E. Hirta Under Soil and Climatic Conditions in Lanao del Sur, Philippines: Its Phytochemical Components

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ABSTRACT

The study was conducted to evaluate the phytochemical properties of *Euphorbia hirta* L. under the soil and climatic conditions of the two municipalities and one city in Lanao del Sur such as: Masiu, Ganassi, and Marawi City. The experiments were conducted in a lab environment. The results of the study revealed that all treatments showed negative (-) in R sugar while positive (+) with the remaining components, indicating that all treatments are safe from harmful phytochemical properties which means that *Euphorbia hirta* L. is safe for human consumption and medication as perceived by the researchers.

Keywords : *Euphorbia hirta* L.; Alkaloids; Flavonoids; Phytosterols; Tannins; Phenolics; R. sugar

1 INTRODUCTION

THE earliest form of medicine humans used to cure all types of illnesses and ailments is herbal medicine. Despite written records about medicinal plants dating back at least 5,000 years to the Sumerians, who described well-established medicinal uses for plants like laurel, caraway, and thyme, archeological studies have revealed that the use of herbal medicine dates as far back as 60,000 years ago in Iraq and 8,000 years ago in China (Leroi Gourhan, 1975; Neolithic site of the cross-lake bridge, 2013). Moreover, it is still widely used to this day. Even conventional medicine's raw ingredients are herbs. Over the years, the number of people who use herbal medicine has tremendously increased. Numerous people are now turning to herbal remedies, phytonutrients, and nutraceuticals to treat various health issues in national healthcare settings as these products continue to proliferate worldwide (WHO, 2004).

"Tawa-Tawa," or "maragatas" (*Euphorbia hirta* L.), is commonly found in any neighborhood in tropical areas. In the province of Lanao del Sur, this plant is found almost anywhere, growing with ordinary bushes and grass. In other countries, Tawa-Tawa is called the "asthma weed" for its known efficacy in curing asthma (Tawa-Tawa and Its Medicinal Uses, 2018). It belongs to one of the great angiosperm families, Euphorbiaceae, which contains over 7500 species and 300 genera. It is extensively distributed in both hemispheres with a vast spectrum of morphological arrangements, from trees to the most extensive, lushest desert plants (Ijaz et al., 2017).

Tawa-Tawa is a small, annual (yearly) plant with thick roots, hairy stems, and yellow fruits (Ijaz et al., 2017). Its characterestics include analgesic, antipyretic, anti-inflammatory, and anxiolytic. It also contains gallic acid, quercetin, triacontane, cetyl alcohol, phytosterol, jambulol, melissic, palmitic, and linoleic acid. It also has euphorbianin, leucocyanidol, camphor, quercitrin and quercitrol (Tawa-tawa and Its Medicinal Uses, 2018). In the study of Galpa and Beltran (2013), the plant has been widely acknowledged for treating cough, coryza, hay asthma, bronchial infections, bowel complaints, worm infestations, and kidney stones in traditional medicine. Tawa-tawa (*Euphorbia hirta* L.) extracts have been reported to be utilized by Filipino rural residents to cure dengue illness in recent publications, but no scientific research has been done on this topic.

Prakash et al. (2020) explain that plants can protect themselves from harmful bacteria, hazardous insects, and dramatic environmental changes by producing specialized chemicals called secondary metabolites that are not nutritive but are crucial in defensive mechanisms. These are called phytochemicals and resemble essential oils in several ways. It can protect against various diseases brought on by bacteria or the poisons these microorganisms produce, protecting not just plants but also people and animals. It is because it has antibacterial qualities (Palombo, 2011).

It was also further explained by Liu (2004) that Phytochemicals are nutrient-rich bioactive plant compounds found in fruits, vegetables,

grains, and other plant-based foods that may have positive health effects beyond supplying the body with needed nourishment by lowering the risk of serious chronic diseases. Phytochemicals may one day be employed as chemopreventive agents (Alabi et al., 2011). Due to differences in chemical structure, Phytochemicals are divided into major groups. According to Bhattacharya (2011), Phytosterols, flavonoids, terpenoids, saponins, alkaloids, carotenoids, aromatic acids, organic acids, essential oils, and protease inhibitors are the main categories of phytochemicals.

