Two new taxa of *Piper* (Piperaceae) from Kerala, India with a note on their origin and inter-relationships[1]

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ABSTRACT

Two new taxa of *Piper*, *P. sugandhi* and *P. sugandhi* var. *brevipilis* are described from Sugandhagiri project area of Western Ghats in South India. They are related to *Piper nigrum*, *P. galeatum* and *P. trichostachyon*. Morphological and ecological evidences point to their origin through hybridisation involving these three species. Their inter-relationships are discussed.

Key words : new taxa, *Piper sugandhi*, *P. sugandhi* var. *brevipilis*.

The genus *Piper* has been reported to have 13 species in the Western Ghats (Gamble 1925) and is economical very important as it yields the black pepper of commerce, the most widely used spice in the world, and also the betel leaf, an important masticatory used in Asia. In any effort to improve these crops, the wild species of the genus are of great importance as source of useful genes. Unfortunately there has not been a concerted effort for a comprehensive revision of the genus *Piper* occuring in peninsular India. The treatments of Hooker (1886) and Gamble (1925) are outdated and inadequate and several new taxa have been discovered and described in the recent past (Ravindran 1990; Ravindran, Nair & Nair 1987; Ravindran *et al.* 1990; Babu *et al.* 1992) from this Research Centre as part of a revisionary work on South Indian taxa of *Piper*.

During the course of our explorations in the Western Ghats, the native home and centre of diversity for black pepper *(P. nigrum* L.), we discovered two interesting taxa, co-existing with other species of the genus, in the tropical evergreen forests in the Sugandhagiri project area at Vythiri, Wynad, Kerala (Anonymous 1990). On detailed studies, they were found to be quite distinct from all known taxa of *Piper* and hence are described here as new. The specific epithet *sugandhi* is after the type locality, Sugandhagiri. These taxa assume great importance as they provide some indications to their probable origin, which in

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turn could shed more light on the origin and evolution of South Indian species of *Piper* in general and black pepper in particular.

Piper sugandhi Ravindran, Babu *et* Naik sp.nova.

Piper nigre L. *et P. galeate* affine; sed differt bracteis, *P. trichostachyeni* affine, sed facile distinguenda floribus stipitatis bractearum fermisque.

Allied to *P. nigrum* L. (black pepper) but differs from it in having stipitate flowers and deeply cupular bract. Allied to *P. gaelatum* (Miq.) C. Dc., but differs from it in the nature of bracts and in having pungent fruits as in black pepper. Also allied to *P. trichostachyon* (Miq.) C.Dc., but differs from it in having stipitate flowers, nature of bract and in having pungent fruits.

Type: India, Western Ghats, Kerala, Wynad District, Vythiri, Sugandhagiri project area. Ravindran , Babu and Naik 637 (♂) and 686 (♀). Holotype in herbarium of NRCS Calicut; live specimen in germplasm conservatory of NRCS.

A stout woody climber, dioecious and perennial, reaching to a height of 10 m or more; branches terete, swollen at the nodes, glabrous,orthotropic shoot tips purple; leaves alternate, glabrous, coriaceous,ovate to ovate-lanceolate, accuminate, base round to actue and often oblique, margins slightly wavy, more prominent in young leaves; 7-13 cm long and 3-8 cm broad in male vines; 10-18 cm long and 4-11 cm broad in the female, prominently 5-7 ribbed, more conspicuous on the lower side, the basal pair of ribs sub-opposite, others alternate. Petiole about 2 cm, grooved, margins modified as sheaths, sheaths caducous.

Male spikes slender, fleshy filiform and pendant or recurved 10-14 cm long; female spikes slightly thicker than male spikes, 5-10 cm long. Flowers held at right angles to the rachis, stipitate, bracteate, bracts deeply cupular with free margins, stamens 2, filaments short and thick, embedded in the cupular bract, anthers projecting out at maturity; dithecous, dehiscing by apical longitudinal slits. Ovary ovoid, monocarpellary, embedded inside the cupular bract except for the tip; style 0, stigma 3-lobed, fleshy, white when young (Fig. 1).

Fruits oblong, bold, 0.8-1.0 cm diam., pungent as in black pepper, turns yellow and then to red on ripening. Flowering April-May, fruit maturity December-January.

Piper sugandhi var. *brevipilis* Ravindran, Babu *et* Naik var. nova.

Piper sugandhi simile sed different bractices minute pubescentibus.

Very similar to *P. sugandhi* described above but differs from it in having pubescent bracts (Fig.2).

Type : India, Western Ghats, Kerala, Wynad district , Vythiri, Sugandhagiri project area. Ravindran, Babu and Naik 678 (♂) and 680 (♀). Holotype in herbarium of NRCS Calicut;live specimen in NRCS germplasm conservatory.

