

Observations on the Seedling Morphology of two species of *Napeta*

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Abstract

This paper provides information on morpho taxonomic observations of juvenile stages and seedlings in two species of *Napeta*- *Napeta ruderalis* and *Napeta hindostana*. Seedling morphology was observed upto 5th leaf stages. Morphological features of seedling like coleoptile, hypocotyl, epicotyl, shape and arrangement of para-cotyledons, leaf base, color, phyllotaxy, number of veins etc. represent high level of constancy within taxon and, thus, have been found useful from taxonomic point of view in identification and eradication of weed at juvenile stage. *Nepeta hindostana*, commonly known as North Indian Catmint or Indian Catnip, is a medicinal herb in the Lamiaceae family found in India, Pakistan, and Afghanistan. North Indian Catmint is an annual or short-lived perennial herb. Stems are erect or ascending, rather slender, 30-50 cm. Leaves are broad ovate or triangular-ovate up to about 2.5 x 2.5 cm, dentate, stalked. Stalk of the lowermost leaves is up to 2 cm long. Inflorescence is lax, composed of many clearly stalked cymes, at least below, or verticillasters, mostly distant. Flower-stalks are up to 3 mm. Bracts are linear-subulate, about as long as calyces, ciliate. Sepal cup is 3.5-4 mm, often purplish, with spreading villous hairs, narrow tubular, throat oblique, teeth about 1/3-1/4 length of tube. Flowers are lilac to purplish, about 8 mm. Nutlets are about 1 x 0.6 mm, oblong-ellipsoid, palish brown, depressed- tuberculate. North Indian Catmint is endemic to India found in Punjab, Upper Gangetic plains, Bihar, West Bengal, Madhya Pradesh, Rajasthan and Deccan Plateau up to an altitude of 2400 m in the Himalayas. *Nepeta ruderalis* Buch.Ham. ex Benth. commonly known as Badranj Boya, is a medium-sized, aromatic annual herb in the Lamiaceae family found in the Indo-Pak-Bangladesh subcontinent.

Key words: *Nepeta hindostana*, *Nepeta ruderalis* Buch.Ham. ex Benth., Morphology, Juvenile, Taxonomy.

Introduction

A weed is a plant growing where it is not desired. 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 example, fruits and rhizomes of some weeds are used as vegetables, food material and medicines.

The seedling is the very juvenile stage of plant after germination. Jackson (1928) defined the seedlings as: (1) a plant produced from seed, in distinction to a plant propagated artificially, (2) a very young plant so produced. In literature, the term seedling is used for woody plants from the beginning of germination up to a stage where it is 25-50 cm high. When larger it is called a young plant, until it is over about one meter high and then it is called sapling. Seedlings have mostly been classified into two main groups, based on the position of the (para)cotyledons and whether or not the testa and fruit wall are shed.

These groups represent germination types. The (para)cotyledons can be raised above the soil and become exposed (epigeal seedlings), or remain in the soil, lateral of the stem, covered by the fruit wall and/or the testa (hypogeal seedlings). Duke (1965) proposed a subdivision into two other groups: cryptocotylar and

phanerocotylar, which also represents germination types. The former has the cotyledons enclosed within the fruit wall and/ or testa; in the later the (para)cotyledons become entirely exposed. In the early stages these (para)cotyledons play an important role in the food supply and they support the development of a shoot with leaves. As soon as they are shed, the plantlet must rely upon food production by organs which are not yet present in the embryo and have been formed after germination. As soon as the cotyledons are shed, juvenile plants of this category are beyond the stage the seedling. Morphologically this stage is easy to recognize, because the cotyledons shed from their former place of attachment can always be found by means of the scars.

