



## Notes on Recent Species Bursts in *Murdannia* (Commelinaceae) From India

## KEYWORDS

*Murdannia*, *Commelinaceae*, capsule, seed, India

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**ABSTRACT** *Murdannia Royle* (Comelinaceae) comprising approximately 50 species has plenteous diversity in tropical Asia. Recent species discoveries in *Murdannia* incorporated 26 species in India with 31% of endemism. However, this leads to ambiguity in many species groups. The recent treatment of *M. satheeshiana* Joby et al. as conspecific to *M. versicolor* (Dalzell) G. Brückner is found without substantial reasons. A detailed literature survey on the genus elucidated two species clusters i.e. *M. semiteris-juncooides-sahyadraca* and *M. satheeshiana-pauciflora-versicolor-lanuginosa-crocea* subsp. *ocharcea* and their taxonomic incertitude.

### Introduction

The genus *Murdannia* Royle (Comelinaceae) with ca. 50 species has rich diversity in tropical Asia (Faden 2000). Karthikeyan et al. (1989) recorded 23 species in India and 7 more names appeared later viz., *M. fadeniana* Nampy and Joby, *M. striatipetala* Faden, *M. satheeshiana* Joby et al., *M. brownii* Nandikar & Gurav, *M. sahyadraca* Ancy & Nampy, *M. assamica* Nampy & Ancy and *M. saddlepeakensis* M.V. Ramana et al. Ancy (2014) itemized 26 species in India with 31% of endemism. Ancy and Nampy (2014) treated *M. satheeshiana* Joby et al. as conspecific to *M. versicolor* (Dalzell) G. Brückner without solid and substantial reasons. A detailed literature survey on the genus elucidated *M. semiteris-juncooides-sahyadraca* and *M. satheeshiana-pauciflora-versicolor-lanuginosa-crocea* subsp. *ocharcea* species clusters and their taxonomic uncertainty.

### Methodology

Methodology includes a detailed review of the literature from the floristics, revisions and monographs of Commelinaceae. The monumental work of Rheede (1678–1703), Roxburgh (1820–1832), Wight & Arnott (1834), Beddome (1868–1874), Hooker (1872–1897), Bourdillone (1908), Cooke (1901–1908), Lawson (1894), Rama Rao (1914), Wight (1838–1853), Drury (1864–69), Gamble & Fischer (1915–1936), Fischer (1921), Fyson (1932) and Matthew (1981–1983, 1988, 1999) are used for reference. Besides these, regional floras of Manilal & Si-

varajan (1982), Manilal (1988), Ramachandran & Nair (1988), Vajravelu (1990), Sreekumar & Nair (1991), Mohanan & Henry (1994), Subramanyan (1995), Sasidharan & Sivarajan (1996), Sivarajan & Mathew (1997), Sasidharan (1997, 1999, 2002), Manilal & Raveendrakumar (1998), Mohanan & Sivadasan (2002) Anilkumar & Sivadasan (2005) and Sunil & Sivadasan (2010) are also analysed. Species protologues were sourced from the Biodiversity Heritage Library (2012), Internet Archive (2012), Botanicus (2012) and published printed literature. Type Herbarium specimen images are consulted from K (Herbarium, RBG, Kew), E (Herbarium, Edinburgh) and BM (Herbarium, British Museum) through internet.

### Discussion

*Murdannia semiteris-juncooides-sahyadraca* group Even though the identity of *M. juncooides* (Wight) R. S. Rao & Kammathy from *M. semiteres* (Dalzell) Santapau was established (Nampy and Joby, 2008), the new species *M. sahyadraca* A. Ancy & Nampy (Nampy et al., 2012) induced a lot of ambiguity in the Murdannian researches. *M. juncooides* was described by Wight (1853) as *Dichaspermum juncooides* based on specimens from Courtallam in Tamil Nadu and Quilon in Kerala. *M. semiteres* was described by Dalzell (1851) from Konkan as *Aneilema semiteres*. The third; *Murdannia sahyadraca* was described from Sinhagad, Maharashtra by Nampy et al. (2012). On close examination and comparison of these three species, both vegetative are reproductive features are strongly merging and intergrading (Table -1).

