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RANGE OF HOST VARIATION OF *CUSCUTA* (CUSCUTACEAE) IN NADIA DISTRICT (WEST BENGAL) ALONG WITH HAUSTORIAL STRUCTURE IN SOME HOST WITH PLANTS

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Abstract: Present survey is conducted on two species of *Cuscuta (C. chinensis* and *C. reflexa)* which are distributed in different parts of Nadia district especially in Kalyani Township. 30 angiospermic host plants have been identified out of which 25 angispermic plants are infected by *C. reflexa* and only 5 plants has been attacked by *C. chinensis*. All angiospermic plants are distributed in 28 genera and 20 families. 2 plants has been identified as pseudo parasite and 2 plants belonging to pteridophytic group are also attacked by *Cuscuta.* Detailed structure and development of haustoria have been studied on 8 angiospermic plants. *Mikania cordata* is identified as primary host plant of *Cuscuta.* Structure of haustorium is variable which is dependent on some factors.

Keywords: Host variability, haustorial development, *Cuscuta,* Cuscutaceae

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INTRODUCTION

Cuscuta is a stem parasites with short lived, brightly coloured chlorophyll less, thread like twining stems, linked by haustoria with the host plants of different families of dicotyledons.

The genus *Cuscuta* was first described by Tournefort and later it was validly published by Linnaeus in his "Species Plantarum" (1753).

Cuscuta L. previously belongs to the family Convolvulaceae, but now it belongs to the family Cuscutaceae. It has 145 species throughout the world (Mabberley, 2008). *Cuscuta* is mostly cosmopolitan in distribution. It is commonly known as "Dodder" or "Devil's guts".

This stem parasite prior to the contact with the host plant, seedlings of all species are self-sufficient and autotrophic (although relying heavily on the seed resources). The evolution to parasitism has led to a gradual reduction of the photosynthetic apparatus from more hemi parasitic-like species to holoparasitic ones.

There are many parasitic plants which are host specific but in case of *Cuscuta* there is no definite host. It grows in different types of plants. There is no record of variation of host by two species of *Cuscuta* (C*. reflexa* and *C. chinensis*) plant. It is also true that structure of haustorium has not been recorded in details, particularly in West Bengal along with the district Nadia of West Bengal. Therefore, the present study has been under taken to record the range of host plants in *Cuscuta* and the structure of haustoria in some host plants.

Most of the species are typical annuals. However, when they are growing on perennial hosts (especially woody host), haustoria of some species remain inside the host and regenerate new plants in the next growing season. Some *Cuscuta* species are serious pests that can cause up to 80% yield losses in many crops.

Some dodders can be used in folk medicine or used as a dye (e.g., *Cuscuta tinctoria*) or it has antifungal or insecticidal effects.

More importantly some *Cuscuta* species can modify the structure of plant communities in an area.

Some *Cuscuta are* "specialists" with a narrow host range, while others are "generalist" capable of parasitizing numerous species from various families. *Cuscuta reflexa* and *Cuscuta chinensis* are the examples of second category.

It is also noted that in marshy places *Cuscuta* are usually grown on herbaceous members only.

Life cycle

Immediately after germination, seedlings found themselves in a life and death race against time to locate and establish

haustorial contact with a suitable host. If that does not happen in one or two weeks, they will die because their root-like organ is not functional, and survival at this stage is based only on the food reserves stored in the endosperm of the seeds (seedlings also do not have cotyledons). Therefore, dodders have evolved special adaptations. Their seeds germinate relatively late in the season when the potential hosts are already established. Seedlings are capable to orient themselves after green canopies and volatile cues (**they can "see" and "smell" the hosts!).** As a result, *Cuscuta* sp. selectively forages in plant communities pretty much like herbivores! Stems twine anticlockwise around the stems of the host; they form numerous small haustoria that penetrate the tissues of the host and reach its vasculature establishing a biochemical and physiological channel.

Once established on the host, shoots grow very fast. Growing stems of different ages of the same plant interconnect among themselves through haustorial connections, a phenomenon known as self-parasitism. As a result, the plant becomes a complex tri-dimensional network of stems, which may optimize the distances that assimilates must travel within the same plant. One single *Cuscuta* plant can parasitize many of hosts in a plant community.

MATERIALS & METHODS

The twining stem parasites with its hosts were collected from different parts of Nadia district especially in Kalyani area, along the railway tracks side (because it grows in large scale beside the railway line). Two species of *Cuscuta* plants were collected from different host plants in different habitats. Some plants were preserved in F.A.A solution which was used for anatomical studies. All collected plants were stored in the Herbarium of the Department of Botany, University of Kalyani for future reference.

The host plants were identified with the help of Indian flora, state and district floras of West Bengal (Prain, 1903; Guha Bakshi, 1984; Hooker, 1879).

Infiltration and embedding

After passing the plant material through 100% TBA in the dehydration series, the studied material was dropped in molten paraffin wax (melting point 56°C) in a glass tube and a small amount of TBA was added .The preparation was then placed in an oven at about 58+2°C to keep the wax in molten state. The wax was changed every day for 3 consecutive days. After that the material was casted into a mold. The cast blocks were stored in refrigerator for sectioning in rotary microtome.

Microtome sectioning and affixing the ribbons

Materials embedded in paraffin were cut with a rotary microtome. For this purpose the whole cast block was first cut with a razor blade and separated into individual pieces each with a stem embedded in it.

This piece of material to be sectioned was fastened to a mounting block. To fasten the piece of material on the mounting block, the paraffin around the material was trimmed and brought to proper size. The face of the material opposite to the cutting plane was slightly heated on the flame of a spirit lamp and by using a heated scalpel firmly attached on the surface of the mounting block. The material was allowed to cool and then clamped into the microtome. Serial transverse sections were cut between15-20 µm. Paraffin sections in the form of a ribbon were fastened to a glass slide with an adhesive prior to staining. Egg albumen was used as adhesive, which was prepared by the following methods:

Egg albumen

The white of an egg was drained into a graduated cylinder and an equal volume of distilled water and the same volume of glycerin were added. 1% sodium salicylate was added to the mixture and stirred well to homogenize the mixture. The mixture was filtered and stored in a refrigerator. For affixing the ribbon a small drop of egg albumen was placed on the slide, smeared into a thin film with the ball of a finger and flooded with water. Two or three pieces of the ribbon were floated on the water in the slide and the slide was slightly warmed over the hot plate until the paraffin expanded and flattened out. Then the ribbon was allowed to cool, and then dried in an oven at a temperature just below the melting point of the wax for 18-24 hours.

