International Standard Serial Number (ISSN): 2249-6807

*International Journal of Institutional Pharmacy and Life Sciences 5(2): March-April 2015*

INTERNATIONAL JOURNAL OF INSTITUTIONAL PHARMACY AND LIFE SCIENCES

**Life Sciences** **Research Article……!!!**

Received: 26-02-2015; Revised: 05-03-2015; Accepted: 06-03-2015

# A REPORT OF THE STEM PARASITIC PLANT *DENDROPHTHOE FALCATA* (L.F.) ETTINGSH.(LORANTHACEAE) FROM THE ASSOCIATES WITH TREES ALONG ROADSIDES IN TIRUCHIRAPPALLI, TAMILNADU, INDIA

A. Vijayan*, P. Vivekraj and S. Kalavathy

P.G. and Research Department of Botany, Bishop Heber College, Tiruchirappalli – 620 017, India

**Keywords:**

Mistletoes, hemi-parasitic flowering plants, *Dendrophthoe falcata*, Parasitism

**For Correspondence:**

**Dr. A. Vijayan**

P.G. and Research Department of Botany, Bishop Heber College, Tiruchirappalli – 620 017, India

**E-mail:**

vijayan.arumuga@gmail.com

## ABSTRACT

Mistletoes, exotic and native hemi-parasitic flowering plants produce their own photosynthetic products, water and mineral nutrients from their host. The degree of damage varies with the species of mistletoe, its longevity and intensity of parasitism. Effect of mistletoes on their hosts may include reduced vigour and growth rates, poor fruit yield or seed set, malformation of woody tissues, sparse foliage, top dying, pre-disposition to insect and other disease attack and pre-mature death. Parasites invade the host plant strong reduction in the vegetative body and host penetration through xylem and phloem using a special structure, the haustorium, to obtain water and minerals. 15 transects were established perpendicular to a road that crosses the Tiruchirappalli city corporation, TN. Only in woody plants with a minimum circumference at breast height (CBH) of tree trunks or stems. All the sampled hemiparasites were adults having flowers, fruits or scars produced in their stems by previous fructification. *Dendrophthoe falcata* (L.f) Ettingsh. is one of them. During the present investigation, 40 species of host plants were found affected. On the other hand, only one individual each of *Bauhinia purpurea*, *Cassia fistula*, *Ficus religiosa*, and *Peltophorum pterocarpum* were found in parasitic plants. The two major genera of host species were *Mangifera indica* (120) and *Azadirachta indica* (90) were records respectively.

## INTRODUCTION

The '*Parasite*' refers to either a plant or an animal which depends on another organism, its host, for nutrition. The parasite and host co-exist in an obligatory association in which the parasite depends metabolically on the host, during a particular stage or throughout its entire life cycle (Krebs, 1994). In the vascular plant kingdom an estimated 3000 species or 1% of the flowering plants are considered to be parasitic (Kuijt 1969; Atsatt 1983), of which approximately 1400 species are classified as mistletoes (Downey, 1998). Mistletoes are hemiparasitic flowering plants which produce their own photosynthetic products, but they provide water and mineral nutrients from their host plants (Calder and Bernhardt, 1983).The adaptability of mistletoes has made them to victimize a large number of plant species, all of them are dicotyledons. The degree of damage varies with the species of mistletoe, its longevity and intensity of parasitism. The effect of mistletoes on their hosts may include reduced vigour and growth rates, poor fruit yield or seed set, malformation of woody tissues, sparse foliage, top dying, pre-disposition to insect and other disease attack and pre-mature death (Gill and Hawksworth, 1961).

