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Survey and Characterization of Edible Fruit and Ethnomedicinal Trees in the Forest Landscape of Apayao Province

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ABSTRACT

This study was conducted in the six municipalities of Apayao Province, namely, Luna, Pudtol, Flora, Conner, Kabugao, and Calanasan. This aimed to survey and characterize the edible fruit and ethnomedicinal trees in the forest landscape of Apayao province. It determined the geographical location, morphological characteristics, ecological status, DNA sequencing, phytochemical contents, uses, and threats of the edible and ethnomedicinal trees in the forests of Apayao. The methods used were qualitative and quantitative research. Fifteen (15) edible and 10 ethnomedicinal trees were surveyed with sixteen (16) families were identified. Out of 25 edible and ethnomedicinal trees, the conservation status is endangered, threatened, rare, vulnerable, and least concerned. Out of 25 edible and ethnomedicinal fruit trees, most are with identity results that range from 93 to 100% identity. Flavonoids, tannins, and sapotin compounds are mostly present in edible and ethnomedicinal trees. The community members are using 15 different ethnomedicinal trees to address 32 health-related conditions. The results of the phytochemical analyses provide support evidence to support the traditional uses of ethnomedicinal trees. All surveyed trees are susceptible to pests, diseases, and destruction brought by natural phenomena such as the effect of climate change. A policy recommendation for the conservation and protection of edible and ethnomedicinal trees is then proposed.

INTRODUCTION

Apayao province, as the last frontier of the watershed in the north, lies in the northernmost part of Luzon mainland. It is landlocked by the province of Cagayan in the northeast, bounded on the northwest by Ilocos Norte and Abra, and on the south by Kalinga province. The elevation of Apayao ranges from 70 to 1,644 meters above sea level, whereas Mount Sulo, the highest registered mountain peak in Apayao, lies at an elevation of 1,503 masl. Low elevations are mostly found in Lower Apayao, particularly in Luna and Sta. Marcela. The province is composed of seven municipalities and 134 barangays. These are geographically subdivided into two separate regions: Upper Apayao, which is composed of the upland municipalities of Calanasan, Conner, and Kabugao, while Lower Apayao is composed of the lowland municipalities of Flora, Luna, Pudtol, and Sta Marcela. Of the six (6) provinces in the Cordillera Administrative, Apayao has the lowest population but has the widest land area of 5,113 sq. km, which is about one-fourth of the region's total land area. The municipality of Kabugao remains the capital town provided under RA 7878. However, the municipality of Luna acts as the newly designated provincial

government center (Apayao Tourism Development Plan 2014-2019).

The province's water resources account for 24 rivers, draining 75% of its area. The Apayao river is the longest stretching a distance of 181 kilometers, traversing through all of the province's municipalities except Conner. It has 18 tributaries and is presently used for irrigation, power generation, and communal fishing ground. Other important rivers in the province include the Matalag River in Conner, Maton and Nagan Rivers in Pudtol, and the Zumigui-Ziwanan River in Calanasan.

The forest landscape of the province is home to many flora and fauna. Vegetation compositions are largely grouped into two, namely timber and non-timber resources. Timber resources are predominantly of Dipterocarp species such as red lauan (*Shorea negrosensis*), mayapis (*Shorea palosapis*), tanguile (*Shorea polysperma*), yakal (*Hopea acuminata*), guijo (*Shorea guiso*) and many other premium species which are considered endangered. The diversity of non-timber resources that are observed in the province are palms, herbs, vines, ferns, orchids, bamboo, and others.

As one of the provinces that still possesses rich floral resources, there might be species in its forests that still need to be discovered to science or some of these species may already have been described but with insufficient data. There is also the big possibility of the presence of other species that were not recorded, and some of these may have already become extinct over the years. The floral species thriving in the forest landscape of the province have specific human use and important roles in the natural ecosystem. The diverseness of the floral composition of the forest landscape of the province is exposed to threats such as conversion of land use, habitat loss, degradation, invasive species, and anthropogenic climate change. These threats may contribute to the loss of biodiversity in the province. Conservation of edible fruit trees and ethnomedicinal important tree species in the province requires initial basic steps that should be given attention and importance such as survey and characterization in terms of their morphological and chemical attributes. With this basic information, approaches in conservation could be determined whether through propagation with the use of seeds or asexual in nature. In addition, this project may contribute to floral species that may need genetic conservation.

This study will have a demonstrable contribution to the significant advances in understanding the methods, theory, and application in the identification, collection, characterization, storage, and DNA barcoding of floral species. Also, knowing the ecological status will be the basis for developing protocols in ex-situ conservation, thus contributing to biodiversity conservation and protection to sustain ecological services for the present and future generations. Hence, this study.

Objectives/Statement of the Problem

General objective: To study the morphological and chemical characteristics and document the edible fruit and ethnomedicinal trees as the basis for conservation in terms of propagation and policy recommendations.

Specifically, this study aimed to:

- a. Survey and map using GIS as a tool of the edible and ethnomedicinal trees in the Apayao forest landscape,
- b. Characterize morphologically of the edible fruit and ethnomedicinal trees.
 - b.1. Determine the conservation status of identified species
 - b.2. Conduct DNA barcoding of edible fruit and ethnomedicinal trees,
- c. Conduct Phytochemical Analysis of edible and ethnomedicinal trees.
 - c.1. Determine the uses and preparation of the ethnomedicinal trees.
 - c.2. Assess the utilization of native fruit and ethnomedicinal trees vis a vis the result of phytochemical analyses

MATERIALS AND METHODS

Location

This research paper was conducted in the forest landscape of Apayao province, particularly in the municipalities of



Fig. 1: Map of Apayao.



Pudtol Luna, Flora, Kabugao, Conner, and Calanasan (Fig. 1).

Data Gathering Procedure and Sources

Survey of Edible Fruit and Ethnomedicinal Trees in the Apayao Forest Landscape

The survey of edible fruit and ethnomedicinal trees in the forest landscape of the municipalities of Conner, Kabugao, Pudtol, Luna, Flora, and Calanasan was conducted through fieldwork and focus group discussions with the community. Before the field survey, a consent letter was given to the office of the Governor of the Apayao Province and cascaded to the different Mayors' offices and the selected barangays. The focus group discussion was conducted to identify the edible fruit and ethnomedicinal trees located in the locality. The coordinates of the edible and ethnomedicinal trees were recorded through the Global Positioning System (GPS) and used to generate maps. The overlay of the location of native fruit and ethnomedicinal trees was developed using Arc GIS 10.8.

Characterization of the Edible Fruit Trees and Ethnomedicinal Trees

Selected edible fruit trees and ethnomedicinal trees were characterized based on their morphological features, such as roots, leaves, stems, bark, flowers, and fruits. The faculty of the Forestry Department of ASC Luna Campus did morphological characterization.

