Axillary Buds of Some Tropical Trees

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Abstract

The presence and development of axillary buds are important in shoot and plant growth, especially in trees. As very little information is available on the axillary buds of tropical trees, about 100 local tree species, growing in the Botanic Gardens, Nature Reserves and along waysides, were investigated. The occurrence, morphology and size variations of the axillary buds are discussed.

Introduction

In a growing shoot system, the relationship between the terminal and axillary buds is important in terms of origin, location, number and the relative role of apical dominance. The general information regarding the origin and development of axillary buds is available in the basic reference works on plant development and anatomy (Cutter, 1972; Esau, 1965; Fahn, 1967). While analysing the architecture of tropical trees, Hallé *et al.* (1978) described the developmental variations noticed in the axillary buds of a few dicotyledonous members. The available data on tropical trees is very scanty or almost nil, considering the large number of tropical tree species available in SE. Asia (Corner, 1952). It is said that the axillary buds vary very widely among the species of a genus or sometimes even among the individuals of the same species or, very rarely even within a tree (Hallé *et al*, 1978). It is also well known that the development and the growth behaviour of the apical and lateral buds determine the shape and the architecture of the shoots and eventually of the tree (Koriba, 1958). The present paper summarises the morphological characteristics of the axillary buds of some 100 species of tropical trees, including their occurrence, number, position, prominence and other related characters.

Materials and Methods

Young branches, up to a length of ten nodes, were collected at random from common and easily available trees growing along roadsides, the Botanic Gardens, primary and secondary forests in Singapore. The leaves were removed to expose the buds and these were examined under the binocular microscope to determine their shapes and sizes. The node that was visible, distinctive and nearest to the apex was considered as the first node and the others counted in basipetal order (fig. 1). The relative prominence of the buds at different nodes on the axis was noted. The hundred species studied belong to 31 dicotyledonous families, Podocarpaceae and Gnetaceae.

Observations and Discussions

Buds were present at the axils of most of the species studied except in the case of *Brownea grandiceps* Jacq. and *Plumeria* sp. where they were indistinct or absent.

The unit of study for each species was the shoot with 10 nodes. The relative prominence of buds at different nodes varied. In the majority of them, almost 70%, the buds were present up to the ninth node. Their absence at other nodes could be due to early bud abscission instead of non-formation, since the bud scars were obvious in most of the shoots studied (table 3). The sequential development of buds in relation to the total shoot and individual internodal length should be interesting (Hallé *et al.*, 1978).

In all the standard works referred, very little or no mention was made on the morphology and characteristic features of axillary buds (Goebel, 1900; Corner, 1952; Symonds, 1958; Clowes, 1961; Menninger, 1962; Symington, 1974; Palmer and Pitman, 1972; Bernatzky, 1978; Hallé *et al.*, 1978; Kunkel, 1978; Hora, 1981). It was also revealing that there is no well established terminology to describe the axillary buds, even though other factors that affect shoot growth like mineral nutrition, water availability, soil conditions and others are well considered.

Bud types

Among the tree species studied presently, buds with different sizes and shapes were encountered. They were broadly classified into eight morphological types. The relative shape and outline of the bud was the only criterion used in recognising the eight bud types. The flattened, bulbous, pear-shaped and round ones were somewhat radially symmetrical with almost a circular outline whereas the linear, oblong and triangular ones were somewhat bilaterally symmetrical (fig. 2) All the

Fig. 1. Young branch with opposite (*left*) and alternate leaf position (*right*) showing the first 10 nodes labelled sequentially (diagrammatic).

