Emirates Journal of Food and Agriculture. 2016. 28(5): 337-347
doi: 10.9755/ejfa.2015-06-463
http://www.ejfa.me/

REGULAR ARTICLE

Ethnobotanical study of "Kaili Inde" tribe in Central Sulawesi Indonesia

Fathurrahman Fathurrahman[1], Jefri Nursanto[2], Andriany Madjid[3], Ramadanil Ramadanil[2]*

[1]Department of Agronomy, Faculty of Agriculture, Tadulako University, Kampus Bumi Tadulako Tondo, Tondo Palu, Indonesia, [2]Department of Biology, Faculty of Mathematics and Natural Sciences, Tadulako University, Kampus Bumi Tadulako Tondo, Tondo Palu, Indonesia, [3]Senior High School 5 Palu, Trans Sulawesi, Tondo Palu, Indonesia

ABSTRACT

The research entitled "Ethnobotanical study of Kaili Inde tribe in Central Sulawesi Indonesia" has been conducted from April to June 2012 at the Mantikole, a village of Kaili Inde which is located in Palu Central Sulawesi Indonesia. This research aims was to know the interaction between Kaili Inde society and their environment especially plant biodiversity being used in their daily need. Basic data of ethnobotany such as traditional plant use in the village have been collected by using direct interview and establishment of transect. Village leaders, religious leaders, traditional healers, government officers and crafts-people are the target groups who interviewed during the study. The interviews were recorded by audio recorders and notebooks. Photographs were also taken to record information. All recognizable morphospecies of plants/voucher specimens were collected for identification purpose. Plant collecting was according to the "Schweinfurth method" (Bridson and Forman 1999). The observation was included vernacular name, scientific name, family, habitus and uses. Processing of the specimens was conducted at Herbarium Celebense (CEB), Tadulako University Palu. Identification was done in the field and in CEB. Data were analyzed quantitatively by using ICS (Index of Cultural Significance) formula. The results indicated that One hundred thirty two (132) plant species consisting of 60 families were used by Kaili Inde tribe. 39 species were used as food, 62 species as medicine, as building material 6 species, 23 species for traditional rituals and 10 plant species as handicrafts. The plant species that have highest ICS was "Pa'e" (*Oryza sativa* L), followed by sweet potato "Untoku" (*Ipomea batatas*), "Pia'lei '(*Allium cepa*), "affo" (*Schyzostachyum brachy–cladum*), "kamonji" (*Artocarpus communis*), "tunau" (*Arenga pinnata*), "lemo barangay (*Citrus aurantifolia*), "cangkore" (*Arachys hypogea*), "gampaya" (*Carica papaya*), "siranindi" (*Kalankoe pinnata*), "kasubi" (*Manihot esculenta*), and "srikaya" (*Annona squamosa*), while the lowest ICS was "Camara" (*Casuarina junghuniana*).

Keywords: Ethnobotany; Kaili Inde; Central Sulawesi; Indonesia

INTRODUCTION

Indonesia, a largest archipelago country, comprising ca.17,000 islands, of which about 6,000 are permanently inhabited by more than 400 different indigenous peoples. It is located in equatorial Southeast Asia having a wide range of habitats with abundant biodiversity and is considered a megabiodiversity country (McKinnon, 1992; Ministry of State For Population and Environment, the Republic of Indonesia, 1992; BAPPENAS, 2003; Waluyo, 2008). Indonesia is very species-rich country, and although it occupies only 1.3% of the world's (Mc Neely et al 1990; UNEP, 1991). Precise number of species is hard to obtain for most taxonomic groups, but a minimum can be said to have about 11% of the world's known flowering plant species (ca. 38,000 species) of which around 18,700 are endemic (Roos, 2004; Pitopang, 2004; van Welzen et al, 2005), 12 % of the world's mammals, 17 % of all birds.

Central Sulawesi is one of the provinces in Indonesia, located in Sulawesi Island (formerly known as Celebes), the main island in "Wallacean region". The biogeographic position of Sulawesi is located between the Greater Sunda islands and New Guinea. It is generally considered to have intermediate level of plants species richness (Roos et al., 2004; Hall, 2009). The province of Central Sulawesi is inhabited by a variety of tribal communities of migrants or indigenous. Based on the data recorded, there are

***Corresponding author:**
Ramadanil, Tadulako University, Faculty of Mathematics and Natural Sciences, Department of Biology, Kampus Bumi Tadulako Tondo, Sukarno Hatta Street Km 10, Tondo Palu, Indonesia, 94117. Phone: +62 (0451) 422844, Mobile: +62 85288560451.
E-mail: pitopang_64@yahoo.com

Received: 29 June 2015; **Revised:** 22 March 2016; **Accepted:** 23 March 2016; **Published Online:** 04 April 2016

19 indigenous tribes in the region, i.e. Kaili Inde, Kaili Ledo, Kaili Daa, Kaili Rai, Kulawi, Lore, Pamona, Banggai, Saluan, Tao Taa, Buol, Tolitoli, Dampelas. These ethnic groups occupy different areas, and each group has its own culture and traditions in utilizing plants for their daily need, such as for pharmaceuticals, household appliances, various woven/rigging, complimentary materials for traditional ceremonies, clothing, food and contruction (Waluyo, 2008; Pitopang, 2009).

Most studies on plant biodiversity in Sulawesi have focused on Taxonomic and Ecological aspects (Pitopang et al., 2002, 2004, 2007, 2008, 2011, 2012; Ramadhanil et al., 2008; Pitopang, 2009; Cannon et al., 2007; Kessler et al., 2012[a], 2012[b]; Kessler et al., 2005; Gradstein et al., 2005; Mogea, 2004, 2005; Thomas, 2010; Thomas et al., 2011; Ciccuza et al., 2010, 2011; Culmsee and Pitopang 2009; Culmsee et al., 2010, 2011; Poulsen, 2014), but the research on the subject of ethnobotany is very few (Purwanto, 2004; Pitopang and Sarifuddin, 2012; Paik et al., 2013; Gailea et al., 2016).

Kaili Inde tribe is one of the indigenous people who have long lived and settled in the village of Mantikole, Sigi district Central Sulawesi Province. Its communities have used various types of plants to meet their daily need i.e.for food supply, drug ingredients, industrial materials and in various ceremonial culture. The simple life of the tribal communities in rural area and location away from urban life, forcing most of the community is dependent on the natural resource to support their life.

