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7 Botanical and phytochemical constituents of several medicinal plants from mount Klabat north Minahasa

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Abstract

11
Medicinal plants are of great importance to the health of individuals and communities. The research has been done to examine the constituents of phytochemical and botanical characteristics of medicinal plants, ethnomedical surrounding mount Klabat, North Minahasa. The results of this study has found alkaloids, tannins, saponins, steroid, terpenoid and flavonoids as phytochemical constituents in 38 medicinal plants belonging to different families when they were compared and characterised. Part of the plant used for ethnomedicinal were: leaves, root, bark, fruit, seeds, pith and the whole plant parts as well. Tree and herbasius were the dominant habitus of medicinal plants. It was also revealed that stewing and ointment were the ethnomedicine general mode of use by the communities. The tested medicinal plants were also used to treat 16 types of diseases in the local communities.

Keywords: Medicinal plants, mount Klabat, botanical, phytochemical constituents

1. Introduction

Sulawesi Island is located in Zone Wallacea has high endeminitas level of flora and fauna. North Sulawesi is at the head of the island of Sulawesi, facing the Philippines and the Pacific Ocean. For generations, ethnic of Minahasa utilize local knowledge of medicinal plants. Knowledge and utilization of medicinal plants passed down from generation to generation. Some endemic plants that are used as a medicinal plant is *Ficus minahassae*, *Aglaiia minahassae*, *Lansium minahassae*, *Arec Vistaria*, *Mangostana indica* (Simbala, 2007). Minahasa ethnic community until today still retain the use of medicinal plants for treating various diseases such as Cancer, Diabetes, Gout, Anti-infective, etc. (Mamahani et al, 2016). Several studies medicinal plant extracts from Minahasa among others, the activity of antioxidant and anticancer extracts stem *Lansium domesticum* (Mokosuli, 2008), the activity of antihyperlipidemia extract gedi red stem (Sumampouw et. al. 2014) and Activities hepatoprotective combination of VCO and Mengkudu (Repi, et . al. 2013).

Klabat is the highest mountain in North Sulawesi with tropical forests, and adjacent to a residential area. In addition, the recorded history of the surrounding area Minahasans mountain Klabat an early settlement in the land area of North Sulawesi. Thus North Minahasa community has known medicinal plants long ago. Klabat forest is one of the protected forest area, as the habitat of various species endemic (Kauditan , 2009) . Previous research that has been conducted found 54 plant species, including the 34 families. There are many potential medicinal plant species which have not been studied and is not known scientific name. This study aims to gain constituents phytochemical and botanical characteristics, the use of medicinal plants in the villages around the mountain Klabat North Minahasa

9 2. Materials and methods

2.1 Location and time of research

The research was conducted in 12 villages. Six villages located in the district Dimembe, three villages in the districts Airmadidi and three villages in the district Kauditan, North Minahasa, North Sulawesi Province, Indonesia. Research carried out for six months.

2.2 Equipment and Materials

Samples of plants, among others, stems and roots or whole plants. Materials used include: a sample bag, label, ethanol, n-hexane, reagents wagner, perekasi dragendorf, reagent meyer,

HCl, sulfuric acid, chloroform, FeCl_3 . Tools used include: Pyrex glasswares, blender, Carl Zeiss Stereomicroscop EVO 40, digital microscope Hirox 3-D, rotary evaporator Heidolph, Spectrophotometer UV - Vis Parkin Elmer, Eppendorf centrifuge, digital cameras, stationery and logbooks.

2.3 Study of Ethnomedical Plants

Identification of plant species done by the local name derived from observations and in interviews with local people, the results are the identified scientific name. Unknown plant species scientific name were identified in the Laboratory of Biological Science, Faculty of Mathematic and Natural Science, State University of Manado. Ethno-directed sampling method of data collection of medicinal plant materials based on knowledge of a community was used in this study. According to Friedberg (1993), one of the approaches that are considered more can reveal the system of public knowledge about medicinal plants, ways of treatment, the use of techniques of medicinal plants and other aspects related to public health is ethno-science approach. Ethno-directed sampling method has several advantages in the study of medicinal plants. This approach is suitable to apply in Indonesia, because Indonesia has a rich biodiversity and culture are quite high.

