

MORPHOLOGICAL AND HISTOLOGICAL CHARACTERS OF *PHYSALIS MINIMA* L.

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Abstract

In this paper, the morphology and histological characters of *Physalis minima* L. have been carried to understand its cell structure and medicinal values. A medicinal plant of *Physalis minima* L. belonged to the family Solanaceae. It was commonly known as Bauk-pin or sunberry in Myanmar, Country gooseberry in English. This plant was collected from Tharketa Township, Yangon Region during the flowering and fruiting period. Then, the collected specimen was classified and identified to confirm the morphological and histological characters with the help of available literatures. In the study of morphological characters, the plant was herb, leaves alternate, cymose inflorescence, the flowers cream colour; bisexual; pentamerous; hypogynous, fruits globose enclosed by the calyx and seeds endospermic. In the anatomical study, the anisocytic type of stomata was present on both surfaces of leaves. The mesophyll cells were made up of palisade and spongy mesophyll cells in lamina. In the transverse section of midrib, it was nearly circular in outline. The vascular bundles were collateral type, tanniferous cells, prismatic crystals found in the parenchyma cells and unicellular hairs present on the epidermis. In transverse section of petiole, it was semicircular in outline, crescent shaped vascular bundles and unicellular hairs present on the epidermis. In transverse section of stem, more or less circular or irregularly quadrangular in outline, vascular bundles were collateral type, unicellular hairs present on the epidermis. In transverse section of roots, circular in outline, the cortex made up of parenchymatous cells and the vascular bundles were pentarch. In addition, the microscopical characters of powdered of the plant were also investigated for their standarization used in medicine. According to the result, vessels, tracheids, fibers, unicellular hairs and calcium oxalate crystals were observed in the powder sample.

Keywords: morphological and histological characters

Introduction

Many varieties of medicinal plants were rich in Myanmar. These plants were widely distributed in different climate zones. These were 12,000 different plants growing in Myanmar and most of them have been regarded as medicinal plants (Kress, 2003).

The medicinal plant of *Physalis minima* L. belonged to the family Solanaceae. It is commonly known as Bauk-pin or sunberry in Myanmar, Country gooseberry in English. (Hundley and Chit Ko Ko, 1961; San Khin, 1970 and Kress, 2003).

The Solanaceae family occurred throughout the world, especially in tropical and temperate regions. This family included 90 genera and between 2000 and 3000 species (Backer, 1963; Dassanayake, 1987). The genus *Physalis* contained 45 species mostly in the warmer part of North and South America (Rendle, 1967); 50 species found in cosmopolitan (Kirtikar & Basu, 1935) and 30 species distributed throughout India, in the tropical region common in tropical Asia, Africa and Australia (Hooker, 1885).

Physalis minima L. has grown in arable lands, dry rice-fields, gardens and waste places. Its edible fruits have vitamin C which was a good quality for antioxidant activities (Backer, 1963; <https://indiabiodiversity.org>. and <https://en.m.wikipedia.org>).

Physalis minima L. used as diuretic, laxative, expectorant, appetizing and tonic, burning sensation, colic, ulcers, cough bronchitis, pruritus, erysipelas and ingredient of the medicinal oil which is given for spleen. Fruits taste like cherry tomato and used as tonic, diuretic, relieve pain

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analgesic and anti-inflammatory. The calyx was toxic and should not be eaten. Extracts from the plant have shown anticancer activity. The juice of the leaves mixed with mustard oil and water has been used as a remedy for earache (Kirtikar & Basu, 1935; Chopra, 1956; Prajapati, 2003; <https://pfaf.org>>user>plant and <https://hort.purdue.edu>).

The ethanolic extract of the whole plant was devoid of antibacterial, antiprotozoal, anthelmintic, antiviral, hypoglycaemic, respiratory and anticancer activities (Medicinal plants of India, 1987).

The medicinal plants were used throughout the world and the regulations defining their proper use such as identification of the correct species and verification of the presence, purity and concentration of the required chemical compounds were widely recognized (<https://ncbi.nlm.nih.gov>).