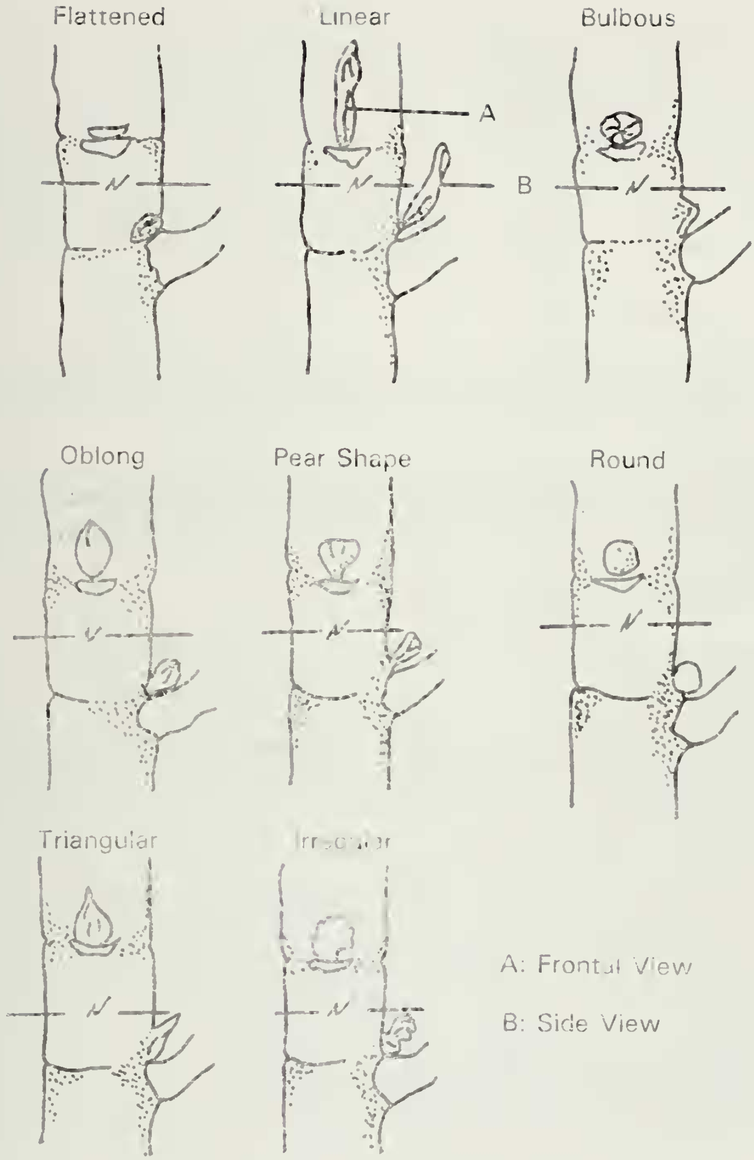

Fig. 2. Diagrammatic representation of the different shapes of axillary buds.

others that did not fit into the above types were grouped under the irregular type. The various types present and the frequency of their occurrence were also noted. The triangular buds (fig. 2, plate 1, h and k) were of most common occurrence, followed by linear (plate 1, b and c), oblong (plate 1, f), bulbous (plate 1, d) and other types. All of them are diagrammatically illustrated in figure 2 and the relative frequencies are shown in table 1.

The bud morphology, quantitative and qualitative aspects are not studied so far in any great detail, especially of tropical trees (Corner, 1952; Opeke, 1982). Lubbock (1899) considered the structure of buds of about 25 temperate trees and shrubs including three Gymnosperms. The buds of each species were described but no bud types were recognised. Greater emphasis was laid on the structures that protect the bud and the bud emergence after wintering. Other papers published occasionally described the buds in individual plants like cotton, sweetgum, bamboos and others (Mannery and Ball, 1959; Kormanik and Brown, 1967; McClure, 1976).

Single and Multiple Buds

In the majority of the trees or woody plants, occurrence of a single axillary bud is common. Of the 100 species presently studied, 17 of them had multiple buds at the nodes (table 2).

The species with multiple buds are grouped in the increasing order of their numbers.

a) Species with 1–2 axillary buds per node

Annona muricata L.
Annona reticulata L.
Annona squamosa L.
Delonix regia (Boj. ex Hk.) Raf.
Gliricidia sepium (Jacq.) Kunth ex Walp.
Hibiscus tiliaceus L.
Mimusops elengi L.
Lithocarpus urceolaris (Jacq.) Merr.
Samanea saman (Jacq.) Merr.

b) Species with 2–3 axillary buds per node

Jacaranda obtusifolia HBK ssp. *rhombifolia* (Meij.) Gent.

c) Species with 3–4 axillary buds per node

Spathodea campanulata Beauv.
Peltophorum pterocarpum (DC.) Back.
Nephelium lappaceum L.

d) Species with 4–5 axillary buds per node

Tabebuia pallida Miers
Acacia auriculiformis A. Cunn. ex Bth.
Erythrophleum suaveolens (Guill. & Perr.) Bren.
Millettia atropurpurea Bth.

The 100 species examined belonged to 74 genera of 33 families. Four or more genera were included in Bignoniaceae, Dipterocarpaceae, Leguminosae and Myrtaceae and in others, 1, 2, or 3 genera were involved (table 2). The family of Leguminosae had the largest representation with about 16 genera and 23 species. In the members of these families, the shape of the buds varied among the different genera, the different species and sometimes even between the allied species in genera such as *Annona, Cassia, Shorea, Nephelium, Tabebuia* and *Podocarpus*. In contrast, the

Table 1

The shapes of axillary buds in some tropical trees.

