

MORPHOLOGICAL, HISTOLOGICAL CHARACTERS AND PRELIMINARY PHYTOCHEMICAL INVESTIGATION OF *TRIDAX PROCUMBENS* L. (HMWEZOK-NE-GYA)

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Abstract

The plant *Tridax procumbens* L. (Hmwezok-ne-gya) belongs to the family Compositae (Asteraceae). It was collected from Mawlamyine University Campus, Mon State during from May to October (2019). In this research, botanical characters and preliminary phytochemical examination were carried out. In morphological study, the plant is a procumbent herb. Leaves are simple and opposite. Inflorescences (head) axillary or terminal solitary, heterogamous head surrounded by an involucre of bracts which consists of outer ray florets and inner disc florets with inferior ovary and its fruits are cypselae. In anatomical study, the anomocytic stomata are present in upper and lower surfaces of lamina. Vascular bundles are collateral type in leaves, stems and roots. Multicellular trichomes found in lamina, midrib and petiole. In stem, granular and multicellular trichomes present. Preliminary phytochemical examination were carried out at Department of Botany, Hpa-an University to find out the presence or absence of chemical constituents such as alkaloids, alpha amino acid, carbohydrates, flavonoids, glycosides, phenolic compounds, reducing sugars, saponins, starch, steroids, terpenoids and tannins. The finding of the present research will be helpful for further investigation.

Key words: *Tridax procumbens* L., morphological and histological characters, phytochemical properties.

Introduction

In many parts of the world, most of the people depend on medicinal plants and herbal medicines rather than modern medicines for the treatment of different kinds of illness. Of these plants, a member species of the family Compositae (Asteraceae), *Tridax procumbens* L. also has a number of pharmaceutical properties (Ganju, 2013).

The family Asteraceae under the order Asterales, divides into two groups: Tubiflorae and Liguliflorae. It consists of about 1,000 genera and about 8,000 species and was divided into 11 tribes (Hooker, 1875).

T. procumbens L. is commonly known as “Ghamra” and in English popularly called coat button (Bhagwat *et. al.*, 2008). It is best known as a widespread weed and pest plant, native to tropical America, but it has been introduced to tropical, subtropical and mid temperate regions worldwide. It is also found along roadsides, waste grounds, dikes, riverbanks, meadows and dunes (Sahoo & Chand, 1998).

This plant is a small perennial herb having short, hairy blade-like leaves. Corolla is pale yellow in colour. It is a semi prostrate, perennial, creeper herb. Stem is ascending 30–50cm height, branched, sparsely hairy, rooting at nodes. Leaves are simple, opposite, exstipulate, lanceolate to ovate, 3–7cm long, irregularly toothed margin, base wedge shaped, shortly petioled, hairy on both surfaces. Flowers are tubular, yellow with hairs, inflorescence capitulum (Khan, 2008).

Fruit is a hard achene covered with stiff hairs and having a feathery, plume like white pappus at one end. The plant is invasive in part because it produces so many achenes, each of which can catch the wind in its pappus and be carried some

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distance. Calyx is represented by scales or reduced to pappus. Seeds have pendulous embryo and endosperm is absent (Jain & Jain, 2012).

T. procumbens L. reported from leaves is calcium, magnesium, potassium, sodium and selenium which is well known medicine for liver disorder. It has been found to possess significant medicinal properties against blood pressure, bronchial catarrh, malaria, dysentery, diarrhea, stomach ache, headache, wound healing, it also prevents hair fall and check haemorrhage from cuts and bruises. Its flowers and leaves possess antiseptic, insecticidal and parasitocidal properties. For these reasons, many studies on *T. procumbens* L. have been carried out in many parts of the world (Chen, 2008).

T. procumbens L. is widely distributed in Myanmar. It has been used in traditional medicine for the thousands of years by local people. However, scarce information to deal with this species grown in Myanmar is available so far. Therefore, morphological and anatomical studies of *T. procumbens* L. which is grown wild in Mawlamyine University Campus have been conducted in the present study.

