

***Siliquamomum alcicorne* (Zingiberaceae: Alpinioideae), a new species from central Vietnam**

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ABSTRACT. *Siliquamomum alcicorne* (Zingiberaceae: Alpinioideae) from central Vietnam is described and illustrated here. It is compared to the other two species so far known in the genus, *S. tonkinense* and *S. oreodoxa*. A key to the three species and a map of their distribution are given. The genome size of each species has been estimated by FCM analysis. The occurrence of flexistyly in the genus *Siliquamomum* is reported here for the first time.

Keywords. Alpinioideae, flexistyly, flow cytometry, genome size, *Siliquamomum oreodoxa*, *Siliquamomum tonkinense*, Vietnam, 2C value

Introduction

The genus *Siliquamomum* Baill. was described by Baillon (1895) from northern Vietnam and was considered monotypic for over a century. Its only species, *Siliquamomum tonkinense*, was later also found in Yunnan in southeastern China (Wu & Larsen, 2000; Gao et al., 2005). A second member of this genus, *Siliquamomum oreodoxa* N.S.Lý & Škorničk., was discovered four years ago in Bidoup Núi Bà National Park, Lâm Đồng Province, southern Vietnam (Lý et al., 2010). Subsequently this species has also been found 30 km further east at Hòn Bà Nature Reserve, Khánh Hòa Province (Leong-Škorničková et al. HB-32 - PR, SING, VNM). A more detailed introduction to *Siliquamomum* was presented in Lý et al. (2010) and is, therefore, not repeated here.

On examination of the Zingiberaceae material in HN herbarium the first author came across an unidentified sheet (*D.K.Harder et al. 4618*) which, together with a single photograph of flowers supplied by Prof. Leonid Averyanov, hinted at the existence of a third *Siliquamomum* species in central Vietnam. Initially insufficient material prevented its formal description. We revisited the locality twice, in July 2010 and April 2012, and now with flowering and fruiting material to hand, the species is

described below as *Siliquamomum alcicorne* Škorničk. & Trần H.Đ. The key to the species of *Siliquamomum* is updated. The terminology follows Beentje (2012).