Conservation Status of Edible Fruit and Ethnomedicinal Trees

The conservation status of the edible fruit and ethnomedicinal trees was determined through the data from the International Union for Conservation of Nature (IUCN) and validated by the data from the Department of Environment and Natural Resources (DENR) Administrative Order No. (DAO) 2007-01 and Administrative Order (DAO) 2007 s.11.

DNA Barcoding of Edible Fruit and Ethnomedicinal Trees

Collection of the identified specimens (leaves) was done at different Barangay of six (6) municipalities of Apayao: Luna (Barangay Marag, Dagupan, and San Gregorio), Pudtol (Barangay Lydia and Upper Maton), Flora (Barangay Balasi, San Jose, and Tamalunog), Kabugao (Barangay Badduat, Cabeyatan, and Poblacion), Conner (Calafug, Karikitan, Malama, and Mawegui), Calanasan (Barangay Lubong, Sabangan, and Eliazar). The specimens (leaves) were airdried for three (3) days and packed using Ziplock with silica gel to avoid the occurrence of moisture. The specimen was then sent to the Philippine Genome Center, University of Philippines, Los Ballos for DNA Barcoding. In DNA Barcoding, BLAST was used to initially identify each edible fruit based on the proportion of individuals assigned to the correct species, genus, or family and the percentage identity of each taxon identified. The primer used was maturase K (*matK*).

Phytochemical Analysis of Edible Fruit and Ethnomedicinal Trees

In the phytochemical analysis, 3-5 kilograms of leaves of each of the 44 edible fruit and ethnomedicinal trees were collected from identified locations. The collected leaves were chopped into small pieces, and approximately 100 g of chopped leaves were used for each specimen. They were then preserved in jars treated with sufficient 90% methyl alcohol to submerge the material completely. The material was soaked for 48 hours. After 48 hours, the soaked materials were extracted using a blender. The collected plant extract was then boiled for about 1 hour and 30 minutes to obtain the concentrated plant extract. After extraction, the leaf extract was stored at a cold temperature of about 0-5 °C and was transported to DOST Tuguegarao. DOST Tuguegarao used the Guevara et al. (2005) method to screen the chemical compounds found in the identified species.

Uses and Preparation of the Ethnomedicinal Trees

Focus group discussion was conducted in the selected municipalities with the communities that are active users of the identified ethnomedicinal trees. The parts of plant use and mode of preparation were then demonstrated to the researchers.

Data Analysis

Data analysis was done through quantitative and qualitative analysis. Quantitative research was used to generate maps and perform DNA Barcoding. A qualitative method was used for morphological and phytochemical characterization and description of uses and threats.

RESULTS AND DISCUSSION

Surveyed Edible Fruit and Ethnomedicinal Trees

The actual identification of the location and local names or vernacular names of edible fruit and ethnomedicinal trees was conducted through field walks with the assistance of the local communities. Table 1 presents the surveyed edible fruit and ethnomedicinal trees. Fifteen (15) edible fruit trees and ten (10) ethnomedicinal trees were surveyed. The Municipality of Calanasan had nine (9) species identified, and the Municipality of Luna had eight (8) species identified. Four (4) species were found in the municipality of Conner, two (2) in the municipality of Flora, and one (1) each in the municipalities of Kabugao and Pudtol.

In addition, six (6) maps were generated using Arc GIS 10.8. The map shows the location of the 15 identified edible fruit trees and 10 ethnomedicinal trees in the respective barangays of Municipality Luna, Pudtol, Flora, Kabugao, Conner, and Calanasan. Fig. 2-7 presents the location of trees under study.

Thus, ethnomedicinal and edible fruit trees exist throughout the municipalities of Apayao. Understanding the locations of the Apayao forest's edible fruit and ethnomedicinal trees is crucial for conservation and preservation initiatives. According to Franklin & Miller (2009), mapping tree species is a crucial activity that yields the data required for sustainable forest management. Data on the distribution of tree species is also a valuable source of information for a range of applications, including habitat characterization and susceptibility to insect infestation or range expansion.

Morphological Characteristics of Edible Fruit and **Ethnomedicinal Trees**

The fifteen (15) surveyed edible fruit trees and ten (10) ethnomedicinal trees were characterized based on their

Table 1: List of surveyed edible fruit and ethnomedicinal trees.

Local Name	Common Name	Scientific Name	Family Name	Location
Native Fruit Trees				
Ada	Lipote	Syzygium polycephaloides (C.B.Rob.) Merr.	Myrtaceae	Sabangan, Calanasan, Apayao
Baluko	Binukau	Garcinia binucao (Blanco) Choisy	Clusiaceae	San Gregorio, Luna, Apayao
Chesa	Tiesa	Pouteria rivicoa (Gaertn.f.) Ducke	Sapotaceae	Mawegui, Conner, Apayao
Gratis	Balimbing	Averrhoa carambola Linn	Oxalidaceae	Marag Valley, Luna, Apayao
Kamagong	Mabolo	Diplodiscus blancoi A.DC	Ebenaceae	Calafug, Conner, Apayao
Kandulce	Black musk heart	Alangium polyosmoides (F.Muell.) W.J.de Wilde & Duuyfjes)	Cornaceae	San Gregorio, Luna, Apayao
Kuribeng/Kusibeng	Katap	Trigostemon philippinesis Stapf.	Euphorbiaceae	Dagupan, Luna, Apayao
Malubeg	Lubeg	Syzygium lineatum (Roxb.) Merr. & Perry	Myrtaceae	Malama, Conner, Apayao
Makopa	Makopa	Syzygium samarangense (Blume) Merr. & Perry	Myrtaceae	Karikitan, Conner, Apayao
Maladalaga	Bitok	Ochrocarpos ramiflorus Merr.	Guttiferae	Eleazar, Calanasan, Apayao
Malatibig	Pakiling	Ficus odorata (Blanco) Merr.	Moraceae	Dagupan, Luna, Apayao
Miscellanous	Balakat-gubat	Balakata luzonica (Vidal) Esser	Euphorbiaceae	Lubong, Calanasan, Apayao
Matabual	Korthal gisihan	Aglaia korthalsii Miq.	Meliaceae	Eleazar, Calanasan, Apayao
Namut	Amuyong	Gonothalamus amuyon (Blanco) Merr.	Annonaceae	San Gregorio, Luna, Apayao
Umila	Subiang	Bridelia insulana Hance	Euphorbiaceae	Lubong, Calanasan, Apayao
Ethnomedicinal Trees	;			
Addil	Matang-hipon	Breynia vitis-idaea (Burm.f.) C.E.C. Fisch	Euphorbiaceae	Eleazar, Calanasan, Apayao
Aplas	Hauili	Ficus septica Burm.f.	Moraceae	San Jose, Flora, Apayao
Apatot	Noni	Morinda citrifolia L.	Rubiaceae	Tamalunog, Flora, Apayao
Arintudog	Horsebush	Dendrolobium umbellatum (L.) Benth.	Leguminosae	Badduat, Kabugao, Apayao
Bagbag	Rarang	Erythrina subumbrans (Hassk) Merr.	Fabaceae	Marag Valley, Luna, Apayao
Binuran	Tangisang- bayawak	Ficus variegata Blume	Moraceae	Eleazar, Calanasan, Apayao
Kakling	Lunas	Lunas amara Blanco var. amara	Rutaceae	Upper Maton, Pudtol, Apayao
Lumpanginay	Halimumog	Ehretia philippinensis A. DC.	Boraginaceae	Eleazar, Calanasan, Apayao
Lusit	Talisai-gubat	Terminalia foetidissima Griff.	Combretaceae	Eleazar, Calanasan, Apayao
Sablot	Bagna	Glochidion triandrum (Blanco) C.B.Rob.	Euphorbiaceae	Marag Valley, Luna, Apayao





