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Why Korean Taxonomic Projects Fail Now

-The Present Status and Operating Aspects of Herbaria in Korea*-

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1. Phytogeography of Korea

Korea is geographically and floristically diverse, with over 2,500 species documented as occurring in Korea. Our flora is most closely related to the northeastern and central Chinese and Japanese flora. A simple examination of the regional arrangement of peninsula helps us picture several possible transmigration routes of plants during the Tertiary and the Quaternary time. Northeast Chinese and Russian elements migrated into Korean high mountains, while many species entered southeastern part of Korea including island Cheju. Japanese elements also migrated into southern part of Korea or vice versa (Maekawa, 1974). A forest region is a broad geographic zone within which the composition of the vegetation is relatively uniform. According to Flora of Japan by Ohwi (1980), four forest regions could be identified in Korea; warm-temperate, temperate, boreal, and arctic-alpine region. The warm temperate region embraces the coastal areas of southern peninsula, while the temperate region begins at about ca. 1,000m above sea level in southern peninsula and in low mountains (ca. 500 m) of mid-peninsula. In the eastern part of peninsula the boreal region occurs from ca. 1,000-1,500 m in altitude. The arctic-alpine region areas are not represented in Korea except several mountain peaks scattered in northern peninsula. The boreal and the northern part of temperate regions belong to the Manchurian province, while the warm temperate and the southern of temperate region is more like Japanese-Korean Province according to Takhtajan (1986). In mid part of peninsula (near Seoul city), we may be able to see some taxa which belong to the North Chinese Province. Since the flora of Korea reflects the broad range of interrelations between Northeast, Central China, Russia and Japan, very few of the

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genera are confined to Korea as endemic, such as *Abeliophyllum* (Oleaceae), *Hanabusaya* (Campanulaceae), *Megaleranthes* (Ranunculaceae), *Pentactina* (Rosaceae) and *Echinosophora* (=Sophora) (Fabaceae) (Lee, 1980).

The flora of the Eastern Asiatic region holds special interest for the study of the history of temperate flora of the Northern Hemisphere (Takhtajan 1986). Since both in Japan and China, many archaic and intermediate forms have been recorded thus far, many species deserve attention for evolutionary studies. On the other hand, Korean flora, which is not quite unique, composed of Manchurian province (Northeastern Chinese elements), Koran-Japanese province (Japanese elements) and North Chinese provinces (North Chinese elements). Although this flora is not interesting to the Chinese taxonomists, study of the distributions of Korean plant groups should play a fundamental part in developing hypotheses about the phylogenetic relationships of the members of many Asian plants. An understanding of the presumed phylogenetic relationships, how this understanding of relationships can be portrayed geographically, and how these geographical patterns can be explained in terms of earth history and the movement of individual organisms through time and space will become increasingly a focal point of systematic studies. Systematic studies are a crucial source of the data necessary for possible elucidation of the role of process in the development of current distributions and resolution of an evolutionary problem, with critical implications for disciplines as diverse as biogeography and ecology (Stussey and Thomson 1981).

2. Concern regarding major shortfalls

Most of the early floristic investigations on the Korean flora, beginning in the late 19th and the early 20th century, were made by European taxonomists. Vascular plants (ca. 50 specimens) of Korea first collected by A. B. A. Schlippenbach of Germany were sent to European taxonomists. Two British botanitsts at Kew Botanic Garden, C. Wilford and R. Oldham, visited Korea as well as other Asian countries and collected many specimens for Maximowicz. In late 1890 two Russian botanists, V. L. Komarov and J. Palibin botanized in northern part of Korea including Amur and Ussuri River and published several books on Korean plants. As French missionaries, U. Faurie (1847-1914) and J. Taquet (1873-1952) were the most energetic of late 19th to early 20th century collectors of Korean plants. Serious study and collection by Japanese botanists

(T. Nakai, Mori, Ishidoya and Uyeki) began first in the early 1900. After the Second World War, several Korean taxonomists (Chung, T. H., Lee, T, B., and Lee Y.N.) should be mentioned as their prolific researches. Their botanical publications increased greatly to include floristic studies on the Korean flora as well as on outlying areas. Unfortunately their collections were not shared with each other at that time and were completely destroyed during the Korean War. These persons edited the Journal of Korean Plant Taxonomy started in 1969. The leading centers for systematic research in Korea have been the Seoul National University, Korea University, Ewha Womans University, and Sung Kyun Kwan University. The younger taxonomists of present-day Korea are produced largely by these universities.

