

REVISION OF THE GENERA *BUTEA* ROXB. EX WILLD. AND
MEIZOTROPIS VOIGT (FABACEAE)

M. SANJAPPA

Botanical Survey of India, Howrah

A B S T R A C T

Butea and *Meizotropis* are small South Asian genera comprising 2 species each. *Meizotropis* which has been merged under *Butea* as a section, is resurrected here as a distinct genus. It shows close resemblance with *Butea* from which it differs in habit, flowers, pollen, pods and seeds. Consequent on the separation of *Meizotropis* from *Butea*, a new combination *Meizotropis pellita* (Hook. f. ex Prain) Sanjappa has become necessary and is made. Keys and descriptions together with illustrations and distribution maps are given. Differences and similarities between *Butea*, *Meizotropis* and *Spatholobus* are also given.

INTRODUCTION

The genus *Butea* was proposed by Koenig (*in Sched.*) to commemorate John, the Earl of Bute (for his services as a botanical author and Patron of botany in tropical Asia in 18th century — vide Prain (1908) with one species—*Butea frondosa* to accommodate the well-known 'Palas' or 'Dhak' (Hindi vernacular name for the 'Flame of the Forest'). Roxburgh (1792) described *Butea frondosa* proposed by Koenig along with *Butea superba* Roxb. — an extensive woody climber representing 'Maduga' and 'Tiga Maduga' respectively of *Gentoos* (tribals of Coromandal Coast). However, he did not describe the genus. The above 2 species were again described with illustrations by Roxburgh in 1795, still without generic description. Under *Butea frondosa*, Roxburgh (l.c.) referred *Plaso* of Rheede (1686) unaware of names, such as *Plaso* Adans. (1763) and *Erythrina monosperma* Lam. (1790) for Rheede's plant. Prior to Lamarck (1790), Adanson (1763) validated *Plaso* Rheede—a pre Linnaean name with description and illustrations, but he did not assign any binomial

under it. However, *Plaso* was further considered by Kuntze (1891) and he transferred *Erythrina monosperma* Lam. as *Plaso monosperma* and treated *Butea monosperma* Kuntze and *B. frondosa* Roxb. as synonyms. He also published 2 varieties viz., *rubra* and *flava* based on colour of flowers.

Although Roxburgh (1792, 1795) described and illustrated two species *Butea frondosa* and *B. superba*, they were validated by Willdenow (1802) when he gave the generic description and briefly described both species attributing them to Roxburgh. Even after validation of the genus *Butea* and its two species by Willdenow, confusion persisted with regard to attribution of correct authority. Panigrahi and Mishra (1984) proposed to amend entries under *Butea* and rightly recommended deletion of the entry 'typ. cons.', attribution of generic authority to Willdenow, and typification of *Plaso* Adans. by *Plaso monosperma* (Lam.) Kuntze (*Erythrina monosperma* Lam.).

In 1814, Roxburgh added one more species *Butea parviflora* Roxb. (*nom. inval.*)

to the genus, which was validated by De Candolle in 1825. This species was later transferred to *Spatholobus* by Benth. (1852) as *Spatholobus roxburghii* Benth. (*nom. superfl.*). This transfer was accepted by Miquel (1855), Baker (1876), Kuntze (1891), Taubert (1894), Gagnepain (1916) and recently by Ridder-Numan and Wiriadinata (1985). However, the correct combination was made by Kuntze (1891) by retaining the original epithet '*parviflorus*' under *Spatholobus* as *S. parviflorus* (Roxb. ex DC.) Kuntze. De Candolle (1825), Sprengel (1826), Graham (1839), Baker (1876) and Prain (1908) added 4 more species : viz., *B. braamania* DC. based on an illustration (t. 23) of Bhote's '*Icones Plantarum Sponte China Nascentium Bibliotheca Braamania Excerpte*': *B. loureirii* Spreng. based on *Genista scandans* Lour. from Cochin-china; *B. gibsonii* Grah. based on specimens from Western India; *B. minor* Buch.-Ham. ex Baker based on specimens collected by Buchanan-Hamilton from Nepal and later issued by Wallich under *Wall. Cat. no. 5439A* along with *Wall. Cat. no. 5439B*—a specimen collected by De Silva from Jaintia Hills and *B. pellita* Hook. f. ex Prain based on specimens collected by Capt. C.A. Sprawson from Kumaon Himalaya respectively.

The genus *Meizotropis* was described by Voigt (1845) with one species *M. buteiformis* ('*buteaeformis*') based on plants raised in Serampore garden from the seeds he received from Griffith in 1837. Subsequently, Griffith (1854) accepted Voigt's new species and gave a detailed description of *Meizotropis buteiformis* ('*Megalotropis buteaeformis*') based on living specimens in Serampore garden (referred to Voigt's garden by Prain (1908) and erroneously

as Saharanpore garden by Grierson and Long (1979). However, the orthographic error* '*Megalotropis*' of Griffith's name persisted as a distinct generic epithet in some later works (Airy-Shaw, 1973 and Farr *et al.*, 1979) even after it has been clarified by Prain (1908). Benth. (1852, 1865), unaware of the publication of *Meizotropis buteiformis* Voigt which is exactly the same plant Buchanan-Hamilton named as *Butea minor*, treated it under *Butea* and this treatment was later adopted by Baker (1876) and Taubert (1894), but the latter clearly indicated *Meizotropis* Voigt including its orthographic variant *Megalotropis* Griff. as its synonyms. Prain (1908), while reassessing the genera *Butea*, *Meizotropis* and *Spatholobus*, united *Butea* and *Meizotropis* treating *Meizotropis* as a section under *Butea*. Under the new section he included *B. minor* and described an allied species *B. pellita*. Haines (1922), Osmaston (1927) and Blatter (1929) followed Prain's views on the status of *Butea* and *Meizotropis*, but, Blatter (l.c.) further emended the circumscription of *Butea* mainly based on number of ovules to include *Spatholobus* Hassk. as new section and transferred all species of *Spatholobus* to *Butea*. However, *spatholobus* was later treated as a distinct genus by Hutchinson (1964), Lackey (1981) and recently by Ridder-Numan and Wiriadinata (1985). In view of these controversies regarding the status of the 3 genera viz., *Butea*, *Meizotropis* and *Spatholobus* their circumscriptions are reassessed in the present study. Although these 3 genera share some characters in common, the distinct differences presented in Table 1 are sufficient to treat them as separate genera. Aside from many quantitative

* "..... used by Taubert as if it were a new generic name proposed by Griffith. This citation does not represent Griffith's intention, since Griffith himself attributes the name to Voigt. It is not impossible, though it is unlikely, that Griffith by a *lapsus calami* wrote *Megalotropis* instead of *Meizotropis* in all probability the altered orthography is one more instance of editorial laxity conspicuous throughout Griffith's posthumous papers" (Prain 1908).

Table 1. Differences and similarities among *Butea*, *Meizotropis* and *Spatholobus*

	BUTEA	MEIZOTROPIS	SPATHOLOBUS
Habit :	Trees or extensive woody climbers	Suffrutescent, erect or scandent shrubs.	Woody climbers
Bark :	Exfoliating or smooth.	Smooth	Smooth
Leaves :	Up to 50 cm long, rachis slender, terete or faintly flat above. Leafless during flowering	60-100 cm long, rachis flat and acute angular above. Leaves present during flowering.	Up to 40 cm long, rachis slender, faintly obtuse angular above. Leaves present during flowering
Leaflets :	(10-) 15-30 (-40) × (8-) 10-20 (-25) cm, rounded or retuse to emarginate at apex.	15-50 (-60) × 10-30 (-40) cm, acute to acuminate at apex	(4-) 6-21 × 2.5-10 (-30) cm, obtuse to retuse at apex.
Stipule :	5-10 × 2.5 mm, linear or subulate, subpersistent	10-20 × 5-10 mm, ovate or suborbicular, caducous	3-10 × 1-4 mm, subulate, caducous
Inflorescence :	Stiff, 10-30 cm long pseudo-panicles, axillary on leafless branches; fascicles 0.5-4 cm long, 1-10-flowered	30-60 cm long, pseudo-panicles, usually terminal and supraaxillary, fascicles 3-10 mm long, 4-8-flowered	10-40 cm long panicles or pseudo-panicles, axillary or terminal, fascicles 0-20 mm long 2-5-flowered
Pediceal	1.5-3 cm long, stout	1-1.5 cm long, slender	1.5-5 mm long, slender
Calyx :	1.5 cm in diameter, 1.5-2 cm long, 5-ribbed, blackish-brown velvety without; grey silky within	8-10 mm in diameter; 1.3-1.6 cm long; yellowish-brown to grey sericeous on both surfaces.	1.5-3 mm in diameter, 1.4-4 mm long, pubescent or puberulous on both surfaces
Standard :	Claw 3-5 mm long, curved, pubescent; blade 1.5-5 × 3-3.5 cm, ovate, acute auricled, strongly reflexed from base, appendages absent, silvery grey velvety without, glabrous within	Claw 4-8 mm long, straight, glabrous; blade 10-16 × 8-10 mm, lanceolate or elliptic, acute, inflexed auricled at base; reflexed from about middle, appendages absent densely yellow sericeous on both surfaces.	Claw 0.5-1.25 mm, straight, glabrous; blade 3-6 × 3-6.5 mm, truncate or emarginate, glabrous rarely auricled, not reflexed, appendages absent.
Wing	Shorter than keels. Claw 1 cm long; blade 5-7 × 2-2.5 cm, silvery-grey velvety on both surfaces except for lower half on ventral surface; upper auricle 4 × 3 mm long, auricle and pocket portion spongy	Shorter than keel. Claw 1 cm long; blade 1.5-3 × 0.8-1.0 cm, yellow sericeous without; glabrous within; upper auricle 1.5 × 1 mm, not spongy	Shorter or longer than keel, claw 1-4 mm long; blade 1-3.5 × 1-2 mm, pubescent or glabrous, upper auricle 0.2-2 × 0.4 mm, not spongy
Petals			
Keel	Claw 1 cm long; blade 8-9.5 × 2.5-3.5 cm, connate ventrally, pubescent	Claw 1 cm long; blade 3-3.5 × 1.5-2 cm, connate ventrally, pubescent.	Claw 1-3 mm long; blade 1.5-4.5 × 1.2-3.0 mm connate ventrally or free
Petals			
Stamens :	6.5-8.5 cm long, free filaments arising at different levels on staminal sheath, sheath pilose on both surfaces; anthers 2-3 mm long, linear, nearly basifixed	2.5-3.0 cm long, free filaments arising from the same level on staminal sheath; pilose as in <i>Butea</i> ; anthers 1-1.2 mm long; ellipsoid, nearly medifixed.	2.5-6 mm long, free filaments arising at different levels on staminal sheath, glabrous or pilose; anthers 0.2-0.5 mm long nearly basifixed
Pollen :	3-zonocolporate, endocolpium elongate; exine reticulate, grains 40-52 × 37-44 μm.	3-zonocolporate, endocolpium circular; exine rugulate verrucate; grains 31-39 × 30-37 μm.	3-zonocolporate, endocolpium elongate; exine psilate; grains 45 × 44 μm.