Fig. 2: Map of the location of the identified species at the Municipality of



Fig. 3: Map of the location of the identified species at the Municipality of Pudtol.



Fig. 4: Map of the location of the identified species at the Municipality of Flora.



Fig. 5: Map of the location of the identified species at the Municipality of Conner.



Fig. 6: Map of the location of the identified species at the Municipality of Kabugao.



Fig. 7: Map of the location of the identified species at the Municipality of Calanasan.

morphological characteristics, such as leaves, fruit, flower, bark, seed, and size of the trees. Out of the twenty-five (25),



Fig. 8: Lipote [Local Name: Ada, Common Name: Lipote, Scientific Name: Syzygium polycephaloides (C.B.Rob.) Merr., Family Name: Myrtaceae, Location: Sabangan, Calanasan, Apayao, Description: Lipote is an evergreen fruit tree, small to medium-sized tree growing up to 15 meters tall. The bark is purplish gray. Leaves are alternate, oblong-lanceolate, or obovate. Flowers are white, numerous, and in panicles. Habitat: In primary forests at low and medium altitudes. Reported in Sulawesi and Lesser Sunda Island. Phenology: Flowering season is from June to July., Propagation: By seed, Timber Classification: Lesser Used, Conservation Status: Endangered (IUCN Red List of Threatened Species)]



Fig. 9: Binukau [Local Name: Baluko, Common Name: Binukau, Scientific Name: Garcinia binucao (Blanco) Choisy, Family Name: Clusiaceae, Location: San Gregorio, Luna, Apayao, Description: Binucao is a tree reaching a height of about 25 m and a diameter of 40 cm. Leaves are opposite, shiny, and smooth. The newly emerged leaves often exhibit a reddish color. It has a smooth bark. The color is black, spotted with white color. Fruits are green in color and can be eaten, somewhat rounded. Habitat: Binucao is common and widely distributed throughout Luzon and Visayan Island. They are found scattered and are second-story trees of primary lowland and secondary forests. Phenology: Flowering season is from February to September. Propagation: Through seed, Timber Classification: Lesser Used Species, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species)]



Fig. 10: Tiesa [Local Name: Chesa, Common Name: Tiesa, Scientific Name: Pouteria rivicoa (Gaertn.f.) Ducke, Family Name: Sapotaceae, Location: Mawegui, Conner, Apayao, Description: Tiesa is a slender, erect tree with a spreading form. The color of its bark is brown containing white gummy latex. Leaves are mostly grouped at branch tips, it is thin, glossy, and petiolate. Flowers are small clusters borne at leaf axils or leaflet nodes. Fruits are variable in shape, from nearly round to somewhat ovoid, oval, or spindle-shaped, with or without a pointed apex or curved break. Habitat: In the Philippines, Tiesa adapts well from sea level to medium altitudes in areas with a short to long rainy season. Phenology: Fruits are best harvested from August to January when the fruits are fully matured and ripened. In general, plant establishment to plant maturity takes about 1 to 3 years. Propagation: Propagation may be done through seeds with fifty-day germination or cleft grafting. Timber Classification: Lesser-used Species, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species]



Fig. 11: Balimbing [Local Name: Granatis, Common Name: Balimbing, Scientific Name: Averrhoa carambola Linn, Family Name: Oxalidaceae, Location: Marag Valley, Luna, Apayao, Description: It is a small tree growing to a height of 5 meters or less. Leaves are pinnate. The petals of its flower are purple to bright purple. Fruit is fleshy, green to greenish-yellow, sharp, and angular lobes. Habitat: In cultivated and semi-cultivated areas throughout the Philippines, Phenology: Carambola flowering seasons, which are generally from July to August, and fruiting seasons from October to January. Propagation: Commonly used when propagating starfruit trees, they are seed propagation, air layering and grafting. Timber Classification: Lesser used species, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species)]

ten (10) species were identified as large-sized trees, followed by the nine (9) species were identified as small while the six (6) species considered as small-sized trees. The morphological characteristics of these species are shown in Figs. 8-22 (Edible fruit) and Figs. 23-32 (Ethnomedicinal Trees).



Fig. 12: Mabolo [Local Name: Kamagong, Common Name: Mabolo, Scientific Name: Diplodiscus paniculatus Turez. Family Name: Ebenaceae, Location: Calafug, Conner, Apayao, Description: Mabolo is a straight tree up to 60 ft tall and above, which has a drooping branch. It has black bark. Leaves are alternate, oblong, and pointed at the apex. It is dark green in color, smooth and glossy on the upper surface, and silver hairy underneath. The fruits are brown, smooth, to somewhat circular. Habitat: In forests, at low and medium altitudes. Phenology: Flowering season: June to September, but occasional fruits may be found on the tree at almost any time of the year. Propagation: The tree is generally grown from seeds. Shield-budding has been successfully practiced in the Philippines and is the preferred means of perpetuating superior types. Timber Classification: Premium species, Conservation Status: Critically Endangered Species (DAO No.2007-01)]



Fig. 13: Blackmuskheart [Local Name: Kandulce, Common Name: Black Muskheart, Scientific Name: Alangium polyosmoides (F.Muell.) WJ de Wilde & Duuyfjes, Family Name: Cornaceae, Location: San Gregorio, Luna, Apayao, Description: A small to medium tree up to 20 meters in height. The bark is marked by lenticels, scales and corky bumps and irregularities, greyish in color. Leaves are alternate on the stem with a long point. The flowers are pale yellow in color from the leaf axis, while the fruit is green when not ripe and reddish when it is ripe. Habitat: Grows in coastal subtropical and dry rainforest. Phenology, The flowering seasons are from October to April. The fruit ripened from September to February. Propagation: Seed, Timber Classification: Lesser Used Species, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species)]

