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Evaluation of the phytochemical constituents of the leaves of *Ficus minahassae* Tesym & De Vr., *Casuarina equisetifolia* Linn., *Leucosyke capitellata* (Pior) Wedd., *Cassia sophera* Linn., *Derris elliptica* Benth., *Cyperus brevifolius* (Rottb.) Hassk., *Piper abbreviatum* Opiz., *Ixora chinensis* Lam., *Leea aculeata* Blume, and *Drymoglossum piloselloides* Linn.

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Abstract. The medicinal plants *Ficus minahassae* Tesym & De Vr., *Casuarina equisetifolia* Linn., *Leukosyke capitellata* (Pior) Wedd., *Cassia sophera* Linn., *Derris elliptica* Benth., *Cyperus brevifolius* (Rottb.) Hassk., *Piper abbreviatum* Opiz., *Ixora chinensis* Lam., *Leea aculeata* Blume, and *Drymoglossum piloselloides* Linn. have been gradually utilized as herbal remedies for the cure of various ailments even though they have not been explored scientifically. The present investigation focused mainly on the phytochemical investigation of the leaves of these plants, employing standard procedures. Results showed the presence of various phytochemicals, particularly the alkaloids, flavonoids, tannins, phlobatannins, cardiac glycosides, steroids and terpenoids. These compounds may be responsible for the utilization of the plants under study for the treatment of different ailments.
Key Words: medicinal plants, traditional medicine, herbal remedies, phytochemicals, phytochemical screening.

Introduction. Nature has been providing man a complete repository of remedies for the cure of all his ailments and this repository have been pre-dispensed in the luscious plant life (Kokate et al 2002). Thus nature offers drugs in the form of herbs, plants, and algae to alleviate various diseases (Trease & Evans 1983). Some plants possess medicinal properties, and its medicinal value is due to the presence of various complex chemical substances of different composition which occur as secondary metabolites. Plant secondary metabolites provide specific physiological action on the human body (Sofowora 1982; Arora & Kaur 1999; Ahmedulla & Nayar 1999; Rios & Recio 2005). Secondary metabolites can boost the immune system, protect the body from free radicals, can kill pathogenic germs and so much more. Some of the most important secondary metabolites are alkaloids, flavonoids, tannins, terpenoids, saponins and phenolic compounds among others (Nweze et al 2004).

Throughout history, plants have provided a source of inspiration for the novel drug compounds, as plant-derived medicines have truly made great contribution to human health and well being (Vineela & Elizabeth 2005; Ekpo & Etim 2009).

The medicinal plants namely *Ficus minahassae, Casuarina equisetifolia, Leukosyke capitellata, Cassia sophera, Derris elliptica, Cyperus brevifolius, Piper abbreviatum, Ixora chinensis, Leea aculeata,* and *Drymoglossum piloselloides* have been gradually utilized as herbal remedies for the cure of various ailments even though they have not been explored scientifically. So far, systematic screening and scientific evidence concerning

their composition are very limited; hence further studies on the presence of biologically active compounds and toxicity effects of plant extracts of the considered plants are still warranted.

F. minahassae is a member of the Moraceae family and genus Ficus (http://www.stuartxchange.org/Hagimit.html). It is a widely spreading tree whose leaves are traditionally used as anti-rheumatic with topical application (WHO 2002). *C. equisetifolia* is in the family Casaurinaceae and genus Casaurina (http://www.stuartx change.org/Agoho.html). It is a large, evergreen tree used as a remedy for bone structure, allergy and cancer (Aher et al 2009). *L. capitellata belongs* to the family Urticaceae and genus Leucosyke. This is an erect shrub with leaves that are used for the treatment of diabetes, high blood pressure and lumbago (http://www.stuartxchange .org/Alagasi.html) *C. sophera* is under the Caesalpinaceae family and Genus Cassia. The leaves of this plant are used for the cure of ringworm, Dhobi itch, gonorrhea, has anthelmic and anti-rheumatic properties (http://www.stuartxchange.org/Andadasi.html). *D. elliptica* is a member of the family Fabaceae and genus Derris. This vine is used to heal wounds and skin disease (http://www.stuartxchange.org/Tubli.html). *C. brevifolius*is in the family Cyperaceae and genus Cyperus. This herb is used for the treatment of colds with fever and bronchitis among others (http://www.stuartxchange.org/PugoPugo.html). *P. abbreviatum* belongs to the family Piperaceae and genus Piper. This vine is used to treat splenomegaly (http://www.stuartxchange.org/Buyo-buyo.html). *I. chinensis* belonging to the family Rubiaceae and genus Ixora, is an erect and smooth shrub with leaves used as a remedy for tuberculosis, rheumatism and acne among others (http://www.stuartxchange.org/ Santan-tsina.html). *L. aculeata* is a shrub under the family Vitaceae and genus Leea. This shrub is used for purifying blood (http://www.stuartxchange.org/Mali-mali.html). *D. piloselloides* belongs to the family Polypodiaceae and genus Drymoglossum. This plant is used for styptic, for blood coagulation and in eczema treatment (http://www.stuartx change.org/Pagong-pagongan.html). The present investigation was designed to evaluate the phytochemical compounds present in the plants under consideration and correlate their presence with the folkloric uses of the plants.

