

Taxonomic studies of mosses of Seram and Ambon  
(Moluccas, East Malesia) collected by Indonesian-Japanese  
Botanical Expeditions, IX. Pottiaceae

Hiroyuki Akiyama

Division of Phylogenetics, Museum of Nature and Human Activities, Hyogo  
6-chome, Yayoigaoka, Sanda, Hyogo 669-13,

**Abstract.** Mosses of Seram and Ambon Islands are reported based on our collections of the botanical expeditions to the islands. This paper is the ninth part of our report and includes the Pottiaceae (total 8 genera and 14 species). One new species, *Barbula seramensis* H.Akiyama is described.

This paper reports the Pottiaceae of Seram and Ambon Islands, the Moluccas, on the basis of materials collected during Indonesian-Japanese Botanical Expeditions in 1984-'85 and 1986. For the general collection sites, see Akiyama (1989).

In citation of specimens, the collector's name (H. Akiyama) is omitted. All specimens are kept at HYO (Herbarium, Museum of Nature and Human Activities, Hyogo) and some are duplicated at BO, FH, H, L, MO and NY.

Pottiaceae

Key to genera and several species

1 Capsules cleistocarpous; seta shorter than

0.3mm.....	<i>Weisia aff. exerta</i>
1 Capsules stegocarpous; seta longer than 3 mm. .....	2
2 Seta lateral.....	<i>Anoetangium</i>
2 Seta terminal (sometimes seemingly lateral by innovation).....	3
3 Peristome absent.....	4
3 Peristome present.....	6
4 Laminal cells smooth or mammillose. .....	<i>Hyophila</i>
4 Laminal cells papillose.....	5

- 5 Leaf margins plane..... *Gymnostomum*
- 5 Leaf margins narrowly involute.....  
..... *Weisia edentula*
- 6 Plants robust; leaves abruptly narrowed from a widened shoulders. (Usually forming large populations on limestone cliff in forests).....  
..... *Pseudosymblepharis*
- 6 Plants small to medium-sized; leaf shoulders not widened as above.....7
- 7 Leaves linear, lanceolate, or subulate from triangular bases; margins narrowly recurved above (excluding *B. javanica* and *B. seramensis*)  
..... *Barbula*
- 7 Leaves ovate-lanceolate, spatulate, or narrowly ligulate; margins plane or narrowly involute above.....8
- 8 Leaves serrate above..... *Leptodontium*
- 8 Leaves entire or minutely crenulate above.  
.....9
- 9 Leaf margins narrowly involute above  
..... *Barbula seramensis*
- 9 Leaf margins plane.....10
- 10 Laminal cells papillose..... *Trichostomum*
- 10 Laminal cells smooth..... *Barbula javanica*

Genus *Anoectangium* Schwaegr.

1. *Anoectangium aestivum* (Hedw.) Mitt.  
 J. Linn. Soc. Bot. 12:175 (1869); Bartram, Philipp. J. Sci. 68:102 (1939) as *Anoectangium euchloron* (Schwaegr.) Mitt.; Saito, J. Hattori Bot. Lab. 39:457 (1975); Norris & Koponen, Acta Bot. Fennica 137:101 (1989); Eddy, Handbook of Malesian Mosses 2:208 (1991).  
 Specimens examined. CENTRAL SERAM: Ena Puti - G. Sinaunia, 2270m, C-15333 (c.sp.); Wae Pasola Hatu - G. Meseleinan, 1240m, C-16177.  
 Habitat. On humus and limestone at open places in montane areas.  
 Distribution. Cosmopolitan.

Genus *Barbula* Hedw.

