

tufted, with culms 10–80 cm tall, erect or geniculate ascending, sometimes rooting from the lower nodes. Leaf-sheath about 1.5 cm long, striate, purplish, hairy at the mouth; ligule a fringe of hairs; leaf-blade linear with broad base and acute top, 2–20 cm × 2–8 mm, flat or inrolled. Inflorescence a loose or contracted, terminal, usually stiffly erect panicle, up to 20 cm long; spikelets 8–60-flowered, ovoid to oblongoid, 4–16 mm × 2.5–4 mm, strongly compressed, on up to 15 mm long peduncles, usually yellowish but reddish-purple tinged; lower florets all fertile, upper ones caducous, but florets falling in succession from the base up; glumes very densely packed, keel scabrid. Caryopsis obovoid to ellipsoid, laterally compressed, ca. 0.7 mm long, orange-brown.

Flower heads emerge 6–8 weeks after seedling emergence and plants flower throughout the year. It is a very variable species, the main variation being in the annual to perennial type and in the degree of stoloniferous habit.

**Ecology** *E. unioloides* can grow from sea-level up to 1250 m altitude, in open or moderately shaded areas, in swampy or paddy fields, roadsides and cultivated land.

**Agronomy** *E. unioloides* is grazed but does not withstand heavy grazing. In northern Thailand, villagers may pull up whole plants and feed them fresh to cattle.

**Genetic resources and breeding** It is unlikely that substantial germplasm collections are being maintained.

**Prospects** Although this species contributes to the feeding of livestock, it is not of great importance.

**Literature** [1] Backer, C.A. & Bakhuizen van den Brink, R.C., 1968. Flora of Java. Vol. 3. Wolters-Noordhoff, Groningen, the Netherlands. p. 531. [2] Gilliland, H.B., Holttum, R.E. & Bor, N.L., 1971. Grasses of Malaya. In: Burkill, H.M. (Editor): Flora of Malaya. Vol. 3. pp. 66–68. [3] Häfliger, E. & Scholz, H., 1981. Grass weeds 2. Ciba-Geigy Ltd., Basel, Switzerland. p. 78. [4] Mehra, K.L. & Fachruruzi, Z., 1985. Indonesian economic plant resources: forage crops. Lembaga Biologi Nasional – LIPI, Bogor, No 31. p. 18.

C. Manidool

## *Ficus subcordata* Blume

Bijdr.: 440 (1825).

MORACEAE

2n = 26

**Synonyms** *Ficus garciniifolia* Miquel (1867), *F. calophylloides* Elmer (1911), *F. fairchildii* Backer (1947).

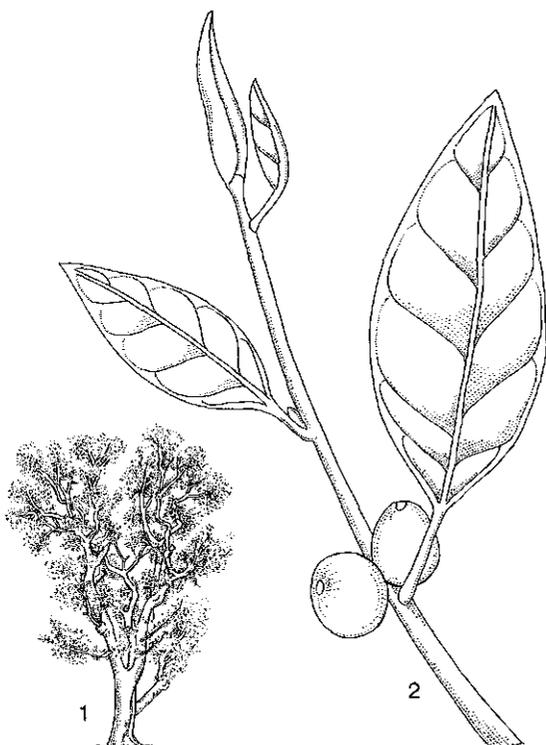
**Vernacular names** Indonesia: bunut lengis (Bali), wunut (Javanese), sipadi (Sumatra). Philippines: marabotum (Bagobo), balete (Tagalog), tibi (Bikol). Thailand: sai (Nakhon Si Thammarat).

**Origin and geographic distribution** *F. subcordata* is widespread in South-East Asia, from northern Vietnam to the New Hebrides. It is also occasionally cultivated in this area.

**Uses** The foliage of *F. subcordata* is used as a feed supplement during the wet season and as the sole diet during the dry season for ruminants in some dryland farming areas. The young fruit can be fed to ruminants. The wood is used as fuel for brick and limestone kilns, and the smaller branches are used for household firewood. The mature stem is used for farmyard posts. The bark is used for making string for farm tools. The timber is not hard enough for building houses, making farm implements or woodcarving. The tree is used as shade for livestock, for storing crop residues, for reclamation of denuded land, for protecting soil on sloping land and as a windbreak.

