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# *In vitro* Anthelmintic Properties of *Buchholzia coriaceae* and *Gynandropsis gynandra* Extracts

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## Abstract

Methanol extracts from the leaves and stems of *Gynandropsis gynandra* and *Buchholzia coriaceae* were investigated for their activity against *Fasciola gigantica*, *Taenia solium* and *Pheritima pasthuma*, respectively. Five concentrations (10–100 mg/ml) of each extract were studied in the bioassay, which involved determination of time of paralysis and time of death of the worms. All the extracts exhibited considerable anthelmintic activities, and the order of sensitivity of the extracts to the worms was *P. pasthuma* > *F. gigantica* > *T. solium*. The most active of the extracts were *B. coriaceae* and *G. gynandra* stem methanol extracts. Piperazine citrate (10 mg/ml) and distilled water were included in the assay as standard reference drug and control, respectively.

**Keywords:** *Gynandropsis gynandra*, *Buchholzia coriaceae*, anthelmintic, worms.

## Introduction

*Buchholzia coriaceae* and *Gynandropsis gynandra* are two plants belonging to the Capparidaceae. Plants from this family have been used in African traditional ethnomedicine for several years and several genera plants have been documented for the treatment of various ailments. Plants of the Capparidaceae have been used for the treatment of syphilis, dressing of wounds, chronic ulcers, and treatment of snake bites (Dalziel, 1937; Kerharo & Adams, 1974). Certain plants in the plant family are also noted for the treatment of gonorrhoea (Pernet, 1972), convulsion in children, aphrodisiacs (Ainsle, 1937), and, mostly, as anthelmintics (Dalziel, 1937; Walker, 1953; Irvine, 1961; Kerharo, 1968; Burkhill, 1985). The plant family is well known for the presence of glucosinolates or the so called mustard oil glucosides (Kjaer & Thompson, 1963; Ahmed et al., 1972). Alkaloids of the stachydrine-type are also well represented in this plant family (Delaveau et al., 1973). To a lesser extent, flavonoids and sterols have been indicated in a few of these plants (Bombardelli et al., 1973).

Specifically, *B. coriaceae* stem bark has been used for the treatment of earache, bark decoction is drunk for chest pains, kidney pains and for washing small pox wounds. The fruit is anthelmintic. Seeds of *G. gynandra* are reputed for anthelmintic properties (Bouquet & Debray, 1974; Walker, 1953). The oil of the fruit is used as a fish poison as well (Oliver-Bever, 1986).

Continuing our studies of the Capparidaceae plants for biological activity and constituents (Ajaiyeoba & Okogun, 1994, 1996; Ajaiyeoba et al., 1998) coupled with our recent studies on other ethnomedically useful plants from the Nigerian flora (Ajaiyeoba et al., 1999), we present the anthelmintic properties of *B. coriaceae* and *G. gynandra*.

## Materials and Methods

### Plant collection and authentication

Leaves (395 g) and stem (420 g) of *Buchholzia coriaceae* were collected from the Nifor forest reserve, in the outskirts of Benin-City, Nigeria, while leaves (385 g) and stem (500 g) of *Gynandropsis gynandra* were obtained from the Olodo area in Ibadan, Nigeria. *B. coriaceae* was authenticated under FHI 32885 and *G. gynandra*, FHI 18486 at the Forest Research Institute of Nigeria (FRIN), Ibadan where voucher specimens were deposited.

### Plant extraction

Plant materials were successively extracted in redistilled hexane and methanol by maceration at room temperature

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(29 °C) for 72 hr. After removal of solvent, percentage yields were estimated and plant extracts were stored in sample bottles in a refrigerator untill needed for analysis.

### Worms collection and authentication

*Fasciola gigantica* (liverfluke, mean weight of 0.05–0.07 g) and *Taenia solium* (tapeworm, 2.4–2.8 g) were obtained from freshly slaughtered cows in the Bodija abbattoir, in Ibadan metropolis. *Pheritimia pasthuma* (earthworm, 0.06–0.6 g) were collected from the Awba dam and the water logged areas of Staff School, both within the campus of University of Ibadan (UI). All three worm types were authenticated at the Parasitology Research Unit, Zoology Department, UI, by Dr. A. Odiabo.

