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Preliminary Survey on Spider Fauna of DMZ Areas in Korea

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Abstract

Spider fauna of Demilitarized Zone (DMZ) and adjacent areas in Korea was surveyed in 2001-2003, 2013-2015, and 2017. Total of 34 surveyed areas across 10 provinces were divided into four main regions (east coast, mid-east mountain, midland, and west coast areas) in accordance with administrative districts and topography. Total of 273 species of 145 genera in 32 families were identified from 10,886 collected spiders. In conclusion, the spider fauna in the DMZ is 281 species of 147 genera in 32 families with 162 species of 99 genera in 23 families in the previous reports. This corresponds to about 37.6% of the Korean spiders as of 2015. The species richness among surveyed localities was ranged 45 species to 92 species. The species richness of each taxon is high in Araneidae, Salticidae, Linyphiidae and Theridiidae. Habitat generalists were 22 species and habitat specialists were 69 species. The 143 species were web builders and 130 species were wanderers by the outlined life style. In DMZ spiders, only 7 species, *Thymoites ulleungensis*, *Arcuphantes pennatus*, *Lycosa coreana*, *Allagelena koreana*, *Cybaeus mosanensis* and *Cybaeus triangulus*, *Kishidaia coreana*, were recognized as Korean endemic. Five species, *Scytodes thoracica*, *T. ulleungensis*, *Lycosa labialis*, *Takeoa nishimurai*, and *Phrynarachne katoi*, are rare species with a trend of decreasing density in recent years. *Araneus rotundicornis* has been discovered for the first time since its first report. This study may be useful in the conservative management and will contribute to knowledge of the distribution and biogeography of DMZ areas in the future.

Key Words: spider, fauna, DMZ, Korea

Introduction

The Demilitarized Zone (DMZ), a symbol of ideological dispute between North and South Korea, winds 155 miles across the Korean Peninsula. Stretching from the Han River to the East Coast, it ranges 2 km north and south of the Military Demarcation Line (MDL), covering a vast region of 99,144 ha. Civil Control Zone (CCZ) which area is 231,405 ha was also established for the purpose of protection of military installations and national security. Protected form human access and economical development for past 7 decades, these areas contain many native animals and plants.

DMZ areas, which contain many ecosystem types such as rivers, forests, mountains, wetlands, prairies, bogs and estuaries, traverse mountain and plain regions from Gyodong Island in west to Goseong province in east. These areas are very important for biogeography in which many globally significant species and endangered species inhabit. Providing many types of habitats for rare cranes and other birds and animals, DMZ areas have been globally noticed for preserving significant species.

Many surveys on the biodiversity of plants and animals

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have been carried out within DMZ areas (Choi 1973; Kim et al. 1992; Lee et al. 2004; Park et al. 2005; Kim et al. 2006; Yoon et al. 2007; Kim et al. 2010; Lee et al. 2013). So far, however, there have been very few studies on the spider fauna in the DMZ and only a few partial surveys have been reported in some areas (Namkung et al. 1988; Kim 1996; 1999). This study was carried out to establish the inventory of the spiders in the DMZ as the first comprehensive and systematic report considering the whole ecosystem of the DMZ areas.

Materials and Methods

Environment of study areas and smapling schedule

The study areas were DMZ and CCL regions which is adjacent areas of DMZ, southern part of MDL. The survey areas were composed of thirty-four localities across ten provinces and divided into four main regions in accordance with climate, plantation, topographical characteristics such as streams and sea; east coast areas, mid-east mountain areas, midland areas, and west coast areas (Ta-

