



RESEARCH ARTICLE

# A comprehensive account on the genus *Hedychium* J. Koenig (Zingiberaceae) in south India

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## Abstract

The genus *Hedychium* J. Koenig in south India is revised based on field investigations and herbarium analysis. Seven species and one variety are recognised, along with *H. flavum* J. Koenig found to be new distributional record. A brief history of the taxonomy of south Indian *Hedychium* along with diagnostic morphological characters are discussed. Photographs and details of distribution and conservation status are also presented. A comprehensive identification key to the species and variety is provided. The name *H. flavum* is lectotypified.

## Keywords

Karnataka, Kerala, Western Ghats, Tamil Nadu, Taxonomy

## Introduction

*Hedychium* J. Koenig, an economically, medicinally and horticulturally important genus, comprises about 80 species chiefly distributed in India, south China and Southeast Asia with some species extending to Australia (1–4). The genus was established on the basis of a single species, *H. coronarium* J. Koenig (5). This is considered to be the largest genus of Zingiberaceae in India with about 45 taxa, with the centre of distribution in the northeast states of India, whilst a few species are occurring in south India (3, 6).

An account on floristic wealth of south Indian region with description of *Hedychium* was published in 1839 by Graham (7). He reported five species such as *H. coronarium*, *H. flavum* Roxb., *H. angustifolium* Roxb., *H. sulphureum* Wall. and a novelty, *H. scaposum* Nimmo. Subsequently, Dalzell (8) treated the latter as *Monolophus scaposus* (Nimmo) Dalzell, followed by Bentham and Hooker (9) as *Kaempferia scaposa* (Nimmo) Benth. & Hook.f. and recently to *Curcuma scaposa* (Nimmo) Škorničk. & M.Sabu (10). Wight (11) described two new species of *Hedychium* from the Western Ghats, namely *H. cernuum* Wight and *H. venustum* Wight.

A remarkable floristic work in south India was published in early 20th century as “Flora of Presidency of Madras”, wherein Fischer (12) treated three species of *Hedychium* from South India such as *H. coronarium*, *H. flavescens* Carey ex Roscoe and *H. venustum*.

*Hedychium griffithianum* Wall. had been merged with *H. venustum* based on the relative length of the stamen and the lip (13). Later, these two were (14) reinstated as distinct species and later it was confirmed by further studies (15).

Recently, reports (16–17) are on 5 species of *Hedychium*, including a

cultivated one (*H. coccineum* Buch.-Ham. ex Sm.), from south India. Further field explorations have resulted in the discovery of 2 new taxa and 2 new distributional records of *Hedychium* (3, 4, 18) from south India.

The present studies, based on study of herbarium specimens and literature and supplemented by extensive field observations, recognizes 6 species and 1 variety of *Hedychium* in peninsular India, namely *H. coronarium*, *H. flavescens*, *H. venustum*, *H. forrestii* Diels, *H. forrestii* var. *palaniense* Sanoj & M. Sabu, *H. matthewii* Sinj. Thomas, B. Mani & Britto and *H. spicatum* Sm. (3, 4, 18). The present investigation also attempts to solve the problems in the identification of some south Indian taxa. Moreover, we recognised *H. flavum* Roxb. as a new distributional record to this area.

### Taxonomic treatment

**Hedychium** J. Koenig in Retz., *Observ. Bot.* 3: 73. 1783.

Type: *Hedychium coronarium* J. Koenig.

#### Key to the south Indian taxa

1. Bracts imbricate ..... 2  
     Bracts lax..... 4
2. Flowers yellow, stamen equal to or exceeding the label-  
     lum..... 3  
     Flowers white, stamen shorter than labellum .....  
     ..... *H. coronarium*
3. Flowers creamy yellow, stamens exceeding lip .  
     ..... *H. flavescens*  
     Flowers sulphur yellow, stamen equalling lip.....  
     ..... *H. flavum*
4. Stamen white..... 5  
     Stamen red..... 6
5. Calyx shorter than bract, cincinnus 2–5-flowered.....  
     ..... *H. forrestii*  
     Calyx equal/longer than bract, cincinnus strictly 3-  
     flowered..... *H. forrestii* var. *palaniense*
6. Stamen shorter than labellum..... 7  
     Stamen longer than labellum ..... *H. matthewii*
7. Stamen 'L' shaped, cincinnus strictly 1-flowered .....  
     ..... *H. spicatum*  
     Stamen straight/arching, cincinnus 1–3-flowered.....  
     ..... *H. venustum*

#### Enumeration of taxa

**1. *Hedychium venustum*** Wight, *Icon. Pl. Ind. Orient.* t. 2012. 1853.

= *Hedychium cernuum* Wight, *Icon. Pl. Ind. Orient.* t. 2011. 1853.

