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Research Article

Phytochemical Constituents, Total Flavonoid and Phenolic Content of *Xanthosoma sagittifolium* Stem Extracts

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Abstract

This study investigated the phytochemical constituents, total flavonoid and phenolic content of *Xanthosoma sagittifolium* stem extracts. The preliminary phytochemical evaluation showed the presence of glycosides (cardiac glycoside), steroids, flavonoids, tannins, phenols and terpenoids. Chloroform extract showed the presence of majority of phytoconstituents. Methanolic extract contained maximum percentage of phenolic and flavonoid content than aqueous and chloroform extract. Total phenol content in the stem extracts (methanol chloroform and aqueous extract) using the calibration curve was found to be 47.35, 16.35 and 11.8172 mg of Gallic acid equivalents/g dry weight of extract. Total flavonoid content in the stem extracts (methanol chloroform and aqueous extract) using the calibration curve was found to be 119.94, 6.35 and 25.60 mg of quercetin equivalents/g dry weight of the extract. To conclude, methanolic extract showed good amount of phenolic and flavonoid content and hence be explored further for pharmacological properties.

Keywords: Phytochemicals, *Xanthosoma sagittifolium,* phenols, flavonoids, gallic acid, quercetin.

Introduction

For thousands of years and in many parts of the world, medicinal plants have been utilized as traditional therapies for a variety of human ailments (Chitme *et al.,* 2003). They are still utilized as the principal source of medication in rural areas of underdeveloped countries. Traditional remedies are used by around 80% of individuals in various countries for their health care. Natural products generated from medicinal plants have shown to be a rich source of physiologically active molecules, with many of them being used to develop novel pharmaceutical lead chemicals (Kim, 2005). There are roughly 5 lakh plant species on the planet, only 1% of which have been studied phytochemically and there is a lot of room for new bioactive chemicals to be discovered in near future. Plants are endowed with various phytochemical molecules such as vitamins, terpenoids, phenolic acids, lignins, stilbenes, tannins, flavonoids, quinones, coumarins, alkaloids, amines, betalains, and other metabolites, which are rich in antioxidant activity. Studies have shown that many of these antioxidant compounds possess anti-inflammatory, anti-mutagenic, anti-atherosclerotic, anti-carcinogenic, antibacterial, and antiviral activities (Jayaprakash, 2017).

Xanthosoma sagittifolium L (*X. sagittifolium*) belongs to the family of Araceae, popularly regarded as a medicinal plant in the Southeast Asia region. In Bangladesh, it is widely distributed and known as Mukhi Kochu (Caxito *et al.,* 2015). *Xanthosoma sagittifolium* is a fast-growing perennial herb and new mature plants can be produced from a small portion of corm or stem. Root formation and rapid root growth take place immediately after planting, followed by rapid growth of the shoot, and after 14-20 weeks it is possible to have complete mature plants. Corms can remain viable underground and survive through unfavorable environmental conditions such as drought. Corms can also be stored for up to 18 weeks or more in dry conditions, but unplanted corms can sprout within a few weeks in hot, humid conditions (Langeland *et al.,* 2008; Manner, 2011). The plant is natural to the tropical America and cultivated in South America and tropical Central America since ancient times. It is also called tannia and new cocoyam in different parts of the world. In Manipur, it is popularly known as "Yendem Amubi" and it has been spread widely all over the tropical world. Now this plant is cultivated in the Caribbean, tropical America, West Africa and the Pacific and to a very limited extent in some other parts of the humid tropics.

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Fig. 1. *Xanthosoma sagittifolium* in its natural habitat.

In India, Xanthosoma is grown in the states of West Bengal, Orissa, Kerala, Andhra Pradesh, Tamil Nadu, Maharashtra and especially including Assam and Manipur. People of Manipur are using the stew and soup of the stem of Xanthosoma mainly by the women in post-natal care to prevent anaemia. Experimentally, *X. sagittifolium* is shown to possess antimicrobial, antioxidant, anti-diabetic and hypolipidaemic activity (Nishanthini *et al.,* 2012; Shajeela *et al.,* 2013). Keeping the above facts in view, this study was aimed to analyze the phytochemical constituents, total flavonoid and phenolic content of *Xanthosoma sagittifolium* stem extracts.