Conservation Status

Ten (10) edible fruit trees were classified as Least Concern, while two (2) species were classified as Critically Endangered. One per species was classified as Near



Fig. 14: Katap [Local Name: Kuribeng/Kusibeng, Common Name: Katap, Scientific Name, Trigostemon philippinesis Stapf. Family Name: Euphorbiaceae, Location: Dagupan, Luna, Apayao, Description: Katap is a medium-sized tree reaching up to 20 meters tall. The bark is brownish to greyish in color. Leaves are petiole terete, glabrous, or slightly pubescent. Fruits are green when unripe while reddish to dark purple when ripe. Habitat: Lowland evergreen to deciduous forests, sometimes on limestone hills, near rivers, growing on red to yellow calcareous soils to granite bedrocks. Phenology: Flowering and fruiting: all year round, Propagation: Seed and stem cutting, Timber Classification: Lesser Used Species, Conservation Status: Least Concern Species (IUCN Red List Threatened Species ver. 3.1. 2021)]



Fig. 15: Lubeg [Local Name: Malubeg, Common Name: Lubeg, Scientific Name: Syzygium lineatum (Roxb.) Merr. & Perry, Family Name: Myrtaceae, Location: Mawegui, Conner, Apayao, Description: It is a tree reaching up to five meters in height. Its bark is flaky, corky, and grayish to brown. Leaves are oppositely arranged, ovoid to elliptical. Flowers have an inferior ovary, regular and complete, while the fruits are in clusters and turn red to purple when ripe. Habitat: Disturbed forests and regrowth, also in the undisturbed swamp, mixed dipterocarp, and sub-montane forests at elevations to 2,000 meters. Usually on alluvial, swampy sites by rivers and streams, as well as on hillsides and ridges. Phenology: Flowering and Fruiting Season: July-August, Propagation: By seeds, cuttings, and grafting, Timber Classification: Lesser-used Species, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species)]





Fig. 16: Makopa [Local Name: Makopa, Common Name: Makopa, Scientific Name: Syzygium samarangense (Blume) Merr. & Perry, Family Name: Myrtaceae, Location: Karikitian, Conner, Apayao, Description: Is a shrub or small tree with a small crown reaching a height of up to 10 meters? The bark is pinkish-gray in color. The leaves are elliptical but rounded at the base. The flowers are white to yellowish-white, while the fruit is bellshaped, with colors ranging from white, pale green, or green to red, purple, or even black when it's ripe. Habitat: Seasonal rainforest, monsoon forest and gallery forest, usually at elevations below 100 meters. Phenology: Flowering Season: March-April, Propagation: Seeds lose their viability quickly and should be sown fresh from the fruit. Air layering is a simple method of propagation. Budding: The buds do not always continue to grow successfully. Timber Classification: Lesser-used species, Conservation Status: Least Concerned Species (IUCN Red List of Threatened Species ver. 3.1)]



Fig. 17: Bitok [Local Name: Maladalaga, Common Name: Bitok, Scientific Name: Ochrocarpos ramiflorus Merr., Family Name: Guttiferae, Location: Calanasan, Apayao, Description: Bitok is a tree with very pretty and glossy foliage. Tiny flowers are borne in clusters on the tree trunk and mature branches. Flowers have a very pleasant scent, which lasts even when the flowers dry up. The flowers appear in hot weather, and the fruits ripen during the rainy season. Local Name: Maladalaga, Common Name: Bitok, Scientific Name: Ochrocarpos ramiflorus Merr, Family Name: Guttiferae, Location: Calanasan, Apayao, Description: Bitok is a tree with very pretty and glossy foliage. Tiny flowers are borne in clusters on the tree trunk and mature branches. Flowers have a very pleasant scent, which lasts even when the flowers dry up. The flowers appear in hot weather, and the fruits ripen during the rainy season. Habitat: A mid-canopy tree in undisturbed mixed dipterocarp to sub-montane forests at elevations up to 1,400 meters. Usually on alluvial sites, but also common on hillsides and ridges. On sandy to clay soils, but also common on or near limestone. Phenology: Flower period is from June to September and fruiting period is from October to January. Propagation: By seed, Timber Classification: Lesser Used Species, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species ver. 3.1)]



Fig. 18: Pakiling. [Local Name: Malatibig, Common Name: Pakiling, Scientific Name: Ficus odorata (Blanco) Merr., Family Name: Moraceae, Location: Dagupan, Luna, Apayao, Description: Pakiling is a small tree reaching a height of up to 9 meters. Leaves are simple, alternate, oblong, or broadly ovate and rounded. Fruits are attached to the trunk and branches, green to reddish in color; they are clustered in form. Habitat: It can be found in lowland primary and secondary forests at 250 to 500 meters. Phenology: The complete fruiting season is from February to August. Propagation: By seeds and can be asexually propagated by cuttings. Timber Classification: Lesser Used species, Conservation Status: Least Concerned Species (IUCN Red List of Threatened Species ver. 3.1)]



Fig. 19: Balakat-gubat [**Common Name:** Balakat-gubat, **Scientific Name:** *Balakata luzonica* (Vidal) Esser, **Family Name:** Euphorbiaceae, **Location:** Lubong, Calanasan, Apayao, **Description:** A tree grows up to 25m and has a diameter of about 100cm. The bark is brown and scaly. Leaves are shiny, alternate, ovately elliptic to oblong in shape, 7-14cm long to 6cm wide. Fruits are ovoid to obovoid and 1-seed. **Habitat:** Found in humid forests of Luzon, Visayas, Davao (Mindanao), **Propagation:** By seed, **Timber Classification:** Lesser Used Species. **Conservation Status:** Vulnerable (DAO No. 2007 s.01)]

Threatened, Vulnerable, and Endangered based on the combined data acquired in the Administrative Orders of the Department of Environment and Natural Resource and the International Union for Conservation of Nature (IUCN). Eight of the ten (10) identified species in Ethnomedicinal Trees were classified as Least Concern, and one species was classified as No Data and Not Threatened.



