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Phytochemical screening to validate the ethnobotanical importance of root tubers of *Dioscorea* species of Meghalaya, North East India

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Qualitative phytochemical analysis was done in root tubers of six species of *Dioscorea* found in Meghalaya. The test confirms the presence of various phytochemicals like flavonoids, saponins, steroids, cardiac glycosides and terpenoids in two aqueous extracts of methanol and ethyl acetate. The results suggest that the methanolic extract shows the presence of maximum phytochemical compounds than ethyl acetate extract during screening. Cholesterol and alkaloid was not detected in present investigation.

Keyword: *Dioscorea*, Ethnomedicine, Phytochemical, Solvent extraction, Secondary metabolites.

1. Introduction

Traditional knowledge of medicine has long been used since ages for curing various human ailments. About 60-80% of world populations still rely on plant based medicines [25]. Though the traditional Indian system of medicine has a long history of use, yet they lack adequate scientific documentation, particularly in light of modern scientific knowledge [28]. The medicinal value of plant lies in the bioactive phytochemical constituents of the plant and which shows various physiological effects on human body. So through phytochemical screening one could detect the various important compounds which could be used as the base of modern drugs for curing various diseases. Keeping this in view, the plant *Dioscorea* commonly known as yam has been taken for phytochemical screening. Yam is the leading form of staple food for millions of people in the tropic and subtropical countries. Many yams are of economic importance as tuberous food crops. This tuber contains the plant food reserves, mainly starch, and it is often incorporated in the human diet. The tuber not

only stores food but also many of the plants secondary metabolites, which are commonly referred to as antinutritional factors.

The study investigates on the qualitative phytochemical screening of few species of *Dioscorea* prepared in two different extracts i.e. methanol and ethyl acetate.

1.1 Food and Economic aspect

The Tubers of several species of Yams (*Dioscorea* spp.) are edible and are counted just after potato in its food value. In fact, species like *D. alata*, *D. pentaphylla* and *D. bulbifera* are the most worldwide cultivated true yams for their tubers which are of rich source of starch that form an important dietary supplement. Apart from starch the root tubers of *Dioscorea* also contain protein, fats, fibers and among minerals nutrients Potassium, Sodium, Phosphorus, Calcium, Magnesium, Copper, Iron, Manganese, Zinc and Sulphur containing amino acids [4]. “Diosgenin” is a pharmacologically active component of *Dioscorea* obtained from root and rhizomes which is one of the most costly and important

steroidal drug used worldwide [27]. Dietary PEs (plant estrogens) of *Dioscorea* can provide wide range of health benefits including protection against development of some cancers, osteoporosis, cardiovascular disease, and nephritis, and asthma, diabetes, used in

Preparation of contraceptives and in the treatment of various genetic disorders. Edible species along with other ethnomedicinal value of *Dioscorea* found in Meghalaya are presented in Table 1.

Table 1: Edible and medicinal uses of six *Dioscorea* species

Species	Part used	Uses/potential uses
<i>Dioscorea alata</i> Linn.	Tuber/bulb	Tuber is Edible, boiled and cooked [14, 22, 29]; Boiled bulb is taken orally twice a day for 15 days to cure piles and gonorrhoea [16]; Tuber is also taken orally for treatment of piles and leprosy [15].
<i>Dioscorea bulbifera</i> Linn.	Tuber	Boiled and cooked tuber is edible [6, 29]; one teaspoonful of tuber powder is given orally with water as single dose once only to cure abdominal pain [23].
<i>Dioscorea pentaphylla</i> Linn.	Tuber, flowers and young shoot	Taken as vegetables [14] tubers are boiled and eaten [6]; Leaf paste mixed with mustard oil is rubbed on the effected part to treat rheumatism [24].
<i>Dioscorea pubera</i> Bl	Tuberous rhizome and Bulbil	Tuber is eaten [12, 29]; tuberous rhizome and Bulbil are cooked and given to cure colic pain [20].
<i>Dioscorea oppositifolia</i> L.	Leaves, flowers and tubers	Leaves paste is used as antiseptic for ulcers; The roots are chewed to cure toothache and aphthae [10].
<i>Dioscorea glabra</i> Roxb	Tuber	Boiled and cooked tuber is edible [9].

