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Original Research Article

Seedling Morphology of Two Species of *Nepeta* L. (Lamiaceae) and its Taxonomic Implication

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Abstract: The present study was carried out to highlight the morphotaxonomic observations of juvenile stages and seedlings in 2 species of *Nepeta* up to 5th leaf stages. Morphological features of seedling like collet, hypocotyl, epicotyl, shape and arrangement of paracotyledons, leaf base, colour, phyllotaxy, number of veins etc. represent high level of constansy within taxon. These characters and features of seedlings have been found useful from taxonomic point of view in solving taxonomic problems, circumscription, delimitation, identification and conservation of taxa at juvenile stage.

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

Introduction

A weed is a plant considered undesirable in a particular situation. Taxonomically, the term "weed" has no botanical significance, because a plant that is a weed in one context is not a weed when growing in a situation where it is in fact wanted (Wikipedia). 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, seed, stem, leaves, rhizomes and rhizomes of certain weeds are used as vegetables, food material and medicines. The genus *Nepeta* comprises about 120 species (Duthie, J.F., 1903-1929). An illustration on the morphotaxonomy of 2 species of *Nepeta* is presented in this study i.e. *Nepeta hindostana* (Roth.) Haines and *Nepeta ruderalis* Buch-Ham. ex Benth. *Nepeta hindostana* is an annual herb of 20-60cm high. It is distributed in submontane Himalaya and major part of India and Afghanistan. Plant yields a cardiac tonic. It is also given in fever and gonorrhea (Gaur, R.D., 1999). *Nepeta ruderalis* is an annual erect herb of 6-18 inch high. It distributed in Siwalik range, Dehradun, plains of Punjab, West Bengal and Afganistan. The plant is used medicinally (Duthie, J.F., 1903-1929). A decoction of the plant is used as a gargle for sore throat.

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Material and Methods

The mature and ripen seeds of *Nepeta hindostana* and *Nepeta ruderalis* were collected from natural habitat in Saharanpur forest division, U. P. India 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 *Nepeta hindostana* (Roth.) Haines were sown in the garden soil at a depth of 0.5cm in February, 2012 (15.02.2012), while seeds of *Nepeta ruderalis* Buch.-Ham. ex Benth. were sown in the garden soil at a depth of 0.5cm in March, 2011 (13.03.2011). Seedlings started protruding above the soil on 7th day and 5th respectively. The seedlings took another 55, and 33 days respectively 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 (Vogel, 1980; Burger, 1972; Hickey, 1973). Besides, deeds on seedling morphology of several other authors (Augustine, 2004; Canne, 1983; Das & Paria, 2008; Sampath Kumar, 1982; Singh et al., 2008a & b; Troup, 1921) have been followed in this study. Day and date of appearance of leaves upto 5th true leaf stage were also recorded (Table 1 and 2). Observations have been made on six seedlings of each species.

Table 1: Day and date of appearance of different leaves in *Nepeta hindostana*

S. No.	Appearance of different leaves	Day	Date
1.	Seed leaf	7th day	15.02.2012
2.	1st true leaf	15th day	23.03.2012
3.	2nd true leaf	25th day	05.03.2012
4.	3rd true leaf	36th day	16.03.2012
5.	4th true leaf	45th day	25.03.2012
6.	5th true leaf	55th day	04.04.2012

Table 2: Day and date of appearance of different leaves in *Nepeta ruderalis*

S. No.	Appearance of different leaves	Day	Date
1.	Seed leaf	5th day	13.03.2011
2.	1st true leaf	11th day	19.03.2011
3.	2nd true leaf	16th day	24.03.2011
4.	3rd true leaf	22nd day	30.03.2011
5.	4th true leaf	27th day	04.04.2011
6.	5th true leaf	33rd day	15.04.2011

Observations:

Key to Species

1a. Paracotyledons persistent up to third true leaf stage, petiole hairy, angular…**1. *N. hindostana***

1b. Paracotyledons persistent up to second true leaf stage, petiole smooth, teret...**2. *N. ruderalis***

1. *Nepeta hindostana* (Roth.) Haines, Bot. Fl. Bihar and Orissa. 744. 1922. Mukerjee in Rec. Bot. Sun. Ind. 14, 1: 133. 1940 p.p.; Wealth of India, Raw material 7: 13. 1966; Stewart, Ann. Cat. Vasc. Pl. W. Pak. and Kashm. 622. 1972. p.p.; Sharma and Kachroo, Fl. Jammu 262. 1981.