Perennial rhizomatous herb. Rhizome 3.0–6 cm wide, aromatic. Leaves 10–14 in number, sessile or slightly petiolate; lamina 37.0–50.0 × 12.5–15.5 cm, elliptic. Inflorescence 23.0–46.0 cm, upright or cernuous, dense; bracts 3.3–4.3 × 1.7–2.6 cm, ovate, lax, convolute, cincinnus 1–3

flowered; bracteoles 2.6–3.2 × 1.5–1.8 cm, tubular, entire or 2-toothed. Flower 11.2–14.0 cm, white or creamy white with red tinge at centre; calyx 4.3–5.8 cm, longer than bract, 3-toothed; corolla tube 6.3–9.1 cm, hairy internally, lobes yellow, drooping, dorsal lobe 4.4–5.2 × 0.7–0.8 cm, lateral lobe 4.0–5.0 × 0.5–0.7 cm; lateral staminodes 4.4–5.9 × 0.3–0.8 cm, linear, white, red towards base; labellum 4.6–5.8 × 2.3–3.3 cm, obovate, white, clawed, apex split about 1.6–2.5 cm; stamen 3.8–4.6 cm, red, shorter than labellum, straight or slightly arching; filament red; anther red; ovary 3–5 × ca. 3 mm, barrel-shaped; epigynous glands oblong, orange, bifid at apex. Fruits globose; seeds red; aril red.

#### Phenology

Flowering: June - September; Fruiting: August - October.

#### Distribution

*Hedychium venustum* is an endemic species distributed in various parts of Kerala and Tamil Nadu at an elevations of 800–1500 m a.s.l. It grows as small populations on thin layer of soil over wet rocks in evergreen forest, wet and dripping rocks in grasslands and on banks of streams.

#### Notes

*Hedychium venustum* shows wide variations in morphology especially on the habit and floral characters. Plants growing in the lower altitudes (800–1200 m) often have slender leafy shoots, attaining a height only up to 1 m, whereas those in the higher altitudes (1200–1450 m) are robust forms and the leafy shoots attain a height up to 2 m. Similarly, the inflorescence of former is slender (Fig. 1A) whereas the latter is massive (Fig. 1B). Additionally, the length of the inflorescence, number of bracts per inflorescence, size of the bract and the size of the flowers are also different. The number of flowers per bract is often three in the robust form whereas it may range from one to three in slender low altitude forms. Additionally, fruiting is common in the former and often three fruits per bract are seen.

#### Specimens examined

India. Kerala: Idukki district, Peermedu, 09 Aug 2015, Thomas *et al.* 67229 (RHT); Idukki, 21 Oct 2014, S. Thomas *et al.* 66462 (RHT); Munnar, Thomas 67233 (RHT); Vazhikadavu, 23 Sept 2012, Thomas *et al.* 65149 (RHT); Trichur district, Sholayar, 15 Aug 2013, Thomas 65148 (RHT); Thiruvananthapuram district, Ponmudi, 26 Jul 2012, Thomas 65127 (RHT). Tamil Nadu: Valparai, 15 Aug 2013, Thomas 65187 (RHT).