Staining

The slides were stained in Safranin-Fast green combinations following the procedure as described in Sass (1958).

Staining schedule followed was as given in the following chart:

1. Boiled

2. Washed with water

3. Dehydrated through the alcohol grade like,

30% (for 20 minutes)

⇩

50% (for 15 minutes)

⇩

70% (for overnight)

⇩

90% (for overnight)

⇩

Absolute alcohol (for overnight)

4. Absolute alcohol: Chloroform

3: 1 (for 10 minutes)

⇩

1: 1 (for 5 minutes)

⇩

1: 3 (for 5 minutes)

5. Pure Chloroform for 5 minutes

6. Paraffin 58^0 or 52^0 – 3 successive changes

7. Made paraffin block

8. Section cutting

9. Staining grade

Xylol I (for 30 minutes)

⇩

Xylol II (for 20 minutes)

⇩

Xylol III (for 20 minutes)

⇩

Xylol: Alcohol – 3:1 (for 10 minutes)

⇩

Xylol: Alcohol – 1:1 (for 1o minutes)

⇩

Xylol: Alcohol – 1:3 (for 10 minutes)

⇩

Absolute alcohol I (for 10 minutes)

⇩

Absolute alcohol II (for 10 minutes)

⇩

90% Alcohol (for 5 minutes)

⇩

70% Alcohol (for 10 minutes)

⇩

50% Alcohol (for 5 minutes)

⇩

30% Alcohol (for 5 minutes)

⇩

Water (for 2 minutes)

⇩

Safranin (for 15-20 minutes)

⇩

Water (for 2 minutes)

⇩

30% Alcohol (for 5 minutes)

⇩

50% Alcohol (for 5 minutes)

⇩

70% Alcohol (for 5 minutes)

⇩

90% Alcohol (for 5 minutes)

⇩

Light green (for 5 minutes)

⇩

90% Alcohol (for 5 minutes)

⇩

Absolute alcohol I (for 5 minutes)

⇩

Absolute alcohol II (for 5 minutes)

⇩

Clove oil (for 2 minutes)

⇩

Clove: Xylol 1:1 (for 2 minutes)

⇩

Mount in Canada balsam

RESULTS AND DISCUSSION

Morphology

Cuscuta reflexa *(*Fig. 1)

Habit: Small, root less, leaf less twining, stem parasitic herb.

Stems: Cylindrical, solid, branched, leaf less twining stem with nodes and provided with teeth like haustorial disc at short intervals fixing the parasite on the stem of the host, glabrous, green.

Inflorescences : Lax axillary, paniculate cyme, 3-6 flowers arranged in fascicles; bracteate; bract 0.5-1 mm long, lanceolate, entire along margin, glabrous, yellowish, sometimes bracts absent.

Flower: Complete, bisexual, actinomorphic, hypogynous, bracteate; bracts 1-2 mm long, sessile or shortly pedicellate; pedicels 0.5-1mm long, glabrous, whitish.

Calyx : Sepals-5, gamosepalous, fleshy-persistent, 4-6 mm long, each lobe 2 mm long and 2 mm wide, ovate, rounded to acute at apex, entire, glabrous, aestivation imbricate.

Corolla : Petals-5, gamopetalous, campanulate, persistent, about 8 mm long and about 3 mm across, lobes about 3 mm long and about 2.5 mm wide, elliptic-ovate, acute at apex, glabrous, green, usually with a ring of fimbriate or lobed scales near the base of below the stamens; scales about 4 mm long and about 1.5 mm long; aestivation imbricate.

Androecium : Stamens-5, epipetalous, persistent, alterni-petalous and adnate, 2 mm below the sinuous of the corolla tube exerted, about 2 mm long; filament thick, linear, about 1 mm long, gradually narrow

towards the apex; anther bi lobed, basifixed, about 1 mm long, oblong, intorse.

Gynoecium : Carpels-2; ovary syncarpous, round, 2 mm in diameter, 2-chambered, septum parallel to floral axis, 2 false septum are formed at right angles to floral axis; axile placentation with 4 ovules, disc present; style-2, distinct, lower part dumpbell shaped, cylindrical, persistent, about 2 mm long; stigma-2, filiform.

Fruit : 4-seeded, septicidal capsule, globose-ovoid, about 3 mm in long and about 2 mm wide with persistent calyx; corolla and stamens towards base with persistent style towards the centre of the apical part; dry or succulent, circumsessile or irregularly rupturing, 2-4 ovules, at maturity only seeds developed.

Seeds: 2-4 in number, glabrous, ellipsoidal to squarish and grooved at the middle, about 2 mm long.

Cuscuta chinensis **(Fig**. 2**)**

Habit: Leaf less, achlorophyllous, parasitic herb with watery juice, total stem parasite.

Stems: Stem cylindrical, solid, branched, leaf less, twining hairy with nodes and provided with teeth like haustorial disc at short intervals, fixing the parasite on the stem of the host, glabrous, golden yellow.

Inflorescences : Lax axillary, basically dichasial cyme, 9-19 flowers arranged in corymbose manner; bracteate; bract about 4 mm long, lanceolate, entire along margin; pedunculate; peduncle about 2 mm long .

Flower: Complete, bisexual, actinomorphic, hypogynous, bracteate, pedicellate; pedicel about 2 mm long, compressed, glabrous, whitish.

Calyx : Sepals-5,gamosepalous, fleshy, persistent, about 3 mm long, creteriform, ovate, rounded to acute at apex, entire along margin, glabrous, green, imbricate .