Bud Shape	Number of Species
Bulbous	16
Flattened	4
Irregular	2
Linear	18
Oblong	16
Pear	7
Round	5
Triangular	30
Buds indistinct	2
	100

Note. The above observations were made on the first 3 nodes where the shape of the distinct buds was relatively consistent. Owing to age, the buds in the older nodes in many species were either detached or the shapes had changed due to emergence. Plate 1 a to q illustrate some of the shapes described.

buds were of the same shape among the species of *Eugenia, Ficus, Artocarpus* and *Bauhinia*.

Hallé *et al.* (1978) also observed that multiple buds are quite common with tropical woody plants such as *Coffea* sp. The frequency of tropical trees species having multiple buds was however not mentioned. The morphogenetic implication of these buds has so far been little considered, especially by developmental biologists. The buds at each node should be further studied as the differential developmental potential of each number of the multiple bud complex will also influence the ultimate architecture of the tree (Hallé *et al.*, 1978). Some preliminary observations made with some tropical plants showed that the pattern of response by the multiple buds, varied from species to species (Varossieau, 1940; Moens, 1963). In *Coffea*, for example, the distal bud of each leaf pair on orthotropic shoots usually grows out as a precocious branch, the others persist as reserve buds. In the case of Dipterocarps, the dominant axillary buds would often grow in a plagiotropic pattern and in some instances, the axillary buds which may be indistinct, would grow to form orthotropic shoots (Ng, 1976).

The distinct variation in numbers, shapes and sizes of the axillary buds among the species within a genus or, between the genera of a family, may have some taxonomic importance. To-date, the morphological features of axillary buds are seldom or not at all used for either identification or species classification (Goebel, 1900; Corner, 1952; Whitmore, 1972; 1973; Cockburn, 1976; Ng, 1978).

Very often, the identification of plants are confirmed through the study of flower characters. However, as most tropical forest trees flower either rarely or infrequently, confirmation through flower features may be a problem. In fact, some tropical trees do not even flower for years (McClure, 1966; Rao, 1973). Therefore, having at one's disposal an additional vegetative character such as the bud morphology may be immensely useful.

Buds, prior to their emergence, seem to be rigid and uniform in their shapes and other morphological characteristics. They may not be so variable as the leaves in sizes and shapes. Stace (1980) has already mentioned that vegetative characters such as leaves of higher plants, are often looked upon as risky evidence because often similar morphological features are found in quite unrelated plants. Therefore, as many other vegetative characters as possible should be included to give an accurate identification and, buds also can be used in terms of their shape, size and number.

In some instances, the number of buds varied from node to node on the same axis. In *Tabebuia pallida*, multiple buds were seen at some of the younger nodes, and at the older ones, the buds were indistinct. Where multiple buds were present, they varied in number from 2 to 5, but in some like *Erythrophleum suaveolens*, five buds were present consistently at most leaf axils. The arrangement of buds varied among the species with multiple buds. Clustered arrangement of buds was seen in *Tabebuia pallida* and in *Erythrophleum suaveolens*; the buds were arranged in basipetal order. The sizes of the multiple buds within a single axil differed greatly and the largest of the lot was dominant. It developed into a shoot when conditions favoured. The smaller ones remained either dormant or frizzled and dropped off.

Regarding their conspicuousness, the buds decreased in prominence in the lower nodes and this was the general pattern for the majority of the species studied (table 3). In most species the buds became detached following leaf abscission and a few species were exceptional like *Bixa orellana* L. and *Michelia alba* DC. where the buds were prominent even at the older nodes.

The largest axillary bud measured up to 1 cm in length was in *Erythrophleum suaveolens* and the smallest, about 0.1 mm, found in *Fagraea fragrans* Roxb., was barely visible even under the binocular microscope. The larger buds were found in the younger leaf axils and this perhaps was due to the vigorous meristematic tissue subtending the bud and the dominant nature of the younger bud itself. In *Peltophorum pterocarpum* and *Fagraea fragrans* the dominant buds at nodes 1, 2 or 3 gave rise to lateral branches.

Apart from shape and size, the buds varied with regard to the number of scale leaves that covered each bud, but on an average, 4–5 bud scales were present in most of them. The bud scales were smooth in certain species as in *Eugenia grandis* Wight

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Plate 1. *(facing page):*

a, lateral view of a flattened bud of *Pterocarpus indicus* Willd.; *b*, frontal view of a linear bud of *Coccoloba uvifera; c*, lateral view of a linear bud of *Michelia champaca* L.; *d*, frontal view of a bulbous bud of *Mangifera indica* L.; *e*, lateral view of a bulbous bud of *Eugenia grandis; f*, lateral view of oblong to triangular buds of *Cinnamomum iners* Reinw. ex Bl.; *g*, frontal view of a pear-like bud of *Samanea saman; h*, frontal view of a triangular bud of *Bixa orellana.*

Scale: 1 division = 1mm.