2.4 Extraction process

Extractions were performed by masserating the plants samples with ethanol (1:4 w/b) for 48 hours, followed by filtration with filter papers. Filtrates were then evaporated using Heidolph rotary evaporator in 45°C , 50 rpm, as described by Harborne (1996).

2.5 Phytochemical screening

Chemical tests were carried out on the methanol extract and on the powdered specimens using standard procedures to identify the constituents as described by Harborne (1996) with some modifications.

2.5.1 Test for alkaloids: For the purpose of phytochemical analysis of the selected plants, 0.2 g of the selected plant samples were added in each test tube and 3 ml of hexane were mixed in it, shaken well and filtered. Then took 5 ml of 2% HCl and poured in a test tube having the mixture of plant extract and hexane. Heated the test tube having the mixture, filtered it and poured few drops of picric acid in a mixture. Formation of yellow color precipitate indicates the presence of alkaloids.

2.5.2 Test for tannins: About 0.5 g of the dried powdered samples was boiled in 20 ml of water in a test tube and then filtered. A few drops of 0.1% ferric chloride was added and observed for brownish green or a blue-black colouration.

2.5.3 Test for saponin: About 2 g of the powdered sample was boiled in 20 ml of distilled water in a water bath and filtered. 10 ml of the filtrate was mixed with 5 ml of distilled water and shaken vigorously for a stable persistent froth. The frothing was mixed with 3 drops of olive oil and shaken vigorously, then observed for the formation of emulsion.

2.5.4 Test for flavonoids: Three methods were used to determine the presence of flavonoids in the plant sample (Sofowara, 1993; Harborne, 1973). 5 ml of dilute ammonia solution were added to a portion of the aqueous filtrate of each plant extract followed by addition of concentrated H_2SO_4 . A yellow colouration observed in each extract

indicated the presence of flavonoids. The yellow colouration disappeared on standing. Few drops of 1% aluminium solution were added to a portion of each filtrate. A yellow colouration was observed indicating the presence of flavonoids. A portion of the powdered plant sample was in each case heated with 10 ml of ethyl acetate over a steam bath for 3 min. The mixture was filtered and 4 ml of the filtrate was shaken with 1 ml of dilute ammonia solution. A yellow colouration was observed indicating a positive test for flavonoids. Test for steroids: Two ml of acetic anhydride was added to 0.5 g ethanolic extract of each sample with 2 ml H_2SO_4 . The colour changed from violet to blue or green in some samples indicating the presence of steroids.

2.5.5 Test for terpenoids: Five ml of each extract was mixed in 2 ml of chloroform, and concentrated H_2SO_4 (3 ml) was carefully added to form a layer. A reddish brown colouration of the inter face was formed to show positive results for the presence of terpenoids.

3. Results

Studies on utilization of medicinal plants by the community were conducted in 12 villages around Mount Klabat of North Minahasa. A total of six villages were located in the district Dimembe, three villages in district Airmadidi and three villages in the district Kauditan. Surveys and identification of medicinal plants were done by interviewing native people recommended by village leaders on the research site. The six villages in the districts Dimembe are Matungkas, Laikit, Dimembe, Warukapas, Tatelu, Wasian and Klabat. Three villages in district Airmadidi are Sukur, Saroinsong and Airmadidi. Three villages in the district Kauditan are Tumulungtung, Treman and Kauditan (Figure 1).



(Source: <https://www.google.co.id/maps.com>)

Fig 1: Locations of three studies in three district around Mount Klabat, North Minahasa. 1. District of Dimembe, 2. District of Airmadidi and 3. District of Kauditan

Table 1: Botanical and Phytochemicals Constituents of Medicinal Plants in Minahasa Utara