**Table -1. Comparison of taxonomic features of *Murdannia juncooides-semiteres-sahyadraca* group**

Taxonomic Features	<i>Murdannia juncooides</i> (Wight) R.S. Rao & Kammathy	<i>Murdannia semiteres</i> (Dalzell) Santapau	<i>Murdannia sahyadraca</i> Ancy & Nampy
	Ref: Nampy & Joby (2008)	Ref: Nampy & Joby (2008)	Ref: Nampy et al. (2012)
Habitat	Soil pockets of Rocks	Lateritic plateau	Soil pockets of rocks
Base	Bulbous	Not Bulbous	Not Bulbous
Flowering time	Afternoon (2.45 p.m. – 5 p.m.)	Forenoon (10 a.m. – 12.30 p.m.)	Forenoon (10 a.m. – 12.30 p.m.)
Petals	Obovate, horizontal to reclined, apex acuminate	Obovate, horizontal to reclined, apex acuminate	Orbicular, nearly incurved, apex subacute
Stamens	Asymmetrically oriented, leaning outwards	Asymmetrically oriented, leaning outwards	Symmetrically oriented, curving inwards
Style	Leans away from the centre	Leans away from the centre	Erect and central in the flower
Capsule	Ovoid; 1.5 × 2 mm	Ellipsoid to narrowly ellipsoid; 2.5 – 3 × 1–1.1 mm	Ovoid; 1 – 2 × 0.8 – 1.6 mm
Seeds	< 0.5 mm in diameter	6 – 8 per locule, biseriate, < 0.5 mm in diameter	2 or 3 per locule, uniseriate, > 0.6 mm in diameter

Testa	Bark brown; covered with farinose granules forming striations	Pale brown; covered with farinose granules forming minute striations	Dark brown to black; covered with fused farinose granules forming faint irregular reticulations
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Ancy and Nampy (2014) also provided detailed capsule and seed characters of both three species as following:

**Murdannia sahyadrica** Ancy & Nampy

Capsule widely ovate, 1–2 × 0.8–1.6 mm, glabrous, brown, trilocular. Seeds uniseriate, 2 or 3 per locule, rounded to elliptic, 0.6–1 × 0.5–0.8 mm; testa smooth with white flaky material fused forming faint, irregular reticulations; hilum dotted to elliptic; embryotega dorsal.

**Murdannia semiteres** (Dalzell) Santapau

Capsule globose-ovate, 2–2.5 × 2 mm. Seeds 6–8 per locule, biseriata, ovate to rectangular, 0.5–0.6 mm; testa smooth with minute striations; hilum dotted; embryotega dorsal.

**Murdannia juncooides** (Wight) R.S. Rao & Kammathy

Capsule globose-ovate, 1.5–2 × 2 mm. Seeds 8 per locule, biseriata, ovate-rectangular, 0.5–0.55 × 0.6 mm; testa smooth, striate, white farinose material; hilum elliptic; embryotega dorsal.

