



## **A REVIEW OF THE BIO-ACTIVITY RELATIONSHIP OF MISTLETOES AND THE LEAVES OF THEIR HOST TREES**

**P. O. Osadebe<sup>1</sup>. and O. R. Johnson-Ajinwo<sup>2\*</sup>**

<sup>1</sup>*Department of Pharmaceutical and Medicinal Chemistry, University of Nigeria, Nsukka, Enugu State*

<sup>2</sup>*Department of Pharmaceutical Chemistry  
University of Port Harcourt, Choba, Rivers State*

### **Abstract**

An investigation into the bioactivity relationship of mistletoes and the leaves of their host trees have been carried out. The following six host trees and their mistletoes were investigated: *Azadirachta indica* (neem), *Psidium guajava* (guava), *Pentaclethra macrophylla* (oil-bean), *Kola acuminata* (cola nut), *Persea americana* (avocado), and *Baphia nitida* (cam wood). The work showed that of the six host trees and their mistletoes studied, four host trees, namely: neem, guava, cola nut and avocado had lots of significant bioactivity, while the other two host trees: oil bean and cam wood had few significant bioactivities. The study revealed that the mistletoes parasitic on the host trees with significant bioactivity possessed some of the reported activities of their host trees. While the mistletoes parasitic on the host trees with few significant bioactivities also showed less significant bioactivities. Also, it was observed from the study that some of the bioactive host trees studied possessed significant insecticidal properties. It could be inferred, that their mistletoes may also possess insecticidal properties. In conclusion, the study has established that there is a relationship between the bioactivity of host trees and the bioactivity of the mistletoes parasitic on them.

**Keywords:** bioactivity, Mistletoes, host tree, leaves

### **INTRODUCTION**

Modern pharmacy has its origin in folklore and the history of medicine is replete with herbal and folk remedies. One of such folk remedies is the use of the mistletoe plant for the treatment of a wide range of ailments.

Today, the European mistletoe (*Viscum album*) is chiefly used to lower blood pressure and heart rate, ease anxiety and promote sleep. In low doses, it can also relieve panic attacks and headaches. The leaves and young twigs contain several medically active compounds with antispasmodic, cardiac, cytostatic, diuretic, hypotensive, narcotic, nerveine, stimulant, tonic and vasodilator properties (Chevallier, 1996).

Mistletoe has a reputation for curing epilepsy and other convulsive nervous disorders. The plant has also been employed in checking internal hemorrhages, in treating high blood pressure and in treating cancer of the stomach, lungs and ovaries (Grieve, 1984). Externally, the plant has been used to treat arthritis, rheumatism, chilblains, leg ulcers and varicose veins (Brown, 1995).

### **Background of Study**

The African mistletoe is a semi-parasitic plant, which grows on the branches of several deciduous species of trees. It depends on its host for minerals and water with which it synthesizes its food. It is cultivated by obtaining the berries and squashing

\*Corresponding author  
ISSN 0189-8434 © 2010 NAPA

them onto the lower side of the branches of the intended host trees in late autumn and early winter (Bean, 1981), which in Nigeria corresponds to the onset of the dry season.

In Nigeria, two species of the mistletoe has been identified: the eastern and the northern species. These have been used traditionally as anti-diabetic, anticancer, antihypertensive agents etc. (Kafaru, 1993). It has been described as an all-purpose herb, which should be taken for the general well-being of the body. (PAX Herbals, 2007). Some of these uses have been verified (Obatomi *et al.*, 1994, 1996).

The plant's medicinal properties have been found to show variation in host trees. In a study of the antimicrobial properties of the Eastern Nigerian specie, parasitic on six host trees, namely *Irvingia gabonensis*, *Pentaclethra macrophylla*, *Kola acuminata*, *Baphia nitida*, *Persea americana* and *Azadirachta indica* and *K. acuminata*, it was shown that they all had significant activity. (Osadebe, 2004).

### Scope of Review

This paper seeks to find out if there is any relationship between the bioactivity of mistletoes and the leaves of their host trees by investigating the bioactivities of six host trees and the mistletoes parasitic on them. The following six host trees and their mistletoes were investigated: *Azadirachta indica* (Neem), *Psidium guajava* (guava), *Pentaclethra macrophylla* (oil-bean), *Kola acuminata* (cola nut), *Persea americana* (Avocado) and, *Baphia nitida* (Cam wood).

### Findings

The following findings were made:-

#### *Azadirachta indica* (Neem)

Neem leaves are used to treat chicken pox, stomach ache, worms, ulcers, malarial fever, warts and various foot fungi. The leaves also possess antidiabetic, antibacterial and antiviral properties (Osadebe *et al.*, 2003). Neem produces pain relieving, anti-inflammatory and fever reducing compounds that can aid in the healing of cuts, burns, earaches, sprains and headaches, as well as fevers. In Ayurvedic medicine, it is used for a variety of conditions such as in curing neuro-muscular pains (Sawaal, 2008).

