

Notes on *Lysimachia* sect. *Idiophyton* (Primulaceae) in the Philippines and Taiwan

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Abstract. A diploid somatic chromosome number of $2n=30$ was determined for both *L. capillipes* from Taiwan and an unidentified plant of *Lysimachia* (subgenus *Idiophyton*) from the Philippines. Results from morphological and cytological data suggest that the Philippine plant with $2n=30$ cannot be *L. sikokiana*, with $2n=60$ disagreeing with the report of Bentvelzen (1962).

Key words: Chromosome number, *Lysimachia*, stem morphology, Philippines, Taiwan.

Introduction

The genus *Lysimachia*, comprising about 180 species mainly in temperate and subtropical parts of the northern hemisphere, with a few species in Africa, Australia, and South America (Hu & Kelso, 1996; Marr & Bohm, 1997), is one of the largest genera in Primulaceae (Cronquist, 1981) or Myrsinaceae (Anderberg & Ståhl, 1995). Bentvelzen (1962) recognized four species in *Lysimachia* subgenus *Idiophyton* in the Malesian region: *L. capillipes* Hemsl. and *L. sikokiana* Miq. in the Philippines; and *L. laxa* Baudo and *L. montana* (Reinw.) Bakh.f. apud Bentvelzen in Indonesia. In Taiwan, which is adjacent to end north of the Malesian region, two species, namely *L. ardisioides* Masamune and *L. capillipes* Miq. (Kao & Peng, 1998), were recorded for subgenus *Idiophyton*.

Although morphological and molecular studies have been advanced for members of *Lysimachia* (e. g. Chen & Hu, 1979; Marr & Bohm, 1997; Hu & Kelso, 2000; Hao *et al.*, 2004), cytotaxonomic information was scanty. The aim of the present study is to investigate chromosome number and stem morphology that is one of diagnostic characters in this subgenus (cf. Kokubugata *et al.*, 2006) in two plants of subgenus *Idiophyton*

collected from the Philippines and Taiwan respectively for their taxonomic status.

Materials and Methods

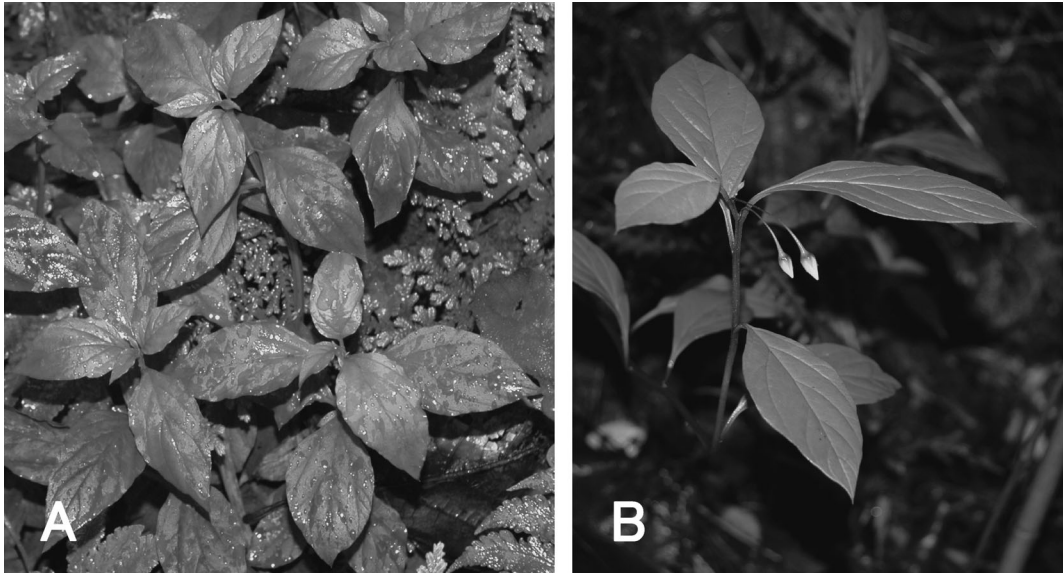
Plant materials were collected from the Philippines and Taiwan respectively (Table 1). These plants were brought to the experimental greenhouse of Tsukuba Botanical Garden, the National Museum of Nature and Science, for cytological and stem morphological comparisons. Voucher specimens were deposited in the herbaria of Academia Sinica, Taipei (HAST), National Museum of Nature and Science (TNS) and the Philippine National Herbarium (PNH).

