of 1970. The epiphyte has covered practically the entire trunk of one of the two stately *Corypha elata* palms with young fruits and shed leaves. The chances of *Raphidophora* choking the crown of *Corypha* is no longer possible as the palm is completing its normal life unhampered by the epiphyte.

Scindapsus officinalis

Growing money plant (*Scindapsus officinalis*) indoors or on garden trees is very common throughout India. The several small climbing roots produced at the nodal as well as internodal regions of the weak stem enable the ornamental plant to be an efficient epiphyte. It can get attached to even steep walls or even on smooth surfaces. In Bengal, where *Roystonea regia* adorns practically every park, *Scindapsus* with its large variegated leaves enhances their beauty by spreading on the trunks of these royal palms. The view seen in Fig. 21 is taken in a Calcutta suburb.



21. *Scindapsus officinalis* creeping on the trunks of *Roystonea regia*.

The photographs for Figures 4–6 were taken by Mr. S. K. De of the Crop Science Unit of the Indian Statistical Institute.

LITERATURE CITED

- HODGE, W. H. 1959. Palm trunks as living planters. *Principes* 3:77, 93–95.
SMITH, D. 1956. *Principes* 1:1, 3.