WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 6, Issue 9, 743-768. Research Article ISSN 2277– 7105

# PHYTOCHEMICAL INVESTIGATION AND TAXONOMIC EVALUATION OF SOME MEDICINAL PLANTS

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Article Received on
24 June 2017,
Revised on 14 July 2017,
Accepted on 04 Aug. 2017
DOI: 10.20959/wjpr20179-9253

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## ABSTRACT

The present study has been designed with the objective of investigating the morphological characters of ten local medicinal plants for the preparation of artificial key and phytochemical analysis including determination of the secondary metabolites. The powdered plant was successively extracted with methanol solvent. Phytochemical analysis revealed the presence or absence of secondary metabolites like flavonoids, alkaloids, cardiac glycosides, steroids, phenols, tannins, saponin, phlobatannin, protein and reducing sugar having several therapeutic purposes. The results may justify the popular uses of these plants as therapeutic drugs.

**KEYWORDS:** Taxa, taxonomy, phytochemistry, extracts, carminative, anti-inflammatory, diuretic, key.

## INTRODUCTION

"In all things there is a poison, and there is nothing without a poison. It depends on only upon the dose whether a poison is a poison or not".[1]

The medicinal plants are useful for healing as well as for curing of human diseases because of the presence of phytochemical constituents.[2] Phytochemicals are primary and secondary compounds naturally occurring in the medicinal plants, leaves, vegetables and roots that have defense mechanism and protect from various diseases. Chlorophyll, proteins and common sugars are included in primary constituents and secondary compounds have terpenoid, alkaloids and phenolic compounds.[3]

Demand for medicinal plant is increasing in both developing and developed countries due to growing recognition of natural products, being non-narcotic, having no side-effects, easily available at affordable prices and sometime the only source of health care available to the poor.

In India, medicinal plants are widely used by all sections of population and it has been estimated that, in total over 7500 species of plants are used by several ethnic communities.[5]

Presently, medicinal plants play a very important role in the modern economy. NTFPs account for 70% of India's forest product exports and the demand for phytochemicals is expected to increase in future as a new frontier for trade. India has probably the oldest, richest and most diverse cultural traditions in the use of medicinal plants. The medicinal qualities of plants are of course due to chemicals. Plants synthesize many compounds called primary metabolites that are critical to their existence. These include proteins, fats, and carbohydrates that serve a variety of purposes indispensable for sustenance and reproduction, not only for the plants themselves, but also for animals that feed on them.

Plants also synthesize a dazzling array of additional components, called secondary metabolites, whose function has been debated. Many secondary metabolites are "antibiotic" in a broad sense, protecting the plants against fungi, bacteria, animals, and even other plants.[6]

Every plant species contains chemicals that can affect some animals or micro-organisms negatively, strongly supporting the interpretation that secondary metabolites play a vital role in combating diseases and herbivores. "Plants have been a rich source of medicines because they produce a host of bioactive molecules, most of which probably evolved as chemical defenses against predation or infection"

## MATERIALS AND METHODS

The investigation was done with the following taxa

1. Abroma augusta Linn.
2. Andrographis paniculata. (Burm. f.) Walt ex Nees.
3. Bacopa monnieri. (Linn.) Pennel.
4. Boerhavia diffusa Linn.
5. Catharanthus roseus (Linn) G. Don.

6. Centella asiatica (Linn.) Urban.
7. Holarrhena antidysenterica. (Roxb. ex Fleming) Wall ex DC.
8. Phyllanthus amarus Schum & Thorn.
9. Terminalia arjuna (Roxb. ex DC) Wight & Arn.
10. Tinospora cordifolia (Willd.) Miers ex Hook. F. & Thoms.

**Taxonomy:** Various localities of Kolkata, Howrah and South 24 pargana were exposed for collection of plant materials during the course of investigation. For collection of specimens and respective field data, several attempts were made in different seasons of the year. In each collection trip, assistance of local people was sought. During the field trip, 3 to 5 samples of each species were taken. The place of collection of plants were carefully marked in such a manner that these could be easily spotted out during flowering and fruiting time.

After collection, these specimens were pressed, preserved and mounted on herbarium sheets following the standard and modern herbarium techniques.[8] For identification purpose, collected specimens were matched with the specimens at the Central National Herbarium (CAL) and the Calcutta University Herbarium (CUH).

The plant parts were figured, characterized from fresh specimens immediately after collection and subsequently scanned from dry specimens. Colour photographs were taken for each specimen. In this case close-up views were taken mostly with scale. Out of the collections, a comprehensive list of species was prepared. Then search of relevant literature including recent ones for determining correct names of taxa was followed. In the systematic enumeration of the taxa, the arrangement of species was considered in an alphabetical order for the sake of convenience. For morphological diagnoses, the characters of stem, leaf, stipules, bracts, stamen, anther, ovary, style, stigma, fruit and seed were taken into consideration. In mentioning the locality under "specimen examined", the collector's name, field number and name of the sector were used. Out of the several specimens examined, only few have been cited.

Detailed artificial keys for the species were developed as in floristic studies for the identification of investigated taxa using diagnostic morphological characters (Table 1). In preparing these keys, important distinguishing features and also some additional characters were used to ensure the identity of a taxon.

**Phytochemistry:** With the methanolic extract of the plant materials the phytochemical analysis was done. The crude extract was used to analyze the presence of reducing sugar, protein and secondary metabolites like tannin, phlobatannin, saponin, flavonoid, steroid, cardiac glycoside, terpenoid and alkaloid.[9] The whole plant body was cleaned and cut into small pieces and then dried in the sun and finally dried in a hot air oven at 50-60°C for 2hours. After complete drying, the entire portion was reduced to coarse powder with the help of a mechanical grinder. Before grinding, the machine was cleaned to avoid contamination. Then powdered materials were stored in air tight bottles.

***Extraction of the plant material***

For methanol extraction, about 1g of the dried and powdered leaves, flower and seed material was taken and added to 10ml of methanol. The mixtures were left at room temperature overnight. The extracts were filtered over Whatmann No.1 filter paper. The methanol extract was subjected to chemical tests to find out the presence of various secondary metabolites and antioxidant property.

***Phytochemical screening***

Different qualitative chemical tests was performed for establishing profile of methanol extract for its chemical composition. The following tests were performed on extracts to detect various phytoconstituents present in them.

***Test for tannins***

1 ml of the sample was taken in a test tube and then 2ml of 2% Ferric chloride was added and appearance of blue green or black colour indicates the presence of tannin.

***test for phlobatannins***

When crude extract of each plant sample was boiled with 2% aqueous HCl, the deposition of a red precipitate was taken as evidence for the presence of phlobatannins.

***Test for saponins***

Crude extract was mixed with 5ml of distilled water in a test tube and it was shaken vigorously. The formation of stable foam was taken as an indication for the presence of saponins.

***Test for flavonoids***

To the sample 10% of lead acetate solution was added and the appearance of white precipitation indicate the presence of flavonoids.

***Test for alkaloids***

***Hagger's test:*** To the sample Hagger's reagent was added. Buff coloured precipitation indicates the presence of alkaloid.

***Mayer's test:*** To the sample Mayer's reagent was added. Yellow coloured precipitation indicates the presence of alkaloid.

***Dragendorff's test:*** To the sample Dragendorff's reagent was added. Orange coloured precipitation indicates the presence of alkaloid.

***Wagner's test:*** Crude extract was mixed with 2ml of Wagner's reagent. Reddish brown coloured precipitate indicates the presence of alkaloids.

***Test for protein***

To the crude extract, Millon's reagent was added. Appearance of white precipitation indicates presence of protein.

***Tests for reducing sugar***

**Fehling's test:** To the sample Fehling solution (Fehling A: Fehling B:: 1:1) was added and heated on a boiling water bath. The brick red precipitation indicates the presence of reducing sugar.

**Benedict's test:** To the sample Benedict's reagent (qualitative) was added and heated on a boiling water bath. A characteristic coloured precipitate indicates the presence of reducing sugar.

***test for steroid***

To the sample 2ml of chloroform was added. To this, concentrated sulfuric acid was added at the side of the test tube. Red coloured produced in lower chloroform layer indicating the presence of steroid.