Key to the species

- 1 Leaves elaminate above; costa round in transverse section, epidermal cells of both sides of costa with dense, stellate papillae. (Stems to 10 mm; leaves rigid, not appressed to a stem; peristome teeth linear, twice twisted.)  
.....6. *B. robbinsii*
- 1 Leaves not elaminate above; costa not so distinctly round in transverse section, epidermal cells otherwise.....2
- 2 Leaf margins two-layered throughout. (Plants pale green to brownish yellow; leaves linear lanceolate, margins plane; laminal cells slightly pluripapillose; peristome teeth long, helically coiled; often growing at streambeds.)  
.....5. *B. pachyloma*
- 2 Leaf margins one-layered throughout. (Rarely two-layered partially in *B. javanica*.)  
.....3
- 3 Uppermost part of costal region distinctly grooved; laminal cells smooth or ventrally mammillose; epidermal cells of adaxial surface of costa smooth.....4
- 3 Uppermost part of costal region not grooved; laminal cells pluripapillose; epidermal cells of adaxial surface of costa densely and highly papillose especially in the upper part..... 5
- 4 Leaves lanceolate, obtuse at apex; median lamina cells quadrate.....3. *B. javanica*
- 4 Leaves narrowly subulate from triangular base; median laminal cells short rectangular to quadrate.....4. *B. novoguinese*
- 5 Leaves narrowly to broadly lanceolate, plane at apex when moist, acute to obtuse at apex, not cucullate; margins revolute below 1. *B. consanguinea*
- 5 Leaves narrowly lanceolate, deeply cucullate at apex; hamate above even when moist; margins plane to revolute below, distinctly involute above..... 2. *B. seramensis*

1. *Barbula consanguinea* (Thwait. & Mitt.) Jaeg.

**Figure 1** - *Barbula consanguinea* (Thwait. & Mitt.) Jaeg. a, b: leaves, c: lower abaxial epidermal cells of costa, d: upper abaxial epidermal cells of costa. All from *H.Akiyama C-8558*. Use the scale bar as 1 mm for a & b, 10  $\mu$ m for c & d.

(Figure 1)

Gen. spec. musc. 673 (1880); Eddy, Handbook of Malesian Mosses 2:178 (1991).

Plants to 15 mm tall, yellowish green in older specimens. Leaves curled when dry, spreading when moist, to 1.6 mm long, 0.4 mm wide at middle, narrowly to broadly lanceolate, grooved above, obtuse to round at apex and distinctly apiculate with one large smooth cell; margins revolute below, entire throughout; median lamina cells quadrate, pluripapillose, more or less mamilllose. Costa excurrent; lower abaxial epidermal cells linear to long-rectangular, papillose at both ends of lumen; upper abaxial epidermal cells short-rectangular to quadrate, pluripapillose, longer than juxtacostal lamina cells. Perichaetial leaves not differentiated from stem leaves. Seta slender, to 12 mm long, reddish brown. Capsule short-cylindric, urn to 1.0 mm long. Peristome teeth filamentous, twisted more than two times; easily detached from the mouth of capsule. Operculum and spores not

examined in our specimens.

Specimens examined. CENTRAL SERAM: Roho-Kanikeh, 560m, *C-8553* (c.sp.). EAST SERAM: in the vicinity of Buria, 10-130m, *C-10856*.

Habitat. On wet boulders covered with soil at riverbed or on soil at river bank.

Distribution. Tropical Asia (according to Eddy 1991).

Note: The distinguishing features of this species are; 1) narrowly to broadly lanceolate leaves, 2) pluripapillose lamina cells, 3) abaxial epidermal cells of costa with papillae on both ends of lumen, and 4) filamentous peristome teeth helically coiled more than two times. This species mostly resembles *Barbula indica* (Hook.) Spreng., but it can be distinguished from the latter by its long filamentous peristome teeth; peristome teeth of *Barbula indica* are short and only weakly coiled.

Eddy (1991) treated *B. consanguinea* as a distinct species that is closely related to *B. indica* but distinguishable from the latter in the larger

**Figure 2**- *Barbula seramensis* H.Akiyama. a & b: leaves, c: leaf apex, d: basal margin of a leaf, e-g: cross sections of a leaf (e: just below apex, f: upper part, g: medina part), h: cross section of a stem, i: lower adaxial epidermal cells of costa, j: upper adaxial epidermal cells of costa, k: ower abaxial epidermal cells of costa, l: upper abaxial epidermal cells of costa, m: capsule. All from *H.Akiyama C-16743*. Use the scale bar as 1 mm for a & b, 4 cm for m, 10  $\mu$ m for the others.

plant and leaf size, longer seta length, and helically coiled peristome teeth. On the other hand, Saito (1975) and Norris & Koponen (1989) regarded *B. consanguinea* as a synonym of *B. javanica* Dozy & Molk. They treated *B. javanica* as one of the best defined species of the genus. I tentatively follow the treatment by Eddy (1991) for *B. consanguinea* because I consider the shape of peristome teeth to be stable and reliable in these species. Among our collections, I could not find any plants agreeing well with typical *Barbula indica*. (For more details, see notes under *Barbula javanica* in this paper).