Corolla : Petals-5, gamopetalous, united into campanulate corolla; corolla about 6mm × 2 mm, lobes elliptic to ovate, about 2.5 mm long and about 2 mm wide, acute at apex, entire along margin, glabrous, white, fimbriate, flap like,

Androecium : Stamens-4, epipetalous, alterni-petalous, adnate, about 1 mm long, below the sinuous of the corolla tube exerted, about 4 mm long, filament thick; about 3 mm long, gradually narrow towards the apex, glabrous, brownish, ,anther bi-lobed; basifixed, about 1 mm long, oblong, connivent intorse.

Gynoecium : Carpels-2, syncarpous, ovary superior; round, about 2 mm in diameter, glabrous, 2 chambered, septum parallel to the floral chamber, surface incompletely faintly striated, disc present, style-2; distinct, filiform, cylindrical, persistent, about 1.75 mm long, glabrous, stigmas-2; capitate.

Fruit: Fruit 2-seeded, septicidal capsule, oblong, rectangular, 5-angled, about 3.5 mm long and about 2 mm wide, with persistent acesscent calyx, dehiscence along 2 valves along both the suture at maturity.

Seeds: Seeds-2, ellipsoidal to squarish and grooved at the middle, about 1.5 mm long, seed coat yellow, thick, incompletely reticulate.

General structure of Stem anatomy of *Cuscuta* in transverse section (Fig. 3)

The transverse section of the stem of *Cuscuta* shows the following cellular arrangement from periphery to centre:

Epidermis: Epidermis 1-cell layered thick; cells mostly rectangular in shape, thin walled, compactly arranged, without any content, medianly cuticularised

Cortex: Cortex 6-8 cell-layered thick, parenchymatous, cells 4-5-poly-gonal in shape, thin walled, loosely arranged. Inner side bounded by a layer of starch sheath.

Vascular Bundle: Vascular bundles 5, collateral, conjoint, open, arranged in specific ring , xylem cells 5, phloem cells 5-7, cambium inconspicuous.

Pith: Cells parenchymatous, polygonal, thin walled, loosely arrange.

Haustorial anatomy of *Cuscuta* under transverse section (Fig. 4)

In transverse section of haustoria oblong, elongated in outline, longer than the broad, reaching up to the vascular bundle of the host or even extending up to pith. The cellular structures quite different, cells larger in size, 3-4-poly-gonal in out line, thick walled, with thick protoplast content showing deep safranin strain.

Haustorial initiation and development (Fig. 5)

In transverse section, the stem of 6 days old *Cuscuta* seedlings that has not contacted the host had a one-cell-layer epidermis, a cortex, and a central stele. The cortex was typically 6–7 cells thick. The epidermal cells were vacuolated, and the cortex consisted of vacuolated parenchyma cells. The epidermal cells at the contact side of the parasite stem are round in transverse section and have dense cytoplasm and more evident nuclei than the epidermal cells before contact. The haustorial initials developed into a group of meristem cells. Concurrently, the epidermal cells at the contact side began to elongate and to branch at their tips. During these events, the cortical cells between the meristem and the stele began to expand toward the contact side. The meristem cells contained large nuclei.

Cross section of host and host-parasite attachment (PM 1-45)

***Alternanthera philoxeroides* :** Haustoria is highly developed dome shaped structure and well established within the host tissue

by penetrating epidermis and cortical tissue of the host (PM : 1-7) .

Cayratia pedata **:** Haustoria is solid tube like in structure and it reaches up to vascular cylinder in stelar region (PM: 8-15) .

Cestrum diurnum **:** Mature haustoria moderately developed, irregular to conical in shape (PM : 16-22) .

Cleome rutidosperma **:** Haustoria is highly developed, initially it is rod like in appearance with truncate head , then it is enlarged and dome shaped (PM : 23-29) .

Clerodendron viscosum **:** Haustoria is rod like in appearance and reached up to vascular cylinder of the host plant (PM : 30-32) .

Coccinia grandis **:** Mature haustoria are tubular to weakly developed dumpbell like in appearance (PM : 33-39) .

Ipomoea aquatica **:** Mature haustoria tube like or rod like in appearance(PM : 40-43) .

Mukia maderaspatana **:** Mature haustoria is irregular in shape(PM : 44-45) .

✧Here PM = Photo Micrograph

Present survey indicates that there are 2 species of *Cuscuta* (*C. chinensis* and *C. reflexa*) which are attacking on 30 angispermic host plant. *C. reflexa* produces haustorium in 25 angiospermic plant where as *C. chinensis* is attacking only 5 angiospermic plants. It has also been observed these 30 plant speics are distributed in 28 genera and 20 families. *Cuscuta* is predominantly affecting on the families like Compositae and Verbenaceae containing 3 species each. 6 species are struggling for second position (Amaranthaceae, Vitaceae, Solanaceae, Cucurbitaceae, Euphorbiaceae and Malvaceae), each containing 2 species. Remaining 12 families have one species each.

It has also observed that *Cuscuta* is equally attacking on 8 herbaceous plants, 8 shrubby plants and 8 arboreal plants i.e., tree, whereas 6 climbers has been affected by *Cuscuta.*

Out of 30 angiospermic species, haustoria are strongly developed in 15 species, followed by moderately developed in 11 species and are weakly developed in 4 species.

In addition to angiospermic host plants, *Cuscuta* produces haustoria in 2 pteridophytic plant species such as *Pteris vittata* and *Chistella dentata* along the side of railway track.

It has been observed that *Mikania cordata* is severely attacked by *Cuscuta*. So, this plant can be regarded as most preferred host of the parasite.

It is very remarkable that one *Cuscuta* attacked on another *Cuscuta* plant, i.e., host and parasite are both representing by

Cuscuta. Here *Cuscuta* absorb nutrition from another *Cuscuta* plant. After some days one *Cuscuta* (host) will dry up for want of nutrition. Such type of association has not been reported earlier in any communication.

Field observation shows that *Cuscuta* appears to have recognized primary hosts and secondary hosts. **Primary hosts** are those on which *Cuscuta* are able to establish and develop from seeding stage. In studied area *Mikania cordata* can be considered as primary host. In **Secondary hosts,** *Cuscuta* is unable establish from the seedling stage.

