

Mistletoes and their hosts in Karnataka

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Abstract: Mistletoes (Loranthaceae and Viscaceae) constitute the most important parasitic plants that have been recognized as damaging agents of many of our fruit yielding, timber yielding and commercial trees. Their damaging effects make the parasitic angiosperms true threats to silviculture and horticultural crops, especially in developing countries. The mistletoes are represented by 8 genera and 20 species in Karnataka. A total of 242 species belonging to 38 families of dicotyledons are recognized as hosts parasitized by mistletoes. The present paper enlists the binomials and families of host plants parasitized by the particular species of mistletoes. Host range, host preference and host specificity are discussed in the light of previous literatures. [Journal of American Science 2010;6(10):827-835]. (ISSN: 1545-1003).

Key Words: Host generalists, Host preference, Host range, Host specificity, Mistletoes.

Introduction

Mistletoes are the predominant group of Angiosperm shoot or stem hemi parasites, which grow on the branches of host trees or shrubs and take water, water-conducted nutrients and organic solutes from the host's vasculature. Mistletoes include notorious parasites and are capable of destroying the trees and shrubs of economic and aesthetic value. Though Mistletoes are widely recognized as damaging agents to various medicinal, ornamental, horticultural, timber yielding and other forest trees (Gill and Hawksworth, 1961), they do not seem to have received much attention from both Botanists and common man. The reason for this could be that they only attack the woody plants which are not staple food plants and hence do not enjoy the same economic status as the cereals or pulses. However, they can attack a large number of varieties of taxonomically unrelated hosts and their attack has been proved to be fatal to various trees and shrubs (Docteres Van Leeuwen, 1954; Kuijt, 1964). Most of the fruit trees and timber yielding trees are severely infested with the mistletoes. There is less information on the extent to which mistletoes damage the yield of forest trees. 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, predisposition to insect and other disease attack and premature death (Gill and Hawksworth, 1961). In spite of this, a very little has been known about the host

range of mistletoes in Karnataka. Most of the earlier reports were all concentrated only on the host range of one taxon i.e., *Dendrophthoe falcata* (Loranthaceae). Further, many authors have contributed to host range of *D. falcata* and its distribution. But a list of hosts attacked by other taxa of mistletoes occurring in Karnataka is much wanting. Such a list would definitely help us to assess the loss of yield and to propose management strategies for the effective integrated management of these pests in forestry and horticulture. In this regard a serious attempt has been made to record the plant species that are attacked by the mistletoes and the frequency of their distribution in Karnataka.

Materials and Methods

The present work was carried out during the years 2007-2009. Intensive plant exploration trips were conducted to different parts of Karnataka to collect the plant specimens belonging to Loranthaceae and Viscaceae. Both the host and the parasites collected were identified, mainly by using the Flora of the Presidency of Madras (Gamble, 1967) and Flora of the Presidency of Bombay (Cooke, 1967) and Flora of Karnataka Vol-II (Saldanha, 1996). During 1925 to 1929 Danser worked extensively on mistletoes and published several monographs. Various mistletoe groups were brought to taxonomic order by Danser. On this foundation contemporary mistletoe experts such as J. Kuijt, B.A. Barlow, D. Wiens and S. Balle have built our present day understanding. For collection and preservation, the procedures provided by Jain and Rao (1977) were generally followed.

Observation

The following are the list of hosts recorded for each mistletoe species during the present

investigation.