The objectives of this research is to document local knowledge system of Kaili Inde Tribe in utilizing plants resources to fulfil their daily need.

MATERIALS AND METHODS

Study site

The research was carried out in Mantikole village, at the western side of Palu valley (Fig. 1), about 30 km away from Palu City, the capital of Central Sulawesi Province Indonesia from April to May 2012. Administratively, this area belongs to Sigi Regency, and occupies an area ranging from 200 to 600 m in elevation. Daily of rainfall in the area varied from 20-60 mm with temperature average ranged from 23°-34° C.

Metodology

The basic data of ethnobotany such as traditional plant use in the village has been collected by using direct interview and establishment of transect. (i) Village leaders, religious leaders, traditional healers, government officers and crafts-people are the target groups who were interviewed

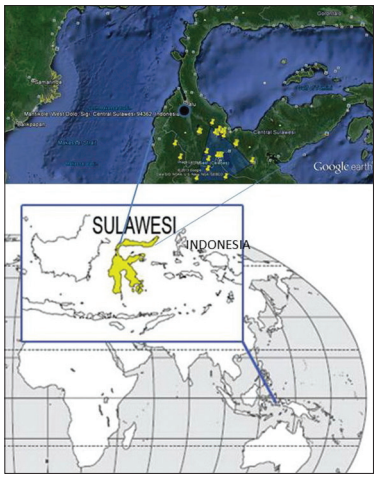

Fig 1. Map of study area. Indonesia and the island of Sulawesi highligted, with the Mantikole (Black spot) as research site in Palu valley.

during the study. These interviews were recorded by audio recorders and notebooks. Photographs were also taken to record information (Turner, 1988). (ii) To understand the effect of daily activity of local people studied on their environment, a transect has been established where size and form of transect really depend on environment condition. The observation included vernacular name, scientific name, family and plant habitus. All of plant materials used for this purpose have been collected in the field and then identified at the Laboratory of Biodiversity, the Department of Biology, Faculty of Mathematics and Natural Sciences Tadulako University and Herbarium Celebense (CEB) Tadulako University Palu Indonesia.

Data analyses

Index of Cultural Significance (ICS) was used to determine utilization of plant diversity and its importance for the people. These values are multiplied in the equation below for each use to yield a composite value for each plant taxa.

$$ICS = \Sigma\ (q \times i \times e)_{u1}$$

$$i = 1$$

Expanded this formula would be:

$$ICS = (q_1 \times i_1 \times e_1)_{u1} + (q_2 \times i_2 \times e_2)_{u2} + (q_3 \times i_3 \times e_3)_{u3} ... + (q_n \times i_n \times e_n)_{un}$$

ICS is equal to the sum of individual use value 1 through n representing the last use described, subscript, represents the value 1 through n, consecutively. For each use given, q = quality value; i = intensity value, e = exclusively value (Turner, 1988). Categories of useful plants is provided in Appendix 1.

Tabel 1: List of plants species were utilized by Kaili Inde tribe which was arranged by their ICS (Index of Culture Significant)

No	Plant name		Family	ICS
	Vernacular name (Kaili Inde)	Botanical name		
1	Pa'e	*Oryza sativa* L	Poaceae	104
2	Untoku	*Ipomoea batatas* L	Convolvulaceae	96
3	Pia' lei	*Allium ascalonicum* L	Amarylidaceae	94
4	Affo	*Schyzostachyum brachy – cladum* L	Moraceae	92
5	Cangkore	*Arachys hypogea* L	Papilionaceae	80
6	Tunau	*Arenga piñnata* (Wurm.) Merr.	Arecaceae	80
7	Kamonji	*Artocarpus communis* J. Forst & G Forst.	Moraceae	80
8	Lemo baranga	*Citrus aurantifolia* (Christ.) Swingle	Rutaceae	80
9	Gampaya	*Carica papaya* L	Caricaceae	76
10	Siranindi	*Kalankoe pinnata* (Lamk.) Pers.	Crassulaceae	74
11	Beau	*Aleurites mollucana* (L) Willd	Euphorbiaceae	72
12	Sarikaya	*Annona squamosa* L	Annonaceae	72
13	Marisa	*Capsicum annum* L	Solanaceae	72
14	Kaluku	*Cocos nucifera* L	Arcaceae	72
15	Ka ' subi	*Manihot esculenta* Crants	Euphorbiaceae	72
16	Mombie lei	*Amaranthus hybridus* L	Amaranthaceae	70
17	Kula	*Zingiber officinale* Roscoe	Zingiberaceae	67
18	Mayana	*Plectranthus scutellarioides* (L.) R.Br.	Lamiaceae	66
19	Poi	*Tamarindus indica* L	Fabaceae	64
20	Tanbue	*Vigna radiata* (L) R. Wilzek	Fabaceae	64
21	Kalosu	*Areca cathecu* L	Arecaceae	62
22	Durian	*Durio zibethinus* Merr.	Malvaceae	62
23	Lokka	*Musa paradisiaca* L	Musaceae	61
24	Bo'ulu	*Piper betle* L	Piperceae	60
25	Polo java	*Solanum lycopersicum* L	Solanaceae	56
26	Rambuta	*Nephelium lappaceum* L	Sapindaceae	52
27	Lengaru	*Alstonia scholaris* R.Br.	Apocynaceae	50
28	Tabaro	*Metroxylon sago* Rottb.	Arecaceae	50
29	Kopi	*Coffea canephora Pierre* ex A. Froehner	Rubiaceae	49
30	Silaguri	*Sida acuta* L	Malvaceae	49
31	Tumpa vai	*Cymbopogon nardus* (L.) Rendle	Poaceae	48
32	Simambu	*Hyptis capitata* L	Lamiaceae	48
33	Kelo	*Moringa oleifera* Lam	Moringaceae	46
34	Lenguru	*Abelmoschus manihot* (L.) Medik.	Malvaceae	45
35	Rumbi	*Colocasia esculenta* (L.) Schott	Araceae	45
36	Nangga landa	*Annona muricata* L	Annonaceae	44
37	Gambu	*Psidium guajava* L	Myrtaceae	44
38	Maku bulla	*Syzygium malacensis* var. indica	Myrtaceae	44
39	Da'le	*Zea mays* L	Poaceae	44
40	Aya	*Acorus calamus* L	Aracaceae	42
41	Kuni	*Curcuma longa* L	Zingiberaceae	42
42	Panda	*Pandanus amaryllifolius* Roxb.	Pandanaceae	41
43	Bo'la	*Dracaena arborea* (Willd.) Link	Asparagaceae	39
44	Cangke	*Syzygium aromaticum* (L) Merr & LM Perry	Myrtaceae	39
45	Kuni bulla	*Curcuma mangga* Valeton & Zijp.	Zingiberaceae	36
46	Ganaga	*Artocarpus heterophyllus* Lamk	Annacardiaceae	34
47	Tamulawa	*Curcuma zanthorrhiza* Roxb.	Zingiberaceae	33
48	Marisa mbaso	*Capsicum annuum* L	Solanaceae	32
49	Marisa	*Capsicum fructescen* L	Solanaceae	32
50	Hilolondo	*Heppeastrum puniceum* (Lamk.) Kuntze	Amarylidaceae	32
51	Taipa	*Mangifera indica* L	Annacardiaceae	32
52	Pinus	*Pinus mercusii* L	Pinaceae	32
53	Marisa jawa	*Piper ningrum* L	Piperaceae	30
54	Roa rangga	*Hibiscus rosa-sinensis* L	Malvaceae	28

