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Traditionaly utilization of *Selaginella*; field research and literature review

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Abstract. *Setyawan AD. 2009. Traditionaly utilization of Selaginella; field research and literature review. Nusantara Bioscience 1: 146-154.* The aims of this research were to find out traditional usage of *Selaginella* in medication and its other usages, especially in Java and other Indonesian Archipelago. About 200 of 700-750 world species of *Selaginella* was found in Indonesian Archipelago. Field research and literature review indicated that *Selaginella* is used traditionally to heal wound, bloody stools, internal hemorrhoid bleeding, menstrual and uterine discomfiture, blood expediting, enhancing body endurance and longevity of live, headache, etc. Besides that some of *Selaginellas* are also used as raw dishes vegetable, ornamental pants, base materials and crafts. The utilization of *Selaginella* is very little against its amount of species and medicinal potency, so it is needed an advance study on ethnobotany and phytochemistry to improve its uses.

Key word: traditional medicines, herbal, ethnobotany, *Selaginella.*

Abstrak. *Setyawan AD. 2009. Pemanfaatan* Selaginella *secara tradisional; survey lapangan dan kajian pustaka. Nusantara Bioscience 1: 146-154.* Penelitian ini bertujuan untuk mengetahui manfaat *Selaginella* dalam pengobatan tradisional dan pemanfaatan lainnya, melalui penelitian lapangan dan telaah pustaka, khususnya di Jawa dan Kepulauan Indonesia. Sebanyak 200 dari 700-750 spesies *Selaginella* hadir di Kepulauan Indonesia. Secara tradisional *Selaginella* digunakan untuk mengobati luka, pendarahan, gangguan menstruasi dan kandungan, memperlancar peredaran darah, meningkatkan daya tahan tubuh, memperpanjang usia, mengobati sakit kepala dan lain-lain. Di samping itu beberapa jenis *Selaginella* juga digunakan sebagai sayuran (lalapan), tanaman hias, dan bahan baku kerajinan tangan. Pemanfaatan *Selaginella* sangat terbatas dibanding jumlah jenis dan potensi manfaat obatnya, sehingga diperlukan kajian etnobotani dan fitokimia lebih lanjut untuk meningkatkan pemanfaatannya.

Kata kunci: obat tradisional, tanaman obat, etnobotani, *Selaginella*.

INTRODUCTION

Medicinal plants are plants that contain ingredients that can be used for treatment or becoming drug synthesis precursor (Sofowora 1982). Medicinal plants have become the leading contributor to health to mankind since time immemorial. In Indonesia, there are various systems of traditional medicine, as a result of high biological and cultural diversity in this country (Erdelen et al. 1999). The oldest and the most widespread system of traditional medication in Indonesia and Malesian Archipelago (Nusantara) is a native herb from Java (*jamu*). Herbal medicine or *jamu* contains more than 30 species of plants. The existence of the process of making herbal relief in Borobudur temple shows that the herb has been widely known since the early 9th century (Jansen 1993). This system has been recorded since the last centuries in various *serat* (letters) and *primbon* (prophecy) (Soedibjo 1989 1990; Sutarjadi 1990). *Jamu* is an original vocabulary of the Java language, which means traditional medicine, in addition it has been absorbed into the Indonesian language (Riswan and Sangat-Roemantyo 2002), the word *jamu* has also been used by other Malay speakers. This system is widespread through trade and migration, since the Hindu Mataram kingdom (Sanjaya), Sriwijaya (Sailendra), and Majapahit. At this time, *jamu* plays an important role in health and economic development of Indonesia (Sidik 1994). In Indonesia, more than 75% disease was treated with *jamu* or traditional medicine (Al-Janabi 2001). Even according to the WHO, 80% of the developing countries depend entirely on traditional medicine to maintain the people's health (Farnsworth et al. 1985; Bodeker et al. 2005).

Tropical forests are the habitat and the main source of medicinal plants (Stepp and Moerman 2001; Stepp 2004), due to high levels of biodiversity and endemisity (Gentry 1993; Macilwain 1998). Some 40,000 species (Rifai MA, 2008, personal communication) or 15% of flowering plants can be found in Indonesia (MOSPP 1993). 10% of the plants is potential for medicinal plants (Schumacher 1996). Heyne (1927) noted the existence of 996 species of flowering plants used in traditional medicine in Indonesia, when added with algae, fungi, nails, and gymnosperms and the number can reach 1040 species. Kazahara (1986) noted

7500 plant species in Indonesia, where 3689 species of which are medicinal plants. *Zuhud* et al (1994) mentions the 1260 species of trees in the Indonesian rain forests are used as medicinal plants.