Material and Methods:

The mature and ripen seeds were collected from natural habitat in Saharanpur Forest division (U. P.) 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 were sown in the garden soil at a depth of 0.5 cm. Seedlings started protruding above the soil on 8th day. The seedlings took another 54 days (Table 1) to reach the 5th true leaf stage. In the present study morphological features of the seedlings have been described according to the terminology proposed by Burger (1972), Hickey (1973) and Vogel (1980). Besides these deeds on seedling morphology, several other authors like Troup (1921), Sampath (1982), Canne (1983), Augustine (2004a, b), Das and Paria (2008) and Singh et al (2008a, b, c) have been followed in this study. Day and date of appearance of leaves up to 5th true leaf stage were also recorded. Observations have been made on three seedlings.

Observations:

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; Press in Hara et. al., Enum. Fl. Pl. Nepal 3: 159. 1982.

Vernacular name: Billilotan

Common name: Catmint

Life- form: Herb

Type of fruit: Nutlet

Seed: Reddish brown, oblong- ellipsoid, 0.15×0.10 cm, trifaced; one face convex and other two faces flat, surface tubercles with orbicular spots on midrib, base rounded, apex acute, margins entire. Hilum distinct, whitish- brown, bilobed, glabrous.

Seedlings: Epigeal. 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 2.6 cm at paracotyledon stage; 2.8 cm at first true leaf stage; 3.2 cm at second true leaf stage; 3.9 cm at third true leaf stage; 4.1 cm at fourth true leaf stage; 5.0 cm at fifth true leaf stage. *Collet distinct white-opaque, teret, smooth, without ring.* Hypocotyl white- green, straight, hairy, teret. Hypocotyl length 1.1 cm at paracotyledon stage; 1.2 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, persistent upto 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 0.4 cm at first true leaf stage; 0.5 cm at second true leaf stage; 0.6 cm at third true leaf stage; 0.7 cm at fourth true leaf stage; 0.9 cm at fifth true leaf stage. Length of internodes 0.9 cm in all true leaf stages.

First true leaves simple, exstipulate, petiolate, opposite. Petiole green, hairy, semi-circular, short, 0.4 cm long. Blade, lanceolate, 4.5×0.9 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 (Table- 2).

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

Flowering period: June- November.

Distribution: Afghanistan, India, Nepal, North Africa.

Uses: The plant is reported to be a cardiac tonic and is used in fevers. In Nepal, it is used internally as a remedy against gonorrhoea. A decoction of the plant is used as a gargle for sore throat.

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

Common name: Nepeta herb

Life- form: Herb

Type of fruit: Nutlet

Seed: Dark brown, oblong- ovate, 0.11×0.10 cm, trifaced; one face convex and other two faces flat, surface tubercled with orbicular spots on midrib, base rounded, apex acute, margins entire. Hilum distinct, whitish brown, bilobed, glabrous.

Seedlings: Epigeal. Seed coat persistent upto seed leaf (paracotyledon) stage. Primary root non-fibrous, branched, white-opaque, smooth, teret; secondaries many, fine, non-fibrous. Root length 2.8 cm at paracotyledon stage; 3.3 cm at first true leaf stage; 3.7 cm at second true leaf stage; 4.0 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 upper half green, lower half white, slightly curved, smooth, teret. Hypocotyl length 1.2 cm at paracotyledon stage; 1.3 cm at first true leaf stage; 1.5 cm at second true leaf stage; 1.6 cm at third and fourth true leaf stage; 1.8 cm at fifth true leaf stage. Paracotyledons 2, phanerocotylar, isocotylar, opposite, exstipulate, leafy, petiolate, persistent upto second true leaf stage. Petiole green, smooth, teret, 0.4 cm 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 0.4 cm at first true leaf stage; 0.5 cm at second true leaf stage; 0.6 cm at third true leaf stage; 0.7 cm at fourth true leaf stage; 1.0 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, smooth, semi-circular, short, 0.4 cm long. Blade, lanceolate, 1.5×0.7 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 (Table- 4).

Total Observation period: 33 days (Table- 3).

Flowering period: May- June

Distribution: Pakistan, Kashmir, NW India.

Uses: The plant is reported to be a cardiac tonic and is used in fevers. In Nepal, it is used internally as a remedy against gonorrhoea. A decoction of the plant is used as a gargle for sore throat.

