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Incidence and distribution of *Loranthus* spp. in Rajshahi, Bangladesh

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Abstract
Loranthus spp., commonly known as mistletoes, are the predominant groups of angiospermic shoot parasites, and are found in a wide range of vegetative zone. They cause more economic loss than members of any other parasitic family of angiosperm. The effects of parasites on hosts are manifolds like reduction of vigour and growth rate, poor fruit and seed production; drying of tops; predisposition to other pests and diseases, and ultimately causing premature death. The motivation of such studies in urban environment is the perception of the need to understand the possible impacts that *Loranthus* spp. could cause on native and mostly on alien species. Therefore, in the present investigation the incidence and intensity of mistletoe infestation on host tree species and their distribution on Rajshahi Metropolitan City, Bangladesh was described.

Keywords: *Loranthus* spp., mistletoe infestation, Rajshahi

Introduction
Parasitic plants are a taxonomically diverse group of angiosperms which grow on other living plants and rely partially or completely on host plants for carbon, nutrients and water, by attaching to host roots or shoots using specialist structures known as haustoria [1, 2]. The site of attachment to the host classifies the parasite as a either root or shoot parasite, whereas the presence or absence of functional chloroplasts further defines the parasite as hemiparasitic or holoparasitic, respectively [2, 3, 4].
Loranthus spp. commonly known as mistletoes is the predominant groups of angiosperm shoots parasites, and is found in a wide range of vegetative zone. It is classified in the genera of Loranthaceae, which has 36 genus and 1300 species all over the world [5]. The Loranthaceae mistletoes are represented in Bangladesh by 7 genera and nearly 15 species [6]. In Bangla mistletoes are called 'pargacha'. They cause more economic loss than members of any other parasitic family of angiosperm. The effects of parasites on hosts are manifolds like reduction of vigour and growth rate, poor fruit and seed production; drying of tops; predisposition to other pests and diseases, and ultimately causing premature death [6]. Extensive studies were carried out in many countries on the flora, vegetation, medicinal values and ecology of economically important plants [7, 8]. Despite the profound effects that parasitic plants have on the communities in which they occur, they are still often ignored in community theory. In the city of Rajshahi, Bangladesh, *Loranthus* spp. grows on several host species. No recent account examines *Loranthus* spp. infestation within the city on native and alien tree species, both naturally occurring and cultivated. The motivation of such studies in urban environment is the perception of the need to understand the possible impacts that *Loranthus* spp. could cause on native and mostly on alien species. Therefore, in this study we describe the incidence and intensity of mistletoe infestation on host tree species and their distribution on Rajshahi Metropolitan City, Bangladesh.

Materials and Methods
Survey Area
The survey of *Loranthus* spp. on infected host plants were conducted in selected locations of Rajshahi University Campus and Rajshahi Metropolitan City. The locations of Rajshahi University Campus were in and around both Faculty of Science and Arts building, bas stand, Shahid miner, auditorium, around both boys and girls hostels, teacher's quarters, botanical garden, Fine Arts department and Institute of Bangladesh Studies. The locations of Rajshahi Metropolitan City were road side tree of Shaheb bazaar, Lakkhipur and Rajshahi Medical College and Hospital.

Geographical Position
Rajshahi Metropolitan City is located at 24.40ºN 88.50ºE. Rajshahi University is situated at 24.370 ºN 88º637 ºE. The campus lies about for 5-6 km east of the Rajshahi city. It is situated in the north side of Dhaka-Rajshahi road, south of Mehercandi Mouza, east of RUET and west of Fruit Research Institute.

Soil Type
The soil all around of Rajshahi University is alluvium. The soil pH of Rajshahi is 7.5.

Climate
Rajshahi's climate is classified as tropical. The summers are much rainier than the winters in Rajshahi. This climate is considered to be Aw according to the Köppen-Geiger climate classification. The annual average temperature in Rajshahi is 25.8 °C. About 1419 mm of precipitation falls annually. Precipitation is minimum in December, with an average of 2

mm. The greatest amount of precipitation occurs in July, with an average of 301 mm. At an average temperature of 29.4 °C, June is the hottest month of the year. The lowest average temperatures in the year was recorded in January, when it was around 18.5 °C.

The method of simple random sampling was carried out to study and collect the parasite–host association from the field. Species identification was done by Taxonomist Dr. A. H. M. Mahbubur Rahman, Associate Professor, Department of Botany, Rajshahi University. Infestation intensity (%) was calculated following Ram *et al.* [9]. as the number of infested branches on a tree/total number of branches on a tree ×100.