**2. *Hedychium coronarium*** J. Koenig, *Observ. Bot.* (Retzius) 3: 73. 1783.

Perennial rhizomatous herb. Rhizome slightly aromatic, fleshy or fibrous. Leafy shoot 86–370 cm long, upright. Leaves sessile; lamina 26.0–60.0 × 7.5–14.3 cm, elliptic or narrowly oblong-lanceolate, pubescent below. Inflorescence 6.4–17.0 cm long, upright, compact; bracts 4.2–7.0 × 1.6–6.6 cm, ovate-elliptic or widely elliptic-orbicular, imbricate, cincinnus 1–4 flowered. Flowers 12.0–15.5 cm long, white; calyx 3.1–4.5 cm long, tubular, shorter





**Fig. 1.** Inflorescence of *Hedychium venustum* (A-B), *H. coronarium* (C-D), *H. flavescens* (E), *H. flavum* (F), *H. forrestii* (G), *H. forrestii* var. *palaniense* (H), *H. matthewii* (I) and *H. spicatum* (J-K)

than bract; corolla tube 8.2–9.6 cm long, lobes oblanceolate or narrowly oblong, white, dorsal lobe 4.2–5.5 × 1.0–1.5 cm, lateral lobes 4.0–4.8 × 0.8–1.5 cm; lateral staminodes 4.7–5.8 × 2.4–3.4 cm, elliptic or obovate, clawed, white; labellum 5.0–6.2 × 5.2–6.2 cm, orbicular, emarginated, white, clawed; stamen 4.2–5.4 cm long, shorter than labellum; filament white; anthers creamy white; ovary barrel shaped; epigynous glands 2, oblong, yellow. Fruits ovoid; seeds red, aril red.

#### Phenology

Flowering: July - January; however, some populations flower throughout the year. Fruiting: rare in wild populations.

#### Distribution

Native to Myanmar and widely distributed all over India. It is cultivated as ornamental throughout the tropics (19).

#### Notes

It is the most common species of *Hedychium* in the area and widely cultivated as an ornamental plant (Fig.1C). The wild plants are larger in size than garden varieties and are slightly fragrant. While sampling the specimens of *H. coronarium* from various parts of south India, the authors came across with a specimen having strobili-form spikes (Fig.1D). Detailed analysis shows that it differs from rest of the collections of *H. coronarium* by characters such as robust habit,

fibrous rhizome, pubescent and larger bracts and bracteoles, 3–4-flowered cincinnii, pubescent calyx and large flowers. Additionally, fruit development has so far not been observed in this population. In 2004, the Board of trustees of the Royal Botanic Gardens, Kew (20) treated a number of names under *H. coronarium*. Following their norms, even if those populations have the above mentioned variations, we treated it as *H. coronarium*.

#### Specimens examined

India. Kerala: Idukki district, Munnar, 13 Oct 2012, Thomas 65120 (RHT); Anayirankal, 13 Oct 2012, Thomas *et al.* 65129 (RHT); Tamil Nadu: Dindigul district, Kodaikanal, 12 Dec 2013, Britto & Thomas 65199 (RHT); Coimbatore district, Sholayar submergible area, Ramamoorthy 18120 (MH!);

65130 (RHT); Gavi, 25 Sept 2013, Thomas 65133 (RHT); Tamil Nadu: Dindigul district, Kodaikanal, near Silver Cascade, 12 Dec 2013, Britto & Thomas 65198 (RHT); Maharashtra: Kohlapur, Tillari, 5 Oct 2006, Malpure 7 (SUK); Andhra Pradesh: East Godavari district: Dummakonda R.F., 28 Sep 1980, Subba Rao 68626 (MH); Visakapatnam district, Cherukanda, 29 Aug 1966, Subba Rao 28192 (MH); Karnataka: Kodagu district, Mercara, 25 May 1976, Sivadasan 17533 (CALI!).

#### 4. *Hedychium flavum* Roxb., Fl. Ind. 1: 81. 1820.

Type (lectotype, designated here): India orientalis (possibly Calcutta Botanic Garden), *Roxburgh s.n.* (BM000958140, digital image!). Additional original material: [unpubl. icon] *Icones Roxburghianae*, No. 2153 (CAL, digital image!), copy

**Table 1.** Comparison of diagnostic characters of *H. flavescens* and *H. flavum*

Characters	<i>H. flavescens</i>	<i>H. flavum</i>
Inflorescence	Compact to lax flowered, cylindrical	Compact, cone-like
Bracts	Imbricate to non-imbricate, hairs golden-yellow	Imbricate, hairs hyaline
Cincinnus	3–5 flowered	3–4 flowered
Flowers	Creamy yellow	Sulphur yellow
Length of the corolla tube	8.2–8.9 cm	6.0–6.8 cm
Cleft of the labellum	ca. 1.5 cm deep	<5 mm deep
Length of the stamen	5.2–5.8 cm, exceeding the labellum	4.0–4.2 cm, equal to the labellum
Anther attachment	At 45° angle	Parallel to filament
Ovary	Densely pubescent, hairs golden-yellow	Moderately pubescent, hairs hyaline

Valparai, 20 Oct 2013, Thomas 65186 (RHT). Karnataka: Kodagu district, Coorg, Sivarajan *s.n.* (CALI!).

