



## Morphological study of some medicinal plants in their juvenile stage from Tripura, north-east India

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### Abstract

Seedling morphology of fifteen medicinal plants were studied from different parts of Tripura, North-east India. Seedling characters are important and promising from the taxonomic as well as evolutionary point of view. Seedling morphology has been investigated on the basis of their germination pattern, position of cotyledon, hypocotyl, epicotyl, and paracotyledon and eophylls development. An artificial key has been constructed for easier identification of plants in their juvenile stage. Correlation between seed and seedling morphology has been observed.

**Keywords:** conservation, phenogram, plant life cycle, seedling

### Introduction

Seedling are basically juvenile stages of a plant germinating from seed (Bose and Paria, 2015) [2]. Seedling characters are important and reliable in the delimitation of species, genera and families. Critical examination of correlation between group of characters of both the adult as well as the juvenile plant has repeatedly shown results in better understanding of taxonomically difficult taxa. (Bokdam 1977) [1].

The study of seedling morphology, which had been a less explored field in flowering plants, particularly in angiosperms, has now emerged as an essential discipline for taxonomic research at present.

So, proper studies on seedling and their morphology will be helpful for their early identification and conservation of natural resources which in turn shall help in conservation of biodiversity. By observing seed size of 353 dicot species, Clifford (2000) [4] concluded that plants with small seed size had phanerocotylar seedlings and cryptocotylar seedlings had relatively big size.

According to Welling and Laine (2000) [10], diversity in seedling characters serve the purpose of identification of plants. They had also studied stomatal and epicuticular wax crystalloids types. Roy and Datta (2014) [9] studied 'Early identification and phenetic analysis of eight species of subtribe Cassiineae (Leguminosae: Caesalpinioideae)'. Seedling morphology is a less explored work in India, so in

this study an attempt has been made to study seedling morphology of some medicinal plants.

### Materials and methods

#### Study area

Tripura is a state in North-East India and considered as a biodiversity hotspot. The state lies between 22° 56' to 24° 32' North latitudes and 91° 09' to 92° 20' East longitudes with an aerial extent of 10,491.69 sq. km. (Figure 1).

#### Methodology

The seedling specimens *Stephania japonica*, *Tinospora sinensis*, *Argemone mexicana*, *Portulaca oleracea*, *Glycosmis pentaphylla*, *Passiflora foetida*, *Turnera ulmifolia*, *Paederia foetida*, *Plumbago zeylanica*, *Calotropis gigantea*, *Catharanthus roseus*, *Cascabela thevetia*, *Rauvolfia serpentina*, *Heliotropium indicum*, *Astraea lobata* were collected from different localities of Tripura. The specimens were photographed and documented in the form of herbarium sheets. They were compared and identified with the help of seedling raised from identified seeds. At least eight to ten specimens of each growth form were studied from various habitats. Morphological observation and description of seedlings were done according to Duke (1965) [6], Burger (1972) [3], Bokdam (1977) [1], Vogel (1980) [5] and Paria (2014) [7]. Artificial keys were prepared for the identification of investigated taxa in juvenile stage.

