A Guide to the Palm Collection in the Botanic Gardens II.

PESTS.

Though not badly attacked as a whole by pests, palms have a number of enemies which have to be dealt with. In view of this fact it is felt that a few words concerning them, together with a few notes for guidance in dealing with them, would be helpful. These pests are practically all insects, being for the most part beetles and their larvae, the larvae of one or two butterflies, grasshoppers, scale, etc. The plants do not seem to suffer much from fungus diseases, in fact up to the present only two cases have come to the notice of the writer, these being on two species of *Cocos* which were attacked by a leaf fungus.

The following is an enumeration of the chief pests so far noted in the Botanic Gardens:—

Insects. (*a*) Beetles.

Rhyncophorus ferrugiens (Red Palm Beetle).
Rhyncophorus sp.
Oryctes Rhinoceros (Rhinoceros Beetle).
Various small beetles and weevils.

(*b*) Chafer.

Cetonica mandarinea.

(*c*) Butterflies.

Erionota Thrax, Larvae of.
Amathusia phidippus (Large Coconut Butterfly) Larvae of.

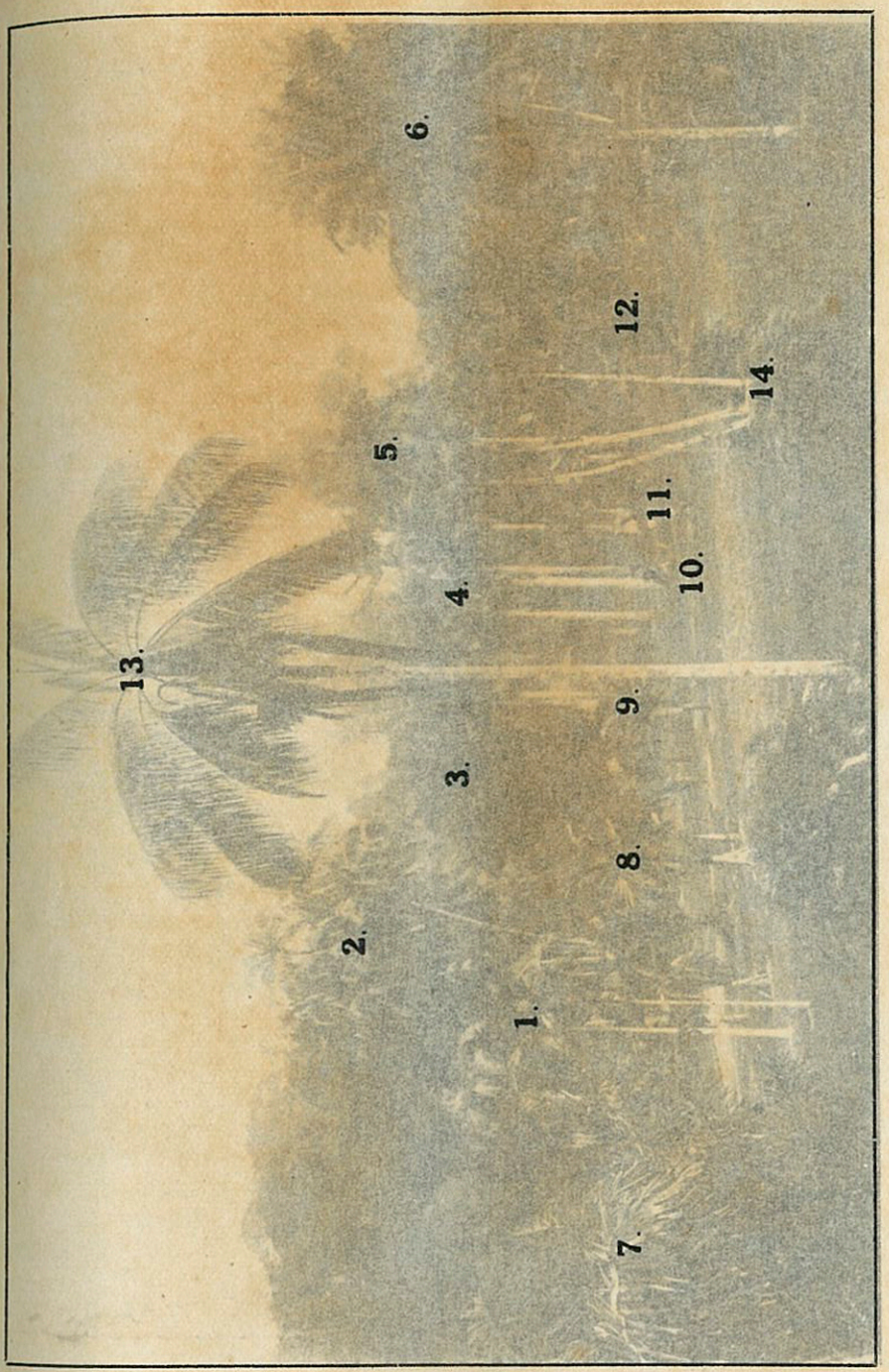
(*d*) Grasshoppers various.
(*e*) Coccids.
(*f*) Scale.
(*g*) Thrips.

