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# Ethnobotany of *Nepenthes* spp. in Dayak Seberuang People, West Kalimantan, Indonesia

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**Key words:** Ethnobotany, *Nepenthes*, DayakSeberuang People, Kalimantan.

**Abstract**

The aims of this research was to identify the use of *Nepenthes* spp. among DayakSeberuang People (DSP), West Kalimantan, Indonesia. Field research was conducted from January-October 2015 in three villages of DSP, namelyPaohBenua, Gernis Jaya, and Lengkenat villages. These villages located at Sintang Regency, West Kalimantan Province, Indonesia. Ethnobotanical research was conducted through participative observation, open-ended interviews, and semi-structured interviews. Snowball sampling was used to determine the informants. Totally there are 96 informants included in this study with informants old range from 25 to 98 years old. Qualitative interviews data was analysis with descriptive method, whereas quantitative ethnobotany data was analysis withUse Values(UVs), Relative Frequency Citation(RFC), and Cultural Significance Index (CSI). Results of this study shows that there were five *Nepenthes* species, namely*Nepenthes ampullaria*Jack.,*Nepenthes bicalcarata*Hook.f., *Nepenthes gracilis*Korth., *Nepenthes mirabilis* (Lour.) Druce., and *Nepenthes rafflesiana*Jack. DSP used stem of *Nepenthes* as traditional ropes and material for handicrafts.Pitcher of *Nepenthes* was used as vessel for traditional food.Fluid from unopened pitcher of *Nepenthes* was used as medicine for cough andstomachace, and also drinking water reserve.Epidermis of *Nepenthes*'sstem was used as material for handicrafts's dye, and small *Nepenthes* plant was used as decorated plants. Traditional ropes and material for handicraft and vessel for traditional food are the most importance roles of *Nepenthes* in DSP (RFC=1.00; 0.98). *N. ampullaria*wasthe most important species on utilization and cultural level of DSP with UVs 2.61, RFC 0.99, CSI 16.

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## Introduction

Indonesia is one of 17 megadiverse countries which set by UNEP (United Nation Environment Programme). It's occupied as third rank in number of biodiversity and second rank in number of endemic species in the world. There were 426 amphibians, 1.666 birds, 8.000 mammals, and more than 11.655 plants species which found in Indonesia (ACB, 2009). Indonesia is inhabited by more than 1300 tribal communities with their indigenous knowledge in managing biodiversity. Some tribes which inhabited in remote areas still depend their daily life to forest. For example, SukuAnakDalam who lived in area of Bukit Duabelas National Park, Jambi Province, still used plants for food, medicine, house to prop their lives (Jumiati*et al.*, 2012; Mairida*et al.*, 2014; Andhika*et al.*, 2015).

*Nepenthes* is one of the plants species which widely used by traditional people. *Nepenthes* is a genus of tropical carnivorous plant which have a pitcher at the tip of the leaf. This pitcher is modification of leaf to adaptation from habitat stress. Pitcher of *Nepenthes* used to catch prey that is occupied as additional nutrients source as form of adaptation from habitat poor nutrient which its inhabit (Clarke, 2001; Clarke, 2006; Mansur; 2006). Borneo Island including Kalimantan (Indonesia), State of Serawak and Sabah (Malaysia) and Brunei Darussalam is one of diversity center of *Nepenthes* in the world, where 31 species can be found on the island, with 24 of them are endemic species (Clarke, 2006). According to ListiawatiandSiregar (2008) there were 11 *Nepenthes* species can be found in West Kalimantan Province and become priceless biodiversity resources for local people.