Table 1. Information of the surveyed areas and environment

Main areas	Surveyed sites	Longitude	Latitude	Habitat types
East coast areas	1. Mt. Gunbong , Goseong-gun, Gangwon-do	128° 22' 17"	38° 23' 28"	Mountain
	2. Madal-ri, Geojin-eup, Goseong-gun, Gangwon-do	128° 36' 87"	38° 51' 62"	Hillock
	3. Obong-ri, Jukwang-myeon, Goseong-gun, Gangwon-do	128° 29' 54"	38° 20' 45"	Hillock
	4. Yongdae-ri, Buk-Myeon, Injegun, Gangwon-do	128° 33' 05"	38° 25' 47"	Hillock
Mid-east mountain areas	5. Jangpyeong-ri, Bangsan-myeon, Yanggu-gun, Gangwon-do	127° 96' 91"	38° 21' 41"	Hillock
	6. Lake Paro, Yanggu-eup, Yanggu-gun, Gangwon-do	127° 46' 25"	38° 05' 45"	Lake
	7. Dongchon-ri, Hwacheon-eup, Hwacheon-gun, Gangwon-do	127° 50' 48"	38° 12' 21"	Dam
	8. Mt. Daesung, Hwacheon-gun, Gangwon-do	127° 35' 18"	38° 11' 47"	Mountain
Midland areas	9. Togyo reservoir, Igil-ri, Cheorwon-gun, Gangwon-do	127° 17' 30"	38° 16' 20"	Reservoir
	10. Mt. Godae, Cheorwon-gun, Gangwon-do	127° 17' 34"	38° 20' 08"	Mountain
	11. Dochang-ri, Ginhwa-eup, Cheorwon-gun, Gangwon-do	127° 27' 05"	38° 14' 34"	Hillock
	12. Mt. Geumhak, Cheorwon-gun, Gangwon-do	127° 12' 09"	38° 11' 00"	Mountain
	13. Goseokjeong, Jangheung-ri, Cheorwon-gun, Gangwon-do	126° 17' 25"	38° 11' 06"	Hillock
	14. Igili-ri, Dongsong-eup, Cheorwon-gun, Gangwon-do	127° 19' 58"	38° 18' 27"	Rocky mountain
	15. Daema-ri,Cheorwon-eup, Cheorwon-gun, Gangwon-do	127° 11' 01"	38° 17' 01"	Rice field
	16. Gangsan-ri, Dongsong-eup, Cheorwon-gun, Gangwon-do	127° 13' 09"	38° 16' 41"	Rice field
	17. Samyul-ri, Gwanin-myeon, Pocheon-si, Gyeonggi-do	127° 18' 04"	38° 16' 46"	Hillock
	18. Eundae-ri, Jeongok-eup, Yeonchon-gun, Gyeonggi-do	127° 04' 17"	38° 02' 35"	Bog
	19. Baekhak reservoir, Ami-ri, Yeonchon-gun, Gyeonggi-do	126° 55' 36"	38° 01' 45"	Reservoir
	20. Pk. Guksa, Jajang-ri, Paju-si, Gyeonggi-do	126° 53' 05"	37° 57' 22"	Peak
	21. Deoksan-ri, Sinseo-myeon, Yeoncheon-gun, Gyeonggi-do	127° 19' 33"	38° 18' 27"'	Mountain
	22. Mageo-ri, Jung-myeon, Yoncheon-gun, Gyeonggi-do	127° 13' 09"	38° 17' 01"	Mountain
	23. Hwoengsan-ri, Jung-myeon, Yeoncheon-gun, Gyeonggi-do	127° 58' 29"	38° 07' 47"	Mountain
	24. Mt. Jangmyeong, Odo-dong, Paju-si, Gyeonggi-do	126° 44' 09"	37° 45' 02"	Mountain
	25. Mt. Wollong, Deokeun-ri, Paju-si, Gyeonggi-do	126° 46' 52"	37° 47' 54"	Mountain
	26. Seongdong-ri, Tanhyeon-myeon, Paju-si, Gyeonggi-do	126° 44' 30"	37° 50' 50"	Estuary
	27. Imjin River, Munsan-eup, Paju-si, Gyeonggi-do	126° 44' 23"	37° 53' 22"	Basin
	28. Eoryong-ri, Jinseo-myeon, Paju-si, Gyeonggi-do	126° 51' 14"	37° 44' 00"	Hillock
	29. Cho-ri, Jindong-myeon, Paju-si, Gyeonggi-do	126° 49' 36"	37° 35' 46"	Hillock
West coast areas	30. Mt. Mani, Hwado-myeon, Ganghwa-gun, Incheon-si	126° 25' 19"	37° 37' 44"	Mountain
	31. Seokm° Isl., Ganghwa-gun, Incheon-si	126° 21' 36"	37° 40' 02"	Island
	32. Pk. Aegi, Haseong-myeon, Gimpo-si, Gyeonggi-do	126° 35' 32"	37° 44' 49"	Peak
	33. Mt. Munsu, Wolgot-myeon, Gimpo-si, Gyeonggi-do	126° 32' 03"	37° 44' 46"	Mountain
	34. Yonggang-ri, Wolgot-myeon, Gimpo-si, Gyeonggi-do	126° 54' 14"	37° 76' 49"	Upland

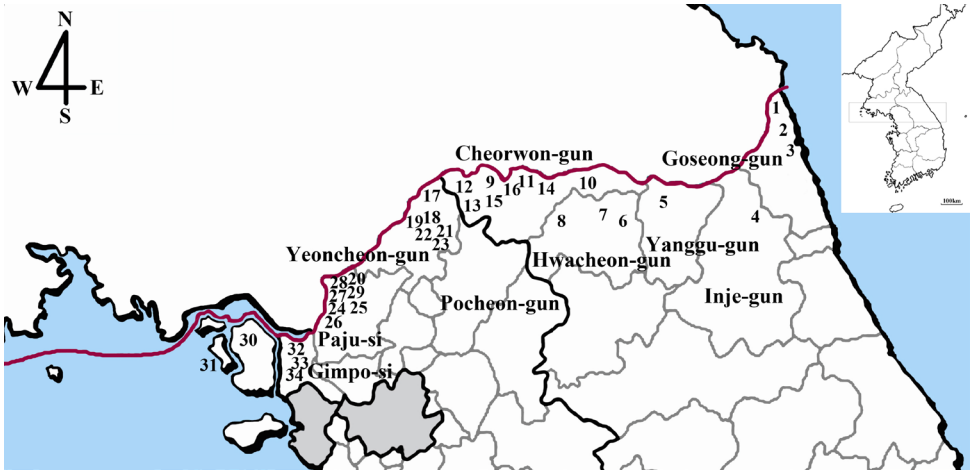

Fig. 1. A map of surveyed location of spiers in DMZ areas (refer to Table 1 for the exact administrative area for the number).

ble 1, Fig. 1).

East coast areas. This region is mainly composed of sandy coast. Some mountains with high elevation, highlands with 100-200 m altitude and many hillocks with 20-30 m altitude were developed along the coast line. Most of this region does not have ecologically stable forests from human interferences and repeatedly occurring forest fires. Setting fire to forests by military forces for clear visibility also accelerate this phenomenon. The survey within this region was conducted at 4 localities in 2001 and complementary in 2014.