Nectary glands :	Distinct	Obscure	Obscure
Pistil	10 cm long including 1.5 cm long stipe, densely pilose, ovules 4-6 (-7)	2.7 cm long including 8 mm long stipe; densely pilose, ovules 2	1-4 mm long including a very short stipe, glabrous or pilose, ovules 2, rarely 2-4
Pod	10-20 × 2.5-5.0 cm, flat, linear-oblong, curved and narrowing at dehiscent seed bearing tip, densely grey or brown velvety and more so towards tip	6.0-8.5 × 2.5-3.5 cm, flat, obovate or oblong, not curved at tip, uniformly brown velvety throughout	(4-) 6-10 × 1.3-2.5 cm, flat, oblong or linear, curved and narrowing at indehiscent seed bearing tip, glabrous or pubescent
Seed :	2.5-4.0 × 2-3 cm, oblong-reniform or obovoid or suborbicular, compressed with distinct reticulate impressions on both surfaces, smooth, reddish-brown	1.5-2.2 × 1-1.7 cm, oblong-reniform or suborbicular, convex on both sides, pitted, obscurely keeled and grooved along margins of lower portion, upper 1/8 portion narrower.	10-16 × 5-10 mm, suborbicular, oblong-reniform or oval, compressed, smooth

differences, some of the salient characters that differentiate *Meizotropis* from *Butea* are its shrubby habitat; distinctly ovate to suborbicular, large stipules; much branched large panicles bearing smaller flowers; straight calyx tube with yellowish-brown pubescence; standard that is much shorter than keels, reflexed from about middle, distinctly inflexed auriculate at base, yellowish-brown pubescent on both surfaces; free filaments arising from the same level, anthers ellipsoid and nearly medifixed, pollen with verrucate exine; ovules always 2; seeds distinctly broader at base and narrower towards tip, margin of broader portion keeled, pitted towards hilum. In the present study, the genera *Butea* and *Meizotropis* are revised based on field and herbarium studies.

BUTEA Roxb. ex Willd. *nom. cons.*

Butea Roxb. [in *Asiat. Res* 3 : 469. 1792; *Fl. Coromandel* 1 : 22. t. 21. 1795] ex Willd. *Sp. Pl.* 3 : 917. 1802; DC., *Prodr.* 2 : 414. 1825; Roxb., *Fl. Ind.* (Carey ed.) 3 : 243. 1832; Miq., *Fl. Ind. Bat.* 1, 1 : 205. 1855; Benth. in Benth. & Hook. f., *Gen. Pl.* 1 : 533. 1865 excl. *B. minor*; Taub. in Engl. & Prantl, *Nat. Pflanzenf.* 3, 3 : 365. 1894; Prain, *Bull. Misc. Inf.* 1908; 385. 1908. *p.p. excl. sect. Meizo-*

tropis; Blatt., *Journ. Ind. Bot. Soc.* 8 : 134. 1929. *p.p. excl. sect. Meizotropis & Spatholobus*; Hutch. *Gen. Fl. Pl.* 1 : 433. 1964; Lackey in Polhill & Raven, *Adv. Legum. Syst.* 1 : 312. 1981; Panigrahi & Mishra, *Taxon* 33 : 119-120. 1984. Lectotype species : *B. frondosa* Roxb. ex Willd. *nom. illeg.* [*Butea monosperma* (Lam.) Taub. (*Erythrina monosperma* Lam.)].

Plaso Adans. *Fam. Pl.* 2 : 325, 529. 1763. Type species : *P. monosperma* (Lam.) Kuntze (*Erythrina monosperma* Lam.).

Trees or extensive woody climbers or climbing shrubs, young branches tomentose; bark smooth or exfoliating, lenticellate. Leaves alternate, pinnately trifoliating, leaflets coriaceous; stipules small, linear or subulate, pubescent, caducous; rachis pulvinate, infrajugal rachis always longer than ultrajugal part; stipels smaller than stipules, subulate, pubescent, caducous, one each at the base of lateral petiolules and 2 at the base of terminal petiolule, petiolules pulvinate; terminal leaflet larger, symmetric, usually rhomboid, obtuse to emarginate at apex; lateral leaflets slightly smaller, asymmetric with basioscopic side broader than acroscopic side, obliquely

ovate, obtuse to rounded at apex; veins prominently raised on lower surface, scalariform reticulate, tomentose on both surfaces, glabrous above with age. Inflorescence an axillary or terminal densely fascicled pseudo-raceme or panicle. Bracts at the base of lateral branches and pedicels of flowers, lanceolate, elliptic or broadly ovate, acuminate, sub-persistent. Pedicels short or long, jointed below calyx, becoming stout in fruits; bracteoles 2, opposite, linear, sub-persistent. Flowers papilionaceous, usually orange-yellow or orange-red, sometimes yellow or white. Calyx broadly campanulate, olive green, blackish-brown velvety; grey-sericeous within, persistent; lobes 4, dorsal lobe broad, emarginate, recurved, ventral lobe narrowly triangular or dentate, acute, lateral lobes broadly triangular. Standard ovate, acute, auricled at base, silvery-white velvety without glabrous, prominently veined and bright pigmented within, appendages absent, strongly reflexed during anthesis; wing petals equal to or slightly longer than standard, falcate, reflexed, silvery-white on both surfaces except for upper half within, pigment absent on claw and spongy upper auricle; interlocks keel with their pockets; keel petals, falcate, acute, longer than other petals, connate along the ventral margin, pockets present, silvery-white velvety without, ciliate along margins, glabrous and prominently veined within. Stamens diadelphous (9+1), vexillary stamen short and free, stamens alternately long and short, staminal tube pilose with two nostril like openings at base, anthers uniform, linear, all fertile, dehiscence longitudinal. Nectary glands 10-lobed, distinct, yellowish-green at the base of staminal sheath, densely pilose. Ovary stipitate, woolly, gradually narrowing into long curved style, style velvety up to the middle; stigma capitate on abruptly narrowed tip of style; ovules 4-6 (-7), arranged along the upper margin of the locule. Pods distinctly stipitate,

pendulous, symmetric or asymmetric at base, oblong or broadly linear, flat with wing-like base empty, seed-bearing tip thick, curved, dehiscent, transversely veined grey or brown velvety, more densely towards tip, upper suture thicker and broader than lower. Seeds ovate or obovate or sub-orbicular, compressed, smooth with impressions of reticulate veins, reddish-brown; cotyledons yellowish-white.

Distribution : 2 species confined to Southeast Asia from sea-level to 1000 m, predominantly in dry habitats (Map).

Anatomy : The indumentum is composed of uniseriate, 5-6-celled hairs. The leaflets lack stomata on the adaxial surface. Paraveinal mesophyll present (Lackey 1978).

Cytology : The chromosome number reports in species of *Butea* (including *Meizotropis*) are presented in the following table 2.

It is clear from the table below that the chromosome numbers known so far in *Butea* (as well as *Meizotropis*) support the base number 9. In the subtribe *Erythrininae* of the tribe *Phaseoleae* *Butea* and *Meizotropis* with base number 9 stand apart cytologically (like *Erythrina* $\times = 21$ and *Strongylodon* $\times 14$ Goldblat, 1981). Unlike *Mucuna* and *Apios* with $n = 11$ which are in line with other members of the tribe *Phaseoleae* in general. Investigation of chromosome numbers in other genera of the subtribe may further support the cytologically diverse nature of the subtribe *Erythrininae*. Lackey (1981) while supporting the base number 9 for *Butea* states that "the chromosome counts of *Butea* (including *Meizotropis*) $2n = 18$, and *Calpogonium* ($2n = 36$) seem to be based on number 9 which deviate from more common numbers 10 and 11 probably reflecting tribal misplacement. These 2 genera perhaps have a common mode of derivation of the base number from ancestors with base number 11 but this derivation

is surely from different ancestors". Recently Raghuvanshi and Paride (1985) have reported the presence of B-chromosomes in pollen mother cells of *Butea monosperma* trees growing near Lucknow (India).

Systematic position : De Candolle (1825) treated *Butea* in his undivided tribe *Phaseoleae*. Wight & Walker-Arnott (1834) placed *Butea* in subtribe *Dalbergieae* which was followed by Voigt (1845). Miquel (1855)

Baker (1876) considered *Butea* and *Spatholobus* to be more close to some members of *Dalbergiae*. This was supported by Murthy (1986, unpublished) based on palynological observations in *Spatholobus* (exine psilate). However, the pollen of *Butea* with exine reticulate and *Meizotropis* with exine verrucate are more close to members of phaseoleae especially the genus *Mucuna*.

The genus *Butea* is one of the two genera

Table 2

Name of the species	Chromosome nos.		References
	n.	2n	
1. <i>Butea monosperma</i> (Lam.) Taub.	9	—	Raghavan & Arora 1958; Sanjappa & Bhatt 1975.
	—	18	Nanda, 1962; Bir & Sidhu 1967; Mitra & Dutta 1967; Mehra & Sareen 1973, Sanjappa & Bhatt 1975.
2. <i>B. superba</i> Roxb. ex Willd.	—	18	vide Goldblatt 1981.
3. * <i>B. minor</i> Buch.-Ham. ex Baker	9	—	Rao, 1967, Sanjappa & Sathyananda 1979.
4. * <i>B. pellita</i> Hook. f. ex Prain	—	18	vide Goldblatt 1981.

* Species marked with asterisk are treated in this paper under the genus *Meizotropis*.

placed *Butea* along with *Spatholobus*, *Erythrina* and *Mucuna* in subtribe *Erythrininae* of the tribe *Phaseoleae*. Bentham (1865) followed Miquel so far it relates to *Butea*, *Erythrina* and *Mucuna* but transferred *Spatholobus* to subtribe *Galactinae*. Taubert (1894) and Hutchinson (1964) followed Bentham's treatment but the latter raised the subtribes to tribal level, thus placing *Butea* in tribe *Erythrininae* and *Spatholobus* in *Galactieae*. Baudet (1978) divided *Phaseoleae* into 3 subtribes based on differences in development of style and also demonstrated polyphyletic origin of *Erythrininae*. He placed *Butea* and *Spatholobus* in subtribe *Glycininae* which he considered as primitive (a group with simple style). Thuan (1979) placed *Butea* along with *Spatholobus* in subtribe *Diocleinae* based on inflorescence having flowers in distinct panicles. Lackey (1981) treated *Butea* and *Spatholobus* in subtribe *Erythrininae* and considered it to be a heterogeneous assemblage.

of the entire tribe *Phaseoleae* with arborescent habit, the other being *Erythrina*. Therefore it seems preferable to treat *Butea* along with *Erythrina* despite the puzzling status of the latter. While in *Meizotropis*, the standard is furnished with two basal inflexed auricles which are free and running down wing-like into claw (a character shared by subtribes *Phaseolinae* and *Cajaninae*) stands isolated in the subtribe *Erythrininae*. In the absence of substantial evidences for placement of *Butea*, *Meizotropis* and their allied *Spatholobus* in other apparently uniform (in exomorphic characters and chromosome numbers) subtribes or tribes, it appears reasonable to retain them in their traditional subtribe *Erythrininae*, along with other heterogenous genera as suggested by Lackey (1981) until support is put forward in favour of their segregation.

ECONOMIC USES

The information on uses is based on Roxburgh (1792, 1795, 1832), Watt

(1890) and also from the data on herbarium specimens.

Gum : Beautiful red juice exudes from natural fissures and artificial incisions in the bark during summer months which hardens into a vitreous ruby-red gum called '*Bengal kino*' or '*Butea gum*'. The gum contains tannin and mucilaginous material which on distillation yield *Pyrocatechin*—a powerful astringent, administered to control chronic diarrhoea. The gum is soluble in water as well as spirit. A durable ink is prepared by adding vegetable alkali to the solution of gum. In combination the gum is used as a lotion and in Poultices (Burkill, 1935).

Wood : The wood is soft, white (when cut fresh) turns yellowish-brown or greyish-brown (liable to sapstain), not durable, used as well curbs and water scoops. It is also used for making gun-powder, charcoal and sometimes as fire wood (produces heavy smoke).

Fibres : The root bark is reported to yield fibres used in rope making in India and is locally called as '*Chhoel*' (in Bihar) and '*Bakambra*' (Uttar Pradesh).