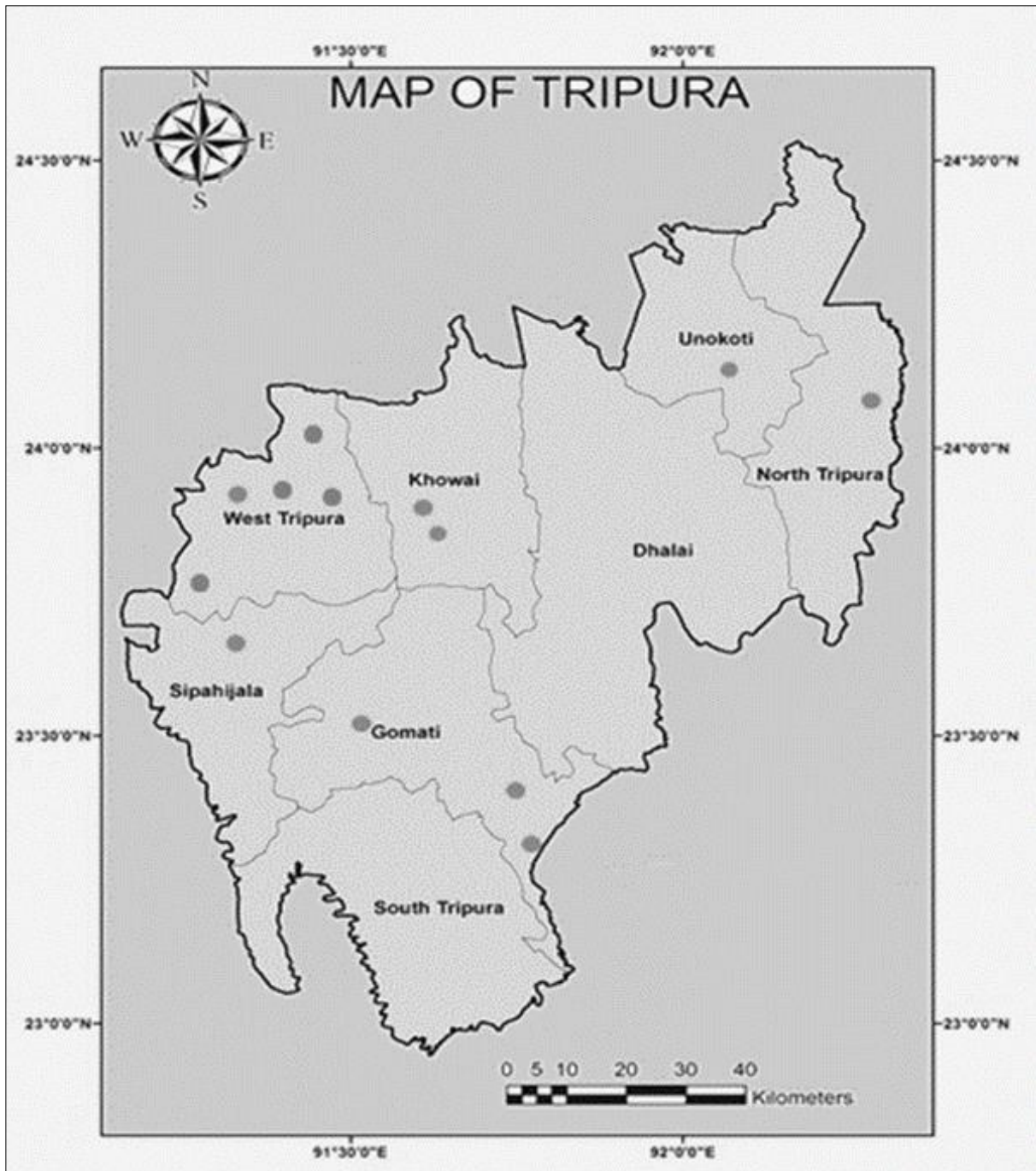


Fig 1: Map of Tripura showing the different areas visited during the field survey.

## Results

**1. *Stephania japonica* (Thunberg) Miers, Ann. Mag. Nat. Hist., ser. 3. 18: 14. 1866. (Menispermaceae). (Plate 1)**

**Local name:** Tape-vine, Akanadi, Nimuka, Maknadi.

**Morphological description of seedling:** (Till 10th leaf stage)

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* are tap,  $\pm 2.0-2.60 \times \pm 0.10-0.20$  cm, elongating. *Hypocotyl*  $\pm 2.30-2.70 \times \pm 0.10-0.20$  cm, glabrous, elongating. *Paracotyledon* opposite, petiolate, leaf linear/oblong, size  $\pm 2.30-3.10 \times \pm 0.20-0.30$  cm, base attenuate, apex acute, margin entire, pinnate venation. *Epicotyl* glabrous,  $\pm 0.10-0.150 \times \pm 0.10-0.20$  cm. *First two leaves* simple, alternate, exstipulate, petiolate ( $\pm 1.10-2.10 \times \pm 0.050-0.10$ cm), lamina oblong, size  $\pm 1.20-2.30 \times \pm 1.20-2.10$  cm, base peltate, apex rounded, margin entire, palmate venation. *Next leaves* alternate, simple, oblong, irrespective

of dimensions other seedling traits are almost similar to eophylls.

