

Two Gingers, *Zingiber orbiculatum* and *Z. flavomaculosum* (Zingiberaceae), Newly Recorded from Myanmar

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(Received 12 May 2015; accepted 24 June 2015)

Abstract In the course of taxonomic studies of Zingiberaceae in Myanmar, field expeditions to Shan State and Mandalay Region revealed that *Zingiber orbiculatum* S.Q.Tong, and *Z. flavomaculosum* S.Q.Tong were present. These represent first records of these species for the flora of Myanmar. Detailed descriptions and photographs of these two species are provided.

Key words: Myanmar, new record, *Zingiber orbiculatum* S.Q.Tong, *Zingiber flavomaculosum* S.Q.Tong, Zingiberaceae.

Introduction

The Zingiberaceae are the largest family in the order Zingiberales with 53 genera and over 1200 species (Kress *et al.*, 2002). The genus *Zingiber* is distinct from other genera of the family by the presence of a single anther with a beak or horn-like appendage which embraces the upper part of the style (Sabu, 2003), it is represented by 141 species, distributed throughout S and SE Asia to China and Japan and to northern Australia with its center of diversity in monsoon continental Asia (Larsen, 2005). Thus far 19 species of *Zingiber* have been recorded from Myanmar (Kress *et al.*, 2003, Tanaka, 2012a, 2012b), however, still relatively few collections have made from the region. Therefore it is considered that there may be many more taxa to be recorded.

To clarify the species diversity of *Zingiber* in Myanmar, field explorations were conducted in Chin, Kachin, Kayah, Mandalay, Sagaing, Shan

and Yangon Regions. Of these, the excursions to Mt. Popa, Mandalay Region and eastern part of Shan State led us to collect two species of the genus *Zingiber*, which did not match any descriptions of taxa thus far recorded from Myanmar. As the result, two gingers that had not recorded from the country were discovered and reported here with their descriptions, and their photographs are additionally provided for identification.

Materials and Methods

Field excursions were carried out in Mandalay Region and Shan State to collect the zingiberaceous plants, and herbarium specimens were made in the field. Besides the herbarium specimens, the living materials were planted in the nursery of the Forest Research Institute (FRI), Forest Department of Myanmar and morphologi-

cal studies of these two species were carried out based on both of the herbarium and living materials. The measurements were made based on dried, living, and also on spirit specimens. The identification was made based on these morphological characters. Voucher specimens are deposited in RAF and TNS.

Results and Discussion

As results of the identifications, it was concluded that these taxa were *Z. orbiculatum* S.Q.Tong and *Z. flavomaculosum* S.Q.Tong; both of which were described from Yunnan, S. China. They are recorded from Myanmar for the first time. Both species belong to sect. *Cryptanthium* Horan. having the radical inflorescences borne on procumbent peduncles. The taxonomic treatment with detailed descriptions based on our materials and Tong (1987) and taxonomic discussion for each species is provided as follows.

Zingiber orbiculatum S.Q.Tong in S.Q.Tong & Y.M.Xia, *Acta Phytotax. Sin.* 25: 463. 1987; Wu, T. L. and K. Larsen in *Fl. of China* 24: 329. 2000. Type: China, South Yunnan, in forest; Mengla Xian, alt. 620m. in forest, 20 July 1981, *S. Q. Tong 24804* (Holotype, HITBC). [Fig. 1. A–C]

