

Study of Elemental Analysis on Curcuma Comosa Roxb.

THAN THAN YEE¹, AYE AYE MYINT², KYI WAR YI LWIN³

¹ Lecturer, Dr., Department of Botany, Kyaukse University

² Associate Professor, Dr., Department of Physics, Kyaukse University

³ Assistant Lecturer, Daw, Department of Botany, Pakokku University

Abstract- *Curcuma comosaRoxb. Belongs to the family Zingiberaceae. Curcuma comosaRoxb is known as the nannwinkhar or sannwinkhar in Myanmar Curcuma comosaRoxb. Were collected from Put Thaing Village, KyaukseTownship, Mandalay Region. Morphological, histological and elemental analysis of Curcuma comosaRoxb. Were carried out, to get their correct identification. In morphological study, this plants was perennial rhizomatous herbs. Leaves were simple and alternate. The aerial pseudo-stem formed by leaf-sheaths. Inflorescences was tubular spike, axillary, with 1-2 flowers. In histological studies, stomata are present on both surfaces but numerous on lower surface than on the upper surface, tetracytic types. The vascular bundles of midrib and petiole are arranged in a crescent shape, collateral type. The vascular bundles of stem are arranged in a ring shape. From EDXRF data, potassium, phosphorus, calcium and sulfur were major constituents in this plant.*

Indexed Terms- *Curcuma comosaRoxb., morphological, histological, surface, elemental analysis*

I. INTRODUCTION

Zingiberaceae family is the largest family of the order Zingiberales. It is widely distributed throughout the tropics particularly in Southeast Asia. In Southeast Asian region, several species of Zingiberaceae are used as spices, traditional medicines, flavoring agents and as the source of certain dyes (Tewtrakul et al. 2007).

Curcuma comosa, a rhizomatous herb belonging to the Zingiberaceae, has been used as a natural food additive, cosmetic and folk medicine in Thailand. According to the similar morphology of Curcuma

species, makes it difficult for species identification (Theanphong et al. 2016).

Curcuma is one of the well-known genera of the family Zingiberaceae. The genus consists of about 110 species widely distributed in tropical Asia and the Asia-Pacific region. The greatest diversity occurs in India, Myanmar and Thailand and the distribution extend to Korea, China, Australia and the South Pacific. Several Curcuma plant have long been known their uses as food, spices and medicinal plants. It is native to much of Asia, including Thailand, Indonesia, and Malaysia (Ravindran et al. 2007).

Curcuma comosaRoxb. (Nanwin-ga) grows widely on Myanmar and Thailand. In Myanmar traditional medicine, this plant is known to be useful in the treatment of diabetes mellitus, hypertension, fever and stress. It also contains in some Myanmar traditional medicine formulations for hypertension and diabetes mellitus (KhinKhinLwin et al. 2008).

Curcuma comosaRoxb. is a perennial herb belonging to the Zingiberaceae family. The rhizome has been traditionally used for the treatment of postpartum uterine bleeding and inflammation in Thailand. Curcuma comosa has pharmacological effects such as estrogenic, choloretic, and hypolipidemic activities. Indigenous medicinal plants play significant role in the economy of a country. Medicinal plants contain both organic and inorganic constituents and many medicinal plants are found to be rich in one or more individual elements, thereby providing a possible link to the medicinal value of the medicines. Minor elements play a vital role in the synthesis of bioactive chemical constituents in medicinal plants and are therefore responsible for both their medicinal and toxic properties (Winuthayanon et al. 2009).

Plants in the Zingiberaceae are widely distributed in Southeast Asia, especially in Thailand. There are some two-hundred species of this ginger family which fifty-eight species have been recorded as medicinal plants. These plants widely used as a food, flavoring, coloring, spice agent and traditional herbs. Several reports have been published on the biological properties of small organic molecules from these plants, such as antioxidant, antimicrobial, anti-inflammatory and anti-tumor activities (Boonmee et al. 2011).

Curcuma comosa Roxb. (Zingiberaceae) is a well-known medicinal plant in Thailand. Rhizome of this plant has been traditionally used for the treatment of various abnormal symptoms of uterus, female postpartum uterine inflammation, uterine pain, amenorrhea, peri-menopausal bleeding and lower abdominal pain in male as well as for the stomachic and choleric effects. Medicinal indications of *Curcuma comosa* Roxb. may be associated with its estrogenic like effects reported by many studies (Lupreechaset et al. 2016).

