

Contributions to the Flora of Myanmar I: Nine taxa of monocots newly recorded from Myanmar

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Abstract We have conducted field explorations in several regions of Myanmar with the aim of updating our floristic knowledge of the country. As a result, the following nine monocotyledonous taxa representing four families proved to be new to the flora of Myanmar: *Peliosanthes weberi* (L. Rodr.) N. Tanaka (Asparagaceae); *Musa markkuana* (M.Sabu, A.Joe & Sreejith) Hareesh, A.Joe & M.Sabu, *M. nagensium* Prain var. *hongii* Häkkinen, and *M. sikkimensis* Kurz (Musaceae); *Porpax elwesii* (Rchb.f.) Rolfe (Orchidaceae); *Alpinia intermedia* Gagnep., *Boesenbergia purpureorubra* Mood & L.M.Prince, *Globba praecox* Chokthawweep, K.J.Williams & Paisooks., and *Zingiber thorelii* Gagnep. (Zingiberaceae). Collection data and notes on the taxonomic and phytogeographical aspects of these taxa are provided.

Key words: Asparagaceae, Musaceae, Myanmar, new record, Orchidaceae, Zingiberaceae.

Introduction

Myanmar is known as the “floristic blank” among Continental Southeast Asian countries, yet it embraces rich floral and faunal diversity from the mangrove forests and coral reefs of the Andaman Islands in the south, to the snow-capped peaks of Mt. Kakaboradzi (5,881 m) in the north, the highest mountain in Southeast Asia. However, an inventory in Myanmar is far from being complete with only limited specimens to be found in the world’s herbaria. Conse-

quently, much remains to be understood concerning its flora as well as of its floristic relations with neighboring regions of Asia (Tanaka, 2005; Tanaka, 2010).

Thus far we have been revising the Myanmar flora, the decade-long continuous inventory studies have discovered many new species, new records and noteworthy plant collections as materials for the flora of Myanmar (Tanaka *et al.*, 2006, 2007, 2009, 2010a, 2010b, 2010c, 2011, 2015, 2016; Tanaka and Nagamasu, 2006; Tanaka and Hughes, 2007; Ito *et al.*, 2009;

Murata *et al.*, 2010; Yukawa *et al.*, 2010; Tanaka and Hayami, 2011; Tanaka, 2012a, 2012b; Tanaka and Peng, 2016; Tanaka and Aung, 2017).

However, many regions in Myanmar still lack sufficient floristic inventories. Among them, the northwestern (Kachin State and Sagaing Region) and southern peninsular regions including the Mergui Archipelago in the Andaman Sea (formerly Tenasserim) are considered as the most under-collected. To help improve this situation, the National Museum of Nature and Science (Japan) and Forest Department, Ministry of Natural Resources and Environmental Conservation (Myanmar), have newly started an inventory project to provide contributions to the Flora of Myanmar since 2016.

Field explorations were carried out in the Hta-

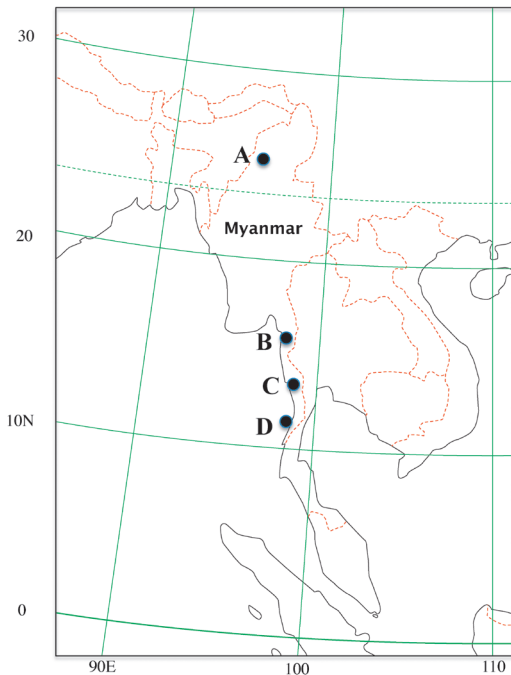


Fig. 1. Map of study sites. Solid circles are showing our explored sites 2016–2018. A. The Htamanthi Wildlife Sanctuary, Sagaing Region. B. Tanintharyi Nature Reserve, in northeast of Dawei. C. Palaw, vicinity of Myeik. D. Lampi Island Marine National Park, Tanintharyi Region.

