

Seedling morphology of three species of *leucas* (roth.) spreng. (lamiaceae) and its taxonomic implication

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Abstract

An overview on morphotaxonomic observations of juvenile stages and seedlings in 3 species of *Leucas* upto 5th leaf stages have been enumerated in the present paper. Morphological features of seedling like collet, hypocotyl, epicotyl, shape and arrangement of paracotyledons, leaf base, colour, phyllotaxy, number of veins etc. show affinity represent high level of constancy within taxon. These characters and features of seedlings have been found useful from taxonomic point of view in solving taxonomic problems, identification, conservation and eradication of taxa at juvenile stage.

Key words : *Leucas*, Seedling morphology, Taxonomy.

INTRODUCTION

A weed is a plant growing where it is not desired^[1]. So long as a plant is growing at a place and time without interfering with man's interest, it is not looked upon as a weed. In other words, while all weeds are unwanted plants, all unwanted plants may not be weeds. In this sense it is very important that plants listed as weeds are qualified by the situation in which they adversely affect man's affairs. This situation may be a crop field, roadside, railway tracks, air field, water bodies, woodland, garden, orchard etc. Besides very harmful effects in crop fields etc., weeds have many useful aspects also. For instance, fruits and rhizomes of certain weeds are used as vegetables, food material and medicines. The genus *Leucas* comprises about 100 species^[2]. An overview of the seedling morphology on the 3 species of *Leucas* is presented in this study i.e. *Leucas cephalotes* (Roth.) Spreng., *Leucas linifolia* Benth. and *Leucas nutans* (Roth.) Spreng. The flowering annual herb *Leucas cephalotes* (Roth.) Spreng. is a common weed. It is used as an edible vegetable and in herbal remedy. It is found in cultivated fields as a weed, especially after rainy season from September to February. It is distributed from E. Afghanistan, Pakistan, Assam to Deccan^[3] and Himalayan from Kashmir to Bhutan^[2]. This plant is pungent in taste and considered as stimulant, diaphoretic, laxative, anthelmintic, antiseptic and insecticide. Syrup of flower is used as a domestic remedy for coughs and colds. It is a valuable homoeopathic drug and used for the treatment of chronic malaria and asthma. *Leucas linifolia* Benth. is an annual erect herb of 35-75 cm high. It distributed from Kashmir, Kumaon to Sikkim, Burma, Indo- Malayasia and plains of India^[2]. A decoction of leaves (or crushed leaves) of this plant is used as a sedative in nervous disorders. It is also used as vermifuge and stomachic. A paste of fresh leaves is applied to old sores and wounds. Crushed leaves are used externally for dermatosis. The flowering period of *Leucas nutans* (Roth.) Spreng. is from August to February. It is distributed from Peninsular India, north India including Saharanpur and Dehradun^[2], Pakistan, Burma to Sri Lanka, Mayanmar^[3]. This herb is used to provide fragrance to food, also used as antioxidant, antimicrobial, antifungal, antipyretic, in scorpion bites and in fevers. Juice of flower can be extracted and

used to treat sinusitis and headaches.

MATERIALS AND METHODS

The mature and ripen seeds were collected from natural habitat in Saharanpur forest division (U. P. India) in 2011 and 2012 and dried in the sun for one week. Morphological observations have been made with the help of hand-lens, dissecting and compound microscope. For correct identification, seedlings were collected from natural habitat and were compared and identified with the help of seedling raised from identified seeds. For the morphological observations of seedling, seeds of *Leucas cephalotes* and *Leucas linifolia* were sown in the garden soil at a depth of 0.5 cm in March, 2011 (08.03.2011), while seeds of *Leucas nutans* were sown in the garden soil at a depth of 0.5 cm in February, 2012 (08.02.2012). Seedlings started protruding above the soil on 8th 5th and 7th day respectively. The seedlings took another 55, 37 and 56 days to reach the 5th true leaf stage. In the present study morphological features of the seedlings have been described according to the terminology given in several elaborated works^{[4], [5], [6]}. Besides, deeds on seedling morphology of several other authors^{[7], [8-9], [10-13]} have been followed in this study. Day and date of appearance of leaves upto 5th true leaf stage were also recorded (Table 1, 2 and 3). Observations have been made on six seedlings of each species.