Dyes : The flowers (fresh as well as dried) yield a brilliant but very fugative yellow or gamboge dye or orange-red. This is used for dyeing cotton and silk cloth and for playing (by spraying) in festival of colours (called '*Holi*' in India).

Medicinal : The bark is given in conjunction with ginger in cases of snake-bite. The seeds have long been valued for their anthelmintic property (freshly powdered new seeds are reported to yield better results). When powdered with lemon juice and applied, the seeds act as a powerful rubifacient and has been successfully used in curing a form of Herpes known as '*Dhobie's itch*'. Seeds yield oil (Burkill, 1935).

Ornamental : *Butea monosperma* is commonly cultivated in gardens for its

beautiful orange-red flowers and goes by the name '*Flame of the Forest*'. The crown of blossoms in sunlight suggests forest in flames, hence the name. The tree when in flowers is totally or partially leafless and appear gorgeous.

Miscellaneous uses The leaves are largely used throughout India for making platters, cups, wrappers for packing eatables and flowers, as '*Beedi wrappers*' (Beedies are made of tobacco rolled in cut leaves used commonly for smoking in India), as fodder for buffaloes, elephants and goats.

The tree as a host is important to *Lac* industry which produces most of world's '*Shellac*'. The *Lac* insects frequent the tree and puncture young twigs and leaf rachises causing the '*stick lac*' gum to exude.

The tree is considered as sacred by Hindus and Buddhists. Hindus attribute that among the 3-leaflets of the leaf, the lateral leaflet (left) as representing '*Brahma*' (God of creation), terminal leaflet as '*Vishnu*' (God of protection) and the other lateral leaflet (right) as '*Mahesh*' (God of destruction). Hindus use the wood for making utensils for religious purposes and dried twigs for burning in sacred fires (called '*Homa*' in Sanskrit) in religious ceremonies.

KEY TO THE SPECIES

Trees : trunk 40-70 cm in diameter

monosperma

Woody climbers : trunk 25-40 cm in diameter

superba

***Butea monosperma* (Lam.) Taub. in Engl. & Prantl, Nat. Pflanzenf. 3, 3 : 365. 1894; Sant. in Rec. Bot. Surv. India 16(1) : 66. 1953; Stearn in Blätt. & Mill, Beaut. Indian Trees 12. 1955; Backer & Bakh. f. Fl. Java 1 : 629. 1963; Ohashi in Univ. Mus. Univ. Tokyo Bull. no. 8 : 58. 1975; Ali in Nasir & Ali, Fl. W. Pakistan Fasc. 100 : 236. 1977; Maxwell in Thai For. Bull. 10 : 86. 1977; *Erythrina monosperma* Lam., Encycl. 2 :**

391. 1790; *Plaso monosperma* (Lam.) Kuntze, Rev. Gen. Pl. 1 : 202. 1891 Type : India, Malabar, *Herb. Lamarck* (P. Microfische).

= *Butea frondosa* Roxb. [in Asiat. Res. 3 : 469. 1792 (1795 ?); Pl. Coromandel 1 : 21, t. 21. 1795] ex Willd. Sp. Pl. 3 : 917. 1802 (*nom. superfl.*); DC. Prodr. 2 : 414. 1825; Spreng., Syst. Veg. 3 : 186. 1826; Roxb., Hort. Bengal. 53. 1814 et Fl. Ind. (Carey ed.) 3 : 243. 1832; Wight in Hook. Bot. Misc. 3 : 102. Suppl. t. 32. 1833; Wight & Arn., Prodr. Fl. Pen. Ind. Or. 243. 1834; Benth. in Miq., Pl. Jungh. 238. 1852; Miq., Fl. Ind. Bat. 1, 1 : 205. 1855; Dalz. & Gibs., Bombay Fl. 71. 1861; Bedd., Fl. Sylv. 176, t. 176. 1872; Baker in Hook. f., Fl. Brit. India 2 : 194. 1876; Kurz, For. Fl. Brit. Burma 1 : 364. 1877; Trimen, Handb. Fl. Ceylon 2 : 66. 1891; Gamble, Man. Indian Timb. 243. 1902 et Fl. Pres. Madras 357. 1918; Cooke, Fl. Pres. Bombay 1 : 371. 1902; Prain, Bengal Pl. 1 : 401. 1903 et in Bull. Misc. Inf. Kew. 1908 : 385. 1908. Duthie, Fl. Upper Gangetic Pl. 240. 1908; Talbot, For. Fl. Bombay & Sind 409. 1911; Gagnep. in Lecomte, Fl. Indo-Chine 2 : 413. 1913; Parker, For. Fl. Punjab 159. 1918 et Comm. Indian Trees 6, t. 3. 1937; Haines, Bot. Bih. & Or. 279. 1922; Craib, Fl. Siam. Enum. 1 : 445. 1928; Blatt. in Journ. Ind. Bot. Soc. 8 : 134. 1929; Bor, Man. Indian For. Bot. 92. 1953; *Rudolphia frondosa* (Roxb. ex Willd.) Poir, in Lam. Encycl. 6 : 333. 1804 (Type : same as *Erythrina monosperma* Lam.-Art. 7. 11).

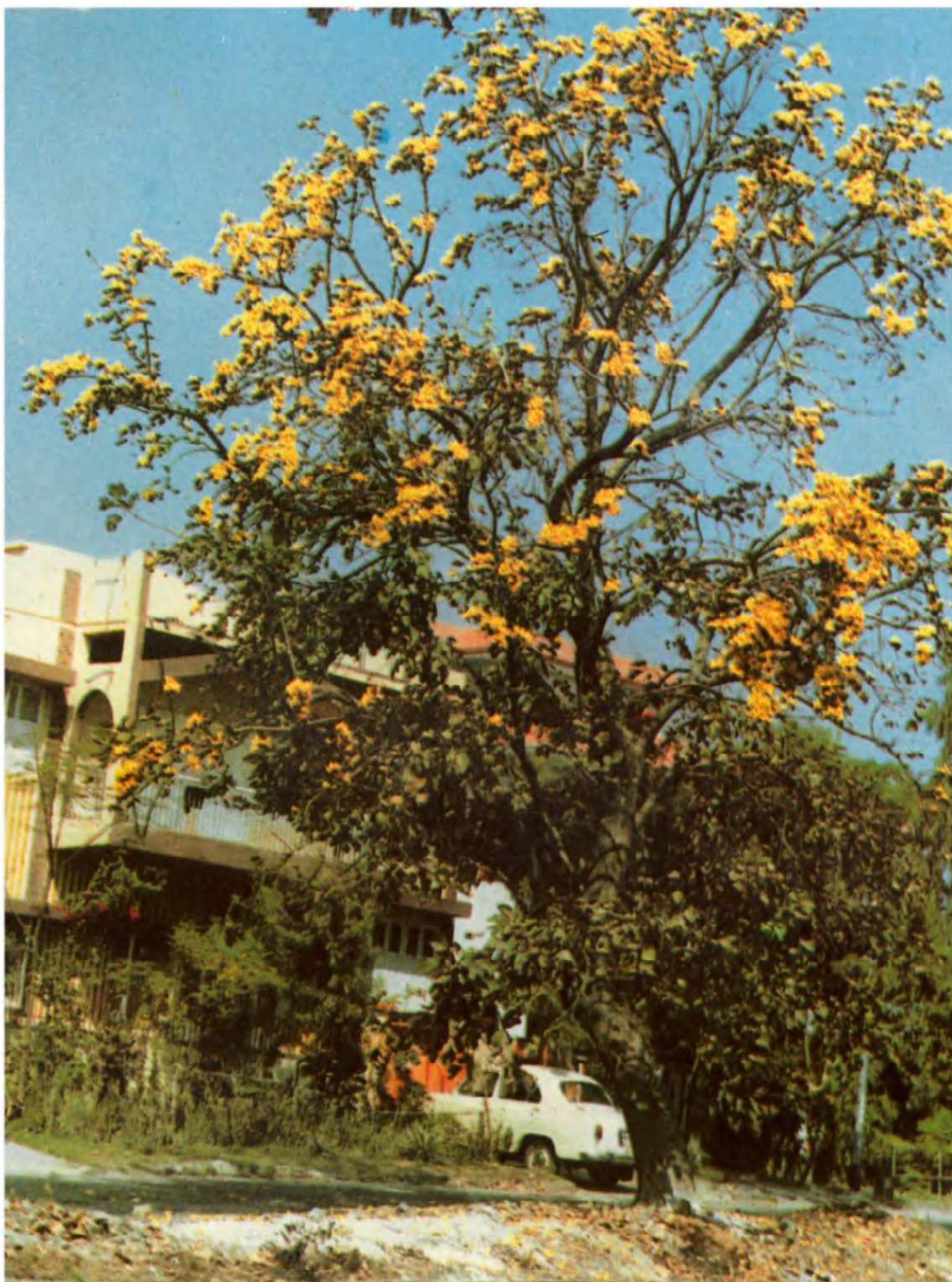
= *B. braamania* DC. Prodr. 2 : 445. 1825 (Type : *Bohte's Icones Plantarum Sponte China nacentium e bibliotheca Braamiana excerptae* t. 23. 1821.

= *Plaso monosperma* (Lam.) Kuntze var. *rubra* Kuntze, Rev. Gen. Pl. 1 : 202. 1891 (Type : *n. v.*).

= *P. monosperma* (Lam.) Kuntze, var. *flava* Kuntze, Rev. Gen. Pl. 1 : 202. 1891 (Type : *n. v.*).

= *Butea frondosa* Roxb. ex Willd. var. *Lutea* Witt, For. Fl. Berar Cir. 75. 1956, *syn. nov.* - *B. monosperma* (Lam.) Taub. var. *lutea* (Witt) Mahesh. in Bull. Bot. Surv. India 3 : 92. 1962; Sant. in Rec. Bot. Surv. India 16(1) : 66. 1953 (Type : India, Maharashtra, Yeotmal Division, Kharbi, alt. 900', 17 March 1909. *C.G. Rogers s. n.* (CAL.).

Deciduous trees, 8-15 m tall; bark smooth or exfoliating in small irregular pieces; branches crooked, green, angular, grey tomentose when young, blackish-brown, terete, glabrous with age. Leaves pinnately trifoliolate or rarely unifoliolate; stipules 4-6 × 2-3 mm, pubescent; ultrajugal rachis 7-15 cm long, flat above, pubescent; infrajugal rachis 4.0-7.5 cm long, pulvinus 1.0-1.5 × 0.5 cm, glabrous, wrinkled when dry; petiolules 5-10 × 2-3 mm, pubescent; stipels 3-5 × 1.0-1.5 mm; terminal leaflet 10-25 × 8-20 cm rhomboid or obovate, rarely orbicular, cuneate to obtuse at base, obtuse to rounded or emarginate at apex, coriaceous, densely grey pubescent or glabrescent, lateral veins 5-7 pairs; lateral leaflets 7-20 × 4-15. Inflorescence 10-25 cm long, axillary in fallen leaf bases towards tree tops; fascicles 1.5-4.0 cm long, (1-) 3-5 (-7)-flowered; bracts 6-12 × 2-3 mm, densely blackish-brown tomentose without, puberulous within; bracteoles 4-8 × 1.0-1.5 mm; pedicels 1.5-3.0 cm long, blackish-brown pubescent. Flowers 4-8 cm long, orange-red, orange-yellow, sometimes yellow or white. Calyx 1.0-1.2 cm in diameter, 1.5 cm long, 5-ridged; dorsal lobe 5-6 × 4 mm; ventral and lateral



Butea monosperma (Lam.) Taub. (yellow flowered) — Habit.