manthi Wildlife Sanctuary (Fig. 1-A), Sagaing Region, Tanintharyi Nature Reserve (Fig. 1-B), in the vicinity of Dawei (formerly Tavoy), Palaw in the vicinity of Myeik (formerly Mergui) (Fig. 1-C), and Lampi Island Marine National Park (Fig. 1-D), Tanintharyi Region, from 2016 through 2017. Additionally, earlier field collections from Kachin State and Shan State were also examined at TI and TNS herbarium. As a result, nine taxa of monocots representing four families were newly recorded from Myanmar.

Newly Recorded Taxa

ASPARAGACEAE

Peliosanthes weberi (L.Rodr.) N.Tanaka in Novon 14: 362 (2004). **Fig. 2-A.**

Neolourya weberi L. Rodr. in Bull. Mus. Natl. Hist. Nat., sér. 2, 6: 97 (1934).

Specimen examined: MYANMAR. **TANINTHARYI REGION:** On the hill, near Mawtaung Pass, boader of Thailand, Mawtaung Township, N11°46'59.3", E99°38'27.5", *Tagane et al. MY289* (RAF, TNS).

Distribution: Laos, Myanmar, Thailand, and Vietnam.

Note: Rodriguez (1934) founded *Neolourya* L.Rodr. on the basis of two species from Vietnam, *N. weberi* L.Rodr. and *N. pierrei* L.Rodr. This genus was later regarded as congeneric with *Peliosanthes* Andrews (Hutchinson, 1959, Tanaka, 2004). When transferring *Neolourya* to *Peliosanthes*, Tanaka (2004) merged *N. pierrei* and *N. thailandica* K.Larsen (from Thailand) into *P. weberi*. This broadly circumscribed *P. weberi* has been known from Laos, Thailand, and Vietnam, but not from Myanmar.

At a site near Mawtaung Pass in the southernmost peninsular region of Myanmar, which is near the border with Thailand, we came across a species of *Peliosanthes*. It has nodding funnel-shaped green flowers, perfectly inferior ovaries, and slender terete styles. We identified the plant as *P. weberi*, since it basically matches the latter. This is the first record of *P. weberi* for Myanmar, and the record represents the species' westernmost distribution.



Fig. 2. A. *Peliosanthes weberi* (L.Rodr.) N.Tanaka (Asparagaceae). B. *Musa markkuana* (M.Sabu, A.Joe & Sreejith) Hareesh, A.Joe & M.Sabu. C, D. *Musa nagensium* Prain var. *hongii* Häkkinen (Musaceae).

In *Peliosanthes weberi*, several of the six free distal portions of monadelphous stamens are usually strongly incurved and largely hidden by the

united proximal portion of the filaments (staminal corona), and the style is more or less helicoid (Larsen, 1966; Tanaka, 2004). In contrast, in the

specimen from Myanmar (*Tagane et al. MY289* in TNS), all six free portions of the stamens are weakly incurved and scarcely hidden, and the style is little helicoid. These traits may represent local variations of this wide spread species.

MUSACEAE

Musa markkuana (M.Sabu, A.Joe & Sreejith) Hareesh, A.Joe & M.Sabu in *Phytotaxa* 303: 283 (2017). **Fig. 2-B.**

Musa velutina H.Wendl.& Drude subsp. *markkuana* M.Sabu, A.Joe & Sreejith in *Phytotaxa* 92: 50 (2013).