2. *Barbula seramensis* H. Akiyama, sp. nov. (Figure 2)

Proxima *Barbulae zennoskeanae*, sed foliis angusti-ligulatis ad linearibus lanceolatis, apicibus integris, caulibus cum conspicuis filis centralibus diversa.

Plant simple, to 10 mm tall, yellowish green to brown in specimens, rather rigid when growing on limestone. Stem with a well differentiated central strand. Leaves crisped and contorted, appressed when dry, patent, curving inwards above even when moist; lanceolate, concave, to 1.6 mm long; cucullate above and obtuse to rounded at apices; margins entire or minutely crenulate with papillae of lamina cells, distinctly incurved throughout (sometimes recurved below); basal lamina cells rectangular, smooth, becoming shorter towards margin; median and upper lamina cells quadrate, distinctly mamillate and pluripapillose. Costa shortly excurrent, forming short apiculus with a single, large and smooth cell; lower abaxial epidermal cells linear to narrowly rectangular, with stellate papillae at both ends of lumen; upper abaxial epidermal cells quadrate, as large as juxtacostal lamina cells, pluripapillose; lower adaxial epidermal cells narrowly rectangular, smooth; upper adaxial epidermal cells quadrate, low-pluripapillose. Seta to 15 mm long, reddish brown, smooth. Capsule cylindrical, 1.2-1.8 mm long, smooth. Operculum conical, as 2/3 long as capsule. Peristome filamentous, 1.0-1.5 mm long, twisted more than two-times. Spore spherical, sparsely and very minutely papillose, 8-10  $\mu\text{m}$  in diameter.

TYPE: Indonesia, Central Seram, en route from Nihehata to Hatumete, 180m alt., *H. Akiyama C-16743* (holotype in HYO; isotype in BM, BO, FH,

H, L, MO, NY).

Other specimens examined. CENTRAL SERAM: Kaloa - Pasahari, 20-120m, *C-9471*, *C-9475b* (c.sp.; intermingled with *Barbula novoguinese* Broth.); Hatu - Piliana, 370m, *C-10213*; Piliana - Hau Harnoe, 400m, *C-15107*; Saunule - Batu Kapal, 5-100m, *C-15447*;

Habitat. On soil at roadside or river banks in lowlands.

Note. These collections resemble *Barbula consanguinea* and *B. indica* in several features, especially in the shape of abaxial epidermal cells of costa; all have stellate papillae at both ends of lumen. The plants are, however, distinguishable from both species by the following features; 1) leaves are lanceolate, 2) leaf margin are strongly incurved especially above (sometimes recurved below), 3) upper part of leaves are cucullate (thus costa with a deep groove), 4) abaxial epidermal cells of lower part of costa are linear to narrowly rectangular with stellate papillae at both ends of lumen, and becoming as short as juxtacostal lamina cells above, 5) a central strand in the stem are differentiated, 6) leaves are shortly apiculate, 7) peristome teeth are filamentous, twisted more than two-times.

Judging from original drawing and description, the new species resembles *Barbula zennoskeana* Tan, recently reported from Philippine (Tan 1994). The latter species differs from *B. seramensis*, however, in the 1) narrowly ligulate to linear-lanceolate leaves, 2) entire leaf apices, 3) weakly developed central strand of stems, 4) larger lamina cells, and 5) the absence of stellar papillae formed between the junction of two adjacent cell walls.

3. *Barbula javanica* Dozy & Molk. (Figure 3)

Ann. Sci. Nat. Bot. ser.3, 2:300 (1844); Saito, J. Hattori Bot. Lab. 39:495 (1975); Norris & Koponen, Acta Bot. Fennica 137:118 (1989).

