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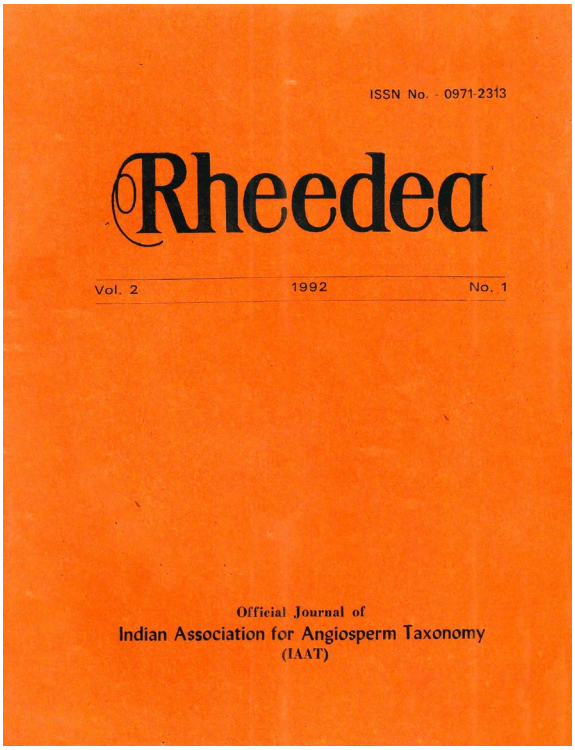

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A taxonomic revision of South Indian *Alpinia* Roxb. (Zingiberaceae)

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Abstract

The genus *Alpinia* Roxb. in South India is revised. It is represented in this region by eight species, falling under different sections and subsections of the sub genus *Alpinia* viz. *A. galanga* (Sect. *Alpinia* subsect. *Alpinia*), *A. calcarata*. *A. malaccensis*, *A. mutica*, *A. smithiae* and *A. zerumbet* (sect. *Alpinia* subsect. *Catimbium*), *A. abundiflora* (Sect. *Fax*) and *A. nigra* (Sect. *Allughas*, subsect. *Allughas*). A key for the species, their nomenclature and full descriptions are provided along with other relevant notes.

INTRODUCTION

The tropical and subtropical genus, *Alpinia* Roxb., with about 230 species, is mainly distributed in the Indo-Pacific region. These rhizomatous herbs, which thrive in humid, shady habitats, mainly as forest undergrowths, are characterised by fairly tall aerial shoots with distichous leaves, the plane of distichy being transverse to rhizomes and mostly terminal (rarely radical) inflorescence. Lateral staminodes are absent or are represented by small teeth at the base of the labellum.

This genus has been reported to have seventeen species in the Indian subcontinent (Baker, 1890-1892). Of these four species have been recorded from the Western Ghats in southern India (Fischer, 1928). Recent exploration along the Western Ghats have, however, revealed that this is a gross underestimate. During our explorations in this region, we have collected eight species including a new species, *A. smithiae* Sabu & Mangaly (1991).

Schumann's (1904) infrageneric classification of the genus, mostly based on characters of secondary bracts (followed by most of the earlier authors) has now been replaced by Smith's (1990), based on characters of labellum. She has recognised two subgenera, viz. subgen. *Alpinia* (with 7 sections and 10 subsections) and subgen. *Dieramalpinia* (with 4 sections and 2 subsections) and has excluded the latter from continental Asia. It is not our intention to deal with this aspect in detail here (those who are interested may refer Smith, 1990), but would only like to indicate the infrageneric positions of the Indian taxa (table 1).

SYSTEMATIC TREATMENT

Alpinia Roxb. (nom. Cons.)

Roxb., Asiat. Res. 11: 350. 1810 & Fl. Ind. 1: 58, 1820; Benth. & Hook. f., Gen. Pl. 3: 648. 1883; Baker in Hook. f., Fl. Brit. India 6: 252. 1892; Schum. in Engler, pflanzenr. 4 (46): 308. 1904; Fischer in Gamble, Fl. Pres. Madras 8: 1491. 1928;

Table 1

Species	subgenus	Section	subsection
A. galanga (L.) Sw.	Alpinia	Alpinia	Alpinia
A. zerumbet (Pers.) Burtt & Smith	Alpinia	Alpinia	Catimbium (Horan.) Smith
A. calcarata Roscee	Alpinia	Alpinia	Catimbium (Horan.) Smith
A. malaccensis (Burm.) Roscoe	Alpinia	Alpinia	Catimbium (Horan.) Smith
A. smithiae Sabu & Mangaly	Alpinia	Alpinia	Catimbium (Horan.) Smith
A. mutica Roxb.	Alpinia	Alpinia	Catimbium (Horan.) Smith
A. abundiflora Burtt & Smith	Alpinia	Fax Smith	
A. nigra (Gaert.) Burtt	Alpinia	Allughas K. Schum.	Allughas (K. Schum.) Smith

Holttum, Gard. Bull. Singapore 13: 140. 1950; Smith, Edinburgh J. Bot. 47: 8. 1990.

Type species: *A. galanga* (Linn.) Sw.

Heritiera Retz., Obs. Bot. 6: 17. 1791 - *non* Aiton, 1978.

Hellenia Willd., Sp. Pl. 1: 4. 1797. - *non* Retz., 1791.

Catimbium Lest., Ann. Sci. Nat. Bot. 2 Ser. 15: 341. 1841. - *non* Juss., 1798.

Rhizome creeping, thick, fleshy or hard; roots stout, many, root tubers absent. Leafy shoots many, robust, 2-4 m tall. Leaves many, oblong or lanceolate, plane of distichy transverse to rhizome. Inflorescence raceme or panicle, congested or lax, usually terminal on leafy shoot, erect or pendulous, covered by 1-3 sheaths when young. Bracts often absent or when present open to the base, rarely lower 1/3 fused, sometimes confined to lower and upper cincinni only, each subtending a single flower or a cincinnus of 2-many flowers. Bracteoles open to the base or tubular, enveloping the young bud, deciduous, sometimes absent. Calyx usually tubular, shortly 3-toothed, unilaterally split. Corolla tube cylindric, more or less equal to or shorter than the calyx; lobes oblong or linear-oblong; the dorsal lobe more or less hooded, sometimes markedly so, generally wider than the lateral lobes. Labellum, often attractively coloured and showy, sometimes inconspicuous and much thickened, variously lobed or entire. Lateral staminodes small or absent. Anther sessile or with a well developed filament, connective sometime scrested. Epigynous glands rarely free from each other, often massive. Ovary usually trilocular, placentation parietal. Capsule spherical, yellow - orange or black. Seeds many, often angular, arillate; aril white, often lacerate.

