THE LIMITS OF THE TRIBE ZINGIBEREAE

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ABSTRACT. Reasons are advanced for restricting the tribe *Zingibereae* to the genus *Zingiber* alone. Characters distinguishing it from *Hedychieae* are both morphological and anatomical.

Within the subfamily *Zingiberoideae* the established pattern was for long to recognize three tribes: *Globbeae*, *Hedychieae* and *Zingibereae*, the last including *Alpinia*, *Amomum* &c. (O. G. Petersen in Engl. & Prantl, Pflanzenfam. 2, 6: 18, 1889; K. Schumann, Pflanzenr., Zingib. 1904; Loesener in Engl. & Prantl, Pflanzenfam. 2 Aufl. 15a: 557, 1930). The distinction between *Hedychieae* and *Zingibereae* lay in the lateral staminodes, well-developed and free in *Hedychieae*, reduced, absent or united to the labellum in *Zingibereae*.

In 1950 Holttum pointed out (Gard. Bull. Sing. 13: 2) that the genus *Zingiber*, in which the lateral staminodes appear as lobes at the base of the labellum, has more in common with *Hedychieae* than with *Alpinia*, *Amomum* &c. in which the lateral staminodes are much reduced or absent. He accordingly removed *Zingiber* from the *Alpinia* group and re-named that tribe *Alpineae*. *Zingiber* he placed in *Hedychieae*, but he did not change the tribal name, fearing the confusion that would ensue. However the tribe of Zingiberaceae which includes the genus *Zingiber* must be called *Zingibereae*. If a student reads of three tribes, *Globbeae*, *Hedychieae* and *Alpineae* he may properly presume that there is another tribe, *Zingibereae*, not mentioned (Int. Code Art. 19).

In a previous article (Burtt & Smith in Trans. & Proc. Bot. Soc. Edinb. 39: 510, 1964), it was very tentatively suggested that the recognition of *Zingiber* as an independent tribe might not only be nomenclaturally convenient but botanically sound. This possibility has now been more thoroughly examined.

In the first place, however, it may be noted that Holttum's removal of *Zingiber* from the *Alpineae* is not in question. Tomlinson (in J. Linn. Soc. Bot. 55: 590, 1956) has since pointed out that *Zingiber* agrees with *Hedychieae* in having the plane of distichy of the leaves parallel to the axis of the rhizome, whereas in all the *Alpineae* it is transverse. This character was first pointed out by Weisse (in Ber. Deutsch. Bot. Ges. 50A: 327, 1932, & 51: 13, 1933). Furthermore *Zingiber* has the rather fleshy type of rhizome which tends to differentiate *Hedychieae* from the *Alpineae*, in which the rhizome is more fibrous.

Mahanty (Cytologia 35: 40, 1970) has suggested that the removal of *Zingiber* from the affinity of *Alpinia* to the *Hedychieae* has a degree of cytological support. He quotes known *Alpineae* as having $2n = 48$ chromosomes whereas *Zingiber* appears to have a base number $x = 11$ with $2n = 22$ the commonest somatic complement. This agrees, for instance, with *Kaempferia*. However in dealing with *Alpineae* Mahanty does not quote the counts of $2n = 44$ for *Renealmia* (S. & G. Mangenot in Rev. Cyt. & Biol. Veg.

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25: 440, 1962). It may be that, as Mahanty says, the chromosomes of *Zingiber* and *Hedychieae* are larger than in *Alpinieae*, but here the available data is even scantier than for the numbers. No confident conclusions can yet be drawn from the cytological evidence.

The floral characters which distinguish *Zingiber* from *Hedychieae* are well marked. The style is always produced well beyond the anther-thecae and the anther-crest is equally well developed and is wrapped around this part of the style. In *Hedychieae* the stigma is borne just beyond the anther-thecae and if an anther-crest is present it is flat and may overtop the stigma. It also seems that the stigma is different. In *Zingiber* there is scarcely any expansion of the top of the style and the marginal cilia of the stigma point forwards. In *Hedychieae* the style is normally expanded into a flat, sometimes more or less bilobed, stigma. This possible distinction needs to be confirmed by observation of more numerous species that has been possible so far.

The condition of the lateral staminodes is also different. In *Hedychieae* they are free from the labellum and usually conspicuous: in *Zingiber* there are two lobes at the base of the labellum which are generally described as adnate staminodes. We do not propose to discuss the nature of these lobes here (see Burtt, Notes R.B.G. Edin. 31: 157, 1972). It may be that pollination mechanisms favour their development in this position. Be that as it may, they provide a good distinction between *Hedychieae* and *Zingiber*.

Turning to vegetative features, *Zingiber* is exceptional in the family in having an obvious pulvinus below the lamina. Anatomically this is associated with a marked development of a collenchymatous sheath to the vascular bundles; elsewhere in the family the bundle sheath is sclerenchymatous. These observations were first made by Tomlinson (J. Linn. Soc. Bot. 55: 568, 1956) on *Zingiber officinale*, the only species of the genus studied. Twenty-seven species of *Zingiber* have now been examined and, with one exception to be mentioned below, they all show a strong development of collenchyma. A collenchymatous bundle sheath is characteristic of subfamily *Costoideae* but has not been found in any genus of Zingiberoideae other than *Zinbiger* itself, although 278 species in 32 genera have been examined (Olatunji, unpublished).

The single species of *Zingiber* that possesses a sclerenchymatous bundle sheath in the petiole is also exceptional in its habit: it is the only epiphytic species known to us. This species (Sarawak, Third Division, SE Hose Mts., c. 2° 6′ N, 113° 42′ E, 9 viii 1967, *Burtt & Martin, B.* 4875) grows some 12–20 m from the ground, usually on branches spreading out over a river, and the leaf-fronds are pendulous. It is not unreasonable to think that the exceptional anatomy and the exceptional habit may be linked. We do not consider that this one instance invalidates the acceptance of the collenchymatous bundle sheath as a feature of *Zingiber*. It may be mentioned that, so far as we are aware, other epiphytic species (e.g. in *Hedychium* and *Amomum*) all have erect leaf fronds and therefore provide no opportunity for further observations on the anatomy associated with the pendulous habit.

The characters discussed provide well marked differences between *Zingiber* and the rest of *Hedychieae*, and they are of the same order as those distinguishing *Hedychieae* from *Alpineae*. We therefore propose to recognize *Zingibereae* as a separate tribe, represented by the one genus *Zingiber* which consists of some 80–90 species. The characters may be tabulated thus:

Zingibereae	*Hedychieae*
Lateral staminodes adnate to the labellum	Lateral staminodes free
Style extended beyond anther-thecae, the upper part wrapped round by the elongate anther-crest; stigma protruding at tip	Style not extended beyond anther-thecae and stigma protruding at top of these: anther-crest if present flat
Petiole swollen, and pulvinus-like; vascular bundle with collenchymatous sheath	Petiole not swollen nor pulvinus-like; vascular bundle with sclerenchymatous sheath.