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The Genus *Psilotrichum* Blume (Amaranthaceae) in South India

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ABSTRACT

The genus *Psilotrichum* was established by Blume in 1826 to include a single species, *P. trichotomum* Bl. He described the new genus as "*Calix 3-bracteatus (Bracteis non spinescentibus), 5-partitus, foliosis lanceolatis, aequalibus. Stamina 5, basi in cyathulum edentulum convata. Antherae biloculares. Stylus indivisus, stigmate capito. Capsula evalvis, monosperma, inclusa calicis foliolis conniventibus nudis*". *P. trichotomum* Bl. was later shown to be conspecific with a species described by Roxburgh (Fl. Indica 2: 502. 1824) two years earlier, and included in the genus *Achyranthes* as *A. ferruginea* Roxb. Moquin-Tandon (1849) transferred it to the genus *Psilotrichum* as *P. ferrugineum* (Roxb.) Moq., and it is accepted as the type species of the genus. The name *Psilotrichum* is derived from the Greek, *Psilos* meaning naked and *trichus*, in three parts (Nayar, 1985), coming under the family Amaranthaceae. Amaranthaceae, popularly called 'amaranth family, is a moderately large family with 77 genera and over 840 species (Müller & Borsch, 2005). It is a pantropical family with some genera or species reaching the warmer temperate regions. Nearly one third of the genera of the family are monotypic. The genus can be distinguished from other genera of Amaranthaceae by its two-chambered anthers, pseudostaminodia alternating with fertile (and sometimes sterile) filaments; stigma capitate; inflorescence of solitary or multiple, axillary or terminal globose heads usually without subtending leafy bracts. The genus was treated with confusion in several regional floras which are devoid of updated nomenclature and citation of type specimens. A key to the taxa are provided along with illustration of 2 species to facilitate identification of the taxa.

1. Introduction

Amaranthaceae, popularly called 'amaranth family, is a moderately large family with 77 genera and over 840 species (Müller & Borsch, 2005). It is a pantropical family with some genera or species reaching the warmer temperate regions. Nearly one third of the genera of the family are monotypic.

The family has been of great interest to botanists, horticulturists, agriculturists and laymen alike, since long. The brilliantly hued, everlasting floral bunches (spikes) and beautifully variegated foliage of many species make them ideal ornamentals for the tropics and subtropics of the world. While some of them like *Amaranthus* species are among the ten popular vegetables in Southeast Asia (Vinning, 1995), many others provide us with other kinds of cereals, secondary chemicals, vegetables and medicines.

Amaranthaceae are regarded as closely related to Chenopodiaceae since the early 19th century (Brown, 1810; Bentham & Hooker, 1880; Baillion, 1887; Volkens, 1893; Ulbrich, 1934; Behnke, 1976a; Kühn *et al*., 1993; Townsend, 1993). They share many features in terms of their morphology, anatomy as well as phytochemistry (Müller & Borsch, 2005). In spite of problems in identifying distinguishing characters, the majority of the authors have treated both the families separately. A merger of Chenopodiaceae and Amaranthaceae into one family was advocated only rarely (Baillon, 1887; Malligson, 1922). However, recently this has been proposed again using the earlier name Amaranthaceae (APG, 1998, 2003). Nevertheless, most of the floristic literature and immense number of ecological studies still refer to separate Amaranthaceae and Chenopodiaceae (eg. Gauquelin *et al*., 1998; Blunden *et al*., 1999; Deil, 2000), whereas usage of single-family name Amaranthaceae is rarely found (eg: Barderas *et al*., 2002).