***test for terpenoid***

To 5ml of the extract 2ml of chloroform and 3ml of concentrated sulfuric acid were added. Reddish brown colouration indicates the presence of terpenoid.

***test for cardiac glycoside***

Keller-kilani test: A total mixture of crude extract and glacial acetic acid containing 1-2 drops of 2% solution of ferric chloride was poured into another test tube containing 2ml of concentrated sulfuric acid side wise. Appearance of brown ring at the junction of two layer indicates the presence of glycoside.

## RESULTS AND DISCUSSION

### Diagnosis of taxa

*Abroma augusta* (L.) L.f., Suppl. Pl. 341.1781, 'Ambroma'; Masters in Fl. Brit. India 1: 375.1874. *Theobroma augusta* L., Syst. Nat. ed.12: 233.1770.

**Local name:** Ulatkambal.

**Habit:** Tree, 1-4 m tall, perennial. **Stem:** solid, cylindrical, fibrous, woody, branched, with densely stellate, hair, differentiated into nodes and internodes, internodal length varies from 3-4.5cm, green. **Leaf:** two types- ovate and 7-9 angled; former simple, alternate, petiolate (6-8mm, green), stipulate(stipule free lateral, 6-7mm, green), with stellate hair, lamina ovate, apex acuminate, margin slightly dentate at base and apex, base cordate, dorsiventrally differentiated, multicostate reticulate veination, primary vein 7, secondary vein numerous, length 6-15cm, breadth 2-5cm, green; later simple, alternate, 7-9 angled, petiolate (petiole 17-18.5cm, green), stipulate (stipule free lateral, 7-8mm, green), with stellate hair, lamina palmately lobed, apex acute, margin dentate, base cordate, dorsiventrally differentiated, multicostate reticulate veination, primary vein 7-9, secondary vein numerous, lamina 18-19 cm long, breadth 9.5-12.5cm, green. **Inflorescence:** axillary cyme. **Flower:** stalked (stalk 2-3cm, green), complete, bisexual, actinomorphic, bracteates, (bract 3, free, lanceolate, pubescent, 1cm, green), bracteoles present, (2 in number, 1cm,green), length 3-4cm, diameter 5cm, bonus purple. **Calyx:** sepals 5, gamosepalous, connate at the very base only, valvate, pubescent, 15-18 mm long, green. **Corolla:** petals 5, valvate, rosaceous, concave below, prolonged upwards as a cochleate lamina, spoon shaped, with staminode commissure base, densely pubescent, red purple. **Androecium:** stamen 15, connate in a copular column, with 5 long staminode opposite the sepals alternating with 5 groups containing each 2-4, filament

suppressed, 0.5mm, greenish, mucilaginous, anther 2, bicelled, adnate, 1-1.5mm, yellow; staminode 5, nearly spatulate, both side hairy. **Gynoecium:** carpels 5, syncarpous, ovary superior, sessile, 5 grooved, 5 locular, axile placentation, each chamber with numerous ovule; style 5, united, straight, stigma 5; 4mm, greenish in colour. **Fruit:** membranous 5 angled, winged, septisidally 5 valved capsule with villous margin and truncate apex, 4.5-6cm, green. **Seed:** numerous, albumen copious, 2-2.5mm greenish white. Plate II: a-j; Fig. 2: a-t.

**Flowering:** June –September.

**Specimen examined:** Sanyal 2, Diamond Harbour; Sanyal 3, Kolkata.

**Uses**

1. Medicinally the bark and the root are used. It is a uterine stimulant, produces an even menstrual flow and decreases pain in menstruation, the condition known as dysmenorrheal. The decoction, powdered root or distilled water of the same is effective in diseases women suffer from, especially in cases where women have pain before or during the menstrual period. The decoction will bring about clear menses without any pain; not only that, the menstrual period will also be regulated.
2. It has antispasmodic, ovulation stimulant, anti-inflammatory, anti-arthritic property. The root is also used to treat itch.

***Andrographis paniculata* (N. L. Burman) Wallich ex Nees in Wallich, Pl. Asiat. Rar. 3: 116. 1832.**

**Local name:** Kalmegh.

**Habit:** Annual, subshrub, with bitter smell, 50 cm tall. **Stem:** solid, quadrangular, branched, glandular hairy, cystolith found on the epidermis of stem, differentiated into nodes and internodes, nodes swollen, intermodal length varies from 10-42mm, dark green in colour. **Leaves:** simple, opposite decussate, linear to ovate, exstipulate, subsessile, delicate, glabrous, base attenuate and deccurrent onto petiole, margin entire, apex acute, dorsiventrally differentiaited,abaxially pale green, adaxially green, multicostate, reticulate, primary veins 3, secondary vein 3-5 on each side of the mid vein, length varies from 1.5-7cm, petiole0.3-1 cm. **Inflorescence:** terminal panicle, panicle branches zigzag, rachis glabrous. **Flower:** complete, bisexual, zygomorphic, hypogynous, bracteates (bract triangular to subulate, hairy, 1-1.5mm, green), bracteolate (bracteoles 2, free, linear to subulate, hairy, 1-1.5 cm green), pedicel 2-9

cm, sparsely pubescent with glamd tipped trichomes, white, 12-18mm. **Calyx:** sepals 5, gamosepalous, glandular tipped pubescent outside, lobes subulate, shortly connate, valvate, 2.5-3mm green. **Corolla:** petals 5, gamopetalous, outside with gland tipped pubescent, bilabiate, upper lip 3 lobbed and lower lip 2 lobbed, imbricate, 0.9-1.5cm, white, upper 3 lobes with magenta lines, lower lobes with magenta dots. **Androecium:** stamen 2, free, epipetalous, excerted, equal length, filaments declinate, bearded, white, anthers bicelled, dorsifixed, two anthers joined, dark in colour. 0.5mm. **Gynoecium:** carpel 2, syncarpous, ovary superior, bilocular, single ovule in each locule, axile placentation, glabrous, style terminal, sparsely pilose towards base, straight, stigma bifurcated, recurved, green, 8-12mm**.** **Fruit:** capsule, beaked, glandular pubescent, oblong, compressed, **Seed:** in two rows, supported by retinacula, green, 1.5-2cm.

**Flowering:** November - December.

**Specimen examined:** Sanyal 1, Howrah Shibpur; Sanyal 2, Diamond Harbour.

**Uses**

1. The whole plant part is used. The plant is bitter, acrid, cooling, laxative, vulnerary, anti-periodic, anti-inflammatory, expectorant, depurative, anthelminthic, digestive and stomachic.
2. It is useful in hyperdipsia, burning sensation, wound, ulcers, chronic fever, malarial and intermittent fever, inflammation, cough, bronchitis, skin disease, treatment of intestinal worm, dyspepsia, flatulence, colic diarrhea, dysentery and hemorrhoids.

***Bacopa monnieri* (L.) Pennel.**

**Local name:** Brahmi.

**Habit:** Prostrate, herb. **Stem:** solid, cylindrical, glabrous, succulent, branched, differentiated into nodes and internodes, intermodal length varies from 13-17mm, light green in colour. **Leaf:** sessile, glabrous, shiny, opposite decussate, not distinctly dorsiventrally differentiated, exstipulate, ovate, apex rounded, margin entire, base rounded, porous lamina, unicostate, reticulate veination, primary vein 1, midrib suppressed, length varies from 12-15mm, green in colour. **Inflorescence:** solitary axillary cyme. **Flower:** complete, zygomorphic, bisexual, stalked, stalk 2.5cm, bracteolate (bracteoles 2, lanceolate, green, 4mm, glabrous), purplish white, 1cm. **Calyx:** sepals 5, polysepalous, connate below in 5 partite calyx, lobes

quincunshial, 2 sepals are triangular to ovate, 2-3mm breadth, remaining 3 narrower, lanceolate, green, 5mm. **Corolla:** petals 5, gamopetalous, personate, imbricate, upper 2lobed, lower 3 lobed, corolla tube cylindrical, white, 10mm, tip bifid, at base purple, green veined. **Androecium:** stamen 4, didynemous, epipetalous, excered, filament 4mm, 2.5mm, white, anther 2mm, purple, bicelled, basifixed, dehisce along longitudinal axis**. Gynoecium**: carpel 2, syncarpous, ovary 2 celled, numerous ovule in each cell, superior, parietal placentaion, 2.5mm, green, style greenish, 4mm, straight, stigma bilobed. **Fruit**: capsule, narrowly ovoid, enveloped in persistent calyx, apex acute, green, 3-5mm. **Seed:** yellow brown, ellipsoid.

