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TAXONOMIC IDENTITY OF *THERIOPHONUM DANIELII* AND *T. MANICKAMII* (ARACEAE)

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Abstract

The genus *Theriophonum* (Araceae), represented by seasonally dormant tuberous perennials is endemic to India and Sri Lanka. Critical taxonomic appraisal of the constituent species supports existence of only five species, viz. *T. dalzellii*, *T. fischeri*, *T. infaustum*, *T. minutum* and *T. sivaganganum*, and all are with restricted distribution in India. *Theriophonum minutum* is the only species with extended distribution in Sri Lanka. The recently described *T. danielii* and *T. manickamii* are considered here as conspecific with *T. infaustum* and *T. fischeri*, respectively.

Introduction

The genus *Theriophonum* Blume (1837) belonging to the subfamily Aroideae of Araceae comprises seasonally dormant tuberous perennials endemic to India and Sri Lanka. In India, the genus is represented by five species confined to the south and central parts, while there is only one species in Sri Lanka (Sivadasan and Nicolson, 1982). In the revision of the genus, Sivadasan and Nicolson (1982) provided a detailed account of the taxonomic history and stated that misidentifications have been frequent and mainly centered around Rheede's (1692) illustration of *Nelenschena minor* and the type of *Arum minutum* Willd. (1805) [=*Theriophonum minutum* (Willd.) Baill. (1895)]. Rheede's *Nir-tsjembu* (1692: 11: 33, t. 16) and *Nelenschena minor* (1692: 11: 33, t. 17) represent the first Pre-Linnean printed records of *Theriophonum*; both are identified as *T. infaustum* N. E. Br. (1880) (Sivadasan and Nicolson, 1982; Suresh *et al.*, 1983). The works of Schott (1860) and Engler (1879, 1920) are significant in recognition and delimitation of the species described until then. Engler (1920) recognized five species, which on scrutiny, were found to represent only three, viz. *T. dalzellii* Schott (1855), *T. infaustum* and *T. minutum*. After forty nine years, a fourth species, *T. sivaganganum* (Ramam. & Sebastine) Bogner (1969), was added to the genus by Bogner by transfer of *Pauella sivagangana* Ramamurthy & Sebastine (1967). Then *T. fischeri* Sivad. (Sivadasan and Nicolson, 1981) was added about 61 years after Engler's revision. Sivadasan and Nicolson (1982) recognized five species, viz. *T. dalzellii*, *T. fischeri*, *T. infaustum*, *T. minutum* and *T. sivaganganum* in their revision. Since then two more species, viz. *T. manickamii* Murugan & K. Natarajan (2008) and *T. danielii* Rajakumar *et al*. (2010) have been described. While reviewing the checklist of species of *Theriophonum*, the protologues of the above two species were studied which aroused suspicion as to their identity prompting reappraisal of the pertinent specimens, including types and protologues. The study revealed misidentifications.

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Identity of *Theriophonum danielii* Rajakumar, Selvakumari., S. Murugesan & Chellaperumal (2010)

Rajakumar *et al.* (2010) described *Theriophonum danielii* based on specimens collected near Tisayanvillai, Tirunelveli district, Tamil Nadu, India. The publication of the new species was based on improper comparison of their specimens with *T. infaustum.* Critical examination of the morphological characters (Table 1 of the protologue reproduced here as Table 1, below) revealed that the tuber size, petiole length, lamina shape, spathe length and spadix length of the two species overlap, indicating clear range of variation in size and shape; and characters of the new species fell within the range of variation of *T. infaustum*. The size of neuter flowers of *T. danielii* as recorded by Rajakumar *et al*. (2010) represented that of a large specimen. The drawing of habit in Figure 1 of the protologue has an erroneous presentation of the leaves. Three petioles were clearly shown attached to the tuber, but the four leaf-laminae were shown above as if one petiole bifurcated producing an additional lamina. The shape of lamina was recorded as 'ovate' in contradiction to the shape of the majority of the leaves. The 'black dots' reported on staminate flowers and specified as a distinguishing character possibly might have been overlooked in *T. infaustum* by Brown (1880), being a trivial character and not clearly discernible in dried specimens.

Table 1. Characters of *Theriophonum danielii* and *T. infaustum* (Reproduced from the protologue of *T. danielii*).