The main objectives of our present study are: to support the correct identification of *Tridax procumbens* L. which has important medicinal value, by using morphological and anatomical characteristics, to study the phytochemical studies of the whole plants and flowers and to investigate and give valuable information for further effective drug development in Myanmar traditional medicine.

Materials and Methods

Plant collection and identification

The plant specimen of *Tridax procumbens* L. was collected from Mawlamyine University Campus from May to October, 2019. By using the collected fresh specimen, the morphological observations and identification of plant have been conducted with the help of literature reported by Backer (1968), Dassanayake (1980), Heywood (1978) and Hooker (1875). The light micrographs of plant specimen including habit, inflorescence and flowers were taken by using a digital camera.

Anatomical study

The microscopical characters of leaves, stems and roots were studied according to the literature of Metcalfe and Chalk (1972), Pandey (1996) and Trease & Evans (2002). Afterwards, each section was cleared by chloral hydrate solution.

Vein-islet numbers

The term 'vein-islet' is used to denote the minute area of photosynthetic tissue encircled by the ultimate divisions of the conducting strands. The number of vein-islets per mm² calculated from four contiguous mm² in the central part of the lamina, midway between the midrib and the margin by the methods of Trease and Evans, (2002).

Vein termination numbers

Vein termination number, which they define as the number of veinlet terminations per mm² of leaf surface. The vein termination were counted the ultimate free termination of a veinlet or branch of a veinlet by Trease and Evans (2002).

Phytochemical investigation of the whole plants and flowers

The fresh specimen of *Tridax procumbens* L. were washed and air-dried. The dried samples of the whole plants and flowers were homogenized by blender to get a fine powder and stored in air tight containers for chemical studies.

Results

Scientific name	-	<i>Tridax procumbens</i> L., Sp. Pl:900.1753: DC. Prod., 5:579. 1836.
Family	-	Asteraceae
Local name	-	Hmwezok-ne-gya
English name	-	Coat button
Flowering time	-	Throughout the year
Specimens examined	-	Mawlamyine University Campus

Morphological characters

Perennial, procumbent herbs; stems and branches terete, pubescent. Leaves simple, opposite, exstipulate; leaf-blade ovate-lanceolate, hirsute on both surfaces, cuneate at the base, irregularly serrate-dentate at the margin, acute at the apex. Inflorescences (head) axillary or terminal solitary, heterogamous head surrounded by an involucre of bracts, receptacles convex, paleaceous; involucre of bract campanulate, peduncles long, bracts 2-seriate, hirsute. Flowers bracteates, the outer whorl ray (ligulate) florets and the inner whorls disc (tubular) florets. Rayflorets uniseriate, irregular, zygomorphic, unisexual epigynous; sepals pappus, petals 3, synpetalous, stamens absent, pistils bicarpellary, syncarpous, style short, stigma bifid, basal placentation, ovary inferior. Disc florets many seriate, regular, actinomorphic, bisexual, epigynous; sepals pappus, petals 5, synpetalous, stamens 5, epipetalous; anthers ditheous, united (syngenesious); pistils bicarpellary, syncarpous, one ovule in each locule, basal placenta, style slender, stigma bifid, ovary inferior. Seeds obconical, cypsel. Seeds exalbuminous.

