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Physicochemical and Phytochemical Composition of locust bean tree emperor moth larvae (*Bunaea alcinoe)* from Gurara Local Government Area, Niger state, Nigeria

*Mathew T. J[1]., Ndamitso M. M[1]., Shaba E.Y[1]., Mustapha S[1].,
Muhammed S.S[2]. and Salihu A. S[3].
[1]*Department of Chemistry Federal University of Technology, P.M.B 65 Minna, Niger state, Nigeria.*
[2]*Department of Biochemistry University of Technology, P.M.B 65 Minna, Niger state, Nigeria.*
[3]*Science Laboratory Technology, Federal Polytechnic Bida Niger state, Nigeria*

SUMMARY: *The physicochemical parameters of the insect determined are; acid value (4.01±0.11), free fatty acids (2.02±0.06), peroxide value (8.81±1.05) mEqvO_2/kg, Saponification content (145.04±0.79) mg/KOH/g and iodine value (102.38±0.93) mg/100g as well as specific gravity and refractive index, however these values fell within the nutritionally accepted values. The anti-nutritional contents of Bunaea alcinoe were determined using various standard methods. The results show that this insect has low cyanide (1.68±0.20), phytate (18.21±2.14) and oxalate content (15.47±1.88) mg/100g. The phytochemical screening obtained in this work revealed the presence of alkaloids, flavonoids, cardiac glycosides, tannins, saponins, reducing sugars, sterols and terpenoids in the aqueous crude extracts while anthraquinones was in active in three extracts.. Thus the oil obtained from this insect is expected to be suitable for the manufacture of soaps, lubricating oil, candles thereby making them attractive options for commercial purpose and also in pharmaceutical industries.*

KEYSWORDS: *Phytochemical constituent, Bunaea alcinoe, Anti-nutritional and Physicochemical properties*

I. INTRODUCTION

Insects have also played an important part in the history of human nutrition in Africa, Asia and Latin America. They are the most successful group of animals constituting about 76% of known species [1]. They affect man either as destroyers of man's valuable materials and crops or as sources of his nutrients. Globally, the use of insects as an alternative source of animal protein has been appreciated, especially for the rural populace; where meat from either domesticated or wild animals is very scarce or expensive [2].

Bunaea alcinoe or locust bean tree emperor moth larvae are the larvae of the African moth species belonging to the family *Saturniidae* and order Lepidoptera. They are known by various names like*Katakpani* in Nupe, *Manimani* in Hausa, *Ikanni* in Yoruba and *Aruru* in Igbo. The larval stage of *Bunaea alcinoe* is about 70mm in length and 15mm in diameter. It has deep velvety black colour with eight yellow tubercular processes and red spiracles [3]. The study is aim to determined the phytochemical constituent, anti-nutritional and physicochemical properties of the *Bunaea alcinoe*.

II. MATERIALS AND METHODS

2.1 Sample collection

The locust bean tree emperor moth larvae (*Bunaea alcinoe*) were handpicked from locust beans trees from different farm land between the months of July and August, 2012 around Diko in Gurara Local Government Area in Niger state, Nigeria. They were washed with distilled water, sun-dried for about 48 hours and ground into powder and stored in air-tight containers for further analysis.

III. METHODS

3.1 Physicochemical properties

Physicochemical parameters were determined using the standard method of Official Analytical Chemists [4].

3.2 Anti-nutritional properties

Oxalate and cyanide contents were determined using the method of Day and Underwood [5]. Phytate content was determined by the method described by Wheeler and Ferrel [6].

3.3 Phytochemical constituents

Phytochemical screening was carried out according to method as described by Sofowara [7].

IV. RSULTS AND DISCUSSION

4.1 Table 1. Physicochemical parameters of the oil Extracted from Bunaea alcinoe

Parameters	Values
Acid value	4.01±0.11
Free fatty acids(as oleic)	2.02±0.06
Iodine value (mg/100g)	102.38±0.93
Saponification value(mgKOH/g)	145.04±0.79
Peroxide value (m Eqv O_2/kg)	8.81±1.05
Specific gravity	0.83±0.03
Refractive index	2.03±0.07
Colour	brown

Values are means ±SD of three determinations

4.2 Table 2. Anti-nutrient properties of *Bunaea alcinoe*

Parameters	Values
Cyanide (mg/100g)	1.68±0.20
Phytate (mg/100g)	18.21±2.14
Oxalate (mg/100g)	15.47±1.88
values are means ±SD of three determinations	

4.3 Table3 Phytochemical Costituents of *Bunaea alcinoe*

Class of Compounds			**sample**	
	Colour	**BA_C**	**BA_P**	**BA_M**
Saponnins	pale brown	–	–	+
Flavonoids	dark yellow	–	–	+
Sterols	Green	+++	+++	+
Anthraquinones	violet or red	–	–	–
Terpenoids	pink to purple	+++	++	+
Tannins	blue, black or purple	++	+++	+
Cardiac glycosides	violet ring	+++	+++	+++
Alkaloids	turbidity or precipitate	+++	++	+
Wagners		+	+++	++
Marquis		+	+	+++
Mayers	Creamy	–	+	++
Molisch		–	–	–

Note: BA_C = *Bunaea alcinoe* chloroform extract, BA_P= *Bunaea alcinoe* petroleum extract, BA_M= *Bunaea alcinoe* methanol extract, +++ = Strongly active, ++ = Moderately active, + = Weakly active and - = Inactive.

