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Sponsors

Japanese Society for Plant Systematics

Japan Association of Botanical Gardens

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Program

Chaird by Masahiro KATO

10:00 ~ 10:30 Jin MURATA (Botanical Gardens, University of Tokyo) An attempt to organize a joint symposium with plant systematists and botanical gardens of East Asia – keynote address

Chaird by Minoru N. TAMURA

10:30 ~ 11:00 Sangtae KIM (Biological Resources Research Department, National Institute of Biological Resources) Diversity, phylogeny, and evolution of Magnoliaceae

brake 10 min

11:10 ~ 11:40 Hongya GU (College of Life Sciences, Peking University) Phylogenetic relationships of Chinese *Arabidopsis thaliana* inferred from chloroplast DNA sequences

11:40 ~ 12:10 Chie TSUTSUMI (Department of Botany, National Museum of Nature and Science) Systematic study on *Liparis* sect. *Liparis* in Korea and Japan

12:10 ~ 13:10 Lunch

13:10 ~ 14:10 Poster session

Chaird by Jin MURATA

14:10 ~ 14:40 Noriyuki FUJII (Department of Biological Science, Graduate School of Science and Technology, Kumamoto University) Chloroplast DNA phylogeography of *Pedicularis resupinata* (Scrophulariaceae) around the Japanese Islands

14:40 ~ 15:10 Yuichi KADOTA (Department of Botany, National Museum of Nature and Science) An aspect of the alpine flora of Hokkaido

15:10 ~ 15:40 Jae-Hong PAK (Department of Biology, College of Natural Sciences, Kyungpook National University) The current aspects and conservation of endemic species in Ullung Island, Korea

brake 15 min

Chaird by Akiko SOEJIMA

15:55 ~ 16:25 Hideki TAKAHASHI (University Museum, Hokkaido University) Conservation of *Cypripedium macranthos* var. *rebunense* in Rebun Island, Hokkaido, Japan

16:25 ~ 16:55 Ki-Ryong PARK (Department of Science Education, Kyung-Nam University) Genetic variation and conservation of *Euphorbia komaroviana* in Far East Russia (Euphorbiaceae)

16:55 ~ 17:25 Mattukkaran RAJAN (Bioconservation India) Genetics, ecology & climate change: challenges for plant conservation in the 21st century

S-01

An attempt to organize a joint symposium with plant systematists and botanical gardens of East Asia - keynote address

*Jin Murata[1,2,3]

[1] Botanical Gardens, University of Tokyo, Japan

[2] Chairman of the Organizing Committee

[3] President of the Japanese Society for Plant Systematics and Japanese Association of Botanical Gardens

Abstract:

Plant systematics with the aid of molecular information is rapidly developing while the massive extinction of plant species globally progressing. As many of the plant species including endangered ones are distributed widely across national borders, we need to collaborate across national borders to promote systematic studies and contribute biodiversity conservation. An endangered species *Kirengeshoma palmata* (Saxifragaceae), distributed in China, Japan and Korea is one of the good target for collaboration.

In the aspect of botanical research, volunteers from Korean, Japanese and Chinese researchers in the field of plant systematics met in Seoul, Korea, in August 2008 to seek possibility to organize an East Asian Association for Plant Systematics and to publish a scientific journal. After a serious discussion this proposal was rejected as being premature but we planed to have international joint symposium annually within the three countries in turn. In due course the first symposium is to be held in Japan in 2008.

In the aspect of botanical gardens, East Asia Botanic Gardens Network (EABGN) was initiated in 2007. The purpose of the EABGN is to encourage and enhance information exchange and cooperation to improve education, research and conservation work in botanic gardens, to assist in the interpretation and implementation of the 2010 targets of the Global Strategy for Plant Conservation (GSPC) drawn up to assist botanical gardens, and to assist efforts for East Asia plant conservation through training and staff exchange. The third meeting of the EABGN was held in July 2008 in Seoul but substantial scheme of collaboration has not been settled.

Under such circumstances the present symposium aimed to promote bilateral collaboration between plant systematists and botanical gardens across national border.

S-02

Diversity, phylogeny, and evolution of Magnoliaceae

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Abstract:

Magnoliaceae has attracted keen interest from many botanists because the family played a key role in forming concepts of the first flowers. Although recent molecular studies provided different views on basal-most angiosperm, Magnoliaceae still considered one of basal representatives among extant angiosperms. Our phylogenetic study based on carefully selected 48 representatives of Magnoliaceae and 10 chloroplast DNA regions (about 8.7kb in total) showed eleven major clades with strong support in the subfamily Magnolioideae: (1) MICHELIA (*Michelia*, *Elmerrillia*, sect. *Maingola*, sect. *Alcimandra*, and sect. *Aromadendron*), (2) YULANIA (subgenus *Yulani*), (3) GYNOPODIUM (*Pachylarnax*, sect. *Manglietiastrum*, and sect. *Gynopodium*), (4) KMERIA (*Kmeria*), (5) THEORHODON [sect. *Theorhodon sensu stricto* (excluding sect. *Splendentes*) and sect. *Magnolia*], (6) GWILLIMIA (sect. *Gwillimia*, sect. *Lirianthe*, and sect. *Blumiana*), (7) TALAUMA (sect. *Talauma* and sect. *Splendentes*), (8) MANGLIETIA (*Manglietia*), (9) RYTIDOSPERMUM [sect. *Rytidospermum sensu stricto* (excluding *Magnolia fraseri*, *M. macrophylla*, and *M. dealbata*) and sect. *Oyama*], (10) FRASERI (*M. fraseri*), and (11) MACROPHYLLA (*M. macrophylla* and *M. dealbata*). Our molecular evidence is different from recent classification systems of Magnoliaceae, such as Nooteboom (1985) and Figlar (2003), and this will be a strong evidence for new classification system of Magnoliaceae. We estimated divergence time of the radiation of subfamily Magnolioideae based on combined data of 10 chloroplast DNA regions and *ndhF* data with a sequence from Miocene fossil (*Magnolia latahensis*) using R8s. Both results well supported Oligocene radiation of subfamily Magnolioideae (24-35 MYBP). Diversity, biogeography, and evo-devo studies of Magnoliaceae are also discussed.

