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Diversity of Mistletoes in Jharkhand: A Review

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Abstract : Mistletoes are obligate hemi-parasites belonging to the family Loranthaceae and Viscaceae. They have developed haustoria to establish parasitic connections with different families of angiosperms called host which fulfill their need of water and nutrient. In Jharkhand, a lot of floristic study was carried out previously but not specialized to the mistletoes. Therefore, present study aimed to collect and enumerate the diversity and indigenous uses of mistletoes in Jharkhand. This exploration trip resulted with a total of 8 species belonging to 4 genera (*Dendropthoe, Macrosolen, Scurrula* and *Viscum*). A total of 59 dicotyledons species are recorded as hosts of different parasitic angiosperms. The highest number of host plants recorded for *Dendrophthoe falcata* and the lowest numbers of host plants are recorded for *Scurrula cordifolia,* and *Viscum orientale.*

Keywords : Parasitic Angiosperms, stem parasitic, host plants, dicotyledonous.

INTRODUCTION

Mistletoes are obligate hemi-parasitic angiosperms, which have established themselves on many forest trees [1]. Many types of mistletoes in the Loranthaceae are dependent on birds to open flower buds and act as pollinators, and therefore often have large, odourless flowers of bright colour to attract these pollinators [2]. By facilitating coexistence and diversity through limitation of competitive dominants, parasitic plants can be considered as 'keystone species' [3]. Parasitic plants themselves can be attractive food sources for herbivores. In the case of mistletoes, their fruit is often available year round, their flowers provide abundant nectar and their foliage is often rich in nutrients [4]. The quality of the parasite as a resource to these herbivores can be greatly affected by host nutrient status [4]. Mistletoes can create a more heterogeneous mosaic of habitat structure [5]. Mistletoes therefore may act simultaneously as parasites and mutualists in natural communities. The various aspects relating to the members of the family Loranthaceae and Viscaceae are studied by eminent workers [6][7][8][9][10][11][12][13][14][15].

MATERIALAND METHOD

Jharkhand state is one of the rich biodiversity and well conserved forest states in India, lies between 25.40°N to 21.87°N and 83.28°E to 88.02°E. This encompasses the area of 79,714 km². Forests in Jharkhand spread over an area of 23,605 square kilometers, which constitutes about 29.61% of the total area of Jharkhand.

The state is explored for floristic study by using available transports. In each collection trip, the assistance of local people and forest guards are sought, especially as and when it was necessary to explore the dense forest. Both the host and the parasites collected and identified by different district floras [10] [11] [12] [13] [14].

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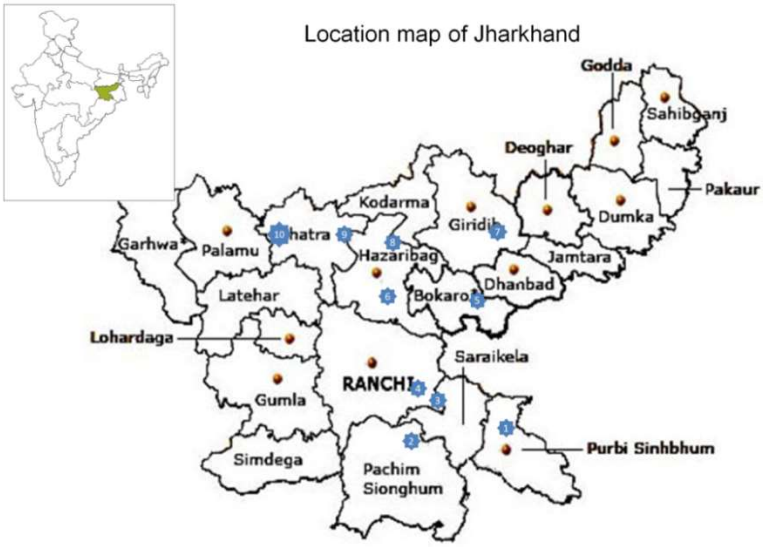


