
Research Note

Organisms Appearing in Japanese and Korean Elementary School Science Textbooks – A Preliminary Study –**Nobuyasu Katayama^{1)*}, Yoona Lee²⁾**¹⁾ *Tokyo Institute of Biology Education, Japan*²⁾ *Formerly Seoul National University of Education, Korea*

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Similarities in the science curricula between Japan and Korea have been frequently pointed out. The purpose of the present study was to compare the organisms appearing in elementary science textbooks used in Japan and Korea and identify their similarities and differences in the contents from the viewpoint of biology education for biodiversity. In Korea, there is only one series of science textbooks for the third grade to the sixth grade students published by the government. On the other hand, there are 6 series of science textbooks for the third grade to the sixth grade students published by private publishers in Japan; so, we selected the leading one from among them for this study. The organism names appearing in these textbooks from both countries are mostly species names, but sometimes genus, family or order names. The number of the organism names in Korean textbooks is almost twice as large as that in Japanese textbooks. In both textbooks, most organisms are “higher” plants and “higher” animals: there are 7 protists, 1 lichen, 61 plants and 65 animals in Japanese textbooks and 2 protists, 2 fungi, 111 plants and 115 animals in Korean textbooks.

Keywords: comparative study, elementary science textbook, Japan, Korea, organisms, textbook survey

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BACKGROUND AND OBJECTIVE OF PRESENT RESEARCH

Similarities in the science curricula between Japan and Korea (see Note 1) have been frequently pointed out. At present, in elementary schools, science is taught from the third grade to the sixth grade in conformity with the national science curriculum in both countries. We carry out cooperative research work to compare the contents of science teaching in elementary schools in Japan and Korea. The present study aimed mainly to compare the organisms used for

teaching science in elementary schools in both countries from the viewpoint of biodiversity education (see Note 2).

Although the newly revised national science curriculum for elementary schools has been enforced from the 2011 school year in both countries, in the present study, we surveyed Japanese and Korean elementary science textbooks used in 2010. In the survey, the organisms appearing in these science textbooks were listed and compared. We know the most important things regarding organisms are “how

these organisms are dealt with in these textbooks” and “what topics are taught by using these organisms.” Therefore, when we surveyed textbooks, we recorded not only organisms’ names but also how these organisms were dealt with. In the present paper, however, we only note organism names appearing in the textbooks, sort them taxonomically and analyze the differences between Japanese and Korean textbooks, because we consider it also important that students realize the diversity of organisms.

Katayama and Kanaizuka (2004) surveyed science textbooks for Japanese compulsory schools published within a time span of about 50 years from the 1950s to 2002 and reported the changes in how algae had been dealt with. Umeno (2007) also surveyed biological terms including organism names appearing in science textbooks for Japanese compulsory schools. Such surveys of organisms and biological terms appearing in school science and biology textbooks can give valuable information about biology education in the corresponding country. The information also may contribute to the development of biology education in other countries. Therefore, the present results, together with the reports mentioned above, may be useful as basic information for analyzing and comparing the contents of elementary science textbooks in further studies as well as for producing or revising elementary science textbooks in the future.

TEXTBOOK SURVEY

In Japan, six series of elementary science textbooks are published. Among them, the series of textbooks published by Dainippon-tosho Co. Ltd. was selected, because this series was chosen by schools most among the six series of textbooks (The Jiji Press, 2009; also, see websites of the National Institute for Educational Policy Research and the Textbook Publishers Associa-

tion of Japan). The textbook series we surveyed was published in 2005. In this report, we refer to it as the Japanese textbook.

In Korea, there is only one series of elementary science textbooks edited by the national government (Department of Education and Human Development) and published by Daehan Printing & Publishing Co. Ltd. The textbook series we surveyed was published in 2007. In this report, we refer to it as the Korean textbook.

The names of organisms mentioned in the text or mentioned with photographs or with illustration in these textbooks were listed, and then, the organisms were classified into taxonomic groups (These organism names are shown in the Appendix). Although Cavalier-Smith (2004) recently proposed the concept of six kingdoms, we adopted five kingdoms proposed by Whittaker (1969), i.e., Monera, Protista, Fungi, Plantae and Animalia.

