

亜熱帯沖縄における天然林の資源植物学的研究(7)

主要島嶼の植物の分布について

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Resources plant studies on the natural forest in subtropical Okinawa

VII. About plant distribution on the main islands of the Ryukyus

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Abstract: Within the frame work of a series of plant resource studies on the natural forests in the subtropical Okinawa, the present study was undertaken to clarify the distribution of forest plant for both indigenous and exotic species on the Ryukyu Islands, especially for the 4 main Islands, i.e. Okinawa, Miyako, Ishigaki and Iriomote Islands in the Ryukyus based on the database of the five reference books. The considerable difference was found for the total number of species among the references. The plants distributed in the entire Ryukyu Islands were 238 families, 1,688 genera and 5,473 species based on Flora of the Ryukyus, Southern of Amami Island (FRSAI), which had the highest number of species, while Flora of Okinawa and Southern Ryukyu Island (FOSRI, 1976) recorded 239 families, 1,061 genera and 2,560 species. According to Check List Vascular Flora of the Ryukyu Islands (CLVFR), 200 families, 949 genera and 2,275 species were present. Flora of the Ryukyus (FR) recorded the least species with a total of 182 families, 863 genera and 2,142 species. The methods of the handling of plant distribution to the exotic species may be responsible for the obvious differences in the main factor on the total number of species among these references. For the composition of the indigenous species, in Okinawa Island, 1,451 (FR), 1,445 (FRSAI) and 1,404 (CLVFR) species were recorded; 1,099(FR), 1,132 (FRSAI) and 1,119(CL VFR) species in Ishigaki Island; 1,151(FR), 1,139 (FRSAI) and 1,142(CL VFR) species in Iriomote Island. No obvious differences were found among the 3 references. Moreover, for the abovementioned indigenous species, the order of species number were Okinawa > Iriomote > Ishigaki > Miyako. As for the least value of indigenous species in Miyako Island, it is thought that the greater part of the Island is covered with the limestone of the upheaval coral reef, and the mountainous forest plant is less than other Islands because of its smooth landform on the Island. Each reference recorded a lot of endemic plants in the Okinawa Island, with 16 species recorded in VJOO, 15 species in FR, and 33 species in CLVFR, while Iriomote Island had the second highest value for endemic plants with 13 species recorded in VJOO, 10 species in FR and 9 species in CLVFR. In Miyako or Ishigaki Islands, few endemic plants were present with a range of 1-3 only.

Keywords: subtropical natural forest, Ryukyu Islands, indigenous species, exotic species, endemic species.

Introduction

In recent years, the forests in the subtropical and tropical regions, which being regarded as the treasury of genetic resources, have been decreasing and

deteriorating due to land uses and excessive over-cutting (Ellenberg, 1979; An et al., 1999). The area of the world's forests decreased by 94 million ha, which is equivalent to 2.5 times Japan's land area, in the 10 years up to 2000 (FAO, 2001). The decrease of the

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forests in the subtropical and tropical has caused the great concerns of loss of biological species (Ehrlich et al., 1991; Roberts et al., 1995). In response to the acceleration in species-loss at global scale, the resources plant approaches have shifted their focus to the wild plants and trees, which are not used nowadays, but may become promising in the future for their genetic characteristics. It has become a pressing research project to investigate these plants or trees systematically with respects of their distribution, conservation, proliferation and utilization in both tropical and subtropical regions.

Okinawa, the unique subtropical prefecture in Japan, consists of over 60 Islands in southern Japan, where forest managements were mainly concentrated on forest plants. It is very important to keep resources under control there for the environmental conservation, utilization of resources plants, forest management and so on. However, in Okinawa, the study on resources plant was not well conducted although several approaches have been made by Aramoto Research Group on the plant distribution and collection and preservation of subtropical economically important plants (Aramoto et al., 1989, 1998, 1999, 2001). However, those reports are insufficient for understanding the plant distribution on the Ryukyu Islands, especially the comparison of the plant distribution among the main Islands for indigenous species and endemic species. It is an urgent project to investigate the distribution of resource plants and in control of reality of the use of such resource plants for not only mountain village promotion but also cooperation study amongst Southeast Asia countries.

