

## Morphological, Anatomical and Phytochemical Studies on *Marchantiapolymorpha* L.

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### Abstract

*Marchantiapolymorpha* L. thallus was collected from, PweKauk waterfall, PyinOoLwin Mandalay Region, during May 2018. The collected plants were classified and identified in order to verify by the literatures. In this paper, morphological and microscopical characters of thallus of the fresh specimen was described. The morphological characters of the thallus were dorsiventrally flattened, dichotomously branched, exhibit apical growth and numerous rhizoids attach the gametophyte (thallus) to the soil. In microscopical characters, the upper assimilatory region forms air chambers, middle storage region with parenchyma cells and ventral region with scales and rhizoids. The microscopical characters of the dried powder of *Marchantiapolymorpha* L. thallus were examined. The preliminary phytochemical investigation showed that alkaloids, glycosides, reducing sugar, saponins, phenolic compound,  $\alpha$ -amino acids, carbohydrates, starch, tannins and flavonoids were present and steroids was absent in the *Marchantiapolymorpha* L.

### Introduction

Bryophytes are widely accepted as the oldest living land plants. Bryophyte includes nearly 960 genera and 24000 species. Bryophytes are essentially small plants sizing from a few millimeters to a few centimeters. Bryophytes are land plants lacking specialized conducting tissues which contains lignin.

The bryophytes comprises the liverworts Marchantiophyta with 6,000 species, while the hornworts (Anthocerotophyta) with 300 species and mosses (Bryophyta) with 15,000 species were thought to be the second largest group of land plants after flowering plants (Shaw and Renzaglia, 2004).

The name "liverwort" is derived from the liver-shaped form of thalloid liverworts like *Marchantia*. In the middle ages in Europe, *Marchantia* was thought to be useful for treating diseases of liver on the basis of the 'doctrine' of signatures, by which a plant resembling a human organ was thought to be useful in treating diseases of the organ (Schuster, 1966).

*M. polymorpha* L. belongs to the family Marchantiaceae. The genus *M. polymorpha* L. is represented by 36 species in the world and distributed mostly in tropical and subtropical or temperate regions (Stotler and Crandall -Stotler, 2005).

*M. polymorpha* L. plants are grown on moist soil and rocks in damp habitats. It is usually green in color but older plants might be brown or purplish. The surface has a pattern of hexagonal marking and the plant produces umbrella like reproductive structure. The gametophores of female plant consist of a star-like stalk. Male gametophytes are topped by a flattened disc. The mature gametophytic plant body is grown radially while repeating dichotomously branched complex thallus, gemma cups, ventral scales and bundle of rhizoids (<https://en.m.wikipedia.org>, A.Rashid (1998), and Reddy (1996).

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Bryophytes are one of the richest sources of medicine. Many liverworts are used for treating gallstones and liver conditions including jaundice, liver enlargement, hepatitis and liver cirrhosis. They are also used for treating stomach and digestive tract discomfort, stimulating the pancreas. Some people use liverwort for treating varicose veins, lowering cholesterol, stimulating blood circulation and purifying blood ([https:// www.webmd.com> vitamins>2005-2008](https://www.webmd.com/vitamins/05-2005-2008)).

## Materials and Methods

The specimens of *M. polymorpha* L. thallus were collected in Pyin Oolwin Township, a scenic hill town in Mandalay Region, during May 2018. The macroscopical characters, microscopical characters and preliminary phytochemical investigation of *M. polymorpha* L. thallus were conducted at the Department of Botany, Dagon University. Fresh specimens of the vegetative parts were used to study its macroscopical characters. The samples were prepared by cutting free hand section with razor blade. The section cutting and dried powdered samples of microscopical characters were studied with the help of Olympus CX21 LED FS1 Microscope. The following reagents were used to examine (Trease & Evans, 2002).

- (i) Chloral hydrate solution was used for cleaning reagents.
- (ii) The oil globules were confirmed by using Sudan III.

The samples were washed and then dried about four weeks in room temperature. After that, they were ground to get powder and stored in air tight containers for studies of phytochemical tests. Preliminary phytochemical investigation of *Marchantiapolymorpha* L. was determined by the methods of Marini-Bettolo *et al.*, (1981), Central Council for Research in Unani Medicine, (1987) and Trease & Evans (1978).

