International Journal of Innovative Research and Advanced Studies (IJIRAS)
Volume 4 Issue 10, October 2017

ISSN: 2394-4404

Identification And Taxonomic Classification Of Plants In The Family Portulacaceae In Dutsin-Ma Local Government Area Of Katsina State, Nigeria

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Abstract: ***This work seeks to investigate taxonomic studies of representative plants of Portulacaceae family in Dutsin-Ma Local Government Area. Plant samples were collected for identification using morphological characters and assigned voucher numbers, phytochemical composition of explored species were determined using standard phytochemical screening test. Quantitative analysis to ascertain the taxonomic relationship between family members was done by spectrophotometry and students t-test was employed to check differences at 5%. Results reveals that Talinum triangulare (water leaf) and Portulaca oleracea (ten O'clock plant) are the common members of the Portulacaceae family present in Dustin-Ma. Phytochemical analysis reports the presence of alkaloids, flavonoids, saponins and tannins in both plants. Quantitative phytochemical comparison of Talinum triangulare to Portulaca oleracea respectively reveals alkaloid content to be 1.50>1.10mg/1000mg, flavonoids; 2.04>1.80mg/1000mg, saponins; 2.84<2.96mg/1000mg and tannins; 4.22>4.01mg/1000mg. Statistical test report significant difference (P≤0.05) in phytochemical components between the two plants. Presence of similar phytochemical contents in both plants confirms that they belong to the same family. Significant difference between each phytochemical in the two plants suggests that they belong to the same family but different genera taxonomically.***

Keywords: ***Taxonomic classification, family portulacaceae, water leaf, ten O'clock plant.***

I. INTRODUCTION

Several members of the family portulacacae are yet to be identified and taxonomically classified. These plants known for their ethno-medicinal importance are nearly universal excluding Europe and Asia (Nyffeler and Eggli, 2010; Owolabi et al., 2008). This family first described by Adanson is known to belong to the order Carophyllales and consist of about 20 genera of flowering plants and 500 species including herbs and shrubs (Stephen et al., 2015; Mc Neil et al., 2006). They grow in several terrestrial habitat including orchads, vineyards and gardens. Fruit and seed morphology, petal number and arrangement, ovary position and floral pattern among others are fundamental features used for differentiating Portulacaceae from other allies (Gilberto, 2013; Nyffeler and Eggli, 2010). Portulacaceae plants are among the few groups of terrestrial plants with C4 photosynthesis compared to C3 photosynthesis found in other terrestrial plants. These plants have been reported to have several chemical constituents including manganese, urea, calcium, copper and fatty acids especially omega-3-acids with highest concentration in P.oleracea among the leafy vegetables (Ezekwe et al., 2000). The leaves are mucilaginous with high oxalate and saponin contents. These plants especially P.oleracea are sources of antioxidants and minerals for nutraceutical applications thus, their use as herbs in the treatment of various ailments in different parts of the world (Uddin et al., 2012; Owolabi et al., 2008).

Taxonomy within the Portulacaceae family posed a challenge earlier as there was no universally accepted method of classification (Wendy and Roberts,1999) however, Nyffeler and Eggli (2010) developed a revised circumscription by dividing the family into several tribes containing a few or single genera on the basis of several characteristics including phylogenetics, taxonomic diversity, molecular and morphological data. Identification of large group of plants belonging to this family is tasking which has limited classification to tribe rather than specie level. Phytochemical analysis by various researchers (Swarma and Ravidhran, 2013; Rahmat et al., 2003) has revealed several organic compounds present in some members of this family however, their findings were not comparative in nature thus limiting the use of these results to indicate the relationship between various species.

This work seeks to investigate taxonomic studies of representative plants of Portulacaceae family in Dutsin-Ma Local Government Area (DLGA). The specific objectives of this research are to identify the members of this family available in Dutsin-Ma, determine the phytochemical composition and quantitative analysis of explored species to ascertain the taxonomic relationship between family members.

II. MATERIALS AND METHODS

SAMPLE COLLECTION AND IDENTIFICATION OF PLANTS

Collection of representative plants were carried out based on morphological characteristics described by Okezie et al., (1998). Polythene bags were used to collect whole plants from the environs of DLGA and Biological garden in the Department of Biological Sciences, Federal University Dutsin-Ma. Collected samples were immediately taken to the department of Botany, Ahmadu Bello University Zaria for further identification and authentication using a standard voucher.

PHYTOCHEMICAL SCREENING

PREPARATION OF PLANT SAMPLES AND COLLECTION OF CRUDE PLANT EXTRACT

Destalked leaves were washed with distilled water to remove dust. Air drying of leaves was done for 3 days and continuous turning of the leaves after every 24 hours to prevent fungal growth. Grinding of leaves to powder was done using an electric blender. The powder obtained was immediately transferred to an air tight container and refrigerated as reported by Aja et al. (2010).