**Flowering**: June-October.

**Specimen examined:** Sanyal 1, Howrah Shibpur; Sanyal 2, Diamond Harbour.

**Uses**

1. The whole plant part is used. The plant is astringent, cooling, laxative, intellect promoting, anodyne, carminative, digestive, anti-inflammatory, anti-consulvant, depurative.
2. It is used as cardiotonic, bronchodilator, diuretic, sudorific, febrifuge and tonic.
3. It is useful in vitiated condition of kapha and vata, biliousness, neuralgia inflammation, epilepsy, insanity, amentia, tumors, ulcers, splenomegaly, dyspepsia, flatulence, constipation, asthma, bronchitis and skin diseases.
4. It is also useful in leprosy, leucoderma, syphilis, hoarseness, elephantiasis, sterility, fever and general debility.

***Boerhavia diffusa* var. *mutabilis* R. Brown; *B. repens* var. *diffusa* (Linnaeus) Heimerl ex J. D. Hooker.**

**Local name:** Punarnava.

**Habit:** Prostrate, perennial herb. **Stem:** Solid, cylindrical, aerial, branched, trailing woody, very fine ridged, sparsely pubescent, differentiated into nodes and internodes, intermodal length varies from 35-75mm, green in colour with some brownish portion. **Leaf:** Simple, opposite decussate, exstipulate, petiolate, petiole 5-15mm; leaf blade ovate, base rounded or cuneate, margin undulate, with stout, muticellular hairs, apex obtuse or acute, dorsiventrally differentiated, both surfaces sparsely pubescent, multicostate, reticulate, veins prominent in ventral side, single primary vein with 4-6 pairs of lateral veins, green, length of leaf varies

from 32-42mm, breadth varies from 14-30mm. **Inflorescence:** terminal, cymose panicle, congested. **Flower:** Incomplete, bisexual, regular, bracteates (bract oblong, 1-1,5mm, green), bracteolate (bracteoles 2, pubescent, green, 0.8mm); actinomorphic, epigynous, 4mm, pink in colour. **Perianth:** Tepal 5, gamotepalous, campanulate, 5 vertical band outside with gland tipped pubescent, valvate, tip of tepal bifid, limb pink; 2-3mm. **Androecium:** Stamen 3, free, intruded, filament curved, dark pink in colour, anther bicelled, flattened, yellowish, dorsifixed, 0.5-1m. **Gynoecium:** Carpel 1, apocarpous, ovary inferior, glandular pubescent, 2 chambered, single ovule in each chamber, basal placentation, green in colour; style white, curved; stigma peltate, yellowish, 2-2.5mm. **Fruit:** Anthocarp clavate, 5-ribbed, with viscid glands and sparse pubescence, apex rounded, 3-3.5mm, green. **Seed:** Minute, albuminous with perisperm.

**Flowering:** June-September.

**Specimen examined:** Sanyal 1, Howrah Shibpur; Sanyal 2, Diamond Harbour.

**Uses**

1. This plant is bitter, astringent, cooling, anthelminthic, diuretic, aphrodisiac, cadiac stimulant, emetic, expectorant, anti-inflammatory, febrifuge, laxative and tonic.
2. Its root is used by a large number of tribes in India for the treatment of hepatic disorder and for internal inflammation.
3. It is useful in all types of inflammation, leucorrhoea, ophthalmia, cardiac disorder, jaundice, anemia, dyspepsia, constipation, cough, bronchitis and general debility.
4. It is popular in Ayurveda, the herb is known having analgesic property.

***Catharanthus roseus* (Linnaeus) G. Don, Gen. Hist. 4: 95. 1837.**

**Local name:** Nayantara.

**Habit:** Erect, perennial shrub. **Stem:** solid, cylindrical, aerial, branched, woody, ridged, young stems puberulent, glabrous, differentiated into nodes and internodes, intermodal length varies from 9-17mm, green and reddish brown combination in colour. **Leaf:** Simple, shortly petiolate, petiole 7-10mm, green, opposite decussate; obovate; base cuneate; margin entire; apex minutely apiculate, glabrous, dorsiventrally differentiated, veins promonent in abaxial surface, multicostate, reticulate, single mid vein, lateral veins 7-11 pairs, length varies from 4.5-5.9cm, breadth varies from 13-18mm, dorsal side deep green., ventral side light green in

colour, twig produces milky exudates. **Inflorescence:** Solitary axillary cyme. **Flower:** Complete, bisexual, pentamerous, stalked, regular, actinomorphic, red pink with darker red centre, length varies from 3-5cm. **Calyx:** Sepals 5, polysepalous, lanceolate, apex sharply pointed, broad base, pubescent, twisted, 5mm, green. **Corolla:** petals 5, gamopatalous, hypocrateriform, twisted, tube 2.5-3cm long, pilose inside, glabrous, green, throat villous, hairy,; lobes broadly obovate, 1.2-2cm, red pink in colour, ring of white hair at base of corolla lobes. **Androecium:** Stamen 5, free, epipetalous, included within corolla, present at corolla throat, filament glabrous, 0.5-0.8mm long, green; anther bicelled, pubescent, adnate, base obtuse, dehiscence longitudinal, 2-2.5mm, green. **Gynoecium:** Carpels 2, syncarpous, ovary 2, free, superior, two chambered, single row of ovule in each chamber, parietal placentation, pubescent,narrowly triangular gland at base of carpel, number of gland 2, white in colour, style 1, joined, filiform, apex thick, straight, terminal, stigma 1, anulate, viscid, with reflexed membrane, tip minute, penicillate, mucilaginous, green, 2.1-2.5cm. **Fruit:** Follicles, glabrous, 2-3.8 cm, green. **Seed:** Subcylindric, truncate at both ends, hilum lateral, albumen fleshy, green in young, dark at maturity with ridges and furrows, 2mm.

**Flowering:** February-October.

**Specimen examined-** Sanyal 1, Howrah Shibpur.

**Uses**

1. The whole plant, particularly the root bark contains alkaloids which have hypotensive, sedative and transquilising properties.
2. It is used as a folk remedy for diabetes.
3. The root is toxic, bitter, acrid, stomachic and tonic. The juice of the leaves is good for wasp stings and menorrhagia.
4. The alkaloid ‘vincristin’ obtained from this plant is useful in some kinds of leukemia.

***Centella asiatica* (Linn.) Urban.**

**Local name:** Thankuni.

**Habit:** Prostrate annual, herb. **Stem:** prostrate, weak, solid, cylindrical, ridged, stolon present, differentiated into nodes and internodes, intermodal length varies from 22-50mm, rooting at nodes, sparsely pubescent, green. **Leaf:** simple, arising in groups from nodes, with long petiole, petiole 5-35mm, green, hollow; leaf blade, reniform, apex rounded, margin

dentate, base auriculate, dorsiventrally differentiated, adaxial surface glabrous, abaxial surface sparsely pubescent, multicostate reticulate, number of primary veins 9, length varies from 10-45mm, breadth varies from 15-50 mm, green in colour. **Inflorescence:** Simple umbel, 3 floers in each umbel. **Flower:** Complete, bisexual, epigynous, stalked (3-5mm, green), regular, actinomorphic, pedicellated, bracteates (bract 2, ovate, veined, apex acute, entire, cuneate, green, 2-3mm in length), 3.5-4mm. **Calyx:** sepals 5, gamosepalous, minute, connate, inseparable from ovary, valvate, pubescent,2-2.5mm, green. **Corolla:** Petals 5, polypetalous, ovate, rosaceous, veined, apex acute, entire, cuneate, glabrous, imbricate, 1mm. dark pink. **Androecium:** Stamen 5, free, excerted, filament length equal to anther length, light coloured,; anther bicelled, dorsifixed, dehiscence longitudinal, 0.2mm, red purple. **Gynoecium:** Carpels 2, syncarpous, connate in an inferior ovary, ovary 2 celled, single ovule in each cell, axile placentation, pubescent, style indistinct, stigma bifurcated, glabrous,3mm, green. **Fruit:** cremocarp, laterally compressed, cremocarp breaks into 2 mericarps, single seed in each mericarp, vittae absent, pubescent, green with brownish purple at base, 2-3mm. **Seed:** laterally compressed, light green.

