FASCICLES
OF
FLORA OF INDIA

FASCICLE 20

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BOTANICAL SURVEY OF INDIA
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BARCLAYACEAE

Li in Am. Midl. Nat. 54 : 40. 1955

R.L. Mitra*

Slender, perennial, rhizomatous, laticiferous, acaulescent, aquatic herbs with air-canals and scattered vascular bundles. Rhizomes short, erect, villous-pubescent, bearing flowers, leaves, vegetative buds and axillary runners. Leaves simple, stipulate, long petiolate, heterophyllous, submerged and erect, or floating, obovate to suborbicular, cordate or sub-sagittate at base; foliar sclereids present. Flowers small, solitary, usually long pedunculate, bisexual, with spirally arranged floral appendages. Sepals 5, free, hypogynous, persistent. Petals numerous, unequal, epigynous, free above, connate into a tube and adnate to ovary below, persistent; innermost ones transitional to stamens. Stamens numerous, free, arranged on corolla tube, pendulous, each differentiated into a short constricted filament (oval in cross section) and a dorsiventrally flattened broad anther with microsporangia arranged laterally or sublaterally. Ovary: 6—14-loculate with a cup-like depression above formed by radiating, curvate stigmas; stigmatic appendages incurved, conviving into a cone. Ovules numerous in each locule, orthotropous, bitegmic, crassinuculate; placentation laminar. Fruit ripening under water, an irregularly dehiscent many-seeded berry, enclosed by and crowned with persistent calyx and corolla. Seeds spinulate, exarillate, operculate, with minute embryo, scanty endosperm and copious perisperm.

Distrib.: Monotypic, 4 species in pools and slow streams in tropical rain forests from S. E. Asia to East Indies; 1 in India (Andamans).

BARCLAYA


Characters and distribution same as family.

Type: Barclaya longifolia Wall.

Notes: The name Hydrostemma Wall. originally proposed for the genus predates Barclaya Wall. by six months. However, Barclaya Wall. has

*Botanical Survey of India, Industrial Section, Indian Museum, Calcutta-700 016.


Leaves 12—28 × 2—6 cm, linear-oblong, membranous, undulate-crispate along margins, puberulous or glabrate beneath, obtuse at apex, cordate-subscapitate at base; petioles 6—25 cm long, puberulous or glabrescent. Flowers 1.5—2.5 cm long, purplish, hardly expanding and emerging above water; peduncles 10—35 cm long. Sepals 1.5—2.5 × 0.5—0.6 cm, linear-elliptic, concave, obtuse, with midrib distinct near to apex and produced into a tail 3—5 mm long, greenish-purple without, purplish within. Corolla shorter than sepals, sap-green without, purplish within; lobes broadly or narrowly oblong. Inner stamens 2.0—2.5 mm long, fertile, curved inwardly. Berries 1.0—1.5 cm across. Seeds c. 1 mm across, brown, globose, spinulose; spines radiating, tufted at micropylar region.


*Fls. & Frts.*: Jul.—Dec.

*Distrib.*: INDIA: South Andaman; BURMA, THAILAND, MALAYSIA, INDO-CHINA.


*Notes*: Prain (*Journ. Asiatic. Soc. Beng.* 59: 252. 1890) considers the plant doubtfully indigenous to Andaman flora. It appears to be very sporadic and localised in distribution, for the plant was collected only thrice (Caddelgunj Jungle, 1893, *King’s Coll. s.n.*; Anikhet valley, 1904, Rogers 369 & Poona nallah, on way to Poochang forest post, 6.9.1922, *Mehrotra* 136) since its first record (King in *Journ. Asiatic. Soc. Beng.* 58: 390. 1889), from a ditch near Haddo (*King’s Coll. s.n.*) in 1884.
CABOMBACEAE


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Aquatic, caulescent, rhizomatous laticiferous, mucilaginous herbs, usually stoloniform with air-canals and scattered vascular bundles devoid of cambium. Roots adventitious in groups at the base of rhizomes and nodes of stolons. Leaves simple, stipulate, usually long petiolate, heterophyllous, submerged and floating, spirally arranged on rhizome, on one side on stolons and distichous or tristichous, or even opposite or ternate on floating shoots; foliar selereids absent. Flowers small, solitary at nodes on floating shoots, usually long pedunculate, bisexual, hypogynous, with floral appendages arranged in low spirals. Sepals (2—) 3 (—4), free or slightly connate at base. Petals (2—) 3 (—4), free or slightly connate at base. Stamens 3—36, free, more or less flattened with paired microsporangia arranged laterally or abaxially; dehiscence longitudinal; pollen unispurate; staminodes absent. Carpels (1—) 2—18, free. Ovules 1—4 in each carpel. anatropous, bitegmic, crassinucelate; placentation laminar to submarginal. Fruit ripening above water, indehiscent, 1—4-seeded pod. Seeds exarillate, operculate with minute embryo, scanty endosperm and copious perisperm.

Distrib.: 2 genera and 8 species in the tropical and temperate regions of the world except Europe; 2 genera and 2 species (including 1 introduced) in India.

KEY TO THE GENERA

1a. Adult leaves monomorphic, floating, entire.................Brasenia 1

1b. Adult leaves dimorphic, submerged and floating;
submerged leaves deeply and finely dissected..........Cabomba 2

1. BRASENIA


Slender, perennial herbs. Rhizomes small, erect with submerged and floating leaves and axillary runners producing at nodes adventitious roots,
floating leaves and floating shoots. Juvenile leaves subulate to eccentrically peltate, submerged; adult leaves centrally peltate, floating. Flowers reddish, inconspicuous, on peduncles of unequal length, emersed at anthesis. Sepals (2—3 (—4). Petals (2—3 (—4). Stamens (12—) 18—36, with or without short apiculate sterile appendages; microsporangia lateral; pollen 1-sulcate. Carpels (4—) 7—18, each with (1—) 2 (—4) pendulous ovules in laminar or dorsal position. Ovules atropous, anatropous at maturity. Pods coriaceous, 1—4 seeded.

**Distrib.**: Monotypic; sporadically distributed in all the continents except Europe; but seeds reported from pleistocene and interglacial deposits in Europe.

**Notes** : The floating shoots bear floating leaves and flowers at nodes which are the products of axillary buds of runners. Though it appears as a continuous axis, it represents a sympodial branch system (Richardson, *Univ. Calif. Publ. Bot. 47*: 4. 1969). In gregarious populations, the floating shoots form a dense interoven mass.


**Local name**: Water-shield (Eng.); Sohpyllain phuhsaw (Kh.).

Floating shoots rising almost to water surface, 1 m or more long, with floating leaves and flowers at nodes; young submerged parts including petioles, peduncles, and under surface of leaves coated with thick transparent mucilage. Floating leaves 4—10 (—13.5) × 2.5—6.0 (—8) cm, distichous or tristichous (when flowers are absent), suborbicular or broadly elliptic, entire, green above, purplish beneath; petioles usually 0.5—1.0 m long. Sepals 1—1.5 × 0.3—0.5 cm, lanceolate, obtuse at apex, reddish within, puberulous, persistent. Petals 1.5—1.8 × 0.3—0.6 cm, lanceolate to linear-oblong, obtuse and cucullate at apex, puberulous, persistent. Anthers c. 3 mm long. Filaments 8—12 mm long, puberulous. Ovary 5—6 mm long, c. 1 cm in fruit, fusiform, appressed puberulous. Styles 3—4 mm long with densely papillose-hairy stigmatic region along adaxial face, persistent and incurved in fruit. Seeds 3—4 × 2.5—3.0 mm, ellipsoid, minutely beaked at hilum, sparsely papillate, dark brown.

**Type**: United States of America, New Jersey, Hope s. n. (Holo, M).
Fls. & Frts. : Aug.—Nov.

Distrib. : INDIA : Meghalaya, Nongkreem in Khasia Hills and Nartiang and Jowai in Jaintia Hills (1200–1800 m); BHUTAN, JAPAN, TAIWAN, CHINA, ASIATIC USSR, N. AMERICA, MEXICO, CUBA, GUATEMALA, GUYANA TROPICAL E. AFRICA and AUSTRALIA.


Notes : The thick coat of transparent mucilage on young plant parts is secreted by densely packed glandular trichomes which, however, swell, rupture and disintegrate with age leaving the older parts free of mucilage (Richardson, op. cit. 7). Specimens, unless pressed between wax-paper, stick to drying sheets (Wood, l.c. 104).

2. CABOMBA


Slender, perennial herbs, completely submerged except during flowering. Roots adventitious in groups at lower nodes of stems trailing through mud. Leaves dimorphic, petiolate; submerged leaves opposite or ternate, palmately divided at the summit of petiole into 3—9 parts, each part dividing 2—3:chotomously several times into many long, narrow segments forming a dissected blade flabellate in outline; floating leaves when present alternate, peltate. Flowers white to yellow or purple, emersed on peduncles of unequal length. Sepals 3, slightly connate at base. Petals 3, clawed and often auriculate, slightly connate at base. Stamens 3—6, without distal sterile appendages; microsporangia lateral to abaxial. Carpels 1—4, each with 3 pendulous ovules in laminar position. Pods coriaceous, usually 3-seeded; seeds covered with hygroscopic hairs.

