# MORPHOLOGICAL AND HISTOLOGICAL STUDIES OF *HYPSELANDRA VARIABILIS* (Collett & Hemsl.) Pax & K. Hoffm.

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## Abstract

*Hypselandra variabilis* (Collett & Hemsl.) Pax & K.Hoffm., locally known as Thamon, belongs to the family Capparaceae (Capparidaceae). It is indigenous to Myanmar, especially found in Mandalay, Sagaing and Magway Regions. The specimens were collected from Pakokku Township in Magway Region. The present work deals with the morphological and anatomical characters of both vegetative and reproductive parts of the plant. In morphological study, *Hypselandra variabiis* (Collett & Hemsl.) Pax & K.Hoffm is a perennial, medium-sized tree that bears greyish brown to dark brown bark, the branches are slightly pubescent when young. The leaves are simple and variable in shape and size. Inflorescences are terminal or axillary corymbose racemes. Flowers are bisexual, actinomorphic, hypogynous and leafy bracts. The outstanding characters are the presence of the androgynophore and the absence of corolla. The ovary is superior and parietal placentation. The histological study showed that stomata were present only on lower epidermis and anomocytic type. Uniseriate, multicellular, basal-celled trichomes were present on the upper surface of epidermal cells. Vascular bundles were found in the form of a collateral, closed type and crescent shape in midrib. The petiole, stem and gall were observed in the form of a collateral, closed type and circular in shape but the root was found in radial type. These characters presented in this research could be used as standardization in traditional medicine.

**Keywords**: *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm., Morphology, Histology

## Introduction

Capparaceae or Capparidaceae of some authorities, the Caper family, derives its name and importance from Kapparis, the Greek name used by Dioscoides for *Capparis spinosa.* The Capper family consists of 42 genera and 725 tropical and warm temperate flowering plant species with strong drought resistant tendencies (Anon, 1950).

*Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm. is a medicinal plant that belongs to the family Capparaceae (Capparidaceae) in the order Brassicales. This plant is a tropical species that widely distributed in Pakokku Township, Magway region. Pakokku is located at the bank of the west of the Ayeyawaddy River. It lies between 21˙35′ and 21˙55′ north latitude and between 95˙08′ and 95˙40′ east longitude and about 40 meters elevation above the sea level.

Capparaceae is mainly tropical family, consists of herbs, shrubs and small trees, while a few genera are included in Cadaba, Capparis and other genera. The stomata are ranunculaceous and variously shaped sclerenchymatous cells frequently present in the mesophyll of certain species of *Hypselandra.* Sclerenchymatous cells are sometimes extending between the epidermal cells and thus coming into contact with the leaf surface in *Capparis* and *Hypselandra* spp. (Metcalfe & Chalk, 1950).

Successive cambia have been reported in *Hypselandra* (*Boscia)* Lam. by Adamson (1935) and *Nieburia* DC. (*Hypselandra variabilis* (Collett & Hemsl.) Pax & K.Hoffm., by Hansen 1977), but some species of *Hypselandra* and *Maerua* as presently sampled do not have successive cambia (Metcalfe and Chalk 1950). Pandey and Chadha (1998) stated that anomocytic type is also called irregular-celled type where the subsidiary cells are indistinguishable from other epidermal cells. Such cases are found in members of Capparaceae.

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The leaves and roots of this plant are used in aching, sedema, cold extremities and also used as stomachic, expectorant and counter irritant (San and Han, 1998). The bark is used for eye disease, and the flowers are famous for making salad. The gall of "Thamon" is used to relieve eye sore. In Myanmar, it is believed that eating the buds and flowers of "Thamon" once a year can keep the good health throughout the lifespan (Ashin-nargathein, 1978).

In this study, an attempt was made to determine the morphological and histological characters of this plant. This plant has been chosen for this research because it has high medicinal value and there is no the previous records on its histological characters.

## Materials and Methods

### Collection, classification and identification of plant samples

The plant samples of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm. were collected from Pakokku Township, Magway Region in January, 2019. After collection, all vegetative and reproductive parts of the fresh specimens were identified with the help of available literatures Hooker (1879), Hundley and Chit Ko Ko (1987), Kurz. (1877).

The collected specimens were washed with water and then air dried at room temperature. When constant weight of the sample was obtained, the dried samples were pulverized by grinding machine and stored in air-tight bottles for further use.