#### 3. *Hedychium flavescens* Carey ex Roscoe, Monandr. Pl. Scitam. t. 50. 1825.

Perennial rhizomatous herb. Rhizome slightly aromatic. Leafy shoot robust. Leaves sessile; lamina elliptic-oblongate, pubescent on abaxial surface. Inflorescence 10–18 cm long, moderately lax; bracts 6.2–6.5 × 3.0–3.8 cm, ovate, often imbricate, cincinnus 3–5 flowered; Flowers 14.0–15.5 cm long, lemon yellow; calyx 3.9–4.3 cm, yellow; corolla tube 8.2–8.9 cm long, yellow, lobes oblongate, yellow; lateral staminodes 5.0–5.2 × 1.7–1.9 cm, elliptic, yellow, reflexed back; labellum 5.0–5.2 × 4.0–4.6 cm, obovate, yellow, reflexed back on upper half, deeply emarginated, clawed; stamen yellow, longer than labellum, filament yellow, straight, anther elliptic; ovary barrel shaped; epigynous glands 2, oblong, orange.

#### Phenology

Flowering: August–November; Fruiting: Not observed.

#### Distribution

*Hedychium flavescens* (Fig.1E) is found in all south Indian states of Kerala, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu. This species shows a narrow range of distribution in Karnataka, Andhra Pradesh and Telangana.

#### Notes

It may be reproductively isolated from other species of *Hedychium* because of the absence of fruit set.

#### Specimens examined

India. Kerala: Idukki district, Munnar, 13 Oct 2012, Thomas

at K, digital image!).

Perennial rhizomatous herb. Rhizome slightly aromatic. Leafy shoot robust. Leaves sessile; lamina elliptic-oblongate, pubescent below. Inflorescence 12–22 cm, compact; bracts imbricate, orbicular-ovate, cincinnus 3–4 flowered. Flowers 11.2–12.5 cm, sulphur yellow; calyx 3.8–4.1 cm, yellow; corolla tube 6.0–6.8 cm, yellow; lobes oblongate, yellow; lateral staminodes 3.3–3.5 × 1.0–1.2 cm, elliptic, sulphur yellow, reflexed back; labellum 3.5–3.8 × 2.7–3.0 cm, obovate, sulphur yellow, clawed at base, apex rounded, 4–5 mm emarginated; stamen equal to the labellum, sulphur yellow; filament yellow, straight; anther elliptic; ovary barrel shaped; epigynous glands 2, oblong, orange.

#### Phenology

Flowering: profusely in September–December and it lasts up to February. Fruiting: So far not observed.

#### Distribution

India, Thailand, China, Bangladesh and Myanmar. In India it is common in North-East region. Presently, this taxon is reported from south India (Tamil Nadu).

#### Notes

Roxburgh (21) described *H. flavum* along with admirable illustrations. However, this species has been wrongly treated by various authors (22, 23). *Hedychium flavum* was described on the basis of plants cultivated in the Calcutta Botanic Garden grown from seeds obtained from Sylhet in Bangladesh received from Mr. M. R. Smith in 1810 (24). It was illustrated by him in his unpublished *Flora Indica* drawings (available at CAL and K). In addition, a specimen col-



lected by Roxburgh could be traced out at BM. These drawings and specimen represent the uncited original material of the name. Although, an uncited drawing as well as specimen have equal priority in lectotype designation as per Art. 9.2 of *ICN* (25), we are selecting herewith the well preserved flowering specimens at BM as the lectotype of the name.