Type : C. aquatica Aubl.

Distrib. : About 7 species in tropical and temperate regions of Americas, elsewhere introduced; 1 introduced in India.

Stems up to 2 m long, branched, thinly mucilaginous. Leaves dimorphic; petioles 1—3 cm long, pubescent. Submerged leaves finely dissected, flabellate in outline, 2—5 cm wide; terminal segments slightly spathulate, 0.3—0.8 mm broad with an obscure midrib. Floating leaves peltate, linear-oblong-elliptic, 5—20 × 1.5—3.0 mm, often emarginate at one end, usually pubescent beneath. Flowers 1.0—1.5 cm across, creamy white with a pair of yellow spots at base of each petal, rising above water on peduncles from upper axils; peduncles 1.5—8.0 cm long, pubescent. Sepals and petals 3, the latter obovate, rounded at apex and auriculate near base. Stamens 3—6. Carpels 2—4, elongate, puberulous. Seeds ovoid, covered with hygroscopic hairs.

**Fls. & Frts. :** May—Aug.

**Distrib. :** INDIA: Kerala (around Cochin in fresh water ponds and ditches; introduced); U.S.A.

**Chr. No. ;** 2n = 34 (Sen & Bhaduri in Journ. Cytol. Genet. 6: 70. 1971).

**Notes :** Aleykutty and Inamdar (l.c.) reported the plant from fresh water ponds and ditches around Cochin as *C. aquatica* Aubl. Except for the creamy white colour of the flower and an enlarged drawing showing clearly the emarginate nature of the linear-oblong floating peltate leaf, all the other characters mentioned by them are generalised in nature and both of these two characters are applicable only to *C. caroliniana* Gray (Gardner, l.c.) On the other hand, in *C. aquatica* Aubl. the flowers are yellow and the floating peltate leaves are broadly elliptic to orbicular ((1—) 1.5—2.5 (—) 5 cm wide) and entire in outline.

The plant is commonly grown in fresh water aquaria for their decorative dark-green fan-shaped submerged leaves and got introduced probably from discarded aquarium plantings. Under indoor aquarium conditions this plant never produce floating leaves and flowers and remain completely submerged, and are thus often mistaken for *Limnophila* sp. The plant can however, be easily recognised by its submerged leaves being long petiolate and leaf-segments 2—3-chotomously branched, while in *Limnophila* these are sessile and pinnately divided.
NELUMBONACEAE

Dum., Anal. Fam. Pl. 53. 1829 (‘Nelumboneae’)

R. L. Mitra*

Large, perennial, rhizomatous, milky laticiferous, ecaulescent, aquatic herbs with air-canals and scattered vascular bundles devoid of cambium. Rhizomes stoloniform, branched, creeping, slender or tuberous, producing at nodes adventitious roots, solitary leaf, flower and axillary bud. Leaves simple, stipulate, long petiolate, orbicular with radiating veins branched dichotomously except the midrib; juvenile ones eccentrically peltate, floating; adult ones centrally peltate, floating or emersed; foliar sclereids absent. Flower solitary on long peduncles, raised well above water, large, showy, rose-pink, white or yellow, bisexual, hypogynous with spirally arranged floral appendages. Sepals 4—5, free, subequal, petaloid, persistent. Petals often numerous, free, intermediate ones largest, caducous; innermost ones sometimes transitional to stamens. Stamens numerous, free, long and linear, each differentiated into a suberete filament, an anther with adaxial to subiateral microsporangia, and a distal, ciliate, incurved sterile appendage; pollen tricolpate. Carpels (9—) 12—28(—39), distinct, embedded singly in cavities on turbinate, acorescent receptacles. Ovules solitary in each carpel, pendulous, orthotropous, anatropous at maturity, bitegmic, crassinucellate; placentation laminar. Nuts ripening above water; pericarp smooth; bony. Seed filling the carpel, exarillate, inoperculate; cotyledons large, fleshy; plumule folded, enclosed in a stipule-like sheath.

Distrib.: Monotopic, 2 species in tropical and subtropical regions, such as West Indies, Columbia, Central America, South-Eastern United States, Eastern Asia to North-Eastern Australia; 1 in India.

NELUMBO


Characters and distribution same as family.

Type: N. nucifera Gaertn.


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Local name: Podam (Asm.); Padma (Beng., Or., Sans.); Kanwal; Kamal (Hind.); Pampos (Kash., Punj.); Kamala, Tavaregida (Kan.); Sohlapudong (Kh.); Tamara, Chentamara (Mal.); Kamal (Mar.); Tamari (Tam.); Kalung, Erata-tamara (Tel.).

Leaves 20—80 cm across, flat when floating, somewhat cupped when emersed, suborbicular, shallowly notched and apiculate at one side terminating a simple vein, with a minute apicula at opposite side, glabrous and glaucous on both surfaces, dark-green above, paler beneath, coriaceous, membranous when dry; petioles up to 2 m long, beset with scattered hard, minute papillae. Flowers 8—25 cm across, rose-pink or white, fragrant; peduncles up to 2 m long, beset with scattered, hard, minute papillae. Sepals 1.5—5.0 × 0.8—3.5 cm, ovate or elliptic, concave, green (in white flowers) or pinkish-green (in rose-pink flowers). Petals c. 20 (single form) or c. 110 (double form), each 4—15 × 2—8 cm, elliptic, obtuse or subacute, concave, gradually becoming obovate to spatulate. Stamens up to 225, each 2.2—4.5 cm long; outermost ones in double form staminodial. Receptacles 2—4 cm across, spongy, yellow during anthesis, turn green, finally become dark brown and 5—10 cm across in fruit. Carpels 8—10 × 2—3 mm, becoming c. 2 × 1 cm in fruit, each differentiated into an oblong-cylindric ovary, a short exserted stigmatum with peltate, centrally depressed and papillose stigma.

**Type**: India, Herb. Linn. 673.7 (LINN, Microf.!).

**Fls. & Frts.**: March—Dec. (Jan.).

**Distrib.**: India: Throughout in fresh water ponds and lakes, also grown as an ornamental; South east and eastern Asia to Far eastern USSR and to North Australia.


*Uses*: The sacred lotus of Hindus, used for religious and decorative purposes, and also in indigenous system of medicine. Tuberous rhizomes and ripe carpels are edible, sold in market; cultivated in a small scale in Punjab and extensively in China and Japan.


*Notes*: The seeds of *Nelumbo nucifera* are perhaps the longest viable; seeds recovered from the moist peat of a drained lake in Southern Manchuria, variously claimed between 100 and 1000 years old, germinated consistently (Sculthorpe, *Biol. Aquatic Vas. Pl.* 325. 1967).
NYMPHAEACEAE


R.L. Mitra*

Aquatic, acaulescent, rhizomatous, laticiferous herbs, usually stoloniform with air-canals and scattered vascular bundles devoid of cambium. Roots adventitious in groups at base of petioles. Leaves simple, stipulate, usually long petiolate, heterophyllus, submerged (usually juvenile ones) and floating, spirally arranged on rhizome; venation palmate; all but one (pinnately branched midrib) dichotomously branched; vernation involute; foliar sclereids present. Flowers solitary in leaf-site or anodic side of leaf-axil, usually long pedunculate, bisexual, with spirally arranged floral appendages. Sepals 4, free, hypogynous or epigynous. Petals usually numerous, subequal, free, innermost ones staminodial, hypogynous to epigynous. Stamens usually numerous, free, hypogynous to epigynous, with or without sterile appendages, dorsiventrally flattened, with paired microsporangia arranged adaxially; dehiscence longitudinal; pollen unialate. Carpels 5—many, partially or fully coherent and fused peripherally with receptacular tissue forming a multilocular ovary. Ovules 2—many in each carpel, anatropous, bitegmic, crassinucellate; placentation laminar. Fruit ripening under water, an irregularly dehiscent, many-seeded berry. Seeds usually arillate, operculate, with minute embryo, scanty endosperm and copious perisperm.

Distrib.: 5 genera and c. 70 species in tropical and temperate regions of the world. 2 genera and 7 species in India, besides a number of exotic species and cultivars belonging to Nymphaea, Nuphar and Victoria are grown in ponds, lakes and water gardens.