Characters	*T. infaustum*	*T. danielii*
Tuber ('Corm') size	0.5-2.0 x 1-2 cm	1.5-2.0 x 1.0 cm
Petiole length	5.0-12.5 cm	4-17 cm
Leaf shape	hastate-sagittate	Ovate
Spathe length	2.0-5.5 cm	3.5-4.5 cm
Spadix length	4.0-4.5 cm	3.0-3.5 cm
Neuter	3.0-3.5 mm	6 mm
Staminate flowers	black dots absent	black dotted

A photograph (Cibachrome) of the type of *T. infaustum* (Fig. 1A) at Kew is with three specimens mounted on a single sheet clearly revealed variation in shape and size of leaves. Rheede (1692) provided illustrations of *Nir-tsjembu* and *Nelenschena minor* (Fig. 1B) which actually represented *T. infaustum* and the extreme variation in size of the two might have been the reason for describing them as distinct elements under separate names.

One of the authors (VAJ) visited MH and the herbarium of St. John's College [JCH, not in Index Herbariorum (http://sciweb.nybg.org/science2/IndexHerbariorum.asp), Palayamkottai, Tamil Nadu] in order to study the types of *T. danielii* which were reported to have been deposited in these institutions. But the types were not available in both the herbaria. Intensive search at JCH helped to locate a few un-mounted specimens bearing the same collection number (*1110*) as that of the holotype, but without designation as type. These specimens were studied in detail and identified as *T. infaustum.* Photograph of one of the specimens, presumably an isotype, is presented in Fig. 1C, and the similarity in nature and stature of the specimen tempt to assume it to be the specimen based on which the Fig. 1A of the protologue was prepared.

Based on all the above observations and study, *T. infaustum* and *T. danielii* are considered as conspecific. As per Articles 11.1 and 11.4 of ICN (McNeill *et al.,* 2012), the correct name for the taxon is *T. infaustum* and *T. danielii* is reduced to synonymy. Accordingly, we have:

Theriophonum infaustum N. E. Br., J. Linn. Soc., Bot. 18: 260 (1880) [‘1881’, publ. 1880].

Type: India, Kerala (‘Malabar’), Paulghautcherry [Palghat?], *Wight 2775* (*Holotype*: K!).

T. danielii Rajakumar, Selvak., S. Murug. & Chellap., Indian J. Forest. 33(3): 447 (2010), pro syn.

Type: ‘India, Southern India, Tamil Nadu, Tirunelveli district, *Rajakumar, Selvakumari, Murugesan & Chellaperumal 1110* (*Holotype*: JCH, *Isotypes*: MH, JCH)’ (extracted from protologue).

Identity of *Theriophonum manickamii* Murugan & K. Natarajan (2008)

Murugan and Natarajan (2008) described *Theriophonum manickamii* based on specimens collected from Playamkottai taluk in Tirunelveli district, Tamil Nadu. While describing the species, they compared its characters with those of *T. sivaganganum*, a distant species. Sivadasan and Nicolson (1982) provided illustrations of spadices of *T. sivaganganum* and *T. fischeri* (Fig. 2A & 2B, respectively of their article), and illustration of spadix of *T. manickamii* is reminiscent of that of the latter species. A comparison of characters of spadices depicted by Sivadasan and Nicolson in Fig. 2B of their article with that provided by Murugan and Natarajan in Fig. 1B of the protologue revealed similarities between the two and brought out the erroneous conclusion on identity of the Tirunelveli specimens as belonging to a new species.

Sivadasan and Nicolson (1981) described *Theriophonum fischeri* as a new species solely based on herbarium specimens available at CAL, FRC and K. Owing to the non-availability of live specimens, details on variations and extent of variation in shape and size of juvenile and adult leaves were not recorded. Shape of juvenile leaves varied from linear-lanceolate to ovate-lanceolate, and that of mature leaves from narrowly hastate-sagittate to hastate-sagittate. The mature leaves of *T. manickamii* were described as narrowly-sagittate whereas in Tables 1 and 2 of the protologue, their shape was mentioned as ‘narrowly hastate’ which is same as that of *T. fischeri*. The characters of *T. fischeri* and *T. manickamii* given in Table 2 of the protologue of the latter are reproduced in Table 2 below, to show their general resemblance. Relatively bigger size of spathe and spadix of *T. fischeri* was due to the bigger size of the specimens studied, and in its protologue the range of size was not given; instead maximum sizes were given within which fall the sizes of spathe and spadix of *T. manickamii*. In both the species, the pistillate flowers were in 1-2 series. The number of ovules was almost the same. The shape and texture of stigma, and shape of filaments described in the protologue of *T. fischeri* were based on dried specimens and hence slight difference from that of the live specimens are possible. The relative positions of neuters and appendix were similar in both the species.