A study on the morphology of the new taxa showed that they are related to *Piper nigrum*, *P. trichostachyon* and *galeatum*. The characters of *P. sugandhi* are intermediate to those of *P. nigrum* and *galeatum* and *P. trichostachyon* especially in the nature of bracts which is a major diagnostic character among the South Indian taxa of *Piper*. *P. nigrum* has shallow cupular bracts and *P. sugandhi* has intermediate type of

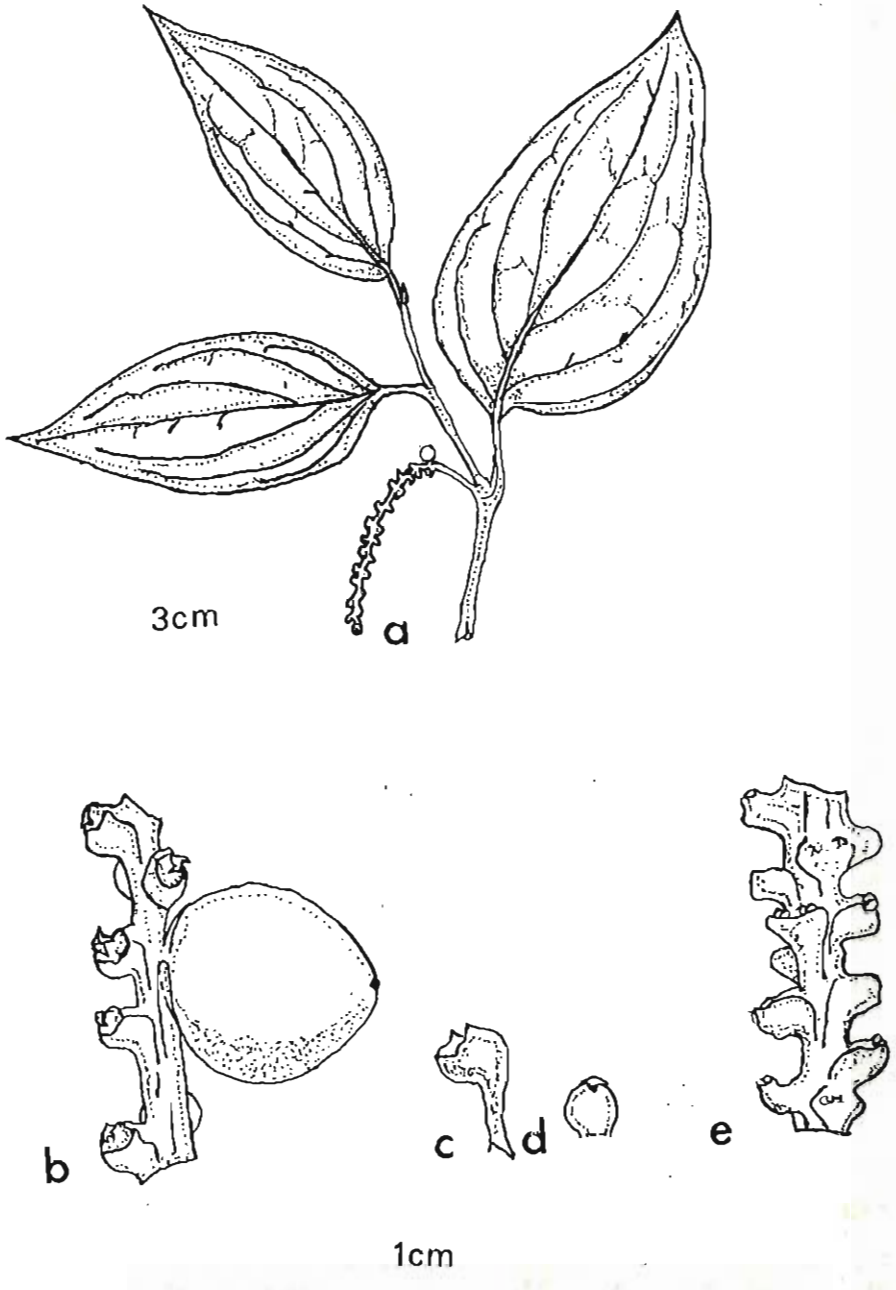

Fig. 1. *Piper sugandhi*

a. a twig b. portion of female spike c. bract d. ovary e.portion of male spike

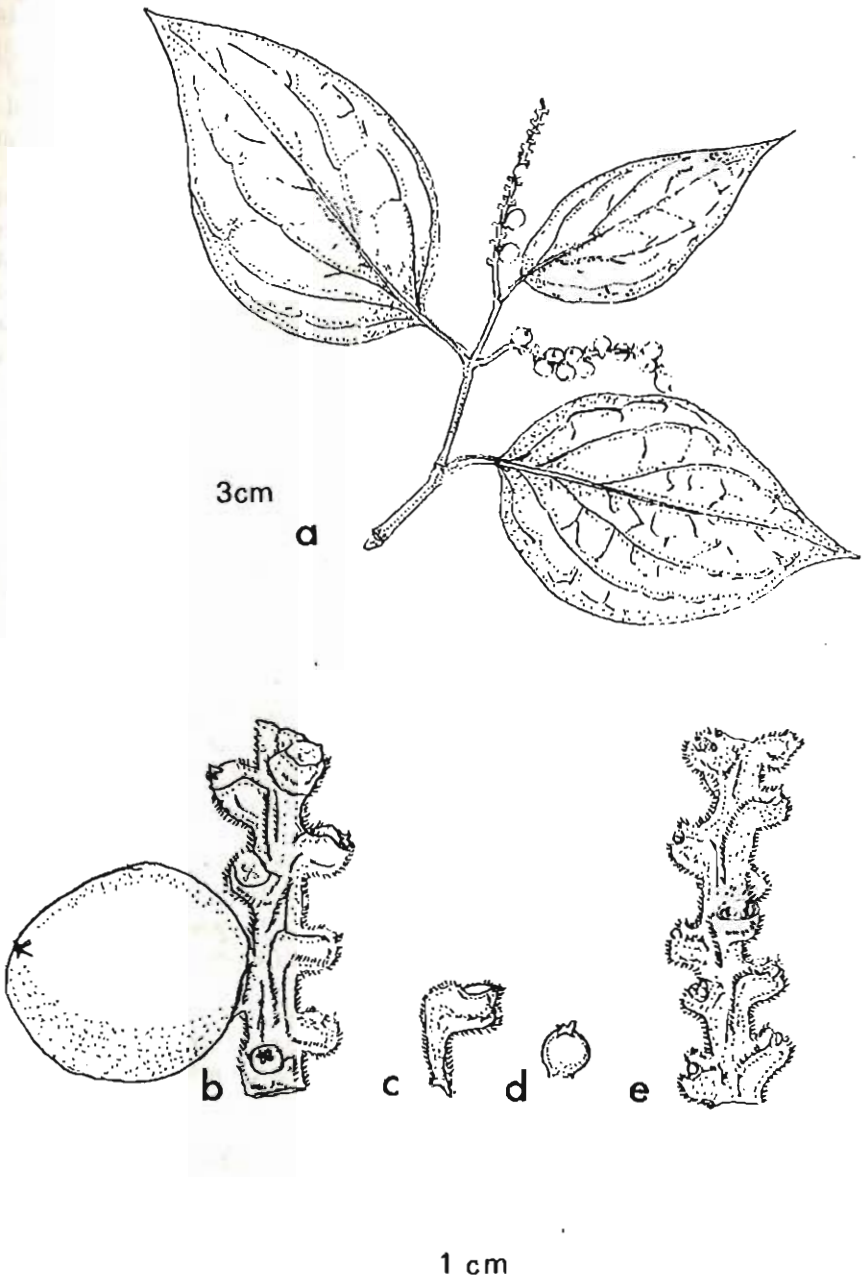

Fig. 2. *Piper sugandhi* var. *brevipilis*

a. a twig b. portion of female spike c. bract d. ovary e. portion of male spike

deeply cupular bracts. It retains the stipitate nature of flowers of *P. galeatum* and also its fruit shape and size. Fruits are pungent as in *P. nigrum* (Tables 1 & 2). *Piper sugandhi* var. *brevipilis* is distinct from *P. sugandhi* in the presence of hairs on the bracts. The presence and absence of hairs is an important diagnostic character for classifying South Indian species of *Piper* especially *P. attenuatum, P. argyrophyllum, P. hymenophyllum* and *P. nigrum* var. *hirtillosum*.

Discussion

The intermediate nature of *P. sugandhi* and *P. sugandhi* var. *brevipilis* indicates that they may be chance natural hybrids involving *P. nigrum, P. galeatum* and *P. trichostachyon*. *P. galeatum* and *P. trichostachyon* are closely related species differing mainly in the stipitate flower of the former and the minutely hair spike character of the latter. Both the hybrid taxa have stipitate flowers and one has minutely hairy bracts.

