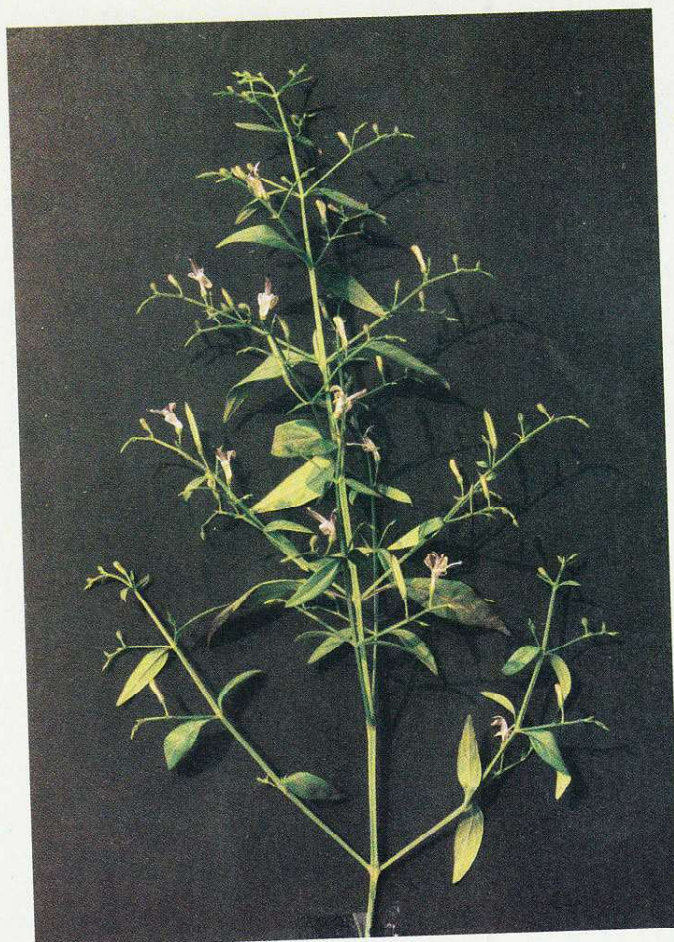


ANDROGRAPHIS PANICULATA

J. Raj¹, K.P. Singh²



Botanical name

Andrographis paniculata
(Burm.f.) Wall.

ex Nees

Shwetakunha, Shankini,
Sookshmapushapa,
Tiktaphala, Yavi,
Yashaswni.

Synonyms

Justicia paniculata
Burm.f.

Siddha

Nilavempu

Unani

Kalmegh, Bhuineem.

Family

Acanthaceae

Homoeopathy

Andrographis
paniculata

Classical names as adopted in various traditional systems of medicine viz. Ayurveda, Siddha, Unani, Homoeopathy etc.

Trade name

Kalmegh, Kirayat.

Ayurveda

Kaalamegha, Yavatikta,
Shwetatikta,

Vernacular names

Bengali: *Kalmegh*; Gujarati: *Kariyatu*;
Hindi.: *Kalmegh, Kirayat, Mahatita*; Kannada:

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Nelaberu; Malayalam: *Kiriyattu, Nelaveppu*; Marathi: *Olikiryata*; Oriya: *Bhunimba*; Tamil: *Nilavembu*; Telegu: *Neelaveemu*. Arabic: *Qusabhuva, Qasabuzzarirah*; Sanskrit: *Bhunimba, Kirata*; English: *The Creat, The great king of biters, Chiretta*.

