



# **Mistletoe Species Richness and Rate of Infestation on the Tree Species in the Campus of Adamawa State University, Mubi, Nigeria**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors TDT and MG planned and designed the experiment, collected data, interpreted the results and wrote the manuscript. Authors CSY and DT analysed the data and did the field layout respectively. Author NNZ identified the plant samples and revised the manuscript. All the authors read and approved the final manuscript.*

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## **ABSTRACT**

Mistletoe species richness and their rate of trees infestation in the campus of Adamawa State University (ADSU), Mubi have not been documented. This study, therefore, was focused on the assessment of mistletoe species parasitic on trees in the campus of ADSU, Mubi, Nigeria. It also determined the level at which trees were infected by mistletoe in the study area. The fresh leaves, stems and flowers or fruits of mistletoes from every tree species alongside that of the host trees within the campus of ADSU, Mubi were collected. Every tree species infected and not infected by mistletoe were marked with red and white paint respectively and their total number noted. The samples of the mistletoes collected and those of the tree species, both infected and uninfected in the study area were taken to a plant taxonomist for identification. The study revealed that, three different species of mistletoes all from the genus *Tapinanthus*, namely: *Tapinanthus oleifolius*, *Tapinanthus globiferus* and *Tapinanthus dodoneifolius* were parasitic on different trees in the campus with *T. oleifolius* being the predominant species. Thirty (30) different tree species from sixteen (16) families were identified in the study area among which eight (8), namely: *Terminalia mantaly*, *Solanum linnéanum*, *Khaya senegalensis*, *Azadirachta indica*, *Gmelina arborea*, *Albizia lebbeck*, *Senna siamea* and *Araucaria columnaris* were infected with mistletoe. Therefore, eight (8)

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out of the 30 different tree species within the campus of ADSU, Mubi were infected with three different mistletoe species which include: *T. oleifolius*, *T. globiferus* and *T. dodoneifolius* with *S. linneanum* having the highest rate of infestation and *T. oleifolius* the most predominant mistletoe species.

**Keywords:** Mistletoe; infestation; tree species; identification.

## 1. INTRODUCTION

Mistletoe is an English common name to all obligate hemi-parasitic plant in the order santales and from five distinct families: Misodendronaceae, Eremolopidaceae, Santalaceae, Viscaceae and Loranthaceae [1,2,3]. They serve as a source of food to birds and medicine to humans as a remedy to diseases such as arthritis, mental disorder, hypertension, curing of wounds, aiding digestion. They contain some bioactive constituents and have antibacterial effect [4, 5].

Trees play a significant role in reducing erosion and moderating the climate. They remove carbon dioxide from the atmosphere and store large quantities of carbon in their tissues thus manufacturing carbohydrate. These trees provide a habitat for many species of animals [6]. However, mistletoes are recognized as damaging agents to trees with their victims being mostly park and shade trees, horticultural plants and forest crops [7]. Their presence on trees could be very damaging and dangerous as they reduce the vigor and growth of their host trees, malformation of the woody tissues, sparse foliage, top dying, predisposition to insects and other disease attack and eventual death of the host plant [7].

Most of these mistletoes could simultaneously parasitize different host trees. A study on the infestation of mistletoe on five (5) selected tree species within the main campus of Ahmadu Bello University (ABU), Samaru, Zaria, Nigeria showed that all tree species studied, *Khaya senegalensis*, *Albizia lebbeck*, *Citrus grandis*, *Terminalia catappa*, and *Terminalia mantaly* were heavily infected with *A. lebbeck* having the highest rate with 780 out of 1389 stands in the study area [8]. Mistletoe parasitic in the study area included: *Tapinanthus globiferus*, *Globimetula braunii*, *Globimetula oreophila*, *Englerina lecardi* and *Tapinanthus belvisii* [8].