The present study also revealed that the shape and mode of development of haustoria is variable. The mode of penetration of *Cuscuta* into host plants has been studied in details on 8 plants (PM 1-45). In *Alternanthera, Cleome* and *Coccinia* haustoria form well defined structure and these are usually, dome shaped or rod like in appearance, whereas irregular shaped haustoria are seen in *Cayratia, Cestrum, Clerodendrum, Ipomoea* and *Mukia.*

In few occasions, *Cuscuta* are superficially coiled that host plant but are unable to produce haustoria in host plants. With the help of these plants, *Cuscuta* migrated to another host plant and are capable to produce haustoria. Then these uninfected host plants can be designated as **pseudoparasite**. From the present study only 2 plants viz. *Brachiaria reptans* (Gramineae) and *Euphorbia hirta* (Euphorbiaceae) are such type.

According to present investigation the length and structure of haustoria are quite different depending on the nature of host habit as well as position of vascular tissue in the host plant. In the arboreal habit of host plant, haustoria is shorter in structure that the herbaceous members. Similarly, if the vascular bundles or vascular cylinders are closer to epidermis, the structure of haustoria is shorter than the deeply located vascular tissue in the host plant.

Present survey also indicates that *Cuscuta* prefers dicotyledonous plants than the monocotyledonous plants as well as ferns. Distribution of *Cuscuta* is mainly found near the abandoned areas, besides the railway lines, road side vegetations, herbaceous plants near shallow ditches as holoparasites.

The mode of penetration in host plant by *Cuscuta* is either intercellularly or intracellularly in the parenchymatous tissue of host plant. On the other hand host plant may create some mechanical or chemical resistance to the parasites. As a result, some host plants are totally resistant to *Cuscuta.* Pseudo parasites are the examples of this category.

Cuscuta is usually annual plant, but in arboreal host it retained its vegetative part within the host plant after completion of life cycle i.e., flowering and fruiting. In next session *Cuscuta* produces new vegetative

body on the same host plant and can thrive as perennial plant on the arboreal host plants. Therefore, permanent control of *Cuscuta* can be done only by uprooting and burning of host plant species.

ACKNOWLEDGEMENTS

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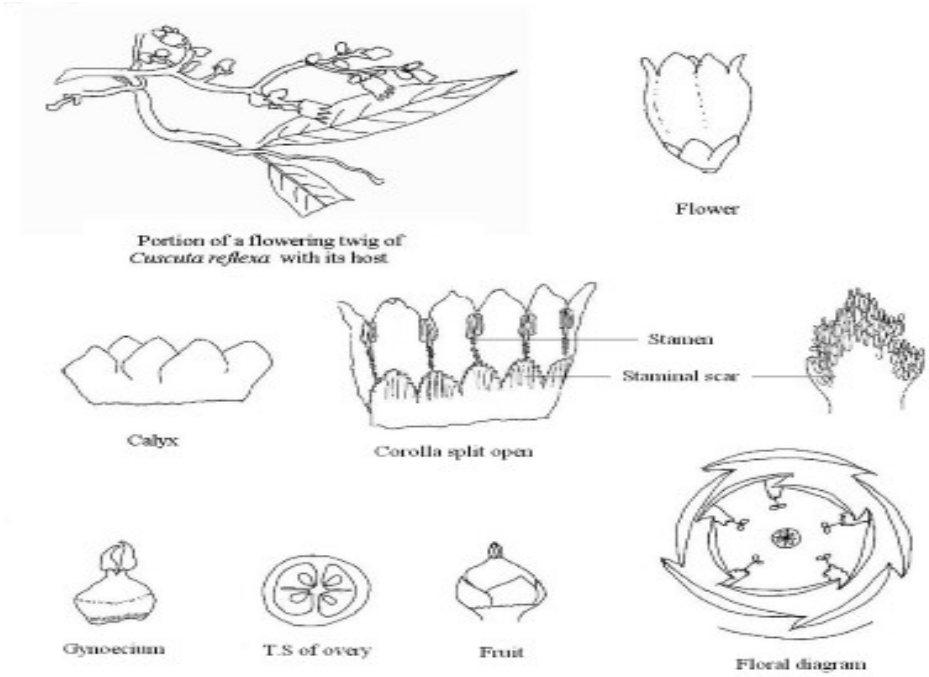