Botanical description

An erect annual, 0.3-1.0 m high, stem dark green, 2-6 mm in diameter, quadrangular with longitudinal furrows and wings at angles of the younger parts, slightly enlarged at the nodes. Leaves 5-8 x 1.2-2.5 cm, lanceolate, acute, glabrous, slightly undulated, pale beneath, base tapering; petioles 0.6 mm long. Flowers small, solitary, in lax spreading, axillary and terminal racemes or panicles, the whole forming a large pyramidal paniculate inflorescence; bracts 2.5 mm long, lanceolate; bracteoles similar or absent; pedicels 0.8-4 mm long, glandular pubescent. Calyx 3 mm long; sepals equal, linear, lanceolate, glandular, pubescent. Corolla rose-coloured, 1 cm long, hairy outside, 2-lipped rather more than half way down, tube 5 mm long, slightly enlarged below the limb, upper lip 4 mm long, oblong, 2-toothed at the apex, lower lip equal in length, deeply lobed, the lobes 2.5 mm long, linear-oblong, sub-obtuse. Stamens 2, filaments flattened, hairy in the upper part, anthers exerted, 2-celled, bearded at the base. Ovary glabrous, style slightly pubescent. Capsule 2 x 0.3 cm, linear-oblong, acute at both ends. Seed numerous, subquadrate, yellowish-brown.

Distribution

Throughout India in plains and hills from Himachal Pradesh to Assam and Mizoram, all over South India, Bangladesh, Pakistan, all South-East Asian and SAARC countries. Common in shady places, waste-lands and roadsides throughout warmer parts of India. Cultivated as an ornamental plant.

Availability (Abundant/rare/threatened/ endangered etc.) Abundant

Part used Whole plant.

Action and uses

Traditional system

Traditional use of the Plant: febrifuge, alterative, anthelmintic, anodyne, useful in debility, diabetes, consumption, influenza, bronchitis, itch-

ing and piles. *Andrographis paniculata* leaf, a constituent of "Kalmegh", a household medicine used in Bengal, has a very good reputation in intermittent fever. *Tribal use:* *Lodhas* prescribe root paste about 10 gm against general debility of children and give plant decoction 15 ml in the treatment of fever. *Santals* take leaf juice about 5 ml for 2-3 days after meals, in colic pain. *Mundas* use saturated infusion of the whole plant to control fever.

Ayurvedic system

तिक्ताम्ला दीपनीरुच्या रेचनी च विषास्त्रानुत्।
क्रिमिकष्ठज्वरहरी वालानां शुभदायिनी।।
(द्रव्यगुण)

Tiktamla dipani rucya recani ca visasranut
krimikusthajvarahari valanam subhadayini.
(Dravyaguna)

*Deepana, yakriduttejaka, pittashama-
nakari, krimighna, raktashodhaka, shothahara,
swedakari, kushtaghna, jwaraghna, vishado-
shahara.*

Roots and leaves are used as stomachic, tonic, alterative, anthelmintic, febrifuge and cholagogue. In the form of *Kalmegh (Alui)*, it is used for general debility, dysentery, and certain forms of dyspepsia associated with gaseous distention of the bowels. In addition, it forms the major constituent of the Ayurvedic drug SG-1 (*Switradilepa*) which is effective in treating vitiligo.

Unani system

Green leaves are used as a tonic and alterative in syphilitic cachexia and foul syphilitic ulcers.

Homoeopathic system

Proved at Homoeopathic Medical College and Research Centre, Midnapore. The drug was first proved by Dr. P. P. Biswas. It has proved its worth in the first stage of cold and cough, convalescence after prolonged fever, general debility, infantile liver and jaundice.

Modern system

Stem, leaf and inflorescence: used as a tonic and in the treatment of fever, worms, dysentery and also beneficial for liver and digestive ailments; it is reported that it has some antityphoid and antibiotic activity. Its decoction is used for sluggishness of liver and in jaundice.

Pharmacognostic

Macroscopic

Stem dark green in colour, 0.3-0.9 m in height attaining diameter of about 2-6 mm, quadrangular with longitudinal furrows and wings at angles of the younger part and slightly enlarged at the nodes. Leaves opposite, decussate, lanceolate, up to 8 cm long and 2-5 cm broad, glabrous, margin entire, venation pinnate; petiole very short. Flowers small with bilabiate corollas. Fruit a small 2-celled capsule. Odourless; taste intensely bitter.

