



Title	Anatomical study on <i>Tridax procumbens</i> L. from Tribe Heliantheae
Author	Dr. Ngu Wah Win
Issue Date	

## Anatomical study on *Tridax procumbens* L. From Tribe Heliantheae

**Dr Ngu Wah Win**

### **Abstract**

In this research, the species of *Tridax procumbens* L. of Tribe Heliantheae belonging to family Asteraceae was studied. This species was growing wild in the Campus of University of Mandalay. Morphological and anatomical structures of leaves, stems and roots were studied, identified, photomicrographed and described. In this study the plant is hirsute perennial herb. Leaves are simple and the flowers solitary head. The study species of stomata are anomocytic type, and non-glandular multiseriate trichomes. Vascular bundles are round or oval in shape and are bicollateral type.

### **Introduction**

The family Asteraceae also called the Compositae has been considered to be a unified evolutionary by all botanists. This family is one of the largest of the eudicots with over 23,000 species and at least 1535 genera. Members of the family Asteraceae can be found everywhere all over the world. They are most common in the northern temperate zone but can also be found in mountain forest in tropic. These plants have evolved many adaptation to withstand harsh environment as well as more moderate climates.

Many plants in the family Asteraceae are economically important as weed, ornamentals, medicinal and green vegetables are poisonous plants. Commercially the flowers of this family are very famous of their colorful florets. A wide range of horticultural species are grown in home garden or national garden plots.

In pharmacognosy the Asteraceae is the largest family of flowering plants and contains about 900 genera and 13,000 species. This family is divided into the two subfamilies: (I) Tubuliflorae with 32 genera and (II) Liguliflorae with 6 genera (Trease and Evan 1978).

---

Lecturer, Department of Botany, University of Mandalay

The Asteraceae consist of 1528 genera and 22,750 species. The Asteraceae has recently been classified into at least ten subfamilies and members of the family have a world wide distribution (Simpson 2006).

The Asteraceae consists of about 1000 genera and about 8000 species. Moreover, this family was subdivided into 11 tribes - Vernoniaceae, Eupatoriaceae, Asteroideae, Inuloideae, Helianthoideae, Anthemideae, Senecioideae, Calendulaceae, Cynaroideae, Mutisiaceae, Cichoriaceae and it was also organized with subtribes in each tribe (Hooker 1881).

The Asteraceae was composed of about 13 tribes with more than 1100 genera and 20000 species (Cronquist 1981).

In best-known family of flowering plants, the Asteraceae may be organized into 3 subfamilies: (1) the Brandesiodieae with a single tribe, (2) the Cichorioideae with 6 tribes, and (3) the Asteroideae with 7 tribes. The tribe of Brandesiodieae is Brandesieae. The tribes of Cichorioideae are Mutisieae, Cardueae, Lactuceae, Vernoniaceae, Liabeae and Arctotideae. The tribes of Asteroideae are Inuleae, Canenduleae, Astereae, Anthemideae, Senecineae, Heliantheae and Eupatoriaceae. And then the tribe Heliantheae includes 18 subtribes, 300 genera and 3,330 species (Heywood *et al.*1978).

In the Flora of British India tribe Heliantheae included 7 subtribes, 19 genera and 25 species (Hooker 1881).

The Asteraceae feature extensively in gardens distributed throughout the world as ornamental. A wide range of horticultural species is grown both under grass, or as herbaceous garden plants throughout the world. About half the species of Asteraceae are native to the Old World and half to the New World. The tribe Heliantheae is pre dominantly New World (Heywood *et al.*1978).

*Tridax procumbens* L. grows abundantly in grass field and throughout every area. It is very common grassy waste lands and along road-side, bearing cream-coloured flower-head on long stalks during the dry season. *Tridax procumbens* L. is native of central America, now widespread throughout tropical and subtropical regions of the world (Grierson 1980.)

*Tridax procumbens* L. distributed throughout tropical America and India (Hooker 1881). This species is native of Central America and India. One species of *Tridax* are found in Myanmar (Kress *et al.* 2003).

The Asteraceae family is the largest of vascular plants. So many researchers emphasize this family from various points of view.

In taxonomical point of view, Naw Wah Wah Paw (1972) had studied in tribe Heliantheae with 27 species and 20 genera and Khin Ohn Myint (1976) had stated the Asteraceae family with 18 genera and 28 species.