**Flowering:** April-October.

**Specimen examined:** Sanyal 1, Howrah Shibpur; Sanyal 2, Diamond Harbour.

**Uses**

1. The whole plant is used. The plant is bitter, acrid, sweet, cooling, soporific, cardiotonic, nerve tonic, stomachic, carminative, diuretic and febrifuge.
2. It is useful in vitiated condition of pitta, insomnia, cardiac debility, epilepsy, hoarseness, asthma, bronchitis, hiccough, amenita, abdominal disorders, leprosy and fever.
3. The leaves are used in abdominal disorders due to dysentery in children.

***Holarrhena antidysenterica* (G. Don) Wall. ex A. DC.; (=) *Holarrhena febrifuga* Klotzsch).**

**Local name:** Kurchi.

**Habit:** Tree upto 10m tall**. Stem:** solid, cylindrical, slightly flattened, minutely ridged, branched, glabrous, fibrous, woody, with milky latex, branches with whitish, dotlike lenticels; differentiated into nodes and internodes, intermodal length varies from 10-70 mm, mature dark brown, young green in colour. **Leaf:** petiolate, petiole 2-3mm, grooved,

glabrous, dorsiventrally differentiated, slightly alternate to opposite decussate, symmetrical, lamina ovate or elliptic, apex acute and obtuse, margin slightly undulate, base cuneate, single mid vein, 14 pairs of secondary veins, at the base of flowering twig two opposite leaves, rounded to elliptical, asymmetrical, apex obtuse, margin entire, base rounded, single mid vein, 6-7 pairs of secondary vein, green, 1mm petiole, 2.3-5.7cm, large leaf 3.5-14.1cm, multicostate reticulate, exstipulate. **Inflorescence:** corymbose cyme. **Flower:** complete, bisexual, actinomorphic, regular, bracteates, (bract 3, green, lanceolate, 3-3.5mm in mature flower, 2, triangular, 1mm, in different position, in bud, same position), yellowish, stalked, peduncle 1-2 cm, with milky latex, green, pubescent, with brownish lines, 3.5-4cm length**.** **Calyx:** sepals 5, polysepalous, triangular, green, 3mm, valvate, connate. **Corolla:** petals 5, (sometime 6) yellowish, elliptical, gamopetalous, twisted, connate in salver shaped corolla, corolla tube green,cylindric, throat contracted, grooved, pubescent, tube 0.9-1.9 cm; lobes oblong, 1-3 cm, twisted. **Androecium:** stamen 5 or 6, saggitate, near base of tube, free, epipetalous, intruded, filament greenish,0,5mm, anther bicelled, oblong, lanceolate, mucronate, cells rounded at the base, attached at the base of corolla tube, 1-1.5mm, greenish. **Gynoecium:** carpels 2, syncarpous, ovary free, 2, green glabrous, 0.5-1mm, style filiform, green, stigma oblong to fusiform, tip 2 toothed, green; 3mm, ovary single chambered, numerous ovule, parietal placentation. **Fruit:** terete, elongated, spreading and incurved follicles, Follicles linear, 20-43 X 0.5-1.5 cm, with whitish, dotlike lenticels. **Seed:** linear or oblong, compressed, tipped with a deciduous coma, seeds 0.9-1.6 cm, coma 2.5-4.5cm.

**Flowering:** April-July.

**Specimen examined**- Sanyal 2, Diamond Harbour., Sanyal 0 Salt Lake.

**Uses**

1. The bark, seed, leaves of the plant are used. Bark and seeds are bitter**,** constipating, astringent, acrid, refrigerant, anthelminthic, antiperiodic, aphrodisiac, carminative, digestive, expectorant, febrifuge and tonic.
2. They are useful in amoebic dysentery, diarrhea, asthma, pneumonia, hepatopathy, gastropathy, internal hemorrhage, rheumatism, malaria, vomiting and skin disease. Leaves are used in chronic bronchitis, boils and dysentery.

***Phyllanthus amarus* Schumacher & Thonning, Kongl. Danske Vidensk. Selsk. Skr. 4: 195. 1829.**

**Local name:** Bhui amla.

**Habit:** Erect, annual or biennial, rarely perennial, herb. **Stem:** solid, cylindrical, aerial, base woody, erect, branched, glabrous, differentiated into nodes and internodes, intermodal length varies from 0.5-1 mm, two types of stem- long shoots of unlimited growth without leaves and intermediate or short shoots of limited growth bearing leaves**. Leaf:** two types of leaves- scale like cataphylls on the branching point of stem, triangular shaped, length varies from 0.8-1 mm, green with dark patch on tip; foliage leaves on the short shoots, simple, sparsely pubescent, alternate, shortly petiolate (petiole 0.5mm), stipulate (stipule lanceolate, 0.8-1.1 in length), arranged in two rows so that branches resemble compound leaves; obovate; base rounded; margin entire; apex obtuse; membranous or thinly papery; multicostate reticulate, single primary vein, 4-7 pairs secondary vein, dorsiventrally differentiated, slightly conspicuous abaxially, obscure adaxially, length varies from 3-8mm, breadth varies from 2-4mm, green. **Inflorescence:** axillary cyme. **Flower:** minute, unisexual, actinomorphic, glabrous, male flower on the lower and female flower on the upper side of the same inflorescence. **Male flower:** unisexual, incomplete, actinomorphic, bracteate, pedicillated (0.5-1mm, green), 1.5-2mm, greenish in colour. **Calyx:** sepals 5, polysepalous, glabrous, elliptic, imbricate, entire, apex abruptly acute, 0.5 mm in length, light green, disc of minute glands inside sepals, alternate with sepals, orbicular or obovate, apex truncate, 0.1 mm in diameter, greenish in colour, **Androecium:** stamens 3, monadelphous, polyandrous, filaments fused to form a coloumn, 0.2-0.3mm in length, anther bicelled, basifixed, dehiscence oblique to horizontal, 0.1mm, yellowish. **Female flower:** unisexual, incomplete, actinomorphic, bracteate, pedicillated (06-1mm, green), 1.5-2mm, green in colour. **Calyx:** sepal 5, polysepalous, glabrous, obovate, margin membraneous, apex obtuse, disc subulate, deeply 5 lobed, 0.8-1mm in length, green. **Gynoecium:** carpels 3, syncarpous, glabrous, ovary globose, 3 celled, each cell containing 2 ovules, style terminal, axile placentation, superior, erect, stigma 3, free, bifid, recurved, 0.5mm, green. **Fruit:** globose capsule, sharply 3 anglede, light brown, with 6 straight parallel longitudinal ribs on back, 0.9-1 mm. **Seed:** trigonous, segmentiform, rarely ovoid, ecarunculate; testa crustaceous; albumen fleshy; cotyledons flat or flexuous.

**Flowering:** Throughout the year.

**Specimen examined:** Sanyal 1, Howrah Shibpur; Sanyal 2, Diamond Harbour.

**Uses**

1. The whole plant part is used. It is bitter, astringent, cooling, diuretic, stomachic, febrifuge and antiseptic.
2. It is useful in gastropathy, dropsy, jaundice, diarrhea, dysentery, intermittent fever, ophthalmopathy, disease of urino-genital system, scabies ulcer and wounds.
3. It is well known natural herbal remedy used to maintain the blood pressure in the body. It is also the herbal remedy for Hepatitis B.