Fungus. One leaf fungus not yet determined.

The above is not a very formidable list when compared with others plants *Hevea brasiliensis* see Gardens Bulletin, ii (1920) 186 for example, and on the whole they are all fairly easily dealt with. The following details are given for general guidance.

1. *Insects.*

(*a*) *Rhyncophorus ferrugiens* (Red Palm Beetle). Attacks the growing bud which is a very vital part in all palms. The eggs are laid in the bud and when hatched the large fleshy grubs burrow into the soft tissue of the bud, often times proving fatal especially to the single-stemmed species. As a rule only large plants are attacked seldom those in pots or tubs. The beetle is 1½ to 2 inches long, black and has red markings.



In the Palm valley, Singapore.

1. Actinorhytis calapparia, Wendl.
2. Oncosperma filamentosum, Bl.
3. Elaeis guineensis, Jacq.
4. Oreodoxa regia, H.B.K.
5. Ptychoraphis angusta, Becc.,
6. Heterospathe elata, Scheff.,
7. Arenga saccharifera, Labill.,
8. Verschaffeltia splendida, Wendl.
9. Stevensonia grandifolia, Dunc.
10. Hyophorbe amaricaulis, Mart.
11. Hyophorbe Verschaffeltii, Wendl.
12. Ptychosperma McArthuri, Wendl.
13. Euterpe Jenmanii, Wright.
14. Chrysalidocarpus lutescens, Wendl.

In the Palm valley, Singapore.

Treatment. If stringent measures are taken the plant can often be saved provided the growing point has not been destroyed. The leaves should be removed and the young leaves cut right down exposing the growing point. The grubs should then be removed and the whole thing covered with a mat or gunny bag to protect it from rain until growth commences.

The genera attacked by the beetle are chiefly *Verschaffeltia, Stevensonia, Oncosperma, Cocos, Oreodoxa, Attalea* and *Livistona.*

In this connection of course it is best known as attacking *Cocos nucifera* (Coconut).

Rhyncophorus sp. This is a larger species than the preceding and attacks in the same manner especially *Oncosperma.* It should be dealt with in the manner recommended for *Rhyncophorus ferrugiens.*

Oryctes Rhinoceros (Rhinoceros Beetle). This beetle attacks differently from those mentioned above though the result is the same and it is the growing bud which suffers. In this case the beetle itself burrows into the stem of the palm near to the growing point, making a large hole quite ½″ in diameter. Once inside it begins feeding on the soft tissue and if not quickly dealt with the damage is fatal to single stemmed palms. The injury caused by the forcible entry into the trunk causes the plant to exude a considerable amount of liquid which takes the form of a very gummy substance. When this is present in any quantity it is a sure sign of the presence of these undesirable pests. When search is made for them they will generally be found inside the stem, but also occasionally, in the sheathing bases of the leaves.

Treatment. This pest is easy to deal with. The beetles should be speared with some sharp pointed object and when all have been removed a little salt should be sprinkled in the hole, this is a useful deterrent to other beetles seeking a suitable place to attack the palm. A sharp look out should be kept for this pest as it is very destructive. If treated soon enough the infected plant soon recovers.

A specimen of *Verschaffeltia splendida, Wendl.* in the Palm Valley demonstrates very effectively the manner in which this pest attacks. The hole in the trunk about five feet from the ground is quite easy to find. Whether this specimen has quite recovered it is difficult to say, but as the attack took place about five months ago, it seems likely that it was dealt with before the growing point had been injured. In any case it is under close examination and it is hoped that it is saved.

The larvae of this pest live in cowdung, decaying leaves and wood, and therefore piles of this should not be allowed to accumulate.

The genera attacked by this beetle are *Cocos* (particularly *Cocos nucifera, L.*, the Coconut) *Stevensonia, Verschaffeltia, Oncosperma,* and occasionally *Elaeis guineensis Jacq.* the African Oil Palm.

Various small Beetles. Under this heading are included various beetles and their larvae which attack the leaf-sheaths, causing the leaves to appear spotty when unfolded and the plant to appear sickly generally.

As a rule, they are in places which are inaccessible to insecticide in the usual way, and more stringent methods have to be adopted in dealing with them. All dead and badly affected sheaths should be removed and all beetles and larvae thus discovered must be destroyed. A good plan is to burn the sheaths straight away. Some reliable insecticide should then be dropped amongst the remaining leaves and allowed to penetrate wherever possible, this will effectually expel those remaining. Care should be taken in choosing the insecticide as it is sometimes necessary to put it in close proximity to tender parts of the plant. Soft soap, or tuba-root powder is suggested for this use.

