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Indigenous Herbs and Spices in Selected Areas of North Cotabato: An Ethnobotanical Survey

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Original Research Article

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ABSTRACT

Aims: To establish an ethnobotanical data on the various species of herbs and spices in selected areas of North Cotabato.
Study Design: The study was carried out using observational and descriptive survey type of research
Place and Duration of Study: The study was conducted from January 2013 to January 2014.
Methodology: this study was conducted using structured interview and actual field survey visit. Samples collected were identified using field Guidelines by Remollo [1]. Selected samples of plants were propagated in a nursery and Conservation and distribution status were determined using the Redlist 2010.
Results: A total of forty-eight (48) species of herbs and spices belonging to thirty-eight (38) genera and twenty-seven (27) families were found in four study areas in North Cotabato. The species richness and abundance and the diversity index were generated on the study. Out of the 48 species, *Euphorbia neriifolia* Linn was categorized as critically endangered, *Cinnamomum mercadoi* Vidal (Kalingag), *Dillenia philippinensis* Rolfe (Katmon) and *Koordersiodendron pinnatum* (Blanco) Merr. (Amugis) belong to the vulnerable category (VU), and four belong to near threatened category (NT) namely: *Hoya multiflora* (Blume) Desne, *Pangium edule* Reinw. Ex Blume, *Peperomia pellucida* (L.) HBK. and *Morinda umbellata* Linn**.**
Various parts of the plants were used as herbs and spices. These were the fruits, seeds, young leaves or shoots, flowers, bark and saps, young stems, rhizomes, tubers that were prepared and cooked with different dishes.

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Two plant species, *Atuna racemosa* Rafin.ssp. *racemosa* and *Euphorbia neriifolia* Linn were subjected to phytochemical screening and were positive for saponins, alkaloids, flavonoids and tannins. Both showed absence of anthraquinones.
Conclusion: A baseline survey of indigenous herbs and spices in the four study sites with emphasis on the characterization of species richness and abundance.

Keywords: Biodiversity; ethnobotanical; herbs; spices.

DEFINITIONS, ACRONYMS, ABBREVIATIONS

Abundance- total number of organisms in an area

Bioactive compounds- refers to a mixture of several components or chemical active properties of the plant. In this study, this refers to the secondary metabolites which are alkaloids tannins, saponins, antraquinones and flavonoids.

Conservation status- an indicator of the likelihood of that species continuing to survive. The conservation status based on IUCN Redlist 2010 maybe critically endangered (CR), data deficient (DD), endangered (EN), extinct (EX), extinct in the wild (EW), Least Concern (LC), Near Threatened (NT), Not Evaluated (NE) and Vulnerable (VU).

Distribution status– refers to the occurrence of the plants in the four study areas.

Diversity- incorporating both the number of species and the evenness of their abundance.

Ethnobotany- refers to the study of the interactions and relationships between plants and people over time. This includes the uses, knowledge and beliefs of populations concerning the use of medicinal plants for the management systems.

Herbs and spices– refer to any part of the plants with medicinal and food value. These may be the leaves, fruits, bark or roots of the plants.

Indigenous– refers to the local inhabitants as well as native herbs and spices found in a community.

Local utilization- refers to the use of the different plant parts in a local community/ area.

Species Richness- number of different species in an area.

1. INTRODUCTION

The Philippines has a vast tropical rainforest which is endowed with rich natural resources and blessed with highly diverse natural vegetation. It is considered as one of the most diversified countries in Southeast Asia and supports one of the world's richest floral and faunal communities [2].

Despite many ethnobotanical studies performed all over the world, in the Philippines, ethnobotanical documents are relatively few, with some focusing on well- known indigenous groups like the Pinatubo Negritoes, the Tagabawa/Bagobo/ Manobos in Mindanao, the Itawes of Cagayan, and the Ibaloi of Benguet province.

According to Macalos [3], Region XII is a melting pot of diverse cultures. Unique as it is, the different ethnic groups exercise cultural and religious tolerance resulting in their appreciation and harmonious co-existence. The different ethnic tribes made Region XII famous for its distinctive ethnic culture. The original inhabitants of the region, the indigenous people (IP's) like Manobo, Tagabawa, Bagobo, B'laan, and Klata are scattered in different parts of the region. It had been observed that these people usually have a good knowledge and uses of varied indigenous herbs and spices in their community (City Tourism, Kidapawan City, 2010) [4]. This is favored by the fact that North Cotabato is one of the areas in region which has a rich biodiversity of both fauna and flora. Its forest is uniquely vegetated by diverse herbs and spices such as *Cinnamomum mercadoii* Vidal *(*kalingag) along with other dominant spices and herbs and Lesser Known Species (LKS) [5].

North Cotabato is rich in plant resources especially in the western and southern areas; however, no ethnobotanical study has been conducted yet because the study areas are not easily accessible although some of these places are inhabited by indigenous peoples particularly, Tagabawa of Sitio Malumpine of Old Bulatukan,

Manobo of Barangay Imamaling of Magpet, Manobo or Bagobo of Manobo (Tiko) of Magpet and Manobo/Bagobo of Barangay Salasang, Mt. Sinaka, Arakan, North Cotabato. Thus, information is scanty particularly on how these indigenous herbs and spices are used traditionally.

Herbs and spices have tremendous importance as ingredients in food, alcoholic beverages, medicine, perfumery, cosmetics, coloring and also as garden plants. Peter [6] reported that together with spices, herbs are also used in foods in enhancing flavor, pungency and color. They also have antioxidant, antimicrobial, pharmaceutical and nutritional properties. In addition to the known direct effects, the use of these plants can also bring about beneficial complex secondary effects like salt and sugar reduction as well as improvement of food texture and prevention of food spoilage [7].

Generally, different indigenous groups in the country have similar knowledge and practices on using plants with medicinal value. Such knowledge on traditional medicine may have been passed from generation to generation originally from their great ancestors.

Most of the tribal communities have strong beliefs on spirits which are thought to be protectors of the bountiful resources of nature, such as plants. Further, they believe that certain diseases are caused by supernatural beings. Among the Ibaloi and Kalanguya societies, the main cause of illness is claimed to be caused by dissatisfied spirits or a dead relative. Thus, rituals and certain ceremonies were performed relative to their utilization of medicinal plants which were believed to enhance the efficacy of these plants. In Rogongon, Higaonons usually perform rituals and offerings or “himata” before they can reveal or share their indigenous knowledge on medicinal plants because they believe that these plants are protected by spirits as even in maintaining their effectiveness [8].

Hundreds of herbs and spices have been used in cultures all over the world for thousands of years. Likewise, in the Philippines, particularly in the province of Cotabato, many wild plants like herbs and spices could have been used for several reasons by community people especially the indigenous people groups. Thus, this study dealt with documentation of ethnobotanical data on the various herbs and spices in four selected areas in Cotabato which are dominantly inhabited by indigenous people.

1.1 Objectives of the Study

This study generally aimed to establish an ethnobotanical data on the various species of herbs and spices in selected areas of North Cotabato. Specifically, this study aimed to:

1. classify and identify the existing indigenous herbs and spices up to the lowest taxonomic level;
2. determine the conservation and distribution status of the herbs and spices in the different study areas;
3. document the local utilization of the indigenous herbs and spices;
4. determine the bioactive components of the selected samples through phytochemical screening; and
5. propagate the selected species of plants.

1.2 Significance of the Study

One of the reasons for studying indigenous herbs and spices comes from the standpoint of conducting inventory and recording all ethnobotanical information among some ethnic communities. Ethnobotanical uses of plants was documented for their food value as spices and active constituents for pharmaceutical purposes. There is a need for the indigenous people to be actively involved in evaluation, planning, implementation and monitoring processes as they are the best judges of the area.

The findings of this study could be of significant value to indigenous people in order to help them realize and value the importance of the indigenous herbs and spices found in the vicinity of their area. The information could become a basis to local culinary enthusiasts to use indigenous herbs and spices as substitutes for commercial spices. Furthermore, the results of the study could also help caterers and culinary establishments in finding substitutes for local additives and flavorings. It could provide valuable information for processors of food flavorings and medicines that will benefit mankind.

