



Original Article

**Proximate Composition and Phytochemical Constituents Of
Aspilia africana (Pers) C. D. Adams and *Tithonia diversifolia*
(Hemsl) A. Gray Stems (Asteraceae)**

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ABSTRACT

Proximate composition and phytochemical constituents of stems of *A. africana* and *T. diversifolia* (Asteraceae) were investigated. The stems of these species contain anti-oxidant, anticancer, anti-tumor, anti-viral, anti-inflammatory and anti-allergic properties which cures malaria, skin diseases, athlete's foot, asthma, gonorrhoea and to stop bleeding. The stems of these two species revealed the presence of flavonoids, tannins, saponins and cardiac glycosides. The proximate analysis of the stems of *A. africana* and *T. diversifolia* showed the moisture content of 15.7% and 20.6%, total ash of 6.10% and 6.55%, acid insoluble ash of 0.55% and 0.33%, sulphated ash of 18.8% and 14.0%, protein content of 7.87% and 9.62%, fat of 3.68% and 4.21%, fibre of 12.30% and 15.82%, carbohydrate of 75.97% and 70.35%, volatile ether soluble of 7.33% and 1.66%, water soluble of 3.33% and 0.33% and diluted alcohol soluble of 5.33% and 5.66%. The results of this study suggest the popular use of *A. africana* and *T. diversifolia* in herbal medicine.

Keywords: *Aspilia africana*, *Tithonia diversifolia*, phytochemical, stem, Asteraceae.

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INTRODUCTION

Today, according to the world health organization (WHO) as many as 80% of the world's people depend on traditional medicine for their primary health care needs [18]. High plants are sources of drugs, which have made important contribution to the welfare and quality of life urban as well as rural communities especially in tropics and sub-tropics [30]. Medicinal plants are now being given serious attention, as in evidence by the recommendation given by the world health organization in 1990 [31] that proven traditional remedies should be incorporated within national drug policies, by recent moves towards a greater professionalism within African medicine [7] and also by the increased commercialization of pharmaceutical production. During the early years of human existence, many plants materials by instinct, intuition of trial and error were used to combat different aliment [21]. *Aspilia africana* (Pers) C. D. Adams and *Tithonia diversifolia* (Hemsl) A. Gray belongs to the family Asteraceae, the longest angiosperm family comprising of 1,528 genera and 22,750 species worldwide [19]. *Aspilia africana* is a common weed of field crops in West Africa, found in follow land, especially in the forest zone [1]. It is also spread in Nigeria and other countries. *Tithonia diversifolia* is a native to eastern Mexico and central America but has a nearly pantropical distribution as an introduced species [12] depending on the area they may be.

Aspilia africana is the most notable being used to stop bleeding and fast healing of wounds. In Southern China, *T. diversifolia* are used to treat skin diseases such as athlete's foot, night sweats, while *A. africana* is used in herbal medicine to treat various infections of bacterial origin such as gonorrhoea, stomach trouble and corneal opacity and also widely used as haemostatic agent [2].

Tithonia diversifolia are sold in herbal medicine markets in Taiwan to be infused to improve liver function and used to treat sprains, bone fractures, bruises and contusions [12]. The fresh leaves of *A. africana* are used on cuts, wound and sores, a decoction has been recommended for the use in

treating pulmonary hemorrhages and haemostasis is thought to be due to vasoconstriction. The root decoction of *A. africana* is taken for tuberculosis in Tangayika [2]. In Ghana, the leaves are made into cough medicine for children and a leaf decoction is taken for the treatment of gonorrhoea in Uganda [28]. The leaf infusion of *A. africana* is used in treating cough and related ailments in children. Traditional midwives administer the leaf and stem extract of *A. africana* as enema to pregnant women to quicken and ease delivery [9]. In Nigeria, the decoctions of the various parts of *T. diversifolia* are used for the treatment of malaria, diabetes mellitus, sore throat, fever and menstrual pains. An oral decoction of the leaves and stem is used for the treatment of hepatitis in Taiwan and gastro-intestinal disorders in Kenya and Thailand [16].

A comparative phytochemical analysis of the leaves of *A. africana* reveal the presence of alkaloids, saponins, tannins, flavonoids, resins, sterols, terpenoids and carbohydrate [20].

The leaf extract has also been shown to cause extracellular Ca^{2+} dependent increase in vascular tone which is a measure of vaso-constriction is suggestive of the possibility of the leaf extracts arresting bleeding from fresh wounds through this mechanism [8]. The effects of aqueous extract of *A. africana* in reproductive function of female Wistar rats have been reported. Result shows that aqueous extract of *A. africana* has anti-fertility effect by altering oestrous cycle and causing a dose dependent adverse effect on ovulation in wester strain rats [27].