The metabolites can act as a direct or indirect defense mechanism against infections or hazardous conditions since they possess qualities including antibacterial, anti-inflammatory, anthelmintic, anticarcinogenic, antigenotoxic, antiproliferative, antimutagenic, and antioxidative (Velu et al., 2018). However, despite its long history of use and effectiveness, there is a need for scientific research to determine the biological activities of medicinal plants, as people still question their safety.

2 RELATED LITERATURE

According to Williamson (2002), *E. hirta* belongs to the plant family Euphorbiaceae and genus Euphorbia. It is a slender- stemmed, annual hairy plant with many branches from the base to top, spreading up to 40cm height, reddish or purplish in color. Leaves are opposite, elliptic - oblong to oblong- lanceolate, acute or subacute, dark green above, pale beneath, 1- 2.5 cm long, blotched with purple in the middle, and toothed at the edge. The fruits are yellow, three- celled, hairy, keeled capsules, 1-2 mm in diameter, containing three brown, four-sided, angular, wrinkled seeds.

According to Enerva et al (2015), the Tawa-tawa leaf extract gave positive results for the tests for alkaloids and tannins. The leaf extract gave the λ max at 420 nm in the visible region. The GC-mass spectra identified eight compounds. The extract inhibited the growth of *P. aeruginosa, Staphyloccus aureus, Candida albicans* and *Trichopyton mentagrophytes* with activity index of 0.2, 0.3, 0.4 and 0.2 respectively. The extract was toxic at 36.7185 grams in water of 350 ml based on the t-test. There is a need to use different concentrations of the leaf extract for a further cytotoxicity test.

According to Alabi et al. (2011), phytochemicals may one day be employed as chemopreventive agents. Due to differences of chemical structure, phytochemicals are divided into major groups. According to Bhattacharya, phytosterols, flavonoids, terpenoids, saponins, alkaloids, carotenoids, aromatic acids, organic acids, essential oils, and protease inhibitors are the main categories of phytochemicals. The metabolites can act as a direct or indirect defense mechanism against infections or hazardous conditions since they possess qualities including antibacterial, anti-inflammatory, anthelmintic, anticarcinogenic, antigenotoxic, antiproliferative, antimutagenic, and antioxidative (Velu et.al, 2018).

2.1 Flavonoids

According to Huang et al. (2012), one type of the important constituents of *Euphorbia hirta* is flavonoids including quercetin, quercitrin, quercitol, and derivatives containing rhamnose, quercetin-rhamoside, a chlorophenolic acid, rutin, leucocyandin, leucocyanidol, myricitrin, cyanide 3,5-diglucoside, pelargonium 3,5-diglucoside, and, camphol. The flavonol glycoside xanthorhamin was also isolated for *E. hirta*. The stems contain the hydrocarbon hentriacontane and myricyl alcohol. The latex contains inositol, taraxerol, friedelin, β-sitosterol, ellagic acid, kaempferol, quercitol and quercitrin.

According to the study of Tiwari and Husain (2017), found that flavonoids are such phytochemicals that play significant role in enhancing the human health benefits. They are good sources of natural antioxidants in human diets. Flavonoids neutralize the harmful effects of free radicals in best of ways, and thus help in prevention of diseases. Flavonoids, occurring virtually, in all plant parts, particularly photosynthesizing plants cells are a major coloring component of flowering plants. Flavonoids have extensive biological A large number of studies showed that, flavonoids have a wide range of biological activities such as free radical scavenging, antioxidant, anti -inflammation, anticancer, bactericidal, regulating immunity, antivirus, (Huiduan and Jianzhong, 2016, 2017), antimutation, antitumor, Protecting liver, and antiallergic and anti-diabetes (Agrawal, 2011).

