

## Lectotypification and taxonomic identity of *Astomum japonicum* G. Roth (Pottiaceae, Bryophyta)

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**Abstract** – *Astomum japonicum* G. Roth is a cleistocarpous moss species but its taxonomic placement remains uncertain because the type material has not been re-examined since being described in 1911. We have examined type specimens and selected the specimen in PC as the lectotype. Based on a morphological study of the type material, we also propose the transfer of the species to the genus *Weissia* Hedw.: *W. japonica* (G. Roth) Y. Inoue & H. Tsubota *comb. nov.* Taxonomic notes on *W. japonica* and a key to the cleistocarpous species of *Weissia* in Japan are also provided.

**Cleistocarpous species / Europe / Japan / Morphology / Moss / *Weissia japonica***

### INTRODUCTION

*Astomum* Hampe is a moss genus (Pottiaceae, Bryophyta), comprising ca. 10 species (Zander, 1993; treating them as a part of *Weissia* Hedw.), and is characterized by its cleistocarpic capsule. Recent molecular phylogenetic studies did not support monophyly of the genus *Astomum* but supported the taxonomic treatment of the genus *Weissia* s.l. to include *Astomum* (Werner *et al.*, 2005). *Astomum japonicum* G. Roth., a little known Japanese species, was described by Roth (1911) based on a single specimen collected by von Siebold. In a monograph of Japanese Pottiaceae, Saito (1975) did not discuss the taxonomic status of *A. japonicum* since the type material was not available, and left it for future study. We have been able to examine the type material of this species, and our taxonomic re-evaluation has been made based on the original material.

### TYPIIFICATION AND MORPHOLOGY OF THE LECTOTYPE

*Astomum japonicum* G. Roth was originally reported from Japan as *Systegium crispum* (Hedw.) Schimp. (Sande Lacoste, 1866) based on a collection of fruiting plants. In Paris' *Index Bryologicus* (1905), Bescherelle proposed a new species *S. japonicum* Besch. citing *S. crispum* (*sensu* Sande Lacoste, 1866) as a synonym, although *S. japonicum* was a *nomen nudum* (Art. 38.1 of the ICN-McNeill *et al.*, 2012). When

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Roth (1911) validly described *A. japonicum* based on the specimen collected by Siebold, he indirectly cited *S. japonicum* (*nom. nud.*), but the species name *A. japonicum* should correctly be ascribed to Roth. Roth (1911) also cited *S. crispum* (*sensu* Sande Lacoste, 1866) as a synonym of *A. japonicum*; however the meaning of this synonymy was either “*S. crispum* (Hedw.) Schimp. pro parte” or “*S. crispum* auct. non (Hedw.) Schimp.” because he recognized *A. crispum* (Hedw.) Hampe [ $\equiv$  *S. crispum* (Hedw.) Schimp.] as a different species from *A. japonicum* in a species key of the same literature (Art. 52.2 of the ICN-McNeill *et al.*, 2012).

In the present study we were able to examine type material of *Astomum japonicum* from three herbaria (PC, BM, and S). When Roth (1911) described this species, he did not specify the herbarium where the type was deposited, so each of these specimens is a syntype (Art. 9.5 of the ICN-McNeill *et al.*, 2012). After detailed examination of these syntypes, we have selected the specimen (PC-0657676) as the lectotype. It corresponds to the original material of *Systegium japonicum* Besch. (*nom. nud.*). Among the three syntypes, only the specimen in PC contains fruiting plants which correspond well with the description provided by Roth (1911). The sporophytic characters were included in the original description by Roth (1911), although he apparently did not observe the sporophytes himself: “Kapsel nach Bescherelle ziemlich groß und schief geschnäbelt (non vidi)”. The description of sporophyte was presumably based on the specimen in PC.

The isolectotype specimen (BM-000867124 - in the Bescherelle collection) does not contain fruiting plants, but information on Bescherelle’s original label includes the sporophytic character of this species, suggesting that the specimen in BM is a duplicate of the specimen in PC.