No	Local Name	Scientific Name	Ailments	Plant parts used for medicinal	Ethnomedical uses reported	The content of Phytochemicals*)
1	Mengkudu hutan	<i>Morinda bracteata</i> Rubiaceae	Malaria, hypertension	Fruit and leaves	Five strands Leaves boiled and then drunk	A++, F+, S++ T+, St++
2	Pohon beringin	<i>Ficus minahasae</i> Moraceae	Pregnancy and maternity	All parts of the plant	Boiled and drunk	A++, F++, Tn++, St++
3	Sirih	<i>Piper betel</i> Piperaceae	Respiratory pain, antibacterials	Leaves	Boiled water and then drink the rest of the stew	A++, F++, Tr++, St++
4	Mangga hutan	<i>Mangifera sp</i> Anacardiaceae	Malaria	Leaves	Leaves boiled, drink boiled water remainder	A++, F+, S++ T+, St++
5	Pangi	<i>Pangium edule</i> Flacourtiaceae	Kidney, Liver, Hypertensi, shortness of breath	Roots and fruits	Roots are not boiled until boiling and then drunk	A++, F+, S++, Tr++
6	Pisang goroho	<i>Musa sp.</i> Musaceae	Respiratory, skin, kidney	Leaves	Pounded then applied on the wound (leaves). Boiled for kidney	T++, S++, F++, A+
7	Pisang hutan	<i>Musa acuminata</i> Musaceae	Skin, anthelmintic	Leaves	Boiled water and then drink the rest of the stew	T++, S++, F+, A+
8	Pondang	<i>Pandanus sp.</i> Pandanaceae	The antidote to the poison, anthelmintic, Liver, kidney, cancer, Hypertensi	Leaves	Boiled water and then drink the rest of the stew	S++, T++, F++
9	Rotan	<i>Calamus sp.</i> Arecaceae	Kidney, Skin	Leaves	Boiled and drunk water leftover stew. For finely ground leather and smeared on the itch because the fungus.	T++, S++, F+, A+
10	Rambutan Hutan	<i>Nephelium sp</i> Sapindaceae	Malaria	Leaves	Leaves boiled, drink boiled water remainder	A++, F++, S++ T+, St++
11	Scho	<i>Arenga pinnata</i> Arecaceae	Headache, Malaria, Tuberculosis	Leaves	Leaves boiled, drink boiled water remainder	A++, F++, Tn++
12	Sesewanua	<i>Clerodendron serratum</i> Verbenaceae	Skin, fever, digestive	Leaves	Leaves placed on the head after broots smoked with wood fire (fever)	T++, S++, F++, A++
13	Tagalolo	<i>Ficus septica</i> Moraceae	Malaria	bark	The bark is boiled and then drink the water	T++, F++, A+
14	Ubi bete	<i>Remusatia vivipara</i> Araceae	Cancer	tuber	Tubers boiled and eaten	S++, T++, F++
15	Benalu mangga	<i>Loranthus sp</i> Loranthaceae	Cancer and tumors		Stem boiled, the water is drunk	F++, A++, Tr++
16	Kamiri	<i>Eleurites moluccana</i> Euphorbiaceae	Cancer	Batang dan leaves dan roots	Stems, leaves and roots boiled, then the rest of the drink boiled water	A++, St++, F++, Tr+
17	Langsat	<i>Lansium minahasae</i>	Malaria, Cancer and tumors	bark, seeds	The bark is boiled and drunk	A++, F++, Tr+, St++
18	Pala	<i>Myristica sp</i> Myristicaceae	headaches, malaria, cancer, women's diseases, tonikum	Stem pith	Stem pith leftover boiled then drink boiled water	S++, F++, T++
19	Kayu wale perempuan	*	Broken bones		Wood wale women + 3 cloves of garlic plus glutinous rice and then brought near the broken parts.	A++, St++, Tr++
20	Cocor bebek	<i>Kalancoe prinnata</i> Crassulaceae	Boils	Leaves	placed on the affected part ulcers	F++, S++, T++, A+
21	Tumulawak	<i>Curcuma xanthorrhiza</i> Roxb Zingiberaceae	Liver, gastritis, diarrhea, flatulence, weariness	Tuber	Boiled beans by using brown sugar and then drunk.	F++, S++, T++, St++, Tr++
22	Sirsak	<i>Annona muricata</i> Annonaceae	Diabetes, gastritis, hypertension	Leaves, barks, ovary	diabetes Boiled with water in a frying pan till almost boiling, and pray. only one drink used 15 pieces of leaves. ulcer Take 3 cups water, stem width of 3 fingers and a length of 10cm, then wash the outer skin and provide a small skillet continue to pray. water in put and stems into a pan, then heat until the remaining 1 cup, put into a glass, cool, praying and drinking. hypertension will poached fruits soursop with 1 cup of water and drink.	S++, T++, A++, Tr++
23	Goraka	<i>Zingiber</i>	Cold, headaches,	Tuber	Boiled with palm sugar.	F++, S++, T++,