Notes: Nymphaeaceae (sensu lato) is often considered a heterogenous assemblage primarily on the basis of gynoecial characters. The three subfamilies originally recognised by Caspary (in Engl. & Prantl, Nat. Pflanzenfam. 3, 2: 4. 1888) have been accorded distinct familial status by Bessey (Ann. Mo. Bot. Gard. 2: 130 & 137. 1915), but segregated further into 5 families by Li (Am. Midl. Nat. 54: 33—40. 1955). Hutchinson (Fam. Fl. Pl. ed. 3, 1: 497 & 501. 1973), however, recognised only Cabombaceae and retained the other two subfamilies in the Nymphaeaceae, while Thakhtajan (Bot. Rev. 46: 261. 1980) in partial modification of his earlier views (Fl. Pl. Origin & Disp. 207. 1969) accepted only three families like Bessey (l.c.). Cronquist on the other hand, though originally (Evol.

*Botanical Survey of India, Industrial Section, Indian Museum, Calcutta-700 016.
Class. Fl. Pl. 147-150, 1968) maintained only Nelumbonaceae and regrouped the remaining two subfamilies into Nymphaeaceae, changed his opinion (An Integrated Syst. Class. Fl. Pl. 105—105. 1981) and maintained four families, a view favoured by Thakatajan (l.c. 1969) earlier. These segregated families have even been placed in different orders or given new ordinal ranks.

In view of the conflicting morphological evidences, some of which are fragmentary, many authors still follow Wood (Journ. Arnold Arb. 40 : 95. 1959) in retaining Nymphaeaceae sensu lato as a single family, while considering a few genera, particularly Nelumbo as most specialised in the whole family. Though there are growing evidences in recent times in favour of the familial concept proposed by Bessey (l.c.), in the present work families have been delimited following Cronquist (l.c. 1981).

**KEY TO THE GENERA**

1a. Plants densely prickly. Sepals, petals and stamens epigynous

... *Euryale* 1

1b. Plants without prickles. Sepals, petals and stamens hypogynous to perigynous...

... ... ... ... ... ... ... *Nymphaea* 2

1. **EURYALE**


Annual or short-lived perennial herbs with submerged and floating juvenile leaves, and densely prickly and strongly venose adult floating leaves. Rhizomes short, thick, erect with leaves and flowers arranged in distinct spirals; vegetative buds absent. Flowers on densely prickly peduncles, partially submerged; sepals, petals and stamens epigynous, arranged on a broad rim along distal outer margin of cup-like depression of ovary. Sepals 4. Petals c. 25, innermost few transitional to stamens. Stamens numerous in fascicles, inflexed, dorsiventrally flattened; outer ones spathulate with broader filaments and reduced anthers, inner ones spathulate with narrower filaments and longer anthers; anther sacs partially sunken in outer stamens. Ovary 7—12-loculate, with a cup-like depression above formed by radiating curvate stigmas; stigmatic appendages absent. Ovules 2—3 in each locule, at length usually one by abortion; placentation parietal. Berries 8—20-seeded.
Distrib.: Monotypic; in fresh water tanks and jheels in India, Bangladesh, Japan, Taiwan, China and Ussuri in USSR. Also reported from Pliocene and later deposits in Europe.


Local name: Makhana, Makhna, (Asm., Beng., Hind.); Jubar, Jewar (Kash., Punj.); Shriew-u-puban (Kh.); Kunta padma (Or.).

Leaves 30—120 × 25—110 cm, centrally peltate, coriaceous, orbicular, acute at one side terminating a pinnately branched vein, shallowly notched at opposite side, green, bullate (also corrugated along margins when young) and prickly along veins above, violet, strongly venose (with interlacing nerves) and prickly along veins beneath; petioles 4—8 mm across, pinkish, densely prickly. Flowers 3—5 cm long, beset with prickles up to 12 mm long. Sepals 2—3 × 1.2—1.8 cm, fleshy, triangular-ovate, concave, obtuse and cucullate at apex, violet or pinkish-violet within, green and armed with scattered recurved prickles without. Outer petals 1.8—2.5 × 0.8—1.2 cm, concave, oblong, obtuse and cucullate at apex, dark violet (fading near to base), gradually smaller in size and fading to white towards centre (innermost ones c. 1.3 × 0.4 cm linear-oblong). Outer stamens 8—10 mm long; inner stamens 4—6 mm long. Berries 4—10 cm across, globular-ovoid, tuberculate and densely prickly, with a conical crown of persistent floral appendages. Seeds 7—12 mm across, with thick and hard testa, subglobose, wrinkled, dark brown, enclosed in pulpy white aril marked with scattered reddish streaks.

Type: China, Banks herbarium (BM).

Fls.: April—July; Frts.: June—Oct.

Distrib.: INDIA: Rajasthan, Kashmir, Uttar Pradesh, Bihar, West Bengal, Assam, Meghalaya, Manipur, Tripura; also cultivated for its starchy edible seeds.


Uses: Extensively cultivated in North Bihar for its starchy edible seeds; sold in market.


Notes: In Euryale ferox, the floating leaves are highly polymorphic. The early floating leaves, which are sometimes preserved in the herbarium, are quite different in appearance from adult leaves. These are membranous, broadly elliptic to elliptic-orbicular, at first non-peltate with a deep sinus up to petiole base, deep violet on both surfaces with a few or no prickles, afterwards peltate with a shallow sinus, green above, deep violet beneath, with prickles on both surface and petioles.

2. NYMPHAEA


Perennial herbs. Rhizomes usually stoloniferous, tuberous, erect or creeping, sometimes branched, hairy in interfoliar region, with leaves, vegetative buds and flowers arranged in spirals. Leaves polymorphic, long petiolate; juvenile leaves membranous, at first subulate, hastate, sagittate, deltoid or cordate-ovate and submerged, afterwards elliptic and cleft up to petiole-base and floating; adult leaves coriaceous, prominently venose beneath, broadly elliptic to orbicular and deeply cleft near or up to petiole-base. floating or rarely emersed. Flowers on long peduncles, floating or emersed, showy. Sepals 4, free, hypogynous. Petals numerous, hypogynous to perigynous, outermost a few sometimes sepaloid, innermost ones often transitional to stamens. Stamens numerous, inflexed, perigynous, dorsiventrally flattened with or without distal sterile appendages, outer stamens with broad, petaloid filaments and reduced anthers, the inner with narrower filaments and longer anthers; anther-sacs partially sunken. Carpels 5—35, partially (septa double) or fully (septa single) coherent, fused peripherally, arranged radially around and adnate below to central core of receptacular tissue to about half their length, with a cup-shaped depression above formed by radiating, curvate, bilobed stigmas with or without an appendage. Ovules numerous, anatropous and laminar, arising all over septa. Berries globose, often crowned with
NYMPHAEEAE

persistent, green filaments, retracted to and ripening under water. Seeds enclosed in bell-shaped aril, indurate.

Type: N. alba Linn.

Distrib.: c. 50 species in tropical and temperate regions inhabiting stagnant fresh water ponds, lakes and swamps; 6 species in India. Besides, a few exotics cultivated in ponds and lakes.

KEY TO THE SPECIES

1a. Leaves distinctly subpeltate; primay veins prominently raised beneath .......... 2

1b. Leaves cleft to petiole-base, non-peltate; primary veins impressed beneath... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... 4

2a. Leaves glabrous. Sepals obscurely veined, persistent in fruit. Stamens with distal sterile appendages ... ... ... ... N. nouchali 3

2b. Leaves velutinous pubescent beneath. Sepals conspicuously veined, decaying after flowering. Stamens without sterile appendage ... 3

3a. Flowers white or a few sepals and outer petals with tinge of purple towards apex without. Anthers yellow; filaments of inner stamens without purpluish band ... ... ... ... ... ... ... ... ... ... ... ... N. pubescens 4

3b. Flowers crimson red. Anthers red; filaments of inner stamens with a purplish band without ... ... ... ... ... ... ... ... ... ... ... ... N. rubra 5

4a. Rhizomes 2.5—7 cm long, erect, densely clothed with black hairs. Leaves 3—7 cm across; petioles c. 1.5 mm across, filiform. Sepals accrescent in fruit ... ... ... ... ... ... ... ... ... ... ... ... N. tetragona 6

4b. Rhizomes much longer than 7 cm, horizontally creeping; interfoliar hairs not black. Leaves 10—28 cm across; petioles 3—10 mm across. Sepals decaying after flowering ... ... ... ... ... ... ... ... ... ... ... ... 5

5a. Flower buds obtuse at apex; receptacle cylindrical. Sepals as long as or shorter than petals. Filaments of innermost stamens filiform, narrower than anther. Stigma almost flat ... ... ... ... N. alba 1

5b. Flower buds acute at apex; receptacle weakly tetragonous. Sepals longer than petals. Filaments of innermost stamens lanceolate, never narrower than anther. Stigma strongly concave ... ... N. candida 2

Local name: Brimposh (Kash.).

