



Insect community dynamics in relation to climate change in Mongolia

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Abstract

In recent years, many research revealed plant-insect interactions are becoming unstable because of climate change, human activities and grazing effect. In this work, it is aimed to disclose that how climate of two different years is influencing on insect community at certain locality in Mongolia. The data on the insect community are collected, covering full flowering season from June to August in 2014 and 2015. In order to include all species of insects in Udleg Station, data was collected in three different sites. One of them was around edge of forest, another one was in ungrazed area or inside the fence that has been kept for more than 9 years and last one was in grazed area. Weather was a perceptible difference during two year's study. This climate differences significantly influenced on the insect community. In 2014, overall 305 insect species were recorded, in which 124 insect species in order of Diptera, 44 in Lepidoptera, 33 in Coleoptera, 31 in Hemiptera, and 73 in Hymenoptera were determined. But in 2015, these number of species noticeably decreased, and total 150 insect species were recorded, in which 58 in Diptera, 26 in Lepidoptera, 13 in Coleoptera, 12 in Hemiptera, and 41 in Hymenoptera were determined.

Keywords: climate change, insect community, Mongolia

INTRODUCTION

The rising temperature and uncertainties in rainfall associated with global warming are likely to increase the frequency and magnitude of climate variability and extremes. On the other hand, changes in climate also increase the risk of unexpected changes in nature and environment (Batima et al. 2005). Mongolia is a semi-arid and arid country in Asia where the climate has been changing more drastically than many other locations across the globe (Fernandez-Gimenez et al. 2015).

Recent studies revealed that many activities associated with climate change are effecting on plant-pollinator interaction. For instances, mismatch in phenology of flower production and of pollinator flight activity, thus altering the opportunity for interaction between the plants and animals (Memmott et al. 2007).

But our aim in this paper to disclose that how two different years climate is influencing on insect community at certain locality in Mongolia.

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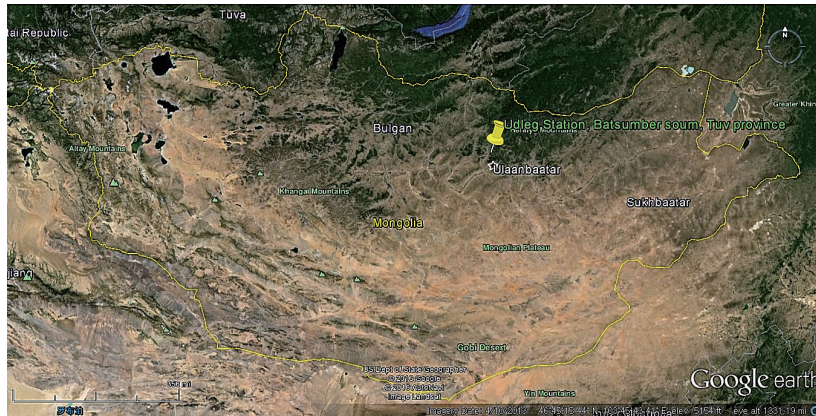


Fig. 1. Map of Study Site (Batsumber, Tuv, Mongolia).



Fig. 2. Aerial view of the Udleg Station.

MATERIALS AND METHODS

Study Site

The study was conducted in The Mongolia-Korea Biodiversity Research Field Station and Forestry Research-Training Center (FRTC) which is located in the territory of Udleg bag (Tusgalt Valley), Batsumber soum of Tuv province (48°15'43.3"N 106°50'56.4"E) between June 2014 and August 2015 (Fig. 1). On the west side it is surrounded by forests and on the north by the river stream. East and south of the Udleg Station is dominated by grazing grassland and field of crop (Fig. 2).

Data collection

The data on the insect community are collected, cov-

ering full flowering season from June to August in 2014 and 2015. In order to include all species of insects in Udleg Station, data was collected in three different sites. The sites were demonstrated different vegetation type. One of them was around edge of forest-mesophytic plants were dominated in this area (A), another one was in ungrazed area or inside the fence that has been kept for more than 9 years-in this site species diversity was significantly higher than other two sites (B) and last one was in grazed area-species diversity was low (C) (Fig. 3). Data was collected three times a day and different hours (morning, afternoon, evening). As a tool for collecting insects we used a butterfly net. Insect specimens were killed in ethyl alcohol and finally pinned for easier identification and private collection. Also pictures of insects were taken on natural by using NIKON D300 camera.