Selaginella (cakar ayam or rane) is a medicinal plant that has not been widely used, either traditional or modern. Small amounts of the species are also used as ornamental plants and vegetables. Family Selaginellaceae Reichb has only one genus, *Selaginella* Pal. Beauv, consisting of 700-750 species and widespread in a cosmopolitan way (Tryon and Tryon 1982; Jermy 1990). In Malesia, there are more than 200 species of *Selaginella*, with the highest diversity and endemism in Papuasia, Borneo, and the Philippines. In Java there are 24 with 5 endemic species. Some species are still waiting to be discovered, but a number of other species waiting to be extinct (Setyawan 2008). All species of Malesia have small leaves resembling scales, with two different sizes: the smaller median leaves in the inner row and the larger lateral leaves in the outer rows (Jermy 1990; Camus 1997).

Selaginella contains a variety of secondary metabolites such as alkaloids, phenol (flavonoids, tannins, saponins), and terpenoids (triterpene, steroid) (Chikmawati and Miftahudin 2008; Chikmawati et al. 2008). The main secondary metabolite of this plant is biflavonoid, whose type is various depending on the species. Biflavonoid that has been identified from *Selaginella*, among others amentoflavone are 2',8"-biapigenin, delicaflavone, ginkgetin, heveaflavone, hinokiflavone, isocryptomerin, kayaflavone, podocarpusflavone A, robustaflavone, sumaflavone, and taiwaniaflavone. These compounds act as antioxidants, anti-inflammatory, anti-cancer, anti-allergic, antimicrobial, antifungal, antibacterial, antiviral, protective against UV irradiation, vasorelaksan, heart boosters, anti-hypertensive, anti-clotting, and affect the metabolism enzymes (Setyawan and Darusman 2008). Biflavonoid is a typical of secondary metabolites which are found only in Selaginellales, Psilotales, gymnosperms (Seigler 1998), and several species of Bryophytes and Angiosperms (DNP 1992).

This study consists of two main activities, namely the field research and literature review. The field research was conducted in several areas in Indonesia, especially Java, in order to know the traditional use of medicinal plants *Selaginella*, while the literature review were collected from studies around the world, especially from the Malesia regions. The literature review is intended to strengthen and expand the knowledge about the traditional use of medicinal plants, *Selaginella*.

MATERIALS AND METHODS

Field research

The field research was conducted to know current state of traditional use of *Selaginella*. The field research was conducted at 40 locations in Java and 9 locations in other islands, namely: (i) Cycloops Mountain Nature Reserve, Jayapura, (ii) Mount Meja, Manokwari, (iii) Mount Gamalama, Ternate, (iv) Atakejawe National Park, Halmahera, (v) Mount Soputan, Minahasa, (vi) Mount Rinjani, Lombok, (vii) Batuliu Nature Reserve, Bali, (viii) Mount Penumbing, Bangka, and (ix) Gunung Leuser National Park, Aceh (Table 1). The field research was conducted in the mid of 2007 to the late of 2008.

The data of the traditional use of *Selaginella* were obtained through interviews (in-depth interviews) with local residents (key person) about 2-3 people at each location. Selected respondents were adults (aged > 18 years), and were born and raised in that region. Respondents did not necessarily have high education or work as traditional healers. To maintain the spontaneity of respondents, interviews were conducted in an informal, unstructured, using a general interview guide; by showing a number of *Selaginella* specimens that have been collected previously from these locations, to ensure the local name of each taxon and other data. In some locations, field studies were conducted more than one visit to deepen the research, so there were 5-10 local residents per location that were interviewed.

The data recorded include the location, scientific name, local name, the efficacy in the treatment, the used parts, single or ingredients (if ingredients, then mentioned the other ingredients that are added), the preparation procedure, the charged dose, the duration of treatment, the abstinence during treatment and the best time of collection. In addition, other non-medical use was also noted (Table 1).

