# Corner's Architectural Model

*by*

F. HALLÉ & D. J. MABBERLEY

*Institut de Botanique*
*Montpellier, France*

*Botany School, Oxford*
*England*

Vegetatively unbranched trees with indeterminate apical growth and lateral sexuality belong to 'Corner's Model', as previously defined (Hallé & Oldeman, 1970). The papaya tree and the oil palm are familiar examples of this strange and probably very old strategy of growth. The monoaxial trunk, often thick in its primary tissues, is built by the activity of a single apical meristem; the leaves are large, often compound, and the internodes are short. Growth may be continuous or rhythmic; cauliflory is frequent in the Angiosperm examples. From an ecological point of view, they are mainly treelets of the tropical rain-forest undergrowth.

Although flowering before branching, these trees are not necessarily unbranched throughout their lives, e.g. old papaya trees produce branches from buds on the trunk; see also Plate I. This repetition of the original model, for each new branch behaves as did the first axis, is the 'réitération' of Oldeman (1974). Again, damage to the apex sometimes leads to the death of some species, e.g. *Cyanea carlsonii* Rock (Degener, Degener & Hörmann, 1969), but others can recover, as their axillary buds grow out, giving a branched tree.

Corner's Model is important in the tropics, as it occurs in nearly all the larger families of flowering plants. A list of 67 trees was published in 1970 by Hallé & Oldeman; now more than a hundred species are known to be monoaxial, but the present list is likely to expand rapidly in the coming years, with the increasing interest in, and knowledge of, tropical tree architecture.

## Taxonomic Distribution

The list below includes that of Hallé & Oldeman (1970: 21–5; 135), examples from which are indicated by an asterisk; bibliographic references to these are to be found in the original list.

### *DICOTYLEDONS*

ANACARDIACEAE†

*Semecarpus magnifica* K. Schum., New Guinea (F. Hallé, 1974)

*Semecarpus* sp., Malaysia, *Mabberley 1668* (Plate 1)

**Trichoscypha ferruginea* Engl., Equatorial Africa

BALANOPACEAE

*Balanops pancheri* Baill., New Caledonia (J. M. Veillon, ined.)

BERBERIDACEAE

*Mahonia bealei* Carr., China; "Les Cèdres" Botanical Garden, Saint-Jean-Cap-Ferrat, France. 1973

† *Harpephyllum caffrum* Bern. exkr., grown from seed, has flowered at Oxford without branching, while this paper was in press.

BIGNONIACEAE

*Colea lantziana* Baill., Madagascar, Tsimbazaza Botanical Garden, Tananarive. 1974

*Colea nana* Perrier, Madagascar; Tsimbazaza Botanical Garden, Tananarive, 1974

*Colea* sp., Madagascar, *Mabberley 822* (1971)

CAMPANULACEAE — LOBELIOIDEAE

*Brighamia rockii* St. John, Hawaii (St. John, 1969)

*Cyanea aspleniifolia* (Mann) Hillebr., Hawaii (Rock, 1919)

*Cyanea carlsonii* Rock, Hawaii (Degener, Degener & Hörmann, 1969)

*Cyanea giffardii* Rock, Hawaii (Rock, 1919)

*Delissea undulata* Gaud., Hawaii (Rock, 1919)

CARICACEAE

**Carica papaya* L., Central America, now pantropical

**Carica* sp., French Guyana

COMPOSITAE

**Espeletia spicata* Sch. Bip. ex Wedd., S. American mountains

CONNARACEAE

**Jollydora duparquetiana* (Baill.) Pierre, Equatorial Africa

CUNONIACEAE

*Cunonia macrophylla* Brongn. & Gris., New Caledonia (J. M. Veillon, ined.)

EUPHORBIACEAE

**Agrostistachys borneensis* Becc., Malaya and Borneo

**Agrostistachys sessilifolia* Pax & Hoffm., Malaya (see F. Hallé, 1971)

*Cleidion lasiophyllum* Pax & Hoffm., New Caledonia, (J. M. Veillon, ined.)

*Euphorbia ankarensis* Boiteau, Madagascar (G. Cremers, ined.)

*Euphorbia bupleurifolia* Jacq., South Africa (G. Cremers, ined.)

*Euphorbia lophogona* Lam., Madagascar; "Les Cédres" Botanical Garden, Saint-Jean-Cap-Ferrat, France, 1973

*Euphorbia moratii* Rauh, Madagascar (G. Cremers, ined.)