Plant rhizomatous, 1.5–2m in height. **Rhizomes** whitish brown externally, creamy white internally, aromatic. **Leafy stems** glabrous, reddish green covered with white. **Leaves** 7–10 pairs, sessile; leaf blade lanceolate, 45–60 × 7–9 cm, glabrous, mid-vein basally enlarged and densely red dotted on both sides, base cuneate, pulvinus, thick, red, apex acuminate; ligule green–white, 1.3–1.5 cm long, glabrous, apex subtruncate. **Inflorescences** arising from rhizomes, ovoid or capitate, 8–10 cm long, 3.5–5 cm wide; peduncle 2.2–3.0 cm long. **Bracts** ovate or broadly ovate, 3–5 cm long, 2–2.5 cm wide, dark red, apex acute or shortly acuminate. **Bracteoles** linear lanceolate, pale proximally, red distally, tubular, ca. 4 cm long and ca. 8 cm wide, white pubescent. **Flowers** white, blooming in the

morning; calyx tubular ca. 3 cm long, white, membranous, puberulent except densely pubescent at base, apex 3-toothed; corolla tube 3.4–3.6 cm long; corolla lobes 3, creamy white; dorsal lobe creamy white with red apex, oblanceolate, 3–3.3 cm long, ca. 1 cm wide, lateral lobes ca. 2.2 cm long, ca. 7 mm wide; **labellum** trilobed, white, orbicular; mid-lobe semiorbicular, margin entire, apex slightly trilobed, emarginate, ca. 2.5 cm long, ca. 1.2 cm wide; lateral lobes auriculate, ca. 1.7 cm long, ca. 7 mm wide. **Stamen** ca. 2.2 cm long; filament sessile; anther yellow, thecae parallel, ca. 1.3 cm long, connective appendage ca. 1 cm long, recurved. **Ovary** pale yellow, sub-ellipsoid, densely pubescent, trilocular with many ovules, placentation axile; epigynous glands linear, two, ca. 7 mm long, white. **Capsule** dark red with brown basally, oblong, 4–5 cm long, 2–2.5 cm wide, triangular. **Seeds** black, obovoid.

Specimen examined. MYANMAR, **Shan State**, Kyaingtong Township, 21°27'40.5"N 99°55'6.5"E, 868 m alt., 28 June 2014, *Mu Mu Aung 027* (RAF, TNS).

Distribution: Myanmar (E. Shan), China (S. Yunnan) and Thailand.

Habitat and Ecology: Growing at the forest edge under the shade in semi-evergreen forest, ca. 865 m alt. Flowering in June–July, one to three flowers open in the morning simultaneously per inflorescence.

Notes: *Zingiber orbiculatum* is characterized by reddish green and waxy white leafy stem, glabrous leaves, basally enlarged mid-vein with densely red dots, white orbicular labellum. It has been reported only from the altitude 600 m above sea level, Yunnan, southern China (Tong and Xia, 1987; Wu and Larsen, 2000), however, it was recently recorded from Thailand (Triboun, 2006; Triboun *et al.*, 2014). This is the first record of this species from Myanmar (Fig. 2).

Zingiber flavomaculosum S.Q.Tong, *Acta Phytotax. Sin.* 25(2): 144–145, pl. 1, f. 1. 1987. Wu, T. L. and K. Larsen in *Fl. of China* 24: 329. 2000. Type: China, Yunnan, Mengla, 580 m alt.,