All species of *Selaginella* found at each study site were sampled and made into herbarium, and also identified further to confirm their identity. Identification was done by referring to the Alderwereld van Rosenburgh (1915a, b; 1916 1917 1918 1920 1922) and Alston (1934 1935a, b; 1937 1940); and herbarium sheets of the Herbarium Bogoriense collection (BO) which has been determined by Alston in the past. Herbarium specimens are stored mainly in the Herbarium Bogoriense (BO), Research Centre LIPI, Bogor Cibinong; with the collection numbers of ADS et al. The duplicate will be sent to the Leiden Herbarium (L), the Netherlands and Herbarium Soloense (SO), Biology Department, Sebelas Maret University of Surakarta.

Literature review

Literature review data were collected until the end of 2008, primarily through the collection of abstracts from: MEDLINE (www.pubmed.gov), JSTOR (www.jstor.org), HighWirePress (http://highwire.stanford.edu), BioInfoBank (http://lib.bioinfo.pl), ProQuest (www.proquest.com), Elsevier (www.sciencedirect.com), and Springer (www.springerlink.com). Literature review data in the form of books, journals, abstracts, articles, patents, and bibliographies were also collected from Google (www.google.com) and Yahoo (www.yahoo.com). Data collection is not restricted to language or time of publication. The data collection used the keyword '*Selaginella*' and/or 'medicinal plant' and/or 'biflavonoid', including the 12 compounds of biflavonoid, namely: amentoflavone, 2,8-biapigenin, delicatuliflavone, ginkgetin, heveaflavone, hinokiflavone, isocryptomerin, kayaflavone, podocarpusflavone A, robustaflavone, sumaflavone, and taiwaniaflavone. Selection was then

performed manually by reading the manuscript one by one to separate the valuable data (from a trusted author and publisher) from the unvaluable ones and to avoid duplication.

All the data whose strength had been proved were compiled in the tables. For traditional use, as well as field research, data collected includes location (country, place), scientific name, local name, the efficacy in the treatment, the used parts, single or ingredients (if ingredients, then mentioned the other ingredients that were added), governance way of preparation, the dose, duration of treatment, abstinence during treatment and the best time of collection. In addition, non-medical use and a list of libraries were also noted (Table 2).

Data analysis

The ethnobotany data was explained descriptively and compared with utilization in the whole world.

RESULTS AND DISCUSSION

Results

The traditional utilization of *Selaginella* based on field studies and literature review are presented respectively in Table 1. From Table 1, it appears that the traditional use *Selaginella* in Java and other islands in Malesia is still relatively rare, compared to the number of species that grow in this region. At least the local name given shows the little popularity of this plant in the community, this is certainly due to least utilization of the plants. The dominance of Javanese herbal medicine systems in traditional medicine in Indonesia and Malaysia, which is generally made from raw materials of about 30 species of cultivated plants, especially *empon-empon* and spices seem to have put aside the potential use of *Selaginella*, whose availability in nature is affected by seasons. From the field studies, it is known that the *Selaginella* is useful to treat wounds, menstrual disorders and for treatments before, during, and after giving birth, and to improve fitness and endurance of the body (tonic).

From Table 1, it is also known that the utilization of *Selaginella* was not only found in Malesia, but relatively and evenly distributed throughout the world, although the number of species that have been used relatively limited. The result of literature study also shows that the herb is commonly used to treat wounds and bleeding, either external wounds or internal injuries such as menstrual disorders and postpartum hemorrhage, and also used as a tonic to improve fitness and stamina. The more number of utilization of *Selaginella plana* (Desv. ex Poir.) Hieron. in Indonesia and Malaysia compared to other species may be linked to the size distribution of these plants on the islands of Malesia, western Malesia region considering the ancestral home of this species (Setyawan 2008). The utilization of *S. tamariscina* and *S. doederleinii* indicates the presence of the influence of traditional Chinese medicine in an area, considering that both are widely used in traditional Chinese medicine recipes that are relatively advanced.

Table 2. Utilization of *Selaginella* medicinal plants through field research and literature review.