Distribution: Japan, China, Burma, India, the Andamans, Sri Lanka, Thailand, Malesia, the Philippines, Carolinas, Indonesia, New Guinea, Australia, the Solomons, New Caledonia, Fiji and Samoa. In South India it is widely distributes in Kerala and Karnataka and poorly represented in Tamil Nadu and Andhra Pradesh.

Pollination: By bees, wasps and ants.

Fls. & Frts.: Jan-June (-Dec).

Uses: The rhizome of some species are used in traditional Indian medicine. Many species are widely cultivated in

garden for their attractively coloured flowers.

Notes :

The placentation in *Alpinia* and in all other taxa of Zingiberaceae except those of the Tribe *Globbeae* are traditionally described as axile. Recent studies (Mangaly & Hamsa, 1991) showed that the placentation in the whole family is parietal. In spite of the apparent trilocular nature of the ovary, various degrees of paracarpy occurs because of intrusion of the placenta into the ovary chamber during development.

Key to the Species

1. Inflorescence capitate, borne separately on a leafless peduncle, surrounded by sterile bracts, (occasionally terminal on the leafy shoot) ..... *A. abundiflora*

1. Inflorescence paniculate or racemose, terminal on the leaf shoot, sterile bracts absent 2

2. Fertitle bracts well-developed 3

2. Fertile bracts absent 6

3. Bracteoles tubular, persistent; fruit black ..... *A. nigra*

3. Bracteoles open to the base, often deciduous, fruit red 4

4. Inflorescence branched; labellum with a long claw ..... *A. galanga*

4. Inflorescence unbranced, labellum without a claw 5

5. Leaves linear, lamina not more than 2.5 cm wide, connective not produced into a crest ..... *A. calcarata*

5. Leaves oblong, lamina 6-12 cm wide, connective produced into a crest ..... *A. smithiae*

6. Bracteoles rudimentary or absent ..... *A. mutica*

6. Bracteoles large and showy 7

7. Bracteoles white, open to base, 1.5-2 × 1-1.5 cm; lower surface of lamina pubescent ..... *A. malaccensis*

7 Bracteoles white with pink tip, lower 1/3 fused to form a cup, 3-3.5 × 2.5-3 cm; lamina glabrous ..... *A. zerumbet*

Alpinia abundiflora Burtt & Smith, Notes Roy. Bot. Gard. Edinburgh 34: 179. 1975; Smith, Edinburgh J. Bot. 47: 36. 1990.

Type: *C. P.* 3374 (PDA)

Elettaria floribunda Thw., Enum. Pl. Zeyl. 319. 1861 - non *Alpinia floribunda* Schum., 1904.

Amomum floribundum (Thw.) Trimen, Cat. 92. 1885 & Handb. Fl. Ceylon 4: 250. 1898-excl. descr.; Baker in Hook. f., Fl. Brit. India 6: 233. 1892.

Amomum involucratum auct. non (Thw.) Trimen; Fischer in Gamble, Fl. Pres. Madras 8: 1487. 1928.

Fig. 2. S-U.

Leafy stem 3-4 m high. Leaves bifarious, sessile or shortly petiolate; petiole upto 2 cm long; lamina 60-70 × 10-13 cm, subcoriaceous, oblong or lanceolate, acuminate, attenuate at base, glabrous or sometimes slightly pubescent beneath; ligule 1.5-1.8 cm long, membranous, obtuse, glabrous or slightly pubescent. Inflorescence capitate, 10 cm across on a leafless peduncle; peduncle 30-40 cm long, covered with sheaths; sheaths 15 × 2 cm, narrowly lanceolate. Sterile bracts *c.* 3 × 5 cm, mucronate, glabrous, red. Fertile bracts glabrous, outer ones resembling sterile bracts, red, subtending a single flower; inner narrower, longer, 3.5 × 2 cm, subtending short-stalked cincinni of upto 7 flowers. Bracteoles open to the base or tubular, *c.* 2 cm, smaller towards the top of the cincinnus, oblong, slightly 2-keeled, apiculate; Calyx 1-1.5 cm long, tubular, unilaterally split. Corolla tube equal to calyx or slightly longer; dorsal lobe broadly ovate, 7 × 5 mm, laterals narrower. Labellum small, *c.* 1 cm long, obovate, shallowly and often unequally 3-lobed, white with pink stripes; lateral staminodes absent. Anther almost sessile, upto 5 mm long; thecae parallel or slightly divergent at apex, ecrestate. Epigynous glands two, free from each other, 3 mm long. Ovary *c.* 4 mm long, glabrous, trilocular; ovules many. Fruit small, spherical-oblong, thin walled, smooth.

Distribution: Sri Lanka and South India (Tamil Nedu).

Ecology: Dense wet - evergreen forests above 1000 m on Western ghats.

Fls. & Frts.: Feb.-Oct.

Notes: The South Indian plants differ from the type in having sessile or shortly petiolate leaves. According to Burtt and Smith (1983) this is not sufficient to give varietal rank to the plants.

Specimens examined: Tamil Nadu: Coimbatore, *Fischer* 3300 (CAL); Kanyakumari, *Shetty* 33063 (CAL); *Henry* 53348 (MH); Thirunelveli, *Henry* 17352 (MH).

Alpinia calcarata Roscoe, Trans. Linn. Soc. London 8: 347. 1807; Wight, Icon. t. 2008. 1853; Roxb., Asiat. Res. 11: 335. 1810 & Fl. Ind. 1: 67. 1820; Baker in Hook. f., Fl. Brit. India 6: 254. 1892; Schum. in Engler, Pflanzenr. 4 (46): 338. 1904; Fischer in Gamble, Fl. Pres. Madras 8: 1493. 1928; Smith, Edinburgh J. Bot. 47. 40. 1990.

Type: Cult. Liverpool, no specimen.

Alpinia spicata Roxb., Asiat. Res. 11: 356. 1810 & Fl. Ind. 1: 68. 1820-non Jacq., 1763.

Alpinia cernua Sims, Bot. Mag. 44: t. 1900. 1817.

Alpinia erecta Steudel, Nomencl. Bot. ed. 2. 62. 1840.

