# EFFECT OF SOME AQUEOUS PLANT EXTRACTS ON *PLASMODIUM YOELLI NIGERIAIENSIS* IN ALBINO MICE

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## Abstract

The aqueous extracts from nine medicinal plants collected locally in Nigeria, were examined for antimalarial properties.These were administered orally by force feeding in a single daily dose of 14ml./25g. body weight to albino mice infected with *Plasmodium yoelli nigeriaiensis.* Administration of aqueous extracts commenced 72 hours after infecting the mice and observations were made for six days. The level of parasitemia, anal temperature and body weight were assessed daily.

Results showed that only the aqueous extract of leaves of *Morinda Lucida, Psidium guajava* and *Baphia nitida* had definite suppressive action against *Plasmodium yoelli nigeriaiensis* in mice. The effect of these three extracts on infected mice was also shown by the arrest of rapid weight loss and restoration of normal body temperature.

## Introduction

In many developing countries of the world, the use of herbal medicine to prevent or treat various diseases dates back to many centuries. Since the spread of herbalism from the far east to the west, a knowledge of herbs was available to everyone, and people used some of the simple concoctions to help themselves (Obin and Makinde, 1985). The fact that plants are potential sources of new drugs, in relation to the current problems in malaria prevention, have spurred the interest of many physicians and scientists into research in herbal medicines (Gbeassor *et. al.*, 1989). In many African countries, there has been a lot of research to reveal the richness of the flora of the continent in plants with medicinal properties (Khalid *et. al.*, 1986; Abatan and Makinde, 1986; Iwu *et. al.*, 1986; Makinde et. al., 1987; Makinde *et. al.*, 1988).

One of the earliest drugs used for the treatment of malaria was the extract from the cinchona bark, from which quinine was prepared. Gramicia (1987) and Deloron *et. al.* (1990) worked on different aspects of the therapeutic dose of quinine. The herb *Artemisia annua* has been used for many centuries in Chinese traditional medicine as a treatment for fever. The compound called quinghaosu (artemisinine) was isolated from the leafy portions of the plant as being responsible for the reputed medicinal action. Klayman (1985) reported that sodium artesunate acted rapidly in restoring to consciousness comatose patients with cerebral malaria.

O'Neill *et. al.* (1987) investigated the antimalarial activity of *Brucea javanica* fruits against two species of *Plasmodium*, *P. fakiparum* and *P. berghei.* Two members of the genus *Potomorphe*, *P. umbellata* and *P. peltata* were screened for antimalarial activity by Amorim *et. al.* (1988). The biochemical mechanism of the antimalarial activity of *Azadirachta indica* leaf extract was studied by Iwu *et. al.* (1986). In Nigeria, Abatan and Makinde (1986) screened two plants, *Azadirachta indica* and *Pisum sativum* for possible antimalarial activities. *Pisum sativum* was found to have significant prophylactic activity by producing a parasite suppression. Makinde *et. al.* (1987) examined the effect of *Solanum erianthum* acqueous leaf extract on *Plasmodium berghei berghei* in mice. The results showed that the extracts did not produce any significant suppression of infection.

From the foregoing, it becomes apparent that much work still needs to be done in the screening of medicinal plants for antimalarial effects.

## Materials and Methods

### Plant Materials

All the plant materials were collected from Papa Ajao market in Lagos and identified by reference to the book for plant identification by Gbile (1984). From a market survey of the amount of plant materials recommended for the treatment of an adult man, an equivalent weight for the treatment of a mouse weighting about 25gm. was calculated.

The appropriate plant materials were placed in separately labelled pots and heated to boil for about 45 minutes in the specified amount of water. The volume of the filterate was adjusted with more water after boiling. The extracts were stored at 4$^{o}$C in a refrigerator while not in use.

| | | |
|---|---|---|
| Morinda lucida leaves | — | 550gm per litre of water |
| Psidium guajava leaves | — | 350gm per litre of water |
| Annona senegalensis roots | — | 300gm per litre of water |
| Rauvolfia vomitoria leaves | — | 250gm per litre of water |
| Nauclea latiflora root and bark | — | 140gm per litre of water |
| Magifera indica leaves | — | 80gm per litre of water |
| Baphia nitida leaves | — | 55gm per litre of water |
| Cajanus cajan leaves | — | 40gm per litre of water |
| Alstonia congensis entire plant | — | 50gm per litre of water |

### Experimental Animals

The animals used were male albino mice of about 7 weeks old. The mice were kept in groups of five in cages fitted with feeding and drinking apparatus. Each cage was labelled with the treatment plant name. The mice were fed on animal ration purchased from Livestock Feed. Nigeria Limited. Each mouse was weighed before infection and daily for six days after the established infection. A control experiment was set up with one of the groups of mice.