So far, only few molecular studies included more than two taxa of Amaranthaceae and Chenopodiaceae in their sampling, and in these, both families were either resolved sister families (Downie & Palmer, 1994) or Amaranthaceae were identified as nested within Chenopodiaceae (Downie *et al*., 1997; Cuenoud *et al*., 2002) making Chenopodiaceae paraphyletic. Various other studies (eg. Rodman, 1994; Pratt, 2003; Müller & Borsch, 2002) aimed at resolving relationship among these two families of Caryophyllales, their sampling was rather narrow and the analyses were indecisive in demonstrating the relationship between both the families. Given these inconsistent results, it appears that further work would be needed to understand relationships between Amaranthaceae and Chenopodiaceae or to make decisions regarding family classifications. In the present study the name "Amaranthaceae" is used in the strict sense of Schinz (1893, 1934) and Townsend (1993).

The Amaranthaceae is one of the core centrospermous families and its reference to the order Caryophyllales has always been beyond dispute. The family comprises herbs or shrubs rarely lianas and small trees, with opposite or alternate exstipulate leaves. The flowers are often small and inconspicuous with scarious tepals; the flowers are bisexual or unisexual and the plants may be monoecious, dioecious or

polygamous. Each flower is generally subtended by a ventral bract and two lateral bracteoles. The stamens stand opposite the tepals, are hypogynous to perigynous, and are in majority of genera stamens united below into a cup or tube. Interstaminal appendages, mostly called pseudostaminodia, frequently occur. The anthers are dorsifixed and introrsely dehiscent. The gynoecium comprises two or three carpels united into one pistil. The unilocular ovary contains one (in most genera) or several ovules. The fruit is generally a thin-walled utricle, rarely a berry-like capsule.

Amaranthaceae shares many of the characters with Chenopodiaceae. The two families are generally placed close together in all systems proposed, although the border line between the families is sometimes vague. The vast majority of the Amaranthaceae differs from Chenopodiaceae in the scarious bracts, bracteoles and tepals, in the filaments being united below into a tube, and in the frequent occurrence of interstaminal appendages. From ultrastructural (sieve-element plastids) and phytochemical points of view the two families coincide very closely.This work is restricted to South India, because of the usual constraints of time and other things that goes with a doctoral programme. It is our intention to carry on with it and bring out a revision of Indian Amaranthaceae in due course.

2. Materials and methods

The study is based on extensive field work and collections made from different parts of South India. The work was commenced on May 1999. Since then frequent collection trips were conducted at different parts of South India, covering the states of Andhra Pradesh, Karnataka, Tamilnadu, Pondicherry and Kerala. Each taxon was collected in sufficient numbers from different habitats to study the variation pattern. Attention has been given to gather specimens with flowering, fruiting or both the stages. Herbarium specimens were made according to standard methods (Lucas, 1989). Field data were properly recorded in the field book, and sufficient quantities of inflorescences were also collected for wet preservation and for further examination. The specimens were studied using stereo microscope and illustrations were made using Camera lucida. Detailed descriptions were made based on fresh specimens except in a few cases. The specimens were examined thoroughly with the descriptions given in the flora of Presidency of Madras (Gamble & Fischer, 1925) and Flora of British India (Hooker, 1885). Revisions and monographs were also consulted to confirm their systematic position and nomenclature. The identified specimens were mounted on the standard herbarium sheets with necessary collection data. Specimens deposited in other herbaria (CAL, CALI, BSI, MH, RHT, TBGT) are also examined to understand more on the variations pattern exhibited by different taxa. Types and protologues were studied (specimens, digital images, cibachromes or microfiches) in all cases where the identity of a taxon is found confusing. Illustrations were entirely based on fresh specimens, except in a few cases. The most typical form is illustrated in all cases with special emphasis given to demonstrate variations. Distribution maps were prepared almost entirely based on specimens examined during the present investigation. Vernacular names and uses of plants if any are given wherever available. Vernacular names are obtained either from local people during field studies or from herbarium labels and published works. Flowering and fruiting period are mostly documented from field observations except for certain cases. All the specimens collected during the course of the work are deposited in the herbarium of Department of Botany, University of Calicut (CALI).