In the textbooks surveyed, some organisms were mentioned by their species’ names and the others were mentioned by their genus names or by generic names (general names). We regarded organisms in the same family, one of which was mentioned by species name and another by generic name (e.g. kidney bean, *Phaseolus coccineus*, and bean), as different organisms for the sake of convenience.

THE CONTENTS OF JAPANESE AND KOREAN TEXTBOOKS

The chapters and sub-chapters related to organisms in the Japanese textbook and the Korean textbook are shown in Table 1 and Table 2, respectively. Although topics of the textbook for students in each grade were somewhat different between the two countries, the contents of the textbook series of both countries as a whole were not so different.

Table 1: The contents related to organisms and their environments in the Japanese textbook (published by Dainippon-tosho)

<p><For the third grade> Expedition in Nature How Plants Grow (1) Let's sow seeds: Sowing seeds, germination of seeds (2) How well the plants grow: Plant body structure, root, stem, leaf (3) Flower blooms; then fruit is borne (4) Fruit ripens: Lifecycle of various plants Raising a Butterfly From egg to larva, insect food, from pupa to imago Let's Examine Insects Examine the body structure of various insects, the pattern of insect growth, food and habitat of insects</p>
<p><For the fourth grade> Let's Examine Various Organisms in Different Seasons (1) In spring Let's examine animals around us Let's examine plants around us (2) In summer Let's examine animals around us Let's examine plants around us (3) In late summer (4) In autumn Let's examine animals around us Let's examine plants around us (5) In winter Let's examine animals around us Let's examine plants around us Look for organisms passing the winter (6) In early spring</p>
<p><For the fifth grade> The Continuity of Life (1) Seed germination Conditions of germination, germination and seed storage nutrients (2) Nutrients and sunlight which encourage plant growth (3) Embryo development and birth: a mysterious event (Select A or B) A. Development of fish embryo Male and female killifish, development of killifish embryos, food for pond fish B. Development of a human embryo (4) Production of fruit and seeds Stamen and pistil, role of pollen, pollination, means of pollen transportation</p>
<p><For the sixth grade> Organisms and Nourishment (1) Plant leaves and sunlight Photosynthesis (2) Plants eaten by animals Herbivores, detritus feeders, Animal (Human) Body Structure Respiration, digestion and absorption, blood circulation, skeletons and muscles Organisms and Their Natural Environment The way of life of various organisms, organism-air relationship, organism-water relationship, organism-nourishment relationship, our life and the environment</p>

Table 2: The contents related to organisms and their environments in the Korean textbook

<p><For the third grade></p> <p>Organisms in Water Organisms in water, conditions for raising fish in a fishbowl, body structure of aquatic animals such as fish, predator-prey relationships</p> <p>The Lifecycle of <i>Drosophila</i> Body structure of insects, lifecycle of insects, holometaboly and hemimetaboly</p> <p>Plant Leaves and Stems Methods of leaf observation, classification of leaves based on their morphologies, leaf positioning, various features of stems / trunks, function of stems: pathways of water and nutrients, trunks and year rings</p>
<p><For the fourth grade></p> <p>Beans Conditions of seed germination, conditions of plant growth, lifecycle of kidney beans and garden balsam</p> <p>Plant Roots Structure and function of roots</p> <p>Body Structure of Animals Body structure of various animals, classification of animals based on their morphologies, the habitats and lifestyles of animals</p> <p>Male and Female Animals Difference between males and females, mating behaviour, animal propagation methods, animal growth and life span</p>
<p><For the fifth grade></p> <p>Flowers Classification of flowers based on their morphologies, male flowers and female flowers, Role of flowers, pollination, means of pollen transportation</p> <p>Functions of Leaves Photosynthesis, stomata and transpiration, how to operate a microscope</p> <p>Microorganisms Microorganisms living in water, microorganisms living in the soil</p> <p>Organisms and Their Environment Temperature-organism relationship, light-organism relationship, water-organism relationship, relationships among organisms, adaptation of animals, human impacts upon the environment</p> <p>Fruits Fruit production, various fruit and seeds, methods of seed propagation, fruit and seeds in our lives</p>
<p><For the sixth grade></p> <p>Structure and Function of Human Body Skeleton and muscles, the respiratory system, the circulatory system, the digestive organ system, the excretory organ system, the nerve and sensory organ system</p> <p>Organisms around Us Inquiry into organisms around us, rough classification of organisms around us, classification of animals, classification of vertebrates based on their features, classification of invertebrates based on their features, classification of plants, phanerogams and cryptogams</p> <p>Comfortable Environment Requirements for organism survival, producers, consumers and decomposers, predator-prey relationships (food chain), ecological pyramid and the balance of the ecosystem, environmental issues and environmental conservation</p>