### Histological examination of different plant parts

The fresh specimens of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm. were examined by cutting free hand sections and studied under microscope. The microchemical tests for the presence of lignin were made according to the methods and reagents given in Esau (1953), Trease and Evans (1978, 2002). The following reagents were used for microchemical test examination:

(1) Chloral hydrate solution B.P as clearing reagent

(2) Safranin for lignified and cutinized cell wall

(3) Solution of Phloroglucinol B.P, followed by concentrated Hydrochloric acid for testing lignin

## Results

### Morphological characters of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm.

Perennial, xerophytic, medium-sized tree, unarmed, about 10 m in height; **Stems** greyish brown to dark brown bark, branches slightly pubescent when young, bear numerous galls. **Leaves** simple, oblong to elliptic; stipules minute; petioles 1.0 to 2.5 cm long. The leaves are light green to dark green and variously shape and size. The midrib is sunken at the upper surface and raised at the below (Fig. 1a). **Inflorescences** are axillary or terminal, corymbose racemes. Flowers bisexual, regular, actinomorphic, hypogynous, apetalous, 3.0-3.5 cm long, 2-2.8 cm wide; bracts leafy, creamy-white (Fig. 1b). **Calyx** campanulate, three to four partite. **Androecium** six to thirteen stamens, filaments filiform, 0.7-1.5 cm long, androphore 0.2-0.3 cm long, anthers dithecous, dorsifixed, longitudinal dehiscent. **Gynoecium** carpel one, unilocular or bilocular due to false septum, many ovules in the locule, parietal placentation; gynophore 0.5 to 1.0 cm long, ovary superior; style very short, stigma discoid (Fig. 1c). **Fruits** berry, ovoid or sub-globoid (Fig. 1c). **Flowering period** is January to March as shown in Fig. 1a, b and c.

Habit

Branches with galls

Branches with flowers

Arrangement of leaves

Upper surfaces of leaves

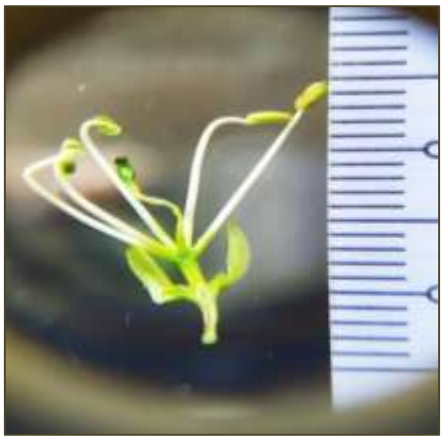
Lower surface of leaves

**Figure 1(a)** Morphological characters of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K.Hoffm.

Leaves with Galls

Galls

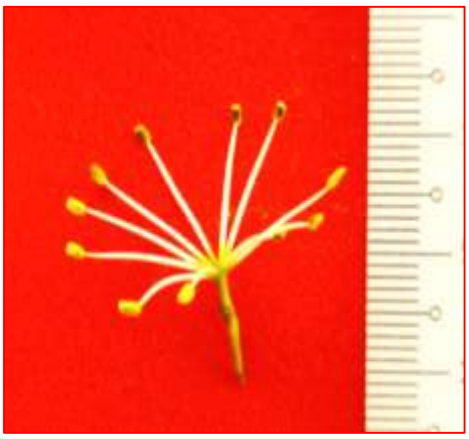
Flower



L.S of flower

Inflorenscence

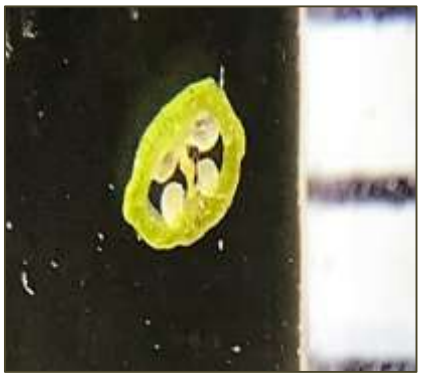
**Figure 1(b)** Morphological characters of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K.Hoffm.