The isolectotype specimen (S-B3524 – in the Roth collection), contains leaves from two different species (Figs 23-25), placed on a pair of mica slides. The specimen label indicates that Roth observed the BM specimen and returned it, except for the two leaves in the mica slides, with a handwritten annotation “all returned”. This suggests that the specimen in S is a unreturned portion of the BM specimen (kleptotype). Our examination revealed the leaf (Fig. 24) belongs to *A. japonicum* and corresponds well with the description and illustration in Roth (1911). The other leaf (Fig. 25) probably belongs to a *Brachymenium* species mixed in the original collection.

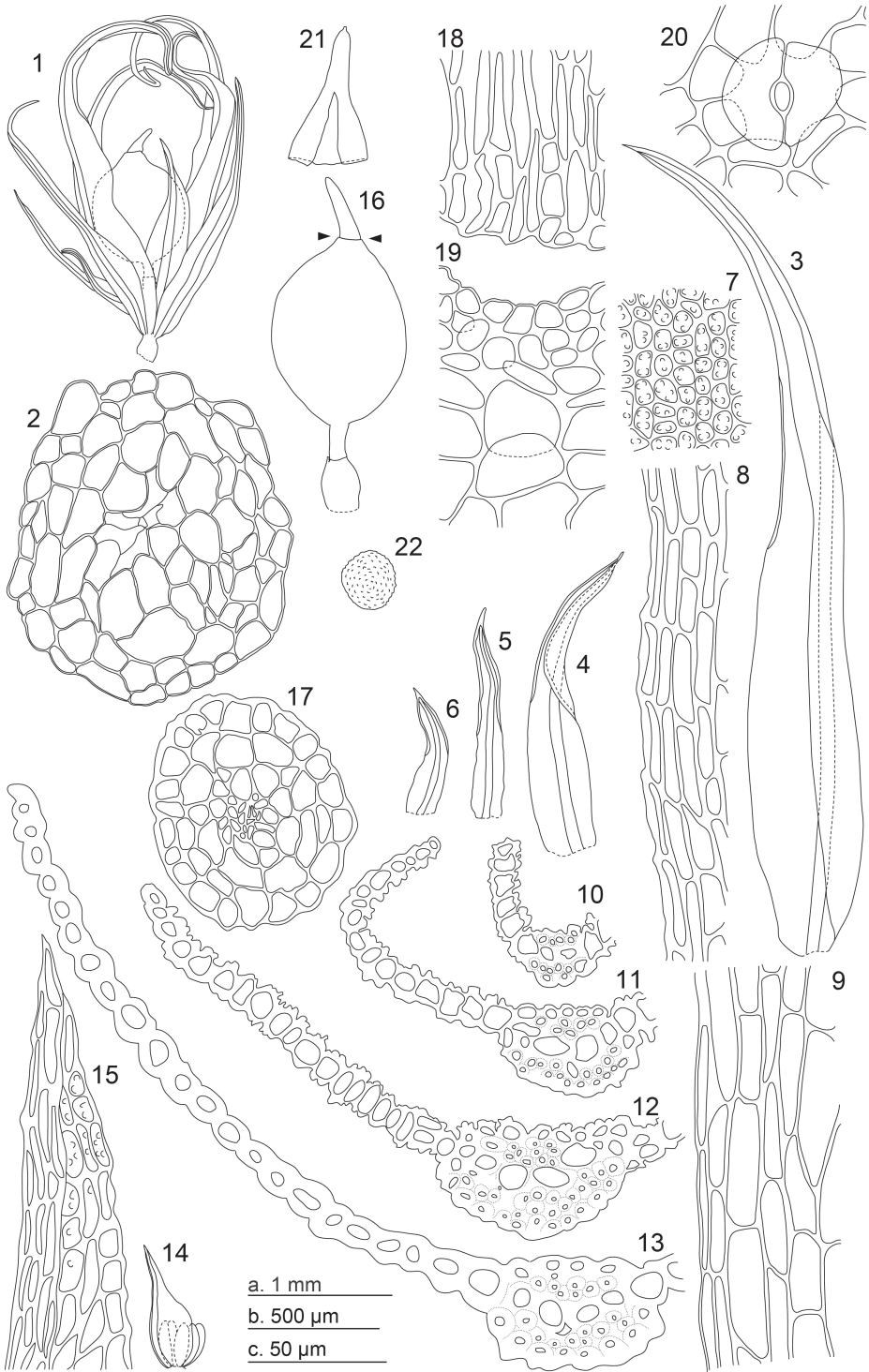
## TAXONOMIC NOTES

Based on our morphological investigation of the types, we propose the transfer of *Astomum japonicum* to the genus *Weissia* as follows:

***Weissia japonica* (G. Roth) Y. Inoue & H. Tsubota, *comb. nov.* Figs 1-22**

*Astomum japonicum* G. Roth, *Aussereur. Laubm.* 187. 1911. Type: Japan, leg. Siebold *s.n.* [lectotype, designated here: PC-0657676!; isolectotypes: BM-000867124!, S-B3524 (Fig. 24)!].

Figs 1-22. *Weissia japonica* (G. Roth) Y. Inoue & H. Tsubota. **1.** Plant. **2.** Cross section of stem. **3.** Perichaetial leaf. **4-6.** Vegetative leaves. **7.** Upper laminal cells of perichaetial leaf. **8.** Laminal cells at shoulder part of perichaetial leaf base. **9.** Basal laminal cells of perichaetial leaf. **10-13.** Cross sections of perichaetial leaf. **14.** Perigonal leaf with antheridia. **15.** Upper portion of perigonal leaf. **16.** Capsule (Arrowheads point dehiscent part). **17.** Cross section of seta. **18-19.** Dehiscence part of capsule between the base of beak (18) and urn (19). **20.** Stoma. **21.** Calyptra. **22.** Spore. Scale bars: a for 1; b for 3-6, 14, 16, 21; c for 2, 7-13, 15, 17-20, 22. All drawn from lectotype (PC-0657676). ▶



*Systegium japonicum* Besch. in Paris, *Index Bryol.* ed. 2. 352. 1905, *nom. nud.*, *nom. inval.* (Art. 38.1 of the ICN-McNeill *et al.*, 2012)