		<i>officinale</i> Zingiberaceae	sprains		-Colds: 3 glasses of water coupled with ginger and palm sugar. -Headache: 1 cup of water plus ginger and palm sugar taken 3 times a day -Sprains: grated ginger plus salt to taste and stick to the joint.	
24	daun turi	<i>Sesbania grandiflora</i>	headaches	Leaves	turileavestieda clothonhis head.	F+++ , S++ , T++
25	Mayana	<i>Solenostemon scutellarioides</i>	Durability body	Leaves	Pulverized/crushed and then squeezed the water and drunk. Then boiled water is drunk	A+++ , S+++ , F+++ , T++
26	Blakama	<i>Ocimum sanctum</i> Lamiaceae	Lower the heat a child	Leaves	leaves mixed with coconut oil then compressed in the child's forehead.	F+++ , S+++ , T++ , A+
27	Pinahong	<i>Anredera cordifolia</i>	Broken bones	Leaves	boiling water, cool and drink	F++ , S+++ , T++
28	Kaca beling	<i>Stroblanthes crispus</i>		Sakit pinggang	Leaves boiled in water to taste and drink (for coughs) Crushed (mashed) then compressed at the waist pain	F+++ , S++ , T+ , A+
29	Bawang kayu	<i>Allium odorum</i>		Menurunkan panas/demam	leaves, kneaded, mixed with coconut oil, then paste on the forehead	S+++ , F++ , T++ , A+
30	Kumis kucing	<i>Orthosiphon aristatus</i>	lumbago	Leaves	Leaves mashed, squeeze the juice and drink immediately	F+++ , S++ , T++
31	Pisang sepatu	<i>Musa sp</i>	Lower the heat and fever	shoots	shoots grab banana leaves and then paste on the forehead/stomach	T+++ , S++ , F++
32	Kayu lawang	<i>Cinnamomum ciliawan</i> Bl	abdominal pain	stem	took the bark, boiled, and then drink the water	A++
33	daun tebal	<i>Prenna oblongifolia</i> Merr	Lower the heat and fever	Leaves	take leaves, puree, then tacked on forehead	S+++ , T++ , F++
34	Jambu biji	<i>Psidium quajava</i>	Diare	Leaves	Leaves washed and eaten raw	T+++ , S++ , F+++
35	daun kenop	<i>Gompherna globosa</i>	Sores, itching,	Leaves	Leaves washed, crushed and then applied	T+++ , F++ , T+ , A+
36	daun geddi	<i>Abelmoschus mamihot</i>		maag	Leaves boiled and drunk the water	S+++ , T++ , F+++
37	Matatekel	<i>Sema allata</i> L.	itching	Leaves	Take fresh leaves are still green and then rubbed in parts body itch To dry content of leaves taken, pulverized and then drink the water Squeezed	A++ , F++ , S++
38	Kuda kuda	<i>Centella asiatica</i> (L.) Urban	Diabetes	Leaves	Leaves (Centella asiatica) is added with leaves of Andrographis paniculata, leaves of red malacai (Jatropha gossypifolia), and leaves of shamanchildren (Phyllanthus niruri), all of them put together and then boiled, filtered and drunk. Decoction drug can be used to heal wounds is by way dioseng then stamped on the sugar wound pain sufferers	F+++ , A+++ , T+++ , St+++

Description:

* A = Alkaloid, F = Flavonoid, Sn = Saponin, St = Steroid, T = Tanin Tr = triterpenoid

+ = indicates presence of phytochemicals and - = indicates absence of phytochemicals. +++ = shows high concentration. ++ = shows moderate concentration

Medicinal plant specimens obtained in each location were collected in biology laboratory, State University of Manado. From the tests, it is known that the medicinal plant contains alkaloids, flavonoids, saponins, tannins, steroids and triterpenoids with different intensities content (Table 1).

In terms of habitus, medicinal plant species are grouped into six types: herbaceous, lianas, shrubs, trees, and bamboo habitus. The most abundant habitus with the highest number of species of medicinal plants are herbaceous trees later, while habitus shrubs found only one type of plant (Figure 2).