Butea monosperma (Yellow flowered)

Meizotropis buteiformis Voigt – Habit

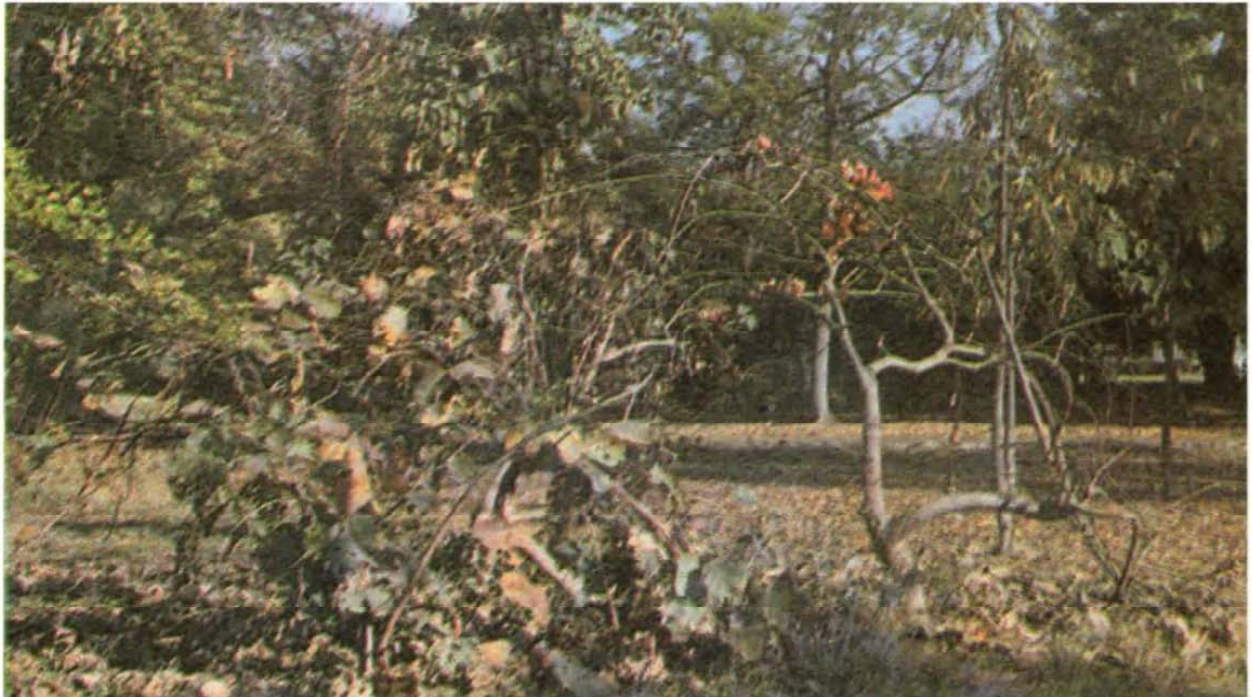




Meizotropis buteiformis



Butea monosperma (Lam.) Taub- (orange-red flowered),



Butea superba Roxb. ex Willd. —Habit.

Butea monosperma (Lam.) Taub. — Close up of flowers (orange-red flowered)





Butea superba Roxb. ex Willd. —Close up of flowers.

lobes 3.5×2.3 mm. Standard 4.5×3.4 cm, densely silvery-white velvety without, glabrous within, claw 3.4×2 mm; wings obtuse at apex, claw $5.6 \times 2.0-2.5$ mm, blade $4.5-5.0 \times 1.2$ cm, upper auricle 3.0×2.5 mm; keel petals united along the ventral margin, blade $5.6 \times 2.5-3.0$ cm, claw $1.0-1.2 \times 0.2-0.3$ cm, silvery-white velvety. Stamens 6-10 mm long, filaments projecting at different levels; anthers 1 mm long, nearly basifixed, gutter-like staminal tube white (brown when dry) pilose on both surfaces and along the opening. Ovary 1.0-1.2 cm long, linear, grey to greyish-pink velvety; ovules 4-6(-7) attached along the dorsal margin; ovary gradually merging into style, 8.5-9.5 cm long, falcate, velvety to pilose up to the middle; stipe 4-6 mm long, velvety, elongating in fruit. Pods 10-16 (-18) $\times$ 3-5 cm; shapes variable (Fig. 2B-D), basal portion thin, prominently veined, velvety when young, glabrous or glabrescent with age; endocarp papery, reddish-brown, smooth. Seeds 2.5-4.0 $\times$ 2-3 cm, compressed, broadly bean-shaped, sometimes, nearly orbicular, hilum small at the junction of lower broader and upper narrower portion.

Flowering : January to March.

Fruiting : March to May.

Distribution : India (throughout), Pakistan, Sri Lanka, Nepal, Burma, Indonesia, Thailand, Indo-China, Introduced in New Guinea.

Habitat : Generally grows gregariously in open grasslands and scattered in mixed forests up to an altitude to 1000 m, Associated with *Shorea robusta* in Sal belt; with *Dalbergia-Anogeissus-Helicteres* in deciduous forests; with *Pongamia pinnata* along rivulets and streams. Thrives very well on both poor and rich soils, drought and saline conditions.

Vernacular names : In India : *Palas* (Bengali, Marathi, Hindi); *Khankar* (Gujarathi); *Dhak* (Hindi); *Muthugada Mara*

(Kannada); *Palas Insamatha* (Malayalam); *Porasu* (Oriya); *Palasha, Kinsuka* (Sanskrit); *Tissu* (Punjabi); *Parasa, Porasat Maram* (Tamil); *Maduga, Moduga* (Telugu); *Dhak, Chichra, Polah* (Urdu). In other countries : *Palasi, Bulyettra, Lahokung* (Nepali); *Poukpan, Pank* (Burmese); *Gaskela* (Sinhalese); *Tawng, Tawng-kwao, Kwao, Chan* (Siamese); *Kwao, Chan* (Laos); *Cha* (Khmer). *The Flame of the Forest, Bastard Teak* (English); *Belaubte Butea* (German).

Notes

1. Prain (1908) had rightly reduced *Butea braamiana* DC. as a synonym of *B. frondosa* Roxb. explaining that Bhote's (who issued a set of thirty drawings believed to be from China, of which t. 23 was the basis of DeCandolle's species) title page is slightly in error and the same set of drawings arranged differently in Cattley's edition 1818 were found to represent plants from China and India. Since *Butea* is not known from China, Prain (*l. c.*) considered the drawing of *B. braamiana* represents with fidelity *B. frondosa* while in young leaves. I support Prain's view as it is clear from DeCandolle's diagnosis of the species "..... Sed foliola albo (Veresim tomento) marginata, calyces virescentes, flores in racemo parvi, genitalia, petalis divergentibus, magis exserata" agrees well with *B. monosperma* (= *B. frondosa*) in late flowers with young leaves.

2. Kuntze (1891) reduced *B. frondosa* Roxb. ex Willd., *nom. superfl.* as a synonym of *Plaso monosperma* and erected two varieties viz., *rubra* and *flava* under it, based on red and yellow coloured flowers. Similarly Witt (1956) described *B. frondosa* var. *lutea* based on yellow coloured flowers. In the present study it is found that the flower colour in *B. monosperma* range from brick-red to pure white with several shades of intermediate orange-yellow and yellow colours. Apart from colour variation, no other character is found to differ among

these plants to support the creation of distinct varieties. Therefore, they are reduced as synonyms in this work.

3. A few trees from Madhya Pradesh (*vide* Punde in *Ind. For.* 34 : 358. 1908 and Sagreiya in *Ind. For.* 45 : 506. 1919) and Maharashtra* (*vide* Malcolm in *Ind. For.* 45 : 504. 1919) are reported to exhibit unifoliate leaves as an exception to normal trifoliate leaves. Apart from the above reports I have observed unifoliate condition in a roadside tree on way from Baroda to Savali (Gujarat, India). Except for the reduction in number of leaflets, no other differences in the exomorphic characters of these plants are observed. Incidentally these trees with unifoliate condition are considered sacred by Hindus and are thus conserved.

4. All the works on the genus *Butea* except Wight (1833) Beddome (1874), Gupta (1924) and Blatter (1929) state that the ovary contains 2 ovules. It was Gupta (*l. c.*) who has reported that *Butea monosperma* (= *B. frondosa*) and *B. superba* have ovules numbering 4-7. In the present study, I confirm Gupta's observation of 4-7 ovules in *B. monosperma* and *B. superba*.

Specimens examined: ** This species grows very commonly throughout India up to an altitude of 1000 m and is represented by a large number of specimens (examined more than 200 specimens). Therefore, only specimens of other countries examined by me are cited here.

BURMA : Prome District, Pegu, Tonk yeahat, *S. Kurz* 1710; Yomah, Thongyee, *S. Kurz* 1710; in Savanna, Pougday, 22 Jan. 1871, *S. Kurz* 2535; Magwe District, Thabyewing, Old extension Naga-tim, 27 Feb. 1915, *C.G. Rogers* 926; Rangoon District, Mingahlon, 22 Feb.

* specimen collected from Ambevani, Nasik Dist. is reported (Singh & Kumar in *Sci. & Cult.* 48 : 183, f. 3-4. 1982) to exhibit 4-5 foliolate leaves.

** Specimens not otherwise specified belong to CAL.

1932, *C.E. Parkinson* 13964; Myanounng, Henzada, Feb. 1903, *S. Mokim* 1306; Upper Burma, Kyoukunyong, July 1891, *A. Huk s. n.* (flowers white); Fort Stedman, Dec. 1892, *A. Huk s. n.*; 3 miles East of Pintta along streams near Forte, 26 Jan. 1888, *J.C. Prazer* 39; Kyoukse, 12 Feb. 1893, *Dr. King's Collector s. n.*; Southern Shan States, Inle Lake, 7 March 1917, *N. Annandale s. n.*; Laikow, *S.A. Khalil s. n.*

INDONESIA : Java, *S.H. Koorders* 4011.

PAKISTAN : Sind, 10 March 1849, *N.A. Dalzell s. n.*

THAILAND : Chiengamai 5 Feb. 1911, *A.F.G. Kerr* 1663.

Butea superba Roxb. [in *Asiat. Res.* 3 : 473. 1792; *Pl. Coromandel* 1 : 23, t. 22. 1795 *nom. invalid.*] ex Willd., *Sp. Pl.* 3 : 917. 1802; DC., *Prodr.* 2 : 415. 1825; Roxb., *Hort. Bengal* 53. 1814 et *Fl. Ind.* (Carey ed.) 3 : 247. 1832; Wight & Arn., *Prodr. Fl. Pen. Ind. Or.* 261. 1834; Benth. in *Miq., Pl. Jungh.* 238. 1852; Dalz. & Gibs., *Bombay Fl.* 71 : 1861; Baker in *Hook. f., Fl. Brit. India* 2 : 194. 1876; *Kurz, For. Fl. Brit. Burma* 1 : 365. 1877; Brandis, *Forest Fl. N. W. Ind.* 143 et *Indian Trees*, 230. 1906; Gamble, *Man. Indian Timb.* 245. 1902 et *Fl. Pres. Madras* 358. 1918; Cooke, *Fl. Pres. Bombay* 1 : 372. 1902; Prain, *Bengal Pl.* 1 : 401. 1903 et in *Bull. Misc. Inf. Kew* 1908 : 385. 1908; Duthie, *Fl. Upper Gangetic Pl.* 1 : 240. 1908; Gagnep. in *Lecomte, Fl. Indo-Chine* 2 : 414. 1913; Haines, *Bot. Bih. & Or.* 280. 1922; Craib, *Fl. Siam. Enum.* 1 : 445. 1928; Blatt., in *Journ. Ind. Bot. Soc.* 8 : 134. 1929; Kanjilal & Das, *Fl. Assam* 2 : 74. 1938; Maxwell in *Thai For. Bull.* 10 : 87. 1977. *Rudolphia superba* (Roxb. ex Willd.) Poir. in *Lam. Encycl.* 6 : 332. 1804. *Plaso superba* (Roxb. ex Willd.) Kuntze, *Rev. Gen. Pl.* 1 : 202. 1891.

