Morphological Study of Bog Bulrush 
(Schoenoplectiella mucronata) from Rokan Hulu, Riau, Indonesia.

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Abstract. Bog bulrush (Schoenoplectiella mucronata) is an aquatic flowering plant, considered as weeds. The stems can be used as material of mats, sacks, box, rope etc. so that it reduce the plastic use. This study aimed to describe the morphology of this aquatic plant collected from Rokan Hulu, Riau, Indonesia. It is a tufted perennial plant with an upright or horizontal rhizome; the stem reaches a height of 80–90) cm, 4–6 mm wide, has a sharp triangular section, has indistinct serrations. The tip leaf is conical into a sheath, 5–7 cm long, ending at a triangular apex, pale brown in color, absent; midrib, petiole, veins, ligule, and blade. Develops a pseudolateral, dense, head-like cluster of 3–20 spikelets; rod main stem, sharp triangle, 20-25 mm long, sharp tip, and usually upright. Fruit an obovoid nutlet, 1.0–2.5 mm x 1–1.5 mm, bluntly 3-angled, blackish, minutely wrinkled. Sessile grain, ovate to cylindrical, flowering length 4–5 mm, fruit length 310-20 mm, many flowers; the glume is spiral, oval, concave, 3–5 mm long, pale brown; bisexual flowers, perianth consisting of (4–) 6 brown hairs with recessed teeth, 3 stamens, superior and 1-locular ovaries, 2–3 stigmas.

1. Introduction
Bog bulrush (Schoenoplectiella mucronata,) is a type of grass that lives in swamps, belonging to the Cyperaceae [1, 2]. This plant is widespread in Europe, Asia, Australia and the Pacific islands and is generally considered a weed. Even though it is considered a weed, the bog bulrush stems can be used as material for making mats, rice sacks, and coffers. The stem is also used as a tie rope in traditional shops and markets in West Sumatra, which has now been replaced by plastic rope [3].

S. mucronata as a weed in cultivation cannot be controlled by flooding, but experiments in the United States show that temporary drought can selectively suppress S. mucronata in rice fields. The success of this control in rice cultivation has been successful with acetolactate synthase inhibitor herbicides such as bensulfuron-methyl, but a resistant form has been developed in some rice-producing areas [4].

Given the potential for bog bulrush which can be used as a product that has economic value, it is necessary to increase the production of this plant. The stems are used in Madagascar to make hats. In Southeast Asia rods are used in the production of ropes, mats, sacks and bags. S. mucronata is sometimes grown as an ornamental plant in ponds and is considered a potential wetland species used for water treatment in the tropics. In Southeast Asia it is used as a forage and in China it is used as a medicine to release heat, clear the eyes and relieve coughs. S. juncoides is a weed which is very important in rice cultivation in Madagascar and elsewhere [5].

Research on this plant is still very limited in Indonesia. Even if there is more to how to get rid of it because it is considered a weed plant. In fact, this plant has several potentials to be developed, including as a craft material for household utensils and needs [6] which is currently dominated by plastic. Plastic bags, plastic boxes, plastic ropes,
plastic mats are examples of household necessities that can be replaced by nature such as the bog bulrush plant. This study aims to determine the morphology and compile a description of the bog bulrush plant.

2. Methodology
This research was conducted in May-July 2020 at the Marine Biotechnology Laboratory, Faculty of Fisheries and Marine Science, Riau University. The materials used were bog bulrush (*S. mucronata*, sin. *Scirpus mucronatus*) with various ages. Starting from the adult, young and seedling stage. This plant is obtained from several rice fields in Rambah District, Bangun Purba District and Rambah Samo District, Rokan Hulu Regency, Riau, Indonesia.

The method used in this research was the survey method, namely by observing carefully the plant morphology. Includes stems, flowers, fruit, roots and so on. The data obtained were recorded, measured, described and photographed. Then it is analyzed descriptively and compares it with the results of previous similar studies.

3. Results and Discussion
3.1 Stem Morphology
The results of this study indicated that bog bulrush is a tufted perennial plant with an upright or sometimes horizontal rhizome. The stem is also a leaf. Stem height varies up to 80–130 cm, triangular-shaped stems 4–6 mm wide (Figure 1 A). The tip of the stem or leaf forms a sharp and serrated triangle, although it is not very clear, is conical into a sheath, 5-7 cm long, ends at the apex of the triangle, is pale brown (Figure 1 B). This stem has no midrib, no petiole and no veins, no ligules and no blades and branches (Figure 1 C).