It is important to look into these traditional herbs and spices as to their active components to establish the basis of their pharmacologic effects. The data gathered could become a basis for response strategies designed to conserve and preserve indigenous herbs and spices especially

those with high economic value being sources of food, medicine and flavorings.

Considering the importance and role of indigenous herbs and spices for human survival and sustenance and to strengthen food security, it is indeed necessary to promote these indigenous herbs and spices for being natural and cheap sources of food, spices and medicine.

1.3 Scope and Limitation of the Study

This study was limited to the survey of herbs and spices in four study areas namely: Sitio Malumpine, Barangay Imamaling, Manobo (Tiko), and Mt. Sinaka in North Cotabato. These sites were chosen based on the willingness of the locals to be interviewed in addition to the significance of the areas being the habitat of wild herbs and spices. The informants were selected by the barangay officials based on their familiarity with local plants used in the areas while the other informants were randomly selected from the population of the study areas. Key informants like the older ones and traditional healers were included as respondents. Meanwhile, the identification of the whole plant samples was confirmed by a plant taxonomist, Prof. Leopoldo L. Remollo of the College of Forestry, Mindanao State University in Maguindanao.

2. MATERIALS AND METHODS

2.1 Research Design

This study utilized an observational, descriptive-survey type of research method.

2.2 Study Areas

The study was conducted in selected areas in North Cotabato (Fig. 1) namely: Barangay Imamaling and Barangay Manobo (Tiko) in Magpet which are mostly inhabited by Aromenen de Menuvo; Malumpine, Makilala with Bagobo-Tagabawa as the original tribes and Barangay Salasang, Mt. Sinaka (Arakan) where the Kulamanen Manobo mostly reside. Coordinates of the sampling stations were determined using Global Positioning System (GPS). The number of tribal groups or other unique communities were identified and recorded. An estimated population of 37 families in each sampling site was the target respondents of the study. Topographic data of each area was recorded. Protocol was observed by asking permission from the tribal chieftains and barangay chairmen of the communities.

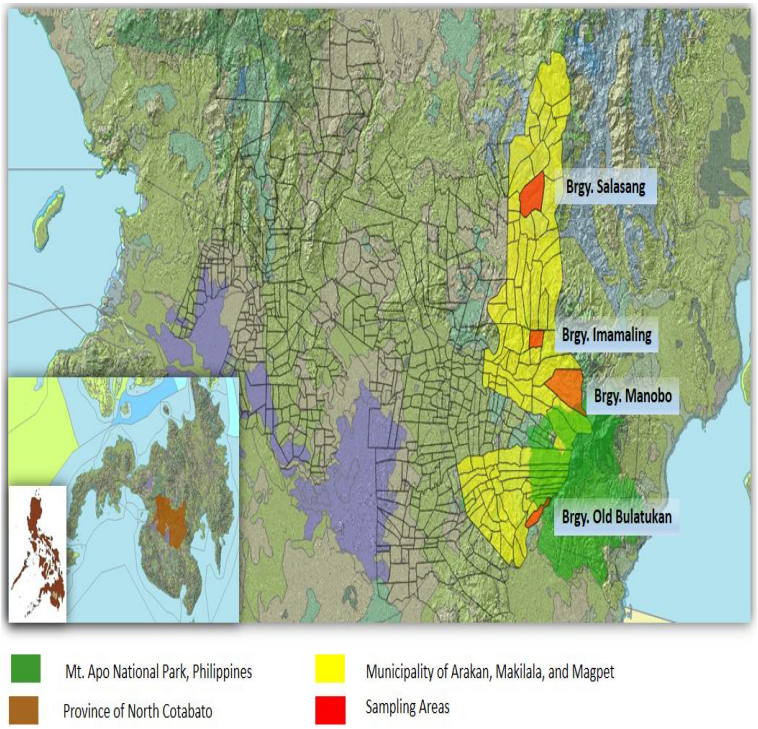

Fig. 1. Map of the sampling areas

2.2.1 Sitio Malumpine, Old Bulatukan, Makilala

Malumpine is the farthest upland sitio of Brgy. Old Bulatukan in the municipality of Makilala in Cotabato. It is literally at the foot of Mt. Apo. To reach its peak, one has to hike for 10 kilometers away from the Kidapawan City passing through a highly curved, steep, rough feeder road and crossing the mountains seven (7) times along the way with a coordinates of 6^{0}57'25.43 43"N 125^{o}1455.72 E.

The village of Malumpine is literally situated at the boundary between Makilala, Cotabato province and the municipality of Bansalan, Davao del Sur. The Malumpine River divides the two provinces. It is situated in the southern slope and within the Mt. Apo Natural Park. Around 70 percent of its total land area is classified as forest with patches of open grasslands. The area is mountainous with an elevation ranging from 600 to 1,200 masl with a cool temperature (about 26^{o}C). It is a mix of two distinct forest formations from lowland tropical rainforest to mid-mountain forests with predominant primary forests. Being a part of Mount Apo National Park, it is rich in diverse species of flora and fauna. Adjacent lands to the forests are inhabited by tribal groups like Tagabawas, Manobos and Bagobos. Ninety-nine (99) percent of which belong to the Tagabawa-Bagobo tribe. They make a living through upland farming and by rendering farm labor services to nearby barangays. The average land tilted per household is three hectares. The cash crops being planted include abaca, coffee and a mix of temperate vegetables. Corn is cultivated in a few arable lands for good. But even then, income from agriculture is not enough to meet their monthly expenses for food, education and medicine.

They are usually farmers and beneficiaries of Mt. Apo Nature Park Restoration Project Phase XI-XII as Component of MANP Restoration Development collaboration with the Protected Areas and Wildlife Bureau (PAWB) under Vice-President Binay (Tribal chieftain Datu Charlie Eli personal communication) [9]. It has a population of 1,450 with 200 households. Anthurium, Corn, bananas, rice, sweet potato and coffee also continuously cultivated in the open spaces available for the purpose of food, cash being secondary consideration. The area which is 3,000 has.is surrounded by distant village people who sometimes consume and utilize the resources in the reforested area (Tribal Chieftain Datu Lasconia O. Enoch, personal communication) [10].

2.2.2 Barangay Imamaling, Magpet North Cotabato

According to the local tribes, Barangay Imamaling was named after a beautiful lady, Imandin while catching fish on the creek she suddenly got lost. The first tribe was a Manobo clan consisting of thirty (30) families headed by Datu Maling before the arrival of the Christian settlers in 1940. At the outbreak of the Japanese-American war, these Manobos started to leave the place because of fear of forcing them to live in the upper portion of the barangay. In 1980, Imamaling was declared as a separate barangay from barangay Sallab.

Barangay Imamaling has a total population of 1,580 aggregated to 221 households of which is mostly dominated by Manobos. The production of crops could not be maximized because the soil is not fertile for the topmost layer of the land that had been eroded due to its sloping topography. It has 4,638 hectares of total land area consisting forestlands, agricultural land, grassland and denuded lands of which 2,350 hectares are natural forest.

It is located at the foot of a mountainous area inhabited by indigenous tribal groups as well as Ilonggos. The area is mountainous with an elevation of 1,200 masl. Most of their crops tilted are banana, rubber, tiger grass and vegetables (Barangay Captain Rey Calimpit) [11].

2.2.3 Manobo (Tiko), Magpet

This study site is within the rainforest situated at the foot of Mount Apo National Park It is about 40 kilometers away from the Kidapawan City passing through a highly curved, steep, rough feeder road and crossing the river five (5) times along the way.

The total land area is 5,536 has with an elevation of about 1100 masl and cool temperature (about 24^{o}C). It is a mix of two distinct forest formations from lowland tropical rainforest to mid-mountain forests with predominant primary forests. Being a part of Mount Apo National Park, it is rich in diverse species of indigenous spices and herbs. Adjacent lands to the forests are inhabited by tribal groups like Bagobos, Manobos and Klata. The barangay is inhabited dominantly by Manobo tribe. It has a population of 2,716 distributed to

548 households. Since the barangay is mostly dominated by a Manobo tribe, it has been renamed as Barangay Manobo. They are usually farmers and beneficiaries of projects like livestock dispersal. They grow banana, rubber, tiger grass and coffee. They earn from tiger grass it by making soft brooms (Barangay Captain Roldan P. Pelonio) [12].