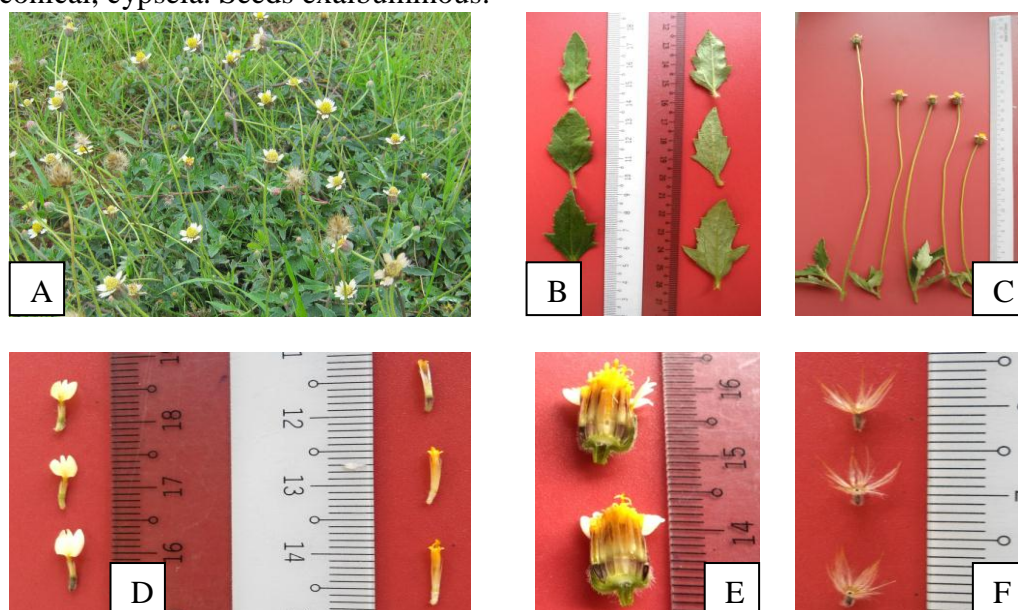


Figure.1 A. Habit of *Tridax procumbens* L.
 B. Leaves of *Tridax procumbens* L.
 C. Inflorescences of *Tridax procumbens* L.
 D. Ray florets and disc florets of *Tridax procumbens* L.
 E. L.S of inflorescences *Tridax procumbens* L.
 F. Seeds of *Tridax procumbens* L.

The Anatomical Study of *Tridax procumbens* L.

Lamina

In surface view, the epidermal cells of both surfaces are parenchymatous and thin-walled. The cells of the abaxial surface are more wavy than those of adaxial surface. The stomata were abundantly observed on the lower epidermis. The stomata were anomocytic (ranunculaceous) type. The vein-islet per square mm 6 – 7 – 9 and the number of veinlet termination 6-8-10. Trichomes were also presented.

In transverse section, the cuticle occurred in adaxial surface is thicker than that in abaxial surface. The epidermis were present as a single layer on both surfaces. The adaxial epidermal cells were rectangular to barrel-shaped. The abaxial epidermal cells were similar in shape and smaller than the upper epidermal cell. Trichomes were also presented.

The mesophyll was differentiated into palisade cells and spongy cells. The palisade cells were one layered with numerous chloroplasts with lying at the adaxial side. The spongy parenchyma cells were 5–6 layered and lying at the abaxial side.

Midrib

In the surface view, the epidermal cells of both surfaces are parenchymatous, elongated along the length of the midrib and multicellular uniseriate trichomes are present.

In transverse section, the midrib is covered with slightly curved outward cuticle in the adaxial and wavy in the abaxial. The adaxial epidermal cells are polygonal in shape. The shape and size of abaxial epidermal cells are smaller than the adaxial epidermal cells.

The cortex is made up of collenchyma cells and thin-walled parenchymatous cells. The collenchyma cells are 2–3 layered in thickness towards the adaxial surface and 1–2 layers in thickness towards the abaxial surface. They are rounded in shape. The parenchyma cells are 4–5 layered in the adaxial and abaxial sides. They are thin-walled and irregular rounded in shape.

The vascular bundle is crescent-shaped in outline, collateral and closed type.

Petiole

In the surface view, the epidermal cells of both surfaces are parenchymatous, elongated along the length of the midrib and multicellular uniseriate trichomes are present.

In transverse section, the midrib is covered with slightly curved outward cuticle in the adaxial and wavy in the abaxial. The adaxial epidermal cells are polygonal in shape. The shape and size of abaxial epidermal cells are smaller than the adaxial epidermal cells.

