RESEARCH ARTICLE

Taxonomic treatment of the family Polytrichaceae Schwägr. in Sri Lanka

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Abstract: Sri Lanka harbors a rich diversity of mosses (Phylum Bryophyta) with 561 species, 185 genera and 55 families. According to the checklist of mosses of Sri Lanka by O'Shea (2002), Polytrichaceae Schwägr. represents one of the most species-rich families comprising of two genera (*Atrichum* and *Pogonatum*) with 12 species. Available details on species and genera of the family are limited to mere literature based lists; no taxonomic keys, descriptions or monographs for therecorded species are available. The present study was carried out to investigate the species diversity and prepare a taxonomic treatment of the Family Polytrichaceae in Sri Lanka. Polytrichaceae is unique among other moss families by the formation of an epiphragm from the columella, presence of photosynthetic lamellae on upper leaf surface and multicellular peristome appearing single with 32 to 64 teeth. Specimens were collected from all possible geographic localities including; NuwaraEliya, Thispane, Horton Plains, Adam's Peak, Piduruthalagala, Badulla, Kanneliya Rain Forest, Riverston, Deanston, Corbert's Gap, Deraniyagla, Elkaduwa, Gannoruwa, Mahakanda, Loolecondera, Kurunegala, Jaffna, Anuradhapura, Dambulla and Galle. Specimens were thoroughly examined for morphological and anatomical characters using, dissecting and light microscopes and identified up to specific/generic level using taxonomic keys, descriptions and monographs. The specimens collected during the study represented two genera (*Atrichum* and *Pogonatum*) genera and seven species of the family Polytrichaceae in Sri Lanka: *Atrichum crispulum* Schimp. Ex Besch., *Pogonatum aloides* (Hedw.) P. Beauv., *P. marginatum* Mitt., *P. microstomum* (Schwägr.) Brid., *P. neesii* (C. Müll.) Dozy, *P. subortile* (C. Müll.) Jaeg. and *Purnigerum* (Hedw.) P. Beauv. A taxonomic key to Sri Lankan Polytrichaceae and descriptions along with illustrations for all the species identified are presented. Further investigations are made to explore all recorded species by O'Shea (2002) and to trace their distribution patterns within the island.

Keywords: Mosses, Polytrichaceae, *Pogonatum*, *Atrichum*, Sri Lanka.

INTRODUCTION

Bryophytes form an informal group comprising three distinct phyla of non-vascular land plants: Marchantiophyta (liverworts, ~ 5000 spp.), Bryophyta (mosses, ~ 13000 spp.), Anthocerotophyta (hornworts, ~ 150 spp.) (Shaw and Renzaglia, 2004; Goffinet and Shaw, 2009). They are small in stature and generally prefer moist shady

habitats, although some survive in extreme dry conditions. Bryophytes are unique among all land plants in having a dominant gametophyte in the life cycle alternating with a sporophyte dependent on the gametophyte (Shaw and Renzaglia, 2004; Magdefrau, 1982).

Sri Lanka is a tropical island with a high diversity of bryophytes, and harbours 327 liverworts, 561 mosses and 07 hornworts species (Abeywickrama and Jansen, 1978a; Abeywickrama and Jansen, 1978b; Abeywickrama and Jansen, 1960; Long and Rubasinghe, 2014; Mitten, 1859; O'Shea, 2002; O'Shea, 2003; Ruklani *et al.*, 2016; Tixier, 1975; Tixier, 1983). Taxonomic studies on Sri Lankan bryophytes initiated only recently and therefore, apart from the lists of taxa, taxonomic descriptions, identification keys, phenological data or details of distribution patterns remain poorly understood. Scarcity of taxonomic information is one of the main barriers to carry out any research on this important group of plants within the country. The study presents the first specimen based taxonomic treatment of the family Polytrichaceae Schwägr in Sri Lanka.

According to the checklist of mosses by O'Shea (2002), the family Polytrichaceae represents one of the most species rich moss families in Sri Lanka with two genera and 12 species (Table 1). However, the recorded number of taxa is primarily based on literature-based checklist published by O'Shea (2002) with only a few specimens deposited at the National Herbarium Peradeniya. The present study was carried out to investigate the species diversity and prepare a taxonomic treatment of the family in Sri Lanka.

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Table 1: Synopsis of genera and species of Polytrichaceae Schwägr. in Sri Lanka from O'Shea (2002).

Genus	Species
<i>Atrichum</i>	<i>Atrichum crispulum</i> Schimp. Ex Besch. <i>Atrichum subserratum</i> (Harv. & Hook. f.) Mitt.
<i>Pogonatum</i>	<i>Pogonatum aloides</i> (Hedw.) P.Beauv. <i>Pogonatum cirratum</i> (Sw.) Brid. subsp. <i>cirratum</i> <i>Pogonatum marginatum</i> Mitt. <i>Pogonatum microstomum</i> (R. Br. ex Schwägr.) Brid. <i>Pogonatum mneesii</i> (Müll. Hal.) Dozy <i>Pogonatum nudiusculum</i> Mitt. <i>Pogonatum patulum</i> (Harv.) Mitt. <i>Pogonatum proliferum</i> (Griff.) Mitt. <i>Pogonatum subtortile</i> (Müll. Hal.) A. Jaeger <i>Pogonatum urnigerum</i> (Hedw.) P. Beauv.

MATERIALS AND METHODS

Literature survey

A thorough literature survey was carried out on the family Polytrichaceae. Past collections and publications of Sri Lankan species were gathered and data-based. Herbarium specimens deposited at the National Herbarium Peradeniya (PDA) were reviewed.

Field collections

Fresh samples were collected from all possible different geographic localities in Sri Lanka: Nuwara Eliya, Horton Plains, Piduruthalagala, Adam's Peak, Riverston, Deanston, Corbert's Gap, Alkaduwa, Loolcondra, Badulla, Kanneliya Rain Forest, Sinharaja Rain Forest, Thispane, Karagahahinna, Deraniyagla, Mahakanda, Peradeniya, Gannoruwa, Kurunegala, Jaffna, Anuradhapura, Dambulla and Galle. Specimens were carefully collected using a pen-knife and stored in paper packets. Field notes on texture, colour, size, odour, substrate, and ecology were recorded. Detailed cellular characters were observed and measurements were made using Olympus CX21FS1 compound microscope and Accu-scope 3025PH-BE-CS Stereomicroscope. Digital photographs were taken using a Nikon D3200 and Nikon D3100 digital cameras. Georeferencing data were recorded using a Global Positioning System Navigator (GPS).