Fig. 3. Aerial view of study sites: A, site near the forest area; B, ungrazed area; C, Crazed area.

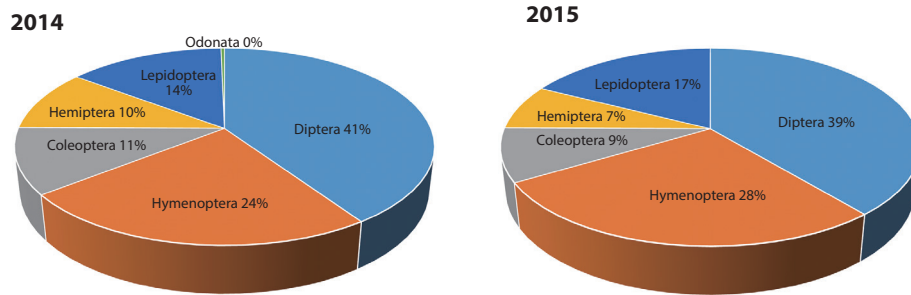


Fig. 4. Occurrence of each orders of insects species in 2014 and 2015 (by percentage).

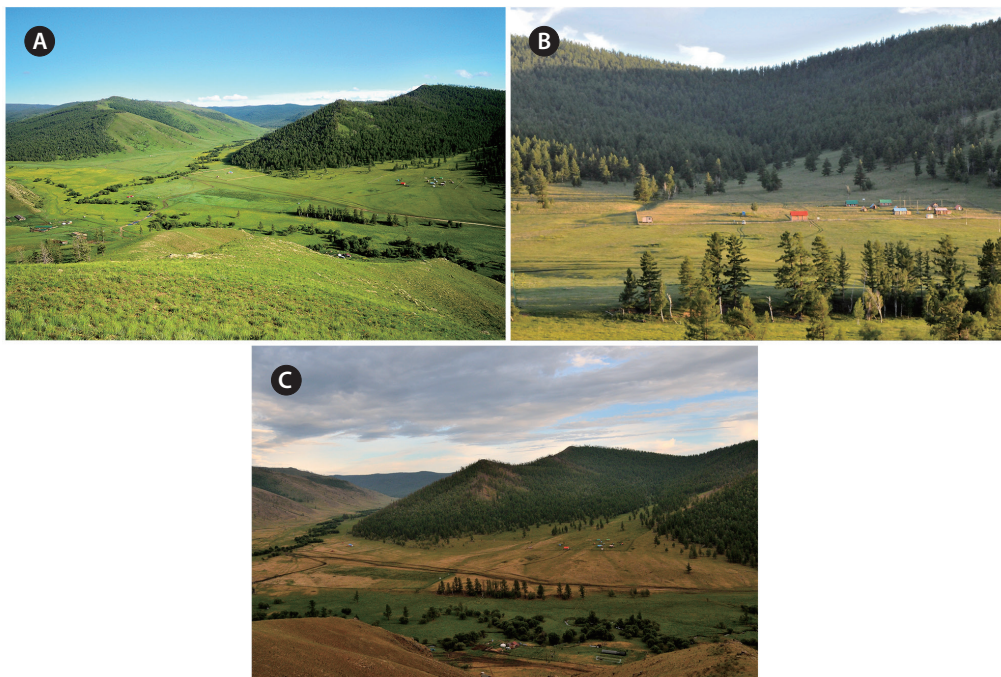


Fig. 5. Landscape and Vegetation in three different years (from different angle). (a) 2013, (b) 2014, and (C) 2015.

RESULTS

In 2014, a total of 305 insects from 6 orders was recorded. Hereof 88 dipteran species from 16 families were identified. The remaining 36 dipteran species were unidentified. 44 species of Lepidoptera, 33 species of Coleoptera, 31 species of Hemiptera, and 73 species of Hymenoptera were sampled.

But in 2015, these number of species noticeably decreased, total 150 insect species was recorded. Thereof 58 species of Diptera, 26 of Lepidoptera, 13 of Coleoptera, 12 of Hemiptera and 41 of Hymenoptera were recorded (Appendix). There is no significant difference between occurrence percentages of each orders in both years (Fig. 4).