***Terminalia arjuna* (Roxb. ex DC.) Wight & Arm, Prodr. 314. 1834. Clarke in Hook. f., l.c.447; Dalz. & Gibson, Bomb. Fl.91.1861; Cooke. l.c.509.; Parker l.c., 240., R.R. Stewart, l.c.**

**Local name:** Arjun.

**Habit:** Tree, up to 6-15m tall with smooth, pale greenish to whitish grey bark. **Stem:** solid, cylindrical to slightly quadrangular, woody, fibrous, mature stem glabrous, brown, young stem pubescent, slightly grooved, differentiated into nodes and internodes, internodal length varies from 10-45mm, green. **Leaf:** Leaves alternate or subopposite coriaceous, exstipulate, crenulate, usually with 2 green glands near the base of lamina, lamina oblong, apex obtuse to mucronate, margin slightly undulate, base acute, petiolated, (petiole green, 4-9mm, grooved, pubescent) dorsiventrally differentiated, pubescent, multicostate, reticulate, single primary vein, secondary vein 12-14 each side of the mid-vein, length varies from 16-96mm,green.breadth 2-4cm, green. **Inflorescence:** compound spike. **Flower:** bisexual, incomplete, regular, bracteates (bract 1, green, lanceolate, 2.5mm) actinomorphic, sessile, 4.5-5mm, greenish**. Calyx:** sepals 5, sometimes 6, connate in a campanulate calyx, gamosepalous, ovate, acute apex, single mid vein, glabrous, valvate, greenish, 2.5mm long. **Corolla:** absent. **Androecium:** stamen 10, sometimes 11 or 12, exserted, episepalous,, present in single whorl, 5 stamen alternate with calyx, other 5 stamens opposite with calyx, filament 3-3.5mm, yellowish green, anther bicelled, dorsifixed, yellow, 0.2-0.3mm.inserted on the calyx tube, with a hairy apigynous disc between stamen and ovary. **Gynoecium:** carpel solitary, Ovary superior, unilocular, ovules 2-3, marginal placentation, style. simple.,

stigma unilobed, greenish, 3.5-4mm. **Fruit:** ovoid, drupaceous, 5 winged, green in young, brown in dry, mature condition, with hard indehiscent endocarp, 2.5-5cm long.

**Flowering:** April-May.

**Specimen examined:** Sanyal 1, Howrah Shibpur; Sanyal 2, Diamond Harbour.

**Uses**

1. Bark is astringent, sweet, acrid, cooling, aphrodisiac, demulcent, cardiotonic, styptic, antidysenteric, urinary astringent, expectorant, lithontriptic and tonic.
2. It is useful in fractures, ulcers, leucorrhoea, diabetes, anemia, fatigue, asthma, bronchitis, tumor, internal and external hemorrhage.
3. It has been traditionaly known for its cardiac properties, since centuries and has been proven by modern research.
4. It is also used in the treatment of cirrhosis of liver.

***Tinospora cordifolia* auct. non (DC). Miers: Hook f. & Thoms. in Hook. f., l.c. 97. Parker, l.c. 9; R.R. Stewart, Ann. Cat. Vasc. Pl. W. Pak. & Kash. 283. 1972.**

**Local name:** Gulancha.

**Habit:** Dioecious climber. **Stem:** solid, cylindrical, mucilaginous, fibrous, 10-11 ridged, branched, sparsely pubescent, differentiated into nodes and internodes, nodes slightly swollen, internodal length varies from 4.5-9.4cm,green **Leaf:** simple, alternate, petiolate (petiole 3-4.5cm thickened and twisted at the base.), alternate, dorsiventrally differentiated, multicostate reticulate, 7-nerved, veins dichotomise near the margin, glabrous, lamina cordate, apex caudate, margin entire, base cordate, Leaves 7.5-13.8 cm long, 9-17cm broad, green. **Inflorescence:** axillary or terminal racemes 7-14cm long. **Flower:** incomplete, unisexual, actinomorphic, mucilaginous, stalked, (2-3mm) bracteates (bract 1, green in colour 1.5mm), sparsely pubescent, 7mm, yellowish green. **Calyx:** sepals 6, in 2 whorl, polypetalous, imbricate, the outer ones small, ovate-oblong, obtuse, concave 1.2mm; the inner large suborbicular, membranous, flat, 2.5-4 mm long, 2-3 mm broad, yellowish green in colour, **Corolla:** petals 6, in 2 whorl, polypetalous, imbricate, rosaceous, subequal, clawed, membranous, smaller than the sepals, 2-3 mm long, 1.2-1.8 mm broad. **Androecium:** stamens 6, excerted, in two whorl, outer whorl opposite to outer corolla whorl, inner whorl opposite to inner whorl of corolla, filaments free, thickened at the apex., mucilaginous, 2.5-3

mm long, greenish, 2 anther on 1 filament, anther 2celled, adnate, 0.5-0.8mm, yellow. **Gynoecium:** carpel 3, apocarpous, ovary single chambered with single ovule, basal placentation, style minute, stigma forked, 2.5mm long, greenish yellow. **Fruit:** Drupes 1-3, ovoid, smooth, crimson, endocarp tubercled, 6-9mm long, 4-5 mm broad, red. **Seed:** usually curved round the intruded endocarp, albumen ruminate. **Flowering:** March-June.

**Specimen examined:** Sanyal 2, Salt Lake, Sanyal 20 Dum Dum.

**Uses**

1. Stem is bitter, astringent, sweet, anodyne, anthelminthic, antispasmodic, anti-inflammatory, antipyretic, antiemetic, digestive.
2. It is carminative, appetizer, stomaching, constipating, cardiotonic, depurative, expectorant, aphrodisiac, rejuvenating and tonic.
3. It is useful in burning sensation, helminthiasis, dyspepsia, flatulence, intermittent fever, chronic fever, inflammation, gout and vomiting.
4. It is also used for the treatment of cardiac debility, skin disease. leprosy, anemia, cough, asthma, general debility, jaundice, seminal weakness and splenopathy.

**Key to the investigated taxa**

With the help of morphological characters an artificial key was prepared which helps in the easy identification of taxa investigated.

1.a. Climber, dioecious, flowers in raceme, sepals in 2 whorl, petals in 2 whorls……***Tinospora cordifolia.***

1.b. Herb, shrub or tree, flowers in cyme, spike, panicle or umbel, sepal in single whorl, petals in single whorl.

2.a. Prostrate, stem cylindrical, glabrous, with or without numerous minute glands.

3.a. Stem woody, ovary inferior, perianth present…….……***Boerhavia diffusa.***

3.b. Stem nonwoody, succulent, weak, ovary superior, sepal and petal present.

4.a. Leaves arise at group at node, petiolate, multicostate, margin dentate, flowers in umbel, actinomorphic ……..……***Centella asiatica*.**

4.b. Leaves arise at opposite decussate manner, sessile, unicostate, margin entire, flowers in solitary axillary cyme……..……...….***Bacopa monnieri.***

2.b. Erect, stem cylindrical or quadrangular, glabrous or pubescent, with or without distinct broader 2 glands.

5.a. Leaves with two green gland at base, fruit drupe, woody……***Terminalia arjuna.***

5.b. Leaves without glands, fruit capsule or follicle, nonwoody.

6.a. Fruit capsule, axile placentation.

7.a. Stem cylindrical, two types of leaves, alternate, flower actinomorphic.

8.a. Two type of stem, long shoots of unlimited growth without leaves & short shoots of limited growth bearing leaves, leaves of scale like and foliage, flower unisexual……..…***Phyllanthus amarus.***

8.b. Single type of stem, long shoots with unlimited growth with ovate and 9 angled leaf, flower bisexual…….....***Abroma augusta.***

7.b. Stem quadrangular, single type of ovate leaf, opposite decussate, flower zygomorphic ……...….***Andrographis paniculata.***

6.b. Fruit follicle, parietal placentation.

9.a. Shrub, without sweet smell, anther at throat of corolla tube, stigma anulate, viscid, with reflexed membrane, penicillate…….…….***Catharanthus roseus.***

9.b. Tree, with sweet smwll, anther at base of corolla tube, stigma oblong to fusiform, tip 2 toothed…. ***Holarrhena antidysenterica.***

## DISCUSSION

From the detailed morphotaxonomical study of 10 medicinal plants of the family Sterculiaceae, Acanthaceae, Scrophulariaceae, Nyctaginaceae, Apocynaceae, Apiaceae, Euphorbiaceae, Menispermaceae and Combretaceae represented by various characteristics. The vegetative as well as reproductive features vary greatly. Among the ten taxa, three (*Abroma augusta, Terminalia arjuna* and *Holarrhena antidysenterica*) are trees, three (*Bacopa monnieri, Boerhavia diffusa* and *Centella asiatica*) are prostrate herb, three (*Andrographis paniculata, Catharanthus roseus* and *Phyllanthus amarus*) are erect herb and one (*Tinospora cordifolia*) is climber.