2. Materials and Methods

2.1 Collection of Plant Material

Six species of *Dioscorea* tubers (*D. pentaphylla*, *D. alata*, *D. oppositifolia*, *D. bulbifera*, *D. glabra* and *D. pubera*) were collected (fig.1) from the East Khasi Hill District of Meghalaya.

2.2 Sample preparation

The tubers were washed and air dried. After drying, the samples chopped into smaller pieces ground into powder and stored in airtight bottles before analysis.

2.3 Preparation of plant extract

10 gm of air dried powder were taken in 100 ml of methanol and ethyl acetate. Plugged with cotton wool and then kept on a rotary shaker at 199-220 rpm for 24 hours. The supernatant were collected and the solvent were evaporated to the final volume one-fourth of the original volume and stored at 4 °C in air tight containers [21].

2.4 Preliminary Phytochemical Screening

The condensed extracts were used for preliminary screening of phytochemicals such as cholesterol, alkaloid, flavanoids, saponin, cardiac glycosides and terpenoids.

2.5 Screening Procedure

2.5.1 Test for flavanoids

Add a few drops of concentrated HCL and Mg turning to 1 ml of ethanol extract. Appearance of pink or magenta-red colour indicates the presence of flavanoids [17].

2.5.2 Test for cholesterol

To 2 ml of the extract 2 ml of the chloroform was added in a dry test tube. Then 10 drop of acetic anhydride and 2 to 3 drops of con. H₂SO₄ was added. A red colour changed to blue green colour [4].

2.5.3 Test for Alkaloids

To the extract added 1% HCl and 6 drops of

Mayer's reagent and Dragendorff reagent. Any organic precipitate indicated the presence of alkaloids in the sample [13].

2.5.4 Test for terpenoids

5ml of each extract was added to 2ml of chloroform and 3ml of con.H₂SO₄ to form a monolayer of reddish brown coloration of the interface was showed to form positive result for the terpenoids [1].

2.5.5 Test for cardiac glycoside

5ml of each extract was treated with 2ml of glacial acetic acid containing one drop of ferric chloride solution. This was underplayed with 1ml of con.H₂SO₄. A brown ring of the interface indicated a deoxysugar characteristic of cardenolides. A violet ring might appear below the brown ring whereas acid layer, a greenish ring might form just gradually throughout thin Layer [1].

2.5.6 Test for steroids

2 ml of acetic anhydride was added to 0.5 g of ethanolic extract of each sample with 2ml of H₂SO₄. The colour change from violet to blue or green indicated the presence of steroids [8].

2.5.7 Test for Saponins

The extract with 20 ml of distilled water was agitated in a graduated cylinder for 15 minutes. The formation of 1cm layer of foam indicated the presence of saponins [13].

3. Results

The result of the preliminary phytochemical screening from root tubers in table 2 shows the presences of different phytochemicals prepared in two different solvent extracts. Cholesterol and alkaloid were not detected during the present investigation. Quantitative assessments of the different phytochemicals detected during investigation was graded as -ve for 0, +ve for 1, ++ve for 2 and +++ve for 3. The present study reveals the presence of phytochemicals like flavanoids, saponins, cardiac glycosides and terpenoids in methanol extracts. High amount of flavanoid and Terpenoids was also found in

species of *D.bulbifera* as shown in fig 5. *D.oppositifolia* shows high amount of terpenoids in methanolic extracts. In ethyl acetate extract, terpenoids was high in *D.bulbifera* as shown in fig. 6.



