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STUDIES ON THE SUBFAMILY APOSTASIOIDEAE (ORCHIDACEAE) IN INDIA

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ABSTRACT

The present paper deals with the taxonomic treatment of the subfamily Apostasioideae in India. the subfamily is represented by the genus *Apostasia* Blume with three species namely *Apostasia nuda* R.Br., *Apostasia odorata* Blume and *Apostasia wallichii* R.Br. In India.

Keywords: Orchidaceae, Apostasioideae, *Apostasia*, India, Taxonomy.

INTRODUCTION

The family Orchidaceae is characterized by the presence of bilaterally symmetrical (zygomorphic), epigynous and resupinate flowers with one highly modified petal called lip or labellum, stamens and carpels are fused to form gynostemium or column, and the seeds are extremely small and devoid of endosperm because the development of endosperm is stopped in the initial stage or totally prevented. The Orchidaceae shows close relationship with the family Hypoxidaceae specially with its two genera namely *Hypoxis* and *Curculigo* and the connecting link between these two families is the subfamily Apostasioideae of Orchidaceae, which is considered to be the most primitive among orchids and comprises of two orchid genera *Neuwiedia* and *Apostasia.* The subfamily Apostasioideae is characterized by the presence of three fertile stamens, the two lateral of inner whorl (similar to subfamily Cypripedioideae) and one dorsal stamen of the outer whorl like in rest of the orchids (subfamily Orchidioideae) except the genus *Satyrium* (Takhtajan, 1981).

The genus *Apostasia* Blume and *Neuwiedia* Blume are represented by 20 species distributed in Sri Lanka, north-east India, Nepal, Bhutan, Myanmar, Thailand, Vietnam, Laos, Cambodia, China, Hong Kong, Japan, Malaysia, Brunei, Indonesia, Philippines, New Guinea, Solomon Islands, Vanuatu and northern Australia (Queensland). In India, the subfamily is represented by the genus *Apostasia* only, which has a very restricted distribution in the North-Eastern region of India and is quite rare in occurrence, which is evident by the presence of a very limited number of mostly old herbarium specimens, mainly collected in the past.

Systematic position:

The systematic position of Apostasioideae was much debated for a long time. Different view points prevailed on this group regarding its systematic position. Many orchidologists believed that this group should be excluded from Orchidaceae due to the dissimilarity in their flower structure with other orchids in having complete absence of a well defined lip and treated the apostasioids as a distinct family more closely related to the Burmanniaceae or the Hypoxidaceae (Hutchinson, 1959; Vermeulen, 1965, 1966). Hutchinson (1959) suggested a phylogenetic affinity with Hypoxidaceae particularly with the genus *Curculigo* and he derived Burmaniaceae from *Apostasia.* However, de Vogel (1969) rejected this view based on the floral anatomy (Rao, 1969a & b, 1973 a & b, 1974) and concluded that there is no close relationship between Apostasiaceae and Burmanniaceae and so is the resemblances to Hypoxidaceae. The Apostasiaceae has been considered as a primitive or ancestral orchid family showing a link between the Lily and Orchid family (Rasmussen, 1985). The apostasiods have slender style with equal and similar stigmatic lobes, which is absent in other orchid groups, the flowers are resupinate, typically trimerous, the two functional stamens become separated from the style, while the staminode remains fused with it and separates only towards the tip. The anthers are characteristically different from other orchid groups, they are dorsifixed, introse having longitudinal slits; the pollen grains are free and do not form a pollinia, monosulcate with an operculum and are reticulately sculptured (Newton & Williams, 1978; Schill, 1978). de

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Vogel suggested that the pollination is by bees that vibrate the flower to release pollen from the anthers. This mechanism is similar to that found in the genus *Solanum* (family- Solanaceae) and in the family Melastomataceae and the flower structure resembles other flowers known to be pollinated in this way.

Dressler & Dodson (1960), while presenting their classification system for the family Orchidaceae, divided Orchidaceae into two subfamilies namely- Cypripedioideae and Orchidioideae, with each subfamily further subdivided into Tribes and Subtribes. The subfamily Cypripedioideae, included two tribes: 1- Apostasieae and 2- Cypripedieae.

Newton & Williams (1978) reported that the Apostasioideae is very distinct and different from Cyprepidioideae and it will be arbitrary to link apostasioids with *Cypriepedium* for the only reason that the floral diagrams in both the groups are similar. Takhtajan (1969), Garay (1960, 1972) considered apostasioids to be placed in a subfamily of Orchidaceae.

