Cyperaceae Indiae Australis Precursores: A novelty in *Cyperus* Linn. and its vegetative anatomy

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MS submitted 18 December 1989

Abstract. One set of specimens collected from higher altitudes of south India showing affinities with *Cyperus kurzii* Clarke is described as new species together with its vegetative anatomy. The anatomical characters of this novelty differ in several details from those of species hitherto known anatomically.

Keywords. Novelty in *Cyperus*: vegetative anatomy.

2. *Cyperus palianparaiensis* Govind. sp. nov.—Sect. Diffusi Kunth (figure 1)

Affinis *Cypero kurzii* C B Clarke sed culmis valde 7 costatis cum foliis minoribus ad numerum per culmum, foliis angustioribus plerumque brevioribus multinervis, bracteis brevioribus involucralibus radiis ad numerum minoribus rigidis, inflorescentis minus densis spiculis majoribus ad numerum brevioribus latioribus per radium cum minoribus ad numerum floribus, glumis laxe distichis (semidistichis) purpureo-fuscis vel atrocastaneis obscure mucronatis cum inciso apice et enervibus lateribus, carina 3 nervata ut videtur 1 nervata fasciata sigmoidea, staminibus 3, antheribus maturis oblongis luteis cum tridentata crista, nucibus suborbicularibus late ellipticis vel cuneatis stipitatis 1/3 longitudinem glorum cum depresso vel rotundato apice et dense subtiliter granulata pagina notabilis.

Govindarajalu 059, 111rd Plot, High Wavys Ms., Madurai Dt., Tamil Nadu (type: CAL); paratypes: Govindarajalu 0106 A-B, Vattaparai, High Wavys Ms., Madurai Dt., Tamil Nadu: 0106 A (DD); 0106 B (BSI); Govindarajalu 14286 A-B, Palianparai, High Wavys Ms., Madurai Dt., Tamil Nadu: 14286 A (MH); 14286 B (BLAT).

Perennial. Roots few, thick, black. Culms prominently 7 ribbed throughout, thickened and woody at base, rigid, erect or flexuous, smooth, 25–75 cm × 2–3 (−3.5) mm. Leaves 1–2(−3) per culm, well developed, prominently multicostate, carinate, gradually acuminate, pale green, smooth margined, flat or canaliculate (15–) 18–35 cm × 4–5 mm; sheaths 1–3 lowermost bladeless, purplish brown or red covering culm bases, often shredded into fibrous strands; nerves purplish red; uppermost with short ovate lanceolate flat green blade and white membranous margin, 5–7 (−8) cm × 7–8 mm. Inflorescence usually decompound (compound) consisting of 3–6(−8) spikelets per ray, 5–10 mm across. Primary rays 5–8, usually 5-ribbed, erect or somewhat flexuous, 4–12 cm long; secondary rays usually 5-ribbed, 1–4 cm long, usually curved towards apex. Involutral bracts 3–5, leaflike, erect, unequal, longer than inflorescence, the longest up to 15 cm long, 3–3.5(−4) mm broad. Spikelets linear oblong or oblong ovate, angular, compressed, (8–) 10–16 flowered, approximate, spreading at ends of secondary rays, (4–) 5–7 × 2–3 mm; rachilla flexuous, persistent, excavated, winged. Glumes trullate, purplish brown or atrocastaneous, notched at apex, more or less compact, distichous (semidistichous)
Figure 1. a-i. Cyperus palianparaiensis Govind. sp. nov. a. habit (x 0.5). b and c. Nuts (x 20). d. Spikelet (x 8). e. Glume, lateral view (x 25). f. Glume, spread out (x 21). g. Rachilla, diagrammatic. h. Anther (x 50). i. Style with stigma (x 50) (from Govindarajalu 059, holotype).
with hyaline margin and nerveless sulcate sides, strongly keeled, mucerululate (acute), tannin streaked in the sulcus (sometimes) in the keel, 2 mm (excl. mucer) long and broad; mucer circa (c.) 0-25 mm long, recurved; keel strong, green, 3 nerved (seemingly 1 nerved and banded), sigmoidea, smooth. Stamens 3, usually exerted with flat membranous 1 nerved broad persistent filament; mature anthers yellow, oblong with tridentate crest, spurred at base, 0-5-0-6 mm long. Style 0-5-0-6 mm long; stigma 3, nearly 1½ times longer than style, sparsely papillate towards apex, often exerted. Nuts variable in shape, suborbicular, broadly elliptic or cuneate with rounded or depressed apex, triquetrous with flat or somewhat depressed sides, minutely apiculate, densely finely granulate, stipitate, dirty brown, 0-9-1 x 0-8-0-9 mm

Notes

(i) Readily recognizable features of this novelty in its habitats and herbarium are strongly 7 ribbed culms, presence of purplish brown or red broad bladeless ovate lanceolate lowermost sheaths with many red nerves, linear oblong or oblong ovate radiating spikelets at the ends of secondary rays and purplish brown or atrocastaneous glumes with nerveless sulcate lateral sides.

(ii) Instead of describing different type of ovate glumes under a general term 'ovate' in a traditional and uncritical way, the term 'trullate' is introduced here as the appropriate one to describe the particular ovate shape of the glume observed in this species (Stearn 1966; figure 1f).

(iii) This novelty is less common and occurs in open places near the margin of rivulets and marshy places at c. 1,500 m.