Fig. 20: Korthal gisihan [Local Name: Matabual, Common Name: Korthal gisihan, Scientific Name: Aglaia korthalsii Miq. Family Name: Meliaceae, Location: Eleazar, Calanasan, Apayao, Description: It is an evergreen tree growing to 26 m tall and above. Leaves are compounds. The bark is pale to dark reddish-brown. The fruit is globose, orange-red when ripe. Habitat: A mid-canopy tree in undisturbed mixed dipterocarp to sub-montane forests at elevations up to 1,400 meters. Usually on alluvial sites, but also common on hillsides and ridges. It is on sandy to clay soils, but it is also common on or near limestone. Phenology: Flower seasoning is from March to June and fruiting season is from June to August. Propagation: By seed, Timber Classification: Lesser Used Species, Conservation Status: Near Threatened (IUCN Red List of Threatened Species ver. 3.1)]



Fig. 21: Amuyong **[Local Name:** Namut, **Common Name:** Amuyong, **Scientific Name:** Gonothalamus amuyon (Blanco) Merr. **Family Name:** Annonaceae, **Location:** San Gregorio, Luna, Apayao, **Description:** Amuyon is a small tree. Leaves are smooth and oblong. Flowers are yellowish green, borne on sides on the or at the axils of the leaves. Fruit is smooth, cylindrically elongated, or sausage-like, green when unripe, and yellow when ripe. **Habitat:** Found in forests at low and medium altitudes, **Phenology:** Flowering seasons in May and June. **Propagation:** Seed, **Timber Classification:** Furniture/ Construction Hardwood, **Conservation Status:** Critically Endangered (IUCN Red List of Threatened Species)]



Fig. 22: Subiang [Local Name: Umila, Common Name: Subiang, Scientific Name: Bridelia insulana Hance, Family Name: Euphorbiaceae, Location: Lubong, Calanasan, Apayao, Description: An evergreen tree reaching a height of up to 10 meters. It has a straight bole and is cylindrical, and the bark is smooth with visible lenticels. Leaves are simple, alternate, and elliptically oblong. Habitat: In primary forest at low altitudes. Phenology: For observation, Propagation: By seed, Timber Classification: Lesser Used Species, Conservation Status: Leave Concern Species (IUCN Red

List of Threatened Species ver. 3.1)]



Fig. 23: Matang-hipon [Local Name: Addil, Common Name: atang-hipon, Scientific Name: Breynia vitis-idaea (Burm.f.) C.E.C. Fisch, Family Name: Euphorbiaceae, Location: Eleazar, Calanasan, Apayao, Description: A large shrub reaches 3-4 m high. The bark is yellowish-gray. Leaves are elliptic to elliptic-ovate. Habitat: Semi-evergreen and moist deciduous forests, also in the plains. Open areas, forest edges, Propagation: Seed, Timber Classification: Lesser Used Species, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species)]

DNA Barcoding

Using a brief, standardized DNA sequence from a particular area of an organism's genome, DNA barcoding is a technique for classifying species. The process entails identifying the species by analyzing an unknown specimen's DNA and comparing it to a reference database of known DNA sequences. It has been applied to the identification of



Fig. 24: Hauili [Local Name: Aplas, Common Name: Hauili, Scientific Name: Ficus septica Burm.f., Family Name: Moraceae, Location: San Jose, Flora, Apayao, Description: Hauili is an erect, small tree that grows 3 to 8 meters high, is smooth, and has more or less hairy young shoots. Leaves are smooth and shining, not all roughened, oblong-ovate to elliptic-ovate. Habitat: Ficus septica trees live up to 1800m in montane forests or secondary-growth environments. It can be seen often along rivers. Phenology: Fruiting and flowering season is observed from January to February. Propagation: Seed and cuttings, Timber Classification: Lesser Used Species, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species)]



Fig. 26: Horsebush [Local Name: Arintudog, Common Name: Horsebush, Scientific Name: Dendrolobium umbellatum (L.) Benth, Family Name: Leguminosae, Location: Badduat, Kabugao, Apayao, Description: The species is a small tree. The leaves are trifoliate. The flowers are small and arranged in an umbel, while the fruit pods are beaded. Habitat: It grows on rocky or sandy seashores or tidal mud, monsoon forest edges, riverbanks, rocky cliffs, savanna, and secondary forests from sea level up to 180 m altitude. Propagation: By seed, Timber Classification: Lesser Used Species, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species)]



Fig. 25: Noni [Local Name: Apatot, Common Name: Noni, Scientific Name: Morinda citrifolia L., Family Name: Rubiaceae, Location: Tamalunog, Flora, Apayao, Description: Is a deciduous tree reaching a height of 10 meters above. Leaves are smooth and shining with tapering pointed tips. They are opposite, pinnately veined. Flowers are borne on inflorescences that grow on the stems of trees, and small white flowers grow around a half in across. Fruits are drupe and pale green in color. Habitat: Common in thickets and forests at low and medium altitudes throughout the Philippines. Phenology: Flowering and fruiting season is throughout the year. Propagation: Seed and cuttings, Timber Classification, Lesser Used Species, Conservation Status: No data]

species in many different settings, such as mixed samples, small or damaged specimens, and environmental samples. Additionally, DNA barcoding has been used to track changes in biodiversity over time and evaluate how human activity affects ecosystems (Hebert et al. 2003).



Fig. 27: Rarang [Local Name: Bagbag, Common Name: Rarang, Scientific Name: Erythrina subumbrans (Hassk) Merr, Family Name: Fabaceae, Location: Marag Valley, Luna, Apayao, Description: A deciduous tree with a trunk and branches with spines, Bark is grey or grey-green, smooth, and soft, often with spine on twigs and trunk. Leaves are trifoliate, with 3 primary basal veins. Leaflets are broadly ovate, pointed, base rounded, margin entire, Flowers are large, pea-flower-shaped, and orange-color. Habitat: Moist valleys, near streams, in open locations, and secondary forests at low and medium elevations. Phenology: Flowering season is on May. Propagation: Seed and cuttings, Timber Classification: Lesser Used Species, Conservation Status: Not threatened]

The BLAST (NCBI-GenBank) was utilized to determine the homology of the plant samples. Table 2 presents the maximum identity of edible fruit and ethnomedicinal species with identical species provided by the Philippine Genome Center using *matK* Primer. One (1) species had a



Fig. 28: Tangisang bayawak [Local Name: Binuran, Common Name: Tangisang-bayawak, Scientific Name: Ficus variegata Blume, Family Name: Moraceae, Location: Eleazar, Calanasan, Apayao, Description: It is a large tree that may reach 40 meters in height. The bark is smooth and greyish in color. Young leaves are dentate, while old leaves have a wavy edge. Fruit is directly attached to the trunk or the branches. It is yellow-green. Habitat: Valleys at low to medium elevations. A mid-canopy tree in regrowth, forest gardens, and disturbed or open sites in mixed dipterocarp forests at elevations up to 500 meters. Along rivers and streams or on alluvial sites. Phenology: Fruiting season is from April to June. Propagation: Seed - germinates best at a temperature around 20°c. Air layering and tip cuttings around 4 - 12cm long, taken from lateral branches. Timber Classification: Lesser Used Species, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species)]