Loranthaceae

***Dendrophthoe falcata* (L.f.) Ettingsh**

1. *Acacia auriculiformis*, A. Cunn. ex Benth. (Mimosaceae)
4. *Acacia decurrens*, Willd. (Mimosaceae)
5. *Acacia ferruginea*, DC. (Mimosaceae)
6. *Acacia nilotica*, (L.) Del. (Mimosaceae)
7. *Acacia sinuata*, (Lour.) Merr. (Mimosaceae)
8. *Acacia suma*, Buch.-Ham. (Mimosaceae)
9. *Achras sapota*, L. (Sapotaceae)
10. *Aegle marmelos*, Corr. (Rutaceae)
11. *Albizzia amara*, Boiv. (Mimosaceae)
12. *Albizzia lebbek*, Benth. (Mimosaceae)
13. *Albizzia odoratissima*, Benth. (Mimosaceae)
14. *Amoora rohituka*, Wt. & Arn. (Meliaceae)
15. *Anogeissus latifolia*, Wall. (Combretaceae)
16. *Annona squamosa*, L. (Annonaceae)
17. *Artocarpus integrifolia*, L. (Moraceae)
18. *Azadirachta indica*, A. Juss. (Meliaceae)
19. *Barringtonia acutangula*, Gaetrn. (Lecythidaceae)
20. *Bauhinia purpurea*, L. (Caesalpiniaceae)
21. *Bauhinia racemosa*, Lam. (Caesalpiniaceae)
22. *Bauhinia variegata*, L. (Caesalpiniaceae)
23. *Bombax ceiba*, L. (Bombacaceae)
24. *Bombax malabaricum*, DC. (Malvaceae)
25. *Bridelia scandens*, Gehrm. (Euphorbiaceae)
26. *Calotropis gigantea*, R. Br. (Euphorbiaceae)
27. *Canthium dicoccum*, (Gaetrn.) Teys. & Binn. (Rubiaceae)
28. *Careya arborea*, Roxb. (Lecythidaceae)
29. *Cassia fistula*, L. (Caesalpiniaceae)
30. *Cassia montana*, Heyne (Caesalpiniaceae)
31. *Cassia siamea*, Lam. (Caesalpiniaceae)
32. *Cassia* sp. (Caesalpiniaceae)
33. *Catunaregam spinosa*, (Thunb.) Triv. (Rubiaceae)
34. *Cedrela toona*, Roxb. (Meliaceae)
35. *Ceiba pentandra*, (L.) Gaetrn. (Bombacaceae)
36. *Citrus medica*, L. (Rutaceae)
37. *Dalbergia latifolia*, Roxb. (Papilionaceae)
38. *Dalbergia paniculata*, Roxb. (Papilionaceae)
39. *Dalbergia sissoo*, Roxb. (Papilionaceae)
40. *Delonix regia*, Raf. (Caesalpiniaceae)
41. *Dolichandrone* sp. (Bignoniaceae)
42. *Elaeodendron glaucum*, Pers. (Celastraceae)
43. *Enterolobium saman*, Prain (Mimosaceae)
44. *Ervatamia coronaria*, Stapf (Apocynaceae)
82. *Swietenia mahagoni*, L. (Meliaceae)
83. *Syzygium jambolanum*, DC. (Myrtaceae)
84. *Tabebuia argentea*, (Bur. & Schum.) Britt. (Bignoniaceae)
85. *Tamarindus indica*, L. (Caesalpiniaceae)
86. *Tecoma argentea*, Don. (Bignoniaceae)
91. *Terminalia chebula*, Retz. (Combretaceae)
92. *Terminalia crenulata*, Roth. (Combretaceae)
94. *Terminalia tomentosa*, Wt. & Arn. (Combretaceae)
95. *Thevetia nerifolia*, Juss. (Apocynaceae)
2. *Acacia chundra*, (Rottl.) Willd. (Mimosaceae)
3. *Acacia concinna*, (Willd.) DC. (Mimosaceae)
45. *Eucalyptus* sp. (Myrtaceae)
46. *Feronia elephantum*, Corr. (Rutaceae)
47. *Ficus carica*, L. (Moraceae)
48. *Ficus hispida*, L.f. (Moraceae)
49. *Ficus religiosa*, L. (Moraceae)
50. *Grevillea robusta*, A. Cunn. (Proteaceae)
51. *Grewia* sp. (Tiliaceae)
52. *Grewia tilaefolia*, Vahl (Tiliaceae)
53. *Hardwickia binata*, Roxb. (Papilionaceae)
54. *Hibiscus Rosa-sinensis*, L. (Malvaceae)
55. *Holoptelea integrifolia*, Pl. (Ulmaceae)
56. *Jacaranda mimosifolia*, D. Don (Bignoniaceae)
57. *Kydia calycina*, Roxb. (Malvaceae)
58. *Lagerstroemia indica*, L. (Lythraceae)
59. *Lagerstroemia lanceolata*, Wall. (Lythraceae)
60. *Macaranga peltata*, M. Arg. (Euphorbiaceae)
61. *Mangifera indica*, L. (Anacardiaceae)
62. *Melia composita*, Willd. (Meliaceae)
63. *Mitragyna parvifolia*, Korth. (Rubiaceae)
64. *Moringa oleifera*, Lam. (Moringaceae)
65. *Morus alba*, L. (Moraceae)
66. *Muntingia calabura*, L. (Tiliaceae)
67. *Murraya königi*, Spr. (Rutaceae)
68. *Naringi crenulata*, (Roxb.) Nicolson (Rutaceae)
69. *Nerium odorum*, Ait. (Apocynaceae)
70. *Nyctanthes arbor-tristis*, L. (Nyctaginaceae)
71. *Persea macrantha*, (Nees) Kosterm. (Lauraceae)
72. *Phyllanthus acidus*, (L.) Skeel. (Euphorbiaceae)
73. *Pithecolobium dulce*, Benth. (Mimosaceae)
74. *Pithecolobium saman*, (Mimosaceae)
75. *Plectronia didyma*, Kurz. (Rubiaceae)
76. *Psidium guajava*, L. (Myrtaceae)
77. *Punica granatum*, Vent. (Punicaceae)
78. *Radermachera xylocarpa*, K.Schum. (Bignoniaceae)
79. *Salix tetrasperma*, Roxb. (Salicaceae)
80. *Samanea saman*, (Jacq.) Merr. (Mimosaceae)
81. *Stereospermum suaveolens*, DC. (Bignoniaceae)
87. *Tectona grandis*, L.f. (Verbenaceae)
88. *Terminalia arjuna*, Wt. & Arn. (Combretaceae)
89. *Terminalia bellerica*, Roxb. (Combretaceae)
90. *Terminalia catappa*, L. (Combretaceae)
93. *Terminalia paniculata*, Roth. (Combretaceae)
96. *Trema orientalis*, Bl. (Ulmaceae)
97. *Vitex altissima*, L.f. (Verbenaceae)
98. *Zizyphus jujuba*, Lam. (Rhamnaceae)