Scientific name	Local name	Location	Medical uses	Single/potion	Preparation	Dosage	Non-medical benefits	References
Field research *)								
S. ciliaris	-	Indonesia, Wonosobo	-	-	-	-	Ornamental plants	Field research
S. opaca	Pulalata	Indonesia, Dieng, Jawa Tengah	Wounds, menstruation, bodyfitness	Single	poultice/ cooked	At sufficiently	-	Field research
	Rane	Indonesia, Bogor	Wounds, menstruation, childbirth	Single	Raw/cooked	At sufficiently	Vegetable	Field research
	-	Indonesia, Wonosobo	Heart desease, stroke	Potion	Cooked	5-6 handfuls	-	Field research
S. wildenowii, S. involvens, S. ornata	Rane	Indonesia, TNGHS	Wounds, menstruation, fitness, liniment herb	Single/potion	Raw, cooked, baked	As needed	-	Field research
S. plana	-	Indonesia, Banjarnegara	tonic for malaria patients		Cooked	At sufficiently	-	Field research
Selaginella spp.	-	Indonesia, Ambon, Manokwari	-	-	-	-	Packaging	Field research
Selaginella singalanensis	-	Indonesia, Wonosobo	-	-	-	-	Ornamental plants	Field research
Selaginella sp.	-	Indonesia, Bogor	-	-	-	-	Ornamental plants	Field research
Literature review								
S. argentea	-	Malaysia, Sabah	Headache and high fever	-	-	-	-	Ahmad and Raji 1992
S. convoluta	-	Brazil	Uterus illness	-	-	-	-	-
S. ciliaris	Semerak-merak	Malaysia, Selangor	Itchy on skin	-	Fresh for lotion	-	-	Hanum and Hamza 1999
S. delicatula	-	India	Gastric illness	-	-	-	-	Dixit and Bhatt 1974; Mathew et al.

								1999
		Laos	sedative	-	-	-	-	ARCBC 2004
S. doederleinii	-	Cina	anti-cancer	-	-	-	-	Lee et al. 1992; Lin et al. 1994
		Korea	anti-cancer	-	-	-	-	Lee et al. 1992; Lin et al. 1994
	-	South East Asia	-	-	-	-	Food supplements	ARCBC 2004
S. epirrhizos	-	Guyana	Headaches treatment	-	-	-	-	DeFilipps et al. 2004
S. firmuloides	-	Vanuatu	Childbirth	-	-	-	-	Bourdy and Walter 1992
S. imbricata	-	Zambia	Not specific	-	-	-	-	Cunningham 1993
		Zimbabwe	Not specific	-	-	-	-	Cunningham 1993
S. involvens	-	India	Life extending	-	-	-	-	Dixit and Bhatt 1974; Sequiera 1998, Khare 2007
S. magnifica, Selaginella spp.	-	Indonesia, BBBR NP	Headache and fever, as well as for skin care	-	-	-	-	Caniago and Siebert 1998
S. myosurus	-	-	Asthma, fever and fatigue	-	-	-	-	Bouquet et al. 1971
	-	Gabon	-	-	-	-	Cultural rituals	Sassen and Wan 2006
S. ornata	Rane	Indonesia	-	-	-	-	Ornamental plants	Sastrapradja and Afriastini 1985
S. parkeri	-	Guyana	treat headaches	-	-	-	-	DeFilipps et al. 2004
	-	Guyana	-	-	-	Burned and lubricate the heel of baby	-	van Andel 2000
S. plana	-	Indonesia	Not specified	-	-	-	Dish of raw vegetables	Heyne 1927
	-	Indonesia, TNKM	bleeding	-	-	-	-	Uluk et al. 2001
	-	Indonesia, TNGHS	postpartum	-	-	-	-	Harada et al. 2002
	-	Malaysia, Sabah	headache and high fever	-	-	-	-	Ahmad and Raji 1992
S. rupestris	-	India	tonic, puerperal tonic, sedative	-	-	-	Ornamental plants	Khare 2007
S. tamariscina	Juan bai	Cina	Anti cancer, wounds, bleeding, hemorrhoids					PAM 2008; Lee et al. 1992; Lin et al. 1994
	Keoun back	South Korea	Anti-cancer, menstrual pain, bruises, and asthma	-	-	-	-	Lee et al. 1992; Lin et al. 1994
	-	Far East Rusia	delay the aging process					Mamedov 2005
	Pakong tulog	Filippina	Wounds, bleeding, hemorrhoids	-	-	-	Vegetables	PAM 2008
S. tamariscina var. *pulvinata*	-	-	tonic to prolong life, prevent amenorrhoea, hemorrhoid	-	Boiled	-	-	Khare 2007
S. uncinata	-	South China	Anti-bacterial, hepatitis, tumors	-	-	-	-	Ma et al. 2002
S. wightii	-	India	urinary tract infections	-	-	-	-	Dixit and Bhatt 1974; Mathew et al. 1999
S. wallichii	-	-	Post-delivery	-	Boiled	-	-	Khare 2007
S. willdenovii	-	-	High fever, ashes to rub back pain	-	Infusion, and burned	-	-	Khare 2007
	Paku merak	Malaysia, Selangor	Cleaning sputum/cough	-	Boiled, for taking bath	-	-	Hanum and Hamza 1999
Selaginella spp.	-	Indonesia, TNGHS	Treating wounds	-	-	-	-	Nasution 1993
Selaginella spp.	Rane	Indonesia, TNGHS	Post-childbirth and menstruation	-	-	-	-	Setyawan and Darusman 2008
Selaginella spp.	Cakar ayam	Indonesia	Cancer, respiratory infection, injury, heart disorders, urinary infections, broken bones and rheumatism	Single/herb	Fresh, dry, raw/cooked	-	-	Dalimartha 1999; Wijayakusuma 2004
Selaginella spp.	-	Malaysia	Endurance	-	-	-	-	Batugal et al. 2004