Mistletoe species parasitic on trees within the campus of ADSU, Mubi were not known. The rate at which trees within the study area were

infected by mistletoe had not been documented, hence the need for this study.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The study was conducted in the campus of ADSU, Mubi which lies within latitude  $10^{\circ} 16'52''N$  of the equator and longitude  $13^{\circ}16'48''E$  of the prime median. It falls within the Sudan Savanna vegetation zone of Nigeria; and the annual rainfall is about 1088 mm and has an average annual temperature of  $26^{\circ}C$ . The land area of Adamawa State University, Mubi campus is  $1.039\text{ km}^2$  and its perimeter is 4.73 km (Fig. 1).

### 2.2 Determination of Tree Species Richness

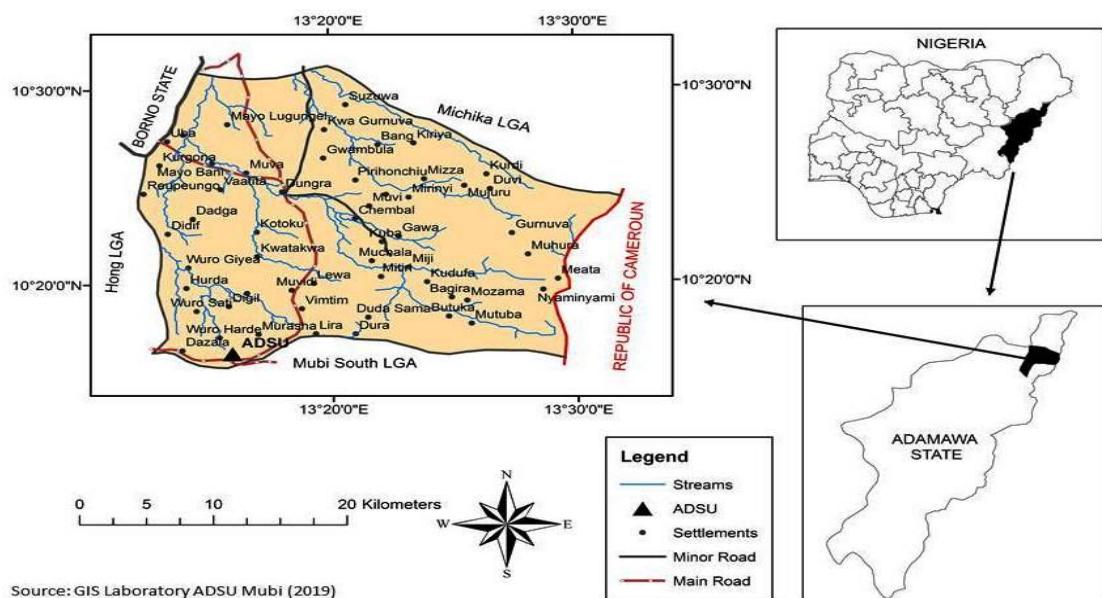
The tree species of ADSU, Mubi campus were determined by collecting the leaves or fruits samples of every tree species within the campus into well labeled polythene bags. Every tree species sampled was marked with blue paint and a serial number was assigned and recorded, thus avoiding re-sampling. The leaves and fruits or flowers samples of the trees sampled were then taken to a plant taxonomist for identification.

### 2.3 Determination of Rate of Trees Infestation by Mistletoe within the Campus of ADSU, Mubi

The fresh leaves alongside the stem and flowers or fruits of every tree species infected with mistletoe were collected into a well labeled polythene bag. Every tree species infected with mistletoe was marked with red paint and serial number was assigned and recorded. This was done so as to avoid re-sampling/counting of infected tree species.

### 2.4 Determination of Mistletoes Species Richness within the Campus of ADSU, Mubi

The fresh leaves, flowers or fruits of mistletoes parasitic on every tree species were collected into a well labeled polythene bags. The labeling



**Fig. 1. Location of Adamawa State University, Mubi campus**

of the polythene bags were done according to host tree. Every tree species on which the samples of the mistletoe were collected was marked with a white paint so as to avoid resampling/collection of sample. The samples were then taken to a plant taxonomist for identification. The number and mistletoe species type collected were noted and recorded according to the type of host tree species.