The aim of this research is to study the medicinal value of plant drugs. The objectives are to investigate the plant constituents and their action. The objective of this research was to study the effect of altitude and different shading conditions on the vegetative growth of *Curcuma comosa* Roxb. to determine the best cultivation practice of this plants.

II. MATERIALS AND METHODS

A. Collection, Identification and Preparation of *Curcuma comosa* Roxb

The specimens of *Curcuma comosa* Roxb were collected from Put Thaing Villag., Sintgaing Township, Kyaukse District, Mandalay Region. The collected plants were taxonomically identified with the help of references literature such as Hooker 1885 and Dassanayake 1987. The fresh specimens were pressed, dried and preserved for morphological studies.

B. Histological studies of *Curcuma comosa* Roxb

The fresh specimens were examined by preparing free hand sections and studied under microscope. The histological characters of fresh specimens of leaves

and stems were prepared by the literature of Metcalfe and Chalk 1957, Esau 1965. The following reagents were used to examine the sections and powdered samples.

- Chloral hydrate solution for clearing agents.
- Phloroglucinol and hydrochloric acid for testing lignin.
- Concentrated sulfuric acid for testing calcium oxalate crystals.
- Iodine solution for testing starch.

C. Elemental analysis of *Curcuma comosa* Roxb

The elements that contain in the fruits of two cultivars of *Curcuma comosa* Roxb were analyzed by using Energy Dispersive X-Ray Fluorescent (EDXRF) method at Department of Physics, Mandalay University.

III. RESULTS

a. Morphological Studies of *Curcuma comosa* Roxb

Scientific name - *Curcuma comosa* Roxb.
 Myanmar name - Nannwinkhar,
 Sannwinkhar
 Family - Zingiberaceae
 Flowering period - October to December

Perennial rhizomatous herbs, 0.6-0.8 m high, rhizomes fleshy, cylindrical branched, smell and taste, pale yellow or orange within: the aerial leafy, 20-35 leaved. Leaves simple, alternate and distichous, tuft basal: petiolate, ligulate distinct, 17.5 cm long pale green, ligules very short: leaf blades lanceolate, 11.8–17.5 cm long and 6.0–10.0 cm wide; entire along the margin acuminate at the apex, green glabrous on both surfaces. Inflorescence terminal on the leafy shoot or on the lateral shoot, cylindric spikes, 14.0-16.0 cm long, appearing with the leaves and the central to the tuft of leaves pedunculate, bracteates 4.5-6.5 cm long, pale green, glabrous; bracts ovate to broadly ovate, unequal in shape and size 2.5-3.0 cm long and 2.0-3.0 cm wide, connate to each other about half of their length and forming pouches, the free ends spreading each bract subtending a short Cincinnati, with 2 to 3 flowers, white and pale green, glabrous persistent. Flowers bracteates, pedicellate, bisexual, zygomorphic, pale yellow, 1.5-1.8 cm in diameter in this research;

pedicels about 3.0 cm long. Calyx short, tubular campanulate, 3-dentate, 1.5-2.0 cm long and 4.0-5.0 cm wide, unilaterally split, soft and membranous, white, glabrous. Corolla tube narrowly funnel shaped, with 3 segments, pale yellow, pubescent at the throat, segment ovate to ovate oblong, white to pale yellow, membranous, unequal, glabrous. Fertile stamen short; filament short; anther ditheous, oblong, pale yellow, basifixed, spur present, labellum ovate or orbicular with a thickened, emarginated central portion and thinner lateral lobes, 3.0-4.0 cm long and 1.5-2.5 cm wide, yellow, glabrous. Ovary oblonged, greenish yellow, pubescent, trilocular, style filiform, 4.0-5.0 cm long, white, glabrous; stigma obscurely 2 lobed, white. Seed aborted.

Specimen examined : Kyaukse
Township, Mandalay Region, PutThaing Village

b. Histological studies of *Curcuma comosa* Roxb

1) Lamina

In surface view of lamina, the upper epidermal cells and lower epidermal cells are covered with thin cuticle. The upper epidermal cells are parenchymatous, thin-walled, and polygonal in shape, 28-44 μm long and 22-36 μm wide. The lower epidermal cells are parenchymatous, thin-walled, straight, and polygonal in shape, 30-60 μm long and 26-42 μm wide. Tetracytic type of stomata are present on both surfaces, numerous on lower surface than on the upper surface. The guard cells are reniform in shape.