OBSERVATION

***Dendrophthoe falcata* (L.f.) Etting. Var. falcata (Family: Loranthaceae)**

Description: Plants with large bushy with thick haustoriferous runners; **Stem:** bark grey and glabrous; **Leaf:** lamina thick, opposite, ca 20 x 8 cm, oblong, glabrous; mid rib prominent, yellowish green; **Inflorescence:** axillary unilateral racemes **Flower:** complete, bisexual, actinomorphic, mature floral bud red up to the neck and with a dark green hand just below which, clavate portion bright green; **Calyx:** 4 mm long, tomentose, **Corolla:** tubular at anthesis, 2.5-4 cm long, bright red, split at back ca 13mm deep; tube curved, slightly widened upwards, lobes 5, red, acute; **Androecium:** stamen polyandrous, yellow; **Gynoecium:** Style slender, quadrangular, up to 60 mm long; **Fruits:** berry 17x6 mm.

Flowering & Fruiting: November- March

Host plants: *Acacia torta*, Craib; *Achras sapota* L; *Adina cordifolia* Hook.f; *Aegle marmelos* Corr; *Albizia lebbeck,* Benth; *Albizia procera* Benth; *Annona squamosa* L; *Anogeissus latifolia* Wall; *Artocarpus integrifolius* L.f; *Azadirachta indica* A. Juss; *Bauhinia racemosa* Lam; *Bauhinia vahilii*, ; *Bombax ceiba* L.f; *Buchanania lanzan,* Spreng; *Butea monosperma,* Roxb; *Casearia tomentosa,* Roxb; *Casuarina equisetifolia,* Forst; *Cedrela toona,* Roxb; *Citrus acidum,* L; *Combretum ovalifolium* Roxb; *Dalbergia latifolia,* Roxb; *Dalbergia paniculata,* Roxb; *Dalbergia sissoo,* Roxb; *Delonix regia,* Raf; *Ficus hispida,* L.f; *Ficus retusa,* L; *Ficus religiosa*, L.; *Flacourtia sepiaria* Roxb.; *Grewia tiliifolia,* Vahl; *Helicteres isora,* L; *Ixora parviflora,* Vahl; *Jacaranda mimosifolia,* D.Don; *Lagerostroemia lanceolate,* Wall; *Lepisanthes tetraphylla,* Radlk; *Mangifera indica,* L; *Morinda tinctoria,* Roxb; *Mitragyna parvifolia,* Korth; *Nyctanthes arbor-tristis,* L; *Plectronia parviflora,* Vahl; *Pongamia glabra,* Vent; *Prosopis spicigera,* L; *Pterospermum heyneanum,* Wall; *Randia dumetorum,* L; *Salix tetrasperma,* Roxb; *Sapindus laurifoliu,s* Vahl; *Shorea robusta,* Roxb; *Stereospermum chelonoides,* DC; *Syzygium jambolanum,* DC; *Syzygium wightianum,* Wall; *Tamaridus indica,* L; *Tectona grandis,* L; *Terminalia bellirica,* Roxb; *Terminalia chebula,* Retz; *Terminalia alata* , W. & A; *Terminalia arjuna,* Bedd; *Theapesia populnea,* Cav; *Vitex altissima,* L.f.

Uses: The plant is known to have narcotic and anti-microbial properties. It can also help treat dysentery, constipation, ulcers, and calculi (stones) found in the renal system (in the kidneys, ureters, urinary bladder, and/or urethra). It can help treat common health problems includes diarrhea, common colds, nose-bleeding, arthritis, and rheumatism.

***Dendrophthoe falcata* (L.f.) Etting. Var. pubescens (Hook.f.)**

(Family: Loranthaceae)

Description: Parasitic shrub with haustoriferous surface runners; **Stem:** branches are swollen from the base; **Leaf:** oppositely arranged leaves are 7 x 15 cm, lanceolate, acute at base, obtuse at apex, midrib is red; **Inflorescence:** an axillary, raceme, **Flower:** complete, bisexual, actinomorphic, mature floral buds yellowish- red, the clavate portion green; **Calyx:** copular, lobes 5, pubescent; **Corolla:** corolla tube, splitting to 15 mm from

the base, lobes 7 mm long, dark green oblong, acute, pubescent; **Androecium:** stamens, 4 filaments green, anthers 2mm long, brownish red; **Gynoecium:** style green filiform, stigma red; **Fruits:** berry, 10x 5 mm, oblong, crowned by calyx lobes.