2.2.4 Mt. Sinaka, Arakan, Cotabato

Mt. Sinaka which is known to have eight peaks, is a sacred mountain (Fig. 2). It is where the Manobo people's greatest spirits reside and is believed to be the place where the magical "Sinalamba" landed to bring the greatest epic hero Tulalang and his people back to heaven. The landmarks around the mountain are vessels of numerous legends and folktales about human and spirits in Mt. Sinaka [13].

It has a population of 1,140 aggregated to 115 households mostly dominated by Manobo tribe. The climate occurring in the area has even rainfall with high monthly average rainfall level during May and November. It has an average annual rainfall of 1,820 to 2,359 mm and average monthly temperature of 22 to 25 degrees Centigrade. The general landform is mountainous with the lowest elevation of 500 m above sea level up to the highest elevation of 1,448 meters above sea level. The area's slope gradient ranging from 3 to 8 percent, is gently undulating to sinuating to 50% very steep elevation (Fig. 3). With the help of their Menro, the Kinaiyahan Foundation, and the Philippine Eagle Foundation, the BK was organized in 2009 to ensure that remaining forest of Mt. Sinaka are preserved and the whole area is reforested with indigenous forest and fruit trees [14].

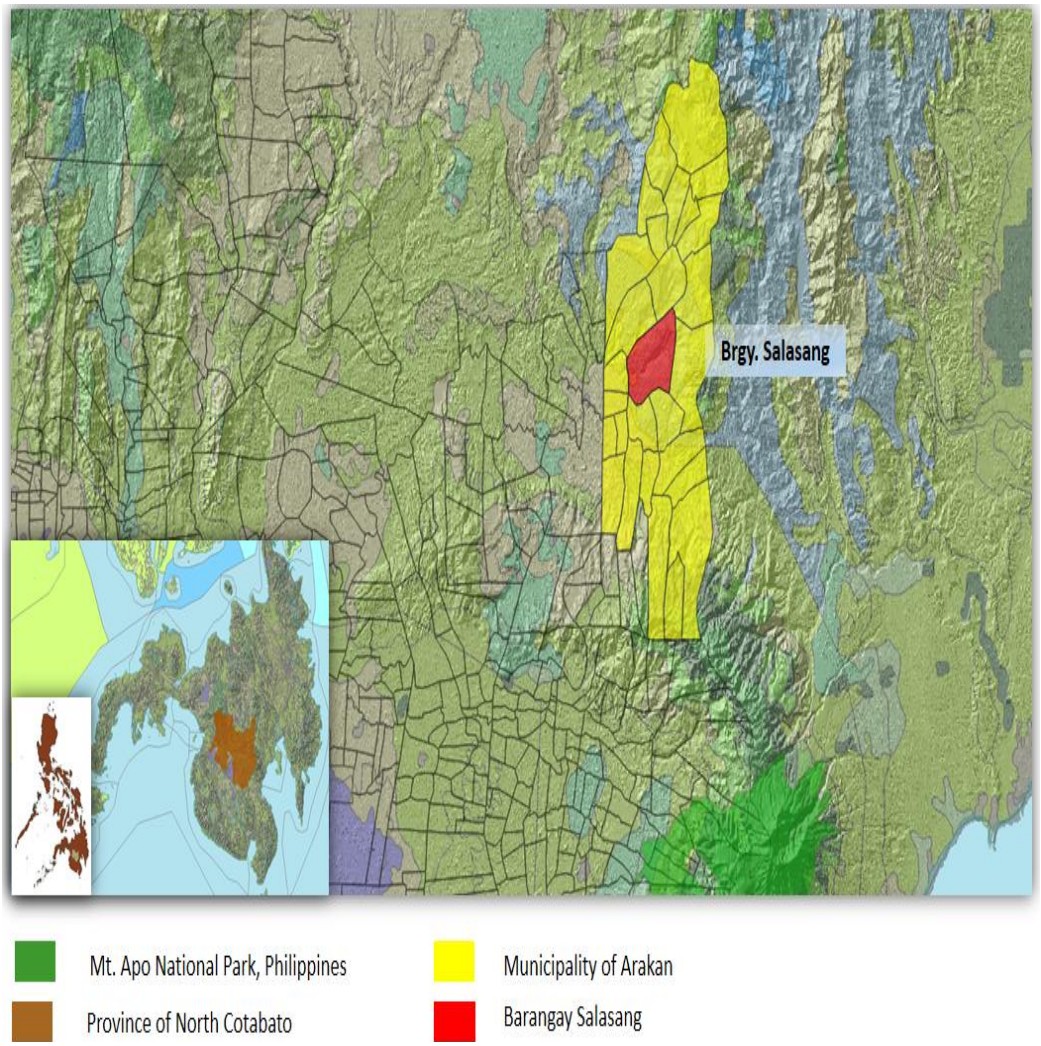

Fig. 2. Map of Barangay Salasang, Mt. Sinaka, Arakan

Fig. 3. Panoramic view of Barangay Salasang, Mt. Sinaka, Arakan

2.3 Ethnobotanical Survey

A preliminary survey was conducted in the study areas to prepare a database. The information about the ethnobotanical uses of the plants in the area were collected using the following methods:

A. An interview-based approach using semi-structured questionnaire in which questions related to the utilization of plants for different purposes (i.e medicine, food, fuels, etc.) were recorded using a voice recorder and with the help of an informant while making visits to the forests for the collection of plant species and their identification.
B. An inventory-based approach involving identification and documentation of plant specimens and subsequent interviews with the key informants registering the local names and uses of plants were documented.
C. An interactive discussion approach through meetings and discussions with various stakeholders like traditional herbal healers, school teachers, social workers, and local people were conducted to record the different uses of plants, methods and periods of collection, their conservation strategies and the fate of traditional knowledge systems.

2.4 Collection and Classification

Herbs and spices found in the study sites were collected for proper identification and description. Local guides accompanied the researcher in obtaining plant samples. The collected specimens were placed in individual cellophane bags and were labeled accordingly. The plant samples include, if possible, the important structures for identification such as the flowers, fruits, leaves and roots. Plant specimens were kept in newspaper stacks to allow absorption of water from samples. Propagated plants coming mostly from wildlings (trees), seeds or cuttings (herbaceous) collected from the survey areas were housed in a nursery at Purok 4, Baroy, Kidapawan City. During the collection, the natural habitat and the abundance of the plants in the area were also noted. Photographs of the plant in its natural habitat were taken for documentation.

2.5 Characterization, Identification and Confirmation of Specimens

Important features and botanical characteristics of the individual herbs and spices were recorded immediately upon collection. In describing the plant samples, the following morphological features were noted: leaf outline, leaf apices, leaf margins, leaf bases, venation, petioles, midrib, phyllotaxy, texture, odor and other distinctive characteristics such as flower arrangement to be consulted with expert plant taxonomists. The following features were also noted: Scientific name, common name, local name and family. Confirmation of identified specimens was done by Dr. Leopoldo L. Remollo (Mindanao State University of Dinaig, Maguindanao) plant taxonomist.

2.6 Preparation of Plant Extracts for Phytochemical Analyses

The plant materials were washed with water, cut into pieces, sun-dried for 5 days and were further dried in an oven below 60°C. The dried plant materials were pulverized into coarse powder in a grinding machine. Ten (10) grams of each plant sample was extracted separately in cold methanol and ethanol. Solvent from each sample is filtered, squeezed off and evaporated under reduced pressure in a rotary evaporator to obtain crude extract [15]. Samples were stored in the dark bottles at 4°C until used [16]. (Mihailovic et al., 2011; Nahak and Sahu, 2011). Extract samples were used for the evaluation of phytochemical components of the herbs and spices.

2.7 Phytochemical Analysis

The following bioactive components were analyzed using the standard methods by Trease and Evans [17] as used by Saidu and Garba [18]. To determine the quantity and percentage composition of the bioactive components, the extracts were subjected to spectrophotometric analysis.

2.7.1 Tannins

Tannins are used as astringent, often antiseptic and as compound for checking bleeding and discharges. A portion of the extract was dissolved in water and clarified by filtration. Ten percent of Ferric chloride solution was added to the resulting filtrate. The bluish color indicates presence of tannins.