[Type : t. 22, Roxb., Pl. Coromandel 1 : 1795 (CAL; K)]. Fig. 1A, 2A-E.

Extensive woody climbers; bark brown, tardily flaking or smooth, lenticellate, branches angular and grey tomentose when young, terete and glabrous or glabrescent with age. Leaves 3-foliolate; stipules 5-7 × 2-3 mm; infrajugal rachis 10-30 (-42) cm long, flat above; pulvinus 1.5-2.0 × 0.6-1.2 cm, glabrous, smooth, wrinkled or transversely cracking when dry; ultrajugal rachis 3-5 (-10) cm long; petiolules 0.5-1.4 × 0.5 cm, pubescent, wrinkled when dry; stipels 2-6 × 1 mm; terminal leaflet (10-) 15-30 (-45) × (6-) 10-25 (-40) cm, broadly obovate or rhomboid; tomentose on both surfaces when young, glabrous above and glabrescent below with age; lateral leaflets 7-25 (-30) × 5-15 (-24) cm. Inflorescence, stiff, erect or pendulous, (10-) 15-30 cm long; rachis angular, blackish-brown pubescent, lateral branches condensed, fascicles (1-) 2-4 (-5)-flowered. Flowers 8-10 cm long, orange-scarlet (much brighter than the previous species); pedicels 2.5-3.0 cm long, blackish-brown velvety; bracts 7-12 × 2-3 mm; blackish-brown velvety without, brown puberulous within; bracteoles 4-6 × 1-2 mm, brown villous without, puberulous within. Calyx 1.2-1.5 cm in diameter, 1.0-1.3 cm long, 4-lobed, dorsal lobe 5 × 8 mm, rounded to emarginate at tip, recurved; ventral lobe 3 × 1.5-2.0 mm; lateral lobes 4.0 × 2.0-3.0 mm. Standard obscurely auriculate at base, claw 5.0 × 2.5 mm, white pubescent; blade 5.0-6.5 × 3-5 cm. Wings reflexed from middle, claw 8-10 × 2-3 mm, white pubescent, upper auricle 1 × 1 cm. Keel petals united along the ventral margin claw 1.0-1.5 × 0.4-0.5 cm; blade 6.5-8.0 × 1.5-2.0 cm. Stamens 7.5-9.0 cm long, free filaments projecting at different levels at the tip of staminal tube; staminal tube curved with 2 basal loop-like openings; anthers 2.5-3.0 mm long, linear, nearly medifixed. Ovary 1.5 cm

long, linear, densely grey or greyish-pink pubescent; ovules 4-6-attached along the ventral margin; ovary gradually merging into falcate, 7 mm long, pubescent style; stipe 1.5 cm long, angular, pinkish-velvety, elongating in fruit. Pods 13.5-16.0 × 2.5-5.0 cm, curved and slightly narrowed at seed bearing woody apex, basal wing-like portion, thin, reticulately veined, densely brown velvety. Seeds 3.0 × 2.7 cm, hilum present towards centre.

Flowering : March-April.

Fruiting : April-June.

Distribution : India, Burma, Sri Lanka, Thailand, Indo-China.

Habitat : Similar to *Butea monosperma*.

Vernacular names : In India : *Lata Palasha* (Bengali & Sanskrit); *Velkhakra* (Gujarati); *Palas lata*, *Chihunt* (Hindi); *Balli Muthuga* (Kannada); *Valli Murukka* (Malayalam); *Belia*, *Palas Palas Vel* (Marathi); *Noi Palas* (Oriya); *Kodi-Marukkam* (Tamil); *Thiga Moduga* (Telugu). In other countries : *Welkela* (Sinhalese); *Tawng-krua*, *Tanchawm-tawng* (Siamese); *Kwao-Kua*, *Chomkua* (Laos); *Pauk-nway*, *Apan*, *Poukonwe* (Burmese); *The climbing palas* (English); *Stolze-Butea* (German).

Specimens examined : INDIA : Andhra Pradesh, Palavaram agency, Itikala Kota, 6 Feb. 1962, *D.C.S. Raju* 1. Bihar, Chota Nagpur, *J.J. Wood* s. n.; Manbhum, 1886, *J. Campbell* 8448; Mayurbhanj, Garicidha 13 Mar. 1941, *Coll.* ? 726; Chota Nagpur, Palamau, 1881, *W. Fohnte* s. n. Karnataka, *J. Campbell* s. n. Madhya Pradesh, Jabbalpore, March 1902, *R.H. Hole* 224; Berar, Nimar, alt. 2000', 10 Mar. 1910, *C.G. Rogers* 4; Bilaspur, Shahpur, 13 April 1965, *G. Panigrahi & C.M. Arora* 8512; Raipur, Pithora, 14 June 1972, *D.M. Verma* 17705; Orissa, Ganjam District, Tarla, March 1884, *J.S. Gamble* 13899; Mayurbhanj District, Ganiadiha alt. 100' 13 Mar. 1941 (BSIS Acc. no. 9528). Tamil Nadu, Lower Panachi, Anamalai Hills, alt. 2800', 31 March 1914.

C.E.C. Fischer 3702; Salem District, Shevori-Hills, *Perrottet* 502, 509; Coimbatore District, Vellingiri Hills, 11 Feb. 1957. *K.M. Sebastine* 2284. Uttar Pradesh, Kheri District, Oudh, 24 March 1898, *Inayat* 21467; Mirzapur, Imliyaban forest, 10 April 1955, *K.B. Singh s.n.* West Bengal, on the Pacher, Bunglow near Burrakar, alt. 800', *Kurz s.n.*; Purulia District, on the way from Bhagmundi to Ajodya, 10 April 1968, *K.C. Malick* 508; Hortus Botanicus Calcuttensis 30 March 1899. *Mr. Lanes s.n.*; April 1896, *D. Prain s.n.*, 15 April 1899, *Dr. Prain's Collector s.n.*

BURMA : Upper Burma, Madoe Hill, 28 Feb. 1893, *Dr. King's Collector* 91; Tavoy, Ginba Channg, alt. 700', 3 Feb. 1925, *Ba Pe* 858; Yamethin District, Myinbin Reserve, Chaungwa, alt. 300', 8 Feb. 1915, *C. G. Rogers* 582; Amherst District, Punye to Thagahta, alt. 500', 21 Jan. 1912, *J.H. Lace* 5680; Hantawaddy District, Halinyoma Reserve, 6 Feb. 1906, *J.H. Lace* 2913; Pegu District, Yomah, *S. Kurz* 1708; Southern Shan States, Tawngyii, 1894, *A. Huk s.n.* Minbu District, Nahmedaung Hills, 20 March 1903, *Aubert & Gage s.n.*; Henzada, Chhin Hills, Feb. 1903, *S. Mokim* 1323; Tenasserim District, in valley 4-5 miles from Keyinchong forest, alt. 200', 20 Feb. 1931, *K. Biswas* 1272; Rangoon District, Mingaladon, 22 Feb. 1932, *C.E. Parkinson* 13964; Magwe District, Thabyeang, Old exclusion, Nagmin block, 27 Feb. 1915, *C.G. Rogers* 926; Yamethin District, Myinbin Reserve, alt. 300', 8 Feb. 1915, *C.G. Rogers* 582; Minbu District, Chichaung forest, Mochanng, 23 Feb. 1939, *C.E. Parkinson* 15730; Insein District, Kinpandi forest, alt. 100', 21 Jan. 1948, *Pokhant* 58; Prome, 16 March 1905, (BSIS Acc. no. 9510).

THAILAND : Maharat, Lampang, Palat, alt. 300' m, July 1910 *A.F.G. Kerr* 1009; N. Thailand, Uttaradit, April 1961, *C. Phengkhlai* 85.

MEIZOTROPIS Voigt

Meizotropis Voigt, Hort. suburb Calcutt. 239. 1845; Griff. Not. Pl. Asiat. 4 : 441. 1854 ('*Megalotropis*') *Butea* sect. *Meizotropis* (Voigt) Prain in Bull. Misc. Inf. Kew 1908. 385. 1908; Blatt. in Journ. Ind. Bot. Soc. 8 : 134. 1929.

Type species : *M. buteiformis* Voigt ('*buteaeformis*'). Fig. '1.

Erect or scandent shrubs; bark smooth; branches from the middle; branches stout, angular, densely velvety when young. Leaves alternate, pinnately trifoliate stipules large, ovate, elliptic or suborbicular, acute to acuminate or rounded at apex; densely velvety without, puberulous within, caducous or subpersistent; rachis distinctly pulvinate, infrajugal rachis longer than ultrajugal part, flat above, angles sharp, pubescent; stipels smaller, narrowly ovate, acuminate, pubescent, caducous; petiolules pulvinate; terminal leaflet larger, coriaceous, symmetric, broadly ovate or rhomboid, sometimes orbicular, rounded at base, acute to acuminate at apex; lateral leaflets smaller, asymmetric, basioscopic side slightly larger than acroscopic side, rounded at base, acute or acuminate at apex; scalariform-reticulate venation prominent below, densely villous when young, becoming glabrescent with age. Inflorescence a terminal or supra-axillary pseudo-racemose panicle, lower branches longer; rachis woody, angular, yellowish-brown pubescent. Bracts at the base of lateral branches and individual flowers, ovate or linear-lanceolate, acute or acuminate, pubescent, caducous. Pedicels short, slender, jointed, pubescent. Bracteoles 2, below the calyx, lanceolate, acute, pubescent, caducous. Flowers medium-sized compared to *Butea* and *Spatholobus*, deep red or orange-red. Calyx campanulate, green, white or yellowish-velvety without, sericeous within, persistent; lobes 4, dorsal lobe broad, notched at apex, slightly recurved, ventral and lateral

lobes triangular, acute or acuminate. Standard elliptic-lanceolate, shortly clawed at base, acute at apex, reflexed from about the middle, veins inconspicuous, lateral appendages present, yellow sericeous on both surfaces except for upper portion within; wing petals equal to or slightly longer than standard, curved upwards, distinctly clawed at base, obtuse at apex, upper auricle well developed with pocket, yellow sericeous without, glabrous within, keel petals connate along the ventral margin, curved upwards at tip, distinctly clawed at base, rounded at tip, pockets present, yellow sericeous without, glabrous within. Stamens diadelphous (9+1), vexillary stamen the shortest, the rest alternately longer and shorter, free filaments arising from the same level, gutter-like staminal sheath pilose; anthers uniform, elliptic, nearly medifixed, all fertile. Nectary glands obscurely 10-lobed, pilose. Ovary shortly stipitate, linear, densely tomentose, gradually narrowed into a curved style; style partially tomentose, stigma obliquely capitate; ovules 2, nearly medially attached in the locule. Pods shortly stipitate, erect or spreading, obovate or linear, flat, symmetric or asymmetric at base, obtuse, acute or rounded at apex, the dorsal suture broader than ventral with or without obscure central keel-like structure, valves with or without prominent veins, densely yellowish-brown velvety, thin or woody, 1-seeded. Seeds apically or centrally attached; reniform, suborbicular, convex on faces, pitted, obscurely keeled and grooved along margins, upper $\frac{1}{3}$ part narrower, lower part broader, reddish-brown.

Distribution : India (Kumaon eastwards in Uttar Pradesh, Bihar, Sikkim, Assam, Arunachal Pradesh, West Bengal, Meghalaya, Nagaland, Manipur, Mizoram, Tripura), Nepal, Bhutan, Bangladesh, Burma (Map 1).