Fig. 29: Lunas **[Local Name:** Kakling, Palitan and Lunas Bundok, **Common Name:** Lunas, **Scientific Name:** *Lunas amara* Blanco var. *amara*, **Family Name:** Rutaceae, **Location:** Upper Maton, Pudtol, Apayao, **Description:** Lunas is an erect shrub growing to a height of 3 meters. Twigs are smooth, and the young tips olivaceous lepidote. Leaves are alternately crowded, obovate-oblong, centimeters wide, often pointed at both ends. Bark are smooth. The outer bark color is grey, while the inner bark is green in color. **Habitat:** In thickets and forests and low and medium altitudes. **Phenology:** Flowering and bearing fruits all year round. **Propagation:** Plantation and seed propagation, **Timber Classification:** Lesser Used Species, **Conservation Status:** Least Concern Species (IUCN Red List of Threatened Species)]



Fig. 30: Halimunog [Local Name: Lumpanginay, Common Name: Halimumog, Scientific Name: Ehretia philippinensis A. DC. Family Name: Boraginaceae, Location: Eleazar, Calanasan, Apayao, Description: This small tree is up to 10 meters high with light brown bark. Leaves are alternate or opposite and usually entire. Fruit is schizocarp. Habitat: Dune bush and coastal forest, and inland in woodland and on forest margins. Propagation: By seed, Timber Classification: Lesser Used Species, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species)]



Fig. 31: Talisai-gubat [Local Name: Lusit, Common Name: Talisaigubat, Scientific Name: Terminalia foetidissima Griff. Family Name: Combretaceae, Location: Eleazar, Calanasan, Apayao, Description: It is a tree, up to 30m tall. The leaves are spirally arranged and tend to cluster near the tips of the branches. The leaves have an attractive cream-green mottled pattern. Flowers are small and occur on a spike. Fruit are hard, ellipsoid. Habitat: An upper canopy tree in dense primary forests, growing on alluvial and dry sites (hillsides and ridges) on clayey to sandy soils at elevations up to 200 meters. Propagation: By seed, Timber Classification: Furniture and Construction hardwood, Conservation Status: Least Concern Species (IUCN Red List of Threatened Species)]

maximum identity of 100% while fourteen (14) species had a maximum identity of 99%, like *Trigostemon philippinesis* Stapf. and *Alangium polyosmoides* (F.Muell.) W.J.de Wilde & Duuyfjes. The rest of the species comprised 98%, 97%,



Fig. 32: Bagna [Local Name: Sablot, Common Name: Bagna, Scientific Name: Glochidion triandrum (Blanco) C.B.Rob., Family Name: Euphorbiaceae, Location: Marag Valley, Luna, Apayao, Description: It is a tree reaching a height of 10 meters and above. The bark is light black to grayish. Leaves are deciduous, simple, and lanceolate, Habitat: In thickets and secondary forests at low and medium altitudes, Phenology: For observation, Propagation: Seed, Timber Classification: Lesser Used Species, Conservation Status: Least Concerned Species (IUCN Red List of Threatened Species)]

93%, 91%, and 90% maximum identity. The results show that matK produced a high amplification rate and, thus, higher universality.

This implies that the percentage of the sequence identified for each species was directly proportional to the accuracy of the identification. The higher the percentages, the more accurate the identification.

Phytochemical Analysis

The use of herbal medicines and phytonutrients or nutraceuticals continues to expand rapidly across the world, with many people now resorting to these products for treatment of various health challenges in different national healthcare settings (WHO 2004). In addition, this past decade has obviously witnessed a tremendous surge in acceptance and public interest in natural therapies both in developing and developed countries, with these herbal remedies being available not only in drug stores, but also in food stores and

Table 2: BLAST analysis with the percentage of maximum identity (Max.Id.) for each sample collected.

A. Edil	ole fruit trees			
No.	Common Name	Scientific Name	matK	Max. Id. %
1	Lipote	Syzygium polycephaloides (C.B.Rob.) Merr.	Syzygium tenuiflorum	93.21
2	Binukau	Garcinia binucao (Blanco) Choisy	Ficus tikoua	90.81
3	Tiesa	Pouteria rivicoa (Gaertn.f.) Ducke	Lucuma campechiana	99.88
4	Balimbing	Averrhoa carambola Linn	Averrhoa carambola	100
5	Mabolo	Diplodiscus blancoi A.DC.	Ficus sagittata	93.18
6	Black musk heart	Alangium polyosmoides (F.Muell.) W.J.de Wilde & Duuyfjes	Alangium salviifolium	99.1
7	Katap	Trigostemon philippinesis Stapf.	Elaeocarpus floribundus	99.01
8	Lubeg	Syzygium lineatum (Roxb.) Merr. & Perry	Lucuma campechiana	99.88
9	Makopa	Syzygium samarangense (Blume) Merr. & Perry	Diospyros blancoi	99.88
10	Bitok	Ochrocarpos ramiflorus Merr.	Ficus hispida	97.96
11	Pakiling	Ficus odorata (Blanco) Merr.	Averrhoa carambola	98.93
12	Balakat gubat	Balakata luzonica (Vidal) Esser	Artocarpus lacucha	99.61
13	Korthal Gisihan	Aglaia korthalsii Miq.	Canarium album	99.2
14	Amuyong	Gonothalamus amuyon (Blanco) Merr.	Microcos blattifolia	99.61
15	Subiang	Bridelia insulana Hance	Brackenridgea australiana	98.45

B. Ethn	omedicinal Trees			
No.	Common Name	Scientific Name	matK	Max. Id. %
1	Matang-hipon	Breynia vitis-idaea (Burmf.) C.E.E. Fisch	Phyllanthus sieboldianus	99.76
2	Hauili	Ficus septica Burm.f.	Ficus tuphapensis	91.42
3	Noni	Morinda citrifolia L.	Ficus sarmentosa	96.76
4	Horsebush	Dendrolobium umbellatum (L) Benth.	Grona heterocarpos	97.72
5	Rarang	Erythrina subumbrans (Hassk) Merr.	Erythrina numerosa	99.62
6	Tangisang Bayawak	Ficus variegate Blume	Parashorea cf. tomentella	91.37
7	Lunas	Lunasia amara Blanco var.amara	Pouteria obovoidea	99.48
8	Halimumog	Ehretia philippinensis A. DC.	Maesa japonica	97.31
9	Talisai-gubat	Terminalia foetidissima Griff	Alseodaphne huanglianshanensis	99.63
10	Bagna	Glochidion triandrum (Blanco) C.B.Rob.	Litsea firma	99.51

supermarkets. Tables 3 and 4 provide the phytochemical analysis of the 25 surveyed tree species. Out of 15 edible fruit trees, only the Amuyong tree has no flavonoid content, only the Lubeg tree has no tannins, and Binukau, Tiesa, Lubeg, and Amuyong trees have no saponin compounds. For ethnomedicinal trees, out of ten (10), only Hauili and Talisai-gubat have no flavonoids, only Hauili and Rarang trees have no tannins, and Tangisang-bayawak, Talisai-gubat, and Lunas tress are lack of saponin metabolite.