Mid-east mountain areas. This region is a mountainous inland districts located in the `Taebaek Mountain. It is a steep area which is mostly composed of mountain districts with 900-1000 m altitude. This region is biogeographically important because many valleys, basins and origin of rivers are developed centering around the Taebaek Mountain. The survey on the spider fauna within this region was conducted at 3 localities in 2001 and complementary in 2015.

Midland areas. This region is composed of many types of habitual environment. They are some mountainous districts with above 800 m altitude, hillocks with below 500 m altitude, plains, reservoirs, agricultural fields and bogs. The survey on the spider fauna within this region was conducted at 10 localities in 2002 and 6 new localities in 2017.

West coast areas. This region is composed of small highland, alluvial plain, estuary swampy place and some mountains with low altitude. The survey on the spider fauna within this region was conducted at 11 localities in 2003 and complementary in 2016.

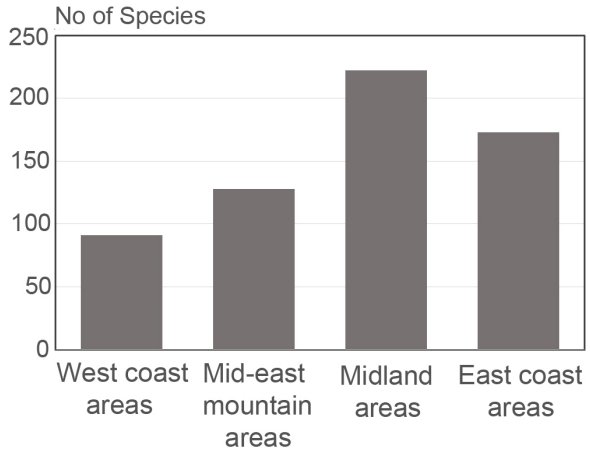

Fig. 2. Comparison of species richness between main areas.

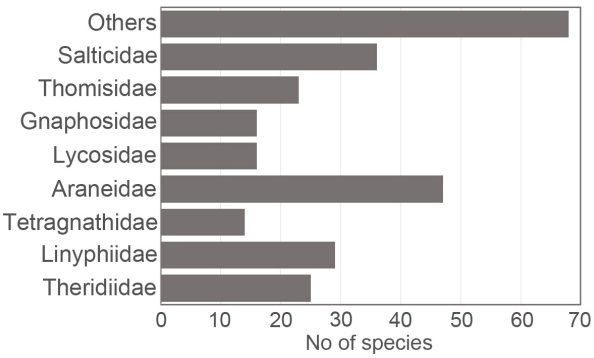

Fig. 3. Composition of DMZ spiders.

Spider collection

The survey for spiders was basically carried out 4 times a year, spring (April), summer (June to August), fall (Sep-

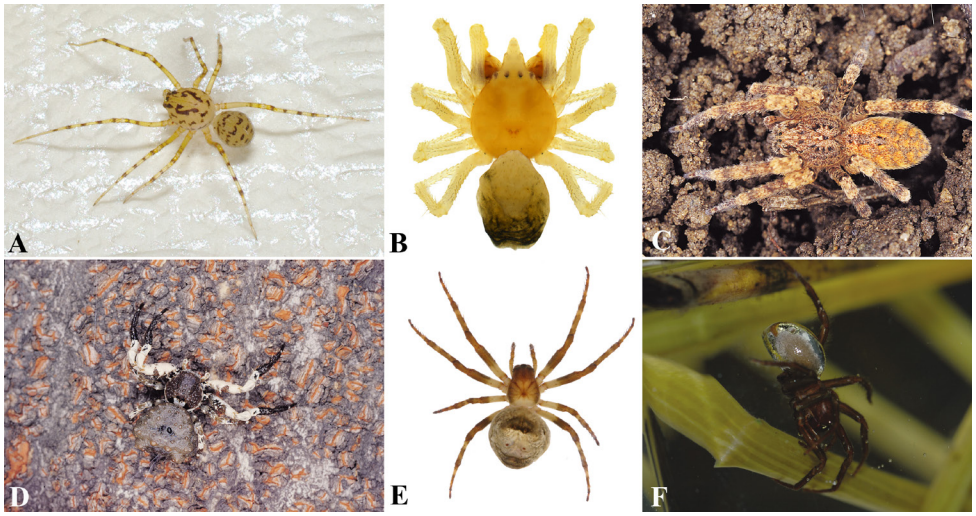

Fig. 4. Some important spiders in DMZ areas (A. *Scytodes thoracica;* B. *Thymoites ulleungensis;* C. *T. nishimurai*; D. *Phrynarachne katoi*; E. *Araneus rotundicornis;* F. *Argyrodes aquatica*).

tember to October), and winter (November to December) during the surveyed years. Since many parts of study areas were mine fields and military operational areas, collection methods were strictly restricted. Spiders were collected by sweeping, sieving, beating, brushing and using aspirator upon environmental and military condition of the collecting sites. Pitfall traps were installed to collect soil-inhabiting spiders in the environmentally permissive areas. Collecting efficacy, therefore, was not likely to be equal among regions and taxa. For some identifiable spiders with their external features were counted on site without collection. Collected spiders were preserved in 100% alcohol and then identified to the species level under dissecting microscope in the laboratory. The spider list was followed to World Spider Catalog (2018) and Yoo et al. (2015). The spider specimens from this study are deposited in Life and Environment Research Institute, Konkuk University.