RESULTS OF TEXTBOOK SURVEY

Organism names mentioned in the text and shown by photographs in both Japanese and Korean textbooks were domestic names most of which indicated the species or genus. Sometimes generic names which indicate a genus or organisms classified into some different genera were used (e. g., the generic name “mame” in

Japanese may include all sorts of legumes). In the Japanese textbook, the names of organisms were sometimes not mentioned, especially when these organisms were shown by illustrations. On the other hand, in the Korean textbook, the names of most organisms shown, not only by photographs but also by illustrations were mentioned.

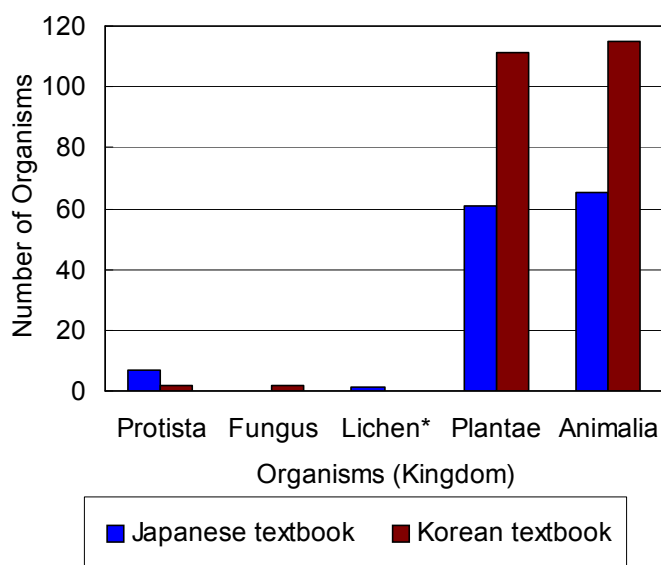


Figure 1: Total number of organism names from each kingdom appearing in the Japanese and Korean textbooks.

* Lichen species cannot be classified into any kingdom.

The number of organisms, whose names appeared in the Japanese textbook and in the Korean textbook, in every kingdom was shown in Figure 1 and in Table 3. In the Japanese textbook, litmus which is the genus name of lichen *Roccella* appeared in the explanation of the litmus test. Lichens could not be classified into any kingdom. Therefore, in Figure 1 and Table 3, the lichen is shown separately. The total number of organism names appearing in the Japanese textbook was 134, and most of them were species names or genus names. The total number of organism names appearing in the Korean textbook was 229, about 1.8 times larger

than that in the Japanese textbook. As shown in Figure 1, the organisms appearing in textbooks of both countries belonged mostly to the plant kingdom (61 in Japanese, 111 in Korean) and the animal kingdom (65 in Japanese, 115 in Korean). No names of Monera appeared in the textbooks of either country.

As shown in Table 3, in both Japanese and Korean textbooks, most of the organisms belonging to the plant kingdom were dicotyledonous angiosperms, and as for the organisms belonging to the animal kingdom, insects and vertebrates were large in number. To examine the number of organisms belonging to each classifi-

cation group in detail, there were some differences between the Japanese textbook and the Korean textbook (See Table 3 and Appendix).