Androecium

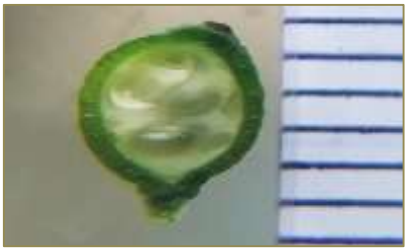
Carpel with androgynophore

L.S of ovary



T.S of ovary

Fruit



L.S of fruit

T.S of fruit

**Figure 1c**. Morphological characters of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K.Hoffm.

**Histological characters of leaves, stems and roots of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm.**

**Lamina**

In the surface view, the cuticle is striated on both surfaces. The epidermal cells are polygonal in shape, thick walled parenchymatous cells with distinctly wavy. Trichomes are uniseriate, multicellular, basal-celled, two or three cells in each trichome. Stomata are present only on lower surface and anomocytic (ranunculaceous) type (Fig. 2).

In transverse section, the cuticles are present on both surfaces. The epidermal cells are only one-layered and barrel-shaped. Mesophyll is differentiated into palisade and spongy. The palisade layer is composed of compactly arranged columnar cells. They are of two layers thick. The spongy layer consists of many layers of isodiametric cells arranged in loosely. Mesophyll cells contain abundant chloroplasts. Vascular bundles are collateral and closed type (Fig. 2).

**Midrib**

In the surface view, the epidermal cells are thick-walled and rectangular in shape, elongated along the axis. In transverse section, midrib is arranged in an arch with the convex surface towards the lower side. Trichomes are observed on both upper and lower surfaces. These are uniseriate, multicellular and basal-celled. Epidermal cells are one layered and barrel shaped. Collenchyma cells are rounded to polygonal in shape. Vascular bundle are with a massive fibrous or sclerenchymatous sheath, crescent shaped, collateral, closed type and endarch. Fibers are present in the cortical region (Fig. 3).

**Petiole**

In the surface view, the epidermal cells are polygonal in shape and thick walled parenchymatous cells. Stomata are also found. In transverse section, petioles are more or less rounded in shape and covered with cuticles. Many trichomes are present in the form of uniseriate, multicellular and basal celled. In cortical region, 2-3 layers of collenchyma cells are found towards the peripheral region. The parenchyma cells are 3-6 layered in thickness. These cells are rounded to oval in shape. Variously sclerenchymatous cells were observed. Vascular bundles are circular in shape, collateral, closed type and endarch. Pith is composed of parenchymatous cells (Fig. 4).

**Stem**

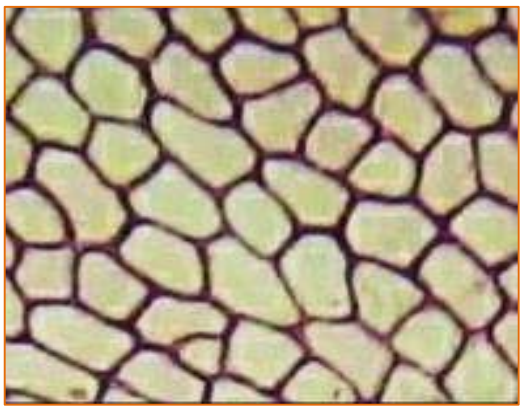
In the surface view, the epidermal cells are thick-walled, rectangular in shape, compact, anticlinal walls and elongated along the axis. Stomata are also found. In transverse section, it is more or less circular in outline. The epidermal cells are one layered, barrel shape, cuticle and trichomes present. Cortex layer consists of 4 - 6 layers of collenchymatous cells and 3 - 7 layers of parenchymatous cells. Many fibers are also found in the cortex. Vascular bundles are arranged in a ring, collateral closed and endarch. Pith composed of thin-walled, rounded parenchymatous cells (Fig. 5).

**Root**

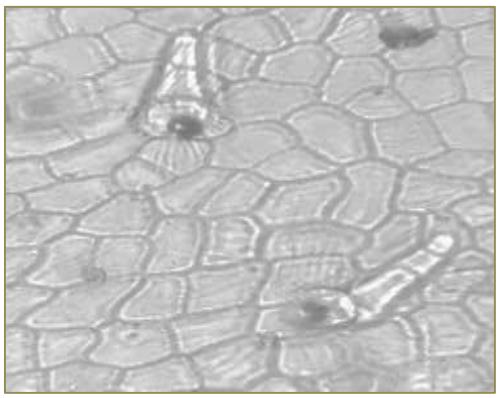
In the surface view, the epidermal cells are polygonal in shape and thick walled parenchymatous cells. Stomata are absent. In transverse section, it is more or less circular in outline. In transverse section, the epidermal cells are 3- layered and barrel shaped and cuticles present. Cortex consists of 3-6 layers, collenchymatous cells, oval shaped and compact. Endodermis composed of many layers, parenchymatous cells. Vascular bundles are radial type (Fig. 7).