Microscopic

Leaf

Upper epidermis of straight-walled cells, stomata absent; lower epidermis of wavy-walled cells, stomata abundant, diacytic, stomatal index 16 to 24; large number of elongated cystoliths with blunt ends, and some rounded cystoliths present on both the epidermises; trichomes numerous, of two types, glandular and nonglandular; the glandular one consists of a short stalk of single cell upto 20 μ m long with a head of eight cells, appearing as disc shaped in surface view; while the nonglandular are small, conical, 1-3 celled, and are distributed on the upper surface mostly towards margin. Palisade cells, single layered, with palisade ratio 3 to 5.5; spongy cells occupying more than half of the thickness of the leaf. The midrib varies in outline at different parts of the leaf. A large fan-shaped vascular bundle is present in the centre surrounded by parenchymatous ground tissue and hypodermal collenchyma; few acicular crystals of calcium oxalate scattered in parenchyma.

Stem

Quadrangular with four projections at 4 corners made of collenchyma tissue; trichomes as in leaf, covering trichomes mostly unicellular; outer cortex of alternate zone of collenchyma and chlorenchyma and inner cortex of 5-6 layers of thin-walled parenchyma; endodermis distinct with casparian dots; pericycle of discontinuous ring of fibres. The vascular bundle is ectophloic siphonostele; small acicular crystals of calcium oxalate present in pith and cortex.

Flowers

Calyx with trichomes and stomata as in leaf; corolla with large number of hair distributed on both the surfaces. Stamens contain both covering and

glandular trichomes, Cystolith is present in the epidermis of the bract, bracteoles and sepals and absent in other parts of the flower.

Powder

Andrographis in powdered form, shows presence of large number of elongated cystoliths with blunt ends in the epidermal layers. Presence of glandular and non-glandular hair, and typical dicot-like spongy and palisade layers of cells. Large number of pitted and spiraled tissue of the xylem of stems and acicular crystals of calcium oxalate are also present.

Standards and tests

<i>Andrographolide</i>	Not less than 1 %.
<i>Foreign organic matter</i>	Not more than 2 %.
<i>Ash</i>	Not more than 20 %.
<i>Acid insoluble ash</i>	Not more than 5 %.
<i>Alcohol (60%) soluble extractive</i>	Not less than 24 %.
<i>Water soluble extractive</i>	Not less than 20 %.

Assay

Exhaust about 20g accurately weighed, of the powdered drug in a small soxhlet by means of chloroform. Evaporate the chloroform and wash the crude green mass with benzene. Extract the mass repeatedly with ethylacetate till the residue gives no bitter taste. Combine the ethyl acetate extractives, evaporate and weigh.

Chemical constituents

The whole plant is reported to contain the following lactones: andrographolide, 0.6%; 14-deoxy-11-oxo andrographolide, 0.12%; 14-deoxy-11,12-didehydroandrographolide, 0.06%; 14-deoxy-andrographolide, 0.02% and a non-bitter constituent - neoandrographolide, 0.005%. The leaves contain andrographolide (yield 1%). The following constituents have been isolated from petroleum ether extract of the leaves from Bangladesh: a-, b-unsaturated lactone, homoandrographolide, andrographosterol, andrographane, andrographone, wax and two esters containing hydroxyl groups. The roots contain flavonoids- andrographin, panicolin, apigenin-4'-7 dimethylether, mono-o-methylwightin

and 5-hydroxy 7,8,2,3,- tetramethoxyflavone and β -sitosterol; diterpenoid and sesquiterpenoid; neoandrographolide and 13-lappadien-16, 15 olide along with previously reported compounds, andrographolide, deoxy- andrographolide, 14-deoxy-11-oxoandrographolide, 14-deoxy-11, 12-didehydroandrographolide, neoandrographolide, 14-deoxyandrographolide - 19- β -D-glucoside, andrographolide -19- β -D-glucoside, 5-hydroxy-2',7,8-trimethoxyflavone, 2',5-dihydroxy-7, 8-methoxyflavone, apiginine -4',7-dimethylether, mono-o-methyl-wightin, 5-hydroxy-7, 8-dimethoxy-flavonone and 5-hydroxy- 3,7,8, 2'-tetramethoxyflavone, a new constituent procumbide was also isolated; from the ethyl acetate soluble fraction of the methanol extract six new diterpenoids of entlabdane type, and four new diterpene dimers, bis-andrographolides AB & D were isolated along with 6 known compounds; a novel monoterpene and new glycoside have also been isolated.