***Dendrophthoe trigona* (Wt. & Arn.) Danser**

1. *Achras sapota*, L. (Sapotaceae)
2. *Aegle marmelos*, Corr. (Rutaceae)
3. *Artocarpus integrifolia*, L. (Moraceae)
4. *Calotropis gigantea*, R.Br. (Asclepiadaceae)
5. *Dalbergia latifolia*, Roxb. (Papilionaceae)
6. *Eugenia* sp., (Myrtaceae)
7. *Ficus asperima*, Roxb. (Moraceae)
8. *Ficus bengalensis*, L. (Moraceae)
9. *Ficus infectoria*, Roxb. (Moraceae)
10. *Ficus glomerata*, Roxb. (Moraceae)
11. *Ficus mysorensis*, Heyne. (Moraceae)
12. *Ficus religiosa*, L. (Moraceae)
13. *Mangifera indica*, L. (Anacardiaceae)
14. *Murraya königii*, Spr. (Rutaceae)
15. *Salix tetrasperma*, Roxb. (Salicaceae)
16. *Swietenia mahagoni*, L. (Meliaceae)
17. *Syzigium caryophyllaeum*, Gaertn. (Myrtaceae)

***Dendrophthoe memecylifolia* (Wt. & Arn.) Danser**

1. *Lagerstroemia lanceolata*, Wall. (Lythraceae)

***Helicanthes elasticus* (Desr.) Danser**

1. *Anacardium occidentale*, L. (Anacardiaceae)
2. *Aporosa lindleyana*, Baill. (Euphorbiaceae)
3. *Artocarpus integrifolia*, L. (Moraceae)
4. *Casuarina equisetifolia*, Forst. (Casuarinaceae)
5. *Ceiba pentandra*, (L.) Gaetrn. (Bombacaceae)
6. *Chukrasia tabularis*, Adr.Juss. (Meliaceae)
7. *Evodia lunu-akenda*, Merr. (Rutaceae)
8. *Ficus glomerata*, Roxb. (Moraceae)
9. *Lagerstroemia flos-reginae*, Retz. (Lythraceae)
10. *Mallotus philippinensis*, M. Arg. (Euphorbiaceae)
11. *Mangifera indica*, L. (Anacardiaceae)
12. *Muntingia calabura*, L. (Tiliaceae)
13. *Psidium guajava*, L. (Myrtaceae)
14. *Swietenia mahagoni*, L. (Meliaceae)

***Helixanthera hookeriana* (Wt. & Arn.) Danser**

1. *Aporosa lindleyana*, Baill. (Euphorbiaceae)
2. *Artocarpus integrifolia*, L. (Moraceae)
3. *Casuarina equisetifolia*, Forst. (Casuarinaceae)
4. *Celtis tetrandra*, Roxb. (Ulmaceae)
5. *Citrus aurantium*, L. (Rutaceae)
6. *Dalbergia sissoo*, Roxb. (Papilionaceae)
7. *Evodia lunu-akenda*, Merr. (Rutaceae)
8. *Ficus glomerata*, Roxb. (Moraceae)
9. *Neolitsea zeylanicum*, Merr. (Lauraceae)
10. *Terminalia tomentosa*, Wt. & Arn. (Combretaceae)