Plants green to yellow in dried herbarium specimens. Stems simple, to 15 mm tall. Leaves inrolled and strongly crisped when dry (thus showing unique appearance for the genus as noted by Norris & Koponen 1989), narrowly ligulate, to 2.4 mm long, 0.5-0.6 mm wide at middle, obtuse; margins entire and plane throughout, sometimes two cells thick above. Costa percurrent or shortly excurrent, totally smooth; lower abaxial epidermal cells long-

**Figure 3** - *Barbula javanica* Dozy & Molk. a: leaf, b & c: margins of median part of leaves, d: median laminal cell, e: basal margin of a leaf, f & g: cross section of a leaf. a-b, e-g from *H.Akiyama C-10209* and c from *H.Akiyama C-10751*. Use the scale bar as 1 mm for a, 10  $\mu\text{m}$  for b - g.

rectangular to linear; upper abaxial and lower adaxial epidermal cells short-rectangular; upper adaxial epidermal cells quadrate. Lamina cells quadrate to short-rectangular above, evenly thickened, distinctly mammillose on adaxial surface, smooth on both surface (sometimes weakly pluripapillose); marginal cells quadrate, slightly or not differentiated from inner ones, but usually 2-3 rows of short-rectangular cells present, and sometimes forming two-cells thick layers. Seta to 15 mm long, reddish brown. Capsule cylindrical, 1.5-1.8 mm long, slightly curved and asymmetrical. Operculum long beaked, 1/3 long of capsule. Peristome teeth filamentous, helically coiled more than two times. Spores ca. 15  $\mu$ m in diameter.

Specimens examined. WEST SERAM: Tanagohyang - Kali Ani, 5-100m, *C-15667* (c.sp.). CENTRAL SERAM: Wasa-Roho, 60m, *C-2443* (c.sp.); Hatu-Piliana, 370m, *C-10209* (c.sp.). EAST SERAM: in the vicinity of G. IliTubi, 30-100m, *C-10751* (c.sp.).

Habitat. On bare soil at sunny place or on rock and soil at stream-sides.

Distribution. Temperate and tropical Asia.

Note. The distinguishing features of *Barbula javanica* are; 1) narrowly oblong to ligulate leaves, 2) smooth (sometimes weakly papillose) and ventrally mammillose laminal cells, and 3) filamentous peristome teeth.

Norris & Koponen (1989) and Eddy (1991) doubted the distinction of *Barbula javanica* from *B. subcomosa* or *B. pseudo-ehrenbergii*. These authors pointed out the similarity in their general appearance. *Barbula javanica*, however, can be distinguished from the other two species in leaf shape, smooth and mammillose lamina cells, and thus I follow Saito (1975) who regarded *B. javanica* as a distinct species.

Norris & Koponen (1989, p.119) first reported that *Barbula javanica* sometimes has bistratose leaf margins. I found plants showing a similar condition among our collections (*C-10209*, Fig. 3, b & f). This specimen was collected on rocks in streambeds, a habitat of typical rheophytic species, e.g., *Barbula pachyloma*. I consider the differentiated leaf margin of *B. javanica* to be an adaptive feature to rheophytic conditions. In addition, an "intra-limbate" condition with longer cells slightly differentiated from surrounding laminal cells (Fig. 3, c) can be seen in plants of C-

10751.

#### 4. *Barbula novoguinese* Broth.

Oefv. Finska Vet. Akad. Foerh. 37:158 (1895); Norris & Koponen, Acta Bot. Fennica 137:117 (1989); Eddy, Handbook of Malesian Mosses 2:181 (1991) as *B. arcuata* Griff.

Plants brownish yellow in herbarium specimen, ca. 10 mm tall, densely tufted. Stems simple, perichaetia and perigonia terminal, lower 1/4 buried in calcareous soil. Leaves straight or slightly curled above and appressed when dry, patent when moist, to 2 mm long, narrowed into subulate apex from triangular base; margins narrowly recurved throughout. Median laminal cells quadrate, smooth. Lower laminal cells short to long-rectangular, smooth. Abaxial surface of costa papillose by low projection of both ends of cells. Setae to 20 mm long, reddish brown. Capsules short-cylindrical, ca. 1.5 mm long and 0.5 mm wide. Peristome filamentous, twisted more than two-times.

Specimen examined. CENTRAL SERAM: Kaloa - Pasahari, 20-120m, *C-9475a* (c.sp.).

Habitat. On bare soil at open place, intermingled with *Barbula seramensis*.

Distribution. New Guinea.