Materials and methods

Collection and authentication of plant material: *Xanthosoma sagittifolium* was collected from Thangmeiband areas of Imphal West, Manipur, India in the month of August to September 2017 (Fig. 1). The plant was authenticated by Dr. Biseshwori Thongam, Scientist, IBSD, Takyel Imphal under reference no. 1380/n-222 dated September 2017. The sample species were submitted to IBSD Takyel Herberium for future reference.

Extraction and fractionation of the plant material: The stems of *Xanthosoma sagittifolium* were washed with water, shade dried and finally ground by using a motorized grinder and deposited in a close-fitting container till extraction.

About 2 kg of the dried coarse powered material was treated with methanol for 72 h for extraction. The entire filtrate obtained was concentrated to dryness with the help of a rotatory evaporator at 40°C to get the methanol extract. The residue obtained of the concentrated methanolic extract was successively fractionated using chloroform, petroleum ether, and water and the extracts were dried and used for the experimental purposes.

Preliminary phytochemical screening: Preliminary phytochemical screening was carried out for the different stem extracts using the standard methods (Harbone, 1973). The screening was performed for alkaloids, saponins, tannins, cardiac glycoside, flavonoids, phenols, steroids, terpenoids, quinones, proteins, anthocyanins and betacyanins. The precipitate formation or the colour intensity was used as analytical responses to these tests.

Determination of total phenolic content: Total phenolic content in the stem extracts was determined using the Folin-Ciocalteu's method with gallic acid as standard. Briefly, 0.2 mL of Folin-Ciocalteu's reagent (1:1) and (500 µg) of the extracts was mixed separately with 0.5 mL of water for 5 min, followed by adding 1 mL of saturated Na_2CO_3 (8% w/v in water) and the volume was made up to 5 mL with distilled water. The samples were kept for 30 min in dark place and the absorbance of blue colour was measured at 765 nm against a blank. The samples were prepared in triplicate for each analysis and the mean value of absorbance was obtained. Different concentrations of gallic acid (0, 10, 20, 40, 80, 160 and 320 µg/mL) were prepared to obtain a calibration curve. The total phenolic content was expressed in milligrams of gallic acid equivalent per gram of extract.

Determination of total flavonoid content: The total flavonoid contents in the stem extracts were measured using aluminium chloride colorimetric assay (Ali *et al.*, 2018). To 500 µg of the extract, a volume of 0.5 mL of 2% $AlCl_3$ ethanol solution was added. After one hour at room temperature, the absorbance was measured at 420 nm using UV/visible spectrophotometer. A yellow colour indicated the presence of flavonoids. A calibration curve was constructed using quercetin (10–320 µg/mL) as standard. Total flavonoid contents were expressed as quercetin (mg/g) using the calibration curve.

Results and discussion

Extraction of Xanthosoma sagittifolium stem extracts: The stems were extracted with different organic solvents according to increasing polarities using chloroform, methanol and water. The successive extraction was carried

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out with the solvents of increasing polarities. The results are shown in Table 1.

Table 1. Extraction and yield of *Xanthosoma sagittifolium* stem extracts.

Plant part	Solvent	Weight of the extract
Stem coarse powder (2 kg)	Chloroform	18 grams
	Methanol	21 grams
	Aqueous	9 grams

Table 2. Preliminary phytochemical analysis of *Xanthosoma sagittifolium stem extracts.*

Extracts	Alkaloid	Saponins	Tannins	Cardiac glycosides	Flavonoids	Phenols	Steroids	Terpenoids	Quinones	Protiens	Anthrocyanin	Betacyanin	Reducing sugar
Aqueous	-	+	-	-	-	-	-	+	-	-	-	-	+
Chloroform	-	-	-	+	+	+	+	+	-	-	-	-	+
Methanol	-	-	-	-	+	+	-	+	-	-	-	-	+

Preliminary phytochemical analysis: Phytochemical analysis revealed the presence of saponins, terpenoids, reducing sugar in the crude extract. Flavonoids, phenols, terpenoids and reducing sugars were present in both chloroform and methanol extracts (Table 2). Cardiac glycosides and steroids were found the chloroform extract. Medicinal plants have long been reported as a prospective hub of natural antioxidant compounds, particularly plant secondary metabolites i.e., phenolic compounds and flavonoids which are generated by plant to defend itself or to promote the growth under unfavorable conditions (Okpuzor *et al.*, 2009). Phenolics and flavonoids are commonly known as the largest phytochemical molecules with antioxidant properties from plants (Wang *et al.*, 2016; Andreu *et al.*, 2018).