(*b*) *Cetonica mandarinea.* The larvae of this chafer attack the roots of tub and pot plants. The signs by which they can be detected are a general sickliness in appearance of the attacked plant.

Treatment. The plant should be turned out of its pot or tub and all grubs destroyed. They are easily recognised by their dark, dirty looking bodies and hard brown heads. After this operation has been carried out the plant should be repotted in fresh soil and a clean pot or tub.

(*c*) *Amathusia phidippus* (Large Coconut Butterfly). The larvae of this butterfly attack the leaflets usually of full grown plants, leaving only the midribs. The caterpillar is smooth, bright green with a broad head and two projecting spikes on its tail.

Treatment. The caterpillars should be picked off and destroyed. Afterwards the plants might be sprayed with tuba root insecticide to prevent more depredations.

Erionota Thrax. The larvae of this butterfly attack the leaves of some palms causing them to roll up, after which they proceed to devour them. The caterpillar is about two inches long, pale sea green in colour, covered with a mealy powder.

Treatment. Pick off by hand and burn, afterwards spraying with insecticide as in the preceding case.

(*d*) *Grasshoppers.* These are occasionally troublesome particularly to young plants. The best way of dealing with them is to catch them in a butterfly net or with a stick dipped in bird-lime.

(*e-f*) *Coccids and Scale.* Both of these pests are fairly abundant. They are particularly troublesome to young plants, though by no means confined to them, as often quite large plants are attacked.

Treatment. These must be dealt with by hand. The best way is to sponge them off the infected parts with a soft soap and paraffin solution.

(*g*) *Thrips.* These tiny insects are very troublesome quite spoiling the appearance of the new leaves, giving them a very blotchy appearance.

Treatment. They can be either sprayed or sponged with a soft soap and paraffin solution.

2. *Fungus.*

As previously stated the writer has only seen one case of fungus attack in the Gardens. Both of the plants attacked being members of the genus *Cocos* (*C. plumosa, Lodd.* and *C. flexuosa,* Mart.). They were attacked by a leaf fungus which caused the leaves to become brown and die off. The following measures were taken to deal with the disease.

Treatment. All the dead leaves, infected leaves and parts of leaves were removed and burnt. The plants were then sprayed with Bordeaux mixture. Up to the present the plants seem to have completely recovered and are already sending up new leaves.

Economic Uses.

The economic value of the palms is widely recognised and the palm family as a whole ranks very high in the list of families of economic value. Apart from the valuable industries of copra, rattans, oils, etc. there are many products which are of great local value and are extremely interesting. Some species seem to be invaluable and of these *Cocos nucifera, L.* is an outstanding example.

The following list, it is hoped, will serve to show how valuable palms are in the production of many articles in daily use, as well as in the important industries mentioned above.

The parts of the plant from which they are obtained are also indicated.

Stem and leaves.—Attaps, Fans, Umbrellas, Baskets, Hats, Mats, Brushes, Wax, Arrows, Spears, Fishing-rods, Sandals, Fancy Articles, Fibre, etc.

Bud.—Cabbage, used as a vegetable, to the detriment of the plant unfortunately.

Inflorescence.—Toddy, which is converted into Sugar, Spirit, Vinegar, etc.

Fruit.—Copra, Oil, Food, etc.

Further notes on this important subject will be given with the description of each species.

List of Genera represented in the Botanic Gardens.

The following list is arranged after the classification of Bentham and Hooker in the Genera Plantarum.

The countries from which they have been introduced are also indicated.

Arecineæ.

1. Areca, L. Trop. Asia; Malay Archipelago; East Indies.
2. Pinanga, Bl. India; Malay Archipelago; East Indies; Philippines.
3. Loxococcus, Wendl. and Drude. Ceylon.
4. Actinorhytis, Wendl. Malaya.
5. Archontophoenix, Wendl. and Drude. Australia.

6. Dictyosperma, Wendl. and Drude. Mauritius.
7. Ptychosperma, Labill. Australia; Polynesia.
8. Ptychococcus, Becc. New Guinea.
9. Coleospadix, Becc. New Guinea.
10. Rhopaloblaste, Scheff. Moluccas.
11. Cyrtostachys, Becc. Malay Peninsula.
12. Chrysalidocarpus, Wendl. Madagascar.
13. Oncosperma, Bl. Ceylon; Malaya.
14. Euterpe, Gaertn. West Indies.
15. Ptychoraphis, Becc. Singapore; Nicobar Islands.
16. Oreodoxa, Willd. West Indies; Trop. America.
17. Calyptrocalyx, Bl. Moluccas.
18. Malortiea, Wendl. Trop. America.
19. Heterospathe, Scheff. Amboina.
20. Iguanura, Bl. Malay Peninsula.
21. Stevensonia, Dunc. Seychelles.
22. Verschaffeltia, Wendl. Seychelles.
23. Dypsis, Noronh. Madagascar.
24. Chamædorea, Willd. Mexico.
25. Hyophorbe, Gaertn. Mauritius; Mascarene Islands.
26. Orania, Zippel. Malaya; Philippines; Moluccas.