**2. *Tinospora sinensis* (Loureiro) Merrill, Sunyatsenia. 1: 193. 1934. (Menispermaceae).**

**Local name:** Giloy, Nimgilo, Hoguni-lot, Guruchi.

**Morphological description of seedling:** (Till 10th leaf stage)

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* tap, with branches (7-8 branches), size  $\pm 2.50-5.20 \times \pm 0.20-0.30$  cm. *Hypocotyl* size  $\pm 6.90-7.80 \times \pm 0.30-0.40$  cm, glabrous, elongating. *Paracotyledon* two, petiolate, leaf ovate, size  $\pm 3.50-7.0 \times \pm 3.50-4.50$  cm, base cuneate, acuminate apex, sinuate margin, palmate venation. *Epicotyl* glabrous,  $\pm 0.20-0.40 \times \pm 0.20-0.40$  cm. *First two leaves* simple, alternate, Exstipulate, petiolate, leaf ovate, size

$\pm 6.0-8.0 \times \pm 4.0-5.50$  cm, cordate base, aristate apex, entire margin, palmate venation.

*Next leaves* alternate, simple, irrespective of dimensions other seedling traits are almost similar to eophylls.

**3. *Argemone mexicana* Linnaeus, Sp. Pl. 1: 508. 1753. (Papaveraceae).**

**Vernacular Name:** Siyal-Kanta, Mexican Prickly Poppy, Satyanashi.

**Morphological description of seedling:** (Till 10th leaf stage).

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* tap, size  $\pm 4.10-4.80 \times \pm 0.10-0.20$  cm, elongating. *Hypocotyl*, size  $\pm 0.50-0.80 \times \pm 0.10-0.20$  cm, glabrous, reduced, soft.

*Paracotyledon* two, sessile, Exstipulate, leaf oblong/linear, size  $\pm 2.30-2.60 \times \pm 0.10-0.20$  cm, cuneate base, acute apex, entire margin, venation pattern pinnate. *Epicotyl* absent. *First two leaves* simple, alternate, Exstipulate, sessile, leaf obovate, size  $\pm 1.40-3.20 \times \pm 0.20-0.30$  cm, base attenuate, apex tridentate/acute, margin serrate/spiny, pinnate venation. *Next leaves* alternate, simple, lamina obovate, irrespective of dimensions other seedling traits are almost similar to eophylls.

**4. *Portulaca oleracea* Linnaeus, Sp. Pl. 1: 445. 1753. (Portulacaceae).**

**Vernacular Name:** Common Purslane, Nune, Lanya, Bara Loniya, Tonkami.

**Morphological description of seedling:** (Till 10th leaf stage).

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* tap, size  $\pm 0.20-0.90 \times \pm 0.050-0.10$  cm, reduced. *Hypocotyl* size  $\pm 0.60-1.20 \times \pm 0.050-0.10$  cm, glabrous, reduced, soft. *Paracotyledon* two, petiolate, leaf oblong, size  $\pm 0.20-0.60 \times \pm 0.10-0.20$  cm, base cuneate, obtuse/acute apex, entire margin, pinnate venation. *Epicotyl* glabrous, size  $\pm 0.10-0.30 \times \pm 0.10-0.20$  cm. *First two leaves* simple, opposite, Exstipulate, petiolate, leaf obovate, size  $\pm 0.50-1.50 \times \pm 0.40-0.80$  cm, base cuneate, rounded/obtuse apex, entire margin, pinnate venation. *Next leaves* simple, opposite, obovate, irrespective of dimensions other seedling traits are almost similar to eophylls.

**5. *Glycosmis pentaphylla* (Retzius) Candolle, Prodr. 1: 538. 1924. (Rutaceae).**

**Vernacular Name:** Ash-sheora, ban jamir, Ashvashakota, Matkhila, Ban nimbu.

**Morphological description of seedling:** (Up to 6th leaf stage)

*Germination* pattern is crypto-hypogeal reserve (CHR). *Roots* tap, elongating,  $\pm 6.50-8.60 \times \pm 0.20-0.30$  cm. *Hypocotyl* hypogeous, size  $\pm 0.20-0.60 \times \pm 0.20-0.40$  cm, reduced. *Cotyledon* hypogeous, two, opposite and equal, symmetric, cryptocotylar, position on the top of hypocotyl, stipules absent, size  $\pm 0.70-1.10 \times \pm 0.70-1.10$  cm, sessile, cotyledon globose, base rounded, apices rounded, margin entire, colour green. *Epicotyl* hairy,  $\pm 5.50-6.50 \times \pm 0.10-0.20$  cm. *First two leaves* simple, opposite, soft, Exstipulate, petiolate, leaf elliptic, size  $\pm 2.50-4.80 \times \pm 2.30-4.50$  cm, cuneate base, retuse apex, entire margin, pinnate venation. *Next leaves* simple, alternate, elliptic, irrespective of dimensions other seedling traits are almost similar to eophylls.