In transverse section of lamina, mesophyll cells are differentiated into palisade parenchyma and spongy parenchyma. Palisade parenchyma consists of a single layer, oval shaped, thin walled, the cells 20-30 μm long and 18-26 μm wide. Spongy parenchyma consist three to five layers, irregular in shape, the cells 27-35 μm long and 20-32 μm wide. It contains calcium oxalate crystals.

Vascular bundles are embedded in the mesophyll cells, bundles collateral type. Xylem composed of spirally thickened vessel, tracheid, and xylem fiber and xylem parenchyma cells. Phloem consists of sieve-tube, companion cell, and phloem fiber and phloem parenchyma cell.

2) Midrib

In surface view of midrib, the epidermal cells are thin walled, parenchymatous, polygonal in shaped, the cells 32-50 μm long and 30-46 μm wide. Tetracytic type of stomata are present. It contains unicellular hair and calcium oxalate crystals.

In transverse section of midrib, epidermis is a single layer, the cells barrel in shape. Cortex consists of collenchyma and parenchyma. Collenchyma are two to three layers, the cells oval or rounded in shape, 24-36 μm long and 12-30 μm wide. Parenchyma are four to five layers, the cells oval or rounded in shape, 48-66 μm long and 30-40 μm wide.

Vascular bundles are arranged in a crescent shape, collateral type. Phloem are four to five layers, the cells 12-18 μm in vertical diameter and 18-26 μm in horizontal diameter, consists of sieve tube, companion cells, phloem fiber, phloem parenchyma. Xylem are arranged in radial row of three to four layers, it consists of vessels, tracheids, xylem fiber, and xylem parenchyma.

3) Petiole

In surface view of petiole, the epidermal cells are thin walled, parenchymatous, polygonal in shape, the cells 30-42 μm long and 28-34 μm wide cuticle. Stomata are present. It contains unicellular hair and calcium oxalate crystals.

In transverse section of petiole, epidermis is a single layer, the cells barrel in shape. Cortex consists of collenchyma and parenchyma. Collenchyma are two to three layers, the cells oval or rounded in shape, 20-32 μm long, 18-34 μm wide. Parenchyma are three to four layers, the cells oval or rounded in shape, 40-60 μm long, 30-44 μm wide. It contains calcium oxalate crystals.

Vascular bundles are arranged in a crescent shape, collateral type. Phloem are four to five layers, the cells 12-18 μm in vertical diameter and 16-24 μm in horizontal diameter, consists of sieve tube, companion cell, phloem fiber and phloem parenchyma. Xylem are arranged in radial rows of

three to four layers, the cells 16-28 μm in vertical diameter and 18-30 μm in horizontal diameter. It contains of vessels, tracheids, and xylemfiber and xylem parenchyma.

4) Stem

In surface view of stem, the epidermal cells are thin walled, parenchymatous, rectangular to polygonal in shaped, the cells 37-48 μm long and 35-46 μm wide with cuticle. Tetracytic type of stomata are present. It contains unicellular hair and calcium oxalate crystals.

In transverse section of stem, epidermis is a single layer, the cells barrel in shape. Cortex consists of collenchyma and parenchyma. Collenchyma are two to three layers, the cells 26-40 μm long, and 20-36 μm wide. Parenchyma are five to six layers, the cells oval or rounded in shape, 35-55 μm long, 32-40 μm wide. It contains few starch grains.

Vascular bundles are arranged in a crescent shape, collateral type. Phloem are three to four layers, the cells 10-16 μm in vertical diameter and 14-22 μm in horizontal diameter, consists of sieve tube, companion cell, phloem fiber and phloem parenchyma. Xylem are two to three layers. It consists of vessels, tracheids, xylemfiber and xylem parenchyma.

5) Rhizome

In transverse section of rhizome, epidermis is a single layer, the cells barrel in shape. Cortex consists of collenchyma and parenchyma. Collenchyma are three to four layers, the cells 30-45 μm long, and 25-35 μm wide. Parenchyma are four to five layers, the cells oval or rounded in shape, 60-82 μm long, 34-46 μm wide. It contains chloroplast and few starch grains.

Vascular bundles are arranged in a quadrangular in shape, collateral type. Phloem are three to six layers, the cells 7-13 μm in vertical diameter and 10-20 μm in horizontal diameter, consists of sieve tube, companion cell, phloem fiber and phloem parenchyma. Xylem are arranged in radial rows of two to three layers. It consists of vessels, tracheids, xylemfiber and xylem parenchyma.