### 3. RESULTS

#### 3.1 The Species and Families of Trees within the Campus of ADSU, Mubi

The assessment of the tree species within the campus revealed that there were thirty (30) different species of trees from sixteen (16) different families. Tree species from the family of Fabaceae were the most predominant in the study area with seven (7) species followed by those of Anacardiaceae with three (3) different tree species whereas tree species from the families: Moraceae, Solanaceae, Lamiaceae, Zygophyllaceae, Araucariaceae, Annonaceae, Euphorbiaceae and Irvingiaceae were the least with only one species from each (Table 1).

#### 3.2 Rate of Infestation of Mistletoe on Tree Species within the Campus of ADSU, Mubi

Assessment of the rate of mistletoe infestation on trees within the campus showed that, only eight

(8) out of the thirty (30) different tree species within the campus were infected. These infected tree species include: *T. mantally*, *S. linnaeanum*, *S. siamea*, *K. senegalensis*, *A. indica*, *G. arborea*, *A. lebbeck* and *A. columnaris*. Of these 8 different tree species, *A. columnaris* had only one stand, but infected with mistletoe, thus making it to have the highest percentage of mistletoe infestation. This was followed *A. indica* with 160(49.84%) out of the 321 stands and *A. lebbeck* with 20(40.82%) out 49 stands. *S. siamea* was the least with 3 (0.93%) out of the 321 stands (Table 1).

#### 3.3 Mistletoe Species Identified on Trees within the Campus of ADSU, Mubi

Assessment of mistletoe species richness on trees within the campus showed a total of three different species of mistletoe all from the same genus, *Tapinanthus*. These include: *T. oleifolius*, *T. globiferus* and *T. dodoneifolius*. Of these three different species of mistletoe, *T. oleifolius* was the most common, found on six out of the eight infected tree species. *T. globiferus* was however, the uncommon mistletoe species found on only three different tree species. This study also revealed *A. indica* and *K. senegalensis* as the only tree species with the highest number of mistletoe species followed by *A. lebbeck* and *T. mantally* with two each in the study area (Table 2).

**Table 1. The species, families of trees and rate of infestations of mistletoe on tree species within the campus of ADSU, Mubi**