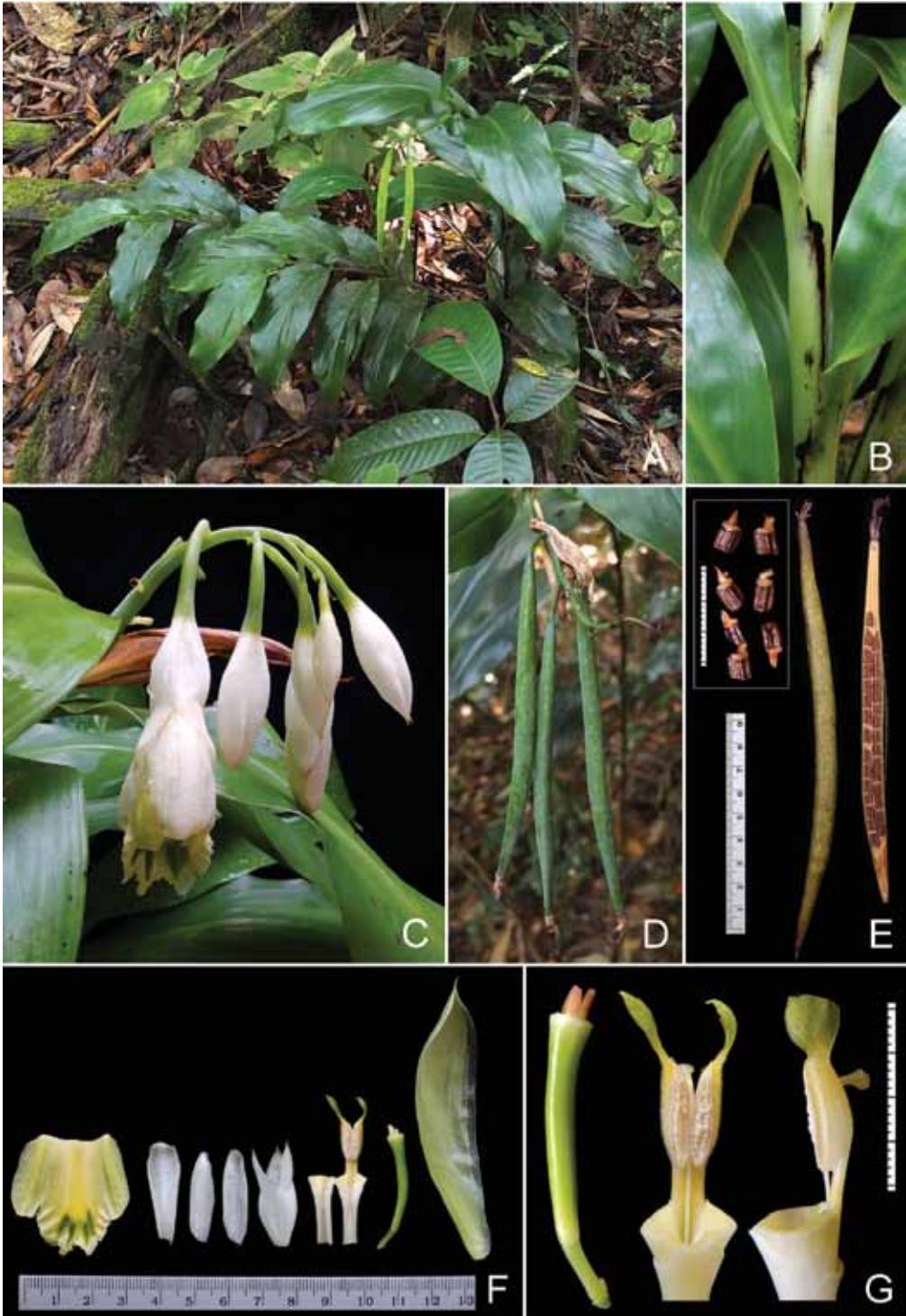
***Siliquamomum alcicorne* Škorničk. & Trần H.Đ., sp. nov.**

Similar to *Siliquamomum tonkinense* Baill. in its robust habit, but differs in having more leaves per leafy shoot (8–11 vs. 3–6), sessile leaf blades (vs. petiolate) and an anther which is deeply divided up to 1/3 from apex with two spatulate, green lobes (as opposed to an emarginate apex without a prominent anther crest).

TYPE: Vietnam, Kontum Province, Kon Plong Dist., Xã Hiếu, 14°38'57.7"N 108°24'57.7"E, 1223 m, 24 April 2012, J. Leong-Škorničková, Nguyễn Q.B., Trần H.Đ., E. Závěská JLS-1560 (holotype SING; isotypes E, PR, VNMN). (Fig. 1)

Terrestrial rhizomatous herb forming loose clumps. **Rhizome** shallowly subterranean, branched, up to 2 cm in diam., creamy white with violet-black tinge externally, cream white internally, slightly aromatic with cinnamon and camphor scent (notable also in crushed leafy shoot); scales papery, brown to black. **Leafy shoots** c. 3–5 cm apart, up to 2 m long, leafless for about 20–45 cm from the base with 3–5 sheathing bracts, with 8–11 leaves per shoot; **sheaths** green, glabrous, slightly reticulate, margin dark (almost black); **ligule** 2–3 mm long, bilobed, dark brown to black, becoming papery and brittle with age, glabrous; **petiole** inconspicuous; **lamina** elliptic to narrowly elliptic, up to 40 × 9 cm, dark green with greyish sheen and glossy above, slightly lighter beneath, glabrous on both sides, apex attenuate, base attenuate, margin entire. **Inflorescence** terminal; **peduncle** enclosed by leaf sheaths of the pseudostem, terminated by a lax pendulous thyrse with 7–10 flowers, **first** (lowermost) and **second bract** at the base of thyrse boat-shaped, c. 9 × 3.7 cm, light green, glabrous, mucronate (c. 4 mm long), enclosing the inflorescence when flowers in bud, soon caducous, leaving semicircular scars on the axis; **fertile bracts** usually minute or completely reduced, whitish green, soon dehiscent (best seen in young inflorescences with unopened buds); **axis of thyrse** to 15 cm long (measured from the lowermost caducous bract to the top of the axis), light green, pruinose, glabrous; **cincinni** 1-flowered; **bracteoles** absent; **pedicels** 3–6 mm long, c. 1 mm diam., light green, glabrous, with a minute white extrafloral nectary. **Flower** c. 7–8 cm long; **calyx** barrel-shaped c. 26–30 mm long, to c. 13 mm diam., unilaterally slit c. 9–11 mm, translucent cream-white, glabrous, 3-toothed at apex, teeth