Plate 1

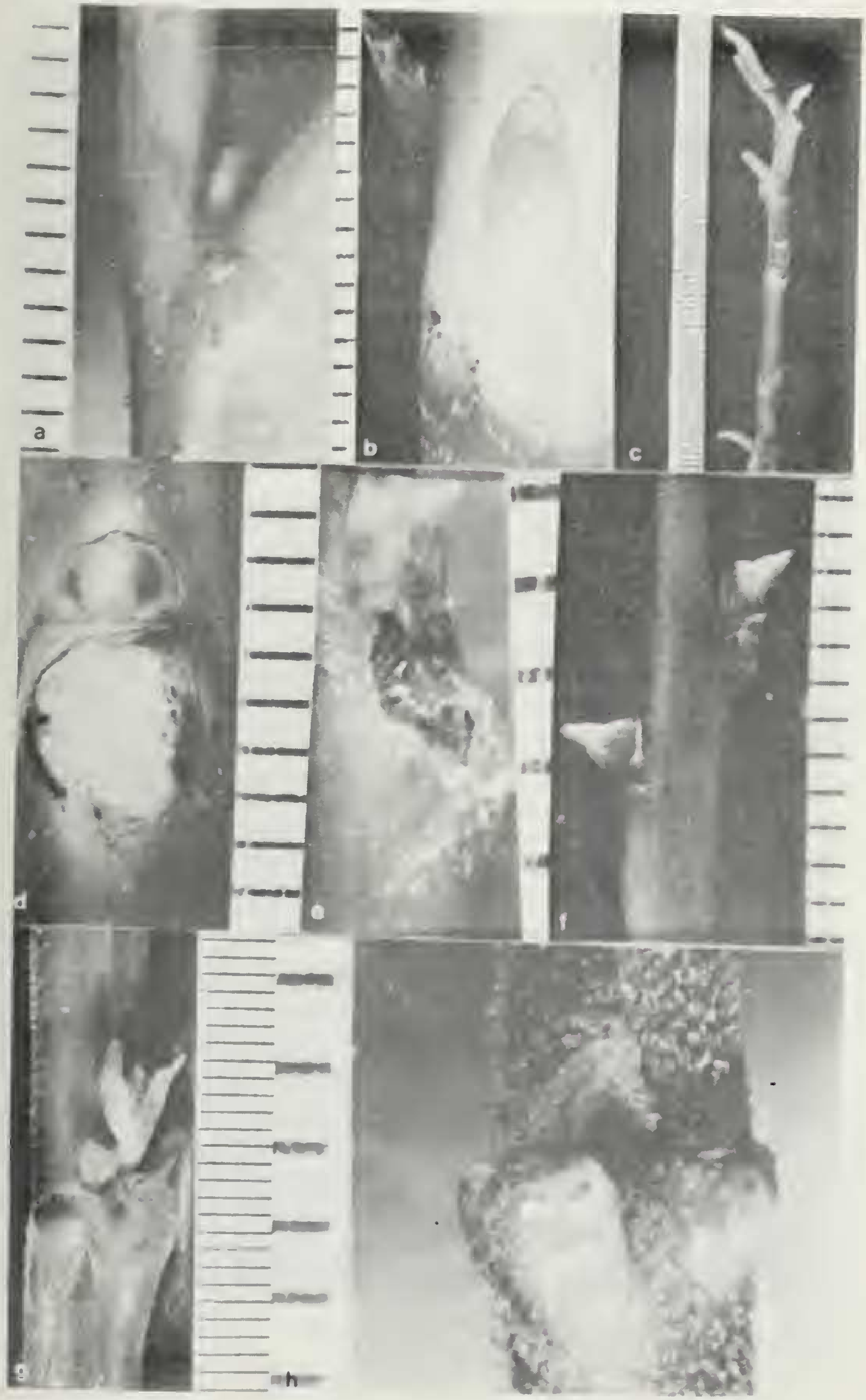
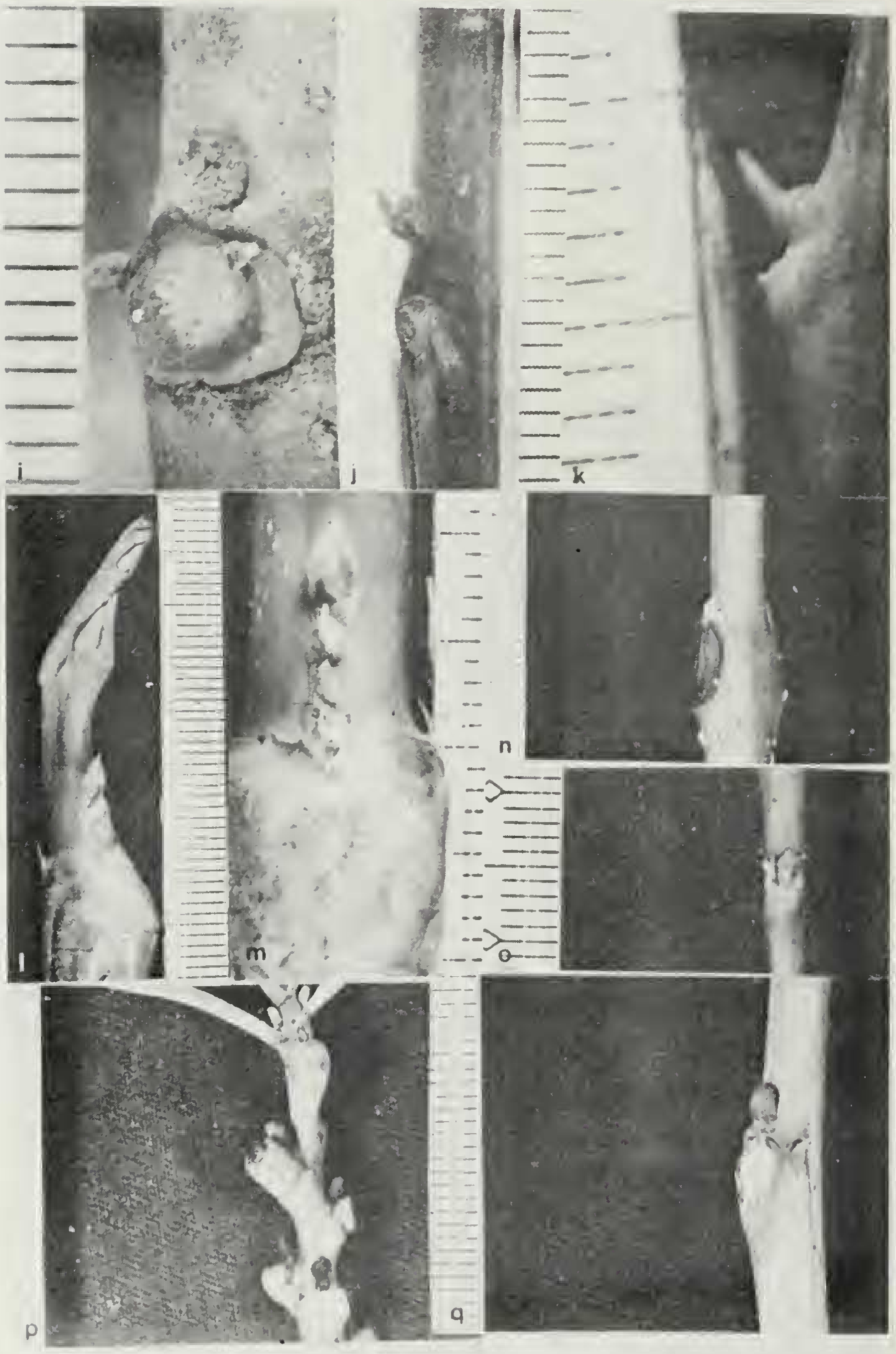