Table 3: The number of organism names which appeared in the Japanese and Korean textbooks

Classification		Number of organism names		
		J*	K**	
Protista		7	1	
Lichen***		1	0	
Fungi		0	2	
Plantae	Bryophyta	0	2	
	Pteridophyta	0	1	
	Gymnosperms	2	8	
	Angiosperms	Dicotyledon	50	81
		Monocotyledon	9	19
Animalia	Cnidaria	0	2	
	Platyhelminthes	0	1	
	Annelida	1	1	
	Mollusca	3	5	
	Echinodermata	0	2	
	Arthropoda	Arachnida	1	2
		Crustacea	3	6
		Diplopoda	1	0
		Insecta	27	29
	Chordata	Pisciformes	8	10
		Amphibia	1	4
		Reptilia	0	4
		Aves	5	23
Mammalia		15	26	
Total		134	229	

*J: Japanese textbook (published by Dainippon-tosho), **K: Korean textbook.

*** Lichen is not a kingdom, but lichen species cannot be classified into any kingdom.

In the Japanese textbook, although Katayama and Kanaizuka (2004) reported that no algal names appeared in the previous textbook series published in 2002, there were 7 protists which were phytoplankton and seaweeds.

There was no name of fungi. Plants appearing in the Japanese textbook were only gymnosperms and angiosperms most of which were cultivated ones (See Appendix). The number of organisms belonging to Arthro-

Pods, most of which were insects, was larger than that of vertebrates. Most vertebrates were fish and mammals and there was no reptile. The selection of organisms for Japanese elementary science textbooks was quite unbalanced, and seemed to be inappropriate for studying biodiversity.

In the Korean textbook, one genus name of protists and two generic names of fungi (mold and mushroom) appeared. Among the plants appearing in the textbook, two mosses and one fern were included. As for invertebrate animals, the names of coelenterates, flatworms and echinoderms appeared, which were lacking in the Japanese textbook, although most of them were generic names. The number of organisms belonging to vertebrates was nearly two times larger than that of Arthropods and all classes of vertebrates were covered. It is noteworthy that the number of organisms belonging to the class

Aves was quite large and nearly equal to that of mammals. Although the Korean textbook covered the plant and animal kingdoms more widely than the Japanese textbook, the selection of organisms in the Korean textbook also did not seem to be satisfactory from the viewpoint of biodiversity education.

The number of organism names appearing in the textbooks from the third grade to the sixth grade fluctuated depending on the contents of the textbook (Table 4). Textbooks dealing with ecosystems, the Japanese textbook for the sixth grade and the Korean textbook for the fifth grade, were somewhat rich in the number of organism names. On the other hand, in the Japanese textbook for the fourth grade, the number of organism names was considerably smaller than in others, because some selected organisms were dealt with throughout the year.

Table 4: The number of organisms in each kingdom* whose names appeared in the Japanese and Korean textbooks for each grade

Grade	Japanese textbook (published by Dainippon-tosho)					Korean textbook				
	Pr	L	F	Pl	A	Pr	L	F	Pl	A
3rd	0	0	0	21	20	0	0	0	55	22
4th	0	0	0	13	10	0	0	0	19	57
5th	0	0	0	22	17	1	0	2	54	40
6th	7	1	0	26	27	0	0	0	26	43

*Pr: Protista, L: lichen, F: Fungi, Pl: Plantae, A: Animalia.

Lichen is not a kingdom, but lichen species cannot be classified into any kingdom.

In addition to the difference in the total number of organism names, there was another distinct difference between Japanese and Korean textbooks. We examined how often each organism appeared in the textbook series. We considered organisms whose names appeared on at least four pages in the textbook series to be

key organisms. Table 5 shows the domestic names and scientific names of these key organisms. In the Japanese textbook, some organisms were dealt with repeatedly in different chapters and subchapters. Therefore, the names of some particular organisms appeared on many pages in one textbook. Such organisms

maybe appeared in the textbook series of other publishers and are considered to correspond closely to the “organisms of high universality” in the report of Umeno (2007). In the Korean textbook, the number of such key organisms was

very small compared to that in the Japanese textbook. In the Japanese textbook, the key organisms sometimes were dealt with throughout the year; that means students learn some different topics by these organisms.