## Parasites

A laboratory strain of *Plasmodium yoelli nigeriaiensis* obtained from the University of Lagos, College of Medicine Parasitology laboratory was used in albino mice. The specie was maintained by weekly serial passage in mice.

## Inoculum

The parasitised inoculum was prepared to contain about 5 million *Plasmodium yoelli nigeriaiensis*. This was done by finding the percentage parasitemia of the donor mouse and the red blood cell count using the haemocytometer and diluting the blood with isotonic saline.

Fifty male albino mice were inoculated intraperitoneally with 0.2ml of infected blood containing about 1 million *Plasmodium yoelli* nigeriaiensis parasitized red blood cells obtained from a donor mouse having 55-60% parasitemia. Starting 72 hours after inoculation, mice in each of the 9 groups received orally by force feeding 14ml per day of the appropriate plant extract. The control group was placed on ordinary tap water.

The body temperatures and levels of parasitemia were followed daily by taking anal temperatures in the morning and preparing thin films of the tail blood. The films were stained with Leishman stain and the percentage parasitemia determined by counting the number of parasitized blood cells out of 500 red blood cells in random fields of the microscope.

## Results

The summary of the effect of aqueous plant extracts of *Morinda lucida*, *Psidium guajava*, *Baphia nitida*, *Annona senegalensis*, *Rauvolfia vomitoria*, *Nauclea latiflora*, *Magifera indica*, *Cajanus cajan* and *Alstonia congensis* on mice infected with *Plasmodium yoelli nigeriaiensis* are shown in Table 1. Water extract of the leaves of *Morinda lucida*, *Psidium guajava* and *Baphia nitida* were significantly effective ($P < 0.05$) on *Plasmodium yoelli nigeriaiensis* infection in albino mice. With the exception of mice treated with extracts of these three plants of promise, the mean parasitemic levels in mice treated with other plant extracts and the control increased steadily from 35.2% to 65% between the 1st and 6th day. The increase finally terminated with the death of the animals by the 5th and 6th days (Table 2). Aqueous leaf extracts of *Morinda lucida*, *Psidium guajava* and *Baphia nitida* reduced the parasitemic level of malarious mice to zero by the fourth, fifth and sixth day respectively, and the animals were alive when the observation was discontinued.

Percent weight loss of the control mice given ordinary tap water increased sharply from the first day and were all dead by the 4th day when a 5.2% weight loss was recorded (Fig. 1). Groups of mice treated with aqueous leaf extracts of *Morinda lucida*, *Psidium guajava* and *Baphia nitida* initially recorded rapid weight loss of 2-3.2% for the first 3-4 days.

**Table 1: Summary of suppressive actions of some plant extracts on *Plasmodium yoelli nigeriaiensis* in mice.**

| Plant extract | Effect on mice |
|---|---|
| Morinda lucida | + ve |
| Psidium guajava | + ve |
| Baphia nitida | + ve |
| Annona senegalensis | - ve |
| Rauvolfia vomitoria | - ve |
| Nauclea latiflora | - ve |
| Magifera indica | - ve |
| Cajanus cajan | - ve |
| Alstonia congensis | - ve |

**Table 2:** Response of *Plasmodium yoelli nigeriaiensis* infected mice to treatment with the aqueous extracts of some medicinal plants for six days.

