

## Seven Taxa of *Zingiber* (Zingiberaceae) Newly Recorded for the Flora of Myanmar

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**Abstract** In the course of study on *Zingiber* (Zingiberaceae) in Myanmar, seven taxa: *Zingiber bradleyanum* Craib, *Z. chrysanthum* Roscoe, *Z. densissimum* S.Q.Tong & Y.M.Xia, *Z. mekongense* Gagnep., *Z. ottensii* Valetton, *Z. parishii* Hook.f. subsp. *phuphanense* Triboun & K.Larsen, *Z. tenuiscapus* Triboun & K.Larsen, are newly recorded from Myanmar. The total number of taxa of *Zingiber* presently occurring in Myanmar is raised to 33 as the results of this study. The photographic illustrations, the distributions, and voucher specimens for each species are provided.

**Key words:** Myanmar, *Zingiber bradleyanum*, *Zingiber chrysanthum*, *Zingiber densissimum*, *Zingiber mekongense*, *Zingiber ottensii*, *Zingiber parishii* subsp. *phuphanense*, *Zingiber tenuiscapus*, Zingiberaceae.

### Introduction

The genus *Zingiber* Mill. is the second largest genus in the Zingiberaceae with about 150 species (Wu and Larsen, 2000; Kishor and Leong-Škorničková, 2013). Kress *et al.* (2003) listed 19 species of *Zingiber* in his checklist of flowering plants of Myanmar. However, among them, *Z. cassumunar* Roxb. was sunk into a synonym of *Z. montanum* (Koenig) Link ex Dietr. (Theilade, 1999). At a later date, eight species have been added to the Flora of Myanmar (Tanaka, 2012a, 2012b; Aung *et al.*, 2015, 2017; Tanaka and Aung, 2017; Tanaka *et al.*, 2018), and presently 26 species have been recorded. Compared to the flora of Thailand (62 taxa) (Triboun *et al.*, 2014; Triboun and Keeratikiet, 2016), this small number of *Zingiber* species could be due to the lack of field works and low collection density in this country. The same situation has been reported in Laos (Souvannakhoummane and Leong-

Škorničková, 2018). In addition, quite large part of the forest areas is still restricted to enter in Myanmar.

In the course of our inventory works especially to unexplored regions to clarify the species diversity of *Zingiber* in Myanmar, we collected seven taxa of *Zingiber* from Myanmar for the first time, namely *Zingiber bradleyanum* Craib, *Z. chrysanthum* Roscoe, *Z. densissimum* S.Q.Tong & Y.M.Xia, *Z. mekongense* Gagnep., *Z. ottensii* Valetton, *Z. parishii* Hook.f. subsp. *phuphanense* Triboun & K.Larsen, and *Z. tenuiscapus* Triboun & K.Larsen.

As the results, the total number of the taxa of *Zingiber* recorded in Myanmar is presently raised to 33. The species number occurring in Myanmar is still small although it has a distinct north-south polarity, and then more various vegetative environments exist. Further extensive fieldworks would reveal much more species diversity of Myanmar *Zingiber*.

## Materials and Methods

The field surveys to collect *Zingiber* species were carried out in Mandalay Region, Kayah State, Kayin State, Shan State, Sagain Region, Tanintharyi Region (old Tenasserim) in Myanmar between 2014 and 2018. Dried and pressed herbarium specimens and spirit collections were made and deposited in RAF and TNS. Photographic data used in the figures in this study were prepared in the field. The specimens collected were morphologically examined for rigorous identification. Herbarium specimens from Myanmar and neighboring countries (other Continental SE Asia) kept in A, AAU, BK, BKF, BM, BO, E, K, MBK, RAF, TI and TNS were examined. Additional materials were also accessed as high-resolution digital images from the following herbaria: G, L, P and US. The distribution of *Zingiber* species in the world was also checked based on Plants of the World Online (<http://powo.science.kew.org>).

## New Records

***Zingiber bradleyanum*** Craib in Bull. Misc. Inform. Kew 1912: 403 (1912). Type: THAILAND. Chiang Mai, Doi Sutep, 300 m alt., Kerr 763 (lecto-K!, designated by Theilade, 1999, isolecto-E, digital image!). Fig. 1. A–B.