![Figure 1. Bog bulrush stem (A). The tip of the stem forms a sharp and serrated triangle (B). The stem has no branch (C).](image-url)
Bog bulrush is a perennial grass, cespitose or not, rhizomatous or not. Leaves: triangular in cross-section, arising from the base of the plant. Culms solitary or not, cylindric to strongly trigonous, smooth, glabrous, spongy with internal air cavities. Terete spikelets, 325 x 25 mm; scales deciduous, 8+, spirally arranged, each subtending flower, or proximal scale empty, floral scales with apex entire or 2-fid, midrib usually prolonged into mucro or awn, smooth or abaxial surface scabrous, margins ciliate. Leaves basal, rarely 1 (2) cauline; tubular sheaths; membranous, glabrous ligules; blades well developed to rudimentary, cross section dorsiventrally flat to C-shaped or laterally compressed, soft, smooth or margins sometimes distally scabrous or spinulose. Terminal inflorescences, capitulate to openly paniculate; spikelets 1100+; involucral bracts 15, leaflike, proximal bract erect to spreading [7, 2]. Very short rhizome. Sturdy, erect, clumping, triangular trunk with approximately curved sides, smooth, ½-1 m x (2-) 3-8 mm. The leaves shrink into a membrane-like sheath, without leaf blade, straw-colored to brown. [8].

3.2 Flower Morphology

Bog bulrush flowers are clustered in a pseudolaterally, compact, head-like consist of 3-20 spikelets (Figure 2). Each triangular spikelet is acute, 20-25 mm long, has a sharp tip, and is usually upright (Figure 3). Fruit seeds or sessyl grains are ovoid, blackish orange in color, 0.2–1.0 mm in size with 0.1-0.5 mm thick to cylindrical. Bisexual flowers, consisting of 4–6 brown hairs with hidden locations, 3 stamens, superior ovary and 1 locular, 2–3 stigmas (Figure 4). Glume is spiral, oval, concave, 3–5 mm long, pale brown.

Some researchers [9, 10, 11] reported that bog bulrush flowers are near the top of the leaf and are brownish, scaly or spiky, carried near the end of a long stem with a distinctive angled bract. However, it was also reported that the flowers may take place 5-15 cm before the tip of the stem. The bog bulrush has head-like flowers, with 3–25 spikelets, or an occasional breed and with several petioles; involucral bract 1–10 cm long.
Spot oblong, acute, 10–20 mm long, 4–6 mm diameter. Acute glumes, mucronate, 3.5–4 mm long, striated, bald, pale red-brown to pale yellow-brown. Hypogynous bristles 5 or 6 are, unequally, slightly longer than peanuts. Bisexual flowers (basal flowers pistillate in amphicarpic species); perianth of 06 (8) bristles, straight or curved, spinulose, straplike, sometimes fringed with soft, blunt hairs, shorter than to somewhat exceeding achene; stamens 3; anthers 3 mm; styles linear, 23-fid, base not or scarcely enlarged, deciduous in fruit. Achenes biconvex to trigonous, with apical beak, faintly to prominently rugose or with transverse wavy ridges, 2.5–3.5 mm including 0.12 mm beak [12].

Figure 3. Spikelet, 20–25 mm long

Figure 4. Fruit seeds or sessyl grains are ovoid, blackish orange in color, 0.2–1.0 mm in size.
3.3 Root Morphology
As a tufted plant, the bog bulrush has a rhizome that propagates horizontally and
sometimes even rises to ground level. Has a lot of hair roots and spreads almost
horizontally and does not enter the ground far. As a result, this plant can easily be
removed by hand. Likewise, the rhizome propagates horizontally and the stolons also
propagates horizontally in all directions. Rhizoma and stolon both function for the
formation of new colony or individual bog bulrush (Figure 5).

![Bog bulrush rhizome propagates horizontally](image)

Previous researchers [13] [14] have reported that natural propagation is by seed or
seed, expansion of rhizomes and relocation of parts of the underside of plants. In
Indonesia, *S. mucronata* is sometimes cultivated in several regions. The planting material
is obtained by dividing the old clump into strips containing 10–15 stems. These sections
are then planted at a distance of 1 m x 1 m. Before planting, the rice fields are plowed or
scraped until they become muddy. Stems are harvested 3–4 months later after planting,
when the flowers have turned brown [15, 16].

4. Conclusion
Bog bulrush has an upright or horizontal rhizome. The stem reaches a height of 80–90
cm, 4–6 mm wide, has a sharp triangular section, blunted 3-angled and has indistinct
serrations. The tip of the leaf is conical into a sheath, 5–7 cm long, ending at a triangular
 apex, and pale brown in color. Spikelets; a pseudolateral, dense, head-like cluster of 3–
20. Has many bisexual flowers, flowering length 4–5 mm, sessile grain, ovate to
cylindrical. Fruit length 10-20 mm, pale brown, the glume is spiral, oval, concave, 3–5
mm long, pale brown. Has round and flat grains with a size of 1.0–2.5 mm × 1–1.5 mm,
and blackish to orange color. Has a lot of hair roots, the rhizome stolons vines
horizontally.
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