Most plants were classified based on the morphological characters of plants, flowers and fruits. These characters were not enough to classify. Therefore, in the classification of plant need to be involved the anatomical studied especially of leaves (Jibril & Jakada, 2016).

The aims and objectives of this research were to identify the morphological and microscopical characters of *Physalis minima* L., to study the sensory characters of powdered of this plant for standardization, to understand its medicinal values and to improve the wide application of traditional medicine.

Materials and Methods

Collection and Identification of *Physalis minima* L.

The specimens were collected from wild areas of Thaketa Township, Yangon Division during the flowering and fruiting period, October - December, 2018. After collection, the identification of the morphological and histological characters was carried out at the Department of Botany, East Yangon University. Then, the collected plants of vegetative and reproductive parts were recorded with photo images. The specimens were identified with the help of available literatures such as Hooker, 1885; Kirtikar & Basu, 1935; Chopra, 1956; Hundley & Chit Ko Ko, 1961; Backer, 1963; San Khin, 1970; Dassanayake, 1987; Kress, 2003 and Prajapati, 2003.

Histological characters of *Physalis minima* L.

In the microscopical study, free hand sections of fresh specimens were prepared by using the razor blade and examined by the help of microscope. The sections of each sample were cleared by with chloralhydrate solution. Then, the powdered samples were examined for the diagnostic characters and used in standardization of plant material for medicinal purposes. The microscopical characters of leaves, stems, roots were examined and confirmed by the available literatures of Medcalfe & Chalk, 1950; Pandey, 1998 and Trease & Evans, 2002.

Results

Morphological characters of *Physalis minima* L.

Scientific Name	- <i>Physalis minima</i> L.
Myanmar Name	- Bauk-pin, sunberry
English Name	- Country gooseberry
Family	- Solanaceae

The plant is herb; stem with angular-ribbed above, solid with narrow cavity, erect and branches. Leaves are simple, alternate, with hairs, ovate-oblong, the tip acuminate, the margin shallowly repand-dentate, tapering at the base, deciduous, petiolate, stipulate. Inflorescences are cymose, terminal and axillary. Flowers are cream colour, bracteates, ebracteolate, solitary, nodding, bisexual, complete, actinomorphic, pentamerous, hypogynous; sepals (5), synsepalous, campanulate, valvate, sepaloïd, persistent, inferior; petals (5), synpetalous, with a brown spot, hairs on the margin, corolla tube widely campanulate, valvate, petaloïd (cream colour), inferior; stamens 5, epipetalous, alternating with the petals, anthers ditheous, basifixed, dehiscence by apical pores; carpel (2), bicarpellary, syncarpous, bilocular, many ovules in each locule; style filiform; stigma capitate; ovary superior. Fruits are berry, pendulous, globose, enclosed by calyx. Seeds are numerous, compressed and endospermic.

Microscopical characters of *Physalis minima* L.

Lamina

In surface view, the epidermal cells of both surfaces were parenchymatous and thin-walled. The cell walls of upper surfaces were slightly wavy and lower surfaces were more wavy. Stomata were present on both surfaces and more abundant in the lower surface. They were anisocytic type, oval in outline. The guard cells were reniform in shape and contained abundant chloroplasts.

In transverse section of leaves, the cuticle layers of the upper and lower surfaces were thick and slightly wavy. The upper and lower epidermal cells were rectangular to barrel in shape. The dorsiventral structure of mesophyll layer made up of palisade and spongy parenchyma cells. The palisade mesophyll cells made up of one layer. They were vertically elongated cylindrical cells which were closely packed with one another and contained numerous chloroplasts. The spongy mesophyll cells made up of 2-3 layers which were irregular in shape, thin wall and loosely arranged with intercellular spaces. They were contained numerous chloroplasts.

The vascular bundle of lateral veins embedded in the mesophyll layers. It consisted of xylem lies towards the upper and phloem towards the lower, these were arrangement collateral type. The xylem tissues consisted of vessels and tracheids. Phloem tissues composed of sieve tube elements, companion cells, phloem fibers and phloem parenchyma. Phloem cells were very small.