Microscopic methods

Specimens were rehydrated prior to observations. Specimens were observed under dissecting (Hertel & Reus-Optik Kassel), and light microscopes (Eruomex, Arnhem, Holland). Morphological and anatomical characters were observed and characters were recorded for each specimen studied.

Identification of specimens

Specimens were identified upto specific/generic levels based on the characters observed using available taxonomic keys, descriptions and monographs (Akatova, 2000; Bell and Hyvönen, 2010; Buck and Goffinet, 2000; Buck, 2007; Cvet *et al.*, 2007; Derdaet *al.*, 1999; Dixon, 1915; Eddy, 1988; Goffinet and Buck, 2004; Hallingbäck and Hodgetts, 2000;

Hyvönen *et al.*, 2004; Ireland, 1968; Peralta and Yano, 2010; Vitt, 1984). Identified specimens were authenticated using type descriptions and/or specimens (as cited under each species).

Taxonomic keys and descriptions

A taxonomic key for the family Polytrichaceae in Sri Lanka was prepared using unique characters of the species identified. Taxonomic descriptions were prepared for each species identified using their gametophytic and sporophytic characters observed.

Herbarium specimens

Herbarium specimens were prepared following Schofield (1985) method. Voucher specimens are deposited at National Herbarium Peradeniya (PDA).

RESULTS AND DISCUSSION

According to the checklist of mosses by O'Shea (2002), two genera (*Atrichum* and *Pogonatum*) and 12 species of the family Polytrichaceae are recorded from Sri Lanka (Table 1). However, of the recorded species, only six specimens have been deposited at the National Herbarium Peradeniya (PDA). Specimens collected during field explorations of the present study represented seven species under two genera (*Atrichum* and *Pogonatum*) of the family Polytrichaceae in Sri Lanka: *Atrichum crispulum* Schimp. Ex Besch., *Pogonatum aloides* (Hedw.) P. Beauv., *Pogonatum marginatum* Mitt., *Pogonatum microstomum* (Schwägr.) Brid., *Pogonatum neesii* (C. Müll.) Dozy, *Pogonatum subtortile* (C. Müll.) Jaeg. And *Pogonatum urnigerum* (Hedw.) P. Beauv. A taxonomic key to Sri Lankan Polytrichaceae and taxonomic descriptions along with illustrations are presented for all the species identified.

Polytrichaceae Schwaegr., Species *Muscorum Frondosorum* l. 1830 (in Willdenow's Species Plantarum ed. 4, 5(2): 1, 1830). Type – *Polytrichum* Hedw.

Plants small, medium to occasionally tall or large, tufts or forming colonies. Stems erect, acrocarpous, rigid, arising from persistent protonemal mats or from subterranean rhizomes that grow on siliceous or acidic substrata, usually unbranched; stem in cross section with distinct central conducting strand composed of hydroids (hydrome) and

Figure 1: Vegetative characters of Polytrichaceae (A) transverse section of the stem of *Pogonatum subortile* (B) transverse section of upper vegetative leaf of *P. aloides* (C) upper vegetative leaf of *P. microstomum*.

Figure 2: Reproductive characters of Polytrichaceae (A) perigonia of *Pogonatum aloides* (B) capsule of *P. neesii* (C) epiphragm of *P. subortile*.

leptoids (leptome) (Figure 1A). Leaves spirally arranged, lower leaves small, often scale-like and appressed to the stem, upper leaves (limbs), often crowded, long and narrow, differentiated into a broad, pale, unistratose, membranous, sheathing base (Figure 1C) and a firm blade; lamina margin 1(3) stratose, entire to distinctly serrate, or with specialized elongated marginal cells; costa single, prominent, narrow at sheathing part, usually broad and percurrent to slightly excurrent; whole or parts of the upper leaf surface covered with numerous, longitudinal, ribbon-like photosynthetic lamellae (Figure 1B). Lamina cells isodiametric; sheath cells mostly rectangular to linear, narrower towards the margin (Eddy, 1988; Hyvönen, 2012; Ignatov, 1995).

Dioicous. Pericheatia terminal, perichaetial leaves scarcely differentiated, usually with a long sheathing base. Pergonia indeterminate, rosulate; perigonal leaves with a wide sheathing base and a rudimentary lamina (Figure 2A). Seta terminal or pseudo-lateral by sub-perichaetial innovations, elongate, usually solitary, smooth. Capsule erect, slightly inclined or horizontal, symmetrical or assymetrical, acutely to bluntly 4(6) angled or terete, stomata absent or present; apophysis indistinct or delimited by an abrupt deep basal constriction; operculum acute or rostellate (Eddy, 1988; Hyvönen, 2012; Ignatov, 1995; Smith Merrill, 2007) (Figure 2B).

Peristomenematodontous, with a single series of 32–64 rigid, short, lingulate or triangular teeth usually curved inwards, composed of elongate cells, pale or strongly pigmented (Figure 2C); teeth attached by their tips to a discoid membranous or fleshy epiphragm an expansion of the distal end of the columella. Spores globose, isomorphic, echinate and granulose, released through spaces between

peristome teeth. Calyptra small or large, mitrate or cucullate, rarely glabrous or apically serrate and often densely hairy (Malcolm and Malcolm, 2000; Eddy, 1988; Hyvönen, 2012; Ignatov, 1995; Merrill, 2007) (Figure 2B).

Note: The family Polytrichaceae is characterized by forming an epiphragm from the distal end of the columella, presence of longitudinal photosynthetic lamellae on upper leaf surface, and the multicellular peristome appearing single and usually with 32 – 64 teeth (Gradstein et al., 2001; Peralta and Yano, 2010). The family comprises of about 400 species in ~ 20 genera, with a cosmopolitan distribution with the highest diversity in the mountains of temperate zone (Ignatov, 1995; Peralta and Yano, 2010). They usually occupy exposed to dry habitats like rocks, humus and mires (Hyvönen et al., 1998; Proctor 2005; Scheier, 1972; Sharma, 1963; Sloover, 1986; Smith, 2004; Suleiman and Edwards, 2002).