***Helixanthera obtusata* (Schultes) Danser**

1. *Aporosa lindleyana*, Baill. (Euphorbiaceae)
2. *Casuarina equisetifolia*, Forst. (Casuarinaceae)
3. *Citrus aurantium*, L. (Rutaceae)

***Helixanthera wallichianus* (Schultes) Danser**

1. *Citrus aurantium*, L. (Rutaceae)
2. *Coffea arabica*, L. (Rubiaceae).
3. *Mamecylon talbotianum*, Brandis (Melastomaceae)
4. *Mamecylon umbellatum*, Burm.f. (Melastomaceae)
5. *Neolitsea zeylanica*, Merr. (Lauraceae)

***Macrosolen parasiticus* (L.) Danser**

1. *Acacia decurrens*, Willd. (Mimosaceae)
2. *Acacia* sp. (Mimosaceae)
3. *Ailanthus* sp. (Simarubaceae)
4. *Anacardium occidentale*, L. (Anacardiaceae)
5. *Anogeissus latifolia*, Wall. (Combretaceae)
6. *Artocarpus integrifolia*, L. (Moraceae)
7. *Bauhinia racemosa*, Lam. (Caesalpiniaceae)
8. *Dalbergia lanceolaria*, L.f. (Papilionaceae)
9. *Dalbergia latifolia*, Roxb. (Moraceae)
10. *Ficus infectoria*, Roxb. (Moraceae)
11. *Lagerstroemia lanceolata*, Wall. (Lythraceae)
12. *Mangifera indica*, L. (Anacardiaceae)
13. *Mimusops elengi*, L. (Sapotaceae)
14. *Syzigium caryophyllaeum*, Gaertn. (Myrtaceae)
15. *Terminalia paniculata*, Roth. (Combretaceae)
16. *Terminalia tomentosa*, Wt. & Arn. (Combretaceae)

***Macrosolen capitellatus* (Wt. & Arn.) Danser**

1. *Anogeissus latifolia*, Wall. (Combretaceae)
2. *Artocarpus integrifolia*, L. (Moraceae)
3. *Ehretia laevis*, Roxb. (Boraginaceae)
4. *Elaeodendron glaucum*, Pers. (Celastraceae)
5. *Ficus religiosa*, L. (Moraceae)
6. *Ficus infectoria*, Roxb. (Moraceae)
7. *Flacourtia montana*, Grah. (Bixaceae)
8. *Mangifera indica*, L. (Anacardiaceae)
9. *Mitragyna parvifolia*, Korth. (Rubiaceae)
10. *Terminalia paniculata*, Roth. (Combretaceae)
11. *Terminalia tomentosa*, Wt. & Arn. (Combretaceae)
12. *Schefflera venulosa*, (Wt. & Arn.) Harms (Araliaceae)

***Scurrula parasitica* Linn.**

1. *Acacia decurrens*, Willd. (Mimosaceae)
2. *Albizzia* sp. (Mimosaceae)
3. *Anacardium occidentale*, L. (Anacardiaceae)
4. *Artocarpus integrifolia*, L. (Moraceae)
5. *Buahinia racemosa*, Lam. (Caesalpiniaceae)
6. *Citrus medica*, L. (Rutaceae)
7. *Cordia myxa*, Roxb. (Boraginaceae)
8. *Dalbergia paniculata*, Roxb. (Papilionaceae)
9. *Ficus infectoria*, Roxb. (Moraceae)
10. *Garuga pinnata*, Roxb. (Bursaceae)
11. *Gmelina arborea*, Roxb. (Verbenaceae)

12. *Grewia* sp. (Tiliaceae)
13. *Holoptelea integrifolia*, Pl. (Ulmaceae)
14. *Litsea floribunda*, Gamb. (Lauraceae)
15. *Morinda citrifolia*, L. (Rubiaceae)
16. *Pithecolobium dulce*, (Roxb.) Benth. (Mimosaceae)
17. *Pithecolobium bigeminum*, Mart. (Mimosaceae)
18. *Psidium guajava*, L. (Myrtaceae)
19. *Sceleropyrum wallichianum*, Arn. (Santalaceae)
20. *Tectona grandis*, L.f. (Verbenaceae)
21. *Terminalia bellerica*, Roxb. (Combretaceae)
22. *Vitex altissima*, L.f. (Verbenaceae)
23. *Vitex negundo*, L. (Verbenaceae)
24. *Zanthoxylum rhetsa*, DC. (Rutaceae)