It has also been reported to work against termites, and other arthropods, thus it could be used as an insecticide (Garcia. *et al.*, 2006).

The mistletoe parasitic on *Azadirachta indica* (neem) has been reported to possess significant antidiabetic activity, and a significant antimicrobial activity ( $P < 0.05$ ), against *Staph. aureus* when compared to amoxicillin. (Osadebe *et al.*, 2003, 2004).

#### *Psidium guajava* (Guava)

An infusion of the leaves and tender stems is used locally to treat fever, diarrhoea and malaria. It has also been used as a tonic in the treatment of psychiatric problems, (Iwu, 1993).

Clinical studies have validated the use of the guava in the treatment of diarrhoea, gastroenteritis as well as other digestive problems. (Jairaj, 1999, Almeida *et al.*, 1995 and Lin *et al.*, 2001).

The plant has been reported to have significant antiamoebic, antibacterial and antispasmodic activities (Lozoya *et al.*, 2002 and Ton *et al.*, 1998).

Documentation also shows that guava leaf has antioxidant properties, which improves myocardial function and is of immense benefit to the heart. It has also shown very significant antibacterial, antimalarial, antifungal

and anti yeast, activities (Abdelrahim *et al.*, 1990). Some active aromatic principles with pronounced antimicrobial activities such as sesquiterpenoid, have been isolated from guava (Nundkumar *et al.*, 2002).

The mistletoe parasitic on guava is used in the treatment of cancer. It contains the highest concentration of lectins (a kind of protein which destroys cancerous tumours and cells), when compared with other mistletoes. This may have contributed to its anti-cancer effect (PAX Herbals, 2007).

#### ***Pentaclethra macrophylla* (Oil-bean)**

The leaves of this plant have been used locally for the treatment of diarrhoea. It has been found useful in the lowering of potentially undesirable enzyme activity and improvement of constipation.

([www.informaworld.com](http://www.informaworld.com), 2005). In Sierra Leone, the fermented tea 'kombucha' (of the oil bean) has been known to possess antimicrobial activity.

Studies on the antidiarrhoeal properties of the leaf extracts have been conducted. The results demonstrated that the extracts significantly ( $P < 0.05$ ) decreased propulsive movement of gastrointestinal contents in mice. It also inhibited the growth of common pathogenic micro-organisms. The antispasmodic and antimicrobial effects of the extracts justified the use of the plant as an antidiarrhoeal therapy (Akah *et al.*, 1999). The leaves of the oil bean have also been investigated for antimalarial activity. It showed significant activity ( $P < 0.05$ ) against *Staph. aureus* when compared to amoxicillin. (Osadebe *et al.*, 2004).

Again, an investigation into the hypoglycemic and antihyperglycemic activities of the mistletoe showed no significant activity in the range of plants studied (Osadebe *et al.*, 1999).

#### ***Kola acuminata* (Cola nut)**

Cola nut, the seed kernel of a large African tree, grown commercially around the world, particularly in Nigeria, Brazil and other parts of South America is extremely popular as a caffeine containing stimulant and is an ingredient in coca cola.

*In vivo* trials, *Kola acuminata* has shown that it is useful as a respiratory stimulant, diuretic, smooth muscle relaxant, and as a vasodilator. (Biochemical Targets, 2003). Cola contains caffeine, theobromine, tannins and phenolics, including d-catechin, 1-epicatechin, kolatin, and kolanin. It also contains phlobaphens, the antocyanin pigment kola red, betaine, protein and starch.

Medically it is used internally as an ingredient for tonics in the treatment of mental and physical exhaustion, low energy and loss of appetite. Cola has a marked stimulating effect on the consciousness, and may be used in nervous debility in states of weakness. It can also be used to treat nervous diarrhoea. It can also aid in states of depression. Because of its caffeine content, cola nut may relieve some migraine headaches. The phenolics and anthocyanin are likely to provide antioxidant activity. (herbalgram. Org. on Colanut, 2009).

Externally, its astringent effect can be useful in treating wounds and inflammations (Sallamander Concepts, 2007). Its leaves are used in the treatment of stuttering in Cameroon (Joseph, 2005).

The cola nut mistletoe is rich in alkaloids and has been reported to possess antifungal activity along with significant antimicrobial activity. (Osadebe *et al.*, 2003). It is used in the treatment of hypertension, nervousness and insomnia. (PAX Herbals, 2007).