The Loranthaceae family comprises approximately 70 genera and 950 species occurring mainly in tropical regions (Ribeiro et al., 1999). These plants are popularly known in India as 'Plavithil, Pulluri' (*Honey suckled mistletoes*), due to their dependence on bird dispersal. There is only one species known to be dispersed by another group, the marsupials (Amico and Aizen,2000; Heide-Jørgensen, 2008). Loranthaceae are hemiparasitic species living on branches, twigs or roots of other plants, generally trees as in tropical and temperate environments (Calder and Bernhardt, 1983; Norton and Carpenter, 1998; Overton, 1994), These parasites invade the host plant xylem using a special structure, the haustorium, to obtain water and minerals (Venturelli(1981), Venturelli and Kraus (1989), Sargent (1995).However, in some Loranthaceae species there is a strong reduction in the vegetative body, and host penetration occurs only in the phloem (Martnez del Rio et al., 1995, 1996; Mauseth et al., 1984, 1985; Medel et al., 2002; Silvaand Martnez del Rio, 1996).

Despite the fact that mistletoes photosynthesize, their presence can cause damage to the hosts, affecting quality and quantity of fruit production, and may cause the death of the host plant (Reid et al., 1994; Silva and Martı´nez del Rio, 1996; Press, 1995;Sinha and Bawa, 2002;Venturelli, 1981).In mistletoe plants, host specificity can be favored by the advantages of interacting with relatively abundant hosts. It can be advantageous to mistletoes to be

generalists in heterogeneous communities, because this allows the plant to grow successfully on the most potential host. Thus, the relative abundance of host species may also interfere in the degree of host specificity for mistletoes (Norton and Carpenter, 1998; Norton and De Lange, 1999).Besides the relative abundance of host species, the size and diameter of branches of host plants can have a strong effect on mistletoe fixation (Reid, 1989Lopez de Buen and Ornelas, 2002;; Sargent, 1995; Yan and Reid,1995). However, Lamont (1983) suggested that germination of mistletoe seeds is less influenced by substrate, for example the type of host's bark, than by the available water, oxygen, temperature and light conditions(Arruda et al., 2006).

Most Asian mistletoes have obligate relationship with certain families of birds such as the sunbirds and flowerpeckers that pollinate the flowers and disperse the seeds. Like other parasitic organisms, mistletoes may shows specialization on host species due to a number of factors. A number of mistletoe species are specialised in living on different hosts due to frequent encounters between mistletoe seeds and commonest plants. Some studies have indicated that non-random perch preferences of seed dispersers are important for determining host specificity. This may result in concentration of mistletoe seeds on either the most abundant trees or the less abundant ones (Fadini, 2011).To control mistletoes, that tend to destroy hosttrees, an understanding of the factors regulating their abundance and distribution is needed. The importance of tree availability in regulating mistletoe distribution has been reported. Additionally, the effects of forest fragmentation on mistletoe abundance and distribution have been studied. However, only little is known about the distribution patterns of mistletoes on tree species. Furthermore, there is limited information concerning the association between mistletoes and their host species. Though roadside survey of mistletoes has been reported to be effective, only a limited number of studies have used this approach (Mathiasen et al. 2008). There are 20 different species belonging to the genus *Dendrophthoe* found all over the world, seven of which are found in India. The partial stem parasite(*D. falcata* (L. f.)) is one of the seven species present in India. Hemiparasites have been reported to exist on more than 300 host plants (Sampathkumar and Selvaraj 1980).The aim of the study was to determine the abundance and distribution of mistletoes, and their association with trees. It was hypothesised that mistletoe abundance may differ among tree species, and between roadside and interior site. Furthermore, it was hypothesized that mistletoes are randomly distributed on host trees and will show associations with tree species.

## MATERIAL AND METHODS

The present extensive plant exploration trips were undertaken during 2013-2014 to different parts of Tiruchirappalli City Corporation to collect the *D. falcata* (L. f.) Ettingh. Family: Loranthaceae. Both the host and parasites were identified by using different floras such as the flora of Madras presidency (Gamble, 1969), Flora of the Presidency of Bombay (Cooke, 1967), Flora of the Palni hills(Matthew, 1999), Flora of the Tamilnadu Carnatic (Matthew, 1983). The collected materials were preserved in the form of herbarium using standard herbarium techniques (Forman and Birdson, 1989). 15 transects were established perpendicular to a road that crosses the Tiruchirappalli city corporation, TN. Only in woody plants with a minimum circumference at breast height (CBH) of tree trunks or stems. All the sampled hemiparasites were adults having flowers, fruits or scars produced in their stems by previous fructification. The height of each tree species included in the sample and the height at which the hemiparasite was attached to the branch in relation to the ground and the main trunk were determined and It was used to determine if a relationship existed between the height of the host and the height at which the mistletoe was attached.