Specimen examined: MYANMAR. **KACHIN STATE:** Along the Ledo Road between Shinbwiyang and Tanain, N26°56'00", E96°52'00", *Murata et al. 041625* (MBK, TI).

Distribution: India and Myanmar.

Note: *Musa markkuana* was firstly described as subspecies of *M. velutina* H.Wendl. & Drude (Sabu *et al.*, 2013), however, at a later date, Hareesh *et al.* (2017) taxonomically re-evaluated its entity based on comparison of anatomical and palynological characters. Presently *M. markkuana* is accepted as a distinct species. *Musa markkuana* has been recorded in Arunachal Pradesh and Nagaland, eastern India. This study revealed that *M. markkuana* was distributed from eastern India to northwestern Myanmar.

Musa nagensium Prain var. **hongii** Häkkinen in *Novon* 18: 337 (2008). **Fig. 2-C, D.**

Specimens examined: MYANMAR. **KACHIN STATE:** 9 miles from Shinbweyan toward Pansaung, near the border of Sagaing Region. N26°47'15", E96°12'30", alt. 1,080m., *Murata et al. 041291* (MBK, TI); along the Ledo Road, between Namyung and Shinbwiyang, 5-7 miles from Shinbwiyang toward Namyung, in border area of Sagaing Region, N26°42'32"–45'48", E96°11'55"–13'01", *Tanaka et al. 041457* (MBK, TI).

Distribution: China, India and Myanmar.

Note: *Musa nagensium* Prain var. *hongii* has been reported only from Yingjiang District of Yunnan Province, southwestern China, and

northern India, and some unauthenticated reports are also from Myitkyina District, Kachin State, northern Myanmar (Gogoi, 2013). Var. *hongii* looked very common along the Ledo Road toward the Pansaung Pass of the Indian Border as the result of the field work. This is the first record based on the voucher specimens from Myanmar side. This variety is characterized by having leaves with prominently glaucous lower surfaces (Fig. 2-D).

Musa sikkimensis Kurz in *J. Agric. Soc. India*, n.s., 5: 164 (1878). **Fig. 3-A, B.**

Specimen examined: MYANMAR. **SAGAI REGION:** Along the Nam Ei Zu River, Nam Ei Zu, Htamanthi Wildlife Sanctuary, N25°29'51.16", E95°26'01.11", 172m alt., *Tanaka et al. MY896* (RAF, TNS).

Distribution: India and Myanmar.

Note: *Musa sikkimensis* is known as Darjeeling banana, and characterized by having dull purple inflorescence bracts, and depressed, irregularly angular seeds (Kurz, 1878). The plant collected from the Htamanthi Wildlife Sanctuary along Nam Ei Zu River, a branch of the upper Chindwin was identified as *M. sikkimensis*. *Musa sikkimensis* is usually growing at more than 1,000m elevation (Noltie, 1994), however, interestingly this species was discovered in a lowland at ca. 200m elev. in Myanmar side. Our collection site is eastern foothill of Myanmar Nagaland.

ORCHIDACEAE

Porpax elwesii (Rchb.f.) Rolfe in *Orchid. Rev.* 16: 8 (1908). **Fig. 3-C.**

Specimens examined: MYANMAR. **TANINTHARYI REGION:** Thet Kal Kwet, Yephu Township, N14°23'22.3", E98°11'16.3", *Tanaka et al. MY1731* (RAF, TNS); along the trail to the waterfall, behind of Tanintharyi Nature Reserve Project Office, Yephu Township, N14°13'2.3", E98°2'54.2", *Tanaka et al. MY1732* (RAF, TNS).

Distribution: Cambodia, India, Laos, Malaysia (Peninsular), Myanmar, Nepal, Thailand, and Vietnam.