Results and Discussion

A total of 16 host tree species were found to be infested with *Loranthus* spp. in the present area (Table 1) of which 15 was nonnative. Protected areas revealed higher infestation of *Loranthus* species than the unprotected areas. Present study has shown that in Rajshahi University Campus the highest infestation intensity was 71.43% on *Mangifera indica* followed by 66.66% on *Thespesia populnea* and 50% on *Ziziphus mauritiana* (Table 2). On the other hand, range of host species was lower. However, *Swietenia mahagoni* is the abundant host species and had the highest infestation intensity (66.66%) in Rajshahi Metropolitan city followed by *Acacia auriculiformis* (50%) and *Citrus grandis* (46.29%) (Table 2) but the number of infected host species is higher than Rajshahi University Campus.

Although there was difference in *Loranthus* infestations in the plants of RU campus and Rajshahi metropolitan city (RMC), statistical analysis indicated that the two sets of data might have the same variance ($F_{0.05} = 1.72$ for df 7,15).

The plant ecosystem has encountered severe damages due to the distribution of semi-parasite *Loranthus* spp. A survey of some fruit orchards in the Central Region of the Sudan revealed severe infestation of citrus and guava trees by mistletoe. Observations indicated that these obligate parasites are causing severe damage to fruit tree crops, which include growth loss, mortality and reduced yields. Alternate hosts, dispersal, nature of damage and methods of control practised by the farmers together with those practised internationally has been discussed in this report [10].

In conclusion, the severity rates of infection could vary from region to region, host to host and mistletoe density to density

Table 1: List of the host plants of *Loranthus* spp. found in Rajshahi

	Species	Location	Local name	Family	Origin
1	*Mangifera indica*	RU, RMC*	Aam	Anacardiaceae	Indigenous
2	*Lannea coromandelica*	RU, RMC	Jiga	Anacardiaceae	India
3	*Ziziphus mauritiana*	RU	Boroi	Rhamnaceae	Indo-Malaysian region
4	*Citrus grandis*	RU	Jambura	Rutaceae	Southeast Asia
5	*Thespesia populnea*	RU, RMC	Poposh pipul	Malvaceae	India
6	*Ficus* spp.	RU, RMC	Dumur	Moraceae	Southwest Asia
7	*Ficus religiosa*	RU, RMC	Paikur	Moraceae	Indian subcontinent
8	*Annona squamosa*	RU	Ataphal	Annonaceae	Tropical America
9	*Melaleuca citrina*	RU	Bottle brush	Myrtaceae	Australia
10	*Cassia nodosa*	RU, RMC	Pink shonalu	Fabaceae	Southeast Asia
11	*Dalbergia sissoo*	RMC	Sisu	Fabaceae	Indian subcontinent, Iran
12	*Swietenia mahagoni*	RMC	Mahagoni	Meliaceae	Southern Florida, Caribbean Island
13	*Butea monosperma*	RU, RMC	Polash	Fabaceae	Indian subcontinent, Southeast Asia
14	*Albizia lebbeck*	RU, RMC	Serish	Fabaceae	Indomalaya, New Guinea, Northern Australia
15	*Albizia saman*	RU	Rain tree	Fabaceae	Mexico, Peru, Brazil
16	*Acacia auriculiformis*	RU, RMC	Akashmoni	Fabaceae	Australia, Indonesia, Papua New Guinea

*RU; Rajshahi University, RMC; Rajshahi Metropolitan city

Table 2: *Loranthus* spp. infestation on different host plants in Rajshahi Metropolitan City

	Name of the Plant	Infestation (%)
1	*Mangifera indica*	33.81
2	*Lannea coromandelica*	22.45
3	*Ziziphus mauritiana*	16.09
4	*Citrus grandis*	46.29
5	*Thespesia populnea*	29.03
6	*Ficus* spp.	31.11
7	*Ficus religiosa*	10.15
8	*Annona squamosa*	04.00
9	*Melaleuca citrina*	20.00
10	*Cassia nodosa*	10.00
11	*Dalbergia sissoo*	27.50
12	*Swietenia mahagoni*	66.66
13	*Butea monosperma*	25.00
14	*Albizia lebbeck*	10.00
15	*Albizia saman*	10.00
16	*Acacia auriculiformis*	50.00

Table 3: Intensity of infection by *Loranthus* spp. on different host plants in Rajshahi University Campus

	Host species	Infestation (%)
1	*Mangifera indica*	71.43
2	*Lannea coromandelica*	33.33
3	*Ziziphus mauritiana*	50
4	*Citrus grandis*	30
5	*Thespesia populnea*	66.66
6	*Ficus* spp.	18.18
7	*Ficus religiosa*	10
8	*Annona squamosa*	25
9	*Melaleuca citrina*	0
10	*Cassia nodosa*	0
11	*Dalbergia sissoo*	0
12	*Swietenia mahagoni*	0
13	*Butea monosperma*	0
14	*Albizia lebbeck*	0
15	*Albizia saman*	0
16	*Acacia auriculiformis*	0

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