KEY TO THE SPECIES

Erect shrubs covered with long spreading hairs; pods

woody throughout, obovate or obovate-oblong, seeds nearly medially attached, endocarp blotched towards hilum (confined to Kumaon and Western Nepal)

pellita

Erect or scandent shrubs; young branches adpressed yellowish-brown tomentose; Pods woody on seed, linear-oblong seeds nearly apically attached, endocarp not blotched (throughout Himalaya E. of Kumaon to N.E. India and Burma)

buteiformis

Meizotropis buteiformis Voigt, Hort.

Suburb. Calcutt. 239. 1845 ('*buteaeformis*'); Griff. Not. Pl. Asiat. 4 : 441. 1854-*Butea buteiformis* (Voigt) Grierson & Long in Notes R.B.G. Edinburgh 37 : 346. 1979; Mabberly in Taxon 29 : 605. 1980 (Type : India, Horti Serampore, W. Griffith s.n. (K, Photo!). *B. minor* Buch.-Ham. [in Wall. Cat. 5439A 1830] ex Baker in Hook. f., Fl. Brit. India 2 : 195. 1876; Prain in Bull. Misc. Inf. Kew 1908 : 385. 1908; Brandis, Indian Trees 230. 1902; Gamble, Man. Indian Timb. 245. 1902; Haines, Bot. Bih. & Or. 280. 1922 p.p.; Blatt. in Journ. Ind. Bot. Soc. 8 : 35. 1929; Kanjilal & Das, Fl. Assam 2 : 74. 1938; Ohashi in Hara, Fl. E. Himal. 141. 1966 et in Univ. Mus. Univ. Tokyo Bull. no. 8 : 57. 1975; Grierson & Long l.c. *prosyn.*; Mabberly l.c. *prosyn.*; Malla et al., Fl. Langtang 78. 1976; *Plaso minor* (Buch.-Ham. ex Baker) Kuntze, Rev. Gen. Pl. 1 202. 1891 [Type : Nepal, *Buchanan-Hamilton* in Wall. Cat. 5439A (K — Wall. ! CALI)].

Erect or scandent shrubs, 3-5 m tall; branches angular, densely adpressed yellowish-brown tomentose when young, terete and glabrescent with age. Leaves 3-foliate; stipules 1.5-1.8 × 0.5-0.8 cm, rachis 8-25 cm long, pulvinus 8-11 × 3-5 mm; infrajugal rachis 8-20 cm long, ultrajugal 3-5 cm long; petiolules 1.0-1.3 cm long; stipels 5-7 × 2-3 mm; terminal leaflet 15-35 × 11-34, green above, pale below, scalariform veins looping along margins; lateral leaflets 10-30 × 6-15 (-20) cm. Inflores-

cence 20-75 cm long; fascicles 1.0-1.5 cm long, (2-) 3-5-flowered. Bracts 6-10 × 3-4 mm, ovate or linear-lanceolate, acuminate; pedicels 10-13 mm long. Bracteoles 3-4 × 1.0-1.5 mm. Flowers 2-3 cm long, orange-red. Calyx 8 mm in diameter, 1 cm long, accrescent in fruits; lobes 4, dorsal lobe 2 × 4 mm, obscurely curved; ventral lobes 2 × 1-2 mm, dentate, middle lobe subulate. Standard 1-1.8 × 0.4-0.6 cm. Inflexed auricles 1-2 × 1 mm, claw 3-4 mm long; wing petals slightly curved upwards; claw 8-9 mm long; blade 12 × 4 mm, obtuse at apex; keel petals curved upwards near the tip, claw 8-10 mm long; blade 1.5 × 0.5-0.6 cm. Stamens 2.2-2.5 cm long; anthers 1 mm long, elliptic, nearly medifixed. Ovary 4-5 mm long on 1-2 mm long stipe, style 2.0-2.2 cm long, ovules 2, nearly medially attached. Pods 6-9 × 2.0-3.2 cm, slightly narrowed towards ends, basal portion thin, wing-like, prominently veined, velvety when young, glabrous or glabrescent with age; dorsal sutures broader than ventral with an obscure wing towards tip; stipe 5-6 mm long; seeds 1.7-2.2 × 1.0-1.7 cm.

Flowering : April-July.

Fruiting : August-January.

Distribution : India (Kumaon eastwards in Uttar Pradesh, Bihar, Sikkim, Assam, Arunachal Pradesh, West Bengal, Meghalaya, Nagaland, Manipur, Mizoram, Tripura); Nepal, Bhutan, Bangladesh, Burma.

Habitat : Found on dry slopes, open grasslands, along riverbanks, streams and cultivated fields in valleys at altitudes from 1000-2000 m.

Vernacular names : *Dieng-la - Pulang* (Khasi); *Bolatru, Bhuletra* (Nepali); *Namo-singlet* (Lepcha); *Pauknwe* (Burmese).

Collector's Notes : Flowers scarlet red, orange-red, golden-red. The plants are

burnt back annually in forest fires in Burma. The young shoots that are produced after cutting back or from burnt stumps usually erect, sometimes scandent.

Notes : Haines (1922) states that "the Eastern Himalayan specimens of *Butea minor* (= *Meizotropis buteiformis*) differ in some respects, rather larger flower and longer base of the pod. Our plant (from N. Champaran, Bihar) more resembles *Butea pellita* (= *Meizotropis pellita*), but is close to Hamilton's type (of *Butea minor*) and collected near the same region, so it is the Eastern form, not the Western form (described by Prain as *B. pellita*) which requires renaming if the two are distinct". On the other hand, a critical examination of the types of *Meizotropis buteiformis* Voigt (K, Photo!), *Butea minor* Baker (K, Photo! CAL) and *B. pellita* (K, Photo!) reveals that the specimens of the former two species are identical, while those of latter are different. Therefore, naming was necessary for the restricted Western form (i.e. *Meizotropis pellita*) than for the widely distributed *M. buteiformis*. All the known specimens from Bihar under this species were found to be *M. buteiformis*.

Specimens examined : INDIA : Assam, Goalpara, *Nath* 13002; Manipur, Mosein Hills, 19 Oct. 1925, *S.N. Bal* 492; Kanglangbi, alt. 3000', Nov. 1907, *A. Meebold* 6576; Ukhrul alt. 5000', 7 July 1948, *S.K. Mukerjee* 3170; Locality ? *D.B. Deb* s. n.; Chung Benthao, 19 Dec. 1973, *K.C. Mallick* 1524; Meghalaya, Khasia Hills, alt. 1000'-4000', *J.D. Hooker & T. Thomson* s. n.; Pomiang to Pamatova, Khasia Hills, alt. 4500', 14 Oct. 1867, *C.B. Clarke* 5791; Narting, alt. 5000', 2 Dec. 1871, *C.B. Clarke* 14538G; Khasia Hills, *Herb. Kurz* s. n. (Acc. no. 9529); *S. Kurz* 290; alt. 4000', *G. Mann* 290; Shillong, Khasia Hills, alt. 5000', June 1890, *H. Collett* 77; Shillong, alt. 4500', 7 July 1886, *C.B. Clarke* 44179B; Pynursla, 22 Aug. 1956, *G.*

Panigrahi 8337, 22339; Jaintia Hills, between Mawlamang & Mawdhumai, alt. 4000', 9 June 1911, *I.H. Burkill & S.C. Banerjee* 35291; Khasi & Jaintia Hills, Mawhot ridge, 29 Nov. 1930, *P.C. Kanjilal* 2286; Dawki Road, 24 Oct., 1934, *S.R. Sharma* 10820; Mawrankheng, 10 July 1956, *G.K. Deka s.n.*; Raling, 23 Aug. 1968, *N.P. Balakrishnan* 47001; Cherrapunji, Mawdmai forest, 29 Oct., 1950, *G.K. Deka s. n.*; Nagaland, Kohima, alt. 6500', 24 Oct. 1885, *C.B. Clarke* 41117H.

Sikkim : Darjeeling Terai Chenga tract, 20 Jan. 1877, *J S Gamble* 2416C; East Dist. Mamring, alt. 1000', 17 Dec. 1981, *P. Chakraborty* 1945; Singtham, alt. 1400', 15 Dec. 1981, *P. Chakraborty* 1866; 1 km from Rangpo towards Gangtok on the banks of Tista river, alt. 600 m, 3 Aug. 1986, *M. Sanjappa* 18402; Tripura, *D.B. Deb.* 27474; Uttar Pradesh, Kumaon, Kali valley, below Dopta, alt. 4000'-5000', 10 July 1886, *J.F. Duthie* 5483; E. Almora Div., Chulkot, alt. 7500', July 10, 1951, *F. Charlton Thomas* 20838; Kali valley, Kheda, alt. 1200 m, 8 July 1923, *R.N. Parker* 2054; Pithorgarah District, Tawaghat, alt. 1200'-1600', 4 Oct. 1975, *C.M. Arora* 56719; Kumaon, Tejum/Girgaon, alt. 1350-1400 m, 10 June 1958, *T.A. Rao* 6595; Near Panchulthi, Chulkot, E. Almora Division, June 1952, *K.C. Sahani* 24611; Botanic Garden, Forest Research Institute, Dehra Dun, 18 Dec. 1882, *G.R. Hingroni s. n.*; 28 Oct. 1953, *M.B. Raizada s. n.*

BHUTAN : Tunsu valley, alt. 2600', Jan. 1905, *G.L. Searight* 204.

BURMA : Shwebo District, dry ridge in Nankyttw Reserve, alt. 1500', 23 Nov. 1917, *C.G. Rogers* 690; Kanpetlet, Mindat, alt. 4000', July 1956, *M. Gale* 25685; *M. Gale & Chitkoko* 5685; Byinboan, Upper Chhindwin, Dec. 1907, *A. Meebold* 7805.

NEPAL : Chhyading, alt. 5000', April,

M.L. Banerjee & P.R. Shakyas 5594; Below Sika, alt. 5000', *V. Puri. s.n.*

Meizotropis pellita (Hook. f. ex Prain) Sanjappa, *comb. nov.*

Butea pellita Hook. f. ex Prain in Bull. Misc. Inf. 1908 : 385. 1908; Gupta in Journ. Ind. Bot. 2 : 233. 1922; Osmaston, For. Fl. Kumaon 175. 1927; Blatt. in Journ. Ind. Bot. Soc. 8 : 135. 1929—*B. minor auct. non* Buch.-Ham. ex Baker, 1876; Haines, Bot. Bih. & Or. 280. 1922. *Proparte* (Type : India, Kumaon Himalaya, Patwa Dangarh near Nainital, alt. 1530 m, *Sprawson s. n.* (K, Photo!). Fig. 1.

Erect shrubs, 1-1.5 m tall; rootstock stout, woody, branching from the base; branches 2.0-2.5 cm in diameter, distinctly angular. Leaves trifoliate; stipules 2-3 × 1.0-1.5 cm, rachis 10-32 cm long, grooved and ridged, pulvinus 1.1-1.5 × 0.5-1.0 cm; ultrajugal rachis 10-25 cm long; petiolules 1.0-1.5 cm long, tomentose; stipels 1.0-1.5 × 0.3-0.5 cm; terminal leaflet 20-65 × 15-50 cm, green above, pale below; lateral leaflets 15-40 × 10-20 cm. Inflorescence 25-40 cm long; rachis grooved and ridged, woody, densely spreading velvety; flowers 3-5 on 1.0-1.5 cm long on lateral branches; bracts 8-12 × 3-4 mm, narrowly ovate, densely spreading tomentose without, puberulous within; pedicels 5-10 mm long, stout and glabrescent in fruits; bracteoles smaller than bracts, tomentum similar to bracts. Flowers 1.5-2.5 cm long, orange-red. Calyx 8-12 mm in diameter, dorsal lobe 5-7 × 3-5 mm; ventral lobes 3-4 × 1-2 mm. Standard bright red, 15-20 × 5-8 mm, auricles 2-3 × 1.0-1.5 mm, claw 2-4 mm long; wing petals slightly curved, upwards, claw 1.0-1.5 cm long; blade 2.0-2.5 × 1.0-1.2 cm, upper auricle 3-5 × 2-3 mm; keel petals curved upwards, claw 8-9 mm long, blade 2 × 0.8-1.0 cm, oblong. Stamens 2.0-2.2 cm long; anthers 1 mm long. Nectary glands 10-lobed. Ovary

5-7 mm long on 1.0-1.5 mm long stipe, gradually narrowed into 2.0-2.2 cm long upcurved style. Pods 5-7 × 3.0-4.3 cm; seeds 1. nearly centrally attached; stipe 5-6 mm long. endocarp reddish-brown, blotched towards hilum. Seeds 1.5-2.2 × 1.0-1.7 cm

Flowering : May-June.