Discrepancies in Figure 1 of the protologue

It is also to be pointed out that some of the illustrations in Fig. 1 of the protologue of *T. manickamii* were erroneous. The picture D of Fig. 1 representing longitudinal section of basal portion of spadix contained longitudinal sections of pistillate flowers on either side of spadix-axis, and ovules were shown as attached to roof of locule of ovary, thereby showing only apical placentation. The pictures F and G of Fig. 1 showed longitudinal section of pistillate flower and cross section of ovary, respectively. In Fig. 1F, three ovules were shown as pendent with apical placentation. In Fig. 1G, cross sections of three ovules were shown thereby representing the same pistillate flower with only three pendent ovules. One of the diagnostic characters of *Theriophonum* distinguishing from its closely related genus *Typhonium* Schott (1829) is having basal and apical placentation. But the drawings provided in the protologue by Murugan and Natarajan (2008) depicted only apical placentation.

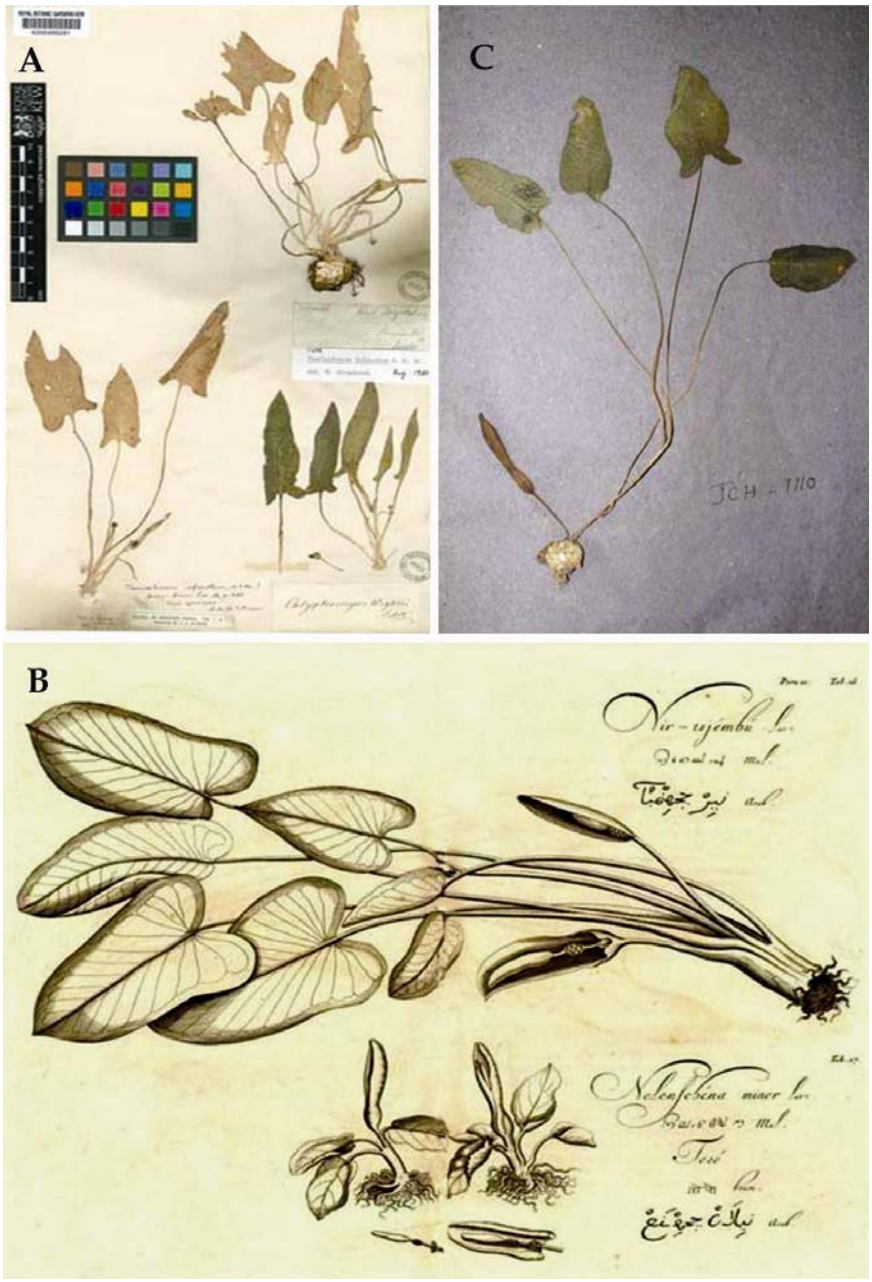

Fig. 1. A. Photograph (Cibachrome) of type of *Theriophonum infaustum* N. E. Br. at K. (© The Board of Trustees of the Royal Botanic Gardens, Kew; reproduced with consent); B. Photo of the double-page plate from Rheede's *Hortus Indicus Malabaricus* with illustrations of *Nir-tsjembu* and *Nelenschena minor* under Tab. 16 and Tab. 17 respectively. (Downloaded from Digital Library of The Real Jardín Botánico-CSIC, via Open access facility strictly following the conditions of Copyright notice); C. A specimen available at the herbarium ('JCH') of St. John's College, Palayamkottai, Tirunelveli with same number of holotype of '*Theriopnonnum danielii*'.