Leaves 10—28 × 9.5—26.0 cm, suborbicular, rounded or retuse at apex, with lowest pair of veins straight and divergently produced into basal lobes at least in the first one-third; basal lobes unequal, nearly straight along inner margin and obtuse at apex. Flowers 10—15 cm across, white. Sepals 5.5—8.0 × 1.5—1.8 cm, green without, ovate-oblong, obtusely cuculate at apex. Petals c. 20, outer ones as long as or longer than sepals, oblong-lanceolate, obtusely cuculate at apex, attenuate at base. Stamens numerous, distributed up to summit of ovary; outer ones 2.5—3.4 cm long with lanceolate filaments. Ovary 14—20-loculate. Stigma flat with a hemispheric central projection, yellow; stigmatic appendages 3—4 mm long, incurved, triangular-ovate, sulcate within. Berries 3—4 cm across. Seeds 2—3 × 1.7 mm, ellipsoid.

Type: Europe, Herb. Linn. 673.4 (LINN, Microf.!).

Fls. & Frts.: Apr.—Oct.

Distrib.: INDIA: Kashmir; N. AFRICA, ASIA MINOR, EUROPE.


Chr. no.: 2n = 56 (Sen & Bhaduri in Journ. Cytol. Genet. 6: 75. 1971).


Leaves 10—20 × 9—19 cm, elliptic-suborbicular, rounded or retuse at apex, with lowest pair of veins arcutely converging into basal lobes; basal lobes subequal, usually concave along inner margin and acute at apex. Flowers 6—8 cm across, white. Sepals 3.5—4.5 × 1.3—1.5 cm, green without, ovate-lanceolate to ovate-oblong, obtusely cuculate at apex. Petals c. 12, outer ones 3.0—4.2 × 1.0—1.3 cm, oblong-lanceolate, obtuse at apex. Stamens c. 40, absent from summit of ovary, outer ones 1.8—2.2 cm long with lanceolate filaments. Ovary 6—10-loculate. Stigmas strongly concave with a conical central projection, purple; stigmatic appendages 2—3 cm long, incurved, flattened, oblong. Berries 3.0—3.5 cm across. Seeds 3—4 × 2 mm, ellipsoid-oblong.
**NYMPHAEACEAE**

_Type_: Czechoslovakia, Bohemia in ponds and ditches (PR).

_Fls. & Frts._: Apr.—Dec.

_Distrib._: INDIA: Kashmir (1200—1800 m); SCANDINAVIA, CENTRAL EUROPE, SIBERIA, SOVIET CENTRAL ASIA.


_Notes_: The small form usually referred to as _N. candida_ var. _minor_ Wainio in *Acta Soc. Fauna & Fl. Fenn.* 8: 58. 1891 is also recorded from Kashmir—_H. Falconer s.n._ (CAL Acc. no. 17783); _J. E. T. Aitchison 6_ (CAL).


_Local name_: Sundi, Nil-sapla (Beng.); Nilkamal (Hind.); Sitambel (Mal.); Subdi Kain (Or.); Nilotpalam (Tam.).

Leaves 6—45 × 5—41 cm, elliptic-orbicular to subrotund, repand to irregularly sinuate-dentate with broad obtuse teeth, or subentire, glabrous and often punctulate on both surfaces, green and sometimes also blotched purple above, reddish purple beneath. Flowers 4—17 cm across, bluish-purple, blue, or pale bluish-white, fragrant. Sepals 2.5—9.0 × 0.7—2.6 cm, triangular-ovate and obtusely cuculate at apex, green, often with dark purplish streaks without. Petals 8—15, outer ones 2.5—7.5 × 0.8—17.0 cm,
lanceolate to oblong-lanceolate, subacute at apex. Stamens 25–40, outer ones 1.5–3.0 cm long, yellow with blue appendage. Ovary 8–16 loculate. Stigmatic appendages 1.0–3.5 mm long, incurved. Berries 1.5–4.0 cm across. Seeds c. 1.5 mm long, ellipsoid, reticulate, longitudinally ribbed, conspicuously ciliate along ribs when immature, become glabrate with growth of aril.

*Type*: India, Coromandel, *Burmannia f. s. n.* in herb. Deessert (G).

*Fls. & Frts.*: All round the year; profusely during Aug.—Jan.

*Distr.*: INDIA: Throughout the plains; SRI LANKA, BURMA, MALAYSIA, THAILAND, LAOS, CAMBODIA, VIETNAM, INDONESIA, PHILIPPINES, NEW GUINEA, TAIWAN.


*Uses*: The tuberous rhizomes and peduncles are eaten as vegetable; seeds on frying are eaten as puffed grain.


*Notes*: Reports of *N. nouchali* Burm. f. from other than plains usually belong to *N. caerulea* Savigny.


*Materials studied belong to N. micrantha* Guill. & Perr. as is evident from the bulbiferous nature of leaf mentioned by the authors (l. c.).

*Local name*: Mokuwa, Nal (Asm.); Shaluk, Shapla (Beng.); Koka (Hindi); Dhabala Kain (Or.); Kumuda (Sans.); Allitamari, Vellambal (Tam.).

Leaves 15—50 × 12—45 cm, broadly ovate-elliptic, or reniform to orbicular, repand to sinuately spinous-dentate and somewhat crispate along margin, dark-green, glabrous and often pustulate above, green or dull purplish-green and velutinous pubescent beneath; petioles to 1.70 m or more long, up to 8 mm across, green or reddish-brown, puberulous. Flowers 4—15 cm across; peduncles similar to petioles, up to 1.5 cm across. Sepals 2.5—8.0 × 1.0—3.2 cm, usually ovate-lanceolate, elliptic-oblong and obovate-oblong respectively, subacute or obtuse at apex, puberulous and green with 5—9 prominent white veins without. Petals 10—25; outer ones 2—7 × 1.0—2.8 cm, oblanceolate, obtuse or subacute at apex. Stamens 25—70; outer ones 1.5—3.5 cm long, yellow. Ovary 13—22-loculate. Stigmatic appendages 0.5—1.0 cm long, oblong, inflexed, yellow. Berries 2.5—4.0 cm across. Seeds c. 1.5 × 1.0 mm, ellipsoid, longitudinally marked with rows of irregular papillae.

*Type*: India, Herb. Willd. 10100 (B, Microf.!).

*Fls. & Frts.*: All round the year; profusely during Aug.—Jan.

*Distr.*: INDIA: Throughout the plain regions; SRI LANKA, BURMA, MALAYSIA, INDONESIA, NEW GUINEA, PHILIPPINES, THAILAND, LAOS, CAMBODIA, VIETNAM.


*Uses*: Similar to *N. nouchali* Burm. f.


*Local name*: Lal Shapla (Reng.); Rang Kai (Or.).

Type: Andrews, Bot. Rep. 8: t. 503. 1808 [drawn from a plant cultivated in Mr. Vere's Kingston Gore, in the vicinity of London].

Fls.: All round the year; profusely during Aug.—Jan.

Distrib.: INDIA: Throughout in Plains; SRI LANKA, BURMA, MALAYSIA, THAILAND, LAOS, CAMBODIA, VIETNAM, INDONESIA, PHILIPPINES.


Uses: Similar to N. nouchali Burm. f.


Notes: N. rubra Roxb. ex Andrews, originally claimed to be a native of Bengal, never sets fruit in nature and appears to be an obligate apomictic species. It propagates mainly through stolons and vegetative buds, and in exceptional cases by proliferation of flowers. Unlike the two common species of Indian plains, viz., N. nouchali Burm. f. and N. pubescens Willd., N. rubra is not met with in temporary habitats like seasonally inundated fields, rice swamps, shallow ditches along road sides and railway tracks, but is restricted only to the permanent ponds, lakes, etc.

In cultivation there is a rose-coloured variety known as N. omarana Hort. — Conard l.c. pl. 30 (N. rubra var. rosea Sims in Curtis, Bot. Mag. t. 1364. 1811) with leaves bronze-green and blotched brown above and yellowish-brown beneath. Stamens are yellow with reddish-brown tips and without any purplish bands on their filaments. It is claimed to be a third generation hybrid between N. lotus Linn. and N. rubra Roxb. ex Andrews, or their derivatives, and occasionally sets fruits. The chromosome number report 2n = 56 (Langlet & Söderberg in Acta Hort. Berg. 9: 85. 1927; Janaki Ammal, l. c.) probably belongs to this cultivated variety.

Curtis, Bot. Mag. t. 1525. 1813; Kanjilal et al., Fl. Assam 1 : 64. 1934.

Local name: Pigmy Water Lily (Eng.); Sohpyllain phuhlilh (Kh.).