**6. *Passiflora foetida* Linnaeus, Sp. Pl. 2: 959. 1753. (Passifloraceae).**

**Vernacular Name:** Jhumka lota, Lam Radhikanachom, Stinking passionflower.

**Morphological description of seedling:** (Up to 10th leaf stage)

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* are tap, size  $\pm 1.20-1.60 \times \pm 0.10-0.20$  cm, reduced. *Hypocotyl* size  $\pm 4.0-5.50 \times \pm 0.10-0.20$  cm, glabrous, elongating. *Paracotyledon* two, opposite, petiolate, stipulate, leaf oblong, size  $\pm 1.0-2.20 \times \pm 0.60-1.50$  cm, obtuse/truncate base, truncate apex, entire margin, palmate venation. *Epicotyl* glabrous,  $\pm 0.50-1.20 \times \pm 0.10-0.20$  cm. *First two leaves* simple, alternate, stipulate, petiolate, leaf ovate, size  $\pm 0.80-4.50 \times \pm 1.0-3.50$  cm, cordate base, acute/acuminate apex, ciliate margin, pinnate venation. *Next leaves* simple, alternate, irrespective of dimensions other seedling traits are almost similar to eophylls.

**7. *Turnera ulmifolia* Linnaeus, Sp. Pl. 1: 271. 1753. (Passifloraceae).**

**Vernacular Name:** Yellow Alder, Yellow Buttercups, Sage Rose, Cuban Buttercup.

**Morphological description of seedling:** (Till 10th leaf stage)

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* are tap, size  $\pm 1.50-2.60 \times \pm 0.10-0.20$  cm, short elongating. *Hypocotyl* size  $\pm 1.20-1.60 \times \pm 0.10-0.20$  cm, hairy, shortly elongating. *Paracotyledon* two, petiolate, smell in the seedling, stipulate present, leaf ovate, size  $\pm 0.60-0.90 \times \pm 0.20-0.50$  cm, obtuse base, obtuse apex, entire margin, palmate venation. *Epicotyl* hairy, size  $\pm 0.40-0.80 \times \pm 0.10-0.20$  cm. *First two leaves* simple, opposite, stipulate, petiolate, leaf pinnatifid/oblong, size  $\pm 1.0-2.80 \times \pm 0.40-1.20$  cm, oblique base, acute apex, lobed margin, pinnate venation.

*Next leaves* simple, alternate, lobed, irrespective of dimensions other seedling traits are almost similar to eophylls.

**8. *Paederia foetida* Linnaeus, Syst. Nat., ed. 12. 2: 189; Mant. Pl. 1: 52. 1767. (Rubiaceae).**

**Vernacular name:** Gandha bhadulia, Paduri lata, Vawih-uh-hrui, Gandhali, Skunk Vine.

**Morphological description of seedling:** (Till 10th leaf stage)

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* are tap, size  $\pm 1.0-2.0 \times \pm 0.10-0.20$  cm. *Hypocotyl* size  $\pm 2.0-6.0 \times \pm 0.10-0.150$  cm, glabrous, elongating. *Paracotyledon* two, petiolate, Exstipulate, leaf ovate, size  $\pm 1.0-1.20 \times \pm 0.90-1.20$  cm, truncate base, obtuse apex, entire margin, palmate venation. *Epicotyl* hairy,  $\pm 1.30-1.80 \times \pm 0.10-0.20$  cm. *First two leaves* simple, opposite, stipulate, petiolate, leaf elliptic, size  $\pm 1.50-2.50 \times \pm 0.80-1.20$  cm, cuneate base, acute apex, entire margin, pinnate venation. *Next leaves* simple, opposite, irrespective of dimensions other seedling traits are almost similar to eophylls.