The cortex is made up of collenchyma cells and thin-walled parenchymatous cells. The collenchyma cells are 2–3 layered in thickness towards the adaxial surface and 1–2 layers in thickness towards the abaxial surface. They are rounded in shape. The parenchyma cells are 4–5 layered in the adaxial and abaxial sides. They are thin-walled and irregular rounded in shape.

The vascular bundle is crescent-shaped in outline, collateral and closed type.

Stem

In transverse section, the stem is circular in outline. The epidermis is one layered, composed of parenchymatous cells and rounded in shape. Multicellular and granular trichomes are present. Next to the epidermis lies the collenchyma which is composed of 2–3 layered rounded to polygonal cells. Immediately below the collenchyma are 3–4 layered of chlorenchyma cells which are rounded in shaped. Pericycle is composed of patches of thick-walled sclerenchyma and parenchyma. The endodermis is inconspicuous.

Vascular bundles forming 5-7 bundles discontinuous ring, parenchymatous cells interrupted between vascular bundle, xylem lying inward and phloem outward,

metaxylem outward, collateral and closed. The central pith is made up of large parenchymatous cells.

Primary root

In transverse section, the superficial layer of the root is epiblema. The epiblema lies the cortex which is composed of 4–5 layers of thin-walled parenchymatous cells. The xylem and phloem are arranged in separate bundles and their arrangement is radial. The protoxylem is commonly exarch and the metaxylem being formed towards the center of the root. Groups of phloem cells are located between the protoxylem groups. The vascular bundles are hexarch.

Secondary root

In transverse section, the mature root is circular in outline. Periderm is composed of three regions namely phellem, phellogen and phelloderm. Phellen (cork cells) is compact, rectangular in shape. Phellogen (cork cambium) consists of thin-walled, rectangular, phelloderm or secondary cortex is parenchymatous cells, thin-walled, polygonal in shape.

The phloem forms a small bundle around the xylem. Below the secondary phloem are 1–2 layers of vascular cambium. The central cylinder of the secondary root composed of xylem tissue, the xylem cells polygonal and rectangular with bordered pits, tracheids, fibres and xylem parenchyma are present.