3. Systematic Treatment

Key to the Genera

Fertile flowers not subtended by modified sterile flowers, Leaves not linear; filaments connate at the base only or free,without pseudostaminodes …….***Psilotrichum***

PSILOTRICHUM Blume

Psilotrichum Blume, Bijdr. Fl. Ned. Ind. 544. 1826; Moq. in DC., Prod. 13(2): 279. 1849; C.C. Towns. in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1: 43. 1980; Kubitzki, Fam. & Gen. Vasc. Pl. 2: 86. 1993; Bao Bojian *et al*., Fl. China 9:415-429. 2003.

Type species: *Psilotrichum ferrugineum* (Roxb.) Moq.

Perennial herbs or subshrubs, prostrate to scandent, with entire, opposite leaves. Flowers bisexual, in axillary and terminal bracteate heads or spikes, solitary in the axil of each bract, bracts persistent, finally spreading or deflexed, bibracteolate; bracteoles falling with the fruiting perianth. Perianth 5, free, strongly to faintly nerved or ribbed, the outer 2 frequently finally more or less indurate at the base. Stamens 5, shortly monadelphous at the base, pseudostaminodes absent or very small; anthers 2-loculed. Ovary ellipsoid or globose; ovule 1, pendulous; style slender; stigma capitate. Utricle enclosed in perianth, ellipsoid, indehiscent. Seed erect, lenticular, smooth, brownish.

Distribution. *Psilotrichum* is a genus of about 14 species, mostly distributed in tropical Asia and Africa.

Key to the Species

1. Flowers pale pink; outer and inner tepals 3-nerved..... 2. *P. nudum*

1. Flowers greenish white; outer tepals 5-nerved, inner tepals 3- nerved.....1. *P. Elliotii*

1. Psilotrichum elliotii Backer in Thiselton-Dyer, Fl. Trop. Africa 6(1): 58.1909; C.C. Towns. in Dassan. & Fosberg, Rev. Handb. Fl. Ceylon 1:45. 1980; K.M. Matthew, III. Fl. Tamilnadu Carnatic t.590. 1982; N. Rani & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 2: 1315, 1983; C.C. Towns. in Polhill, Fl. Tropical East Africa 97, 1985; K.K.N. Nair & M.P. Nayar, Fl. Courtallum 56, 1986; K.M. Matthew, Fl. Central Tamilnadu 420. 1991; Raju & Padmavathi in Pullaiah & Ali, Fl. Andhra pradesh 2:806. 1997; K.M. Matthew, Fl. Palni hills 2: 1034. 1999 .

Type: Uganda, *Scott-Elliot 8062* (holotype, K).

Ptilotus ovatus Moq. in DC., Prod. 13(2): 281. 1849.

Psilotrichum calceolatum Moq., *Ibid*., 280. 1949, *nom. nud.,* Hook. f. Fl. Brit. India 4: 725. 1885, *nomen illegit*.; Trimen, Handb. Fl. Ceylon 3: 400. 1895; Gramble, Fl. Pres.

Madras 2: 1174. 1925; K.M. Matthew, Ill. Fl. Tamilnadu Carnatic t. 590. 1982.

Psilotrichum ovatum Peter in Feddes Rep. Beih. 40(2) Anhang. 28. 1932.

Psilotrictum ovatum (Moq. ex Hook. f.) Haum. in Bull. Jard. Bot. Brux. 18: 11. 1946.

Psilotrichum peterianum Susseng. in Mitt. bot.staatss. Munchen Heft 4: 131. 1952.

Psilotrichum moquinianum Abeywick. in Ceylon J. Sci., Biol. Sci. 2(2): 158. 1959.