Flowering & Fruiting: January - March

Host plants: *Adina cordifolia* Hook.f; *Aegle marmelos* Corr; *Albizia lebbeck* Benth; *Albizia procera* Benth; *Annona squamosa* L; *Anogeissus latifolia* Wall; *Artocarpus integrifolius* L.f; *Azadirachta indica* A. Juss; *Bombax ceiba* L.f; *Buchanania lanzan,* Spreng; *Casearia tomentosa,* Roxb; *Cassia fistula,* L; *Combretum ovalifolium* Roxb; *Dalbergia latifolia,* Roxb; *Dalbergia sissoo,* Roxb; *Delonix regia,* Raf; *Helicteres isora,* L; *Ixora parviflora,* Vahl; *Lagerostroemia lanceolate,* Wall; *Mangifera indica,* L; *Morinda tinctoria,* Roxb; *Mitragyna parvifolia,* Korth; *Nyctanthes arbor-tristis,* L; *Pongamia glabra,* Vent; *Prosopis spicigera,* L; *Pterospermum heyneanum,* Wall; *Randia dumetorum,* L; *Salix tetrasperma,* Roxb; *Sapindus laurifoliu,s* Vahl; *Shorea robusta,* Roxb; *Syzygium alternifolium,* Walp; *Syzygium jambolanum,* DC; *Tamaridus indica,* L; *Tectona grandis,* L; *Terminalia bellirica,* Roxb; *Terminalia chebula,* Retz; *Terminalia paniculata,* Roth; *Terminalia alata ,* W. & A; *Terminalia arjuna,* Bedd.

Uses: It is also believed that it possesses anti-cancer properties, as consumption can lead to tumor reduction.The plant works as an astringent and help to treat various respiratory problems, such as asthma and pulmonary tuberculosis.It can help with various menstrual disorders. Also, a decoction of the plant can be used by women in order to prevent conception, is known to have anti-fertility properties.

Macrosolen cochinchinensis **(Lour.) Van Tiegh.**
(Family: Loranthaceae)

Description: Shrub with disc shaped haustoriferous runners; **Stem:** branches, lenticellate; **Leaf:** Glabrous, lamina broad ovate, 4 x 6 cm, leaf blade glossy; **Inflorescences:** axillary racemes; **Flower:** complete, actinomorphic, bisexual, **Calyx:** calyx funnel-shaped; elliptical and 0.2 cm long. **Corolla:** corolla in the mature bud strongly 6-alate and inflated in the middle, reflexed, orange, straight, inflated in middle, hexagonal; **Androecium:** Anthers filaments 0.2 cm, anthers are 0.1cm long; **Gynoecium:** Style articulate near the base; **Fruit:** berry orange, globular, dark violet when ripe.

Flowering & Fruiting: May - September

Host plants: *Annona squamosa,* L; *Artocarpus integrifolius,* L.f; *Azadirachta indica,* A. Juss; *Cassia siamea* Lam. *Cassia fistula* L. *Casuarina equisetifolia* Forst. *Cedrela toona* Roxb. *Citrus acidum* L. *Dalbergia sissoo* Roxb. *Delonix regia* Raf. *Ficus religiosa*. *Mangifera indica* L. *Melia azadirech,* Roxb*; Syzygium wightianum* Wall. *Tamaridus indica* L.

Uses: The leaf paste is taken by Tribes as a remedy for jaundice. Berries are eaten to treat cough. Paste of leaves applied to the head to assuage headache.The juice from the bark is ingested to abort the placenta in woman.