Note: It is difficult to distinguish *Barbula novoguinese* from *B. arcuata*, and there is confusion about these two species among previous authors, too; for example, see Eddy (1991) and Norris & Koponen (1989). Seram plants agree well with the description and figures of *Barbula novoguinese* by Norris & Koponen (1989) and one specimen collected in Papua New Guinea (*Streimann 21666*, H!). Therefore, I determined our plants as *B. novoguinese*. I could not find any typical plants of *Barbula arcuata* among our collections.

#### 5. *Barbula pachyloma* Broth. (Figure 4)

Oefv. Finska Vet. Akad. Foerh. 35:38 (1893); Norris & Koponen, Acta Bot. Fennica 137:122 (1989); Eddy, Handbook of Malesian Mosses 2:184 (1991).

Plant green to brownish yellow, sometimes reddish brown, rather flaccid in appearance, to 1 cm tall. Leaves curled when dry, obliquely spreading when moist, ligulate-lanceolate, broadest at base, to 3.3 mm long, 0.6 mm wide at base, acute and shortly mucronate; margins plane or

**Figure 4** - *Barbula pachyloma* Broth. a & b: leaves, c: median laminal cells, d & e: cross sections of leaves. All from H. Akiyama C-15101. Use the scale bar as 1 mm for a & b, 10 µm for c - e.

slightly incurved, two- to three-layered with or without stereids. Median lamina cells short-rectangular to quadrate, faintly pluripapillose and slightly mammillose at adaxial surface. Marginal laminal cells little differentiated from inner ones, but slightly thick-walled. Basal laminal cells short-rectangular, smooth. Costa shortly excurrent; with stereids on both sides in cross section. Adaxial surface cells of costa similar to laminal cells. Abaxial cells of costa short-rectangular to linear, smooth. Seta reddish brown, to 12 mm long, smooth. Capsules brownish yellow, shortly cylindrical, 1.3 mm long x 0.4 mm wide, plicate when dry. Peristome teeth red, filamentous, to 1.2 mm long, cleft to the base, twisted more than three times.

Specimens examined. EAST AMBON: Air Besar, 10m, C-2350. WEST SERAM: Batu Putih and Batu Soli in the vicinity of Buria, 400-700m, C-10048.

CENTRAL SERAM: Saunule - Piliانا, 400m, C-14827 (c.sp.); Piliانا - Hau Harnoe, 700m, C-15101.

Habitat. On boulders covered with soil at streambeds. One specimen (C-10048) was collected on limestone rock located at steep slope of a

forest.

Distribution. New Guinea.

Note: The distinguishing features of this species are, 1) two- to three- layered leaf margins, and 2) ligulate-lanceolate, flaccid leaves. The number of stereids in the transverse section of leaf margins varies much even among leaves from a single stem; for example, some leaves of C-15101 and C-10048 do not have stereids.

*Barbula pachyloma* grows in small mats at rather sunny streambeds in lowland forests, and is a representative of the rheophytic mosses in Seram and Ambon Islands. The color of plants varies according to the habitat; plants inhabiting sunny places are tinged red.

This species have been known from only a few specimens from New Guinea. It seems, however, not to be rare in Seram and Ambon Islands.

#### 6. *Barbula robbinsii* Bartr.

Brittonia 13:370 (1961); Norris & Koponen, Acta Bot. Fennica 137:114 (1989); Eddy, Handbook of Malesian Mosses 2:185 (1991).

Plants dull green, 1.5 cm tall. Leaves patent and

rather straight even when dry, sometimes slightly curled above, linear, to 2.8 mm long, narrowed into a long and conspicuously terete subula occupying 4/5 of leaf length from triangular base; apiculate at apex with a large and smooth cell. Median laminal cells quadrate, with a single large compound papillae. Basal laminal cells linear to rectangular, smooth, but marginal one row quadrate, each cell with a large compound papilla. Costa reddish brown, nearly round in cross section, occupying 1/3 of leaf base. Cell walls of epidermal cells of costa on both sides obscure with large, high, compound papillae. Setae to 18 mm long, reddish brown. Capsules yellowish brown, ovoid, 1.3 mm long and 0.3 mm wide. Operculum long rostrate, ca. 1.0 mm long. Peristome teeth filamentous, cleft to the base, longer than capsule length, ca. 1.6 mm long, twisted several times.