## Galls

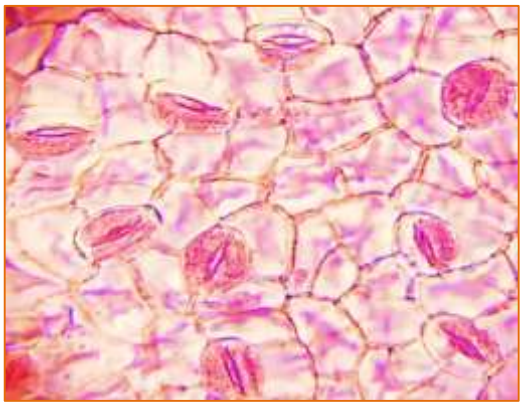
In the surface view, the epidermal cells are parenchymatous, thick-walled and polygonal in shape. In transverse section, vascular bundles are radial type, collateral, closed type and endrach. Pith consists of parenchymatous cells (Fig. 6).



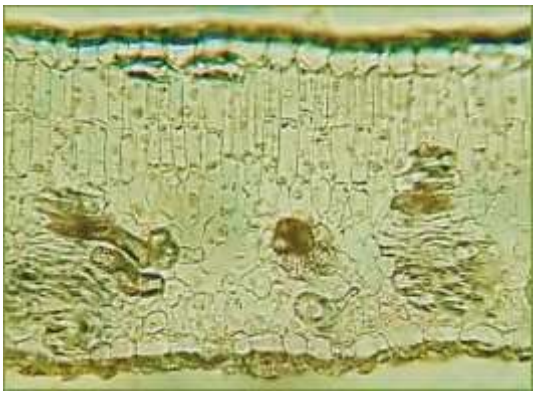
Upper surface of lamina (x400)



Upper surface of lamina with trichomes (x400)



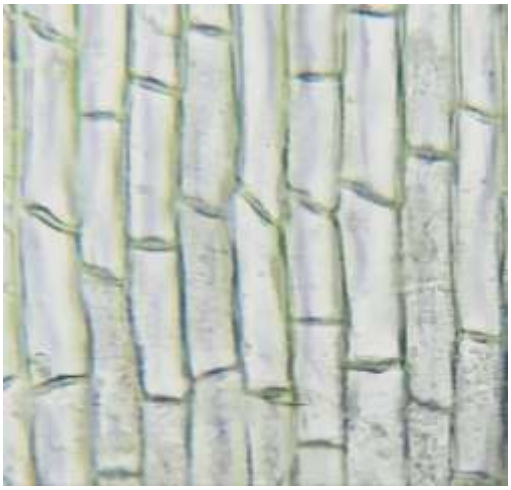
Lower surface of lamina (x400)



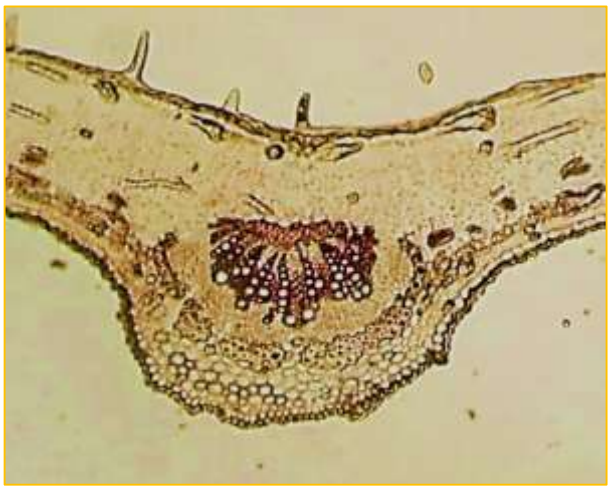
T.S of Lamina (x100)

Close up view of vascular bundle (x400)