Pharmacology

Apigenin-7,4' - di-o-methyl ether produced significant dose dependent antiulcer activity in rats, in histamine induced ulcer in guinea pigs and in aspirin induced ulcers in rats. Total root flavonoids were reported to be effective in experimental myocardial ischemic necrosis induced by isoprenaline in rats and by ligation of left descending coronary artery in rabbits. It also decreased infarction size. Pathological changes in ST segment and Q wave were inhibited. Andrographolide (5 mg/ kg and 10 mg/kg) or single dose of leaf extract (0.5g/kg and 1g/kg) given orally to adult male rats produced dose related and time dependent characteristic activation of brush-border membrane bound hydrolases, lactase, maltase and sucrase in duodenum, jejunum and ileum. Plant extract exhibits anti-typhoid, anti-fungal and antibiotic activity. Dry leaf powder at a dose of 20mg powder/day for 60 days resulted in cessation of spermatogenesis in albino rats. Flavone extract from the root prevent the formation of thrombi and development of myocardial infarction. Andrographolide showed significant anticholestatic effect. Ethanol extract and andrographolide induced significant stimulation of antibody and delayed type hypersensitivity response to sheep's red blood cells in mice. Alcoholic extract and diterpenes-andrographolide and neoandrographolide showed significant antihepatotoxic action in *P. bergeighjei* K 173-induced hepatic damage in *M. natalensis*.

Toxicology

LD₅₀ of flavonoids isolated from *Andro-*

graphis paniculata was reported to be 1.15 g/kg intravenously in mice.

Information related to therapeutic evaluation

Dose

Homoeopathy - Mother tincture; 3x, 6x, 30x.
Ayurveda - 0.5 to 1 ml

Formulations and preparations

A. Homoeopathic Mother Tincture preparation

Andrographis paniculata moist
magma containing solids 100 g.
and plant moisture 300 ml. 400g.
Purified Water 100ml.
Strong Alcohol 635ml.
To make one litre of the Mother Tincture.

(i) Potencies

2x with Dilute alcohol. 3x and higher with Dispensing alcohol.

(ii) Standards of the finished product

Alcohol content	57.0 to 61.0 % v/v.
pH	5.50 to 6.90
Wt. per ml	0.903 g. to 0.925 g.
Total solids	Not less than 0.53 %
1 max	260 nm.

(iii) Identification

Carry out TLC using chloroform: methanol (9:1: v/v) as mobile phase. Under UV light-six spots appear at Rf.0.05, 0.30, 0.53, 0.67, 0.75 and 0.83

B. Ayurvedic preparations

Kalmegh, Kalmeghsava, Navayas churna.

C. Unani

Kalmegha Mayas Haub.

Trade and commerce

Sold in Andhra Pradesh for medicinal purpose.

Substitutes and adulterants

It is used as an adulterant to genuine chirata (*Swertia chirata*).

Agrotechniques

The plant is gregarious and grows abundantly in moist shady waste grounds and sometimes in dry forest; it is also cultivated. It prefers a sunny situation. The seeds are sown during May-June. The seedlings are transplanted at a distance of 60 cm x 30cm. Two or three irrigations may be given during the dry periods. It flowers during Aug-Nov, and the whole plant starts maturing during Feb-March when it is harvested for the drug. In Andhra Pradesh, it is collected during November-January. The whole plant is dried in shade and sold.

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"The spiritual power of medicine achieves its object not by quantity but by quality."