***Persea americana* (Avocado)**

The avocado leaves have been reported to have vasorelaxant activity, (Adeboye *et al.*, 1999). Its aqueous extract is considered also useful for the treatment of high blood pressure (Owolabi *et al.*, 2005). Also, anti-inflammatory and analgesic activities have been observed in the aqueous extracts from the leaves (Adeyemi *et al.*, 2002) as well as a strong inhibition on herpes simplex virus type 1 (HSV-1), Aujeszky's disease virus (ADV) and adenovirus type 3 (AD3), (De Almeida *et al.*, 1998).

Again, the plant could be used in the treatment of disorders of connective tissues (German *et al.*, 1990). Insecticidal properties have also been reported in this plant (Pubs. acs.org, 2009).

The mistletoe parasitic on avocado is used in the treatment of nervousness, insomnia and hypertension. It is rich in alkaloids and has pronounced antimicrobial activity and anti-pseudomonal activity, ( $P < 0.05$ ), when compared to amoxicillin and can be used in the treatment of non-specific infections (Osadebe, *et al.*, 2003). It has also demonstrated pronounced antidiabetic activity.

***Baphia nitida* (camwood)**

*Baphia nitida*, famous for its red dye, has been used locally to treat parasitic skin diseases, cure enteritis and other gastro-intestinal problems. In Ghana, Cote d'Ivoire and Nigeria, the leaves and bark are considered haemostatic and anti-inflammatory and are used for healing sores and wounds. The plant is frequently used in combination with other plants in the treatment of a wide range of ailments. E.g. leaf extracts of *B. nitida* and *Senna occidentalis* (L.) Link, is used in the management of asthma. (Cordon *et al.*, 2005)

Clinical studies have been carried out on this plant, such as the

effect of the extract of *Baphia nitida* on the gastro intestinal tract of rats and mice. It showed no anti-ulcerogenic effect. (Onwukaeme *et al.*, 1992). Extracts of the fresh leaves inhibited digestion in mice and rats and showed antidiarrhoeal effects. The leaf extracts have also demonstrated analgesic activity in mice. (Cordon *et al.*, 2005). Several compounds such as sativan and medicarpin have been isolated from *B. nitida*. (Omobuwajo *et al.*, 1992).

The flavonoid-rich fraction of the leaves obtained by chromatographic process was formulated into an ointment and exhibited significant anti-inflammatory activity in several rodent inflammation models. (Onwukaeme *et al.*, 2005).

But an analysis of the plant's extract for antiviral activity showed that the plant was active in the treatment of respiratory infections with cough. After fractionation, an enriched fraction which was more active in the *in vivo* assay than ribavirin (an approved treatment for respiratory syncytial virus (RSV) infections was obtained. When the fraction was subjected to purification, the activity was lost.

LC/MS and MS/MS studies on a Perkin-Elmer-Sciex API 365 triple quadruple mass spectrometer was used to characterize the enriched fraction. Seven additional compounds, which were previously not found in the *Baphia* spp., were identified. It is possible that the biological activity of the extract of the cam wood plant is due to synergism between multiple components or an unstable compound (Michael, *et al.* 1998).

The mistletoe parasitic on cam wood has been investigated for the presence of antimicrobial activity. It was observed that the mistletoe showed no significant activity. (Osadebe *et al.*, 2004). But studies on

the hypoglycemic activity of the crude extract gave significant hypoglycemic activity, which was less pronounced in comparison with the activities of the avocado mistletoe, and several others used in the study. (Osadebe *et al.*, 2004).

## CONCLUSION

It is therefore recommended, that:

- i. Studies on the mistletoes should be focused on host trees with well-established bioactivities.
- ii. The bioactivity observed in a host tree should also be tested for in its mistletoes and vice versa.
- iii. The active principles of a host tree should be compared with the active principles of its mistletoe to establish the presence of a relationship.
- iv. Since mistletoe is a semi parasitic plant, its cultivation on plants with pronounced bioactivity should be encouraged.
- v. The cultivation of mistletoes on plants which have lots of biological activities but have not been known to accommodate mistletoes should be attempted in order to obtain more biologically potent mistletoes that may hold the keys to the treatment/cure of a number of the challenging disease of our time.