*Specimens examined:* MYANMAR. KAYAH STATE: Nat Taung Reserved Forest, Chikae, Loikaw Township. 975 m elev., 19°42'00"N, 97°15'74"E, *Mu Mu Aung et al. MMA82* (RAF, TNS); Kholeso reserved forest, Phruso Township. 1167 m elev., 19°22'10"N, 97°13'42"E, *Mu Mu Aung et al. MMA098* (RAF, TNS). MANDALAY REGION: along the highway road, Pyin Oo Lwin Township, 1072 m elev., 21°58'14.497"N, 96°25'45.092"E, *Mu Mu Aung et al. MMA215* (RAF, TNS); Singyaung-lay, Pyin Oo Lwin Township, 1150 m elev., 21°58'18.411"N, 96°29'40.170"E, *Mu Mu Aung et al. MMA212* (RAF, TNS).

*Distribution:* Myanmar and Thailand.

*Note:* *Zingiber bradleyanum* is well character-

ized by its long, bilobed ligules with whitish margin. The lobes are slightly twisted and often unattached to the leafy stem. Thus far all collections of this species have been obtained from central part of Myanmar.

***Zingiber chrysanthum*** Roscoe, Monandr. Pl. Scitam.: t. 86 (1824); Hook.f., Fl. Brit. India 6: 243 (1892); Kumar in Hajra *et al.*, Fl. Sikkim 1: 133 (1996); Tripathi and Singh in J. Econ. Taxon. Bot. 30: 524 (2006). Type: An illustration of Monandr. Pl. Scitam. t. 86. Fig. 1. C–D.

*Specimen examined:* MYANMAR. KAYAH STATE: 21 km SW of Phruso, Phruso Township between Mawthido village and Rae Parar village, 1450 m elev., 19°21'50.5"N, 97°01'40.4"E, *Tanaka et al. MY3502* (RAF, TNS).

*Distribution:* Bhutan, India (N & NE), Bangladesh, Myanmar and Nepal.

*Note:* *Zingiber chrysanthum*, a Himalayan species, thus far recorded from Indo-Himalayan region, was found in SE of Myanmar in this study (Fig. 2). According to the Bhutan Biodiversity Portal (<https://biodiversity.bt>), this species is apparently distributed in Bhutan based on the photo image provided in the database. It has been reported that Mt. Victoria (Natma Taung) in Chin Hill acted as a refugia for the Sino-Himalayan elements (Kingdon-Ward, 1956; Tanaka, 2005). According to this study, mountain region at high elevation, even if in southeastern part of Myanmar, is considered to be a refugia for the Himalayan species.

***Zingiber densissimum*** S.Q.Tong & Y.M.Xia in Acta Phytotax. Sin. 25: 467 (1987); Tong and Xia in Fl. Yunnan 8: 538 (1999); Wu and Larsen in Fl. China 24: 330 (2000); Souvannakhoumane & Leong-Škorničková in Nordic J. Bot. 75: 4 (2018). Type: CHINA. Yunnan, Menghai, 1400 m, *S.Q.Tong & Y.M.Xia 24998* (holo-HITBC). Fig. 3. A–B.

*Specimens examined:* MYANMAR. MANDALAY REGION: Singyaung-lay, Pyin Oo Lwin Township, 1150 m elev., 21°58'18.411"N, 96°29'40.170"E, *Mu Mu Aung et al. MMA223*



Fig. 1. A–B. *Zingiber bradleyanum*. A: Flower in front view. B: Leafy stem showing ligules. C–D. *Z. chrysanthum*. C: Flower in front and side view. D: Leafy stem showing ligules.

(RAF, TNS). SHAN STATE: Shwe Borne Pwit Pagoda, North Taunggyi Nature Reserve, Taunggyi, 1700m elev., 20°46'35.1"N, 97°03'03.6"E, Tanaka *et al.* MY3555 (RAF, TNS).

*Distribution:* China, Laos, Myanmar and Thai-

land.