S-03

Phylogenetic relationships of Chinese *Arabidopsis thaliana* inferred from chloroplast DNA sequences

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[1] College of Life Sciences, Peking University, China

Abstract:

In this study, we report the phylogenetic relationships of 19 field collected Chinese accessions of *Arabidopsis thaliana* among 58 accessions of *A. thaliana* in other parts of the world based on the sequences of 11 chloroplast intergenic regions. Three related species (*Arabidopsis arenosa* subsp. *arenosa*, *Arabidopsis suecica*, *Olimarabidopsis cabulica*) were used as outgroups. About 48 different haplotypes are detected in the sample of 77 accessions and nucleotide diversity (π) is 0.00169. The phylogenetic and haplotype network analyses showed that the 77 accessions of *A. thaliana* are divided into two clades and two major haplotype classes respectively. The dimorphism in the chloroplast DNA could be due to ancient founder effect and thereafter admixture of two differentiated populations. The percentage of singletons is very high and this result is consistent with the suggested recent expansion of the species. The estimated divergence time of the two haplotype classes is about 0.24~0.46 million years ago. The 19 Chinese accessions are distributed in different clades. The 17 central and southeast Chinese accessions, together with an Indian accession (Kas-2), form a robust branch in the tree in one clade, and two accessions from Xinjiang Province are clustered together and distributed in another clade. The two Chinese groups may have diverged about 0.23~0.44 mya, and they were originated from two different most recent ancestral populations. The correlation between the geographical distances and the genetic similarity for the 17 Chinese accessions indicates strong founder effect and demographic expansions in central and southeast China.

S-04

Systematic study on *Liparis* sect. *Liparis* in Korea and Japan

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[2] Division of Eco Science, Graduate School, Ewha Womans University, Korea

Abstract:

Liparis section *Liparis* (Orchidaceae) has nine described species distributed in Japan and Korea. To clarify its systematics, we performed molecular and morphological studies of the taxa distributed in Korea and Japan. The molecular phylogenetic study revealed that Korean and Japanese species of *Liparis* sect. *Liparis* are divided into three clades: *L. auriculata,* a clade comprising *L. truncata* and *L. krameri,* and a clade consisted of the other species examined. The last clade comprises two subclades: one is *L. japonica, L. makinoana* and *L. yongnoa*, and the other is *L. fujisanensis, L. koreojaponica, L. kumokiri, L. latisepala,* and *L. purpureovittata*. The phylogenetic data also indicated that some terrestrial *Malaxis* species with conduplicate leaves are nested within *Liparis* sect. *Liparis,* suggesting that the section is a polyphyletic group. Based on the morphological and molecular data, we revealed that there exist at least four new species. The results also indicated inconsistencies between Korean and Japanese samples of *L. japonica* and *L. makinoana.* These suggested that there are some taxonomic problems in the plants widely called *L. japonica* and *L. makinoana,* and more new entities of *Liparis* sect. *Liparis* may exist in Korea and Japan.

S-05

Chloroplast DNA phylogeography of *Pedicularis resupinata* (Scrophulariaceae) around the Japanese Islands

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Abstract:

Pedicularis resupinata L. is a perennial herb and a sunny meadow plant occurring in areas from lowland to subalpine in Japan. This species is distributed in eastern Asia from Japan, Korea, N. to C. China, Manchuria, Mongolia, Siberia, Sakhalin and Kamchatka. This species has high diversity in its external morphology, and several infraspecific taxa have been proposed in Japan. In order to elucidate the evolutionary patterns and processes of intraspecific diversification of *P. resupinata* in Japan, I investigated cpDNA variation and the phylogeographic patterns of the species, using 48 populations in the Japanese Islands and adjacent regions (Korea and Sakhalin Island). I recognized nine distinct cpDNA haplotypes based on the intergenic spacer between the *trnL* (UAA) 5'exon and *trnF* (GAA) (ca. 900 bp). One cpDNA haplotype was distributed widely (type A), and most of the other haplotypes were found to be geographically structured. Two major clades (I and II) were revealed in phylogenetic analyses among the haplotypes by adding the sequence data as follows: the intergenic spacers of *trnT* (UGU) and *trnL* (UAA) 5' exon, and *atpB* and *rbcL* (ca. 2500 bp in total). The haplotypes of Clade I were also widely distributed in the Korean Peninsula and Sakhalin, not only the Japanese Archipelago, and on the other hand, those of Clade II were distributed only in the central Honshu and Shikoku districts of Japan. These results suggest that the cpDNA haplotypes of Clade II originated in the Japanese Islands, and they remain, as relics, in the central Honshu and Shikoku districts. As an intriguing result, I will refer that the haplotype G discovered in the Sorak mountain area of the central Korean Peninsula was most ancestral in Clade I.