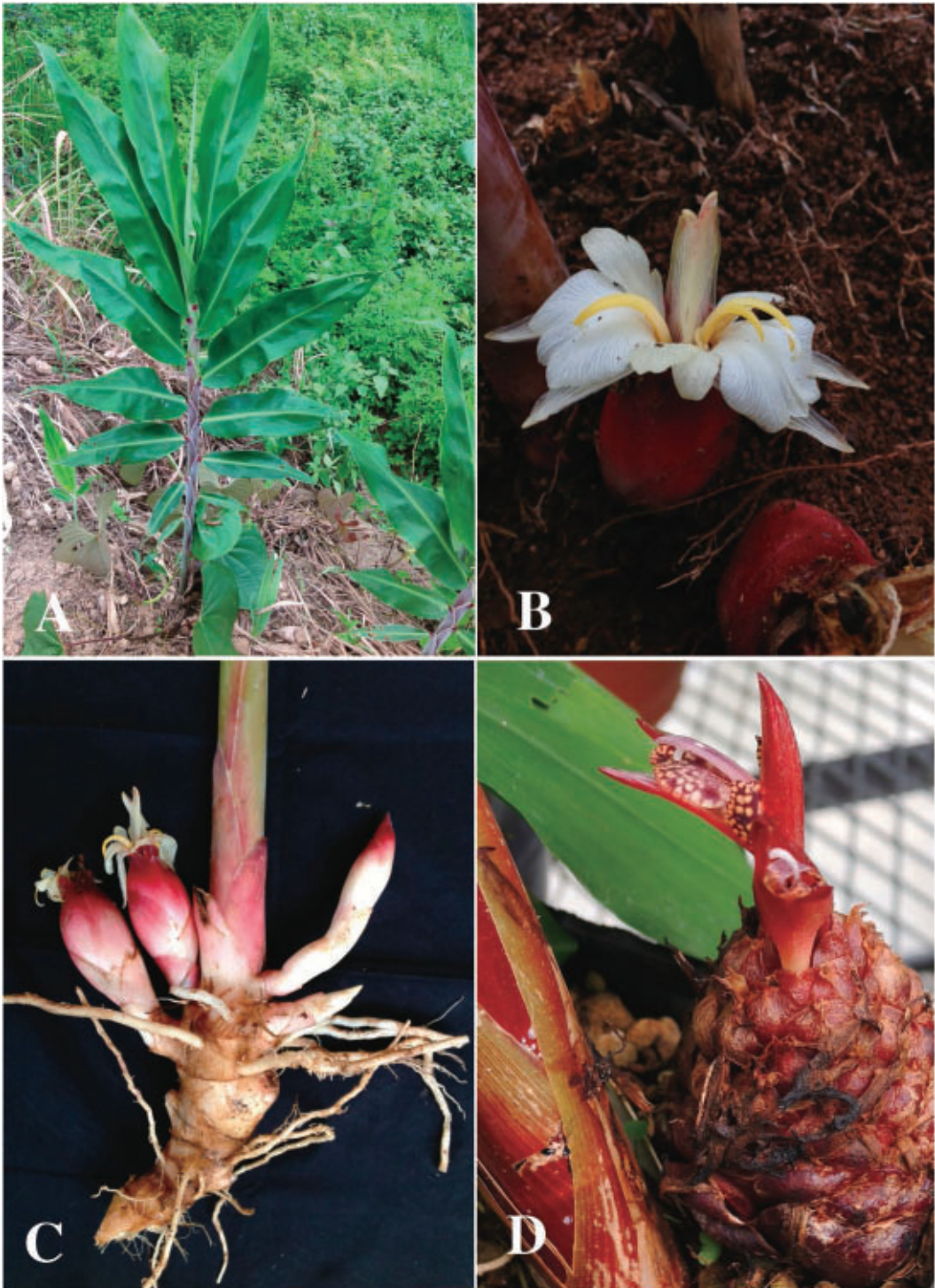


Fig. 1. *Zingiber orbiculatum* S.Q.Tong. A, habit. B, close up view of the inflorescence. C, inflorescences arising from rhizome. *Zingiber flavomaculatum* S.Q.Tong. D, inflorescence with flowers.