(Contd)...

Tabel 1: ***(Continued)***

No	Plant name		Family	ICS
	Vernacular name (Kaili Inde)	Botanical name		
55	Pia' bulla	*Allium sativum* L	Amarylidaceae	27
56	Nanas	*Ananas comosus* (L) Merr	Bromeliaceae	27
57	Katimu	*Cucumis sativus* L	Cucurbitaceae	27
58	Mengkudu	*Morinda citrifolia* L	Rubiaceaeces	27
59	Panuntu	*Phyllanthus niruri* L	Arecaceae	27
60	Balimbi	*Averroa belimbi* L	Oxalydaceae	26
61	Katumbar	*Coriandrum sativum* L	Apiaceae	24
62	Hale taveve	*Orthosiphon aristatus* (Blume) Miq.	Lamiaceae	24
63	Jati	*Tectona grandis* L.f.	Verbenaceae	22
64	Mombie rui	*Amaranthus spinosus* L	Amaranthaceae	21
65	Mombie	*Amaranthus tricolor* L	Amaranthaceae	21
66	Belante	*Homalanthus populneus* (Geisler) Pax	Euphorbiaceae	21
67	Tangtangan	*Jatropha curcas* L	Euphorbiaceae	21
68	Valanpanga	*Physalis minima* L	Euphorbiaceae	21
69	Gerseng	*Muntingia calabura* L	Muntingiaceae	20
70	Petobo	*Centrosema* sp	Leguminosae	18
71	Mpolo ridi	*Geunsia pentandra* L	Verbanaceae	18
72	Talise	*Terminalia catappa* L	Combretaceae	18
73	Lonja	*Lansium domesticum* Correa	Meliaceae	16
74	Kayu lei	*Macaranga glaberrima* (Hassk.) Airy Shaw	Euphorbiaceae	15
75	Sambiloto	*Andrographis paniculata* (Burm.f) Ness	Acanthaceae	15
76	Sangulera	*Averrhoa carambola* L	Oxalidaceae	15
77	Vunga lei	*Clerodendrum* sp	Verbanaceae	14
78	Balaroa	*Kleinhovia hospita* L	Sterculiaceae	14
79	Bentunu	*Mellochia umbelata* (Hout) Stapf.	Sterculiaceae	14
80		*Pedilanthus tithymaloides* (L) Pasteu	Euphorbiaceae	14
81	Kayu manis	Cinnamommum burmanii (C.G. & T.H. Ness) Ness ex. Bl	Lauraceae	13
82	Kayu aloe	*Areca vestiaria* Giseke	Arecaceae	12
83	Kakafu	*Ceiba pentandra* (L) Gaertn	Bombacaceae	12
84	Hangka	*Schefflera gigantifolia* Merr	Araliaceae	12
85	Tava tilu	*Tacca palmate* Blume	Taccaceae	12
86		*Mitracarpus hirtus* (L) DC	Rubiaceae	11
87	Delima	*Punica granatum* L	Punicaceae	11
88	Topekai	*Rubus fraxinifolius* Poir	Rosaceae	11
89	Topekai	*Rubus mollucanus* L	Rosaceae	11
90	Mantalalu	*Ageratum conyzoides* L	Asteraceae	9
91	Sam'aa	*Bidens pilosa* L	Asteraceae	9
92	Panoto	*Cheilocostus speciosus* (J. Koenig) C.D.Specht.	Costaceae	9
93	Nggurasi vau	*Ocimum basilicum* L	Lamiaceae	8
94	Jambo ibo	*Anacardium occidantale* L	Annacardiaceae	8
95	Kalagi	*Etlingera elatior* (Jack) R.M.Sm.	Zingiberaceae	8
96	Jono	*Imperata cylimdrica* L	Poaceae	8
97	Paria	*Memordicha caranthia* L	Cucurbitaceae	8
98	Coklat	*Thebroma cacao* L	Malvaceae	8
99	Patoko	*Cyperus amabilis* Vahl	Cyperaceae	7
100	Hale taveve	*Acalypha indica* L	Euphorbiaceae	6
101	Beranahe	*Acalypha catturus* Blume	Euphorbiaceae	6
102	Jilakapura	*Aloe vera* L	Xanthorroeaceae	6
103	Silagie	*Arcangelisia flava* (L.) Merr.	Menispermaceae	6
104	Tabobure	*Blumea balsaminifera* (L.) DC	Asteraceae	6
105	Sulepe	*Conyza sumatrensis* (Retzius) E. Walker	Asteraceae	6
106	Hehi nipo	*Crassocephalum crepidioides* (Benth.) S.Moore	Asteraceae	6
107		*Elatostema* sp	Urticaceae	6

(Contd)...