S-06

An aspect of the alpine flora of Hokkaido

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Abstract:

1. Outline of Hokkaido Island

The Hokkaido Island, the second largest island in Japan, is located in the north of Japan Archipelagoes and approximately lies in 41º－46ºN, 140º－146ºE. The island is included in the cool temperate and the subfrigid zones. It is dominated by summer-green forests (*Fagus*) in the southernmost part and by subfrigid coniferous forests (*Abies*-*Picea*) in the rest. This coniferous forest has an intermediate characteristic between northern coniferous forests (taiga) and those of the Sino-Japanese floral region; taiga is dominated by *Picea* while Sino-Japanese coniferous forests are by *Abies*.

The mountain system of Hokkaido is mainly composed of four blocks: Southern Mountains (Dônan District), Yubari Mountains, Hidaka Mountains and Central Mountains to Shiretoko Peninsula. Each of the four blocks has its own floristic character. The Pacific Rim Volcanic Belt (so-called Chishima [Kuriles] Volcanic Belt) runs in the middle of the island. There are some instances of natural hybridization among plant species due to the volcanic activities.

2. Endemics of the Hokkaido Mountains －Relationships among Hokkaido, Asian and North American Continents－

Many endemic plants occur in high mountains of Hokkaido. Phytogeographically they are mostly circumpolar arctic elements; e.g., *Oxytropis hidakamontana* (Fabaceae) is an endemic of the Hidaka Mountains and has a close relationship with *O. retusa* (the Kuriles) and *O. littoralis* (Kamchatka).

Scorzonera rebunensis (Asteraceae) is an endemic of Rebun Island and differs from *S. radiata* in having broader leaves and smaller heads. *Scorzonera radiata* is widely distributed in Eastern Asia as well as in Sakhalin.

Papaver fauriei (Papaveraceae) is endemic to the summit area of Mt. Rishirizan, Rishiri Island. This species should be attributed to a relict race among the polymorphic *Papaver radicatum* group.

3. Speciation in the Hokkaido Mountains

Several plant groups have diversified in the mountains of Hokkaido. Here such examples of the speciation will be presented as genera *Trollius* and *Aconitum* (Ranunculaceae), and genera *Cirsium* and *Saussurea* (Asteraceae).

S-07

The current aspects and conservation of endemic species in Ullung Island, Korea

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Abstract:

Ullung Island is a small island, situated at 150 km east of mainland Korea and 300 km west from Japan, extending from 37°27′27″ ~ 37°33′01″ North latitude and from 130°47′37″ ~ 130°56′20″ East longitude. Ullung Island has mountainous forest vegetation composing of Ullung-do Beech forest, Pine-Hemlock forest, Evergreen Broadleaved forest, Hardwood forest, and Wind-swept forest (Kim *et al.* 1996). The flora of Ullung Island contains approximately 700 vascular plant species, of which about 500 are native or endemic. Some 31 angiosperms taxa are endemic, representing 25 families and 30 genera. Although the whole island had been once covered by dense virgin forests before being felled (Nakai 1928), natural vegetation now only remains in an extremely restricted area of the island because of long term heavy human impacts, like collecting wild edible plants, burning for field clearance, cutting for housing and fire wood, and grazing. There are some landslides in Ullung Island because of steep slopes. Nowadays a lot of tourists near about up to 35,000 in summer are coming to the small Ullung Island. As a point of view of the endemic species in Ullung Island, many artificial and natural reasons are responsible for causing its destruction. Currently we have conserved some places for protecting the wild plants in Ullung Island from being extinction. We have designated 8 natural monuments since 1964. We will be going to establish some strategy to protect all endemic species in Ullung Island in near future. Some endemic species dwell in very restricted area, they are endangered species. The present scenario of widespread endemic plants is still yet unknown. We will be going to introduce the origin and genetic diversity of very common endemic species, *Rubus takesimensis*.

Of volcanic origin, Ullung Island has never been connected to any other land mass (Kim 1985). In comparison with other oceanic islands, Ullung Island is very young, and this is an important factor in explaining the evolutionary patterns and processes occurring within the island. The endemic angiosperms of Ullung Island appear mostly to have evolved by simple anagenesis, there are being little evidence of intra-island cladogenetic speciation events (Sun and Stuessy 1998).

S-08

Conservation of *Cypripedium macranthos* var. *rebunense* in Rebun Island, Hokkaido, Japan

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The Hokkaido University Museum, Japan

Abstract:

Cypripedium macranthos var. *rebunense* characterized by cream to white flowers, is believed to be an endemic variety to the Island of Rebun, northern Hokkaido, Japan. This variety is recognized as an endangered species in the latest Red List of Japan, but its variety status is controversial. Usually this plant had been classified as a variety or forma rank of *C. macranhtos*, but recently Cribb (1997) accepted the only species, *C. macranthos* without any recognition of the infra-specific taxa. We examined the broad flower color variation within several populations of *C. macranthos* growing around Vladivostok, Russia. Thus, we can understand the taxonomic treatment of Cribb, but the conservative taxonomic treatment is received in this study.