Fig. 1: Floral and vegetative parts of *Cuscuta reflexa*

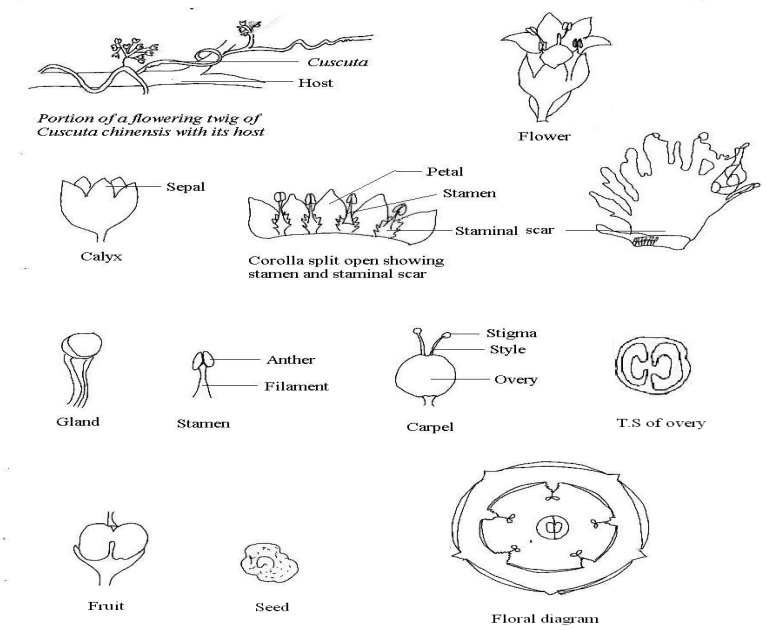


Fig. 2: Floral and vegetative parts of *Cuscuta chinensis*

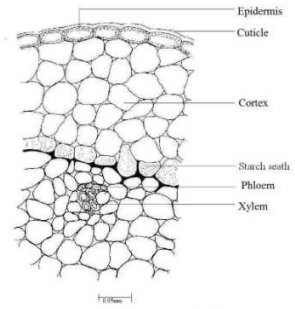


Fig 3 : Transverse Section of the Stem of *Cuscuta*

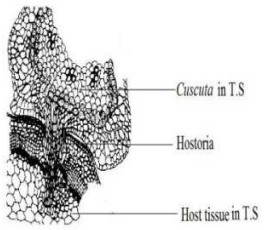


Fig 4 : Transverse Section of Hostoria of *Cuscuta* with its Host

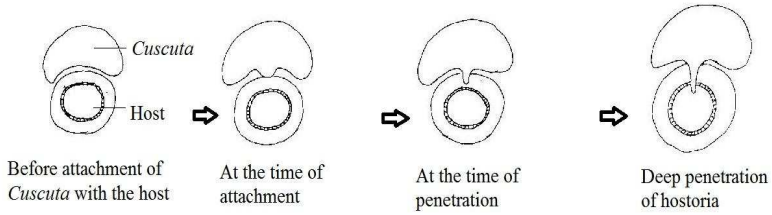
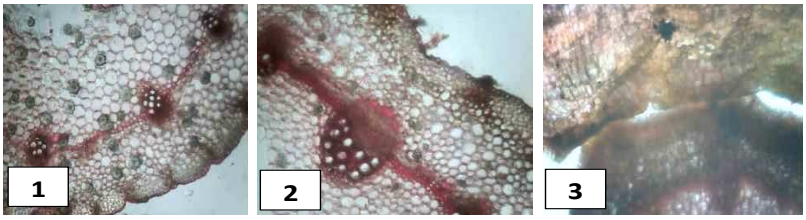
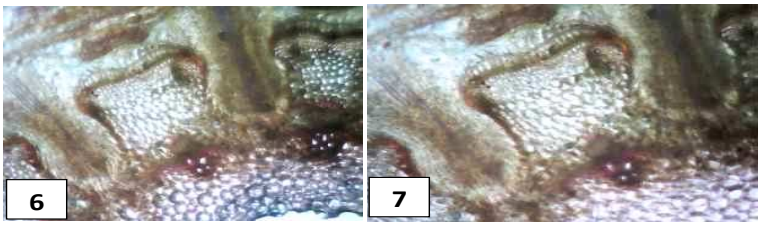


Fig 5 : Diagrametic view of the process of penetration of *Cuscuta* to the host tissue





PM : 1-7 . *Alternanthera philoxxeroides* . Cross section of host and host parasite attachment zone.

1-2 : T.S of Host plant , 3 : T.S of Host Parasite attachment zone between the cells of adhesive disk and host tissue , 4-7 : Development and penetration of haustoria towards the vascular bundle of Host Plant.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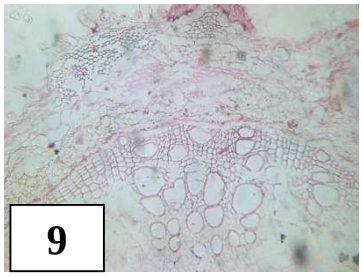
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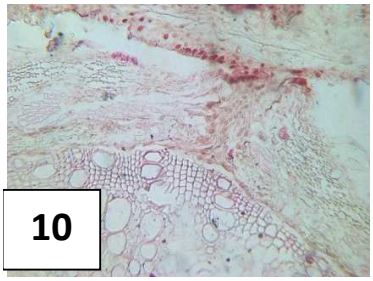
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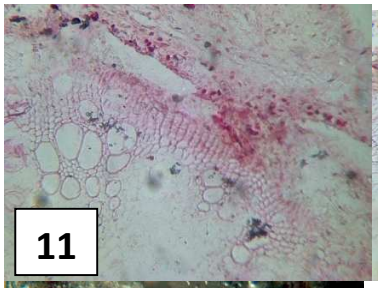
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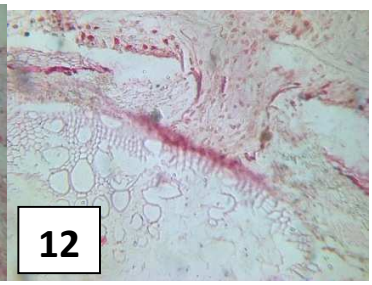
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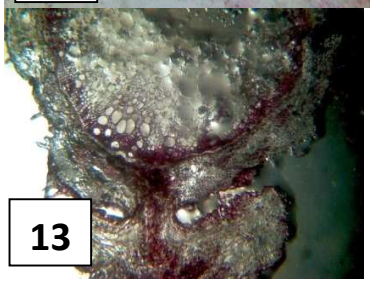
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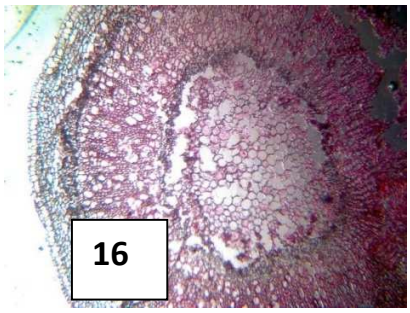
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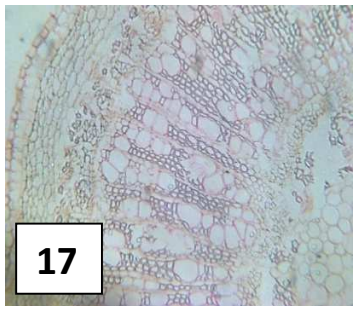
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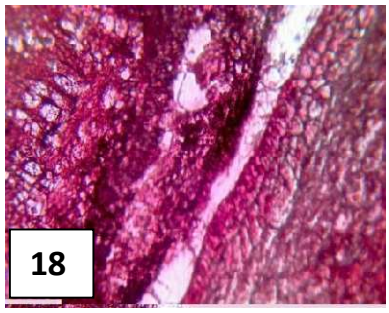
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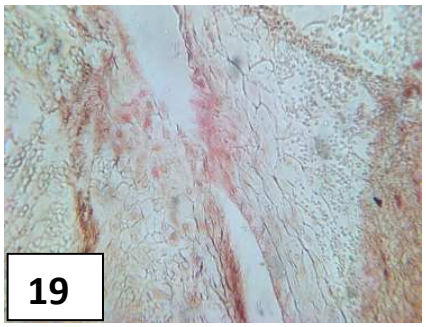
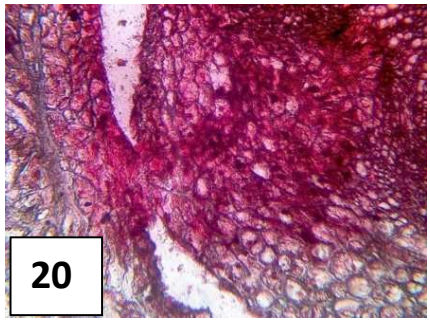
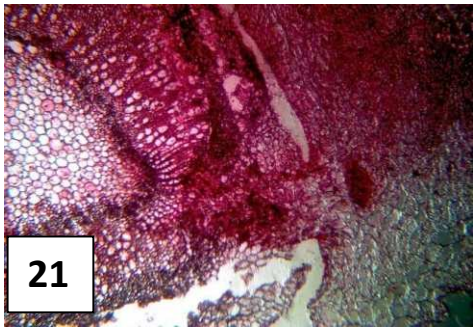
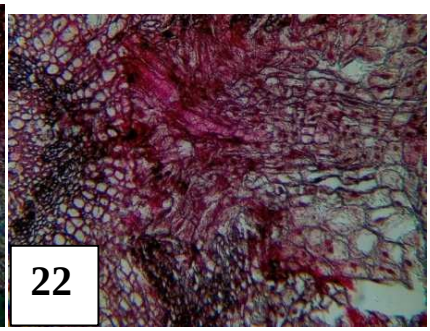