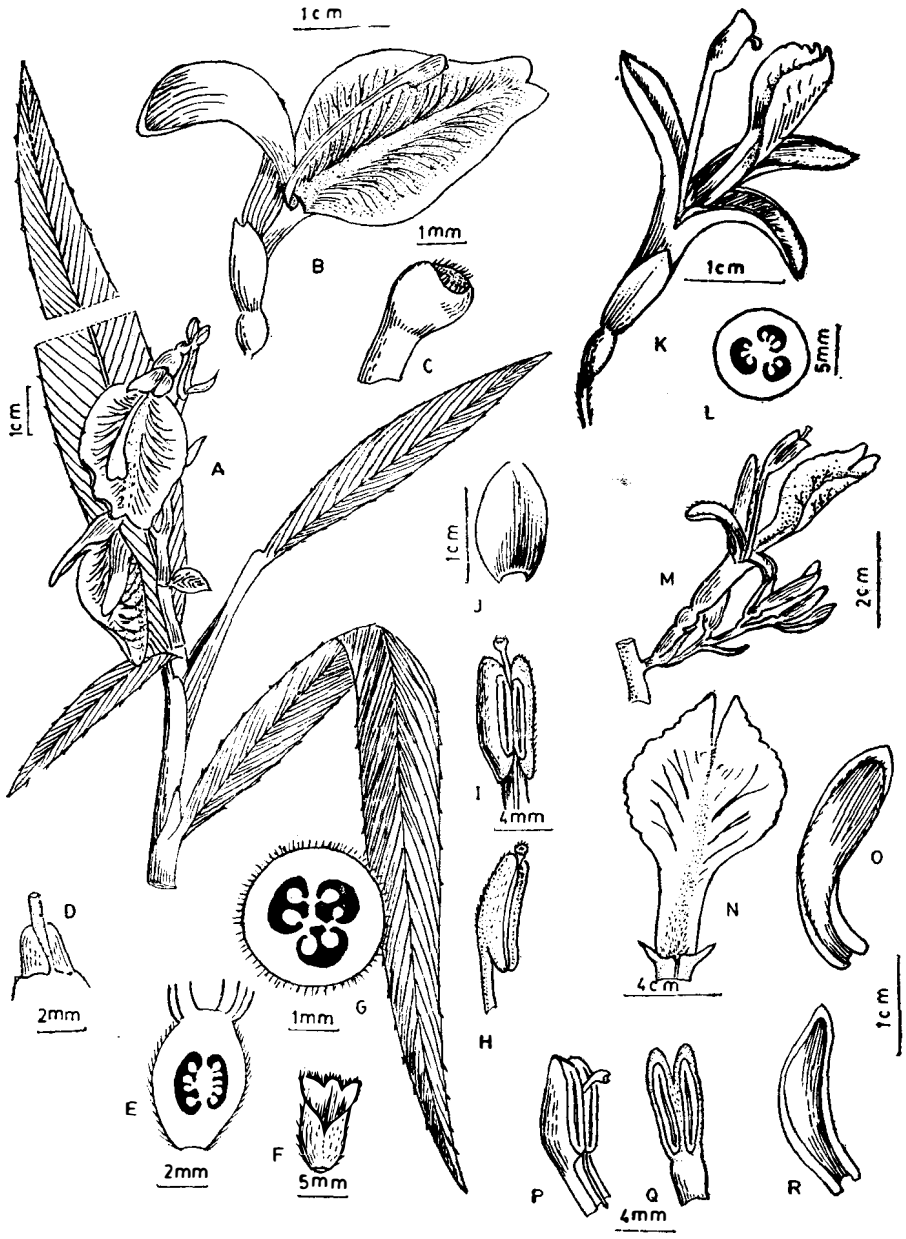

Fig. 1. **A-J Alpinia calcarata:** A, habit; B. flower, C. stigma; D. epigynous glands; E. ovary in L. S.; F. calyx; G. ovary in T. S., H, anther lateral view; I. anther front view; J. bract. **K-R. Alipinia galanga:** K, flower; L. ovary in T. S.; M, brach of an inflorescence; N. labellum; O. dorsal corolla lobe; P. anther lateral view; Q. anther front view; R. lateral corolla lobe.

Languas calcarata (Roscoe) Alston in Trimen, Handb. Fl. Ceylon 6: 282. 1931. Fig. **1. A-J.**

Leafy stem 1-1.5 m. Leaves sessile; lamina glabrous, 40-50 × 2-2.5 cm, linear-lanceolate, narrowed towards the base, tip acuminate, margin with short bristles placed 1-2 mm apart; ligule membranous, *c.* 1 cm long, tip shortly bifid, margin ciliate. Inflorescence terminal, 10-15 cm long, densely paniculate, lower cincinni 4-flowered, upper 2-flowered; peduncle densely pubescent. Bracts minute, *c.* 1 mm long, triangular, pubescent, deciduous. Bracteoles membranous, splitting to the base, 1-1.5 × 0.7-0.8 cm, ovate, minutely pubescent outside, glabrous within, deciduous. Flowers shortly pedicellate; pedicel densely pubescent. Calyx tubular, 0.8-1 cm long, sparsely pubescent. Corolla tube almost equal to the calyx, pubescent, lobes oblong, pubescnet outside; dorsal lobe 1.5-1.8 × 0.6-0.8 cm; lateral lobes *c.* 1.5 × 0.5 cm. Labellum obovate, 3 cm long, 1.5-1.8 cm wide in the lower half, tip emarginate, variegated with dark purple and yellow, glabrous. Lateral staminodes small, subulate, at the base of the labellum. Stamen 2 cm long, shorter than the labellum, anther 8 mm long, thecae parallel, pubescent, ecrestate; style slightly projected above the anther; stigma rounded with ciliate opening. Epigynous glands two, 3 mm long, thick, free from each other. Ovary 4 × 3 mm, densely pubescent, trilocular with many ovules. Fruitg lobose, 2-2.5 × 1.5 cm, pubescent, orange-red. Seeds many.

Distribution: Native of India. Also occurs in Burma, Thailand, Indonesia, New Guinea, and the Bismark Archipelago. In South India it is reported from Karnataka, Kerala and Tamil Nadu. Cultivated in Sri Lanka, Malay Peninsula and China.

Ecology: In dense forests at high altitudes.

Fls. & Frts.: May-Dec.

Uses: The zhizomes, with a sharp odour and a pleasant taste, are used in the form of an infusion for fever, rheumatism and catarrhal affections. It is also supposed to improve voice (Kirtikar & Basu, 1935). The rhizomes form a major ingredient of several ayurvedic prepararions.

Specimens examined: Karnataka: Coorg, *Mangaly* 17565 (CALI). Kerala: Alappuzha, *Mangaly* 10268 (CALI); Calicut, *Sabu* 39163 (CALI); Idukki, *Mangaly & Sabu* 10325 (CALI); Pathanamthitta, *Nair* 50739 (CAL & MH); Thiruvananthapuram, *Bourdillon* 115 (CAL). Tamil Nadu: Tirunelveli, *Jacob* 16234 (MH).