| Name of Medicinal Plant | | Mean level of parasitemia (%) in experimental mice | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Day 1 | Day 2 | Day 3 | Day 4 | Day 5Day 6 |
| | Mean | 37.0 | 30.2 | 10.4 | 0 | 0 | 0 |
| Morinda lucida | S.D. | 1.41 | 1.72 | 1.62 | 0 | 0 | 0 |
| Psidium guajava | Mean | 37.6 | 35.6 | 21.6 | 9.6 | 0 | 0 |
| | S.D. | 1.36 | 1.02 | 1.02 | 1.02 | 0 | 0 |
| Baphia nitida | Mean | 34.8 | 25.4 | 19.2 | 9.6 | 2.8 | 0 |
| | S.D. | 0.75 | 1.02 | 1.47 | 1.02 | 0.75 | 0 |
| Annona | Mean | 37.4 | 40.4 | 46.8 | 54.0 | 63.0 | – |
| Senegalensis | S.D. | 1.02 | 1.02 | 2.79 | 3.16 | 3.50 | – |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Rauvolfia** | Mean | 35.2 | 42.0 | 47.4 | 53.3 | 60.3 | – |
| **Vomitoria** | S.D. | 2.86 | 2.10 | 2.15 | 3.00 | 3.40 | – |
| **Nauclea** | Mean | 37.0 | 36.0 | 40.8 | 47.3 | 55.3 | – |
| **latiflora** | S.D. | 1.41 | 1.90 | 1.48 | 1.48 | 2.17 | – |
| **Magifera** | Mean | 37.6 | 45.2 | 52.3 | 60.7 | 65.0 | – |
| **Indica** | S.D. | 1.02 | 1.33 | 1.79 | 2.87 | 0.0 | – |
| **Cajanus** | Mean | 37.2 | 44.6 | 52.0 | 56.7 | 64.0 | – |
| **cajan** | S.D. | 1.33 | 1.50 | 2.83 | 1.25 | 0.82 | – |
| **Alstonia** | Mean | 35.8 | 43.6 | 49.8 | 57.7 | 63.0 | – |
| **congensis** | S.D. | 1.33 | 2.33 | 1.64 | 1.89 | 0.82 | – |
| **Control** | Mean | 36.8 | 43.8 | 52.0 | 58.5 | – | – |
| **(tapwater)** | S.D. | 0.75 | 1.92 | 2.12 | 1.50 | – | – |

* Each value is the mean of 5 animals.

– Death of animals.

S.D. Standard Deviation.