Soxhlet extraction was used to obtain extracts from grounded plant leaves adopted from Yadav and Agarwala. (2011). Into 250ml methanol, 30g of the plant powder was added thimble containers and used for the extraction. This was left for 24 hours until the solvent became colourless, it was then transferred into a beaker and heated at 30-40ºC using a Bunsen burner until solvent evaporated. Dried extract was refrigerated at 4ºC for further analysis.

QUALITATIVE ANALYSIS

To test for Alkaloids, methods of Trease and Evans. (1989) was adopted. Dried extract was dissolved in dilute hydrochloric acid and filtered. One mil (1ml) of various filtrates was transferred to test tubes followed by addition of two drops of Mayer's reagent to each experiment. To determine the presence of saponins, methods of Kokate. (1998) was adopted. Five grams (5g) of dried extract was diluted using distilled water to make up 20ml. Obtained suspension was vigorously shaken using graduated cylinder for about 15 minutes. Methods of Tahiya, et al. (2014) was used to test for flavonoids by adding few drops of sodium hydroxide to 5ml extract. Test for Tannins were done as described by Trease and Evans. (1989). Five mils (5ml) 45% ethanol was added into 2g of ground sample and heated for 5 minutes. Upon cooling and filtration of the mixture, 3 drops of lead sub acetate were added to 1ml filtrate and to another filtrate, 0.5ml bromine water.

QUANTITATIVE ANALYSIS

ALKALOIDS: Into 96% ethanol-20%HSO (1:1), 0.5g of sample was added after which 1ml of 24 filtrates was mixed with 5ml of 60% tetraoxosulphate (VI) for 5 minutes. Addition of 5ml 0.5% formaldehyde followed and solution was left for three hours after which absorbance was read at 565nm using a spectrophotometer.

FLAVONOIDS: Into 5ml dilute HCL, 0.5g of extracted plant sample was added and heated for 30 min. Cooling and filtration of heated extract followed then 1ml of filtrate was mixed with 5ml ethyl acetate and 5ml of 1% NH. Absorbance was read at 420n-520nm as reported by Harborne. (1976).

SAPONINS: Into 20ml 1NHCL, 0.5g of sample was added and heated for 4 hours. After cooling and filtration, addition of 50ml petroleum ether was done to completely evaporate suspension and obtain ether layer. Residue obtained was mixed with 5ml acetone ethanol after which 0.4ml of product was transferred to 3 individual test tubes and mixed with 6ml Ferrous sulphate then 2ml concentrated H_2SO_4 and left for 10 minutes. The solution was properly mixed and absorbance was read at 490nm as described by Oloyede. (2005).

TANNINS: Into 50ml distilled water, 5g of sample was added and shaken on a rotator for 1hour after which 5ml of filtered solution was mixed with 2ml 0.1M $FeCl_3$ in 0.1N HCL and 0.008M potassium ferrocyanide. Absorbance was read after 10 minutes at 120nm as reported by Van-Burden and Robinson. (1981).

STATISTICAL ANALYSIS

The level of significant difference between mean values of each phytochemical component in plant samples under study was checked using students T-test at 95% confidence interval.

III. RESULTS

Table 1 shows the representative plant members of the Portulacaceae family in DLGA as identified based on their common names, botanical names and voucher numbers to include water leaf (Talinum triangulare) and Ten O'clock plant (Portulaca oleracea) with voucher numbers 2398 and 2389 respectively. Plate 1A and 1B shows pictorial representation of Talinum triangulare and Portulaca oleracea.

Common name	Botanical name	Voucher number	Stem colour	Flower colour
Water leaf	*Talinum triangulare*	2398	Green	Purple
Ten O'clock plant	*Portulaca oleracea*	2389	Red	Yellow