One of traditional people who commonly used *Nepenthes* in their daily lives is DayakPeople who are natives tribes inhabiting in Borneo Island (Schweiler*et al.*, 2015). DayakSeberuang People (DSP) are one of sub-tribes of Dayak with their traditional knowledge in utilizing biodiversity, like timbers and non-timbers product, one of them is *Nepenthes*. DSP inhabiting in watersheds of Seberuang River, Tempunak River, and Sepauk River, West Kalimantan and located far from the capital of Sintang Regency and which make them utilize the natural resources for lives (Alloy *et al.*, 2008). The ethnobotanical survey is important to documented indigenous knowledge from traditional people in managing biodiversity. So far no systematic ethnobotanical survey has been made in this tribe and this is the first report on *Nepenthes* plants used by the local people. The aims of the present research is to document species andthe utilization of *Nepenthes* in DayakSeberuang People community.

## Materials and methods

*Study site*

This study was conducted in three settlements area of DSP namelyPaohBenua, Gernis Jaya, and Lengkenat villages, sub-district of Sepauk, Sintang Regency, West Kalimantan Province, Indonesia on January-October 2015. Its located on 0°0'31.29"S-0°0'44.71"N and 111°16'21.28"E-111°13'15.00"E. This area are lowland with altitude 0-60 m asl. The type of the soil are red-yellow podsolite (RYP) which poor of nutrients. Annual temperature range from 22°-34°C. Annual rainfall in this area range from 214.2-541.2 mm (Statistics of West Kalimantan, 2011).

Vegetation in DSP settlements area commonly are lowland plants species, like lowland *Shorea* spp., *Duriozibethinus*, *Garciniamangostana* L., *Artocarpus integer* (Thunb.), *Baccaureaangulata* Merr., etc. There were some species which lived together with *Nepenthes* like *Cratoxylumarborescens*, *Cratoxylumglaucum*, *Gleichenia* spp., *Shoreaalbida*, *Eliodoxaconferta* (Griffith.) Burre.,*Dilleniasuffruticosa* Mast., etc.

*Data collection*

Data was collected with participativeobservation method, open-ended interviews, and semi-structured interviews.*Nepenthes* inventory was conducted with participative observation method with local guides. Observation was done over the settlement area of

DSP which indicated as potential to *Nepenthes* habitat. Snowball sampling method was used to determine the informants based on Silva *et al.* (2015). Number of informant will increase until data was saturated. There are two kind of informants in this study, first, key informants are the persons who really now the information of *Nepenthes* in DSP including chiefman, head of tribes, traditional healers, and traditional craftmans, second is general informants are the informant who appointed by key informant and utilize*Nepenthes* in their daily life (Vogl*et al.*, 2004).