Key to Sri Lankan Polytrichaceae

1. Sheathing base of leaves absent, leaf lamina unistratose2
 Sheathing base of leaf present, leaf lamina multistratose.....3
2. Lamellae 2–4 on nerve, leaf margin unistratose.....*A. crispulum*
 Lamellae absent, leaf margin multistratose*P. marginatum*
3. Apical cell forked, leaf base dentate.....*P. microstomum*
 Apical cell single, leaf base entire4
4. Apical cell flat or notched, dissimilar to lamellae cells.....*P. neesii*
 Apical cell rounded, similar to lamellae cells5
5. Lamellae short, with 2–3 cells.....*P. subtortile*
 Lamellae long, with 4–7 cells6
6. Aloe-like plant, very small, height < 10 mm.....*P. aloides*
 Robust plant, height > 50 mm*P. urnigerum*

Atrichum P.Beauv.,Magasin Encyclopédique 9(5): 329, 1804.*nom cons.*Type – *Atrichum undulatum* (Hedw.) P. Beauv.≡ *Catharinea* Ehrh.exF.Weber & D. Mohr, Index Musei Plantarum Cryptogamarum 2:1803 *nom rejic.* Type –*C. undulate* (Hedw.) F.Weber & D.Mohr [= *Atrichum undulatum* (Hedw.) P.Beauv.] (Hyvönen, 2012)(Figure 3).

Figure 3: General morphology of *Atrichum* (*A. crispulum*) (A) vegetative leaf (B) gametophytes without sporophytes (C) leaf margin, (D) transverse section of a leaf, (E) leaf marginal teeth.

Plants small to medium sized, delicate or tall and robust, usually forming dense tufts, dark-green or brownish green. Stem simple, erect, not branched or rarely branched. Leaves crowded at stem apex or evenly arranged along the stem, broadly attached to the stem without sheathing bases, ovate, triangular-lanceolate or lingulate in shape, translucent, erect spreading when moist, crisped when dry. Leaf margin denticulate or sharply serrate, with single or double teeth (Ireland, 1968). Leaf lamina unistratose, spines present on back of leaf. Lamina cells isodiametric, chlorophyllous (Eddy, 1988). Costathin, excurrent or percurrent. Photosynthetic lamellae few on ventral side of costa or absent (Nyholm, 1971; Lou and Koponen, 1986).

Plants dioicous or monoicous. Sporophyte one or more from the same perichaetium. Seta elongate, smooth, reddish, brownish or yellowish. Capsule erect or curved, inclined, short or elongate, oval or cylindrical and narrowed towards the base (Nyholm, 1971; Lou and Koponen, 1986; Smith, 2004). Peristome teeth 32 and a yellowish or orange midline, attached to the epiphragm (Stoneburner *et al*, 1992). Operculum rounded-convex and elongate rostrate (Smith, 2004). Calyptra rough at apex with spinosely projecting cells. Spores smooth or papillose (Hyvönen, 2012; Nyholm, 1971; Lou and Koponen, 1986).

Plants usually found on siliceous sandy or loamy soils in exposed habitats or earth covered rocks in damp, sometimes wet and more rarely on dry habitats (Nyholm,

1971). Distributed in temperate regions, Europe, Asia, U.S.A., North Africa and Australia (Lou and Koponen, 1986).

One species of the genus *Atrichum* was identified during the study.

Atrichum crispulum Schimp. Ex Besch., Annales des Sciences Naturelles; Botanique, sér. 7, 17: 351, 1893. $\equiv$ *Catharinea crispula* (Besch.) Broth., Die Natürlichen Pflanzenfamilien 1(3): 673, 1905. Type: Japan. Yokoska, *Savtier* 530n.v. = *Atrichum henryi* (Salm.) Bartr. Annales Bryologici 8: 21, 1935 (Lou and Koponen, 1986) (Figure 4).

Plants 9–12 mm tall, delicate, green to dark green, forming compact mats, persistent protonema absent. Stem light green, erect, unbranched, diameter 0.29–0.33 mm; base of stem loosely covered with matted whitish rhizoids; scale leaves absent. Leaves spirally arranged, green, erect spreading when moist, dark green, highly incurved, appressed, altered when dry, 4–6 mm x 0.9–1.2 mm, oblanceolate, shoulders and sheath absent, apex acute with a hyaline tip, apical base wide, base narrow, extended leaf base absent; costa brownish, percurrent, prominent on both surfaces, clearly visible to naked eye on lower surface; costa cells elongated, long rectangular, thin-walled often with 2–4, unicellular, hyaline, sharp teeth on abaxial surface towards the apex; leaf lamina unistratose except at costa, lamina cells on both surfaces similar; lamina cells at apex and middle loosely arranged, mostly spherical to irregular,

usually isodiametric, thin-walled; lamina cells at base mostly short rectangular, not isodiametric, hyaline; leaf margin unistratose, doubly toothed, two layers of marginal teeth present from apex to middle, mostly entire towards the base; marginal cells hyaline to slightly yellowish, elongated, mostly triangular, thick-walled, chloroplasts absent; marginal tooth cells sharp, thick-walled, hyaline to slightly yellowish. Photosynthetic lamellae on abaxial surface 2–4(6), loosely arranged, erect, short, restricted to costa, 2–4(6) cells high; lamellae cells spherical, thick-walled, chlorophyllous; crest cell similar to lamellae cells, thick-walled, spherical, chlorophyllous, round, smooth.

Plants dioicous, male and female plants similar in size. Sporophyte not observed. Seta reddish. Capsule cylindrical, slightly curved to straight; peristome teeth 32, operculum rounded-convex. Spores finely papillose or smooth (Lou and Koponen, 1986)

Specimens examined: Central Province: Kandy District: Loolcondra; 7.14463°N 80.70306° E, alt. 1400 m, on wet soil slope of a ditch, *Wasala & Rubasinghe* 12–14PWSR, 29/01/2014 (PDA).

Note: *Atrichum crispulum* is distinguished by its broad leaves with few, short lamellae, long narrow, curved capsules. The species mostly prefers shady, wet environments, often wet banks along streams (Hyvönen, 2012; Stoneburner *et al.*, 1992).

Figure 4: *Atrichum crispulum* Schimp. Ex Besch. (A) fresh habit (B) dry habit, (C) leaf tip, (D) vegetative leaf, (E) leaf marginal cells, (F) leaf margin with two rows of marginal teeth, (G) teeth on leaf lamina, (H) teeth on back side of costa, (I) leaf lamina cells, (J) transverse section of leaf, (K) transverse section of stem.

Distribution: The species is also known from North America, China and Japan.

Pogonatum P.Beauv. Magasin Encyclopédique 9(5[19]): 329, 1804. Type –*Pogonatum aloides* (Hedw.) P. Beauv. (≡*Polytrichum aloides* Hedw.) (Hyvönen, 2012) (Figure 5).