Dressler in 1981 and again in 1993 revised his earlier classifications wherein he raised the number of subfamilies from 2 to 5 namely- Apostasioideae (apostasioids) and Cypripedioideae (*Cypriepedium*), Orchidioideae, Spiranthoideae and Epidendroideae. Dressler (1993) also suggested that the genus *Neuwiedia* might be considered an ancestor of the orchid family.

Vermeulen (1966), Dahlgren & Rasmussen (1983) and Rasmussen (1985) have recognised three families within the order Orchidales- 1. Apostaciaceae, 2. Cypripediaceae and 3. Orchidaceae based on the structure and nature of anthers and pollen grains; gynostemium structure and the organization of perianth.

A number of botanists like Bentham, 1881; Pfitzer, 1887; Garay, 1960, 1972; Dressler, 1979, 1981, 1983, 1986, 1989, 1990a-c, 1993; Burns-Balogh & Funk, 1986, etc. have treated these three families into one, Orchidaceae *s. lato*. Sometimes Cypripediaceae is included among the Orchidaceae, the status of an independent family being reserved for Apostasiaceae (Endlicher, 1840; Lindley, 1840; Schlechter ,1915, 1926; Brieger, 1971, 1973, 1976).

After Dressler (1993), the most recent orchid classification 'Systema Orchidalium' has been proposed by D. L. Szlachetko (1995). His evolutionary system of orchid classification follows the concept of Vermeulen (1966), Dahlgren & Rasmussen (1983) and Rasmussen (1985). Szlachetko divided the Order- Orchidales Bromhaed, into three families namely, 1- Apostaciaceae (Lindl., Nixus Pl.: 188.1833); 2- Cypripediaceae (Lindl., Nixus Pl.: 188.1833) and 3- Orchidaceae (Juss., Gen. Pl.: 64. 1789). In the family Apostaciaceae, the subfamily- Apostasioideae with the tribe Apostasieae, which has been divided into two subtribes- Neuwiediinae and Apostasiinae.

According to Szlachetko (1995), the generative structures have developed differently in Apostasiaceae, Cypripediaceae and Orchidaceae. In Apostasiaceae, two or three anthers remain fertile, the median of the outer whorl sometimes missing. The fertile anthers are large, long, dehiscing longitudinally, dorsi- or sub- basifixed. The pollen grains are free and dry. The finger-like filaments are fused with the style only basally, as a result the column part is short. The stigma is small, apical, horizontal, with three similar lobes.

In Cypripediaceae, both lateral anthers of the inner whorl are fertile. The anthers are small, ovoid, with a large connective and motile. The pollen grains are sticky or aggregated into waxy pollinia. The remnant of the median anther of the outer whorl forms a large, usually a disc or shield-like staminode, set on the distinct, finger-like filament. The column is well developed and the stigma consists of three unequal lobes, which perform the similar function.

Orchidaceae possess only one fertile anther in the outer whorl. The lateral anthers of the inner whorl are sterile, staminodial or even absent. The anther is usually motile, often operculate. The pollen grains form a well defined pollinia. The column is well developed, with some exceptions and the median lobe of the stigma is transformed into the rostellum in majority of species.

Apart from the differences in the gynostemium structure, the three families differ in the organization of the perianth. In Apostasiaceae, the flowers are only slightly zygomorphic, and the median petal is similar to the other

petals. In Cypripediaceae, the labellum is well-developed and characteristically slipper or sac- like. Whereas in Orchidaceae, the lip differs in size, shape and colour from the remaining petals.

The studies of Stern & al., (1993b) and Judd & al., (1993) have shown that the apostasiad clade is diagnosed by the operculate pollen, *Apostasia* type seeds and vessel members of roots with simple perforation plates. Taking into account the differences in the gynostemium structure, as well as the results of the studies by Stern & al., (1993) and Judd & al., (1993), the maintaining of the status of separate families for Apostasiaceae. Cypripediaceae and Orchidaceae would seem to be fully justified.

Pridgeon & al., (1999) have placed together *Apostasia* and *Neuwiedia* in the subfamily Apostasioideae within in the family Orchidaceae. According to them "the apostasiod flowers have basic orchid symmetry and are resupinate; there is also partial union of the three filaments with each other and with the style. The DNA sequence data place *Apostasia* and *Neuwiedia* together as sister pair to the rest of the Orchidaceae and are well supported as members of the family, so there seems little reason to separate them simply based on their abundant autapomorphies (Stern and Warcup, 1994). Although they add significant heterogeneity to the characters that define the orchids, this makes a much more evolutionarily interesting picture; the alternative-separate familial status-would require recognition of at least the slipper orchids as separate as well, and this could lead to the eventual recognition of several more families, for which there are no valid practical reasons. It is therefore preferable to maintain one large, somewhat heterogeneous family. Overall, these two genera are clearly orchid-like plants with many unusual or unique traits, but other than their androecia they bear little resemblance to anything that we would consider an ancestor of the orchid family".

