

Full Length Research Paper

Phytochemical constituents and antioxidant properties of extracts from the leaves of *Chromolaena odorata*

Afolabi C. Akinmoladun^{1*}, E.O. Ibukun¹ and I.A. Dan-Ologe²

¹Biochemistry Department, Federal University of Technology, Akure, Nigeria.

²Department of Fisheries, College of Environmental Sciences, University of Agriculture, Abeokuta, Nigeria.

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Aqueous and methanolic extracts of *Chromolaena odorata* were screened for phytochemical constituents. The evaluation of the antioxidant potential of the methanolic extract was also carried out. Tests for tannins, steroids, terpenoids, flavonoids and cardiac glycosides were positive in both methanolic and aqueous extracts. Alkaloids were detected only in the methanolic extract. The total phenolic content, reducing power and percent DPPH scavenging effect were 0.01 ± 0.00 mg/g GAE, 0.22 ± 0.01 and $28.85 \pm 0.99\%$, respectively. Against the backdrop of many known medicinal properties of this plant, results from the present work suggest that relatively low values of antioxidant indices may not imply a low medicinal value.

Key words: *Chromolaena odorata*, phytochemicals, antioxidant activity, reductive potential, medicinal plants

INTRODUCTION

Chromolaena odorata (L) King and Robinson Asteraceae commonly known as Siam weed, is a fast-growing perennial and invasive weed native to South and Central America. It has been introduced into the tropical regions of Asia, Africa and other parts of the world. It is an aggressive competitor that occupies different types of lands where it forms dense strands that prevents the establishment of other flora. It is a menace in plantations and other ecosystems. It suppresses young plantations, agricultural crops and smothers vegetation as it possesses allelopathic potentialities and growth inhibitors (Ambika and Jayachandra, 1980; Ambika and Jayachandra, 1982; Muniappan and Marutani, 1988). The economic value of *C. odorata* is low. Consequently, there is a relative paucity of research works on it. It is a perennial shrub native of South and Central America. In recent decades, it has become a serious pest in the humid tropics of South East Asia, Africa and Pacific Islands. It spreads rapidly in lands used for forestry, pasture and plantation crops such as rubber, coffee, coconut, cocoa and cashew. The plant can be poisonous to livestock as it has exceptionally high level of nitrate (5 to 6 times above the toxic level) in the

leaves and young shoots; the cattle feeding on these die of tissue anoxia (Sajise et al., 1974).

Despite the negative sides to the plant, it still has patronage from practitioners of traditional medicine. It has been reported to have antispasmodic, antiprotozoal, anti-trypanosomal, antibacterial and antihypertensive activities. It has also been reported to possess anti-inflammatory, astringent, diuretic and hepatotropic activities (Watt and Brandwijk, 1962; Feng et al, 1964; Weniger and Robinean, 1988; Iwu, 1993). In the southern part of Nigeria, the leaves are used for wound dressing, skin infection and to stop bleeding. Some specific phenolic compounds have been isolated from the plant (Metwally and Ekejuba, 1981).

The medicinal values of plants lie in their component phytochemicals such as alkaloids, tannins, flavonoids and other phenolic compounds, which produce a definite physiological action on the human body (Hill, 1952). A systematic search for useful bioactivities from medicinal plants is now considered to be a rational approach in nutraceutical and drug research. Therefore, the present work has been designed to evaluate the antioxidant potential of *C. odorata* with a view to contributing to the search for beneficial uses of this invasive plant which is a menace to farmers.

*Corresponding author. E-mail: akinmoladunfc@gmail.com.

Table 1. Phytochemicals detected in extracts of *Chromolaena odorata*.

Phytochemicals	Methanolic extracts	Aqueous extracts
Alkaloids	+	-
Saponins	-	+
Tannins	+	+
Phlobatannins	+	+
Anthraquinones	-	+
Steroids	+	+
Terpenoids	+	+
Flavonoids	+	+
Cardiac glycosides		
With steroidal ring	+	+
With deoxy – sugar	+	+

+ = Present

- = Absent

MATERIALS AND METHODS

Chemicals

DPPH (2, 2-diphenyl-1-picrylhydrazyl) radical, gallic acid, ascorbic acid and Folin-Ciocalteu reagent were obtained from Sigma-Aldrich, USA. All other chemicals and reagents used were of analytical grade.