Tabel 1: ***(Continued)***

No	Plant name		Family	ICS
	Vernacular name (Kaili Inde)	Botanical name		
108	Hehi nipo	*Erectites valerianifolia* (Wolf.) DC	Asteraceae	6
109	Polite	*Euphorbia hyrta* L	Euphorbiaceae	6
110	Levonu	*Ficus septica* L	Moraceae	6
111	Bure	*Glochidion insignis* (Muell) MA	Euphorbiaceae	6
112		*Graptophyllum pictum* (L.) Griff.	Acanthaceae	6
113		*Gynura procumbent* (Lour) Merr.	Asteraceae	6
114	Pambuhu	*Hedicyum* sp	Zingiberaceae	6
115	Katumbara	*Lantana camara* L	Verbenaceae	6
116		*Mikania micranta* Kunth	Asteraceae	6
117	Putrimalu	*Mimosa invisa* Colla	Mimosaceae	6
118	Bingkaramo	*Mussaenda frondosa* L	Rubiaceae	6
119		*Pouzolzia zeylanica* (L.) Benn.	Urticaceae	6
120	Panuntu	*Phyllanthus niruri* L	Phyllantaceae	6
121	Leuho	*Pipturus argenteus* (Forster) Wedd	Urticaceae	6
122	Bintitumbu	*Poikilospermum suaviolen* (Blume) Merr	Cecropiaceae	6
123	Tangkada	*Persicaria barbata* (L.) H.Hara.	Polygonaceae	6
124	Tile	*Themeda arguens* (L) Hack.	Poaceae	6
125	Talipa	*Tinospora crispa* (L.) Hook.F.& Thomson	Menispermaceae	6
126	Bono	*Trema orientalis* (L) Blume	Ulmaceae	6
127		*Urena lobata* L	Malvaceae	6
128		*Dioscorea alata* L	Dioscoreaceae	6
129	Kayu pase	*Leucaena leucocephala* (Lam.) de Wit.	Fabaceae	3
130	Affo ngguni	*Bambusa vulgaris* Schrad.	Poaceae	2
131	Bunga rahasia	*Passiflora foetida* L	Passifloraceae	2

RESULTS AND DISCUSSION

Plant utilization

The Kaili Inde people have utilized about 131 plant species (belonging to 60 families) (Table 1). There were 39 species plants used as food, 66 as an ingredient of medicines, 6 for building material, 23 species for traditional rituals and 10 as craft hand. The Kaili Inde people have collected and utilized both wild and cultivated plant species to meet their daily need. Some plants species were collected from garden, secondary forest and primary forest that used for vegetable and fruit.

ICS is the result of quantitative ethnobotany analysis to show the value of the interest of each type of useful plants based on community needs. The tabel indicates that the results of calculations ICS interest rate of each type of plant to the community. Based on the data analysis of useful plant on Inde tribe people in the Mantikole village obtained results as listed above.

Food plants

Food is a basic need that is very important in human life, as well as for Kaili Inde society. We noted 39 plant species were used by Kaili Inde people as a food ingredient. There were a various part of plant used but the most widely used were 28 species of fruit sections, 5 species of bulbs, the leaves were 5 species, one species of root, and the rhizome 2 species. The utilization way of plant by Kaili Inde people was still very simple, either eaten immediately or have to process by means cooked before in a variety of ways such as boiled, fried and as a mixture in other foodstuffs.

The staple food of Kaili Inde people was " Pa'e" (*Oryza sativa* family Poaceae). This plant was most commonly used, but they also still consume " Unto'ku " (*Ipomea batatas*). Fruits of some plants was directly consumed such as: "ganaga" (*Artocarpus intergra*), " Sangulera " (*Averrhoa carambola*), "Lonja " (*Lansium domasticum*), " Lokka " (*Musa paradisiaca*), *Pasifiora foetida*, "Katimu" (*Cucumis sativus*), "Sarikaya" (*Annona squamosa* L), "Nangga lye" (*Annona muricata*), and other so on. Another part of the fruit can be consumed by them with boiled or fried, for example, "ngkonau" (*Arenga pinnata*), "cangkore" (*Arachys hipogea*), "marisa" (*Capsicum annuum*), and "kamonji" (*Arthocarpus communis*).The leaves of plants should be cooked before consumed as vegetables and eaten with rice and other foodstuffs as staple foods such as cassava, sweet potato and so forth. The flowering plant species were used "Kelor" (*Moringa oleifera*), gedi "Lenguru" (*Abelmoschus Manihot*), "lamtoro" (*Leucaena leucocephala*), "mombei lei" (*Amaranthus hybridus*).

The Kaili Inde communities were also utilized shoots of plant for vegetable such as: the leaves and flower of papaya

"Gampaya" (*Carica papaya* L). The tuber of " Kasubi " (*Manihot esculenta*), "Untoku" (*Ipomea batatas*), "Rumbi " (*Calocasia monlalon*) were used as a substitute for the staple food. In addition they also often take advantage of the bulbs as part of "Pi'a bulla " (*Allium sativum*), " Pi'a lei " (*Allium ascalonicum*) as spice.

Pitopang and Syarifuddin (2012) reports that rice "Pae" (*Oryza sativa* L.) was also the staple food of the "Tao Taa Wana" community, the indigenous people who live in the Morowali Nature Reserve Central Sulawesi, but at certain seasons they use cassava (*Manihot esculenta*),"sago' (*Metroxyllon sago*) as a meal substitute. Rice was planted in non irrigated ricefield. In addition there were some local rice varieties which still cultivated such as; "paegondu" (black seed), "pae lamboro" (yellow seed), "pae moraa" (striped bran), "pae ranta" (fall off easily), "pae talingku" (hairy fruit) and many others of which number at least there were 20 local varieties of rice.

Purwanto (2004) reports that 89 plant species utilized as food and vegetable by Dani society who live in Baliem valley Irian Jaya, Papua island Indonesia. In this area, the Dani use sweet potato (*Ipomoaea batatas*) as a principal food source. The sweet potato is quantitatively the most important plant grown in the Baliem valley. Both tuber and leaves are eaten; the tubers either roasted among hot coals or baked in a pit with hot rock (called: *seni*). Other plants are collected from the wild when traditional foods are scarce were; *Pandanus julianettii, Pandanus conoides, Pandanus brosimos.* The red Pandanus fruit (*Pandanus conoides*) is cooked and then reduced to pulpy soup by kneading. There were several plant species used as vegetable such as *Planconella* sp, fern *Cyathea, Pteridium* and fern *Pteridium aquilinum.*

Medicinal plants

There were 64 plant species used by Kaili Inde for medicine. List of medicinal plants which was used by Kaili Inde is providede in Table 2. Mecininal plants play a very important role in the Kaili Inde medicine. Various organs of plant were used by them includes leaves, stems, fruits, roots, and tubers. The use of plants as medicine by Kaili Inde people are still very simple, a number species of plant were used singularly and some combined with other species. Those plants can be applied for medicine directly without any treatment but many of them should be processed such as boilied, grated before being used them.

The medicinal plants were used by the community Kaili Inde were grows wild in the surrounding countryside and crop cultivation, It can be found around.the farm, forest, bush, along rivers, and in the rice fields. Some of medicinal plants were planted around their home, in the garden and in cultivated area.