Fruiting : July-December.

Distribution : India (Kumaon) Nepal (Boti).

Habitat : Occurs on flat Hill tops as well as on slopes in valleys at altitudes from 1500-1600 m.

Vernacular names : *Patwa* (Hindi); *Bhujiataro* (Nepali).

Field notes : Whole plant dries up to the base after fruiting.

Specimens examined : INDIA : Uttar Pradesh - Kumaon, Patwa Dangarh, near Nainital, alt. 1530 m. C.A. *Sprawson s. n.* (K. -Photo!); alt. 5000' A. E. *Osmaston* 1252 (Immature shrub-20 April 1925, flowers 29 May 1925, fruits 2 Aug. 1925); Botanic Garden, Forest Research Institute, Dehra Dun, June 1936, M.B. *Raizada s. n.* (DD Acc. No. 72008); Eastern Almora District, Kumaon, Kali, alt. 5000', May-June 1920, W.J. *Lambert* 1; W.J. *Lambert s. n.* (DD Acc. NO. 24040).

NEPAL : Doti District, Baglag, 15 June 1929, Bis Ram 239 (DD); Garba, 14 April 1929; Bis Ram 239 ? (DD).

EXCLUDED SPECIES

1. *Butea acuminata* (Benth.) Kurz in Journ. Asiat. Soc. Beng. 45 : 243. 1876 = *Spatholobus acuminatus* (Wall.) Benth. in Miq., Pl. Jungh. 238. 1852.
2. *Butea gibsonii* Grah., Cat. Pl. Bombay 55 1839 = ? *Ougeinia oojeinensis* (Roxb.) Hochr. in Ann. Cons. Jard. Bot. Geneve 13-14 51. 1909 (vide T. Cooke, Fl. Pres. Bombay 1 : 372. 1902).
3. *Butea gyrocarpa* (Benth.) Blatt. in Journ. Ind. Bot. Soc. 8 : 136. 1929 = *Spatholobus gyrocarpus* Benth. in Miq., Pl. Jungh. 258. 1852.
4. *Butea loureirii* Spreng., Syst. Veg. 3 : 186. 1826 = *Caesalpinia crista* L., Sp. Pl. 380. 1753 (vide Hattink in Reinwardtia 9 : 21. 1974).
5. *Butea parviflora* Roxb. ex DC., Prodr. 2 : 415. 1825 = *Spatholobus parviflorus* (Roxb. ex DC.) Kuntze, Rev. Gen. Pl. 1 : 205. 1891.
6. *Butea peltata* Pers., Syn. Pl. 2 : 279. 1807 = *Rhodopsis planisliqua* (L.) Urb., Symb. Antill. 2 : 304. 1900.
7. *Butea sericophylla* Wall. Cat. no. 5441. 1831-32 nom. nud. = *Spatholobus parviflorus* (Roxb. ex DC.) Kuntze, Rev. Gen. Pl. 1 : 205. 1891.
8. *Butea volubilis* (Willd.) Pers., Syn. Pl. 2 : 279. 1807 = *Neorudolphia volubilis* (Willd.) N.L. Britton in N.L. Britton & P. Wilson, Siert. Surv. Porto Rico 5 : 426. 1924.

Blatter (1929) while reducing the genus *Spatholobus* as a section of *Butea*, transferred 31 species to *Butea*. All these species except *Butea africanus* (Baker) Blatt. [= *Leptoderris brachyptera* (Benth.) Dunn] have been restored under *Spatholobus*, either as valid species or as synonyms (Ridder-Numann & Wiriadinata (1985).

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REFERENCES

- ADANSON, M. *Families des Plantes* 2 : 325, 529. Paris. 1763.
- AIRY-SHAW, H.K. *Dictionary of Flowering Plants and Ferns*, by J.C. Wills, ed. 8. Cambridge 1973.
- BACKER, C.A. AND R.C. BAKHUIZEN VAN DEN BRINK Jr. *Flora of Java* 1 : 629 Groningen. 1963.
- BAKER, J.G. *Leguminosae*. In : J.D. Hooker, *The Flora of British India* 2 : 56-306. London. 1876
- BAUDET, J.C. *Prodrome d'une Classification generique des Papilionaceae-Phaseoleae*. *Bull. Jard. Bot. Nat. Belg.* 48 (1/2) : 183-220. 1978.
- BENTHAM, G. *Leguminosae*. In : F.A.G. Miquel, *Plantae Junghuhnianae* 205-269. Lugduni-Batavarum, Aripipel drukkerji Buitenzorg. 1852.
- *Leguminosae*. In : G. Bentham & J.D. Hooker, *Genera Plantarum* 1 : 533-534 London. 1865.
- BIR, S.S. AND S. SIDHU. IOPB Chromosome number reports X. *Taxon*. 15 : 120. 1967.
- BLATTER, E. Revision of the genus *Butea* Koen. *Journ. Indian Bot. Soc.* 8 : 133-138. 1929.
- BURKILL, I.H. *A Dictionary of the Economic Products of the Malay Peninsula* 1 : 384-385 London 1935.
- CANDOLLE, A.P. de *Prodromus Sytematis Naturalis Regni Vegetabilis : Leguminosae* 2 : 93-524. Paris. 1825.
- GAGNEPAIN, F. *Leguminosae*. In : M.H. Lecomte, *Florae Generale de l' Indo-China* 2 : 413-414. Paris. 1916.
- GOLDBLATT, P. *Cytology and the Phylogeny of Leguminosae* In : R.M. Polhill & P.H. Raven (Eds.). *Advances in Legume Systematics* 2 : 442. London. 1981.
- GRAHAM, J. *A Catalogue of the Plants growing in Bombay & its vicinity*. Bombay. 1839.
- GRIERSON, A.J.C. AND D.G. LONG Notes relating to the flora of Bhutan : II. *Notes R. B. G. Edinburgh* 37 : 341-354. 1979
- GRIFFITH, W. *Notulae Ad Plantas Asiaticus* 4 : 441-443. Calcutta. 1854.
- GUPTA, B L. A note on the genus *Butea*. *Journ. Ind. Bot. Soc.* 3 : 233. 1922.
- HAINES H H. *The Botany of Bihar & Orissa* 1 : 279-281. London. 1922.
- HUTCHINSON, J. *The Genera of Flowering Plants* 1 : 431-433. London. 1964.
- KUNTZE, O. *Revisio Generum Plantarum* 1 : 202. Wuerzburg. 1891.
- LAMARCK, J B A. P. M. de *Encyclopedie Methodique Botanique* 2 : 391. Paris. 1790.
- LACKEY, J A. Leaflet anatomy of Phaseolae (Leguminosae-Papilionoideae) and its relation to taxonomy *Bot. Gaz.* 139 : 436-446. 1978.
- *Phaseoleae*. In : R.M. Polhill & P.H. Raven (Eds.) *Advances in Legume Systematics* 1 : 312. London. 1981.
- MEHRA, P N AND T S SAREEN. Cytological observations on arborescent Leguminosae of Western Himalayas *The Nucleus* 14 : 20-24. 1973.
- MIQUEL, F A G. *Flora Indiae Batavae* 1, 1 : 171-206. Van der Post, Leipzig. 1855.
- MITRA, K. AND N. DATTA. IOPB Chromosome number reports XIII. *Taxon* 16 : 456. 1967
- MURTHY, G V S. Pollen morphology of *Butea* (Fabaceae). unpublished.
- NANDA, P.C. Chromosome numbers in some trees and shrubs. *Journ. Indian Bot. Soc.* 41 : 271-277. 1962
- OSMASTON, A E A. *Forest Flora for Kumaon* 174-176. 1927. Allahabad.
- PANIGRAHI, G AND S C MISHRA. Proposal to amend 3876 *Butea* Nom. cons. (Fabaceae) *Taxon* 33 : 119-120. 1984

- PRAIN, D. A new species of *Butea*, with notes on the genus. *Bull. Misc. Inf. Kew* 1908 : 381-387 1908.
- RAGHAVAN, R.S. AND C.M. ARORA. Chromosome numbers in Indian Medicinal Plants-III. *Proc. Indian Acad. Sci.* 47B : 352-358. 1958.
- RAGHUVANSHI, S.S. AND K. PANDE, B chromosomes in *Butea monosperma*, a tree. *Caryologia* 38(2):161-168 1985.
- RAO, H.S. Chromosome counts in some trees and shrubs. *Indian For.* 93 : 243-253. 1967.
- RHEEDE TOT DRAAKESTEIN, H.A. VAN Hortus Indicus Malabaricus 6 : 29, t. 16 & 17. Amsterdam. 1686.
- RIDDER-NUMAN, J.W.A. AND H. WIRIADINATA. A revision of the genus *Spatholobus* (Leguminosae-Papilionoideae). *Reinwardtia* 10 : 139-205. 1985.
- ROXBURGH, W. A description of the plant *Butea*. *Asiat. Res.* 3 : 469-474. 1792 (1795?)
- Plants of the Coast of Coromandel 1 : 22, t. 21 & 22. London. 1795.
- Hortus Bengalensis 53. Calcutta. 1814.
- Flora Indica (CAREY, Ed.) 3 : 244-249. Serampore. 1832.
- SANJAPPA, M. AND R.P. BHATT. An investigation on the Cytology of *Butea monosperma* Taub. *J. M.S. Univ. Baroda* 24 : 31-32. 1976.
- AND N. SATHYANANDA IOPB Chromosome number reports LXIV. *Taxon* 28 : 393. 1979.
- SPRENGEL, K. Carlo Linnaei *Systema Vegetabilium* ed. 10, 3 : 186 Goettingen. 1826.
- TAUBERT, P. Leguminosae. In : A. Engler & K. Prantl, *Die Natürlichen Pflanzenfamilien* 3, 3 : 70-384. Berlin. 1894.
- THUAN, N.V. Leguminosae-Papilionoides, Phaseoleae. In : *Flora Cambodia, Laos & Vietnam* 17 : 3-20, 100-105. 1979
- VOIGT, J.O. Hortus Suburbanus Calcuttensis 238-239. Calcutta. 1845.
- WATT, G. Dictionary of Economic Products of India 1 : 548-556. Calcutta. 1890.
- WIGHT, R. In : W.J. Hooker, *Botanical Miscellany* 3 : 102. Suppl. t. 32, London. 1833.
- AND G.A. WALKER-ARNOTT. *Prodromus Florae Peninsulae Indiae Orientalis* 1: 43-261-London 1834.
- WILLDENOW, C.L. *Caroli a Linne Species Plantarum* Editio quarta. 3 : 917 Berlin 1802.