2.7.2 Alkaloids

Alkaloids are bitter and are often alkaline nitrogenous compounds. They affect the central nervous system and many are toxic and addictive. A 0.5g of the 70extract was stirred in 5.0mL of 1% HCl on steam bath and filtered while hot. Few drops of distilled water were added and 1.0mL of the filtrate was treated with few drops of Wagner's reagent. A reddish brown precipitate indicates presence of alkaloids.

2.7.3 Flavonoids

Flavonoids are bitter or sweet compounds, often diuretic, antiseptic, antispasmodic, and anti-inflammatory. Two milliliter of diluted NaOH was added to 2.0mL of the extract. The appearance of a yellow color indicates presence of flavonoids.

2.7.4 Anthraquinones

Antraquinones are bitter compounds used as irritant and laxative. Five grams of extract was shaken with 10mL of benzene and filtered, then 10% of ammonia solution was added to the filtrate and the mixture was shaken. The formation of a pink, red or violet color on the ammoniacal phase indicates presence of anthraquinones.

2.7.5 Saponins

Saponins are sweet, stimulant hormonal, often anti-inflammatory or antidiuretic compounds. One milliliter distilled water was added to 1.0mL extract and was shaken vigorously. A stable persistent froth indicates the presence of saponins.

2.8 Methodology for Plant Propagation

Selected plants were propagated in a nursery at Purok 4 Lanao, Kidapawan City. Different plant parts were used to propagate the plants such as bulbs, wildlings, seeds, stem cuttings and roots of trees, shrubs and herbs. storage organs such as tubers of most of Zingiberaceae family.

2.9 Determination of Conservation and Distribution Status

The conservation and distribution status of plants were determined using the International Union for the Conservation of Nature Version 2010.4Redlist, Germplasm Resources Information Network [19] and Fernando et al., [20].

2.10 Data Analysis

Species analysis was conducted using only the parameters such as Shannon Index to determine the importance value of the species.

3. RESULTS AND DISCUSSION

3.1 Classification of Herbs and Spices in Different Study Areas in North Cotabato (2013)

A total of forty-eight (48) species of herbs and spices belonging to thirty-eight (38) genera and twenty-seven (27) families were found in four study areas in North Cotabato (Table 1).

Table 1. Occurrences of indigenous herbs and spices in four study sites 2013

Family	Scientific Name	Common Name	Local Name	Occurrences in the Study Sites			
				Ss 1	Ss 2	Ss 3	Ss 4
1. Anacardiaceae	1. *Buchanania Arborescens* (Blume)	Balinghasai	Balinghasai				+
	2. *Koordersiodendron pinnatum* (Blanco) Merr.	Amugis	Amugis				+
	3. *Spondia purpurea* Linn.	Sineguelas	Sargilas (Manobo)		+		
	4. *Spondias pinnata* (L.f.) Kurz.	Libas	Alubihod (Manobo)				+
2. Annonaceae	5. *Annona reticulata* Linn	Anonas	Anonas	+			+
3. Apocynaceae	6. *Hoya multiflora* (Blume) Desne	Hoya	Hoya			+	+
4. Berberidaceae	7. *Rubus fraxinifolius* Linn	Wild Strawberry	Ananahon (Manobo)	+		+	
5. Brassicaceae	8. *Nasturtium officinale* Linn	watercress	Muti-muti (Bagobo)		+	+	
6. Clusiaceae	9. *Garcinia binucao* (Blanco) Choisy	Binucao	Batuan (Manobo)		+		+
7. Chrysobalanaceae	10. *Atuna racemosa* Rafin.ssp. *racemosa*	Tabon-tabon	Tabon-tabon				+
8. Dilleniaceae	11. *Dillenina hilippinensis* Rolfe	Katmon	Kolambog (Manobo)	+			+
9. Euphorbiaceae	12. *Antidesma bunuis* (L.) Spreng	Bignai	Bugnay (Manobo)	+			+
	13. *Antidesma entandrum* (Blanco) Merr	Bignai-pugo	Bignai-pugo				+
	14. *Euphorbia neriifolia* Linn	Soro-soro	Sudu-sudu (Manobo)		+		+
	15. *Melanolepis multiglandulosa* (Reinw.ex Blume) Reichb & Zoll.var *multiglandulosa*	Alim	Alom-alom (Manobo and Bagobo)			+	
	16. *Phyllanthus acidus* (L) Skeels	Karmay	Iba			+	

Family	Scientific Name	Common Name	Local Name	Occurrences in the Study Sites			
				Ss 1	Ss 2	Ss 3	Ss 4
	17. *Phyllanthus debilis* Klein	Surusampalok	Sursampalok				+
10. Flacourtaceae	18. *Pangium edule* Reinw. Ex Blume	Pangi	Pangi	+		+	+
11. Lamiaceae	19. *Coleus amboinicus* Linn	Oregano	Oregano	+	+	+	+
	20. *Mentha arvensis* Linn	Hierbabuena	Yerba Buena	+	+	+	+
	21. *Mentha spicata* Linn	Garden mint	Minti (Manobo)	+	+	+	+
	22. *Ocimum basilanicum* Linn.	Bawing	Sangeg, Tahiya (Manobo)	+	+	+	+
12. Lauraceae	23. *Cinnamomum mercadoi* Vidal	Kalingag	Karingag	+			+
13. Liliacea	24. *Allium ascolonicum* Linn	Sibuyas Cuyos	Lagada		+	+	
	25. *Allium schoenopressum* Linn	Chives	Sabojing	+	+	+	+
14. Malvaceae	26. *Hibiscus rosa-sinensis* Linn	Gumamela	Gumamela	+	+	+	+
	27. *Hibiscus surattensis* Linn.	Labuag	Kolabog (Manobo)		+	+	
15. Melastomaceae	28. *Hibiscus sabdariffa* Linn	Roselle morado	Labog (Manobo)		+	+	
	29. *Melastoma malabaricum* Linn	Malatungao	Malatungao		+		+
16. Moraceae	30. *Artocarpus nitidus* Trec. Ssp. Nitidus	Kubi	Terekawan (Bagobo)				+
17. Myrtaceae	31. *Syzygium curanii* (G.B. Bob) Merr	Curran's Lipote					+
	32. *Syzygium sputchinsomi* Merr	Malatambis	Tambis (Manobo)		+	+	
18. Pandanaceae	33. *Pandanus amaryllifolius* Roxb.	Pandan mabango	Pandan		+	+	+
19. Poaceae	34. *Cymbopogon citratus* Stapf.	Tanglad	Bayang-gusan	+	+	+	+
20. Portulacaceae	35. *Peperomia pellucida* (L.) HBK	Olasiman ihalas		+	+		
21. Rubiaceae	36. *Coffea Arabica* Linn	Kape		+	+		
	37. *Morinda umbellata* Linn	Indian mulberry		+	+		
22. Rutaceae	38. *Citrus macroptera* Montr. var. *micrantha* (Wester) Tan.	Biasong		+			+

Family	Scientific Name	Common Name	Local Name	Occurrences in the Study Sites			
				Ss 1	Ss 2	Ss 3	Ss 4
23. 2Sapindaceae	39. *Dimocarpus longan* Lour ssp. *malesianus* Leenh var. *malesianus*	Alupag lalaki					+
24. Solanaceae	40. *Capsicum frutescens* Linn	Chili	Sili	+	+	+	+
25. Sterculiaceae	41. *Sterculata oblongata* R. Br.	Malabuho					+
26. Umbelliferae	42. *Anethum graveolens* Linn	Dill		+		+	
27. Zingiberaceae	43. *Alpinia galangal*	Galanga	Tikwas (Manobo)	+		+	+
	44. *Curcuma domestica* Linn	Dilaw	Karawag, Dulaw (Manobo)	+	+	+	+
	45. *Curcuma zedoaria* Bosc.	Barik	Barak (Manobo)	+		+	+
	46. *Kolowratia elegans* Linn	Tagbak	Bagombon (Manobo)	+		+	+
	47.*Languas speciosa* (Wadl.)	Langkuas	Langkuas	+			+
	48. *Zingiber officinale* Linn	Ginger	Luya	+	+	+	+
Total				**27**	**22**	**36**	**35**