Observations:

KEY TO THE SPECIES OF *LEUCAS*

1a. Hypocotyl white.....2. *L. linifolia*

1b. Hypocotyl green

2a. Paracotyledons persistent upto second true leaf stage..... 1. *L. cephalotes*

2b. Paracotyledons persistent upto fifth true leaf stage.....3. *L. nutans*

1. *Leucas cephalotes* (Roth.) Spreng., Syst. Veg. 2: 743. 1825. Benth. in DC., Prodr. 12: 532. 1848; J. L. Stewart in Journ. Agr. Hort. Soc. India 1, 1: 99. 1867; Hook. f., Fl. Brit. Ind. 4: 689. 1885; Mukerjee in Rec. Bot. Surv. Ind. 14, 1: 168. 1940; Wealth of

Leucas cephalotes (Roth.) Spreng**Table 1.** Day and date of appearance of different leaves.

S. No.	Appearance of different leaves	Day	Date
1.	Seed leaf	8 th day	16.03.2011
2.	1 st true leaf	17 th day	25.03.2011
3.	2 nd true leaf	27 th day	04.04.2011
4.	3 rd true leaf	36 th day	13.04.2011
5.	4 th true leaf	45 th day	22.04.2011
6.	5 th true leaf	55 th day	01.05.2011

Leucas linifolia Benth**Table 2.** Day and date of appearance of different leaves.

S. No.	Appearance of different leaves	Day	Date
1.	Seed leaf	5 th day	13.03.2011
2.	1 st true leaf	13 th day	21.03.2011
3.	2 nd true leaf	19 th day	27.03.2011
4.	3 rd true leaf	25 th day	02.04.2011
5.	4 th true leaf	31 st day	08.04.2011
6.	5 th true leaf	37 th day	14.04.2011

Leucas nutans (Roth.) Spreng.**Table 3.** Day and date of appearance of different leaves.

S. No.	Appearance of different leaves	Day	Date
1.	Seed leaf	7 th day	15.02.2012
2.	1 st true leaf	17 th day	25.02.2012
3.	2 nd true leaf	27 th day	07.03.2012
4.	3 rd true leaf	37 th day	17.03.2012
5.	4 th true leaf	47 th day	27.03.2012
6.	5 th true leaf	56 th day	05.04.2012

India. Raw Materials 6: 79. 1962.

Vernacular name: Bara Halkush, Dronapushpi, Gumma

Life form: Herb

Type of fruit: Nutlets

Seedlings: Epigeal, macranga type, seed coat persistent upto paracotyledon stage; primary root non-fibrous, branched, white-opaque, smooth, teret; secondaries many, fine, non-fibrous; root length 2.6 cm at paracotyledon stage, 2.9 cm at first true leaf stage,

3.5 cm at second true leaf stage, 3.9 cm at third true leaf stage, 4.4 cm at fourth true leaf stage, 5.0 cm at fifth true leaf stage; *collet distinct white-opaque, teret, smooth, without ring*; hypocotyl green, straight, smooth, teret; hypocotyl length 1.1 cm at paracotyledon stage, 1.1 cm at first true leaf stage, 1.3 cm at second true leaf stage, 1.5 cm at third true leaf stage, 1.6 cm at fourth true leaf stage, 1.7 cm at fifth true leaf stage.

Paracotyledons 2, phanerocotylar, isocotylar, opposite, exstipulate, leafy, petiolate, persist upto second true leaf stage.