In the present study, the genus *Apostasia* and *Neuwiedia* have been treated in a subfamily Apostasioideae of Orchidaceae.

***Subfamily*: Apostasioideae**

Garay in Bot. Mus. Leafl. 19 (3): 86. 1960

Type: *Apostasia odorata* Blume

Description: (partially adopted from Pridgeon & al., 1999)

Erect or ascending, small or large terrestrial herbs, with erect, narrow but stiff, often fairly long, branching, usually woody at base stems. Rhizome scaly if present or absent, scaly, with stiff roots and new erect branches arising from the creeping part. Roots generally aerial and stilt-like in the basal part of the stem to support the stem, they pierce the base of the lower leaves and the rhizome-scales (if present), terete, longitudinally grooved or ribbed, the underground part branched, sometimes woolly or tubercled, swollen, to act as storage roots in *Apostasia*. Stems erect or ascending, branched or unbranched, terete to irregularly angular or ribbed. Leaves many, spirally arranged, spaced or the lower ones crowded, blade with or without longitudinal folds, herbaceous to papyraceous, entire, fairly large, plicate, convolute, linear, oblong to ovate-oblong, narrowly elliptic or ovate-elliptic, acuminate, glabrous or with scattered hairs, prominently nerved beneath, the basal leaves usually dying off, decrescent; sheath shortly connate;. Inflorescence an erect, terminal, peduncled raceme, simple or branched, rachis glabrous or hirsute; floral bracts as the upper leaves but smaller in size, persistent, glabrous or hirsute. Flowers with short, resupinate or non-resupinate pedicel, spirally arranged, nearly zygomorphic, yellow to yellowish or white. Ovary cylindrical or ellipsoid, 3-angled or cylindric, straight, trilocular, with axile placentation. Sepals 3, free, in bud overlapping the petals, the midrib forming a thick ridge on the out side ending in a subulate cusp below the incurved apical margin. Petals 3, free, narrowed to the base or not, the midrib forming a thick, fleshy, projecting keel on the outside. Lip similar to sepals and petals, sometimes broader, simple. Column straight to strongly curved, formed by the fusion of the lower portion of the style, the base of the filaments, and the staminode (when present), glabrous. Stamens 2 or 3, the median one (if present) alternipetalous, the lateral ones epipetalous; the filaments are mostly apically partly free from the style; anthers with 2 equal or unequal thecae, each of them bilocular dorsifixed or sub-basifixed, introrse, pollen grains as monads, powdery, with reticulate or perforate-reticulate sculpturing. Staminode when present median, alternipetalous. Ovary cylindric or ellipsoid, 3-angular to terete, not twisted, 3-celled with axillary placentation.

Plate 1 : Holotype A *Apostasia nuda* R.Br.

Fig. 1: *Apostasia nuda* R.Br.- **A.** Habit- lower part of the stem; **B.** upper part of the stem; **C.** Flower

Style free in the upper portion, cylindric, fleshy; stigma terminal, rounded or pyramidal or 2-3-lobed, flattened at the top. Fruit a thin-walled or fleshy, trilocular capsule, disintegrating or opening loculicidally with 3 valves. Seeds numerous in each cell, more or less ovoid to elliptic, apically provided with a minute appendage, testa dark when ripe, usually alveolate or reticulate, sticky when dry.

Key to the Genera

1. Leaves usually narrow; racemes usually branched, recurved or spreading, not erect; anthers 2, fused with one or both margins, median one of the inner whorl staminodial or absent; filaments free from each other; ovary and fruit narrowly cylindrical, apically not contracted — 1. *Apostasia*

1a. Leaves usually wide; racemes usually unbranched, erect; anthers 3, free from each other, median one not staminodial; filaments connate in the lower portion; ovary and fruit long-ellipsoid to rounded, apically stronglycontracted — 2. *Neuwiedia*

Of the two genera only the genus *Apostasia* is found in India.