IV. ELEMENTAL ANALYSIS OF ENERGY DISPERSIVE X-RAYS FLUORESCENCE OF CURCUMA COMOSA

a) Roxb

The element that contain the rhizome of Curcuma comosaRoxb. Wereanalyzed by using the Energy Dispersive X-rays Fluorescent (EDXRF) method at Department of Physics, Monywa University. Among the elements having atomic number 13 to 92, it was found that there are 9 elements including macro elements and micro elements samples. The elements having high to low concentration were present in Table 1-3.

Table 1. The elements present in the rhizome of Curcuma comosaRoxb.

No.	Elements	Concentration (%)
1	Potassium (K)	1.193
2	Silicon (Si)	0.250
3	Phosphorus (P)	0.239
4	Sulfur (S)	0.163
5	Calcium (Ca)	0.123
6	Iron (Fe)	0.011
7	Manganese (Mn)	0.004
8	Copper (Cu)	0.002
9	Zinc (Zn)	0.001
10	C,H	98.015

Table 2. The macroelements present in the rhizome of Curcuma comosaRoxb.

No.	Macroelement	Concentration (%)
1	Potassium (K)	1.193
2	Phosphorus (P)	0.239
3	Calcium (Ca)	0.163
4	Sulfur (S)	0.123

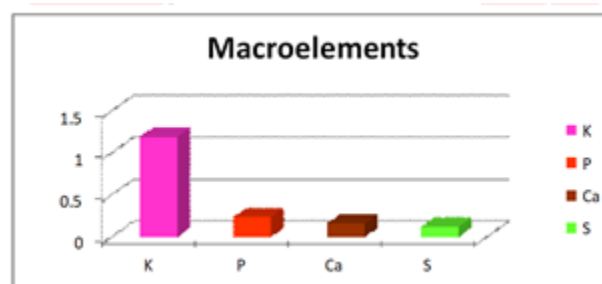


Figure 1. The macroelements present in the rhizome of *Curcuma comosa* Roxb.

Table 3. The microelements present in the rhizome of *Curcuma comosa* Roxb.

No.	Microelement	Concentration (%)
1	Silicon (Si)	0.250
2	Iron (Fe)	0.011
3	Manganese (Mn)	0.004
4	Copper (Cu)	0.002
5	Zinc (Zn)	0.001

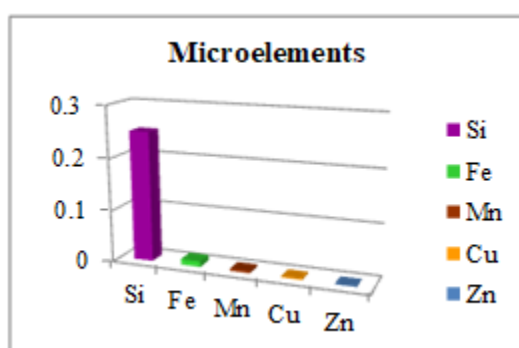


Figure 2. The microelements present in the rhizome of *Curcuma comosa* Roxb



Figure 3. Morphological Studies of *Curcuma comosa* Roxb. A. Habit, B. Rhizome

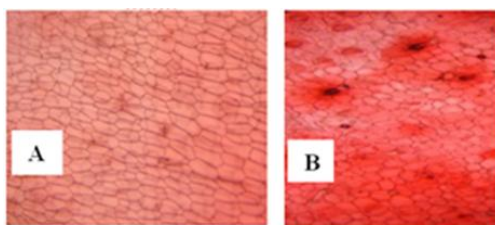


Figure 4. Histological studies of Lamina and powder
A. Upper surface of lamina, B. Lower surface of lamina

b) Transverse section of lamina

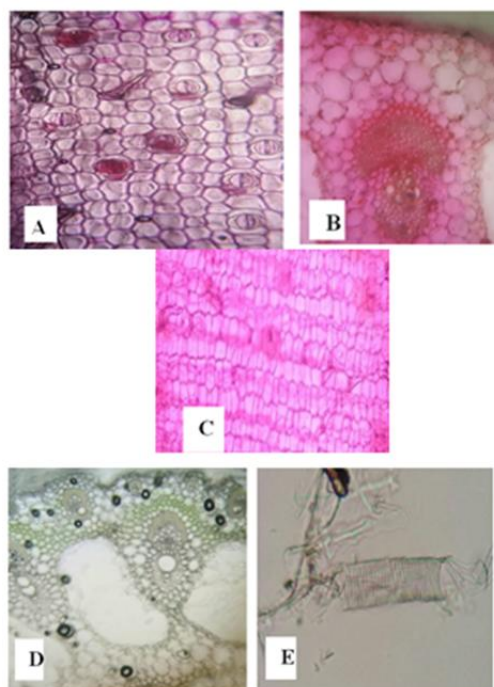


Figure 5. Histological studies of midrib and petiole powder, A. Surface view of midrib, B. Transverse section of midrib, C. Surface view of petiole, D. Transverse section of petiole, E. Vessel