Plant materials

Leaves of *C. odorata* were collected from a farmland in Akure, South-Western Nigeria and identified at the Department of Crop, Soil and Pest Management, Federal University of Technology, Akure. They were air dried, packed in paper bags and stored. The dried leaves were pulverized and 196 g of the pulverized sample was extracted with 500 ml of 80% methanol by maceration for 72 h. The methanolic extract was concentrated in a rotary evaporator, lyophilized and thereafter preserved for further use. An aqueous extract was also prepared from the pulverized sample for the purpose of comparison of the phytochemical constituents with that of the methanolic extract.

Phytochemical screening

Chemical tests were carried out on the aqueous and methanolic extracts for the qualitative determination of phytochemical constituents as described by Harborne (1973), Trease and Evans (1989) and Sofowora (1993). Total phenolic content was determined using Folin-Ciocalteu reagent as previously described (McDonald et al., 2001). Total phenol value was expressed as mg/g gallic acid equivalent.

DPPH radical scavenging activity

The ability of the extract to scavenge DPPH radical was determined according to the method described by Mensor et al. (2001). One ml of a 0.3 mM DPPH methanol solution was added to a solution of the extract or standard (250 µg/ml, 2.5 ml) and allowed to react at room temperature for 30 min. The absorbance of the resulting mixture was measured at 518 nm and converted to percentage antioxidant activity (AA %). Methanol (1.0 ml) plus extract solution (2.5 ml) was

used as a blank. 1 ml of 0.3 mM DPPH plus methanol (2.5 ml) was used as a negative control. Solution of gallic acid served as positive control.

Reductive potential

This was determined according to the method of Oyaizu (1986). The extract or standard (100 µg/ml) was mixed with phosphate buffer and potassium ferricyanide. The mixture was incubated at 50°C for 20 min. Trichloroacetic acid (10%, 2.5 ml) was added to the mixture. A portion of the resulting mixture was mixed with FeCl₃ (0.1%, 0.5 ml) and the absorbance was measured at 700 nm in a spectrophotometer. Higher absorbance of the reaction mixture indicates higher reductive potential.

Statistical analysis

Data were expressed as mean ± SEM. A one-way analysis of variance was used to analyze data. P<0.5 represented significant difference between means (Duncan's multiple range test).

RESULTS AND DISCUSSION

Table 1 shows the phytochemicals detected in *C. odorata* leaf extract. Tests for tannins, steroids, terpenoids, flavonoids and cardiac glycosides were positive in both methanolic and aqueous extracts. Alkaloids were detected only in the methanolic extract. Phenolics, alkaloids, terpenoids and cardiac glycosides detected in the extracts are compounds that have been documented to possess medicinal properties and health-promoting effects (Salah et al., 1995; Del-Rio et al., 1997; Okwu, 2004; Liu, 2004). The total phenolic content in the methanolic extract was 0.01 ± 0.00 mg/gGAE; a rather low value. Phenolics are the largest group of phytochemicals and have been said to account for most of the antioxidant activity of plant extracts (Thabrew et al., 1998).

The result of the DPPH scavenging assay is shown in Figure 1. The percentage antioxidant activity of *C. odora-*