The geographical distribution pattern of *C. macranthos* suggests that the populations of Rebun Island are possibly related to those in Sakhalin. The natural habitats of the variety are geographically separated into northern and the southern populations on the island. They grow on somewhat different plant communities and the coastal sand dune meadows are characteristic at Teppu (N region) including the largest population. The records of population structure from 2002 to 2007 at Teppu show comparatively low reproduction rates, but the long-term monitoring shall be carried out in several populations on the island. Floral mimic hypothesis of *C. macranthos* var. *rebunense* has been advocated by Sugiura (2002). This hypothesis may be acceptable in the largest Teppu population, but the effectiveness of it shall be tested for other populations critically. Disappearance of alleles and increase in homozygosity expected as a result of the bottleneck effect were observed, particularly in the southern populations composed of a small number of plants. We are afraid of the deterioration of genetic diversity of the southern populations in the near future. Two propagation methods have been established by Koda and his colleagues, and the method from symbiotic seed germination may be more environment-friendly one. For rehabilitation of decreased and fragmented populations and restoration of extinct populations the juvenile plants propagated ex situ will be used in situ in future.

S-09

Genetic variation and conservation of *Euphorbia komaroviana* in Far East Russia (Euphorbiaceae)

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Abstract:

Euphorbia komaroviana is a rare, perennial endemic of the south Primorye of Russian Far East. Until now, only about 20 populations of the species are restricted in these areas. We investigated genetic diversity of eight populations of the *E. komaroviana* using starch gel electrophoresis to understand genetic variation, and get the information for conservation of the species. Comparing to other *Euphorbia* species very low levels of genetic variation were found within the populations (19.98% of loci polymorphic, 1.37 mean numbers of alleles per locus, and 0.052 expected heterozygosity). The high genetic identity between populations suggests the lack of genetic diversity. The low genetic diversity, lack of the unique alleles in populations, and high genetic identity between population are evidence that *E. komaroviana* is the species of recent origin. Besides, the events of the late glaciations, and frequent occurring of fires probably account for the lack of genetic variation of *E. komaroviana* in south Primorye. Conservation efforts should be focused on the population surrounding Chernyatino village of Oktyabrsky District which contains most of the unique alleles and genetic variation of the species.

S-10

Genetics, ecology & climate change: challenges for plant conservation in the 21st century

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[1] Bioconservation India, India

Abstract:

Until the mid-1980s plant conservationists focused on protecting the habitats where endangered taxa occurred, trusting that protection of their habitat would prevent their extinction. The rise of modern conservation biology helped us to realize that protecting habitat is not enough. We came to realize that "rarity" and "endangerment" are not the same thing. Taxa that have recently become rare are more likely to go extinct than those that have always been rare. Genetic analyses can help us to distinguish these possibilities. To prevent the extinction of recent rarities, managers may need to intervene to enhance reproductive success and survival. Demographic analyses can be a vital part of such efforts. In the last decade it has become increasingly clear that all rare plants are endangered, but not for the reasons we thought in the 1970s. Projections from the fourth report of the Intergovernmental Panel on Climate Change suggest that 20–40% of plant and animal species are at increased risk of extinction if the global average temperature increases more than 1.5-2.5°C. In the Western Ghates Region of South India, for example, 40% or more of the Proteaceae are at risk. The expected global average increase in temperature over the next century is about 3°C. The new challenge for plant conservationists is to identify the taxa most vulnerable to climate change and to develop the tools necessary to prevent their extinction.

P-01

Taxonomy and distribution of *Calamagrostis gigas* (Poaceae)

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[2] The Hokkaido University Museum, Japan

Abstract:

Calamagrostis Adans. (ca. 150-200 spp.), which is a genus of perennial herbs in the Poaceae, is distributed mainly in the temperate regions of the Old and New Worlds. *Calamagrostis gigas* Takeda, an endemic species to Japan, grows on mountainous regions of northern Honshu and Hokkaido of Japan along the Japan-Sea (East-Sea) side.

Takeda (1910) described the *Calamagrostis* plants, with minute hairs on the upper parts of the leaf sheaths, as *C. gigas* Takeda based on the specimens collected from Mt. Shirouma, Nagano Prefecture, Honshu, Japan. Next Honda (1926) recognized the *Calamagrostis* plants, with dense hairs on the whole surface of the leaf sheaths, as *C. aspera* based on the collection at Mt. Iwaki, Aomori Prefecture, Honshu. But later Ohwi (1936) regarded *C. aspera* Honda as a variety of *C. gigas*; i.e., *C. gigas* var. *aspera* (Honda) Ohwi. Ito (1960) recognized the plants characterized by smooth surface of the leaf sheaths, which grow in Hokkaido, as *C. gigas* form. *alpicola* (Ohwi) Koji Ito.

Based on our research on main Japanese herbaria (KANA, SAPS, TI, TNS and TUS), the taxon *C. gigas* form. *alpicola* was clearly discerned based on its naked leaf sheaths. At the present study we clarified the geographical distribution pattern of this taxon in Japan.

As a result, *C. gigas* is distributed throughout the mountainous regions at the Japan-Sea side of northern Honshu and Hokkaido. But *C. gigas* form. *alpicola* is confined to the northern part of the geographical distribution area of *C. gigas*, from northern Honshu to especially Hokkaido.

Because *Calamagrostis gigas* form. *alpicola* is clearly distinguished from other infraspecific taxa of *C. gigas* by the smooth leaf sheaths, and it's geographical distribution is restricted in the northern part of the distribution area of the species *C. gigas*, forma *alpicola* should be recognized as a geographical variety not as a forma.