Midrib

In surface view of the midrib, the epidermal cells of both surfaces were rectangular in shape. Unicellular hairs and calcium oxalate crystals were present on the surface.

In transverse section of the midrib, it was nearly circular in outline. The cuticle layer was thin and slightly wavy. The upper and lower epidermal cells were rectangular to barrel shaped. Unicellular hairs were present on the upper and lower epidermal cells. The cortex was made up of collenchyma cells and thin-walled parenchymatous cells. Collenchyma cells were beneath the upper epidermal cells and above the lower epidermal cells, 2-3 layers. They were oval to rounded in shape. The upper side and lower side of the parenchymatous cells were 4-6 layers. They were thin-walled and rounded to polygonal in shape.

Vascular bundles were collateral type and crescent-shaped. Xylem strands were made up of 2-4 cells in each row. Xylem cells were towards the upper surface. They were hexagonal in shape. Xylem consisted of vessels and tracheids. Phloem cells made up of 2-4 layers. Phloem tissues consisted of sieve tube elements, companion cells and phloem fibers.

Petiole

In surface view of petiole, the epidermal cells of both surfaces were thin-walled, parenchymatous and rectangular to polygonal in shape and unicellular hairs and calcium oxalate crystals were present.

In transverse section of petiole, it was semicircular in outline. The cuticle layer was thick and slightly wavy. The epidermal cells were rectangular to barrel in shape. The cortex was made up of collenchyma cells and thin-walled parenchymatous cells. The collenchyma cells were beneath the upper and lower epidermal cells, 2-3 layers. They were oval to rounded shape. The upper sides of the parenchyma cells was 7-9 layers and lower one were 5-7 layers. They were thin walled and rounded to polygonal in shape. Calcium oxalate crystals were present in the parenchyma cells.

The vascular bundles were collateral type and crescent-shaped. The vascular bundles embedded in the parenchyma cells. Xylem strands were made up of 3-5 cells in each row. Xylem cells were towards the upper surface and hexagonal in shape. Xylem composed of vessels, tracheids and xylem fibers. Phloem cells made up of 2-4 layers. Phloem tissues consisted of sieve tube, companion cells, phloem parenchyma and phloem fibers.

Stem

In surface view, the epidermal cells were parenchymatous, thin-walled and rectangular to polygonal shape, elongated lengthwise. Unicellular hairs and stomata were present on the surface. Stomata were anisocytic type.

In transverse section of primary stem, it was more or less circular or irregularly quadrangular in outline with 4-prominent ridges. The cuticle layers thick and slightly wavy. The epidermal cells were parenchymatous, rectangular to barrel-shaped. Unicellular hairs were present on the epidermis. The cortex was made up of outer collenchymatous and inner parenchymatous cells, the collenchymatous cells toward the peripheral region and parenchymatous cells toward the inner region. The collenchymatous cells consisted of 2 - 4 layers. They were oval to rounded in shape. The parenchymatous cells consisted of 3-5 layers. They were rounded to polygonal in shape. Pith parenchymatous cells consisted of 9-12 layers, irregularly rounded to polygonal in shape. In mature stem, the cells of pith were broken and disorganized leaving a hollow pith cavity in the center. The endodermis was made up of one layer, barrel shaped with starch sheath. Prismatic calcium oxalate crystals were present in the cortex and pith.

The vascular bundles were circular ring and 7-10 numbers. They were collateral type. The bundles were embedded in the parenchymatous tissues. The sclerenchymatous bundle caps were 3 - 5 layers and compactly, thick-walled, rounded to polygonal in shape. Xylem consisted of pitted and scalariform vessels, tracheids and fibres. The xylem cells were hexagonal in shape. The phloem tissues consisted of sieve tube elements and companion cells. Phloem tissues were 2 - 4 layers. Phloem cells were compactly arranged.

Roots

In surface view, epidermal cells were compactly and rectangular in shape. In transverse section of root, it was circular in outline. The epidermis was single layer and rectangular to polygonal in shape. Root hairs were present on the epidermis.