Graham (7) reported *H. flavum* in Parell garden, Bombay. However, it was introduced from Bengal, as noted by him in the publication. During the expedition in Western Ghats, it was by accident that a few populations of *Hedychium* growing in Nilgiris possessing characteristics similar to *H. flavum* were seen (Fig. 1F). Upon careful scrutiny, it is authenticated as *H. flavum* (Table 1). Consequently, it forms the first valid report of this species from south India.

#### Specimens examined

India. Tamil Nadu: Nilgiri district, Nilgiris, 22 Dec 2012, Thomas 65139 (RHT).

**5. *Hedychium forrestii*** Diels, Notes Roy. Bot. Gard. Edinburgh 5: 304. 1912.

Rhizomatous perennial herb; rhizome aromatic. Leafy shoot robust; lamina sessile, narrowly elliptic, sparsely hairy below. Inflorescence 16–24 cm long, lax, erect; bracts lance-ovate, lax, cincinnus 2–4 flowered; Flowers 12.4–13.2 cm long, white; calyx 3.7–4.1 cm long, shorter than bract; floral tube 6.5–6.8 cm long, white; corolla lobes linear, white; lateral staminodes, oblanceolate to obovate, white, reflexed back; labellum orbicular, clawed, shallowly emarginated; stamen white, exceeding the labellum; ovary puberulous; epigynous glands two, oblong, yellow. Fruits terete; seeds red, aril red.

#### Phenology

Flowering: August–October; Fruiting: October–December.

#### Distribution

It grows on thin soil over exposed wet rocks in evergreen montane forests and marshes in grasslands at an elevation of 950–1200 m. In south India, it is reported from Idukki and Thrissur districts of Kerala and Nilgiris in Tamil Nadu.

#### Notes

When compared with *H. coronarium*, *H. forrestii* could be distinguished by its lax spikes (Fig.1G), closely convolute bracts, stamen exceeding the lip and oblong–cylindric capsules.

#### Specimens examined

China. 1908, Cavalerie 00211021 (E); 1912 Forrest 00211015 (E). NEPAL. 1821, Wallich 000574704 (BM). India. Kerala: Thrissur, Sholayar, 15 Aug 2013, Thomas *et al.* 65146 (RHT); Idukki, Nellippara slopes, 07 Feb 1981, Nair 70106 (MH); 28 July 2013 Thomas *et al.* 65490 (RHT!); Tamil Nadu: Nilgiri district, Kailas Pillai Estate to Sirur (near Ebanad), Subba Rao 36524 (MH).

**6. *Hedychium forrestii*** Diels var. *palaniense* Sanoj & M. Sabu, J. Bot. Res. Inst. Texas 4: 633–639. 2010.

Perennial rhizomatous herb. Rhizome slightly aromatic. Leaves sessile; lamina elliptic, puberulent below. Inflo-

rescence 16.5–29.2 cm, lax, upright; bracts lanceolate, convolute, cincinnus ca. 3 flowered. Flowers 15.0–15.2 cm, white; calyx 3-toothed at apex; corolla tube 9.2–9.4 cm long, white; lobes oblong, white; lateral staminodes 4.1–4.4 × 1.9–2.0 cm, elliptic, white, reflexed back; labellum 4.3–4.6 × 4.0–4.2 cm, ovate, white, clawed at base, 1.9–2.1 cm emarginated at apex; stamen longer than labellum, white; ovary barrel-shaped; epigynous glands two, oblong, yellow. Fruits three-angled; seeds red, aril red.

#### Phenology

Flowers: June–November; Fruiting: starts September onwards.

#### Distribution

*Hedychium forrestii* var. *palaniense* is a narrow endemic reported only from Palni Hills, Tamil Nadu at an altitudinal range of 1300–1600 m.

#### Notes

Matthew, Charles and Rajendran (RHT46992) collected this specimen from the Palni hills in 1986 and were able to distinguish it from other south Indian species of *Hedychium*, but not to identify it as *H. forrestii*. Subsequently, this plant had been collected from the same locality and described it as *H. forrestii* var. *palaniense* (18) (Fig.1 H). It differs from *H. forrestii* var. *forrestii* in having longer flowers and corolla tube (9.2–9.4 cm) and calyx equal or slightly longer than bracts (18).