Scurrula cordifolia, **(Wall.) G. Don**
(Family: Loranthaceae)

Description: Hanging parasitic shrubs; **Stem:** young shoots whitish tomentose; **Leaf:** Leaves subopposite, orbicular-ovate, to 5.5 x 4 cm, base cordate, apex obtuse; **Inflorescence:** a condensed raceme, **Flower:** Flowers are 2-2.5 cm long, velvety, Flower-tube is curved, greenish-brown, velvety, 2 cm long; **Calyx:** truncate, 3 mm; teeth obscure; **Corolla:** deep red, split down on one side from above the middle; tube 1.5 cm; lobes 4, each 7 mm. **Androecium:** Stamens 4, filaments crimson; **Gynoecium:** Style 2.3 cm, stigma is club-shaped. **Fruit:** Berry is 6-7 mm long.

Flowering & Fruiting: September - February

Host plants: *Butea monosperma,* Roxb;

Uses: Used as contraceptive and menstrual disorder.

Scurrula parasitica **L.**
(Family: Loranthaceae)

Description: *Scurrula parasitica* L. is 1m tall; **Stem:** brownish grey and lenticelled; **Leaf:** leaves are opposite. The blade is ovate, papery, obtuse at apex; **Inflorescence:** raceme, axillary, to 3-7 flowers; **Flower: Calyx:** turbinate and 0.2 cm long; **Corolla:** yellow, curved, 1-2.5 cm long and reflexed; **Androecium:** filaments are 0.3 cm long, anther 0.2 cm long; **Gynoecium:** ; **Fruit:** berries are reddish yellow.

Flowering & Fruiting: August - March

Host plants: *Annona squamosa,* L; *Citrus acidum,* L; *Prosopis spicigera,* L; *Vitex altissima,* L.f; *Ziziphus oenoplia,* Mill; *Ziziphus xylopyrus,* Willd.

Uses: Plant parts are used to excite the discharge of urine, to treat the lack of milk, to strengthen the bones, to lower blood pressure. Leaf paste applied to reduce swellings, to mitigate back and knee pain, and to treat liver diseases.

***Viscum articulatum* Burm.f.**

(Family: Viscaceae)

Description: Epiparasitic, monoecious, usually becoming pendulous, green, 20-50 cm tall; **Stem:** dichotomous, flattened; internodes longitudinally 3-ridged; **Leaf:** Leaves reduced to pairs of scarious scales; **Inflorescence:** axillary, cymes, 3-flowered, central flower female, lateral flowers male, **Flowers:** Male flowers globose in bud, 0.5-1 mm; perianth lobes 4. Female flower ellipsoid in bud, 1-1.5 mm; bract annular; perianth lobes 4, triangular, ca. 0.5 mm; **Gynoecium:** stigma cushion-shaped; **Fruit:** berry whitish.

Flowering & Fruiting: December – March.

Host plants: *Butea monosperma,* Roxb; *Diospyros melanoxylon,* Roxb.

Uses: A preparation from the plant is given in fever attended with aching limbs. It also used in the diseases of blood, ulcers, epilepsy, biliousness.

***Viscum monoicum* Roxb. Ex DC. (Family: Viscaceae)**

Description: A large parasitic shrub; **Stem:** Branches slender, smooth, terete, slightly swollen at the nodes; **Leaf:** petiole short, rather thin and usually drying black, 2.5-12.5 cm. long, variable in width, obliquely ovate, often falcately curvate, acute; basal nerves 3-5, prominent; **Inflorescence:** axillary; **Flowers:** minute, monoecious, greenish, arranged in axillary sessile, usually 3-flowered fascicles; central flower of each fascicle usually pistillate, monoecious the central pistilate and the lateral staminate, bracts truncate, apiculate. Perianth –lobes 3 or 4, triangular-oblong; **Fruit:** berry 6-13mm. long, oblong, narrowed at both ends.

Flowering & Fruiting: October – April.

Host plants: *Cleistanthus collinus,* Benth; *Ixora parviflora,* Vahl; *Croton oblongifolius,* Roxb;

Uses: The powder of dry leaf is used as antiseptic.

Viscum orientale Willd.

(Family: Viscaceae)

Description: Dark green, stem parasite; **Stem:** densely- branched; branches terete and grooved apically branched thickened at the nodes; **Leaf:** numerous, 3.2-5 cm. elliptic, obtuse, glabrous, basal nerves 3-5; **Inflorescence:** axillary; **Flowers** sessile in clusters of 3-5 per node, monoecious the central pistilate and the lateral staminate; **Calyx**- limb quite absent; **Corolla**-lobes 4, triangular, acute, deciduous. **Berry** ovoid sub- globose.