Stem of most of the investigated taxa are cylindrical. Quadrangular stem is only found in *Andrographis paniculata*. Succulent stem is only found in *Bacopa monnieri* and *Centella asiatica*. Stem surface are often glabrous (*Bacopa monnieri, Boerhavia diffusa, Catharanthus roseus, Centella asiatica, Holarrhena antidysenterica, Phyllanthus amarus*) or pubescent (*Andrographis paniculata, Abroma augusta). Boerhavia diffusa* has glands on its stem and leaves. Leaves are alternate only in *Phyllanthus amarus, Tinospora cordifolia* and *Abroma augusta*, in other taxa it is opposite decussate. Shape of the lamina is various. In most cases it

is ovate. Obovate leaf is found in *Phyllanthus* and *Catharanthus roseus*, in *Tinospora cordifolia* it is cordate; reniform leaf is found in *Centella asiatica*. Leaf apex is mostly acute but in a few investigated taxa acuminate and rounded leaf apex is observed.

Inflorescence is generally axillary cyme, but umbel (*Centella asiatica*), spike (*Terminalia arjuna*), raceme (*Tinospora cordifolia*), terminal panicle (*Andrographis paniculata*) are also found. Flowers are actinomorphic, bisexual; zygomorphic flower is in *Bacopa monnieri* and *Andrographis*, unisexual flower is in *Phyllanthus amarus* and *Tinospora cordifolia.* Epigynous flower is only found in *Centella asiatica* and *Boerhavia diffusa*. Calyx is generally in single whorl, gamosepalous; polysepalous calyx is found in *Catharathus roseus*, *Tinospora cordifolia*, *Bacopa monnieri* and *Holarrhena antidysenterica*; in *Tinospora cordifolia* it is in two whorls. Corolla is gamopetalous, but polypetalous corolla is in *Centella asiatica* and *Tinospora cordifolia*; corolla is absent in *Terminalia arjuna* and *Phyllanthus amarus;* in *Boerhavia diffusa*, instead of corolla perianth is present. Epipetalous stamen is found in *Terminalia arjuna*, *Bacopa monnieri*, *Andrographis paniculata*, *Catharanthus roseus* and *Holarrhena antidysenterica*. Anthers may be basifixed, dorsifixed or saggitate. Number of carpels varies from 1-3 in different taxa. Placentation may be axile (*Phyllanthus amarus*, *Centella asiatica*, *Abroma augusta*, *Andrographis paniculata*), marginal (*Terminalia arjuna*), parietal (*Bacopa monnieri*, *Catharanthus roseus* and *Holarrhena antidysenterica*), basal (*Boerhaavia diffusa* and *Tinospora cordifolia*).

Fruits are of different types, anthocarp (*Boerhavia diffusa*), cremocarp (*Centella asiatica*), follicle (*Catharanthus roseus*, *Holarrhena antidysenterica*), drupe (*Terminalia arjuna*, *Tinospora cordifolia*) and capsule (found in rest taxa).

The study of the chemical constituents and the active principles of the medicinal plants have acquired a lot of importance all over the world. The present study includes the phytochemical screening of the ten plants. Here the qualitative chemical tests for the methanolic extracts were performed. The results were given in Table 1 and Table 2.[10-21]

**Table 1: Preliminary qualitative test of different plant methanolic extracts.**

| Components | *Terminalia arjuna* | *Boerhavia diffusa* | *Abroma augusta* | *Catharanthus roseus* | *Phyllanthus amarus* |
|---|---|---|---|---|---|
| Alkaloids | +++ | +++ | + | +++ | + |
| Tannins | +++ | - | ++ | +++ | +++ |
| Saponins | ++ | + | - | + | ++ |
| Flavonoids | +++ | +++ | - | +++ | +++ |
| Phlobatannins | - | - | - | - | - |
| Reducing sugar | +++ | +++ | +++ | ++ | +++ |
| Protein | +++ | + | - | +++ | + |
| Steroid | + | + | - | + | + |
| Glycosides | +++ | ++ | - | + | + |
| Terpenoids | ++ | + | - | + | + |

**+++Highly present, ++Modererately present, +Present in low amount, –Absent.**

**Table 2: Preliminary qualitative test of different plant methanolic extracts.**

| Components | *Bacopa monnieri* | *Centella asiatica* | *Andrographis paniculata* | *Tinospora cordifolia* | *Holarrhena antidysenterica* |
|---|---|---|---|---|---|
| Alkaloids | + | + | +++ | + | +++ |
| Tannins | +++ | - | +++ | +++ | +++ |
| Saponins | +++ | + | - | + | ++ |
| Flavonoids | ++ | +++ | + | + | +++ |
| Phlobatannins | - | - | - | - | + |
| Reducing sugar | ++ | +++ | ++ | ++ | +++ |
| Protein | + | +++ | + | - | +++ |
| Steroid | + | + | - | - | +++ |
| Glycosides | +++ | + | - | - | - |
| Terpenoids | + | ++ | - | - | - |

## PLATES AND FIGURES

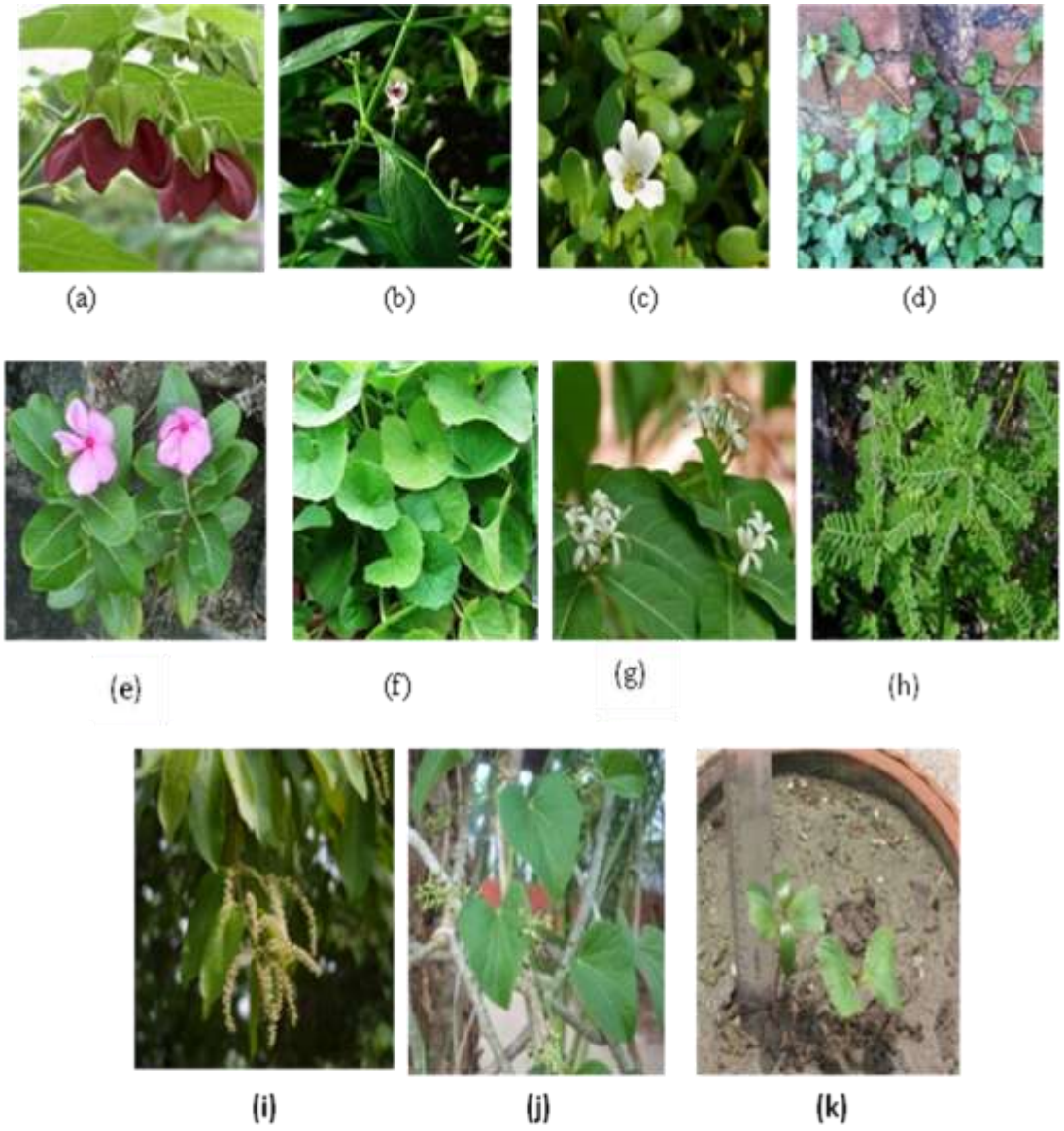


PLATE I: Adult plant body of investigated taxa.