**9. *Plumbago zeylanica* Linnaeus, Sp. Pl. 1: 151. 1753. (Plumbaginaceae).**

**Vernacular Name:** Safaid-sitarak, Telhidak angouba, Boga agechita, Chitrak, Plumbago, White leadwort, Ogni.

**Morphological description of seedling:** (Up to 6th leaf stage)

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* are tap. Hypocotyl size  $\pm 1.0-1.5 \times \pm 1.1-1.3$  cm, glabrous, reduced. *Paracotyledon* two, sessile, Exstipulate, leaf obovate, size  $\pm 1.5-2.1 \times \pm 0.6-1.2$  cm, base attenuate, apex truncate, margin entire, venation pattern pinnate. *Epicotyl* reduced, glabrous, size  $\pm 0.1-0.2 \times \pm 0.1-0.2$  cm.

*First two leaves* simple, alternate, soft, stipules absent, petioles present, petiole size  $\pm 0.3-0.9 \times \pm 0.1-0.2$  cm, angular, petiole surface glabrous, leaf elliptic, size  $\pm 1.5-4.0 \times \pm 1.9-2.9$  cm, attenuate base,

obtuse apex, entire margin, pinnate venation, 1 primary vein, bronchiodromous venation, veins prominent, glabrous, base balance symmetric. *Next leaves* alternate, stipule absent, petiole present, simple, lamina elliptic, attenuate base, acute apex, entire margin, bronchiodromous, irrespective of dimensions other seedling traits are almost similar to eophylls.

**10. *Calotropis gigantea* (Linnaeus) W. T. Aiton, Hortus Kew. ed. 2: 78. 1811. (Apocynaceae). Vernacular Name:** Akanda, Angkot, Safed aak, Madaar, Ark, Aank.

**Morphological description of seedling:** (Till 10th leaf stage)

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* are tap, size  $\pm 3.0-6.0 \times \pm 0.1-0.4$  cm, elongating. *Hypocotyl* size  $\pm 1.0-3.0 \times \pm 0.2-0.5$  cm, glabrous, shortly elongating. *Paracotyledon* two, petiolate, leaf oblong, size  $\pm 1.0-3.0 \times \pm 0.6-1.5$  cm, cuneate base, rounded apex, entire margin, pinnate venation. *Epicotyl* glabrous, size  $\pm 2.0-3.50 \times \pm 0.20-0.40$  cm. *First two leaves* simple, opposite, Exstipulate, petiolate, leaf elliptic, size  $\pm 2.0-4.0 \times \pm 1.0-2.0$  cm, cuneate base, acute apex, entire margin, pinnate venation. *Next leaves* simple, opposite, irrespective of dimensions other seedling traits are almost similar to eophylls.

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

**Vernacular Name:** Nayantara, Sadabahar, Periwinkle, Madagascar periwinkle, Rosy periwinkle.

**Morphological description of seedling:** (Up to 10th leaf stage)

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* are tap, size  $\pm 2.0-3.0 \times \pm 0.1-0.2$  cm, shortly elongating. *Hypocotyl* size  $\pm 2.0-3.5 \times \pm 0.05-0.1$  cm, glabrous, elongating. *Paracotyledon* two, petiolate, Exstipulate, leaf oblong, size  $\pm 0.8-1.5 \times \pm 0.3-0.6$  cm, cuneate base, obtuse apex, entire margin, pinnate venation. *Epicotyl* glabrous, size  $\pm 1.0-2.0 \times \pm 0.1-0.2$  cm. *First two leaves* simple, opposite, Exstipulate, petiolate, leaf elliptic, size  $\pm 1.0-2.5 \times \pm 0.4-0.8$  cm, cuneate base, obtuse apex, entire margin, pinnate venation. *Next leaves* simple, opposite, irrespective of dimensions other seedling traits are almost similar to eophylls.

**12. *Cascabela thevetia* (L.) Lippold, Feddes Repert. 91: 52 (1980). (Apocynaceae).**

**Vernacular Name:** Kalki phul, Halde karabi.

**Morphological description of seedling:** (Up to 10th leaf stage)

*Germination* pattern is phanero-epigeal reserve (PER). *Roots* are tap, elongating. *Hypocotyl* glabrous, short

elongating. *Paracotyledon* opposite, petiolate, stipulate, lamina oblong, cuneate base, obtuse apex, entire margin. *Epicotyl* green, glabrous. *First two leaves* simple, opposite, Exstipulate, petiolate, lamina linear, cuneate base, acute apex, entire margin, pinnate venation. *Next leaves* simple, alternate, irrespective of dimensions other seedling traits are almost similar to eophylls.