Table 5: The names of “key organisms*” in the Japanese and Korean textbooks

Grade	Japanese textbook (published by Dainippon-tosho)	Korean textbook
3rd	Okra (<i>Abelmoschus esculentus</i>) Garden balsam (<i>Impatiens balsamina</i>) Oriental longheaded locust (<i>Acrida cinerea</i>) Cabbage butterfly (<i>Pieris rapae</i>)	Daimyo oak (<i>Quercus dentata</i>) Cherry tree (<i>Prunus</i> sp.) Bamboo grass (<i>Sasa</i> sp.) Fruit fly (<i>Drosophila</i> sp.) Crucian carp (<i>Carassius carassius</i>)
4th	Fat hen (<i>Chenopodium album</i>) Balsam pear (<i>Momordica charantia</i>) Sponge gourd (<i>Luffa aegyptiaca</i>) Chinese mantis (<i>Tenodera aridifolia</i>) Japanese rhinoceros beetles (<i>Trypoxylus dichotomus</i>) Japanese toad (<i>Bufo japonicus</i>) Barn swallow (<i>Hirundo rustica</i>)	Bean (<i>Phaseolus coccineus</i>) Korean stag beetle (<i>Lucanus maculifemoratus dybowskii</i>)
5th	Morning glory (<i>Ipomoea nil</i>) Kidney bean (<i>Phaseolus coccineus</i>) Killifish (<i>Oryzias latipes</i>) Human (<i>Homo sapiens</i>)	
6th	Kidney bean (<i>Phaseolus coccineus</i>) Potato (<i>Solanum tuberosum</i>) Pillbug (<i>Armadillidium vulgare</i>) Rabbit (<i>Oryctolagus cuniculus</i>) Cattle (<i>Bos taurus</i>) Human (<i>Homo sapiens</i>)	Rice (<i>Oryza sativa</i>)

* Organisms whose names appeared on at least four pages in the textbook series are considered to be key organisms. Plant names are shown in green and animal names in purple.

DISCUSSION

The results of the present survey indicate that, compared to the Korean textbook, the Japanese textbook seems to select biological materials more carefully for science teaching in

elementary schools, although the viewpoint of biodiversity education is lacking. We surmise the reasons as follows:

Recently in Japan, it has been pointed out (see Note 3 in detail) that 1) Most elementary

school teachers are not good at teaching science, because they were not science education majors in pre-service teacher training courses, 2) On biology education in elementary schools, many teachers know few organism names because they are not familiar with organisms, and 3) Many elementary school teachers wish to use some very familiar organisms for teaching materials and they expect to reduce the number of organisms appearing in science textbooks (see Note 3 in detail). The small number of organism names appearing in the Japanese textbook and the fact that the majority of plants were cultivated species may reflect this situation. On the other hand, such problem seems to have not occurred yet in Korea, because most Korean elementary school teachers have been instructed well in biological teaching materials at teacher training colleges and in-service training programs (Professor Jae-Young Kim's personal communication).

However, to confirm these differences in biological knowledge of elementary school teachers in both countries, we have to carry out a survey on how well elementary school teachers in both countries know the organisms which appear in the textbooks they are using. The same survey to elementary school children will also give us meaningful information on the teaching skills in science of elementary school teachers in both countries. In addition, a survey on whether these organisms are easily available to elementary school teachers is also required. Together with the results of the present study, these results would be useful for selecting organisms for elementary school science education in the future.

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Note 1: In the present paper, we refer to the Republic of Korea simply as Korea.

Note 2: The present paper was read at the 23th Biennial Conference of AABE, Singapore (2010).