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

1. *Butea monosperma*, (Lam.) Taub. (Papilionaceae)
2. *Cordia myxa*, Roxb. (Boraginaceae)

***Taxillus tomentosus* (Roth.) Van Tiegh.**

1. *Anogeissus latifolia*, Wall. (Combretaceae)
2. *Casuarina equisetifolia*, Forst. (Casuarinaceae)
3. *Chuckrasia* sp. (Meliaceae)
4. *Dalbergia paniculata*, Roxb. (Papilionaceae)
5. *Embllica officinalis*, Gaertn. (Euphorbiaceae)
6. *Muntingia calabura*, L. (Tiliaceae)
7. *Spondias acuminata*, Roxb. (Anacardiaceae)
8. *Terminalia tomentosa*, Wt. & Arn. (Combretaceae)
9. *Grewia tilaefolia*, Vahl (Tiliaceae)

***Tolypanthes lagenifer* (Wt.) Van Tiegh.**

1. *Hopea ponga*, (Dennst.) Mabblerly (Dipterocarpaceae)

Viscaceae***Viscum nepalense* Spr. (= *V. articulatum* Bl.)**

1. *Cassia fistula*, L. (Caesalpiniaceae)
2. *Cordia* sp. (Boraginaceae)
3. *Dalbergia latifolia*, Roxb. (Papilionaceae)
4. *Dalbergia paniculata*, Roxb. (Papilionaceae)
5. *Diospyros montana*, Roxb. (Ebenaceae)
6. *Ehretia laevis*, Roxb. (Boraginaceae)
7. *Erythroxylon monogynum*, Roxb. (Linaceae)
8. *Gmelina arborea*, Roxb. (Verbanaceae)

***Viscum ramosissimum* Wall.**

1. *Bauhinia racemosa*, Lam. (Caesalpiniaceae)
2. *Erythroxylon monogynum*, Roxb. (Linaceae)
3. *Ficus bengalensis*, L. (Moraceae)

3. *Dalbergia* sp. (Papilionaceae)
4. *Lagerstroemia flos-reginae*, Retz. (Lythraceae)

***Taxillus cuneatus* (Roth.) Danser**

1. *Anogeissus latifolia*, Wall. (Combretaceae)
2. *Bauhinia racemosa*, Lam. (Caesalpiniaceae)
3. *Grewia orientalis*, L. (Tiliaceae)
4. *Premna tomentosa*, Willd. (Verbenaceae)

***Taxillus recurvus* (DC.) Van Tiegh.**

1. *Anogeissus latifolia*, Wall. (Combretaceae)
2. *Embllica officinalis*, Gaertn. (Euphorbiaceae)
3. *Grewia* sp. (Tiliaceae)
4. *Plectronia didyma*, Kurz. (Rubiaceae)
5. *Punica granatum*, Vent. (Punicaceae)
6. *Soymidia febrifuga*, A. Juss. (Meliaceae)
7. *Xylia xylocarpa*, (Roxb.) Taub. (Papilionaceae)

***Viscum angulatum* Heyne.**

1. *Schrebera swietenoides*, Roxb. (Oleaceae)
2. *Terminalia tomentosa*, Wt. & Arn. (Combretaceae)

***Viscum capitellatum* Sm.**

1. *Dendrophthoe falcata*, (L.f.) Ettingsh
2. *Dendrophthoe trigona*, (Wt. & Arn.) Danser
3. *Helixanthera hookeriana*, (Wt. & Arn.) Danser

***Viscum orientale* Willd.**

1. *Albizia amara*, Boiv. (Mimosaceae)
2. *Albizia* sp. (Mimosaceae)
3. *Flacourtia indica*, (Burm.) Merr. (Flacuortiaceae)
4. *Holoptelia integrifolia*, Pl. (Ulmaceae)
5. *Pongamia pinnata*, (L.) Pierre (Papilionaceae)
6. *Punica granatum*, Vent. (Punicaceae)
7. *Dalbergia paniculata*, Roxb. (Papilionaceae)
8. *Macaranga peltata*, M. Arg. (Euphorbiaceae)