Although several species in the Loranthaceae occur in many rural and disturbed sites, often on exotic or cultivated hosts, one species, *D. falcata* (L. f.) Ettingh were common in urban parks and gardens and on street trees as well as roadside trees of semi-rural areas. The objective of this paper is to examine the status and possible reasons for the abundance of this mistletoe in these urban and semi-rural environments in and around the roadside of the Tiruchirappalli city, Tamilnadu.

## RESULTS AND DISCUSSION

During the present investigation, 40 species of host plants were found affected by *D. falcata*(L.f) Ettingsh. In total, 40 individuals of host plants were recorded, affected by a parasite plant. On the other hand, only one individuals each of *Bauhinia purpurea*, *Cassia fistula*, *Ficus religiosa*, and *Peltophorum pterocarpum* were found in parasitic plants (Table 1). The two major genera of host species were *Mangifera indica* L. and *Azadirachta indica* A. Juss. were records respectively. There were 120 species of *Mangifera indica* L. and 90 species of *Azadirachta indica* A. Juss. were recorded. Mistletoe species commonly parasitised exotic and native angiosperms plants host species.

*D. falcata* (L. f.) Ettingha widespread hemi parasite belonging to family Loranthaceae, has been recorded 420 hosts distributed among 227 genera of 77 families and is considered to be

one of the most devastating parasitic weed on important timber yielding plants. In the present investigation recorded 40 host species in Tiruchirappalli. Among these 40 reported as new hosts for *D. falcata*. It has been widely recognized as a parasite containing broad host range. Parasites exercises some selectivity in the hosts that utilizes, so that some species are more frequently attacked than one might expect by chance, although the selectivity is not consistent between population or between plants from different parts of the same population. The plants which are growing besides the trees highly infested with mistloes need not be its host always due to dissemination of mistletoe seeds. Fruits are often adapted for bird dispersal. Birds act as seed dispersers, some instances same species may act as pollinators and seed dispersers.

Table I: Angiospermic host list in *Dendrophthoe falcata* (L.f.) Ettingsh.