*Note:* *Zingiber densissimum* is close to *Z. bradleyanum* and *Z. orbiculatum* in having white orbicular labellum and bright yellow anther, however it is distinguished from both of the two

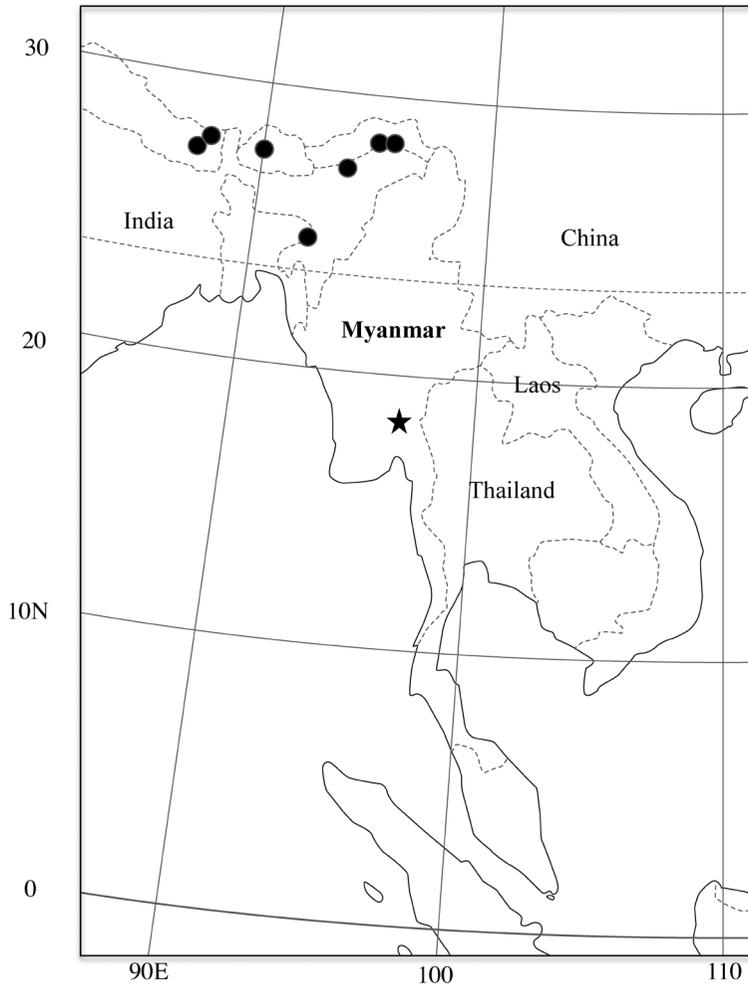


Fig. 2. Distribution of *Z. chrysanthum*. Solid circles showing the previous recorded locations based on Long *et al.* 842 (E), Mikage *et al.* 9558137 (TI) and Tripathi and Singh (2006). Star showing the new location reported here.

in having bilobed ligules, white hairs on leafy stem and lower surface of lamina. *Zingiber densissimum* is also characterized by inflorescence often covered with gelatinous substance to keep the moisture for its delicate flowers. The species is commonly found in the eastern part of Myanmar.

**Zingiber mekongense** Gagnep. in Bull. Soc. Bot. France 54: 168 (1907); Gagnepain, in Lecomte, Fl. Indo-Chine 6: 79 (1908); Triboun *et al.* in Thai J. Bot. 6: 57 (2014). Type: LAOS. De Stung Streng à Kong, Luang-prabang, Thorel

2198 (holo-P, digital image!). Fig. 3. C–D.

*Specimens examined*: MYANMAR. KAYAH STATE: Lweekahtai, Demawso Township, 1166 m elev., 19°34'30"N, 96°59'54"E. Mu Mu Aung *et al.* MMA93 (RAF, TNS); Rhunku village, Demotho Township, Loikaw District, 1240 m elev., 19°35'03.84"N, 97°00'12.24"E, Tanaka *et al.* MY3467 (RAF, TNS).

*Distribution*: Laos, Myanmar and Thailand.