Leaves 3—7 × 2.2—5.8 cm, orbicular-ovate or horse-shoe shaped, rounded or Retuse at apex, reddish-brown with patches of green above (green above and pale pubescent beneath when submerged), turn scarlet with age, green with tinge of purple along margin beneath; basal lobes subequal, acuminate, more or less straight and divergent. Flowers 2.5—5.0 cm across, white; receptacle sharply tetragonal; peduncles c. 2 mm across, spirally twisted in fruit. Sepals 1.4—3.2 × 0.5—1.2 cm, ovate-lanceolate to oblong-lanceolate, obtusely cuculate at apex. Petals c. 12; outer ones 1.3—2.5 × 0.5—0.8 cm, obovate-oblong or oblong-lanceolate; innermost ones abruptly much reduced and transitional to stamens. Stamens c. 50; outer ones 7—12 mm long with spatheulate or obovate-oblong filaments. Ovary 6—8-loculate. Stigmas raised, convex; stigmatic appendages 2—3 mm long, ovate-lanceolate with involute sulcate margia. Berries 1.5—2.0 cm across, enclosed by coriaceous sepals and remnants of other floral appendages. Seeds 3—4 × 2 mm, oblong, black.

Type: Siberia, banks of Lena river, Gmelin in herb. Pallas (BM).

Fls. & Frts.: July—Sept. (Dec.).

Distrib.: INDIA: Kashmir and Meghalaya (1200—1800 m); FINLAND, E. SIBERIA, JAPAN, N. AMERICA.


CULTIVATED SPECIES

I. A. Flowers blue or bluish-purple. Stamens 50—80, appended:

1. Nymphaea caerulea Savigny in Dec. Egypt. 3 : 74. 1798; Conard, l. c. 141. pl. 8.

Leaves green beneath with dark purple spots and pale purplish along margin. The Blue Lotus of Egypt, grown in Ward Lake, Shillong, and elsewhere; often indistinguishable from N. nouchali Burm. f. in herbarium.

Leaves reddish beneath with dark violet spots, green above with a woolly umbo at the summit of petiole when young, become characteristically bulbiferous afterwards. A native of Africa, introduced in ponds and lakes in Tripura, Manipur, and elsewhere. The viviparous habit is reported to develop only during second year of plant's growth; till then the plant is liable to be mistaken for *N. caerulea* Savigny and *N. nouchali* Burm. f.

B. Flowers yellow. Stamens c. 75, without appendages:


Leaves blotched with brown when floating, raised well above water when crowded and become somewhat cupped and dark-green above, paler beneath with reddish-brown blotches towards margin; petioles and peduncles inconspicuously ribbed and slightly flattened. Contrary to the claim by Marliac (l. c.), often believed to be a hybrid between *N. tuberosa* and *N. mexicana*.

C. Flowers carmine red. Stamens c. 75, without appendages:

4. *Nymphaea alba* var. rubra Lönnroth in Bot. Notis. 124. 1856; Conard, l. c. 179. pl. 15. f. 1–19.

Leaves reddish both above and beneath when young, turn dark green above and pale green beneath except along margin with age, and rise well above water when crowded. Flowers deep red in the centre, paler towards periphery.

Grown in Ward Lake, Shillong and elsewhere; often misidentified as *N. alba* Linn.


Similar to *V. amazonica*, sometimes considered a variety of it; easily recognised by its green upturned leafmargins which are purplish in *V. amazonica*. Also grown in Indian Botanic Garden, Howrah.
EXCLUDED SPECIES

*Nymphaea sioux* — a tradesman name for ornamental *Nymphoides peltata* (Gmel.) Kuntze (Gentianaceae) with bright yellow flowers and 'nymphaea-like' leaves. Evidently, Sen & Bhaduri (Journ. Cytol. Genet. 6: 84, 1971) while reporting its chromosome number as $2n = 70$, had difficulty in explaining its chromosome morphology in relation to other species of *Nymphaea.*
RHAMNACEAE

DC., Prod. 2: 19. 1825

M.M. Bhandari* and A.K. Bhansal**

Trees, shrubs or lianas; unarmed or thorny, branches spinous or aculeate, rarely cirrhose or tendrillar. Leaves simple, alternate or opposite or subopposite, penninerved or 3-5-nerved from the base; stipules deciduous or modified into persistent prickles, free or interpetiolar or intra-axillary. Inflorescence axillary or terminal cyme, rarely raceme or panicle or spicate. Flowers minute, regular, bisexual or less commonly polygamous, hypogynous, perigynous or epigynous, intrastaminal disc cup-like, nectariferous, sometimes thickened near and/or produced beyond the rim of the cup. Calyx 4 or 5-lobed, rarely 6, usually carinate within down the middle or with a raised line within, the tube generally more or less united with the ovary or disc and usually persistent. Petals 4—5, sometimes 6, rarely absent narrowed or clawed at base, cucullate or involute at tip. Stamens 4—5, antepetalous, inserted with petals on edge of disc; filaments filiform, rarely flattened; anthers small, 2-celled or rarely the 2-cells confluent. Ovary 2—3-loculed, rarely 4 or 1-loculed, ovules solitary in each cell, anatropous, placentation basal; style simple or divided into as many lobes as ovary locules; stigmas capitate or club-shaped. Fruits capsules, sometimes winged. Seeds solitary, erect, ovoid, angular or compressed, often arillate; testa coriaceous, crustaceous or membranous, often shining; albumen fleshy or horny, rarely exalbuminous; embryos large, straight.

Distrib.: 70 genera and c. 1500 species, rather extensively represented throughout the temperate and tropical regions of the world. 12 genera with 57 species in India.

Notes: Several species have been introduced in India. These include Colletia cruciata Gill. ex Hook., a curious South American plant, which is nearly a leafless shrub with decussate branches and flattened spines; Pomaderris lanigera Sims., a conspicuous unarmed shrub of Australia and New Zealand with dense rusty tomentose tender parts and Noltea africana (Linn.) Reichb. ex Harv. & Sond., an upright glabrous shrub with virgate branches and polygam dioecious flowers and 2-lobed fruits covered with persistent calyx tube.

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KEY TO THE GENERA

1a. Flowers hypogynous:

2a. Leaves prominently 3 or rarely 5-nerved from the base:

3a. Peduncle not fleshy in fruits; fruit drupe... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... 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1. BERCHEMIA


Trees or shrubs, erect or climbing. Leaves opposite, subopposite, or alternate, coriaceous, penninerved, nerves parallel, nervules transverse; stipules small, deciduous, often intraaxillary or free. Inflorescence axillary, spicate, paniculate or clustered at ends of branches. Flowers sessile or pedicellate, polygamous. Calyx 5-lobed, rarely 6; tube short, hemispherical or turbinate. Petals 5, rarely 6, obovate, ungulicate, cucullate. Stamens 5, rarely 6; anthers large, ovate, 2-celled; filaments filiform, often flattened. Disc fleshy, annular, margin free, swollen. Ovary superior, sunk in the disc but free from it, ovoid, 2-loculed; style 2-fid or notched; stigma terminal, obtuse, convex. Drupes girt at base with calyx tube, ellipsoid, ripening black, purple or yellow, putamen crustaceous or woody, exocarp fleshy. Seeds 2, linear-oblong, testa membranous, raphe lateral; albumen fleshy, cotyledons narrowly oblong, radicle short.

Distrib.: 22 species in the world (in 1 N. America, 2 in Africa and 19 in S. Asia). 3 in India, species of Berchemia are confined to subtropical N. W. Himalayas and tropical evergreen forests of E. Himalayas.

Pollen: 3-zonocolporate; grain size 22–24/18–22 μm prolate, spheroidal or circular; sexine is almost as thick as nexine, psilate (Parveen & Bhandari in Bir, Recent Res. Plant Sci. 687–697, 1979).

KEY TO THE SPECIES

1a. Flowers 6-merous... ... ... ... ... ... ... B. edgeworthii 1

1b. Flowers 5-merous:

2a. Climbing shrubs; leaves more than 2.5 cm long, acute or subacuminate at apex; lateral nerves 9–15 pairs; fruits surrounded at base by the rim of calyx... ... ... ... ... ... ... B. floribunda 2

2b. Undershrubs; leaves upto 2.5 cm long, obtuse at apex; lateral nerves 6–8 pairs; fruits surrounded at base by the 5-lobed calyx tube... ... ... ... ... ... ... B. lineata 3

Shrubs; branches glabrous. Leaves 2.0—2.5 cm long, elliptic or ovate-lanceolate, scarious; petioles 3—6 mm long; stipules 6 mm long. Flowers 6-merous, shortly pedicelled, 2 together in the axil of the leaves, the buds almost hidden by the stipules. Calyx lobes 6. Petals 6, broadly ovate. Stamens 6. Drupes 1.6 cm long, surrounded at the base by the persistent entire calyx.

Type: India: Western Himalayas. *M. P. Edgeworth* 376 (K!).

Distrib.: INDIA: Himalayas; NEPAL, PAKISTAN, AFGHANISTAN.

Notes: This is a distinct species due to the hexameros nature of its flowers. Parker (1918) included *B. edgeworthii* under *B. lineata* in his flora of Punjab, but a critical study of the type material supports its distinct identity.


Fig. 3

Local names: Koulo or Kauloi (Jaunsar); Amii Kalapag (Hindi); Rungyony rik (Lepcha); Chiaduk (Nepal).