2.2 Terpenoids

According to Huang et al. (2012), another type of constituents of the aerial parts of *E. hirta* are terpenoids, including triterpenes: α-amyrin, β-amyrin, friedelin, taraxerol, and its esterst: Taraxerone, 11α, 12α-oxidotaraxerol, cycloartenol, 24-methylene-cycloartenol, and euphorbol hexacosoate. The aerial parts and roots of *E. hirta* also contain diterpene esters of the phorbol type and ingenol type, including 12-deoxyphorbol-13-dodecanoate-20-acetate, 12-deoxyp horbol-13-phenylacetate-20-acetate, ingenol triacetate, as well as the highly toxic tinyatoxin, a resiniferonol derivative. Some new ent-kaurane diterpenoid were isolated from the ethanol extract of *E. hirta* and identified as 2-beta, 16-alpha,19-trihydroxy-ent-kaurane, 2-beta,16- alpha-dihydroxy-ent-kaurane, and 16-alpha,19-dihydroxy-ent-kaurane (Yan et al., 2011). The other terpenoids isolated are sterols, including β-sitosterol, campesterol, cholesterol, and stigmasterol (Hazimi et al., 2008; Baslas and Agarwal, 1980).

According to Yang, W. et al., (2020), terpenoids, the most abundant compounds in natural products, are a set of important secondary metabolites in plants with diverse structures. Terpenoids play key roles in plant growth and development, response to the environment, and physiological processes. As raw materials, terpenoids were also widely used in pharmaceuticals, food, and cosmetics industries. Terpenoids possess anti-tumor, anti-inflammatory, antibacterial, antiviral, antimalarial effects, promote transdermal absorption, prevent and treat cardiovascular diseases, and have hypoglycemic activities. In addition, previous studies have also found that terpenoids have many potential applications, such as insect resistance, immunoregulation, antioxidation, antiaging, and neuroprotection. Terpenoids have a complex structure with diverse effects and different mechanisms of action.

2.3 Tannins

According to Huang et al. (2012), tannins isolated from *E. hirta* include the dimeric hydrolysable dehydroellagitannins euphorbins A, B, C, E, and terchebin, the monomeric hydrolysable tannins geraniin, 2,4,6-tri-O-galloyl-β-D-glucose and 1,2,3,4,6- penta-O-galloyl-β-D-glucose and the esters 5-O-caffeoylquinic acid (neochlorogenic acid), and 3,4-di-O-galloylquinic acid, and benzyl gallate. Acids isolated from *E. hirta* include ellagic, gallic, tannic, maleic and tartaric acids.

Tannins are plant secondary metabolites usually considered as natural non-nutrients. Moreover, some of the phytochemicals normally found associated to tannins, including alkaloids and phenolic compounds occur as toxins. Among the antinutritional and toxic effects described for tannins, decreases in food intake, growth rate, feed efficiency, net metabolizable energy, and protein digestibility are the ones mainly investigated. Other deleterious effects of tannins include damages to mucosal lining of gastrointestinal tract, alteration of excretion of certain cations, and increased excretion of proteins and essential amino acids (Chung et al., 1998). Negative effects of foods rich in plant secondary metabolites can be also by reducing food intake, associated to decreases in food organoleptic quality. Many low molecular weight plant secondary compounds are bitter and high molecular weight ones, such as tannins, are usually involved in the interaction with macromolecules, particularly with salivary proteins, resulting as astringent (Hagerman, 1992).