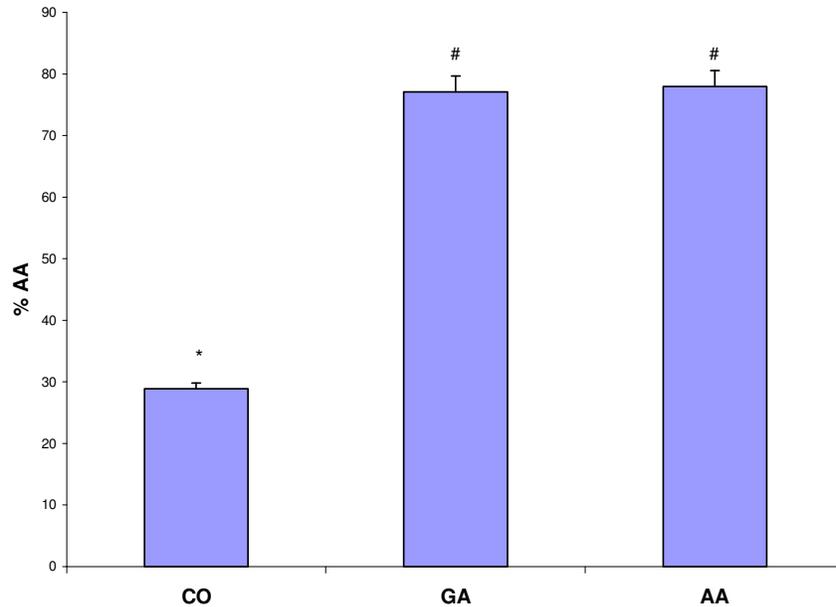


Figure 1. Antioxidant activity of CO compared with some standards. CO, *Chromolaena odorata*; GA, gallic acid; and AA, ascorbic acid. #Not significantly different, $P > 0.05$ and *Significantly different, $P < 0.001$.

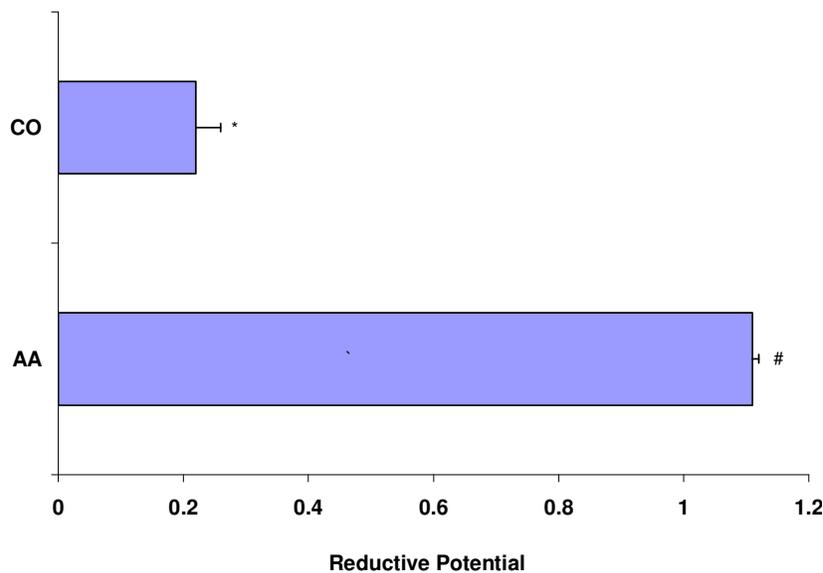


Figure 2. Reductive potential of *Chromolaena odorata*. AA, Ascorbic acid; and CO, *Chromolaena odorata*. *# Significantly different ($P < 0.001$).

ta is about a third of the value for gallic acid and ascorbic acid while the reductive potential is about a fifth of the value for ascorbic acid. These values are appreciable enough for a plant that has been tagged as an obnoxious weed.

The relatively low values for the percentage antioxidant activity (Figure 1) and the reductive potential (Figure 2) are in harmony with the finding that a strong positive

association exists between total phenolic content and DPPH scavenging effect and also between total phenolic content and reductive potential (Miliauskas et al., 2004). Low values in some antioxidant assays do not imply low value in all other assays since many antioxidant assays show no correlation (Schaich, 2006). Result of a particular antioxidant assay depends on the chemistry of the assay and the nature and combination of bioactive princi-

ples in the material under investigation.

Emerging trends in antioxidant research point to the fact that low levels of phenolics (and other phytochemicals) and low values of antioxidant indices in plants do not translate to poor medicinal properties. Mineral elements, other secondary plant metabolites not detected or evaluated and vitamins contribute to the synergy of phytochemicals that confer medicinal properties on plants. The present investigation indicates that though *C. odorata* has been described as a plant of low economic value, it is not worthless. Its use in traditional medicine attests to this. There are prospects for its commercial utilization especially in view of its abundant and widespread nature. The toxic compounds in the plant could be removed through appropriate extraction and processing methods making extracts and products from the plant safe for the utilization of animal and man. Control of this invasive and notorious weed has been unsuccessful. Finding ways of profitably utilizing it may be the best option left. Further work is in progress in our laboratory along these lines.

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