Large climbing shrubs; branches glaucous when young; bark thin, whitish. Leaves alternate, spreading, 4.0—8.3 × 2.2—4.4 cm, ovate-oblong or elliptic, acute to ruminate at apex, obliquely furrowed, rounded or subcordate at base, subcoriaceous, shining, glabrous, margin entire, lateral nerves oblique; petioles 1.3—1.8 cm long, channelled; stipules intraxillary 2—4 mm long, subulate, bifid, connate up to middle, early deciduous. Inflorescence 3—8-flowered clusters in terminal panicles. Flowers 5—6 mm across, sessile or shortly pedicellate; pedicels 1—2 mm long. Calyx lobes 5, 2—3 mm long, keeled up to the middle, glabrous. Petals 5, 1.5—2.2 mm long, spatulate. Stamens 5, longer than the petals; anthers dorsifixed; filaments flat. Disc massive, enveloping the ovary, margin notched above the insertion of filaments. Ovary glabrous; style long with 2 stigmata. Drupes 9—12 × 4—6 mm, ellipsoid or cylindrical. Seeds 2, 6—8 × 3—4 mm, compressed, black.

Type: Kumaon, *Wall. Cat. no. 4256b* (K-W).

Fls.: May—Aug.; Frts.: Feb.—Apr.

Distrib.: INDIA: Kashmir, Uttar Pradesh, Assam, W. Bengal.

Chr. No.: n = 12 (Mehra & Khosla in *Taxon* 18: 213—221. 1969).
Fig. 3 *Berchemia floribunda* (Wall.) Brongn.
Notes: Wallich 4256 consists of 3 sheets, all preserved at Kew. 4256a from Nepal, 4256b from Kumaon and 4256c from Silhet. There are no fruits on the first sheet. The fruits on the specimen from Kumaon are smaller than those from Silhet. M. Johnston (1969) regards 4256a as the probable holotype (ex Nepal). B. laxa Wall. Cat. 4257 (K) has larger fruits compared to 4256b or 4256c.


Diffuse undershrubs; bark smooth, shining; young branches puberulous. Leaves 0.7—2.5 x 0.3—1.5 cm, very variable, ovate-elliptic, glabrous, obtuse at apex, mucronate, rounded at base, entire, midribs depressed above, prominent beneath; petioles 3—4 mm long; stipules intra axillary, setaceous, 3—4 mm long. Inflorescence axillary or terminal fascicle, 2—4-flowered Flowers 5 mm across, glabrous; pedicels 2—3 mm long. Calyx 2.0—2.5 mm long, keeled up to base; tube campanulate. Petals 5, 1.5—2.0 mm long, ensheathing the stamens. Stamens 5, 2—2.5 mm long, inserted below the disc; anthers dorsifixed; filaments flat. Disc massive, glabrous. Ovary glabrous, ovules 1 in each locule; style 2 mm long; stigma emarginate or notched. Drupes 6—10 x 3—5 mm, ellipsoid or cylindrical, bluish when ripe, glabrous. Seeds 2, 6—8 x 2—3 mm, compressed, black.

Fls.: May—July. Frts.: Sept.—Nov.

Ecol.: Very common. A very pretty small shrub often found among rocks at about 2100 m, particularly in N. W. Himalayas.

Distrib.: INDIA: Himachal Pradesh, Kashmir, Uttar Pradesh; CHINA.

2. COLUMBRINA


Scandent or erect shrubs or trees, unarmed or rarely armed. Leaves alternate or opposite, basally 3-nerved, or penninerved, petiolate; stipules small, deciduous. Inflorescence axillary, thyrsoid or cymose fascicles. Flowers small, protandrous, 5-merous, calyx, corolla, and androecium
attached to the rim of hemispheric or shallow floral cup. Calyx lobes 5, spreading, valvate, deltoid, pubescent without, deciduous along the rim of the cup. Tube hemispherical. Petals 5, cuculate, obovate, convolute, clawed at base, inserted below the disc. Stamens 5; filaments filiform; anthers ovate. Disc fleshy, annular, flat, and nearly completely surrounding the ovary, accrescent along the cup and adnate to the lower fifth to half of capsule. Ovary inferior, 3-loculed; style 3-cleft; stigmas truncate or obtuse. Capsules nearly globular, slightly 3-lobed, dehiscing septicidally into 3 cocci, exocarp thin. Seeds obovoid, compressed, 3-gonous; albumen fleshy, thin; cotyledons flat or incurved; embryo flat.

**Distrib.**: 31 species in the world (21 in the warmer parts of America; 1 in Hawaii; 4 in Madagascar; 5 in S. E. Asia). 2 species in India.

**Ecol.**: In India the genus is characteristic to coastal areas, just above high tide level.

**Pollen**: 3-zonocolporate; P/E 26—33/24—26 μm; prolate or subprolate spheroidal as slightly lalongate, sexine as thick as nexine, reticulate. (Parveen & Bhandari in Bir, Rec. Res. Plant Sci. 691. 1979).

**KEY TO THE SPECIES**

1a. Leaves ovate, basally 3-nerved, lateral nerves

2—3 pairs... ... ... ... ... ... ... ... ... C. asiatica 1

1b. Leaves elliptic to lanceolate, pinnerved, lateral nerves 4—6 pairs...

... ... ... ... ... ... ... ... ... C. travancorica 2


**Local name**: Guti (Mar.)

Glabrous, straggling, littoral, unarmed shrub, 1—3 m high; branchlets slender, often zig-zag, internodes 5—45 mm long. Leaves alternate, 3.0—10.2 × 2.3—6.5 cm, ovate, broadly rounded to shallowly cordate at base, acuminate, membranous, crenate, crenatures gland-tipped; petioles 7—22 mm long, stipules 1 mm long, deltoid. Inflorescence a cyme. Flowers yellowish-green, 5—6 mm across, fragrant, lower fertile, the upper abortive or staminate; peduncles 2—6 mm long; pedicels 2—5 mm long, elongating. Calyx lobes 5, 2.5—3.0 mm long, glabrous; tube glabres-
Fig. 4. *Colubrina aslatica* (Linn) Brongn.
cent. Petals yellow, 1.8 mm long, emarginate, glabrous, claw slender. Stamens 1.6 mm long, anthers dorsifixed. Disc 5-lobed, glabrous. Ovary globose; style 1.5 mm long; stigma truncate. Capsules globose, 8–10 mm long, slightly depressed at top, dehiscent, cocci thin-walled, radial walls membranous, occasionally adherent to the receptacle after dehiscence. Seeds 3, chocolate-brown, 4–7 × 4–5 mm, slightly emarginate at the base.

_Type:_ Sri Lanka, Herb. Hermann, Vol. 2, f. 11 (Lecto, BM!).

_Fls. & Frts._: Dec.—Mar.

_Distrb._: INDIA: Andaman Nicobar Islands, Orissa, Karnataka, Maharashtra, Tamil Nadu; BURMA, SRI LANKA, INDONESIA, AUSTRALIA, S. AFRICA.

_Ecol._: Especially near the coasts and just above high tide level.

_Uses_: The bark contains saponin, and is reported to be used in Samoa for clearing mats.

_Notes_: Johnston (1971) recognises two varieties under this species; the Indian plant is _C. asiatica var. asiatica._

2. _Colubrina travancorica_ Bedd., _Jc. Pl. Ind._ Or. 1: 43, t. 188, 1874; Lawson in Hook. f., _Fl. Brit. India_ 1: 653, 1875; Gamble, _Fl. Pres. Madras_ 1: 224. 1918 (Repr. ed. 1: 161. 1957); Brandis, _Ind. Trees_ 174. 1971 (Repr. ed.). _Fig. 5_

Unarmed shrubs, young branches antrorse, appressed golden silky hairy. Leaves membranous, alternate or subopposite towards the flowering region, 9.8–12.5 × 3.5–4.4 cm, elliptic to lanceolate, acuminate, apex mucronate, base rounded, crenate, crenatures black callous tipped, distal ones more conspicuous than the proximal ones, when young densely pubescent beneath and costa above, lateral nerves impressed above and raised below; petioles 5–9 mm long, pubescent; stipules 2–3 mm long, subulate, pubescent. Inflorescence thyrses or congested dichasia; peduncles 4–8 mm long, pubescent. Flowers pinkish, 5–6 mm across; pedicels 4–8 mm long, golden silky hairy. Calyx lobes 5, 2.0–2.5 mm long; tube campanulate, sparsely hispid. Petals 5, 1.5–2.0 mm long. Stamens shorter than petals; anthers dorsifixed; filaments flat. Disc 10-lobed, pitted. Ovary glabrous; style 3-cleft up to the middle, glabrous. Capsules globose, 6–8 mm in diam., slightly depressed at the top.

_Type:_ India, Travancore, plains between Kotakarray and Panalur. Nov. 1872, _Beddome_ 301 (Holotype, BM!)