Table 1 presents the physico-chemical properties of the oils extracted from *B. alcinoe.* The oil extracted was brown. The peroxide value of oil is a sign of its rancidity, thus a high peroxide value of oil indicates a poor resistance of the oil to peroxidation during storage [8]. Higher peroxide value between 20 and 40 results in a rancid taste while the low peroxide value further confirms the stability of the oil [9]. The peroxide value of 8.81±1.05mEqO_2/kg was recorded for *B. alcinoe*. This value obtained in this work was lower than the

20.00±080 meqO_2/mg reported for *M. bellicosus* by Agomuo [10]. It was however higher than the 6.90±0.57meqO_2/kg reported for skin of *R.palmarum L.* larva by Edmond *et al*. [11]. The peroxide value obtained from this work indicated that, this oil will take long time before they deteriorate. The low iodine values of the oils indicated that they have low contents of unsaturated fatty acids. This showed that these oils will not be more susceptible to oxidation deterioration thus they will be easily stored for a long time without spoilage [12]. Thus this oil are expected to be suitable for the manufacture of soaps, lubricating oil, candles thereby making them attractive options for commercial purpose and minimizing the dependence on use of know edible oils for making such products [13]. The iodine value of *B. alcinoe* oil was 102.38±0.93. This was lower than the 108.00±0.15 reported for *M. bellicosus* oil and 112-159 gI_2/100g reported for *lepidopterous larva* by Ekpo and Onigbinde [14] and also lower than the 140 gI_2/100g reported for *O. rhinoceros larva* oil by Ekpo [15]. This value was however, higher than the 48.35±0.55gI_2/100g reported for *R. palmarum L.* larva by Edmond *et al*. [11]. This implied that, the oils obtained from this work could be used in the production of lubricating oils, candles and soaps which will reduce the dependence on the known edible oils for making such products. Saponification value is used in checking adulteration. The high saponification value of the sample was 145.04±0.79mgKOH/g (*B. alcinoe)* suggested that the oils could be quite suitable for cosmetic production [16]. This value was similar to the 189.22±0.92 mgKOH/g and 198.26±0.99mgKOH/g reported for the skin and DFC from *R. palmarum L. larva* oils by Edmond *et al.* [11]. The saponification value obtained in this study was lower than the 218.70±0.80) mgKOH/g reported for *M. bellicosus* by Agomuo, [10]. Free fatty acids are more susceptible to lipid oxidation, leading to rancidity and production of off-odour compared to intact fatty acids in the triglycerides [17]. The free fatty acid value of *B. alcinoe* was 2.02±0.06 mgKOH/g and a similar value of 2.25mg/KOH/g was reported for *C. albidum* by Adebayo *et al*. [18]. However, this value was lower than the 7.76±0.14 % reported for skin of *R. palmarum L* larva by Edmond *et al*. [11]. The acid value of oil is a direct measure of the percentage content of free fatty acids in a given amount of the oil. It is a measure of the extent to which the triglycerides in the oil is decomposed by lipase action into free fatty acids. This value depends on the degree of rancidity which is used as an index of freshness [13]. The acid value of *B. alcinoe* oil was 4.01±0.11 mgKOH/g. This value was higher than the 2.21±0.02 mgKOH/g reported for DFC but similar to the 4.72±0.06 mgKOH/g reported for the skin of *R. palmarum L.* larva by Edmond *et al*. [11]. The low acid value obtained in this study gave an indication of their lower susceptibility to rancidity which depicted a higher shelf life. The refractive index of oil indicates the level of optical clarity of the oil sample relative to water. The refractive index of 2.0300±0.07 was recorded for *B. alcinoe*. This value was higher than the 1.4672 reported for *C. albidunm* by Adebayo *et al.* [18]. This implies that the oils obtained from this insect are lighter and could be considered to be of high quality and as such find much use in the pharmaceutical industries. The specific gravity of 0.83±0.03 was obtained for *B. alcinoe*. Similar value was obtained for *C. albidun* (0.89) by Adebayo *et al*. [18]. The oils obtained from these insects were more unsaturated than the seed oil which suggested that they might be more fluidic at room temperature and less viscous at low temperatures.