*Note*: *Zingiber mekongense* was described from Laos by Gagnepain (1907), and was recently recognized from Thailand (Triboun *et al.*, 2014). The species is very similar to *Z. fla-*

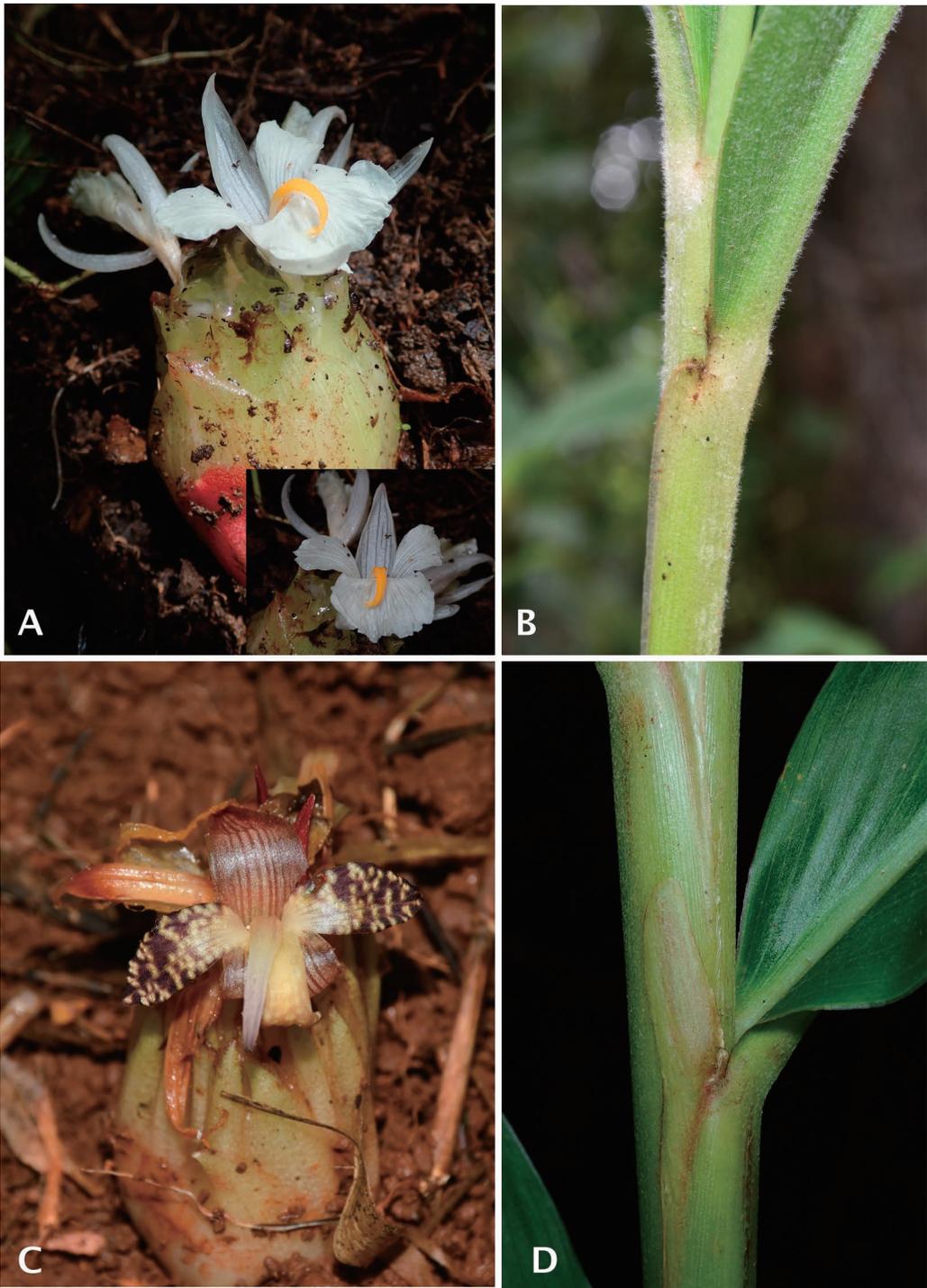


Fig. 3. A–B. *Zingiber densissimum*. A: Inflorescence. Flower in front view (inset). B: Leafy stem showing ligules. C–D. *Z. mekongense*. C: Flower in front view. D: Leafy stem showing ligules.