9. *Grewia orientalis*, L. (Tiliaceae)
10. *Grewia* sp. (Tiliaceae)
11. *Grewia tilaefolia*, Vahl (Tiliaceae)
12. *Randia dumatorium*, L. (Rubiaceae)
13. *Rhus mysorensis*, Heyne (Anacardiaceae)
14. *Terminalia paniculata*, Roxb. (Combretaceae)
15. *Terminalia tomentosa*, Wt. & Arn. (Combretaceae)
16. *Zizyphus oenoplia*, Mill. (Rhamnaceae)

4. *Grewia orientalis*, L. (Tiliaceae)
5. *Holoptelea integrifolia*, Pl. (Ulmaceae)
6. *Schrebera swietenoides*, Roxb. (Oleaceae)
7. *Zizyphus jujuba*, Lam. (Rhamnaceae)

8. *Zizyphus oenoplea*, Lam. (Rhamnaceae)

elasticus on *Psidium guajava*

Hyper parasitism

1. *Viscum capitellatum* on *Dendrophthoe falcata* on *Dalbergia* sp.
2. *Viscum* sp. on *Dendrophthoe trigona* on *Ficus bengalensis*
3. *Taxillus cuneatus* on *Viscum articulatum* on *Grewia* sp.
4. *Viscum capitellatum* on *Helixanthera hookeriana* on *Terminalia paniculata*
5. *Viscum capitellatum* on *Dendrophthoe falcata* on *Nyctanthes arbor-tristis*
6. *Viscum capitellatum* on *Dendrophthoe falcata* on *Azadirachta indica*

Double parasitism

1. *Dendrophthoe falcata* and *Viscum orientale* on *Albizia amara*
2. *Dendrophthoe falcata* and *Viscum orientale* on *Punica granatum*
3. *Dendrophthoe trigona* and *Macrosolen parasiticus* on *Syzigium caryophyllaeum*
4. *Dendrophthoe falcata* and *Dendrophthoe trigona* on *Jacaranda mimosifolia*
5. *Dendrophthoe falcata* and *Viscum capitellatum* on *Bauhinia racemosa*
6. *Macrosolen capitellatus* and *Dendrophthoe falcata* on *Anogeissus latifolia*
7. *Macrosolen capitellatus* and *Dendrophthoe falcata* on *Terminalia tomentosa*
8. *Dendrophthoe falcata* and *Viscum capitellatum* on *Mitragyna parviflora*
9. *Dendrophthoe falcata* and *Scurrula parasitica* on *Albizia odoratissima*
10. *Viscum ramosissimum* and *Dendrophthoe trigona* on *Ficus bengalensis*
11. *Viscum* sp. and *Dendrophthoe trigona* on *Ficus bengalensis*
12. *Viscum articulatum* and *Taxillus cuneatus* on *Grewia* sp.
13. *Scurrula parasitica* and *Viscum articulatum* on *Cordia* sp.
14. *Dendrophthoe falcata* and *Dendrophthoe trigona* on *Achras sapota*
15. *Dendrophthoe falcata* and *Macrosolen parasiticus* on *Terminalia paniculata*
16. *Scurrula parasitica* and *Viscum articulatum* on *Gmelina arborea*
17. *Helicanthes elasticus* and *Dendrophthoe falcata* on *Mangifera indica*
18. *Macrosolen capitellatus* and *Taxillus tomentosus* on *Muntingia calabura*
19. *Scurrula parasitica* and *Helicanthes*

Triple parasitism

1. *Dendrophthoe falcata*, *Viscum nepalense* and *Scurrula parasitica* on *Dalbergia* sp.

Results:

A total of 293 species belonging to 93 genera, and 38 families were recorded as mistletoe hosts. Of the 93 genera, 6 did not contain host records identified to species level, eg. *Ailanthus* sp., *Albizia* sp., etc. The remaining host genera were all determined up to species rank. The number of host species recorded per mistletoe species ranged from 1 to 93. The major genera of host species were *Ficus*, *Artocarpus*, *Acacia* and *Terminalia*. There were eight species of *Ficus* and six species of *Terminalia* and *Acacia*. The number of host species in each genus ranged from 1 to 7 (*Ficus* species). The number of records for each host species ranged from 1 to 7.

All the recorded host plants were dicotyledonous angiosperms, without even a single taxa from the monocotyledons. No host species were herbaceous (as expected for woody aerial parasites), although many of the host genera included are herbaceous species.