Alpinia galanga (Linn.) Sw., Obs. Bot. 6. 1791; Roxb., Asiat. Res. 11: 352. 1810 & Fl. Ind 1: 58. 1820; Baker in Hook. f., Fl. Brit. India 6: 253. 1892; Schum. in Engler, Pflanzenr. 4 (46): 316. 1904; Fischer in Gamble, Fl. Pres. Madras 8: 1492. 1928; Smith, Edinburgh J. Bot. 47: 45. 1990.

Maranta galanga Linn., Sp. Pl. ed. 2, 3. 1762.

Languas glanaga (Linn.) Stuntz, U. S. Dep. Agrl. Bull. 261: 21. 1912; Holttum, Gard. Bull. Singapore 13: 157. 1950.

Fig. **1. K-R.**

Leafy stem over 2 m high. Leaves large, 60-70 × 10-15 cm, oblong-lanceolate, acuminate at the apex, base

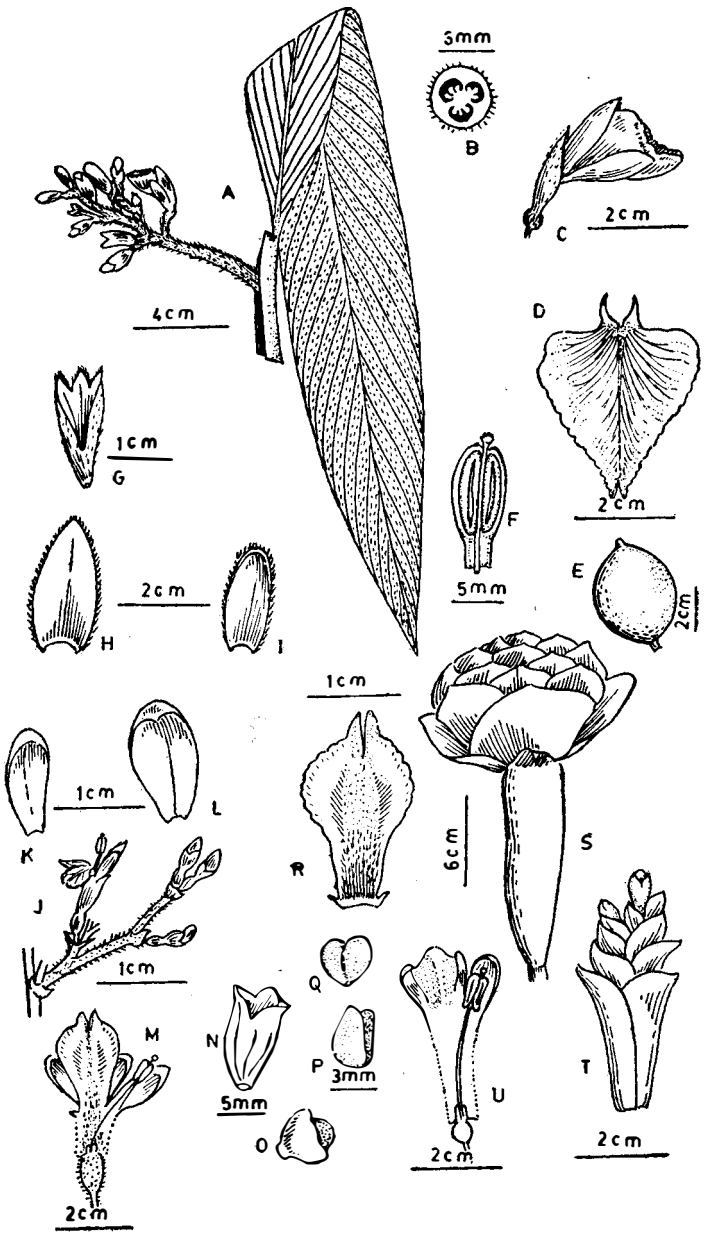

Fig. 2. **A-I. Alpinia mutica:** A. habit; B. ovary in T. S.; C. flower; D. Labellum; E. fruit; F. anther; G. calyx; H. dorsal corolla lobe; I. lateral corolla lobe; J-R. **Alpinia nigra:** J. branch of an inflorescence; K. lateral corolla lobe; L. dorsal corolla lobe; M. flower split open; N. calyx; O. seed with aril; P. Q. seed; R. labellum. **S-U. Alpinia abundiflora:** S. inflorescence; T. a cincinnus; U. flower split open.

cuneate, glabrous; petiole short, 5 mm long, pubscent; ligule 7-8 mm long, entire, acute, hairy outside. Inflorescence terminal, panicled, 25-30 cm long, covered by two, large, yellowish - green bladeless sheaths when young, outer 18-20 × 3-4 cm; inner 12-15 × 2-3 cm. Peduncle densely pubescent, branched, branches about 2 cm long. Bracts 2-2.5 × 0.5-0.8cm, membranous, deciduous, sparsely pubescent, each subtending a cincinnus of 4-5 flowers. Bracteoles smaller, *c.* 1.5 × 0.6 cm, enclosing buds. Flowers *c.* 4 cm long, shortly pedicellate; pedicel 5-8 mm long. Calyx *c.* 1 cm long, cylindrical, greenish - white, minutely hairy. Corolla tube slightly longer than the calyx, *c.* 1.2 cm long, greenish - white; lobes unequal, spreading, pvuescent along the margin, dorsal lobe 1.7-2 × 0.7 cm, rounded at the apex; lateral lobes 1.5-1.7 × 0.6 cm. Labellum *c.* 2 cm long, unguiculate in lower half, tip emarginate, margin wavy, white with a few oblique lilac lines on either side of the midrib, glandular hairy at base. Lateral staminodes small, subulate, 4-5 mm long. Filament 1.3-1.6 cm long, slender; antherthecae 6-8 mm long, parallel, light green to yellow, ecrestate. Epigynous glands two, free from each other, 3 mm long, irregularly lobed with rounded apices. Ovary 3 mm long, ellipsoid, green, glabrous. Fruit orange-red, smooth, globose, 1 cm across. Seeds few.

Distribution: Wild in India, Indo-China, Philippines and Borneo. Cultivated throughout S. E. Asia, Malesia, Ceylon and in some parts of India. In South India, sparsely represented along the Western Ghats.

Ecology: In dense evergreen forests at high altitudes.

Fls. & Frts.: April-Dec.

Uses: The rhizome of this species is aromatic, pungent and bitter. It improves appetite, taste and voice. It is also used in head-ache, lumbago, rheumatic pains, sore-throat, stuttering, chest pain, diabetes, burning sensation of the liver and diseases of the kidney (Kirtikar & Basu, 1935).