Material and Method

Preparation of plant samples. Fresh samples of selected medicinal plants were collected from different localities in Mindanao, Philippines. All the collected plants were identified and authenticated by Alicia Tabaranza from the Department of Biological Sciences, Mindanao State University - Iligan Institute of Technology, Iligan City, Philippines. The plant samples were washed with distilled water, air-dried, pulverized using an electric blender and stored in clean and sealed plastic bags until analysis.

Preparation of plant extracts. The aqueous extract of each sample was prepared by soaking 10 g of dried powdered samples with 200 mL of distilled water for 12 hours. The extracts were filtered using a filter paper in a canonical flask.

Ethanol extract of each sample was prepared by soaking 50 g dried powdered samples with adequate amount of 80% ethanol for 48 hours. The extracts were filtered using a filter paper in a canonical flask.

Phytochemical screening. Phytochemical screening was carried out on the aqueous extracts, ethanol extracts and on the powdered dried plant materials. Qualitative analysis for tannins, phlobatannins, saponins, flavanoids, terpenoids, and cardiac glycosides were investigated following the phytochemical screening procedure described by Edeoga et al (2005). The qualitative analysis for the occurrence of alkaloids and steroids were investigated on the crude ethanol extracts following the procedure described by Guevarra et al (2005).

Test for tannins. (Edeoga et al 2005): About 0.5 g of each dried powdered samples were boiled in 20 mL of distilled water in a test tube and then filtered. Positive test was

confirmed by addition of 0.1% $FeCl_3$ solution resulting in a characteristic blue, blue-black, green or blue-green color.
Test for phlobatannins (Edeoga et al 2005): 10 mL of each aqueous extract was boiled with 1% aqueous hydrochloric acid for 5 min. A positive test result was confirmed by deposition of a red precipitate.
Test for saponins (Edeoga et al 2005): About 2 g of each powdered sample was boiled in 20 mL of distilled water on a water bath and filtered. A fraction of aqueous filtrate measuring 10 mL was mixed with 5 mL of distilled water and shaken vigorously to form a stable persistent froth. The frothing was mixed with about three drops of olive oil and shaken vigorously. Formation of an emulsion confirmed presence of saponins.
Test for flavonoids (Edeoga et al 2005): About 5 mL of each aqueous extracts was added with 1% NH_3 solution. A positive test result was confirmed by the formation of a yellow coloration or turbidity.
Test for terpenoids (Edeoga et al 2005): About 5 mL of the extract was mixed with 2 mL of chloroform and 3 mL of concentrated H_2SO_4 was added to form a layer. A positive test result was confirmed by presence of a reddish brown coloration at the interface.
Test for cardiac glycosides (Edeoga et al 2005): About 5 mL of the extract was mixed with 2 mL of glacial acetic acid containing one drop ferric chloride solution. To this, 1 mL of concentrated sulphuric acid was slowly underplayed to the sample mixture. A positive test result was confirmed by the presence of a brown ring at the Interface.
Test for steroids (Guevarra et al 2005): About 10 mL of each ethanol extract are evaporated to insipient dryness over a steam bath and cooled to room temperature. It was then defatted repeatedly with hexane. The defatted aqueous layer was then warmed over a steam bath to remove the residual hexane. To this, 3 mL of $FeCl_3$ reagent was added and 1 mL of concentrated sulfuric acid was then slowly added. A positive test was evident when a reddish brown coloration occurred.
Test for alkaloids (Guevarra et al 2005): About 10 mL of each ethanol extract was evaporated to insipient dryness over a steam bath and cooled to room temperature. The residue was added with 5 mL of 2 M HCl and heated for 5 min and cooled, after this 0.5 g sodium chloride was added. The mixture was then stirred, filtered and the volume was adjusted to 5 mL. A volume of 1 mL was taken form the mixture and placed each into two separate test tubes. To one test tube, about 2 to 3 drops of Dragendorff's reagent were added while the other test tube, about 2 to 3 drops of Meyer's reagent.