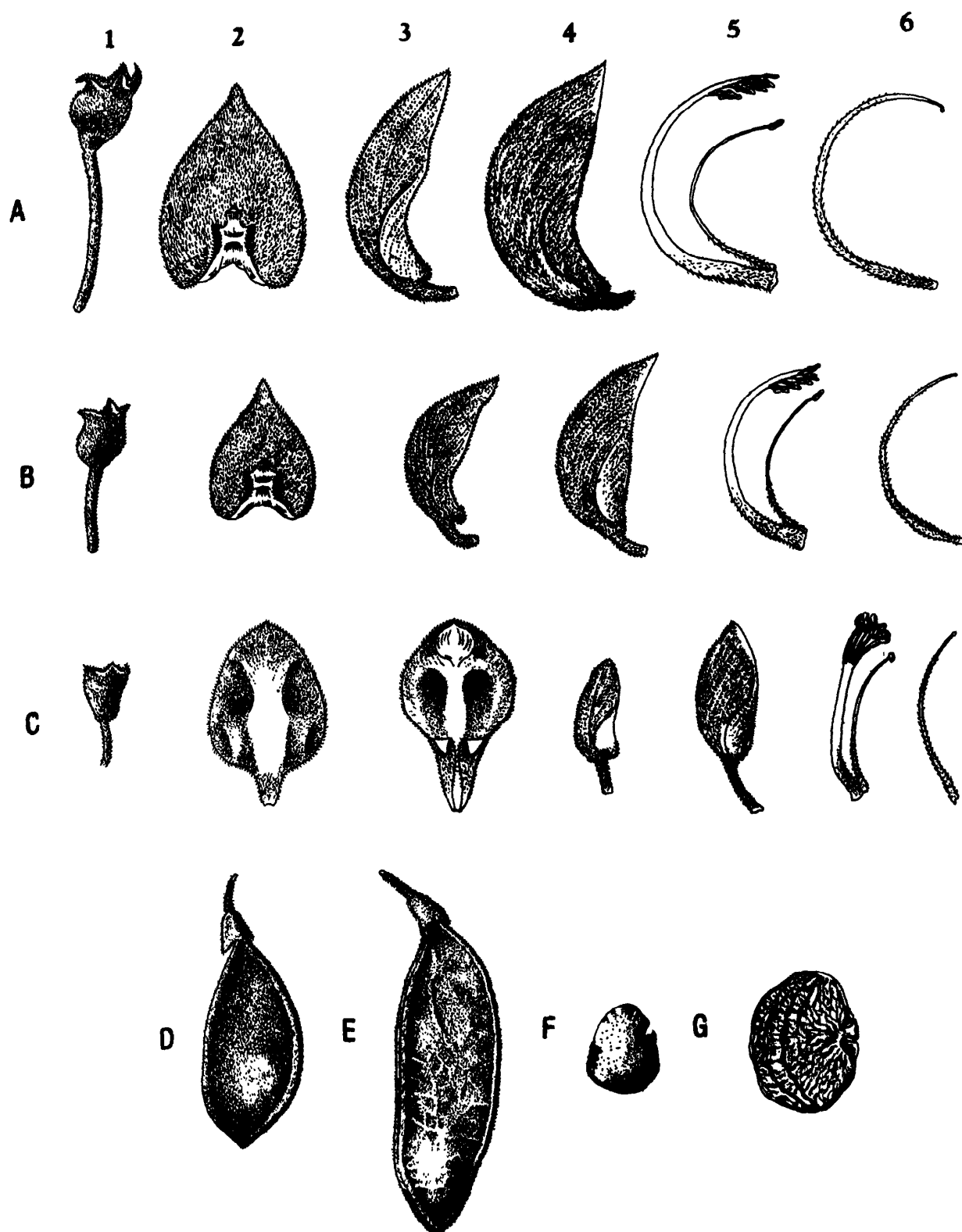


Fig. 1. Floral parts, pods and seeds

- A. *Butea superba* Roxb. ex Willd. B. *Butea monosperma* (Lam.) Taub.
 C. *Meizotropis buteiformis* Voigt. D. Pod of *Meizotropis buteiformis* Voigt.
 E. Pod of *M. pellita* Hook. f. ex Prain. F. Seed of *M. buteiformis* Voigt.
 G. Seed of *Butea monosperma* (Lam.) Taub.
 1. Calyx. 2. Vexillum. 3. Wing petal. 4. Keel petal. 5. Stamens. 6. Carpel.

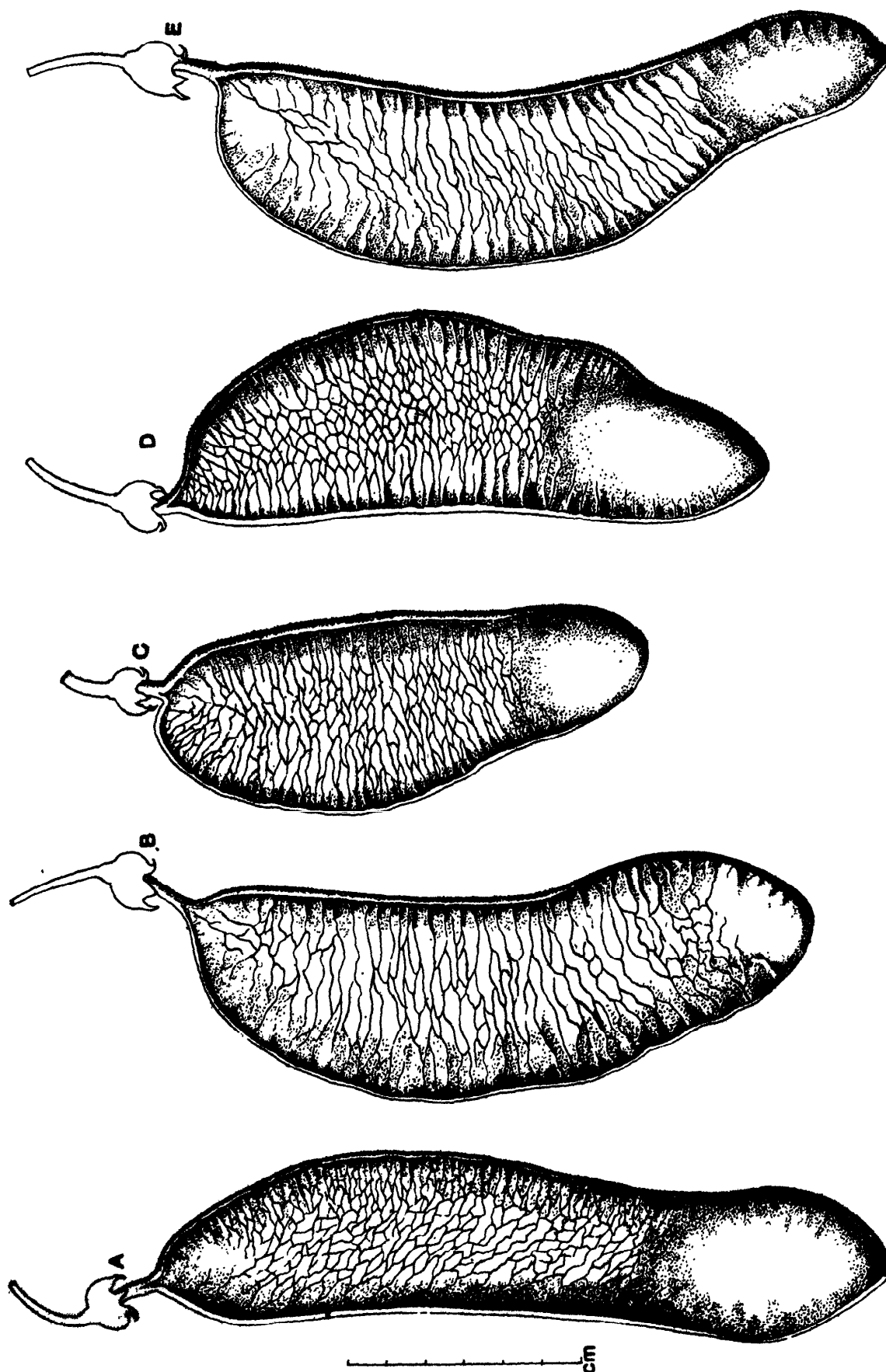
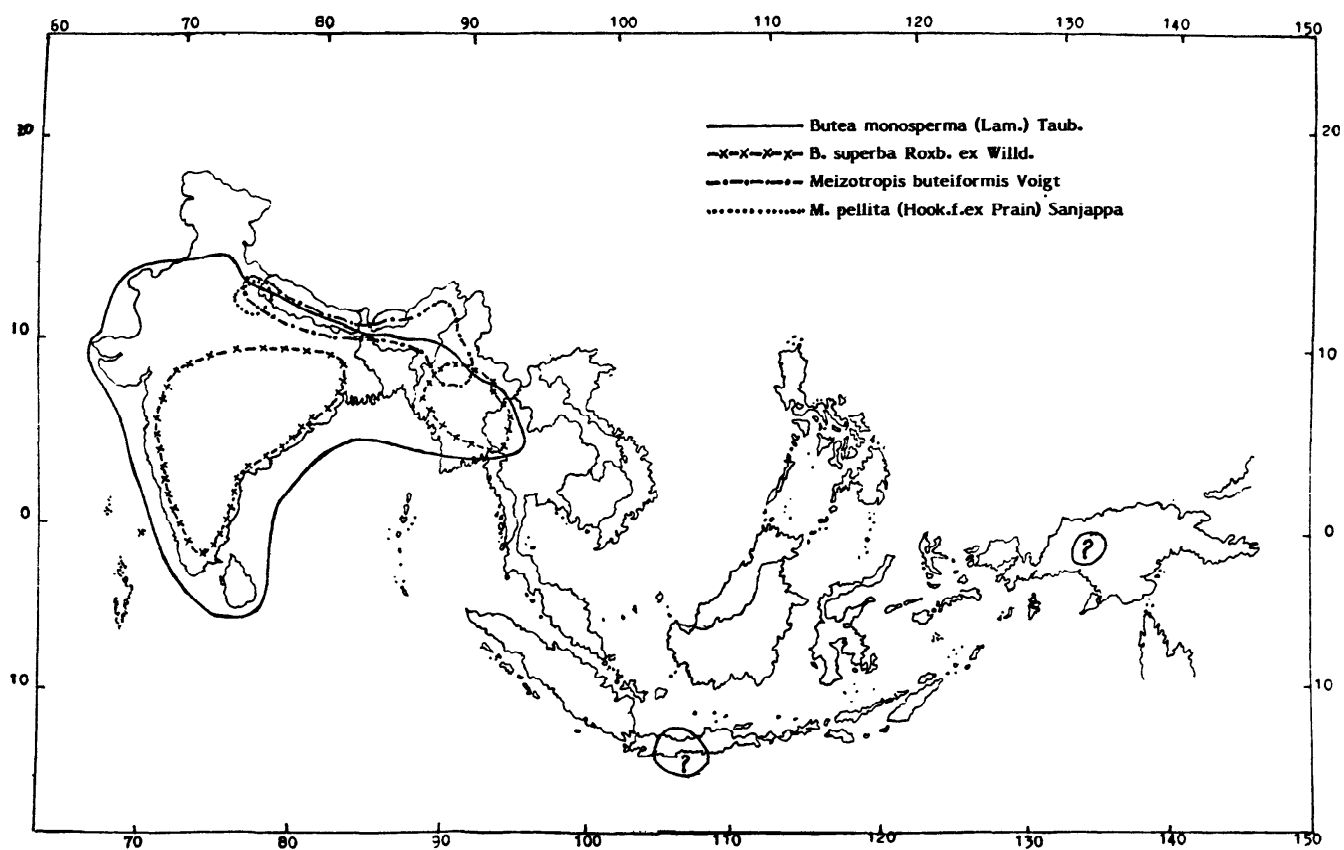


Fig. 2. Pods of *Butea* sp.
A & E. *B. superba*. B-D. *B. monosperma*

Distribution of species of *Butea* and *Meizotropis*