**13. *Rauvolfia serpentina* (Linnaeus) Bentham ex Kurz, Forest Fl. Burma. 2: 171. 1877. (Apocynaceae).**

**Vernacular Name:** Chandra, Sarpagandha, Indian Snakeroot, Insanity herb.

**Morphological description of seedling:** (Till 10th leaf stage)

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* are tap, size  $\pm 3.0-8.0 \times \pm 0.10-0.20$  cm, elongating. *Hypocotyl* size  $\pm 2.0-4.50 \times \pm 0.10-0.20$  cm, glabrous, elongating. *Paracotyledon* two, petiolate, exstipulate, leaf elliptic, size  $\pm 1.50-3.0 \times \pm 1.0-2.0$  cm, base attenuate, apex retuse, margin entire, venation pattern pinnate. *Epicotyl* glabrous, size  $\pm 0.40-1.0 \times \pm 0.20-0.30$  cm. *First two leaves* simple, opposite, stipulate, petiolate, leaf elliptic, size  $\pm 3.0-6.0 \times \pm 2.0-4.0$  cm, cuneate base, acute apex, entire margin, pinnate venation. *Next leaves* simple, opposite, irrespective of dimensions other seedling traits are almost similar to eophylls.

**14. *Heliotropium indicum* Linnaeus, Sp. Pl. 1: 130. 1753. (Boraginaceae).**

**Vernacular Name:** Hatisurh, Leihenbi, Hathajori, Indian Heliotrope, Indian turnsole, Vrsckali, Hastishundi, Shrihastini, Chanchuphala.

**Morphological description of seedling:** (Till 10th leaf stage)

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* are tap, size  $\pm 1.0-2.8 \times \pm 0.1-0.2$  cm, reduced. *Hypocotyl* size  $\pm 0.5-3.0 \times \pm 0.1-0.2$  cm, hairy, short elongating. *Paracotyledon* two, petiolate, leaf ovate, size  $\pm 0.5-1.0 \times \pm 0.3-0.6$  cm, cuneate base, obtuse apex, entire margin, pinnate venation. *Epicotyl* hairy, size  $\pm 0.5-1.8 \times \pm 0.1-0.2$  cm. *First two leaves* simple, opposite, stipulate, petiolate, leaf ovate, size  $\pm 1.2-1.8 \times \pm 0.5-0.9$  cm, base cuneate, apex acute, margin sinuate, pinnate venation. *Next leaves* simple, opposite, irrespective of dimensions other seedling traits are almost similar to eophylls.

**15. *Astraea lobata* (L.) Klotzsch, Arch. Naturgesch. (Berlin) 7(1): 194 (1841). (Euphorbiaceae).**

**Vernacular Name:** Lobed croton.

**Morphological description of seedling:** (Up to 10th leaf stage)

*Germination* pattern is phanero-epigeal foliaceous (PEF). *Roots* are tap, size  $\pm 0.5-1.5 \times \pm 0.1-0.2$  cm, reduced. *Hypocotyl* size  $\pm 2.0-4.0 \times \pm 0.1-0.2$  cm, hairy, elongating. *Paracotyledon* two, petiolate, exstipulate, leaf elliptic, size  $\pm 1.0-2.0 \times \pm 0.4-0.6$  cm, cuneate base, retuse apex, entire margin, pinnate venation. *Epicotyl*  $\pm 0.2-0.5 \times \pm 0.1-0.2$  cm. *First two leaves* simple, alternate, stipulate, petiolate, leaf lobed, size  $\pm 3.0-5.0 \times \pm 3.0-5.0$  cm, auriculate base, acute apex, dentate margin, palmate venation. *Next leaves* simple, alternate, irrespective of dimensions other seedling traits are almost similar to eophylls.