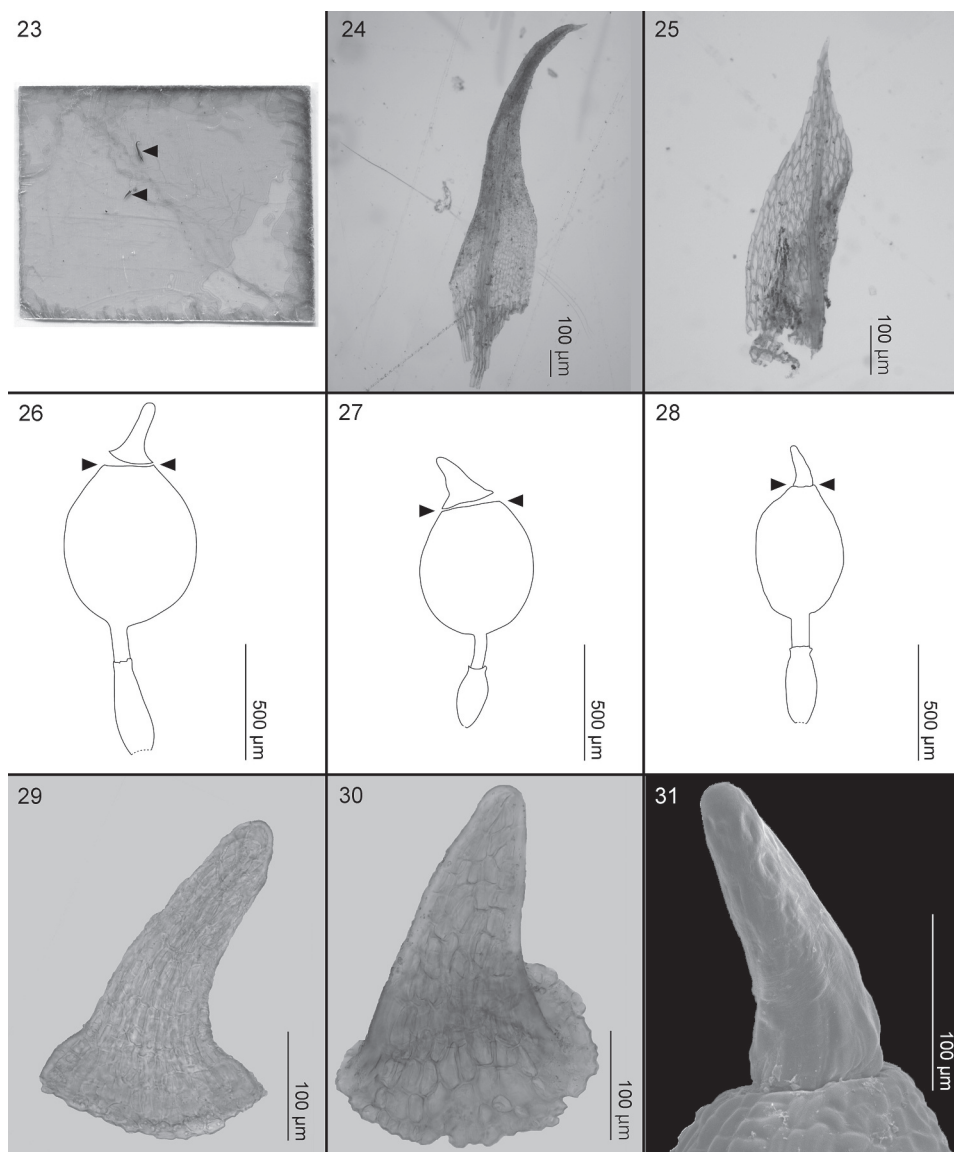
*Systegium crispum* auct. non (Hedw.) Schimp.: Sande Lacoste, *Ann. Mus. Bot. Lugduno-Batavum* 2: 292. 1866.

*Astomum crispum* auct. non (Hedw.) Hampe: Sande Lacoste, *Ann. Mus. Bot. Lugduno-Batavum* 2: 292. 1866.

*Plants* ca 5 mm high including capsule when moist. *Stems* simple, erect with weakly differentiated central strand and less differentiated epidermal cells. *Leaves* strongly crisped when dry, spreading when moist, gradually becoming larger toward shoot apex. *Autoicous*. *Perichaetial leaves* much larger than vegetative leaves, lanceolate to linear lanceolate, ca 3.5 mm long and 0.5 mm wide at base, tapering to apex from wide base; margins incurved in distal 1/2, plane in basal portion, nearly smooth with faint projections at shoulder part of leaf base; costa stout, excurrent in a point reaching ca 80  $\mu$ m, papillose on adaxial surface and smooth on abaxial surface; guide cells 4 in a single row in middle portion; adaxial and abaxial stereids 2-3 stratose in middle portion; upper laminal cells subquadrate, papillose on both surfaces, the papillae often bifid, appearing crescentic or circular in surface view, 6-9  $\times$  6-8  $\mu$ m; basal laminal cells enlarged, rectangular, smooth, 58-90  $\times$  8-16  $\mu$ m. *Perigonal leaves* much smaller than vegetative leaves, oval, acuminate, concave, papillose in apical portion. *Asexual reproduction* unknown. *Seta* ca 120  $\mu$ m long; epidermal cells quadrate to subquadrate, thin-walled. *Capsules* cleistocarpous, deeply immersed among perichaetial leaves, ovoid to subovoid, ca 780  $\times$  560  $\mu$ m with slightly oblique beak to ca 260  $\mu$ m long; exothelial cells irregularly quadrate, thin-walled; annulus differentiated at the base of the beak consisting of much smaller cell region, ca 80  $\mu$ m wide at the capsule mouth; stomata phaneroporous, ca 6 at base of capsule. *Calyptra* cucullate, ca 500  $\mu$ m long. *Spores* 18-20  $\mu$ m in diam., finely papillose.