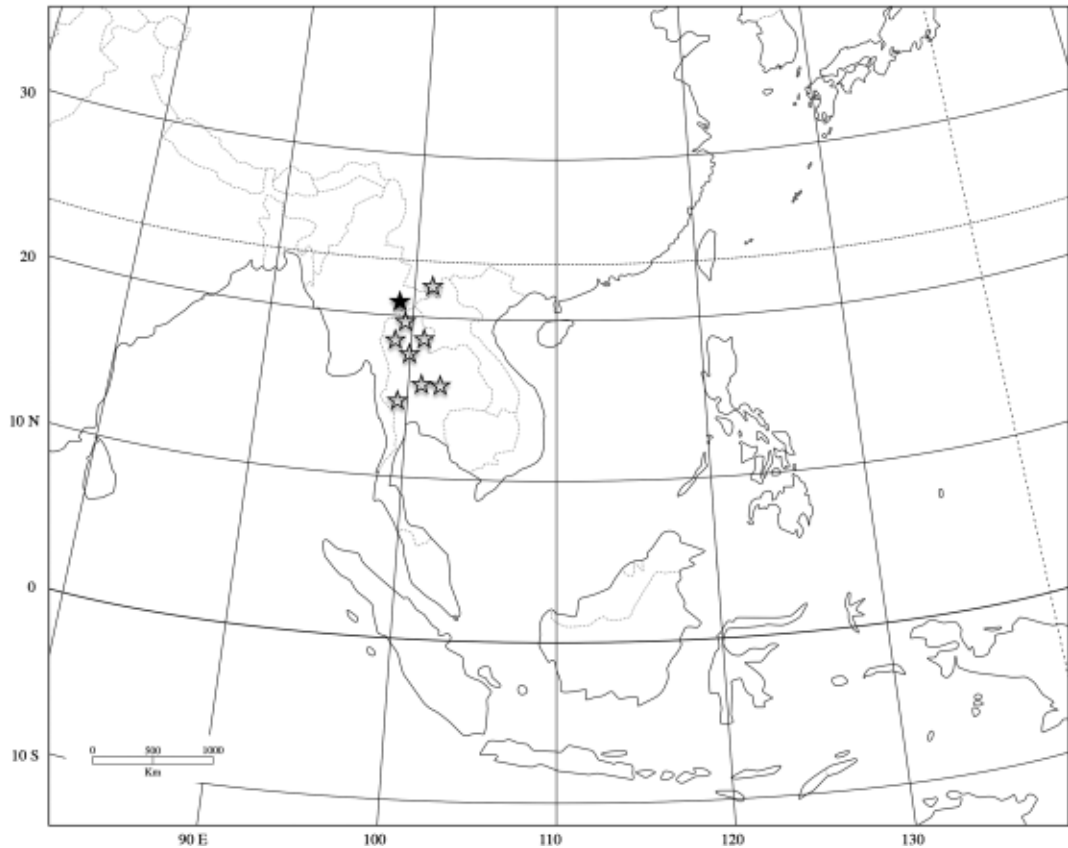


Fig. 2. Distribution map of *Zingiber orbiculatum* S.Q.Tong. Solid star indicates the new habitat in Myanmar, and open stars indicate the previous range of distribution based on Tong and Xia (1987) and Triboun (2006).

in the forest, 6 Aug 1981, *S. Q. Tong* 24806 (Holotype, HITBC). [Fig. 1-D]

Plant rhizomatous, 1–1.5 m in height. **Rhizomes** whitish brown externally, creamy white internally, aromatic. **Leafy stems** slightly hairy, reddish brown basally. **Leaves** 3–17 pairs, subsessile; petioles 1.5–2 cm long, leaf blade lanceolate, 20–35 cm long, 4–7 cm wide, adaxially glabrous, abaxially appressed pilosulose, ciliate, base attenuate, apex acute thinly acuminate; ligule membranous, 4 cm long, 2 cm wide, apex subtruncate, sheath abaxially pubescent. **Inflorescences** arising from rhizomes, 8–9 cm long, 4 cm wide, ovate-oblong, apex obtuse. **Bracts** densely imbricate, widely oblong, 3–5 cm long, 1.5–2 cm wide, red, coriaceous, apex convex, acute, pubescent with brown hairs.