Plants variable in height, with rosette-like species forming compact mats or loose lumps (~ 8 mm), and robust species reaching 20 cm (Eddy, 1988), with or without conspicuous persistent protonema. Stem erect, simple or branched, lower part of stem loosely or densely covered or not covered with rhizoids. Stem anatomy mostly similar among species, consisting of epidermis, cortex and central conducting strand; epidermis mostly unistratose with brownish, thick walled, closely arranged cells; cortex multilayered, with large, loosely arranged, hyaline, parenchyma cells; stereides present in central cylinder and beneath epidermis, thick walled and closely arranged, stereides beneath epidermis reddish or yellowish, stereides in central cylinder hyaline or reddish, leptoides present surrounding central cylinder, with tightly arranged, thin

walled, hyaline parenchyma cells. Leaves spirally arranged or in rows, green or whitish green, erect and spreading when moist, dark green or brownish when dry, lanceolate; costa percurrent or excurrent, usually broad and shallow, often toothed on abaxial side towards leaf apex. Leaf margin dentate, rarely entire, unistratose or occasionally bistratose. Photosynthetic lamellae usually well developed, covering most of the leaf surface, occasionally few confined to costa, 2–7 cells high, crest cell smooth or papillose, round, flat or slightly notched or cone shaped.

Plants dioicous. Sporophyte terminal, on female gametophyte or rarely on sub-perichetial innovations. Seta reddish or brownish, single, erect. Capsule, cylindrical or ovoid, erect to inclined, greenish, smooth when fresh, brownish to dark green, slightly ridged when dry; exothecial cells hyaline, thick walled and often mamilllose. Epiphragm whitish, brownish or grayish, covered by beak-shaped lid. Peristome teeth 32, reddish or reddish orange, elongate triangular. Calyptra mostly brownish or off-white, completely hairy in nature.

Genus *Pogonatum* includes 04 subgenera: subgen.

Figure 5: General morphology of *Pogonatum* (A) male gametophytes with perigonia on the top, (B) female gametophytes with the sporophytes (C) vegetative leaf blade with hyaline sheathing base (D) transverse section of stem (E) transverse section of leaf blade, (F) Hairy calyptra completely covering the capsule (G) capsule with lid, (H) epiphragm (I) part of transverse section of capsule wall, (J) spores.

Alienum Hyvönen, subgen. *Dendroidea* (Schimp.) Hyvönen, subgen. *Catharinella*, and subgen. *Pogonatum*. The 06 species of *Pogonatum* identified during the present study represented 03 subgenera: *P. aloides* (subgen. *Pogonatum*), *P. marginatum* (subgen. *Catharinella*), *P. microstomum* (subgen. *Catharinella*), *Pogonatumneesii* (subgen. *Pogonatum*), *P. subtortile* (subgen. *Catharinella*), and *P. urnigerum* (subgen. *Dendroidea*) (Hyvönen, 1989).

Pogonatum aloides (Hedw.) P. Beauv., *Prodrome des Cinquième et Sixième Familles de l'Aethéogamie* 84. 1805. $\equiv$ *Polytrichum aloides* Hedw., *Species Muscorum Frondosorum* 96. 1801. Type – Europe? (Hyvönen, 1989) (Figure 6).

Plants 4–8 mm tall, light green to bright green, forming rosette-like, stiff, loose mats, persistent protonema present. Stem reddish or light brown, erect, unbranched, diameter 0.3–0.4 mm; scale leaves absent; rhizoids absent or sparsely present at base of stem, wool-like, light brown to hyaline. Leaves spirally arranged, bright green to dark green, erect and spreading when moist, dark green, incurved, altered and appressed when dry, lower leaves shorter than upper leaves, narrow-lanceolate, 3–4 mm long, apex acute with a yellowish or yellowish-brown tip, apical base narrow; leaf shoulders and sheath well developed, shoulder margin entire, sheath hyaline, margin entire, extended leaf base absent; costa percurrent, not prominent or slightly prominent only on lower surface; costa cells green, thin-walled, short rectangular, chlorophyllous; teeth on abaxial

side of costa usually absent or with 1–2 brownish, blunt, 1–3 cells high teeth; leaf margin unistratose, mostly entire to very slightly dentate towards apex, marginal cells thin-walled, usually hyaline, short rectangular, chlorophyllous; marginal teeth one row, 3–4 cells high; marginal teeth cells blunt, thick-walled, chlorophyllous, 7–17.5 $\mu\text{m} \times$ 7–14.0 μm . Leaf lamina multistratose at costa with 2–3 cell layers; lamina cells on upper surface closely arranged into continuous rows, thin-walled, spherical, on lower surface loosely arranged, mostly short rectangular, thin-walled, chlorophyllous; teeth absent from leaf lamina. Sheath cells, thin-walled, rectangular, hyaline, chlorophyllous. Photosynthetic lamellae 27–40, well-developed, 4–6 cells high, erect, densely arranged covering most of the leaf surface except at margin; lamellae cells spherical, thin-walled, light greenish, crest cell similar to lamellae cells, single celled, round, smooth.

Plants dioicous, perigonium rosette-like. Seta slightly brown, single, unbranched, erect to slightly inclined, 8–18 mm long. Capsule, cylindrical, erect or slightly inclined, mostly symmetrical, 1–4 mm long, without lid; greenish, smooth when fresh, grayish, ridged when dry; exothecial cells hyaline, thick-walled and slightly mamillate; epiphragm grayish or slightly brown; peristome teeth 32, reddish brown, elongated triangular. Calyptra off-white or brown, completely hairy. Spores greenish yellow, spherical, margin entire, thin walled.

Specimens examined: Central Province: Nuwara Eliya

Figure 6: *Pogonatum aloides* (Hedw.) P. Beauv. (A) persistent protonema, (B) transverse section of leaf (C) female gametophytes with sporophytes (D) female gametophyte (E) leaf margin (F) transverse section of stem, (G) calyptra, (H) capsule without lid (I) spores.

District: Piduruthalagala, 7.117°N 80.4663°E, alt. 2430 m, on wet soil surface, *Wasala & Rubasinghe 48a-14PWSR*, 27/06/2014 (PDA); Mathale District: Riverston, on wet brown soil on slopes along roadside, *Wasala & Rubasinghe 68-14PWSR*, 8/8/2014 (PDA); Central Province, locality information lacking (PDA); Dolosbage, 28/09/1928, locality information lacking (PDA).

Note: The short rosette-like, stiff, dark green plants with triangular leaves resembling small *Aloe* plants is characteristic of the species. The species is closely related to *P. nanum* (European species) and are difficult to distinguish without sporophytes (Hyövänen, 1989). According to Hyövänen (1989), plants of *P. aloides* are larger, and have distinct marginal serrations along the entire blade and costa has numerous teeth. Also, leaf apices of *P. nanum* are wide and rounded whereas those of *P. aloides* are acute (Hyövänen, 1989).