| S/N | Tree Species                   | Family         | No. in the Study Area | No. Infected (%) | No. Uninfected (%) |
|-----|--------------------------------|----------------|-----------------------|------------------|--------------------|
| 1.  | <i>Araucaria columnaris</i>    | Auracariaceae  | 1                     | 1 (100)          | 0 (0)              |
| 2.  | <i>Azadirachta indica</i>      | Meliaceae      | 321                   | 160 (49.84)      | 161 (50.16)        |
| 3.  | <i>Albizia lebbeck</i>         | Fabaceae       | 49                    | 20 (40.82)       | 29 (59.18)         |
| 4.  | <i>Khaya senegalensis</i>      | Meliaceae      | 57                    | 19 (33.33)       | 38 (66.67)         |
| 5.  | <i>Terminalia mantaly</i>      | Combretaceae   | 75                    | 24(32)           | 51 (68)            |
| 6.  | <i>Solanum linnaeanum</i>      | Solanaceae     | 11                    | 3 (27.27)        | 8 (72.73)          |
| 7.  | <i>Gmelina arborea</i>         | Lamiaceae      | 89                    | 2 (2.25)         | 87 (97.75)         |
| 8.  | <i>Senna siamea</i>            | Fabaceae       | 321                   | 3 (0.93)         | 318 (99.07)        |
| 9.  | <i>Tamarindus indica</i>       | Fabaceae       | 36                    | 0(0)             | 36(100)            |
| 10. | <i>Borassus aethiopum</i>      | Arecaceae      | 3                     | 0(0)             | 3(100)             |
| 11. | <i>Terminalia catappa</i>      | Combretaceae   | 27                    | 0 (0)            | 27 (100)           |
| 12. | <i>Ficus benjamina</i>         | Moraceae       | 90                    | 0 (0)            | 90 (100)           |
| 13. | <i>Ceiba pentandra</i>         | Malvaceae      | 11                    | 0 (0)            | 11 (100)           |
| 14. | <i>Delonix regia</i>           | Fabaceae       | 12                    | 0 (0)            | 12 (100)           |
| 15. | <i>Mangifera indica</i>        | Anacardiaceae  | 61                    | 0 (0)            | 61 (100)           |
| 16. | <i>Daniella oliveri</i>        | Fabaceae       | 9                     | 0 (0)            | 9 (100)            |
| 17. | <i>Eucalyptus tereticornis</i> | Myrtaceae      | 331                   | 0 (0)            | 331 (100)          |
| 18. | <i>Balanite aegyptiaca</i>     | Zygophyllaceae | 61                    | 0 (0)            | 61 (100)           |
| 19. | <i>Psidium guajava</i>         | Myrtaceae      | 13                    | 0 (0)            | 13 (100)           |
| 20. | <i>Adansonia digitata</i>      | Malvaceae      | 7                     | 0 (0)            | 7 (100)            |
| 21. | <i>Carica papaya</i>           | Caricaceae     | 6                     | 0 (0)            | 6 (100)            |
| 22. | <i>Parkia biglobosa</i>        | Fabaceae       | 12                    | 0 (0)            | 12 (100)           |
| 23. | <i>Isoberlinia doka</i>        | Fabaceae       | 51                    | 0 (0)            | 51 (100)           |
| 24. | <i>Citrus sinensis</i>         | Rutaceae       | 4                     | 0 (0)            | 4 (100)            |
| 25. | <i>Spondias mombin</i>         | Anacardiaceae  | 1                     | 0 (0)            | 1 (100)            |
| 26. | <i>Citrus aurantium</i>        | Rutaceae       | 2                     | 0 (0)            | 2 (100)            |
| 27. | <i>Annona reticulata</i>       | Annonaceae     | 2                     | 0 (0)            | 2 (100)            |
| 28. | <i>Irvingia gabonensis</i>     | Irvingiaceae   | 1                     | 0 (0)            | 1 (100)            |
| 29. | <i>Anacardium occidentale</i>  | Anacardiaceae  | 5                     | 0 (0)            | 5 (100)            |
| 30. | <i>Hura crepitans</i>          | Euphorbiaceae  | 32                    | 0(0)             | 32(100)            |

**Table 2. Mistletoe species identified on trees within the campus of ADSU, Mubi**

| S/N | Host Tree Species           | Mistletoe Species             |                               |                                  |
|-----|-----------------------------|-------------------------------|-------------------------------|----------------------------------|
|     |                             | <i>Tapinanthus oleifolius</i> | <i>Tapinanthus globiferus</i> | <i>Tapinanthus dodoneifolius</i> |
| 1.  | <i>Araucaria columnaris</i> | *                             |                               |                                  |
| 2.  | <i>Terminalia mantaly</i>   | *                             | *                             |                                  |
| 3.  | <i>Solanum linneanum</i>    |                               |                               | *                                |
| 4.  | <i>Senna siamea</i>         | *                             |                               |                                  |
| 5.  | <i>Azadirachta indica</i>   | *                             | *                             | *                                |
| 6.  | <i>Gmelina arborea</i>      |                               |                               | *                                |
| 7.  | <i>Albizia lebbeck</i>      | *                             |                               | *                                |
| 8.  | <i>Khaya senegalensis</i>   | *                             | *                             | *                                |