Certain provinces or areas have been sparsely collected and await future botanical activity. In some cases, gaps in distribution may be attributed to lack of collectors interest in such things as common weeds, aquatics, grasses and sedges. The difficulty of finding the unusual or rare plants and the unusual or rare habitats also has limited collections. Species concepts have not been generally conservative since Nakai and other Japanese botanists studied and certainly many nomenclatural ambiguities have not been resolved. The severity of these problems has been recognized for many years but efforts to overcome these problems are currently impeded by the following shortfalls;

1) lack of adequate knowledge about biogeography of eastern Asia;
2) lack of funds to support the research efforts and publish the results;
3) lack of personnel and physical resources;
4) lack of sustained effort for long-term studies;
5) lack of an integrated mechanism to identify and execute a research effort on an international scale;
6) lack of type specimens and herbarium specimens for taxonomic research;
7) lack of field and herbarium taxonomists (no curator at any herbaria and no distribution map based on specimens);
8) lack of taxonomic literatures available for taxonomists;
9) lack of professional jobs availability for the future taxonomists (no herbarium taxonomist in Korea);
10) lack of well trained gardner and professional organizers in botanic garden.

Many recent Korean projects direct on the one hand toward elucidating phylogenetic relationships among worldwide-based taxa using molecular

techniques. These only involve collections of molecular material for their researches from botanical gardens or arboreta, totally excluding dried herbarium specimens. Growth rates of faculty have fallen very rapidly from the levels of the late 80s and early 90s in Korea. The impending downturn in the size of the college population, high rates of retirement (no replacement for systematic faculty), and a scientific environments unfavorable to taxonomic research are leading toward molecular biology, computer science and biotechnology and declining proportion of younger students in field and herbarium work.

The next question is how many academic institutions in Korea offer organized programs of study in systematic botany. Less than 10 institutions in Korea have trained ca. seven Ph.D. students in five years, many of whom were not able to continue careers in systematic botany yet due to lack of job market. Literally the number of systematic positions available in academic institutions, government and industry is apparently none to accept graduates in Korea. The increasingly broad training required in the field poses problems in career development which need to be addressed immediately. To deal with the rapidly increasing scope of the field, such as biodiversity and conservation, students need to be more broadly trained in diverse areas of biology. Unfortunately, governmental institutions not only ignore these diverse areas, but also do not support research activities. At present, the lack of quality control limits the usefulness of systematic field in the near future.

To understand how the field of systematics is doing, it is necessary to know how many workers there are in systematic research. The membership lists of Korean Plant Taxonomic Society provide the following information on each taxonomists. These data estimate that there are only 35 taxonomists concerned with vascular plants. Each systematic specialty is skewed and biased and very few people is working on some specialized groups, such as grass, sedge, rush, legume, fern and woody plants (see Table 1). Training programs and post-doctoral opportunities specifically related to alpha taxonomy need to be highlighted in Korea. Some efforts should be made to include Japanese, Russian and Chinese institutions which could help training many young Korean students for field and herbarium taxonomy in the future. Faculty members listing systeamtics as their specialty may provide information on the availability and scope of curricula in systeamtics for Chinese and Japanese researchers (Table 2).

Table 1. The number of taxonomists and their interested plant groups

Plant groups	No. of taxonomist
Fern	1
Conifers	0
Monocots	6
Dicots	
Archichlamydeae	20
Metachlamydeae	6
Other groups	
Grasses	0
Sedges and rushes	1
Woody plants	1
Legumes	2
Composites	3

Table 2. The number of taxonomists and their specialties

Specialty	No. of persons
Molecular taxonomist	5
Chemotaxonomist	5
Palynotaxonomist	3
Cytotaxonomist	4
Field taxonomist	2
Others	16 (including non-active taxonomists)
Herbarium taxonomist	0
Total	35

The majority of Korean young taxonomists, who had been trained in U.S.A. and Japan, are employed by molecular and chemical taxonomy. At present, the lack of herbarium taxonomist in Korea limits the development of systematics. Advanced planning must involve input from the widest range of concerned plant taxonomists who will have targeted organisms and habitats of special interest. Also, it is recognized that efforts must be made to collect those forms that are poorly known and for which there are few working taxonomists at the present time.

Research in systematic botany depends on the availability of adequate samples of the flora. In most cases these samples will be represented by preserved specimens. The Index Herbariorum lists the number of herbaria in Korea (Table 3). An estimate of plant taxonomists and herbaria in Korea from this book showed the only six herbaria (13 herbaria in current web site of the Index Herbariorum) including less than five active taxonomists.

Table 3. Korean herbaria with the number of specimens and the year of foundation. Acronyms are shown in Index Herbariorum (Holmgren *et al.* 1990).