Results and Discussion

Total of 273 species of 145 genera in 32 families were identified from 10,886 collected spiders (Supplementary Table 1). The species richness among surveyed localities was ranged 45 species at Goseokjeong in Cheorwon-gun, and Seongdong-ri and Eoryong-ri in Paju-si to 92 species at Mt. Daesung in Hwacheon-gun. According to main areas, the species richness was ranged 91 species in east coast areas to 222 species in midland areas (Appnd. 1, Fig. 2). So far, there have been very few studies on the spider fauna in the DMZ and only a few partial surveys have been reported in several areas (Namkung et al. 1988; Kim 1996; 1999). Namkung et al. (1988) reported 122 species (2 unidentified) of 67 genera in 17 families from 16 localities. Kim (1996; 1999) reported 54 species (2 unidentified) of 36 genera in 18 families from Paikryeong Island and 54 species (2 unidentified) of 54 genera in 14 families from Cheorwon provinces. Among them, 8 species, *Ero japonica* of Mimetidae, *O. sinensis* of Uloboridae, *Phoroncidia pilula* (= *Chrothiotes sudabides)* of Theridiidae, *Cyclosa confusa* and *Cyclosa okumae* of Araneidae, *Pardosa lugubris* of Lycosidae, *X. concretus* of Thomisidae, and *Pseudicius himeshimensis* of Salticidae, were not found in present investigation compared to their reports. In conclusion, according to the present result and the previous reports, the spider fauna in the DMZ is 281 species of 147 genera in 32 families. This corresponds to about 37.6% of the Korean spiders as of 2015 (Yoo et al. 2015).

The species richness of each taxon is high in Araneidae (47 species, 17.2% of total), Salticidae (36 species, 13.1%), Linyphiidae (29 species, 10.6%), and Theridiidae (25 species, 9.1%) in order (Fig. 3). Habitat generalists, found in more than twenty of the surveyed localities showing wide distribution, including *P. tepidariorum* (Theridiidae), *A. ventricosus* (Araneidae), and *P. astrigera* (Lycosidae) were 22 species (about 0.8%). Habitat specialists, found only a single locality, including *S. thoracica* (Scytodidae), *D. punctisparsa* (Theridiidae) and *M. testaceus* (Mimetidae), were 68 species (about 25.3%). The 143 species (about 52.4%)

were web builders and 130 species (about 47.6%) were wanderers (or hunters) by the outlined life style (Appnd. 1). In DMZ spiders, only 7 species (about 0.25% of total) from 281 species, *T. ulleungensis* of Theridiidae, *A. pennatus* of Linyphiidae, *L. coreana* of Lycosidae, *A. koreana* of Agelenidae, *C. mosanensis* and *C. triangulus* of Cybaeidae, *K. coreana* of Gnaphosidae, were recognized as Korean endemic. The reason for the low rate of endemic species among the spiders in the DMZ is that most of the endemic species are mostly soil-inhabiting in Korea (21.5% of total, Yoo et al. 2015), but most of the surveyed regions failed to operate the pitfall trap due to the military environment. Five species, *S. thoracica* of Sctodidae, *T. ulleungensis* of Theridiidae, *L. labialis* of Lycosidae, *T. nishimurai* of Zoropsidae, and *P. katoi* of Thomisidae, are rare species with a trend of decreasing density in recent years (Kim et al. 2016) (Fig. 4A-D). *A. rotundicornis* of Araneidae (Lee et al. 2012) has been discovered for the first time since their first report (Fig. 4E). Korean Cultural Heritage Administration registered the habitat of *A. aquatica* of Dictynidae (Fig. 4F), the only spider living in the water for the rest of my life worldwide and only known in Yeoncheon area in Korea, as natural monument No. 412 in 1999. Kim et al. (2014) designated this species as CR (Critically endangered) in Red Data Book of Endangered Spiders in Korea. The major threats on this species were the diminution of the habitat the landization progress the reduction of rainfall due to climate change, and fragmentation at the time of the evaluation. Ministry of Environment also designated this species as an 'endangered wildlife II' according to 'Wildlife Protection and Management Act (Act No.13882)' in 2017.

Many scientists have discovered hundreds of new and rare species adding to our knowledge of DMZ nature. Besides political and idealogical purposes, DMZ areas are very important spot of history for natural environment and wildlife since protected from economic development and human access for past 7 decades. Many survey projects and monitoring programs about the whole animals and plants in DMZ areas have been considered for conservational concerns, and habitat reservation for outstanding natural features by and large. Often, natural inventories can help to guide effective allocation of scarce conservation resources and management of them. Spider inventory provides important biodiversity information and prescribes management that maintains or enhances native biological diversity in addition to protecting ecosystem and conserving their productivity. Because spiders are the largest order of arachnids and rank seventh in the total species diversity among all other groups of organisms (Sebastin and Peter 2009), with 47,304 recorded species of 4,076 genera belonging to 116 families (World Spider Catalog 2018). Though spiders, abundant and ubiquitous generalist predators, play an important roles in most terrestrial ecosystems and there exist a growing works on spider conservation, they have not been received relatively little attention from the conservation research. Spiders, which have a distinct ecological niche, play several important roles in ecosystems: 1) as a component of biodiversity, 2) by contributing to material circulation and energy transfer through preying on many animals in higher trophic levels in the food web, 3) as a natural enemy that feed on many agricultural and forest insect pests, 4) as indicator species detecting environmental changes, such as global warming and environmental pollution, and 5) providing physiologically active substances, such as poison and spider thread, which has used in many research fields (Yoo et al. 2015).