Plate 1 *cont.*



(plate 1d) or covered with hairs as in *Muntingia calabura* L. Most of the buds were brown in colour and some had the same colour as the bark of the tree. Some buds were distinctly pink as in *Coccoloba uvifera* (L.) L. (plate 1b), and covered by very broad stipules.

The architecture and form of a tree is heavily influenced by the growth response of axillary buds (Corner, 1952; Hallé *et al*, 1978; Koriba, 1958). The geometry of the arrangement of the buds and the manner of the response determine the ultimate form of the tree. In monopodial trees, the axillary buds are normally arranged in regular whorls around the orthotropic shoot and the uniform response and growth of these buds give rise to the monopodial pattern of branching. In contrast with the monopodial trees, the response of the axillary buds of sympodial trees varies tremendously. Hallé *et al*, (1978) stated that the pattern of the nodes on which the axillary buds are located, is extremely complex and diverse, thus resulting in a variable response. Furthermore, the distribution and the kinds of lateral or axillary buds can vary widely on the different parts of one plant. Because of these variations, different patterns of branching are observed in sympodial trees (Koriba, 1958).

Buds are also of great value in vegetative propagation as they can serve as starting units for mass propagation. De Fossard (1980) had shown that when nodes of *Eucalyptus ficifolia* F. Muell. were cultured in culture media containing 5 μM IBA and 2 μM BAP, several shoots were obtained. As a result, young nodal segments containing the axillary buds were used widely as explants to induce multiple shoot formation *in vitro* condition for many species of trees (Hutchinson, 1981; Lee and Rao, 1981; Mascarenhas *et al*, 1981). It will therefore be beneficial for further studies to be carried out to determine whether there is any correlation between the prominence or the morphology of these buds and the ease with which they develop into multiple shoots.