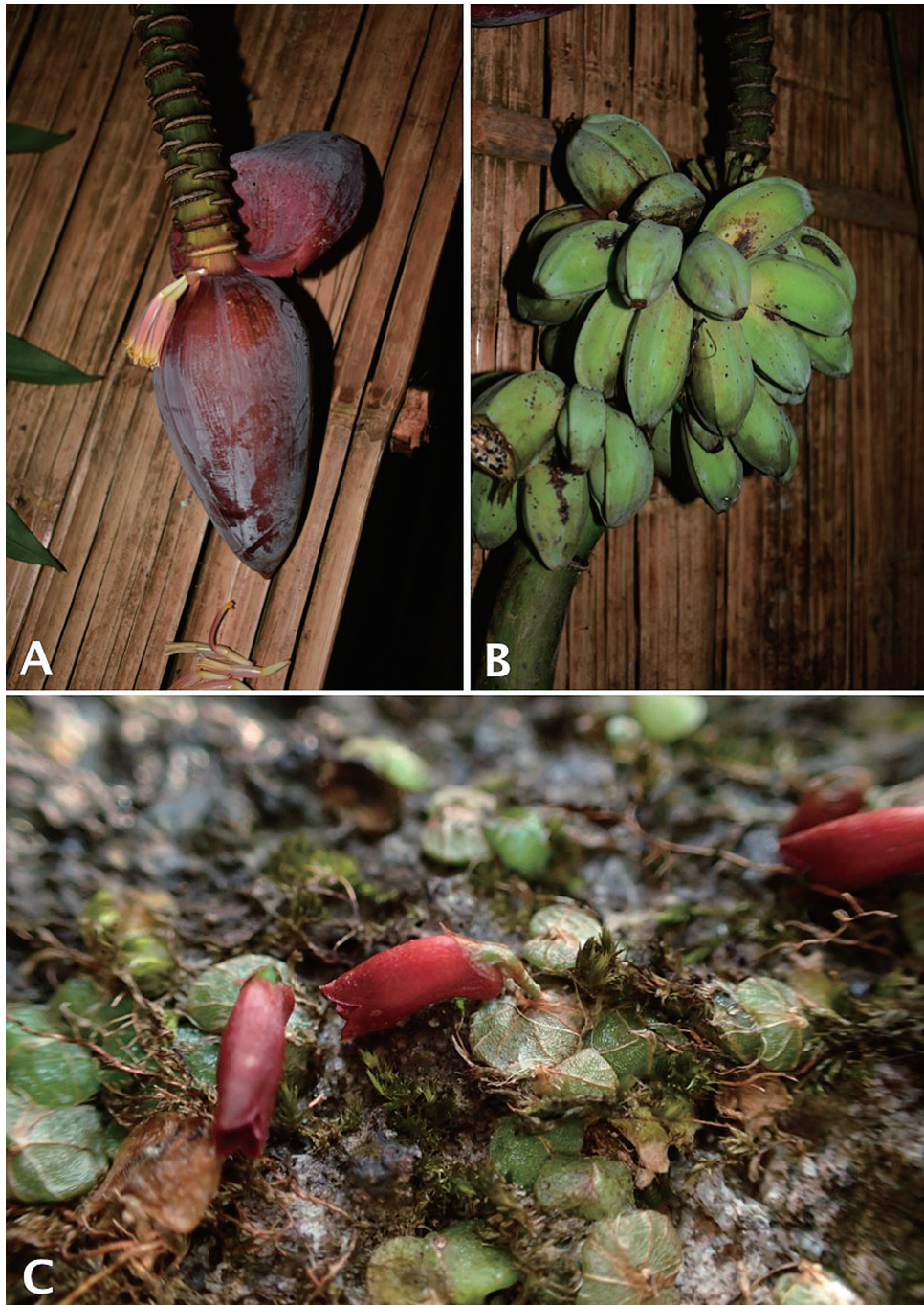


Fig. 3. A. & B. *Musa sikkimensis* Kurz. C. *Porpax elwesii* (Rchb.f.) Rolfe (Orchidaceae).