Vernacular name: Billilotan, Catmint

Life-form: Herb

Type of fruit: Nutlet

Seedlings: Epigeal, macranga type, seed coat persistent up to third pair of leaf; Primary root non-fibrous, branched, white-opaque, smooth, semi- circular; Secondaries many, fine, non-fibrous; Root length 2.6cm at paracotyledon stage, 2.8cm at first true leaf stage, 3.2cm at second true leaf stage, 3.9cm at third true leaf stage, 4.1cm at fourth true leaf stage, 5.0cm at fifth true leaf stage; *Collet distinct, white-opaque, teret, smooth, without ring*; Hypocotyl white- green, straight, hairy, teret; Hypocotyl length 1.1cm at paracotyledon stage, 1.2cm at first true leaf stage, 1.3cm at second true leaf stage, 1.5cm at third true leaf stage, 1.6cm at fourth true leaf stage, 1.7cm at fifth true leaf stage.

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

Petiole green, hairy, angular, short, 0.4cm long; Blade cordate, 0.4 × 0.4cm, broad base, apex acute, entire, adaxial surface dark green but abaxial surface light green, smooth surface, reticulate venation.

Epicotyl green, hairy, solid, short, angular; Epicotyl length 0.4cm at first true leaf stage, 0.5cm at second true leaf stage, 0.6cm at third true leaf stage, 0.7cm at fourth true leaf stage, 0.9cm at fifth true leaf stage; Length of internodes 0.9cm in all true leaf stages.

First true leaves simple, exstipulate, petiolate, opposite; Petiole green, hairy, semi-circular, short, 0.4cm long; Blade, lanceolate, 4.5×0.9 cm, margin serrate, apex acute, adaxial surface dark green but abaxial surface light green, hairy. Multicostate reticulate venation. Other features of subsequent true leaves are same as first true leaf (Plate 1).

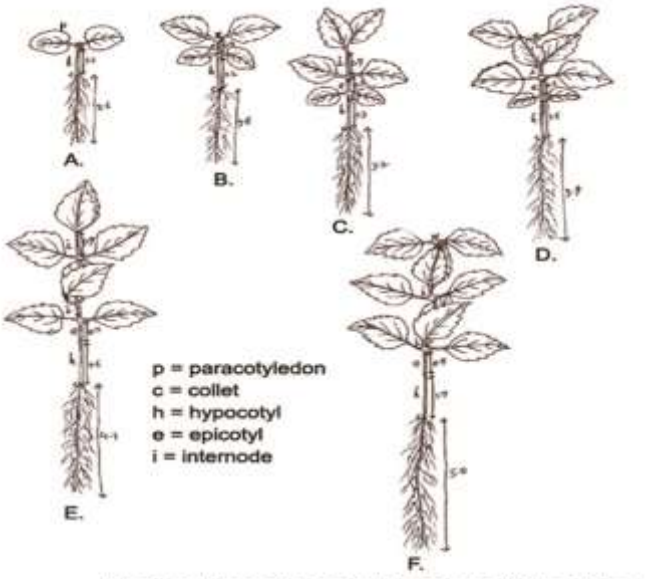

Fig. Seedlings of *Nepeta hindostana* (Roth.)Haines
A. Paracotyledons (seed leaf) stage
B. First true leaf stage
C. Second true leaf stage
D. Third true leaf stage
E. Fourth true leaf stage
F. Fifth true leaf stage

Plate 1:

Total Observation period: 55 days (Table 1).
Flowering period: June- November.