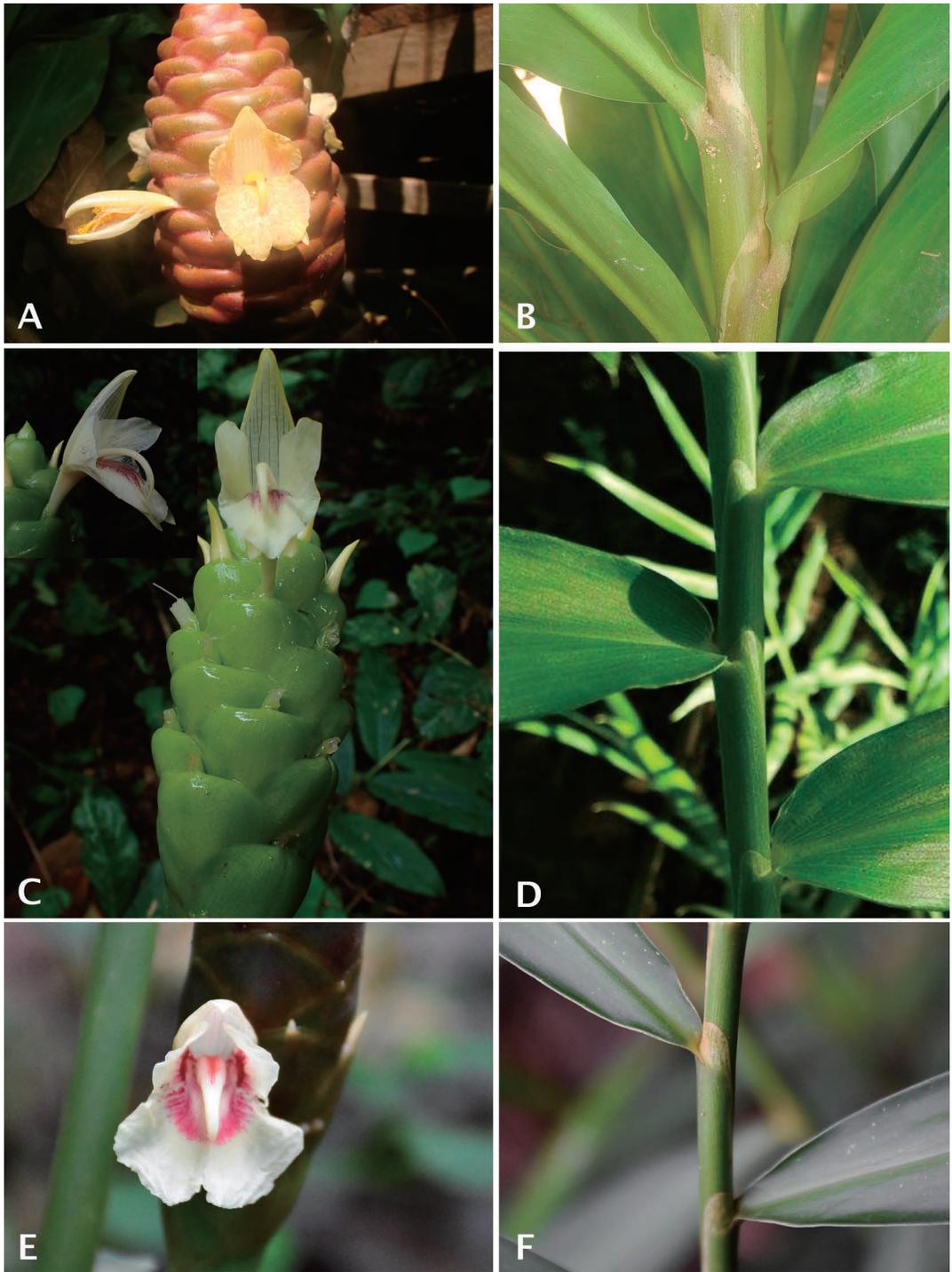


Fig. 4. A–B. *Zingiber ottensii*. A: Inflorescence. B: Leafy stem showing ligules. C–D. *Z. parishii* subsp. *phuphanense*. C: Inflorescence. Flower in side view (inset). D: Leafy stem showing ligules. E–F. *Z. tenuiscapus*. E: Inflorescence with a flower. F: Leafy stem showing ligules.