| S.No | Host name | Host family | Host Parameter | | Parasite Parameter | |
|---|---|---|---|---|---|---|
| | | | Girth (cm) | Height(ft) | Girth (cm) | Height (ft) |
| 1 | *Albizzialebbeck*, Benth. | Mimosaceae | 190 | 15 | 3 | 10 |
| 2 | *Annonasquamosa*, L. | Annonaceae | 120 | 8 | 4 | 4 |
| 3 | *Azadirachtaindica*, A. Juss. | Meliaceae | 215 | 12 | 6 | 9 |
| 4 | *Bauhinia purpurea*, L. | Caesalpiniaceae | 090 | 8 | 4 | 4 |
| 5 | *Bauhinia racemosa*, Lam. | Caesalpiniaceae | 088 | 7 | 6 | 4 |
| 6 | *Bauhinia variegata*, L. | Caesalpiniaceae | 079 | 9 | 2 | 5 |
| 7 | *Cassia fistula*, L. | Caesalpiniaceae | 130 | 7 | 3 | 4 |
| 8 | *Cassia montana*, Heyne | Caesalpiniaceae | 125 | 6 | 5 | 8 |
| 9 | *Cassia siamea*, Lam. | Caesalpiniaceae | 138 | 9 | 4 | 6 |
| 10 | *Ceibapentandra*, (L.)Gaetrn. | Bombacaceae | 150 | 20 | 3 | 15 |
| 11 | *Citrus medica*, L. | Rutaceae | 085 | 12 | 6 | 7 |
| 12 | *Dalbergiapaniculata*, Roxb. | Papilionaceae | 124 | 14 | 2 | 5 |
| 13 | *Dalbergiasissoo*, Roxb. | Papilionaceae | 116 | 13 | 4 | 6 |
| 14 | *Delonixregia*, Raf. | Caesalpiniaceae | 203 | 20 | 5 | 13 |
| 15 | *Swieteniamahagoni*, L. | Meliaceae | 124 | 20 | 3 | 13 |
| 16 | *Tamarindusindica*, L. | Caesalpinaceae | 230 | 24 | 2 | 12 |
| 17 | *Syzygiumjambolanum*, DC. | Myrtaceae | 140 | 14 | 4 | 8 |
| 18 | Syzygiumcumini | Myrtaceae | 154 | 14 | 4 | 5 |
| 19 | Spathodeacompanulata | Bignoniaceae | 160 | 11 | 6 | 7 |
| 20 | *Ficusreligiosa*, L. | Moraceae | 220 | 18 | 8 | 12 |
| 21 | *Millingtoniahortensis* | Bignoniaceae | 140 | 11 | 5 | 7 |
| 22 | *Lagerstroemeaindica*, L. | Lythraceae | 195 | 10 | 4 | 7 |
| 23 | *Lagerstroemeaspeciosa*L. | Lythraceae | 135 | 10 | 4 | 6 |
| 24 | *Mangiferaindica*, L. | Anacardiaceae | 235 | 25 | 9 | 12 |
| 25 | *Meliadubia* L. | Meliaceae | 160 | 18 | 8 | 13 |
| 26 | *Muntingiacalabura*, L. | Elaeocarpaceae | 130 | 12 | 5 | 9 |
| 27 | *Murrayakönigi*, Spr. | Rutaceae | 060 | 10 | 4 | 7 |
| 28 | *Murraya exotica* | Rutaceae | 065 | 8 | 4 | 6 |
| 29 | *Psidiumguajava*, L. | Myrtaceae | 103 | 17 | 3 | 8 |
| 30 | *Tabernaemontanadivaricata* | Apocynaceae | 040 | 6 | 2 | 5 |
| 31 | *Samaneasaman*, (Jacq.) Merr. | Mimosaceae | 205 | 19 | 4 | 12 |
| 32 | *Cordiasebastena*L. | Boraginaceae | 136 | 12 | 5 | 10 |
| 33 | *Kigelia Africana* | Bignoniaceae | 169 | 9 | 5 | 8 |
| 34 | *Gmeliaarborea* | Verbanaceae | 192 | 13 | 6 | 10 |
| 35 | *Nyctanthes arbor-ytristis, L.* | Nyctaginaceae | 056 | 3 | 3 | 2 |
| 36 | *Tecomastans (L.) Juss.* | Bignoniaceae | 072 | 7 | 4 | 4 |
| 37 | *Pongamiapinnata*L. | Fabaceae | 115 | 7 | 6 | 6 |
| 38 | *Manilkarazapota*L. | Sarotaceae | 106 | 5 | 6 | 5 |
| 39 | *Zizyphusjujuba*, Lam. | Rhamnaceae | 136 | 9 | 7 | 7 |
| 40 | *Callistemon pauciflorus R.Br.* | Myrtaceae | 137 | 9 | 5 | 6 |

Figure: I: Angiospermic host list in Dendrophthoe falcata (L.f.) Ettingsh.

**CONCLUSIONS**

The current catalogue of host species indicates the great diversity of plant species which can be parasitised. In addition, the collection of the current lists allows objective questioning of terms like host-specificity and impressions to be undertaken. Until now the knowledge of host species for each of the 40 species of mistletoes has been less documented. The current study has established a baseline for the study of host-mistletoe combination in Tamilnadu.