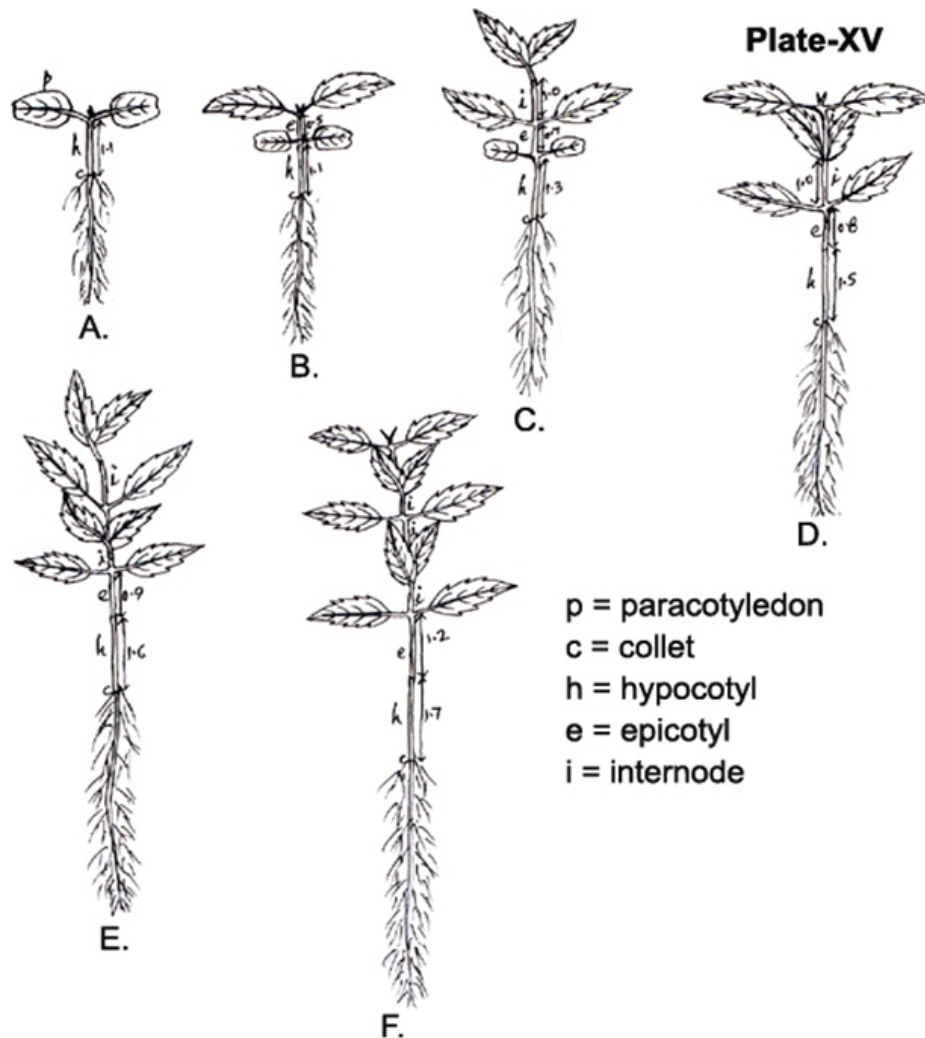


Fig.: Seedlings of *Leucas cephalotes* (Roth.) Spreng

- A. Paracotyledons (seed leaf) stage**
B. First true leaf stage
C. Second true leaf stage
D. Third true leaf stage
E. Fourth true leaf stage
F. Fifth true leaf stage

Plate I

Petiole green, smooth, teret, short, 0.4 cm long; blade oblong, 0.6 × 0.4 cm, broad base, apex acute, entire, adaxial surface dark green but abaxial surface light green, smooth, reticulate venation with 9 (1+8) strands.

Epicotyl green, smooth, solid, very short, teret; epicotyl length 0.5 cm at first true leaf stage, 0.7 cm at second true leaf stage, 0.8 cm at third true leaf stage, 0.9 cm at fourth true leaf stage, 1.2 cm at fifth true leaf stage; length of internodes 1.0 cm in all true leaf stages.

First true leaves simple, exstipulate, petiolate, opposite; petiole green, glabrous, semi-circular, short, 0.4 cm long; blade, ovate-lanceolate, 3.8 × 1.5 cm, margin serrate, apex acute, adaxial surface dark green, abaxial surface light green, hairy;

multicostate reticulate venation. Other features of subsequent true leaves are same as first true leaf (Plate-I).

Total observation period: 55 days (Table-1).

2. *Leucas linifolia* Benth. in Wall., Pl. As. rar. 1: 60. 1830. Benth. in DC., Prodr. 12: 531. 1848; Hook. f., Fl. Brit. Ind. 4: 690. 1885; Mukerjee in Rec. Bot. Surv. Ind. 14, 1: 166. 1940; Stewart, Ann. Cat. Vasc. Pl. W. Pak. and Kashm. 615. 1972.