**Pycnocoma angustifolia* Prain, West Africa (see F. Hallé, 1971)

FLACOURTIACEAE

*Phyllobotryon spathulatum* Muell. Arg., (including **P. soyauxianum* Baill.) Equatorial Africa (Richards, 1952; Letouzey, Hallé and Cusset, 1969)

GERANIACEAE

*Geranium canariense* Reuter, Canary Islands (Yeo, 1970)

GESNERIACEAE

*Boea lanata* Ridl., Malaysia (Burtt, 1964)

LAURACEAE

*Litsea ripidion* Guill., New Caledonia (J. M. Veillon, ined.)

Plate I. *Semecarpus* sp., *Mabberley 1668* — Sepilok Forest Reserve, Sabah, Malaysia, 8 May 1974.

LECYTHIDACEAE

*Barringtonia calyptrocalyx* K. Schum., New Guinea (F. Hallé, 1974)

**Grias* sp., Brazil

LEGUMINOSAE-MIMOSOIDEAE

*Pithecellobium hansemanii* (F. Muell.) Mohl, New Guinea (F. Hallé, 1974)

LEGUMINOSAE-PAPILIONOIDEAE

*Angylocalyx oligophyllus* Bak.f., Tropical Africa (Mangenot, 1975)

*Sophora* sp., New Caledonia (J. M. Veillon, ined.)

MALVACEAE

*Goethea strictiflora* Hook., Brazil; J. N. Maclet Botanical Garden, Tahiti, French Polynesia, 1973

MELIACEAE

*Aglaia* sp., Malaysia, *Mabberley 1699* (1974)

*Chisocheton macranthus* (Merr.) Airy Shaw, Malaysia, *Mabberley 1718* (1974)

*Chisocheton medusae* Airy Shaw, Malaysia, *Mabberley 1680* (1974)

*Chisocheton polyandrus* Merr., Malaysia, *Mabberley 1688* (1974)

*Chisocheton princeps* Hemsl., Malaysia, *Mabberley 1561* (1974)

*Chisocheton setosus* Ridl., Malaysia, *Mikil SAN 30162* (1963)

*Dysoxylum urens* Val., Indonesia; Bogor Botanical Garden, 1972

**Guarea richardiana* A. Juss., French Guyana

MENISPERMACEAE

*Penianthus* sp. Gabon, *N. Hallé 4056* (1966)

MORACEAE

**Ficus theophrastoides* Seem., Solomon Islands

MYRSINACEAE

*Oncostemon* sp., Madagascar (J. L. Guillaumet, ined.)

*Rapanea grandifolia* S. Moore, New Caledonia (J. M. Veillon ined)

*Tapeinosperma pachycaulum* St. & Whitm., Solomon Islands (Stone & Whitmore, 1970)

*Tapeinosperma cristobalense* St. & Whitm., Solomon Islands (Stone & Whitmore, 1970)

*Tapeinosperma* sp., New Ireland (M. Coode, ined.)

*Gen. dub.*, Rondonia, Brazil, *F. Hallé 2351* (1975)

MYRTACEAE

*Jambosa acris* Panch., New Caledonia (J. M. Veillon, ined.)

OCHNACEAE

**Campylospermum duparquetianum* (Baill.) Van Tiegh., Tropical Africa

**Campylospermum sacleuxii* (Van Tiegh.) Farron, Tropical Africa

**Campylospermum subcordatum* (Stapf) Farron, Tropical Africa

**Campylospermum zenkeri* (Engl.) Farron, Tropical Africa

PITTOSPORACEAE

**Pittosporum ceratii* Guill., New Caledonia (J. M. Veillon ined.)

PROTEACEAE

*Hicksbeachia pinnatifolia* F. Muell., Australia; Sydney Botanical Garden, 1972

*Macadamia angustifolia* R. Virot, New Caledonia (J. M. Veillon, ined.)

RUBIACEAE

**Bertiera simplicicaulis* N. Hallé, Equatorial Africa

*Bikkia macrophylla* K. Schum., New Caledonia (J. M. Veillon, ined.)

*Captaincookia margaretae* N. Hallé, New Caledonia (N. Hallé, 1973)

*Coffea macrocarpa* A. Rich., Mauritius (G. Mangenot, ined.)