Note: Due to lack of the specimen accumulation, Myanmar is a distribution hole for *P. elwesii* between Himalaya and other Indochinese Regions. Our specimens will bridge this distribu-

tional disjunction of the species. In both localities cited above this species are growing on rocks along the streams. Rocks are quite dry at anthesis in dry season but probably will be sunk into

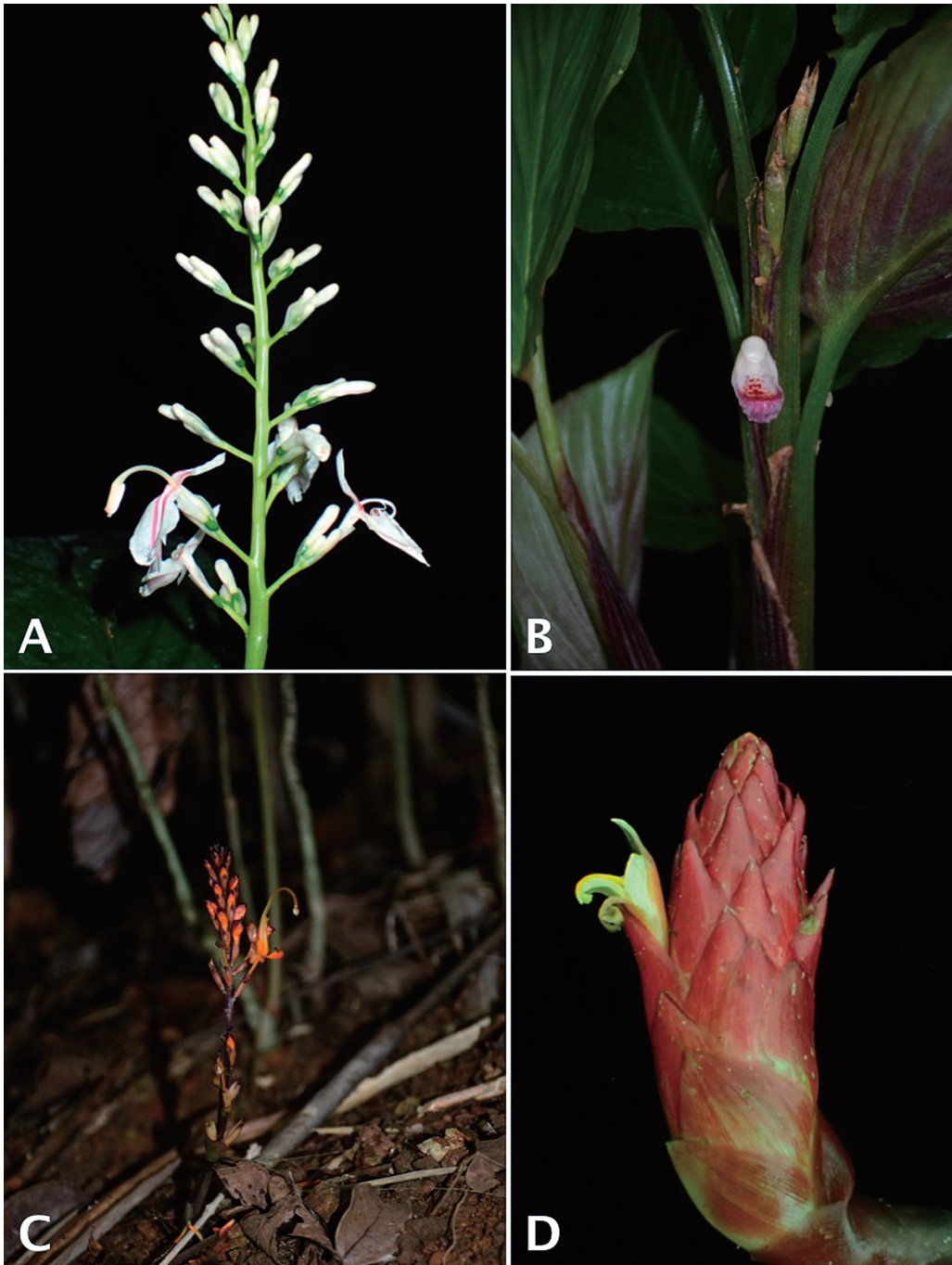


Fig. 4. A. *Alpinia intermedia* Gagnep. (Zingiberaceae). B. *Boesenbergia purpureorubra* Mood & L.M.Prince. (Zingiberaceae). C. *Globba praecox* Chokthaweep, K.J.Williams & Paisooks. (Zingiberaceae). D. *Zingiber thorelii* Gagnep. (Zingiberaceae).

stream water during rainy season.