**Properties** The leaves contain 1.2–1.8% N, crude fibre 26–30%, N-free extract 42–47%, ash 8–11%, total digestible nutrient 33–35%, and massic energy of DM is 10000–19000 kJ/kg. Cut stems exude white latex but this does not affect the palatability of the leaves.

**Description** Strangling deciduous tree, without aerial roots, up to 30 m tall and 70 cm in diameter; branching starts 2 m above the ground and twigs are brownish-grey; in shallow soil the lateral roots near the soil surface can spread 4–7 m away from the base of the trunk. Bark whitish-grey, slightly smooth and fissured, flexible and durable, 10–17 mm thick; inner bark whitish, exuding white sap. The blunted spearhead-like bud extends from the node while the leaf is still intact. Leaves alternate, oblong, ovate-oblong, or elliptical, 9–20 cm × 4–10 cm, with a prominent light green midrib and a light green petiole of 2–5 cm length; leaf margin entire; leaf-blade broadly cuneate or rounded at base, pointed at apex, smooth to hairy, purple when young, light green beneath and dark green above when mature. Fruit a short-ellipsoid fig, 3–5 cm × 2–2.5 cm, solitary, occasionally in pairs,



*Ficus subcordata* Blume - 1, habit tree; 2, fruiting branch.

green when young, gradually turning from yellow to reddish-brown or black when ripe. Seeds small, hard and numerous. Weight of a fresh fruit ranges from 10–20 g, and there are 1000–2000 ripe seeds per g.

**Growth and development** Under natural conditions, reproduction starts when the tree is 5–6 years old. Flowering and fruiting take place during the dry season when the tree sheds its old leaves. The mature fruit falls off when the new season's leaves are fully expanded. Under favourable conditions the small seeds will germinate in 3–4 weeks. Under natural conditions, the seeds may germinate in a crack in other trees and develop into a stunted tree (known in Bali as 'bunut panggang'). Once the aerial roots reach the ground they can develop into a normal tree that can kill the host.

**Other botanical information** *F. subcordata* is subdivided into two varieties by Corner: var. *subcordata*, the typical variety; and var. *malayana* Corner, with large subcylindrical figs 3.5–5 cm × 2–2.5 cm, and elliptical to narrowly obovate, thick leaves, 11–16 cm × 4–7 cm, occurring in Peninsular Malaysia and in northern Borneo.

Besides *F. subcordata*, in dryland farming areas in Bali (Indonesia), farmers plant also 3 other *Ficus* species vegetatively:

- *F. stricta* Miquel ('bunut bingin' in Bali): evergreen tree, up to 18 m tall with deeply fluted bole and large spreading crown; leaves elliptical, 7–12 cm × 3–6 cm, with numerous almost parallel secondary nerves; figs globose, 1.5 cm in diameter, orange; Indo-China, Malaysia, Indonesia, the Philippines.
- *F. elastica* Roxb. ex Hornem. ('bunut lulub' in Bali): large strangling fig developing many aerial roots from the trunk and main branches; young parts reddish; leaves elliptical, 7–15 cm × 4–7 cm, larger in saplings; figs oblongoid, 1.25 cm × 0.8 cm, yellow. Formerly used for rubber production (India rubber tree); originally distributed from India through Indo-China and Malaysia to Sumatra; now cultivated all over the tropics, mainly as an ornamental.
- *F. drupacea* Thunb. ('bunut bulu' in Bali): big tree with brown woolly hairs on buds, twigs and underside of leaves; leaves oblong-elliptical, 11–23 cm × 4–11 cm, tri-nerved at base; figs oblongoid, 2–3 cm × 1–2 cm, yellow; widely distributed from India, throughout South-East Asia to Australia.

**Ecology** In Indonesia, *F. subcordata* grows well in dryland and hilly areas with annual rainfall ranging from 900–2500 mm, mean daily maximum temperatures from 26–39°C and altitudes ranging up to 800 m. It tolerates a wide range of soil types, growing well on limestone-based soil and on sloping land of 25 cm soil depth.

**Propagation and planting** Even though *F. subcordata* can be propagated by seed or layering, propagation by cuttings is most commonly practised by farmers. For direct planting, healthy and straight 2-year-old stems of 5–10 cm in diameter and 1.5–2.5 m length are cut from the parent tree. The end to be planted should be even and free from splitting, and any leaves and twigs should be removed. Each cutting should be planted in a prepared hole of 25 cm depth and 15 cm width, then covered with soil in such a way that the planted stem cannot move. Direct planting should be carried out at the onset of the rainy season, since planting during the wet season causes the buried cambium to rot. Twelve weeks after planting 75% of the cuttings can develop buds and about 70% survive after 52 weeks. Twenty-six weeks after planting a cutting, there can be 8–13 main branches of 45–55 cm length and 10–12 leaves per branch. For planting in nurseries, twigs with

50–100 cm length are inserted in 10–15 cm of soft and moist soil. Such cuttings are not ready for transplanting until the roots are well developed. Since *F. subcordata* seed is very small, it is preferably sown under nursery conditions. After development of the cotyledons and a few secondary leaves, seedlings should be transplanted into pots. Planting into permanent sites is carried out during the rainy season when the plants are 6–12 months old. It can be planted at 5–10 m spacing when used as fence border and at 10 m × 10 m within and between rows spacings when used as windbreak or fodder bank.