Plants that grow wild among them are *Imperata culindrica*, *Ageratum conyzoides*, *Hyptis capitata*, *Lantana camara*, *Rubus mollucanus*, *Sida rhombifolia, Androgrzpahis paniculata, Graptophyllum pictum Alstonia scholaris, Blumea balsaminifera, Conyza sumatraensis, Erectites valerianifolia, Dioscorea alata and Mussaenda frondosa.* Cultivated medicinal plants belonging are, among *Orthosipon aristatus, Pedilanthus tithymaloides, Memordica charantia, Arenga pinnata, Acorus calamus, Allium ascalonicum*, *Piper betle*, *Psidium guajava, Cinnamommum burmanii* and garlic (*Allium sativum*).

The utilization of plants as traditional medicines by Indonesian people has been practiced for a long time (Riswan and Rumantyo, 2002; Padua et al., 1999). Javanese people for example have utilized herbal medicine (called "Jamu") since along time ago. Jamu can consist of a single or a mixture of some medicinal plants. The word of' "jamu" now has been adopted into lndonesian language. Sangat and Larashati (2002) pointed out that the use of "Jamu" are grouped into five categories as follow: medicine, health care, beauty care, tonic and baverage and body's protection or endurance. The modern trend of jamu production is very easy to be consumed and carried. Powdering jamu is an example for nice and simple packing. It is very easy to be sobbed with boiled water. Jamu has been used to treat some common diseases and therefore it supports program of national health in Indonesia.

Heyne (1987) reports that there were 996 species of flowering plants which had been used as traditional medicines in lndonesia, and he informed that it would make a total l,040 specics if including algae, fungi, ferns and gymnospermae species. Zuhud (1994) expresses that about 1260 tree species in tropical rain forests of lndonesia are used as medicinal plants.

Herbal medicine is still the maintain of about 75 - 80% of the world population, mainly in the developing countries, for primary health care (Oladele et al., 2011; Ahvazi et al., 2012). This is primarily because of the general belief that herbal drugs are without any side effects besides being cheap and locally available (Rodrigues et al., 2003). WHO (World Health Organization) estimates that about 80% of these people rely almost exclusively on traditional medicine for their primary healthcare needs. Medicinal plants are the "backbone" of traditional medicine, which means more than 3.3 billion people in the less developed countries utilize medicinal plants on a regular basis. There are nearly 2000 ethnic groups in the world, and almost every group has its own traditional medical knowledge and experiences. In Malaysia i.e. Ong et al. (2011) reported 56 species medicinal plants were used by Malay village in Trengganu Malaysia.

Tabel 2: List of plants for medicine by Kaili Inde societies in the studied area

No	Local name (Kaili Inde)	Botanical name	Family	Uses
1	Aya	*Acorus calamus* L	Araceae	Diarrhea, dysentery
2	Beau	*Aleurites mollucana* (L) Willd	Euphorbiaceae	Treating wound
3	Belante	*Homalanthus populneus* (Geisler) pax	Euphorbiaceae	Asthma, insane
4	Bentunu	*Mellochia umbelata* (Houtt) Stapf	Sterculiaceae	Treating eye
5	Beranahe	*Acalypha catturus* Blume	Euphorbiaceae	Wound
6	Bingkaramo	*Mussaenda frondosa* L	Rubiaceae	Post Natal
7	Bintitumbu	*Poikilospermum suaviolen* (Blume) Merr	Cecropiaceae	Wound
8	Bonoh	*Trema orientalis* (L) Blume	Ulmaceae	Blood purified
9	Bou'lu	*Piper betle* L	Piperaceae	Antiseptic, Dental care
10	Bowanu	*Dioscorea alata* L	Dioscoreaceae	Treating eye
11	Bunga oktober	*Heppeastrum puniceum* (Lamk.) Kuntze	Amarylidaceae	Ulcer treatment
12	Bunga pabengko	*Pedilanthus tithymaloides* (L) Pasteu	Euphorbiaceae	Toothache
13	Cangke	*Syzigium aromaticum* (L) Merr & LM Perry	Myrtaceae	Toothache, spices
14	Dana	*Imperata cylindrica* L	Poaceae	Hypertention
15	Delumpa	*Urena lobata* L	Malvaceae	Treating wound
16	Dui Naru	*Amaranthus spinosus* L	Amaranthaceae	Milk production
17	Hale Taveve	*Orthosipon aristatus* (Bl) Miquel	Lamiaceae	Kidney disease
18	Hangka	*Schefflera gigantifolia* Merr	Araliaceae	Treating lung
19	Hehi Nipo	*Crassocephalum crepidioides* (Benth) S. Moore	Asteraceae	Worm parasite
20	Hehinipo	*Erectites valerianifolia* (Wolf.) DC	Asteraceae	Treating wounds and infection
21	Hilolondo	*Graptophyllum pictum* (L.) Griffith	Acanthaceae	Digestive problem and hemorrhoids
22	Kalagi	*Etlingera elatior* (Jack) R.M.Sm.	Zingiberaceae	Fever
23	Kao gambu	*Psidium guajava* L	Myrtaceae	Diarrhea
24	Katumbara	*Lantana camara* L	Verbenaceae	Treating wound
25	Kayu manis	*Cinnamommum burmanii* (C.G. & T.H. Ness) Ness ex. Bl	Lauraceae	Cough, dysentery
26	Konau	*Arenga pinnata* (Wurm.) Merr	Arecaceae	Blown
27	Kula	*Zingiber officinale*	Zingiberaceae	Gout
28	Leboni	*Ficus septica* L	Moraceae	Skin parasite
29	Lehune bula	*Allium sativum*	Liliaceae	Ulcer
30	Lelempohud	*Rubus fraxinifolius* Poir	Rosaceae	Hair care
31	Lengaru	*Alstonia scholaris* R.Br.	Apocynaceae	Malaria
32	Leuho	*Pipturus argenteus* (Forster) Wedd	Urticaceae	Treating wound and infection
33	Loka pogata	*Musa paradisica* L	Musaceae	Mag
34	Mantallu	*Ageratum conyzoides* L	Asteraceae	Treating wound and cough
35	Marisa	*Capsicum fructescen* L	Solanaceae	Skin disease
36	Mayana	*Plectranthus scuttelaroides* (L.) R.Br	Lamiaceae	Cough
37	Nanas	*Ananas comosus* (L) Merr.	Bromeliaceae	Syphilis
38	Palola/Terung bulat	*Solanum* sp	Solanaceae	Diabetes
39	Pama'a	*Bidens pillosa* L	Asteraceae	Diabetes
40	Pambuhu	*Hedicyum* sp	Zingiberaceae	Worm parasite
41	Panuntu	*Phyllanthus niruri* L	Euphorbiaceae	Fertility
42	Paria	*Memordicha caranthia* L	Cucurbitaceae	Blown, increase appetite
43	Pedura walehu	*Elatostema* sp	Urticaceae	Skin disease
44	Pia' lei	*Allium cepa* L	Liliaceae	Blown
45	Polite	*Euphorbia hyrta* L	Euphorbiaceae	Kidney infection, Cancer
46	Putri malu	*Mimosa invisa* Colla	Mimosaceae	Antitoxin , cough
47	Sambiloto	*Andrographis paniculata* (Burm.f) Ness	Acanthaceae	Fever, headache
48	Silaguri	*Sida acuta* L	Malvaceae	Toothache
49	Simambu	*Hyptis capitata* Poir	Lamiaceae	Hepatitis
50	Sulepe	*Conyza sumatrensis* (Retzius) E. walker	Asteraceae	Treating wounds and infection
51	Tabaro	*Metroxyllon sago* Rottb.	Arecaceae	Cosmetic
52	Tabobure	*Blumea balsaminifera* (L.) DC	Asteraceae	Blown
53	Talipai	*Tinospora crispa* L	Menispermaceae	Malaria
54	Tambone	*Glochidion insignis* (Muell) MA	Euphorbiaceae	Cough
55	Tangkada	*Polygonum barbatum* L	Polygonaceae	Worm Parasite. Hypertention