ZINIGIBERACEAE

Alpinia intermedia Gagnep. in Bull. Soc. Bot. France 48: 83 (1902). **Fig. 4-A.**

Specimen examined: MYANMAR. **SHAN STATE:** Kengtung, *Mu Mu Aung 37* (RAF, TNS).

Distribution: China, Japan, Myanmar, the Philippines, Taiwan, and Thailand.

Note: *Alpinia intermedia* is thus far known from eastern Asia to the Philippines and westward to Thailand. Japan is the eastern limit of the distribution for this species and Thailand was the western limit (eMonocot, 2017). Our collection in Shan State represents the westernmost limit of the distribution.

Boesenbergia purpureorubra Mood & L.M. Prince in Gard. Bull. Singapore 66: 208 (2014). **Fig. 4-B.**

Specimen examined: MYANMAR. **TANINTHARYI REGION:** Bo Cho Island, Kawthaung Township, Lampi Island Marine National Park, N 10°40'37.8", E 98°15'4.7", *Tanaka et al. MY2032* (RAF, TNS).

Distribution: Myanmar (Mergui Archipelago) and Peninsular Thailand.

Note: *Boesenbergia purpureorubra* was described from Peninsular Thailand (Mood *et al.*, 2014). As was initially reported and also observed in Myanmar, the flowers open in the morning and close early the following day. As a strand species, it is most likely to be found in other coastal areas of the peninsula.

Globba praecox Chokthaweep, K.J.Williams & Paisooks. in Harvard Pap. Bot. 10: 57 (2005). **Fig. 4-C.**

Specimen examined: MYANMAR: **TANINTHARYI REGION.** Reserved forest of Awwyatha Temple, Palaw Township, N12°56'28.83", E98°39'13.47", alt. 101 m, *Tanaka et al. MY204* (RAF, TNS).

Distribution: Myanmar and Thailand.

Note: *Globba praecox* is quite unique among

Globba spp. due to its early flowering in April, prior to leaf production. It was described from the limestone areas of Kanchanaburi, Thailand, where it was considered a very rare endemic. This collection in peninsular Myanmar, close to the Thai border, constitutes a new record.

Zingiber thorelii Gagnep. in Bull. Soc. Bot. France 54: 169 (1907). **Fig. 4-D.**

Specimens examined: MYANMAR. **KAYAH STATE:** Kyat Gu Reserved Forest, Chikae, Loikaw Township, 925 m alt., *Mu Mu Aung et al. 84* (TNS); Kholeso Reserved Forest, Fruso Township, 1,167 m alt., *Mu Mu Aung et al. 99* (TNS). **TANINTHARYI REGION:** Tanintharyi Nature Reserve, *Tanaka et al. MY2695* (RAF, TNS).

Distribution: China (south), Laos, Myanmar, Thailand.

Note: *Zingiber thorelii* is often observed in Yangon Region as well beside the cited locations, therefore it seemed to be relatively common in Myanmar. The young inflorescences are locally eaten as vegetable, and in traditional Myanmar curries.