Kyu Kyu Sein (1991) had reported Asteraceae family with 13 genera and 18 species and Aye Aye Than (1991) had described 22 genera and 37 species of Asteraceae family from Mount Popa. Tin Tin Nyunt (1992) had studied 40 species belong to 17 genera and Kress *et al.* (2003) had reported 309 species belonging to 128 genera of Asteraceae. Hundley and Chit Ko Ko (1987) stated that 256 species belonging to 98 genera of Asteraceae has been found in Myanmar.

In taxonomic study, Htay Htay Win (2008) had reported 57 genera and 116 species of Asteraceae family with several tribes from Mandalay District and then Yin Yin Toe (2009) had stated 153 species belong to 66 genera of family Asteraceae from Goktwin area of Northern Shan State, Myanmar.

But anatomical structures of this family are scanty in study. In the present study, Asteraceae family concerned with tribe Heliantheae are studied by anatomical structures of leaves, stems and roots.

The main objective of this present study is to understand the anatomical characters of the studied species, to record the different morphological and anatomical characters of studied species, to compare the anatomical characters among the members of tribe Heliantheae, and to get anatomical information that can fulfil the need of systematic studies on tribe Heliantheae.

### **Materials and Methods**

The species of *Tridax procumbens* L. was collected from University of Mandalay region. Field notes were made of precise location and of habitat type. They were recorded and photographed in the field trip. After the collection, the vegetative and floral parts of fresh specimens were studied, measured and identified by using literature ( Hooker 1881; Heywood 1978; Grierson 1980; Cronquist 1981) based on the earlier record in Department of Botany, University of Mandalay. Some of collected specimens were dried and pressed to make herbarium sheet.

The collected specimens were preserved in 50% solution of ethyl alcohol for further morphological and anatomical study.

For anatomical studies, the fresh and preserved specimens were examined by preparing free-hand section. These plant parts were cut by using a new razor blade to obtain thin sections (about 0.5 – 1 mm in thickness) for microscopic study. These plant sections were cleared in chloral hydrate solution on a glass slide and stained with saffranin solution and temporarily mounted in dilute glycerin solution.

Maceration of leaves, stems and roots were made by boiling the materials in equal volume of 50% acetic acid and 50% hydrogen peroxide according to the method of Jaffery (1917).

The plant section and macerated components of plant parts were fixed in standard F.A.A solution (90ml of 50% or 70% of ethyl alcohol, 5ml of glacial acetic acid and 5ml of formalin employed by Johnson (1940).

The plant section and macerated components of plant parts were measured by the microscope with an ocular micrometer which was then calibrated against at a stage micrometer. After calibrating, an ocular micrometer was used to determine the size of a cell in terms of length, breadth and diameter by the formula.

Photomicrographic plates of the free-hand sections were also prepared by the use of a microscope with digital camera and presented in this research.

## Results

### Morphological studies

#### *Tridax procumbens* L., Sp. Pl. 900. 1753.

Myanmar name : Nay kya gale; Tapin shwe hti; Hnwezok ne gya

English name : Unknown

Flowering period : Nearly throughout the year

Hirsute perennial herb with spreading basal portion, 20-45 cm tall. Stems pilose or glandular, terete, sometimes reddish. Leaves simple, opposite and decussate, exstipulate; blade ovate or lanceolate, 2.0-4.0 cm by 1.5-2.5 cm, cuneate at the base, serrate to coarsely dentate or trilobed along the margin, acute at the apex, scabrid hairs on both surfaces, petiolate, petioles 0.7-2 cm

long. Inflorescences axillary or terminal, solitary head on elongate peduncle, pedunculate; peduncles slender, 8.0-15.0 cm long, hirsute and sparsely glandular. Head heterogamous, radiate, 1.0-2.0 cm in diameter; involucre campanulate, 2-seriate, 6.0-8.0 mm in diameter, the outer phyllaries foliaceous, ovate lanceolate, 5.0-7.0 mm by 2.0-4.0 mm, shortly acuminate, herbaceous, densely hairy; the inner phyllaries oval, membranous, 6.0-7.0 mm long; 1.5-3.0 mm wide, thinly hairy; receptacle convex, paleaceous, the paleae lanceolate, 6.0-7.0 mm long, 1.5-2.0 mm wide, persistent. Ray floret 6 to 7 per head, ligulate, zygomorphic; the ligules oval, 3.5-5.0 mm by 3.0-4.0 mm, 2-3 lobed at the apex, pale yellow, the basal tube 3.0-4.0 mm long; style exerted, stylar arms wide diverged; carple one; ovary 1.5 mm long, obovate, sericeous. Disc floret numerous per head, tubular-campanulate, yellow, bisexual, actinomorphic, pentamerous, epigymous; the tube 5-lobed at the apex, 5.5-6.5 mm long; stamen 5 exerted; anther base sagittate and apical appendage acute; style exerted, the stylar arms with subulate appendage; carple one; ovary inferior, 2.0-3.0 mm long, obovate, sericeous. Achenes obovate, angular, hairy, 5.5-6.5 mm long, blackish. The pappus bristles 18 to 20, radiating unequal in length, 5.0-7.0 mm long.