APOSTASIA BLUME

Apostasia Blume, Bijdr. (1825) 423; R. Br. in Wall., Pl. As. Rar. 1: 74. 1830; Blume, Ann. Sc. Nat. II, 2: 93. 1834; Miq., Fl. Ind. Bat. 3: 748. 1859; Benth., Fl. Austr. 6: 395. 1873; Benth. & Hook. f., Gen. Pl. 3: 635. 1883; Pfitzer in Engl. & Prantl., Nat. Pfl. Fam. 2, 6: 80. 1888; Rolfe in J. Linn. Soc. Bot. 25: 236. 1889; Hook. f., Fl. Brit. India 6: 174. 1890; Rolfe, Orch. Rev. 4: 329. 1896; Kraenzlin, Orch. Gen. & Spec. 1: 6. 1897; Trim. in Handb. Fl. Ceylon 4: 238. 1898; Pfitzer, Pfl. Reich Heft 12: 8. 1903; J. J. Smith, Orch. Java 17. 1905; Ridl., Mat. Fl. Mal. Pen. 1: 232. 1907; Holttum, Rev. Pl. Malaya 1: 64. 1953; Back. & Bakh. F., Fl. Java 3: 211. 1968; de Vogel in Blumea 17: 2, 335-48. 1969; Seidenf. in Opera Bot. 114: 13. 1992; Pridgeon *et al.*, Gen. Orchidac. 100. 1999; Comber, *Orch. Sumatra*: 19-22. 2001; Pearce & Cribb, Fl. Bhutan 3(3): 17. 2002; S. Misra, Orch. India. 189.2007.