In the present study, on the basis of abovementioned situations, the plant distribution on the main Islands of the Ryukyus was conducted as a part of the study of resources botany in subtropical Okinawa on natural forest. The following is clarified: 1). the total number of plant and number of indigenous species on the Ryukyu Islands; 2). the total number of plant and number of indigenous species on the 4 main Islands; 3). the endemic species on the 4 main Islands and comparison of these endemic species among the Islands. To clarify the abovementioned tasks, the database were constructed based on the 5 reference books for the all species present on the Ryukyu Islands. This study may provide useful information for collection, conservation, proliferation and development of the resources plants as a basic study in subtropical Okinawa. We also hope this study serve as an available guidance for both conservation and utilization of the resources plants in Okinawa.

Methods

There were many vegetation books about plant distribution on the Ryukyu Islands, however, this paper deals with the composition and distribution of family, genus and species on the 4 main Islands, i.e. Okinawa Island, Miyako Island, Ishigaki Island and Iriomote Island, in subtropical Okinawa, according to the below references. The basic data were from four reference books, namely, Flora of the Ryukyus Including Amami Islands, Okinawa Islands (FR, 1975); Flora of the Ryukyus, Southern of Amami Island (FRSAI, 1994); Check list vascular flora of the Ryukyu Islands (CLVFR, 1997) and Floral of Okinawa and Southern Ryukyu Islands (FOSRI, 1976). In addition, the endemic species were clarified also by Vegetation of Japan, Okinawa and Ogasawara (VJOO, 1989). The databases were constructed based on FRSAI with Microsoft Excel, as well as the other 4 references.

Results and discussion

1. The general distribution of plants on the Ryukyu Islands.

The general composition of plant distribution on the Ryukyu Islands was clarified based on the database of 4 references (Table 1). FRSAI recorded the highest species numbers with a total of 238 families, 1,688 genera and 5,473 species, whereas it has been understood that the classification of indigenous species and exotic species is not done in FOSRI, which recorded the second highest species numbers with 239 families, 1,061 genera and 2,560 species. In addition, CLVFR recorded a total of 200 families, 949 genera and 2,275 species, while in FR 182 families, 863 genera, and 2,142 species were recorded, which had the least value in species. The considerable difference was found for the total number of species among the references. The methods of the handling of the distribution to the exotic species may be responsible for the difference in the main factor.

Table 1. Number of the family, genus and species by the references on the Ryukyu Islands.

Reference	Indigenous species			Exotic species			Total		
	Family	Genus	Species	Family	Genus	Species	Family	Genus	Species
FOSRI	—	—	—	—	—	—	239	1,061	2,560
FR	178	794	1,912	43	139	230	182	863	2,142
FRSAI	180	754	1,933	184	1,175	3,540	238	1,688	5,473
CLVFR	193	797	1,849	60	239	426	200	949	2,275

FOSRI : Flora of Okinawa and the Southern Ryukyu Island; FR : Flora of the Ryukyus; CLVFR : Check List Vascular Flora of the Ryukyu Islands; FRSAI : Flora of the Ryukyus, Southern of Amami Island.

The composition of indigenous species and the exotic species is clarified by the three references of CLVFR, FR and FRSAI. For the indigenous species, the families existed in the range of 178-193, the genus existed between 754-797, and species in 1,849-1,933, showed a similar composition from the 3 references. For the exotic species, 43-184 families, 139-1,175 genera, 230-3,540 species were recorded, showing enormous differences among the three references. Especially, as many as 3,540 exotic species described in FRSAI, and this can be said that the plants for appreciation, fruit, food, and the medicinal use, etc. had been considerably introduced from foreign countries.

