International Journal of Education and Science Research Review
Volume-13 Issue-3 May-June-2026 E-ISSN 2348-6457
(Peer-Reviewed, Open Access, Fully Refereed International Journal) P-ISSN 2349-1817
www.ijesrr.org Impact Factor - 7.02 Email- editor@ijesrr.org

Diversity, Distribution and Infection Dynamics of Shrubby Host Species of Cuscuta chinensis Lam. in Daspur-I Block, Paschim Medinipur, West Bengal

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Abstract
The present study investigates the diversity, distribution, and infection characteristics of shrubby host species parasitized by *Cuscuta chinensis* Lam. in Daspur-I Block, Paschim Medinipur, West Bengal. Field surveys conducted across four habitat types recorded 25 shrubby host species belonging to 18 families and 23 genera. The parasite exhibited a broad host spectrum and varying degrees of infection among host species. The highest infection percentage was observed in *Cephalandra indica* (70.25%), followed by *Phyllanthus reticulatus* (67.85%) and *Colocasia esculenta* (61.45%), whereas *Hibiscus rosa-sinensis* showed the lowest infection percentage (13.23%). Agricultural and plantation habitats supported the highest number of infected host species, while forest habitats showed no infestation. The results demonstrate the ecological adaptability of *Cuscuta chinensis* and highlight its potential role in altering shrub community structure and ecosystem dynamics.
Keywords: *Cuscuta chinensis*, shrub hosts, infection percentage, host diversity, parasitic angiosperm, West Bengal.

Introduction

Parasitic angiosperms represent a unique and highly specialized group of flowering plants that obtain water, mineral nutrients, and organic compounds from other plants through specialized organs known as haustoria. These plants have evolved remarkable physiological and morphological adaptations that enable them to establish intimate vascular connections with their hosts and exploit host resources for growth and reproduction (Kuijt, 1969; Press and Graves, 1995). Parasitic plants occur in nearly every major terrestrial ecosystem and account for approximately 1% of all angiosperm species worldwide, comprising more than 4,500 species distributed among about 20 families (Westwood et al., 2010; Nickrent, 2020). Their ecological significance extends beyond simple host exploitation, as they influence plant community composition, biodiversity patterns, nutrient cycling, and ecosystem functioning (Pennings and Callaway, 2002).

Among parasitic flowering plants, species belonging to the genus Cuscuta L. (Convolvulaceae) are regarded as some of the most successful and widely distributed stem parasites. The genus comprises approximately 200 species distributed throughout tropical, subtropical, and temperate regions of the world (Stefanović and Olmstead, 2004; Costea et al., 2015). Members of Cuscuta are characterized by their slender twining stems, highly reduced leaves, absence of functional roots after host attachment, and limited photosynthetic capability. These morphological reductions are compensated by highly efficient haustorial systems that facilitate direct access to host vascular tissues, enabling the parasite to obtain water, carbohydrates, amino acids, hormones, and other essential metabolites from host plants (Dawson et al., 1994; Furuhashi et al., 2011).

The ecological success of Cuscuta species is largely attributed to their extraordinary host range and efficient host-location mechanisms. Research has shown that seedlings of Cuscuta can detect volatile organic compounds released by potential host plants and use these chemical cues to locate suitable hosts (Runyon et al., 2006). Once contact is established, the parasite rapidly coils around host stems

and develops haustoria that penetrate host tissues and establish vascular continuity. Through these physiological connections, the parasite effectively diverts nutrients and assimilates from host plants, often causing severe reductions in host growth, photosynthetic activity, reproductive performance, and overall fitness (Press and Graves, 1995; Kaiser et al., 2015).

Cuscuta chinensis Lam. is one of the most widespread and ecologically important species of the genus in Asia. The species is extensively distributed throughout India, China, Bangladesh, Nepal, Sri Lanka, and several Southeast Asian countries (Costea et al., 2015). It occurs in diverse habitats including agricultural fields, grasslands, roadsides, plantations, wetlands, scrublands, and forest margins. Due to its broad ecological amplitude and ability to parasitize a wide variety of host plants, C. chinensis has become a dominant component of many disturbed and semi-natural ecosystems (Heide-Jørgensen, 2008). Previous studies have reported its occurrence on numerous herbaceous, shrubby, and woody hosts, demonstrating its capacity to exploit taxonomically unrelated plant species (Dawson et al., 1994; Parker, 2012).

The interaction between Cuscuta chinensis and its hosts has important ecological and economic consequences. Infestation often results in reduced host vigor, suppression of vegetative growth, decreased flowering and fruiting, and increased susceptibility to environmental stresses and pathogens (Musselman, 1987; Aly, 2007). In agricultural ecosystems, heavy infestations may cause substantial yield losses in economically important crops, whereas in natural ecosystems they may alter competitive relationships among plant species and influence patterns of species dominance and succession (Pennings and Callaway, 2002). Consequently, Cuscuta species are increasingly recognized as important ecological engineers capable of modifying community structure and ecosystem processes.