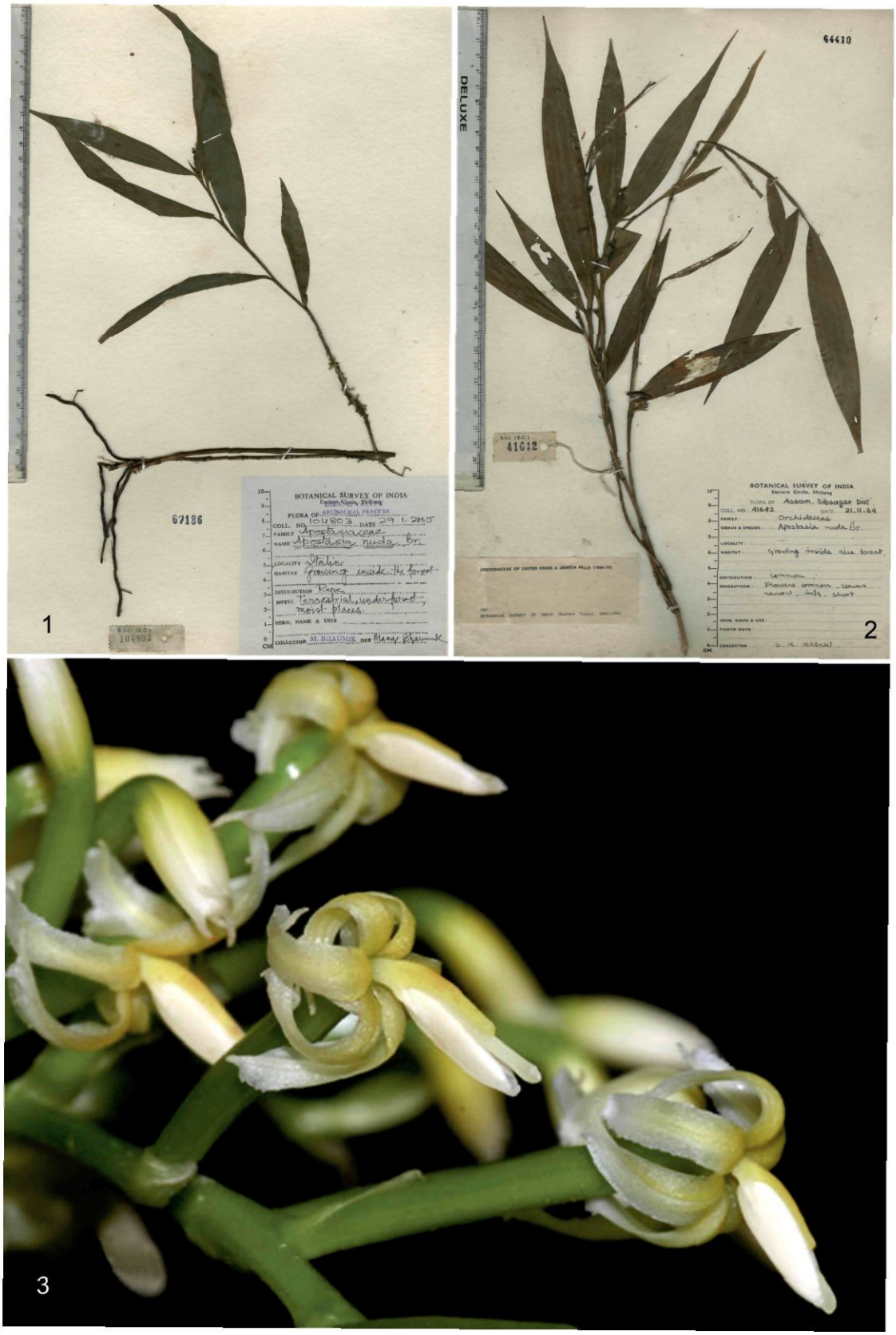

Plate 2: *Apostasia nuda* R. Br. **1 & 2.** Herbarium specimens; **3.** Flowers (*Photo* : Ravan Schneider).

Type species: *Apostasia odorata* Blume.

Niemeyera F.Muell., *Fragm. Phyt. Austr.* 6: 96. 1867.

Mesodactylis [Wall., *Pl. As. Rar.* 1: 74. 1830, *in obs.*] *Index Kew.* 2: 217. 1895.

Adactylus (Endl.) Rolfe in *Orchid Rev.* 4: 329. 1896.

The genus *Apostasia* was established in 1825 by the Dutch botanist Carl Ludwig Blume in his *Bijdragen tot de Flora van Nederlandsche Indie.*

Etymology: The generic name *Apostasia* is a Greek word meaning separation and refers to its unique floral structure, which lead many earlier workers to separate it from the family Orchidaceae.

Distribution: The genus comprises about 14 species (Mabberley, 2008) distributed in south-west China (Yunnan), Sri Lanka, north-east India, Nepal, Bhutan, Myanmar, Japan, Thailand, Laos, Cambodia, Vietnam, Malaysia, Brunei, Indonesia, and the Philippines, northern Australia (Queensland) and Papua New Guinea. The richest centre of diversity of this genus is Borneo from where five species have been recorded, of these, *Apostasia parvula,* is endemic. *Apostasia wallichii* is the most widely distributed species. *Apostasia latifolia* is endemic to Peninsular Malaysia and *A. nipponica* to the southern Japanese Ryukyu Islands. In India, the genus is represented by 3 species.

The genus *Apostasia* is characterized by terrestrial, perennial leafy herbs with an erect slender, often branched stem, with fibrous tuberculate roots, basal part of stem often with stilt roots. Leaves spirally arranged, narrow, linear-lanceolate, strongly veined. Inflorescence terminal, erect or spreading, racemose or paniculate, pendent simple or branched, the branches spreading or decurved; bracts present. Flowers sessile, yellow or white. Sepals, petals and lip almost similar and equal, keeled, free, usually widely spreading. Column erect; style free in upper portion, lower part only partially adnate to short filaments opposite the petals. Stigma superior, terminal, simple, not distinctly lobed. Fertile anthers two, dorsifixed, finger-like, attenuate towards the apex, rounded at the base, agglutinating with one another forming a staminal tube above the style; two-chambered,

Plate 3 : *Apostasia odorata* Blume

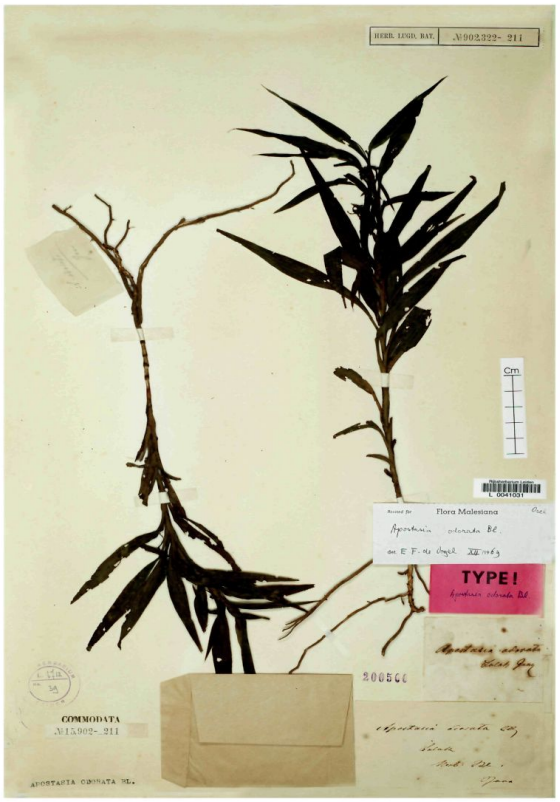

Plate 4 : Holotype A *Apostasia odorata* Blume.