Table 1: Plants identified with voucher number

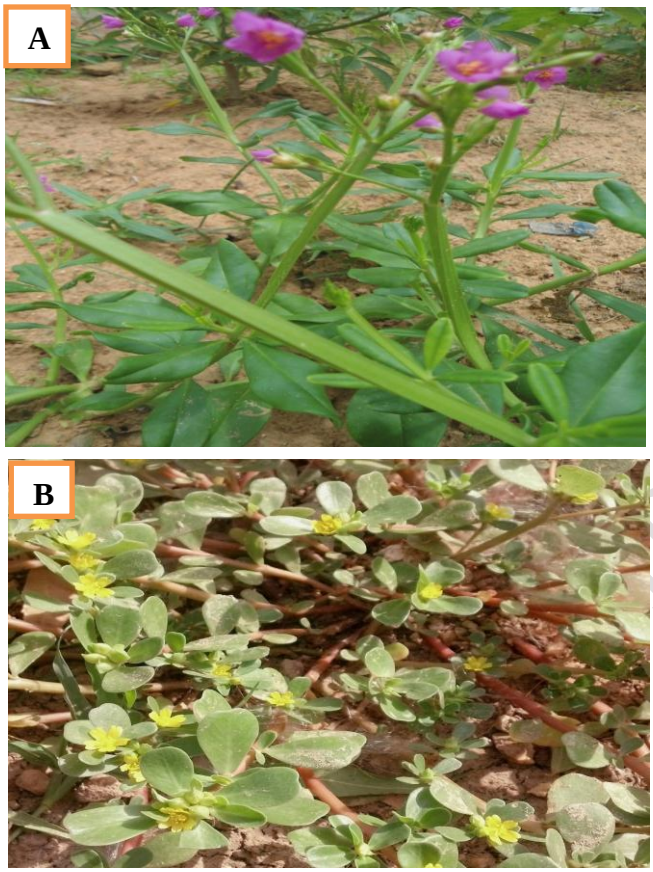

Plate 1: Talinum triangulare (A) and Portulaca oleracea (B). Plants identified based on morphological characteristics and assigned voucher numbers

Table 2 shows the phytochemicals present in the two plants to include alkaloids, flavonoids, saponins and tannins.

Phytochemicals	*T.triangulare*	*P.oleracea*
Alkaloids	+	+
Flavonoids	+	+
Saponins	+	+
Tannins	+	+

Table 2: Phytochemicals present in T.triangulare and P.oleracea

Fig 1 shows the quantity of phytochemicals present in both plants. *T.triangulare* had 1.50mg while *P.oleracea* had 1.10mg. Similar differences were observed in the level of flavonoids(2.04mg and 1.80mg). Saponins measured 2.84mg and 2.96mg while tannins were 4.22mg and 4.01mg respectively. Significant differences (P≤0.05) exist among the various quantitative values.

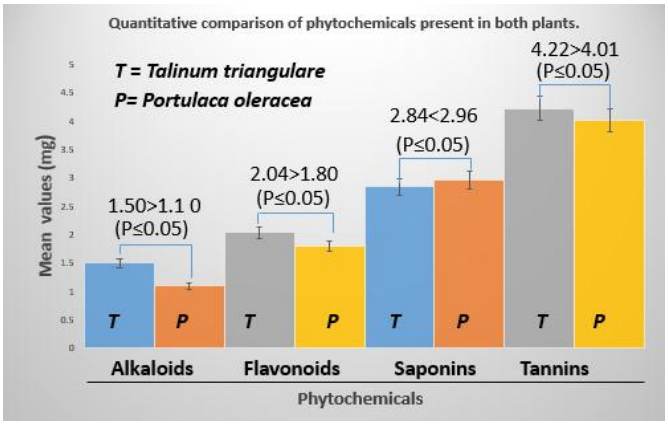

Figure 1: Quantitative comparison of Phytochemicals present in T.triangulare and P.oleracea

IV. DISCUSSION

It is obvious that some members of the portacalaceae are found in DLGA as only two members were identified based on their morphological features which is in accordance with the findings of Okezie *et al.* (1998) who morphologically identified same plants to belong the portalacaceae family. Our findings reveal that both plants have alternate leaves, flowers and succulent stem implying that they have the same evolutionary origin which further suggests that they are members of the same family. Plants show differences in stem and flower colour. This is consistent with the findings of Okezie *et al.* (1998) suggesting the basis for grouping both plants in different genera.

Similar phytochemicals were observed in the plants studied which further support our hypothesis that the two plants belong to the same family. This emanated from the findings of Sharma and Kaur. (2017) who proposed the categorisation of plants based on the presence of similar phytochemical components. Presence of alkaloids, flavonoids, saponins and tannins in the two plants correlates with the findings of Swarna and Ravidhran, (2013) and Arrais-Silva *et al*. (2014) who identified similar chemical components during their studies on related medicinal plants.

Experimental studies show that quantitative variations exist in the level of phytochemicals of the two plants. This finding contrast that of Aja *et al*. (2010) who revealed that the leaves of *T. triangulare* contain an appreciable amount of flavonoids, alkaloids, saponins among others and low level of toxicants like tannins. The possible differences could be attributed to instability of chemical compounds due to environmental changes. This was also reported by Coleen, (1998). This is evident that the plants belong the Portulacaceae family which is consonance with that of PROTA, (2014).

V. CONCLUSION

This work is designed to lay standards that will be useful to determine taxonomic relationships of this vaguely characterized family. Although establishing our findings to chromosomal level and determining the specific alkaloids,

flavonoids, saponins and tannins in both plants is absent due to some limitations, this study reveals that *Talinum triangulare* and *Portulaca oleracea* are the common members of the Portulacaceae family present in Dustin-Ma. Alkaloids, flavonoids, saponins and tannins include phytochemicals that are present in both plants implying they belong to the same family. Significant difference between each phytochemical in the two plants suggests that they belong to different genera and species taxonomically.

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