Results and Discussion. The analysis was carried out on the leaves of each plant studied and it revealed the presence of phytochemical compounds. The results summarized in Table 1 shows that tannins and saponins were found to be present and absent in all the plants, respectively.

Rheumatoid arthritis is an autoimmune disease characterized by chronic inflammation of the joints and can affect multiple other organs of the body (http://www.Wikipedia.com). The leaves of *F. minahassae* have been utilized as anti-rheumatic with topical application. From the analysis, it revealed the presence of tannins, flavonoids, terpenoids, cardiac glycosides and steroids. These phytochemicals may attribute to its anti-rheumatic activity through the anti-inflammatory activity of the observed phytochemicals.

From the results, *C. equisetifolia* leaves are shown to be rich in flavonoids. Flavonoids are known to have the capability to treat certain physiological disorder and diseases. These compounds are also potent water-soluble, super antioxidant, and free radical scavengers which prevent oxidative cell damage and have strong anticancer activity which adds protection against all stage of carcinogens (Okwu & Okwu 2004). Tannins are known for their antimicrobial, anticancer, and antioxidant activities (Trease & Evans 1983; Sadipo et al 1991; Chung et al 1998). Moreover, tannins are known to have an important role in wound healing (Hawkins & Ehrich 2006). Steroids have been reported to possess anti-inflammatory activities (Chawla et al 1987). The presence of these phytochemicals may justify the folkloric uses of its leaves.

Table 1

Phytochemical screening results on the air-dried leaves of the medicinal plants

Subject	*Tannin*	*Phlobatannins*	*Saponins*	*Steroids*	*Terpenoids*	*Cardiac glycoside*	*Alkaloids*	*Flavonoids*
F. minahassae	+	-	-	+	+	+	-	+
C. equisetifolia	+	-	-	+	+	-	-	+
L. capitellata	+	-	-	+	+	+	-	+
C. sophera	+	+	-	+	+	+	+	+
D. elliptica	+	+	-	-	+	+	-	+
C. brevifolius	+	+	-	-	-	-	-	-
P. abbreviatum	+	-	-	-	+	-	+	-
I. chinensis	+	+	-	+	+	+	-	+
L. aculeata	+	-	-	+	+	+	-	+
D. piloselloides	+	-	-	+	+	+	-	+

+ = present; - = absent.

Results have indicated the presence of terpenoids in leaves of *L. capitellata*, a compound known to reduce complications associated with diabetes and lowers sugar level in the blood (http://en.wikipedia.org/wiki/Terpenoid). Also, terpenoids help reduce diastolic blood pressure (Hawkins & Ehrich 2006). This perhaps is the reason why this plant has been used for diabetes and high blood pressure. Moreover, the presence of steroids may explain why it has been used for lumbago as this compound has been shown to possess anti-inflammatory and analgesic effects (Singh 2006). Also, the leaves are rich in flavonoids, a compound known to have anti-inflammatory properties (Requena & Kenner 1996).

Based on the results of the study, the leaves of *C. sophera* have been found to be rich in flavonoids, compounds known to have antifungal properties (Trease & Evans 1983). Presence of flavanoids and steroids explain the reason why this plant have been employed for rheumatic and inflammatory fever, as these compounds are reported to have anti-inflammatory properties (Chawla et al 1987; Requena & Kenner 1996). Plants having alkaloids are used in medicines for fever. These are attributed for its analgesic properties (Stary 1998). The leaves of this plant are also rich in alkaloids and this perhaps is the reason why infusion of the leaves of *C. sophera* is given to asthma patients, since alkaloids can cure asthma (Mary 2008). The leaf part of *C. sophera* also contains terpenoids and such presence may contribute to the plants use as expectorant, for cough, and bronchitis as terpenoids are known to have anti-inflammatory, anticancer, antimalarial, anti-viral, and anti-bacterial properties (Mahato & Sen 1997). Furthermore, terpenoids improve lung function (Singh 2006). Anthelmintic refer to any drug that acts against helminthic infections such as those that are caused by parasitic worms (Encyclopedia Britannica 2010). *C. sophera* has been used as anthelmintic and this is because of the presence of tannins as tannins are known to have antiparasitic activity (Kolodziej & Kiderlen 2005).