## Results

### Systematic position

Kingdom	-	Plantae
Division	-	Bryophyta
Class	-	Hepaticopsida (Hepaticae)
Order	-	Marchantiales
Family	-	Marchantiaceae
Genus	-	<i>Marchantia</i>
Species	-	<i>polymorpha</i>

### Morphological Characters of *Marchantiapolymorpha* L.

The thallus is prostrate, dichotomously branched, dorsiventral symmetry and a distinct midrib on the dorsal surface is represented by a groove on the ventral surface, the midrib on the dorsal surface and the midrib is represented by a ridge. The apex of each branch has a terminal notch with the growing points. The mature gametophytic plant body thallus is 2-4 mm width and grows radially on white surface repeating dichotomous branching at the apex. The thickness of the thallus is 0.1-0.3 mm at its midrib region and gradually became thinner towards the margin. On the dorsal surface of the thallus bears a number of cup-like outgrowths, the gemma cup is 95 µm in length and width. The dorsal surface of the thallus consists of upright branches near the apical notches are known as gametophores, which are born with sex organs. On the

ventral surface of the thallus on either side of the midrib with two or more rows of the pinkish multicellularly presented and it protects the growing points. The special branches bear the male reproductive branches-antheridiophores and female reproductive branches-archegoniophores, which are produced on different thalli. A median longitudinal groove is present on the ventral surface of thallus and on both side of this groove contains numerous rhizoids and scales.



Fig. 1 Habit of *Machantia polymorpha* L. thallus



Fig. 2 Close up view of thallus



Fig. 3 Dorsal view of thallus

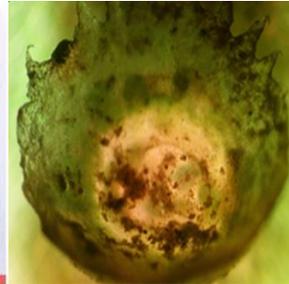


Fig. 4 Gemma cup



Fig. 5 Antheridia



Fig. 6 Archegonia



Fig. 7 Ventral view of thallus



Fig. 8 Rhizoids

### Microscopical Characters of *Machantia polymorpha* L.

In transverse section of *M. polymorpha* L. it consists of three-layered structure. They are the upper assimilatory region, the middle storage region and the ventral epidermis region. The upper epidermis contains a single layer of thin-walled cells and the air chambers are covered on the upper surface by a single-layered epidermis. Each chamber is partitioned with a side wall of one cell thickness and opened to the exterior by an air pore. The air pores are an intracellular space circularly surrounded by four tiers of cells forming barrel shape. Each chamber contains assimilatory filaments or chlorenchyma containing many discoid chloroplasts. The air chamber is equipped with air pores and assimilatory filaments are considered to facilitate gas exchange of photosynthesis, transpiration and respiration. The middle storage region contained parenchymatous cell and oil cells. The parenchymatous cells contained many starch grains and a few chloroplasts. The cells of this region are isodiametric and thin walled. The oil cells are idioblasts with a large oil body. The oil body is an organelle and bounded by a single membrane. The ventral region of the thallus is covered by many leaf-like scales and rhizoids. The ventral scale is a thick cell and obliquely arranged in three rows on each side of the thallus. Rhizoids are always unicellular and they are developed from lower epidermal cells. The brownish ventral surface of the thallus has almost regularly arranged scales and rhizoids. There are two types of rhizoids; smooth or simple rhizoids have a smooth wall and tuberculate or pegged rhizoids have peg-like thickenings. The scales arrange in three to four rows of violet

coloured scales are present along the ventral margin of the thallus, especially near the growing points. Appendiculate scales have an appendage arising out of a wedge shaped structure.



Fig. 9 Transverse section of thallus



Fig. 10 Transverse section of thallus in oil cells and air tires

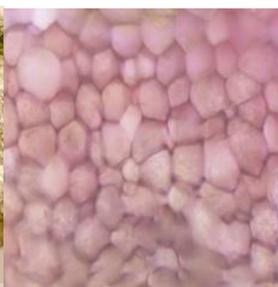


Fig. 11 Parenchyma cells



Fig. 12 Simple rhizoid

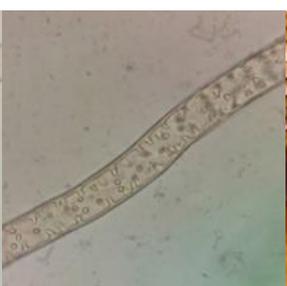


Fig. 13 Tuberculate rhizoid

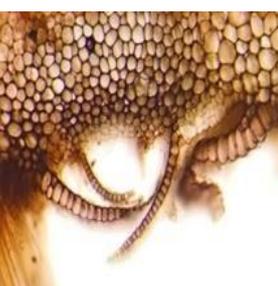


Fig. 14 Ventral surface of scales

**Table 1: Preliminary phytochemical tests of *Marchantia polymorpha* L. Thallus**

No.	Constituents	Extract	Test Reagent	Observation	Results
1.	Alkaloids	10% Acetic acid + EtOH	(1) Mayer's reagent (2) Dragendroff's reagent	White ppt Orange ppt	++ ++
2.	Glycosides	H <sub>2</sub> O	10% lead acetate	White ppt	++
3.	Reducing sugar	Dil H <sub>2</sub> SO <sub>4</sub> + 5 N NaOH	Benedict's solution	Pale yellow ppt	+
4.	Saponins	H <sub>2</sub> O	Distilled Water	Frothing	+
5.	Steroids	Pet-ether	Acetic anhydride + Conc: H <sub>2</sub> SO <sub>4</sub>	Pale brown	-
6.	Phenolic compounds	H <sub>2</sub> O	Ferric chloride solution	Deep brown ppt	+++
7.	α-amino acids	H <sub>2</sub> O	Ninhydrin reagent	Yellow colour	+