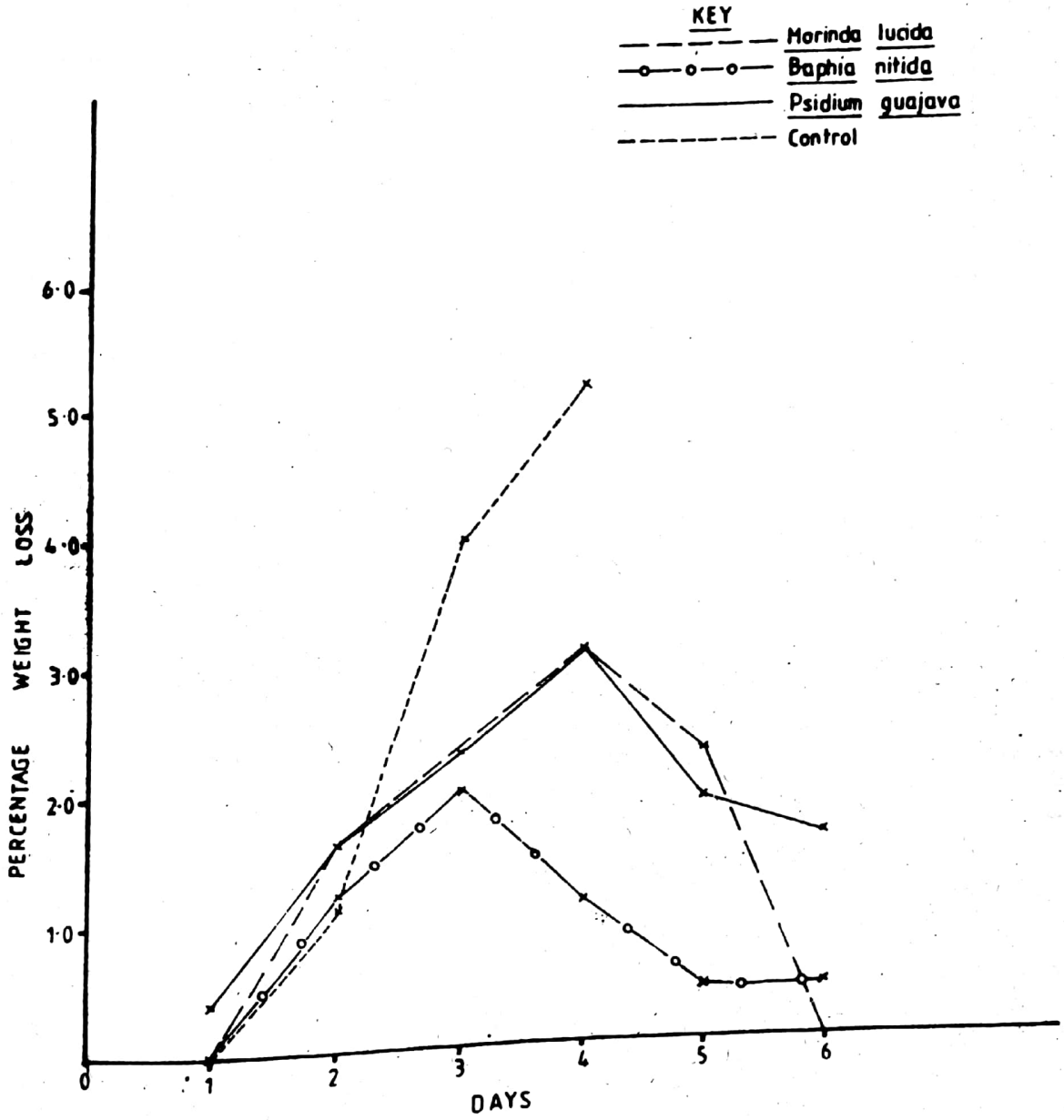


Fig: 1:- Mean weight loss(%) of mice treated with aqueous extracts of Morinda lucida, Psidium guajava, Baphia nitida and the control for six days