Legend:

Ss 1- Sitio Malumpine *Ss 3- Barangay Monobo (Tiko)*
Ss 2- Barangay Imamaling *Ss 4- Barangay Salasang, Mt. Sinaka, Arakan*

List 1. Shannon Diversity Index (H)

Species	Abundance				*pi*				*ln(pi)*				*Pi* x *ln(pi)*			
	a	b	c	d	a	b	c	d	A	b	c	d	a	b	c	D
herbs	2	6	4	3	.25	.29	.29	.50	-1.39	-1.24	-1.24	-0.69	-0.34	-0.36	-0.36	-0.34
spices	6	15	10	3	.75	.71	.71	.50	-0.29	-0.34	-0.34	-0.69	-0.22	-0.24	-0.24	-0.34
	8	21	14	6									-0.56	-0.60	-0.60	-0.68

Legends: *A- Brgy. Malumpine* *B- Brgy. Imamaling* *C- Brgy. Tiko* *D-Brgy. Sinaka*

Inventory of species in the 4 study areas showed that Barangay Manobo (Tiko) and Barangay Salasang, Mt. Sinaka, Arakan areas have the highest species richness among the four study areas. This could be attributed to the more intact forest of the areas compared to that of Sitio Malumpine which was slopy and Barangay Imamaling observed to have fewer vegetation.

$$H' = -\sum_{i=1}^{S} p_i \ln p_i$$

Brgy A= 0.56 B=-0.60 C=-0.60
D= 0.68

The higher the value of H, the higher the diversity of species in a particular community. The lower the value of H, the lower the diversity. A value of H = 0 indicates a community that only has one species. The Shannon Equitability Index is a way to measure the evenness of species in a community.

This describes that the study areas occur at distinct altitudes due to varying environmental conditions. Temperature, humidity, soil composition are important factors in determining the presence of the species, which consequently support different vegetation of species [21].

The families of the herbs and spices are shown in Fig. 4. The highest number of species recorded were under Family Euphorbiaceae (12.5%) and Zingiberaceae (12.5%) followed by Family Anacardiaceae and Lamiacea with (8.33%) respectively, with 4 taxa each. Family Liliaceae, Malvaceae, Melastomaceae, Myrtaceae and Rubiaceae with (4.16%) have 2 representative taxa each. The rest of the families were represented by one species which comprise 37.5% are the following: Family Annonaceae, Apocynaceae, Berberidaceae, Brassicaceae, Clusiaceae, Chrysobalanceae, Dilleniaceae, Flacourtiaceae, Hydrocharitaceae, Lauraceae, Melastomaceae, Moraceae, Pandanaceae, Poaceae, Portulacaceae, Rutaceae Sapindaceae, Solanaceae, Sterculiaceae and Umbelliferaceae.

Species of herbs and spices under Family Euphorbiaceae and Zingiberaceae were the most commonly propagated species by the locals because of their important uses. According to Choudhary et al., 2008, local people are dependent on these Species of plants for treatment of various ailment because of their therapeutic properties and are widely used as spice and condiments.

Members of the Family Zingiberaceae (ginger family) are important root spices. These plants mostly grow from thickened aromatic rhizomes with large, upright, alternate leaves. They are mostly found in tropical and subtropical regions of the world. This family include “galangal”, “gingers”, “turmeric”, “dilaw”, “barik, langkwas” and “tagbak” [22].

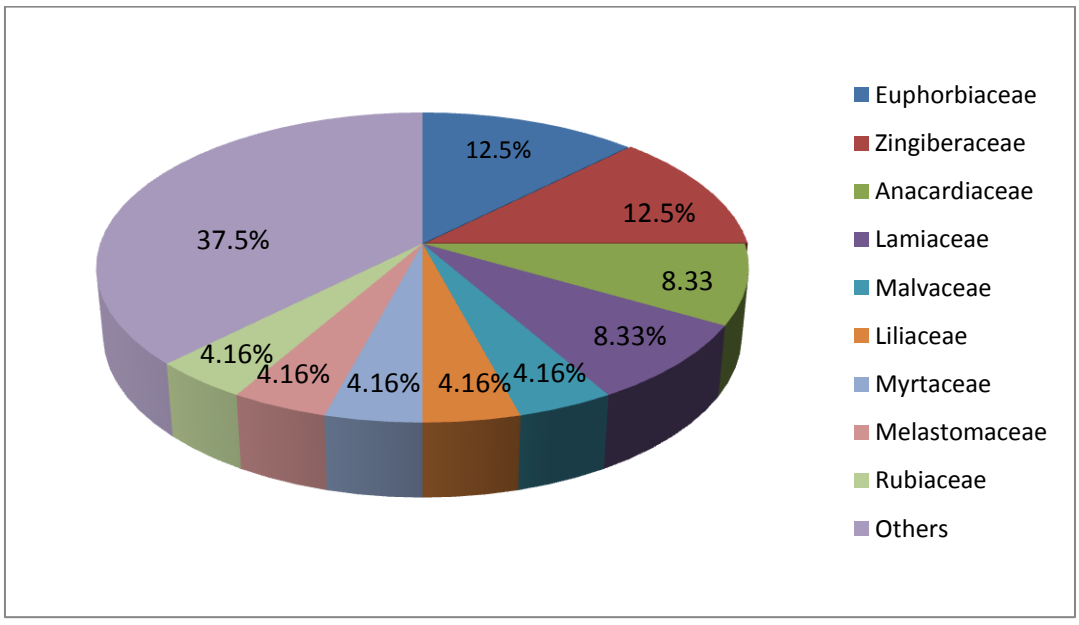

Fig. 4. Families of plants utilized as herbs and spices

Zingiberaceae family is consumed widely not only as a spice but also as a medicinal agent. The principal constituents of ginger include [6]-gingerol, [6]-paradol, [6]-shogaol (dehydration gingerols), and zingerone .Gingerol has also been shown to decrease intracellular formation in human keratinocyte cells [23], inhibit angiogenesis in human ECs, and limit nitrogen oxide synthase expression and epidermal growth factor-induced cell transformation and AP-1 transcriptional complexes in JB6 cells [24,25] (Ippoushi et al., 2007; Kim et al., 2005) [26]. According to Sontakke et al., [27]. Zingiberaceae also appears to have antitumorigenic properties.

Euphorbiaceae ranks the same with Zingiberaceae on their used as herbs and spices. The latex of Euphorbiaceae seems to possess magical properties and have been worked out extensively. Chemical and phytochemical analysis of Euphorbiaceae reveal the presence of many important active ingredients like, flavonoids, phenolic compounds, vitamins and amino acids. This plant has immense potential and have broad spectrum of activity on several ailments. This plant can be used safely for longer duration as a cheap source of active therapeutics for alleviation of commonly occurring ailments [28].

Phytochemical analysis of family Anacardiaceae particularly *Spondia purpurea* Linn reveals that the plant contains tannins, alkaloids, flavonoids, steroidal saponins, sterols, terpenes and a large amount of essential oil [2].

Family Malvaceae contains a wide range of chemical compounds such as terpenoids, lipids, glycoside, flavanoids which are responsible for its various pharmacological properties. The various parts of the plant like roots, bark, leaves, flowers and fruits are known to possess different pharmacological properties.

Family Lamiaceae are mint family and are frequently aromatic and widely used as culinary herbs. It contains alkaloids, tannins, flavonoids and terpenoids [30].

