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Total phenolic contents of selected indigenous fruit trees in Apayao

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Key words: Phenolic content, Indigenous tree species, Apayao

Abstract

This study was conducted to determine the morphological characteristics, identity and total phenolic contents of three indigenous fruit trees in Apayao namely Namot, Bignai kalabaw and Lubeg. These lesser known trees were abundant in the region but were underutilized as very little information were available for its maximization. Results of the study showed that the Namot is the richest source of phenolics. Among the four (4) plant extracts, Namot leaves extracts showed the highest total phenolic contents at 1.06mg/g of the Gallic acid equivalent (GAE). The lowest phenolic contents were noticed in Bignai kalabaw (*Antidesma bunius* (L.) Spreng leaves at 0.71mg/g of the Gallic acid equivalent (GAE). The total phenolic contents of the extracts of lubeg fruits were found to be lower than the leaves at 0.99 and 1.05mg/g of the Gallic acid equivalent (GAE), respectively. Lubegbelongs to Family Myrtaceae under Phylum Magnoliophyta. The chemical composition of Lubeg leaves was high in steroids, tannins, and coumarins while its fruits were highly positive in quinones and flavonoids. It has anti-oxidant property, and anti-inflammatory. Phenolics are the largest group of phytochemicals that account for most of the antioxidant activity in plants or plant products. The total phenolic content will be helpful for developing new drugs and standardizing the drug. Gallic acid may occur in plants in soluble form either as quinic acid esters (5) or hydrolyzable tannins. The most important biological activity of phenolic compounds is probably their many observed inhibitory effects on mutagenesis and carcinogenesis.

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Introduction

The use of plants for varied purposes is undeniable. Today, many are using plants for health and wellness. As such, there is a growing interest to tap plants as sources of food supplements, medicines, dyes and many more. Molecules are unique to plants or a group of plants. These metabolites are used as food, flavors, color, dyes, and as raw materials for industrial products Plants are rich in a wide variety of secondary metabolites, such as terpenoids, alkaloids, phenols, flavonoids and tannins.

The presence of these metabolites is responsible for plant pigment and coloration. This group of compounds has received a great deal of attention in today's recent years (Cowan, 1999). A revisit on the use of plant-derived commodities coming from nature is encouraged nowadays. With the recognition and promotion of plants, with modern use of standardized extraction and chemical analysis, it is now possible to identify and characterize the active ingredient of plants like phenolic contents.

Phenolic compounds act as essential metabolites for plant growth and reproduction, and as protecting agents against pathogens. In addition, they are related to the sensorial properties of food of vegetal origin, mainly regarding color (Mujica & Soto, 2009). A. Aberoumand & Deokule (2008) cited that these compounds one of the most widely occurring groups of phytochemicals are of considerable physiological and morphological importance in plants. Phenolic compounds exhibit a wide range of physiological properties, such as anti-allergenic, antiatherogenic, anti-inflammatory, anti-microbial, antioxidant, anti-thrombotic, cardioprotective and vasodilatory effects.

The Province of Apayao in Northern Cordillera is rich with various natural resources such as forest resources and agricultural resources, water resources, mineral resources and etc. With these rich resources, needs for food, shelter, medicines and the like come from the environment. The forests include various species of flora like trees, food plants, medicinal plants, veterinary plants, ornamental plants and etc. These trees have developmental potentials if the biochemical ingredients will be discovered. Plants contain primary metabolites essential to the life of the plants like sugars, amino acids and nucleotides and secondary metabolites used as food, flavors, color, dyes, poisons, perfumes, aromatherapy, industrial products such as rubber, oils and prescription drugs, which contain at least one chemical originally identified and extracted from a plant (Cowan, 1999). The bioactive phytochemicals like total phenolic contents of these three indigenous fruit trees in Apayao namely namot, bignai kalabaw and lubeg,once analyzed can enhance their potential commercial values and utilization for better biodiversity conservation. This study was conducted to determine the morphological characteristics and identity of the three indigenous fruit trees in Apayao namely namot, bignai kalabaw and lubeg; and to determine the total phenolic contents of three indigenous fruit trees in Apayao.

Materials and methods

Research Design

The study used the descriptive- survey and laboratory analysis.

Collection of Plants

Plant specimens and representatives of the three indigenous fruit trees in Apayao were collected. (Lubeg, Namot and Bignai Kalabaw)

Taxonomic Identification of the Specimen

a. Initial Identification of Specimens. The initial identification of the specimens was conducted by the researchers themselves using literatures and keys of plants.

b. Verification and Confirmation of the Taxonomy of the Plants. The researchers sought assistance and the expertise of Biologists from Museum of Natural History UP-Los Baños on the verification and confirmation of the taxonomy of the trees.

Total Phenolic Content Analysis of Plant Samples

Healthy plant parts were collected and used for extraction.