Note: *) In other locations not found utilization. **) The plant used as samples are all, especially the leaves. TNKM: Kayan Mentarang National Park, TNGHS: Gunung Halimun-Salak National Park. BBBR NP: Bukit Baka - Bukit Raya National Park.

Traditional use of *Selaginella*

Field research

In the Indonesian language, especially new libraries generally name *Selaginella* as *cakar ayam*, referring to the leaf shape that resembles the scales on either side of the stem, like scales on a chicken leg (Dalimartha 1999); or *rane* uptake of Sundanese (Sastrapradja and Afriastini 1985). *Selaginella* has many local names, such as: *rumput Solo, cemara kipas gunung, cakar ayam* (Java), *paku rane* (Sunda), *menter* (Betawi), *tai lantuan* (Madura), *usia* (Ambon), *sikili batu, lingonai* (Minangkabau) (Heyne 1927), and *shi shang bai* or *juan bai* (Chinese) (Bensky et al. 2004). But the field research shows local names are now beginning not to be recognized by society, even most of the respondents did mention the local names of *Selaginella* shown to them, except in West Java where the Sundanese people uniformly used the word *rane* to name a few species of *Selaginella*, particularly *S. plana*. On the Dieng plateau and surrounding the word *pulalata* was used to name *S. opaca*. In the vicinity of Mount Arjuno, Probolinggo where there was pretty much of the Madurese population, the word *tai lantuan* was still used to name a few species of *Selaginella* such as *S. plana, S. involvens,* and *S. remotifolia.*

In this study, most people did not know the local names or the benefits of *Selaginella*, either as raw drugs, food, ornamental plants or other benefits. Most of them were also unable to show the difference between one species of *Selaginella* from other species. However, many of whom were familiar with this plant, proved by the ability to indicate where the habitats of *Selaginella* grew when shown with the examples of the specimens. Generally they identified the habitat of *Selaginella* as cliffs near springs or small water channel that was humid, wet and somewhat open.

The field research shows the use of *Selaginella* in Indonesian Archipelago is relatively limited, although there is a relatively large number of the species. Type of utilization is generally in the form of utilization as a medicinal plant, besides it was also noted the utilization as raw vegetables or *lalapan* and food wrappers from the field. Types of diseases and health problems that can be healed with this plants among others are injury, menstrual disorders and pregnancy, postpartum (puerperal), and to improve physical fitness. In the field research, the use of *Selaginella* as ingredients was only found in Java, while it was not found in nine other locations (islands) outside Java.

On the island of Java, the traditional use of *Selaginella* is generally limited in West Java (and Banten). This may be related to the abundance and higher diversity than in other parts of this island. This is supported by the habitat conditions which are more humid with higher rainfall, and the level of a relatively higher slope as well, thus supporting the life of *Selaginella*. In East Java, the utilization of *Selaginella* was not found in the tribe of Javanese, Madurenese, as well as the Tengger.