**Husbandry** When planted as a cutting, it can be lopped 3 years after planting. Complete defoliation can be carried out before the end of the dry season every year, or partial defoliation twice during the wet season and twice during the dry season. For accumulation of in situ fodder, the tree should be lopped 3–4 months before the dry season so that the foliage is well developed during the dry season, otherwise the leaves will shed during the period of flower and seed formation.

Many species can be grown with *F. subcordata* including grasses such as *Cenchrus ciliaris* L., *Panicum maximum* Jacq. and *Urochloa mosambicensis* (Hack.) Dandy; herbaceous legumes such as *Stylosanthes hamata* (L.) Taub., *Stylosanthes scabra* Vogel, and *Centrosema pubescens* Benth.; shrub legumes such as *Leucaena leucocephala* (Lamk) de Wit and *Gliricidia sepium* (Jacq.) Kunth ex Walp. and fodder trees such as *Lannea coromandelica* (Houtt.) Merrill and *Hibiscus tiliaceus* L.

**Diseases and pests** *F. subcordata* is generally resistant to diseases and pests. Red ants (*Phagiopis longipis*) and black ants (*Formica fusa*) living in the foliage cause no ill effect to the host, but may inconvenience the farmer lopping the tree.

**Harvesting and yield** Fruits of *F. subcordata* are not regularly harvested since they lack commercial or socio-cultural value. The annual fodder and firewood DM yields of a 3-year-old *F. subcordata* range from 12–20 kg and 30–65 kg per tree respectively. As the tree grows older, the annual fodder and firewood DM yields can increase up to 140–225 kg and 240–350 kg per tree respectively. The foliage of a 25-year-old tree can feed one animal of 250 kg live weight for 20–30 days.

**Genetic resources and breeding** Germplasm has been collected but there are no breeding programmes of *Ficus* species in South-East Asia. Germplasm collection and breeding of *Ficus* species has been initiated in Nepal.

**Prospects** *F. subcordata* is a location-specific

species rather than of regional importance. However, once established, it produces a year round supply of fodder for ruminants in dryland farming areas. *F. subcordata* is one of the fodder trees integrated in the 'Three Strata Forage System' currently under test to increase the productivity of dryland farming in Indonesia. In this system the 1st, 2nd and 3rd strata consist of grass and herbaceous legumes, shrub legumes and fodder trees, respectively. Establishment of *F. subcordata* from seeds, so as to increase its distribution and role as a multipurpose tree, should be explored.

**Literature** [1] Backer, C.A. & Bakhuizen van den Brink, R.C., 1965. Flora of Java. Vol. 2. Noordhoff, Groningen, the Netherlands. pp. 20–35. [2] Corner, E.J.H., 1965. Check-list of *Ficus* in Asia and Australasia with keys to identification. The Gardens' Bulletin Singapore 21: 1–186. [3] de Guzman, E.D., Umali, R.M. & Sotalbo, E.D., 1986. Non-Dipterocarps. *Ficus*. In: Umali, R.M., Zamora, P.M., Gotera, R.R. & Jara, R.S. (Editors): Guide to Philippine flora and fauna. Vol. 3. Natural Resources Management Center and University of the Philippines, Manila. pp. 123–130. [4] Kochummen, K.M., 1978. Moraceae, *Ficus*. In: Ng, F.S.P. (Editor): Tree flora of Malaya. A manual for Foresters. Vol. 3. Longman Malaysia, Kuala Lumpur. pp. 135–162. [5] Nitis, I.M., Lana, K., Suarna, M., Sukanten, W., Putra, S. & Arga, W., 1989. Three strata system for cattle feeds and feeding in dryland farming area in Bali. Final report to IRDC, Canada. 252 pp. [6] Panday, Kk., 1982. Fodder trees and tree fodder in Nepal. Swiss Development Co-operation, Berne and Swiss Federal Institute of Forestry Research, Birmensdorf, Switzerland. 107 pp. [7] Sukarji, N.W., Puger, A.W. & Nitis, I.M., 1990. Draft performance of Bali steers fed grass, shrub legume and fodder tree [Indonesian]. National Seminar on Bali cattle, September 20–22, 1990, Denpasar, Bali. 5 pp.

I.M. Nitis

### ***Flemingia macrophylla* (Willd.) Merr.**

Philip. Journ. Sci. 5: 130 (1910).

LEGUMINOSAE

2n = 22

**Synonyms** *Flemingia congesta* Roxb. ex Ait. f. (1812), *F. latifolia* Benth. (1852), *Moghania macrophylla* (Willd.) Kuntze (1891).

**Vernacular names** Indonesia: apa apa (Javanese), hahapaan (Sundanese), pok kepokan (Madura). Malaysia: serengan jantan, beringan.