_Fls. & Frts._: Nov.—Mar.
Fig. 5. *Colubrina travancorica* Bedd.
Distrib.: INDIA: Kerala—endemic.

Ecol.: Coastal forests.

3. GOUANIA


Climbing shrubs, branches circinately tendril ar. Leaves alternate, petiolate; stipules free, caducous. Inflorescences terminal or axillary racemes or panicles. Flowers bisexual, epigynous, pentamerous, rachis often cirrhose. Calyx lobes 5, valvate, glabrous or pubescent. Petals 5, cuculate, clawed at base, inserted below the margin of disc. Stamens 5, enclosed in petals; anthers dehisce longitudinally. Disc massive, glabrous or hairy, 5-lobed, lobes opposite to calyx lobes. Ovary connate to the bottom of calyx tube, 3-carpellary, 3-locuied, immersed in the disc, usually urceolate; style 3-cleft, obscurely or deeply 3-lobed; stigma papillose. Schizocarpic capsules trigonous, 3-winged, or cocci 3, woody, 3-locular, indehiscent. Seeds 3, obovate, plano-convex; testa shining, horny; albumen thin; cotyledons rotundate; embryo erect, furnished with perisperm.

Distrib.: c. 70 species in the world, (c. 35 in America, 14 in Asia, 15 in Madagascar and other islands of the Indian ocean, 2 in Australia and 2 in Africa). 4 species in India.


**KEY TO THE SPECIES**

1a. Leaves entire; fruits rusty tomentose... ... ...G. andamanica 1

1b. Leaves crenate-serrate; fruits glabrous:

2a. Leaves distantly and minutely serrulate, rounded at base; flowers sessile; disc villous, the lobes rounded, emarginate... ... ...G. microcarpa 3

2b. Leaves crenate, cordate at base; flowers shortly pedicellate; disc glabrous, the lobes stellately horned:

3a. Inflorescence glabrous; lateral nerves 4—6 pairs... ... ... ... ... ... ... ... ... ... ... ... ...G. leptostachya 2
3b. Inflorescence puberulous; lateral nerves
6—8 pairs... ... ... ... ... ... G. napalensis 4


Climbing shrubs or lianas, tendrilar, young branches rusty brown pubescent. Leaves 4.3—7.5 × 2.2—5.6 cm, oblong or elliptic-ovate, sometimes rounded at apex, mucronate, lateral nerves 7—9 pairs, secondary veins camptodromous, tertiary veins transverse; petioles 1.0—1.5 cm long, pubescent; stipules 2 mm long, subulate, pubescent. Inflorescence axillary or terminal, racemes or 5—6-flowered clusters. Flowers 5—7 mm across, sessile; bracteoles conspicuous, 5 mm long; subulate, pubescent, deciduous. Calyx lobes 2 mm long, deltoid, glabrous within, densely pubescent without, thickened at apex. Petals 1.5 mm long, spathulate. Stamens 1.7 mm long; anthers dorsifixed. Disc glabrous, saucer-shaped; lobes stellately horned, filling the calyx tube. Style 3-cleft, up to half the length. Capsules triquetrous, crowned with persistent calyx, tardily dehiscent. Seeds minutely emarginate or retuse at apex; testa hard, gibbous.

KEY TO THE VARIETIES

1a. Leaves sparsely pubescent above, lateral nerves not conspicuous; fruits not winged... ... ... ... var. andamanica

1b. Leaves glabrous above, lateral nerves conspicuously impressed; fruits somewhat winged... ... ... ... var. breviolata

var. andamanica

Leaves persistently sparsely pubescent above, sparsely antrorse appressed hairy below, densely on nerves. Capsules 1.5 × 1.0 cm. Seeds 6 × 3 mm.

Type: Middle Andaman Island. Collector ? (K !).

Fls.: Oct.—Dec.; Frs.: May—Sept.

Distrib.: INDIA: Andaman—endemic

Ecol.: On the rocky places in thick forests near the streams.

var. breviolata Bhandari & Bhansali var. nov.

Folia in supra parte glabella, in parte tamen infr, pubescentia, nervi laterales, depressi. Fructus 0.8—2.0 × 0.5—1.7 cm, ferrugineus tomentosus, alae minus evolutae.
Leaves glabrous above, pubescent below, lateral nerves depressed above. Fruit 0.8–2.0 × 0.5–1.7 cm, wings slightly developed.

Type: India, North Andamans, Sengupta 6089 (Holo, DD)


Local names: Penki tiga (Tcl.); Kalalag (Hindi); Khanta (Oriya).

Unarmed climbing shrubs or lianas, upto 8 m long; tendrils axillary or extra-axillary; branches glabrous with continuous brown vertical lines; internodes 2–5 cm long. Leaves 3.5–8.6 × 2.0–8.5 cm, ovate, acute to acuminate, glabrous above, grey or brown antrorse hairy on veins beneath, primary and secondary veins camptodromous; petioles 1.5–3.4 cm long, glabrous; stipules 4–5 × 0.5–1.0 mm, subulate. Racemes in 3–7-flowered clusters. Flowers white, 5–6 mm across; pedicels 2 mm long; bracteoles subulate, pubescent at base, caducous. Calyx lobes 2.5 × 1.5 mm, deltoid, thickened at apex, glabrous or sparsely hairy without. Petals 1–2 mm long, spathulate, inserted below the margin of disc. Stamens 1.0–1.5 mm long; filaments alternating with subulate appendages of disc. Style 3-cleft upto middle; stigma recurved, obtuse. Capsules crowned by persistent calyx.

KEY TO THE VARIETIES
1a. Fruits dehiscing by 3-valves. Seeds c. 5 mm long ... ... ... ... ... ... ... ... ... var. leptostachya
1b. Fruits indehiscent. Seeds upto 3.5 mm long ... var. nainitalensis

var. leptostachya

Fruits 9–15 × 7–12 mm, 3-valved. Seeds 5 × 3 mm.


Distrib.: INDIA: Andaman & Nicobar Islands, Assam, Maharashtra, Orissa, Uttar Pradesh, W. Bengal; BURMA, NEPAL, MALAYSIA, INDONESIA, PHILIPPINES.

Ecol.: Abundant along banks of streams and in hedges.

var. nainitalensis Bhandari & Bhansali, var. nov.
Fig. 6. *Gouania leptostachya* DC. var. *leptostachya*
Differt a varietate *leptostachya* fructis indehiscentibus, 7–9 × 6–9 mm, alis brevibus nitidis, seminibusques 3.5 × 4.0 mm, nigris, nitidis.

*Typus*: Kathgodam road, Nainital, 900 m, 28.9.1917, A. E. Osmaston 851 (Holo, DD). var. *nainitalensis* Bhandari & Bhansali, var. nov.

Fruits indehiscent, 7–9 × 6–9 mm, wings short, shining. Seeds 3.5 × 4.0 mm, black, shining.

*Type*: Kathgodam road, Nainital, 900 m, 28.9.1917, A. E. Osmaston 851 (Holo, DD).

*Exsicc.*: Uttar Pradesh: Dehra Dun, 11.10.1817, J. F. Duthie 1451 (DD); Daurwala, Dehra Dun, 700 m, 4.10.1957, Y. K. Sarin 342B (BSD).

*Distrib.*: INDIA: Uttar Pradesh.


Climbing shrubs; tendrils axillary or extra-axillary; branchlets and tendrils with longitudinal stripes of antrorse dense brownish hairs. Leaves 2.8–9.5 × 1.5–5.6 cm, elliptic-ovate, acute at apex, rounded at base, serratures tipped by deciduous, glandular mucro, secondary veins camptodromous; petioles 5–16 mm long, villous with antrorse brownish hairs; stipules 3–6 × 0.5–1.2 mm, subulate, pubescent. Racemes 4–8-flowered clusters. Flowers white, 4–5 mm across, sessile; bracteoles conspicuous, 2–3 mm long, lanceolate. Calyx lobes 1.5–2.0 × 1.0–1.5 mm, densely pubescent without, glabrous within, deltoid, thickened at apex, keeled inside up to middle. Petals 1.0–1.5 × 2.0–2.5 mm, oblanceolate, spathulate. Stamens 1 mm long; filaments filiform. Disc saucer-shaped, glabrous. Style 3-cleft about two-third its length, style arms elongate, hairy, obtuse. Capsules 10–15 × 7–13 mm, glabrescent, polished, green, 3-winged, wings yellow, crowned by persistent calyx. Seeds 5 × 4 mm; cotyledons ovate, cordate at base, retuse at apex.

*Fls. & Frts.*: Jun.-May.

*Distrib.*: INDIA: Jammu & Kashmir, Punjab; SRI LANKA, BURMA, MALAYSIA, INDONESIA.

*Uses*: The fruits are edible and sold in markets for preparing condiments and chutney.