Fig. 1 Morphological characters of *Tridax procumbens* L.

A. Habit

B. Inflorescence

## Anatomical Studies

### Internal Structure of the Leaf of *Tridax procumbens* L.

#### Lamina

In transverse section, the lamina of *T. procumbens* L. studied is 375.0-625.0  $\mu\text{m}$  in thickness. Typically dorsiventral, venation reticulate. Distinguishable into dermal, ground and vascular tissue systems.

**Dermal Tissue System:** Composed epidermal cells, guard cells of the stomata and trichomes.

In surface view, epidermal cells parenchymatous, compactly arranged anticlinal wall of upper epidermal cells thin and wavy; lower epidermal cells thin and more wavier; cuticle thin and smooth on both surface; stomata anomocytic type, more abundant on abaxial surface, 12.5-43.7  $\mu\text{m}$  in length, 2.5-10.0  $\mu\text{m}$  in breadth; trichomes present on both surface, multiseriate, 187.5-525.0  $\mu\text{m}$  in length, 18.7-43.7  $\mu\text{m}$  breadth.

In transverse section, both upper and lower epidermis one-layered, the cells 21.2-100.0  $\mu\text{m}$  in length, 18.75-43.75  $\mu\text{m}$  in breadth, compact, rectangular on barrel-shaped, the anticlinal wall straight, the outer horizontal walls slightly convex, the inner horizontal walls straight; cuticle smooth and thin on both surface, 1.8-2.5  $\mu\text{m}$  thick.

**Ground Tissue System :** Mesophyll differentiated into palisade parenchyma at the upper side and spongy parenchyma at the lower side; palisade parenchyma cells one-layered, the cells elongated in shape, 87.5-150.0  $\mu\text{m}$  in length, 25.0-43.75  $\mu\text{m}$  in breadth; spongy parenchyma cells 4.5-layered, the layers 25.0-37.5  $\mu\text{m}$  in thick, the cells rounded to oval in shape, 18.75-41.25  $\mu\text{m}$  in diameter.

**Vascular Tissue System:** The vascular bundle embedded in ground tissue, oval in shape, 100.0-300.0  $\mu\text{m}$  in horizontal diameter, 125.0-275.0  $\mu\text{m}$  in vertical diameter; bundle sheath not distinct, bicollateral type; phloem on both side of xylem, 5-7 tiered; xylem in center, 2-6 cells; phloem composed of sieve tube, companion cells, phloem parenchyma and phloem fibers; xylem composed of vessels, tracheids, fibers and xylem parenchyma.

## Midrib

In transverse section, the midrib of *T. procumbens* L. studied is ovate shape, semicircular at the abaxial side and prominent ridges at the adaxial side, 625.0-1250.0  $\mu\text{m}$  in tangential diameter, 875.0-1125.0  $\mu\text{m}$  in radial diameter.

**Dermal Tissue System:** Composed of epidermal cells, guard cells of the stomata and trichomes.

In surface view, epidermal cells parenchymatous, irregularly rectangular in shape, the cell walls thin, the anticlinal walls straight, the cells 100.0-175.0  $\mu\text{m}$  in length, 25.0-37.5  $\mu\text{m}$  in breadth; non-glandular trichomes and stomata present.

In transverse section, both upper and lower epidermis one-layered, the cells oval or barrel in shape, 10.0-62.5  $\mu\text{m}$  in tangential diameter, 16.25-62.5  $\mu\text{m}$  in radial diameter, the outer and inner walls convex, the radial walls straight; cuticle thin, about 1.25-3.75  $\mu\text{m}$  in thick; non-glandular trichomes, 250.0-1562.5  $\mu\text{m}$  in length, 100.0-125.0  $\mu\text{m}$  breadth, elongated, multicellular.