2. *Nepeta ruderalis* Buch.- Ham. ex Benth. in Wall., Pl. As. rar. 1: 64. 1830. Benth. in DC., Prodr. 12: 380. 1848; Hook. f., Fl. Brit. Ind. 4: 661. 1885; Kashyap and Joshi, Lahore District Flora 1936.
Vernacular name: Badranj Boya
Life-form: Herb
Type of fruit: Nutlet

Seedlings: Epigeal, macranga type, seed coat persistent upto second true leaf (paracotyledon) stage; Primary root non-fibrous, branched, white-opaque, smooth, teret; Secondaries many, fine, non-fibrous; Root length 2.8cm at paracotyledon stage, 3.3cm at first true leaf stage, 3.7cm at second true leaf stage, 4.0cm at third true leaf stage, 4.4cm at fourth true leaf stage, 4.9cm at fifth true leaf stage; *Collet distinct, white-opaque, teret, smooth, without ring;* Hypocotyl upper half green, lower half white, slightly curved, smooth, teret; Hypocotyl length 1.2cm at paracotyledon stage, 1.3cm at first true leaf stage, 1.5cm at second true leaf stage, 1.6cm at third and fourth true leaf stage, 1.8cm at fifth true leaf stage.

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

Petiole green, smooth, teret, 0.4cm long; Blade cordate, 0.6 × 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 0.4cm at first true leaf stage, 0.5cm at second true leaf stage, 0.6cm at third true leaf stage, 0.7cm at fourth true leaf stage, 1.0cm at fifth true leaf stage; Length of internodes 1.0cm in all true leaf stages.

First true leaves simple, exstipulate, petiolate, opposite; Petiole green, smooth, semi-circular, short, 0.4cm long; Blade, lanceolate, 1.5×0.7 cm, margin serrate, apex acute, adaxial surface dark green but abaxial surface light green, hairy; Multicostate reticulate venation. Other features of subsequent true leaves are same as first true leaf **(Plate 2).**

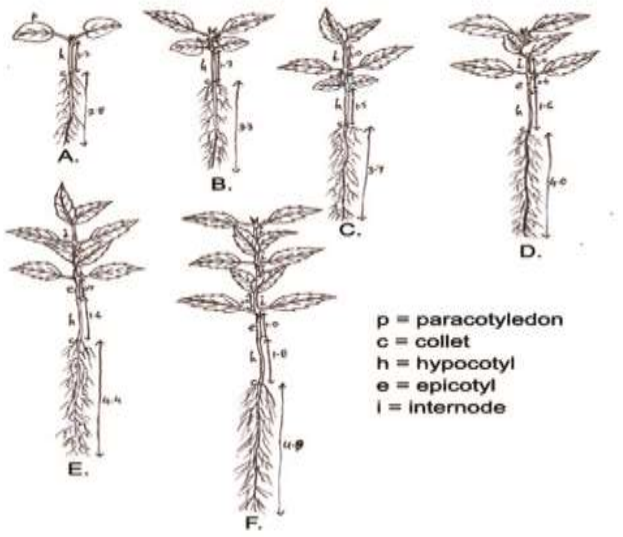

Fig.: Seedlings of *Nepeta ruderalis* Buch.- Ham. ex Benth.
A. Paracotyledons (seed leaf) stage
B. First true leaf stage
C. Second true leaf stage
D. Third true leaf stage
E. Fourth true leaf stage
F. Fifth true leaf stage

Plate 2:

Total Observation period: 33 days **(Table 2).**

Conclusion

Characteristic information provided by the seedling is as important and reliable as that of floral ones. These information and illustrations 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 paracotyledons and petiole are very important to delimit species in genus *Nepeta*. Thus this study is important in solving taxonomic problems on one hand and in identification, eradication and conservation of taxa at juvenile stage on the other hand.

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