8.	Carbohydrates	H <sub>2</sub> O	10% $\alpha$ – naphthol + Conc: H <sub>2</sub> SO <sub>4</sub>	Purple ringcolour	+
9.	Starch	H <sub>2</sub> O	I <sub>2</sub> Solution	Bluish blackppt	+
10.	Tannins	H <sub>2</sub> O	Ferric chloride solution	Brown	+
11.	Flavonoids	Methanol	HCl / Mg	Brown colour	+

(+) = Present, (-) = Absent, (ppt) = Precipitate

## Discussion and Conclusion

In this research, the morphological, microscopical and phytochemical examination of *M. polymorpha* L. have been carried out. The study plant, grown in Myanmar was collected from Pyin-Oo-Lwin. According to the morphological examination, it has been identified as *M. polymorpha* L. belong to the Bryophyte. The thallus dorsiventrally flattened, prostrate and dichotomously branched and which is in agreement with pandey *et al.*, (2011) and Rashid (1998). The thallus is dark green in colour and the prominent median midrib on the dorsal surface and growing point of the thallus situated in the apical notch. Dorsal surface of the thallus has broad and which is further marked into polygonal or rhomboidal areas called areoles or areole and it is in agreement with Reddy (1996). The gemma cup is usually present in a cup-like structures with serrate margin along the midrib which is agreed with Reddy (1996) and Rashid (1998).

The transverse section of *M. polymorpha* L consists of a complex with an air chamber, ventral scales, two rhizoid types, gemma cups, stalked archegoniophore and antheridiophore and which is in agreement with Bischler (1998). The thallus is usually flattened and it has outlined air chambers with pores. Pores are visible with the naked eyes. These characters are in agreement with Schonherr and Ziegler (1975). The ventral surface of the thallus is covered by numerous leaf-like scales and rhizoids. The scales are multicellular and one cell in thickness. They are usually violet in color due to present anthocyanin pigments which is agreed with 2014. Rhizoids are of two types. They are smooth or simple rhizoid Singh *et al.* (2013 and 2014). In this paper, the preliminary and phytochemical tests showed the presence of alkaloids, glycosides, reducing sugar, saponins, phenolic compounds,  $\alpha$ -amino acids, carbohydrates, starch, tannins and flavonoids. These characters are in agreement with Trease and Evans (1978), Marini-Bettolo *et al.*, (1981) and Central Council for Research in Unani Medicine, (1987). According to literature, the steroids are also present but they are not examined in this study.

Alkaloids have a wide range of pharmacological activities including anticancer, antiasthma, anti-hyperglycemic activities, anesthetic agents, treating diabetes, anti-tumor agents, anti-malarial, antibacterial and pain killer. Glycosides are one of the several classes of drugs used to treat the heart and related conditions.

Reducing sugar intake and eating a healthful diet may be helpful to people to lose weight and prevent obesity, more energy throughout the day, clearer skin, avoid mood swings, reduce inflammation, reduce the risk of digestive conditions and of type-2 diabetes.

Saponins have a favorable effect on cholesterol, and it helps to boost the immune system, an antioxidant effect, and may even support bone strength and have several qualities to fight against cancer cells.

Phenolic compounds include antioxidative, antimicrobial and anticarcinogenic activities.

Carbohydrates are main sources of energy for a human body. They help fuel human brain, kidneys, heart, muscles and central nervous system. For instance, fiber is a carbohydrate that aids in digestion and keeps blood cholesterol levels and which is also a necessary role for starch in human nutrition.

Tannins have been used to treat tonsillitis, pharyngitis, hemorrhoids, skin eruptions and intestinal bleeding.

Flavonoids are a wide range of phytochemical with various pharmacological effects including antioxidant, anti-inflammation, anti-allergic, and prevent risk to heart disease and cancer.

Anto & Matsuo, (1984); Asakawa (1998); Singh *et al.*, (2006) mentioned that Marchantiaceae are possessed for tremendous therapeutic activities and they have been used therapeutically worldwide including India for long. Many liverwort extracts have been investigated for their different biological activities, such as antibacterial, antifungal, anticancerous, molluscicidal, insecticidal and antioxidant activities.

In conclusion, the study has focused on the morphological and microscopical of the plant *M. polymorpha* L. that thallus is rich in phenolic compounds and it has a good antioxidant activity. Fresh liverwort is likely unsafe when taken by mouth or applied to the skin. It can cause many side effects such as diarrhea, stomach irritation, kidney and urinary tract irritation when taken by mouth. It can be safely used as a dried liverwort. It can be used as a natural source of antioxidant to prevent the progression of many diseases such as antioxidant, anti-inflammatory and anticancer that justified its use in traditional system of medicine in other Asian countries. Further research works should be undertaken for the production of plant based drugs for their better economic and therapeutic utilization for the betterment of mankind.

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