Specimen examined: Karnataka: North Kanara, *Talbot* 2552 (BSI). Kerala: Idukki, *Mangaly & Sabu* 10324 (CALI); Kollam, *Mohanan* 58411 (MH). Tamil Nadu: Kanyakumari, *Mangaly* 10256 (CALI).

Alpinia malaccensis (Burm. f.) Roscoe, Trans. Linn. Soc. 8: 345. 1808; Roxb., Asiat. Res. 11: 353. 1810 & Fl. Ind. 1: 62. 1820; Schum. in Engler, Pflanzenr. 4 (46): 335. 1904; Fischer in Gamble, Fl. Pres. Madras 8: 1493. 1928; Smith, Edinburgh J. Bot. 47. 50. 1990.

Maranta malaccensis Burm. f., Fl. Ind. 2, 1768.

Type: Rumphius, Herb. Amb. 5: t. 71. 1747.

Costus malaccensis Koenig in Retz., Obs. Bot. 3: 71. 1983.

Alpinia nutans Roscoe var. *sericea* Baker in Hook. f., Fl. Brit. India 6: 256. 1892.

Catimbium malaccense (Burm. f.) Holttum, Gard. Bull. Singapore 13: 155. 1950. **Fig. 4. O-Q.**

Leafy stem robust, up to 3 m tall. Leaves bifarious, long petioled; petiole 3-3.5 cm, rounded, densely pubescent; lamina 50-60 × 6-7 cm, lanceolate-acuminate, pubescent or not, margins wavy, fringed with sparce, short, brown hairs;

ligule 0.5-1 cm long, ovate, entire, coriaceous, hairy; sheaths pubescent, more densely near the blade. Inflorescence terminal, erect or slightly curved, main axis densely pubescent. Bracts absent. Cincinni of 1-2 flowers. Pedicel 0.5-1.5 cm long, pubescent. Bracteoles white, open to the base, 1.5-2 × 1-1.5cm, deciduous, minutely pubescent at the apex. Calyx white, 1.8-2 cm long, shortly 3-lobed, deeply split on one side, pubescent towards the apex. Corolla tube *c.* 1 cm long, shorter than the calyx, white, glabrous; lobes white, almost equal; dorsal lobe *c.* 3 × 1.5 cm, margin ciliate, laterals *c.* 3 × 1cm, margin ciliate. Labellum yellow, striped scarlet, 3-4 cm long, 3 cm across at widest part, sides incurved, narrowed to an emarginate apex, with 2 papillose, fleshy swellings at the base. Lateral staminodes subulate, 5 mm long. Filament 1 cm long; anther-thecae 1.2 cm, parallel, ecrestate. Epigynous glands 3 mm long, free from each other. Style long, filiform, hairy towards the apex, stigma funnel shaped, hairy. Ovary 5 mm long, pubescent, apparently trilocular; ovules many. Capsule turning red at maturity, globose; 3 - celled, 3 cm in dimeter, pubescent. Seeds numerous, ovate or obovate with white aril.

Distribution : India (throughout S. India), Malesia, Java, Sri Lanka and Indo-China.

Ecology : Common in dense evergreen forests upto 1000 m on Western Ghats. In Java it is reportedly found in secondary bamboo-teak-forests, brushwood, ravines, but rarely in primary forests.

Fls. & Frts. : April - Dec.

Specimen examined : Andhra Pradesh: Visakapatnam, *Balakrishnan* 745 (CAL). Karnataka : Shimoga, *Sabu* 39120 (CALI). Kerala: Idukki, *Sharma* 42427 (MH); Kollam, *Calder* 1420 (CAL) ; Palakkad, *Satheesh Kumar* 11213(CALI); Pathanamthitta, *Mangaly* 10302 (CALI); Wyanad, *Ellis* 25195 (MH). Tamil Nadu: Coimbatore *Henry* 543 (MH). Madurai, *Deb* 30180 (MH),

Alpinia mutica Roxb., Asiat. Res. 11:354. 1810 & Fl. Ind. 1: 65. 1820; Baker in Hook. f., Fl. Brit. India 6: 254. 1892; Schum. in Engier. Pflanzenr. 4(46): 327. 1904; Bhat & Venugopal, J. Bombay Nat. Hist. Soc. 84: 714. 1987; Smith, Edinburgh J. Bot. 47: 51. 1990.

Type: Cult. Calcutta, Originally collected from Penang.

Renealmia mutica (Roxb.) Salisb., Trans. Hort. Soc. 1: 280. 1812.

Alpinia korthalsii Schum. in Engler, Pflanzenr. 4(46): 327. 1904.

Languas mutica (Roxb.) Degener, Fl. Hawaii Fam. 76. 1932.

Catimbium muticum (Roxb.) Holttum, Gard. Bull. Singapore 13: 150. 1950. **Fig. 2. A-I.**

Leafy stem robust, upto 2 m high. Leaves bifarious, petiolate; petioles 3.5 cm long, pubescent; lamina oblong-lanceolate, acuminate, 40-60 × 10-13 cm. glabrous above, more or less densely pubescent below; ligule *c.* 8 mm long, coriaceous, entire, glabrous or fringed with hairs; sheaths pubscent. Inflorescence up to 16 cm long, emerging from the uppermost leaf sheath, erect or slightly curved; rachis densely pubescent, protected when young by 2-3 bladeless sheaths, 11-16 × 2.5-4,5 cm. Cincinnus 1-3 flowered. Pedicels 0.5-1 cm long,