Monoecious, procumbent, scrambling herb, 35-100 cm long, woody base; stems slender, terete, green and glabrescent. Leaves opposite-decussate, ovate-lanceolate, 2-4.5x1-2.8 cm, subappressed white hairs on both the surfaces, margins entire, apex acute, base obtuse; petiole 2.5-3 mm, glabrescent. Inflorescence axillary spike, 1-2 cm, usually greenish. Flowers bisexual, greenish 5 x 1.5 mm; bracts ovate-lanceolate, 2 x 1mm, apex acuminate, densely sericeous; bracteoles 2, cordate-ovate, 2.5 x 1.25 mm, sericeous; tepals 5, subequal, outer 2 slightly larger, ovate-lanceolate 3.25 x1 mm, 5-nerved, apex acute, subappressed white hairs, inner 3 slightly smaller, linear-lanceolate, 3 x 1 mm, 3-nerved, apex blunt, long pilose; stamens 5, connate at the base, filaments 1-1.5 mm long; anthers oblong, bithecous, 0.3 mm long, whitish. Ovary ovoid-globose, 0.75mm long, glabrous, ovules solitary; style 1.25 mm long, glabrous; stigmas minutely lobed, capitate. Capsule oblong ovoid, 2-2.5 mm. Seed ovoid, 1-1.5 mm, compressed, brown, shiny.

Distribution and habitat: Drier regions of South India and Tropical Africa. In South India it is mostly seen in scrub jungles usually in sandy soil.

Specimens examined. ANDHRA PRADESH: Chittoor Dt.: Nagari, 2.12.1987, *D. Ranga Charyulu 1889* (MH). Visakhapatanam Dt.: Circuit House, 5.10.1964, *G.V. Subba Rao 21473* (MH). KERALA: Idukki Dt. Chinnar, 21.12.2004, *Anil kumar 81*; Chinnar W.L.S., 19.5.1999, *T. Resmi 78386* (CALI). TAMIL NADU: Coimbatore Dt.: Nellimalai R.F., 23.5.1962, *K. Ramamurthy 14085* (MH, CAL); Agricultural College, Coimbatore,1.8.1967, *M. Chandrabose 29008*; Chinnathadagam, 3.7.1956, *K. M. Sebastine 89*; Kuridimalai, 10.9.1956, *K. Subramanyam 691*; Maruthamalai, 30.8.1956, *K.M. Sebastine 649*; Attakatti Anamalais, 25.10.1961, *J. Joseph 14171*; Aliyar submergible area, 27.7.1962, *K.M. Sebastine 14546*; Nellimalai R.F., 25.8.1962, *K. Ramamurthy 14822*; Palamalai, 23.7.1969, *M.B. Viswanathan 39*; Kallar-Mettupalayam, 22.4.1944, *D. Daniel 87095* (MH); Thadayam hills, 29.4.1911, *C.E.C. Fischer 2709* (CAL); Navumalai, 26.6.1962, *J. Joseph 14171* (CAL). Dindigul Dt.: Thirumurthimalai, 22.12.2004, *Anilkumar 84* (CALI); Onpathar, 22.12.2004, *Anilkumar 83* (CALI). Kanyakumari Dt.: Near Anjugramam, 27.3.1979, *A.N. Henry 61568* (MH). Madurai Dt.: Govigundumalai, 21.2.1958, *K. Subramanyam 5398* (MH, CAL); Way to Soranganar falls, 23.6.1959, *K. Subramanyam 8168* (MH, CAL). Nilgiri Dt.: Segur Peak, 23.8.1970, *G.V. Subba Rao 36230*; Kunjaparai slopes, 7.11.1970, *E. Vajravelu 36771* (MH). Ramanathapuram Dt.: Kalaiyar koil Forest, 20.8.1964, *K. Ramamurthy 21001*; Aiyanarkoil forest, 13.3.1970, *E. Vajravelu 33720* (MH); Chittarur river bank, Khansapuram beach, 17.2.1979, *N.C. Nair 60926* (CAL). South Arcot Dt.: Cuddalore 12.12.1979, *K.M. Matthew 25038* (RHT). Tirunelveli Dt.: Kalakkadu R.F., 8.11.1962, *J. Joseph 15183* (MH, CAL); Kodamady, 23.7.1966, *B.V. Shetty 27907* (MH); Mundanthurai, 12.7.1959, *K.M. Sebastine 8504* (MH, CAL).