Total phenolic content: The total phenolic contents of *Xanthosoma sagittifolium* stem extracts were determined using Folin-Ciocalteu reagent in comparison with standard gallic acid. It was noted that the total phenolic content of the methanolic extract was higher than chloroform and aqueous extract of *Xanthosoma sagittifolium.* The phenolic content was calculated as Gallic acid equivalents GAE/g of dry plant material on the basis of a standard curve of Gallic acid (10-320 µg/mL). Total phenol content in the aqueous stem extracts using the calibration curve was found to be 11.82 mg of Gallic acid equivalents/g dry weight of extract (Table 3).

Total flavonoid content: The total flavonoid contents of *Xanthosoma sagittifolium* stem extracts were determined using aluminium chloride with standard Quercetin. It was noted that the total flavonoid content of the methanolic extract was higher than chloroform and aqueous extract of *Xanthosoma sagittifolium.*

Fig. 2. Standard curve for total phenolic content.

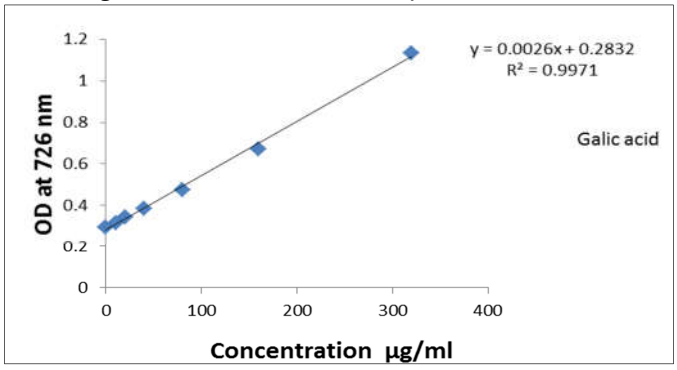

Table 3. Total phenolic content of different extracts of *Xanthosoma sagitifolium* stem.

Sample	Total Phenolic content (mg of Gallic acid equivalents/g dry weight of extract)
Methanol extract	47.35
Chloroform extract	16.21
Aqueous extract	11.81

Fig. 3. Standard curve for total flavonoid content.

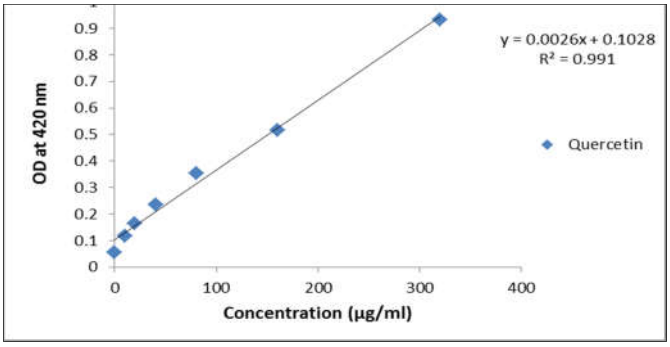

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Table 4. Total flavonoid content of different extracts of *Xanthosoma sagitifolium* stem.

Sample	Total flavonoid content (mg of Quercetin equivalents/g dry weight of extract)
Methanol extract	119.94
Chloroform extract	16.35
Aqueous extract	25.60

The flavonoid content was calculated as Quercetin equivalents/g of dry plant material on the basis of a standard curve of Quercetin (10–320 µg/mL). Total flavonoid content in the aqueous stem extracts using the calibration curve was found to be 25.60 mg of Quercetin equivalents/g dry weight of extract (Table 4).

Conclusion

The preliminary phytochemical evaluation showed the presence of glycosides (cardiac glycoside), steroids, flavonoids, tannins, phenols and terpenoids. Chloroform extract showed the presence of majority of phytoconstituents. Methanolic extract contained maximum percentage of phenolic and flavonoid content than aqueous and chloroform extract. Total phenol content in the stem extracts (methanol chloroform and aqueous extract) using the calibration curve was found to be 47.35, 16.35 and 11.8172 mg of Gallic acid equivalents/g dry weight of extract. Total flavonoid content in the stem extracts (methanol chloroform and aqueous extract) using the calibration curve was found to be 119.94, 6.35 and 25.60 mg of quercetin equivalents/g dry weight of the extract. To conclude, methanolic extract showed good amount of phenolic and flavonoid content and hence be explored further for pharmacological properties.

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