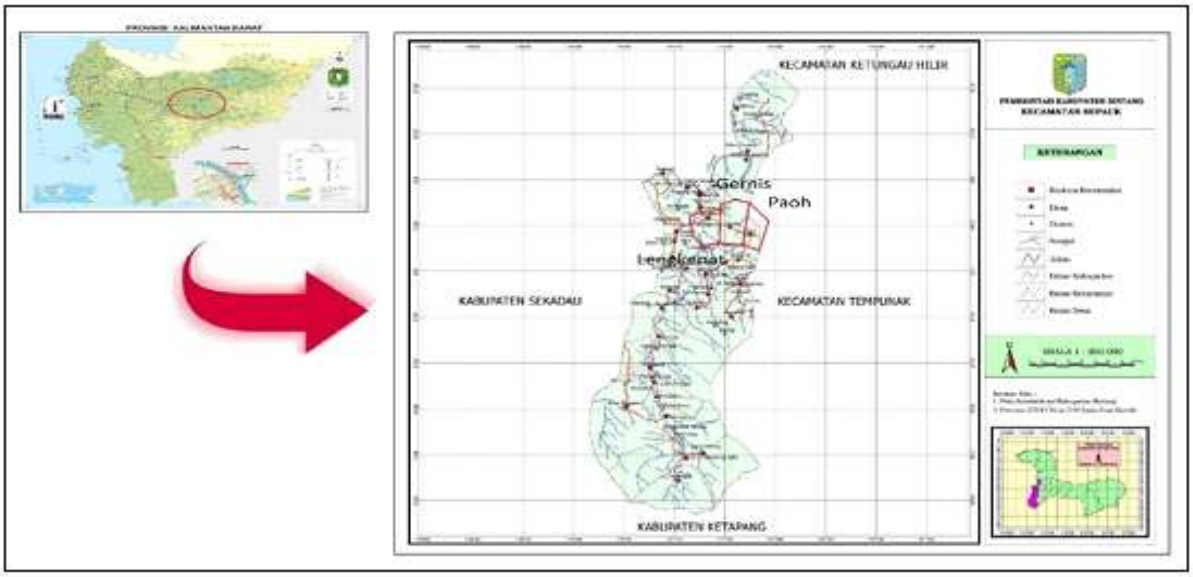


**Fig. 1.** Map of DayakSeberuang People's seatlements (Statistics of Sintang Regency, 2013).

*Data analysis*

In this study, data can be grouped as qualitative and quantitative data. Qualitative descriptive analysis was used to analyze interviews data about indigenous knowledgedanmitology of *Nepenthes* in DSP (Batoro*et al.,* 2011). Quantitative analysis was used to analyze use values, frequency of citation, and cultural aspect of *Nepenthes* in DSP. Use values (UVs) analyze based on (SreekeesoonandMahomoodally, 2014; Ong and Kim, 2014). Analysis of cultural values of *Nepenthes* in DSP was conducted with cultural significance index (CSI) according to Silva *et al.* (2006), and frequency of citation was analysis with relative frequency citation (RFC) based on (SreekeesoonandMahomoodally, 2014, Kalala*et al.,* 2014). Identification of *Nepenthes* was used Clarke (2001), Clarke (2006), Mansur (2006), and ListiawatiandSiregar (2008).

## Results and discussion

*Nepenthes inventory on DayakSeberuang People's settlement area*

There are five *Nepenthes* species in settlements area of DSP and its commonly found in West Kalimantan, namely *Nepenthes ampullaria*Jack.,*Nepenthes bicalcarata*Hook.f., *Nepenthes gracilis*Korth., *Nepenthes mirabilis* (Lour.) Druce., and *Nepenthes rafflesiana*Jack (Fig. 2). *Nepenthes* in DSP settlements area were categorized as *Nepenthes* lowland area which found on altitude 0-500 m asl (Clarke, 2006). One of its, which is *N. bicalcarata* are endemic in Borneo Island, particularly in west part of Borneo, such as West Kalimantan, Sabah, and Serawak (Moran *et al.*, 1999; Clarke, 2006). *N. bicalcarata* is also the biggest plant of this genus (Clarke, 2006).

Four of *Nepenthes* in DSP settlements area are categorized as least concern based on IUCN red list, only one of them are vulnerable, which is *N. bicalcarata*, but now, the population of all *Nepenthes* are threatened because of conversion of *Nepenthes*

habitat into palm oil plantation (Gaveau*et al.*, 2014). Its caused decrease of *Nepenthes* population in DSP settlements area, especially *N. bicalcarata* and *N. rafflesiana*which need special condition to life (Mansur, 2006; ListiawatiandSiregar, 2008). One of the best action to conserve of this species is manage it with indigenous knowledge approach. Based on Singh *et al.* (2011) and Schwallier*et al.* (2015) indigenous knowledge from local people in manage their environment can be the most effective strategy to conserve biodiversity, but Its also need support from local stakeholder.