The collected plant parts were washed with running water, air dried, and sorted separately. The plants collected included Lubeg fruits, Lubeg leaves, Namot Leaves and Bignai kalabaw leaves.

Determination of the Total Phenolic Contents

The determination of the total phenolic contents was done at UST-Research Center for the Natural and Applied Sciences. Total phenolic content was done based on the modified Folin-Ciocalteau reaction by Singleton *et al*., (1999) with some modification from Gajula *et al*. (2009). Increasing concentration (31.25-2000ug/ml) of gallic acid was used as standards and aliquots of the extracts were treated with Folin-Ciocalteau reagent and Na2CO3. The mixtures were allowed to stand at room temperature for 90 minutes and the absorbance were measured at 750 nm using Corona SH-1000 lab microplate reader. The total phenolic content of the sample was measured against the gallic standard calibration and the results were expressed as milligram gallic acid equivalents per gram dry weight of sample (mg/GAE/g extract).

Results and discussion

Morphological Characterization and Identification of the three indigenous fruit trees in Apayao

NAMOT (Microcos stylocarpa Burret)

Due to absence of proper nomenclature identity of the Namut tree, a sample specimens were brought to Museum of Natural History at University of Philippines, Los Bańos, Laguna. After thorough identification, it was found out that Namut tree is scientifically known a *Microcos stylocarpa* Burret under the family MALVACEAE. Namut tree usually reaches a height of 10-15 meters and usually considered as small tomedium tree.

Fig. 1. Photo of Mature Namut Trees.

Namot Leaves

The leaves are simple attached to the stem, generally elliptic-oblong-lanceolate, papery, glabrous, and shining on the upper side with an average size of 5-20cm. The leaf arrangement is pinnately alternate. The leaf apex is acuminate, the leaf base is obtuse, leaf margin is entire and leaf venation is arcuate. The petiole is about 1cm long, with prominent midrib and obscure veins.

Fig. 2. Photo of the Namut leaves.

Namot Flower

The flower is usually zygomorphic, very small indehiscence racemose, or paniculate, axillary and terminal, yellowish in color. The fruits are indehiscent or drupaceous; the color of the Fruit is from green turning to yellow when ripe, seeds are fleshy and fibrous. The phenology of the species starts from the month of March up to the month of May.

Fig. 3. Photo of Namut Flower.

Namot Bark

The bark is light green, slightly smooth to rough, the inner bark in reddish color and the wood or cambium is yellowish color. In terms of thickness, the bark is about 0.5cm to 1.0cm thick from its cambium.

Fig. 4. The Outer Bark of Namot.

Fig. 5. The Inner Bark.

Bignay Kalabaw (Antidesma bunuis)

Bignay Kalabaw or *Antidesma bunuis*is a small tropical bushy tree that is usually 3 - 6 m tall but can reach 15 -30 m high. It is also known as Chinese laurel, currant tree, and buni. It is a dioecious plant. In Asia, the dark green, long, narrow, and shiny leaves are commonly used for treating snakebites. The leaves and roots are used for traumatic injury. Bignay fruit is edible, usually eaten raw or cooked and used in jam, jellies and preserves.

It is round in shape, small, juicy and has a sweet taste. Young leaves are also edible and commonly eaten raw in salads or steamed as a side dish. The bark produces strong fiber for rope and cordage. The hard, reddish timber is used for making cardboards. The bark contains a toxic alkaloid. Bignay is also used as an ornamental tree.

Fig. 6. The reproductive parts and leaves of bignaikalabaw.

Lubeg (Syzygium lineatum (DC.) Merr. & L.M. Perry

Lubeg is under Family Myrtaceaeit reaches a height from 4-5 meters upon maturity. The Leaf is simple attached to the stem oppositely arranged, alternate, and simple. The stipule are small and deciduous, frequently with an intra-marginal nerve leaves elliptical to elliptical-lanceolate, 5-12cm x 2-5cm, with numerous and close set secondary veins fairly distinct below. The margin is usually entire, the base is wide and obtuse, the apex is acuminate and with a 1-1.5cm cuspidate.

Fig. 7. Matured Lubeg.

Fig. 8. Photo showing the leaf.

Lubeg Bark

The bark is flaky and corky; it has a cracking with scaly grayish brown bark that is rough and fissured. The inner part of the bark is turning Reddish brown.

Fig. 9. Photo showing the outer part of the bark.

Lubeg Flower

The flower is usually regular, perfect solitary or in axillary spikes, it is multiple with pair of bracts from the base, the colour of the flower is white, calyx superior or perigynous, towards the base the anthers are small with rounded ovary, it is inferior or nearly so; crowned by fleshy disks; ovules are numerous; with simple style. Flowers have an inferior regular ovary.

Fig. 10. Photo showing the flower of Lubeg tree.