Flowering & Fruiting: August - March

Host plants: *Cleistanthus collinus,* Benth.

Uses: Leaf paste is used to healing of wounds.

Table I. Information on Host and Parasite Plant Species

Host Plant Species	No. of affected individuals	No of dead host plants	No of Mistletoe clumps	No of Mistletoe species	Economic Value of Host Plants
Acacia torta, Craib	7	0	8	1	Tm
Achras sapota L	5	0	5	1	Fr
Adina cordifolia Hook.f	20	1	27	2	Rl, P
Aegle marmelos Corr	14	0	38	2	Fr, P
Albizia lebbeck, Benth	30	0	43	2	Tm
Albizia procera Benth	10	0	30	2	Tm, P
Annona squamosa L	8	0	9	4	Fr, P
Anogeissus latifolia Wall	22	0	24	2	Fw
Artocarpus integrifolius L.f	9	0	14	3	Fr
Azadirachta indica A. Juss	32	0	42	2	Md, P
Bauhinia racemosa Lam	18	0	13	1	Fd, Wd
Bauhinia vahilii. Vahl.	5	0	5	1	Fd, Eu
Bombax ceiba L.f	21	1	24	2	Eu
Buchanania lanzan, Spreng	28	0	31	2	Fr

Butea monosperma, Roxb	40	2	57	3	Md, Eu, P
Casearia tomentosa, Roxb	10	0	11	2	P
Cassia fistula, L	6	0	9	2	P
Cassia siamea Lam.	4	0	5	1	Fw
Casuarina equisetifolia, Forst	15	1	21	2	Tm
Cedrela toona, Roxb	20	0	28	2	Tm
Citrus acidum, L	9	0	9	3	Fr
Cleistanthus collinus, Benth	35	2	57	2	P
Combretum ovalifolium Roxb	5	0	5	2	Fw
Croton oblongifolius, Roxb	10	0	18	1	Fw
Dalbergia latifolia, Roxb	38	0	40	2	Tm
Dalbergia paniculata, Roxb	5	0	8	1	Tm
Dalbergia sissoo, Roxb	11	0	16	3	Tm
Delonix regia, Raf	13	0	16	3	Tm
Dendrophthoe falcate (L.f.).	3	0	4	1	Md
Diospyros melanoxylon, Roxb	25	4	80	1	Fr
Ficus hispida, L.f	7	0	9	1	Fr
Ficus retusa, L	4	0	6	1	Fd
Ficus religiosa,L.	9	0	11	2	Rl
Flacourtia sepiaria Roxb.	6	0	7	1	Fw
Grewia tiliifolia, Vahl	2	0	2	1	Fw
Helicteres isora, L	2	0	2	2	Fw
Ixora parviflora, Vahl	25	0	29	2	Fw
Jacaranda mimosifolia, D.Don	3	0	3	1	Wd
Lagerostroemia lanceolate, Wall	15	0	17	2	Tm
Lepisanthes tetraphylla, Radlk	5	0	5	1	Wd
Mangifera indica, L	55	2	63	3	Fr
Melia azadirech, Roxb	20	0	57	1	P, Md
Morinda tinctoria, Roxb	6	0	7	2	Wd
Mitragyna parvifolia, Korth	10	0	11	2	Wd
Nyctanthes arbor-tristis, L	11	0	14	2	Eu
Plectronia parviflora, Vahl	7	0	7	1	Wd
Pongamia glabra, Vent	19	0	19	2	P, Eu
Prosopis spicigera, L	8	0	9	3	Wd
Pterospermum heyneanum, Wall	2	0	3	2	Wd
Randia dumetorum, L	4	0	6	2	Wd
Salix tetrasperma, Roxb	5	0	7	2	Tm
Sapindus laurifolious Vahl	10	0	11	2	Fr