**Table 1.** Demographic characteristics of informants of DayakSeberuang People.

| Informants demographic's profile | | Paoh village | | Gernis village | | Lengkenat village | |
|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % |
| Age | 25-45 | 5 | 12.82 | 14 | 46.67 | 9 | 33.33 |
| | 46-55 | 15 | 38.46 | 8 | 26.67 | 7 | 25.93 |
| | >56 | 19 | 48.72 | 8 | 26.67 | 11 | 40.74 |
| Gender | Men | 28 | 71.79 | 23 | 76.67 | 21 | 77.78 |
| | Women | 11 | 28.21 | 7 | 23.33 | 6 | 22.22 |
| Educational | No school | 8 | 20.51 | 7 | 23.33 | 2 | 7.41 |
| level | Not graduated ES[1] | 9 | 23.08 | 4 | 13.33 | 7 | 25.93 |
| | Elementary school | 17 | 43.59 | 10 | 33.33 | 13 | 48.15 |
| | Junior HS[2] | 2 | 5.13 | 1 | 3.33 | 3 | 11.11 |
| | Senior HS[2] | 2 | 5.13 | 6 | 20.00 | 2 | 7.41 |
| | College | 1 | 2.56 | 2 | 6.67 | 0 | 0.00 |
| Profession | Farmers | 24 | 61.54 | 23 | 76.67 | 22 | 81.48 |
| | Craftsman | 5 | 12.82 | 0 | 0.00 | 1 | 3.70 |
| | Traditional healers | 5 | 12.82 | 1 | 3.33 | 1 | 3.70 |
| | Merchant | 3 | 7.69 | 4 | 13.33 | 3 | 11.11 |
| | Teacher/PE[3] | 2 | 5.13 | 2 | 6.67 | 0 | 0.00 |

Note : N=numbers, [1]ES=elementary school,[2]High School,[3]PE=public employee.

*Demographic characteristic of informants*

The informants in this study were DSP from three villages, which is PaohBenua, Gernis Jaya, andLengkenat villages. This three villages are the most DSP inhabiting on sub-district of Sepauk which can easily reach from capital regency. Total of informants in this study were 96 person consist of 23 key informants and 73 general informants (age range 25-98 years old). Informants was categorized based on social-economic factor to determine preferency of informantion from informants (Beltran-Rodriguez *et al.*, 2014).

Information from informants generally can be group based on age, gender, education level, and profession of informants. Based on age category, elder people of DSP have more knowledge about *Nepenthes* and their information ware came from DSP ancestor without interference from outsiderather than younger informants (age range 25-98 years old). Gender wereinfluence the *Nepenthes* information from DSP, which women informants disposed to mention roles of *Nepenthes* as medicine for cough andstomachache, and also material for handicraft dye, otherwise man informants mention*Nepenthes* roles in field such as vessel for traditional food, drinking water reserve in forest when they hunting or gathering non-timbers, traditional ropes and handicrafts. Based on educational level, informants was grouped as never get school, not graduate from elementary school, graduate elementary school, middle school, high school, and collage, where the informations from

informants who never get school and not graduated from elementary school arepure informations from ancestor of DSP. Information based on profession of informants are disposed to follow their ability, such as traditional healers generally cited roles of *Nepenthes* as cough, stomachache, and others mythology of *Nepenthes* in DSP (table 1).

*Nepenthes utilizations in DSP*

All of *Nepenthes* which found in DSP settlements area were utilize by DSP since elder ancestor. Every *Nepenthes* has at least two utility from every part of its like stem, stem epidermis, pitcher and including pitcher liquid. DSP used stem of *Nepenthes* as traditional ropes and material for handicraft, pitcher of *Nepenthes* is used as vessel for traditional food, fluid from unopened pitcher is used as cough, stomachache, and drinking water in several condition like in the middle of forest, epidermis of *Nepenthes*'sstem used as material for dye, and small *Nepenthes* plant utilize as decorated plants. The most cited of *Nepenthes* utilization was traditional ropes with RFC 1.00, followed by vessel for traditional foods (RFC=0.98), drinking water reserve (RFC=0.65), cough medicine (RFC=0.30), stomachachemedicine (RFC=0.18), traditional dye (RFC=0.13), and decorated plants (RFC=0.07) (Fig. 3). The RFC values represent frequency of local utilization of *Nepenthes* by DSP. Utilization of *Nepenthes* with value 1.00 means that this utilizations are the most cited and has the high roles in DSP. The low values of RFC in some utilization like cough medicine, stomachache medicine, and traditional dye material were caused by the information of this are not well known by younger informants and there were gapbetween information from elder and younger informants (Sreekeesoonand Mahomoodally, 2014).