S. Hahnemann
"Spirit of the new theory of Healing"

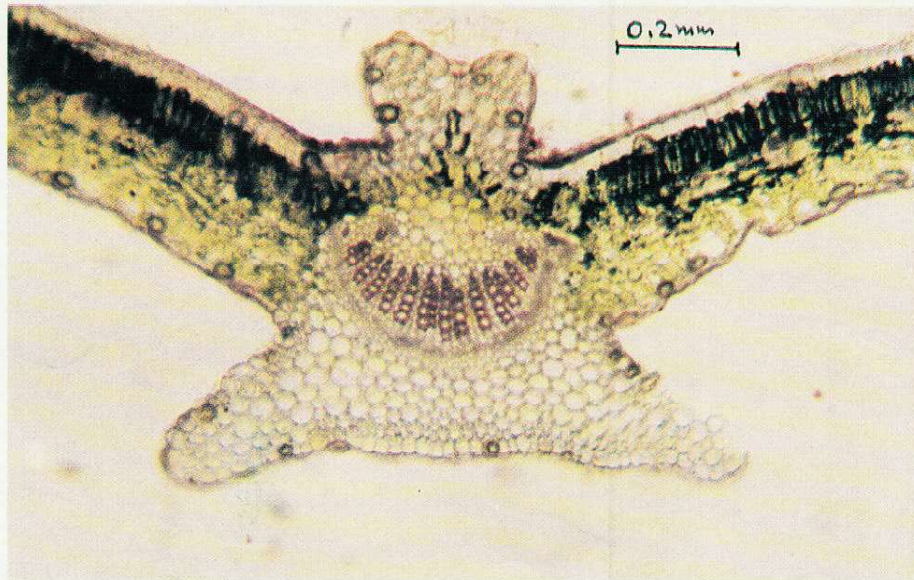


Fig. 1. Transection of leaf through midrib region showing a fan-shaped vascular bundle, cystoliths in epidermis and dorsiventral lamina.

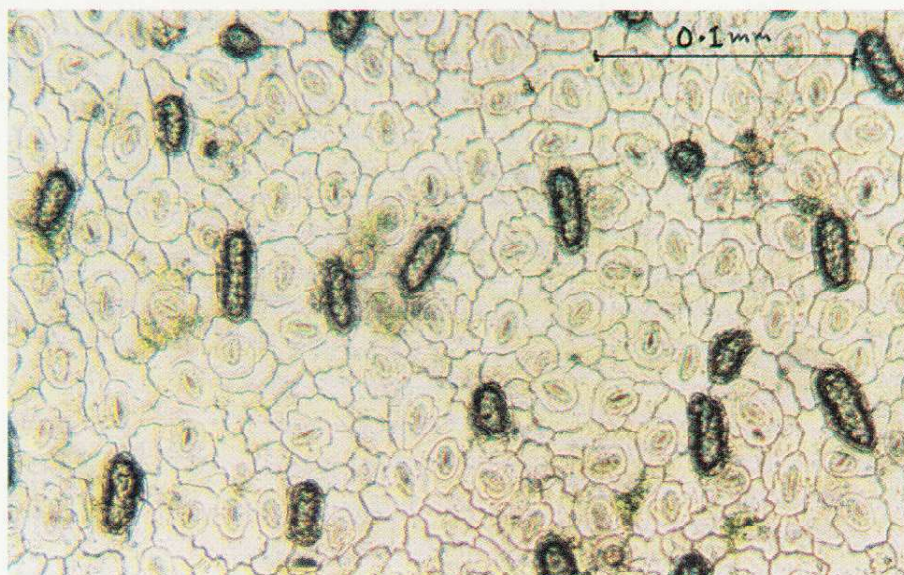


Fig. 2. Surface view of epidermis showing diacytic stomata, cystoliths and disc-shaped head of glandular trichomes.