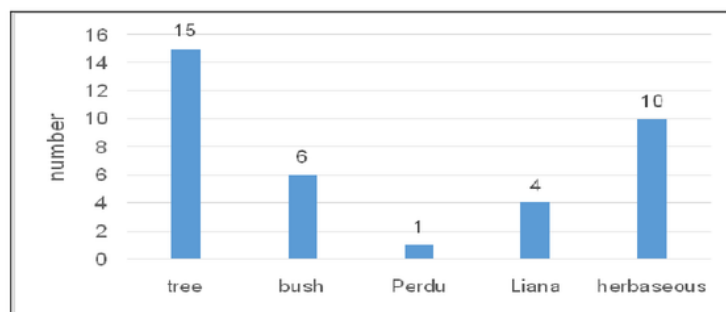


Fig 2: Diagram of plant habitus.

Based on parts of plant used, medicinal plants were classified into 10 groups: seeds, leaves, roots, stems, bark, fruit, pith, bark, buds, roots, fruit, and complete plants. Most parts of the

plant used as raw material for medicine is the leaf (22 species of medicinal plants) (Figure 3).

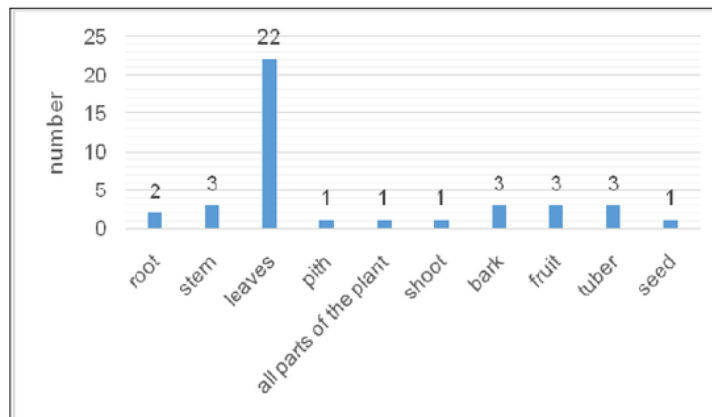


Fig 3: The part of the plants used as raw material for medicine

Based on the information from the society, the kind of plants existing drugs can be grouped into 16 types of diseases. From the number of plant medicine, treated disease groups were

cancer, skin and malaria. On the other hand, the plants were used for maternity and pregnancy only in a small number (Figure 4).

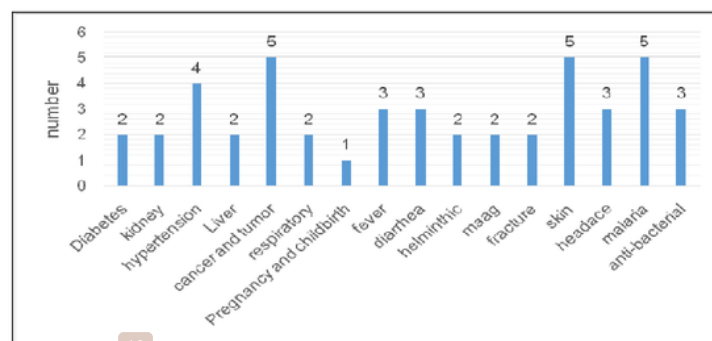


Fig 4: The utilization of medicinal plants is based on the type of disease

4. Discussion

Geographically, North Minahasa is located between 124°40'38.39"E to 125°15'15.53"E and 1°17'51.93"N to 1°56'41.03"N (<http://www.minutkab.go.id>). North Minahasa tends to have dry tropical climates during May to October and wet season during November to April. The average temperature ranges from 28 to 31°C and 27-30° C in the coastal and residential area, respectively. This climate condition is one of the reason why North Minahasa regency has a fertile area and potentially great for the development of production center of food crops, horticulture, plantation and forestry (Whitemore et.al. 1989).

North Minahasa people still use medicinal plants to treat various types of diseases. However, public knowledge about medicinal plants has not been passed thoroughly to younger generations. Knowledge of medicinal plants and how to use it can only be found in residents who age more than 50 years old (Sumampouw and Mokusuli, 2015). Some species of medicinal plants are already planted in the residents' yards but without regular maintenance. The rate of medicinal plants utilization is 65%, showing that the people still largely depend on nature. Medicinal plants are generally administered to

people in need without asking for a fee as reward for the giver (Mahahani et.al. 2016).