*Local names*: Jwarpat (Asm.); Jermei-ja-main, Mei-tein-ian (Khasi); Dibok-pak-bindu, Dugithang, Dumigong (Garo); Tungvheong, Mon-rik (Lepcha).
Fig. 7. *Gouania microcarpa* DC.
Extensive climbing shrubs, young branches rusty hairy; tendrils terminal or basal on racemes, simple, slender, villous, spiral. Leaves 8—16 × 4.5—5.0 cm, ovate or cordate, entire, apex acuminate, acumen cuspidate to obtuse, basal serratures glandular, subulate, primary and secondary veins camptodromous; petioles 1.0—2.8 cm long, pubescent, with a few subulate, evanescent villous glands at base; stipules membranous, lanceolate or falcate, acute, puberulous. Inflorescence terminal, cylindric, 4—6-flowered racemes or panicles. Flowers 5—6 mm across, white, pubescent; pedicels 2—4 mm long; bracteoles lanceolate, subulate, deciduous. Calyx lobes 2—3 mm long, glabrous within; tube 2 mm wide. Petals 1.5—2.0 mm long, cuneate, obtuse, glabrous. Stamens 1.2—1.8 mm long; anthers dorsifixed. Disc saucer-shaped, lobes linear. Style 3-cleft, elongate. Capsules 3-winged, semicircular, 1.2 cm long, separating into 3 single seeded cocci. Seeds 5.5 × 3.5 mm.


Ecol.: Particularly grows in wooded grasslands up to 1800 m altitude and also found near the coastal areas.

Distrib.: INDIA: Assam, Bihar, Punjab, Uttar Pradesh, W. Bengal Deccan plateau; NEPAL.

Uses: Young leaves are eaten in West Bengal.

4. HELINUS


Unarmed, scandent, cirrhose shrubs. Leaves alternate, uppermost sometimes much reduced and bract-like, entire, petiolate; stipules linear, caducous. Inflorescence axillary, solitary or umbellate; peduncles slender, often longer than the subtending leaves; pedicels short to elongate, filiform. Calyx lobes 5, deltoid, often with membranous white margins; tube broadly campanulate or obconic, adnate to the ovary. Petals 5, yellowish or greenish-white, oblanceolate, cucullate, arcuate, ascending during anthesis. Stamens as many as petals; anthers 2-loculed, dehiscing longitudinally. Disc flat, filling the calyx tube, massive, thickened adherent to the ovary. Ovary inferior, 3-carpellary, 3-loculed; style 3-fid. Capsules schizocarpic, coriaceous; endocarp thin, crustaceous, separating into 3 mericarps, each of which releases its seeds by a sudden opening of the ventral suture.

Distrib.: 6 species in the world; 1 in Madagascar, 4 in Africa, and 1 in India.
Ecol.: Grows in thickets and wooded grasslands, forest margins, and in dry open woody vegetation, ascending up to 1200 m. Also found in ravines, banks of streams and shady places, occasionally in valleys.


Bright green slender, tendrilr shrub; tendrils usually near the tips of branches or sometimes branchlets ending in short simple tendrils, young branches hairy. Leaves ovate, lanceolate, glabrous, membranous, entire, apex acute, rounded or usually shallowly cordate at base, penninerved, lateral nerves 3—5 pairs, secondary nerves campotromous; stipules 0.5—2.0 × 0.5—1.0 mm, subulate. Umbels 2—12-flowered. Flowers 4—8 mm across; peduncles filiform, 1.0—3.2 cm long; pedicels 4—7 mm long in flower, 7—15 mm in fruit; bracteoles 1.2 × 0.5 mm long. Calyx 2.5—4.0 × 1.5—2.0 mm, glabrous. Petals 5, whitish, 2.0—3.0 × 0.5—1.0 mm, inserted on the margin of disc, margin and apex incurved, enclosing stamens. Stamens 1.5—2.5 mm long; filaments filiform, flat; anthers dorsifixed. Disc glabrous. Ovules solitary in locules; style 3-fid; stigma lobes recurved, glabrous. Fruits pendulous, 5—10 mm long, glabrous, globose to slightly obovoid, reddish-green to dark brown or black when ripe. Seeds 3, 3.5 × 3 mm, plano-convex; testa coriaceous, shining; albumen fleshy; cotyledons large, flat, obtuse; radicle short.

KEY TO THE VARIETIES

1a. Leaves glabrous on both surfaces... ... ... var. lanceolatus

1b. Leaves tomentose below, slightly pubescent above on nerves only... ... ... ... ... var. tomentella

var. lanceolatus

Leaves 1.3—8.1 × 0.3—3.2 cm; petioles filiform, 5—10 mm long, pilose.

Fls.: Jan.—Apr.; Frts.: Apr.—May (rarely throughout the year).

Distrib.: INDIA: Bihar, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Punjab, Uttar Pradesh, W. Bengal; NEPAL, PAKISTAN.
var. *tomentella* Bedd. ex Bhandari & Bhansali, *var. nov.*

Differt a varietate *lanceolata* ramis, cirrhis, bracteisque pilis brunneis sericeis adpressis aureis vestitis; foliis 2.3–4.6 × 1–2.8 cm, infra tomentosis supra leviter pubescentibus lantum ad nervos; petiolis 7 mm longis, tomentosis.

Typus: Pervulgatus in sylvas inter Jabalpur et Mandla, Beddome 13 (Holo, CAL).

var. *tomentella* Bedd. ex Bhandari & Bhansali, *var. nov.*

Branches, tendrils and bracts appressed brown silky hairy. Leaves 2.3–4.6 × 1.0–2.8 cm, tomentose below, slightly pubescent above on nerves; petioles 7 mm long, tomentose.

Type: Very common amongst the ravines between Jabalpur and Mandla, Beddome 13 (Holo, CAL).

Notes: This new variety is based on a single specimen collected by Beddome from Madhya Pradesh. He had proposed the varietal name 'tomentella' on the sheet; however, this name remained unpublished and it is validated here.

5. **HOVENIA**


Small, unarmed trees. Leaves alternate, subbifarious, membranous, basally 3-nerved. Inflorescence axillary and terminal, dichotomous, pedunculate cymes, many-flowered. Flowers bisexual, pentamerous. Calyx lobes 5, glabrous, ovate, acute. Petals 5, cucullate, glabrous, unguiculate, inserted below the disc. Stamens 5; filaments embeded in the margins of the 5-lobed disc, filiform; anthers 2-loculed, dehiscence longitudinal. Ovary hypogynous, tricarpellary, trilocular, sunk in the disc, conical; style 3-cleft branches straight; stigma capitate. Fruits obscurely 3-lobed, indehiscent. Seeds 3, one in each locule, testa coriaceous, separating from inner membranous tegmen.

Distrib.: 5 species in the world, 1 in India.

Ecol.: Grows in dense forests at altitude ranging from 900–1550 m; in some places it grows as a large handsome tree.


Local names: Chamhum (Ravi); Muralimarm (Tam.); Chamun (Chamba).

Deciduous trees with straight bole and a broad rounded crown, 9—24 m high; young shoots hairy; bark greyish-white, smooth. Leaves 6—14 × 3—9 cm, often inequilateral, cordate-ovate, acuminate, deeply and sharply serrate, glabrescent above, hairy beneath on veins when young. Cymes axillary or terminal, peduncles 5 cm long, subcylindrical, hairy when young, becoming thick with sweet red pulp after flowering. Flowers 4—7 mm across; pedicels 2—5 mm long. Calyx lobes 2.0—2.5 × 1.5—2.0 mm, whitish, tube conical with raised median ridge inside, somewhat spreading, deciduous. Petals 2.0—2.5 × 1.5—2.0 mm, yellowish, obovate, emarginate. Stamens 2—3 mm long, enclosed in petals; anthers dorsifixed. Disc lining the calyx tube, hairy, fleshy, flat. Ovary hairy, ovule one in each locule, basal; style cylindric, 3-fid. Fruits sphaerical, nearly dry, calyx tube adhering to the base. Seeds 4—5 × 4 mm; embryo erect, yellowish; cotyledons orbicular, radicle oval.


Distrib.: INDIA: Assam, Himachal Pradesh, Kashmir, Tamil Nadu, Uttar Pradesh, W. Bengal; CHINA, JAPAN.


Uses: The fleshy peduncle which is sweet and aromatic is eaten. The leaves are eaten by cattle. The tree is cultivated for its fleshy peduncles which taste like Bergamot pear.

6. PALIURUS


Shrubs or trees. Leaves alternate, basally a 3—5-nerved, petiolate; stipules prickly, usually persistent. Inflorescence axillary, pedunculate cymes. Calyx lobes 5, green, broad. Petals 5, obovate, yellow, clawed at base. Stamens 5, opposite to petals, inserted on broad green fleshy disc; filaments short, greenish. Ovary half immersed into the disc, 3-loculed; style 3-cleft. Fruits dry, indehiscent, hemispherical and 3-celled. Seeds 3.

Distrib.: 8 species in the world, 1 in India.

Fig. 8. *Hovenia dulcis* Thunb.