**Ground Tissue System:** Differentiated into collenchymatous and parenchymatous tissues. Collenchymatous cells below the adaxial epidermis, 1-2-layered, the layers 18.75-45.0  $\mu\text{m}$  in thick; cells above the abaxial epidermis, 1-layered, the layers 18.75-31.25  $\mu\text{m}$  in thick; cells polygonal in shape, 18.75-45.0  $\mu\text{m}$  in length, 18.75-45.0  $\mu\text{m}$  in breadth. Parenchymatous cells between the adaxial epidermis and vascular strand 7.5-layered, the layers 25.0-56.25  $\mu\text{m}$  in thick; the cells between the abaxial epidermis and vascular strand 4-5-layered, the layers 37.5-75.0  $\mu\text{m}$  in thick; cells oval or rounded in shape, 25.0-93.75  $\mu\text{m}$  in diameter; intercellular space present.

**Vascular Tissue System :** Vascular bundle single, bicollateral type, crescent shape, 225.0-400.0  $\mu\text{m}$  in tangential diameter, 175.0-250.0  $\mu\text{m}$  in radial diameter; phloem present on both side of xylem, phloem 3-6-tiered, 10.0-18.75  $\mu\text{m}$  in thick; xylem arranged in radial row, 1-5-cells in each row, 6.25-25.0  $\mu\text{m}$  in thick; phloem composed of sieve tube elements, companion cells, phloem parenchyma and phloem fibers; xylem composed of vessel elements, tracheids, fibers and xylem parenchyma.

## Petiole

In transverse section, the petiole of *T. procumbens* L. studied is semicircular at the abaxial side and crescent-shaped at the adaxial side, 55.0-

900.0  $\mu\text{m}$  in tangential diameter, 350.0-425.0  $\mu\text{m}$  in radial diameter. Distinguishable into dermal, ground and vascular tissue systems.

**Dermal Tissue System:** Composed of epidermal cells, guard cells of the stomata and trichomes.

In surface view, epidermal cells parenchymatous, rectangular or polygonal, the cell walls thin, the anticlinal walls straight, the cells 35.0-100.0  $\mu\text{m}$  in tangential diameter, 18.75-37.5  $\mu\text{m}$  in radial diameter; non-glandular trichomes and stomata present.

In transverse section, epidermis one-layered on both surfaces, the cells barrel-shaped or oval-shaped, 12.5-40.0  $\mu\text{m}$  in tangential diameter, 12.5-31.25  $\mu\text{m}$  in radial diameter, the outer and inner walls convex, the radial walls straight; non-glandular trichomes 450.0-200.0  $\mu\text{m}$  in length, 50.0-100.0  $\mu\text{m}$  in breadth, elongated, multicellular.

**Ground Tissue System:** Differentiated into collenchymatous and parenchymatous tissues. Collenchymatous cells below the adaxial epidermis, 1-layered, the layers 12.5-25.0  $\mu\text{m}$  in thick; cells above the abaxial epidermis, 1-2-layered, the layers 18.75-37.5  $\mu\text{m}$  in thick; the cells oval or polygonal in shape, 12.5-37.5  $\mu\text{m}$  in tangential diameter, 8.75-27.5  $\mu\text{m}$  in radial diameter. Parenchymatous cells between the adaxial epidermis and vascular strand 3-5-layered, the layers 18.75-56.25  $\mu\text{m}$  in thick; cells between the abaxial epidermis and vascular strand 3-7-layered, the layers 31.25-75.0  $\mu\text{m}$  in thick; the cells polygonal in shape, 25.0-112.5  $\mu\text{m}$  in tangential diameter, 12.5-100.0  $\mu\text{m}$  radial diameter; intercellular space present.

**Vascular Tissue System:** Occurred in 3 groups of farcically arranged in crescent shape of bicollateral type, the middle bundle large, peripheral bundles small, the bundle 125.0-225.0  $\mu\text{m}$  in tangential diameter; phloem lying 165.0-225.0  $\mu\text{m}$  in radial diameter, on both side of xylem, phloem 4-6-tiered, 6.25-18.75  $\mu\text{m}$  in thick; xylem lying in center, arranged in vertical row, 2-5 cells in each row, 12.5-25.0  $\mu\text{m}$  in thick; phloem composed of sieve tube element, companion cells, phloem parenchyma and phloem fibers; xylem composed of vessel elements, tracheids, fibers and xylem parenchyma.

### **Internal structure of the Stem of *Tridax procumbens* L.**

In transverse section, the stem of *T.procumbens* L. studied is circular in outline, 1875-3750.0  $\mu\text{m}$  in diameter. Distinguishable into dermal, ground and vascular tissue systems.