D. alata



D. bulbifera



D. glabra



D. pentaphylla



D. pubera



D. oppositifolia

Fig 1: showing different root tubers of *Dioscorea* species

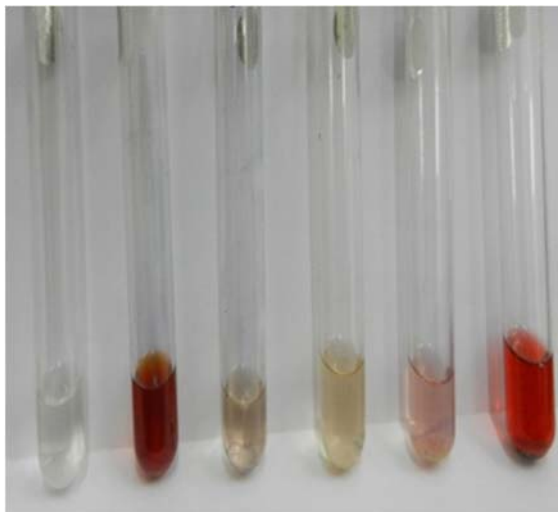


Fig 2: Test for flavonoid in Methanol Extract

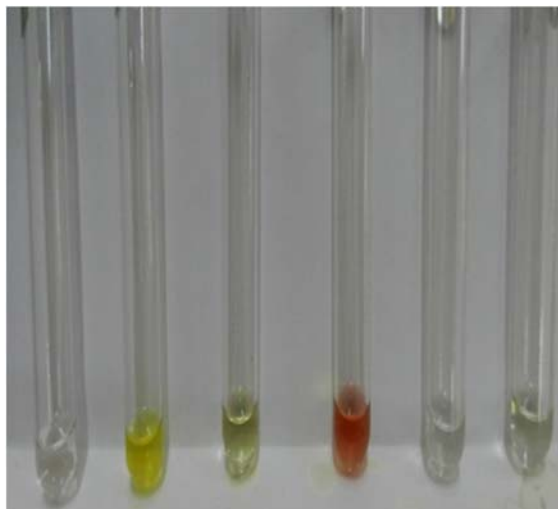


Fig 3: Test for flavonoid in ethyl acetate extract

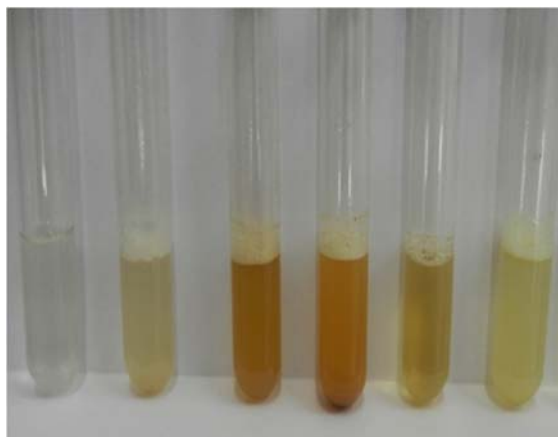


Fig 4: Test for saponins in methanol extract

Table 2: Phytochemical screening of six species of *Dioscorea*

	Name of the compound	<i>Dioscorea</i> species					
		D. pentaphylla	D. alata	D. bulbifera	D. oppositifolia	D. pubera	D. glabra
Ethyl acetate extract	Cholesterol	-	-	-	-	-	-
	Alkaloid	-	-	-	-	-	-
	Flavanoid	-	-	++	-	-	-
	Terpenoid	+	+	+++	-	-	-
	Cardiac glycoside	-	-	-	-	-	-
	Steroid	-	-	+	-	-	++
	Saponin	+	-	+	+	+	+
Methanol Extract	Cholesterol	-	-	-	-	-	-
	Alkaloid	-	-	-	-	-	-
	Flavanoid	-	-	+++	-	+	++
	Terpenoid	++	++	+++	+++	+	-
	Cardiac glycoside	++	+	++	++	+	+
	Steroid	-	-	-	-	-	-
	Saponin	+	-	+	+	+	+