Bracteoles pale red, ca. 3 cm, white puberulent. **Flowers** red; calyx tubular ca. 2 cm long, white, membranous, puberulent except densely pubescent at base, apex 3-toothed; corolla tube red, ca. 3 cm long, yellowish white; corolla lobes 3, red, white hairy abaxially, dorsal lobe lanceolate, ca. 3 cm long, 1.5 cm wide, white hairy abaxially, lateral lobes ca. 2.5 cm long, 1 cm wide; **labelium** trilobed, dark red, yellow spotted; central lobe ligule-like, ca. 2 cm long, 1 cm wide, apex almost emarginate, slightly notched, margin entire; lateral lobes auriculate, ca. 1.5 cm long, 8 mm wide. **Stamen** ca. 3 cm; filament sessile; anther pale yellow, ca. 1.5 cm; anther crest ca. 1.5 cm, cylindrical, recurved. **Ovary** white, sub-ellipsoid, densely pubescent, trilocular with many ovules, placentation axile; style long,

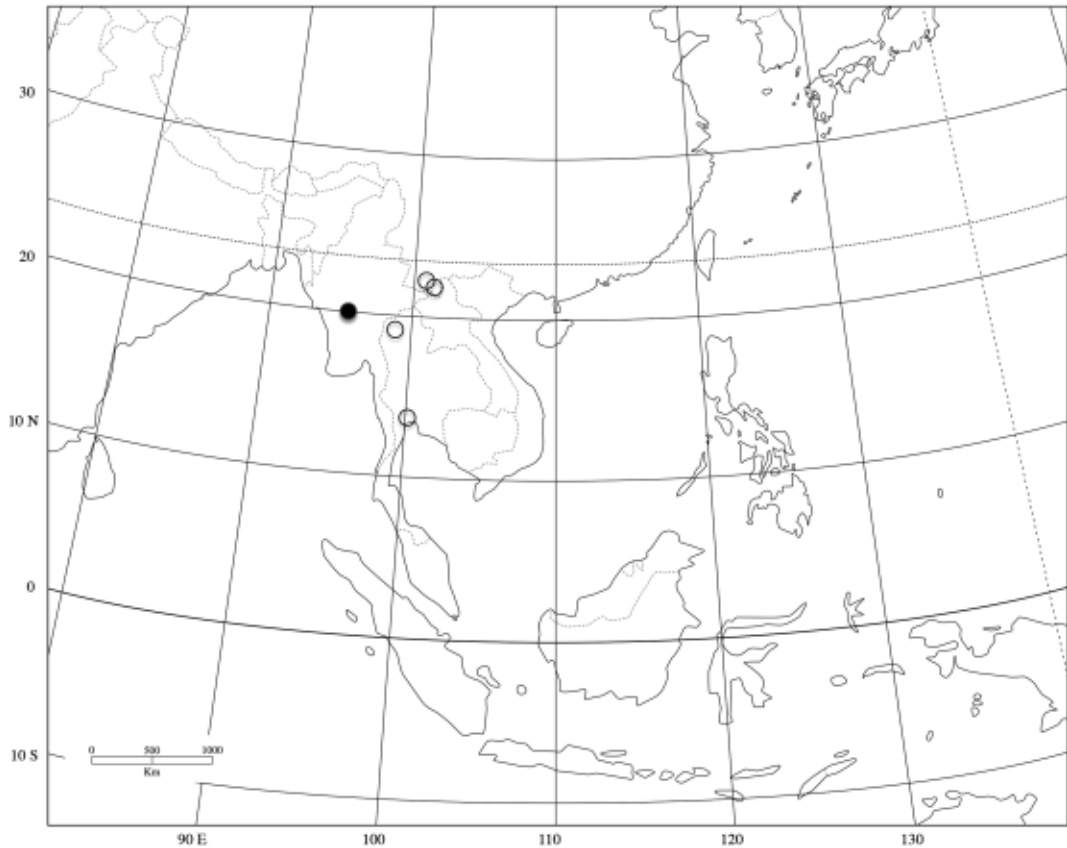


Fig. 3. Distribution map of *Zingiber flavomaculosum* S.Q.Tong. Solid circle indicates the new habitat in Myanmar, and open circles indicate the previous range of distribution based on Tong (1987) and Triboun (2006).

filiform; stigma white, ciliate; epigynous glands linear, two, ca. 7 mm long, light yellow.