**Dermal Tissue System:** Composed of epidermal cells, guard cells of the stomata and trichomes.

In surface view, epidermal cells 50.0-187.5  $\mu\text{m}$  in length, 31.25-37.5  $\mu\text{m}$  in breadth, irregularly rectangular in shape, the cell walls thin, the anticlinal walls straight; non-glandular trichomes and stomata present.

In transverse section, epidermis one-layered, parenchymatous, the cells rectangular or barrel in shape, 10.0-43.75  $\mu\text{m}$  in length, 8.75-31.25  $\mu\text{m}$  in breadth, both outer and inner walls convex, the lateral walls straight; non-glandular trichomes 250.0-1000.0  $\mu\text{m}$  in length, 25.0-75.0  $\mu\text{m}$  in breadth, elongated multicellular.

**Ground Tissue System:** Composed of cortex, endodermis, pericycle and pith. The cortex differential into outer collenchymatous tissue and inner parenchymatous tissue. Collenchymatous cells forming a continuous sheath, 1-2-layered, the layers 12.5-25.0  $\mu\text{m}$  in thick, the cells polygonal or oval in shape, 10.0-50.0  $\mu\text{m}$  in tangential diameter, 7.5-37.5  $\mu\text{m}$  in radial diameter, thickening angular. Parenchymatous cells occur in continuous cylinder, 4-7-layered, the layers 25.0-50.0  $\mu\text{m}$  in thick, the cells oval or radially elongated in shape; intercellular space large, 25.0-1125.0  $\mu\text{m}$  in tangential diameter, 18.75-68.75  $\mu\text{m}$  in radial diameter. Endodermis inconspicuous. Pericyclic sclerenchymatous forming discontinuous sheath, 1-5-layered, the layers 8.75-18.75  $\mu\text{m}$  thick, the cells irregularly polygonal in shape, 12.5-37.5  $\mu\text{m}$  in length, 6.25-25.0  $\mu\text{m}$  in breadth. Pith cellular, large, 1350.0-2000.0  $\mu\text{m}$  in diameter, the cells thin-walled, parenchymatous, oval or polygonal, 35.0-185.0  $\mu\text{m}$  in tangential diameter, 30.0-175.0  $\mu\text{m}$  in radial diameter; intercellular space present.

**Vascular Tissue System:** Vascular bundles arranged in a continuous circular ring, collateral type, about 12-16 bundles, the bundles 125.0-600.0  $\mu\text{m}$  in tangential diameter, 15.0-250.0  $\mu\text{m}$  in radial diameter; phloem outer and xylem inner, 3-5-layered, the layers 5.0-12.5  $\mu\text{m}$  in thick, the cells 3.75-37.5  $\mu\text{m}$  in length, 3.75-18.75  $\mu\text{m}$  in breadth; vascular cambium develop between the xylem and phloem, 1-3-layered, the layers 6.25-12.5  $\mu\text{m}$  in thick; xylem arranged in radial rows, 3-8 cells in each row, 15.0-43.75  $\mu\text{m}$  in thick, the cells

polygonal in shape, 12.5-62.5  $\mu\text{m}$  in length, 10.0-62.5  $\mu\text{m}$  in breadth; phloem composed of sieve tube elements, companion cells, phloem parenchyma and phloem fibers; xylem composed of vessel elements, tracheids, fibers and xylem parenchyma.

### **Internal Structure of the Root of *Tridax procumbens* L.**

In transverse section, the root of *T. procumbens* L. studied is circular in outline, 1125.0-2000.0  $\mu\text{m}$  in diameter. Distinguishable into dermal, ground and vascular tissue systems.

**Dermal Tissue System:** The root epiblima parenchymatous cell, one-layered, the cells 18.75-81.25  $\mu\text{m}$  in length, 15.0-31.25  $\mu\text{m}$  in breadth, rectangular or irregular in shape.

**Ground Tissue System:** Composed of cortex, pericycle and pith. Cortex 3-5-layered, the layers 25.0-62.5  $\mu\text{m}$  in thick, parenchymatous, barrel-shaped or oval or irregular in shape, 31.25-131.25  $\mu\text{m}$  in length, 18.75-68.75  $\mu\text{m}$  in breadth. Pericyclic sclerenchymatous, 2-4-layered, the layers 12.5-31.25  $\mu\text{m}$  in thick, the cells 18.75-43.75  $\mu\text{m}$  in length, 12.5-33.75  $\mu\text{m}$  in breadth, polygonal or oval in shape. Pith parenchymatous, 4-5-layered, the layers 35.0-50.0  $\mu\text{m}$  in thick, the cells 31.25-81.25  $\mu\text{m}$  in tangential diameter, 18.75-62.5  $\mu\text{m}$  in radial diameter.