Plate 1. *cont. (facing page)*:

i, frontal view of a rounded bud of *Erythrina variegata* L.; *j*, lateral view of an irregular bud of *Nephelium lappaceum; k*, lateral view of a triangular bud of *Citrus microcarpa* Bunge; notice the sharp thorn structure enclosing the axillary bud; *l, m*, lateral and frontal view of multiple buds of *Erythrophleum suaveolens; n*, lateral view of multiple buds of *Gliricidia sepium;* buds were mainly pear-shaped; *o*, frontal view of multiple buds of *Acacia auriculiformis;* buds were linear to triangular in shape; *p*, lateral view of multiple buds of *Peltophorum pterocarpum;* buds were mainly linear to pear-shaped; notice the leader bud being he largest of the 3 to 4 buds present; *q*, lateral view of multiple buds of *Millettia atropurpurea;* buds were oblong to triangular in shape; notice the larger leader bud of the 2 present.

Scale: 1 division = 1mm.

Table 2

Number, shape and sizes of the axillary buds in the different taxa.

* The numbers are mentioned for those taxa which had multiple buds. All others had a single bud at each leaf axil.

\+ The sizes given for each species in this table refer to the smallest and the largest buds (length of) the buds only), distinct at the nodes 1 to 10. All measurements were made only on buds before emergence. Mean lengths of the buds were derived from nodes 1 to 4. Buds were somewhat indistinct in certain species at subsequent nodes. Hence measurements were variable, e.g. *Tabebuia pallida.*

Family/Species	Shape	Sizes (mm) +	Mean (mm)
Anacardiaceae			
1. *Anacardium occidentale* L.	bulbous	0.5–1.0	0.7 ± 0.2
2. *Mangifera indica* L.	bulbous	0.5–1.0	0.8 ± 0.2
3. *Rhus succedanea* L.	triangular	2.0–3.0	2.5 ± 0.5
Annonaceae			
4. *Annona muricata* (1–2)*	linear	1.0–4.0	2.4 ± 1.3
5. *Annona reticulata* (1–2)*	oblong	1.0–2.0	1.5 ± 0.5
6. *Annona squamosa* (1–2)*	irregular	1.0–2.0	1.5 ± 0.5
7. *Polyalthia longifolia* (Sonn.) Thw.	linear	4.0–8.0	5.8 ± 1.7
Apocynaceae			
8. *Ervatamia dichotoma* (Roxb.) Burk.	round	0.1–0.5	0.2 ± 0.1
9. *Plumeria acuminata* W.T. Ait.	–	–	–
Bignoniaceae			
10. *Jacaranda* (2–3)*	linear to oblong	1.0–5.0	3.6 ± 1.8
11. *Spathodea campanulata* (3–4)*	linear to triangular	1.0–5.0	3.4 ± 1.7
12. *Tabebuia pallida* (4–5)*	irregular to linear	1.0–3.0	1.6 ± 0.9
13. *Tabebuia rosea* (Bertol.) DC.	bulbous	0.5–1.0	0.7 ± 0.3
14. *Tabebuia spectabilis* (Planch. & Lindl. ex Planch.) Nichols.	round	0.5–2.0	1.5 ± 0.7
Bixaceae			
15. *Bixa orellana*	triangular	1.0–3.0	2.2 ± 0.8
16. *Cochlospermum religiosum* (L.) Alston	linear	1.0–4.0	1.7 ± 1.3
Capparidaceae			
17. *Crataeva religiosa* Forst. f.	triangular	2.0–4.0	3.1 ± 0.9
18. *Cratoxylon formosum* (Jack) Dyer	triangular	1.0–4.0	2.1 ± 1.0
19. *Cratoxylon pruniflorum* Kurz	bulbous	1.0–3.0	1.8 ± 0.9
Celastraceae			
20. *Elaeodendron quadrangulatum* Reiss.	oblong	1.0–2.0	1.4 ± 0.5
Combretaceae			
21. *Terminalia catappa* L.	triangular	3.0–6.0	4.2 ± 1.3