P-02

Recent population fluctuation of *Melastoma tetramerum* (Melastomataceae), an endemic and endangered species on the Bonin Isls., and necessity of genetic assessment for its conservation

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Abstract:

The Botanical gardens of the University of Tokyo (BGUT) have been a center of the conservation activities for the endemic and endangered species on the Bonin Islands for the recent two decades. One of the most remarkable contributions is a conservation project for *Melastoma tetramerum*. *Melastoma tetramerum* is one of the most seriously endangered species on the Bonin (Ogasawara) Islands. Although the population in Higashi-daira (HD) of Chichi-jima reduced to a single wild tree in the 1980s and then extinct, a population of over 200 trees was newly found in Higashi-kaigan (HK) of Chichi-jima in 1993. This study reports gradual reduction of the number of adult trees in HK, which resulted in the death of most adult trees in 2007. BGUT is keeping a living collection of the last 10 individuals including the last one in HD, introduced by cuttings, and starts the genetic assessment of the collection for their conservation in the future. The phylogenetic analysis using chloroplast *ndhF* and *rpl16* intron indicated that *M. tetramerum* is sister to *M. pentapetalum* (Toyoda) T. Yamaz. & Toyoda, endemic to Haha-jima. Within *M. tetramerum*, two sequence types were found in chloroplast *psbA-trnH* region. This result of genetic assessment suggested that we would come into next stage for propagation and risk aversion on conservation activity based on the recognized genetic background.

P-03

Divergence and cytogeography of the *Aster ageratoides* complex in East Asia

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Abstract:

The *Aster ageratoides* complex is one of the representative elements of Sino-Japanese region. The distribution area of this group is very large through China, Russia, Korea, Taiwan, and Japan. And there are many taxa within the group. Although the taxonomic treatments concerning taxon status and/or taxonomic boundaries are different between the previous researchers, one species and ten varieties are recognized in China (Ling and Chen 1985) and five species and four varieties are recognized in Japan (Ito and Soejima 1995). Most of them are endemic to each country indicating independent speciation. This kind of species diversity is characteristic to East Asia and seems to cause the high diversity of this region.

In addition to the taxonomic complexity, the existence of ploidy series makes it more intriguing plant group. Because polyploidization is basically one way evolution, it is easy to speculate the direction or process of their evolutionary history. There are many researches on the cytogeography of the *A. ageratoides* complex elucidating the distribution of diploids and polyploids. Here the previous reports to date are summarized to show the present knowledge of cytogeography of this plant group and connect to future study.

P-04

Asymmetrical hybridization between *Arisaema angustatum* and *A. izuense* (Araceae) in the Izu Peninsula

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Abstract:

The *Arisaema serratum* group contains 14 species of understorey herbs distributed in Japan and Korea. Despite being morphological diverse, previous studies have demonstrated genetic differentiation between the species to be extremely low. This has confounded attempts to confirm hybridization, though reports of morphologically intermediate plants suggest some taxa may interbreed under natural conditions. We examined the occurrence of a putative natural hybrid between *A. angustatum* and *A. izuense* at a contact zone in the Izu Peninsula, to shed light on the processes leading to the formation and maintenance of hybrids within the group. Principal component analysis of morphological characters and morphological hybrid index confirmed the existence of plants intermediate to the two putative parents. Molecular hybrid index based on microsatellite markers was positively correlated with morphological hybrid index. The mean molecular hybrid index for individuals of putative hybrids was intermediate between the putative parents. Among the putative hybrids, each cpDNA haplotype derived from the two putative parents was retained. The putative parents were found to have partially overlapping flowering periods, and artificial cross-pollination produced fertile seed. We conclude that bidirectional interbreeding between *A. angustatum* and *A. izuense* generates natural hybrids. Moreover, since the hybrid indices were variable along the contact zone, we infer a dynamic pattern of hybrid formation and subsequent back-crossing.

P-05

Distribution and habitats of endangered species *Amsonia elliptica* (Apocynaceae) in Japan

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Abstract:

Amsonia elliptica (Thunb.) Roem. et Schult. (Apocynaceae) is a perennial herbaceous species distributed China, Korea peninsula and Japan. This species is considered to have expanded after the last glacial period, from the southern to northern part (the central part of Hokkaido island) of Japan. Unfortunately, it is endangered mainly because of destruction of populations by the exploitation, and designated as an endangered species in Japan.

To realize their present situation in Japan, we surveyed distribution of *Amsonia elliptica* and its habitat condition (e.g. vegetation, population size) at 38 populations in the whole of Japan. As a result, large populations are found in fragment riparian forests dominated by *Alnus japonica* and *Quercus acutissima* around Kanto plain, and dominated by *Fraxinus mandschurica* var. *japonica* around Ishikari plain (Hokkaido). However, around Kyushu, Shikoku, Chugoku and Kinki regions, only small and isolated populations are remained in narrow valleys or marshes. These regions have been exploited since early times, and especially an alluvial plain has been the center of human activity.

Consequently, small populations in southern part of Japan are under extremely critical condition. To conserve this species, it is necessary to consider genetic diversity of these isolated populations. Furthermore, phylogeographical research including populations of China and Korea peninsula will bring important knowledge about historical background of this species.

P-06

Notes on *Artemisia montana* Pamp. var. *shiretokoensis* Koji Ito (Asteraceae)

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Abstract:

The genus *Artemisia* is the largest genus in tribe Anthemideae (Asteraceae), which is consisted more than 200 to 500 taxa at the specific or subspecific level (Ling 1992, Bremer & Humphries 1993, Torrell *et al.* 1999). *Artemisia* is widespread in mid-to high-latitudes, and shrubby species dominate very cold places and many deserts in the Northern Hemisphere. We can find them from seacoast to high mountains and in brackish water swamps also (Ling 1992, Kitamura 1981).