*vomaculosum* S.Q.Tong, which was also reported from Myanmar recently (Aung *et al.*, 2015), but differs from it in having densely imbricate inflorescence bracts with convex, acute, brown hairy apex. The color of inflorescence bracts varied from red to green. This species is often growing on the bamboo forest floor in Myanmar.

***Zingiber ottensii*** Valetton in Bull. Jard. Bot. Buitenzorg, sér. 2, 27: 136, t.19 (1918); Ridley, Fl. Mal. Penin. 4: 259 (1924); Holttum in Gardens' Bull. Singapore 13: 56 (1950); Theilade in Gardens' Bull. Singapore 48: 223 (1998). Type: INDONESIA. Java, Bogor, *Ottens 676* (lecto-L, designated by Theilade, 1998, isolecto-K!). Fig. 4. A–B.

*Specimens examined*: MYANMAR. TANINTHARYI REGION: Taninthryi Nature Reserve, *Myo Min Latt, TNR 00198 & 00199* (RAF!).

*Distribution*: Indonesia (Java, Sumatra), Laos, Peninsular Malaysia, Myanmar, Thailand and Vietnam.

*Note*: *Zingiber ottensii* has been reported as a village plant and used for medicine by local people in Thailand (Theilade, 1998, 1999), however the above collection in RAF shows its distribution in peninsular part (Tanintharyi) of Myanmar. The location of the specimens is inside the Tanintharyi Nature Reserve, and it is considered to grow in the wild. During our field works in Tanintharyi Region, we came across this plant being cultivated in a villager residence too, which was collected from the forest. Recently *Z. ottensii* was also reported from Vietnam (Ly *et al.*, 2016). Rhizomes are dark purple inside.

***Zingiber parishii*** Hook.f. subsp. ***phuphanense*** Triboun & K.Larsen in Thai J. Bot. 6: 62 (2014); Souvannakhoummane & Leong-Škorničková in Nordic J. Bot. 75: 10 (2018). Type: THAILAND. Sakon Nakhon, Phu Pan, *Triboun & Kantachote 3323* (holo-BKF, iso-AAU!). Fig. 4. C–D.

*Specimens examined*: MYANMAR. KAYAH STATE: Nan Oo reserved forest, Loilin Lay village, Loikaw Township, 821 m elev., 19°51'43"N, 97°14'16"E, *Mu Mu Aung et al. MMA088* (RAF,

TNS). KAYIN STATE: Thaundaung Reserve Forest, Thaundaungyi Township, 410 m elev., N19°01'23.9", E96°36'41.04", *Tanaka et al. MY3411* (RAF, TNS).

*Distribution*: Laos, Myanmar and Thailand.

*Note*: *Zingiber parishii* subsp. *phuphanense* was originally described from E. Thailand, however, recently it was also recorded from Laos (Souvannakhoummane and Leong-Škorničková, 2018). In Myanmar plant the labellum has more prominent purplish blue streaks than that from the Thai and Laos, but it matches very well the original protologue by Triboun *et al.* (2014) and the illustration by Souvannakhoummane and Leong-Škorničková (2018). Accordingly, we tentatively accommodate this plant in a variation within *Z. parishii* subsp. *phuphanense*, and do not give any other names for this plant at this stage. Further clarification of its entity is much needed and probably more field observation and collections are required to compare to the Thai and Laos plants, and also need to compare with *Z. parishii* subsp. *parishii*. *Zingiber parishii* subsp. *parishii* is easily recognized by yellowish inflorescence bracts with orange tip and more purplish red tinged labellum.

***Zingiber tenuiscapus*** Triboun & K.Larsen in Thai J. Bot. 6: 65 (2014). Type: THAILAND. Tak Mae Sot, *Triboun 3343* (holo-BK!, iso-AAU!). Fig. 4. E–F.

*Specimen examined*: MYANMAR. TANINTHARYI REGION: Michaug Hlaung (old village), Taninthayi Reserved Forest, Yephyu Township, 35 m elev., *Tanaka et al. MMA157* (RAF, TNS).