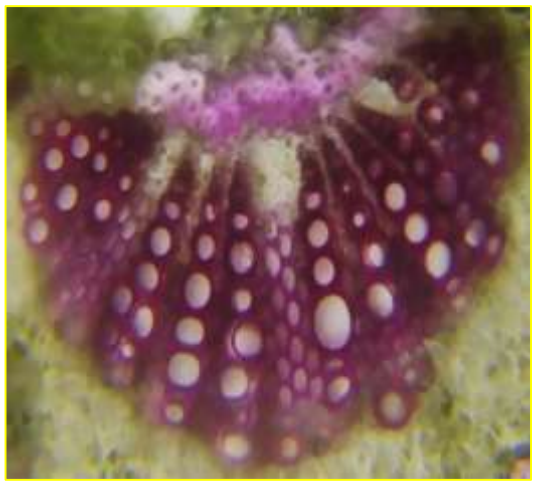
**Figure 2** Microscopical characters of lamina of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm.



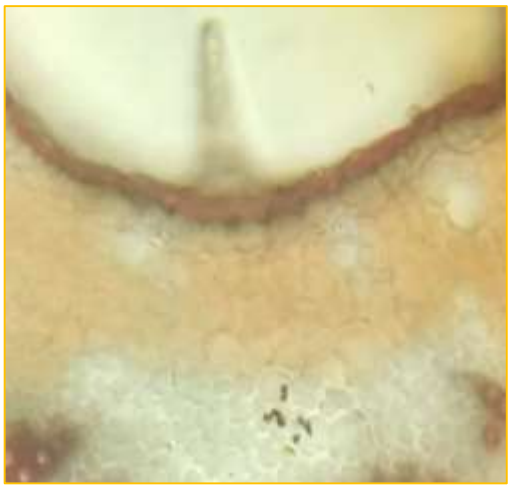
L.S of madrib (x400)



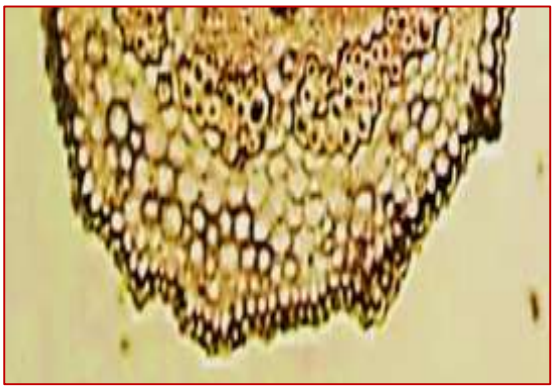
T.S of madrib (x400)



Close up view of vascular bundles (x400)

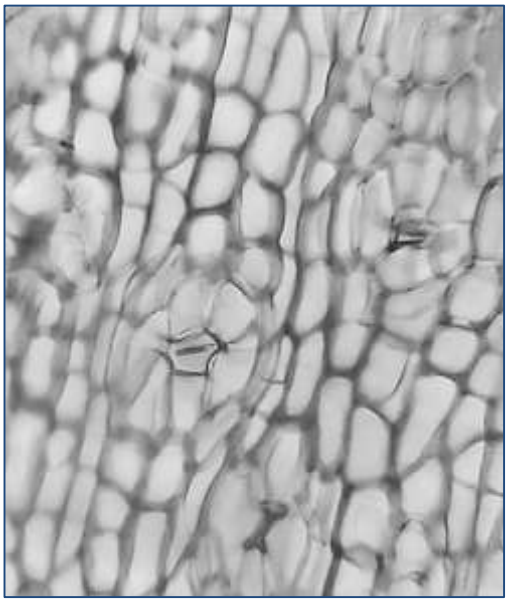


T.S of upper surface of midrib (x400)

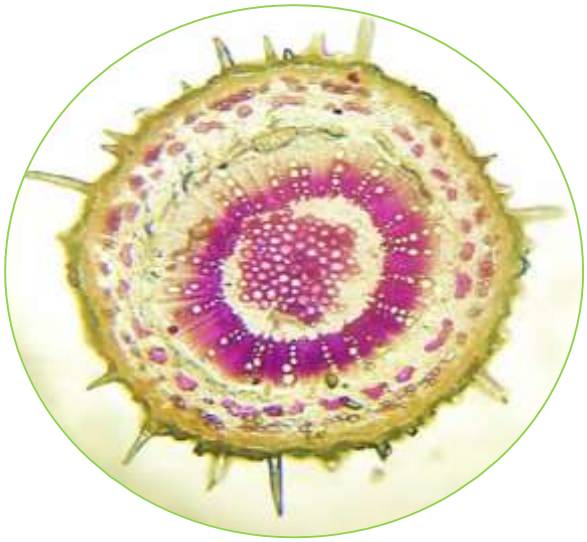


Transverse section of lower surfaces of midrib (x400)