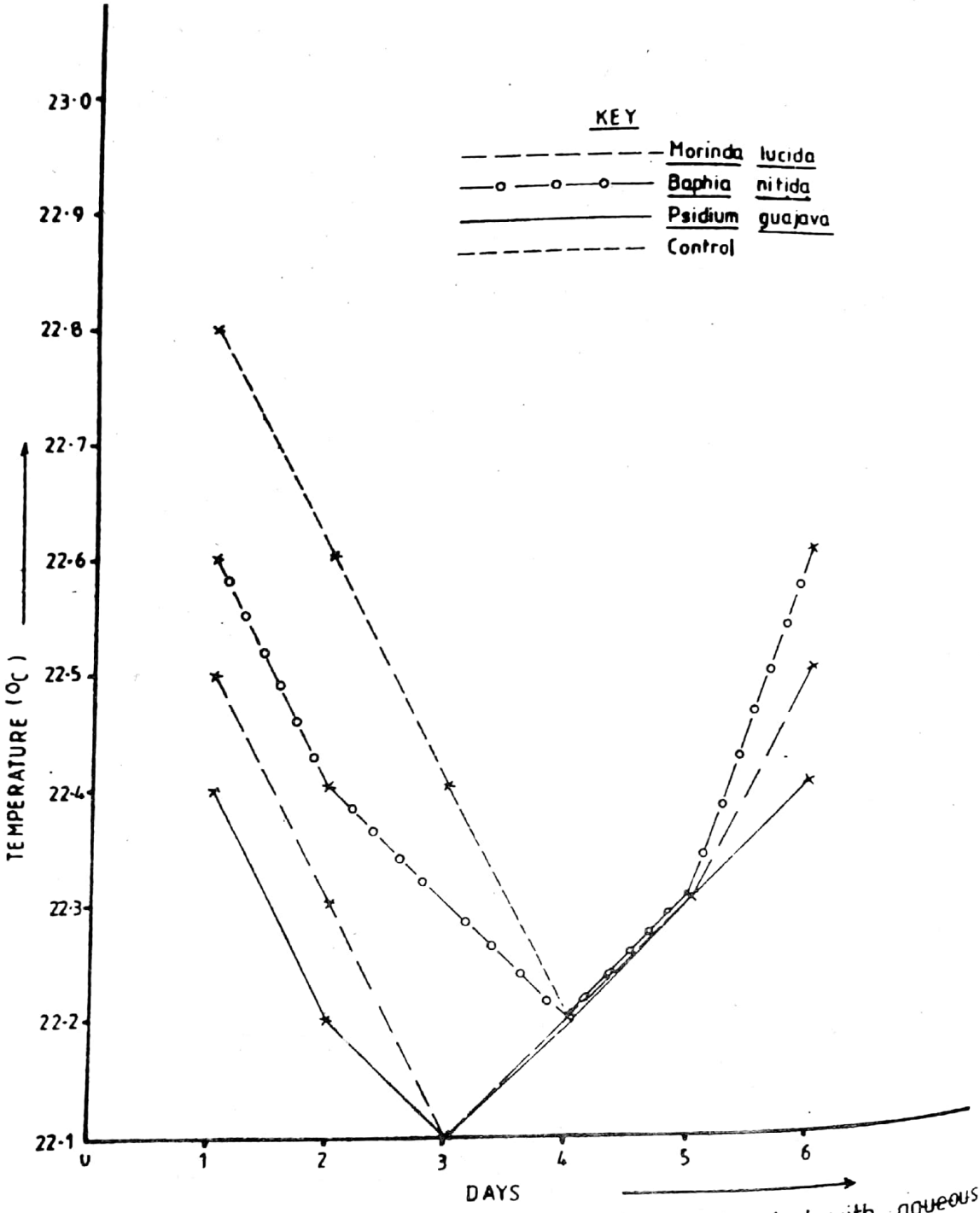


Fig: 2:- Mean temperature fluctuations of mice treated with aqueous extracts of Morinda lucida, Psidium guajava, Baphia nitida and the control for six days.

Thereafter, a progressive decline in weight loss was observed in these three groups (Fig. 1). A sharp drop of 22.8°C to 22.1°C in body temperature of infected mice was observed in the first three days in all the groups (Fig. 2). After the 4th day, body temperature of groups of mice treated with *Morinda lucida*, *Psidium guajava* and *Baphia nitida* were on the increase, almost reaching initial temperatures prior to infection (Fig. 2). The body temperature of the control group of mice dropped sharply from 22.8°C to 22.2°C after which all animals died.

## Discussion

The screening of various plant species for their antimalarial properties is still an ongoing exercise in which more studies have to be done. Previous studies carried out by Peters (1965) and Ampofo (1977) showed that some local herbs were found to be ineffective in older mice of about twelve weeks and above, since this group has the capability of developing immunity to infection. Hence, in this study, mice of about seven weeks of age were used. The results of this investigation has brought to light the efficacy of the aqueous extracts of some plants in the suppression of *Plasmodium yoelli* infection in mice. The antimalarial activity of the aqueous leaf extracts of *Baphia nitida* and *Psidium guajava* are being reported for the first time. The antimalarial property of *Morinda lucida* in different experimental models has been previously reported. Odetola and Bassir (1986) showed that only the aqueous extract of leaves of *Morinda lucida* had a definite suppressive action against *Plasmodium gallinaceum* in chicks but not in *Plasmodium berghei* in mice. In this study, the aqueous leaf extract of *Morinda lucida* was significantly effective against *Plasmodium yoelli ingeriaiensis* in mice. The fact that the aqueous extract of *Morinda lucida* was found effective in mice infected with *Plasmodium yoelli* in this study, but not in *Plasmodium berghei* in mice as reported by Odetola and Bassir (1986), confirmed earlier reports of species differences in response to drugs.

The present study shows that malaria parasites in the blood of infected mice were cleared by the fourth, fifth and sixth day respectively by the aqueous leaf extracts of *Morinda lucida*, *Psidium guajava* and *Baphia nitida*. Factors which may influence the response of experimental animals to drug trials include variations of experimental animals to especially, the strain of parasite, environment, diet, concomittant infections, route, frequency and duration of drug administration (Odetola and Bassir, 1986). This study also shows that the antimalarial property of the three active aqueous leaf extracts was fully apparent in infected mice by the fourth day of treatment. This was evidenced by the rapid decline of parasites in the blood, rise in body temperature to normal level while the percent weight loss was drastically reduced. The loss in weight was due to poor apetite of infected animals.

The inability of the aqueous plant extracts of *Rauvolfia vomitoria*, *Magifera indica*, *Cajanus cajan*, *Alstonia congensis*, *Annona senegalensis* and *Nauclea latiflora* to lower the parastemic levels of malarious mice is similar to the findings of Makinde *et. al.* (1987) in which the aqueous leaf extract of *Solanum erianthum* did not produce any significant suppression of infection in *Plasmodium berghei berghei* infected mice.

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