2.4 Alkaloids

According to Huang et al. (2012), the other compounds found in *E. hirta* are alkaloids, saponins, amino acid and mineral. The mineral content of a sample of the dried leaves was: Ca 1.1%, P 0.3%, Fe 0.03%, Mg 0.5%, Mn 0.01%, Zn 0.01%, and Cu 0.002%. Fresh leaves from *E. hirta* plants of Nigerian origin were found to contain high levels of Mn (189 ppm), Cu (30.5 ppm), Zn (152 ppm), and NO3 (4600 ppm). Varying proportions of Fe, Mg, K, Ca, and Na were also found. More recently, two novel butanol rhamnopyranosides (1 and 2), have been isolated from various non-polar and polar extracts of an Indian traditional herb, *E. hirta*. The structures of the new compounds were elucidated as n-butyl-1-O--L-rhamnop-yranoside (1) and n-butyl-1-O--L-rhamnopyranoside (Mallavadhani and Narasimhan, 2009).

According to Sibi et al. (2014), alkaloids have a wide distribution in the plant kingdom and mainly exist in higher plants, such as those belonging to the family Ranunculaceae, Leguminosae, Papaveraceae, Menispermaceae and Loganiacea. Approximately 60% of the drugs from plants are alkaloids. Lu et al. (2012) asserted that, alkaloids exhibit significance biological activities, examples are the relieving action of ephedrine for asthma, the analgesic action of morphine, the anticancer effects of vinblastine (Lu et al., 2012; Vaghora and Shukla, 2016). Quinine has been used in the treatment of malaria atropine serves as a vasodilator, berberine is used in the treatment of diarrhea, diabetes and others (Lu et al., 2012). Other important alkaloids include evodiamine, piperine, sanguinarine, matrine, tetrandrine, caffeine, codeine, tubocurarine, sanguinafine, cocaine, ajmaline, scopolamine, atropine, hyoscamine (Welegergs et al., 2015), nicotine, ergotamine.

3 METHODOLOGY

3.1 Research Design and Locale of the Study

The researchers employed experimental research, which relies on the scientific method to modify and control other factors which may affect the result of the study. The experiment was conducted in a lab environment. Phytochemical properties were determined under soil and climatic conditions of the two municipalities and one City of Lanao del Sur.

3.2 Data Analysis

3.2.1. Phytochemical Properties

The phytochemical analysis of *E. hirta* demonstrated the presence of alkaloids, carbohydrates, steroids, saponins, tannins, polyphenols, and flavonoids.

3.2.1.1 Phytochemical Screening

The concentrated extract of selected plant was subjected to different chemical tests for the detection of different phytoconstituents using standard methods.

3.2.1.1.1 Detection of Alkaloids

200 mL of 10% CH3COOH in ethanol (C2H5OH) and 5 ml of the extract will be formed in a beaker. Filtering the mixture will allow the extract to concentrate in a water bath until it is one-fourth of its original volume. NH4OH concentrate must be added. Formation of the white precipitate or turbidity will indicate the presence of alkaloids (Trease and Evans, 1983).

3.2.1.1.2 Detection of Carbohydrates

A few drops of Benedict's reagent will be added to 1 ml of the sample solution and shall be heated for 2 minutes. A colorful precipitate's appearance denotes the presence of carbohydrates.

3.2.1.1.3 Detection of Steroids

The crude extract of selected plant will be dissolved in 0.5mL dichloromethane to prepare a dilute solution and then 0.5 mL of acetic anhydride shall be added followed by four drops of concentrated sulphuric acid. A blue-green colouration will indicate the presence of steroids.

3.2.1.1.4 Detection of Saponins

Crude extract when mixed with 5ml distilled water in a test tube then it will be shaken briskly. The formation of stable foam which will indicate the presence of saponins

3.2.1.1.5 Detection of tannins

In a test tube, 10 mL of distilled water should be mixed with an aliquot of the sample plants' 0.5 mL extract before being filtered. To the filtered sample, two mL of 5% ferric chloride (FeCl) will be added. Tannins are present when brownish green or black coloring is present.

3.2.1.1.6 Detection of phenols

A 1mL solution of 1% ferric chloride will be added after 0.03g of crude ethanolic extract has been weighed. The presence of phenols is indicated by the appearance of blue or green color.

3.2.1.1.7 Detection of flavonoids

In a test tube containing 5 mL of plant extract, 1% ammonia (NH_3) solution will be added sparingly. Flavonoids are present if the color is yellow.