Not all woody plants species are parasitized by mistletoes; in fact all the species of a genus or all the genera of a family are not parasitized. The numbers of host species mistletoe were found to vary considerably. Several mistletoe species share many common host genera; this could be due to the result of the distribution of both host and mistletoe by the dispersal agents (usually the birds). Future studies should address the relationship between mistletoe distribution, their host species and dispersal agents; so that we can safe guard our valuable trees from the adverse effects of mistletoes. Mistletoe abundance and distribution were influenced by host species and their characteristics(diameter, height and canopy shape). Road side mistletoe abundance did not differ significantly from the interior site abundance. Mistletoes showed non-random distribution on their hosts. All the mistletoe species showed associations with different tree species. The general patterns of mistletoe abundance and distribution as well a smistletoe-tree associations observed in this study could be useful in the management of mistletoes in Tiruchirappalli city, Tamilnadu.

**REFERENCES**


1. Krebs, C.J. (1994) *Ecology: The experimental analysis of distribution and abundance*. 4th edn. (HarperCollins College Publishers: New York).
2. Kuijt, J. (1969) *The Biology of Parasitic Flowering Plants*. (University of California Press: Berkeley). Lazarides, M. &Hince, B. (Eds) (1993) *CSIRO Handbook of Economic Plants of Australia*. (CSIRO:Melbourne).
3. Atsatt, P.R.(1983) Host-parasite interactions in higher plants. Lange, P.S. Nobel, C.B.
4. Downey, P.O. (1998). An inventory of host species for each aerialmistletoe species (Loranthaceae and Viscaceae) in Australia. *Cunninghamia* Vol. 5(3): 685-720.
5. Calder M, Bernhardt P (Eds.) (1983).The Biology of Mistletoes.Academic Press, Sydney.
6. Gill, L.S. and Hawksworth, F.G. 1961.The Mistletoes.A literature review.Technical bulletin No.1242. United States. Department of Agriculture, Washington, DC.
7. Ribeiro, J.E.L.S., Hopkins, M.J.G., Vicentini, A., Sother, C.A and Costa, M.A.S. (1999). The Flora of Ducke Reserve: A guide to the identification of vascular plants from an upland forest in central amazon. Amazon Research National Institute, Manaus, Brazil.
8. Amico, G., Aizen, M.A., 2000. Mistletoe seed dispersal. Nature 408, 929–930.
9. Heide-Jørgensen, H. S. 2008. Parasitic Flowering Plants. Leiden: Brill.Joel, D. M., J. Hershenhorn, H. Eizenberg, R. Aly, J.Ransom, J. Sauerborn, and D. Rubiales. 2007. Biology and managementof weedy root parasites. Horticultural Reviews 33: 207–349.

10. Norton, D.A. and Carpenter, M.A., 1998. Mistletoes as parasites: host specificity and speciation. Trends Ecol. Evol.13,101–105.
11. Overton, J.,1994. Dispersal, infection in mistletoe meta populations. J. Ecol. 82, 711–723.
12. Venturelli, M., 1981.EstudossobreStruthanthus vulgaris Mart.: anatomia do fruto e semente de germinac¸a˜ o, crescimento e desenvolvimento. Rev. Bras. Bot. 4, 131–147.
13. Venturelli, M., Kraus, J.E., 1989. Morphological and anatomical aspects of the primary haustorium of Struthanthus vulgaris Mart. (Loranthaceae) in vitro. Rev. Bras. Bot. 12, 17–22.
14. Sargent, S., 1995. Seed fate in a tropical mistletoe: the importance of host twig size. Funct. Ecol. 9, 197–204.
15. Martı´nezdel Rio, C., Silva, A., Medel, R., 1995. The influence of cactus size and previous infection on bird deposition of mistletoe seeds. Aust. J. Ecol. 20, 571–576.
16. Martı´nezdel Rio, C., Silva, A., Medel, R., Hourdequin, M., 1996. Seed dispersers as disease vectors: bird transmission of mistletoe seeds to plant hosts. Ecology 77, 912–921.
17. Mauseth, J.D., 1984. Studies of the holoparasiteTristerixaphyllus(Loranthaceae) infectingTrichocereuschilensis(Cactaceae). Can. J. Bot. 62, 847–857.
18. Mauseth, J.D., Montenegro, G., Walckowiak, A.M., 1985. Host infection and flower formation by the parasite Tristerixaphyllus(Loranthaceae). Can. J. Bot. 63, 567–581.
19. Medel, R., Botto-Mahan, C., Smith-Ramı´rez, C., Me´ndez, M.A., Ossa, C.G., Caputo, L., Gonza´ les, W.L., 2002.Historia natural e cuantitativa de umarelacio´ n parasitohospedero: elsistemaTristerix-cacta´ ceas en Chile semia´ rido. Rev. Chil. Hist. Nat. 75, 127–140.
20. Silva, A., Martı´nezdel Rio, C., 1996. Effects of the mistletoe Tristerixaphyllus (Loranthaceae) on the reproduction of its cactus host *Echinopsis chilensis*.Oikos 75, 437–442.
21. Reid, N., 1994. Impact of mistletoes (*Amyema miquelli*) on host (*Eucalyptus blakelyi* and *Eucalyptus melliodora*) and growth in temperate Australia.For. Ecol. Manage. 70, 55–65.
22. Press, M. C., and J. D. Graves..Parasitic Plants. London: Chapmanand Hall.1995
23. Sinha, A., Bawa, K.S., 2002. Harvesting techniques, hemiparasites and fruit production in two non-timber forest tree species in south India.For. Ecol. Manage. 168, 289–300.
24. Norton, D.A., De Lange, P.J., 1999. Host specificity in parasitic mistletoes (Loranthaceae) in New Zealand.Funct. Ecol. 13, 552–559.