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References

- eMonocot. 2017. eMonocot: An online resource for monocot plants, version 1.0.2. Available from: <http://emonocot.org/> (accessed on 11 October 2017).
- Gogoi, R. 2013. *Musa nagensium* var. *hongii* Häkkinen—a new addition to the flora of India. *Taiwania* 58: 49–52.
- Govaerts, R. 1995. World Checklist of Seed Plants, Vol. 1, part 1: 1–483, part 2: 1–529, Antwerp.
- Hareesh, V. S., Joe, A., Sreejith, P. E. and Sabu, M. 2017. *Musa markkuana* stat. nov. (Musaceae)—A reassessment of *Musa velutina* subsp. *markkuana*. *Phytotaxa* 303: 279–284.
- Hutchinson, J. 1959. The Families of Flowering Plants, Vol. 2. Monocotyledons. 2nd ed. Oxford University Press, London.
- Ito, Y., Tanaka, N. (Nobuyuki), Ohi-Toma, T. and Murata, J. 2009. New or noteworthy plant collection from Myanmar (3): *Cardesia parnassifolia*, *Nechamandra alternifolia*, *Potamogeton maackianus* and *P. octandrus*. *Journal of Japanese Botany* 84: 321–329.
- Kress, J., DeFilipps, R. A., Farr, E. and Kyi, Y. Y. 2003. A checklist of the trees, shrubs, herbs, and climbers of Myanmar. Smithsonian Institution, Contributions from the United States National Herbarium 45: 1–590.
- Kurz, W. 1878. The Banana: A Pomological contribution. *Journal of Agricultural and Horticultural Society of India* 5: 112–168.
- Larsen, K. 1966. Two new Liliaceae from the Khao Yai National Park. *Botaniska Notiser* 119: 196–200.
- Mood, J., Veldkamp, J. F. and Prince, L. M. 2014. A new species and a new record of *Boesenbergia* (Zingiberaceae) for Thailand. *Gardens' Bulletin Singapore* 66: 207–214.
- Mood, J., Tanaka, N. (Nobuyuki), Aung, M. M. and Murata, J. 2016. The genus *Boesenbergia* (Zingiberaceae) in Myanmar with two new records. *Gardens' Bulletin Singapore* 68: 299–318.
- Murata, J., Ohi-Toma, T. and Tanaka, N. (Nobuyuki) 2010. New or noteworthy plant collections from Myanmar (4): *Typhonium cordifolium* and two new species, *T. neogracile* and *T. praecox* (Araceae). *Journal of Japanese Botany* 85: 1–7.
- Noltie, H. J. 1994. Musaceae. In: *Flora of Bhutan*. Volume 3, Part 1, pp. 177–181. Royal Botanic Garden Edinburgh, Edinburgh.
- Rodriguez, L. 1934. Hemodoraceae. *Nouvelles d'Indochine*. *Bulletin du Muséum National d'Histoire Naturelle* (Paris), sér. 2, 6: 95–97.
- Sabu, M., Joe, A. and Sreejith, P. E. 2013. *Musa velutina* subsp. *markkuana* (Musaceae): A new subspecies from northern India. *Phytotaxa* 92: 49–54.
- Tanaka, N. (Nobuyuki). 2004. Inclusion of *Neolourya* in *Peliosanthes* (Convallariaceae). *Novon* 14: 360–364.
- Tanaka, N. (Nobuyuki) 2005. Plant inventory research: contributions to the flora of Myanmar. *Acta Phytotaxonomica et Geobotanica* 56: 21–26.
- Tanaka, N. (Nobuyuki) 2010. Plant inventory research in Myanmar. *Bunrui* 10: 139–149 (in Japanese).
- Tanaka, N. (Nobuyuki) 2012a. Studies of Zingiberaceae in Myanmar I: *Zingiber idae*, newly recorded from Myanmar. *Makinoa New Series* 10: 153–157.
- Tanaka, N. (Nobuyuki) 2012b. Studies of Zingiberaceae in Myanmar II: *Zingiber popaense*, a new species from Myanmar. *Makinoa New Series* 10: 159–163.
- Tanaka, N. (Nobuyuki) and Hayami, Y. 2011. *Begonia kachinensis* (Begoniaceae, sect. *Sphenanthera*), a new species from Myanmar. *Acta Phytotaxonomica et Geobotanica* 61: 151–154.
- Tanaka, N. (Nobuyuki) and Hughes, M. 2007. *Begonia* (sect. *Sphenanthera*) *hayamiana* (Begoniaceae), a new species from northern Myanmar. *Acta Phytotaxonomica et Geobotanica* 58: 83–86.
- Tanaka, N. (Nobuyuki) and Nagamasu, H. 2006. A new record of *Gmelina tomentosa* Fletcher (Verbenaceae) from Myanmar. *Acta Phytotaxonomica et Geobotanica* 57: 233–236.
- Tanaka, N. (Nobuyuki) and Peng, C.-I. 2016. *Begonia togashii* (Begoniaceae: sect. *Platycentrum*), a new species from central Myanmar. *Acta Phytotaxonomica et Geobotanica* 67: 191–197.
- Tanaka, N. (Nobuyuki), Kobayashi, S., Ohi-Toma, T. & Murata, J. 2006. New or noteworthy plant collections from Myanmar (1) *Hydrobryum japonicum*, *Balanophora subcupularis*, *Rhopalocnemis phalloides* and *Sonerila laeta*. *Journal of Japanese Botany* 81: 324–331.
- Tanaka, N. (Nobuyuki), Tanaka, N., Ohi-Toma, T. and Murata, J. 2007. New or noteworthy plant collections from Myanmar (2) *Aponogeton lakhonensis*, *Cryptocoryne cruddasiana*, *C. crispatula* var. *balansae* and *Stichoneuron membranaceum*. *Journal of Japanese Botany* 82: 266–273.
- Tanaka, N. (Nobuyuki), Ohi-Toma, T. and Murata, J. 2009. A taxonomic study of *Rosa clinophylla* var. *glabra* (Rosaceae), newly recorded from Myanmar, based on morphological and molecular data. *Journal of Japanese Botany* 84: 27–32.
- Tanaka, N. (Nobuyuki), Yukawa, T. and Murata, J. 2010a. New or noteworthy plant collection from Myanmar (5): *Dendrobium koyamae*, a new species in sect. *Formosa* (Orchidaceae). *Acta Phytotaxonomica et Geobotanica* 60: 171–174.
- Tanaka, N. (Nobuyuki), Ohi-Toma, T. and Murata, J. 2010b. A new species from *Argostemma* (Rubiaceae) from Mt. Victoria, Myanmar. *Blumea* 55: 65–67.
- Tanaka, N. (Nobuyuki), Kadota, Y. and Murata, J. 2010c. New or noteworthy plant collection from Myanmar (6): Ranunculaceae of Mt. Victoria. *Journal of Japanese*