(Contd)...

Tabel 2: ***(Continued)***

No	Local name (Kaili Inde)	Botanical name	Family	Uses
56	Tile	*Themeda arguens* (L) Hack	Poaceae	Schistosomiasis
57	Titilu	*Tacca palmata* L	Taccaceae	Wound infection
58	Topekai	*Rubus mollucanus* L	Rosaceae	Malaria
59	Valanpanga	*Physalis angulata* L	Solanaceae	
60	Walugae Towau	*Pauzolzia zeylanica*	Urticaceae	Hair care
61	Waro-waro	*Mikania micranta*	Asteraceae	Quick childbirth
62		*Gynura procumbent* (Lour) Merr	Asteraceae	Fillariasis
63		*Mitracarpus hirtus* (L) DC	Rubiaceae	Hypertension
64	Jahe	*Zingiber officinale* Rescoe	Zingiberaceae	Stomach ache
65	Tamulawak	*Curcuma zanthorriza* Rotb.	Zingiberaceae	Hepatitis
66	Kuni	*Curcuma longa* L	Zingiberaceae	Spice, Stomach ache

Pal and Sukhla (2003) point out that the WHO has recently defined traditional medicine (including herbal drugs) as comprising therapeutic practices that have been in existence, often for hundred of years, before the development and spread of modern medicine and are therapeutic experience of generations of practicing physicians of indigenous system of medicine. Traditional preparations comprise medicinal plants, minerals and organic matters etc. Herbal drugs constitute only those traditional medicines which primarily use medicinal plant preparations for therapy.

Plant for building material

Based on field observations, there were 6 species of plants used by Kaili Inde community as a building material. They were used stems, roots, and leaves as part of plant for material Building. Teak tree (*Tectona grandis*) and pine tree (Pinus mercusii) are used as the main pillar of the house, stairs, and railings stage. Besides the leaves of sugarpalm tree (*Arenga pinnata*) and Palm sago tree (*Metroxylon sago*) are used as roofing and wall of house. Coconut tree (*Cocos nucifera* L) is used for multipurpose where the leaves are used as roof or often said to be a thatched roof, trunk for pillar house. Bamboo tree (*Schyzostachyum brach-cladum*) is used as leverage and floor terrace house. Additionally, the bamboo tree is also used for house wall. (in Kaili Inde called "Pitate").

Plant for ritual/magic activity

The Kaili Inde tribe community still has a magical beliefs, where the people are still doing customs or rituals such as healing rituals, rituals in build house, custom wedding, and custom in cutting teeth. They were used plants as requerement for customary ritual procession the. There were 8 (eight) plant species that were usually used in the Kaili Inde tribe rituals. In ritual building a house, they need plant species included "Silaguri" (*Ageratum conyzoides*), *Cyperus* sp. On the other hand papaya " Gampaya " (*Carica papaya*), "Kula" (*Zingiber officinale*), garlic " Pi'a bulla " (*Allium sativum*). Those were used for traditional customary.

There were a number of plant species which were used in traditional weedings such as the flower of *Hibiscus rosa-sinensis*, *Clerodendrum* sp, *Cocos nucifera, Areca catechu*, *Piper betle* and breadfruit (*Artocarpus communis*).

CONCLUSIONS

One hundred and thirty two (132) plant species consisting of 60 families were used by Kaili Inde tribe, 39 species were used as food, 62 species as medicine, as building material 6 species, 23 species for traditional rituals and 10 plant species as handicrafts. The plant species that have highest ICS is "Pa'e" (*Oryza sativa* L), followed by sweet potato "Untoku" (*Ipomea batatas*), "Pia'lei '(*Allium cepa*), "affo" (*Schyzostachyum brachy–cladum*), "kamonji" (*Artocarpus communis*), "tunau" (*Arenga pinnata*), "lemo barangay (*Citrus aurantifolia*), "cangkore" (*Arachys hypogea*), "gampaya" (*Carica papaya*), "siranindi" (*Kalankoe pinnata*), "kasubi" (*Manihot esculenta*), and "srikaya" (*Annona squamosa*), while the lowest ICS is "Camara" (*Casuarina junghuniana*).

ACKNOWLEDGEMENTS

This study was funded by Tadulako University under management of Prof. Dr. Ir. Muhammad Basir SE, MSc. We also thank to Prof. Luca Rastrelli (Department of Pharmacy, University of Salermo, Italy) and Prof. Alev Tosun (Faculty of Pharmacy Ankara University, Turky For their invaluable comments on the manuscript.

Author contributions

Conceived and designed the experiments: F, R. Performed the experiments: JN, AM dan R. Analysed the data: F, JN, AM. Wrote the paper: F, AM, JN and R.