In Central Java, precisely in the Dieng plateau, *Selaginella opaca* locally known as *'pulalata'* is used to cure wounds, menstrual disorders and to increase stamina. The name is specifically imposed only on *S. opaca*, whereas other species of *Selaginella* that grow on one plant site are not named *pulalata*, such as *S. remotifolia* and *S. ciliaris*. As a drug for injury, *pulalata* freshly cleaned is to be chewed, and then placed on the wound as a poultice. Up to now the utilization is relatively limited and only used on small wounds, it is still used in case of accidents in the field, as first aid until a doctor or a drug is found in the nearest *warung*. *Pulalata* is also used as medicine for menstrual disorders and for increasing endurance, by boiling and eating them as vegetables. One respondent in the subdistrict Kaliwiro, Wonosobo stated that *S. plana* and *S. ornata* shown to him was useful to strengthen the heart, although he did not know the local names of the plants, and did not know the procedure of how to use it. One respondent in Wonosobo informed that a hospital in Yogyakarta once prescribed herbal remedies, *'jamu godog'*, in which one form of simples was *S. plana*, to treat stroke. In Banjarnegara, *S. plana* was used to strengthen the immunity of patients against malaria. On the slopes of Mount Lawu, the respondents knew that *S. opaca* is needed by a company for herbal medicine ingredients, but they themselves did not know the benefit and did not use them traditionally.

In West Java, the respondents generally knew the traditional benefits of *rane* to treat wounds, menstrual disorders, and to improve fitness. In West Java, particularly in the lowlands of Bogor, sub-district such as West Bogor, Darmaga, and Ciampea, *S. plana*. known as *rane* was used as drugs for injury, menstrual disorders and vaginal discharge, and post-labor tonic. As a drug for wounds, fresh herbs that have been chewed is put on the wound, while for other treatment purposes it is used by cooking or eating it straight as a vegetable. Meanwhile in the highlands of Bogor, for example in the sub-district of Pamijahan, or at sub-district Kalapanunggal, Sukabumi, the term *rane* is also used for some other species such as *S. wildenowii, S. involvens,* and *S. remotifolia* also used for the purpose of treatment as above, besides the ash produced from burning dried herbs are used as a liniment to relieve stiffness and warm your back.

Literature review

Selaginella has been prescribed in traditional medicine of China and India, which has been thousands of years old. The utilization of these medicinal plants was also done by various other cultures, although generally limited to specific species. *Selaginella* can be found in the pharmacopoeia in Asia, Africa and Latin America, but not found in Europe and North America (Duke et al. 2002). The high diversity of species of *Selaginella* in the first three locations is likely to be the cause of this difference in the rates of utilization. The intensity of the highest utilization was carried out in China, especially for *S. tamariscina* (include var. *pulvinata* Spring), *Selaginella doederleinii* Hieron*, Selaginella moellendorffii* Hieron*, S. uncinata,* and *Selaginella involvens* (Sw.) Spring (Chang et al. 2000; Lin et al., 1991; Wang and Wang 2001). In India, there were several species of *Selaginella* used as ingredients, such as *Selaginella involvens* Spring*, Selaginella rupestris* Spring*, S. tamariscina* var. *pulvinata,*

S. wallichii Spring*, S. willdenovii* Baker and others (Dixit and Bhatt 1974; Mathew et al. 1999; Khare 2007).

Selaginella traditionally used to treat several diseases such as: injury, treatment of post-childbirth, cancer, skin diseases, headaches, fever, respiratory infections, urinary tract infections, menstrual disorders, liver disorders, fractures and arthritis. The parts used are all parts of the plants, although sometimes they are called only a leaf (herb) (Setyawan and Darusman 2008). Its use can be done singularly or in combination, fresh or dried, eaten immediately or cooked before (Dalimartha 1999; Wijayakusuma 2004). These plants are sweet and have warm effect (Bensky et al. 2004).

Nusantara (Malesia). In Nusantara (Malesia), the utilization is still relatively limited. The Javanese traditional herbal medicine, as a traditional medicine's most advanced systems in the region, tends to use tubers (*empon-empon*) and spices, while the use of herbs and wild grasses is more limited. In Indonesia, the Dayaks in the vicinity of Kayan Mentarang NP, East Kalimantan using *S. plana* to treat bleeding (Uluk et al. 2001), whereas in the surrounding of Bukit Baka-Bukit Raya NP, West Kalimantan, *Selaginella magnifica* Warb and several other species of *Selaginella* are used to treat headaches and fever, as well as for skin care (Caniago and Siebert 1998). Sundanese people in the surrounding of Mount Halimun-Salak NP, West Java, use some species of *Selaginella* to treat wounds, post-childbirth, menstrual disorders, and as a tonic (Nasution 1993; Harada et al. 2002; Setyawan and Darusman 2008). In Sumatra and Java, some species of *Selaginella* are used to counter poison, drug fever, washing blood, menstrual blood purifier, eczema and for drug childbed (Warintek. 2002). In Kedah, Malaysia, *Selaginella* is used to increase body resistance (Abu-Shamah et al. 2000). In Sabah, Malaysia, *Selaginella argentea* (Wall. ex Hook. & Grev.) Spring and *S. plana* are used to treat headaches and high fever (Ahmad and Raji 1992). In Papua New Guinea, *Selaginella flabellate* Spring is used to treat headaches and fever (Kambuou 1996). In the Philippines, *S. tamariscina* (pakung tulog) is used to treat wounds, bleeding from peptic ulcers or excessive menstruation, and hemorrhoids (PAM 2008). In the mainlands of Southeast Asia, *S. doederleinii* is used as drugs for various diseases and as dietary supplements, while in Laos *Selaginella delicatula* (Desv. ex Poir.) Alston is used to relieve tension (ARCBC 2004). In Indonesia, many species of *Selaginella* is offered in the form of dry powder, both local as *S. plana* and imports from China, in particular as *S. tamariscina* and *S. doederleinii*.