Fig. 1. *Siliquamomum alcicorne*. **A.** Habit. **B.** Detail of ligules. **C.** Inflorescence (side view). **D.** Fruits. **E.** Fruit dissected (scale bar in cm) with detail of seeds (inset; scale bar in mm). **F.** Dissection (from left): labellum, dorsal corolla lobe, lateral corolla lobes, calyx, floral tube with anther (front view with tube dissected and opened), ovary with epigynous glands, bract (scale bar in cm). **G.** Detail of ovary with epigynous glands and anther (front and side view; scale in mm). Based on JLS-1560. (Photos: Jana Leong-Škorničková)



7–10 mm long; *floral tube* c. 14 mm long, cream-white and entirely glabrous externally and internally; *staminal tube* 6–7 mm long, greenish yellow and glabrous externally and internally, with two bulges covered with glandular hairs clasping the style; *dorsal corolla* lobe broadly elliptic, concave, c. 28×20 mm, cream-white, glabrous on both sides, *lateral corolla lobes* elliptic, concave, c. 27×17 mm, cream-white, glabrous on both sides; *labellum* obovate, c. 32 mm long, c. 24 mm wide at broadest (c. 40 mm wide incl. staminodes), apex rounded, irregularly crisped, sulphur-yellow with green patches at apical free part, adaxially with a few glandular hairs in centre in upper third and on the green patch, glabrous abaxially; *lateral staminodes* connate to labellum in basal 2/3, oblong-obovate, apex rounded, c. 24×8 mm, greenish-sulphur yellow, glabrous, margin slightly undulate. **Stamen** to 22 mm long, *filament* c. 3×3 mm, greenish-white, sparsely hairy at back; *anther* 18×5.5 –6 mm, attached to filament at an 180° angle, greenish to cream-white at the back, yellow towards the apex and thecae, with short and fairly dense glandular hairs on connective, apex deeply divided in upper third, each lobe ending in spatulate green *anther crest* $3\text{--}7 \times 3\text{--}6$ mm, each of which may be either entire or divided into 2 lobes; *anther thecae* c. 11 mm long, light cream, dehiscing longitudinally for their entire length, glabrous. **Epigynous glands** two, each c. 4 mm long, c. 1.5 mm in diam., apex irregularly truncate, cream to light brown. **Style** c. 35 mm long, white, glabrous, flexistylous, basal half fully adnate to the flower tube; *stigma* c. 1.8 mm in diam., club-shaped, ciliate on top; *ostiole* ciliate, sub-apical, transverse elliptic, c. 1.5 mm wide, facing forwards to upwards. **Ovary** narrowly cylindrical, 20–25 mm long, c. 2.5 mm in diam. at base, up to 4 mm at apex, mid-green, glabrous, trilocular, placentation axile. **Fruit** green, up to 20 cm long, c. 1 cm in diam., with numerous seeds, seeds 7–10 mm long, bluntly ridged, rusty-brown with cream to light brown aril.

Phenology. The phenology of this species is not yet well understood. The presence of flowers has been confirmed from early March and rarely extending into April. However, the presence of fruit in various stages of ripeness in April suggests that flowering perhaps starts much earlier, possibly in January. The flowers last for two days.

Distribution & Ecology. So far known only from two locations in Kon Plong District, Kontum Province (central Vietnam), where it is locally common on slopes in montane evergreen broadleaved forest at an elevation of 1100–1300 m. It also occurs near shallow streams.