Key: \* present

#### 4. DISCUSSION

A total of 30 trees species belonging to 16 families were encountered in the study area. The family Fabaceae recorded the highest number of tree species. This was not surprising as trees

belonging to this family are generally in abundance in the savannah region and plays a significant role in the socio-economic life of the people. [9] and [10] also reported a similar observation when they carried out trees assessment in the savannah region. Abundance

of tree species from this family could be attributed to afforestation and to the fact that they are valued by the inhabitants of savanna region as a result of their role in soil improvement, conservation, feeds for animals, medicinal and economic value. Also, the abundance of the family Fabaceae might be attributed to the fact that they are wind dispersed, hence reason for their wide spread. This claim was proved by the work of [11] who reported tree species from Fabaceae family as the most abundant in Ehor forest reserve, Edo State, Nigeria; and attributed it to their efficient seed dispersal mechanism. Again, it was observed that, trees from the families: Moraceae, Solanaceae, Lamiaceae, Zygophyllaceae, Araucariaceae, Annonaceae, Euphorbiaceae and Irvingiaceae had the least number of trees species in the study area. This might be due to lack of interest in the afforestation of tree species belonging to those families possibly as a result of difficulty in breeding them.

The tree species in ADSU, Mubi were mostly *A. indica*. This explains why it had the highest number of mistletoe species and level of infestation as abundance of host tree in an area could influence parasitization by mistletoe [12, 13]. The collection of mistletoes from ADSU, Mubi reveals that the host plant *A. columnaris* had the highest percentage of infestation (100%), followed by *A. indica*, *A. lebbeck*, *K. senegalensis*, *T. catappa*, *S. linnaeanum*, *G. arborea* and *S. siamea* respectively. This incidence could be attributed to the susceptibility of *A. columnaris* to mistletoes more than the other host trees; host choices of the mistletoes; the host plant characteristics such as the height of the plant, branch size, and the movement patterns of dispersal agents [8]. [14] further emphasized that the characteristics such as branch size, age and height of the host plant can have a strong effect on mistletoe attachment. Observed also in the study area, some trees species are not infected by mistletoe. This might be due to their resistance to mistletoe attack or lack of constant visit by agents of mistletoe seeds dispersers (birds).

It was also observed that out of the several species of mistletoe obtained from these eight different host trees, *Tapinanthus oleifolius* is the common specie of mistletoe found parasitic on all the eight host trees. This could be due to their seeds being very sticky in nature than other mistletoe seeds, thus enhance their distribution by birds and other animals [15,16]. It can also be

as a result of their being less host specific compared to the other mistletoe species [17].

Only three (3) species of mistletoe were found present in the study area. This might be that the environmental conditions were suitable for their establishment. [18] attested this fact when they said that mistletoe distribution and host availability alone do not determine mistletoe establishment, instead, suitable environmental conditions do and are a pre-requisite. The three (3) mistletoe species identified in the study area were all members of the genus *Tapinanthus*. This discovery was in tandem with the report of [19] who said that *Tapinanthus* is the most widely spread genus in savanna region of Nigeria.

## 5. CONCLUSION

In the campus of ADSU, Mubi there are thirty (30) different species of trees from sixteen (16) different families; and trees from the family of Fabaceae were the most predominant whereas tree species from the families: Moraceae, Solanaceae, Lamiaceae, Zygophyllaceae, Araucariaceae, Annonaceae, Euphorbiaceae and Irvingiaceae were the least with only one species from each in the study area.

*T. oleifolius*, *T. dodoneifolius* and *T. globiferus* were the only mistletoe species parasitic on trees which include *T. mantally*, *S. linnaeanum*, *S. siamea*, *K. senegalensis*, *A. indica*, *G. arborea*, *A. lebbeck* and *A. columnaris* in ADSU, Mubi with *S. linneanum* having the highest percentage of trees infestation and *T. oleifolius* the predominant mistletoe species.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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