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A STRIKING NEW EPIPHYTIC *HEDYCHIUM* (*ZINGIBERACEAE*) FROM MYANMAR WITH A DISCUSSION ON SOME ANOMALOUS RELATED GENERA

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Hedychium bordelonianum W.J. Kress & K.J. Williams (*Zingiberaceae*) is described and illustrated. Several characters make this species one of the most unusual in the genus; however, molecular phylogenetic data place it unequivocally in *Hedychium*. The similarities and relationships of this species to the anomalous taxa *Nanochilus*, *Rhynchanthus*, *Stadiochilus*, and *Hedychium* (*Brachychilum*) *horsfieldii* are discussed.

Keywords. Burma, *Hedychieae*, new species.

Introduction

Hedychium J. König ex Retz., one of the largest genera of gingers (*Zingiberaceae*), is distributed through most of tropical Asia (Wood *et al*., 2000). The genus has its highest diversity of species in the tropical and subtropical Himalayan region. During a collecting trip to a remote region of western Myanmar (formerly Burma) in 1999 an extraordinary new species of *Hedychium* was discovered. The morphology of this species is unusual enough to make generic placement difficult, as the new taxon shares strong affinities with *Rhynchanthus* Hook.f., *Stadiochilus* R.M. Sm., and *Nanochilus* K. Schum. as well as *Hedychium*. While the results of molecular phylogenetic techniques clearly confirm its placement in *Hedychium* (Kress *et al*., 2002), several morphological characters also make this species recognizable as a member of the genus (see discussion below). This taxon is here described; its characters are compared with those of several related genera, and its phylogenetic relationships (based upon ITS nrDNA and *mat*K cpDNA evidence) within *Hedychium* are discussed.

New Species

Hedychium bordelonianum W.J. Kress & K.J. Williams, **sp. nov. Fig. 1.**
Hedychio densifloro Wall. affinis sed bracteis rubris; calyce corollaque intense roseis et filamentis rubris; staminodiis lateralibus roseis pallidis multo minoribus (3–4mm

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vs. c.20mm longo); labello roseo pallido trilobo breviore (5mm vs. c.20mm longis), lobo medio emarginato differt.
Type: Union of Myanmar: border of Rakhine (Arakan) State and Magwe Division, near Ann Township. Road between Padein and Ann, W of Minbu, 50mi from Schwesettaw and 14mi from Ann, 19°53′13″N, 94°22′01″E, 1460m, 27 vi 1999, *W.J. Kress*, *M. Bordelon*, *K.J. Williams & Thet Htun* 99-6462 (holo. RAF, iso. US).

Epiphytic herb to c.70cm tall. Rhizomes bulbous. Roots thickened. *Shoot distichy* perpendicular to the rhizome. *Pseudostem* 24 × 1.5cm, green with margins of sheathing bases pale pink, glabrous. *Leaves* c.7 per shoot, petiole reduced, c.10 × 9mm, green, glabrous. *Ligule* rounded, 1.5 × 1.7cm near petiole, pinkish green, glabrous. *Blade* c.40 × 8.5cm, base truncate, apex long-acuminate, deep green and glabrous above with pale green midrib, grey-green and with sparse transparent hairs below, midrib with sparse pale hairs. *Inflorescence* erect on leafy shoot, c.10cm long; peduncle 5 × 1cm, reddish green, glabrous. *Rachis* 1cm in diameter, reddish green, glabrous. *Bracts* numerous, more than 50, spirally arranged and congested, especially at apex of inflorescence, angle between adjacent bracts 60–70°; middle bracts 3.1 × 1.6cm, margins slightly involute and undulate with acute apex, rose red inside and outside, entirely glabrous, subtending a single flower. *Bracteoles* 17 × 8mm, tubular, deep pink, glabrous. *Flowers* held at 80° to inflorescence axis, sessile. *Calyx* tubular, 2 × 0.2cm wide, 3-lobed with split 4mm down one side, deep pink, sparsely hirsute. *Corolla tube* 2.4cm long, 3-lobed, each lobe 2.1cm in length, held loosely around anther, with a groove enclosing the style, deep pink, glabrous. *Lateral staminodes* inserted at top of corolla tube, 3–4mm × 1mm, acute, white, pink inside, glabrous. *Labellum* 6mm wide at base, 3-lobed, lateral lobes 5 × 1–2mm, central lobe 2 × 1–2mm, white, pink inside, glabrous. *Filament* exserted 1.1cm from corolla tube, 1mm wide, red. *Anther* reflexed 90°, introrse, 8mm long, bright orange. *Ovary* 3 × 4mm, trilocular with axile placentation, pinkish green, densely hirsute with white hairs; epigynous nectary glands 2, fused. *Style* pink. *Stigma* orange, hirsute. *Fruits* and *seeds* not known.

Distribution. Known only from the type locality in western Myanmar. *Hedychium bordelonianum* is named in recognition of Mr Michael W. Bordelon, horticulturist and manager of the National Museum of Natural History Botany Research Greenhouses at the Smithsonian Institution. Mr Bordelon has collected and successfully propagated many gingers from Asia, including this new *Hedychium*.