*Distribution*: Myanmar (south) and Thailand. Local name (Myanmar): Pade-kaw.

*Note*: *Zingiber tenuiscapus* is well characterized by its pubescent brown ligules and labellum with half ring-shaped pink red mottle at base. This species is common in Tanintharyi, peninsular region of Myanmar, where local villagers also cultivate and use their rhizomes as medicine.

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### References

- Aung, M. M., Tanaka, N. and Miyake, N. 2015. Two gingers, *Zingiber orbiculatum* and *Z. flavomaculosum* (Zingiberaceae), newly recorded from Myanmar. Bulletin of the National Museum of Nature and Science, Series B (Botany) 41: 107–112.
- Aung, M. M., Tanaka, N. and Miyake, N. 2017. A new species of *Zingiber* (Zingiberaceae) from Mt. Victoria, western Myanmar. Bulletin of the National Museum of Nature and Science, Series B (Botany) 43: 51–55.
- Gagnepain, F. 1907. Zingiberacées nouvelles de l’herbier du muséum. Bulletin de la Société Botanique de France 54: 161–170.
- Kishor, R. and Leong-Škorničková, J. 2013. *Zingiber kangleipakense* (Zingiberaceae): a new species from Manipur, India. The Gardens’ Bulletin Singapore 65: 39–46.
- Kingdon-Ward, F. 1956. A sketch of the flora and vegetation of Mount Victoria in Burma. Acta Horti Gothoburgensis 22: 53–74.
- Kress, W. J., DeFilipps, R. A., Farr, E. and Kyi, D. Y. Y. 2003. A checklist of the trees, shrubs, herbs, and climbers of Myanmar. Contributions from the United States National Herbarium 45: 118–124.
- Ly, N. S., Truong, B. V. and Le, T. H. 2016. *Zingiber ottensii* Valetton (Zingiberaceae)—a newly recorded species for Vietnam. Bioscience Discovery 7: 93–96.
- Souvannakhoummane, K. and Leong-Škorničková, J. 2018. Eight new records of *Zingiber* Mill. (Zingiberaceae) for the flora of Lao P.D.R. Edinburgh Journal of Botany 75: 3–18.
- Tanaka, N. 2005. Plant inventory research: contributions to the flora of Myanmar. Acta Phytotaxonomica et Geobotanica 56: 21–26.
- Tanaka, N. 2012a. Studies of Zingiberaceae in Myanmar I: Newly recorded species of *Zingiber*, *Zingiber idae*. 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.
- Tanaka, N. and Aung, M. M. 2017. A new species of *Zingiber* (Sect. *Dymczewiczia*: Zingiberaceae) from northwestern Myanmar. Phytotaxa 316: 195–199.
- Tanaka, N., Tagane, S., Naiki, A., Aung, M. M., Tanaka, N., Dey, S., Mood, J. and Murata, J. 2018. Contributions to the flora of Myanmar I: Nine taxa of monocots newly recorded from Myanmar. Bulletin of the National Museum of Nature and Science, Series B (Botany) 44: 31–39.
- Theilade, I. 1998. Revision of the genus *Zingiber* in Peninsular Malaysia. The Gardens’ Bulletin Singapore 48: 207–236.
- Theilade, I. 1999. A synopsis of the genus *Zingiber* (Zingiberaceae) in Thailand. Nordic Journal of Botany 19: 389–410.
- 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.
- Triboun, P. and Keeratiket, K. 2016. *Zingiber sirindhorniae*, a remarkable new species in *Zingiber* section *Dymczewiczia* (Zingiberaceae) from Thailand. The Thailand Natural History Museum Journal 10: 1–6.
- Tripathi, S. and Sing, K. K. 2006. Taxonomic revision of the genus *Zingiber* Boehm. in north-east India. Journal of Economic and Taxonomic Botany 30: 520–532.
- Wu, T. L. and Larsen, K. 2000. Zingiberaceae. In: Wu, Z. Y. and Raven, P. H. (eds), Flora of China vol. 24, pp. 322–377. Science Press, Beijing and Missouri Botanical Garden Press, St. Louis.