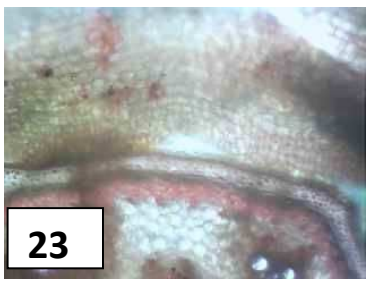


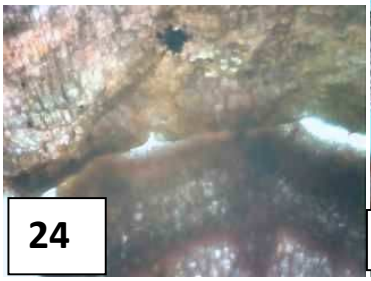


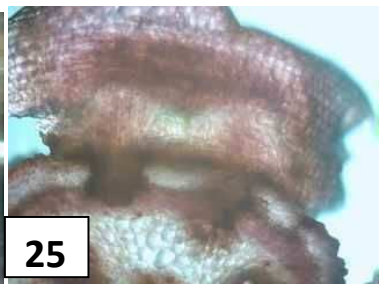


PM : 16-22 . *Cestrum diurnum* . Cross section of host and host parasite attachment zone.

16-17 : T.S of Host Plant ; 18 : Host Parasite association with cementing material ; 19-20 : Initiation of haustoria ; 21-22 : Gradual development and penetration of haustoria towards the ring of vascular cylinder of stelar region.

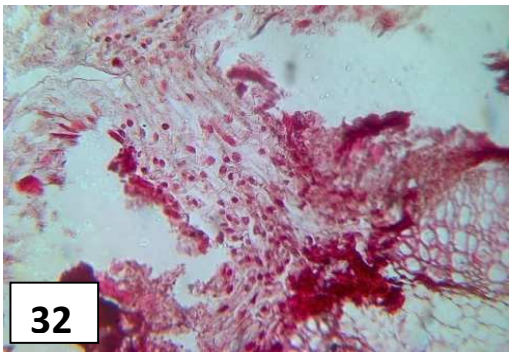






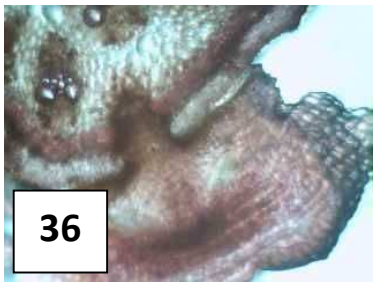
PM : 23-29 .*Cleome rutidosperma* . Cross section of host and host parasite attachment zone.

25 : Attachment zone between the cells of adhesive disk and host tissue ; 24-27 : Development and penetration of haustoria towards the vascular bundle of Host Plant ; 28-29 : Mature haustoria in Host Plant.



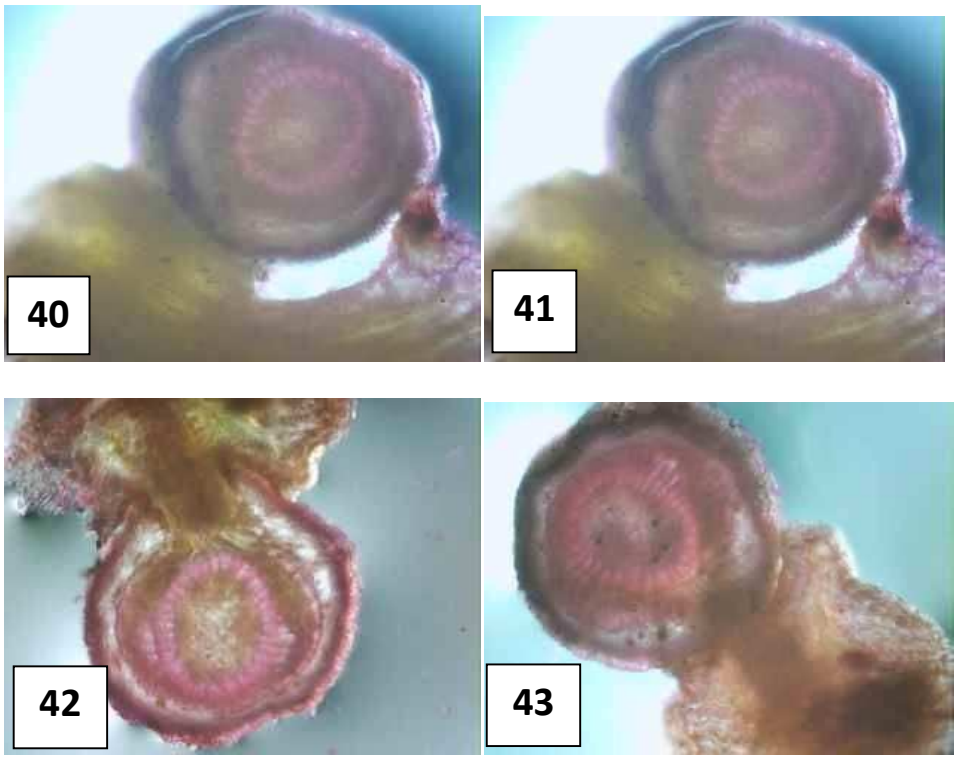
PM : 30-32 . *Clerodendron viscosum* . Cross section of host and host parasite attachment zone.