**Table 2.** Quantitative ethnobotany data of *Nepenthes* in DSP.

| Scientific name | Local name | UVs | RFC | CSI |
|---|---|---|---|---|
| *Nepenthes ampullaria*Jack. | *Entuyutduduk* | 2.61 | 0.99 | 16 |
| *Nepenthes bicalcarata*Hook.f. | *Entuyutrusa'* | 0.69 | 0.33 | 2.72 |
| *Nepenthes gracilis*Korth. | *Entuyutrambai* | 1.11 | 0.95 | 7.68 |
| *Nepenthes mirabilis* (Lour) Druce. | *Entuyutbabas* | 1.56 | 0.99 | 12 |
| *Nepenthes rafflesiana*Jack. | *Entuyutlabu* | 0.28 | 0.16 | 2.56 |

*Nepenthes as traditional ropes and material for handicrafts*

*Nepenthes* was utilized by DSP for traditional ropes especially for tied "the long house", which are traditional house of Dayak because its hasgood endurance in dry or wet season and can be used for 5-6 years. Otherwise, *Nepenthes* utilized to tied the long house because DSP has prohibited to used rattan (*Callamus* spp.) which are common traditional ropes in Borneo for house. They believed that rattans are belongs to died people, because in long time ago when member of DSP pass away, they are wrapped with plaited mat which made from *Pandanustectorius* and tied with rattans. If they still used rattans for tied the house it can made died people will angry and caused misfortune.

*Nepenthes* were commonly used as material for handicrafts by DSP. *Nepenthes* used as rope to make traditional fish catcher called *bubu*, chicken cage called *kurungmanuk*, and transportation device for pig called*nyalungbabi*. In addition to, *Nepenthes* also used as main material for traditional handicrafts to make base of wok namely *lekarkuali* which is the plait of *Nepenthes* stem to hold the hot wok after cooking (Fig. 4a). Plait of *Nepenthes* also used as foundation of traditional candle called *jangka' lampu* and plate shelf called *pencerangpinganmangkuk*. *Jangkaklampu*are made from plait of *Nepenthes* stemslike flattened-globe shape with circle hole in the middle of the plait. The hole was filled with resin from *Shorea* spp. and wrapped with leaf of wild-banana (*Musaborneensis*) and after that, the resin can be

burn and produce light like candle. *Pencerangpinganmangkuk* has same shape with *jangka' lampu*but it consist of two part of flattened-globe shape which hold each other and patch to the wall of DSP kitchen to put cooking stuff (Fig. 4b). Utilization of plants as traditional ropes and material for handicrafts are common in Indonesian traditional people. Dani's people in Baliem valley, Papua, used stem of *Calamus*sp. and bark of *Wikstroemiavenosa*as ropes (ArobayaandPattiselanno, 2007). Stem and bark of plants was used as rope because its has high elasticity, flexibility, and arranging by tight fiber (Ritonga*et al*., 2014).


**Fig. 2.** *Nepenthes* species in DSP settlements areaa) *N. ampullaria*, b) *N. bicalcarata*, c) *N. gracilis*, d) *N. mirabilis*, e) *N. rafflesiana*.

*Nepenthes as vessel for traditional food*

*Nepenthes* pitcher as vessel or container to cook rice or sticky rice by DSP are indigenous knowledge from elder ancestor (Fig. 4c). Elder people of DSP are commonly working as hunter and gathering honey in forest for many days. For provision along the journey, DSP only brought rice and salt, and used *Nepenthes* pitcher, especially the big one like lower pitcher of *N. bicalcarata*, *N. ampullaria,* and *N. rafflesiana* as stoneware. They also used *Nepenthes* pitcher to cook some water and vegetable.