Table 3 shows the phytochemical constituent of *B. alcinoe.* Saponins bind cholesterol, block its uptake by the intestines thus facilitating its excretion as well as the coagulation of the red blood cells [19]. Saponins also have the ability to kill or inhibit cancer cells [20] [21]. This chemical was found in the methanolic extract of this insect but not in the chloroform and petroleum ether extracts and this disparity may be due to the polarities of the solvents. Thus the presence of saponins in this insect could be explore for it possible application in medicine for the stoppage of bleeding, treat wounds and reduce the risk of heart diseases [22]. Tannins have biological activities that may favour the prevention and management of minor illness [23]. Tannins was found in the solvents employed in this study for the it insect. *B. alcinoe* had much of it in petroleum ether extract while methanolic extract had the least. The tannin content of this insect could be used to exhibit antiviral, antibacterial and antitumor activities as well as diuretics [24]. While none of the extracts in this study had anthraquinones, only the methananolic extract of *B. alcinoe* contained flavonoids. In general, flavonoids have antioxidant potentials that enhance the body defence against pathogen induced free radical generation [25]. The absence of flavonoids in both the chloroform and petroleum ether extracts in this work might be due to the disparity in polarities of the solvents. Flavonoid constituents obtained from these insects could protect blood vessels especially the tiny catapillaries that carry oxygen and nutrients to cells and are believed to slow down the development of cataracts in persons who have diabetes [26]. Steroidal compounds are of importance and interest in pharmacy due to their relationship with such compounds as sex hormones [27]. It was found in the

methanol, chloroform and petroleum ether crude extracts of this insect. Thus this insect was expected to be good sources of materials that could aid the sexual prowess of humans and other animals. Cardiac glycosides have been shown to aid in the treatment of congestive heart failure and cardiac arrhythmia. The crude extracts of this insect in this study contained cardiac glycosides. However, the glycoside content of *B. alcinoe* was strongly active in the three extracts. Terpenoids improve lung function [28]. These compounds were found in the petroleum ether, chloroform and methanol crude extracts of *B. alcinoe.* Alkaloids are used as basic therapeutic agents because of their analgesic, antispasmodic and bactericidal effects [22]. It also exhibits marked physiological activity when administered to animals. The Wagner's, Marqui's and Mayer's tests for alkaloids were positive for the crude extracts of *B. alcinoe* but was negative for Molisch's test.

The result of the level of anti-nutritional contents of the insect was as presented in Table 3. The cyanide content of *B. alcinoe* was 1.68±0.20 mg/100g. This value was lower than the 2.65 mg/100g reported for *H. meles* and 2.53mg/100g reported for *R. phoenicis* by Adesina [29]. The cyanide contents obtained in this work showed that their consumption could be safe as far as their cyanide contents were concerned. Phytic acid has been implicated in the removal of phosphorus, indigestion and flatulence in human system [30]. Phytates also limit the availability of some notable minerals like zinc, magnesium, iron and calcium by forming complexes that are indigestible, thereby decreasing their bioavailability [31][32]. The Phytate content of 18.21±2.14 mg/100g was recorded for *B. alcinoe*. This value was lower than the 178mg/100g reported for larva of *O. monoceros* by Ifie and Emeruwa[33]. However, this value was higher than the 0.311mg/100g reported for *H. meles* and 0.276mg/100g reported for *R. phoenicis* by Adesina [29]. Based on the phytate value obtained from this work this insect could be consumed without much fear of harm to humans and his animals in respect of phytic acid toxicity. Oxalate is known to isolate and cause some useful metallic elements, to be deposited in solid forms, thus making them unavailable for adsorption in human system [34]. Oxalate can bind to calcium present in the food thereby rendering calcium unavailable for normal physiological and biochemical role such as the maintenance of strong bone, teeth, nerve impulse transmission and cofactors in enzymatic reactions as well as clotting factors in the blood [35]. The lethal dose of oxalates is between 200 and 500mg/100g [36]. The value of oxalate contents of 15.47±1.88mg/100g was recorded for *B. alcinoe*. This value was lower than the 29.00mg/100g reported for yam beetle and 19.32mg/100g reported for palm weevil by Adesina [29]. However, this value was higher than the 2.1mg/100g reported for larva of *O. monoceros* by Ifie and Emeruwa [33]. The oxalate contents obtained from this work suggested that, they could be safe for consumption as far as their oxalate contents were concerned since they all fell below the lethal dose limit.

V. CONCLUSION

This result suggest that the oil obtained from this insect could be exploited in industry places like the production of paints, emulsions, plastics, soap making, drying agents, lubricants and as additives in pharmaceutical as well as drug productions. Anti-nutrition properties obtained from this study shows that this insect has no any effects pose to man and his animal. The presence of secondary metabolites in the sample indicates that this insect could be useful in the treatment of diseases cause by some microorganisms.

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