Fig. 2: *Apostasia odorata* Blume- **A.** Habit- lower part of the stem; **B.** upper part of the stem; **C.** Flower; **D.** Column. (d- after de Vogel, 1969).

opening inwards; the pollen grains do not form any pollinium, free, dry, monads; staminode single, if present, finger-like. Ovary and fruit long and slender, not stalked.

The three species *Apostasia nuda* R.Br. ex Wall., *Apostasia odorata* Blume, *Apostasia wallichii* R.Br. are found in India.

Key to the Species

1.	Staminode present	2
1a.	Staminode absent; anthers sub-basifixed; almost always a tuft of sterile bracts at the base of the raceme	1. *A. nuda*
2.	Column hardly flattened with 2 longitudinal projecting wings below the staminode, slightly to strongly flattened	2. *A. odorata*
2a.	Column neither flattened and enlarged nor with wings below the staminode	3. *A. wallichi*

1. **Apostasia nuda** R. Br. in Wall., Pl. As. Rar. 1: 76. t. 85. 1830; Bauer & Lindl., Illustr. Orch. Pl. t. XV, f. 1-16. 1832; Blume in v. d. Hoeven & de Vriese, Tijd. Nat. Gesch. Phys. 1: 140. 1834; Rolfe in J. Linn. Soc. Bot. 25: 239. 1889; Hook. f., Fl. Br. India 6: 175. 1890; Kraenzlin, Orch. Gen. & Spec. 1: 9. 1897; J. J. Smith, Orch. Java 19.1905; Riddle in Fl. Mal. Pen. 4: 297. 1924; Holttum, Rev. Fl. Malaya 1: 65. 1953; Mitra, Fl. Pl. East. India 1: 261. 1958; Seidenf. in Opera Bot. 114: 15. 1992; Comber, Orch. Sumatra 21. 2001; S. Misra, Orch. India: 281. 2007.

Type: Penang, coll. Wallich, Wall. Cat. 4449 (Holo. K).

Adactylus nudus Rolfe in Orch. Rev. 4: 329. 1896; Pfitz., Pfl. Reich Heft 12: 8. 1903.

A. odorata Lindl., Veg. Kingd. 184, f. 125. 1846, *non* Blume.

A. brunonis Griff., Notul. 3: 234. 1851 and Ic. Pl. As. III f. 262. 1851; Backer & Bakh. f. in Fl. Java 3: 211. 1968.

Plate 5 : Holotype A *Apostasia wallichii* R. Br.

Fig. 4: *Apostasia wallichii* R.Br.- **A.** Habit; **B.** Flower; **C.** Flower; **D.** Sepal- inner side; **E.** Sepal- outer side; **F.** Petal- inner side; **G.** Petal- outer side; **H.** column; **I.** Column. (c & h- after Seidenfaden, 1992).

A. lobbii Reichb. f. , Flora 55: 278. 1872; Rolfe in J. Linn. Soc. Bot. 25: 238. 1889; Riddle in J. Linn. Soc. Bot. 31: 305. 1893; Kraenzlin, Orch. Gen. & Spec. 1: 9. 1897. *Adactylus lobbii* Rolfe in Orch. Rev. 4: 329. 1896; Pfitz., Pfl. Reich Heft 12: 8. 1903.

Description: Perennial, rhizomatous herbs, with 50- 70 cm long, leafy stems rooting near the base. Leaves many, about 1 cm apart, arranged along the length of the stem, linear-lanceolate, acute, about 20 cm long and 1 cm broad in the middle, tapering towards the base and apex, many nerved. Inflorescence branched pendulous raceme, with a tuft of sterile bracts at the base, peduncle covered with narrow, leaf-like sterile bracts, branches arising from between the sterile bracts. Flowers 15- 25 on each branch, closely arranged, white or yellow, 1- 1.5 cm long with recurved perianth; floral bracts narrowly lanceolate, acute, about 5 × 1.5 mm. Sepals and petals are almost equal about 3- 4 × 0.4- 0.6 mm, with an apical cusp. Column strongly curved or sometimes straight, 0.5- 1.2 × 0.2- 0.3 mm. Stamens 3.0- 4.0 × 0.5-1.5 mm; anthers semi-elliptic in cross-section, with sagittate base and more or less equal lobes, 0.2- 0.3 mm long. Ovary 5-12 × 0.5-1.2 mm. Stigma broadened at the base, either flattened, orbicular to irregularly quadrangular, sometimes 3-lobed, or conical. Fruit 1.0-1.5 × 1-1.2 mm. Seeds regularly alveolate to nearly smooth.