(a). *Abroma augusta*
(b). *Andrographis paniculata*
(c). *Bacopa monnieri*
(d). *Boerhavia diffusa*
(e). *Catharanthus roseus*
(f). *Centella asiatica*
(g). *Hollarhena antidysenterica*
(h). *Phyllanthus amarus*
(i). *Terminalia arjuna*
(j). *Tinospora cordifolia.*
(k). Seedling of *Terminalia arjuna*

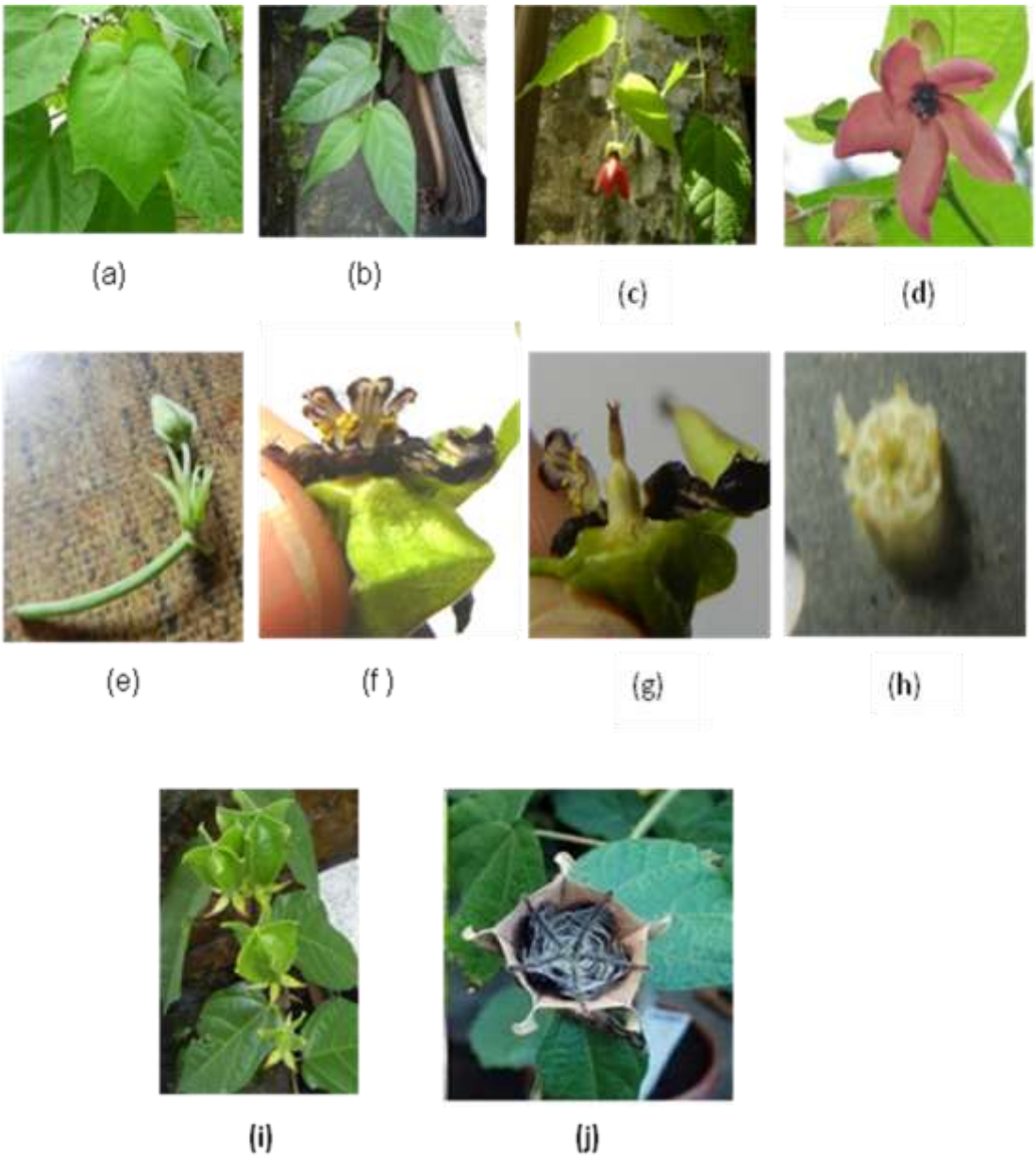


PLATE II: Different parts of *Abroma augusta*

(a). Angled leaf
(b). Ovate leaf
(c). & (d). Flower
(e). Bud
(f). Stamen with attached to staminode
(g). Carpel
(h). T.S of ovary
(i). Young fruit
(j). Dehisced fruit