### Anthelmintic assay

Two worms (same type) were both placed in 9 cm Petri dishes in solutions of crude extracts in five different concentrations (10, 20, 50, 80 and 100 mg/ml in distilled water), respectively. This was done in duplicates for all the worm types.

Mean times for paralysis (P, in minutes) were taken when no movement of any sort could be observed, except when the worms were shaken vigorously. Times of death of worms (D, minutes) were recorded after ascertaining that worms neither moved when shaken vigorously nor when dipped in warm water (50 °C). Piperazine citrate (10 mg/ml) was included as reference compound, while distilled water was included as control. This method is similar to our previous method (Ajaiyeoba & Okogun, 1996).

## Results

Yields (%) of extracts and the result of the anthelmintic studies of methanolic extracts of leaves of both plants are presented in Table 1, while the intrinsic anthelmintic properties of the stem extracts are shown in Table 2. The anthelmintic properties of the leaf extracts of *G. gynandra* and *B. coriaceae* were studied using *Pheritimia pasthuma* and *Fasciola gigantica.* The stem methanol extracts of both plants were screened for bioactivity using *P. pasthuma* and *Taenia solium* as the helminths. Null´s hypothesis was used to test significance with $P < 0.05$ ($n = 2$). Results are summarized in Table 1 and Table 2.

## Discussion

As shown in Tables 1 and 2, the four methanolic extracts of leaves and stems of *Gynandropsis gynandra* and *Buchholzia coriaceae* displayed intrinsic anthelmintic properties. The extracts showed concentration related anthelmintic activities with all the worms used in the study, with 100 mg/ml giving a shortest time of paralysis (P) and death (D) for all the worm types. The results from both tables showed that the leaves of the plants exhibited a higher activity than the stems of the plants for all the worm types used.

Earthworms were most sensitive to the leaf methanol extract of *G. gynandra*, as shown in Table 1. It produced paralysis of 2 min and time of death (D) of 8 min, when P and D for the reference drug were 20 and 60 min, respectively. It took a longer time for the earthworms to die with *B. coriaceae* leaf extract. The activity of both leaf extracts

*Table 1.* Anthelmintic activities of *B. coriaceae* and *G. gynandra* leaf extracts.

| | | | Time of Paralysis (P) and Death (D) of worms in minutes (±SEM)[b] | | | |
|---|---|---|---|---|---|---|
| | | | *P. pasthuma* | | *F. gigantica* | |
| Extracts[a] | Yield (%) | Conc. (mg/ml) | **P** | **D** | **P** | **D** |
| *G. gynandra* (leaves) | 4.8 | 10 | 15 ± 0.5 | >60 | 26 ± 0.1 | 38 ± 0.5 |
| | | 20 | 10 ± 0.3 | 55 ± 0.2 | 23 ± 0.3 | 35 ± 0.2 |
| | | 50 | 8 ± 0.2 | 40 ± 0.6 | 15 ± 0.8 | 30 ± 0.1 |
| | | 80 | 3 ± 0.5 | 20 ± 0.5 | 8 ± 0.2 | 10 ± 0.1 |
| | | 100 | 2 + 0.9 | 8 + 0.2 | 3 + 0.5 | 5 + 0.2 |
| *B. coriaceae* (leaves) | 12.3 | 10 | 16 ± 0.2 | >60 | 28 ± 0.3 | 40 ± 0.9 |
| | | 20 | 13 ± 0.5 | 58 ± 0.2 | 25 ± 0.2 | 39 ± 0.5 |
| | | 50 | 10 ± 0.3 | 50 ± 0.5 | 20 ± 0.1 | 35 ± 0.5 |
| | | 80 | 7 ± 0.8 | 40 ± 0.3 | 7 ± 0.3 | 9 ± 0.1 |
| | | 100 | 5 + 0.5 | 35 ± 0.1 | 3 ± 0.8 | 6 ± 0.9 |
| Piperazine citrate | | 10 | 20 + 0.3 | 60 ± 0.5 | 1 ± 0.2 | 3 ± 0.05 |

[a] Extracts/reference drug were dissolved with distilled water.
[b] All values were significant ($P < 0.05$). In the control (distilled water treated), *P. pasthuma* lived 48 hr, *F. gigantica* lived 5 hr.