**However,**

1. Observation on flowering time indicated that, experimentally cultivated *M.juncooides* specimens in Kerala flowered between 10.30 A.M. and 12.30 P.M. The flowering time of *Murdannia* primarily depends on atmospheric humidity and temperature (micro-climate) and in *M.juncooides* it moves the needle further towards the forenoon flowering pattern of *M. semiteres* and *M.sahyadrica*. It breaks the natural barrier when introduced to other locations, and adapted to flower in the new environments. Moreover, it never forms a bulbous stock during the experimental cultivation. The bulbous base of *M.juncooides* is an adaptation to the climate of Courtallam i.e. high atmospheric humidity in the morning and occurrence of limited rainfall. This species, found naturally in rocky crevices, is adapted to store maximum available water from the surroundings where rocky substratum forms major landform.
2. The petal characters are also intergrading and there is no significance in obovate – orbicular shape and acute – sub acute – acuminate apex. Geological and environmental factors can affect the size and shape of the flower in species level as a temporal phenomenon.
3. Symmetric arrangement of stamens and staminodes in *M. sahyadrica* requires careful attention. Most of the plants have incurved stamen in their budding stage and if dissected prematurely or forced to flower in laboratory condition, incurved stamens may be observed. Nampy et al. (2012), probably dissected a flower bud and came to a conclusion of the presence of incurved stamens.
4. All the *Murdannia* species so far identified have enantiostyly (style leans away from the stamens) and at least some slight bending of style except in *M.sahyadrica*. The type illustration of the *M.sahyadrica* capsule has some bending of persistent style. Most of the *Murdannia* capsules possess a small beak (remnant of style), which are found mainly in the mature dried capsules as curved. If it is curved, probably it has enantiostyly in floral stage.
5. Seeds of these three species have smooth testa with white farinose/flaky material and minute striations/reticulations. The nature of hilum and embryotega is also analogous. The micromorphological differences are not convincing and are undesirable for species segregation.
6. Biseriate seed arrangement is noticed in *M. semeteris*

and *M. juncooides* and uniseriate in *M.sahyadrica*; and the number varies 6–8, 8 and 2 or 3 per locule respectively. The seed sizes of all three species are intergrading with the largest in *M.sahyadrica* (0.6– 1 × 0.5 – 0.8 mm). The uniseriate condition is considered as an abnormal character where the size and shape of capsule is almost the same. If it is uniseriate, the seed size should be twice larger than *M. semeteris* and *M. juncooides*.

The similarities are credible to merge them in to the earliest valid name *Murdannia semiteres* (Dalzell) Santapau.

**II. Murdannia satheeshiana-pauciflora-versicolor-lanuginosa-crocea subsp. ochracea group**

*Murdannia crocea* (Griffith) Faden subsp. *ochracea* (Dalzell) Faden, *M. lanuginosa* (Wallich ex C.B. Clarke) G. Brückner, *M. versicolor* (Dalzell) G. Brückner, *M. pauciflora* (Wight) G. Brückner and recently published *M. satheeshiana* Joby, Nisha & Unni (Joby et al., 2011) are found to be evidently distinct from each other. But Ancy and Nampy (2014) treated *M. satheeshiana* as conspecific to *M. versicolor* without appropriate judgment. The major justification for this treatment as per Ancy (2013) is that the habit *M. satheeshiana* is within the range of *M. versicolor*. However, *M. satheeshiana* can be distinguished by the following key:

1. Seeds unise ate..... 2  
- Seeds biseriata..... 4
2. Flowers 2 cm diameter, bluish in withering, stamin des white, leaves oblong-lanceolate, acuminate, seeds 5– 7 per locule..... *M. versicolor*  
- Flowers 0.5–1.2 cm diameter, not bluish in withering, staminodes yellow, leaves ovate acute, seeds 2–4 per locule ..... 3
3. Seeds scrobiculate, ascending-creeping herb, up to 60cm long, flowers 1.0–1.2 cm diameter, fruiting pedicel 1.5–1.7 cm long, strongly curved–bent, capsule 0.6–0.7 × 0.2 cm.....  
.....*M. pauciflora*  
- Seeds rugose, with ridges and furrows, erect-ascending herb, up to 10 cm long/tall, flowers 0.5–0.6 cm diameter, fruiting pedicel 0.7–1.0 cm long, erect–slightly bent, capsule 0.3–0.4 × 0.2 cm....*M. satheeshiana*
4. Root tuberous, plants found in grasslands, leaves linear lanceolate, flowers 2.0 cm diameter, embryotega lateral.....  
.....*M. lanuginosa*  
- Root fibrous, plants found in marshes, leaves ovate, flowers 1 cm diameter, embryotega semi dorsal.....  
..... *M. crocea* subsp. *ochracea*

The capsule and seed morphology of *M. versicolor* (Dalzell) G. Brückner and *M. satheeshiana* Joby, Nisha & Unni are given in Table 2.