- Botany 85: 199–212.
- Tanaka, N. (Nobuyuki), Yukawa, T., Htwe, K. M., Koyama, T. and Murata, J. 2011. New or noteworthy plant collections from Myanmar (7): Fourteen additional species of Orchidaceae. *Acta Phytotaxonomica et Geobotanica* 61: 161–165.
- Tanaka, N. (Nobuyuki), Sugawara, T., Htwe, K. M., and Murata, J. 2015. *Impatiens kingdon-wardii* (Balsaminaceae), a new species from Mt. Victoria (Natma Taung), Myanmar. *Phytotaxa* 234: 90–94.
- Tanaka, N. (Nobuyuki), Ohi-Toma, T., Murata, H., Aung, M. M. and Murata, J. 2016. New or Noteworthy Plant Collections from Myanmar (9): *Agapetes* (Ericaceae) from Northwestern Myanmar. *Journal of Japanese Botany* 91 suppl.: 99–111.
- Tanaka, N. (Nobuyuki) and Aung, M. M. 2017. A new species of *Zingiber* (sect. *Dymczewiczia*: Zingiberaceae) from northwestern Myanmar. *Phytotaxa* 316: 195–199.
- Yukawa, T., Tanaka, N. (Nobuyuki) and Murata, J. 2010. *Doritis natmataungensis* (Orchidaceae), a new species from Myanmar. *Acta Phytotaxonomica et Geobotanica* 60: 167–170.