Specimens examined. CENTRAL SERAM: Hau Harnoe - Piliانا, 600m, *C-15431* (c.sp.); Hatumete - Losa, 260m, *C-16475* (c.sp.).

Habitat. On bare soil at open, sunny places.

Distribution. New Guinea.

Note: Distinguishing features of *Barbula robinsonii* are 1) straight leaves even when dry, 2) long subula (=costa) of leaves which is round in transverse section, and 3) large, compound papillae of laminal cells. Judging from figures and description presented by Norris & Koponen (1989) and Eddy (1991), Seram plants are much larger in leaf length, seta length, and peristome length.

Genus *Gymnostomum* Nees & Hornsch.

1. *Gymnostomum aurantiacum* (Mitt.) Par.

Ind. Bryol. 542 (1894).; Saito, J. Hattori Bot. Lab. 39:451 (1975).

Specimens examined. WEST SERAM: Batu Putih and Batu Soli near Buria, 400-700m, *C-10048*; G. Nakaela near Buria, 200m, *C-10125*; *ibid.*, 350m, *C-10029*. CENTRAL SERAM: in the vicinity of Kanikeh, 600m, *C-8559*; Selmena - Maraina, 700-800m, *C-9104b* (c.sp.); G. Uwelehu near Hatuolo, 630-1000m, *C-9226*; Wae Niniyoa - Wae Pulo, 800m, *C-9590*; Wae Nuo - G. Mapahue, 990m, *C-14814*; Piliانا - Hau Harnoe, 1420m, *C-15077*; Ena Puti - G. Sinaunia, 2150m, *C-15321*; Wae Pasola Hatu - G. Meseleinan, 1260m, *C-16203*; *ibid.*, 1240m, *C-16207* (c.sp.); Hatumete - Losa,

290m, *C-16473* (c.sp.).

Habitat. On shaded, moist or wet limestones in primary and secondary, lowland and lower to upper montane forests.

Distribution. Widely distributed in Asia.

Note: I follow Saito (1975) and treat *Gymnostomum aurantiacum* and *G. recurvirostre* Hedw. as distinct species. The distinguishing features of these two species are well summarized by Saito (1975, p.452). I mostly rely on the smooth epidermal cells of stems of *G. aurantiacum*; they are obviously papillose in *G. recurvirostre* in the study area.

Genus *Hyophila* Brid.

1. *Hyophila involuta* (Hook.) Jaeg., Bartram, Philipp. J. Sci., 68:114 (1939); Saito, J. Hattori Bot. Lab. 39:468 (1975); Norris & Koponen, Acta Bot. Fennica 137:109 (1989); Eddy, Handbook of Malesian Mooses 2:199 (1991).

Specimens examined. WEST SERAM: Batu Putih and Batu Soli near Buria, 350m, *C-10026*. CENTRAL SERAM: Rumah Sokat Batu near Sawai, 30m, *C-9899*; in the vicinity of Hatumete, 50m, *C-10153* (c.sp.); Hatu - Piliانا, 300m, *C-10203*; Wolu - Wae Waya, 360m, *C-10306*; Hatumete - Hoale Pass, 760m, *C-10589* (c.sp.); in the vicinity of Saunule, 0-140m, *C-14539*; along Wae Nua near Salunule, 110-190m, *C-14634*. EAST SERAM: G. Ili tubi near Bula, 30-100m, *C-10758* (c.sp.); G. Simfakan, 10-150m, *C-10846*.

Habitat. Forming a dense, pure mats on rocky cliffs, tree roots, or boulders in rather sunny places in forests or streamsides.

Distribution. Cosmopolitan.

Genus *Leptodontium* (C. Muell.) Lindb.

1. *Leptodontium flexifolium* (Dicks. ex With.) Hampe in Lindb.

Oefv. K. Vetensk. Akad. Foerh. 21:227 (1964); Saito, J. Hattori Bot. Lab. 38:463 (1975); Noguchi, Illust. Moss Flora, Japan, 2:289 (1988); Eddy, Handbook of Malesian Mosses 2:206 (1991)

Specimens examined. CENTRAL SERAM: Wae Huhu - Owae Puku, 2860m, *C-8940*, *C-8941*.