32 : T.S of Host Plant ; 31-32 : Mature haustoria in between host and *Cuscuta* .



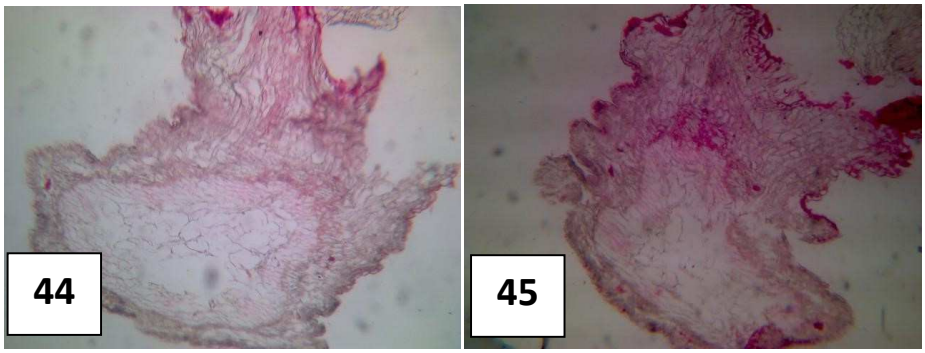
PM : 33-39 . *Coccinia grandis* . Cross section of host and host parasite attachment zone.

33 : Host parasite association with cementing material ; 34-39 : Gradual development and penetration of haustoria towards the inner ring of vascular bundle.



PM : 40-43 . *Ipomoea aquatica* . Cross section of host and host parasite attachment zone.

40 : T.S of Host plant ; 41 : Host parasite association with cementing material ; 42-43 : Gradual development and penetration of haustoria towards the vascular cylinder of stelar region.



PM : 44-45 . *Mukia maderaspatana* . Cross section of host and host parasite attachment zone.

44-45 : Mature haustoria formation in between host and parasitic plant.

Table 1. Different hosts of *Cuscuta* species in Nadia district

Name of the host plant with family name	Habit of the host plant	Name of parasitic species of *Cuscuta*	Nature of haustorium development
Achyranthus bidantata (Amaranthaceae)	Herb	*C. reflexa*	Maximum, large and strongly developed.
Alternanthera philoxeroides (Amaranthaceae)	Herb	*C. chinensis*	Few, moderately developed.
Azadiracta indica (Meliaceae)	Tree	*C. reflexa*	Medium, moderately developed.
Bombax ceiba (Bombacaceae)	Tree	*C. reflexa*	Few, weakly developed.
Cassia tora (Ceasalpiniaceae)	Herb to Subshrub	*C. reflexa*	Medium, strongly developed.
Cayratia pedata (Vitaceae)	Climber	*C. reflexa*	Maximum, strongly developed.
Cayratia triflora (Vitaceae)	Climber	*C. reflexa*	Maximum, strongly

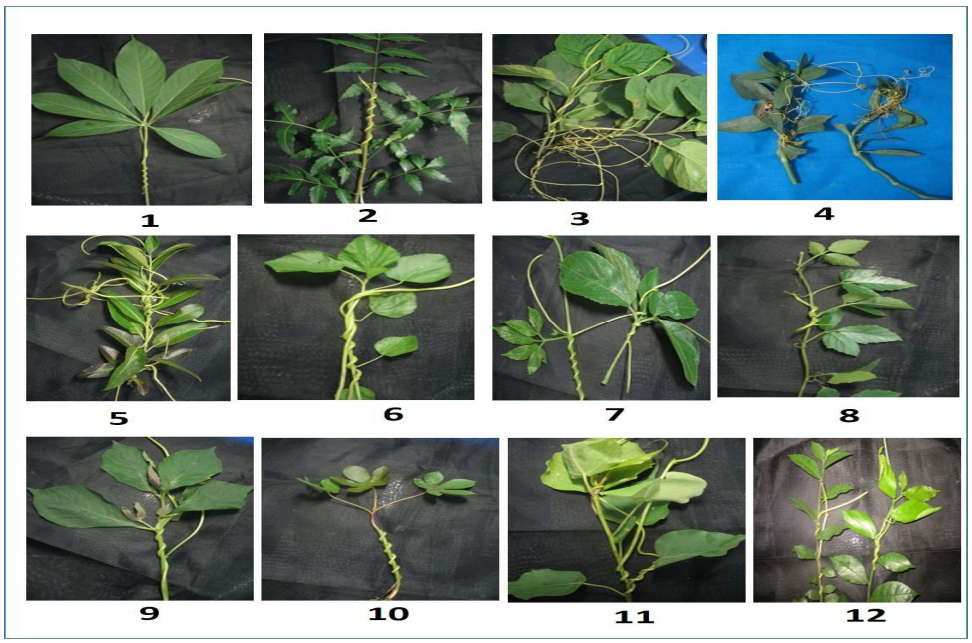
			developed.	
Cestrum diurnum (Solanaceae)	Shrub	*C. reflexa*	Maximum, developed	moderately
Cleome rutidosperma (Cleomaceae)	Herb	*C. chinensis*	Medium, developed.	moderately
Clerodendron viscosum (Verbenaceae)	Shrub	*C. reflexa*	Maximum, developed.	moderately
Coccinia grandis (Cucurbitaceae)	Climber	*C. chinensis*	Maximum, developed	strongly
Duranta repens (Verbenaceae)	Shrub	*C. chinensis*	Maximum, developed	strongly
Ficus religiosa (Moraceae)	Tree	*C. reflexa*	Medium, developed	weakly
Ipomoea aquatica (Convolvulaceae)	Herb	*C. chinensis*	Maximum, developed	strongly
Jatropha carcus (Euphorbiaceae)	Shrub	*C. reflexa*	Medium, developed	moderately
Jatropha gossipipholia (Euphorbiaceae)	Shrub	*C. reflexa*	Medium, developed	moderately
Lagerstroemia speciosa (Lythraceae)	Tree	*C. reflexa*	Medium, developed.	weakly
Lantana camera (Verbenaceae)	Shrub	*C. reflexa*	Maximum, developed.	strongly
Mikania cordata (Compositae)	Climber	*C. reflexa*	Maximum, developed.	moderately
Mukia maderaspatana (Cucurbitaceae)	Climber	*C. reflexa*	Maximum, developed.	strongly