DISCUSSION

From year to year, weather conditions is becoming unpleasant and deteriorating. It's effecting on a lot of things such as growth, development and breed of animals and plants. Furthermore, these also are generating more and more positive or negative consequences. In 2015, weather conditions were relatively dry and windy in June and July, while in August it was heavy rain compared to 2013 and 2014 (Fig. 5). As shown in Fig. 4 and 5, the different weather conditions affected vegetation and insect community during the years. But in this paper we considered only insect community. Number of insect species was decreased in last year study. Also some families of Coleopteran and Hemipteran did not appear in 2015. It may be the reasons of this situation that make it possible for phenological drift of host plant or dry, windy conditions. Hereupon, insect species of these families tend to be vulnerable on

climate change. On the other hand, it's possible for species of new families to appear which favor the warm temperature and dry conditions in last year study. Therefore, we need to study more on this data.

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Appendix. List of insect species by taxonomic order and their abundance sampled from 2014 and 2015

2014				
Order	Family	Genus	Species	Number of species
1		Anthomyiidae	sp	1
2			sp	2
3		Muscidae	<i>Coenosia</i>	1
4			<i>Eudasyphora or Neomyia</i>	1
5			<i>Tricops</i>	2
6		Bombyliidae	<i>Hemipenthes</i>	1
7			<i>Phthiria</i>	1
8			<i>Anastoechus</i>	1
9			<i>Bombomyia</i>	1
10			<i>Villa</i>	1
11		Chloropidae	<i>Chlorps</i>	2
12		Conopidae	<i>Sicus</i>	<i>abdominalis</i>
13		Tachinidae	<i>Peleteria</i>	1
14			<i>Cylindromyia</i>	1
15			<i>Phasia pusilla</i>	1
16			<i>Gymnosoma</i>	1
17		Tephritidae	<i>Campiglossa</i>	<i>defasciata</i>
18		Therevidae	<i>Thereva</i>	1
19		Dolichopodidae		1
20		Syrphidae	<i>Eristalis</i>	1
21			<i>Chrysotoxum</i>	1
22			<i>Chrysotoxum</i>	<i>bicinctum</i>
23			<i>Volucella</i>	<i>bombylans</i>
24			<i>Cheilosia</i>	1
25			<i>Helophilus</i>	1
26			<i>Paragus</i>	1
27			<i>Syrphus</i>	1
28			<i>Sphaerophoria</i>	sp 1
29			<i>Sphaerophoria</i>	sp 2
30			<i>Eupeodes l</i>	1
31			<i>Episyrphus</i>	1
32			<i>unidentified</i>	44
33		Sarcophagidae	<i>Sarcophaga</i>	3
34		Sepsidae	<i>Sepsis</i>	1
35		Stratiomyidae	<i>Oplodontha</i>	<i>viridula</i>
36		Asilidae		2
37		Tipulidae		2
38		Culicidae		1
39		Unidentified		36
Total				124

2015				
Order	Family	Genus	Species	Number of species
1		Syrphidae	<i>Paragus</i>	sp
2			<i>Sphaerophoria</i>	sp
3			<i>Syrphus</i>	sp
4			<i>Cheilosia</i>	sp
5			<i>Melangyna</i>	sp
6			<i>Helophilus</i>	sp
7			Unidentified	-
8		Muscidae	<i>Eudasyphora</i>	sp
9			<i>Coenosia</i>	sp
10			Unidentified	-
11		Tachinidae	<i>Phasia pusilla</i>	sp
12			<i>Cylindromyia</i>	sp
13			<i>Peleteria</i>	sp
14			<i>Gymnosoma</i>	sp
15		Bombyliidae	<i>Anthrax</i>	sp
16			<i>Hemipenthes</i>	sp
17			<i>Villa</i>	sp
18			<i>Anastoechus</i>	sp
19			<i>Bombylius</i>	sp
20			<i>Bombomyia</i>	sp
21		Conopidae	<i>Conops</i>	<i>flavipes</i>
22			<i>Zodion</i>	<i>cinerea</i>
23			<i>Physocephala</i>	sp
24		Chloropidae	<i>Chlorps</i>	sp
25		Sepsidae	<i>Sepsis</i>	sp
26		Sarcophagidae	<i>Sarcophaga</i>	sp
27		Tephritidae	<i>Campiglossa</i>	<i>defasciata</i>
28		Milichiidae	-	sp
29		Anthomyiidae	-	sp
30		Dolichopodidae	-	sp
31		Tipulidae	-	-
		Unidentified	-	8
Total				58