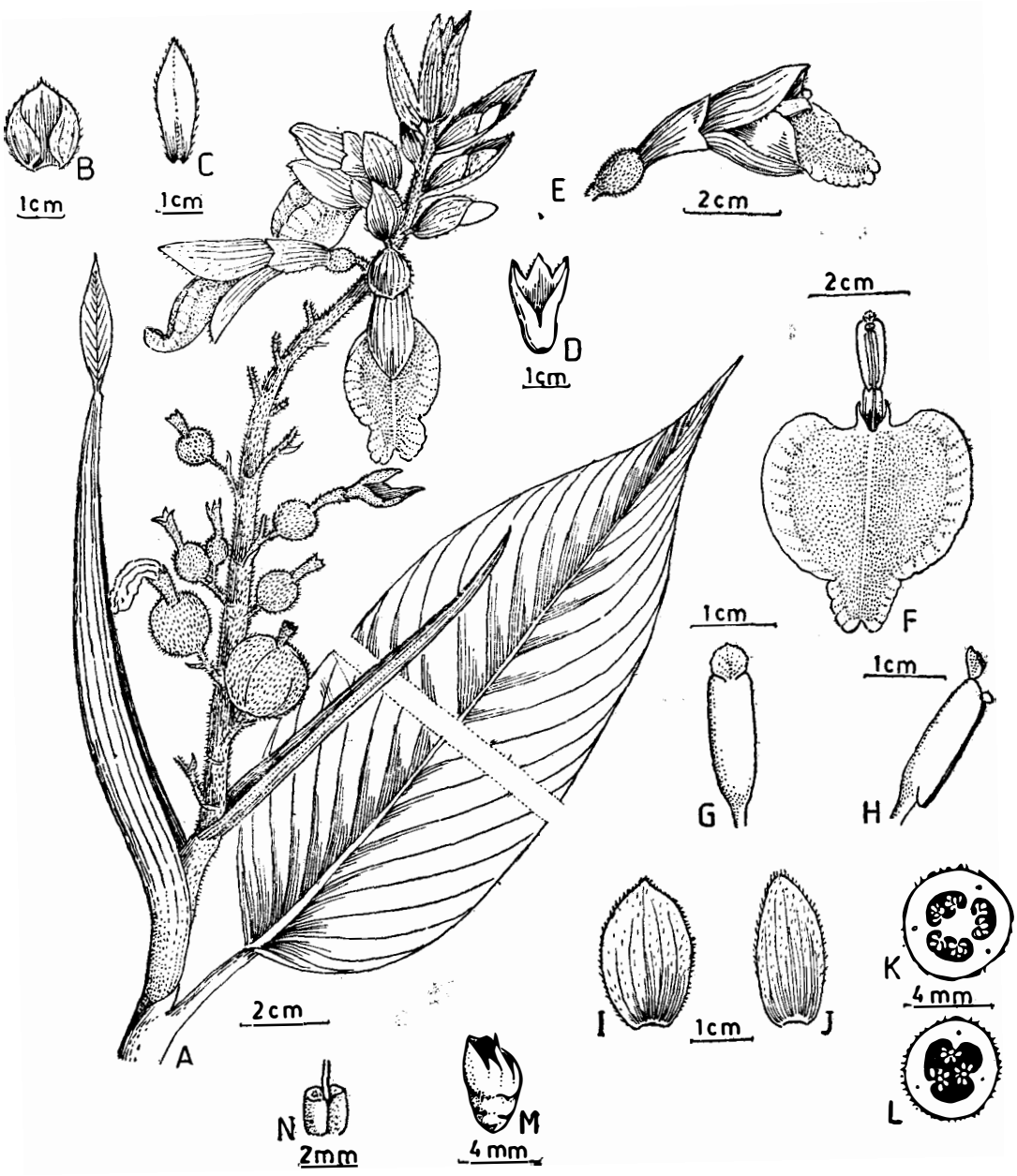

Fig. 3. **Alpinia smithiae.** A. inflorescence with sheaths and uppermost leaf; B. bracteole; C. upper bract; D. calyx; E. Flower; F. labellum; G. anther back view; H. anther lateral view; I. dorsal corolla lobe; J. lateral corrola lobe; K. ovary in T. S. towards base; L. ovary in T. S. towards top; M. seed with arial; N. epigynous gland.

pubescent. Bracts absent. Bracteoles absent or very small, upto 6 mm long on the upper cincinni only, deciduous. Calyx white, 1.8-2 cm long, funnel shaped, 3-lobed, outer surface sparsely hairy. Corolla white, tube c. 1.3 cm long, curved, shorter than the calyx; dorsal lobe 2.5 × 1.8 cm, linear-oblong, concave, margins shortly ciliate; lateral lobes as long as the dorsal lobe but narrower, 2.5 × 1.5 cm, margin shortly ciliate. Labellum *c.* 3 × 3.5 cm, broadly ovate, narrowing to an emarginate apex, yellow, variegated with red, the basal part strongly concave, sides incurved. Lateral staminodes reduced, 5 mm long, subulate. Filament 1-1.2 cm long; anther as long as filament; thecae parallel, ecrestate. Epigynous gland one. Style filiform. Stigma funnel shaped, ciliate. Ovary 5-8 mm long, trilocular, pilose with many ovules. Capsule globose, 3-3.5 × 2-2.5 cm, red when mature pubescent with accrescent calyx. Seeds many, angular, 6- 7 mm long, black with white, lacerate aril.

Distribution: Borneo, Penang, Perak, Singapore, Malesia, and N. E. and South India (Western Ghats in Kerala & Karnataka).

Ecology: It grows very well in swampy areas near springs or rivers at high altitudes.

Fls. & Frts.: Feb.-Oct.

Specimens examined: Karnataka : Coorg, *Bhat* 1965 (PPCH). Kerala : Palakkad, *Mangaly & Sabu* 17431 (CALI).

Alpinia nigra (Gaertn.) Burtt, Notes Roy. Bot. Gard. Edinburgh 35: 213. 1977; Smith, Edinburgh J. Bot. 47: 26. 1990.

Zingiber nigrum Gaertn., Fruct. 1: 35. t. 12. 1788.

Type: *Cardamomum zeylanicum fructu rotundo nigro*, in *Caulium summitate* Hermann, Parad. Bot. 320. 1689.

Heritiera allughas Retz., Obs. Bot. 6: 17. t. 1. 1791.

Hellenia allughas Willd., Sp. Pl. 1: 4. 1797.

Alpinia allughas (Retz.) Roscoe, Trans. Linn. Soc. London 8: 346. 1807; Roxb., Fl. Ind. 1: 60. 1820; Baker in Hook. f., Fl. Brit. India 6: 253. 1892; Schum. in Engler, Pflanzenr. 4 (46): 344. 1904; Fischer in Gamble, Fl. Pres. Madras 8: 1493. 1928.

Fig. 2. J-R.

Leafy stem 2-3 m tall. Leaves bifarious, sessile or very shortly petiolate, 30-50 × 9-15 cm, linear-lanceolate, acuminate, glabrous or slightly pubescent on either side of the midrib below; ligule *c.* 5 mm long, entire, tip rounded, pubescent; sheath glabrous. Inflorescence terminal on the leafy stem, 20-30 cm long, paniculate, copiously compound, erect or slightly bend to one side; main axis and branches pubescent; cincinni remote; flowers numerous. Bracts membranous, ovate, upper smaller, 5 mm long, lower larger, each subtending a cincinnus of up to 4 shortly pedicellate flowers. Bracteoles tubular, membranous. Flowers small, 3-3.5 cm long. Calyx 0.8-1.2 cm long, 3 toothed, pubescent outside, persistent. Corolla tube slightly smaller or equal to the calyx; lobes almost equal, linear-oblong, greenish white, pubescent outside, glabrous within, dorsal lobe 1.2-.4 × 0.7 cm, cucullate, lateral lobes 1-1.2 × 0.4-0.5 cm. Labellum 2-2.2 × 0.9-1.2 cm, clawed, limb cuneiform. Lateral staminodes reduced, 1-2 mm long, subulate. Filament 0.8-1 cm. Anther