Mostly, the part of the plant that is used as raw materials for medicine is the leaves. Initially, ancient people of North Minahasa use the leaves based on indigenous knowledge and trial and error (Sumampouw and Mokusuli, 2015; Mokusuli, 2008). Leaves are the organ that plays a role in the process of photosynthesis. Thus, the cells in the leaf tissue have a lot of raw materials for the formation of secondary metabolites that can have a potency to treat diseases. Therefore, the medicinal properties of plants known to the public were based on experience and heritage from generation to generation. In addition to the leaves, people also used other plant organs, i.e. bark, roots and tubers (Mokusuli, 2008; Simbala, 2007).

As the mountain slope has wet tropical climate, most of the plants that grow in North Minahasa around Mount Klabat have the habitus type of trees, herbs and lianas. Therefore, many traditional medicinal plants were indeed tree and herbaceous species. The method of usage of the plant parts as a medicinal ingredient is predominantly by stewing. In addition to that, people also extracted the plants by means of ground and making ointments (Simbala, 2007; Mahahani

et.al. 2016). Stewing at a high temperature may deactivate the active compounds in medicinal plants, thus reducing their pharmacological effects (Mokosuli, 2008). The medicinal plants can be utilized for treating the prevalent degenerative diseases, infectious diseases and diseases caused by metabolic disorders (Repi et. al. 2013). We found that many types of plant have been used for the treatment of malaria, yet the malaria prevalence in North Minahasa is lower than the average prevalence for the region of North Sulawesi. Malaria was once a lethal and debilitating disease in this area during 1940s, so people know a lot of plants that can be used as a source of malaria drug (Worang et. al. 2013).

Physiological and pharmacological properties of the plant are caused by the contents of the active chemical compounds which is generally a result of secondary metabolism of plants (Wadood et. al. 2013; Ilodibia et. al. 2015). Secondary metabolism, among others, is known to produce phenols and phenolic acids, fenilpropanoid, tannins, flavonoids and flavonols, triterpenoids, steroids, saponins, and the other nitrogen compounds such as alkaloids (Simbala, 2009). Alkaloids have been known to have antihypertensive and antidiabetic effect (Ilodibia et. al. 2015; Tchimine et. al. 2015). In this study, the plants used to treat high blood pressure is the avocado (*Persea gratissima Gaertn*), parasites Langsa (*Loranthus sp*), gedi (*Abelmoschus moschatus*), Pisang goroho (*Musa sp*), and Sirsak (*Ammona squamosa L*), while herbs used to treat diabetes mellitus is ginger (*Zingiber officinale Rosc*) and jambolang (*Eugenia cumini Merr*). All of the above plants are positive for alkaloids. It can be estimated that the compounds that can treat high blood pressure can be found on the avocado, Benalu Langsa, gedi, Pisang goroho and Sirsak; while the compounds that are active against diabetes mellitus are found in ginger and jambolang. However, more research is needed to enquire this. According to Sakong et al., 2011, tannins and flavonoids have antioxidant activity and may inhibit HeLa and Raji cell lymphoma. Flavonoids are also active as antitumor compounds, hypo-allergenic, hepato-protective, cardioprotective and have an antioxidant property (Markham, 1988). Class of triterpenoids can be used as an anti-bacterial (James and Dubery, 2009), anticancer, and to treat wounds and inflammation (Cai et al., 2008). According to Wadood et. al. (2013), triterpenoid is a compound that is active against pecks snakes, diabetes, liver damage, skin disorders and fungi. Triterpenoids have the effect of treatment against malaria. According to Fransworth, (2006) saponins can reduce the risk of atherosclerosis due to its ability to bind cholesterol.

5. Conclusion

From these results, it was found that 38 species of plants were used actively by the public in 12 villages in three districts around the mountain Klabat in North Minahasa. Parts of plants used for medicinal are the leaves, roots, bark, fruit, seeds, pith and all parts of the plant. The dominant habitus of the medicinal plants are trees and herbaceous. Mostly, people use the medicinal plants by stewing and making ointment. We found 16 types of diseases that have been treated using medicinal plants. The dominant phytochemicals are flavonoids, alkaloids, saponins, tannins, steroids and triterpenoids.

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