Traditional food which vessel with *Nepenthes* pitcher produce some taste and smells typically. DSP usually serve this food with combination to salted fish of *lais* (*Cyptopterus* sp.) or smoked fish of *toman* (*Channamicropeltes*), but it can also be eat without any mixture. The utilization of *Nepenthes* for vessel of traditional food which regards to indigenous knowledge and local custom will not be reduce the population of *Nepenthes*. In accordance with Schwallier*et al.,* (2015) which conducted ethnobotanical research about *Nepenthes* as vessel for traditional food in traditional people of Serawak, Malaysia, in their reports that indigenous knowledge can be sustainably way to utilize *Nepenthes* with not reduce the population. Manyof traditional food in Indonesia are vesseled with plants, beside *Nepenthes*,

traditional people of Bengkulu Province, utilize bamboo (*Gigantochloascortechinii*) to cook traditional food called *lemang*which are sticky rice in bamboo (Yani, 2014).

*Nepenthes as medicine for cough, stomachache, and drinking water reserve*

Utilization of *Nepenthes* as medicine for cough and stomachache are indigenous knowledge from ancestor of DSP. The *Nepenthes* liquid from unopen pitcher are pure water which produced by the plants (Fig. 4d). The composition of liquid which can be used as medicine are still unclear. We indicated that composition of hydrolytic enzymes, defense-related proteins, and pathogenesis-related protein (PR-1) in the liquid that can be used as antibacterial and antifungal for cough and stomach medicine (Buch*et al.*, 2014). The liquid from unopen pitcher were also used by Indian people as eye drop (Ghosh and Ghosh, 2012).

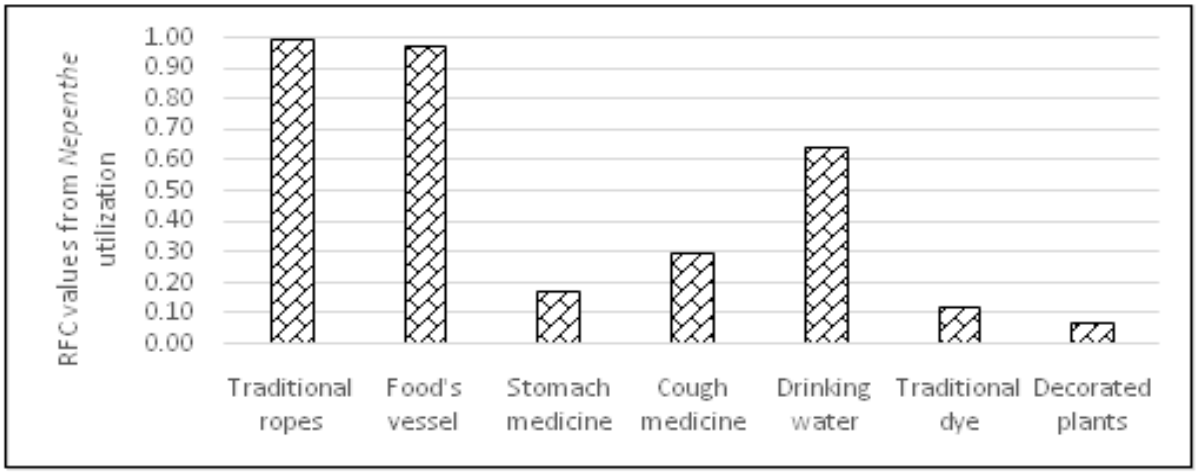


**Fig. 3.** RFC values of *Nepenthes* utilizations.

DSP has local wisdom in harvesting *Nepenthes* as medicine. When DSP drink the liquid from the unopen pitcher of *Nepenthes*, they believe that their sickness will move into the pitcher and they will throw the empty pitcher into forest or shrubs. DSP always bring some offerings which aim to God (DSP name for God :*betarapuyang*gana) when harvesting *Nepenthes* as medicine. DSP believed that if they not brings some offerings, God will not take the sickness from them, and the medicine they brought ineffective. The offerings consist of some rice (usually 5-7 grains of rice) and an iron (usually a part of fracturing machete). The utilization of *Nepenthes* liquid as cough and stomach medicine were also did by Meghalaya people, in around of NokrekNationa Park, India Singh *et al.,* 2011; Ghosh and Ghosh, 2012).