#### Specimens examined

India. Tamil Nadu: Dindigul district, Vadakavungi, Palar Dam view, 12 Dec 2013, Thomas & Britto 65200 (RHT); Kodakanal, Palani Ghat Road between Perumal Malai and Vadakavunchi, 23 Sept 1986, Matthew, Charles and Rajendran 46992 (RHT, E).

**7. *Hedychium matthewii*** Sinj. Thomas, B. Mani & Britto, *Webbia* 70: 221. 2015.

Rhizomatous perennial herb. Leafy shoot robust; lamina sessile, narrowly oblong to narrowly elliptic, abaxial side pubescent. Inflorescence lax, upright; bracts narrowly elliptic, involute, cincinnus 1–3 flowered. Flowers 13–15.3 cm long, spreading; calyx 4.5–6.1 cm long, tubular; floral tube 6–8 cm long, pale yellow; corolla lobes linear, pale yellow; lateral staminodes linear, white, pale yellow–red tinged towards base; labellum spatulate, clawed, apex rhombic, white; stamen 7.1–7.8 cm long, bright red, exceeding labellum; ovary barrel-shaped; epigynous glands two, narrowly cylindrical, orange. Fruits terete; seeds red, aril red.

#### Phenology

Flowering: August - September; Fruiting: September - November.

#### Distribution

*Hedychium matthewii* shows a narrow range of distribution and reported only from Kerala (Idukki and Thrissur). It occurs as small populations in thin soil over rocky slopes of moist evergreen forests at elevations of 1150–1230 m. This species is assessed as Critically Endangered (3, 26).

#### Notes

This is the only species with very long stamen among the different species reported from the peninsular India (Fig. 1I).

### 8. *Hedychium spicatum* Sm., Cycl. 17: 8. 1811.

Perennial rhizomatous herbs; rhizome aromatic. Leafy shoot slender; lamina sessile, narrowly elliptic to lanceolate. Inflorescence 12–32 cm, lax; bracts 2.6–4.7 × 0.9–1.5 cm, subulate, lax, cincinnus strictly 1-flowered. Flowers 10.6–12 cm long, spreading; calyx 3.4–3.6 cm long, tubular; floral tube 5.3–5.6 cm long, pale yellow; corolla lobes linear, yellow; lateral staminodes 4.6–5.1 × ca. 0.3 cm, linear, creamy white, red tinged towards base; labellum obovate, pale red, clawed, apex obovate, creamy white, deeply clefted with incision 2–3.7 cm; stamen red, shorter than labellum, bent at middle; ovary glabrous; epigynous glands two, oblong, yellow, bifid. Fruits sub-globose; seeds red, aril red.

#### Phenology

Flowering: Starts on end of June - August. Fruiting: July–September.

#### Distribution

It is reported from south India from moist and shady places under shola forests at an altitude of 1500–1600 m in Idukki, Kerala. These populations are under extreme decline due to habitat loss.

#### Notes

*Hedychium spicatum* shows ample distribution in the North-eastern parts of India, but shows only a narrow range of distribution in the southern parts of India. *Hedychium venustum* has been occasionally misidentified as *H. spicatum*. However, *H. spicatum* (Fig. 1J) could easily be distinguished from *H. venustum* by its slender habit, strictly 1-flowered cincinnii, sessile leaves, narrow labellum, shorter and bent stamen and spurred thecae (4). During the present investigation the authors met with an interesting specimen from Old Devikulam, Idukki characterised by flowers with tripartite and non-clawed labellum, subulate and short bracts, non-tubular and short bracteoles and apically hairy calyx tube. At the same time, it is related to *H. spicatum* in all other features. Therefore, we treating it as a variant form of *H. spicatum* (Fig. 1K).

#### Specimens examined

Nepal. 1819, Wallich 000574705 (BM); 1819, Wallich 000574708 (BM). INDIA. Sikkim: 1887, Hooker 72407 (MH); Khasia, 1887, Hooker 72408 (MH); Kerala: Munnar 16 July 2012 Thomas *et al.* 65121 (RHT); Old Devikulam, 04 Aug 2013, Thomas *et al.* 65488 (RHT).

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### Authors contributions

All authors contributed equally to the work.

### Compliance with ethical standards

**Conflict of interest:** No potential conflict of interest was reported by the authors.

**Ethical issues:** None.

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