Family Lamiaceae like *Ocimum basilanicum* Linn. *(*bawing), *Menthe spicata* Linn *(*garden mint*), Mentha arvensis* Linn *(H*erbabuena*)* and *Coleus amboinicus* Linn*(*oregano*),* Family Liliaceae *such as Allium schoenopressum* Linn *(c*hives*),* Family Malvanaceae *Hibiscus rosa-sinensis* Linn *(*gumamela*),* Family Poaceae *(Cymbopogon citratus)* Stapf. (tanglad), Family Solanaceae (*Capsicum frutescens)* Linn (chili) and Family Zingiberaceae *(Curcuma domestica* Linn (dulaw) and *Zingiber officinale)* Linn *(*ginger) are commonly found in the study sites. It is because these species have its food and medicinal value. *Curcuma zedoaria* Bosc. *(*barak*), Kolowratia elegans* Linn (Tagbak), *Alpinia galangal (*galangal*), Curcuma domestica* Linn *(*turmeric*), Pandanus amaryllifolius* Roxb. *(*pandan mabango*), Pangium edule* Reinw. Ex Blume *(*pangi*)* and *Atuna racemosa* Rafin.ssp. *racemosa (*tabon-tabon*)* are found in three study sites*.*

3.2 Conservation and Distribution Status of Herbs and Spices in the Study Sites 2013

The conservation and distribution status of herbs and spices are presented in Table 2. Out of the 48 plant species identified, one species *Euphorbia neriifolia* Linn of Family Euphorbiacea was categorized as Critically Endangered by GRIN [19]. It qualified as Endangered (EN) based on its small extent of occurrence (13 km²) and ongoing decline. *Euphorbia neriifolia* Linn (Soro-soro) is a very large plant which is observed to be declining by 40% over the past 50 years and there is continuing decline until the present. It is estimated that the decline is>20% over the next generation. This plant is common in primary forests at moderate elevations. It grows seven feet or tall or higher. Its population is very dense but is decreasing due to cuttings for fear that it brings bad omen and is home to bad spirits (based on a personal interview Kagawad Celso Inig of Tiko, 2013) [31].

Three (3) vulnerable species (VU), *Cinnamomum mercadoi* Vidal (Kalingag) and *Dillenia philippinensis* Rolfe (Katmon) and *Koordersiodendron pinnatum* (Blanco) Merr. (Amugis) were also found in the areas of Sitio Malumpine and Barangay Salasang, Mt. Sinaka, Arakan and in Barangay Manobo (Tiko). The conservation status of the 3 vulnerable species was assessed based on Fernando et al., [20] and IUCN [32].

Four species were assessed as lower risk or near threatened (LR/nt) category; that is, it is not yet threatened but is under threat from adverse factors, such as over collection, predation and destruction of habitat like *Hoya multiflora* (Blume) Desne, *Pangiu medule* Reinw. Ex Blume, *Peperomia pellucida* (L.) HBK. and *Morinda umbellata* Linn**.** Because of such threat, it is likely to move to the vulnerable category in the near future [20]. Twenty-five species were categorized as least concern (LC).

Table 2. Conservation and distribution status of indigenous herbs and spices in four study sites, 2013

Family	*Scientific Name*	Conservation Status	Distribution Status
Anacardiaceae	*1. Dracontomelon dao*	VU	Common
	2. Magnifera indica .	LC	Endemic
	3. Spondias pinnata (Lof.) Kurz..	LC	Common
	4. Spondia purpurea Linn.	LC	Endemic
Annonaceae	*5. Annona reticulata* Linn	LC	Endemic
Apocynaceae	*6. Alstonia scholaris*	LR/NT	Endemic
Berberidaceae	*7. Ehretia microphylla*	LC	Common
Brassicaceae	*8. Nasturtium officinale* Linn	LC	Common
Clusiaceae	*9. Garcinia binucao* (Blanco) Choisy	LC	Endemic
Chrysobalanaceae	*10. Atuna racemosa* Rafin.ssp. *racemosa*	LC	Common
Dilleniaceae	*11. Dillenina philippinensis* Rolfe	VU	Endemic
Euphorbiaceae	*12. Antidesma bunuis (*L.) Spreng	LC	Common
	13. Antidesma pentandrum (Blanco) Merr	LC	Endemic
	14. Euphorbia neriifolia Linn	CR	Common
	15. Melanolepis multiglandulosa (Reinw.ex Blume) Reichb & Zoll.var multiglandulosa	LC	Endemic
	*16. Phyllanthus acidus (*L) Skeels	LC	Endemic
	17. Phyllanthus debilis Klein	LC	Endemic
Flacourtaceae	*18. Pangium edule Reinw.* Ex Blume	LR/NT	Endemic
Lamiaceae	*19. Coleus amboinicus* Linn	LC	Common
	20. Mentha arvensis Linn	LC	Endemic
	21. Mentha spicata Linn	LC	Common
	22. Ocimum basilanicum Linn.	LC	Common
Lauraceae	*23. Cinnamomum mercadoi* Vidal	VU	Endemic
Liliacea	*24. Allium ascolonicum* Linn	LC	Common
	25. Allium schoenopressum Linn	LC	Common
Malvaceae	*26. Hibiscus rosa-sinensis* Linn	LC	Common
	27. Hibiscus sabdariffa Linn	LC	Common
	28. Hibiscus surattensis Linn.	LC	Common
Melastomaceae	*29. Melastoma malabaricum* Linn	LC	Common
Moraceae	*30. Artocarpus nitidus Trec. Ssp. nitidus*	LC	Common
Myrtaceae	*31. Syzygium curanii* (G.B. Bob) Merr	LC	Endemic
	32. Syzygium sputchinsomi Merr	LC	Endemic
Pandanaceae	*33. Pandanus amaryllifolius* Roxb.	LC	Common
Poaceae	*34. Cymbopogon citratus* Stapf.	LC	Endemic
Portulacaceae	*35. Peperomia pellucida (*L.) HBK	LR/NT	Endemic
Rubiaceae	*36. Coffea Arabica* Linn	LC	Common
	37. Morinda umbellata Linn	LR/NT	Endemic
Rutaceae	38. *Citrus macroptera* Montr. var. *micrantha* (Wester) Tan.	LC	Common
Sapindaceae	39*. Dimocarpus longan* Lour ssp. *malesianus* Leenh var. *malesianus*	LC	Common
Solanaceae	40*. Capsicum frutescens* Linn	LC	Common
Sterculiaceae	41*. Sterculata oblongata* R. Br.	LC	Common
Umbelliferae	42*. Anethum graveolens* Linn	LC	Common
Zingiberaceae	43*. Alpinia galangal*	LC	Endemic

Family	*Scientific Name*	Conservation Status	Distribution Status
	44.*Curcuma domestica* Linn	LC	Common
	45*. Curcuma zedoaria* Bosc.	LC	Common
	46*. Kolowratia elegans* Linn	LC	Common
	47.*Languas speciosa* (Wadl.)	LC	Endemic
	48*. Zingiber officinale* Linn	LC	Common

Legend :
CR- Critically Endangered, NE- Not Evaluated, LC- Least Concern
LR/NT- Lower Risk/Near Threatened, VU- Vulnerable

The presence of fourteen endemic species were noted in the 4 study sites. Namely: *Spondia purpurea* Linn (Sineguelas), *Spondias pinnata* (Lof.) Kurz. (Libas) , *Annona reticulata* Linn (Anonas), *Garcinia binucao* (Blanco) Choisy (Batuan), *Melanolepis multiglandulosa* (Reinw.ex Blume) Reichb & Zoll.var *multiglandulosa* (Alim), *Phyllanthus acidus* (L) Skeels, *Phyllanthus debilis* Klein (Surusampalok), *Antidesma pentandrum* (Blanco) Merr (Bignai-pugo), *Mentha arvensis* Linn (Hierbabuena), *Syzygium sputchinsomi* Merr (Malatambis), *Syzygium curanii* (G.B. Bob) Merr (Curran's Lipote), *Cymbopogon citratus* Stapf. (Tanglad) and *Alpinia galangal (*Langkuas*).*

3.3 Utilization of Herbs and Spices in the Four Study Sites

Utilization of herbs and spices in the four different study sites (Table 3). It was noted that there were 15 plant samples used as herbs and thirty-four (34) used as spices and condiments in food. Various parts of herbs and spices were edible. Among the trees were fruits (ripe/unripe), fleshy pericarp, translucent pulp: seeds (cotelydon); young leaves/ shoot tips, fresh flowers, bark and saps. Among shrubs, the edible parts were fruits (ripe/unripe). The edible parts for herbs were rhizome, young leaves/ shoots, young stems, tubers and fruits (ripe). The edible parts of vines were fruits (ripe young fruit), young shoots, young stems and tubers. These parts could be prepared and cooked with different dishes.