Shorea robusta, Roxb	45	5	67	2	Tm, Rl
Stereospermum chelonoides, DC	7	0	7	1	Wd
Syzygium alternifolium, Walp	9	0	9	1	Fr, Md
Syzygium jambolanum, DC	6	0	8	2	Fr, Md
Syzygium wightianum, Wall	5	0	6	2	Fr, Md
Tamaridus indica, L	20	0	25	3	Fr, P
Tectona grandis, L	20	0	31	2	Tm
Terminalia bellirica, Roxb	17	0	20	2	Md
Terminalia chebula, Retz	11	0	13	2	Md
Terminalia alata , W. & A	18	1	23	2	Tm, P
Terminalia arjuna, Bedd	22	0	21	2	Tm
Theapesia populnea, Cav	3	0	3	1	Wd
Vitex altissima, L.f.	9	0	9	2	P
*Ziziphus oenoplia,*Mill	12	0	15	1	Fr
Ziziphus xylopyrus, Willd	6	0	11	1	Fr
Total	**955**	**19**	**1270**	**124**	**0**

Fd = Fodder; Fr = Fruits, Fw = Fuelwood; Md = Medicinal; Rl = Religious; Tm = Timber; Wd = Wood; Economic uses = Eu; Pesticide = P; Gradient of Effect: 1 – 10 (Light); 11 – 50 (Moderate); > 50 (Severe)

RESULTS AND DISCUSSION

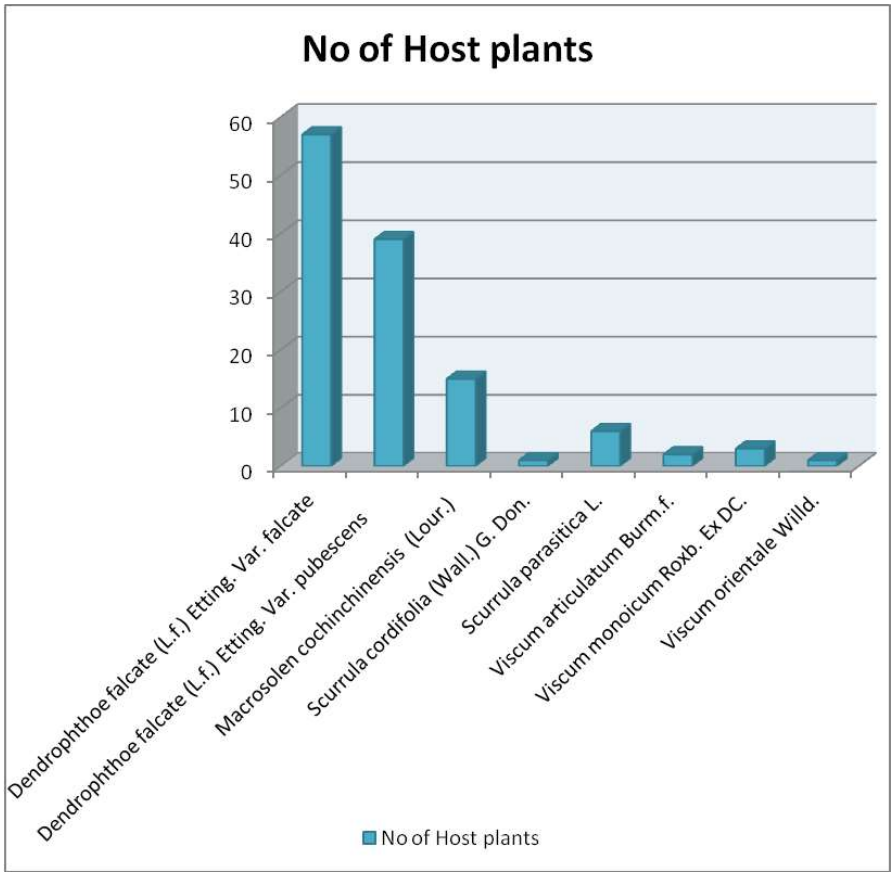
During the present investigation a total of 8 species belonging to 4 genera and 2 families are recorded as stem parasitic angiosperms. Most of the plant species are affected by the plants belongs to the family Loranthaceae and Viscaceae which are parasites on host plants.