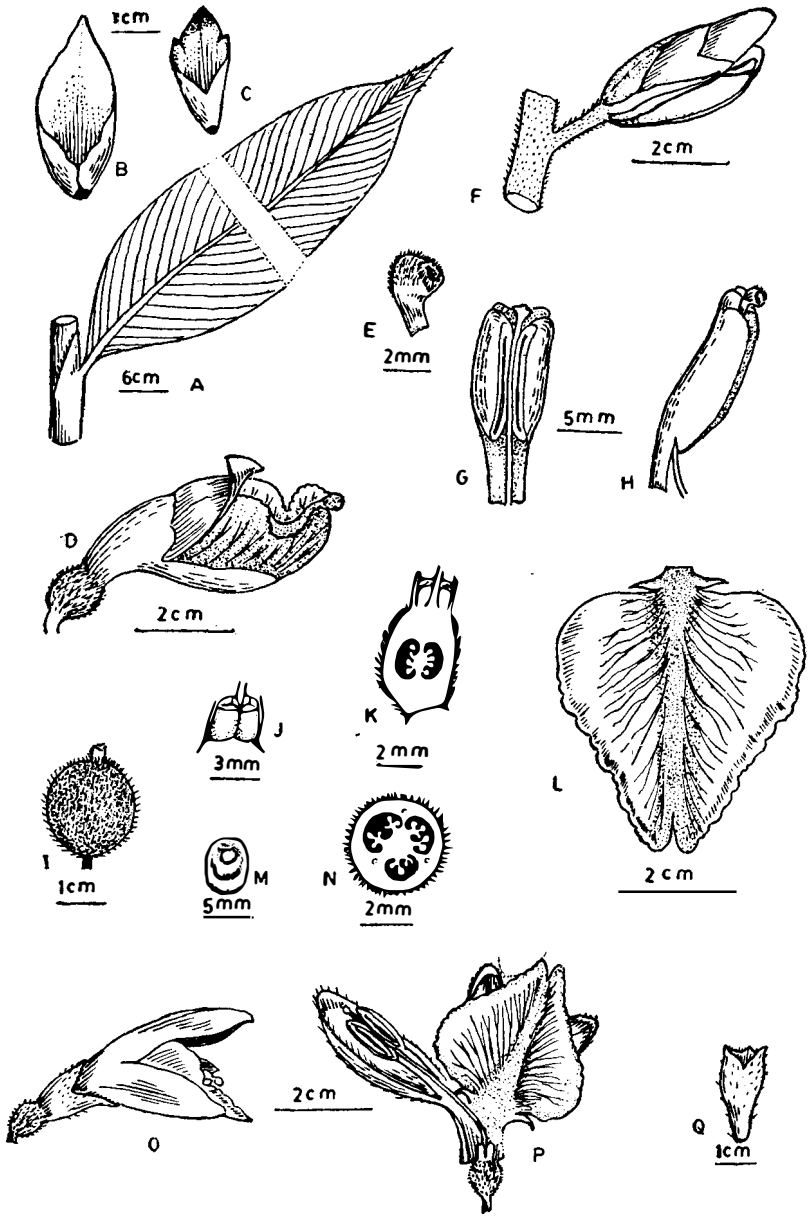

Fig. 4. **A-N. Alpinia zernmbet**: A. a leaf with ligule; B. bracteole; C. calyx; D. flower; E. stigma; F. a cincinnus; G. stamen front view; H. stamen lateral view; I. fruit; J. epigynous glands; K. ovary in L. S.; L. labellum; M. seed with aril; N. ovary in T. S. **O-Q. Alpinia malaccensis**; O. flower; P. flower split open; Q. calyx.

5-6mm, thecae parallel, ecrestate. Epigynous glands 2, 3-5 mm long, free from each other. Ovary 4-6 × 2-4 mm, triloeular, pubescent. Capsule globose, 2 cm across, glabrous, black when ripe. Seeds many, black with white membranous aril, 3 × 4 mm.

Distribution: Throughout India, Malesia and Sri Lanka. In South India it is reported from the Western Ghats in in Tamil Nadu upto 1200 m. The existence of this plant in Karnataka is doubtful. Arora *et al*. (1981) and Sharma *et al.* (1984) reported it from Karnataka but this ts doubtful,

Ecology: In evergreen and moist deciduous forest, up to 1200 m.

Fls. & Frts.: Jan. - June.

Uses: The rhizome is used medicinally.

Specimen examined: Tamil Nadu: Tirunel-Veli, *Hooper & Ramaswami* 38352 (CAL).

Alpinia smithiae Sabu & Mangaly, Edinbrugh J. Bot. 48: 69. 1991.

Type: India. Kerala State, Palakkad Dt., Attapady, dense evergreen forests, *c*. 500 m, 6. 3. 1989, *Mangaly & Sabu* 17563 (holo: MH; iso.: CALI, E & CAL).

Leafy stem robust, 2-3 m tall. Leaves petiolate, petioles 3-4 cm long, rounded, hairy; lamina 50-60 × 6-12 cm, oblong-lanceolatc to oblanceolate, acuminate, base oblique, densely pubescent below, glabrous above; ligule 1 cm long, entire, coriaceceous, hairy outside. Inflorescence terminal errect, 15-25 cm long; main axis aensely hairy, protected when young by 1-2 large bladeless sheaths, decidueus, outer larger, 15-20 × 2.5-3.5 cm, inner smaller, 6-7 × 1.5 cm, light green, Bracts only towards the tip, small, 3-4 × 1-1.2 cm, light green, hairy along the margin. Flowers pedicellate. stalk 0.5-1 cm long, densely pubescent. Bracteoles white, clasping the bud, 2-2.5 × 3.5 cm, pubescent outside, glabrous within, deciduous. Calyx white, tubular, 1.8-2 cm long, shortly 3-lobed, deeply split on one side, minutely pubescent outside. Corolla white, tube 1 cm long, shorter than the calyx, glabrous; lobes oblong, outer surface sparsely pubescent, margin ciliate; dorsal lobe 2.5 × 1.5 cm, laterals, 2.5 × 1 cm. Labellum 3.5-4 × 3.5 cm, yellow, striped with purple - red, margin dark yellow, sides incurved, narrowing to a slightly emarginate apex. Lateral staminodes subulate, 5 mm long. Filament 1 cm long, densely hairy; anther 1.2 cm long, thecae parallel, glandular hairy on the back; crested. Crest 4 × 3 mm, rounded, yellow. Epigynous glands two, united on one side, 3 mm long. Overy 7 × 5 mm long, densely pubescent, green, trilocoular below, ovules many. Fruit globose, 2.5 × 2.5 cm, yellow - orange when mature. Seeds many, with white lacerate aril.