Provisional IUCN conservation assessment. Endangered EN B1ab(iii) (IUCN, 2012). *Silicquamomum alcicorne* is currently known from three populations in two locations. Two large populations are within a 1 km radius, while the third small population is about 20 km away in a NW direction. Logging activities have been noticed in the area, which is not protected by any legislative status. We, therefore, propose to treat this species as Endangered.

Etymology. The specific epithet '*alcicorne*' refers to the peculiar shape of the anther crest which extends above each anther thecae and is reminiscent of the antlers of the Eurasian elk (*Alces alces*).

Other specimens examined (paratypes). VIETNAM. **Kontum Province:** Kon Plong Dist., Hiếu Municipality, Mang La Forest Enterprise Station, 14°38'55.7"N 108°25'15"E, 1186 m, 1 Mar. 2000, *Harder et al.* 4618 (E, HN, MO n.v.); *ibidem*, 14°42'34.3"N 108°14'35.9"E, 1257 m, 20 July 2010, *Trần et al.* 364 (PR, SING, VNM).

Notes. *Siliquamomum alcicorne* has a uniquely shaped anther. While a deeply divided apex to the anther is also seen in other Alpinioideae, an anther crest with spatulate lobes seems so far to be unique in the family (see Fig. 1G). In its robust habit *Siliquamomum alcicorne* is similar to *S. tonkinense*, but differs in having more leaves per leafy shoot (8–11), leaf blades with no petioles, and an anther divided up to 1/3 from apex with each lobe ending in a spatulate green anther crest. *Siliquamomum tonkinense* has leafy shoots with 3–6 leaves, clearly petiolate leaf blades and an anther with a weakly divided apex without a prominent anther crest. In the shape of the leaf blades it is also similar to the second known species, *Siliquamomum oreodoxa*, which is, however, much smaller in habit with leafy shoots up to 0.9 m long and with petiolate leaves blades up to 18 × 4.5 cm, compared to leafy shoots up to 2 m long with leaf blades up to 40 × 9 cm. The flowers of *Siliquamomum oreodoxa* are more open and the anther is weakly divided at apex (c. 1/6 way from the apex) and, while the two tips may end in sharp teeth, it does not form the prominent spatulate anther crest. The colour of the labellum in *Siliquamomum alcicorne* is sulphur-yellow with green patches, while the labellum of the other two species is white or cream-white with yellow and olive-green patches.

Of the three species, *Siliquamomum tonkinense* is the most widely distributed, with herbarium records from six provinces in northern Vietnam (Hà Giang, Lào Cai, Tuyên Quang, Vĩnh Phúc, Phú Thọ and Hòa Bình) as well as from southern Yunnan (all confirmed specimens are from close proximity to the Vietnam border across from Hà Giang and Lào Cai provinces). While *Siliquamomum oreodoxa* and *S. alcicorne* are each known only from two locations (in each case the populations are separated by 20–30 km), it is predicted that with further floristic exploration of southern and central Vietnam, these species will be reported from adjacent areas as suitable habitats for these species still exist in the region (Fig 2.).

The genome size of all three *Siliquamomum* species has been estimated following the methodology as outlined in Leong-Škorničková et al. (2007). The genome size of *Siliquamomum alcesinum* has been estimated at 2C=3.83 pg (internal standard *Bellis perennis* 2C=3.42 pg). This value is nearly identical (4% difference) to the genome size of *Siliquamomum oreodoxa* (2C=3.99 pg), while *S. tonkinense* has a much larger genome size (2C=5.38 pg). These data suggest closer affinity of the southern and central Vietnamese species to each other than to the northern *Siliquamomum tonkinense*.