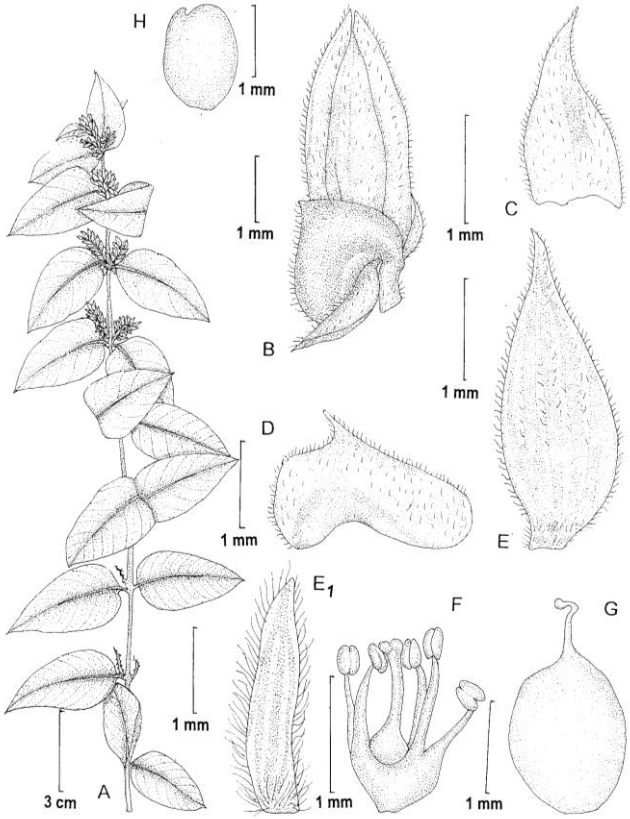

Fig. 31. *Psilotrichum elliotii* Baker: A. Flowering branch; B. Flower; C. Bract; D. Bracteole; E & E1. Outer & inner tepal; F. Androecium with Pistil; G. Capsule; H. Seed (from *Anilkumar 83*)

2. Psilotrichum nudum (Wall.) Moq. in DC. Prod. 13(2). 280. 1849; Hook. f., Fl. Brit. India 4: 724. 1885; Gamble, Fl. Pres. Madras 1174. 1925; K.M. Matthew, Mat. Fl. Tamilnadu Carnatic 316. 1981; N. Rani & K.M. Matthew in K.M. Matthew, Fl. Tamilnadu Carnatic 2: 1316. 1983; K.K.N. Nair & M.P. Nayar, Fl. Courtallum 57.1986; K.M. Matthew, Fl. Central Tamilnadu 430. 1991.

Type: India Orientali, *Wallich 6926* (K-W).

Achyranthes nuda Heyne ex Wallich in Roxb., Fl. Ind. 2: 507. 1824; Wall. Cat. 6926.

Monoecious prostrate or erect herb; stem profusely branched from the base up to 75 cm long, terete, dark green, glabrous. Leaves opposite, decussate, ovate-lanceolate, 2.5-6 x 1.5-3.5 cm, glabrous on the adaxial side, sparsely pilose on the abaxial side, margins entire, apex acute, base truncate; petiole 0.5-1 mm long, glabrous. Inflorescence axillary paired spike, upto 1-3.5 cm long, greenish pink. Flowers bisexual, greenish with pink veins; bracts broadly deltoid-ovate, 2.5 x 15 mm, hirsute; bracteoles 2,broadly

cordate-ovate, 2 x 2 mm, hirsute; tepals 5, membranous, 3-nerved, pinkish, ovate-lanceolate, 4 x 1.25 mm, acute at apex, sparsely pilose. Stamens 5, connate at the base; Filaments 0.75-1 mm long, glabrous; anthers oblong, bithecous, 0.25 mm long brownish. Ovary ovate-globose, 1 mm long, glabrous, ovules solitary; style 1 mm long, glabrous, persistent; stigma capitate, obscurely 2-lobed. Capsule ellipsoid, 3 x 2 mm, glabrous, irregularly rupturing. Seeds ovoid, 2 x 1.5 mm, compressed, balckish brown, shiny.