Caryotideæ.

27. Wallichia, Roxb. India.
28. Didymosperma, Wendl. and Drude. Malay Peninsula; Java.
29. Arenga, Labill. Formosa; Malay Peninsula; Christmas Islands; Borneo; India.
30. Caryota, L. Trop. Asia; Malaya; Java; Philippines.

Phœniceæ.

31. Phoenix, L. Africa; India; Ceylon; Siam; China.

Corypheæ.

32. Corypha, L. India; Borneo.
33. Sabal, Adans. Southern United States America; West Indies; Trop. America.
34. Teysmannia, R. and Z. Malaya.
35. Acanthorhiza, Wendl. Central America.
36. Copernicia, Mart. Brazil.
37. Licuala, Thunb. India; Malaya; Polynesia; Moluccas.
38. Livistona, Br. Indo-Malayan region; China; Cochin-China; New Guinea; Philippines; Australia.
39. Pholidocarpus, Bl. Malaya.
40. Rhapis, L. China; Japan.
41. Thrinax, L. West Indies.
42. Cocothrinax, Sarg. West Indies.

Lepidocaryeæ.

43. Dæmonorops, Bl. India; Malaya.
44. Calamus, L. India; Ceylon; Malaya; Philippines; East Indies.
45. Korthalsia, Bl. Malaya; Java.

46. Myrialepis, Becc. Malaya.
47. Zalacca, Reinw. Malaya; Java.
48. Metroxylon, Rottb. Malaya; Borneo.

COCOINEÆ.

49. Bactris, Jacq. Brazil; Colombia.
50. Desmoncus, Mart. Brazil.
51. Astrocaryum, Mey. Mexico; Trop. America; South America.
52. Martinezia, R. and P. Venezuela; West Indies.
53. Elæis, Jacq. Africa.
54. Cocos, L. Tropical and Sub-tropical America.
55. Maximiliana, Mart. Brazil.
56. Attalea, H. B. K. Brazil; Peru.
57. Pseudophoenix, Wendl. Florida.
58. Raphia, Beauv. Trop. Africa; Madagascar.

BORASSEÆ.

59. Borassus, L. India; Africa; Malayan Peninsula.
60. Lodoicea, Comm. Seychelles.
61. Latania, Comm. Mauritius.
62. Hyphæne, Gaertn. Africa.

A general description of the Palm family has already been given. It is now proposed to take the individual species separately.

PALMÆ.

Shrubs or trees, solitary or gregarious, armed or unarmed, rarely pubescent. *Stem* erect, scandent or decumbent, rarely branched above. *Leaves* alternate, plaited in bud, pinnatisect or palmate, rarely simple or bipinnate; petiole sheathing. *Flowers* 1 or 2 sexual, small, in panicles or spikes that are enclosed in one or more large sheathing bracts, generally termed spathes, usually 3-bracteate. *Perianth* inferior, segments 6 in two series, sepals and petals, usually all free, imbricate or valvate. *Stamens* 3 or 6 rarely more; anthers versatile. *Ovary* 1—3 celled or of 3 1-celled carpels; stigmas 3, usually sessile; ovules 1—2 in each carpel, adnate to the wall, base or top of the cell, anatropous. *Fruit* a 1—3 celled drupe or hard berry or of 1—3 carpels. *Seeds* erect or laterally attached, rarely pendulous; albumen horny or bony, solid or ruminate.

Genera about 140. Chiefly tropical.
Represented in the Gardens—about 60 genera.

No key to the genera has been inserted owing to its highly technical character. A key to enable visitors to distinguish specimens in the Gardens will be given later.

The descriptions have been kept as simple as possible, but to describe a species accurately without using a fair number of technical expressions is very difficult and would make them very long. Where practicable a key to species has been inserted, based on general characters as much as possible.

1. Areca, L.

Large or small palms either single or many stemmed, erect, ringed by scars of fallen leaves. *Leaves* pinnate. *Inflorescence* produced below the leaves, consisting of spathe and spadix, the former enclosing the latter. *Spadix* branches numerous, slender, terminal portions male, with a few female flowers at the base of each branch. *Male flowers* asymmetric, very small; sepals ovate, small; petals lanceolate often ribbed obliquely; stamens 3 to 6 in number; anthers attached by base. *Female flowers* much larger; sepals ovate, flat with a circular outline; petals slightly longer than sepals; stigmas 3, small; ovule, erect, basal. *Fruit* ovoid-oblong tapering towards each end; stigma terminal. *Seed* ovoid, truncate, that is as though cut off at the end; albumen ruminate.