Present results are characterized as pre-survey or preliminary before its use or conservation. Biological information including spiders might be helpful to decide the direction of conservation or development after unification of North and South parts conservation or development. Further inventory and research should address the protection of the biota and landscape around DMZ areas in order to protect habitats and fauna. DMZ areas are unique natural habitats and contain endemic and rare species. Further study of the biota and ecology of DMZ areas are therefore warranted. The objective of this study was to conduct biological inventory for spiders in DMZ areas that were not developed and were believed to have significant biodiversity and conservation value. This study may be useful in the conservative management and will contribute to knowledge of the distribution and biogeography of DMZ areas in the future.

Acknowledgements

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Supplementary Table 1. List of DMZ spiders.

Families	Species	Surveyed areas**																																		
		East coast Areas				Mid-east mountain areas				Midland areas																				West coast areas				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
Scytodidae*	*Scytodes thoracica*				1																															
Pholcidae*	*Pholcus cryptiocolens*		3	2				5	7		2		3				1	4	2		7	1		7	5	2			2	2			2	2		
	Pholcus extumidus	15			12																	2														
	Pholcus manueli	2		3								1		1				3								4										5
Mimetidae*	*Mimetus testaceus*	3																																		
Oecobiidae*	*Uroctea lesserti*											6																								
Uloboridae*	*Miagrammopes orientalis*				2	3	3	1	2		2		1	1				2							1					2						
	Octonoba sybotides	2			3				3	1	3		1			1		2			3				4	1				2			2		
	Octonoba varians				3											1																			
	Philoponella prominens						6			1		7		5	2							5		2				4	3	4						
	Uloborus walckenaerius					3	2												2																	
Nesticidae*	*Nesticella mogera*																			8				1				2							4	
Theridiidae*	*Anelosimus crassipes*	3	4	2	3	2			4		5		8					4			5				6	4				2	2	2	4	3	
	Ariamnes cylindrogaster		3	1			1								2										1										
	Chrysso albipes							3	4	4					1				2				1	3			2				1	2				
	Chrysso foliata									3					1																					
	Chrysso lativentris																				1								2							
	Coleosoma octomaculatum						2	3		2									4	4							3	4				2			2	
	Dipoena punctisparsa				2																															
	Enoplognatha abrupta				2																			1												
	Enoplognatha carcis				6											10	9																			
	Episinus nubilus					2																														
	Neospintharus fur			2			4																													
	Paidiscura subpallens	2		4	3		2			8			3				1	3	3						1			4	2	3	1	4	4	3	2	
	Parasteatoda angulithorax			1																			1												
	Parasteatoda culicivora				1																												2	2		
	Parasteatoda japonica		4							15							2		9	12				27					16							
	Parasteatoda kompirensis	6						8				9							11	13	17				5	6				8	3	4	8			
	Parasteatoda oculiprominentis					2	1	1		2								4	5								3	4				2			1	
	Parasteatoda tabulata		6			4				3					7	1																				
	Parasteatoda tepidariorum	2	4	7	3	6	7	8	2	7	5	3	5	4	7	4	7	3	6	11	8	5	3	3	7	12	11	6	8	9	11	5	4	3	4	
	Phycosoma mustelium														1																					
	Takayus latifolius	3	4		2		1		2		2	2	2																		4	3	2	1		
	Takayus takayense			3	4	1	2			1					2	1		2					2	4	6											
	Theridion pinastri		7	2						1	2			2	3				1					4					2	2		3			
	Thymoites ulleungensis								1	1																										
	Yaginumena castrata	3								2	4				2								1	2												
Linyphiidae*	*Arcuphantes pennatus*	2																																		
	Bathyphantes gracilis																	3	2	2								2							2	

Supplementary Table 1. continue.