Key: - absence, + presence, ++ fairly good amount, +++ good amount

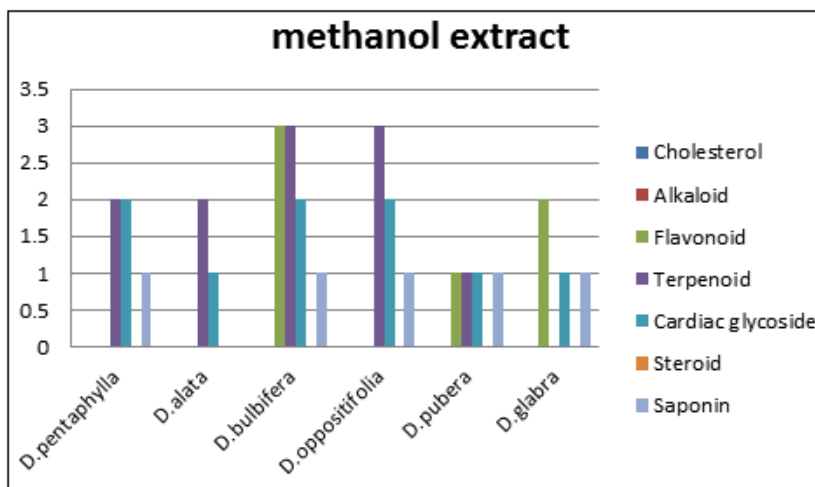


Fig 5: methanol extract of the compounds.

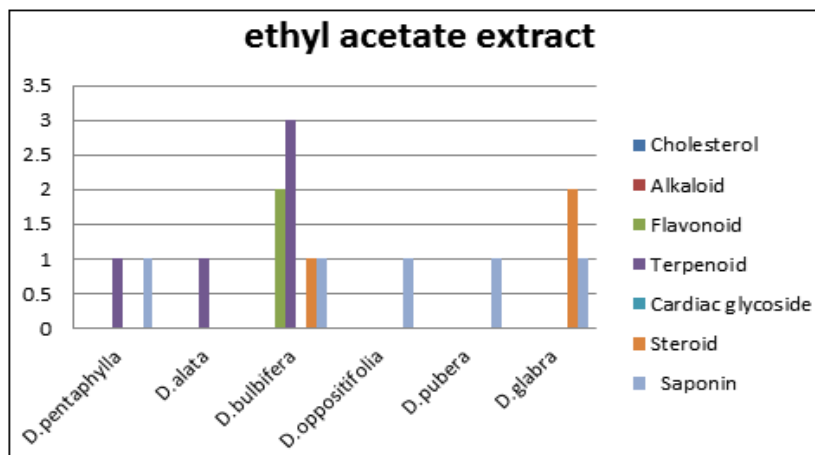


Fig 6: Ethyl extract of the compounds

4. Discussion

The Phytochemical screening and qualitative estimation of root tubers of six species of *Dioscorea* shows the presence of flavanoids, terpenoids, saponin, steroid and cardiac glycosides. Yams have been well respected by the herbalist community for generations due to their potency in enhancing fertility in males due to the presence of steroidal drug i.e. diosgenin which have been isolated from yam tubers. Diosgenin is used as precursors for the synthesis of hormones and corticosteroids which improve fertility in males [7, 19]. Saponins natural tendency to ward off microbes makes them good candidates for treating fungal and yeast infections. These compounds served as natural antibiotics, which help the body to fight infections and microbial invasion [30]. The biological functions of flavanoids apart from its antioxidant properties include protection against allergies, inflammation, free radicals, platelet aggregation, microbes, ulcers, hepatoxins, viruses and tumors [2]. Cardiac glycosides content was found in methanol extract. Cardiac glycosides have been used for over two centuries as stimulant in case of cardiac failure [31, 18]. Further terpenes or terpenoids are active against bacteria [3, 11, 26]. The presence of terpenoids shows that it could be effective against any bacterial infections. This perhaps could probably support and justify the information about the usage of phytochemicals which were isolated from the solvent extract in the present study.

5. Conclusion

The presence of various phytochemicals such as flavonoids, terpenoids, saponin, steroid and cardiac glycosides in the different species of *Dioscorea* confirms that this genus is a potent source for modern drugs. The present study not only paves way for preliminary contribution to the medico-botany investigation but also shows a way for pharmacological research in future for the discovery of new sources of drugs from these phytochemicals.

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