Distribution and habitat. A native of India, this species is now widespread in tropical countries. In South India, it is usually found in dry sandy areas of Tamil Nadu.

Specimens examined. TAMIL NADU: Coimbatore Dt.: Thekkumalai, 28.11.1956, *K.M. Sebastine 1506* (MH, CAL); Maruthamalai, 7.8.1956, *K.M. Sebastine 509*; Anaikkatti, 22.2.1931, *S.R. Raju 4769*; Perumalmudi, 29.12.1969, *M.B. Viswanathan 318*; Slope of Konamalai, 25.4.1963, *C.P. Sreemadhavan 573* (MH). Madurai Dt.: Alagar hills, 26.9.1975, *K.M. Matthew 14867* (RHT). Nilgiri Dt.: Kalhatti, Masinagudi Road, 23.8.1970, *B.D. Sharma 35733* (MH). South Arcot Dt.: Kallakurichi, Kalrayars, 25.9.1978, *N.Venugopal & C. Manoharan 17772*; Cuddalore, 27.1.1979, *N. Venugopal 21304* (RHT). Thanjavur Dt.: Thanjavur temple campus, 25.2.1988, *S. Ragupathy 645* (MH) (CAL). Tirunelveli Dt.: Courtallum Falls, 21.4.1957, *K.Subramanyam 2806* (MH, CAL); Papanasam, 5.7.1959, *K.M. Sebastine 8303*; Kizhmanimuthar, 26.6.1957, *K.M. Sebastine 3671* (MH, CAL); Courtallum, 10.12.2004, *Anilkumar 59* (CALI).

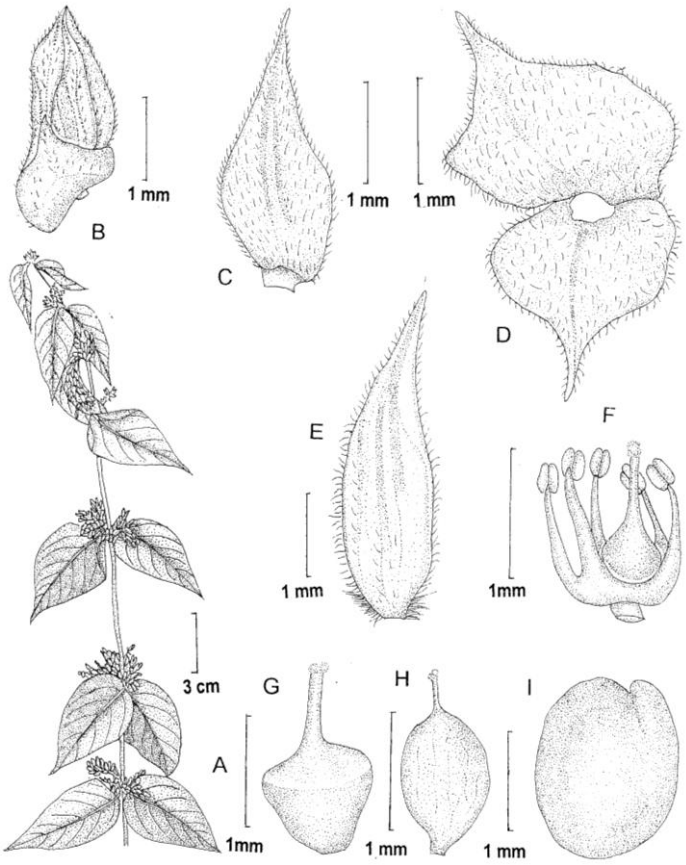

Fig. 32. *Psilotrichum nudum* (Wall.) Moq.: A. Flowering branch; B. Flower; C. Bract; D. Bracteoles; E. Tepal; F. Androecium with pistil; G. Pistil; H. Capsule; I. Seed (from *Anilkumar 59*)

4. Conclusion

The study provides an insight into the floral morphology of Psilotrichum, illustration of floral parts; dichotomous key clearly reveals the identification of species without much confusion.

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