**Key to the investigated taxa**

- 1a. (Para) cotyledon exstipulate ..... 2
- b (Para) cotyledon stipulate ..... 14
- 2a. Eophylls are stipulate ..... *Paederia foetida*
- b. Eophylls are exstipulate ..... 3
- 3a. (1) (Para) cotyledon always phanerocotylar..... 4
- b. (Para) cotyledon always cryptocotylar ..... *Glycosmis pentaphylla*
- 3a. (2) Paracotyledon always foliaceous type..... 5
- b. Paracotyledon always reserve type ..... *Cascabela thevetia*
- 5a. Eophylls and subsequent leaves have alternate phyllotaxy ..... 6
- b. Eophylls and subsequent leaves have opposite phyllotaxy .....10
- 6a. Paracotyledons are linear in shape..... 7
- b. Paracotyledons are other than linear in shape..... 8
- 7a. Eophylls are oblong ..... *Stephania japonica*
- b. Eophylls are obovate ..... *Argemone mexicana*
- 8a. Paracotyledons are ovate ..... *Tinospora sinensis*
- b. Paracotyledons are other than ovate ..... 9
- 9a. Paracotyledons are obovate ..... *Plumbago zeylanica*
- b. Paracotyledons are elliptic ..... *Astraea lobata*
- 10a. Paracotyledons are oblong ..... 11
- b. Paracotyledons are other than oblong ..... 12
- 11a. Eophyll leaf apex is acute ..... *Calotropis gigantea*
- b. Eophyll leaf apex is obtuse ..... *Catharanthus roseus*
- 12a. Paracotyledon is linear ..... *Portulaca oleracea*
- b. Paracotyledon is elliptic or ovate ..... 13
- 13a. Paracotyledon is elliptic ..... *Rauwolfia serpentina*
- b. Paracotyledon is ovate ..... *Heliotropium indicum*
- 14a. Paracotyledons are oblong ..... *Passiflora foetida*
- b. Paracotyledons are ovate ..... *Turnera ulmifolia*



**Fig 1:** Paracotyledon of (1) *Stephania japonica* (2) *Tinospora sinensis* (3) *Argemone mexicana* (4) *Portulaca oleracea* (5) *Glycosmis pentaphylla* (6) *Passiflora foetida* (7) *Turnera ulmifolia* (8) *Paederia foetida* (9) *Plumbago zeylanica* (10) *Calotropis gigantea* (11) *Catharanthus roseus* (12) *Rauwolfia serpentina* (13) *Heliotropium indicum*

## Discussion

In this investigation, fifteen species has been described based on seedling morphological characters. These seedling characters can serve as marker character for identification of taxa. Out of fifteen studied taxa *Glycosmis pentaphylla* showed Cryptocotylar Hypogeal Reserve (CHR) type of germination and rest 14 species showed Phanerocotylar Epigeal type of germination. PEF type of germination is advantageous over other types of germination as they generally grow faster than when exposed to increased light (Pooma and Bongers 1988)<sup>8</sup>. Seedling characters like germination pattern, nature of root, hypocotyl, shape, size, color, apex, base, margin of paracotyledons and eophylls has been considered in this investigation. Root of *Stephania japonica*, *Argemone mexicana*, *Glycosmis pentaphylla*, *Calotropis gigantea*, *Rauvolfia serpentina* is elongating. *Portulaca oleracea*, *Passiflora foetida*, *Paederia foetida*, *Plumbago zeylanica*, *Heliotropium indicum* have reduced roots. Hypocotyl of *Stephania japonica*, *Tinospora sinensis*, *Passiflora foetida*, *Paederia foetida*, *Catharanthus roseus*, *Rauvolfia serpentina* had elongating while *Argemone mexicana*, *Portulaca oleracea*, *Glycosmis pentaphylla*, *Plumbago zeylanica* have reduced hypocotyl. Eophylls have either opposite (*Portulaca oleracea*, *Glycosmis pentaphylla*, *Turnera ulmifolia*, *Paederia foetida*, *Calotropis gigantea*, *Catharanthus roseus*, *Rauvolfia serpentina*, *Heliotropium indicum*) or alternate (*Stephania japonica*, *Tinospora sinensis*, *Argemone mexicana*, *Passiflora foetida*, *Plumbago zeylanica*) phyllotaxy. Based on these seedling characters artificial key has been constructed for the easier identification of plants in their juvenile stage.

## Conclusion

This work shows that seedling character of investigated plants is related to each other and the artificial key is extremely useful for early identification and restoration of plants. Seedling morphological studies of medicinal plants help to restore the wild medicinal plants in early stage of their life cycle. Therefore from the conservation point, identification of seedlings of medicinal plants can help to prevent or restore the plant source loss in the Tripura and can also help in developing strategies for protection, conservation and management of medicinal plant of Tripura.

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