To observe stem morphology, the two plants were cultivated under uniform environmental condition for six months, and the newly developed stem node between the third and fourth leaves (from top) of each plant was observed.

To observe somatic chromosomes, root tips were cut out from each plant and pretreated in 2 mM 8-hydroxyquinoline at 20°C for 2 hrs, then fixed in acetic ethanol (1:3) at 4°C for at least 2 hrs. The fixed root tips were macerated in a mixture of 1 N hydrochloric acid and 45% acetic acid at 60°C for 10 second. Somatic chromosomes at mitotic metaphase were stained in 2%

Table 1. Vouchers of *Lysimachia* investigated.

Locality and date	Voucher specimen	Chromosome no. ($2n$)
TAIWAN, Hualien: trail to Tali, Taroko National Park, Hsiulin Hsiang, July 7, 2005.	<i>G. Kokubugata</i> 6377	30
PHILIPPINES, Luzon: edge of Mt. Polis, Banaue, Ifuga. May 30, 2007.	<i>G. Kokubugata</i> 9646	30

Fig. 1. Habit of *Lysimachia*. A. *L. capillipes* (Taiwan, GK6377). B. *L. sp.* Philippines (GK9646).

aceto-orcein for 2 hrs, and smeared by conventional squash method.

Results and Discussion

The plant collected from Taiwan was identified as *Lysimachia capillipes* based on the creeping habit (Fig. 1: A), distinctly winged stem (Fig. 2: A) and smaller corolla and leaves, which fits the species description of Kao and Peng (1998). The plant revealed a diploid somatic chromosome number of $2n=30$ at mitotic metaphase (Fig. 3: A & C). The chromosome number of *L. capillipes* is reported here for the first time.

The plant collected from the Philippines was erect from a slightly creeping base (Fig. 1: B). Stem was minutely pubescent and winged (Fig. 2: B). It was also a diploid with $2n=30$ (Fig. 3: B).

Bentvelzen (1962) treated plants of *Lysimachia* subgenus *Idiophyton* with erect stem and occurring in the central Luzon, including Mt. Polis where we collected the plant for the present study, as *L. sikokiana*. This species was described by Miquel (1867), based on a type collected from Japan. Kokubugata *et al.* (2006) reported that *L. sikokiana* was characterized by the chromosome number of $2n=60$ and distinctly winged stem, and thus was cytologically and morphologically distinguishable from allied species in subgenus *Idiophyton*. The present cytological and morphological data suggest that the Philippine plant investigated cannot be *L. sikokiana* disagreeing Bentvelzen's taxonomic treatment concerning the Philippine plant (1962).

On the other hand, there is another major taxonomic treatment for the Philippines plant: Merrill (1907) treated plants with erect stems in Luzon