**Table - 2. Comparison of taxonomic features of Murdannia versicolor and M. satheeshiana.**

Taxonomic Features	<i>Murdannia versicolor</i> (Dalzell) G. Brückner	<i>Murdannia satheeshiana</i> Joby, Nisha & Unni
	Ref: Ancy and Nampy (2014)	Ref: Joby et al., (2011)
Capsule	Capsule oblong to elliptic, 4–6 × 1–2 mm.	Capsule 0.30–0.40 × 0.15–0.20 cm, ovate-oblong, trivalvate, glabrous, green.

Seed	Seeds 5 or 6 per locule, uniseriate, elliptic to ovate, 0.8–1.2 × 0.9–1 mm.	Seeds uniseriate, 2–3 per locule, $\geq 0.1 \times 0.1$ cm, rectangular in ventral view, cylindrical to heart shaped in apical view.
Testa	Testa smooth, with flattish raised warts or ridges and furrows, finely granular.	Testa greyish brown, rugose, with ridges and furrows, white farinose granules in the furrows, small ventral pit near the hilum, filled with white flakey material and farinose granules, apex rounded in basal and apical seeds, cupulate in the middle seeds.

Hilum and embryo-tega	Hilum ovate; embryo-tega semi-dorsal.	Hilum ovate-elliptic, embryo-tega lateral.
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Evidences from distribution and floral senescence also suggest strong divergence between the species.

1. The global distribution of *M. versicolor* is mainly in the tropics, starting from India to Philippines. However, the distribution data from Ancy (2014) indicated that the species is confined to the Northern Western Ghats. The author has no collection of *M. versicolor* from Kerala region. The collection of *R. Ansari 73993* (MH) from the Payyannur, Kannur Dist., Kerala is probably *M. crocea* subsp. *ochracea* and collection of *Wight 1180* (CAL) from Quilon, Kerala is wrongly attributed to *M. versicolor* by Ancy (2014), even though C.B. Clarke designated it as *Dichospermum repans* Wight. Ancy (2014) also cited the same specimen from K under the type of *M. versicolor*. There is no rationale for citing *Wight 1180* under both *M. versicolor* and *M. crocea* subsp. *ochracea*. While considering the collection of *Wight 1180* is accurate under *M. crocea* subsp. *ochracea* and since there is no further distributional record so far from Kerala, the distribution of *M. versicolor* is emphatically confined to the Northern Western Ghats. It seems that there is no specialised and evolved seed distributional mechanism for *M. versicolor* to reach the

shola-grassland in Mathikettanshola National Park of Idukki district from the Northern Western Ghats.

2. Hooker (1894) observed that flowers of *M. versicolor* changes to bluish in withering. *In lieu* of bluish withering in *M. versicolor*, *M. satheeshiana* petals have brownish yellow colour during and after withering.

Since vegetative and reproductive characters are distinct from *M. versicolor*; *M. satheeshiana* Joby, Nisha & Unni could be segregated as a separate species. Although Ancy and Nampy (2014) have not validly published *M. satheeshiana* Joby, Nisha & Unni as a synonym of *Murdannia versicolor* (Dalzell) G. Brückner; their conspecific treatment is disagreeable.

*Murdannia* is an actively evolving genus in the family Commelinaceae. However recent species bursts in the genus require heedful study. The present review is only a part of the nomenclature problems associated with this genus. Strong evidences from molecular and micro-morphology are also required for resolving nomenclature uncertainty. The discipline of taxonomy is not static and it always undergoes revision and modification. There is no role of opinion in science without valid evidence and reasoning. Taxonomists should be brave enough to justify their reasons instead of treating species as conspecific for embarrassing the contributions of other authors.