Distribution: The species is also known from Europe, New Zealand, Asia and Africa (Hyövänen, 1989).

***Pogonatum marginatum* Mitt.**, Journal of the Proceedings of the Linnean Society, Botany, Supplement 1: 153, 1859. $\equiv$ *Plagioracelopus marginatus* (Mitt.) G.L. Merrill, Memoirs of The New York Botanical Garden 45: 469, 1987. Type – Sri Lanka (Ceylon), ad Hantani, *Gardner 1223* (NY, holotype. *n.v.*) (Hyövänen, 1989) (Figure 7).

Plants 25–38 mm tall, pale to dark green, delicate, forming compact mats, persistent protonema absent. Stem reddish, erect, unbranched, diameter 0.4–0.7 mm; basal part covered with small, greenish scale leaves; rhizoids brownish, absent or present only at base of stem. Leaves arranged in three rows, two lateral rows and one ventral

row, ventral leaves smaller than lateral leaves, bright green, erect, spreading when moist, dark green, strongly incurved, altered and not appressed when dry, lanceolate, 5–6 mm long, apex acute with a hyaline leaf tip, apical base wide, leaf shoulders and sheath not developed, extended leaf base present, 0.9–2.0 mm long; cells of extended leaf base reddish brown, elongated, rectangular, thick-walled, chloroplasts absent or 3–4; costa percurrent, prominent on both surfaces; costa cells light greenish, long rectangular, thin-walled, chloroplasts 12–19; teeth on abaxial surface of costa absent or up to 2 towards apex, hyaline, sharp, 02 cells high; leaf margin, dentate from apex to middle, entire towards leaf base, with 2–7 cells; marginal teeth one layered, 3–5 cells high; marginal tooth cell thick-walled, green, mostly spherical to irregular, chloroplasts 3–5, crest cell often larger and translucent. Lamina cells on upper surface of leaf loosely arranged without rows, thin-walled, mostly spherical, light greenish and entire, on lower surface loosely arranged, mostly spherical to irregular, mostly isodiametric, thin-walled, hyaline, chloroplasts 6–10; lamina cells at leaf base long rectangular, not isodiametric, hyaline, chloroplasts 4–5. Teeth absent from leaf lamina. Leaf lamina except at costa unistratose. Photosynthetic lamellae not developed. Thick-walled 8–11, greenish cells found along costa.

Plants dioicous. Seta reddish, single, unbranched, erect, 17–21 mm long. Capsule long cylindrical, erect, mostly symmetrical, 1–2 mm long, without lid, greenish, smooth when fresh, brownish, ridges absent when dry; exothecial cells hyaline, thick-walled and slightly mamillate; epiphragm whitish, diameter 1.0–1.2 mm; peristome teeth 32, reddish orange, elongated triangular. Calyptra, light brownish, completely hairy. Spores greenish yellow,

Figure 7: *Pogonatum marginatum* Mitt. (A) female gametophytes with sporophytes, (B) dorsal surface of fresh habit (C) ventral surface of fresh habit (D) ventral leaf, (E) dorsal leaf (F) dry habit (G) transverse section of leaf at the nerve (H) transverse section at the leaf margin (I) leaf lamina cells, (J) transverse section of stem (K) calyptra covering the capsule, (L) dry capsule (M) spores.

spherical, margin entire, thin walled, $\sim 7\mu\text{m}$ diameter.

Specimens examined: Southern Province: Galle District: Kanneliya Forest Reserve, 6.2501°N , 80.3745°E , alt. 220 m., on wet soil, *Wasala & Rubasinghe 19–14PWSR*, 29/03/2014 (PDA); Central Province: Badulla District: Badulla, On shady bank, 06/05/1928 (PDA); Wariyagala, 2250 feet, 26/10/1928 (PDA); Ulugala and Kadugannawa, 19/02/1929 (PDA).

Note: Type specimen of *Pogonatum marginatum* collected by George Gardner from Sri Lanka is not deposited in the National Herbarium, Peradeniya. The species can be distinguished from its leaf arrangement, absence of lamellae, unistratose leaf lamina, bistratose leaf margin, presence of an extended leaf base and nature of spores.

Distribution: The species is also known from India and Vietnam (Daniels *et al.*, 2016).

Pogonatum microstomum (R. Br. ex Schwägr.) Brid., *Bryologia Universa* 2: 745, 1827. $\equiv$ *Polytrichum microstomum* R. Brown ex Schwägr., *Species Muscorum Frondosorum, Supplementum Secundum* 2(2):10. pl. 154, 1826. $\equiv$ *Pogonatum minutum* Brid., *Bryologia Universa* 2: 127, 1827. *nom. illeg. superfl.* Type – Nepal, *Taylor* (FH, isotype, n.v.) (Hyövänen, 1989) (Figure 8).

Plants 25–60 mm tall, green, forming robust loose mats, persistent protonema absent. Stem erect, unbranched, reddish, diameter 0.4–0.6 mm, basal part densely covered with hyaline to brownish rhizoids and small, brownish

scale leaves. Leaves spirally arranged, upper surface olive to dark green, lower surface slightly brownish green or slightly brown, erect and spreading when moist, reddish brown, slightly incurved, slightly altered and appressed when dry, lower leaves dark green or reddish brown, shorter than upper leaves or same as upper leaves, broad lanceolate, 5–9 mm $\times$ 1.0–1.2 mm, apex acute with a brownish or reddish tip, apical base wide, leaf shoulders and sheath well developed, shoulder margin dentate, sheath slightly yellowish brown, margin entire, extended leaf base absent; costa percurrent, slightly prominent on lower surface or not, not prominent on upper surface, dark brown; costa cells light brown, rectangular, thick-walled, reddish brown at sheath, 17.5–52 $\mu\text{m} \times$ 10.5–21.0 μm ; chloroplasts absent or 2–4; teeth on abaxial side of costa 17–42, brown, sharp, 1–3 cells high; leaf margins unistratose, 2–3 marginal cells; marginal cells thin-walled, usually hyaline to slightly yellow, short rectangular, chlorophyllose, dentate from apex to shoulders, marginal teeth 01 row; marginal teeth cells in upper half and lower half of leaf similar, 1–3 cells high, sharp, thick walled, dark reddish brown, chloroplasts absent. Leaf lamina multistratose with 2–3 layers, lamina cells on upper surface closely arranged into continuous rows, thin-walled, cone shaped, entire, on lower surface from apex to base loosely arranged, mostly rectangular, thick walled, chlorophyllose, teeth absent from leaf lamina. Sheath cells thin-walled at apex and middle, thick-walled at base, short rectangular at apex and middle, long rectangular at base, hyaline, chlorophyllose. Photosynthetic lamellae 49–74, well developed, 3–4 cells high, densely arranged throughout the leaf surface except at margin, erect; lamellae

Figure 8: *Pogonatum microstomum* (R. Br. ex Schwägr.) Brid. (A) fresh habit (B) dry habit (C) transverse section of leaf (D) vegetative leaf (E) leaf shoulder (F) teeth on back side of costa (G) leaf margin (H) leaf sheath cells (I) upper surface of leaf (J) lower surface of leaf (K) transverse section of leaf.

cells spherical, thin-walled, greenish, crest cell highly differentiated, hyaline, thick walled, forked, elongated double bottle shaped, round top with entire margin.