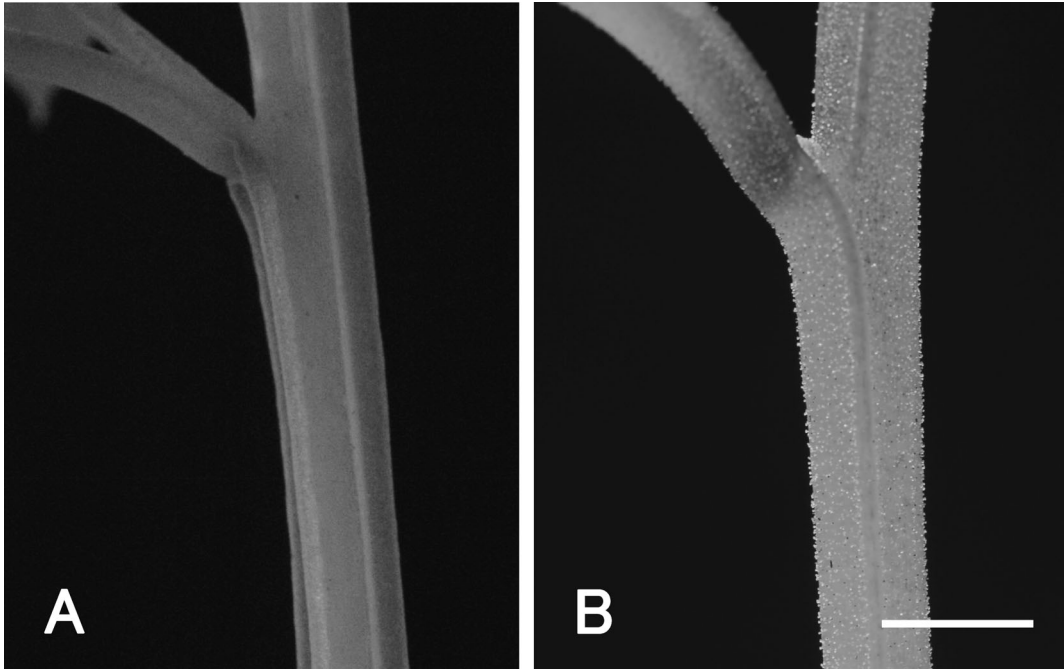


Fig. 2. Stem of *Lysimachia*. A. *L. capillipes* (Taiwan, GK6377). B. *L. sp.* Philippines (GK9646). Scale bar: 3 mm.

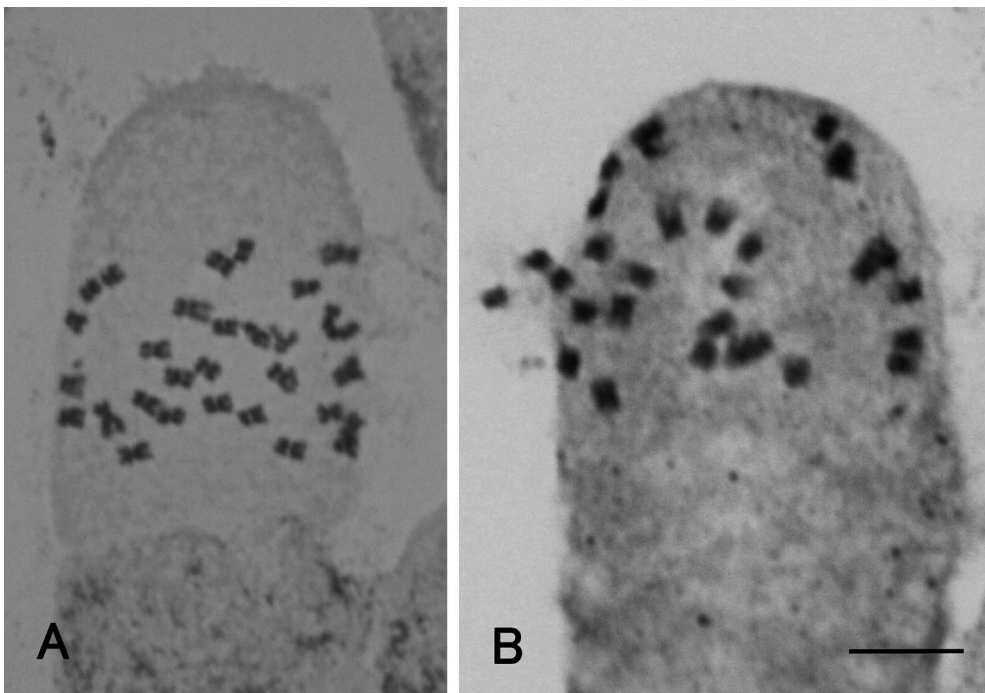


Fig. 3. Somatic chromosomes of *Lysimachia*. A. *L. capillipes* (Taiwan, GK6377). B. *L. sp.* Philippines (GK9646). Scale bar: 10 μ m.