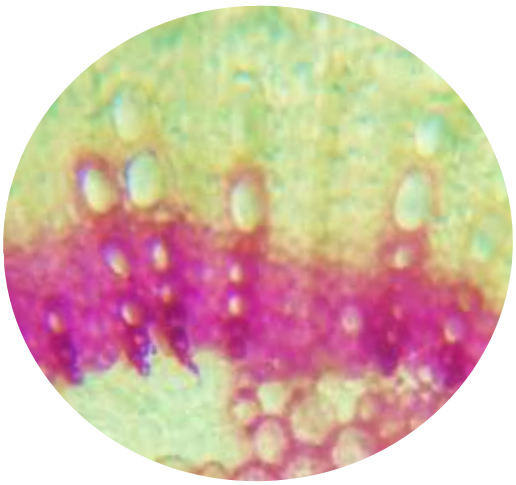
**Figure 3** Microscopical characters of midrib of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm



Surface view of petiole (x400)



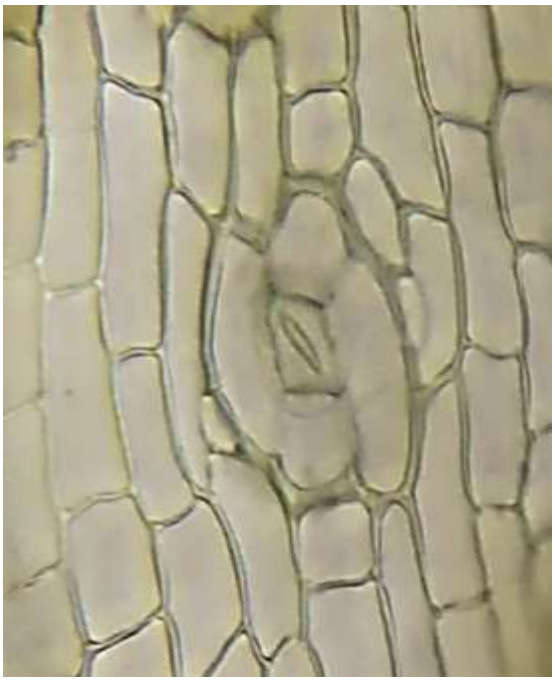
T.S of petiole (x100)



Close up view of vascular bundles (x400)

Trichome (x400)

**Figure 4** Microscopical characters of petiole of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K.Hoffm



Surface view of stem (x400)

T.S of stem (x100)

Close up view of vascular bundle (x400)