Institute	No. of reportedspecimens	Estimated no. of Specimens	Curator	Year of foundation
SNU	250,000	ca. 80,000	-	1953
SNUA	100,000	ca. 80,000	-	1952
KUS	50,000	ca. 25,000	-	1953
SKK	27,000	ca. 27,000	-	1953
IUI	10,000	ca. 10,000	-	-
KFI	25,000	ca. 25,000	-	-
GNUC (only in web site)		ca. 20,000	-	-
KNU (only in web site)		ca. 20,000	-	-
JNU (only in web site)		ca. 25,000	-	-
Kang-Won Nat' l Univ.		ca. 30,000	-	-
NPRI (only in web site)		ca. 25,000	-	-
Han-Nam Univ.		ca. 10,000	1	-
JJU (only in web site)		ca. 30,000	-	-
Cheon-Nam Nat' l Univ.		ca. 40,000	-	-
EWH (only in web site)		ca. 25,000	-	-
Others		ca. 50,000	-	-
Total		ca. 500,000		

Herbarium specimens are the only acceptable records of the occurrence of species. Herbarium specimens provide vouchers documenting a species existence at a particular place and time and are a valuable contribution to the knowledge of the flora of any given area. Without the existence of voucher specimens, it is impossible to prove or to disprove distribution records of species. Every taxonomist knows that the herbarium is a valuable tool in the field of botanical research. To be useful, however, it should contain material of every species present in the region covered by the herbarium. Unfortunately a large number of poor specimens without good collecting data had been preserved in Korea.

The current Korean taxonomists should encourage and support field studies for young scientists involving collaboration of systematics of various tools. What is needed is identification of the distribution of the taxon, population size, critical parts to its life cycle, the community structure to which it belongs, and the prepare management techniques needed to preserve the species from extinction. The ultimate goal is to inventory and survey the plant distribution and biodiversity of many regions before they are severely modified and destroyed.

Until we have a basic knowledge about a flora, it will be impossible to develop a sound conservation. This will involve well-trained persons in field taxonomy.

Due to no reliable data on the number of specimens in Korea, it is not clear about the information on total number of specimens and the average number of specimens per herbarium. Personal observations and experiences provide approximate figures on ca. 500,000 and ca. 25,000 as the total number of specimens within Korea and the average number of specimens per herbarium respectively (Table 3). It may be noted that these numbers are far below the numbers of China (10,418,583 and 53,406) according to Qin (1999).

In 1980, plant collections of Korea were revised by T. B. Lee at our institute. Thirty years of his intensive work at the herbarium produced the Flora of Korea. His work provided predictive frameworks of Korean plants and natural history information useful in establishing natural areas or reserves. Also, other Korean taxonomists produced their continued work as different flora books. On the other hand, additional work on the flora of China, Japan and Russia has provided numerous new data on Asian plants. Further, many nomenclatural changes have occurred and necessitate an update of the Flora. The best persons to collect specimens and to make inventories are herbarium taxonomists since they are conversant with nomenclature, field experience and the special techniques for collections. We need new Korean Flora so badly now.

The optimum mode for the support of basic research in systematics is through grants to individual investigators. Unfortunately, such large grants normally restricted to applicants who have been principal investigators on molecular taxonomy. We urge that the systematic programs encourage and support field studies involving collaboration of systematics of various disciplines. Also, we recommend that the systematic programs react favorably toward networks of investigators contributing to a common systematic problem internationally. Particularly effective uses of such funds include short-term visits by taxonomists to institutions with collaborators, critical collections, specialized methodologies or other resources, work by investigators from small institutions at large, well-equipped research facilities, and improved information exchange and retrieval among international network members in eastern Asia.

Our institute which includes the arboretum and the herbarium (SNUA) and the systematic laboratories is working on both chemosystematics and conservation biology. First, we would like to establish priorities and funding for regional and

local collections as well as international collections. Second, we would like to develop research initiation projects on plant speciation in eastern Asia using chemosystematic tools and to stimulate more collaborative research by funding networks of researchers across the countries.

3. Conclusions and our efforts

The implementation of the accelerated systematic work we recommended in Korea will need a large increase in funding for human resources and floristic work. Fortunately, the 21 Century Frontier program supported by the Ministry of Science and Technology could expedite collaborative studies involving teams of investigators and extended work for the Korean flora this October ($ 370,000/ year). Our group (young plant taxonomists) expresses, however, concern with the utilization and the housing of specimens for this project. Our unit also should concern itself with the improvement of facilities for specimens in eastern Asia. Another topic of discussion for this program was the difficulties in obtaining human resources for special tasks. Principal investigators in Korea must therefore consider these problems and include requests for additional personnel from China, Russia and Japan to accommodate the amplified work load. It is evident that studies in taxonomic botany require settled conditions as well as cooperation among botanists and institutions. Adequate communications is really essential to us for exchange of specimens, living materials and literature among Asian countries.

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