2. The distribution of the indigenous species on the main Islands.

The composition of indigenous species on the 4 main Islands was showed by the references of FR, FRSAI and CLVFR (Fig. 1). In Okinawa Island, a range of 169-184 families, 651-681 genera, and 1,404-1,451 species were recorded (Table 1). In Miyako Island, 131-141 families, 414-424 genera, and 633-656 species were recorded. For Ishigaki Island, 167-182 families, 598-612 genera and 1,099-1,132 species were present. As for Iriomote Island 167-182 families, 599-642 genera and 1,139-1,151 species recorded. No obvious differences were found among these references for family, genus and species.

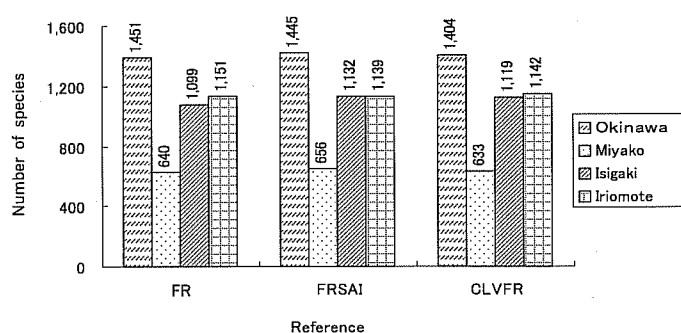


Fig. 1. Number of the indigenous species on the 4 main islands by the references.

For indigenous species among the 4 main Islands on the Ryukyu Islands, it was the order of Okinawa > Iriomote > Ishigaki > Miyako, not only for family, but also for genus and species. Especially, Miyako Island had the least values among the 4 Islands; it is thought that the greater part of the Island is covered with the limestone of the upheaval coral reef, and the mountainous forest plant is less than other Islands because of its smooth landform in the Island.

3. The distribution of the endemic species on the main Islands.

Fig. 2 showed the endemic species on the 4 main Islands in the Ryukyus. Okinawa Island had the highest endemic species among the four main inlands, i.e. 16 species in VJOO, 15 species in FR, 33 species in CLVFR, following by Iriomote Island, which had the 13 species in VJOO, 10 species in FR, 9 species in CLVFR. Miyako Island and Ishigaki Island had the values in the range of 1-3 only in each reference.

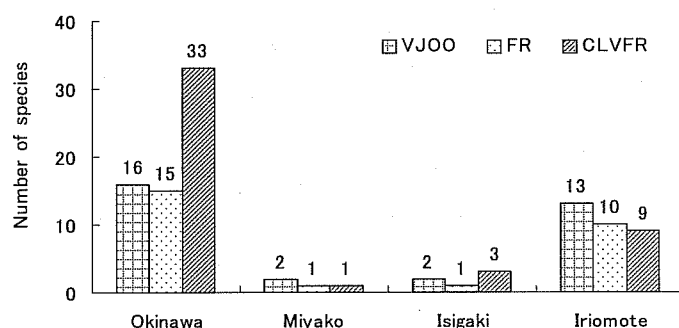


Fig. 2. Number of the endemic species on 4 main islands in the Ryukyus by the references.

As for the common endemic species among the references of VJOO, FR and CLVFR (Table 2), 7 species, i.e. *Deutzia amanoi*, *Callicarpa oshimensis* var. *okinawensis*, *Rhamnus calcicola*, *Bredia okinawensis* *Eupatorium* × *tawadae*, *Hydrangea liukiuensis* and *Carex maculata* var. *tetsuoi* were present in Okinawa. One common endemic species was present in Miyako, i.e. *Celtis biondii* var. *insularis* and one species, *Asarum dissitum* present in Ishigaki Island. Three common endemic species were present in Iriomote Island, i.e. *Chikusichloa brachyanthera*, *Alpinia flabellata* and *Asarum yaeyamense*.

It should be pointed that there are still a lot works need to do to clarify the plant distribution on the Ryukyu Islands. In the present study, there is an obvious difference in the number of endemic species on Okinawa Island according to the references. To confirm them the further study is needed.