*Gardenia conferta* Guill., New Caledonia (J. M. Veillon, ined.)

**Pentagonia gigantifolia* Ducke, Peru

*Pseudomantalania macrophylla* J. F. Leroy, Madagascar (Leroy, 1973)

SAPINDACEAE

**Chytranthus longiracemosus* Gilg ex Radlk., Tropical Africa

**Chytranthus mangenotii* N. Hallé & Assi, Tropical Africa

**Chytranthus pilgerianus* (Gilg) Pellegr., Gaboon

**Chytranthus welwitschii* Pellegr., Gaboon

*Deinbollia* sp., Banco Arboretum, Ivory Coast, 1967

*Jagera serrata* Radlk., Papua New Guinea, *Frodin & Mabberley UPNG 4305* (1974)

**Placodiscus bancoensis* Aubr. & Pellegr., Ivory Coast

**Radlkofera calodendron* Gilg, Gaboon

SAPOTACEAE

**Delpydora gracilis* A. Chev., West Africa

**Delpydora macrophylla* Pierre, Equatorial Africa

*Planchonella pronyensis* Guill., New Caledonia (J. M. Veillon ined.)

SIMAROUBACEAE

**Brucea antidysenterica* Lam., Ivory Coast

**Eurycoma longifolia* Jack, Malaysia

SOLANACEAE

aff. *Solanum*, Acre, Brazil, *F. Hallé 2352* (1974)

STERCULIACEAE

**Chlamydocola chlamydantha* (K. Schum.) Bodard, Tropical Africa

**Cola buntingii* Bak.f., West Africa

**Cola caricaefolia* (G. Don f.) K. Schum., West Africa

**Cola mahoundensis* Pellegr., Equatorial Africa

*Herrania albiflora* Gaudot, Tropical America; Bogor Botanical Garden, 1972

**Ingonia digitata* (Mast.) Bodard, West Africa

**Theobroma mariae* K. Schum., Tropical America

SYMPLOCACEAE

*Symplocos stravadioides* Brongn. & Gris., New Caledonia (J. M. Veillon, ined.)

THEOPHRASTACEAE

**Clavija lancifolia* Desf., French Guyana

**Clavija longifolia* (Jacq.) Mez, Tropical America

URTICACEAE

*Dendrocnide moroides* (Wedd.) Chew, Australia; "Les Cèdres" Botanical Garden, Saint-Jean-Cap-Ferrat, France, 1975

*Obetia radula* (Bak.) B. D. Jackson, Madagascar, *Mabberley 752* (1971)

VERBENACEAE

*Oxera coriacea* Dubard, New Caledonia, *J. M. Veillon 2574* (1973)

VIOLACEAE

**Allexis cauliflora* (Oliver) Pierre, Equatorial Africa

*Neckia serrata* Korth., Indonesia, (Boerlage & Koorders, 1901)

## *MONOCOTYLEDONS*

AGAVACEAE

**Nolina recurvata* Hemsl., Mexico

PALMAE (Corner's is the main architectural model within the family — see Corner (1966) and Whitmore (1973). The following is a short list of typical examples)

*Borassus aethiopum* Mart., Tropical Africa

**Cocos nucifera* L., pantropical

*Dypsis hildebrandtii* Becc., Madagascar; Tsimbazaza Botanical Garden, Tananarive, 1971

**Elaeis guineensis* Jacq., Tropical Africa

*Lodoicea maldavica* (Gmel.) Pers., Seychelles

**Mauritia flexuosa* Benth., Hook.f. Tropical America

*Oenocarpus distichus* Mart., Brazil

**Phytelephas macrocarpa* Ruiz & Pav., Colombia

**Roystonea oleracea* O. F. Cook, Central America

*Verschaffeltia splendida* H. Wendl., Seychelles

PANDANACEAE

*Pandanus danckelmannianus* K. Schum., Solomon Islands (Stone, 1972)

*Pandanus princeps* B. C. Stone, Madagascar (Stone, 1970; Guillaumet, 1973)

## *OTHER VASCULAR PLANTS, LIVING OR FOSSIL*

FERNS

**Caulopteris* sp., fossil

**Hagiophyton* sp., fossil

**Megaphyton* sp., fossil

**Psaronius* sp., fossil

**Alsophila australis* R.Br., Tasmania

**Cyathea camerooniana* Hook., Tropical Africa
**Dicksonia* sp., Melanesia
**Thamnopteris schlechtendalii* (Eichwald) Brongniart, fossil