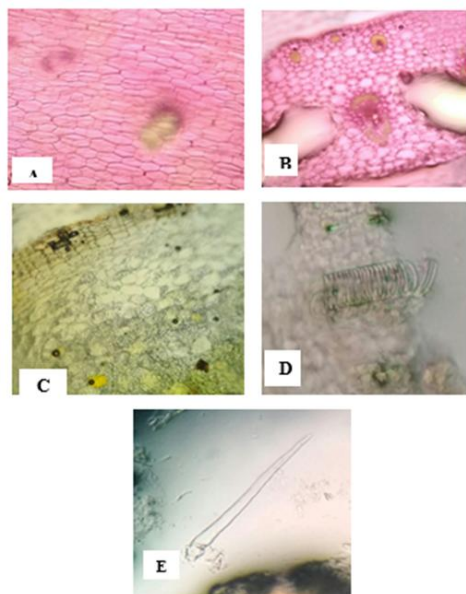


Figure 6. Histological studies of stem and rhizome powder, A. Surface view of stem, B. Transverse section of stem, C. Transverse section of rhizome, D. Vessel, E. Trichome

V. DISCUSSION AND CONCLUSION

Curcuma comosa Roxb. are widely cultivated throughout the tropical region of Myanmar. It is one of the species in Zingiberaceae family. In the present work, the morphological and histological characters of *Curcuma comosa* Roxb. were presented.

In morphological studies, *Curcuma comosa* Roxb. was perennial rhizomatous herbs. The stems are aerial pseudo-stem formed by leaf-sheaths. The leaves are alternate, simple, leaf blade, elliptic, acute at apex, green glabrous on both surfaces. These characters are similar to those given by Lawrence 1965.

For *Curcuma comosa* Roxb. Inflorescences are tubular spike axillary. Flowers are white, center purple, bisexual, zygomorphic. Ovary is inferior, pubescent, trilocular, axile placentation. Style is filiform white. These characters are similar to those given by Dassanayake 1987.

In the histological studies, *Curcuma comosa* Roxb. the leaves are dorsiventrally, tetracytic type of stomata are present on both surfaces of the lamina but usually more numerous on the lower surface than on

the upper surface. The epidermal cells are parenchymatous, anticlinal thin walled, straight, polygonal in shape. These characters are agreed with those given by Metcalfe and Chalk 1957.

In the midrib, *Curcuma comosa* Roxb. the epidermal cells are thin walled, parenchymatous, polygonal in shaped. Cortex consists of collenchyma and parenchyma. The vascular bundles are arranged in a crescent shaped, collateral type. It contains unicellular hair and calcium oxalate crystals. These characters are agreed with those given by Esau 1965.

In the petiole, *Curcuma comosa* Roxb, the epidermal cells are thin walled, parenchymatous, polygonal in shaped. Cortex consists of collenchyma and parenchyma. The vascular bundles are arranged in a crescent shaped, collateral type. These characters are agreed with those given by Metcalfe and Chalk 1975.

In the stem, *Curcuma comosa* Roxb, the epidermal cells are thin walled, parenchymatous, compactly arranged, polygonal in shaped. Cortex consists of collenchyma and parenchyma. The vascular bundles are arranged in a crescent shaped, collateral type. These characters are similar to those given by Esau 1965.

From EDXRF data, K, Si, P, S, Ca, Fe, Mn, Cu, Zn and C, H, O are present in *Curcuma comosa* Roxb. Silicon, iron, manganese, copper and zinc are present in microelements and phosphorus, potassium, calcium and sulfur of macroelements present in *Curcuma comosa* Roxb.

In Myanmar, a large number of medicinal plants are found as natural resources. Local people are identifying plants based mostly on morphological characters, but they cannot be able to identify the dry parts of the medicinal plants.

In this research work, the morphological and histological characters of *Curcuma comosa* Roxb. were examined clearly a systematically and agree with those of references.

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