Species 10, Indo-Malaya and Australia. Represented in Gardens 4.

The four species of *Areca* represented in the Gardens are, with the exception of *A. triandra, Roxb.*, very alike in general appearance. This renders it somewhat difficult to make a key without using much technical detail. However an attempt has been made to separate the species on leaf and fruit characters.

Single stemmed.

Leaflets about 30 pairs, placed fairly closely on the rhachis, fruit ovoid ..	1. *A. Catechu*
Leaflets about 20 pairs, placed fairly widely apart on rhachis, fruit spindle-shaped	2. *A. concinna*
Leaflets about 40 pairs, placed close together on rhachis, fruit obovate ..	3. *A. glandiformis*
Several stemmed	4. *A. triandra*

1. *Areca Catechu,* L. Sp. Pl. 1189. (Pinang or Betel Nut Palm.)

Stem.—Solitary, from 40 to 60 ft. in height when fully grown; diameter 8-12 inches, straight, cylindric, grey, of equal thickness throughout. *Crown* small in comparison with height. *Leaves* 4-6 ft. in length, spreading; leaflets many, 1-2 ft. long, linear, many veined, having 2 to 3 prominent ribs, lower leaflets acuminate, upper præmorse that is as though the end were bitten off, topmost leaflets short and broad. *Sheath,* long, smooth, green. *Spathe* simple, flattened, glabrous, produced below the leaves. *Spadix,* shortly peduncled, 12-18 in. long, branched at the base in a paniculate manner; branches filiform, bearing pendulous male spikes at their extremities. *Male flowers* small, disposed more or less in two rows; sepals 3, very small, and triangular; petals longer, oblong, rigid, marked with fine lines; stamens six. *Female flowers* 1-3 at the bases of the spadix branches or in their axils, larger than the male; sepals $\frac{1}{3}$ in. long, ovate, obtuse; petals longer than sepals. *Fruit* ovoid, orange or scarlet, 1-2 inches long. *Seed* $\frac{3}{4}$ inch in diameter, ovoid.

This palm is much cultivated throughout Trop. Asia, Malaya, etc. Its origin is not known as it is always found as a cultivated plant only.

The fruits are much used by the natives for chewing purposes and impart the red appearance to the lips and teeth when being masticated with betel leaves.

It has certain medicinal properties, and is chiefly used as an astringent and vermifuge. It is also used as a medicine in the treatment of worms in dogs.

There are also two specimens of a yellow form of *Areca Catechu, L.* This form is quite yellowish in appearance and produces yellow fruits. It can be seen in the Palm Valley in close proximity to the other species of *Areca.*

2. *Areca concinna,* Thw. Enum. 328 (1864).

Stem.—Solitary, from 8-12 ft. in height, 1-3 inches in diameter, cylindric, green. *Crown*—Larger than in *A. Catechu. Leaves* 3-3½ feet in length, spreading; leaflets 1½ to 2 feet in length, 2-3 inches broad, lanceolate, sickle shaped, acuminate, almost glabrous, lower simple, one ribbed, upper 2-3 ribbed, topmost pair of pinnae very broad, toothed at the margin. *Sheath* fairly long, up to 18 inches. *Spathe,* flattened. *Spadix* up to 1 foot in length, shortly peduncled, paniculately branched, branches filiform bearing male flowers in pendulous spikes at their extremities, female flowers borne in axils of branches or at their bases. *Male flowers*—arranged in two rows, small; sepals oblong, obtuse; petals nearly three times as long as sepals, obliquely ovate-lanceolate, acuminate, ribbed or striped; stamens 6. *Female flowers* very small; sepals form an unequally lobed cup of very tiny dimensions, petals, ovate oblong, obtuse. *Fruit* 1½ inches long, almost spindle shaped and bearing a protuberance in the centre, scarlet.

Habitat.—Ceylon.

The fruits of this *Areca* are also chewed with betel and are generally obtained from wild specimens. Only small specimens up to about 6 ft. in height are present in the Gardens collection.

3. *Areca glandiformis,* Lam. Encyl. 1. 241.

Stem.—Solitary, up to 40 ft. high, cylindric, annulate, diameter 4 to 6 inches. *Crown* medium. *Leaves* produced at top of stem, 4 to 6 or more feet in length, dark green; leaflets several, reduplicate, that is doubled back at the edges, sub-opposite, 1½ to 2 ft. in length, 1½ to 2 inches broad, linear lanceolate, acuminate, glabrous, green above, slightly glaucous below, nerves several, pale. *Spadix* produced below the leaves, monoecious, pendulous, peduncle about 4 inches long, several branches. *Male flowers* distichous, small; stamens 6. *Female flowers* larger than male; calyx lobes coriaceous, ovate, acute or acuminate, stigmas 3. *Fruit* longly-obovoid, glabrous, cuspidate, olive coloured at first, turning later to red.