Vernacular name: Gumma, Halkush, Kumbha

Common name: Line Leaf Leucas

Life form: Herb

Type of fruit: Nutlet

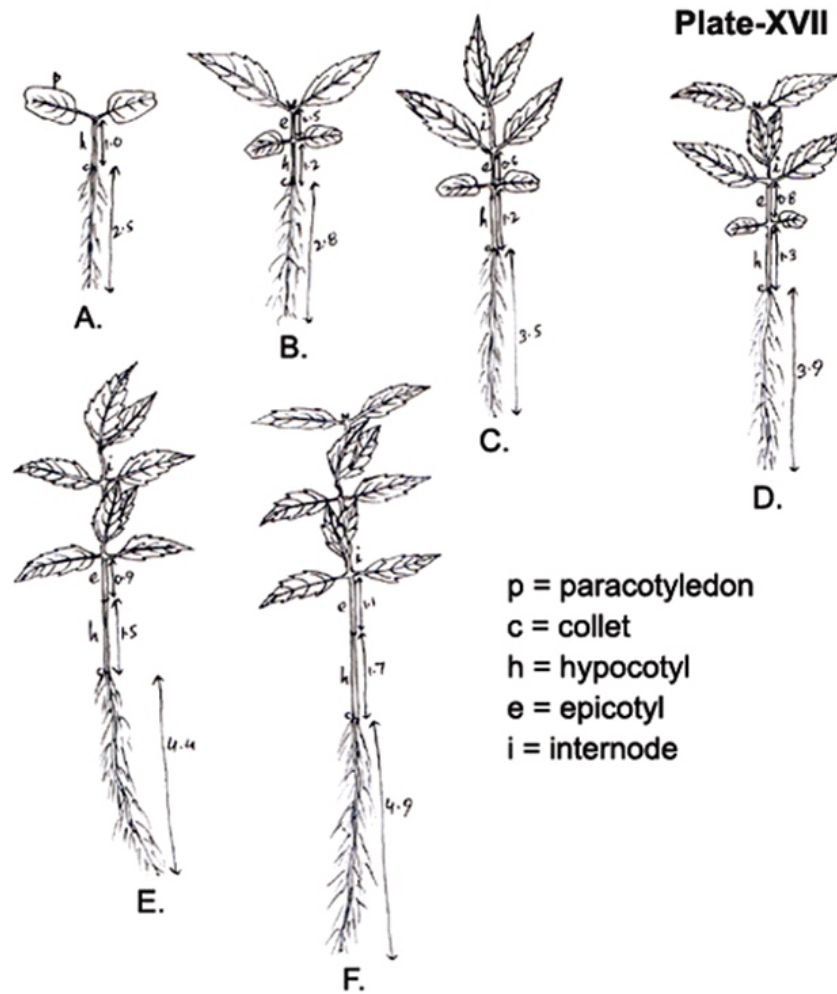


Fig.: Seedlings of *Leucas nutans* (Roth.) spreng

- A. Paracotyledons (seed leaf) stage**
B. First true leaf stage
C. Second true leaf stage
D. Third true leaf stage
E. Fourth true leaf stage
F. Fifth true leaf stage

Plate II

Seedlings: Epigeal, macranga type, seed coat persistent upto first pair of leaf; primary root non-fibrous, branched, white-opaque, smooth, teret; secondaries many, fine, non-fibrous; root length 2.5 cm at paracotyledon stage, 2.8 cm at first true leaf stage, 3.5 cm at second true leaf stage, 3.9 cm at third true leaf stage, 4.3 cm at fourth true leaf stage, 4.8 cm at fifth true leaf stage; *collet distinct white-opaque, teret, smooth, without ring*; hypocotyl white, slightly curved, smooth, teret; hypocotyl length 0.9 cm at paracotyledon stage, 2.0 cm at first true leaf stage, 2.2 cm at second true leaf stage, 2.4 cm at third true leaf stage, 2.5 cm at fourth true leaf stage, 2.6 cm at fifth true leaf stage.