Wadood et al. (2013) stated that the phytochemical study of plants is particularly significant in the pharmaceutical industry's quest to produce novel medications that may cure a wide range of illnesses. Secondary metabolites are organic chemicals produced by any life form, such as bacteria, fungi, animals, or plants, that are not directly engaged in the regular growth, development, or reproduction of the organism. They are sometimes referred to as specialized metabolites, toxins, secondary products, or natural products. It frequently has a significant impact on other interspecies defenses as well as plant defenses against herbivory. Humans use secondary metabolites as recreational drugs, flavorings, medications, and pigments.

In this study, the secondary metabolites that were considered are flavonoids, tannins, and saponins. Flavanoids consist of a large group of polyphenol compounds with a benzoyl-y-pyrone structure and are ubiquitously present in plants. The phenylpropanoid pathway synthesizes them. Available reports tend to show that secondary metabolites of a phenolic nature, including flavonoids, are responsible for a variety of pharmacological activities (Pandey et al. 2007). Flavonoids are hydroxylated phenolic substances and are known to be synthesized by plants in response to microbial infection (Dixon et al. 1983). The term tannin is widely applied to a large complex biomolecule of a polyphenol nature that has sufficient hydroxyls and other suitable groups such as carboxyl, to form strong complexes with various macromolecules (Navarrete 2013). Tannins are generally used in the tanning process and as healing agents in inflammation, burns, piles, and gonorrhea. Lastly, Saponins are an important group of plant secondary metabolites that are widespread throughout the plant kingdom. Saponins are basically phytochemicals that are found in most vegetables, beans, and herbs (Francis et al. 2002)

Uses and Threats of Ethnomedicinal Trees

Table 4 provides the identified ethnomedicinal trees from different barangays of six (6) municipalities of Apayao, including information on the utilization of cures for illnesses as claimed by community members. Ten (10) different ethnomedicinal trees are being used by the community members that address 32 health-related conditions. The most frequently used plant parts for the preparation of the remedy were leaves, followed by bark, roots, and sap.

Table 4 provides information on the uses of the identified ethnomedicinal species. Ten different ethnomedicinal trees were used to address 32 diseases or health-related conditions in this study. The most frequently used plant parts for the preparation of the remedy were leaves, followed by bark, roots, and sap. There were fourteen different ways to prepare the ethnomedicinal trees, and the most common forms were mashed or crushed, followed by boiling and decoction. Smoking, drinking, chewing, grinding, and directly applying to the skin were also practiced. The plant parts used and the mode of preparation of the ethnomedicinal trees depend on the ailments to be addressed and to whom they will be administered.

Most of the ethnomedicinal tree modes of preparations recorded were administered externally or by applying plant parts directly on the body parts, rubbing plant extracts and drops, and bathing or soaking. The rest were taken orally by drinking decoction, using it as a mouthwash, and chewing.

In this study, the identified ethnomedicinal trees belonged to the following families: Combretaceae, Euphorbiaceae, Moraceae, Boraginaceae, Leguminasae, Fabaceae, Rutaceae, and Rubiaceae.

The study conducted by Dapar (2020) on the Ethnomedicinal Importance and Conservation Status of Medicinal Trees among Indigenous Communities in Esperanza, Agusan del Sur, Philippines, supports some identified families of the study, such as the Moraceae (fig family) has proven for their potential biological and pharmacological activities. This family possesses a wide variety of bioactive compounds with biomedicinal properties that were formerly investigated in Ficus racemose L., Ficus carica, and Ficus benjamina. The Rutaceae family is comprised of aromatic deciduous shrubs and trees that have been used in gastronomy and traditional medicine. For instance, secondary metabolites of Zanthoxylum limonella were isolated from the stems, barks, and fruits which were reported to cure several health problems like stomachache, diarrhea, dental carries, and rheumatism.

In addition, threats to the survival of these trees were also determined, such as the effect of extreme weather events, forest fires caused by lightning, conversion of forest land into agricultural land, the occurrence of pests and diseases, and illegal logging.

Assessment of the Utilization of Edible and Ethnomedicinal Trees Vis A Vis the Result of Phytochemical Analyses.

The results of the phytochemical analyses provide support

A. Edi	ible Fruit Trees			
No.	Common Name	Parameter (Phytochemical Screening)	Result	Method Used
1	Lipote	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
2	Binukau	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
2	T '	Saponins	Absent	G (1 (2005)
3	Tiesa	Flavanoids	Present	Guevara et al. (2005)
		Saponing	Absent	
4	Balimbing	Flavanoids	Present	Guevara et al. (2005)
·	Duminonig	Tannins	Present	Guevanu et un (2005)
		Saponins	Present	
5	Mabolo	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
6	Black muskheart	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
7	Katap	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Absent	
8	Lubeg	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Absent	
		Saponins	Absent	
9	Makopa	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
10	Bitok	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
11	Pakiling	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
12	Balakat gubat	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
13	Korthal gisihan	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
14	Amuyong	Flavanoids	Absent	Guevara et al. (2005)
		Tannins	Present	
15	C	Saponins	Absent	C
15	Sublang	Flavanoids	Present	Guevara et al. (2005)
		i annins Saponins	FICSCIII Present	
		Saponnis	1 1030111	

Table 3: Compounds that are present in the identified species.

Table Cont....

B. Ethnomedicinal Trees				
No.	Common Name	Parameter (Phytochemical Screening)	Result	Method Used
1	Matang-hipon	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
2	Hauili	Flavanoids	Absent	Guevara et al. (2005)
		Tannins	Absent	
		Saponins	Present	
3	Noni	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
4	Horsebush	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
5	Rarang	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Absent	
		Saponins	Present	
6	Tangisang bayawak	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Absent	
7	Lunas	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Absent	
8	Halimumog	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	
9	Talisai-gubat	Flavanoids	Absent	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Absent	
10	Bagna	Flavanoids	Present	Guevara et al. (2005)
		Tannins	Present	
		Saponins	Present	

evidence to support the traditional use of ethnomedicinal trees.