Fl. & Fr. : March - December.

Ecology: In primary forests, mostly on hills and in the mountains; up to 1300 m, rarely at lower altitude.

Distribution: INDIA: North East India; MYANMAR; MALAYSIA; JAVA; SUMATRA; CAMBODIA; BORNEO; VIETNAM; THE RIAU ARCHIPELAGO; THE MENTAWAI ISLANDS.

2- **Apostasia odorata** Blume, Bijdr.: 423. 1825 and in Tab. en Pl. Jav. Orch. f. V. 1825; Miq., Fl. Ind. Bat. 3: 748. 1859; Rolfe in J. Linn. Soc. Bot. 25: 236. 1889; Kraenzlin, Orch. Gen. & Spec. 7. 1897; Pfitzer in Pfl. Reich Heft 12: 6. 1903; J. J. Smith, Orch. Java 17. 1905; Back. & Bakh. f., Fl. Java 3: 211. 1968; Hegde & A.N.Rao in Ind. J. Forest. 10 (3): 192. 1987; Seidenf. in Opera Bot. 114: 13. 1992; Comber, Orch. Sumatra. 19. 2001; Pearce & Cribb, Fl. Bhutan 3(3): 20. 2002; S. Misra, Orch. India: 281. 2007.

Plate 5: *Apostasia wallichii* R. Br.- Herbarium specimens at Central National Herbarium CAL.

Plate 6: *Apostasia wallichii* R. Br.- **A.** Herbarium specimens at Lloyed Botanic Garden, Darjeeling; **B, C & D.** Herbarium specimens at BSI, Shillong (ASSAM).

Type: Java, Blume s.n. (lecto. L, Herb. no. 9023221149).

A. platystylis J.J. Sm. in Bull. Jard. Bot. Buit. ser. 3, 2: 16. 1920.

A. selebica J.J. Sm. in Bot. Jahrb. Syst. 65: 449. 1933.

A. thorelii Gagnep. in Bull. Soc. Bot. Fr. 80: 350. 1933.

Description: Terrestrial, 20-50 cm tall, erect, rhizomatous herbs. Stem densely covered with leaves. Aerial roots emerging from the lower leaves and the scales. Leaves closely arranged, ovate to linear, narrowed gradually towards the apex and ending in a long spike, margin sometimes minutely dentate, many nerved of which 3-5 are more prominent, about 30 cm long and 1.5-2 cm broad. Inflorescences terminal and axillary, pendulous, branched racemes, each side branch bears 10-20 flowers; bracts ovate to ovate-lanceolate, acute, 0.2-5 cm long, 3-13-nerved, the lower ones with a filiform tip about 2 mm long. Flowers yellow, sometimes white, widely opening, 1.5-4 cm long. Sepals 6- 12 × 1- 2.5 mm, median sometimes smaller, 3-5-nerved; dorsal sepal lanceolate, gradually narrowed towards the apex, the midrib on the reverse extending beyond the apex; lateral sepals oblique, nearly equaling the, at least 1 cm longer than the dorsal ones. Petals nearly equal, obliquely oblong-linear, obtuse, 6 -11 × 1-2 mm, cusped, margins irregular, 3-5-nerved, sometimes the median one is smaller and more convex. Lip similar than the petals, concave, 10-12 × 2- 2. 6 mm. Column 0.8-1.5 × 0.2- 0.5 mm, straight or strongly curved at base, hardly flattened and with 2 longitudinal, projecting wings at the staminodial side. Stamens 3- 7 × 0.6-1.5 mm; the shorter one entirely adnate to the longer one, or the apical portion up to 0.1 mm free. Staminode 2.0- 4.5 × 0.1- 0.2 mm; free apical portion with an obtuse tip. Ovary 10- 20 by 1-2 mm, the free part of the style 4- 6 × 0.3- 0.5 mm, with 4-6 longitudinal redges corresponding with the lobes and incisions (if present) of the stigma. Stigma somewhat enlarged, shallowly 3-lobed to suborbicular. Fruit about 20 mm long. Seeds alveolate.

Fl. & Fr.: March - December.

Ecology: In primary forests; between 700 to 1700 m. Rare.

Distribution: INDIA: Arunachal Pradesh, North East India (Assam); MYANMAR; CHINA;VIETNAM; THAILAND; MALAYSIA; SUMATRA; MALAY PENINSULA; JAVA; BORNEO.