Table 2. List of endemic species on the 4 main islands of the Ryukyus by the references.

Island	species	VJOO	FR※	CLVFR
Okinawa	<i>Anoetochilus tashiroi</i> (Oogimiran)	○	○	
	<i>Rubus utchinensis</i> (Okinawaurajiroichigo)		○	
	<i>Deutzia amanoi</i> (Okinawahimeutugi)	◎	◎	◎
	<i>Illicium anisatum</i> (Okinawasikimi)	◎		
	<i>Carex sacrosancta</i> var. <i>tamakii</i> (Okinawahimenamorisuge)	○		○
	<i>Callicarpa oshimensis</i> var. <i>okinawensis</i> (Okinawayabumurasaki)	◎	◎	◎
	<i>Calanthe discolor</i> var. <i>kanashiroi</i> (Katuudakeebine)	◎		◎
	<i>Rhamnus calcicola</i> (Kunigamikuroumemodoki)	◎	◎	◎
	<i>Elatostema suzukii</i> (Kunigamisanshozuru)	○		○
	<i>Eurya zigzag</i> (Kunigamihisakaki)		○	○
	<i>Bredia okinawensis</i> (Kobanomiyamabotan)	◎	◎	◎
	<i>Eupatorium</i> × <i>tawadae</i> (Sawasimahujibakama)	◎	◎	◎
	<i>Platanthera sonoharae</i> (Sonoharatonbo)		○	
	<i>Colysis</i> × <i>megalolepis</i> (Sinnyarinoharan)	○		
	<i>Polystichum hancockii</i> (Hagoromojumonsida)	○		
	<i>Asarum okinawense</i> (Hinakanaoi)		○	○
	<i>Rhamnus kanagusukii</i> (Himekuroumemodoki)		○	○
	<i>Rubus utchinensis</i> (Hozakiichigo)	○		○
	<i>Cheirostylis takeoi</i> (Yosihisaran)	○		
	<i>Hydrangea liukiuensis</i> (Ryukyukonterigi)	◎	◎	◎
	<i>Carex maculata</i> var. <i>tetsuoi</i> (Ryukyutatisuge)	◎	◎	◎
	<i>Adinandra ryukyuensis</i> (Ryukyunagaesakaki)		○	○
	<i>Carex collifera</i> (Ryukyu-hiesuge)		○	
	<i>Dendrobium okinawense</i> (Okinawasekkoku)			○
	<i>Eleocharis Wichrae</i> var. <i>liukiuensis</i> (Ryukyu-hairi)			○
	<i>Liriope Tawadae</i> (Oniyaburan)			○
	<i>Eleocharis</i> × <i>subangulata</i> (Okinawahairi)			○
	<i>Arisaema heterocephalum</i> ssp. <i>okinawense</i> (Okinawatennnansho)			○
	<i>Viola okinawensis</i> (Simajirisumire)			○
	<i>Viola stoloniflora</i> (Orizurusumire)			○
	<i>Viola utchinensis</i> (Okinawasumire (Haisumire))			○
	<i>Symplocos anomala</i> (Ryukyu-hainoki)			○
	<i>Osmanthus okinawensis</i> (Yanagibamokusei)			○
	<i>Rhynchoetechum discolor</i> f. <i>incisum</i> (Kirehayamabiwaso)			○