Although numerous investigations have focused on the biology, physiology, and management of Cuscuta species, most studies have concentrated primarily on agricultural hosts and herbaceous vegetation (Dawson et al., 1994; Parker and Riches, 1993). Comparatively little attention has been given to shrubby hosts despite their ecological importance in maintaining ecosystem stability, supporting biodiversity, and providing habitat resources for wildlife. Shrubs constitute a critical component of many terrestrial ecosystems by contributing to nutrient cycling, soil conservation, carbon sequestration, and vegetation succession (Odum and Barrett, 2005). Understanding patterns of parasitic infection among shrubby species is therefore essential for evaluating the broader ecological impacts of Cuscuta chinensis.

Host susceptibility to parasitic plants is influenced by multiple factors including host morphology, tissue anatomy, nutrient composition, growth rate, phenological stage, and defensive responses (Joel et al., 2013). Differences in these characteristics may explain variations in infection intensity observed among different host species. Identifying highly susceptible and relatively resistant host species can provide valuable insights into host-parasite interactions and contribute to the development of effective management strategies for controlling parasitic weeds (Parker, 2012).

The Daspur-I Block of Paschim Medinipur district, West Bengal, represents a heterogeneous landscape consisting of agricultural lands, plantation areas, barren lands, and forest patches that support a diverse assemblage of shrubby vegetation. The varied habitat conditions provide an excellent opportunity to investigate host diversity and infection patterns of Cuscuta chinensis across different ecological settings. Despite the ecological significance of the region, comprehensive information regarding shrubby hosts of C. chinensis and their susceptibility to parasitism remains scarce.

In view of these considerations, the present investigation was undertaken to document the diversity of shrubby host species infected by Cuscuta chinensis in Daspur-I Block, to evaluate patterns of host distribution across different habitat types, and to assess variation in infection intensity among host species. The findings are expected to contribute to a better understanding of host-parasite relationships in tropical ecosystems and provide baseline information for future ecological studies and management programmes aimed at mitigating the impacts of parasitic weeds.

Materials and Methods

The investigation was conducted in four selected sites of Daspur-I Block representing distinct habitat conditions: Dihipalsa (Agricultural Land), Baikunthapur (Plantation Land), Kalaikunda (Barren Land), and Sagarpur (Forest Land). Shrubby vegetation was sampled using 5 m × 5 m quadrats. All shrubs infected by *Cuscuta chinensis* were recorded and identified using standard floristic manuals. Information on host species, family, habitat distribution, infection percentage, affected plant parts, flowering and fruiting status, and utility value was collected. Infection percentage was estimated based on the extent of parasite coverage and haustorial attachment observed on individual host plants.

Results and Discussion

The survey recorded 25 shrubby host species belonging to 18 families and 23 genera infected by *Cuscuta chinensis*. The wide range of host species observed during the investigation confirms the generalist nature of the parasite and its ability to establish successful associations with taxonomically diverse hosts. Similar observations have been reported by Heide-Jørgensen (2008), who noted that species of *Cuscuta* often exhibit broad host compatibility due to their highly specialized haustorial systems.

Table 1. Distribution and Infection Percentage of Shrubby Host Species of *Cuscuta chinensis* Lam. in Daspur-I Block

Sl. No.	Host Species	Family	Site I	Site II	Site III	Site IV	Infection (%)
1	*Cassia alata* L.	Caesalpiniaceae	+	–	–	–	60.14
2	*Cassia sophera* L.	Caesalpiniaceae	+	–	–	–	40.15
3	*Cayratia trifolia* (L.) Domin.	Vitaceae	+	–	–	–	35.98
4	*Cephalandra indica* (Wight & Arn.) Naud.	Cucurbitaceae	+	–	–	–	70.25
5	*Clerodendrum viscosum* Vent.	Verbenaceae	+	–	+	–	60.10
6	*Codiaeum variegatum* (L.) Bl.	Euphorbiaceae	–	+	–	–	41.58
7	*Colocasia esculenta* Schott.	Araceae	+	–	–	–	61.45
8	*Corchorus capsularis* L.	Tiliaceae	–	+	–	–	25.41
9	*Desmodium gangeticum* (L.) DC.	Papilionaceae	+	–	–	–	40.15
10	*Dioscorea bulbifera* L.	Dioscoreaceae	+	–	–	–	35.87
11	*Eupatorium odoratum* L.	Asteraceae	–	+	–	–	30.14
12	*Ficus cunia* Ham.	Moraceae	–	+	–	–	58.21
13	*Ficus glomerata* Roxb.	Moraceae	+	–	–	–	43.75
14	*Glycosmis pentaphylla* (Retz.) A. DC.	Rutaceae	–	+	+	–	41.66
15	*Hibiscus rosa-sinensis* L.	Malvaceae	–	+	–	–	13.23
16	*Ichnocarpus frutescens* (L.) R.Br.	Apocynaceae	+	–	–	–	19.23
17	*Jasminum sambac* (L.) Ait.	Oleaceae	+	–	–	–	18.75
18	*Justicia adhatoda* L.	Acanthaceae	+	–	–	–	54.52
19	*Luffa aegyptiaca* Mill.	Cucurbitaceae	+	+	–	–	20.75
20	*Mikania cordata* (Burm.f.) Robinson	Asteraceae	+	+	+	–	43.75
21	*Mimosa pudica* L.	Mimosaceae	–	+	–	–	29.16
22	*Phyllanthus reticulatus* Poir	Euphorbiaceae	+	+	–	–	67.85