The species of *Artemisia* "Ezo-no-yuki-yomogi (Japanese name)" was described by Dr. Koji Ito in 1966. The scientific name is *Artemisia montana* Pamp. var. *shiretokoensis* Ko. Ito. "Ezo-no-yuki-yomogi" was classified into *A. montana* group by the feature of capitula and inflorescence. In his description, he pointed out that the classification still has some questions (Ito 1966). The type locality of "Ezo-no-yuki-yomogi" is the Cape Shiretokomisaki of Hokkaido, Japan (transplanted to the Sapporo city of Hokkaido and cultivated). The plant was whole whitish, so he became suspicious the parentage of *A. stelleriana* Bess. But from the shape of leaves, capitula, inflorescence, he distinguished from *A. stelleriana* Bess. On the final analysis, he classified "Ezo-no-yuki-yomogi" into *A. montana* group by the feature of capitula and inflorescence (Ito 1966). These specimens are deposited in the herbarium SAPS. Author report based on the findings from morphological analysis and some suggestive hint at field research.

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P-07

Phylogeny of Korean *Galium* (Rubiaceae) based on ITS (nrDNA) and *trnL*/*F* intergenic region (cpDNA)

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Abstract:

The genus *Galium* L. comprising annual and perennial herb in the family of Rubiaceae. *Galium* is distributed worldwide, from the lowland tropics to the subarctic region and is found on all continents except Australia (Ohwi 1965). It exhibits tremendous morphological diversity, with species showing upright, climbing characteristics. The species comprised of 11 sections and distributed of 400 species is known to have hard classification in taxonomy by hybridization, polymorphy and diploid. The genus *Galium* L. is classified in 11 sections by Pobed (Fl. URSS), and there is 7 Section in Korea.

We examined the phylogeny of Korean *Galium* using an internal transcribed spacer (ITS) of the nuclear ribosomal DNA and a *trnL-trnF* (*trnL*/*F*) intergenic region of the chloroplast DNA. In all, 16 ingroup species (1.2 kb for each species) were analyzed using parsimony, resulting in 792 aligned sequences from ITS, and 515 bases with *trnL*/*F*. The analysis of ITS and *trnL/F* data proved that the genus *Galium* is a monophyletic group. The taxa, when mapped onto the ITS tree, suggested that evolution proceeded from somatic chromosome basic number *X*=12 to *X*=11, from corolla rotate lobes 3 and 4 in Korean *Gallium*.

P-08

Intraspecific variation and geographic structure analysis of *Rubus takesimensis* Nakai (Rosaceae) and some related taxa

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Abstract:

Ulleung Island is of volcanic origin, never been connected to any other land mass (Kim, 1985). In comparison with other oceanic islands, Ulleung Island is very young, and this is an important factor in explaining evolutionary patterns and processes within the island. Sequences of the *trnL-trnF* intergenic spacer of chloroplast DNA was used to investigate the intraspecific genetic variation of *R. takesimensis* (Rosaceae). *Rubus takesimensis* is endemic to Ulleung Island, Korea. This species is an important model system for the evolution of Ulleung Island plant species. Nine *R. takesimensis* population from throughout Ulleung Island and twenty-nine *R. crataegifolius*, *R. trifidus* populations, close relatives of *R. takesimensis* were examined. Seven haplotypes of chloroplast DNA were distinguishable in *R. takesimensis* and *R. crataegifolius*; CP01~CP07. The geographical distribution of cpDNA haplotypes was found to be highly structured in this species. This species share CP01 and CP06 each other. CP01 are prevalent on the Ulleung Island and Korean peninsula from Mt. Baekdu to Gyeongsangnam-do Namhae-gun. CP06 are prevalent on the Ulleung Island, Jeju Island and Japan. This confirmed the existence of two cpDNA lineages with different geographical distributions in this species. Phylogenetic analysis of cpDNA types showed that neither *R. takesimensis* nor *R. crataegifolius* was monophyletic for the types, suggesting the occurrence of two intraspecific evolutionary lineages (Korean peninsula and Ulleung Island – Jeju Island, Japan and Ulleung Island) of *R. takesimensis* and *R. crataegifolius*. As well as, types of nuclear ribosomal DNA were distinguishable in *R. takesimensis* and *R. crataegifolius*. This species share several nrDNA types. Phylogenetic analysis of cpDNA and ITS types showed that neither *R. takesimensis* nor *R. crataegifolius* was monophyletic for the types, suggesting either ancestral polymorphism or ancient introgression between the lineages of these two *Rubus* species.

P-09

Taxonomy of two Japanese species of *Volvox* sect. *Volvox* (Chlorophyceae)

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Abstract:

Volvox is one of the most well known algae, and is distributed worldwide. Since Linnaeus (1758, Syst. Nat. ed. 10. 820) described the genus *Volvox*, approximately 19 species have been recognized in this genus. Smith (1944, Trans. Am. Microsc. Soc.) classified the genus *Volvox* into four sections based on differences in cytoplasmic bridges between cells and structure of the colonial matrix. Sect. *Volvox* (=*Euvolvox*, *sensu* Smith 1944) demonstrates thick cytoplasmic bridges that are not recognized in other members of the colonial green flagellates. Recent molecular phylogenetic analyses (e.g. Nozaki *et al.* 2000, MPE) demonstrated that sect. *Volvox* is separated from other members of *Volvox* as well as *Eudorina* and *Pleodorina*. After Smith (1944) recognized eight species in sect. *Volvox*, no additional species have been described. In Japan, only *V. globator* was recorded in sect. *Volvox* without detailed morphological examinations (Nozaki 2000, Illust. Freshw. Zooplank. Japan). During these 24 years, several strains of sect. *Volvox* were established from samples collected from various localities of Japan. Based on the comparative morphological examinations and molecular phylogeny, two monoecious species were recognized in Japan. One forms 20 to 80 spiny zygotes within a sexual colony, which is similar to *V. globator* and *V. merrillii*. However, it differs from the latter two species by its pear-shaped vegetative cells that are not flattened. The other Japanese species resembles *V. capensis*, although its phylogenetic position was separated from *V. capensis* zyg-6 (Mai & Coleman 1997, JME).