The morphological characters which place this new species in *Hedychium* include: the inflorescence terminating a leafy stem; stiff, involute bracts; an elongate, exserted stamen (relative to the rest of the flower); thecae of the dorsifixed anther facing proximally away from the flower; and a groove in the corolla tube enclosing the style. This placement is supported by molecular evidence from the ITS region of nrDNA and the *mat*K region of cpDNA in 40 genera of *Zingiberaceae* and over 30 species of *Hedychium*. The results of individual and combined analyses of both genes

FIG. 1. *Hedychium bordelonianum* W.J. Kress & K.J. Williams: A, habit; B, inflorescence bract; C, flower, lateral view; D, bracteole tube; E, flower, flattened and partially dissected to show petals, lateral staminodes, 3-lobed labellum, stamen, and style; F, transverse section of corolla tube with groove enclosing style; G, transverse section of anther; H, ovary; I, longitudinal section of ovary; J, transverse section of ovary. Drawn by Alice Tangerini from plants in cultivation: Botany Research Greenhouse Accession 1999-145 and US National Herbarium Voucher WJK 01-6831.

demonstrate strong support for placing this taxon within *Hedychium* (Kress *et al.*, 2002).

Hedychium bordelonianum stands apart from all other species in the genus in several respects. The flower is one of the smallest known in *Hedychium*. The lateral staminodes are the smallest in the genus, being little more than minute lobes. The labellum is highly reduced (matched only by that of *H. horsfieldii* R. Br. ex Wall.), and is unique in its trilobed structure. The fertile stamen is exceptionally short, being matched by few *Hedychium* species. The epiphytic habit, small size, and vibrant red colour of the inflorescence, while not unique to this species, are unusual in the genus as a whole. Interestingly, the molecular analyses do not place the epiphytic *H. bordelonianum* in Clade II of Wood *et al.* (2000), a group of circum-Himalayan species with small flowers and one flower per bract. Instead *H. bordelonianum* belongs to Clade IV of Wood *et al.* (2000), a circum-Himalayan group of terrestrial hedychiums with two or more flowers per bract, further emphasizing its uniqueness in the genus.

The labellum is particularly noteworthy in having a small but distinct central lobe, which may represent the median stamen of the outer whorl. In the vast majority of *Zingiberaceae* this stamen is generally considered not to be expressed at all, or to be a minor part of the labellum (Holttum, 1950; Kirchoff, 1997, 1998). Detailed study of this species, along with the poorly known genera *Gagnepainia* K. Schum. and *Hemiorchis* Kurz, which also produce a distinctive central lobe on the labellum, may provide additional insight into floral development of the *Zingiberaceae* as a whole.

In her paper on the monotypic *Stadiochilus*, Smith (1980) provided an eloquent discussion on the problems with the traditional four-tribe classification of the *Zingiberaceae*, particularly the largest tribes *Hedychieae* and *Alpinieae*. The lack of well-developed lateral staminodes in *Stadiochilus*, as well as in *Rhynchanthus* and *Pommereschea* Wittm., has forced taxonomists to place these genera in the *Alpinieae* despite the strong affinities with the *Hedychieae*, especially *Hedychium*. While clearly not a true intermediate between any of these genera, *H. bordelonianum* shows an extreme reduction of the lateral staminodes, suggesting that these structures may have been lost more than once within the family.

Smith (1980) also pointed out the features shared by *Stadiochilus*, *Rhynchanthus*, and *Pommereschea* as well as their similarities to *Nanochilus*, *Hedychium*, and *Brachychilum* Petersen (now recognized as *H. horsfieldii* R. Br. ex Wall., see Newman, 1990). *Rhynchanthus*, though the most distinctive of these genera in its uniquely large, flattened, and boat-shaped filament, is similar to the others in its rudimentary labellum, prominent corolla lobes, and epiphytic habit. The affinities between the monotypic *Stadiochilus* and *Hedychium* have been recognized since the former genus was described: 'In fact, if a pair of petaloid lateral staminodes were added to *Stadiochilus* we should have a perfectly good *Hedychium*...' (Smith, 1980). Study of *H. bordelonianum* serves only to strengthen the similarities between the genera. In addition to possessing a groove in the corolla tube (characteristic of *Hedychium* as a whole), both taxa commonly grow as epiphytes, have pubescent ovaries, red to

reddish-purple bracts and flowers, and are endemic to Myanmar. The labellum on *H. bordelonianum* collected in the field was partially wrapped around the base of the filament; this is the most distinctive character of *Stadiochilus*. However, field observations of *H. bordelonianum* may have been based on partially opened flowers, as cultivated specimens at the Smithsonian Institution do not show this character. The few known herbarium specimens of *Stadiochilus* (all made on the Keenan expedition of 1961–62) may also be of partially opened or partially wilted flowers. While the similarities between *S. burmanicus* R.M. Sm. and *H. bordelonianum* are great, *H. bordelonianum* can be distinguished by its small lateral staminodes, thicker inflorescence bracts, smaller flowers, and more compact inflorescence.

Florally, our new taxon most closely resembles the monotypic Sumatran endemic *Nanochilus*. The labellum is highly reduced in both species and the lateral staminodes are reduced in size relative to the rest of the flower. Consequently, the corolla is the most conspicuous whorl of the perianth in both species. The anther and pubescent ovary are nearly identical in both species. Smith (1980) stated '*Nanochilus* ... is clearly not a *Hedychium*' based on the reduced labellum, short and grooveless corolla tube exceeded by the calyx, and unbranched inflorescence with flowers arising singly from each bract and surrounded by a bracteole. With the discovery of *H. bordelonianum* most of Smith's (1980) distinctions between the genera become blurred. All of the above characters are found in *H. bordelonianum* except that the corolla tube is grooved. While the corolla tube is slightly longer than the calyx (c.4mm) in this species, the difference in length is so small that it should not be considered a valid character in distinguishing the genera. Further study of *Nanochilus palembanicum* (Miq.) K. Schum. may show a close relationship to *Hedychium*, possibly *H. bordelonianum*. Unfortunately, tissue of neither *Nanochilus* nor *Stadiochilus* was available for molecular analysis.

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