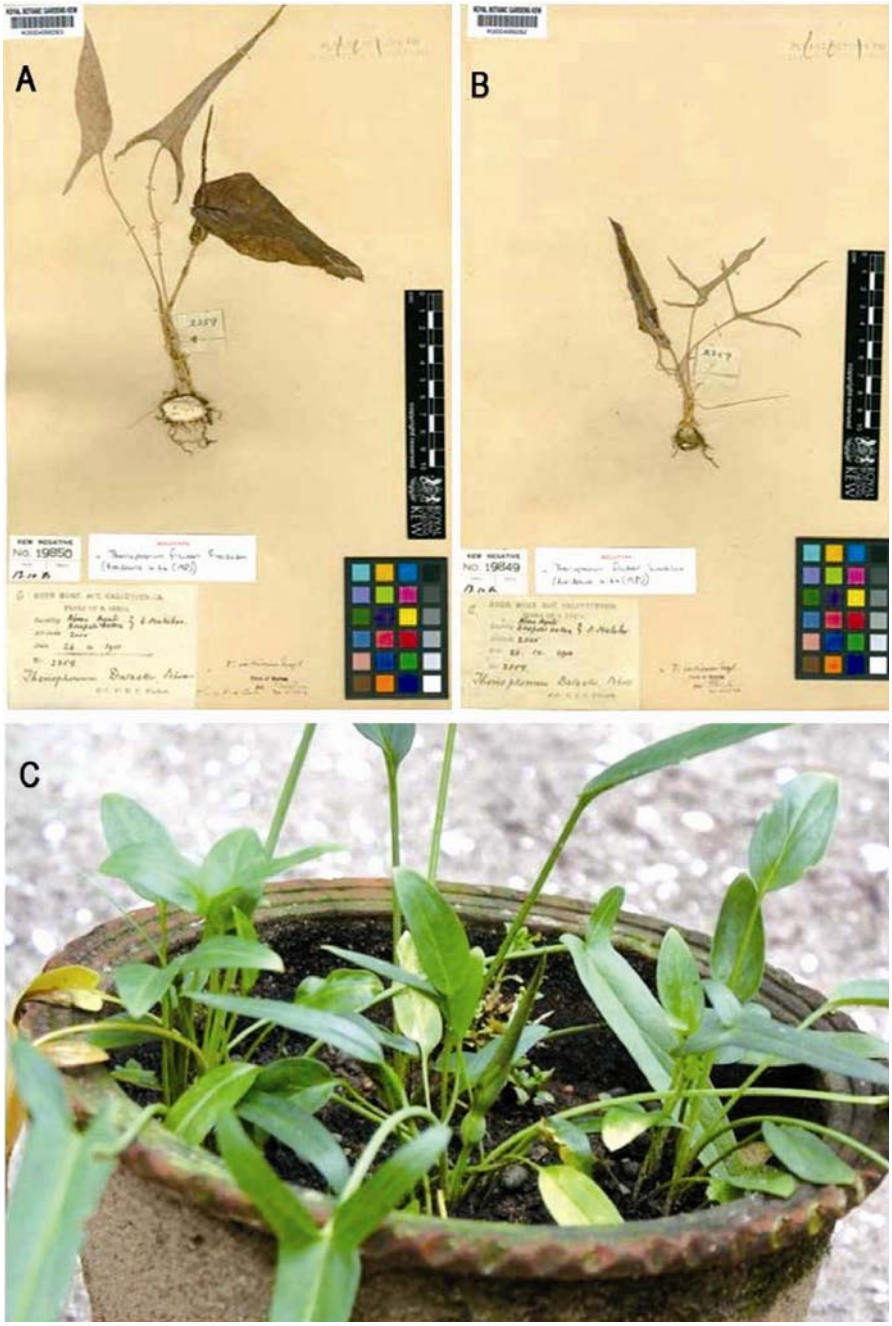

Fig. 2. *Theriophonum fischeri* Sivad. A. Photograph (Cibachrome) of holotype at K. (© The Board of Trustees of the Royal Botanic Gardens, Kew; reproduced with consent); B. Photograph (Cibachrome) of isotype (but labeled as holotype) at K. (© The Board of Trustees of the Royal Botanic Gardens, Kew; reproduced with consent); C. Plants under cultivation displaying variation in shape and size of leaves (Photo: C. N. Sunil).

One of the authors (VAJ) visited MH and XCH to study the types reported to have deposited there; but types were not available in either MH or in XCH and he was informed by the authorities that the types have not yet been deposited there, and assured to contact the authors in this regard. Photographs (Cibachrome) of holotype and isotype of *T. fischeri* (Holotype - *Fischer 2359*, Kew Negative No. 19850; Isotype - *Fischer 2359*, Kew Negative No. 19849 – but labeled as 'Holotype') obtained from K are presented below as Fig. 2A and Fig. 2B respectively to show variation in shape and size of leaves of the two specimens and to have an idea about the range of variation of mature leaves. Recently, Dr. C. N. Sunil, Department of Botany, S.N.M. College, Maliankara, Ernakulam, Kerala State collected specimens of *T. fischeri* from Ottappalam in Palakkad district, Kerala and is growing them in pots in the Botanic Garden of the College. A photograph of the plants (Fig. 2C) showed variation in shape and size of leaves.

Table 2. Characters of *T. fischeri* and *T. manickamii* (Rreproduced from the protologue of *T. manickamii*).

Characters	*T. fischeri*	*T. manickamii*
Leaves		
Juvenile	ovate-lanceolate	linear-lanceolate
Mature	hastate-sagittate	narrowly hastate-sagittate
Spathe	up to 12 cm long	5-6 cm long
Spadix	c. 9.5 cm long	4.5 cm long
Pistillate flowers	1-2-seriate	1-2-seriate
Ovules	4-5	3-6
Stigma	Discoid, smooth	Hemispherical, obscurely spinulose