23	*Pluchea lanceolata* L.	Asteraceae	+	+	–	–	39.01
24	*Polygonum orientale* L.	Polygonaceae	–	+	–	–	37.81
25	*Xanthium strumarium* L.	Asteraceae	+	+	–	–	41.66

Note: (+) Present and infected; (–) Absent.

Table 1 demonstrates the distribution of shrubby host species infected by *Cuscuta chinensis* across four study sites. A total of 25 shrub species belonging to 18 families were identified as hosts. Site I recorded the highest host richness, indicating that agricultural habitats provide favorable conditions for parasite establishment. Site II also supported a considerable number of infected hosts, while Site III exhibited comparatively lower diversity. No infected shrub species were recorded from Site IV, suggesting that forest habitats are less suitable for the growth and spread of *Cuscuta chinensis*. The highest infection percentage was observed in *Cephalandra indica* (70.25%), followed by *Phyllanthus reticulatus* (67.85%), indicating their high susceptibility to parasitism.

Table 2. Biological Characteristics and Susceptibility of Shrubby Hosts to *Cuscuta chinensis*

Host Species	Infection (%)	Plant Parts Affected	Flowering/Fruiting Status	Parasite Presence
Cephalandra indica	70.25	Leaf, Stem	Yes	Yes
Phyllanthus reticulatus	67.85	Leaf, Stem	Yes	Yes
Colocasia esculenta	61.45	Leaf, Stem	Yes	Yes
Cassia alata	60.14	Leaf, Stem	No	Yes
Clerodendrum viscosum	60.10	Leaf, Stem	Yes	Yes
Ficus cunia	58.21	Leaf, Stem	Yes	Yes
Justicia adhatoda	54.52	Leaf, Stem	Yes	Yes
Ficus glomerata	43.75	Leaf, Stem	Yes	Yes
Mikania cordata	43.75	Leaf, Stem	Yes	Yes
Glycosmis pentaphylla	41.66	Leaf, Stem	Yes	Yes
Xanthium strumarium	41.66	Leaf, Stem	Yes	Yes
Codiaeum variegatum	41.58	Leaf, Stem	No	Yes
Cassia sophera	40.15	Leaf, Stem	Yes	Yes
Desmodium gangeticum	40.15	Leaf, Stem	Yes	Yes
Pluchea lanceolata	39.01	Leaf, Stem	Yes	Yes
Polygonum orientale	37.81	Leaf, Stem	Yes	Yes
Cayratia trifolia	35.98	Leaf, Stem	Yes	Yes
Dioscorea bulbifera	35.87	Leaf, Stem	Yes	Yes
Eupatorium odoratum	30.14	Leaf, Stem	Yes	Yes
Mimosa pudica	29.16	Leaf, Stem	Yes	Yes
Corchorus capsularis	25.41	Leaf, Stem	Yes	Yes
Luffa aegyptiaca	20.75	Leaf, Stem	Yes	Yes
Ichnocarpus frutescens	19.23	Leaf, Stem	Yes	Yes
Jasminum sambac	18.75	Leaf, Stem	Yes	Yes
Hibiscus rosa-sinensis	13.23	Leaf, Stem	Yes	Yes

Table 2 presents the biological characteristics and infection intensity of shrubby host species. Leaves and stems were the principal organs affected by *Cuscuta chinensis*, indicating that these tissues provide suitable sites for haustorial attachment and nutrient extraction. Infection percentages varied widely among hosts, suggesting differences in host compatibility and resistance mechanisms. Species such as *Cephalandra indica*, *Phyllanthus reticulatus*, and *Colocasia esculenta* were highly susceptible, whereas *Hibiscus rosa-sinensis*, *Jasminum sambac*, and *Ichnocarpus frutescens* exhibited comparatively lower infection levels. Such variation may be attributed to differences in host morphology, physiology, chemical defenses, and habitat conditions.