Table 2 *Continued*

Family/Species	Shape	Sizes (mm) +	Mean (mm)
Dipterocarpaceae			
22. *Dryobalanops aromatica* Gaertn. f.	triangular	1.0–3.0	1.6 ± 0.8
23. *Hopea mengarawan* Miq.	bulbous	0.1–0.5	0.3 ± 0.1
24. *Shorea curtisii* Dyer ex King	bulbous	0.1–0.5	0.3 ± 0.2
25. *Shorea leprosula* Miq.	triangular	0.5–1.5	0.3 ± 0.1
26. *Shorea sumatrana* (V. Sl. ex Foxw.) Sym.	oblong	4.0–6.0	5.3 ± 1.0
27. *Vatica pallida* Dyer	triangular	0.1–1.0	0.6 ± 0.4
Ebenaceae			
28. *Diospyros discolor* Willd.	triangular	2.0–4.0	3.1 ± 1.1
Euphorbiaceae			
29. *Antidesma bunius* (L.) Spreng.	triangular	0.5–1.0	0.6 ± 0.3
30. *Elateriospermum tapos* Bl.	bulbous	0.1–0.5	0.4 ± 0.2
31. *Macaranga triloba* (Bl.) M.A.	pear	3.0–6.0	4.4 ± 1.5
Fagaceae			
32. *Lithocarpus urceolaris* (1–2)*	pear	1.0–2.0	1.4 ± 0.5
Gnetaceae			
33. *Gnetum gnemon* L.	flattened	0.5–1.0	0.8 ± 0.2
Guttiferae			
34. *Calophyllum inophyllum* L.	triangular	1.0–2.0	1.7 ± 0.5
Lauraceae			
35. *Cinnamomum iners* Reinw. ex Bl.	oblong to triangular	2.0–3.0	2.6 ± 0.5
Leguminosae			
36. *Acacia auriculiformis* (2–5)*	oblong to linear	0.5–2.0	1.3 ± 0.7
37. *Albizzia falcata* (L.) Back.	linear	1.0–7.0	–
38. *Andira inermis* (W. Wight) HBK ex DC.	linear	3.0–4.0	3.7 ± 0.5
39. *Bauhinia acuminata* L.	triangular	4.0–6.0	5.0 ± 1.0
40. *Bauhinia blakeana* Dunn	triangular	4.0–6.0	4.5 ± 0.9
41. *Bauhinia purpurea* L.	pear	2.0–5.0.	4.6 ± 1.0
42. *Brownea capitella* Jacq.	linear	2.0–6.0	3.4 ± 2.1
43. *Brownea grandiceps*	–	–	–
44. *Cassia bakeriana* Craib	flattened	1.0–2.0	1.5 ± 0.5
45. *Cassia fistula* L.	triangular	2.0–6.0	4.6 ± 0.8
46. *Cassia multijuga* Rich.	linear	1.0–5.0	3.3 ± 1.6
47. *Cassia* sp. (hort. variety)	triangular	2.0–4.0	3.2 ± 1.0
48. *Cassia spectabilis* DC.	oblong	1.0–3.0	1.9 ± 0.9
49. *Dalbergia oliveri* Gamble & Prain	flattened	1.0–2.0	1.3 ± 0.5
50. *Delonix regia* (2)*	pear	1.0–2.0	1.4 ± 0.5
51. *Erythrophleum suaveolens* (3–5)*	triangular to linear	1.0–10.0	6.9 ± 3.4
52. *Erythrina fusca* Lour.	bulbous to pear	2.0–4.0	3.0 ± 0.8
53. *Erythrina variegata* L.	round to triangular	1.0–3.0	2.3 ± 1.0
54. *Gliricidia sepium* (2)*	pear to round	1.0–3.0	1.9 ± 1.1
55. *Millettia atropurpurea* (3–5)*	oblong	1.0–6.0	4.0 ± 1.9
56. *Peltophorum pterocarpum* (2–4)*	linear	1.0–5.0	3.3 ± 1.9