3 RESULTS AND DISCUSSIONS

Table 1
Replication 1
Phytochemical Analysis of Tawa-tawa (*Euphorbia hirta* L.)

	Treatments	Phytochemical Components					
		Alkaloids	Flavonoids	Phyosterols	Tannins	Phenolics	R. Sugar
T_1	*Euphorbia hirta* L. Under Soil and Climatic Condition of Marawi City	+	+	+	+	+	-
T_2	*Euphorbia hirta* L. Under Soil and Climatic Condition of Ganassi	+	+	+	+	+	-
T_3	*Euphorbia hirta* L. Under Soil and Climatic Condition of Masiu	+	+	+	+	+	-

Legends: Absent (-) Present (+) Toxic (++)

Table 2
Replication 2
Phytochemical Analysis of Tawa-tawa (*Euphorbia hirta* L.)

	Treatments	Phytochemical Components					
		Alkaloids	Flavonoids	Phyosterols	Tannins	Phenolics	R. Sugar
T_1	*Euphorbia hirta* L. Under Soil and Climatic Condition of Marawi City	+	+	+	+	+	-
T_2	*Euphorbia hirta* L. Under Soil and Climatic Condition of Ganassi	+	+	+	+	+	-
T_3	*Euphorbia hirta* L. Under Soil and Climatic	+	+	+	+	+	-

	Condition of Masiu						

Legends: Absent (-) Present (+) Toxic (++)

Table 3
Replication 3
Phytochemical Analysis of Tawa-tawa (*Euphorbia hirta* L.)

	Treatments	Phytochemical Components					
		Alkaloids	**Flavonoids**	**Phyosterols**	**Tannins**	**Phenolics**	**R. Sugar**
T_1	*Euphorbia hirta* L. Under Soil and Climatic Condition of Marawi City	+	+	+	+	+	-
T_2	*Euphorbia hirta* L. Under Soil and Climatic Condition of Ganassi	+	+	+	+	+	-
T_3	*Euphorbia hirta* L. Under Soil and Climatic Condition of Masiu	+	+	+	+	+	-

Legends: Absent (-) Present (+) Toxic (++)

The analysis of phytochemical properties in Tawa-Tawa (*Euphorbia hirta* L.) resulted in positive (+) in alkaloids, flavonoids, tannins, phytosterols, and phenolics. However, reducing sugar resulted in negative (-). According to the study of Tiwari and Husain (2017), they found out that flavonoids are phytochemicals that play a significant role in enhancing human health benefits. They are good sources of natural antioxidants in human diets. It neutralizes the harmful effects of free radicals in the best ways and thus helps in the prevention of diseases.

While alkaloids, Lu et al. (2012) asserted that it exhibits significance in biological activities. Examples are the relieving action of ephedrine for asthma, the analgesic action of morphine, and the anticancer effects of vinblastine (Lu et al., 2012; Vaghora and Shukla, 2016). Phenolic content can reduce the risk of heart disease by slowing the progression of atherosclerosis since they act as an antioxidant (Kapoor, 2002). Phytosterols are relevant in pharmaceuticals (production of therapeutic steroids), nutrition (anti-cholesterol additives in functional foods, and anti-cancer properties), and cosmetics (creams and lipstick) (Fernandes 2006). Furthermore, Ghosh et al. (2019) reported that various parts of the plants are reported to possess anti-microbial, anti-diabetic, anti-cancer, anti-tumor, anti-plasmodial, anti-fertility, wound healing, anti-inflammatory, sedative, and diuretic properties. Thus, the presence of phytochemicals appeared that it is safe and may cure various diseases.

4 CONCLUSION

Euphorbia hirta L. revealed a positive (+) result in alkaloids, flavonoids, phytosterols, tannins, and phenolics. However, it shows a negative (-) result in r. sugar which means that it contains chemical components that are safe for human consumption and medication.

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