Distribution: Endemic to South India. Known only from the type locality.

Ecology: Found growing in dense evergreen forests above 300 m in association with *A. malaecensis*.

Fls. & Frts.: Jan. - Oct.

Pollination: Mainly by the weaver ants, *Oecophylla smarandina* F. They make nests on this plant by weaving together its leaves during the flowering season.

Specimens examined : Kerala: Palakkad, *Sabu & Mangaly* 17563 (Type).

Alpinia zerumbet (Pers). Burtt & Smith, Notes Roy. Bot. Gard. Edinburgh 3: 204. 1972; Smith, Edinburgh J. Bot. 47: 62. 1990.

Costus zerumbet Pers., Synops. 1:3. 1805.

Type: Wendl., Sert. Hannov. 4:3, t. 19, 1798.

Zerumbet speciosum (Wendl.) Schum. in Engler, Pflanzenr. 4 (46): 339. 1904- non *A. spcioesa* Dietr , 1839.

Catimbium speciosum (Wendl.) Holttum, Gard. Bull. Singapore 13: 152. 1950. **Fig. 4. A-N.**

Leafy shoot robust, upto 3 m tall. Leaves large, lamina 60-80 × 10-15 cm, oblong - lanceolate, acuminate, margin towards apex ciliate, otherwise glabrous; petiole rounded, 1 cm long, hairy; ligule 1.5 cm long, coriaceous, tip slightly befid, densely hairy outside.. Inflorescence terminal on the leafly shoot, pendulous; main axis densely hairy, protected when young by 3-5 bladeless sheaths, outer larger, 18-20 × 4-4.5 cm, inner smaller, 10-12 × 3-4 cm, glabrous, deciduous. Bracts absent. Bracteoles large, fused at base to form a cup, 3-3.5 × 2.5-3 cm, white with a pink tip, glabrous. Lower cincinni with 2-3 flowers, stalk 5-7 mm, densely hairy. Calyx tubular, 2-2.2 × 1.5-1.8 cm, shortly 3-lobed at the tip, deeply split on one side, white with a pink tip, glabrous except on margins. Corolla white, tube 1 cm long, shorter than the calyx, glabrous; lobes oblong, pubescent along the margin; dorsal lobe 2.5-3.5 × 2.5-3 cm, tip rounded with a pink spot; laterals 2.5-3 × 0.8-1.1 cm. Labellum 4.5-5.5 cm long, 5 cm across at widest part, narrowing to an emarginate apex, yellow, heavily lined with red, sides incurved. Lateral staminodes subulate, 3-5 mm long. Filament 0.8-1 cm long, anther - thecae parallel, glandular hairy on the back. Epigynous glands two, 2 mm long, free from other. Ovary 6-7 × 2 mm, densely hairy, trilocular, ovules many. Capsule large, orange red, 2.5 × 2 cm, hairy. Seeds 4 × 2 mm, arillate; arile white, membranous.

Distribution : This species is considered to be a native in N. E. India, Burma and Inbochina (Holttum, 1950). It is widely cultivated in South India in gardens.

Fls. & Frts. : Jan. - Oct.

Uses : Very attractive due to the glossy leaves and large flowers and easy to propagate, this species has great potential in horticulture.

Specimen examined: Kerala: Calicut, *Sabu* 39178 (CALI); Malappuram, *Sabu* 39146 (CALI); Waynad *Mangaly* 6789 (CALI).

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The characteristics of the Flora of Shanghai

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Abstract

The natural vegetation of Shanghai, is highly denuded, but the province shelters a sizeable number of exotic species, both casuals and ruderals. At present, the native flora is composed of various geographical elements and has about 492 species. The paper endeavours to provide a general picture of the flora of Shanghai.

INTRODUCTION

Shanghai is located at the mouth of Yangtze River, at latitude of 31°14'N and longitude of 121°21' E, with an area of 6186 square kilometers. Shanghai is mainly an alluvial plain which has been opened up long ago. The natural vegetation has nothing left except the saline vegetation along the sea beaches and the freshwater vegetation. However, besides crops, vegetables and weeds, there are still a number of native species occurring in the countryside of the plain, though they are becoming less and less owing to human disturbance. These plants are mostly identical with those growing on the plain or at the foot of the hilly lands of southern Jiangsu and northern Zhejiang, and have probably originated from there. The hilly lands composed of about twenty small hills, mainly of Sheshan and Dajinshan Island, occupy only a limited area in the southwestern part of the city. The hilly land flora, therefore, represents to a great extent, the native flora of Shanghai.

The exotic flora is another important component of the local flora. Shanghai has always been the largest coastal port and trade centre of China and has trade relations with foreign countries since long ago. This has contributed heavily to the introduction of plants from both inland and abroad.

THE NATIVE FLORA

There are about 492 species (incl. infraspecific taxa) of native seed plants in Shanghai. Based upon their present distribution, these species could be divided into seven geographical elements as follows:

(1) *North Temperate Elements*: Species have a distribution throughout most of the north temperate region. These elements, though not many in Shanghai (ca. 27 spp.), are the dominant species of the saline as well as the fresh water vegetations.

(2) *Old World Temperate Elements*: Species with a distribution in both Europe and China, and sometimes extending to Japan and Korea. These components are quite rare (ca. 9 spp.) and ocour sporadically in Shanghai.

(3) *Old World Pantropical Elements*: Species with a distribution including tro-

pical Africa, Asia and Australasia. These elements are very few in Shanghai (7 spp.). Those with their distribution confined to tropical Asia and Australasia and absent in Africa are more than the former (ca. 18 spp.).

(4) *Asiatic Tropical Elements*: Species with a distribution throughout the tropical Asia. Since Shanghai is situated along the northern border of subtropical China, these elements are limited in number (ca. 15 spp.).

(5) *Himalayan and Eastern Asiatic Elements*: Species with a distribution including the Himalayan and Sino - Japanese region. These elements are quite rare (9 spp.) and are of minor importance to

Table 1

Floristic region compared	Number of sp identical
Jiangsu Province	294
Zhejiang Province	295
Anhui Province	279
Jiangxi Province	255
Fujian Province	222
Taiwan Province	167
Japan	198

Based on the data above, the following postuiated:

The native flora of S comprises altogether abo is rather a poor one as c flora of the adjacent re accounts for this is that small area of hilly lar and the original vegetat has, to a large extent, totally destroye