**Vascular Tissue System:** Vascular bundles occurs as continuous ring, collateral type, vascular cylinder polyarch, the bundles 350.0-500.0  $\mu\text{m}$  in diameter; phloem distributed at the periphery of the xylem, 5-7-layered, the layers 6.25-18.75  $\mu\text{m}$  in thick, the cells 6.25-31.25  $\mu\text{m}$  in length, 3.75-25.0  $\mu\text{m}$  in breadth, xylem arranged as a continuous cylinder and in the form of radiate group, 250.0-400.0  $\mu\text{m}$  in diameter, cells polygonal or rounded, 8.75-62.5  $\mu\text{m}$  in tangential diameter, 6.25-56.25  $\mu\text{m}$  in radial diameter; phloem composed of sieve tube elements, companion cells, phloem parenchyma and phloem fibers; xylem composed of vessel elements, tracheids, fibers and parenchyma.

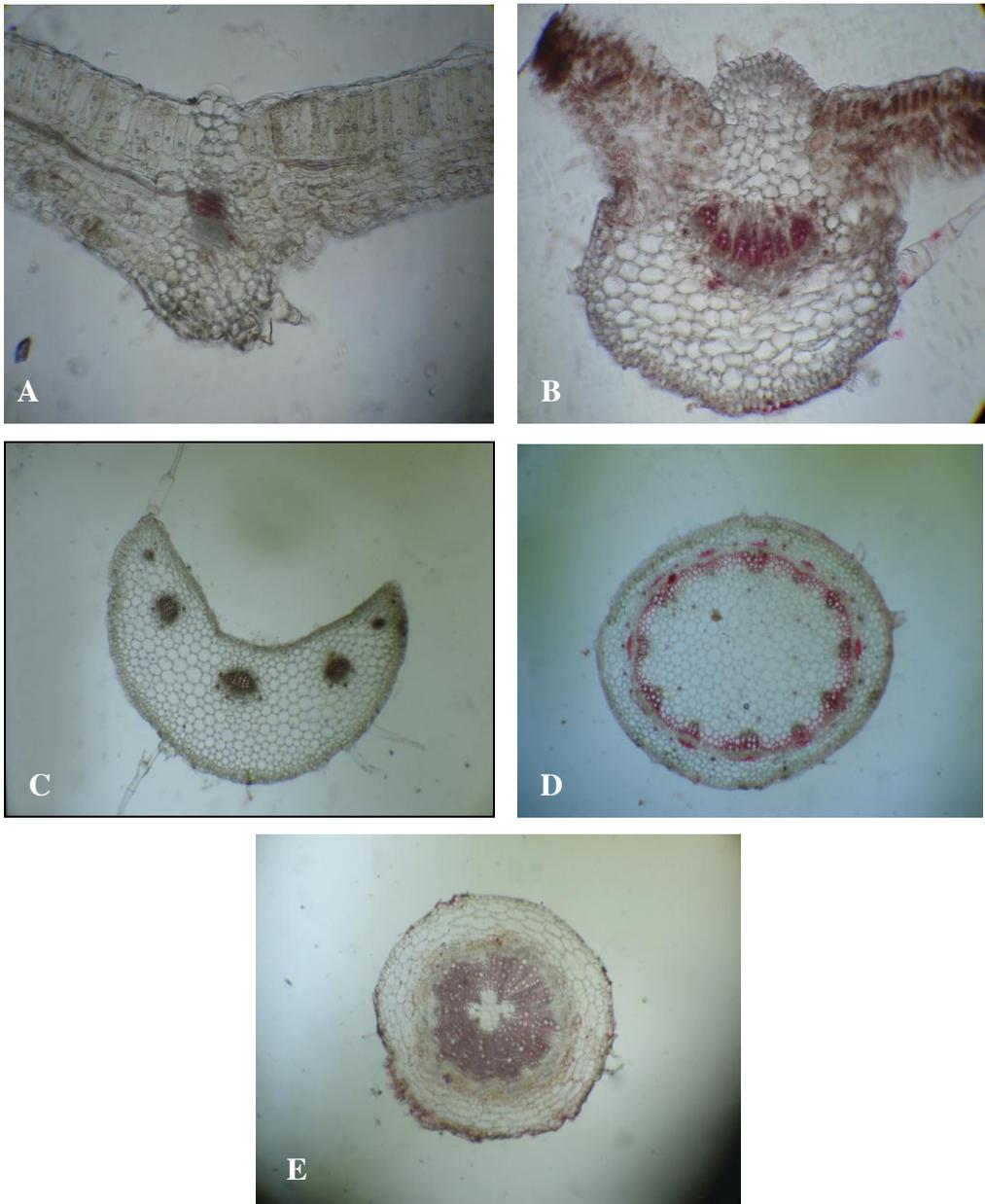


Fig. 2 Internal structure of *Tridax procumbens* L.