*Table 2.* Anthelmintic activities of *B. coriaceae* and *G. gynandra* stem extracts.

| Extracts[a] | Yield (%) | Conc. (mg/ml) | Time of Paralysis (P) and Death (D) of worms in minutes (±SEM)[b] | | | |
|---|---|---|---|---|---|---|
| | | | *P. pasthuma* | | *T. solium* | |
| | | | **P** | **D** | **P** | **D** |
| *G. gynandra* (stem) | 7.51 | 10 | 15 ± 0.1 | >90 | 45 ± 0.5 | 70 ± 0.2 |
| | | 20 | 12 ± 0.5 | 50 ± 0.5 | 36 ± 0.4 | 60 ± 0.1 |
| | | 50 | 7 ± 0.3 | 10 ± 0.8 | 18 ± 0.5 | 55 ± 0.3 |
| | | 80 | 4 ± 0.5 | 8 ± 0.2 | 8 ± 0.2 | 30 ± 0.3 |
| | | 100 | 2 ± 0.4 | 5 ± 0.3 | 5 ± 0.1 | 11 ± 0.2 |
| *B. coriaceae* (stem) | 5.69 | 10 | 40 ± 0.9 | >90 | 52 ± 0.3 | 78 + 0.5 |
| | | 20 | 30 ± 0.5 | >90 | 41 ± 0.6 | 65 ± 0.7 |
| | | 50 | 10 ± 0.3 | >90 | 22 ± 0.5 | 60 ± 0.2 |
| | | 80 | 5 ± 0.8 | 10 ± 0.2 | 10 ± 0.2 | 35 ± 0.5 |
| | | 100 | 2 ± 0.2 | 5 ± 0.2 | 6 ± 0.3 | 13 ± 0.4 |
| Piperazine citrate | | 10 | 20 ± 0.3 | 60 ± 0.5 | 1.5 ± 0.05 | 40 ± 0.05 |

[a] Extracts/reference drug were dissolved with distilled water.
[b] All values were significant ($P < 0.05$). In the control (distilled water treated), *P. pasthuma* lived for 48 hr, and *T. solium* lived for 24 hr.

against *F. gigantica* were also worthy of note. The leaf methanol extracts exhibited appreciable anthelmintic properties with *F. gigantica*. Worms were paralysed or died after a time of 3–6 min, at 100 mg/ml, and piperazine citrate did same in 1–3 min. Control worms (in distilled water) lived for periods of 5–48 hr (Table 1).

As shown in Table 2, *B. coriaceae* stem methanol extract showed the highest activity against the earthworms. P = 2 min and D = 5 min when both parameters for the reference drugs were 20 and 60 min, respectively. Tape worms were most sensitive *to G. gynandra* stem extract with P and D values as shown in Table 2.

Generally, the earthworms were most sensitive to the extracts, especially when compared to the reference drug, piperazine citrate (10 mg/ml). At 100 mg/ml, P for the earthworms varied between 2–5 min and D ranged between 5–8 min. With *T. solium* (tapeworms) and at 100 mg/ml, the extracts were more effective in causing death of the worms rather than paralysis. Times for paralysis / death were 6/13 min for *B. coriaceae* stem extract; *G. gynandropsis* stem extract, 5/11 min; and for reference compound, P/D was 1.5/40 min.

The function of most worm expellers like piperazine citrate is to cause paralysis of worms such that they are expelled in the feaces of man and animals. The extracts not only demonstrated this property, they also caused death of the worms, especially at 100 mg/ml. In conclusion, the folkoric uses of these plants in traditional settings in Africa (i.e., as having anthelmintic properties) (Dalziel, 1937; Bouquet & Debray, 1974; Walker, 1974; Burkhill, 1985) have been confirmed, as extracts displayed anthelmintic properties against the different worms used in the study. We are working on isolation of anthelmintic compounds from these extracts and this will be reported at a later date.

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