Sporophyte not observed.

Specimens examined: Central Province: Nuwara Eliya District: Nuwara Eliya, 6.9537° N, 80.7788° E, alt. 1865 m, on wet soil, *Wasala & Rubasinghe 40-14PWSR*, 12/05/2014 (PDA); Nuwara Eliya District: Piduruthalagala, 7.1170° N 80.4663° E, alt. 2430 m, on wet soil, *Wasala & Rubasinghe 47-14PWSR*, 27/06/2014 (PDA).

Note: This species can be easily identified in the field by its robust habit, apically wide and basally narrow leaf blade, olive to brownish leaves. Double bottle-shaped apical cells of lamellae are diagnostic of the species.

Distribution: The species is also known from Africa, Bhutan, Burma, China, India, Indonesia, Nepal, Formosa, Philippines, Sikkim, Thailand, Tonkin and Vietnam (Hyöyönen, 1989; Yadav, 2015).

Pogonatum neesii (C. Müll.) Dozy, *Nederlandsch Kruidkundig Archief. Verslagen en Mededelingen der Nederlandsche Botanische Vereeniging* 4(1): 75. 1856. = *Polytrichum neesii* C. Müll. Hal., *Synopsis Muscorum Frondosorum omnium hucusque Cognitorum* 2: 563, 1851. = *Pogonatum aloides* fo. *neesii* (C. Müll.) Gang., *Mosses of Eastern India and Adjacent Regions* 1: 100, 1969. Type – Indonesia, Java *Blume Herb. Al. Braun* (B, holotype, n.v.) (Hyöyönen, 1989) (Figure 9).

Plants 15–36 mm tall, bright green, dark green, grayish green or yellowish green, forming loose or dense mats, persistent protonema present or absent. Stem dark brown,

reddish or reddish brown, erect, unbranched or rarely branched, diameter 0.3–0.7 mm, basal part densely or loosely covered with brownish to hyaline rhizoids and small brownish to greenish scale leaves. Leaves spirally arranged, bright green, dark green, grayish green or yellowish green, erect and spreading when moist, dark green, brown or reddish brown, slightly incurved to strongly incurved, altered and appressed or not when dry, lower leaves same as or shorter than upper leaves, narrow lanceolate, 4–6 mm long, apex acute with yellowish or brown tip, apical base narrow, shoulders and sheath well developed, shoulder margin entire, sheath hyaline, sheath margin entire, extended leaf base absent; costa percurrent or not, brown, slightly prominent only on lower surface, or not prominent on any surface, costa cells greenish or brownish from apex to base, light brown, reddish brown or hyaline at sheath, rectangular, thin-walled, 10.5–70 µm x 3.5–17.5 µm, chlorophyllose; teeth on abaxial side of costa from apex to middle, 3–28, dark brown, 1–4 cells high, sharp; leaf margins unistratose, dentate or blunt from apex to middle, entire towards the base, 2–4 marginal cells clearly visible, thin or thick-walled, hyaline, usually spherical, short rectangular, or irregular, chlorophyllose; marginal teeth 01 row, 1–5 cells high, marginal teeth cells, sharp or blunt, thick-walled, yellowish orange, brownish, or hyaline, chlorophyllose or not. Leaf lamina multistratose with 2–3 cell layers, lamina cells on upper surface closely arranged into continuous rows, thin-walled, spherical, papillose or smooth, on lower surface mostly spherical or mostly spherical, irregular to rectangular, mostly isodiametric, thin-walled, dark or light greenish, 7–17.5 µm x 7–17.5 µm, chlorophyllose, teeth absent from leaf lamina. Sheath cells thin or thick-walled, irregular to spherical,

Figure 9: *Pogonatum neesii* (Müll. Hal.) Dozy (A) female gametophytes with sporophytes (B) transverse section of leaf with flat apical cells (C) transverse section of leaf with slightly notched apical cells (D) male gametophytes with perigonia (E) transverse section of leaf with flat, papillose apical cells (F) leaf margin (G) dry female gametophytes (H) part of transverse section of capsule wall (I) spores.

or rectangular, hyaline, 7–38.5 x 7–14 µm, chlorophyllose. Photosynthetic lamellae well developed, 27–49, densely arranged throughout leaf surface except at margin, erect, 4–7 cells high, lamellae cells spherical to rectangular, thin-walled, greenish, crest cell differentiated, slightly larger, spherical, short or elongated rectangular, green, thin or thick-walled, single, deeply or slightly notched, flattened or round finely papillose.

Plants dioicous. Sporophyte terminal. Seta reddish, reddish brown or brownish, single, unbranched, erect, 10–34 mm long. Capsule long cylindrical, erect or slightly inclined, mostly symmetrical, 3–4 mm long, without lid, greenish, smooth when fresh, dark green, ridged when dry, exothecial cells mamillate; epiphragm brown to slightly yellowish, light gray or white; peristome teeth 32, reddish, pink or brownish, elongated triangular, 0.1–0.2 mm. Calyptra light brown, completely hairy. Spores greenish yellow, spherical, margin entire, diameter 7–10 µm.