REFERENCES

Ahvazi, M., F. K. Sigarodii, M. M. Charkchiyan, F. Mojab, V. A. Mozaffarian and H. Zakeri. 2012. Introduction of medicinal

plants species with the most traditional usage in Alamut region. Iran. J. Pharm. Res. 11(1): 185-194.

BAPPENAS [National Planning Board of Indonesia]. 2003. IBSAP (Indonesian Biodiversity Strategy and Action Plan 2003-2020. Jakarta.

Bridson, D. and L. Forman. 1989. The Herbarium Handbook. Royal Botanic Garden KEW, England.

Cannon, C. H., M. Summer, J. R. Hartig and P. J. A. Kessler. 2007. Developing conservation priorities based on forest type, condition, and threats in a poorly known ecoregion: Sulawesi, Indonesia. Biotropica. 39: 747-759.

Choudhari, K., M. Singh and U. Pillai. 2008. Ethnobotanical survey of Rajasthan - An update. Am. Eurasia J. Bot. 1(2): 38-45.

Culmsee, H. and R. Pitopang. 2009: Tree diversity in sub montane and lower montane primary rain forest in Central Sulawesi. Blumea. 54: 119-123.

DePadua, L. S., N. Bunyapraphatsara and R. H. M. Lemmens. 1999. Plant resources of Southeast Asia. No. 12(1). PROSEA, Bogor Indonesia.

Gailea, R., A. A. Bratawinata, R. Pitopang and I. W. Kusuma. 2016. The use of various plant yypes as medicines by local community in the enclave of the Lore Lindu National Park of Central Sulawesi, Indonesia. Glob. Res. Med. Plants Indig. Med. 5(1): 29-40.

Gradstein, S. R., B. Tan, C. King, R. L. Zhu, C. Drubert and R. Pitopang. 2005. Catalogue of the bryophytes of Sulawesi, Indonesia. Hattori Bot. Lab. 98: 213-257.

Hall, R. 1995. The plate tectonics of Cenozoic SE Asia and the distribution of land and Sea. In: Hall, R. and J. D. Holloway, editors. Biogeography and geological evolution of SE Asia. Backhuys, Leiden, Pp. 99-131.

Heyne, K. 1987. Useful Plants of Indonesia III. Center for Forest Research and Development. The Ministry of Forestry Republic of Indonesia. Bogor, Indonesia.

Kessler, M., P. J. A. Keßler, S. R. Gradstein, K. Bach, M. Schmull and R. Pitopang. 2005. Tree diversity in different land use systems in Central Sulawesi, Indonesia. Biodivers. Conserv. 14: 547-560.

Keßler, P. J. A., M. Bos, S. E. C. Sierra Daza, L. P. M. Willemse, R. Pitopang and S. R. Gradstein. 2002. Checklist of woody plants of Sulawesi, Indonesia. Blumea Suppl. 14: 1-160.

Ministry of State for Population and Environmental of Republic Indonesia. 1992. Indonesia Country Study on Biological Diversity. Ministry of State for Population and Environmental Republic Indonesia. Prepared for UNEP Under The Work Programme for Environment Cooperation Between The Republic of Indonesia and The Kingdom of Norway.

Mogea, J. P. 2002. Preliminary studi on the Palm flora of the Lore Lindu National Park, Central Sulawesi, Indonesia. Biotropia. 18: 1-20.

Mogea, J. P. 2005. Diversity and density palms and rattans in primary forest, old secondary forest, and recent established traditional cacao and coffee garden in Central Sulawesi, Indonesia. Abstract: Proceedings International Symposium “The Stability of Tropical Rainforest Margins: Linking Ecological, Economic and Social Constrains of Land Use and Conservation” Georg-August-University of Goettingen. September 19-23. 2005.

Oladele, A. T., G. O. Olade and O. R. Omowubajo. 2011. Medicinal conservation and cultivation by traditional medicine practitioner (TMPs) in Aiyedaadee local government area of Osun State, Nigeria. Agric. Biol. J. N. Am. 2(3): 476-487.

Ong, H. C., R. M. Zuki and P. Milow, 2011. Traditional knowledge of medicinal plants among the Malay villagers in Kampung Mak kemas, Trengganu Malaysia. Ethno. Med. 8(3): 175-185.

Pal, S. K and Y. Sukhla. 2003. Herbal medicine: Current status and the future. Asian Pac. J Cancer Prev. 4: 281-288.

Paik, J. H., J. Lee, S. Choi, B. Marwoto, F. Juniarti, D. Irawan and R. Pitopang. 2013. Medicinal of Lore Lindu National Park, Sulawesi Indonesia. Vol. I. KRIBB-BPPT-Tadulako University, PT. Alimindo Sejati. Bekasi Indonesia.

Pitopang, R, S. R. Gradstein, P. J. A. Keβler and E. Guhardja. 2004. 4 Years the Herbarium Celebense (CEB). Sixth International Flora Malesiana Symposium, Los Banos, Philippines, 20-24 September, 2004.

Pitopang, R., H. Culmsee, H. Mangopo, M. Kessler and S. R. Gradstein. 2008. Structure and floristic composition of old growth secondary forest in Lore Lindu National Park, Central Sulawesi, Indonesia. In: Proceedings of International Symposium of Tropical Rainforests and Agroforests Under Global Change. October 5-9, 2008, Kuta Bali Indonesia.

Pitopang, R., I. Lapandjang and I. Burhanuddin. 2011. In: Basri, Z., (Ed.), Profil Herbarium Celebense Dan Deskripsi 100 Jenis Pohon Khas Sulawesi. Edisi Kedua, UNTAD Press, Palu.

Pitopang, R, I. Lapandjang, I. Taha and Safaruddin A. 2012. Ten Years of The Herbarium Celebense (CEB) Universitas Tadulako. Proceedings of the Society for Indonesian Biodiversity – International Conference. Vol. 1. July 2012; Pp. 209-214.

Pitopang, R. 2012. Impact of forest disturbance on the structure and composition of vegetation in tropical rainforest of Central Sulawesi, Indonesia. Biodiversitas. 13(4): 179-189.

Pitopang, R, N. Ariyanto and E. Yuniati. 2012. Ethnobotany Studies of "Lauje" Tribe In Central Sulawesi, Indonesia. Proceedings of Biology National Seminar, Medan 11 May 2012.

Poulsen, A. D. 2012. *Etlingera* of Sulawesi. Natural History Publications (Borneo) Kota Kinabalu in association with Royal Botanic Garden Edinburgh and natural History Museum, University of Oslo. Kota Kinabalu, Sabah, p. 278.