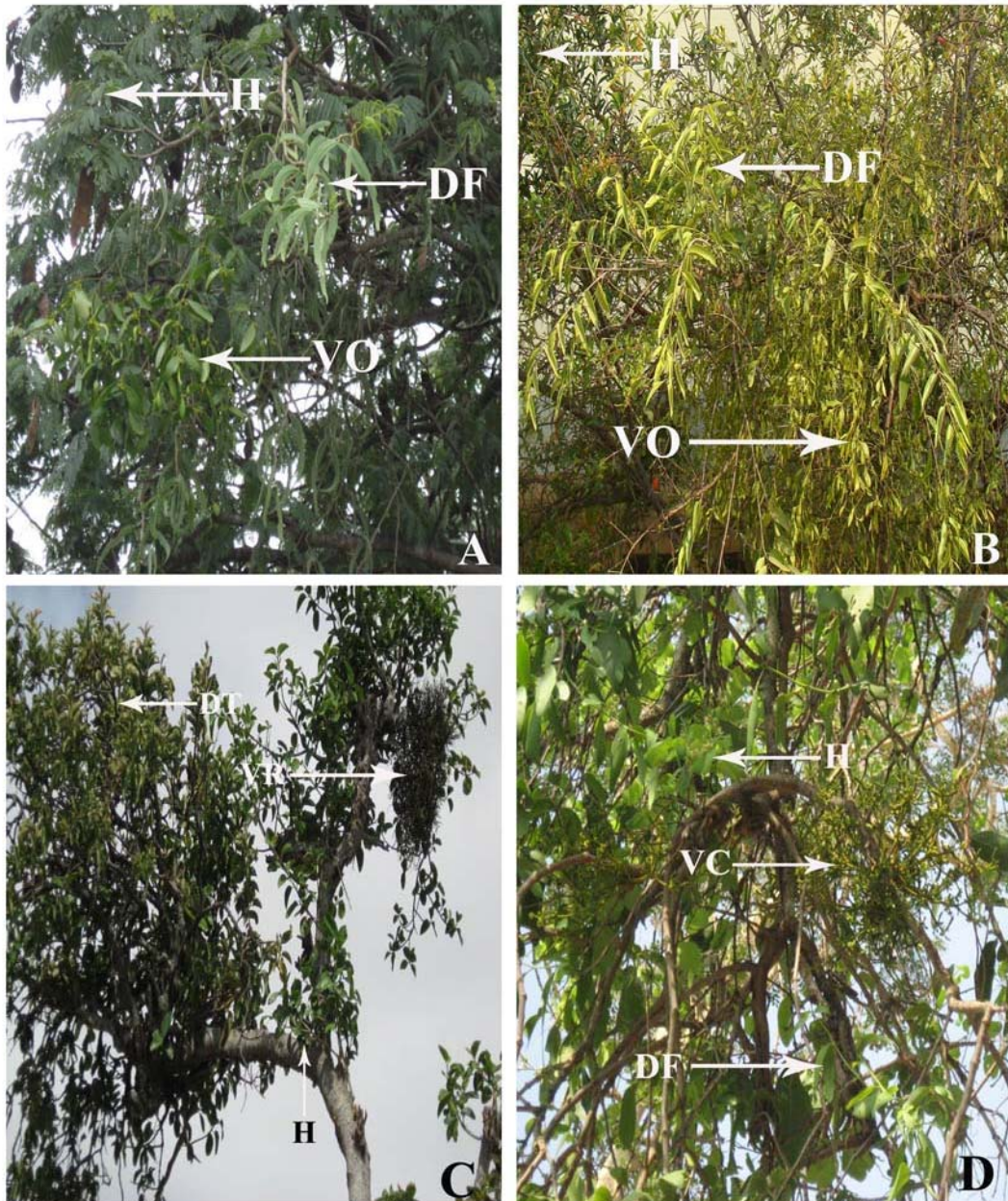
The most amazing observation, during the present study is the propensity of mistletoes to parasitize other mistletoes. If the host choice involved mistletoe such association is termed hyperparasitism (Fig. 1) (Visser, 1982; Wiens and Calvin, 1987). Another fascinating aspect of mistletoes is the parasitization of two or three different species on the same host is called as double parasitism (Fig. 2) and triple parasitism respectively.