3. **Apostasia wallichii** R. Br. in Wall., Pl. As. Rar. 1: 75. t. 84. 1830; Bauer & Lindl, Illustr. Orch. Pl. t. XV, f. 16-20. 32; Miq., Fl. Ind. Bat. 3: 748. 1859; Thwaites, En. Pl. Zeyl. 4: 315. 1861; Rolfe in J. Linn. Soc. Bot. 25: 237. 1889; Hook. f., Fl. Br. India 6: 175. 1890; Ridl., J. Linn. Soc. Bot. 32: 415. 1894; Rolfe in Orch. Rev. 4: 329. 1896; Kraenzlin, Orch. Gen. & Spec. 1: 7. 1897; Trimen, Handb. Fl. Ceylon. 4: 238. 1898; Pfitzer, Pfl. Reich Heft 12: 7. 1903; J. J. Smith, Orch. Java 18. 1905; Ames in Philip. J. Sc. Bot. 2: 311. 1907; Ridl., Fl. Mal. Pen. 4: 297. 1924; J. J. Smith in Fedde Rep. 32: 131. 1933; Masamune, J. Jap. Bot. 11: 46. 1935; Holttum, Rev. Fl. Malaya 1: 64. 1953; Mitra, Fl. Pl. East. India 1: 261. 1958; Back. & Bakh. f., Fl. Java 3: 211. 1968; Seidenf. in Opera Bot. 114: 13. 1992; Comber, Orch. Sumatra. 20. 2001; Pearce & Cribb, Fl. Bhutan 3(3): 18. 2002; S. Misra, Orch. India: 281. 2007.

Type: Nepal, Naokote, coll. Wallich, Wall. Cat. 4448 (Holo. K- LINDL., Iso. E, K-W, K, W).

A. gracilis Rolfe in J. Linn. Soc. Bot. 25: 242. 1889.

A. alba Rolfe in Orch. Rev. 4: 329. 1896.

A. lucida Blume ex Siebe, Anat. Bau Apost. 16. 1903.

A. papuana Schltr. in K. Schlum. & Laut., Nachtr. 72. 1905.

Description: Terrestrial, rhizomatous, erect herbs, 30 - 100 cm high. Stems rooting near the base and the aerial roots appearing from the lower leaves and the scales. Leaves closely arranged, with bases overlapping one another, 10-50 × 0.5-2 cm, linear to narrowly lanceolate, acute, margin entire or minutely dentate and glandular, many nerved. Inflorescences racemes, horizontally produced from near the stem apex, pendent or sometimes erect, branched, with 5-30 flowers 2-5 mm apart on each branch. Floral bracts 5-15 mm long, triangular to

lanceolate, acute, with entire or minutely dentate margin. Flowers very fragrant, yellow, rarely white, about 1.5 – 2.7 cm long. Sepals 4- 6.5 × 0.5-1.5 mm, 3 -7 nerved, acute, slightly recurved, cusped. Petals more or less alike, 3.5-6 × 0.5-1.5 mm, 1-5 nerved, acute, median one sometimes broader and more convex, cusped. Column straight or strongly curved, about 1.5 mm long. Stamens enveloping the column, about 5x 1mm; anthers with an unequally bilobed to oblique, entire tip. Ovary 10-20 × 1-2 mm, free part of the style straight, occasionally curved, sometimes irregularly longitudinally ribbed, mostly overtopping the anthers, but sometimes overtopped by the anthers; stigma 2-3-lobed, sometimes suborbicular. Fruit 10-25 × 1.5-2 mm. Seeds alveolate to nearly smooth.

Fl. & Fr.: March - December.

Ecology: In primary forests; from 100 to 1700 m. Rare.

Distribution: INDIA: Sikkim, North East India (Assam); NEPAL; MYANMAR; THAILAND; MALAYSIA; CAMBODIA; SRI LANKA; VIETNAM; QUEENSLAND; SUMATRA; MALAY PENINSULA; JAVA; BORNEO; PHILIPPINES; NEW GUINEA; AUSTRALIA.

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भारत में व्यापत उपकुल एपोस्टासियोडाई (आर्किडेसी) का अध्ययन

एच. जे. चौधरी

सार सारांश

प्रस्तुत शोध पत्र भारत में उपकुल एपोस्टासियोडाई के अध्ययन एवं वर्गिकी का विस्तृत अध्ययन किया गया है। भारत में इस उपकुल को वंश *एपोस्टासिया* ब्लूम की तीन जातियों क्रमशः *एपोस्टासिया नूडा* आर. ब्रा. *एपोस्टासिया ओडोराटा* ब्लूम एवं *एपोस्टासिया वालिचाई* आर. ब्रा. के साथ दर्शाया गया है।