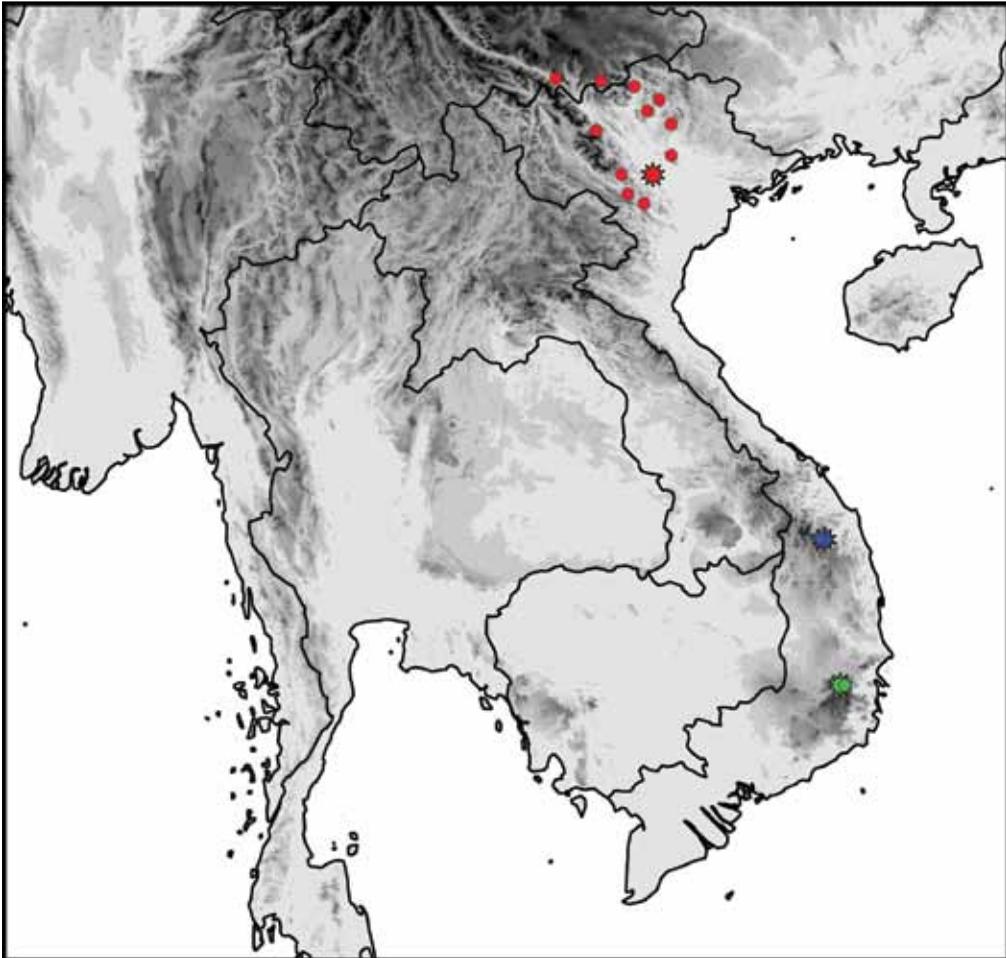


Fig. 2. Distribution of the three *Siliquamomum* species. *Siliquamomum tonkinense* (red), *S. allicorne* (blue) and *S. oreodoxa* (green); type localities (star symbol), distribution records supported by specimens at HN, IBSC, KUN, P, SING and VNMN (circle).

Flexistylis, a special form of stylar behaviour promoting outcrossing in Zingiberaceae, has so far been reported to occur in more than 10 species in three Alpinioideae genera, namely *Alpinia*, *Amomum* (including *Paramomum petaloideum*) and *Etilingera* (e.g. Li et al., 2002; Takano et al., 2005; Ren et al., 2007). It is reported here for the first time that flexistylis also occurs in all three species of *Siliquamomum*. Both anaflexistylous and cataflexistylous flowers were observed in the field. More field observations and further studies at the population level are needed to better understand floral and pollination biology of *Siliquamomum* species.

Key to the species of *Siliquamomum*

- 1a. Pseudostem with 3–6 leaves; petiole 2.5–9 cm long (northern Vietnam & southeastern Yunnan, China) *S. tonkinense*
 1b. Pseudostem with 8–13 leaves; petiole inconspicuous or up to 2 cm long 2
- 2a. Pseudostems up to 2 m long, petiole inconspicuous, anther with prominent spatulate crest-lobes above each theca (central Vietnam) *S. alcicorne*
 2b. Pseudostems up to 0.9 m long, petiole up to 2 cm long, anther with minute sharp point above each theca (southern Vietnam) *S. oreodoxa*

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