Pitopang, R. 2009. Plant biodiversity of Sulawesi; prospects, challenges and the role of plant taxonomy. Inauguration speech of Professor at the Tadulako University Palu.

Pitopang, R. and Sarifuddin. 2012. Ethnoecological system of *Tao Taa Wana* Tribe in the Morowali Nature Reserve, Central Sulawesi, Indonesia. Proceedings of the Society for Indonesian Biodiversity – International Conference. Vol. 1. July 2012; Pp. 209-214.

Purwanto, Y. 2004. Understanding traditional plants use and management: The dani-baliem perceptions of the plant diversity. Trop. Ethnobio. I(1): 9-43.

Ramadhanil, S., S. Tjitrosudirdjo and D. Setiadi. 2008. Structure and composition of understory plant assemblages of six land use types in the Lore Lindu National Park, Central Sulawesi Indonesia. Bangladesh J. Plant Taxon. 15(1): 1-12.

Riswan, S. and H. S. Rumantyo. 2002. Jamu as traditional medicine in Java, Indonesia. South Pac. Stud. 1(23): 2-10.

Rodrigues, J. C., L. Ascensao, M. A. Bonet and J. Valles. 2003. An ethnobotanical study of medicinal and aromatic plants in the national park of “Serra de Sao Mamede, Portugal. Ethno-Pharmacol. 89: 199-209.

Roos, M., P. J. A. Keβler, S. R. Gradstein and P. Baas. 2004. Species diversity and endemism of 5 major Malesian islands: Diversity-area relationships. Biogeogr. 31: 1893-1908.

Sangat, H. M. and I. Larashati. 2002. Some ethnopithomedical aspects and conservation strategy of several medicinal plant in Java, Indonesia. Biodiversitas. 3(2): 231-235.

Thomas, D. C. 2010. Phylogenetic and historical biogeography of

Southeast Asian Begonia L (Begoniaceae). Thesis of Philosophy of Doctor. Division of Environmental and Evolution of Biology. The University of Glasgow. United Kingdom.

Thomas, D. C., W. H. Ardi and M. Hughes. 2011. Nine of new species of Begoniaceae, from South and West Sulawesi, Indonesia. Edinburg J. Bot. 68(2): 225-255.

Turner, N. J. 1988. The importance of a rose: Evaluating the culture significance of plants in thompson and lilloet interior salish. Am. Anthropol. 90: 272-290.

Van Welzen, P. C., J. W. F. Slik and J. Alahuta. 2005. Plant distribution pattern and plate tectonics in Malesia. Biol. Skr. 55: 199-217.

Waluyo, E. B. 2008. Research ethnobotany in Indonesia and the future perspectives. A review. Biodiversitas. 9(1): 58-63.

Zuhud, E. A. M., A. Hikmat, E. Siswoyo, E. Sandra and N. Jamil. 2001. Buku acuan umum tumbuhan obat Indonesia Jilid I : *dalam* Kajian etnobotani masyarakat di sekitar Taman Nasional Gunung Merapi. Yayasan Sarana Wana Jaya Fakultas Kehutanan IPB. Available from: http://www.repository.ipb.ac.id/handle/123456789/47610. [Last downloaded on 2012 Feb 09.

Table Appendix 1: Categories of useful plants (Purwanto, 2004)

No	Categories of useful plants
1	**Cultivated plants (domesticated plants)**
	1. Staple food
	2. Secondary food crops (inc.cash crops)
	2.1. Vegetable and Legumes
	2.2. Oil plants
	2.3. Tuber
	2.4. Spices
	2.5. Baverage/plant juices
	2.6. Fruit and edible seeds
	3. Forage crops
	4. Latex and crops
	5. Fiber crops
	6. Stimulants
	7. Fuelwood
	8. Ornamental crops
	9. Aromatics and cosmetics
	10. Dye plants
	11. Plants of magical and ritual significance
	12. Nitrogen-fixing plant/green manure
	13. Utensils
	14. Toxicants
	15. Variation object (cigarette)
2	**Wild plants**
	1. Palatable, Medicinal non plant
	1.1. Edible leaves, stems and shoots
	1.2. Edible flowers, fruits and seeds
	1.3. Edible roots and rhizomes
	1.4. Spices
	1.5. Baverages/plant juices
	2. Latex and resin plants
	3. Rope
	3.1. Bamboo and rattans
	3.2. Binding/weaving
	4. Dye plants
	5. Ornamental plants
	6. Fiber plants (clothes and basketry)
	7. Plants for household utensils and tools
	8. Plants for musical instruments and toys
	9. Aromatics and cosmetics
	10. Stimulants
	11. House and hut contruction
	11.1. Boards
	11.2. Poles
	11.3. Roofing
	11.4. Walls
	11.5. Fence
	12. Fuelwood
	13. Commercial timber
	14. Ecological indicators
	15. Plant magic and ritual or spiritual uses
	15.1. Hunting or fishing or agriculture rituals
	15.2. First foods ceremony
	15.3. Specific taboo or superstition and traditional ritual for healing
	15.4. Cham for luck, wealth, love, gambling, weather modification
	Toxicants
	15.5. Fish poisons
	15.6. Others
	16. Variation use
	17. Medicinal plants (both cultivated and wild plants)
	17.1. Tonic, general medicine
	17.2. Purgative, Laxative
	17.3. Medicine for colds, coughs, tuberculosis, influenza
	17.4. Poultice or wash for wounds, sores, burns
	17.5. Medicine for arthritis, rheumatism, muscular arches, paralysis
	17.6. Medicine for kidney and urinary ailments
	17.7. Medicine fofr venereal diseases
	17.8. Medicine for eye infection
	17.9. Medicine for women, obstetric or gynecological or reproduction
	17.10. Medicine for babies and or young childrens specifically
	17.11. Medicine for cancer
	17.12. Medicine for heart, circulatory systems, blood pressure
	17.13. Counter irritant
	17.14. Analgetic or anesthetic
	17.15. Antidote for poisoning
	17.16. Medicine for stomach and/or digestive tract, dysentery
	17.17. Medicine for aphrodisiac
	17.18. Medicine for ear infection
	17.19. Medicine for fever and Malaria
	17.20. Medicine for dent
	17.21. Medicine for animal desease
	17.22. Medicine for skin infection and skin treatment

Table Appendix 1: ***(Continued)***