**Figure** 5 Microscopical characters of stem of *Hypselandra variabilis* Pax & K. Hoffm.

Surface view of gall

T.S of gall

**Figure 6** Microscopical characters of gall of *Hypselandra variabilis* Pax & K. Hoffm.

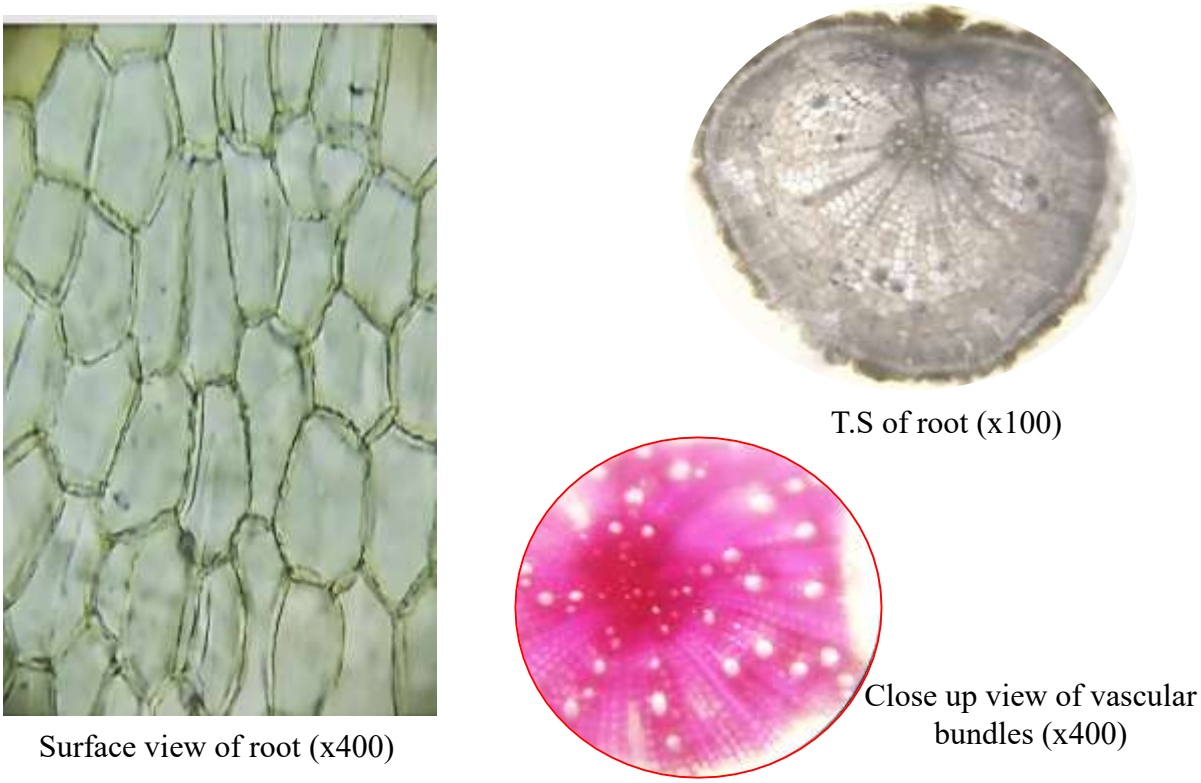



**Figure 7** Microscopical characters of root of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm.

## Discussion and Conclusion

*Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm. is a perennial, xerophytic plant that belongs to the family Capparaceae. In the present investigation, the morphological and histological characters of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm. were performed. Metcalfe & Chalk (1950) have reported that Capparaceae is mainly tropical family consists of herbs, shrubs and small trees, while a few genera are included in Cadaba, Capparis and other genera. Morphological studies were in agreement with the statements of Dassanayake (1996) and Kurz. (1877). This plant was tree; the stem color was found as grayish brown to dark brown; branches bear numerous galls, flowers bisexual, actinomorphic; sepals 3-4, united at the base into a funnel; petals none; stamens 6 to numerous; gynophore elongated; parietal placentae. These features were in agreement with Metcalfe and Chalk, 1950 and Trease and Evans, 2002.

In histological study, the anomocytic types of stomata were found only on lower surface of the leaves but on upper surfaces were not found. Two layers of palisade parenchymatous cells were found under the upper epidermis of leaves, and three to six layers of spongy parenchymatous cells above the lower epidermis. Variously sclerenchymatous cells are frequently present in the mesophyll. Sclerenchymatous cells are sometimes extending between the epidermal cells and thus coming into contact with the leaf surface. Midribs were found in an arc with the convex surface towards the lower side. These histological characters agreed with the statements of Metcalfe and Chalk, 1950.

Adamson (1935) stated that successive cambia have been reported in *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm. by Hansen (1977). But, Metcalfe & Chalk (1950) have reported that some species of *Hypselandra* do not have successive cambia. Pandey and Chadha (1998) stated that anomocytic type also called irregular-celled type where subsidiary cells

are indistinguishable from other epidermal cells. Such cases are found in members of Capparaceae. The diagnostic characters of powdered leaves, stems and roots of this plant were also found the presence of the fragments of tracheids, vessels and fibres.

In this research *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm. was chosen because it has high medicinal value. San and Han (1998) stated that its leaves and roots are used to treat aching, sedema, cold extremities and also used as stomachic, expectorant and counter irritant. Its galls are used to relieve eye sored. Local people believed that taking its buds and flowers once a year can keep the good health throughout the lifespan in Mzanmar (Ashin-nargathein, 1978). It is concluded that the histological characters and the diagnostic characters of *Hypselandra variabilis* (Collett & Hemsl.) Pax & K. Hoffm. have not been conducted by other scientists in Myanmar before. These characters presented in this research could be used as standardization in traditional medicine.

## Acknowledgements

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