For example, Matang hipon leaves and bark have been used in the traditional medicine of the communities to treat a variety of diseases, including fever, tonsilitis, and after childbirth. Phytochemical analyses of matanghipon have revealed the presence of active compounds, including flavonoids, tannins, and saponins. Flavanoids were stated to show anti-cancer properties, and plants containing high amounts of flavonoids could be useful as anti-bacterial; tannins are also known as healing agents for inflammation, burns, piles, and gonorrhea, and saponins are for lowering cholesterol levels, reducing blood

sugar levels, and boosting the immune system, antiinflammatory, antiviral, and anti-cancer properties (Sharma et al. 2020)

However, in the study of Guinto & Bautista (2020), they mention that saponins have a detrimental effect on one's health because they can cause sneezing and can irritate the mucous membrane. They can also destroy red blood corpuscles by hemolysis or the liberation of hemoglobin. In tannin compounds, they also mentioned that it is beneficial in the treatment of burns because they can precipitate the protein of the exposed tissue and will provide an antiseptic protective coat, thus preventing external infection, which is similar to the claim of the communities in Rarang (Erythrina Table 4: Uses of ethnomedicinal trees.

Parts used	Uses	Preparation
1. Matang-hipon		
Leaves	Fever	Infusion of leaves in warm water, then drink 3-4 times daily.
	Tonsilitis	Smoked the dried leaves like tobacco.
Bark	After Childbirth	The processed bark is used as a stringent to prevent hemorrhages.
2. Hauli		
Leaves	Headaches	Heat the leaves to the fire and put it directly on the forehead.
	Stomachache	Crushed/smashed the leaves, then put them to the stomach.
Roots	Diuretic	Decoction of roots.
	Boils	Grind the roots until they produce juice/sap, turn them into a paste, and add water or a certain oil. Collect the paste into a waterproof cloth and tie it off then place it directly on the affected surface skin.
	Asthma	Extract the liquid/juice/sap and add menthol to the juice, then can be inhaled.
Sap	Herpes	Extract the sap from the plant and directly apply to the affected area.
3. Noni		
Leaves	Cough	Boil the leaves into the water or use the decoction process.
	Sprain	Poultice from the leaves applied to the affected sprained foot.
Roots	Painful body parts	Extract the sap/juice from the roots, add oil, and then apply it to the body parts.
	Wounds, Cuts, and sores	Follow the decoction process and apply it to the wounds, cuts, and sores.
Bark	Dermatitis	Chopped bark is boiled to the water. The decoction is used to wash the affected areas twice a day.
4. Horsebush		
Leaves	Not able to sleep	Leaves were put at the back of the body as a remedy for sleeping.
	Malaria	Crushed the leaves and shoot and massaged to an enlarged spleen.
	General Tonic	Follow the decoction process, then drink.
	Fever	Used to bathe the body to prevent slight chill.
Bark	Fever	Used to bathe the body to prevent slight chill.
Roots	Vitamin	Boiled the roots, then drank.
5. Rarang		
Leaves	Sores Eyes	Mashed and squeeze the leaves until the juice is extracted, and then drop them to the eyes.
	Wounds	Crush the leaves, then apply on the surface of the skin.
	Coldness to the Body	Crush the leaves and add oil, apply it to the back of the body.
Bark	Coldness to the Body	Decoction/Extract the liquid from the bark, then apply to the back of the body
6. Tangisang bayawak		
Leaves	Boils	Mashed/crushed the leaves, then applied them to the affected skin.
Bark	Boils/Skin infection	Paste prepared from the sap/juice is mixed with milk and then applied to the affected skin.
	Dysentery	Directly chewed the bark. Another process is decoction or boiling the bark and then drinking.
7. Lunas		
Leaves	Stomachache	Extract the juice/sap from the leaves, add oil, and use it as an ointment for the stomach.
	Ulcers	Boil the leaves
Bark	Snake Bites	Crush/mash the bark until the sap/juice is extracted and put into the affected area for first aid.
	Sore Eyes	The sap of the bark is used as the eye drops for the affected/irritated eyes.

Table Cont....

Hannie T. Martin et al.

Parts used	Uses	Preparation
8. Halimumog		
Leaves	Bruises and swelling joints	Mash/crush the leaves, then apply them to the affected skin or use the poultice preparation.
	Cellulitis	Mash/crush the leaves, then apply them to the affected skin or use the poultice preparation.
Bark and roots	Toothache	Boil the bark in the water and use it as a mouthwash
	Diarrhea and Dysentery	Boil the chopped bark or roots, not too many, and then wait until it becomes warm, then drink.
9. Talisa-gubat		
Leaves	Heart failure and chest pain	Boil the leaves, and then drink the boiled water to prevent heart failure and chest pain.
Bark	Diabetes and High Cholesterol	Boil the bark in the water then drink.
10. Bagna		
Leaves	Bruises	Crush the leaves, then apply them to the skin.
	Sprained Foot	Boil the leaves, then soak the sprained foot.
Bark	Rheumatic joints	Boil the bark, then soak the feet.

subumbrans), Botgo (*Ficus caulocarpa*) species wherein they contain tannins. The leaves of the Rarang and Botgo species are used to treat wounds. However, prolonged utilization of tannin-rich plants, such as ordinary tea, is hazardous due to its carcinogenic potential.

CONCLUSIONS

In this study, there are 25 edible and ethnomedicinal trees thriving in the forest of Apayao with the ecological status of critically endangered, vulnerable, rare, nearly threatened, least concerned, and data deficient. This serves as baseline information on native and medicinal trees as critical genetic resources in Apayao province.

Using DNA barcoding provides useful baseline data in selected edible and medicinal trees to distinguish genuine edible from non-edible fruit trees and medicinal tree species from non-medicinal ones. The primer matK is thought to be effective. The practical and precise verification of edible and medicinal plants using this DNA barcode may help to avoid the use of substitutes.

The phytochemical results of this study revealed that most of the edible fruit and ethnomedicinal trees contain flavonoids, saponins, and tannins compounds. The phytochemical results of this study revealed that most of the plants contain flavonoids, saponins, and tannins compounds. These phytochemicals have been shown to have a variety of biological activities, including antibacterial, antiviral, anti-inflammatory, and anti-cancer properties, which also support the claim of the communities on their traditional uses of ethnomedicinal trees as first aid in illnesses such as toothache, bruises, and rheumatic joints. All surveyed trees are susceptible to pests, diseases, and destruction brought about by natural phenomena such as the effect of climate change.

Recommendations

- 1. Further study on the abundance of edible fruit trees and ethnomedicinal trees,
- 2. Further research on quantitative chemical analysis of the edible fruit and ethnomedicinal trees,
- 3. Further study on the causal organism on pests and diseases of the edible fruit and ethnomedicinal trees,
- 4. Conduct Information Dissemination and Communication (IEC) activity to communities to raise awareness on the importance, conservation, and protection of edible fruit and ethnomedicinal trees and
- 5. A policy recommendation for conservation and protection of the edible and ethnomedicinal trees.

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