	Collinsia inerrans								2			2																								
	Doenitzius pruvus											3														4										
	Erigone prominens															7	9																			
	Escovina clava																	6						3												
	Floronia bucculenta								4							10	8																			
	Gnathonarium dentatum						2	1						1				1	1	1									2				1			1
	Gnathonarium gibberum				2																															
	Gonatium japonicum				1						2										3				1											
	Hylyphantes graminicola	4	7	4	3				2	6		3				6	37	3	4	4	5	5		1	2				1	2	3	5				4
	Neriene albolimbata				2								1																							
	Neriene clathrata				2		1	1				2																								
	Neriene emphana				4																															
	Neriene japonica		4		11	12	9	6	5		4	3	4	2	1	2		7	2	4	5			3	6	10	6	7	8	4	3		2	1	3
Linyphiidae*	*Neriene limbatinella*	3	4		2			2				2												1											
	Neriene longipedella	4			3	3	3	3			2	2				1			4				1	2	2	1		2		1	2	1		3	
	Neriene nigripectoris	17	6	9	10					9					1							26	24	23											
	Neriene oidedicata		3		2				4	1		2							3		3				3	2			4	3	2	1	3	2	
	Neriene radiata				2		2		4			3		3					1	1				2			2	2				1		2	
	Nippononeta ungulata																	2																	4
	Ummeliata feminea							1			2									1				1											2
	Ummeliata insecticeps		3				1	2								12	16		1	1							1	1				1	1		1
	Walckenaeria orientalis																				1				1	2									
	Platnickina sterninotata			1												1					2								1		1	1	1		
	Steatoda albomaculata						1																													
	Steatoda erigoniformis											1																								
	Stemmopes nipponicus		7																		6				2	1				3		2	2	2
	Takayus chikunii			2	3	2	3		1	1			4							6															
	Leucauge celebesiana			12			17	22		12		13	16	12		1		21	12	13	9	6	3	5	8	12	11	14	23	17	22	23	20	12	
	Leucauge subgemmea		12	7	11	6	7	8		27	4	5	11		2		8		16	23		5	7	4			15	17				12			
	Menosira ornata	4			3			4																											
	Metleucauge yunohamensis	2	2			1	1	1		1									2	2							1	1			1	1			1
	Pachygnatha clercki				1											15	12	1	1	1											1	1			1
	Pachygnatha quadrimaculata			2																															2
	Pachygnatha tenera									2									2	2												3			2
Tetragnathidae*	*Tetragnatha caudicula*									3						3	3																		2
	Tetragnatha extensa		6							41		5			1	32	16		4	3		2	4	4											
	Tetragnatha maxillosa	3	4			2								2		7	4	2	1	2										3					
	Tetragnatha pinicola					1																														
	Tetragnatha praedonia	12	13	9	4	5	7	8		15	12	1	2	5				7	8	9	2	3	3			7	8	2			8	8		4	2
	Tetragnatha squamata	6	7	5	4	6	3	4		17					2	6	26		4	4		1		24			2	2			2	2		5	
	Tetragnatha vermiformis															1		2						1											
Araneidae*	*Acusilas coccineus*																									2									
	Alenatea fuscocololata		2				1	2					2	2				2					1	2			3	4		2	2	2			

Supplementary Table 1. continue.

	Araneus acusisetus									2					1	2						5															
	Araneus ejusmodi	1	1	1						3		1	1			5	8	2	2	2		2	1	2	1		2						3	4	2		
	Araneus ishisawai				1																																
	Araneus marmoreus				1																																
	Araneus mitificus															1																					
	Araneus rotundicornis																							1													
	Araneus stella			1																																	
	Araneus tsurusakii				2						3													1													
	Araneus variegatus				2					1																											
	Araneus ventricosus	4	6	8	3	4	5	5	3	8	2	5	6	2	3	4	3	1	2	2	2	2	3	1	6	3	3	4	5	2	3	7	6	3	4		
	Araniella displicata	2														1																					
	Araniella yaginumai		1		1	2	1	1			2		1																						1	1	
	Argiope amoena									2							3										3	4									
	Argiope bruennichi	17	12	22	16	18	19	23	10	37	9	8		7	31	42	24	8	9	9	12	25	31	69	27	22	22	28	14	12	7	34	16	12	11		
	Argiope minuta		7	4			2	2						3	1				2	2							4		5	6	2	2	3	4		
	Chorizopes nipponicus			2						1					1		1					1															
	Cyclosa atrata	2		3												1			1		1				1	2										
	Cyclosa japonica				4																											3					
	Cyclosa laticauda				1		1	1			1			2			1		1	1							2	2	1		1	1				
	Cyclosa octotuberculata			3			4	3	7	11				4			1		3	3		1	2	2			3	3			2	2		4		
	Cyclosa omonaga														1									6												
Araneidae*	*Cyclosa sedeculata*		9			12		18										9				5	7	12		8				11	14			19		
	Cyrtarachne inaequalis																					2	1	3		2										
	Gasteracantha kuhli									1											2			1	3	2				1						
	Gibbaranea abscissa										1												1	2												
	Hypsosinga sanguinea			2																				1			2					2	3	3		
	Lariniaria argiopiformis									1							4							1												
	Lariniodes cornutus	7	8	3	4	6	7	12	5	7	7	8		9		27	15		2	4		4		2			4	4	5	2	3	1	8	12	8		
	Mangora herbeoides		4														2							1												
	Neoscona adianta		12	18	21		14	16	22	25	27	22	12	15	4	19	15		14	13		4	1	1		22	16	18	19		24	22	28	26	17		
	Neoscona melloteei		12	14		15		16	22	20	15	19	20	11	3	11	5	9	8	6	11	5	4	12		12			18	16	14			12		
	Neoscona multiplicans					2																														
	Neoscona nautica	2			3		4	3		3		4		1				2	4	7							8	7		8	4		3	2	1		
	Neoscona pseudonautica	1	2				2	4		5						2			1	3				1			2	2		3	4	1	2	5		
	Neoscona punctigera	2	2			1			1		1		2			1	1											3			3			2		
	Neoscona scylla	4	3	3	6			7	2	7	3	3	4	5	8	4	7	4				3	5	18		5			6	4				4	3		
	Neoscona scylloides	7	11		5					5					13		2	8				5		5			11	9	8	6	7	8	10			
	Neoscona semilunaris			2																				1												
	Neoscona subpullata	2			1	1	1		1	2	2						1		1		2				3	2			4		3			2		
	Neoscona tianmenensis					2																														
	Nephila clavata	13	21	14	9			14	27	54	16	17		14	42	29		13	22		17	38	28	67		12		19	17	12	14	16	17	18	20		
	Plebs sachaliensis	4							5		6																									
	Pronoides brunneus					1																														

Supplementary Table 1. continue.