Vegetative anatomy

Materials and methods: Bits of different organs were selected from the paratypes. The same methods and the descriptive terms followed in earlier works are adopted here (Govindarajalu 1966, 1968a,b, 1975; Metcalfe and Gregory 1964; Cheadle and Uhl 1948a,b).

Leaf—Abaxial surface: Intercostal cells axially elongated; cell walls thin, sinuous. Stomata (length 66-7-69-6 μm; width 34.8-37.7 μm), narrowly elliptic oblong; subsidiary cells parallel-sided (figure 2d); interstomatal cells long with concave ends. Silica cells moderately long, broad occurring in 2-3 continuous rows each cell containing 3-4 cone-shaped silica-bodies surrounded by satellites.

Adaxial surface: Cells shortly hexagonal; cell walls thin, smooth. Stomata and silica cells, see abaxial surface.

T S Lamina (figure 2c). Width of specimen examined 4-2 mm. Outline 'T' shaped. Cuticle very thin. Keel elongated (length c. 1 mm long), distally bilobed. Margin abruptly acute. Hypodermis 1-2(-3) layers of polygonal translucent cells present both abaxially and adaxially. Sclerenchyma strands (length 34-8-46-4 μm; width 34-8-58-0 μm) pulviniform or rounded throughout. Air-cavities well developed, transversely elongated, large, regularly alternating with vascular bundles (vb's) each containing stellate parenchyma cells; keel with 3 vertically elongated air-cavities. Bulliform cells of single layer of 6-7 undifferentiated cells. Chlorenchyma and bundle sheaths as in group B of this genus (Metcalfe 1971). Vascular bundles 14; laminal vb's 11 and 3 in the keel; median vb inversely oriented; large keel vb (type III A); the remainder (type I); large keel vb containing protoxylem lacuna;
Figure 2. a–d. *Cyperus palianparaiensis* Govind. a. Transection of culm (× 55). b. Transectional outline of entire lamina, diagrammatic. c. A part of transection of lamina (× 44). d. Surface view of stoma (× 226) (all based on paratypes).

(AC, Air-cavity; BC, bulliform cells; CH, chlorenchyma; E, epidermis; GT, ground tissue; HY, hypodermis; PH, metathloem; PL, protoxylem lacuna; SC, subsidiary cell; SH, bundle sheath; ST, sclerenchyma strand; VB, vascular bundle; XY, metaxylem).
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*Metaxylem vessel elements (34.8 µm in diameter). Metaphloem of ‘intermediate type. Secretory cells not common.’*

*Culm — Epidermis, surface view: Cells short, variable in size, hexagonal; cell walls thin, smooth. Stomata (length 58.0-65.7 µm; width 40.6-46.4 µm), elliptic oblong; subsidiary cells low dome-shaped; interstomatal cells short with concave ends. Silica cells not obvious.*

*T. S. Culm: (figure 2a): Width of the specimen along the longest axis c. 1 mm. Outline very irregular with 7–9 prominent ribs. Cuticle moderately thick. Epidermal cells large, isodiametric except over the ribs. Assimilatory tissue consisting of 2–3 layers of palisade chlorenchyma. Air-cavities c. 8 containing stellate parenchyma cells. Vascular bundles c. 14–15 forming a peripheral ring, those opposite to large ribs larger (type III A) than the remainder (type I); all vb's containing protoxylem lacunae. Metaxylem vessel elements (34.8 µm in diameter). Metaphloem of ‘regular type’. Bundle sheaths and crescentiform sclerenchyma of vb's, see Metcalfe (1971). Sclerenchyma strands opposite to ribs crescentiform (pulviniform) (height 58.0 µm; width (92.8–) 116–174 µm). Central ground tissue consisting of large thin-walled cells tending to form central cavity. Secretory cells common in chlorenchyma.*

*Root. Transverse section: Diameter of root examined 0.9 mm. Exodermal cells single layered, variable in size; cell walls moderately thick. Cortex recognizable into 2 zones, outer broad, lacunose becoming net-like with several air-cavities, inner narrow containing 3–4 layers of compactly arranged cells. Endodermis: cells isodiametric, moderately thick-walled with broad lumen. Metaxylem central, circular; protoxylem units and metaxylem groups not distinct; metaxylem vessel elements (46.4 µm in diameter). Ground tissue parenchymatous.*

**Acknowledgements**

I am thankful to the University Grants Commission, New Delhi for sanctioning the Project, Prof. A Mahadevan, for providing laboratory facilities and Mr C A Appachu, High Wavys Tea Estates for the help during field works.

**References**

Cheadle V I and Uhl N W 1948a Types of vascular bundles in the Monocotyledoneae and their relations to the late metaxylem conducting elements; *Am. J. Bot.* 35 486–496
Cheadle V I and Uhl N W 1948b The relation of metaphloem to the types of vascular bundles in the Monocotyledons; *Am. J. Bot.* 35 578–583
Govindarajalu E 1966 Systematic anatomy of south Indian Cyperaceae: *Bulbostylis* Kunth; *J. Linn. Soc. (Bot.)* 59 289–304
Govindarajalu E 1968b Systematic anatomy of south Indian Cyperaceae: *Cyperus* L. subgen. *Kyllinga* (Rottb.) Suringar; *J. Linn. Soc. (Bot.)* 62 41–58
Metcalfe C R and Gregory M 1964 Some new descriptive terms for Cyperaceae with a discussion of variations in leaf form noted in the family; *Notes Jodrell Lab.* 1 1–11
Stearn W T 1966 *Botanical Latin* (London: Nelson T and sons Ltd.).