Zinger officinale Linn is a wild tuberous plant which is used as spice and condiment not only by the indigenous people but also by the urban people [33]. *Pangium edule* Reinw. Ex Blume is reported to contain toxin but the tribal community like Nicobaries, Onges, Oraons, phanias, Rotha, Saoras, Santals and Shompensin Rajasthan, India has much knowledge has much about its detoxification by keeping them overnight in running water or boiling with water before cooking [33].

Other uses of the plants which are prepared in different ways were as aromatics and flavorings to meat and fish stews and other recipes, soups, drinks, salads and even cakes. These plants though may also be used as alternative food, medicine and others. The Manobo and Tagabawa tribes depend on plant resources mainly for herbal medicines, food, forage, fodder, construction of dwellings, making household implements, sleeping mats, and as firewood and shades, hence importance of conserving their natural habitats (Bora et al., 2006).

3.4 Phytochemical Analysis

Out of forty-nine (49) samples, only two (2) samples were selected for phytochemical analysis based on the results of the prescreening done on their antimicrobial activity. These are *Atuna racemosa* Rafin.ssp*. racemosa* (tabon-tabon) and *Euphorbia neriifolia* Linn (soro-soro). The two species possess greater antimicrobial potential (Table 4).

The phytochemical composition of *Atuna racemosa* Rafin.ssp. *racemosa* (tabon-tabon) fruit extract and *Euphorbia neriifolia* Linn leaf extracts revealed the presence of secondary metabolites of therapeutical importance. *Atuna racemosa* Rafin.ssp. *racemosa* was positive for saponins, alkaloids and flavonoids while *Euphorbia neriifolia* Linn was positive for saponins, alkaloids, flavonoids and tannins. However, all extracts showed the absence of anthraquinones.

All of these phytochemicals except anthraquinones possess good antioxidant activities and has been reported to exhibit multiple biological effect including anti-inflammatory and antitumor activities [34].

Table 3. Local utilization of herbs and spices in the four study sites 2013.

Scientific Name	Common Name	Local Name	Parts Utilized	Preparation and Its Uses
Allium ascolonicum Linn	Sibuyas Cuyos	Sibuyas (Manobo)	Leaves	Dried leaves are sliced thinly and used to garnish mixed salads, vegetables and soups to give mild onion flavor.
Allium schoenopressum Linn	Chives	Sabojing (Tagabawa) Lahagda (Manobo)	leaves, roots	Dried leaves are sliced thinly and used to garnish mixed salads, vegetables and soups to give mild onion flavor, roots to be boiled.
Alpinia galangal	Galanga	Tikwas (Manobo) Langkuas (Tagabawa)	Tubers, roots	Add in soups and curries.
Anethum graveolens Linn	Dill	Dill	Seeds Leaves	Fresh and dried leaves called dill weed are used as tea or added to boiled or fried meat and fish, in sandwiches and fish sauces. It is also an essential ingredient for flavouring of sour vinegar.
Annona reticulata Linn	Anonas	Anonas (Manobo)	Fruits, leaves and bark	Wash and slice into small pieces. Can add flavor to meat and fish dishes.
Antidesma bunuis (L.) Spreng	Bignai	Bugnay (Manobo)	Fruits, leaves, bark	Used in preparation of sauce for fish dishes.
Antidesma pentandrum (Blanco) Merr	Bignai-pugo	Bignai-pugo (Manobo)	Fruits	Fruits are used to sour soups or to enhance flavor to "*sinigang*".
Artocarpus nitidus Trec. Ssp. *Nitidus*	Kubi	*Terekawan* (Bagobo)	Fruits	Peel and wash with running water. Can be added to improve flavor of "*paksiw*"
Atuna racemosa Rafin.ssp.*racemosa*	Tabon-tabon	Tabon-tabon	Fruits	The kernel is scraped off with a spoon, added with vinegar, and squeezed to extract liquid. Used to remove the fishy smell of the "kinilaw" and to improve taste.
Buchanania arborescens (Blume) Blume	Balinghasai	Balinghasai	Seeds, leaves, bark	Roast and pound to garnish into cakes or used as an icing. It is also used to add flavor to "Kare-kare"
Capsicum frutescens Linn	Chili	Sili	Fruits	Fruits are used to give spicy flavor to food
Cinnamomum mercadoi Vidal	Kalingag	Karingag (Manobo)	Bark	Used to enhance flavor of fish and meat stew.
Citrus macroptera Montr. Var.	Biasong	Biasong	Fruits	Squeeze to extract juice to flavor food and drinks.

Scientific Name	Common Name	Local Name	Parts Utilized	Preparation and Its Uses
(Wester) Tan.				
Coffea Arabica Linn	Kape	kape	seeds	Roasted powder used to flavor food and drinks.
Coleus amboinicus Linn	Oregano	Oregano	Leaves	Used to enhance flavor to soups, stews, sauces, cheese, breads, eggs and vegetables.
Curcuma domestica Linn	Turmeric	Dulaw	Fruits /roots	Dried roots give flavor and color to curry powders. Used to add flavor to certain dishes.
Curcuma zedoaria Bosc.	Barik	Barak	Fruits	Added as flavoring for soups and sauces.
Cymbopogon citratus Stapf.	Tanglad	Baying-gusan (Manobo)	Leaves	Added to soups, stir-fries, stews, seafood and sauces.
Dillenina philippinensis Rolfe	Katmon	Kolambog (Manobo)	Flowers Fruits, young shoots	Used as flavoring for sour fish soup and taste somewhat like green sour apples.
Dimocarpus longan Lour ssp. *malesianus* Leenh var. *malesianus*	Alupag lalaki	Alupag	Fruits Seeds	Added to salads to enhance flavor.
Euphorbia neriifolia Linn	Soro-soro	Sudu-sudu (Manobo)	Leaves, roots,	Used to improve fish flavor like *"paksiw"* and *"sinigang*". Can be added as filling in roasted chicken and pork.

Table 4. Phytochemical composition of the selected plant samples in the four (4) study sites 2013

Phytochemical Test	Plant Extract	
	***Atunaracemosa* (tabon-tabon)**	***Euphorbia neriifolia* (soro-soro)**
Saponins	+	+
Alkaloids	+	+
Flavonoids	+	+
Tannins	-	+
Anthraquinones	-	-

***Legend**:*
+ present, - absent

Saponins are a group of naturally occurring plant glycosides, characterized by their strong foam-forming properties in aqueous solution. The presence of saponins has been reported in more than 100 families of plants out of which at least 150 kinds of natural saponins have been found to possess significant anti-cancer properties. Due to the great variability of their structures, saponins always display anti-tumorigenic effects through varieties of antitumor pathways [35].

Alkaloids are significant for the protection and survival of plants because they ensure their survival against microorganisms as antibacterial, antifungal activities, antitussive (agents that suppresses the coughing reflex). It is also used as local anesthetic and indispensable analgesic used for treatment of severe pain [36].

The presence of Flavonoids was found in the extract and are potent water -soluble antioxidants which prevent oxidative cell damage suggesting antiseptic, anticancer, anti-inflammatory effects and mild hypersensitivity properties [37]. Tannins suggests wound healing property of this plant [38]. Elmarie and Johan, 2001 have reported tannins to have antibacterial activity. Tannins and flavonoids are thought to be responsible for antidiarrheal activity [39].

Euphorbia neriifolia Linn have been known for its medicinal value, such as antibacterial, antifungal, antiviral, antiparasitic, antiarthritic, antidiabetic, anticonvulsant, antioxidant, wound healing and immuno-modulatory, radio protective, spasmodic, aphrodisiac, anticancer, purgative and limit diseases limit diseases among others [28].

According to Burkill and Haniff [40,41], the leaves are reported to be useful as carminative, stomachic and expectorant. A fluid extracted from the roasted leaves is used for earache. The expressed juice of the leaves is reported as very effective in relieving the paroxyms of spasmodic asthma. Gaur et al. [42] reported that anti-inflammatory and analgesic activity of hydrolcoholic leaves extract of *Euphorbia neriifolia* Linn is due to the presence of flavonoids. Flavonoids which is present in *Euphorbia neriifolia* Linn can reduce chronic diseases [28].