China. In China and the neighboring countries, the most widely used species is *S. tamariscina*. The area mentioned is the center of distribution of this species, with quite thorough distribution, both wild and cultivated plants. The checking of Herbarium Bogoriense (BO) collection indicates that in Malesia, *S. tamariscina* only grows wild on the island of Flores and is not found on other islands, which raises an assumption that this plant is an introduced plant that has become naturalized (Setyawan 2008). In China, the dry powder of *S. tamarascina* that has been cooked is used for blood clotting. Decoction of the dry powder used for amenorrhea orally either alone or mixed with some other herbs. For bleeding, in the hemorrhoid and in the uterine bleeding, the dry powder is mixed with some other plants then boiled for drinking. For single use of rectocele (NAS 1975). *S. uncinata* which usually grow in southern China is used to fight diseases caused by bacteria, hepatitis infections and tumors (Ma et al. 2002).

India. In India, *Selaginella involvens* Spring is used as a tonic to prolong life. The decoction of *S. rupestris* is used as a tonic after childbirth and as sedatives. It is also used as an ornamental plant. *S. tamariscina* var. *pulvinata* is used as a tonic to prolong life whose benefit has been wisely recoqnized. The decoction is used to prevent amenorrhea, bleeding from hemorrhoid or rectal elongation. *S. wallichii* Spring is used for post-birth treatment. Infusion of *S. willdenovii* Baker is used to treat high fever, while its ashes are used for back pain liniment (Khare 2007). *S. involvens* is used to prolong life span and prevent degeneration diseases caused by old ages (Dixit and Bhatt 1974; Sequiera 1998). *Selaginella delicatula* (Desv. ex Poir.) Alston is used to treat stomach deseases, while *Selaginella wightii* Hieron is used to treat urinary tract infections (Dixit and Bhatt 1974; Mathew et al. 1999).

Oceania and Asia. In Vanuatu, *Selaginella firmuloides* Warb is used to assist delivery (Bourdy and Walter 1992). In the eastern part of Russia *S. tamariscina* is used to slow down the aging process (Mamedov 2005). In China and South Korea *S. doederleinii* is used as anticancer drugs (Lee et al. 1992; Lin et al. 1994).

Africa. In some African countries, like Zambia and Zimbabwe, *Selaginella imbricata* (Forsk.) Spring ex Decaisne is traded as medicinal ingredients that has lead to threatening its sustainability in nature (vulnerable, VU) (Cunningham 1993; Golding 2002).

Latin America. In Brazil, *Selaginella convoluta* (Arn.) Spring is used to prevent and treat diseases related to female reproductive system (de Almeida-Agra and Dantas 2004). In Guyana, the ashes of *Selaginella parkeri* (Hook. & Grev.) Spring (= *Selaginella pedata* Klotzsch) is used by putting it hard onto the heel of your baby gently that can help the baby start walking (van Andel 2000). *Selaginella parkeri* and *S. epirrhizos* Spring are also used to treat headaches (DeFilipps et al. 2004). In Mexico, *S. lepidophyla* is traditionally used for medicinal diuretics, as the solver of the kidney stones and as a medicine for cystisis (Martinez 1961).