A. Lamina

B. Midrib

C. Petiole

D. Stem

E. Root

## Discussion

Morphological and anatomical study of species *Tridax procumbens* L. of tribe Heliantheae has been investigated in this research. This species is belonging to the family Asteraceae. The habit of Asteraceae family is herbs and some species may be shrub, often they are decumbent, prostrate or twing. Occasionally they are climbers or vines and trees are hardly found. Asteraceae is annual or perennial and biennials are also found. Leaves are simple or compound, alternate, opposite or rosulate and petiolate or sessile.

The habits of tribe Heliantheae are herbs or rarely trees. All leaves are opposite, sometimes the upper ones are alternate but sometimes all leaves are alternate. Capitula are heterogamous, radiate, homogonous and monoecious. Involucres are one or several seriate, herbaceous. Phyllaries are free or united. Anther bases are obtuse or sagittate. Style branches are truncate or undivided. Receptacles are usually paleaceous. Paleae are flat, concave or enfolding the flower. Occasionally they are tightly enveloping the achene. Achenes are angular or compressed. Pappus are paleaceous, aristate or coronate, sometimes absent. Asteraceae had been divided into 12 tribes by Grierson (1980). Hundley and Chit Ko Ko (1987) reported that 256 species belonging to 98 genera were distributed in Myanmar. Kress *et al.* (2003) described that 309 species belonging to 128 species had been found in Myanmar. Naw Wah Wah Hpaw (1972) had investigated on tribe Heliantheae in Myanmar. According to this research 27 species from 20 genera of tribe Heliantheae were found in Myanmar. Many researchers had studied on taxonomic revision on genera of family Asteraceae from upper Myanmar. This species of tribe Heliantheae is found abundantly in tropical regions and the flowers appear mostly in rainy season. This species is growing wild in grass field, along ditches, wet places and along road sides.

According to study *Tridax procumbens* L. is perennial herbs; leaves are simple, opposite and decussate, the laminae are ovate or lanceolate and leaf margins are serrate to coarsely dentate or trilobed, leaf tips are acute, bases are cuneate; inflorescences is axillary or terminal but is solitary head on elongate peduncle; involucre are campanulate and 2-seriate; receptacle is convex and ray florets are 6 of 7 per head. These finding agrees with that of Hooker (1881), Grierson (1980) and Backer (1965).

In present study styles of all species are exerted but style arms of both florets of this species is different to each other. Ovary of *Tridax procumbens* L. is obovate.

According to study, Disc florets of *Tridax procumbens* L. are numerous per head. These characters of observed species agree with Hooker (1881), Grierson (1980) and Backer (1965) but some characters are slightly differing from a few literatures.

Anther bases of *Tridax procumbens* L. are sagittate This character of observed species agree with Hooker (1881), Grierson (1980) and Backer (1965) but some characters are slightly differ from a few literatures.

In present study, achene of *Tridax procumbens* L. is obovate, angular and hair. According to Hooker (1881), Grierson (1980) and Backer (1965) achene of observed species agree with literature but are slightly differ from some literatures.

According to the study, the pappus of *Tridax procumbens* L. are bristles, 18 to 20 and radiating unequal in length. These characters agree with some literature but are slightly differ from a few literatures.

This species of Tribe Heliantheae are traditionally well known as medicinal plant. In foreign countries, these plants are also used for various medicinal purposes.

In this work, several distinctive anatomical features of laminae, midribs, petioles, stems and roots of four species were studied. The leaves of all species are dorsiventral type.

In surface view, the study species of stomata are anomocytic type. The stomata are found on both surfaces and are more abundant on the lower surface. These types of stomata agree with Metcalfe and Chalk (1950). Non-glandular multiseriate trichomes are found in all species. These types of trichomes agree with Metcalfe and Chalk (1950).

In surface view of lamina, cuticle is thin and smooth on both surface of all species. The epidermis of laminae of all study species are one-layered. The ground tissue of lamina is differentiated into palisade and spongy parenchyma. Vascular bundles are round or oval in shape and are bicollateral type. Phloem exists on both sides of xylem.