Note 3: There are several reports, written in Japanese, on this topic, for example, Tsuchida and Hayashi (2005), Japan Science and Technology Agency (2010, 2012), Benesse Educational Research and Development Institute (2010), Nakata *et al.* (2012) and Naganuma (2015).

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Appendix (List of organism names appearing in the Japanese and Korean textbooks)

Organism names are basically shown by their species names or genus names. The organisms whose scientific names cannot be determined are printed in their domestic names or generic names (sometimes family names are indicated).

[Japanese textbook]

Protista: green laver (*Enteromorpha* sp.), duckweed (*Spirogyra* sp.), *Closterium ehrenbergii*, *Biddulphia* sp., *Arachnoidiscus ehrenbergii*, kelp (*Laminaria* sp.), *Undaria pinnatifida*

Lichen: litmus (*Roccella* sp.)

Plantae: Gymnosperms *Ginkgo biloba*, *Cryptomeria japonica*; **Angiosperms <Dicotyledon>** *Fagus cre-nata*, *Ficus carica*, *Ficus erectus*, *Morus bombycis*, *Chenopodium album*, *Achyranthes bidentata*, *Portulaca oleracea*, *Nymphaea tetragona*, *Cabomba caroliniana*, *Magnolia denudate*, *Brassica campestris* var. *napus*, *Brassica campestris* var. *perviridis*, *Brassica oleracea* var. *capitata*, red cabbage (*Brassica oleracea* var. *capitata*), *Raphanus sativus*, *Hydrangea macrophylla*, *Fragaria ananassa*, cherry tree (*Prunus* sp.), *Prunus mume*, *Malus pumila*, *Trifolium repens*, *Phaseolus coccineus*, *Vicia angustifolia*, *Vicia cracca* var. *japonica*, *Pueraria lobata*, *Zanthoxylum piperitum*, *Poncirus trifoliata*, mikan (*Citrus* sp.), grapefruit (*Citrus* sp.), *Impatiens balsamina*, *Abelmoschu esculentus*, *Daucus carota* var. *sativa*, *Petroselinum sativum*, *Cathanthus roseus*, *Ipomea nil*, *Ipomea batatas*, *Salvia splendens*, mint (*Mentha* sp.), *Lycopersicon esculentum*, *Solanum tuberosum*, *Momordica charantia*, *Luffa cylindrical*, pumpkin (*Cucurbita* sp.), *Cucumis melo*, *Xanthium occidentale*, *Artemisia princeps*, *Ambrosia artemisiaefolia*, *Erigeron canadensis*, *Cosmos bipin-nayus*, *Helianthus annuus*; **<Monocotyledon>** *Egeria densa*, *Phragmites communis*, *Oryza sativa*, *Setaria viridis*, *Triticum aestivum*, *Miscanthus sinensis*, *Zea mays*, *Spirodela polyrhiza*, lily (*Lilium* sp.)

Animalia: Annelida earthworm; **Mollusca** terrestrial snail (*Euhadra* sp.), *Radix auricularia japonica*, river snail (*Cipangopaludina* sp.); **Arthropoda <Arachnida>** *Argiope amoena*, **<Crustacea>** *Procambarus clarkia*, *Armadillidium vulgare*, water flea (*Daphnia* sp.), **<Diplopoda>** millipede, **<Insecta>** cicada, *Graptopsaltria nigrofuscata*, aphid, locust, *Acrida cinerea*, grasshopper (*Oxya* sp.), phasmids (*Entoria* sp.), *Tenodera aridifolia*, *Allomyrina dichotoma*, *Luciola cruciata*, *Coccinella septempunctata*, dragonfly, *Orthetrum albistylum speciosum*, springtail, *Camponotus japonicus*, honey bee (*Apis* sp.), species of Chalcidoidea, species of Agaonidae, *Colias erate*, *Pieris rapae*, *Papilio xuthus*, *Papilio machaon*, *Sasakia charonda* (*Diadema charonda*), *Bombyx mori*, *Biston robustus robustus*, species of Syrphidae, chironomids *lavea* (*Chronomus* sp.); **Chordata <Pisciformes>** *Rhincodon typus*, *Salvelinus* sp., *Oncorhynchus keta*, *Gambusia affinis*, killifish (*Oryzias* sp.), orange-colored mutant killifish (*Oryzias* sp.), *Carassius carassius*, *Carassius auratus auratus*, **<Amphibia>** *Bufo japonicus*, *Anas acuta*, **<Aves>** *Dendrocopos leucotos*, *Hirundo rustica*, *Motacilla alba*, *Gallus gallus domesticus*, **<Mammalia>** *Canis lupus familiaris*, *Ailuropoda melanoleuca*, *Felis silvestris catus*, *Panthera leo*, *Oryctolagus cuniculus*, *Mesocricetus auratus*, *Glirulus japonicus*, mole, *Bos taurus*, goat (*Capra* sp.), *Giraffa camelopardalis*, *Equus caballus*, elephant, whale, *Homo sapiens*