Other uses

Foodstuffs. In Nusantara (Malesia), the utilization of *Selaginella* as food ingredients is very limited. In the field research, the use of *Selaginella* as food (vegetables) is found only in West Java, ranging from lowlands of Bogor to the area around the mountains of Halimun-Salak. In Bogor that species that is consumed in general is only *S. plana*, whereas in the plateau region, *S. wildenowii* is also consumed by people. Heyne (1927) notes that in West Java, young buds of *S. plana* can be eaten as vegetables and for medicinal purposes. PAM (2008) notes that in the Philippines, young leaves of *S. tamariscina* can be cooked as vegetable.

Ornamental plants. The utilization of *Selaginella* as an ornamental plant is found in West Java. For example, some sellers of ornamental plants in Bogor, including the Mekarsari Park at Cileungsi once sold *Selaginella* spp. which allegedly was an introduced species as for ornamental plants, whereas in the Sringanis Garden and Medicinal Plant Garden of Karyasari *S. plana* and *S. wildenowii* were once sold as medicinal plants. According Sastrapradja and Afriastini. 1985, *S. ornatha* is planted in Bogor as an ornamental plant, although the stem is easily broken, so it must be treated with caution. The field research shows that in the village Kejiwan, Wonosobo district, Wonosobo regency *S. ciliaris* was left to grow wild or they were planted in cemeteries to cover the surface of the soil to avoid scouring of rain urging the growth of other weeds, and also to beautify the cemetery. In Bogor Botanical Garden, *S. rothertii* is used as the land cover on the part of the collection of *Selaginella* species. In Wonosobo, *Selaginella singalanensis* Hieron was found as a new record with huge potential for land cover crops, because it can be grown in the surface of the soil quickly to cover the land, and can appear in blue metallic color on shaded conditions, such as *S. wildenowii*.

According to the writer's observation (ADS 2008), about 10-15 species *Selaginella* potential as an ornamental plant, and comes from Java, Sumatra, Papua, Lombok and Bali, and can grow well in the experiment field in Java located in the highlands (Wonosobo, 700-800 m asl) and in the lowlands (Bogor, 200-250 m above sea level), but some species can grow well only in the highlands, such as *S. opaca* and *S. remotifolia*. Some remaining species only grow well in lowlands, such as *S. rothertii* whose seedlings are obtained from the Bogor Botanical Gardens and Bogor Agricultural University at Darmaga Campus. *S. rothertii* is an endemic plant of West Java, which is generally easily found in lowland that is moist and open, but there are also variants found in the plateau. Observations of *Selaginella* collections of Herbarium Bogoriense indicate that this species ever found wild in Cibodas Botanical Gardens and the Puncak area in general. One species, ie. *S. wildenowii* is endemic in the middle and highland of western Java grown, from Banten to Mount Slamet, it grows well in Wonosobo, Central Java. This plant has a bluish appearance that very attractive for ornamental plants. *Selaginella* is very attractive as an ornamental plant leaves, given his appearance can be quite diverse. In one species, sometimes there are various shapes and shades of leaves, for example *S. ornata*, so that in the past this species was divided into several species. Khare (2007) states that in India, *S. rupestris* is used as an ornamental plant.

Crafts materials. According to de Winter and Jansen (2003) reported several species of *Selaginella* can be used as craft material. But in this field of research such a thing is not found and no support from also other libraries. One reason possibly because the habit of *Selaginella* tend to be brittle and easily broken. Some species are thought to have high chemical levels even curl when dried, such as *S. involvens*.

Socio-cultural (traditional). In Gabon, *Selaginella myosurus* (Sw.) Alston is used for rituals or for other cultural aspects (Sassen and Wan 2006). There are no records for the utilization of *Selaginella* for the purpose of customs in the archipelago. Field observations in several batik shops and museums in Solo, and visits to the library palace of Solo kingdoms did not find any real pattern designs inspired from *Selaginella*, although there are some designs that are inspired from other ferns.

Other utilization. Other utilization ie, as food wrappers is found in Ambon, Maluku and Manokwari, Papua. In these locations there are several species of leafy *Selaginella* that is wide enough to be used to wrap the sago, fruits, or other crops from the forest or fields.

CONCLUSION

Selaginella has been used traditionally to treat wounds and bleeding such as menstruation, uterine disorders and other internal injuries. It is also used as a tonic to improve fitness and to prolong life span. In addition, several species of *Selaginella* are also used as food (raw vegetables), ornamental plants, and handicrafts materials. The utilization of *Selaginella* is very limited compared to the number of species and the potential benefits of the medicine, so it requires further ethnobotany and phytochemistry study.

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