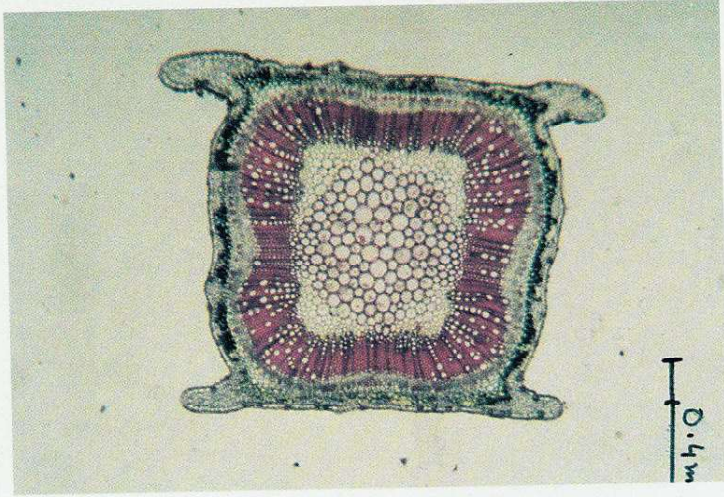


Fig. 3. Transection of stem showing four projections at four corners and ectophloic siphonosteles.

Fig. 4. Transection of stem, a portion enlarged to show projections composed of collenchymatous tissue, cortex, pericyclic fibres, ectophloic siphonosteles and acicular crystals in pith.

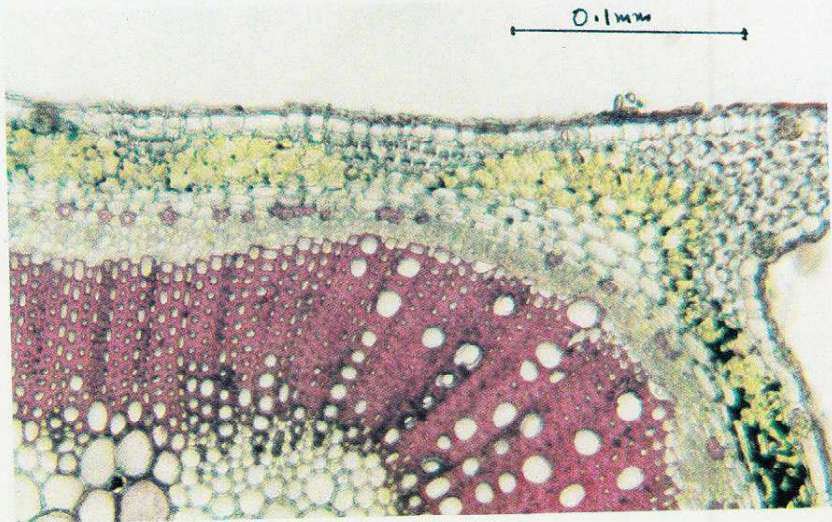
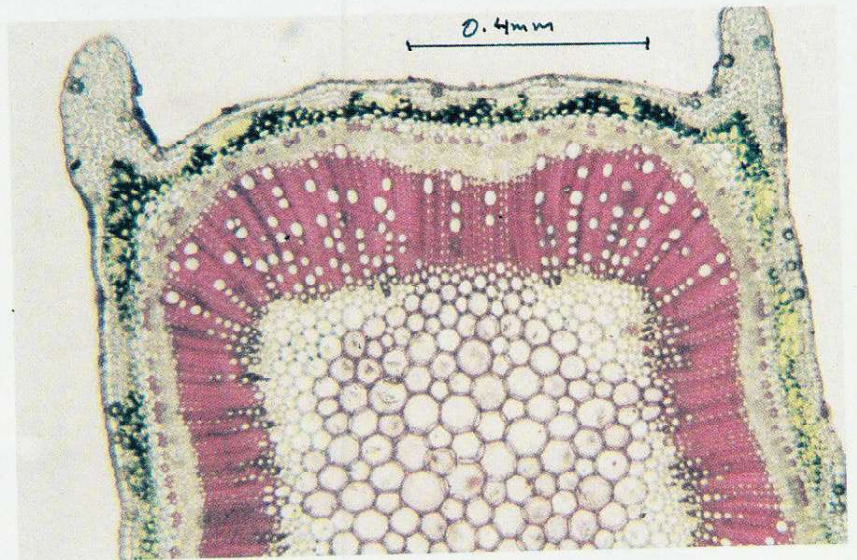


Fig. 5. Transverse section of stem, a portion magnified to show cystoliths in epidermis, outer cortex of alternate zone of collenchyma and chlorenchyma, discontinuous ring of pericyclic fibres, phloem and xylem.