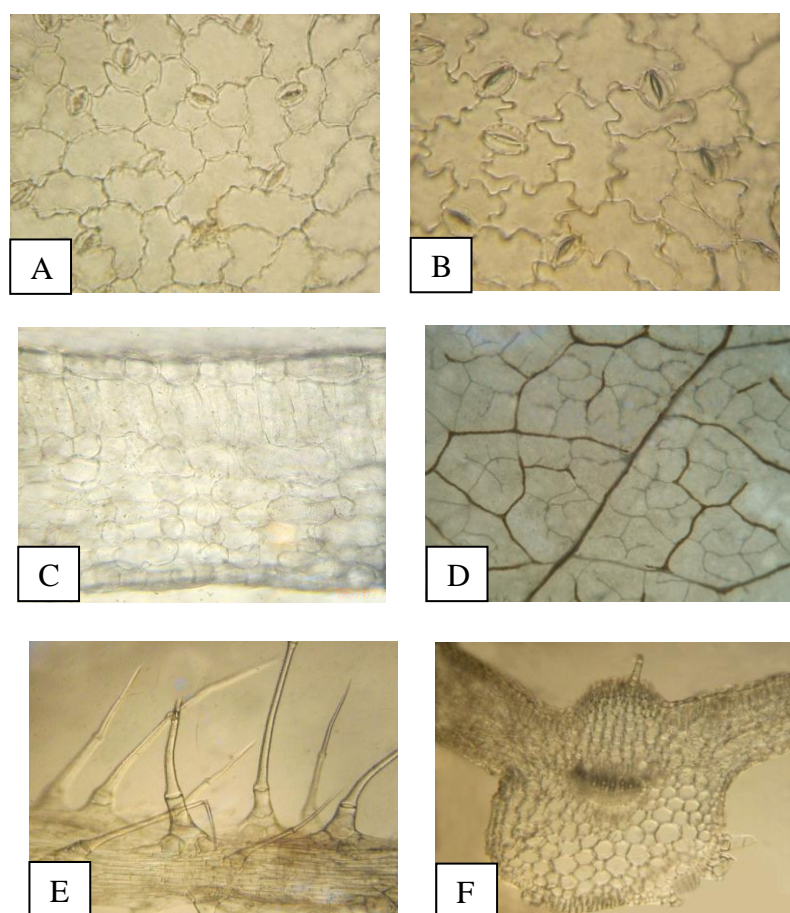


Figure.2 A. Upper surface of *Tridax procumbens* L.
 B. Lower surface of *Tridax procumbens* L.
 C. Lamina of *Tridax procumbens* L.
 D. Vein islet and vein termination of *Tridax procumbens* L.
 E. Surface view midrib of *Tridax procumbens* L.
 F. Midrib of *Tridax procumbens* L.

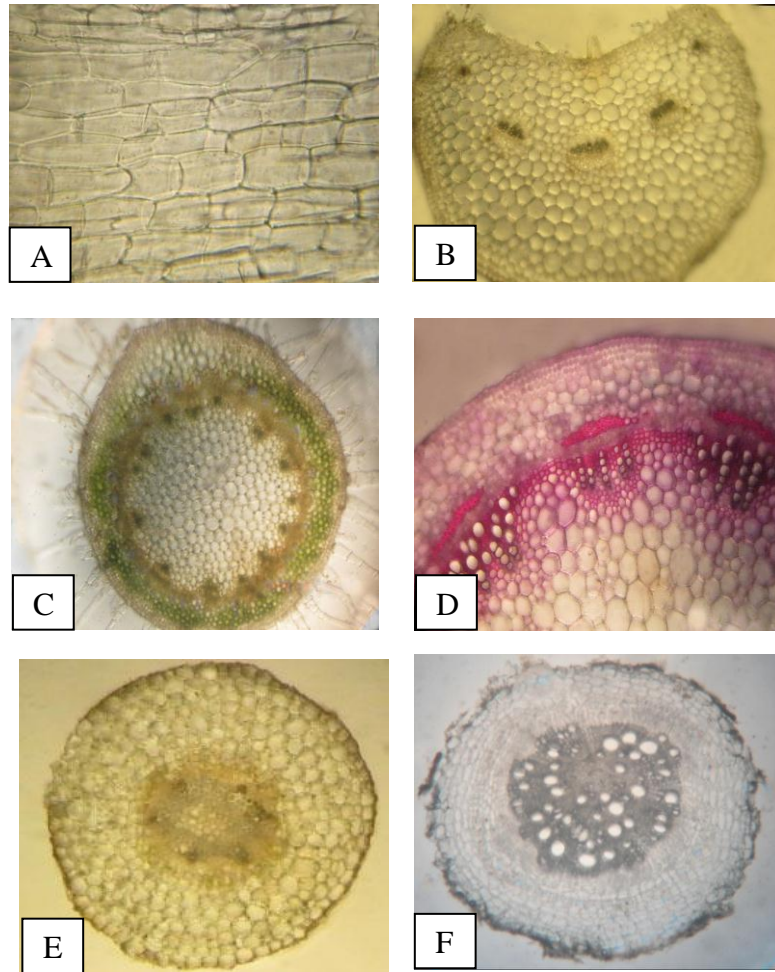


Figure. 3 A. Surface view petiole of *Tridax procumbens* L.
B. Petiole of *Tridax procumbens* L.
C. Young stem of *Tridax procumbens* L.
D. Stem of *Tridax procumbens* L.
E. Young root of *Tridax procumbens* L.
F. Root of *Tridax procumbens* L.

Table 1 Results of preliminary phytochemical tests of the whole plants and flowers of *Tridax procumbens* L.