P-10

Evidence for natural selection on chloroplast DNA in the ecologically differentiated populations of the ubiquitous freshwater alga *Chara braunii* (Charales) in Japan

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Abstract:

Ecological differentiation and reproductive isolation are mutually associated to provide the initial process of speciation in which barriers to gene flow evolve between populations by ecologically-based divergent selection. Although such natural selection can act in both nuclear and organelle genes, very little information has been demonstrated regarding the evidence for natural selection acting in plastid genes in the closely related, ecologically differentiated populations or in the actual process of speciation. *Chara braunii* (Charales) is a freshwater macrophyte alga that grows in a range of aquatic habitats from shallow water in paddy fields to the bottom of deep lakes. Our previous study of *C. braunii* collected from various habitats and localities in Japan demonstrated two robust clades (groups A and B) of chloroplast haplotypes of *C. braunii* that are essentially different in the aquatic habitats: shallow paddy fields versus deep lakes/ponds. This chloroplast DNA (cpDNA) dimorphism can be attributed either to neutral evolution by genetic drift or natural selection acting in cpDNA. In order to elucidate these possibilities, we here determined sequences from two nuclear DNA (nDNA) regions, encoding the transcribed region of a heat shock protein 90 (*hsp*90) and an elongation factor 1-alpha (*EF-1α*). Phylogenetic relationships based on each of the two nDNA regions were essentially different from those the cpDNA phylogeny, suggesting that gene flow between groups A and B of *C. braunii*. The migration rate (Nm) between shallow and deep aquatic habitats calculated based on cpDNA sequences was markedly smaller than that based on sequences from each of the two nDNA regions, suggesting small gene flow of cpDNA between shallow and deep aquatic habitats. Furthermore, Tajima's D tests for each of the three DNA regions showed significant departure from neutrality only in cpDNA region, indicating that the dimorphism in cpDNA of *C. braunii* was caused by natural selection, not by genetic drift. Thus, plants of *C. braunii* distributed in Japan are adapted to their shallow or deep aquatic environments by chloroplast genes and may represent an initial stage of speciation in which natural selection is acting in cpDNA before complete establishment of sexual isolation.

P-11

Higashiyama Zoo and Botanical Gardens Evolution Plan ~Acting as a bridge between human and nature~

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Abstract:

On top of the basic functions of research and display of species in zoos and botanical gardens, and support of the Higashiyama forest project, environmental education programs will be provided to encourage visitors to have curiosity in nature, and to think and act towards sustainable living. The programs will let the visitors experience the wonder of nature and realize the importance of nature. Aiming to be the stronghold of “Eco-City” Nagoya, conservation of the species will be promoted to conserve the biodiversity.

P-12

Clonal propagation and chemical characteristics of *in vitro* plant of licorice (*Glycyrrhiza uralensis*).

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Abstract:

The licorice (Chinese licorice) plant (*Glycyrrhiza uralensis* Fischer) is a legume and native to Asia (China, Mongolia, etc.) It is an herbaceous perennial. The dried roots and stolons of licorice is one of the most important drugs in oriental traditional medicine for anti-inflammatory, antiallergenic and anti-ulcer activities. Licorice is also an important commercial product used as a sweetener and a flavor in the tobacco and confectionary industries in the worldwide. This study describes the establishment of an *in vitro* stolon tissue culture system of *G. uralensis* Fischer. The formation of *in vitro* stolon tissue was induced from a stem node with an axillary bud in Murashige-Skoog (MS) medium supplemented with 0.01μM α -naphthaleneacetic acid (NAA) liquid culture in the dark. The best response of growth of the cultured stolon was achieved in MS medium with 0.01μMNAA and 6% sucrose (more than 6-fold, fresh weight / 4 weeks). Adventitious root and shoot induction were easily achieved on solid MS medium with 0.01μM NAA and 0.2% gerlite under the light culture. Furthermore, chemical analysis was also performed using GC-MS. Some triterpenoid metabolites were detected in the cultured stolon tissue. The *in vitro* stolon tissue culture system offers a possibility for the effective propagation, and useful tool for the study of the metabolic pathway of triterpenoid and triterpene saponins of licorice.

P-13

Efforts made by Niigata Prefectural Botanical Garden for conserving biodiversity

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Abstract:

The Niigata Prefectural Botanical Garden located 400km north from Tokyo. We have about 3,000 vascular plant species including the largest collection of genus *Rhododendron* section *Tsutsusi*.

In recent years, Japanese botanic garden is expected for the center of *ex situ* conservation, but the general public lacks sufficient understanding of conservation activities of botanical garden. To change such a circumstances, we promote conservation in cooperate with local organization and/or individuals. In this paper, I described the efforts of *ex situ* or *in situ* conservation at our garden.