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#### REFERENCE

- Ancy A. A. & Santhosh Nampy (2014) Taxonomic significance of capsule and seed characters of Indian species of *Murdannia* Royle (Commelinaceae). *Phytotaxa* 178 (1): 001–022 | Ancy, A.A. (2014) Taxonomic revision of the genus *Murdannia* Royle (Commelinaceae) in India. Ph.D. thesis (Mahatma Gandhi University, Kottayam). | Anilkumar, N. & Sivadasan, M. (2005) Flora of Pathanamthitta district, Western Ghats, India. Daya Publishing House, New Delhi, 640 pp. | Archive.org (2012) <http://www.archive.org/details/India>. Accessed during June 2015. | Beddome, R.H. (1868–1874) *Icones Plantarum Indiae Orientalis*. Grantz Brothers, Madras, 70 pp. | Biodiversity Heritage Library (2012) <http://www.biodiversitylibrary.org/Default.aspx>. Accessed during June 2015. | Botanicus.org (2012) <http://www.botanicus.org/>. Missouri Botanical Garden Library. Accessed during June 2015. | Bourdillon, T.F. (1908) *The forest trees of Travancore*. Government Press, Thiruvananthapuram, 456 pp. | Cooke, T. (1903) *Flora of the Presidency of Bombay 1*. Taylor & Francis, London, 645 pp. | Cooke, T. (1908) *Flora of the Presidency of Bombay 2*. Taylor & Francis, London, 1083 pp. | Drury, H. (1864) *Handbook of the Indian Flora: being a guide to all the flowering plants hitherto described as indigenous to the continent India 1*. Travancore Sircar Press, Trivandrum, 659 pp. | Drury, H. (1866) *Handbook of the Indian Flora: being a guide to all the flowering plants hitherto described as indigenous to the continent India 2*. Travancore Sircar Press, Trivandrum, 604 pp. | Drury, H. (1869) *Handbook of the Indian Flora: being a guide to all the flowering plants hitherto described as indigenous to the continent India 3*. Richardson & Co., London, 708 pp. | Faden, R.B. (2000) *Commelinaceae*. In: Dassanayake, M.D. & Clayton, W. (Eds.) *A revised handbook to the flora of Ceylon*. Oxford & IBH Publishing, New Delhi. | Fischer, C.E.C. (1921) *A survey on the flora of Anamalai Hills in the Coimbatore district, Madras Presidency*. Records of Botanical Survey of India 9: 1–218. | Fyson, P.F. (1932) *The flora of the South Indian Hill stations: Ootakamund, Coonoor, Kotagiri, Kodaikanal, Yerkaud and the country round 1*. Government Press, Madras, 697 pp. | Gamble, J.S. & Fischer, C.E.C. (1915–1936) *The flora of the Presidency of Madras 1–3*. Adlard & Son Ltd., London, 2017 pp. | Hooker, J. D. (1872–1897) *The Flora of British India 1–7*. L. Reeve & Co., London, 5505 pp. | Joby, P., Nisha, P., Rameshan, M., Toms Augustine, Rogimon, P.T. & Shankaran Unni, K. (2011) *Murdannia satheeshiana*—a new species of Commelinaceae from Western Ghats, India. *Phytotaxa* 22: 41–46. | Karthikeyan, S., Jain, S.K., Nayyar, M.P. & Sanjappa, M. (1989) *Flora Indicae enumeration: monocotyledonae*. Botanical Survey of India, Calcutta. | Lawson, M.A. (1894) *Notes of a tour in Travancore etc*. Records of Botanical Survey of India 1: 58–60. | Manilal, K.S. & Raveendrakumar, K. (1998) *Additions to the flora of Kerala since Gamble (1935)*. *Rheedeia* 8(2): 179–241. | Manilal, K.S. & Sivarajan, V.V. (1882) *Flora of