Studies have been carried out on the effects of oral administration of extract of *A. africana* used in ethnomedical practice in Africa for the management of various ailments, on the ovarian tissues of matured female Wistar rats [11]. *Tithonia diversifolia* has been reported to exhibit analgesic and anti-inflammatory properties [26]. The aims of this work is to establish some diagnostic parameters of the crude drug (stems). It also aims at establishing the chemical constituents of the stems which would eventually be useful in preparing a monograph on the plant for its identification. The objectives therefore include: to identify the different bioactive agents presents in the stems of *A. africana* and *T. diversifolia*, to contribute useful information to the proper and easy identification of *A. africana* and *T. diversifolia*, thus providing a useful tool for collection and preservation of these species and the significance of this study is to justify and ascertain that *A. africana* and *T. diversifolia* have various therapeutic uses for the synthesis of drugs and medicinal plants.

MATERIALS AND METHODS

Materials

The stems of *Aspilia africana* (Pers) C. D. Adams and *Tithonia diversifolia* (Hensl) A. Gray were collected from a bush in Ifa Atai in Uyo Local government Area of Akwa Ibom State.

Extraction of Plant Materials

The petals of *A. africana* and *T. diversifolia* (Asteraceae) were separated from the flowers. The fresh petals were air dried and reduced to powder with the aid of a mortar and pestle. The powdered petals were accurately weighed and then macerated cold in 50% ethanol and distilled water for 72 hours (3 days) at room temperature following the method suggested by Sofowora [30]. The liquid extracts were recovered by filtration using cotton wool and glass funnel. The filtrate obtained was concentrated in a vacuo at 40°C to yield a semi-solid mass. The extract obtained was accurately weighed and then used for phytochemical screening.

Phytochemical Screening

Cold extraction was carried out on the materials, which was later concentrated to dryness in vacuo at 40°C. The dry extract was subjected to phytochemical screening according to the methods of Sofowora [30, 33].

Quantitative Microscopy/Proximate Analysis

The moisture content of the powdered leaves was determined by loss on drying method [3]. The ash value, acid insoluble ash, water-soluble ash and sulphated ash were determined as described [3, 6]. The water and alcohol extractive values were obtained using the method outlined [5, 6]. The fat (lipids), crude fibre, crude protein and carbohydrate were obtained using the method outlined [4, 22, 29].

Preparation of the Extract

After collection and identification of the two plant stems, the stems were then separated from the leaves and flower, sun dried and then powdered. The powdered material were weighed accurately and 20g each were macerated cold in 400ml of 70% ethanol for 72 hours (3 days) in a maceration tank at room temperature following Sofowora [31] method. The plant materials were then filtered

and the filtrate obtained was concentrated in water bath at 40°C which yield a semi-solid extract that is then used for the phytochemical screening. The extract was used to carried out phytochemical screening using a suitable methods [31, 32].

RESULTS

Phytochemical Screening

Results for the phytochemical screening metabolities in the stems of *A. africana* and *T. diversifolia* are summarized in Table 1

Compound	Test	Observation	<i>A. africana</i>	<i>T. diversifolia</i>
Alkaloids	Dragendorff	No colour solution was observed	-	-
Saponins	Frothing test	Frothing persisted for more than 10minutes	+++	++
Tannins	Ferric chloride test	Blue green colour with precipitate	+++	++
Flavonoids	Shinoda reaction	Orange-red colouration was observed	++	+
Anthraquinones		Colourless solution was observed	-	-
Cardiac glycosides	a) Salkowski's test	Reddish brown colour at interphase	+++	++
	b) Keller killian	A brown ring at interphase	+++	-
	c) Lieberman's test	Pink colour at interphase	++	-

Keys

- + Present
- ++ Moderately present
- +++ Abundantly present
- Absent

Proximate Analysis

The result for the proximate analysis of the stems of *A. africana* and *T. diversifolia* in percentage are summarized in Table 2.

Parameters	<i>A. africana</i> (%)	<i>T. diversifolia</i> (%)
Moisture	15.7	20.6
Total ash	6.10	6.55
Acid insoluble ash	0.55	0.33
Sulphated ash	18.8	14.0

Nutritional Analysis

The result for the nutritional analysis of the stems of *A. africana* and *T. diversifolia* in percentage are summarized in Table 3.

Parameters	<i>A. africana</i> (%)	<i>T. diversifolia</i> (%)
Protein	7.87	9.62
Fat	3.86	4.21
Fibre	12.30	15.82
Carbohydrate	75.97	70.35

Extractives

The result for the extractives in the stems of *A. africana* and *T. diversifolia* in percentage are summarized in Table 4.