No	Text	Extract	Test reagent	Observation		Results	
				whole plants	flowers	whole plants	flowers
1	Alkaloids	1% HCl	Dragendorff's reagent	brown ppt	reddish brown ppt	+	+
			Mayer's reagent	pale yellow ppt	pink ppt	+	+
			Wagner's reagent	pale yellow ppt	pale yellow ppt	+	+
			Sodium picrate solution	dark black ppt	dark black ppt	+	+
2	α -amino acids	H ₂ O	Ninhydrin	pink spot	pink spot	+	+
3	Carbohydrates	H ₂ O	10% α -naphthol & conc: H ₂ SO ₄	red ring	red ring	+	+
4	Starch	H ₂ O	Iodine solution	greenish brown	reddish brown ppt	+	+
5	Reducing sugar	H ₂ O	Fehling A & B	yellow ppt	white ppt	+	+
6	Cyanogenic glycosides	H ₂ O	Sodium picrate solution	reddish brown ppt	reddish brown ppt	+	+
7	Glycosides	H ₂ O	10% lead acetate solution	pale yellow ppt	yellow ppt	+	+
8	Phenolic compounds	H ₂ O	1% ferric chloride solution	greenish brown ppt	blue black ppt	+	+
9	Saponins	H ₂ O	Distilled water	frothing	frothing	+	+
10	Tannins	H ₂ O	3% ferric chloride solution	greenish brown ppt	black ppt	+	+
11	Steroids/ Terpenoids	Chloroform	Acetic anhydride & conc: H ₂ SO ₄	green	white	+	+
12	Flavonoids	95%: EtOH	95% EtOH, 0.5g Mg turning conc: HCl	pink colour	pink colour	+	+

(+) = presence

ppt = precipitate

Discussion

In the present study, morphological and anatomical characters of *Tridax procumbens* L. have been investigated. Both vegetative and reproductive parts of the specimens were used for identification. Anatomical characters of the respective parts were also studied in detail.

Perennial, procumbent herbs; stems and branches terete, pubescent. Leaves are simple, exstipulate; leaf blade ovate-lanceolate, hirsute on both surfaces, irregularly serrate-dentate at the margin, acute at the apex. Flowers are bracteate, the outer whorl ray florets and the inner whorls disc florets. Those characters observed in the specimens used were largely congruent with those described by Hooker (1875).

Transverse sections of the whole plant of *T. procumbens* L. were studied. The section of leaves show unicellular covering trichomes and anomocytic stomata are present on both surfaces. These characters are in agreement with those described by Chetan *et al.*, (2011).

The transverse section of the midrib is covered with cuticle slightly curved outward in the adaxial and wavy in the abaxial. The vascular bundle is crescent-shaped in outline, collateral and closed. In the petiole region, transverse section passing through shows slightly depression on adaxial side and slightly protuberated on abaxial side. Trichomes are simple, multicelled (3–6 celled) and more in number on abaxial side. The basal cells of the trichome are swollen. The vascular bundles are

3-5 bundles, collateral and closed. These characters are agreed with Metcalfe & Chalk (1972).

In transverse section, the stem is circular in outline. The epidermis of stem is one layered and composed of parenchymatous cells and rounded in shape. Multicellular and granular trichomes are present. The section of stem shows cortex consisting of 1–2 layers of collenchyma and 4–5 layers of parenchyma. Endodermis is indistinct, glandular trichomes of stem are present Ganju (2013).

In transverse section of young root, the vascular bundles are hexarch. In mature root is circular in outline. Periderm is composed of three regions namely phellem, phellogen and phelloderm. These characters are in agreement with those described by Ganju (2013).

Phytochemical constituents are the basic source for the establishment of several pharmaceutical industries. The preliminary phytochemical investigation was carried out on the powdered of whole plants and flowers of *T. procumbens* L. according to these results, it indicated that alkaloids, α -amino acids, carbohydrates, starch, reducing sugar, cyanogenic glycosides, glycosides, phenolic compounds, saponins, tannins, steroids/terpenoids and flavonoids were present in the whole plants and flowers. These characters are agreed with Jain & Jain (2012).