Figure 1 Hyperparasitism in Mistletoes



- A. *Viscum* sp. on *Dendrophthoe trigona* (DT) on *Ficus bengalensis* (H)
 B. *Scurrula parasitica* (SP) on *Dendrophthoe falcata* (DF) on *Zizyphus* sp. (H)
 C. *Scurrula parasitica* (SP) on *Viscum articulatum* (VA) on *Grewia* (H)
 D. *Viscum capitellatum* (VC) on *Dendrophthoe falcata* (DF) on *Nyctanthes arbor-tristis* (H)

Figure 2 Doubleparasitism in Mistletoes



A. *Dendrophthoe falcata* (DF) and *Viscum orientale* (VO) on *Albizzia amara* (H)
 B. *Dendrophthoe falcata* (DF) and *Viscum orientale* (VO) on *Punica granatum* (H)
 C. *Dendrophthoe trigona* (DT) and *Viscum ramosissimum* (VR) on *Ficus bengalensis* (H)
 D. *Dendrophthoe falcata* (DF) and *Viscum capitellatum* (VC) on *Mitragyna parvifolia* (H)

Discussion:

The current catalogue of host species of mistletoes in Karnataka indicates a great diversity of plant species which can be parasitized. It would almost appear that no tree or shrub is immune to mistletoe attack under the right conditions. In addition, it is very important to distinguish the terms like host range, host preference and host specificity. Host range refers to the total number of plant species that can be parasitized. If a parasite appears only on some group of hosts and not on others, such a condition may be considered as host preference. Usually the number of preferred hosts is much narrower. Based on the limited number of host species, it cannot be called as host specific.

In one locality, a species of mistletoe will show distinct preference for certain hosts where as in another, the preference may change to an entirely new group. In most instances the preference is not associated with close phylogenetic relationship between hosts (Gill and Hawksworth, 1961).

Mistletoes have the capacity to infest a large number of unrelated hosts and are considered as non host specific or host generalists. For example *Dendrophthoe falcata* is the most common parasite belonging to Loranthaceae present in each and every geographical location and has been reported on 93 host species of 28 families in Karnataka. It has been widely recognized as a parasite containing a broad host range. In contrast, some have very few host species.

The fact that a tree does not have mistletoe plants growing on it even though neighboring trees do, may or may not indicate a kind of resistance. The general trend in the mistletoes is towards a very low degree of a host-specificity (Abbiatti, 1946; Docteres Van Leeuwen, 1954; Kuijt, 1964).

Fischer (1926) reported that the trees with resinous sap were comparatively free from parasites unlike those hosts which had milky juice. Similarly trees with dense evergreen foliage are thick scaly bark were less frequently parasitized. Fischer attributed the failure of parasite to attack a particular host to "definitive repulsion or inhibition of some kind" as on Loranthaceous plants which do not grow on plants of their own species. But Singh (1954) has observed the cases of autoparasitism in *Dendrophthoe falcata*. He marked that failure to grow on its own species may not due to repulsion or inhibition (as suggested by Fischer), "but merely due to the lack of nutrition in an unsuitable position". Occasionally, some species does not get infected in one locality but reverse is the case in another locality. According to Singh, this is due to the fact that "the parasitic species which appear morphologically identical consist of biological races, as in rusts".

The understanding of the interactions between parasitic angiosperms and their host species lags behind that of other plant symbiotic associations (Musselman and Press, 1995). The role host species play in this

parasitic interaction is rarely considered to be important. However, the host species may play a role in determining its parasitic constituents, through host resistance to haustorial penetration and chemical incompatibility (Kuijt, 1969). The plants which are growing besides the trees highly infested with mistletoes may not be its host always. This could be due to the dissemination of mistletoe seeds. Birds are considered the primary source of mistletoe dissemination. The feeding habit of birds may also account for hyperparasitism that is a parasite on another of the same or different species. *Viscum capitellatum* hyperparasitizes *Dendrophthoe falcata* and the latter on *Dalbergia* species.

However, host specificity is considered as an advanced feature in parasitic angiosperms. A better understanding of the mechanism related to host specificity would have applications to mistletoe control, particularly in developing greater host resistance (Shamoun and Dewald, 2002). The control of any plants is risky if the host ranges of the parasite are broad. It is hoped that the compilation of these lists generate interest in mistletoe host species in Karnataka.

Conclusion:

Until now the knowledge of host species for each of the 20 species of mistletoes has been less documented. The current study has established a baseline for the study of host-mistletoe combination in Karnataka. 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 number of host species for each 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 (generally 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.

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