Nepeta hindostana (Roth.) Haines

Table 1: 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	15 th day	23.03.2012
3.	2 nd true leaf	25 th day	05.03.2012
4.	3 rd true leaf	36 th day	16.03.2012
5.	4 th true leaf	45 th day	25.03.2012
6.	5 th true leaf	55 th day	04.04.2012

Table 2: Length of different parameters at different leaf stages of seedlings.

S. No.	Different leaf stages	Primary & secondary root (cm)	Hypocotyl (cm)	Epicotyl (cm)	Internode (cm)
	Variant-1				
1.	Length at paracotyledon stage	2.6	1.2	-	-
2.	Length at first true leaf stage	2.9	1.3	0.4	-
3.	Length at second true leaf stage	3.3	1.4	0.5	0.9
4.	Length at third true leaf stage	3.9	1.5	0.6	0.9
5.	Length at fourth true leaf stage	4.2	1.6	0.8	0.9
6.	Length at fifth true leaf stage	5.0	1.6	1.0	0.9
	Variant-2				
1.	Length at paracotyledon stage	2.7	1.1	-	-
2.	Length at first true leaf stage	2.8	1.3	0.4	-
3.	Length at second true leaf stage	3.2	1.4	0.6	0.9
4.	Length at third true leaf stage	3.9	1.6	0.6	0.9
5.	Length at fourth true leaf stage	4.1	1.6	0.8	0.9

6.	Length at fifth true leaf stage	5.0	1.8	0.9	0.9
Variant-3					
1.	Length at paracotyledon stage	2.6	1.1	-	-
2.	Length at first true leaf stage	2.8	1.2	0.4	-
3.	Length at second true leaf stage	3.3	1.3	0.5	0.9
4.	Length at third true leaf stage	3.9	1.5	0.6	0.9
5.	Length at fourth true leaf stage	4.2	1.6	0.7	0.9
6.	Length at fifth true leaf stage	5.1	1.8	0.9	0.9

Nepeta ruderalis Buch.- Ham. ex Benth.

Table 3: 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	11 th day	19.03.2011
3.	2 nd true leaf	16 th day	24.03.2011
4.	3 rd true leaf	22 nd day	30.03.2011
5.	4 th true leaf	27 th day	04.04.2011
6.	5 th true leaf	33 rd day	15.04.2011

Table 4: Length of different parameters at different leaf stages of seedlings.

S. No.	Different leaf stages	Primary & secondary root (cm)	Hypocotyl (cm)	Epicotyl (cm)	Internode (cm)
Variant-1					
1.	Length at paracotyledon stage	2.8	1.2	-	-
2.	Length at first true leaf stage	3.3	1.4	0.4	-
3.	Length at second true leaf stage	3.7	1.5	0.5	1.0
4.	Length at third true leaf stage	3.9	1.6	0.6	1.0
5.	Length at fourth true leaf stage	4.4	1.6	0.8	1.0
6.	Length at fifth true leaf stage	4.9	1.8	1.0	1.0

Variant-2					
1.	Length at paracotyledon stage	2.8	1.2	-	-
2.	Length at first true leaf stage	3.3	1.3	0.4	-
3.	Length at second true leaf stage	3.7	1.5	0.5	1.0
4.	Length at third true leaf stage	4.1	1.6	0.6	1.0
5.	Length at fourth true leaf stage	4.4	1.6	0.8	1.0
6.	Length at fifth true leaf stage	5.0	1.9	1.0	1.0
Variant-3					
1.	Length at paracotyledon stage	2.8	1.2	-	-
2.	Length at first true leaf stage	3.3	1.3	0.4	-
3.	Length at second true leaf stage	3.7	1.5	0.5	1.0
4.	Length at third true leaf stage	4.1	1.6	0.6	1.0
5.	Length at fourth true leaf stage	4.4	1.6	0.6	1.0
6.	Length at fifth true leaf stage	5.0	1.9	1.0	1.0

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