Calicut*. Bishen Singh Mahendrapal Singh, Dehradun, 387 pp. | Manilal, K.S. (1988) *Flora of Silent Valley Tropical rain forests of India*. Calicut University, Calicut, 398 pp. | Matthew, K.M. (1981–1983) *The flora of Tamilnadu Carnatic 1–3*. Rapinath Herbarium, Thiruchirappalli, 2154 pp. | Matthew, K.M. (1982) *Illustrations on the flora of Tamilnadu Carnatic*. Rapinath Herbarium, Thiruchirappalli, 979 pp. | Matthew, K.M. (1988) *Further illustrations on the flora of Tamilnadu Carnatic*. Rapinath Herbarium, Thiruchirappalli, 915 pp. | Matthew, K.M. (1999) *The flora of Palni Hills, South India 1–3*. Rapinath Herbarium, Thiruchirappalli, 1880 pp. | Mohanan, M. & Sivadasan, M. (2002) *Flora of Agasthyamala*. Bishen Singh Mahendrapal Singh, Dehradun, 890 pp. | Mohanan, M. & Henry, A.N. (1994) *Flora of Thiruvananthapuram*. Botanical Survey of India, Calcutta, 621 pp. | Nampy S., & Joby, P. (2008) *On the identity of Murdannia juncoides* (Wight) R.S. Rao & Kammathy (Commelinaceae). *Rheedeia* 18: 57–60. | Rama Rao, M. (1914) *The flowering plants of Travancore*. Government Press, Trivandrum, 495 pp. | Ramachandran, V.S. & Nair, V.J. (1988) *Flora of Cannanore district*. Botanical Survey of India, Calcutta, 599 pp. | Rheede, H.A. van (1678–1703) *Hortus Indicus Malabaricus: continens regni Malabarici apud Indos cereberri omnis generis plantas rariores, Latinas, Malabaricas, Arabicis, Brachmanum caracterebus hominibusque expressas 1–12*. Sumptibus Joannis van Someren & Joannis van Dyck, Amstelaedami, 114 pp. | Sasidharan, N. & Sivarajan, V.V. (1996) *Flowering plants of Thrissur forests*. Scientific Publishers. Jodhpur, 578 pp. | Sasidharan, N. (1997) *Studies on the flora of Shenduruni Wildlife Sanctuary with emphasis on endemic species*. Research report No. 128. Kerala Forest Research Institute, Peechi, 401 pp. | Sasidharan, N. (1999) *Studies on the flora of Chinnar Wildlife Sanctuary*. Research report No. 167. Kerala Forest Research Institute, Peechi, 365 pp. | Sasidharan, N. (2002) *Floristic studies in Parambikulam Wildlife Sanctuary*. Research report No. 246. Kerala Forest Research Institute, Peechi, 408 pp. | Sasidharan, N. (2004) *Biodiversity Documentation for Kerala Part 6: Flowering Plants*. KFRI Handbook 17, Kerala Forest Research Institute, Peechi, 702 pp. | Sivarajain V.V. & Philip Mathew (1997) *Flora of Nilambur (Western Ghats, Kerala)*. Bishen Singh Mahendra Pal Singh. Dehradun, 900 pp. | Sreekumar, P.V. & Nair, Velukutty Jayachandran (1991) *Flora of Kerala—Grasses*. Botanical Survey of India, Calcutta, 470 pp. | Subramanyan, K.N. (1995) *Flora of Thecnala division*. International Book Distributors, Dehradun, 516 pp. | Sunil, C.N. & Sivadasan, M. (2010) *Flora of Alappuzha District, Kerala, India*. Bishen Singh Mahendra Pal Singh, Dehra Dun, 949 pp. | Vajravelu, E. (1990) *Flora of Palghat district*. Botanical Survey of India, Calcutta, 646 pp. | Wight, R. & Amott, G.A. Walker (1834) *Prodromus Florae Peninsulae Indiae Orientalis 1*. Parbury, Allen & Co., London, 480 pp. | Wight, R. (1838–1853) *Icones Plantarum Indiae Orientalis or Figures of Indian plants 1–6*. Messrs. Franck & Co., Madras, 2101 pp. |