PTERIDOSPERMS
**Eospermatopteris* sp., fossil
**Lyginopteris oldhamia* (Binney) Potonie, fossil
**Medullosa noei* Steidtmann, fossil

CYCADS
**Cycadeoidea jenneyana* Ward, fossil
* ♀ *Cycas circinnalis* L., South East Asia
* ♀ *Cycas revoluta* Thunb., Asia
**Encephalartos laurentianus* De Wild., Zaïre
**Palaeocycas integer* (Nath.) Florin, fossil
**Williamsonia sewardiana* Sahni, fossil

## References

BOERLAGE, J. G. & S. H. KOORDERS. 1901. Tabula LXXVI. Neckia serrata *Korth. Icon. Bogor.* **4**: 1–3.

BURTT, B. L. 1964. Angiosperm taxonomy in practice. *Syst. Assoc. Publ.* **6**: 5–16.

CORNER, E. J. H. 1966. *The Natural History of Palms.* Pp. 393. Weidenfeld & Nicholson, London.

DEGENER, O, I. DEGENER & H. HÖRMANN. 1969. *Cyanea carlsonii* Rock and the unnatural distribution of *Sphagnum palustre* L. *Phytologia* **19**: 1–4.

GUILLAUMET, J. L. 1973. Formes et développment des Pandanus malgaches. *Webbia* **28**: 495–519.

HALLÉ, F. 1971. Architecture and growth of tropical trees exemplified by the Euphorbiaceae. *Biotropica* **3** (1) : 56–62.

———— F. 1974. Architecture of trees in the Rain Forest of Morobe District. New Guinea. *Biotropica* **6** (1) : 43–50.

HALLÉ, F. & R. A. A. OLDEMAN. 1970. *Essai sur l'architecture et la dynamique de croissance des arbres tropicaux.* Pp. 178. Masson éd., Paris.

HALLÉ, N. 1973. *Captaincookia,* genre nouveau monotypique néocalédonien de Rubiaceae — Ixoreae. *Adansonia* **13** (1) : 195–202.

LEROY, J. F. 1973. Sur l'organisation et le mode de développment d'un très remarquable ensemble naturel de Rubiacées-Gardéniées à Madagascar. *C.r. hebd. Séanc. Acad. Sci. Paris* **277**: 1657–1659.

LETOUZEY, R., N. HALLÉ & G. CUSSET. 1969. *Phyllobotryae* (Flacourtiaceae) d'Afrique Centrale; variations morphologiques et biologiques; conséquences taxonomiques. *Adansonia* **9** (4) : 515–537.

MANGENOT, G. 1957. *Angylocalyx oligophyllus* Bak. f. 1913. *Icones Pl. afr.* **4**: 77.

OLDEMAN, R. A. A. 1974. *L'architecture de la forêt Guyanaise.* O.R.S.T.O.M., Paris.

RICHARDS, P. W. 1952. *The tropical rain-forest.* Cambridge University Press.

ROCK, J. F. 1919. A monographic study of the Hawaiian species of the tribe Lobelioideae family Campanulaceae. *Mem. Bernice P. Bishop Mus.* **7** (2) : 1–394.

ST. JOHN, H. 1969. Monograph of the genus *Brighamia* (Lobeliaceae). Hawaiian Plant Studies 29. *Bot. J. Linn. Soc.* **62**: 187–204.

STONE, B. C. 1970. Observations on the genus Pandanus in Madagascar. *Bot. J. Linn. Soc.* **63**: 97–131.

———— 1972. The genus Pandanus in the Solomon Islands with notes on adjacent regions. *Malaysian J. Sci.* **1** A: 93–132.

STONE, B. C. & T. C. WHITMORE. 1970. Notes on the systematy of Solomon Islands plants and some of their New Guinea relatives. XI. *Tapeinosperma* (Myrsinaceae). *Reinwardtia* **8** (1) : 3–11.

WHITMORE, T. C. 1973. *Palms of Malaya.* Pp. 148. Oxford University Press.

YEO, P. F. 1970. *Geranium palmatum* group in Madeira and the Canary Isles. *J. R. hort. Soc.* **95**: 410–414.