A chemotaxonomic study based on flavonoid profile analysis gave the following chemical similarity (paired affinity indices):

P. sugandhi - *P. nigrum* = 71%

P. sugandhi - *P. galeatum* = 70 %

P. sugandhi - *P. trichostachyon* = 65%

P. sugandhi var. *brevipilis* - *P. nigrum* = 72%

P. sugandhi var. *brevipilis* - *P. galeatum* = 82%

P. sugandhi var. *brevipilis* - *P. trichostachyon* = 70%

P. galeatum - *P. trichostachyon* = 87%

P. galeatum - *P. nigrum* = 70%

P. nigrum - *P. trichostachyon* = 65%

This data on chemical similarity when interpreted along with morphological data indicates that *P. sugandhi* is a hybrid involving two of the three species, *P. galeatum, P. nigrum and P. trichostachyon* . *P. galeatum* and *P. trichostachyon* are very closely related species (Ravindran & Babu 1992). *P. galeatum* is believed to be one of the putative parents of *P. nigrum* (Ravindran 1990). The conclusion that *P. sugandhi* is related to both *P. nigrum* and *P. galeatum* - *P. trichostachyon* is also supported by the intermediate nature of the bract, fruit size, etc. The probable relationships of these five taxa can be represented as:

P. nigrum x *P. galeatum*
↓
P. sugandhi x *P. trichostachyon*
↓
P. sugandhi var. *brevipilis*

In the natural habit, these new taxa coexist with *P. galeatum, P. trichostachyon* and *P. nigrum* and instances were noticed where they climb up the same tree thereby offering chances for crossing. The capacity for successful vegetative propagation through runners have conferred on the hybrids a great selective advantage for survival, apart from seed propagation that ensures variability and further spread.

It has been shown that in South Indian *Piper* there is no active pollen transfer mechanism, thereby preventing random mating and subsequent gene flow between individuals (Ravindran *et al.* 1990). This leads to establishment of effective isolation mechanism for the hybrid which over a period of time undergoes variations through segregation and accumulation of mutations. Because of the conservation of distinct taxonomical characters, the hybrids described here deserve to be recognised as new taxa.

Table 1. Diagnostic characters of *P. nigrum, P. galeatum, P. trichostachyon* and *P. sugandhi*

Character	*P. nigrum*	*P. galeatum*	*P. trichostachyon*	*P. sugandhi*	*P. sugandhi* var. *brevipilis*
Habit	Woody climber	Woody climber	Woody climber	Woody climber	Woody climber
Spike	Flowers very close	Flowers spaced	Flowers spaced	Flowers close	Flowers close
Bract	Shallow, cupular	Connate, shoe-shaped	Connate, shoe-shaped	Deeply cupular	Deeply cupular
Texture of bracts	Glabrous	Glabrous	Minutely hairy	Glabrous	Minutely hairy
Flowers	Sessile	Shortly stipitate	Sessile	Shortly stipitate	Shortly stipitate
Stamens	2	2	2	2	2
Fruit shape	Round	Oblong	Oblong	Oblong	Oblong
Fruit taste	Pungent	Bitter	Bitter	Pungent	Pungent

Table 2. Morphological characters of *Piper sugandhi* and related taxa

Character	*P. nigrum*	*P. galeatum*	*P. trichostachyon*	*P. sugandhi*	*P. sugandhi* var. *brevipilis*
Mean leaf length (mm)	154.0	106.0	108.0	128.0	131.7
Mean leaf breadth (mm)	80.3	40.0	36.5	77.0	78.5
Mean petiole length (mm)	17.0	10.8	11.5	24.0	23.8
Leaf shape	Ovate lanceolate	Ovate lanceolate	Ovate	Ovate	Ovate
Leaf base	Round	Round	Acute	Round	Round
Leaf texture	Glabrous Coriaceous	Glabrous Coriaceous	Glabrous Coriaceous	Glabrous Coriaceous	Glabrous Coriaceous
Mean distance from leaf base to the 2nd pair of ribs (mm)	22.5	8.2	7.3	16.0	15.9
No. of ribs	5-7	5	5-7	5-7	5-7
Mean spike length (mm)	84.4	105.0	76.0	69.0	71.0
Mean peduncle length (mm)	10.9	17.4	15.3	14.0	14.6
Chromosome number (2n)	52	52	52	52	52

The humid tropical forest of the Western ghats is also the centre of origin of the cultivated black pepper, *P.nigrum*. Studies carried out so far tend to indicate that *P. nigrum* also had originated probably as an interspecific hybrid between two other species occuring in the same region, namely *P. wightii* and *P. galeatum* (Ravindran 1990). The present report of *P. sugandhi* and *P. sugandhi* var. *brevipilis* gives added proof that chance inter-specific hybridisation is an important force to reckon with in speciation and evolution of various South Indian *Piper* taxa.

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