Habitat.—Moluccas.

The specimens of this species present in the Gardens are to be found in the Palm Valley. No specimen is at present more than 20 ft. in height.

4. *Areca triandra,* Roxb. Hort. Beng. 68.

Stem.—Soboliferous, producing several strong stems, annulate, internodes fairly wide apart, green, up to 15 ft. in height, diameter 1-1½ inches. *Leaves* 3 to 4 ft. long, spreading, light green; leaflets 1½ to 2 feet long, 1 to 3 inches broad, linear lanceolate, acuminate, upper leaflets confluent producing a broad, præmorse pair of pinnae; nerves 2 or 3 in all but the top pair in which there are up to 7. *Spathe* 1 foot or more in length. *Spadix* shortly peduncled, up to 1 foot in length over all, branches many, paniculate. *Male flowers* small, disposed in two rows; sepals 3, small; petals larger than sepals; stamens 3. *Female flowers* 1-3 at base of branches of spadix or in the axils, larger than male; sepals shorter than petals, small. *Fruit* about the size of an olive, orange coloured eventually scarlet, upwards of 1 inch in length, ¼″ in diameter at middle, ellipsoid, tapering to base, truncate at apex, beaked.

Habitat.—India.

This plant is easily distinguished from the other species of *Areca* in the Gardens collection, on account of its soboliferous habit, the others all being single stemmed. Several specimens may be seen in the Palm Valley, it being quite an ornamental plant.

2. Pinanga, Blume.

Single or many stemmed palms, often producing good strong clumps, varying in height from 2 ft. in some species to 12 ft. or more in others, unarmed. *Stem* erect, annulate. *Leaves* pinnate with the upper leaflets confluent, more rarely entire; leaflets vary in length and breadth fairly considerably in different species. *Inflorescence* produced below the foliage. *Spathe* varying in size from 1 in. to over 1 ft., solitary. *Spadix* branched; flowers arranged distichously or spirally, one female between two males. *Male flowers* symmetric; sepals acute, keeled, not imbricate; petals ovate or lanceolate, valvate; stamens 6 or more; anthers erect, affixed by base. *Female flowers* much smaller, ovoid or globose, sepals and petals orbicular; ovary 1-celled, stigmas 3; ovule basal, erect. *Fruit* drupe, ovoid or elliptic. *Albumen* ruminate.

Species about 50. India, Malay Archipelago.
In the Gardens 7 species.

Dwarf palms—up to 4ft. in height.
- Leaves broad as long .. .. .. 1. *P. disticha*
- Leaves twice as long as broad .. .. 2. *P. subruminata*

Tall palms—up to 10 ft. in height.
- Stems ½ to 1½ inches in diameter.
  - Leaflets numerous .. .. .. 3. *P. malaiana*
  - Leaflets few.
    - Leaflets linear or linear lanceolate 4. *P. riparia*
    - Leaflets sigmoidly lanceolate .. 5. *P. patula*

Stems 2 to 2½ inches in diameter.

Leaflets 7 or 8 pairs	6. *P. fruticans*
Leaflets 20 to 24 pairs	7. *P. ternatensis*

1. *Pinanga disticha,* Bl. Rumphia, ii. p. 77 (Pinang Luggong).

Stems several, slender, up to 3 ft. in height, diameter ¼", green. *Leaves* usually simple, divided into 2 lobes, or with a few broad acuminate leaflets, up to 1ft. in length, dark green mottled with yellowish-green patches, nerves prominent, numerous; petiole up to 4 inches in length, scurfy; sheathes short, up to 3 inches. *Spathe* oblong, beaked, about 1 inch in length. *Spadix* solitary, occasionally branched, 1 to 4 inches in length, deflexed, green, peduncle tomentose; flowers distichously arranged. *Male flowers* ⅛ in. long; sepals short, rounded; petals ovate, acuminate; stamens usually 15. *Female flowers* small; sepals orbicular; petals ovate, with sharp rigid point; pistil much longer than petals; stigma capitate. *Fruit* drupe ½ inch in length, ovoid, acute, red. *Seed* elliptic.

Habitat.—Malaya.

This pretty little palm makes a charming pot plant when well grown.

2. *Pinanga subruminata,* Becc. Males. iii. 174.

Stems short, erect, about 2 feet in height, diameter about ⅜ inch, annulate; internodes about 1 inch long. *Leaves* narrowly cuneate, forked, sometimes very deeply, apex truncate, toothed, light green, up to 12 inches in length, 3 to 4 inches wide; nerves numerous and strong; petioles about 2 inches long; sheaths about 2 inches long, ribbed. *Spathe* 3-angled, about 1½ inches in length, more or less oblong, having two horns about ¼ inch in length at the apex. *Spadix* solitary, deflexed, glabrous, up to 4 inches in length, thickening in fruit; flowers distichous or spiral, often opening and producing fruit inside the spathe. *Male flowers* ¼ inch long; sepals acuminate, deltoid; petals linear, narrow; stamens about 12. *Female flowers,* sepals round, spreading; petals erect, orbicular, larger than sepals; pistil conical. *Fruit,* drupe about ½ inch long, elliptic, beaked, red. *Seed* elliptic, subacute.