Ex situ conservation, we have conserved 63 threatened Japanese plant species with clear origins. These are several programs to promote *ex situ* conservation, such as seed, plant, and information exchange under the National Network of Botanical Gardens for the Conservation of Plant Species Diversity of the Japan Association of Botanical Gardens. These plants are utilized not only for conservation but also education and exhibition.

On the other hand, *in situ* conservation, we cooperate with local organizations or individuals to conserve native habitats of threatened plants in Niigata Prefecture (i.e. *Pulsatilla cernua*, *Monochoria korsakowii* etc.). We recognize that education of biodiversity is very important, as well as local collection and research of threatened plants.

P-14

Current plant diversity studies and conservation in the World Cultural and Natural Heritage, Wuyi Mountain, China

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Abstract:

The Wuyi Mountains are located in the southeastern of China. The mountains extend through northwestern Fujian and contain the Huanggang mountain, the highest peak (2158 m) in southeastern China. The variable landform, with high mountains, deep valleys (the greatest drop is c.1000m) and streams interspersed, warm and moist climate, provide Wuyi Mountains various ecosystems, which support an abundance of plant diversity.

Plant diversity researches of the Wuyi mountains have been carried out in the recent fifty years. Especially, the scientific investigations have been performed in the Wuyi mountain national nature reserve since 1979. The researches on plant diversity are focused on the vegetation and species diversity. It can be briefly summary as: 1) This is a subtropical region with evergreen broad-leaf forest. Various types of vegetation in complex natural environment are observed. Vertical distribution of vegetation is clear, from the grassland in the top of huanggang mountain, coniferous forest, the pine and broadleaf mixed forest, to the evergreen broadleaf forest (below 1700m). 2) The vascular plant of 2610 is known, and it is a feature in the region that there are a lot of relic, endemic, and new species. The plant specimens of 36,000 or more were collected. "Wuyi Science Journal" is issued since 1981, and “the science investigation reports” was issued in 1993.

Wuyi mountain national nature reserve was registered in the world cultural and natural heritage in 1999. Conservation of the biological diversity, nature landscape and the humanity culture are given to priority. Administrative management is systematized, and an artificial influence on ecosystem is suppressed to the minimum. A research station of the evergreen broadleaf forest ecosystem of the subtropics, in Wuyi mountains was built in 1998, the researches of ecosystem, hydrology, plant community and meteorological observation are performed.

It is important to preserve biological diversity and its continued utilization for humanity. Therefore, it seems necessary to do the promotion of international cooperation, and to do more biosystematic studies in Wuyi mountains.

P-15

Diversity and conservation of orchids in Hiroshima Prefecture

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Abstract:

The Hiroshima Botanical Garden investigates the plant growing naturally in Hiroshima Prefecture to clarify the flora in the region. As a result of recent investigations, 69taxa of orchid were confirmed to grow naturally in Hiroshima Pref. Among these taxa, *Dactylostalix ringens* and *Gymnadenia camtschatica* are considered to be subalpine elements, while subtropical members are included, e.g. *Epipogium roseum* and *Liparis odorata,* which have the center of distribution in a south area. Moreover, in Hiroshima Pref. there are cytologically varied species, e.g. *Goodyera foliosa* var. *maximowicziana* and *G. schlechtendaliana* which show intraspecific polyploidy, and some morphologically various species like *Platanthera madarinorum sensu lato.* From above thing, it is said that the orchidaceous flora in Hiroshima Pref. is comparatively rich in diversity.

Number of orchidaceous plants in Hiroshima Pref. is decreasing every year without some particular species and many orchids are listed as endangered species. The most serious factor which has caused such a situation might be a collection of the gardening purpose. Therefore, locality information of the species is kept but there are some localities which were damaged not by collection but owing to a dearth of information. It is thought that not only technical developments to restore natural habitat but also the relevant information management and education program for various citizens are effective to conserve orchids.

P-16

Genetics, ecology & climate change: challenges for plant conservation in the 21st century

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Abstract:

Until the mid-1980s plant conservationists focused on protecting the habitats where endangered taxa occurred, trusting that protection of their habitat would prevent their extinction. The rise of modern conservation biology helped us to realize that protecting habitat is not enough. We came to realize that "rarity" and "endangerment" are not the same thing. Taxa that have recently become rare are more likely to go extinct than those that have always been rare. Genetic analyses can help us to distinguish these possibilities. To prevent the extinction of recent rarities, managers may need to intervene to enhance reproductive success and survival. Demographic analyses can be a vital part of such efforts. In the last decade it has become increasingly clear that all rare plants are endangered, but not for the reasons we thought in the 1970s. Projections from the fourth report of the Intergovernmental Panel on Climate Change suggest that 20–40% of plant and animal species are at increased risk of extinction if the global average temperature increases more than 1.5-2.5°C. In the Western Ghates Region of South India, for example, 40% or more of the Proteaceae are at risk. The expected global average increase in temperature over the next century is about 3°C. The new challenge for plant conservationists is to identify the taxa most vulnerable to climate change and to develop the tools necessary to prevent their extinction.

P-17

Approach to obtain understanding and sympathy of citizen to conservation of plant diversity

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Abstract:

We present our exhibitions about endangered plant and the conservation trials by photos. We intend to obtain understanding and sympathy of citizen to conservation of plant diversity. Because we believe that without the understanding and sympathy of citizen to conservation of plant diversity, we cannot propel the work about endangered plant. We expect the understanding and sympathy of citizen to conservation of plant diversity to grow to the powerful support.

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