Habitat: Forming low, dense cushions on trunks of *Cyathea* sp. or on humus around the trunks in sparse alpine *Cyathea* forest.

Distribution. Cosmopolitan.

Note. Seram plants have long, flagellate stem apices.

Genus *Pseudosymblepharis* Broth.

1. *Pseudosymblepharis angustata* (Mitt.) Hilp. Beih. Bot. Centralbl. 50(2):670 (1933); Saito, J. Hattori Bot. Lab. 39:439 (1975); Norris & Kop., Acta Bot. Fennica 137:94 (1989); Noguchi, Illust. Moss Flora Japan, 2:271 (1988); Eddy, Handbook of Malesian Mosses 2:156 (1991).

Specimens examined. CENTRAL SERAM: Kanikeh - Wae Angsela, 750m, C-8630; Wae Angsela - Wae Huhu, 1490m, C-8764; Wae Huhu - Owae Puku, 2520m, C-8918; G. Uwelehu near Hatuolo, 630-1000m, C-9213; G. Musisi near Sawai, 1240m, C-9794; *ibid.*, 1030m, C-9811; Hatumete - Hoale Pass, 790m, C-10592; *ibid.*, 900m, C-10608; *ibid.*, 1400m, C-10661; Hau Harnoe - Ena Puti, 1920m, C-15151; *ibid.*, 1720m, C-15203; *ibid.*, 2070m, C-15318; Wae Pasola Hatu - G. Meseleinan, 1210m, C-16168; Nihehata - G. Hoale Besar, 1770m, C-16663.

Habitat. Growing on limestone walls (rarely on humid soil or rotten logs) in primary and secondary montane forests.

Distribution. Temperate to subtropical Asia.

Note. *Pseudosymblepharis angustata* is the most common species of the Pottiaceae in Seram and Ambon Islands. It usually grows on moist limestone cliffs in forests forming very large populations there. I found no sporophytes among our collections.

As most students have pointed out, this species shows considerable variability in morphology, such as appearance of plants in dry conditions, plant size, leaf shape and length and width of lamina. Plants having leaves with a wider sheath tend to have leaves that are widely spreading above.

*Pseudosymblepharis angustata* almost always grows on limestone and plants collected from this substrata do not have fragile leaves at all. I found, however, two specimens (cited below), which grow on rotting logs and have very fragile leaves. There might be some kind of relationship among substrata and the fragile nature of the leaves.

CENTRAL SERAM: Ena Puti - G. Sinaunia, 2250m, C-15231; *ibid.*, 2070m, C-15319.

Genus *Trichostomum* Bruch

1. *Trichostomum barchydontium* Bruch ex F.A. Muell.

Flora 12:393 (1829); Saito, J. Hattori Bot. Lab. 39:431 (1975); Norris & Koponen, Acta Bot. Fennica 137:96 (1989); Eddy, Handbook of Malesian Mosses 2:158 (1991).

Specimen examined. CENTRAL SERAM: G. Owae Puku - G. Binaya, 2800-2900m, C-9017.

Habitat. On limestone at sunny and open place in an alpine meadow.

Distribution. Cosmopolitan.

Note. Plants are very small and do not exceed 3.5 mm tall. They resemble *Pseudosymblepharis subduriuscula* in appearance, but much smaller in size.

Genus *Weissia* Hedw.

Key to the species

1. Seta longer than 3 mm. Capsule dehisced by an operculum. .... 1. *W. edentula*

1. Seta less than 0.3 mm, and thus the capsule deeply immersed in the perichaetial leaves. Capsule cleistocarpous, without operculum. ....

..... 2. *W. aff. exerta*

1. *Weissia edentula* Mitt.

Jour. Proc. Linn. Soc. Bot. Suppl. 1:27 (1859); Bartram, Philipp. J. Sci. 68:104 (1939) as *Hymenostomum edentulum* (Mitt.) Besch.; Saito, J. Hattori Bot. Lab. 39:421 (1975); Noguchi, Illust. Moss Flora Japan 2:262 (1988); Norris & Koponen, Acta Bot. Fennica 137:87 (1989); Eddy, Handbook Malesian Mosses 2:163 (1991).