Island as *L. ramosa* Wall & Duby. Unfortunately, we were not able to examine the type specimen of *L. ramosa*. In addition, the Philippines plant we collected was sterile. Thus we cannot conclude the taxonomic status of the Philippine plant investigated at the present time. Noteworthy, however, the Philippine plant is morphologically close to *L. ardisioides* Masamune, which is heretofore considered to be endemic to Taiwan (Masamune, 1932; Kao & Peng, 1998), in having erect stem and narrow leaves. Furthermore, the Philippine plant and *L. ardisioides* have the same somatic chromosome number of $2n=30$. The only difference between the Philippine plant and *L. ardisioides* is that the former had hairy stem with wings while the latter is glabrous stem without wings. Further studies with additional samples including herbarium specimens of subgenus *Idiophyton* in the Philippine and the type specimen of *L. ramosa* are desirable to clarify the taxonomy of *Lysimachia* in the Philippines.

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References

- Anderberg, A. A. & Ståhl, B., 1995. Phylogenetic interrelationships in the order Primulales, with special emphasis on the family circumscription. *Canadian Journal of Botany*, **73**: 1699–1730.
- Bentvelzen P. A. J., 1962. Primulaceae. *Flora Malesiana*, **Ser. I, Vol. 6**: 174–192.
- Chen, F.-H. & C.-M. Hu, 1979. Taxonomic and phyto-geographic studies on Chinese species of *Lysimachia*. *Acta Phytotaxonomica Sinica*, **17**: 21–53.
- Cronquist, A., 1981. An Integrated System of Classification of Flowering Plant. P. 1262. Columbia University Press, New York.
- Hao, G., Y.-M. Yuan, C.-M. Hu, X.-J. Ge & N.-X. Zhao, 2004. Molecular phylogeny of *Lysimachia* (Myrsinaceae) based on chloroplast *trnL-F* and nuclear ribosomal ITS sequences. *Molecular Phylogenetics and Evolution*, **31**: 232–229.
- Hu, C.-M. & S. Kelso, 2000. Primulaceae. In: Wu, Z.-Y. & P. H. Raven (eds.), *Flora of China*. Vol. XV. Pp. 39–189. Science Press, Beijing and Missouri Botanical Garden, St. Louis.
- Kao, M.-T. & C.-I Peng, 1998. Family Primulaceae. In: Editorial Committee of the Flora of Taiwan (eds.) *Flora of Taiwan IV. 2nd ed.* Pp. 57–78. Editorial Committee of the Flora of Taiwan, Taipei.
- Kokubugata, G. C.-I Peng, Y. Saito, M. Yokota & S. Kobayashi, 2006. Taxonomic reconsideration of *Lysimachia ardisioides* (Primulaceae) from Taiwan. *Memoirs of National Science Museum, Tokyo*, **44**: 136–140.
- Marr, K. L. & B. A. Bohm, 1997. A taxonomic revision of the endemic Hawaiian *Lysimachia* (Primulaceae) including three new species. *Pacific Science*, **51**: 254–287.
- Masamune, G., 1932. Symbolae florae Australi-Japonicae II. *Journal of the Society of Tropical Agriculture*, **6**: 300–304.
- Merrill, E. D., 1907. The flora of Mount Halcon, Mindoro. *The Philippine Journal of Science*, **2**: 259–309.
- Miquel, F. A. G., 1867. Prolusio florae Iaponicae. *Annales Musei Botanici Lugduno-Batavi*, **3**: 1–66.

フィリピンと台湾に分布するオカトラノオ属 2 種の外部形態と染色体数

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フィリピンと台湾に分布するオカトラノオ属モロコシソウ亜属 2 種の外部形態と染色体を観察した。台湾から採集された個体は *L. capillipes* と同定され、本種が染色体数 $2n=30$ をもつことが初めて報告された。フィリピンの Mt. Polis に産するモロコシソウ亜属植物を日本に分布する *L. sikokiana* (モロコシソウ) と取り扱う分類学的見解は染色体数と茎の外部形態の形質から支持されなかった。