The exodermis was 1-2 layers. They were rounded in shape. The cortex was below the exodermis layer. The cortical cells made up of parenchymatous cells. They were rounded to polygonal in shape and 3 - 5 layers. Tanins were present in the cortical cells. Endodermis was

single layer. They were barrel shaped and parenchymatous. Pericycle was 2 - 3 layers. Pith present in the center of the root.

The vascular bundles were pentarch. Xylem strands consisted of 2 - 3 cells. Xylem composed of pitted and scalariform vessels, pitted, annular and spiral tracheids and fibres. Phloem tissues composed of sieve tubes and companion cells.

Diagnostic characters of the powdered *Physalis minima* L.

The powdered of *Physalis minima* L. was yellowish green colour and slightly aromatic, slightly bitter taste and fibrous in texture as shown in table (1).

In the investigation of powder sample, the epidermal cells, unicellular hairs, vessels, tracheids, fibres and calcium oxalate crystals were observed. The epidermal cells were parenchymatous, thin walled and wavy in surface view. Covering unicellular hairs were present. The vessels were simple pitted and scalariform with perforation plate. Tracheids were thick walled. Fibres were thick walled and the end walls tapering acute. Prismatic crystals were present.

Table 1 Sensory characters of powdered of *Physalis minima* L.

No.	Sensory character	Sample
1.	Colour	Yellowish green
2.	Odour	aromatic
3.	Taste	Slightly bitter
4.	Texture	Fibrous

Morphological Characters of *Physalis minima* L.



Figure 1 Habit of the plant



Figure 2 Inflorescences



Figure 3 Leaves



Figure 4 flowers



Figure 5 L.S of flower



Figure 6 T.S of ovary



Figure 7 Fruits



Figure 8 Seeds

Microscopical Characters of *Physalis minima* L.



Figure 9 Surface view of upper epidermal cell (x 100)

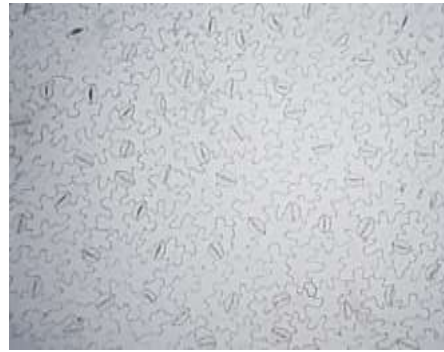


Figure10 Surface view of lower epidermal cells (x 100)



Figure11 T.S of lamina (x 100)



Figure 12 Surface view of (x 100)



Figure 13 T.S of midrib midrib (x100)



Figure 14 Surface view of petiole (x 100)

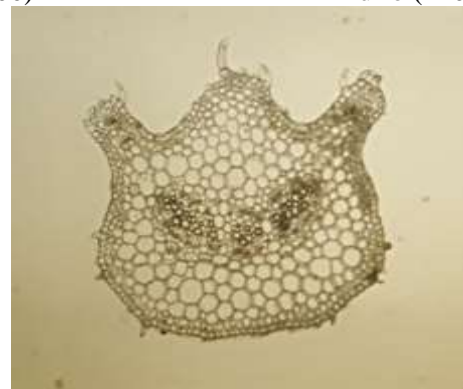


Figure 15 T.S of petiole (x 100)



Figure 16 Surface view of stem (x 100)



Figure 17 T.S of young stem (x 100)

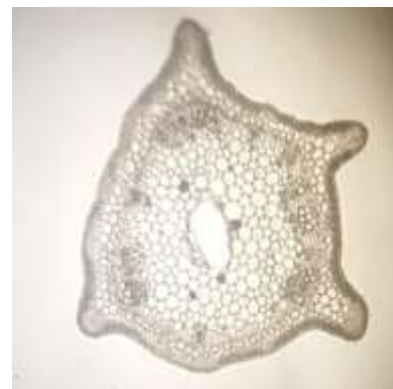


Figure 18 T.S of mature stem (x 100)



Figure 19 Surface view of root (x 100)