	<i>Damnacanthus okinawensis</i> (Yanbaru-aridousi)			○
	<i>Poa acroleuca</i> var. <i>ryukyuensis</i> (Okinawamizoichigotunagi)			○
	<i>Saccharum</i> × <i>kanashiroi</i> (Murasakiobana)			○
	<i>Arachniodes okinawensis</i> (Okinawakanawarabi)			○
	<i>Polygonum hydropiper</i> var. <i>filiforme</i> (Nagaboyanagitade)			○
	<i>Juncus effusus</i> f. <i>filiformis</i> (Okinawai)			○
	<i>Saonia shinzatai</i> (Hosizakishakujo)			○
	41 species	16species	15species	33species
Miyako	<i>Celtis biondii</i> var. <i>insularis</i> (Sakisimaenoki)	◎	◎	◎
	<i>Triumfetta procumbens</i> var. <i>repens</i> (Kenasihaterumakazura)	○		
	2 species	2 species	1 species	1 species
Isigaki	<i>Asarum dissitum</i> (Omorokanaoi)	◎	◎	◎
	<i>Prosaptia kanashiroi</i> (Simamukadesida)	○		○
	<i>Fimbristylis leptoclada</i> var. <i>takamineana</i> (Chairotentuki)			○
	3 species	2 species	1 species	3 species
Iriomote	<i>Conandron ramondiioides</i> (Iriomoteiwatabako)	○		
	<i>Chikusichloa brachyanthera</i> (Iriomotegaya)	◎	◎	◎
	<i>Stereosandra javanica</i> (Iriomotemuyoran)	◎		
	<i>Asarum gelasinum</i> (Ekubokanaoi)	○	○	
	<i>Isachne lutchuensis</i> (Kenasihachigozasa)		○	
	<i>Cephalomanes atrovirens</i> (Sakisimahoragoke)		○	
	<i>Ctenitis eatoni</i> var. <i>iriomotensis</i> (Komidakesida)	○		○
	<i>Lecanorchis flavicans</i> (Sajigatasukerokuran)	○		
	<i>Aster taiwanensis</i> var. <i>lucens</i> (Terihanogiku)	○	○	
	<i>Alpinia flabellata</i> (Hadakagetto)	◎	◎	◎
	<i>Gastrodia nipponica</i> (Huyuzakiyatusiroran)	◎		
	<i>Asarum yaeyamense</i> (Yaeyamakanaoi)	◎	◎	◎
	<i>Viola tashiroi</i> (Yaeyamasumire)	○	○	
	<i>Deutzia yaeyamensis</i> (Yaeyamahimeutugi)	○	○	
	<i>Plagiogyria koidzumii</i> (Ryukyukijinoo)	○	○	
	<i>Symplocos liukiuensis</i> var. <i>iriomotensis</i> (Iriomotehainoki)			○
	<i>Gastrodia shimizuana</i> (Nangokuyatusiroran)			○
	<i>Osmanthus heterophyllus</i> var. <i>iriomotensis</i> (Yaeyamahiiiragi)			○
	<i>Asarum gelasinum</i> (Ekuboksaisin)			○
	<i>Asarum monodoriiflorum</i> (Monodorakanaoi)			○
	20 species	13species	10species	9 species