Parameters	<i>A. africana</i> (%)	<i>T. diversifolia</i> (%)
Volatile ether soluble	5.33	4.66
Non-volatile ether soluble	7.33	1.66
Water soluble	3.33	0.33
Diluted alcohol soluble	5.33	5.66

DISCUSSION

The phytochemical screening carried out with *Aspilia africana* (stem) revealed the presence of saponins, tannins, flavonoid and cardiac glycoside (Salkowski's test, Keller-killiani and Lieberman's test) and this was in agreement with Ibrahim, Ajaegbu and Eghareuba [14]. Alkaloids and Anthraquinones were not detected. In *T. diversifolia*, (stem) saponins, tannins, flavonoid and cardiac glycoside (Salkowski's test) were present while Alkaloids, anthraquinones and cardiac glycoside (Keller-killiani and Lieberman's test) were not detected. The presence of some of these secondary metabolites suggests that the plant might be of medicinal importance and supports the bases for some of the ethno-uses. The presence of flavonoids suggests that the plant might have anti-oxidant, anti allergic, anti-inflammatory, anti-microbial, anti-cancer activity [17, 33].

The presence of tannins in both species shows that the plant is astringent as documented and suggests that it might have anti-viral and anti-bacterial activities and can aid in wound healing and burns. [13] saponins and glycoside are also very important as some are cardio-active and used in treatment of heart conditions [24,33]. Some researchers have also reported that some saponins have anti-cancer and immune-modulatory properties [17, 33]. This presence of this compound in both species confirms their usefulness to traditional practitioners for treatment of heart disease and asthma.

The proximate analysis of the stems showed the moisture content of 15.7% in *A. africana* and 20.6% in *T. diversifolia* (Table 2). The high moisture level implies that the crude drugs cannot be stored for longer period. Since the normal range was 14% by African pharmacopoeia [3] and 20% by Ibrahim, Ajaegbu and Egbareuba [14] that means that *A. africana* with 15.7% which is normal implies that the plant can be stored for a longer period with lower chances of microbial attack and growth [25].

Total ash value was 6.10% in *A. africana* and 6.55% in *T. diversifolia* since the accepted range was 22% (British Pharmacopoeia, 1980) which implies that the plant has low inorganic component. This values were in agreement with Ibrahim, Ajaegbu and Eghareuba [14]. Acid insoluble ash value for *A. africana* was 0.55% and *T. diversifolia* was 0.33%. This implies that a large portion of the ash content is acid soluble and hence may be physiologically important as salts in the body when consumed. It also indicative of high digestibility of the plant when eaten [14]. Sulphated ash value in *A. africana* was 18.8% which was higher than that of *T. diversifolia* been 14.08% (Table 2).

The nutritional analysis of the stems showed the crude protein content of 7.87% and 9.62% in *T. diversifolia*. This corroborates the work of Javid *et al.* [15]. Fat content in *T. diversifolia* was 4.21% and 3.86% in *A. africana* [15]. The beneficial effects of the high content of unsaturated fatty acids in *T. diversifolia* can be exploited for nutritional advantage in health [26]. The fibre content in *T. diversifolia* was 15.82% is higher than that of *A. africana* which was 12.30%. This average are nutritionally significant because fibre helps to maintain gastro-intestinal tract health [3]. Carbohydrate content in *A. africana* was 75.99% and 70.35% in *T. diversifolia* which is comparable to findings of Javid *et al.* [15] (Table 3).

The volatile ether-soluble recorded in *A. africana* and *T. diversifolia* are 5.33% and 4.66% respectively and non-volatile ether soluble in *A. africana* was 7.33% which is higher than *T. diversifolia* been 1.66%. The volatile ether soluble was used in the industries for various purposes, both as a pharmaceutical and cosmetic raw material for production of emollients and demulcents as well as flavouring agents, in aromatherapy and perfumery [10] Water soluble extractive values of 3.33% in *A. africana* and 0.33% in *T. diversifolia* is lower than the alcohol soluble extractive values of 5.33% in *A. africana* and 5.66% in *T. diversifolia* which suggest that alcohol is a better solvent of extraction than water (Table 4).

CONCLUSION

The present study has verified the usefulness of *A. africana* and *T. diversifolia* stems for phytochemical, nutritional and medicinal purposes which explained the use of these species in herbal medicine. As rich source of bioactive compound coupled with the presence of the nutrients the stems of these two species studied can be seen as a potential source food, drugs, fodder and a good source of important nutrients for livestock. So the uses of these plants for the treatments of the disease as claimed by traditional healers can also be investigated.

RECOMMENDATIONS

It is recommended that *A. africana* and *T. diversifolia* stems should be further investigated for new drugs in order to isolate, characterize and elucidate the structure of the bioactive compounds for these plants for industrial drug formation.

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