[Korean textbook]

Protista: duckweed (*Spirogyra* sp.)

Fungi: mold, mushroom

Plantae: Bryophyta *Marchantia polymorpha*, hair moss (*Polytrichum* sp.); **Pteridophyta** *Pteris aquilinum*; **Gymnosperms** *Ginkgo biloba*, *Cycas revolute*, *Torreya nucifera*, pine (*Pinus* sp.), *Pinus densi-flora*, *Pinus koraiensis*, *Abies firma*, *Thuja orientalis*; **Angiosperms <Dicotyledon>** *Quercus acutissima*, *Quercus dentate*, *Quercus mongolica*, *Corylus heterophylla*, *Betula platyphylla*, *Zelcova serrata*, *Viscum album*, *Chenopodium rubrum*, *Mirabilis jalapa*, *Dianthus caryophyllus*, *Dianthus superbus* var. *longicaly-*

cinus, *Nelumbo nucifera*, *Cercidiphyllum japonicum*, *Pulsatilla cernua*, *Magnolia liliflora*, *Magnolia denudata*, *Dicentra spectabilis*, red cabbage (*Brassica oleracea* var. *capitata*), *Raphanus sativus*, *Platanus occidentalis*, *Fragaria ananassa*, *Malus pumila*, rose (*Rosa* sp.), *Rosa multiflora*, *Rosa rugosa*, cherry tree (*Prunus* sp.), *Prunus armeniaca* var. *anzu*, *Prunus persica* var. *vulgaris*, pear (*Pyrus* sp.), bean, black bean (*Glycine max*), *Robinia pseudo-acacia*, *Phaseolus coccineus*, *Trifolium repens*, *Lespedeza maximowiczii*, mikan (*Citrus* sp.), *Buxus microphylla*, *Rhus javanica*, *Euonymus japonicus*, maple (*Acer* sp.), *Impatiens balsamina*, *Impatiens textori*, *Zizyphus jujube*, *Vitis coignetiae*, *Vitis vinifera*, *Parthenocissus tricuspidata*, *Hybiscus syriacus*, *Gossypium indicum*, camellia (*Camellia* sp.), violet (*Viola* sp.), begonia (*Begonia* sp.), cactus (*Opuntia* sp.), *Trapa natans*, *Panax schinseng*, *Daucus carota* var. *sativa*, azalea (*Rhododendron* sp.), *Ipomea nil*, *Calystegia japonica*, *Syringa dilatata*, *Forsythia suspense*, *Cornus officinalis*, *Elsholtzia ciliate*, *Solanum tuberosum*, *Lycopersicon esculentum*, *Petunia hybrida*, pumpkin (*Cucurbita* sp.), *Luffa cylindrica*, *Cucumis sativus*, *Zinnia elegans*, *Helianthus annuus*, *Kalimeris yomena*, *Cosmos bipinnatus*, *Bidens bipinnata*, *Bidens tripartita*, *Chrysanthemum morifolium*, *Artemisia princeps*, thistel (*Cirsium* sp.), *Cirsium japonicum* var. *ussuriense*, *Arctium lappa*, dandelion (*Taraxacum* sp.), *Taraxacum albidum*; <Monocotyledon> *Typha latifolia*, *Hydrilla verticillata*, bamboo grass (*Sasa* sp.), *Oryza sativa*, *Triticum aestivum*, *Hordeum vulgare*, *Phragmites communis*, *Setaria viridis*, *Zoysia japonica*, *Miscanthus sinensis*, *Zea mays*, *Spirodela polyrhiza*, *Commelina communis*, *Tradescantia reflexa*, *Eichhornia crassipes*, lily (*Lilium* sp.), *Lilium lancifolium*, *Narcissus tazetta*, *Iris sanguinea*