Neuters	Adjacent to pistillate flowers and separated from staminate flowers	Adjacent to pistillate flowers and separated from staminate flowers
Filaments	Not beaked at apex	Obscurely beaked at apex
Appendix	Adjacent to staminate flowers	Adjacent to staminate flowers

Based on all the above evidences, it is concluded that the recognition of *T. manickamii* as a new species by comparing characters of the specimens with that of *T. sivaganganum*, a very distant and dissimilar species rather than with *T. fischeri* has lead to the misidentification. *Theriophonum fischeri* has already been reported earlier from various localities in Tamil Nadu (Sivadasan and Nicolson, 1983; Daniel *et al.*, 1988; Kottaimuthu and Kumuthakavalli, 2011) including Tirunelveli district which is the type locality of *T. manickamii*. Therefore, *Theriophonum manickamii* is considered as conspecific to *T. fischeri*:

Theriophonum fischeri Sivad. in Sivadasan & Nicolson, Aroideana 4(2): 64 (1981).

Type: India, Kerala, Palghat district, Attappadi valley above Agali, 2000 ft.[600 m], *Fischer 2359* (*Holotype*: K!, *Isotypes*: CAL!, FRC!).

T. manickamii Murugan & K. Natarajan, J. Econ. Taxon. Bot. 32(3): 618 (2008), pro syn.

Type: 'India, Tamil Nadu, Tirunelveli district, Palayamkottai Taluk, on the way to Sasthakoil from Sivanthipatti village, 25.12. 2001. *Murugan 21277* (*Holotype*: MH, *Isotype*: XCH)' (extracted from protologue).

Conclusion

Sivadasan and Nicolson (1982) recognized five species, *viz. Theriophonum dalzellii*, *T. fischeri*, *T. infaustum*, *T. minutum* and *T. sivaganganum* in their revision of the genus, and the number of species hold good even today since the two recently described species, viz. *T. danielii* and *T. manickamii* are unequivocally recognized as conspecific with *T. infaustum* and *T. fischeri*, respectively in the present taxonomic appraisal.

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