A total of 59 species are recorded as hosts of different parasitic angiosperms. The highest numbers of host plants are recorded for *Dendrophthoe falcata* (L.f.) Etting. Var. falcata is 58, the lowest numbers of host plants were recorded for *Scurrula cordifolia,* (Wall.) G. Don and *Viscum oriantale,* Willd had one species each. 39 hosts have been recorded for *Dendrophthoe falcata* (L.f.) Etting. var. pubescens (Hook.f.), 15 hosts for *Macrosolen cochinchinensis* (Lour.) Van Tiegh**,** 6 hosts for *Scurrula parasitica* L**,** 4 hosts for *Viscum monoicum* Roxb. Ex DC, 2 hosts for *Viscum articulatum* Burm.f. All the recorded host plants are dicotyledonous angiosperms. Monocotyledons did not have such parasite infection. Moreover, parasite plants were found to prefer trees rather than shrubs or herbs. The reason for such selective preference for host plants (trees) being that *Loranthus* seeds are distributed chiefly by birds and trees are more likely to receive them than shrubs or herbs.

During the entire study period, in total 1270 mistletoe clumps were observed affecting 955 host plants (75.19%), which are exhibited by their profuse growth on slightly broad secondary branches.

In total, 955 individuals of host plants are recorded, affected by a parasite plant. Of these, maximum number of individuals (55) of *Mangifera indica* is found affected. Maximum number of mistletoe clumps (80) are noted on *Diospyros melanoxylon,* Roxb followed by affected host plant species e.g. *Shorea robusta,* Roxb (67), *Mangifera indica,* L (63), *Butea monosperma,* Roxb; *Cleistanthus collinus,* Benth; and *Melia azadirech,* Roxb (57). In forest area, 19 plants are found dead, probably owing to be infected by huge number of mistletoe clumps.

Graph I – Distribution of mistletoes on their host.

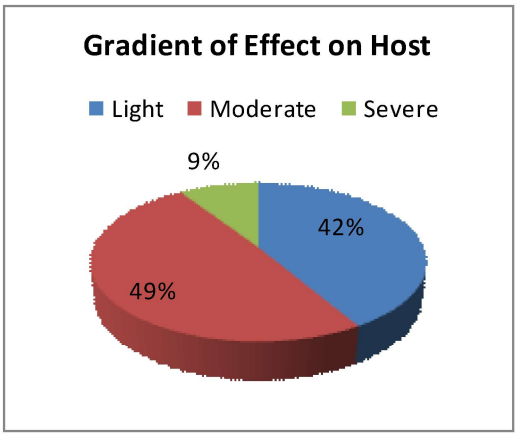


In the total of 59 species, 27 host species (45.76%) are recorded as lightly infected, 32 host species (54.23%) are moderately infected, and 6 host species (10.16%) are severely infected by mistletoes and distribution of host plants are recorded during the study period.

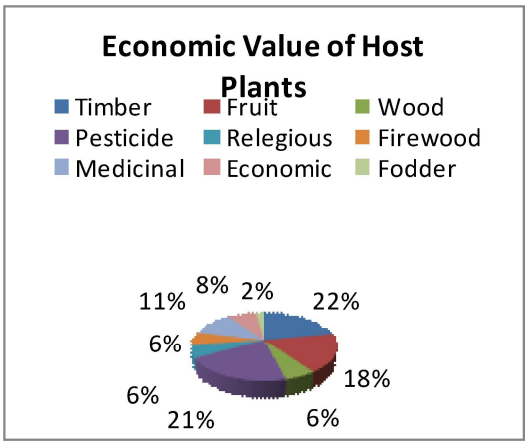
In total of infected host species recorded, 28.7% of host species produces valuable timber, 23.87% of fruit plants, 7.64% produces wood for different purposes, 27.32% used as pesticide plants, 7.74% host plants were believed as religious and used in different festivals by tribal of Jharkhand. Out of these 7.95% host plants were observed as fuel wood plants, 14.97% were reported as medicinal importance, 10.05% in different economic uses and 2.82% as fodder plants.