Specimens examined: Rathnapura District: Adam's peak, 6.8096° N, 80.4993° E, alt. 2230 m, on soil along the trail, *Wasala & Rubasinghe 04-14PWSR*, 11/01/2014 (PDA); Kandy District: Loolcondra Tea Estate, 7°08.588' N 80°42.271' E, alt. 1394 m, on wet reddish soil on a rocky slope, *Wasala & Rubasinghe 8b-14PWSR*, 29/01/2014 (PDA); Riverston, 07°31.464' N 080°44.401' E, alt. 1185 m, on roadside slopes, *Wasala & Rubasinghe 26-14PWSR* (PDA); 03/04/2014 (PDA); Deanston, Knuckles Mountain Range, 7.32623° N 80.86167° E, alt. 1180 m, on roadside slope, *Wasala & Rubasinghe 30-14PWSR*, 24/04/2014 (PDA); Corbert's Gap, Knuckles Mountain Range, 7.37318° N 80.84034° E, alt. 1196 m, on roadside slope, *Wasala & Rubasinghe 31-14PWSR*, 24/04/2014 (PDA); Corbert's Gap, Knuckles Mountain Range, 7.37439° N 80.84294° E, alt. 1179 m, on a soil slope of a home garden, *Wasala & Rubasinghe 32-14PWSR*, 24/04/2014 (PDA); Gannoruwa, 7.39357° N 080.61636° E, alt. 532 m, on wet soil along roadside *Wasala & Rubasinghe 41-14PWSR*, 20/05/2014 (PDA); Nuwara Eliya District, Nuwara Eliya, 7°11.68' N 080°60.02' E, on wet soil surface along roadside, 27/06/2014, *Wasala & Rubasinghe 42-14PWSR* (PDA); Galle District: Deraniyagala, 6.9284° N, 80.3394° E, alt. 162 m, on wet soil surface in a home garden, *Wasala & Rubasinghe 64-14PWSR*, 19/07/2014 (PDA); Mathale District, Riverston, 7.4555° N, 80.88° E, alt. 1190 m, on red soil surface along roadside, *Wasala & Rubasinghe 74-14PWSR*, 08/08/2014 (PDA); Nuwara Eliya District: Thispane-Kothmale, 7.0541° N, 80.602° E, alt. 710 m, on a wet soil slope in a tea estate, *Wasala & Rubasinghe 83-14PWSR*, 17/08/2014 (PDA); Kandy District: Mahakanda, 7.2238° N, 80.6134° E, alt. 718 m, on wet, light brown, gravelly soil surface in a home garden, *Wasala & Rubasinghe 93-14PWSR*, 04/09/2014 (PDA); Mathale District: Karagahahinna-Alkaduwa, 7.40290° N 080.68216° E, alt. 740 m, on red soil slope along roadside on wet soil surface, *Wasala & Rubasinghe 102b-14PWSR*, 17/09/2014 (PDA).

Note: *Pogonatum neesii* is the most common species of Polytrichaceae in Sri Lanka with a wide geographical range (162 m–2230 m). The species has been collected from

various localities during the present study. This species is characterized by its long (4–7 cells) photosynthetic lamellae with notched, slightly larger, finely papillose crest cells and pale leaf margins of dry plants which are easily seen with a hand lens. *Pogonatum neesii* is closely related to *P. aloides*. However, the apical cells of *P. aloides* are mostly rounded in cross section whereas those of *P. neesii* are typically retuse (Hyvönen, 1989).

Distribution: The species is known from India, Nepal, China, Burma, Thailand, Sumatra, Vietnam, Russia, Java, Borneo, Celebes, Indonesia, Malaysia, Papua New Guinea, Philippines, Formosa, Europe, Australia, New Caledonia, Samoa, Vanuatu, and Asia (Hyvönen, 1989; Yadav, 2015).

Pogonatum subtortile (C. Müll.) A. Jaeger, Bericht über die Thätigkeit der St. Gallischen Naturwissenschaftlichen Gesellschaft 1873–74: 256, 1875. = *Polytrichum subtortile* C. Müll. Hal., Synopsis Muscorum Frondosorum omnium hucusque Cognitorum 1: 216, 1848. = *Pogonatum teysmannianum* var. *tortile* Dozy & Molk., Bryologia Javanica 1: 44, 1856. Type – Indonesia, Java, Zollinger 853 (NY, H-BR, JE, L, n.v.) (Hyvönen, 1989) (Figure 10).

Plants 17–34 mm tall, green to yellowish, forming loose mats, persistent protonema absent. Stem erect, unbranched, reddish, diameter 0.3–0.6 mm, basal part loosely covered with hyaline rhizoids and small, greenish scale leaves. Leaves spirally arranged, green, erect, spreading when moist, dark green or brown, incurved, altered and appressed when dry, lower leaves green or yellowish brown, shorter than upper leaves, narrow lanceolate, 4–6 mm long, apex acute with brownish or yellowish tip, apical base narrow, shoulders and sheath well developed, shoulder margin entire, sheath hyaline, sheath margin entire, extended leaf base absent; costa percurrent, or not, brownish, slightly prominent only on lower surface or not prominent on any surface, costa cells rectangular, thin-walled, 10.5–49.0 µm x 3.5–14.5 µm, chlorophyllose; teeth on abaxial side of costa 3–16, brown, sharp, 1–3 cells high; leaf margin unistratose, dentate from apex to middle, entire towards base, marginal cells 03, clearly visible, thick or thin-walled, hyaline, short rectangular or irregular, chlorophyllose, marginal teeth 01 row, 1–3 cells high, marginal teeth cells sharp, thick-walled, yellowish or yellowish orange at upper half, hyaline at lower half, chloroplasts absent or 2–4. Leaf lamina multistratose with 2–3 layers, lamina cells on upper surface closely arranged into continuous rows, thin-walled, spherical, entire, on lower surface loosely arranged, spherical to irregular or rarely short rectangular, mostly isodiametric, chlorophyllose, 7–17.5 µm x 10.5–17.5 µm, teeth absent from leaf lamina. Sheath cells thin-walled, hyaline, rectangular to spherical, chlorophyllose. Photosynthetic lamellae, 38–66, well developed, 3 (4) cells high, densely arranged throughout the leaf surface except at margin, erect, short, 28–52 µm, lamellae cells mostly spherical or short rectangular, thin-walled, greenish, crest cell similar to lamellae cells, green, thin-walled, single celled, rounded or rarely flattened, smooth.

Plants dioicous. Seta reddish, single, unbranched, erect, 10–30 mm long. Capsule long cylindrical, erect or

Figure 10: *Pogonatum subtortile* (Müll. Hal.) A. Jaeger (A) female gametophytes with sporophytes (B) transverse section of leaf (C) lower part of stem (D) fresh capsule (E) dry female gametophytes (F) part of transverse section of leaf (G) vegetative leaf (H) dry capsule (I) spores.

slightly inclined, mostly symmetrical, 2 mm long, without lid, greenish, smooth when fresh, grayish, ridged when dry, exothelial cells mamillate, epiphragm gray, peristome teeth 32, reddish brown, elongated triangular. Calyptra pale brown, completely hairy. Spores greenish yellow, spherical, margin entire, 10.5 µm diameter.