Conclusion

Tridax procumbens L. is widely used in traditional medicine to combat and cure various ailments thus appear to be rich in secondary metabolites. The above mentioned characters support the discrimination of *T. procumbens* L. from other member species of Asteraceae which is superficially resemble to it. So, these reports are standardized for differences genus of Asteraceae.

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References

- Backer, C.A & R. C. Bakhuizen Van Den Brink JR., 1965. **Flora of Java Vol.III**, N.V.P. Noordhoff-Groningen - The Netherlands.
- Bhagwat *et al.*, 2008. **Antidiabetic activity of leaf extract of *Tridax procumbens* L.** Intl. J. Green Pharma, 2:126–128.
- Bhat, R. S., Shankrappa, J. & Shivakumar H. G., 2008. **Asian Journal of Pharmaceutical Sciences**, 2 (1):11–17.
- Chen *et al.*, 2008. **Chemical constituent diversity of *Tridax procumbens* L.** Canadian Journal of Chemistry, 86(9):892–898.
- Chetan *et al.*, 2011. **Pharmacognostical and pharmacological screening of *Tridax procumbens* L.** India.
- Dassanayake, M.D. (Editor), 1997. **A revised hand book to the flora of Ceylon, Volume I**, A.A. Balkema Rotterdam Press.
- Durgacharan *et al.*, 2008. ***Tridax procumbens* L.** International Journal of Green Pharmacy, 2:126–128.

- Ganju, K., 2013. **Pharmacognostic and phytochemical evaluation of *Tridax procumbens* L.** Vol.I, Issue 5.
- Heywood, V. H., Brummit, R. K., Culham, A. & Seberg, O. (1978). **Flowering plant families of the World**, Published in the United State by Fieflly Book (U.S.) Inc.
- Hooker. J. D., 1875. **The flora of British India, Vol. V.** L., Reeve & Co., Ltd. London.
- Jain A. & Jain A., 2012. ***Tridax procumbens* L. A weed with immense medicinal importance: A Review.** International Journal of Pharma and Bio Sciences, 3 (1):544–552.
- Khan *et al.*, 2008. **Taxonomic Studies on the Family Asteraceae of the Rajshahi Division.** Research Journal of Agriculture and Biological Sciences, 4(2):134–140.
- Marini Bettolo, G.B., Nicolettic, M. and Patamia, M., 1981. **Plant Screening by Chemical Chromatographic Procedure Under Field Conditions**
- Metcalf, C. R. & Chalk, L., 1972. **Anatomy of the dicotyledons; (Vol.II).** London, Oxford University Press.
- Michael, A., 1965. **Taxonomy of *Tridax* (Compositae).** Brittonia, 17(1): 47–96.
- Narayan Das Prajapati, S.S. Purohit, Asun K. Sharma & Tarun Kumar, 2003. **A handbook of medicinal plants**, Shyam Printing Press, Jodhpur.
- Pandey, B.P., 2000. **Taxonomy of angiosperm.** Chand and Company Ltd., New Delhi.
- Pathak, A.K., Saraf, S. & Dixit, V. K., 1991. **Fitoterapia**, 62, 495.
- Rabison, T., 1983. **The Organic Constituents of Higher Plants.** Department of Biochemistry, University of Massachusetts.
- Sahoo M. & Chand P.K., 1998. **In vitro multiplication of a medicinal herb *Tridax procumbens* L. growth regulator synergy.** Phytomorphology 48:195-206.
- Trease, G. E & Evans, W. C., 2002. **Pharmacognosy. 15th Ed.** Harcourt Publishers Ltd., London.
- Vogel, A.I., 1956. **A Text Book of Practical Organic Chemistry**, Longmans Green and Co. Ltd., London.
- Wealth of India, 1976. **A dictionary of Indian raw materials and industrial products.** Publication and Informatation Directorate, CSIR, Vol.X, New Delhi.