CONCLUSION

Five hemi parasite belonging to family Loranthaceae and three from family Viscaceae. It has been widely recognized as a parasite containing broad host range. Fruits are often adapted for bird dispersal. Birds act as seed dispersers, and some instances the same species may act as both pollinators and seed dispersers [1]. Indeed, many of the bird species are highly specialized to consume mistletoe berries [24]. The loranthaceae family with large, one seeded, highly nutritious fruits dispersed by specialized avian frugivores. The viscaceae with small, many seeded, less nutritive fruits dispersed by more generalized avian frugivores. The seed coat is sticky allowing seeds to adhere to host branches, and seeds can often germinate in the absence of water.



Graph II- Gradient of effect of parasitism on different hosts.



Graph III- Effect of parasitism on economic value of host plants.

Plate I

***Dendrophthoe falcate* (L.f.) Etting. Var. falcate**

***Scurrula cordifolia* (Wall.) G. Don.**

Plate II

***Scurrula parasitica* L.**

Viscum orientale Willd.

***Viscum articulatum* Burm.f.**

***Viscum monoicum* Roxb. Ex DC.**

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REFERENCES

1. **Kuijit, J. (1969).** *The Biology of parasitic flowering plants.* Berkeley, Calfornia, U.S.A: University of California press.
2. **Bennetts RE, White GC, Hawksworth FG, Severs SE. (1996).** *The influence of dwarf mistletoe on bird communities in Colorado ponderosa pine forests.* Ecological Applications **6***:* 899–909.
3. **Watson DM. (2001).** *Mistletoe – A keystone resource in forests and woodlands worldwide.* Annual Review of Ecology and Systematics32: 219–249.
4. **Pennings SC, Callaway RM. (1996).** *Impact of a parasitic plant on the structure and dynamics of salt marsh vegetation.* Ecology **77**:1410–1419.
5. **Smith D. (2000).** *The population dynamics and community ecology of root hemiparasitic plants.* American Naturalist **155**: 13–23.
6. **Barlow, B. A. (1997).** *Loranthaceae.* And *Viscaceae.* In: Flora Malesiana, 1 (13): 209-401.
7. **Hooker, J.D. (1872-1897).** *The Flora of British India,* Vols. I-VII. L. Reeve & Co., London.
8. **Maheshwari, P., B.M. Johri & S.N. Dixit (1957).** *The floral morphology and embryology of the Loranthoideae (Loranthaceae).* J. Madras Univ. 27B: 121-136.
9. **Dixit, S.N. (1962) 1963.** *Rank of the subfamilies Loranthoideae and Viscoideae*. Bull. Bot.Surv.India, 4:49-55.
10. **Haines, H.H. (1910).** *A Forest flora of Chotanagpur including Gangpur and the Santal Parganahs* - Calcutta, Superintendent Government printing, 374-377 pp.
11. **Haines, H.H. (1922, 1925).** *The Botany of Bihar and Orissa:* 6 parts: Vol- III, 840-844 pp. (1925). London, Govt. of Bihar & Orissa.
12. **Paria, N.D. & S.P. Chattopadhyay (2000, 2005).** *Flora of Hazaribagh District*, *Bihar*. Vol. I: 441-444 pp. (2000). Botanical Survey of India, Calcutta.
13. **Sharma, T.K. & A.K. Sarkar. (2002).** *Flora of Palamau District*, Jharkhand In: N.P Singh & P.S.N. Rao (Eds.). Botanical Survey of India, Calcutta, 738 pp.
14. **Singh, N.P., V. Mudgal, K.K. Khanna, S.C. Srivastava, A.K. Sahoo, S. Bandyopadhyay, N. Aziz, M. Das, R.P. Bhattacharya & P.K.Hajra. (2001).** *Flora of Bihar – Analysis*. Botanical Survey of India, Calcutta, 446-447 pp.
15. **Restrepo, C., Sargant, S., Levey, D. J., & Watson, D. M. (2002).** *The role of vertebrates in the diversification of New World mistletoes.* In D. J. Levery, W. R. Silva & M. Galetti (Eds.), *Seed Dispersal and Frugivory: Ecology, Evolution and conservation* (pp. 83-98). Oxford, UK: CAB International.

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