In transverse section, the epidermis cells of midrib, petiole and stem are one-layered and parenchymatous cells with non-glandular trichomes. The

ground tissue of midrib of the species is composed of collenchymatous and parenchymatous. Collenchymatous cells are found on both sides of epidermis. Parenchymatous cells are also found between epidermis and vascular strand. Vascular bundles of midrib are bicollateral type but are composed of solitary crescent shape in *Tridax procumbens* L.

In transverse section, the ground tissue of petioles of all species is differentiated into collenchymatous and parenchymatous. Vascular bundles of petiole are separated into 3 bundles farcically arranged in crescent shape in *Tridax procumbens* L.

According to the present study, the transverse section of stem is circular in shape. In the ground tissue of stem of this species, cortex is composed of outer collenchymatous and inner parenchymatous layer with large intercellular space. Endodermis is the inner most layer of cortex and conspicuous but inconspicuous in *Tridax procumbens* L.. Pericycle is composed of discontinuous sclerenchymatous sheath occurred at the outer boundary phloem groups of vascular bundles. Pith is composed of many layers of parenchymatous cells occurred at the central part of stem. Vascular bundles of stem are form as continuous circular ring. They are collateral type and vary in number of bundles.

In transverse section, the shapes of roots are circular in outline. The primary epidermal cells of roots are disorganized and displaced by the formation of epiblema or protective layer which consists of one layer.

In *Tridax procumbens* L. discontinuous strand of pericycle develops as sclerenchymatous cells at outer boundary of phloem groups of vascular bundles and endodermis is inconspicuous.

### References

- Aye Aye Than. 1991. Angiosperm Flora of Mount Popa. M.Sc Thesis, Department of Botany, Mandalay University.
- Backer, C.A. & R.C. Bakhuizen Van Den Brink. 1965. Flora of Java vol. II. Rijksherbarium, Leyden, N.V.P. Noordhoff, Ltd.
- Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.
- Grierson, A.J.C, In M. D. Dassanayake, 1980. A Revised Handbook to the Flora of Ceylon. Vol. I. Amerind Publishing Co. Pvt. Ltd., New Delhi.

- Htay Htay Win. 2008. Taxonomic Study on Members of the Family Asteraceae From Mandalay District, PhD Dissertation, Department of Botany, University of Mandalay.
- Hundley, H.G. and Chit Ko Ko, 1987. List of Trees, Shrubs, Herbs and Principal Climbers, etc. Four the Revised Edition, Shwe Daw Oo press, Mayargon, Rangoon, Burma.
- Heywood, V.H., R.K., Brummitt, A., Culham, & O. Seberg. 1978. Flowering Plant Families of the World. Oxford University Press, London.
- Hooker, J. D. 1881. The Flora of British India, Vol. III, L. Reeve and Co, 5 Henrietta Street, Convent Gerden, London.
- Kress, J., W. Robert. Defilipps, A. Ellen Farr & Daw Yin Yin Kyi. 2003. A Checklist of the Trees, Shrubs, Herbs and Climbers of Myanmar. Department of Systematic Biology-Botany. National Museum of National History, Washington DC. USA.
- Kyu Kyu Sein. 1991. Polypetalous And Sympetalous Dicotyledons (Angiosperms) of Maymyo And Its Surrounding Area. M.Sc Thesis, Department of Botany, Mandalay University.
- Khin Ohn Myint. 1976. Angiosperm Flora of Pinku Hill, Kyatpyin (Mogok Township). M.Sc. Thesis, Department of Botany, Mandalay University.
- Metcalf, C. R & L. Chalk. 1950. Anatomy of Dicotyledons. Vol. II. Oxford University Press Amen House, London.
- Naw Wah Wah Paw. 1992. A Taxonomic Revision of the Tribe Heliantheae (Compositae) In Burma Genera of Family Compositae ( in Part) in Upper Myanmar. M.Sc Thesis, Department of Botany, Mandalay University.
- Simpson, M. G. 2006. Plant Systematic. Elsevier Academic Press.
- Tin Tin Nyunt. 1992. A Taxonomic Revision of the Genera of Family Compositae ( in Part) In Upper Myanmar. M.Sc Thesis, Department of Botany, Mandalay University.
- Trease, G. E & W.C.Evan, 1978. Pharmacognosy. Macmillan Publishing Co. Inc. New York.
- Yin Yin Toe, 2009. Taxonomic Study on Family Asteraceae from Goktwin Area of Nothern Shan State, Myanmar, PhD Dissertation, Department of Botany, University of Mandalay.