Araneidae*	*Singa hamata*					2																											
	Yaginumia sia						4												3	2							1							
Lycosidae	*Alopecosa licenti*		2	1					2	2		1				1																	
	Alopecosa virgata																	4																
	Arctosa ebicha		2							1									2	1							1							1
	Arctosa subamylacea																		1															1
	Lycosa coreana	1											1						1															
	Lycosa labialis														1																			
	Pardosa astrigera	12	22	23	17	15	9	4	8	19	12	14	22	29	4	3	21	8	10	16	19	23	22	12	21	12	15	17	21	22	15	14	14	13	6
	Pardosa brevivulva						12	22		12	12		14	13	7		4		17	18		13	9	24		16	12	4		3		4	6		
	Pardosa hedini	3	4	2			5		7		6	2	2								1				1	1				1	2			1	
	Pardosa herbosa											2																						
	Pardosa laura		13	12		32		12	13	17	16	23	12	17			4	16	12	3		2					4	7	8		2	3	5	3	4
	Pirata subpiraticus							1								12	11	1	1			2	1											2
	Piratula knorri																		1															
	Piratula piratoides				2		1	1		1			2			2	1		3	2							1	1			2	1			
	Piratula procurvus	13		17	19			5	7	6	8	4	3	12				11	23	12	11		1		9	8	5		6	7	9	11	12	10	
	Trochosa ruricola		3	2						4						21	2					1	7	3										
Pisauridae	*Dolomedes sulfureus*	3	7			8					11	5	6	9					6	4	7						11	12	3		4	7		8	
	Pisaura ancora																		4									2						
	Pisaura lama	14	7	4	3	5	6	8	4	21	5	2	1	3	2	2	1	4	7	8	2			14	1	2	3	9	11	4	11	3	2	4	5
Oxyopidae	*Oxyopes koreanus*						3								1	1						2												
	Oxyopes licenti	4			5	6	7	9	12	19	5			6		3	19		8	9	12		5	8	1	5			6				7	5
Zoropsidae	*Takeoa nishimurai*																								1									
Ctenidae	*Anahita fauna*		8	3	4	8	9	11	4	2	5	7	3					7	2	3	6								4	5		3			4
Agelenidae*	*Agelena labylinthica*		1																								2						1	1
	Agelena limbata	4		7					9	1	5	7	8	5	1	1		7	9			6	3	3					8	8				
	Allagelena difficilis		6		7				5					4			10	3	2	2	2				2	5	6	7	4	3	2	8		4	
	Allagelena koreana							1																										
	Allagelena opulenta				2				3		2			1				2							4	3									
	Iwogumoa songminjae	11	3		7				6	11	7	8	9					4		3					7	8	4		3	3	2		2	2	1
	Paracoelotes spinivulvus	3	4	4	5	2			2		2	2	2		13		1	1	1		3	5		15	4	2				3	1		1	1	1
Cybaeidae*	*Cybaeus mosanensis*	5				4					6										12				11	9				13	2			8	
	Cybaeus triangulus	3			4																													
Hahniidae*	*Habnia corticicola*		2		3						3								2	3								3				4			4
Dictynidae*	*Argyroneta aquatica*																		4															
	Dictyna arundinacea				2	4																												
	Dictyna felis																								1	2			2	2				
	Dictyna foliicola															1			2					2										
	Sudesna hedini									1																								
Titanoecidae*	*Nurscia albofasciata*				2			2		1		1	1				1		2					1						1				
Eutichuridae	*Cheiracanthium japonicum*		1					1				2																						
	Cheiracanthium uncinatum		4						5	4						4			3			2		4										

Supplementary Table 1. continue.

Eutichuridae	*Cheiracanthium unicum*								2		3									3																		
	Cheiracanthium zhejiangensis		3						3																													
Miturgidae	*Zora nemoralis*											3																										
Liocranidae	*Itatsina praticola*			17		15	21	39		23				18																								
Clubionidae	*Clubiona japonicola*																		4												2							
	Clubiona jucunda								2	2		2	1	3	2																							
	Clubiona kurilensis	1				2					1	1		1		12	12	2	3	3				1	2	1	1	1	2		2	2			1			
	Clubiona odesanensis	1																																				
	Clubiona phragmitis					1																																
	Clubiona rostrata																						2														
	Clubiona vigil			3																																	
Corinnidae	*Castianeira shaxianensis*			2				3			2			3																								
Trachelidae	*Trachelas japonicus*							2										1				1	1	1				1		1							
Phrurolithidae	*Orthobula crucifera*												4					6	4	7	8				4	3	3		4	5	6	7	2	2			
	Phrurolithus pennatus							7																														
Gnaphosidae	*Callilepis schuszteri*																				1				1	1				1				1			
	Drassodes lapidosus				1																																
	Drassodes serratidens		2	3	5		7	6	4	5	4	7						9	2	2	2	1			2	3			2	2	2			2	2		
	Drassyllus coreanus																																				2	
	Drassyllus vinealis				1		1	1											1	1	1			1													
	Gnaphosa hastata		1																																		
	Gnaphosa kompirensis		7	9				11			6							7	2		5				6	8			7	11	12		4			
	Gnaphosa potanini																	1																		1	
	Gnaphosa sinensis				1																																
	Micaria japonica																																	1			
	Kishidaia coreana																													2							
	Sernokorba pallidipatellis		12												1						13				9	8			2	4	5	8		9		
	Zelotes asiaticus																				3				7	3			4	3	4			2		
	Zelotes davidi								7										6	7						8										
	Zelotes kimwha				7							7																									
	Zelotes wuchangensis			1					1		1	1	2																							1	
Sparassidae	*Micrommata virescens*		2	2		3			2																												
	Sinopoda stellatops				1							1																									
Philodromidae	*Philodromus aureolus*	2		1							2	2	3								2							3			4	5		6		
	Philodromus auricomus			2																																	
	Philodromus cespitum														1							5	2	1						2			3			
	Philodromus emarginatus				3																																
	Philodromus margaritatus				3				2	3	4	3	1	1																							
	Philodromus lanchowensis											1																									
	Philodromus rufus				2	2	2								3	1						3	6	2												
	Philodromus spinitarsis			1															2									1	1							
	Philodromus subaureolus		3	4	2					1			1		3								1	1						4						
	Thanatus coreanus		2																																		