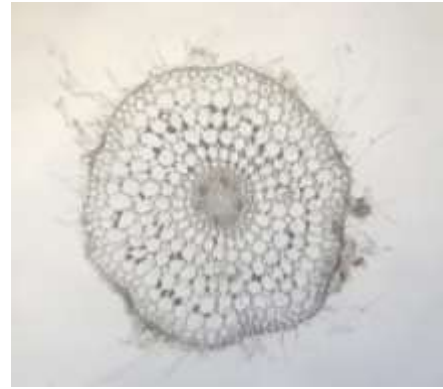


Figure 20 T.S of young root (x 400)

Diagnostic characters of powdered of *Physalis minima* L.



Figure 21 powder of the plant



Figure 22 vessels (x 40)



Figure 23 Vessel (x 100)



Figure 24 Tracheid (x 400)



Figure 25 Tracheid (x 100)



Figure 26 Tracheids (x 40)



Figure 27 Fiber (x 40)



Figure 28 Crystals (x 100)



Figure 29 Hairs (x 100)

Discussion

In this research, the morphological characters and histological characters of *Physalis minima* L. have been described.

Physalis minima L. belonged to the family Solanaceae. It was commonly known as Bauk-pin, sunberry in Myanmar, Country gooseberry in English. These characters were agreement with those described by Hundley and Chit Ko Ko, 1961; San Khin, 1970 and Kress, 2003.

Physalis minima L. was annual herb, stem with angular-ribbed. Leaves were simple, alternate, shallowly toothed margin, pubescent, petiolate. Flowers were cream colour, solitary in the axil, pedicels filiform, nodding; sepals (5), synsepalous, campanulate, valvate; petals (5), with a brown spot, hairs on the margin; stamens 5, epipetalous, alternating with the petals, anthers ditheous, basifixed, dehiscence by apical pores; ovary ovoid, style glabrous. Fruits were berry, pendulous, globose, entirely enveloped in the enlarged calyx. Seeds were numerous and discoid. These characters were agreement with those mentioned by Hooker, 1885; Kirtikar & Basu, 1935; Backer, 1963; Dassanayake, 1987; Prajapati, 2003 and <https://indiabiodiversity.org>.

Stem of the Physalis minima L. has angular ribbed, subterete below solid with narrow cavity. Stem, petiole and pedicel cover with hairs. These were agreement with those described by Backer, 1963.

In the microscopical study of *Physalis minima* L., stomata were present on both surfaces, more abundant and more wavy in the lower surface. They were anisocytic, oval in outline. The guard cells were reniform in shape and contain abundant chloroplasts. In transverse section of leaf, the dorsiventral structure of mesophyll layer made up of 1- layer of palisade mesophyll cells and 2-3 layers of spongy mesophyll cells. In transverse section of the midrib, it was semicircular in outline. The cortex was made up of collenchymas cells and parenchyma cells. Vascular bundles of lamina, midrib and petiole were collateral type and crescent-shaped in midrib and petiole. Unicellular hairs present on the epidermis of midrib and petiole. The transverse section of primary stems was more or less circular or irregularly quadrangular in outline with 4-prominent ridges. Unicellular hairs were present. Pith parenchymatous cells consisted of 9-12 layers, irregularly rounded to polygonal in shape. In mature stem, the cells of pith were broken and disorganized leaving a hollow pith cavity in the center. The vascular bundles were circular ring and collateral type. In transverse section of roots were circular in outline, epiblema cells were compactly and rectangular in shape. The vascular bundles were pentarch.

Pitted vessels, scalariform vessels, tracheids, fibers, fiber-tracheids, anisocystic stomata and calcium oxalate crystals were observed in powdered of the plant. These characters were agreement with those mentioned by Metcalf and Chalk, 1950 and Trease and Evans, 2002.

Conclusion

The classification of the plant based on the morphological and histological characters. The research will support to the traditional use of the plant for the treatment of various diseases. The extracts of the *Physalis minima* L. should be further study in phytochemical constituents and antimicrobial activity for medicinal purpose.

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