○ : Recorded as endemic species in reference; ◎ : recorded as endemic species in all of the 3 references. ※ from the list in general list of endemic species in this reference.

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References

1. An, S., Zhu, X., Wang, Z., David, G.C., Li, G. and Chen, X. 1999. The plant species diversity in a tropical montane rain forest on Wuzhi Mountain, Hainan. *Acta Ecol. Sinica*. 19 (6): 803-809 (in Chinese with English abstract).
2. Aramoto, M., Asato, I., Shinzato, T. and Hirata, E. 1998. Plant resources studies on the natural forest in subtropical Okinawa (III) Economically important plants in the Iriomote Island. *Trans. Jap.For. Soc.*109:161-164 (in Japanese).
3. Aramoto, M., Ishigaki, C., Hirata, E., Shinzato, T. and Asato, I., 2001. Plant resources studies on the natural forest in subtropical Okinawa (VI) Distribution of the economically important plant in Miyako Island. *Sci. Bull. Fac. Agr. Univ. Ryukyus* 48: 195-203 (in Japanese with English abstract).
4. Aramoto, M., Shinzato, T., Nakazato, N. and Ishigaki, C. 1999. Plant resources studies on the natural forest in subtropical Okinawa (IV) *Pterocarpus indicus* Willd in the Hirakubo, Ishigaki Island. *Sci. Bull. Fac. Agr. Univ. Ryukyus* 46: 169-181(in Japanese with English abstract).
5. Aramoto, M., Shinzato, T., Yamamori, N. 1989. Studies on the collection and preservation of tropical and subtropical economically important plants (I) Classification by use of economically important plants in Iriomote Island. *Trans. Jap. For. Soc.*100: 125-126 (in Japanese).
6. Ehrlich, P.R., Wilson, E.O., 1991. Biodiversity studies science and policy. *Science* 253, 750-752.
7. Ellenberg, H., 1979. Man's influence on tropical mountain ecosystems in South America. *J. Ecol.* 67: 401-416.
8. FAO, *State of the World's Forests 2001*, Food and Agriculture Organization of the United Nations.
9. Hatusima, S., 1971. *Flora of the Ryukyus* (Including Amami Islands, Okinawa Islands, and Sakishima Archipelago). Okinawa Biological Research Club, Okinawa, Japan (in Japanese):1-940.
10. Hatusima, S and Amano, T., 1994. *Flora of the Ryukyus, Southern of Amami Island* (Second edition). The Biological Society of Okinawa, Japan (in Japanese):1-399.
11. Miyawaki, A. 1989. *Vegetation of Japan, Okinawa and Ogasawara*. Vol. 10. Shibundo Co., LTD Publishers Tokyo:1-676 (in Japanese).
12. Roberts, M.R., Gilliam, F.S., 1995. Patterns and mechanisms of plant diversity in forested ecosystems- implications for forest management. *Ecol. Appl.* 5, 969-977.
13. Shimabuku, K., 1997. *Check list vascular flora of the Ryukyu Islands* (Revised Edition). Publishing House of Kyushu University, Japan (in Japanese):1-855.
14. Walker, H. E., 1976. *Floral of Okinawa and Southern Ryukyu Islands*. Smithsonian institution press, Washington, D.C., USA:1-1,159.

亜熱帯沖縄における天然林の資源植物学的研究(VII) — 主要島嶼の植物の分布について —

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要 約

本研究は、亜熱帯沖縄における天然林の資源植物学的研究の一環として、亜熱帯・沖縄県の主要島嶼の沖縄島、宮古島、石垣島、西表島を対象に既応の著書・文献を用いて分布植物のデータベース化をはかるために森林植物を中心とした全ての在来植物の分布種及び外来種を明らかにするために行ったものである。

琉球列島全体の分布植物は、琉球植物目録 (FRSAI, 1994) で238科、1688属、5,473種で最も多く、Flora of Okinawa and Southern Ryukyu Island (FOSRI, 1976) で239科、1,061属、2,560種、琉球列島維管束植物集覧 (FRSAI, 1997)、200科、949属、2,275種、琉球植物誌 (FR, 1975) 182科、863属、2,142種の順であった。全体的に総分布種は文献間に差異があり、その主な要因は外来種の分布の取り扱いによるものと思料される。在来植物の種の構成は沖縄島FR 1,451、FRSAI 1,445、CLVFR 1,404、宮古島FR 640、FRSAI 656、CLVFR 633、石垣島FR 1,099、FRSAI 1,132、CLVFR 1,119、西表島FR1,151、FRSAI 1,139、CLVFR 1,142で各島嶼とも分布種に大きな差異はなかった。また、

島嶼別の在来種は沖縄島＞西表島＞石垣島＞宮古島の順であった。宮古島が最も少ないのは、同島の大部分が隆起サンゴ礁の石灰岩でおおわれ、平坦な島であるため、分布植物において山地性植物の森林植物が他島に比べて少ないものと思料される。島嶼別固有植物はいずれの文献も沖縄島に多くの固有植物が分布しVJOO 16種、FR 15種、CLVFR 33種であった。ついで西表島で多くVJOO 13種、FR 10種、CLVFR 9種、宮古島、石垣島では1～3種であった。