Perthenium histerophorous (Compositae)	Herb	*C. reflexa*	Medium, moderately developed.
Polyalthia longifolia (Annonaceae)	Tree	*C. reflexa*	Few, weakly developed.
Sida cordata (Malvaceae)	Shrub	*C. reflexa*	Maximum, strongly developed.
Sida cordifolia (Malvaceae)	Shrub	*C. reflexa*	Maximum, strongly developed.
Solanum indicum (Solanaceae)	Shrub	*C. reflexa*	Maximum, moderately developed.
Spilanthus culva (Asteraceae)	Herb	*C. reflexa*	Maximum, moderately developed.
Streblus aspera (Urticaceae)	Tree	*C. reflexa*	Maximum, strongly developed.
Tinospora cordifolia (Menispermaceae)	Climber	*C. reflexa*	Maximum, strongly developed.
Trema orientalis (Ulmaceae)	Tree	*C. reflexa*	Maximum, moderately developed.
Zizyphus mauritiana (Rhamnaceae)	Tree	*C. reflexa*	Maximum, strongly developed.

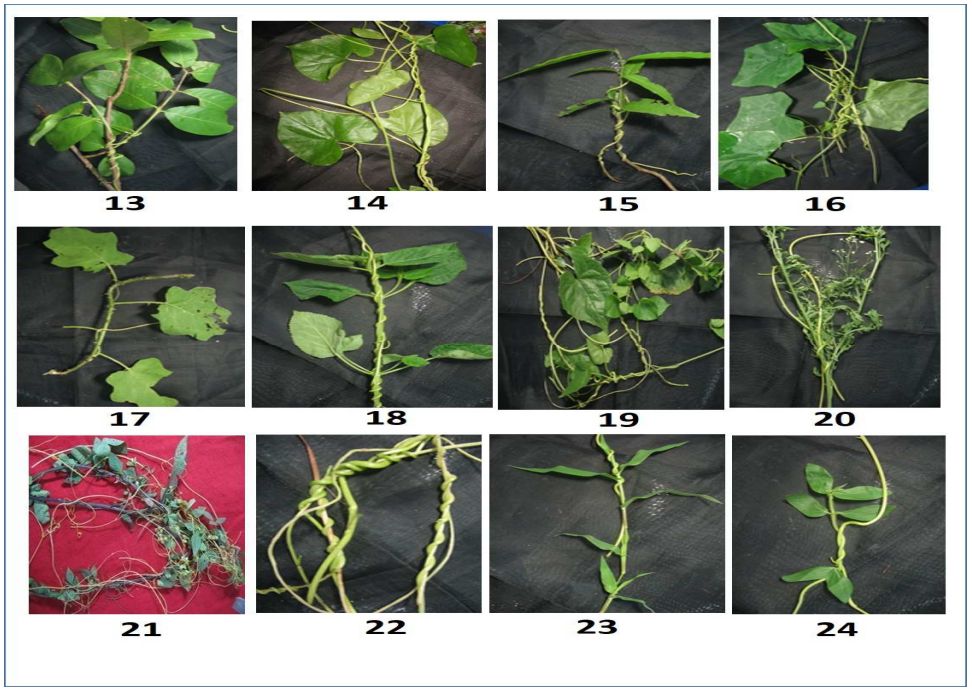
- **Strongly developed**: If the haustorium enter and touch up to vascular bundle.
- **Moderately developed**: If the haustorium enter up to cortex region of the host.
- **Weakly developed**: If the haustorium enter up to epidermal region of the host.

Table 2. Photographs of *Cuscuta* plants with their host plants (Figs. 1-24)

Fig.No.	Name of the Host Plants
1	*Bombax ceiba*
2	*Azadiracta indica*
3	*Clerodendrum viscosum*
4	*Alternanthera philoxeroides*
5	*Cestrum diurnum*
6	*Sida cordata*
7	*Cayratia pedata*
8	*Cayratia triflora*
9	*Achyranthus bidantata*
10	*Jatropha gossipipholia*
11	*Ficus religiosa*
12	*Streblus aspera*
13	*Lagerstroemia speciosa*
14	*Tinospora cordifolia*
15	*Polyalthia longifolia*
16	*Coccinia grandis*
17	*Sida cordata*
18	*Lantana camera*
19	*Mikania cordata*
20	*Perthenium histerophorous*
21	*Cleome rutidosperma*
22	***Cuscuta* on *Cuscuta* - selfparasite**
23	***Brachiaria reptans* - pseudoparasite**
24	***Euphorbia hirta* - pseudoparasite**



Photographs of *Cuscuta* plants with their host plants (Figs. 1-12)



Photographs of *Cuscuta* plants with their host plants (Figs. 13-24)

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