Euphorbia neriifolia Linn has immense potential and have broad spectrum of activity on several ailments. This plant can be used safely for longer duration as a cheap source of active therapeutics for alleviation of commonly occurring ailments by the poor and under privileged people of India. In spite of its various medicinal uses, no systematic studies in the literature regarding the pharmacological effect of Sehund leaves extract for degenerative diseases has been reported [28].

The phytochemical composition of *Atuna racemosa* Rafin.ssp. *racemosa* fruit extract indicated the presence of secondary metabolites such as saponins, alkaloids and flavonoids. Castilho and Kaplan (2008) described the chemical constituents isolated from the fruits of *Atuna racemosa* Rafin.ssp. *racemosa*. These are terpenes, betulinic acid, ursolic acid, oleanolic acid, palmitoleic acid, hexadecanoic acid, and other compounds. Other members of Chrysobalanaceae [43], such as Chrysobalanus, Coupeia and Parinarium also presented similar chemical composition: flavonoids, tannins, diterpenes, terpenes and steroids as secondary metabolites [44,45,46] (Oberlies et al., 2001; Fernandes et al., 2003; Zuque et al., 2004; Castilho et al., 2008).

Atuna racemosa Rafin.ssp. *racemosa* (tabon-tabon) remarkably showed high equivalent values for phenolics content. In addition, the results showed that the antioxidative potentials of

Table 5. Propagation and Survival Rate of the Herbs and Spices

Scientific name	Plant Part Propagated	Number of individuals Propagules	Number that Survived	Survival Rate (%)
Allium schoenopressum Linn	Bulb	3	3	100
Allium ascolonicum Linn	Bulb	4	4	100
Alpinia galangal	Wildling	2	2	100
Anethum graveolens L.	Bulb	2	2	100
Annona reticulata Linn	Wildling	2	1	50
Antidesma bunuis (L.) Spreng	Wildling	1	0	0
*Antidesma pentandrum (*Blanco) Merr	Wildling	1	0	0
Atuna racemose Rafin.ssp.*racemosa*	Wildling	11	9	82
*Artocarpusnitidus*Trec. Ssp. *Nitidus*	Wildling	2	1	50
Buchanania arborescens (Blume)Blume	Wildling	1	0	0
Capsicum frutescens Linn	Seeds	3	3	100
Citrus macroptera Montera Var. macrantha Wester Tan	wildling	1	0	0
Coleus amboinicus Linn	Stem cutting	3	3	100
Curcuma zedoaria Bosc.	Wildling	2	2	100
Curcuma domestica Linn	Roots	2	2	100
Cymbopogon citratus Stapf.	Stem cutting	5	5	100
Dillenia philippinensis Rolfe	Wildling	1	0	0
Dimocarpus longan Lour ssp. *Malesianus* Leenh var. *Malesianus*	Wildling	1	0	0
Euphorbia neriifolia Linn	Stem cutting	5	3	60
Garcinina binucao (Blanco) Choisy	Wildling	1	1	100
Hibiscus rosa-sinensis Linn	Stem cutting	3	3	100
Hibiscus surattensis Linn	Stem cutting	5	5	100
Hibiscus sabdariffa Linn	Stem cutting	5	5	100
Hoya multiflora (Blume) Desne	Stem cutting	3	3	100
Kolowratia elegans Presl	Stem cuttings	2	2	100
*Koordersiodendron pinnatum (*Blanco) Merr	wildling	1	0	0
Languas speciosa (Wadl.)	Roots	2	2	100
Melastoma malabaricum Linn	Wildling	2	2	100
Mentha arvensis Linn	Stem cutting	3	3	100
Mentha spicata Linn	Wildling	3	3	100
Melanolepis multiglandulosa(Reinw.exBlume) Reichb & Zoll.var *multiglandulosa*	Wildling	3	3	100
Morinda umbellata Linn	Wildling	5	3	60
Nasturtium officinale Linn	Stem cutting	2	2	100
Ocimum basilanicum Linn.	Stem cutting	3	3	100
Pandanus amaryllifolius Roxb.	Wildling	2	2	100
Peperomia pellucida (L.) HBK	Wildling	4	4	100
Pangium edule Reinw. Ex Blume	Wildling	1	0	0

herbs and spices may not only be due to its total phenolics but also to the other groups of phytochemicals present. This finding marks a significant contribution as a prevention of cancer especially that these herbs and spices are readily available and can be found as condiments to any cooking procedure. These herbs and spices as found in a dish like *Atuna racemosa* Rafin.ssp. r*acemosa* can be an anticancer specialist in every meal [47].

An experiment conducted by Buenz [48] revealed that the fruit has phytochemicals and anti-bacterial properties. An extract of *Atuna racemosa* Rafin.ssp. *racemosa* (tabon-tabon) can significantly reduce the number of bacteria in the fish. This is probably the reason why there is virtually no reported food poisoning as a result of eating "*kinilaw"* that is prepared with a liquid extract of (*Atuna racemosa* Rafin. ssp. *racemosa*) or (tabon-tabon*)*.

3.5 Propagation and Survival Rate of the Herbs and Spices

To promote conservation of the herbs and spices identified, planting materials were collected and propagated. Table 5 shows the propagated sample species from the four study sites. It revealed that 29 species had 100% survival rate. This explains why these species are commonly found in dense stands along roadsides and abandoned lands. They are fast-spreading, thicket- forming, perennial herbs and somewhat shade tolerant. The species were *Allium schoenopressum* Linn, *Allium ascolonicum* Linn, *Alpinia galangal, Anethum graveolens L., Capsicum frutescens* Linn, *Coleus amboinicus* Linn, *Curcuma zedoaria* Bosc.,*Curcuma domestica* Linn, *Cymbopogon citratus* Staph., *Garcinia binucao* (Blanco), *Hibiscus rosa-sinensis* Linn Choisy, *Hibiscus surattensis* Linn, *Hibiscus sabdariffa* Linn, *Hoya multiflora* (Blume) Desne, *Kolowratia elegans* Presl., *Languas speciosa* (Wadl.), *Melastoma malabaricum* Linn, *Mentha arvensis* Linn, *Mentha spicata* Linn, *Melanolepis multiglandulosa*(Reinw.exBlume) Reichb & Zoll.var *multiglandulosa, Nasturtium officinale* Linn, *Ocimum basilanicum* Linn, *Pandanus amaryllifolius* Roxb, *Peperomia pellucida* (L.) HBK, *Phyllanthus acidus* (L) Skeels, *Spondia purpurea* Linn, *Spondias oblongata* R. Br, *Syzygium spotchinsomi* Merr. and *Zingeber officianale* Linn.

Atuna racemosa Rafin.ssp. *racemosa* had 82% survival rate. Tabon-tabon tree usually grows in the wild, and difficult to find. However, there are trees that are grown in the backyards in some towns of Northern Mindanao. Some people are making effort to propagate the tabon-tabon but only in a limited scale [49].

The rest of the species have a survival rate of below 100% probably because they were used to certain geographic location and could not adapt well in the open grasslands, lower elevation, medium altitudes and wet intermediate zone.

4. CONCLUSION

Indigenous tribes of North Cotabato utilize an ample number of plants as herbs and spices. Consumption of these in their daily diets may be considered strongly scientific as literatures and the survey show that a large number of them are used as sources of medicines and drugs. However, presence of threatened species of herbs and spices in the four areas requires urgent conservation action to prevent these important species from becoming extinct.

DISCLAIMER

The study highlights the efficacy of " herbal " which is an ancient tradition, used in some parts of India. This ancient concept should be carefully evaluated in the light of modern medical science and can be utilized partially if found suitable.

CONSENT

Informed consent was sought and obtained before the study.

The study adhered to RA 10173 or the Data Privacy Act of 2012.

1. Informed consent was sought and obtained before the study.
2. Anonymity was ensured by not collecting identifying information of individual subjects.
3. Confidentiality was ensured by not divulging the identity of the respondent's organizations.
4. The author enters into a relationship with participants treated with respect, cared and empathy.
5. The author spent sufficient time with the participants and engaged them in dialogue to obtained extensive results of the study.
6. The author provided communication and feedback mechanisms and 2-way communication throughout the study and beyond.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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