Specimens examined: Kandy District: Peradeniya, 7.2564°N, 80.6031°E, alt. 577 m, on wet soil slope of a ditch along roadside, *Wasala & Rubasinghe 14a-14PWSR*, 19/02/2014 (PDA); Badulla District: Badulla, 7.0009°N, 81.0515°E, alt. 774 m, on wet soil surface along roadside, *Wasala & Rubasinghe 63-14PWSR*, 12/06/2014 (PDA); Mathale District: Alkaduwa, 7.40736°N, 80.68330°E, alt. 710 m, on red soil on roadside slope, *Wasala & Rubasinghe 103-14PWSR*, 17/09/2014 (PDA); Riverston, 7.52432°N 80.73796°E, alt. 1274 m, *Wasala & Rubasinghe 104-14PWSR* (PDA).

Note: The species can be distinguished by the presence of wide leaves, lamellae with 2-3 cells, round apical cells similar to lamellae cells.

Distribution: The species is also known from Indonesia, Malaysia, Papua New Guinea, Philippines, Fiji, Samoa and Solomons (Hyvönen, 1989).

Pogonatum urnigerum (Hedw.) P. Beauv., *Prodrome des Cinquième et Sixième Familles de l'Aethéogamie* 85. 1805. $\equiv$ *Polytrichum urnigerum* L. ex Hedw., *Spec. Musc.* 100. 22: 5-7. 1801. Type: Europe? (Hyvönen, 1989) (Figure 11).

Plants 50-75 mm tall, robust, glaucous green, forming dense mats, persistent protonema absent. Stem reddish, erect, unbranched, most part of the stem free from leaves, diameter 0.4-0.5 mm, basal part densely or loosely covered with hyaline or brownish rhizoids and green to brownish

scale leaves. Leaves spirally arranged, whitish green, erect, spreading when moist, dark green or yellowish brown, slightly incurved, altered, appressed when dry, whitish green on both surfaces, lower leaves whitish green or brown, shorter than upper leaves, narrow lanceolate, 5-7 mm long, apex acute with yellowish orange or yellowish brown tip, apical base narrow, shoulders and sheath well developed, shoulder margin entire, sheath hyaline, sheath margin entire, extended leaf base absent; costa percurrent or not, not prominent on any surface, costa cells green or light brownish, hyaline or reddish brown at sheath, rectangular, thin or thick-walled, 14-42 µm x 7-14 µm, chlorophyllose; teeth on abaxial side of costa 7-25 brown, sharp, 1-3 cells high; leaf margin unistratose, dentate from apex to middle, entire towards base, marginal cells clearly visible, 3-5, thin walled, hyaline, mostly spherical or irregular, chlorophyllose or not, marginal teeth 01 row, 1-3 cells high, marginal teeth cells sharp, thick or thin-walled, yellowish or hyaline at upper half and hyaline at lower half, devoid of chloroplasts or with few. Leaf lamina multistratose with 2-3 layers, lamina cells on upper surface closely arranged into continuous rows, thin-walled, spherical, papillose or entire, on lower surface mostly spherical or mostly irregular to spherical at apex, mostly spherical at middle and base, loosely arranged, mostly isodiametric, 7-14 µm x 7.0-14 µm, thin-walled, greenish, chlorophyllose. Teeth absent from leaf lamina. Sheath cells thick or thin-walled, mostly spherical to irregular or short rectangular, hyaline, 7-38.5 µm x 10.5-17.5 µm. Photosynthetic lamellae 35-48, well developed, 5-7 cells high, densely arranged throughout leaf surface except at margin, erect, lamellae cells spherical, thin-walled, greenish, crest cell usually similar to lamellae cells or short rectangular, green, thin-walled, single celled, rounded, slightly notched or rectangular to spherical smooth or slightly papillose.

Plants dioicous. Sporophyte terminal. Seta reddish,

Figure 11: *Pogonatum urnigerum* (Hedw.) P. Beauv. (A) fresh habit (B) male gametophyte with perigonia (C) female gametophytes with sporophytes (D) vegetative leaves (E) part of a transverse section of leaf with the margin (F) dry female gametophytes.

single, unbranched, erect, 15–22 mm long. Capsule long cylindrical, erect, mostly symmetrical, 2 mm long, without lid, greenish, smooth when fresh, gray, ridged when dry; epiphragm brown; peristome teeth 32, reddish, elongated triangular. Calyptra light brown, completely hairy. Spores greenish yellow, spherical, margin entire, thin-walled, 10.5 µm diameter.

Specimens examined: Nuwara Eliya District: Piduruthalagala, 07°0.117 N 080°46.63 E, alt. 2430 m, on wet soil, Wasala & Rubasinghe 58-14PWSR, 27/06/2014 (PDA); Mathale District: Riverston, 7.4555° N, 80.7509° E, alt. 1198 m, on wet soil along roadside, Wasala & Rubasinghe 67-14PWSR, 08/08/2014 (PDA).

Note: The species is characteristically robust and has distinct glaucous green colour. *Pogonatum urnigerum* is the most widespread species of the genus and is specifically variable in size, pattern of branching, leaf marginal dentations, form of crest cell (apical cell of lamellae) (Hyvönen, 1989). Sri Lankan specimens lack edexcurrent costa, strongly mammilose exothecial cells, and coarsely papillose, thick-walled crest cells. However, according to Hyvönen (1989), these variations do not support segregation into sub-specific taxa.

Distribution: The species is also known from northern Eurasia, North America, Africa, south-east Asia and Papua New Guinea (Hyvönen, 1989).

CONCLUSIONS

The present taxonomic survey of Sri Lankan Polytrichaceae recognized one species of *Atrichum* (*Atrichum crispulum*

Schimp. ex Besch.) and six species of *Pogonatum* (*Pogonatum aloides* (Hedw.) P. Beauv., *Pogonatum marginatum* Mitt., *Pogonatum microstomum* (Schwägr.) Brid., *Pogonatum neesii* (C. Müll.) Dozy, *Pogonatum subtortile* (C. Müll.) Jaeg. And *Pogonatum urnigerum* (Hedw.) P. Beauv.) from different geographical localities within the island. However, *Atrichum subserratum* (Harv. & Hook. f.) Mitt., *Pogonatum cirratum* (Sw.) Brid. subsp. *cirratum* Sw., *Pogonatum nudiusculum* Mitt., *Pogonatum patulum* (Harv.) Mitt. and *Pogonatum proliferum* (Griff.) Mitt., recorded by O'Shea (2002) were not reported during the present study. Further investigations are made with extensive field explorations throughout the country to locate all the species recorded, to study their phenology and to highlight the importance of conserving threatened taxa.

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