25. Lopez de Buen, L., 2002. Host compatibility of cloud forest mistletoe *Psittacanthuss chiedeanus* (Loranthaceae) in central Veracruz, Mexico. Am. J. Bot. 89, 95–102.
26. Reid, N., 1989. Dispersal of mistletoe by honeyeaters and flowerpeckers: components of seed dispersal quality. Ecology 70, 137–145.
27. Yan, Z., Reid, N., 1995. Mistletoe (Amyemamiquelii and A. Pendulum) seedling establishment on eucalypt hosts in eastern Australia. J. Appl. Ecol. 32, 778–784.
28. Lamont, B., 1983. Germination of mistletoes. In: Calder, M., Bernhardt, P. (Eds.), The Biology of Mistletoes. Academic Press, Sydney, pp. 117–128.
29. Arruda, R., Luce´ liaNobre Carvalho2, Kleber Del-Claro. 2006. Host specificity of a Brazilian mistletoe, Struthanthusaff. Polyanthus (Loranthaceae), in cerrado tropical savanna.Flora 201 (2006) 127–134.
30. Fadini, R.F. 2011. Non-overlap of hosts used by three congeneric and sympatricloranthaceous mistletoe species in an Amazonian savanna: host generalization to extreme specialization. Acta Botanica Brasilica 25: 337-345.
31. Mathiasen, R.L.; Nickrent, D.L.; Shaw, D.C. & Watson, D.M. 2008. Mistletoes: pathology, systematics, ecology, and management. PlantDisease 92: 988-1006.
32. Sampathkumar, R. and R.Selvaraj (1980).Some new hosts for *Dendrophthoe falcata* (L.f) Ettingsh.(*Loranthus longiflorus*Desr.).*Journal of Bombay Natural History Society*.78: 200.
33. Gamble, J.S. 1967. Flora of the Presidency of Madras (II Reprinted edition) I-III.Botanical Survey of India, Calcutta.
34. Cooke, T. C. I. E. 1967. Flora of the Presidency of Bombay (II Reprinted edition) I-III Botanical Survey of India, Calcutta.
35. Matthew, K.M. 1999. Flora of Palani hills.The Rapinat Herbarium.Tiruchirapalli. Vol. I.
36. Matthew, K.M. 1983. The flora of the Tamilnadu Carnatic. Rapinat Herbarium, St. Joseph's College, pp.2154.
37. Forman, L. and Birdson, D. (1989).The herbarium hand book. UK: Royal botanical gardens, Kew.