Supplementary Table 1. continue.

Philodromidae	*Thanatus miniaceus*			3	4		2	2		2	2	1	2		1				1	1	1					3	2			1	1		2	
	Thanatus nipponicus								2		1	1										2	2	5											
	Tibellus tenellus	2									2					1	1						2												
Thomisidae	*Diaea subdola*	7	6	2	5	8	3	4		7			4											3											
	Ebelingia kumadai			7		4		3		10							3					1		6				6		5					
	Ebrechtella tricuspidatus	12	11	15	9	7	19	23	31	29	17	12	2	3	7	9	10	4	5	8	7	15	12	11	5	12	21	23	22	15	16	12	17	17	12		
	Heriaeus melloteei				3																																
	Lysiteles coronatus				2			3																													
	Oxytate parallela																							2													
	Oxytate striatipes	7		8	5			6		20					1	2				2	2	1		1		7		9	11	2	3	7	8	2			
	Ozyptila nipponica	1					2				1																										
	Ozyptilla nongae			4														3																	1		
	Pistius undulatus	1	3				4	5		1				2	2			2			1	1		1		1				2	2			1			
	Phrynarachne katoi				1																																
	Synema globosum		2	3			1	1			1	1						2	2							2			3			2					
	Tmarus horvathi				1																																
	Tmarus koreanus									1													1														
	Tmarus piger	2				2		3		4		2							2																		
	Xysticus atrimaculatus											1																									
	Xysticus croceus				3																																
	Xysticus ephippiatus		4	5	7	6	2	3	2	2	4	5	7	6	1		2	3	4	3	3	2	3		3	4	4	4	5	5	3	2	1	2	7		
	Xysticus bedini										4								3										3								
	Xysticus insulicola				3																																
	Xysticus kurilensis																											2									
	Xysticus pseudobliteus				2																																
	Xysticus saganus			2																																	
Salticidae	*Asianellus festivus*	3	2	4				2		1	4		3		5		1				4		2		4	5				3	3	4		3			
	Attulus avocator														2																						
	Attulus fasciger														4																						
	Attulus penicillatus					2																															
	Carrhotus xanthogramma	4								2	4	4	5		1						3				3	3				4	4	6		2			
	Euophrys kataokai												2																								
	Evarcha albaria	7	8	5		2	4	5	9	9	11	3	2	1	2		1	3	5	6	8		4	1	9	6	5	6	6	3	3	4	5	8	2		
	Evarcha coreana									2					1																						
	Evarcha proszynskii				1																																
	Harmochirus brachiatus							4																													
	Helicius yaginumai									1																											
	Heliophanus lineiventris		1							2	2					6										2											
	Heliophanus ussuricus	2				3			7	9		3	4		2	4	11		2			2				3				4						
	Mendoza canestrinii																		1																		
	Mendoza elongata				2					2								2	1	1						1									1		
	Mendoza pulchra					2				20					2	7	5						3	3		3											
	Myrmarachne formicaria																				7									5	4		3	5			

Supplementary Table 1. continue.

	Myrmarachne inermichelis			2					1																										
	Myrmarachne japonica		5	7					8							1					2	1	1	11				3		9					7
	Phintella abnormis		2	2														3	3																
	Phintella arenicolor			2		1		1	1	1				1	1	2	7		2			2		1	3					1	1				
	Phintella linea																		2																
	Plexippoides regius								2	3					1							1	1	2											
	Plexippus paykulli												2																						
	Plexippus setipes														1								7	1											
	Pseudeuophyrus iwatensis	1		1															1																
Salticidae	*Pseudicius vulpes*			1									1																						
	Rhene atrata		1							2					1		3		1			1		1											
	Sibianor pullus	1		2	3			3		2				1					4	5	2											2	2	2	1	2
	Siler cupreus				2										5																				
	Sitticus albolineatus														6																				
	Sitticus fasciger			2					3	3	3			2					1																
	Synagelides agoriformis		5	6	3			7	8		4																					4	5	7	8
	Talavera trivittata																		1	2						1	1				1				1
	Telamonia vlijmi									1											2				3	5					2		4	7	
	Yaginumaella medvedevi				8																														
Total (Species richness)		62	73	75	88	53	57	70	92	57	66	63	52	45	57	54	54	55	91	62	51	49	47	76	50	58	45	51	45	62	66	60	43	64	56
Total (Number of individuals)		296	397	381	367	269	273	440	327	682	337	303	241	254	228	366	384	253	376	319	274	259	236	470	240	320	253	304	315	304	320	321	249	326	200

*web builders, no mark wanderers (or hunters), **actual administrative districts see Table 1