Habitat.—Malaya.

I have found only one plant of this species, in the Gardens.

3. *Pinanga malaiana,* Scheff. Natuurk. Tijdschr. Nid. Ind. xxxii, 175. (Pinang Dampong).

Stems several, slender, up to 12 ft. in height, diameter 1 inch, internodes about 3 inches long. *Leaves* pinnate, large, from 5 to 8 ft. in length, spreading; leaflets linear acuminate, about 15 inches in length, ½ to 1 inch broad, dark green, glaucous beneath, having 2 prominent nerves; petiole about 18 inches in length. *Spathe* about 10 inches in length, oblong. *Spadix* deflexed, stout, about 12 inches in length; branches 2—5, flattened, red in fruit; flowers arranged in two rows. *Male flowers* flat; sepals lanceolate;

petals much larger; stamens, filaments short. *Female flowers* sepals and petals very short; stigma in form of a disc (discoid). *Fruit,* drupe ¾ inch in length, narrowed at both ends, black when ripe. *Seed* olive-shaped with a truncate apex.
Habitat.—Malaya.

4. *Pinanga riparia,* Ridley, Journ. Roy. As. Soc. Straits Branch, xliv (1905) 201.

Stems several, distant, up to 12 ft. in height, ½ to 1½ inches in diameter, internodes 3-4 inches in length. *Leaves* about 3 ft. long, pinnate; rachis angled, scurfy; leaflets three or four pairs of lateral and one terminal bilobed one, lateral leaflets linear or linear lanceolate, acuminate, with 3 to 6 nerves, 3 to 9 inches in length, 1 to 2 inches broad, terminal leaflet broad, bilobed, many nerved, coarsely toothed. *Spadix* decurved, peduncle stout, about ¾ inch in length, branches 3 or 4, stout, 6 to 7 inches long; flowers distichous, close. *Female flowers* globose, about ⅛ inch in length; sepals and petals very short; stigma in form of a disc. *Fruit,* drupe ¾ inch in length, narrowed at both ends, black when ripe. *Seed* olive-shaped with a truncate apex.

Habitat.—Malaya.

5. *Pinanga patula,* Bl. Rumphia, ii, 86, t. 115.

Stems several, slender, up to 10 ft. in height, diameter ½ to 1 inch, internodes 2½ to 3 inches long. *Leaves* 2 to 3 ft. in length, pinnate; leaflets about 6 pairs, sigmoid, acuminate with a long point, narrowed at the base, terminal leaflet deeply divided, apex toothed, 7 inches in length, 2 to 2½ inches wide, dark green; nerves 3 to 7. *Spadix* 4-branched, deflexed, branches slender about 6 inches long, red in colour. *Male flowers* not seen. *Female flowers* small; sepals orbicular, margins crenulate and appear as though bitten; petals smaller and rounder. *Fruit* drupe, flesh colour, elliptic, ribbed, about ½ inch long. *Seed* elliptic, ruminate.

Habitat.—Malay Peninsula, Sumatra.

This species forms very effective clumps and in common with most *Pinangas* is always very clean stemmed.

6. *Pinanga fruticans,* Ridley, n. sp. MSS.

Stems several, close, light green, annulate, up to 10 ft. in height, diameter 2-2½ inches; internodes 2 to 2½ inches long. Leaves up to 5ft. long, light green; petiole 1 to 1½ ft. long, yellow, scurfy; sheath 1 to 1½ ft. long, very scurfy giving a brownish appearance; leaflets 7 or 8 pairs, 1½ to 2 ft. long, 4 to 5 inches wide, trapeziform acuminate, 5 to 7 nerved, upper 2 pairs of leaflets 9-nerved, very broad, strongly toothed præmorse. *Spathe* boat shaped, reddish, papery, caducous. *Spadix* red, 8 or 9 branched; peduncle ¾″ long, stout; branches up to 9 inches long; flowers distichous. *Male flowers* ¼″ in diameter; sepals ovate acuminate, flesh colour; stamens 12. *Female flowers* smaller than the male, orbicular; sepals ovate acute; stigmas 3. *Fruit* almost round, slightly narrowed at the base, ¼ inch long, at first light green, when ripe quite black.

Habitat.—Java.

Up till quite recently this plant was called *P. Kuhlii,* Bl., but Ridley has now made it a new species. There are several specimens of it in the Gardens. It spreads itself all over the place, and in a shady spot makes a very ornamental plant.

7. *Pinanga ternatensis,* Scheff. Ann. Jard. Buitenz. i (1876) 149.