Specimen examined. MYANMAR, **Mandalay Region**, Along the trail to Mt. Popa peak, Popa Mountain Park, Kyaukpadaung Township, June 2000, *N. Tanaka et al. 093* (TNS-spirit).

Distribution: Myanmar (Central), China (S. Yunnan) and Thailand.

Habitat and Ecology: Evergreen forest, wet place, ca. 800 m alt.

Notes: *Zingiber flavomaculosum* S.Q.Tong was described from Xishuangbanna, South Yunnan, China. Recently Triboun *et al.* (2014) recognized 56 species of the genus *Zingiber* in Thailand and *Z. flavomaculosum* was included therein. This is the first record from Myanmar (Fig. 3), and thus far this is the western limit of

the distribution of this species. In the figure of the original protologue by Tong (1987), labellum is somewhat truncate at apex, however, in the plant from Mt. Popa it is slightly notched at apex. This species could be also morphologically related to *Z. fragile* S.Q.Tong known from Yunnan. Further detail comparison between the Yunnan related taxa and Myanmar ones are required to clarify its rigorous entity and the range of its morphological variations. The gap of the distribution (Fig. 3) might be bridged by further field studies in Myanmar.

Acknowledgments

This study was partially supported by Ri-Yo-Kan research grant from Graduate School of

Integrated Arts and Sciences, Kochi University, and JSPS KAKENHI Grant Numbers 23770101 and 15K07207 (to N. Tanaka). We are grateful to Forest Department, Ministry of Environmental Conservation and Forestry in Myanmar for permission to conduct this study in several national parks and reserved forests, and for their support and collaboration. The authors also express the sincere thanks to I. M. Turner for his useful comments.

References

- Kress, W. J., Prince, L. M. and Williams, K. J. 2002. The phylogeny and a new classification of the gingers (Zingiberaceae): evidence from molecular data. *American Journal of Botany* 89: 1682–1696.
- Kress, W. J., DeFilipps, R. A., Farr, E. and Kyi, Y. Y. 2003. A checklist of the trees, shrubs, herbs, and climbers of Myanmar. *Contributions from the United States National Herbarium* 45: 1–590.
- Larsen, K. 2005. Distribution patterns and diversity centres of Zingiberaceae in SE Asia. In: Friis, I. and Balslev, H. (eds.), *Plant Diversity and Complexity in Patterns. Local, Regional, and Global Dimensions*. *Biologiske Skrifter det Kongelige Danske Videnskaberne Selskab* 55: 219–228.
- Sabu, M. 2003. Revision of the genus *Zingiber* in South India. *Folia Malaysiana* 4: 25–52.
- Tanaka, N. 2012a. Studies of Zingiberaceae in Myanmar I: newly recorded species of *Zingiber*, *Zingiber idea*. *Makinoa New Series* 10: 153–157.
- Tanaka, N. 2012b. Studies of Zingiberaceae in Myanmar II: a new species, *Zingiber popaense* from Mt. Popa. *Makinoa New Series* 10: 159–163.
- Triboun, P. 2006. Biogeography and biodiversity of the genus *Zingiber* in Thailand. PhD thesis, 277 pp. Khon Kaen University.
- Triboun, P., Larsen, K. and Chantaranonthai, P. 2014. A key to the genus *Zingiber* (Zingiberaceae) in Thailand with descriptions of 10 new taxa. *Thai Journal of Botany* 6: 53–77.
- Tong, S. Q. 1987. New plants of *Zingiber* from Yunnan. *Acta Phytotaxonomica Sinica* 25: 140–149.
- Tong, S. Q. and Xia, Y. M. 1987. New taxa of Zingiberaceae from southern Yunnan. *Acta Phytotaxonomica Sinica* 25: 460–471.
- Wu, T. L. and Larsen, K. 2000. Zingiberaceae. In: Wu, Z.-Y. and Raven, P. H. (eds.), *Flora of China* vol. 24, pp. 333–346. Science Press, Beijing and Missouri Botanical Garden Press, St. Louis.