Paracotyledons 2, phanerocotylar, isocotylar, opposite, exstipulate, leafy, petiolate, persistent upto third true leaf stage.

Petiole green, smooth, teret, short, 0.2 cm long; blade orbiculate, 0.4×0.4 cm, broad base, apex acute, entire, adaxial surface dark green but abaxial surface light green; smooth, reticulate venation.

Epicotyl green, smooth, solid, short, teret; epicotyl length 0.9 cm at first true leaf stage, 1.0 cm at second true leaf stage, 1.2 cm at third true leaf stage, 1.3 cm at fourth true leaf stage, 1.4 cm at fifth true leaf stage; length of internodes 1.0 cm in all true leaf stages.

First true leaves simple, exstipulate, petiolate, opposite; petiole green, glabrous, semi-circular, short, 0.5 cm long; blade, linear-lanceolate, 4.5×0.9 cm, margin serrate, apex obtuse, adaxial surface dark green but abaxial surface light green,

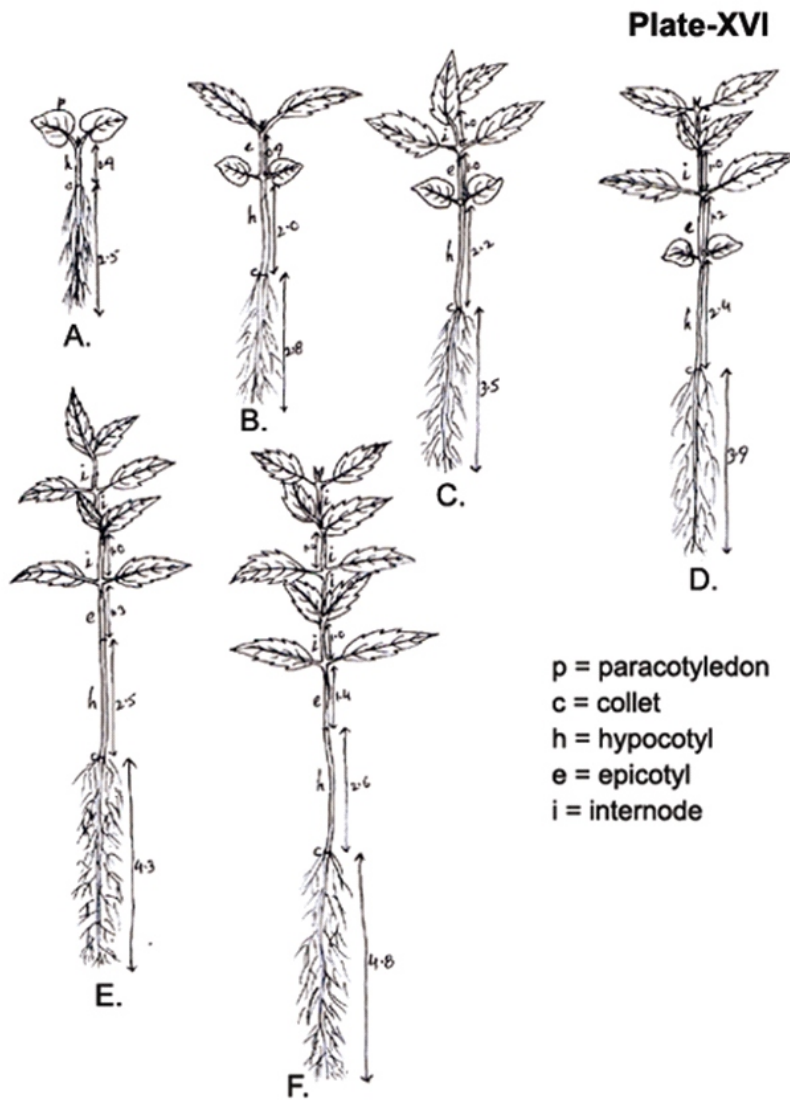


Fig.: Seedlings of *Leucas linifolia* Benth

- A. Paracotyledons (seed leaf) stage
 B. First true leaf stage
 C. Second true leaf stage
 D. Third true leaf stage
 E. Fourth true leaf stage
 F. Fifth true leaf stage

Plate III

smooth; multicostate reticulate venation. Other features of subsequent true leaves are same as first true leaf (Plate-III).