The leaves of *D. elliptica* are rich in flavanoids and tannins have been also found to be present, both of which are known to have important roles as potent antioxidants (Trease & Evans 1983; Stauth 2007). Moreover, phlobatannins have been reported to have anti-inflammatory and analgesic (Ayinde et al 2007) and antioxidant (Okwu & Okwu 2004) properties. This further supports the wound healing ability of this plant. Furthermore, the presence of terpenoids in the leaves of *D. elliptica* may explain as to why this is used as a remedy for healing skin disease as terpenoids strengthen the skin, increase the concentration of antioxidant in wounds, and restore inflamed tissues by increasing blood supply (Hawkins & Ehrich 2006).

Tannins have been found to have antiviral, antibacterial, antiparasitic, anti-inflammatory and antioxidant therapeutic applications (Kolodziej & Kiderlen 2005). Furthermore, phlobatannins have been reported to have anti-inflammatory, and analgesic properties (Ayinde et al 2007) as well as antioxidant properties (Singh 2006). The folkloric uses of *C. brevifolius* can be attributed to the presence of these phytcohemicals in the plant.

The leaves of *P. abbreviatum* have been used for the treatment of splenomegaly, an enlargement of spleen usually associated with viral and bacterial infections (Ghazi et al 2010). This may be attributed to the presence of tannins as these compounds inhibit the growth of many fungi, yeast, bacteria, and viruses (Chung et al 1998). The results also showed the leaves of this plant to be rich in alkaloids, compounds that have diverse useful bioactivities like anti-inflammatory activity (Barbosa-Filho et al 2006).

From the phytochemical analyses resulted that the leaves of *I. chinensis* contains terpenoids, compounds which help reduce diastolic blood pressure (Hawkins & Ehrich 2006), known to posses anti-inflammatory, antiviral, and antibacterial properties (Li et al 2003), hence supporting the use of this plant for high blood pressure, rheumatism, tuberculosis, urinary trouble and acne (http://www.stuartxchange.org/Santan-tsina. html). This plant also contains flavonoids, steroids and phlobatannins which further support the reason why this plant is utilized for rheumatism, tuberculosis, acne and for hemoptysis as these phytochemical constituents have anti-inflammatory activity (Chawla et al 1987; Requena & Kenner 1996; Ayinde et al 2007).

Anticancer and antioxidant compounds are known to help the liver for detoxifying blood and act as cleansing agent for the blood (Menger et al 2012). The leaves of *L. aculeata* have been used for purifying blood (http://www.stuartxchange.org/PugoPugo. html.). The folkloric application may be justified by the presence of tannins, terpenoids, cardiac glycosides and flavonoids as these phytochemicals have been reported to have anticancer and antioxidant properties (Requena & Kenner 1996; Kinghorn et al 2000; Zain et al 2011; Zhang & Li 2007; Sugimoto et al 2012).

From the phytochemical analyses, the leaves of *D. piloselloides*is are rich in flavonoids, compounds which have anti-inflammatory properties (Requena & Kenner 1996. This perhaps is the reason why this plant is used for eczema treatment. Presence of tannins has been revealed in the leaves of this plant, compounds which have been found to have antiviral, antibacterial, antiparasitic, anti-inflammatory and antioxidant effects for possible therapeutic applications (Kolodziej & Kiderlen 2005; Ghazi et al 2010). This may be the reason why this plant have been used for superficial bacteria infections, cough, and gonorrhea.

Conclusions. The plants under study could be sources of phytochemical compounds like alkaloids, flavonoids, terpenoids, saponins, cardiac glycosides, steroids, tannins and phlobatannins as shown by the results. The utilization of these plants by traditional healers to treat various ailments may be due to the presence of the aforesaid phytochemicals as these possess diverse pharmacological activities.

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