Animalia: **Cnidaria** sea anemone, jellyfish; **Platyhelminthes** *Planaria* sp.; **Annelida** earthworm; **Mollusca** terrestrial snail (*Euhadra* sp.), *Semisulcospira libertina*, river snail (*Cipangopaludina* sp.), *Turbo sazae*, squid; **Arthropoda** <Arachnida> spider, *Argiope bruennichii*, <Crustacea> *Cambaroides japonicus*, crab, *Ocypode stimpsoni*, *Armadillidium vulgare*, corn barnacle, water flea (*Daphnia* sp.), <Insecta> cicada, *Graptosaltria nigrofusca*, *Hyalessa maculaticollis*, *Aquarius paludum*, *Ranatra chinensis*, locust, *Ducetia japonica*, grasshopper (*Oxya* sp.), *Oxya chinensis*, praying mantis (*Tenodera* sp.), *Cybister japonicus*, *Paracycrotrachelus longiceps*, *Lucanus maculifemoratus dybowskii*, *Massicus raddei*, firefly (*Luciola* sp.), ladybird (*Coccinella* sp.), dragonfly, *Crocothemis servilia*, ant, butterfly, *Papilio xuthus*, moth, *Adris tyrannus*, *Actias aliena*, *Eristalis tenax*, *Musca domestica*, fruit fly (*Drosophila* sp.), mosquito; **Echinodermata** starfish, *Patiria pectinifera*; **Chordata** <Pisciformes> *Gasterosteus aculeatus*, *Cyprinus carpio*, *Carassius carassius*, *Carassius auratus auratus*, *Pungtungia herzi*, *Tanakia lanceolata*, *Zacco temmincki*, *Amphiprion clarkia*, mackerel (*Scomber* sp.), flying fish (*Cypselurus* sp.); <Amphibia> newt (*Cynops* sp.), frog, green tree frog (*Rhacophorus* sp.), *Pelophylax nigromaculatus*; <Reptilia> turtle, iguana, lizard, snake; <Aves> *Aix galericulata*, *Ardea cinerea*, white heron (*Egretta* sp.), *Grus japonensis*, *Numenius arquata orientalis*, *Larus crassirostris*, hawk (*Accipiter* sp.), *Aegyptius monachus*, *Strix uralensis*, *Bubo bubo*, *Caprimulgus indicus*, *Halcyon coromanda*, *Upupa epops*, *Alauda arvensis*, *Hirundo rustica*, *Ficedula zanthophygia*, *Phoenicurus aureus aureus*, *Zosterops japonica*, *Passer montanus*, *Columba livia*, *Pavo cristatus*, *Anas platyrhynchos* var. *domesticus*, *Gallus gallus domesticus*, <Mammalia> bat, *Canis lupus familiaris*, Korean Jindo dog, sand fox, *Vulpus lagopus*, *Ursus thibetanus*, *Felis silvestris catus*, *Panthera leo*, *Panthera tigris*, *Oryctolagus cuniculus*, squirrel, *Sciurus vulgaris corea*, camel (*Camelus* sp.), *Bos Taurus*, goat (*Capra* sp.), *Ovis aries*, deer, *Cervus elaphus*, *Capreolus capreolus*, *Sus scrofa domesticus*, *Giraffa camelopardalis*, elephant, dolphin, *Delphinus delphis*, *Pan troglodytes*, *Homo sapiens*