Table 2 *Continued*

Family/Species	Shape	Sizes (mm) +	Mean (mm)
Leguminosae *cont.*			
57. *Pongamia pinnata* (L.) Pierre	flattened	1.0–2.0	1.4 ± 0.5
58. *Pterocarpus indicus* Willd.	flattened	1.0–3.0	2.3 ± 0.5
59. *Samanea saman* (1–2)*	pear to irregular	1.0–6.0	4.0 ± 2.1
Lecythidaceae			
60. *Barringtonia asiatica* (L.) Kurz	bulbous	2.0–3.0	2.4 ± 0.5
Loganiaceae			
61. *Fagraea fragrans*	bulbous	0.1–0.5	0.4 ± 0.2
Lythraceae			
62. *Lagerstroemia speciosa* (L.) Pers.	linear	2.0–6.0	4.2 ± 1.5
Magnoliaceae			
63. *Michelia champaca* L.	linear	5.0–15.0	10.1 ± 3.0
Malvaceae			
64. *Hibiscus tiliaceus* (1–2)*	oblong	1.0–4.0	2.3 ± 1.4
Meliaceae			
65. *Khaya grandiflora* C. DC.	round to oblong	0–1.0	0.9 ± 0.3
66. *Sandoricum koetjape* (Burm. f) Merr.	round to oblong	1.0–3.0	1.9 ± 0.9
Myrsinaceae			
67. *Ardisia elliptica* Thunb.	round	3.0–6.0	4.5 ± 1.2
Myrtaceae			
68. *Callistemon citrinus* (Curtis) Stapf	triangular	5.0–8.0	6.6 ± 1.5
69. *Eugenia aquea* Burm. f.	bulbous	0.5–1.0	0.7 ± 0.3
70. *Eugenia grandis*	bulbous	0–1.0	0.4 ± 0.4
71. *Eugenia javanica* Lmk	bulbous	0.5–1.0	0.8 ± 0.2
72. *Eugenia longiflora* (Presl.) F. Vill.	bulbous	0.5–2.0	1.3 ± 0.8
73. *Eugenia malaccensis* L.	bulbous	0.5–1.0	0.8 ± 0.2
74. *Eugenia michelii* Lmk	linear	2.0–6.0	3.9 ± 1.7
75. *Melaleuca cajuputi* Powell	pear	4.0–6.0	4.4 ± 0.8
76. *Psidium guajava* L.	oblong	2.0–3.0	2.8 ± 0.4
77. *Rhodamnia cineria* Jack	triangular	2.0–4.0	2.6 ± 0.8
Podocarpaceae			
78. *Podocarpus koordersii* Pilg.	bulbous	1.0–2.0	1.7 ± 0.5
79. *Podocarpus neriifolius* D. Don	round	1.0–3.0	2.0 ± 0.8
80. *Podocarpus polystachyus* R. Br. ex Mirb.	oblong	1.0–2.0	1.4 ± 0.5
Polygonaceae			
81. *Coccoloba uvifera*	triangular to linear	4.0–8.0	5.6 ± 1.6
82. *Triplaris americana* L.	oblong	1.0–3.0	2.3 ± 0.9

Table 2 *Continued*

Family/Species	Shape	Sizes (mm) +	Mean (mm)
Rutaceae			
83. *Atalantia spinosa* (Willd.) Tanaka	linear	1.0–3.0	2.0 ± 1.1
84. *Citrus grandis* (L.) Osb.	triangular	2.0–6.0	3.2 ± 1.5
Salicaceae			
85. *Salix* sp.	linear to triangular	5.0–9.0	5.6 ± 1.7
Sapindaceae			
86. *Arfeuillea arborescens* Pierre	oblong	2.0–3.0	2.6 ± 0.5
87. *Filicium decipiens* (Wright & Ann.) Thw.	oblong	2.0–4.0	3.1 ± 1.0
88. *Nephelium lappaceum* (1–4)*	irregular	1.0–3.0	2.0 ± 1.0
89. *Dimocarpus longan* Lour. var. *malesianus* Leenh.	oblong	1.0–2.0	1.3 ± 0.6
Sapotaceae			
90. *Achras sapota* L.	oblong to irregular	1.0–2.0	1.2 ± 0.4
91. *Mimusops elengi* L. (2)*	triangular	2.0–5.0	3.5 ± 1.3
92. *Palaquium obovatum* (Griff.) Engl.	bulbous	0.5–1.0	0.8 ± 0.2
Saxifragaceae			
93. *Brexia madagascariensis* (Lmk) Thou.	triangular	2.0–4.0	2.8 ± 0.8
Tiliaceae			
94. *Muntingia calabura*	linear	0.5–1.0	0.8 ± 0.2
Urticaceae			
95. *Artocarpus integer* (Thunb.) Merr.	linear	2.0–3.0	2.4 ± 0.5
96. *Artocarpus gomeziana* Wall.	linear	2.0–5.0	3.7 ± 1.4
97. *Artocarpus heterophyllus* Lamk.	oblong	1.0–3.0	1.5 ± 0.8
98. *Ficus benjamina* L.	triangular	2.0–4.0	3.0 ± 1.0
99. *Ficus elastica* Roxb. ex Hornem.	triangular	2.0–6.0	2.8 ± 0.8
100. *Ficus retusa* L.	triangular	1.0–3.0	1.6 ± 0.8

Table 3

The prominence of the axillary buds in relation to their positions at different nodes.

Relative prominence of buds	Number of species exhibiting the pattern of prominence
Buds prominent in all 10 nodes	29
Buds prominent up to 7th to 9th node	39
Buds prominent up to 4th to 6th node	18
Buds prominent only in first 3 nodes	12
Buds not visible	2
	100

Note. All buds above the size of 2mm, which were visible to the naked eye, were classified as prominent.

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