Among the recorded host families, Asteraceae was represented by the highest number of species, including *Eupatorium odoratum*, *Mikania cordata*, *Pluchea lanceolata*, and *Xanthium strumarium*. Other prominent families included Euphorbiaceae, Moraceae, Caesalpiniaceae, and Cucurbitaceae. The dominance of these families may be attributed to their abundance in disturbed and semi-natural habitats where *Cuscuta chinensis* finds favorable conditions for growth and host colonization. Host availability has frequently been recognized as one of the most important factors determining parasite distribution and success (Press and Graves, 1995).

The site-wise distribution of infected shrubs revealed considerable variation among habitats. Site I recorded the highest number of infected species (23), followed by Site II (18 species) and Site III (14 species). No infected shrub species were recorded from Site IV. The predominance of infected hosts in agricultural and plantation habitats indicates that open environments with abundant host vegetation facilitate parasite establishment. Similar findings have been reported in tropical ecosystems where parasitic plants are often associated with disturbed habitats characterized by high sunlight exposure and dense vegetation (Musselman, 1987).

The infection percentage varied substantially among host species, indicating differences in host susceptibility. The highest infection percentage was recorded in *Cephalandra indica* (70.25%), followed by *Phyllanthus reticulatus* (67.85%), *Colocasia esculenta* (61.45%), *Cassia alata* (60.14%), and *Clerodendrum viscosum* (60.10%). These species appear to provide highly favorable physiological and structural conditions for parasite attachment and nutrient extraction. High infection percentages may be associated with stem architecture, nutrient content, and prolonged availability of suitable tissues for haustorial penetration.

Moderate infection levels were observed in species such as *Ficus cunia* (58.21%), *Justicia adhatoda* (54.52%), *Ficus glomerata* (43.75%), *Mikania cordata* (43.75%), *Codiaeum variegatum* (41.58%), and *Glycosmis pentaphylla* (41.66%). These hosts support successful parasite establishment but may possess certain resistance mechanisms that restrict complete colonization. Previous studies have demonstrated that host anatomical barriers and biochemical defenses can influence the degree of parasite success (Heide-Jørgensen, 2008).

The lowest infection percentages were recorded in *Hibiscus rosa-sinensis* (13.23%), *Jasminum sambac* (18.75%), *Ichnocarpus frutescens* (19.23%), and *Luffa aegyptiaca* (20.75%). Such low levels of infection may indicate host resistance resulting from unfavorable stem characteristics, secondary metabolites, or physiological incompatibility. Host resistance has been widely recognized as a critical determinant of infection intensity in parasitic plant-host interactions (Dawson et al., 1994).

An examination of affected plant organs revealed that leaves and stems were consistently infected across all host species. The parasite extensively twined around host branches and formed numerous haustorial connections with stem tissues. This pattern is typical of stem parasitic species, which rely on direct vascular connections for resource acquisition. Extensive parasitism of stems and leaves may reduce photosynthetic efficiency, impair water transport, and weaken host growth (Press and Graves, 1995).

Most host species were infected during flowering and fruiting stages. The continued activity of the parasite during host reproductive periods suggests a significant diversion of nutrients away from reproductive structures. Such competition may adversely affect flowering, fruit production, and seed

development. Similar impacts have been reported in several host species infected by *Cuscuta* where reproductive performance declined significantly under heavy infestation (Musselman, 1987).

The ecological implications of these findings are considerable. Shrubs constitute an important structural component of terrestrial ecosystems and provide habitat, food, and shelter for numerous organisms. Selective infection of highly susceptible species may alter competitive relationships among shrubs and influence vegetation composition. Species such as *Cephalandra indica*, *Phyllanthus reticulatus*, and *Colocasia esculenta* may experience substantial reductions in growth and reproductive output under severe infestation, potentially affecting local biodiversity and ecosystem functioning.

Furthermore, several recorded host species possess medicinal, horticultural, and economic value. For example, *Justicia adhatoda*, *Phyllanthus reticulatus*, and *Hibiscus rosa-sinensis* are widely utilized in traditional medicine and ornamental horticulture. Heavy infestation by *Cuscuta chinensis* may therefore have implications not only for ecosystem stability but also for local livelihoods and resource availability.

Conclusion

The present investigation demonstrates that *Cuscuta chinensis* exhibits extensive parasitic associations with shrubby vegetation in Daspur-I Block. A total of 25 shrub species belonging to 18 families were identified as hosts. Agricultural and plantation habitats supported the highest diversity of infected hosts, while forest habitats showed no infestation. Infection intensity varied considerably among host species, with *Cephalandra indica* exhibiting the highest susceptibility and *Hibiscus rosa-sinensis* the lowest. The broad host spectrum and high infection levels observed in several species highlight the ecological adaptability and invasive potential of *Cuscuta chinensis*. Continuous monitoring and appropriate management strategies are therefore necessary to minimize its ecological and economic impacts.

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