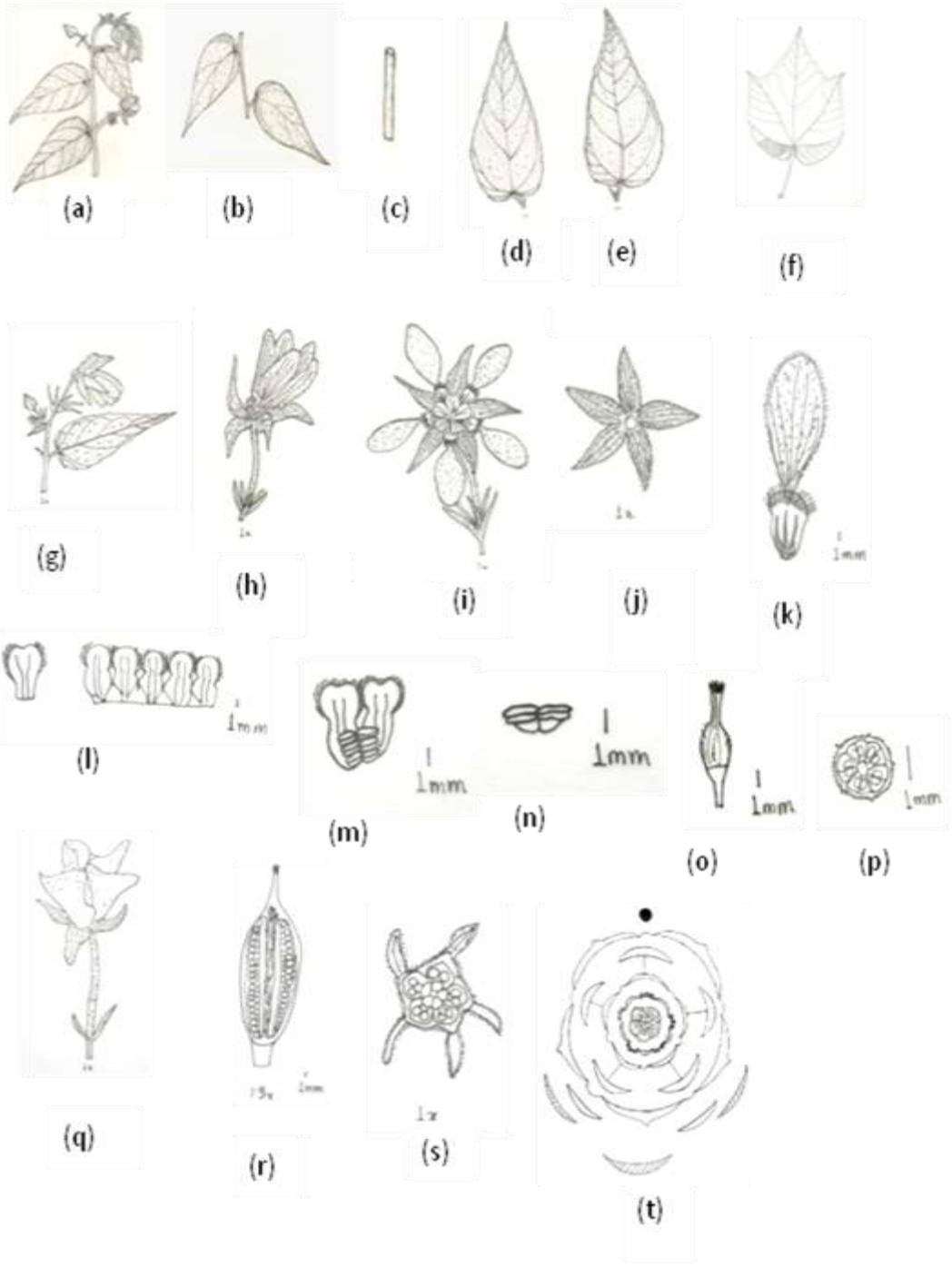


FIGURE 2: Different parts of *Abroma augusta*.
(a). Habit sketch, (b). Phyllotaxy, (c). Portion of stem, (d).Dorsal surface of ovate leaf, (e). Ventral surface of ovate leaf, (f).Palmate leaf, (g). Inflorescence (h). Side view of flower (i). Top view of flower (j) Calyx, (k). Single petal. (l). Staminode (m). Anther with staminode, (n). Single anther, (o). Gynoecium, (p). T. S. of ovary. (q). Fruit. (r). L.S of fruit, (s). T. S of fruit, (t). Floral diagram.

## CONCLUSION

The morphological characters were used for the construction of artificial key which helped in the easy identification of taxa. The various phytochemical compounds detected are known to have beneficial importance in medicinal sciences. For instance: flavonoids have been referred to as nature's biological response modifiers, because of their inherent ability to modify the body's reaction to allergies and virus and they showed their anti-allergic, anti-inflammatory, anti-microbial and anti-cancer activities.[22] Alkaloids have been used to treat diseases like malaria, pain killers and managing heart diseases.[23] Glycosides serve as defense mechanisms against predation by many microorganisms, insects and herbivores. Tannins can inhibit the growth of microorganisms and act as an antifungal agent.[24] Saponin is used to allow antibody access in intracellular proteins.[25]

All the ten plants discussed here exhibited significant clinical and pharmacological activity. Different combinations of active constituents after isolation and identification can be made and have to be further evaluated for the synergetic effect. Preparation of standardize dose and dosage regimen may play a crucial role in therapeutics for mankind.

## REFERENCES

1. H. Ahsan, A. Ahad, J. Iqbal, W. A. Siddiqui, Pharmacological Potential of Tocotrienols: A Review. Nutrition and Metabolism, 2014.
2. Nostro, A. Gemano, V. Dangelo, A. Marino. M. A. Cannatelli, Extraction methods and bioautography for evaluation of medicinal plants antimicrobial activity", Lett Appl microbial, 2000; 30(5): 379-384.
3. Doctor, T. R. and Manuel, J. F, Phytochemical Screening of Selected Indigenous Medicinal Plants of Tublay, Benguet Province, Cordillera Administrative Region, Philippines. International Journal of Scientific and Research Publications, 2014; 4(4).
4. R. Jalonen, K. Y. Choo, L. T. Hong and H. C. Sim. Forest genetic resources conservation and management. Status in Seven South and South-east Asian Countries. FRIM, Biodiversity International and APAFRI, 2009.
5. R. Small and P. M. Catling, Canadian Medicinal Plant Biodiversity Priority Issues, 2003.
6. M. Ahvazi, F Khalighi-Sigaroodi, M. M. Charkhchiyan, F. Mojab, V. A. Mozaffarian and H. Zakeri, Introduction of Medicinal Plants Species with the Most Traditional Usage in Alamut Region, Iranian Journal of Pharmacological research, Iran J Pharm Res. Winter, 2012; 11(1): 185–194.

7. V. N Naik, Taxonomy of Angiosperm. Tata McGraw Hill, Education, 1984; 197.
8. Wadood et al. Phytochemical Analysis of Medicinal Plants Occurring in Local Area of Mardan, Biochem Anal Biochem, 2013.
9. R. Bisht and S. Bhattacharaya, Phytochemical and antibacterial screening of root extracts of *Abroma augusta* Linn. *Der Pharmacia Sinica*, 2013; 4(3): 75-79.
10. S. Deepak, A. Pawar and P. Shinde, Study of antioxidant and antimicrobial activities of *Andrographis paniculata.* Asian Journal of Plant Science and Research, 2014; 4(2): 31-41.
11. C. Majee, B. K. Gupta, R. Mazumder, G. S. Chakraborthy, HPLC Method Development and Characterization of Bio-Active Molecule isolated from *Andrographis paniculata*. International Journal of PharmTech Research, CODEN (USA): IJPRIF ISSN: 0974-4304, 2011; 3(3): 1586-1592.
12. B. B. Joshi, G. Megha, H. Patel, B. Dabhi, K. N. Mistry, In vitro phytochemical analysis and anti-microbial activity of crude extract of *Bacopa monniera*, Bulletin of Pharmaceutical and Medical Sciences (BOPAMS.), 2013; 1: 2.
13. K. Azad, M. Awang, M. M. Rahman, Phytochemical and Microbiological Evaluation of a Local Medicinal Plant *Bacopa monnieri* (l.) Penn. International Journal of Current Pharmaceutical Review and Research, 2012; 3(3): 66-78. ISSN: 0976-822X.
14. K. Meena, U. S. Niranjan, A. K. Yadav, B. Singh, K. Rao, Quality Assessment of *Boerhaavia diffusa* Linn. Commonly Known as 'Punarnava' Plant. International Journal of Pharmacognosy and Phytochemical Research, 2010; 2(1): 25-28.
15. S. Shalini and P. Sampathkumar, Phytochemical screening and antimicrobial activity of plant extracts for disease management. International Journal of Current Research. SCI, 2012; 209-218.
16. M. M. Rahman, M. S. Sayeed, M. A. Haque, M. M. Hassan and A Islam, Phytochemical screening, Antioxidant, Anti-Alzheimer and Anti-diabetic activities of *Centella Asiatica.* Journal of Natural Product and Plant Resources, 2012; 2(4): 504-511.
17. J. James and I. Dubery, Identification and Quantification of Triterpenoid Centelloids in *Centella asiatica* (L.) Urban by Densitometric TLC. Journal of Planar Chromatography, 2011; 82–87.
18. E. D. Umoh, Ukana, D. Akpabio and E. Udo, Phytochemical screening and nutrient analysis of *Phyllanthus amarus*. Asian Journal of Plant Science and Research, 2013; 3(4): 116-122.

19. S. Mandal, A. Patra, A. Samanta, S. Sanyal, A. Mandal, T. D. Mahapatra, S. Pradhan, K. Das and D. K. Nandi, Analysis of phytochemical profile of *Terminalia arjuna* bark extract with antioxidative and antimicrobial properties. Asian Pacific Journal of Tropical Biomedicine, 2013; 3(12): 960–966.
20. P. Mishra., P. Jamdar, S. Desai, D. Patel and D. Meshram, Phytochemical analysis and assessment of in vitro antibacterial activity of *Tinospora cordifolia.* International Journal of Current Microbiology and Applied Science. ISSN: 2319-7706, 2014; 3(3): 224-234.
21. Vishwanath Sardesai, Introduction to Clinical Nutrition, 3rd Edition, 2011; 267.
22. D.M. Musyimi, J.A. Oqur and P. M. Muema, Effects of Leaf and Root Extracts of Aspilia Plant (*Aspilia mossambicensis)* (Oliv) Wild. on Some Selected Micro-Organisms, 2007. Science Alert.
23. B. Shinde1 and Y. R. Mulay, Phytochemical Analysis And Antibacterial Properties Of Some Selected Indian Medicinal Plants. International Journal of Current Microbiology and Applied Science. *ISSN: 2319-7706,* 2015; 4(3): 228-235.
24. L.C. Javois, Immunoctytochemical: Methods and Protocols. Springer Science & Business Media, Spp, 1999; 46.