The liquid from unopen pitcher are also used by DSP as drinking water reserve (Fig. 3d). When DSP has out of water in forest when hunting or gathering the wild honey, they usually drink from *Nepenthes*. The liquid are felt cold and refreshing.

*Nepenthes as material for dye and decorated plants*

*Nepenthes* commonly used by traditional craftsman as black dye in DSP settlements area (Fig. 4e). The part of *Nepenthes* which used as dye are stem epidermis from *N. rafflesiana*and *N. bicalcarata* which has large stem and produce more epidermis. DSP peeling the bark of Nepenthes stem by hand and scrape the stem with machete to take the stem epidermis. After that, stem epidermis mixed with charcoal pot and left a while. Mixture of epidermis and charcoal can be used to coloring the material for handicrafts like bamboo or leaf of *Pandanustectoris*. The resin from stem epidermis of *Nepenthes* commonly brown- black and when it mixture with charcoal pot, its color become darkblack. The resin are contains of tannin which are the natural dye for brown-black, and its commonly found in banana resin

and has high adhesive into other materials (Kwartiningsih*et al.*, 2010).

*Nepenthes* are also used by DSP as decorated plants (Fig. 4f). Decorated plants information were came from outside of DSP community, results from interaction between DSP and entrants, and also from mass media. *N. ampullaria*and *N. gracilis*are two common species which used as decorated plants. Actually, ancestor of DSP was used as decoration, not the whole plants but only the pitchers and stem of *Nepenthes*. The pitcher were hanged in front of the door of the long house as repellent of mystical things and misfortune which want to come inside the house.


**Fig. 4.** Utilization of *Nepenthes* (a) wok base (b) plate shelf (c) vessel for traditional food (d) cough and stomachache medicine and drinking water (e) dye material (f) decorated plants.

*Use values (UVs) and Cultural significance index (CSI)*

*Nepenthes* which has the highest UVs is *N. ampullaria* (2.61) which followed by *N. mirabilis* (1.68), *N. gracilis*(1.11), *N. bicalcarata* (0.69), and *N. rafflesiana*(0.28) (Table 2). UV is an index which represent the use values of some species in some community. In DSP community, *N. ampullaria*is the most importance *Nepenthes* species and has its own roles in DSP culture. UVs index has relation to conservation issues in community, Albuquerque *et al.* (2006) and Ong and Kim (2014) said that the most importance species in some community has the highest pressure because of over harvesting and need some conservation action. Indigenous knowledge become the most effective conservation action to the area related to some community (Schwallier*et al.*, 2015).

*Nepenthes* species with the highest CSI values is *N. ampullaria*(16) and after that *N. mirabilis* (12), *N. gracilis* (7.68), *N. bicalcarata* (2.72), and *N. rafflesiana* (2.56) (Table 2). CSI values based on Silva *et al.* (2006) is an indexs that show the cultural importance of some species in some community. CSI emphasized to cultural importance of species without categorized it based on their utilization.

In DSP community, the most utilization of *Nepenthes* are to traditional ropes, handicrafts material, and vessel for traditional food and make *N. ampullaria*and *N. gracilis*has the highest CSI values because both of this species was utilize for its.

**Conclusion**

There were five *Nepenthes* species in DSP settlements area, which is *N. ampullaria*, *N. bicalcarata*, *N.*

*gracilis*, *N. mirabilis*, and *N. rafflesiana*. DSP utilize *Nepenthes* as traditional ropes and material for handicrafts, vessel for traditional foods, drinking water reserve in forest, cough and stomachache medicine, traditional dye materials, and decorated plants. The most cited of *Nepenthes* utilization is as traditional ropes and material for handicrafts (RFC=1.00). The most importance *Nepenthes* species in DSP is *N. ampullaria* which has RFC= 0.99, UV=2.61, and CSI=16.

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