In Japan Saito (1975) recognized two cleistocarpous species of *Weissia*: *W. longifolia* Mitt. [as *W. crispa* (Hedw.) Mitt.] and *W. exserta* (Broth.) P.C. Chen. *W. japonica* has a similar appearance to *W. longifolia* in having the capsules deeply immersed among the perichaetial leaves, but it can be distinguished from *W. longifolia* by the ovoid to subovoid capsule with an annulus formed just below the finger-like beak. The annulus of *W. japonica* consists of several rows of much smaller cells than adjacent exothelial cells of the beak and urn (Figs 16, 18 & 19). Examination of other Japanese specimens showed that the deoperculation found in this species is nonfunctional, that is, spores are not released from the dehiscent part of the capsule. The capsules of *W. japonica* are morphologically stegocarpous but functionally cleistocarpous, as shown in *Pleuroidium japonicum* Deguchi, Matsui & Z. Iwats. (Deguchi *et al.*, 1994). We also observed that capsules of *W. japonica* have a fragile, capsule-abscission tissue region located at the junction of the capsule and seta, where the mature capsules are easily detached from the seta. Another Japanese species, *W. exserta* (Broth.) P.C. Chen, is also cleistocarpous, but the seta is much longer than that of *W. japonica*, and the capsules are exserted from the perichaetial leaves.

*Weissia japonica* is also similar to the European species *W. levieri* (Limpr.) Kindb. and *W. longifolia* Mitt. var. *angustifolia* (Baumgartner) Crundw. & Nyholm in having deeply immersed capsules which also have an annulus. However, the capsule mouth is much wider in latter two species (ca 130-200  $\mu$ m). As a consequence, the "opercula" on these two species look the normal shape (Figs 26, 27, 29 & 30).



Figs 23-31. Specimen in Roth collection (S-B3524, 23-25) and Dehiscence positions of *Weissia levieri* (26 & 29), *W. longifolia* var. *angustifolia* (27 & 30) and *W. japonica* (28 & 31). **23.** Overview (Arrowheads indicate leaves). **24.** Leaf of *A. japonicum* (Isolectotype of *Astomum japonicum*). **25.** Leaf of *Brachymenium* sp. **26-28.** Illustrations of capsule overviews (Arrowheads indicate dehiscence line). **29-30.** Light microscope views of opercula. **31.** Scanning electron microscope (SEM) view of beak attaching to urn (Preparation for SEM observation followed Inoue *et al.* 2011). 26 and 29 from *Ros & Jiménez s.n.* (HIRO); 27 and 30 from *A. Ginzberger s.n.* (W-KRYPT 1964-0021668, holotype of *Astomum crispum* var. *angustifolium*); 28 and 31 from *Y. Inoue 3830* (HIRO).

In *W. japonica*, because the mouth of the capsule is much narrower (ca 50-90  $\mu\text{m}$ ), there is no flaring of the base of the beak (Figs 28 & 31).

Morphological variation, distribution and phylogenetic position of the cleistocarpous species of *Weissia*, including *W. japonica*, will be included in our forthcoming revision. Three cleistocarpous species of *Weissia* are now known from Japan and can be separated as in the following key.

### Key to the cleistocarpous species of *Weissia* in Japan

1. Seta 0.5-1.2 mm long; capsule ellipsoidal, exerted from perichaetial leaves ..... *W. exserta*
1. Seta less than 0.4 mm long; capsule spherical or ovoid to subovoid, deeply immersed among perichaetial leaves ..... 2
2. Capsule spherical, annulus absent ..... *W. longifolia*
2. Capsule ovoid to subovoid, annulus present ..... *W. japonica*

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