Total observation period: 37 days (Table-2).

3. *Leucas nutans* (Roth.) Spreng., Syst. Veg. 2: 743. 1825. Benth. in. DC., Prods. 12: 532. 1848; Hook. f., Fl. Brit. Ind. 4: 688. 1885; Mukerjee in Rec. Bot. Surv. Ind. 14, 1: 169. 1940; Jafri, Fl. Karachi 291. 1966; Stewart, Ann. Cat. Vasc. Pl. W. Pak. and Kashm. 616. 1972; Sharma and Kachroo, Fl. Jammu 264. 1981; Misra and Verma, Fl. Allahabad 301. 1992; Sharma and Dhakre, Fl. Agra 225. 1995.

Vernacular name: Chhota Halkush

Common name: Leucas

Life-form: Herb

Type of fruit: Nutlet

Seedlings: Epigeal, macranga type, seed coat persistent up to paracotyledon stage; primary root non-fibrous, branched, white-opaque, smooth, teret; secondaries many, fine, non-fibrous; root length 2.5 cm at paracotyledon stage, 2.8 cm at first true leaf stage, 3.5 cm at second true leaf stage, 3.9 cm at third true leaf stage, 4.4 cm at fourth true leaf stage, 4.9 cm at fifth true leaf stage; *collet distinct white-opaque, teret, smooth, without ring*; hypocotyl green, straight, smooth, teret; hypocotyl length 1.0 cm at paracotyledon stage, 1.2 cm at first and second true leaf stage, 1.3 cm at third true leaf stage, 1.5 cm at fourth true leaf stage, 1.7 cm at fifth true leaf stage.

Paracotyledons 2, phanerocotylar, isocotylar, opposite, exstipulate, leafy, petiolate, persist up to fifth true leaf stage.

Petiole green, smooth, teret, very short, 0.2 cm long; blade oblong, 0.6 × 0.4 cm, broad base, apex obtuse, entire, adaxial surface dark green but abaxial surface light green, smooth, reticulate venation with 9 (1+8) strands.

Epicotyl green, smooth, solid, very short, teret; epicotyl length 0.5 cm at first true leaf stage, 0.6 cm at second true leaf stage, 0.8 cm at third true leaf stage, 0.9 cm at fourth true leaf stage, 1.1 cm at fifth true leaf stage; length of internodes 1.0 cm in all true leaf stages.

First true leaves simple, exstipulate, petiolate, opposite; petiole green, hairy, semi-circular, short, 0.2 cm long; blade, oblong-elliptical, 4.0×1.6 cm, margin serrate, apex acute, adaxial surface dark green, abaxial surface light green, hairy, multicostate reticulate venation. Other features of subsequent true leaves are same as first true leaf (Plate-II).

Total observation period: 56 days (Table- 3).

DISCUSSION

The seedling is the very juvenile stage of plant after germination. Several workers have utilized seedling morphology and juvenile characteristics in the preparation of seedling flora^[4].^[5] In this study the morphological characters of seedlings have been observed up to the development of fifth juvenile leaf. In all the above taxa paracotyledons are thin, long, green persistent and leaf like. They become free and spread in air and have photosynthetic function. This suggests that developmental type of seedling is macranga type^[4]. In *L. cephalotes* minimum development of seedling was observed at II and V true leaf stage and at I true leaf stage in *L. linifolia* whereas in *L. nutans* minimum development was observed at V true leaf stage. The stage of seedling at which it grows slower may be the transplanting stage for those taxa. An artificial dichotomous key to the three species of *Leucas* has been prepared for identification of these species at juvenile stage.

CONCLUSION

Characteristic information provided by the seedling is as important and reliable as that of floral ones. This information should be taken into consideration in the delimitation of species and genera. So to make any group more natural and monophyletic, juvenile data may be helpful. Morphological features of seedling like hypocotyl and paracotyledons are very important to delimit species in genus *Leucas* and also in solving taxonomic problems on one hand and in identification, eradication and conservation of taxa at juvenile stage on the other hand. It is also suggested that seedling morphology may be taken into consideration to distinguish the species and in solving taxonomic and phylogenetic problems.

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