Lubeg Fruits

Fruits are berry with thick and fleshy, spongy pulp rind, oblong to ovoid in shape, it has an average diameter of 13mm. the color of the fruit is green when it is young and turns red to violet as it ripens. The phenology of the species starts from the month of July up to the month of September. The fruit is highly perishable and only lasts for about two (2) weeks when ripe.

Fig. 11. Photo showing the fruits of Lubeg tree.

Total Phenolic Content

The results showed that the Namot, is the richest source of phenolics. As reflected from the table, among the four (4) plant extracts, Namot leaves

extracts showed the highest total phenolic contents at 1.06mg/g of the Gallic acid equivalent (GAE). The lowest phenolic contents were noticed in Bignai kalabaw (*Antidesma bunius* (L.) Spreng leaves at 0.71mg/g of the Gallic acid equivalent (GAE). The plant belongs to Family Euphorbiaceaea.

The total phenolic contents of the extracts of lubeg fruit were found to be lower than the leaves at 0.99 and 1.05mg/g of the Gallic acid equivalent (GAE), respectively. Lubeg belongs to Family Myrtaceae under Phylum Magnoliophyta. The chemical composition of Lubeg leaves was high in steroids, tannins, and coumarins while its fruits were highly positive in quinones and flavonoids. It has anti-oxidant property, and anti-inflammatory. It can lower cholesterol level and reduce risks of heart disease (Columna, 2019).

Biju *et al.* (2014) cited that phenolics possess a wide spectrum of biochemical activities such as antioxidant, antimutagenic, and carcinogenic. Phenolics are the larget group of phytochemicals that account for most of the antioxidant activity in plants or plant products. The total phenolic content will be helpful for developing new drugs and standardizing the drug. The presence of a high total phenolic content shows that plant possess antioxidant properties (Nazish Siddiqui *et. al.* (2016).

Gallic acid may occur in plants in soluble form either as quinic acid esters (5) or hydrolyzable tannins. The most important biological activity of phenolic compounds is probably their many observed inhibitory effects on mutagenesis and carcinogenesis.

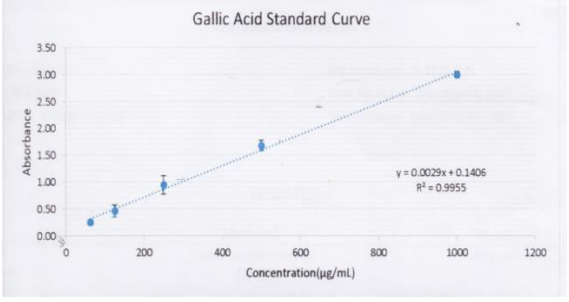

Fig. 1. Gallic Acid Standard Calibration Curve (Gallic Acid).

Table 1 presents the result of the total phenolic contents of selected plant parts.

Table 1. Total phenolic content of the three selected plants.

Name of Plant	Total Phenolic Content (mg GAE/g extract)
1. Lubeg fruit	0.99+/- 0.06
2. Lubeg Leaves	1.05+/-.01
3. Namot leaves	1.06+/-.00
4. Bignaikalabaw leaves	0.71=/-.03

Review of Literature

Hossain and Shas (2015), cited that the plant kingdom is a good source to produce a wide range of natural antioxidants. However, still there is not enough knowledge and data about the practical usefulness of most of them. Groups of secondary plant metabolites, antioxidant phenolics, and flavonoids are commonly found in various fruits, vegetables and herbs and they have been shown to provide a fruitful defense against oxidative stress from oxidizing agents and free radicals.

Abootalebian *et al.* (2016) investigated total phenolic and antioxidant activity of five Iranian mint accessions from two different species, *Mentha spicata* L. The content of total phenolics (mg tannic acidequivalent per g dry weight of the sample) differed from 50.1 in Mzin3 to 67.2 in Mzin6. The highest percent radical scavenging activity was observed with Mzin6 at all concentrations studied (50, 100, 250, and 500 ppm). Peroxide value of sunflower oil containing Mzin5 and Mzin6 was the lowest among the mint accessions and almost equivalent to that of butylated hydroxytoluene at 200 ppm concentration. In overall, *M. longifolia* was superior to *M. spicata*, as determined by two model systems, indicating its potential use as a natural source of dietary antioxidant.

Conclusion

The current study revealed that phenolic spectrum of medicinally important plants. The three selected plants indicated positive results of phenolics. The namot (*Microcos stylocarpa*), bignai kalabaw Bignai kalabaw (*Antidesma bunius* (L.) Spreng),

Lubeg (*Syzygium lineatum)* can be regarded as promising plant species for natural plant sources of antioxidants for future drug preparation.

Recommendation

Biochemical and toxicity tests should be conducted on these plants. Further studies are needed for the isolation and identification of individual phenolic compounds for deeper understanding of the antioxidant properties of the plants.

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