## REFERENCES

- Abdelrahim, S.I. (1990). Antimicrobial activity of *Psidium guajava* L. Fitoterapia” 73 (7-8):713-5.
- Akah P. A., Aguwa C.N. and Agu R.U. (1999). Studies on the antidiarrhoeal properties of *Pentaclethra macropphylla* leaf extracts. Phytotherapy research Vol. 13 No. 4, pp. 292-295.
- Almeida, C.E. (1995). “Analysis of the Antidiarrhoeic Effect of Plants used in Popular Medicine”. Rev. Sande Publishers, 29(6): 428-33.
- Bean, W. (1981). Trees and Shrubs. Hardy in Great Britain. Vol. 1-4 and Supplement. Murray.
- Biochemical targets of plant bioactive compounds, Google books result 2003 by Gideon Maxwell.
- Brown D. (1995). Encyclopedia of Herbs and their uses. Dorling Kindersley, London.
- Cardon D. and Jansen P.C.M. (2005). *Baphia nitida* lodd. (Internet) Record from protabase. <http://database.prota.org/search.htm>>.
- Chevalier A. (1996). The Encyclopedia of Medicinal Plants, Dorling Kindersley London.
- Cytotoxic and Insecticidal Constituent of the Unripe fruit of Avocado. 2009. Pubs.ac.org.
- Evangeline T, Oparaocha and Okorie C. (2009). *In vivo* evaluation of anti-malarial activity of three medicinal plants used in South Eastern Nigeria. J. of Herbs, spices and medicinal plants, Vol. 15, Issue 1, pp. 121-128.
- Grieve. A modern Herbal Penguin 1984.
- Herbalgram. Org. on Colanut (2009).
- Iwu, M.M. (1993). Handbook of African Medicine, Plants. CRC Press Inc. Florida, pp. 1-50.
- Jairaj, P. (1999): “Anticough and antimicrobial activities of *Psidium guajava* Linn. Leaf extract”. J. Ethnopharmacol; 67(2): 203-12.
- Joseph Lokong (2005). Cahn.mnsu.edu/5africa.
- Kafaru, E. (1993). Herbal Remedies. The Guardian Thursday, June 3, pp. 24.
- Lozoya, X. (2002). “Intestinal anti-spasmodic effect of a phytodrug of *Psidium guajava* folia in the treatment of diarrhoeic disease”, J. *Ethnopharmacol.* 83 (1-2):19 – 24

- Medicinal plants in the Republic of Korea. World Health Organization, Manila, 1998.
- Michael K. Kernan, Tri Murningsih, Dane Karr, Ed Rozhon. (1998) Analysis of an Antiviral extract of the plant *Baphia nitida* by LC/MS and MSMS. AAPS Annual meeting, shaman pharmaceuticals south San Francisco CA; PE Sciex, Foster City, CA.
- Mistletoe. The Wonder Herb, [www.paxherbals.net2007](http://www.paxherbals.net2007).
- Nundkumar, N. (2002): "Studies on the Anitplasmodial properties of some South-African medical plants used for Antimalarial remedies in Zulu folk medicine". Exp. Glin. Pharmacol; 24(7):397-401.
- Obatomi, D. K., Aina, V. O. and Temple, V. J. (1996). Effects of African mistletoe on blood pressure in Spontaneously Hypertensive rats. International Journal of Pharmacognosy 34(20:124-127).
- Obatomi, D. K., Bikomo, E. O. and Temple, V. J. (1994). Anti-diabetic properties of African Mistletoe in Streptozotocin induced diabetic rats. J. of Ethnopharmacology (43), 13-17.
- Omobuwajo (1992). In "From nature to drugs: Theories and Realities". An inaugural lecture delivered by Saburi Adejimi Adesanya at University of Ile Ife, 12<sup>th</sup> July, 2005.
- Onwukaeme D. N. and Lot T. Y. (1992). The Effects of *Baphia nitida* Lodd (Leguminosae) extract on the gastrointestinal tract of rats and mice in books.google.Com.ng.
- Onwukaeme D. N. (1995). Anti-inflammatory activities of flavonoids of *Baphia nitida* Iodd (leguminosae) on mice and rats. J. Ethnopharmacology:121-124.
- Osadebe, P.O. and Akabogu I. C. (2003). Host tree variation of acute toxicity and antidiabetic activities of *Loranthus micranthus*, (03) J. Ethnopharmacology: 133-138
- Osadebe, P.O. and Ukwueze, S. E. (2004). A comparative study of the phytochemical and antimicrobial properties of the Eastern Nigerian species of African mistletoe (L. M.) Sourced from different host trees. Biological research and biotechnology 2(1): 18-23.
- Osadebe, P.O., Okide G. B. and Akabogu I. C. (2004). A study of extracts of African mistletoes for hypoglycemic and anti-hyperglycemic activities. J. Ethnopharmacol. 95. 133-138.
- Rasmus-Jez, M. R. (2007) Phytochemical Analysis of Avocado Seeds (*Persea americana*). Google books result.
- Tona, L. (1998). "Antiamoebic and spasmolytic activities of *Psidium guaiava* Linn. Leaf extract from some antidiarrhoeal traditional preparation used in Kinshasa, Congo". *Phytomedicine* 7 (1): 31-8.
- Salamander Concepts (Pty) Ltd. (2007). [www.ageless.co.za/herbs-colanut](http://www.ageless.co.za/herbs-colanut).
- Sawaal.ibibo.com2008. What is the Popular name of *Azadirachta Indica*.
- Uses of *Pentaclethra macrophylla* (2005).www.informaworld.com.