Plant brownish yellow, to 5 mm tall. Stems blackish, with hyalodermis and a weakly differentiated central strand. Leaves crisped when dry, erect spreading when moist, linear-lanceolate, to 2.2 mm long; margins incurved above, plane below, entire throughout. Basal laminal cells rectangular, thin-walled. Upper and median laminal cells quadrate, densely and highly papillose, walls obscure, rather thick-walled. Cells of the boundary between papillose and non-papillose area, rectangular, strongly thick-walled, not pitted, upwards along costa than margins or plane. Costa excurrent shortly; uppermost cells smooth and

**Figure 5** - *Weisia aff. exerta* (Broth.) Chen a: plant, b & c: leaves, d: capsule, e: operculum. All from H. Akiyama C-8950. Use the scale bar as 2.5 mm for a, 1 mm for b & c, 1.3 cm for d & e.

conical. Adaxial surface cells of costa linear, seriate papillose. Abaxial surface cells of costa linear, seriate papillose. Sporophyte not seen.

Specimens examined. CENTRAL SERAM: Selmena - Maraina, 700-800m, C-9104a.

Habitat. On limestone cliff at open and dry place.

Distribution. Widely distributed in temperate to tropical Asia and Pacific regions.

Note. According to Noguchi (1988, p.266), the presence of peristome teeth in *Weissia controversa* Hedw. seems to be the only character separating *Weissia controversa* Hedw. from *Weissia edentula*.

2. *Weissia aff. exerta* (Broth.) Chen (Figure 5)

Hedwigia 80:158 (1941)

Plants brownish yellow, very minute, to 3 mm tall including leaves. Leaves inrolled above when moist, crispate when dry, to 2 mm long, linear, acuminate; margins incurved above, minutely crenulate. Upper laminal cells quadrate, pluripapillose. Basal laminal cells long-rectangular to linear, thick-walled, smooth. Costa excurrent, occupying 1/3 of leaf base; abaxial surface of costa linear and smooth.

Dioecious. Perichaetia terminal. Seta ca. 0.3 mm

long, straight, smooth, pale yellow. Capsule spherical, very thin-walled, ca. 0.5 mm long. Operculum and peristome not differentiated. Calyptra cucullate, extending half of capsule length, smooth and naked. Spores spherical, densely and minutely papillose, 18-22  $\mu$ m in diameter.

Specimens examined. CENTRAL SERAM: Wae Huhu - Owae Puku, 2870m, C-8950 (c.sp.).

Habitat. On humid soil among limestone rocks, at sunny and open place in an alpine meadow.

Note. Seram plants differs from the typical *Weissia exserta* in the deeply immersed capsule and shorter seta. It also differs from *Weissia crispa* in longer setae and the habitat; *W. crispa* usually grows at low elevations. This might represent a new species.

**Acknowledgements**

I thank Dr. Timo Koponen and other staffs of the Herbarium of Helsinki University, who offered me a chance to examine many valuable specimens kept there. I also thank Dr. Benito Tan who kindly informed me about *Barbula zenoskeana*. This study was partly supported by a Grant-in-Aid from the Ministry of Education, Science and Culture of Japan (01790319).

**Literature cited**

- Akiyama, H. 1989.** Taxonomic studies of mosses of Seram and Ambon (Moluccas, East Malesia) collected by Indonesian-Japanese botanical expeditions I. *Acta Phytotaxonomica et Geobotanica* 39:147-162.
- Bartram, E. B. 1939.** Mosses of the Philippines. *The Philippine Journal of Science* 68:1-425.
- Eddy, A. 1991.** *A Handbook of Malesian Mosses*, vol.2. 256 pp. Natural History Museum Publications, London.
- Noguchi, A. 1988.** Illustrated moss flora of Japan, part 2. Hattori botanical Laboratory, Nichinan.
- Norris, D. H. & T. Koponen. 1989** Bryophyte flora of the Huon Peninsula, Papua New Guinea. XXVIII. Pottiaceae (Musci). *Acta Botanica Fennica* 137:81-138.
- Saito, K. 1975.** A Monograph of Japanese Pottiaceae (Musci). *Journal of the Hattori Botanical Laboratory* 39:373-537.
- Tan, B. C. 1994.** Noteworthy range extensions of some East Asiatic moss taxa and a new species of Philippine *Barbula*, *B. zennoskeanna*. *Hikobia* 11:415-421.