Stems several, close, green, annulate; internodes 3-4 inches long. *Leaves* 6-8 ft. long, light green; petiole 1-1½ ft. long, yellow, scurfy; sheath 1½ ft. long, very scurfy giving a brownish appearance; leaflets 20-24 pairs, acuminate, 1½-2 ft. long, 1-1½ inches broad, generally 2 ribbed, upper pair of leaflets præmorse, 2 inches broad, strongly nerved, having 6 nerves, next five pairs of leaflets bifid or præmorse, 1″ broad. *Spathe* boat-shaped, brown, caducous. *Spadix* red, 12 branched; peduncle short, 1 inch long, stout; branches 9″ to 1 ft. long. *Male flowers* ¼″ in diameter; petals 3, ovate, acuminate; stamens 18, filaments much shorter than the anthers. *Female flowers* orbicular; sepals ovate, acute. *Fruit* ½ inch long, oblong, truncate at base and apex, at first yellow, when quite ripe black.

Habitat.—Ternate Islands.

This plant is very like *P. fruticans,* Ridley, in appearance, but it has considerably more leaflets, and a more branched spadix.

3. Loxococcus, Wendl. and Drude.

Trunk tall, erect, cylindric, annulate. *Leaves* pinnate; leaflets linear, obliquely truncate, margins of leaves folded back, surface plaited lengthwise. *Spathe* 2, boat shaped. *Spadix* monœcious, that is stamens and pistils in separate flowers on the same inflorescence, branched; flowers in threes, mostly in clusters of a female between two males, spirally arranged around the branches. *Male flowers,* sepals 3, orbicular, imbricate; petals 3, much larger, ovate, valvate; stamens 9-12, filaments very short, anthers subversatile; pistillode, minute, ovoid. *Female flowers* smaller than male, sub-globose, sepals orbicular, broadly imbricate, tips valvate, staminodes 0; ovary 1-celled, stigmas 3, minute, ovule parietal. *Fruit* subglobose, beaked with a sharp rigid point, stigmas terminal, endosperm ruminate. Monotypic.

Species 1, Ceylon. Represented in Gardens 1.

1. *Loxococcus rupicola,* Wendl. and Drude in Linnœa, xxxix, 185.

Stem.—Solitary, erect, up to 40 ft. in height, 4-5 inches in diameter, swollen slightly at base, annulate. *Leaves* spreading 6-8 ft. in length, pinnate; petiole 1-1½ ft. in length, with green smooth base; leaflets 12-20 pairs, up to 2 ft. in length by about 2½ inches in breadth, spreading, somewhat recurved, linear, subglaucous beneath with scattered furfuraceous scales; sheath very short. *Spathe* about 1 ft. long, pale yellow, clothed with reddish scales. *Spadix* produced below the leaves, blood red in colour, about 1 ft. in length, triangular when fully developed; peduncle

short, branches spreading, glabrous; flowers spirally arranged, generally in scattered clusters of 3, males in pairs towards the upper part of the branches, females solitary between 2 males in lower part. *Male flowers* ½ inch in diameter; stamens 12, filaments equalling the anthers. *Female flowers* ovoid with appressed perianth segments. *Fruit* globosely ovoid, about 1 inch in length. *Seed* globose.

Habitat.—Ceylon.

This palm has not yet fruited in the gardens, though it has several times flowered. The plant which is in the Palm Valley is at present about 15 feet in height and is very attractive with its close growing crown of leaves and blood red flower spikes.

F. Flippance.

(*To be continued.*)

Polyembryony.

Two instances of what presumably are cases of polyembryony were recently noticed by Mr. G. B. Deshmukh on germinating seeds in the Economic Gardens.

In one case, that of *Citrus decumana,* L. the Pomelo, one seed bore five shoots each with its own diminutive cotyledon and rootlet. These shoots were separated and planted and have done well.

The other case was a seed of the Avocado Pear, *Persea gratissima, Gaertn.* which gave rise to six shoots and a common root. They were difficult to separate and have been allowed to grow as they arose.

The above seeds took longer to germinate than the normal seeds did, and the first shoots were somewhat weakly in their early stages.

Mr. Deshmukh also reports that at the same time adventitious buds were observed on the leaves of a cabbage.

T. F. C.

Relation of Soil Acidity to Plant Juice.

In Soil Science Vol. VII, No. 6. E. Trong and M. R. Meacham bring to a conclusion their paper on Soil Acidity in its bearing on the acidity of the Plant Juice. In view of the large amount of fruit planting at present contemplated in Malaya the following extract from the above quoted paper should prove of value in influencing planters in their selection of soil.

"There are considerable differences in the acidities of juices of different species of plants. The acidity of each species of plant, while it may vary to an extent easily measurable, is, however, usually limited to a rather narrow range. Undoubtedly for each species of