Appendix. Continued

2014

Order	Family	Genus	Species	Number of species	
1	Lepidoptera	Nymphalidae	Brentis ino	1	
2		Argynnis aglaja	1		
3		Neptis rivularis magnata	1		
4		Lycaenidae	Aglais urticae	1	
5			Lycaena virgaureae virgaureola	1	
6			Polyommatus icarus fuchsi	1	
7			Plebejus idas	1	
8			Plebicula amanda	1	
9			Glaucopsyche lycormas lederi	1	
10			Eumedonia eumedon	1	
11			Aricia agestis	1	
12			Cyaniris semiargus altaiana	1	
13			Lycaeides subsolanus	1	
14		Lycaeides argyrognemon	1		
15		Everas argaides	1		
16		Maculinea cyanecula	1		
17		Maculinea -	1		
18		Hesperiidae	Hesperia comma	1	
19			Pyrgus speyeri	1	
20			Pyrgus -	1	
21		Satyridae	Thymelicus lineola	1	
22			Minois dryas septentrionalis	1	
23			Aphantopus hyperanthus sibiricus	1	
24			Erebia medusa trans	1	
25			Erebia ligea eunomia	1	
26			Erebia neriene neriene	1	
27			Hipparchia autonoe sibirica	1	
28			Hyponephele lycaon catamelas	1	
29			Coenonympha amarylli	1	
30			Coenonympha glycerin iphicles	1	
31			Parnassius nomion	1	
32			Pieridae Colias hyale ssp	1	
33			Geometridae Siona lineata	1	
34			-	Moth	5
35			Unidentified	-	6
Total				44	

2015

Order	Family	Genus	Species	Number of species
1	Lepidoptera	Lycaenidae	<i>Plebejus idas</i>	1
2		<i>Lycaeides subsolanus</i>	1	
3		<i>Lycaena virgaureae virgaureola</i>	1	
4		<i>Lycaeides argyrognemon</i>	1	
5		<i>Maculinea sp</i>	1	
6		Nymphalidae	<i>Argynnis aglaja</i>	1
7			<i>Brentis ino</i>	1
8			<i>Melitaea didyma</i>	1
9			<i>Coenonympha glycerion iphicles</i>	1
10			<i>Erebia nerine</i>	1
11		<i>Erebia ligea eunomia</i>	1	
12		Pieridae	<i>Aporia crataegi</i>	1
13		Satyridae	<i>Minois dryas septentrionalis</i>	1
14			<i>Aphantopus hyperantus sibiricus</i>	1
15			<i>Hyponephele lycaon catamelas</i>	1
16		Hesperiidae	<i>Muschampia tessellum</i>	1
17			<i>Pyrgus speyeri</i>	1
18			<i>Thymelicus lineola</i>	1
19			-	Moth
20		Unidentified	-	-
Total				26

Appendix. Continued

2014				
Order	Family	Genus	Species	Number of species
1	Anthicidae	Notoxus	sp	1
2	Carabidae	-	-	1
3	Cerambycidae	Eodorcadion	carinatum	1
4		Brachyta	interrogationis	1
5		-	-	2
6	Coccinellidae	-	-	7
7	Curculionidae	Ceutorhynchus	sp	2
8		-	-	1
9	Chrysomelidae	Chrysolina	sp	1
10		Chrysomela	bipunctata	1
11		-	-	1
12	Elateridae	-	-	1
13	Mordellidae	Mordella	sp	1
14	Meloidae	Mylabris	speciosa	1
15	Nitidulidae	-	-	1
16	Unidentified			10
		Total		33

2015				
Order	Family	Genus	Species	Number of species
1	Mordellidae	<i>Mordella</i>	sp	1
2	Coccinellidae	-	-	2
3	Meloidae	<i>Epicauta</i>	<i>ambusta</i>	1
4	Meloidae	<i>Mylabris</i>	<i>speciosa</i>	1
5	Curculionidae	-	-	2
6	Unidentified	-	-	6
		Total		13

2014				
Order	Family	Genus	Species	Number of species
1	Alydidae	<i>Megalotomus</i>	<i>ornaticeps</i>	1
2		<i>Alydus</i>	<i>calcaratus</i>	1
3	Rhopalidae	<i>Corizus</i>	<i>hyoscyami</i>	1
4		<i>Stictopleurus</i>	-	2
5	Lygaeidae	<i>Rhyparochromus</i>	<i>pini</i>	1
6	Miridae	<i>Polymerus</i>	<i>cognatus</i>	1
7		<i>Plagiagnathus</i>	sp	1
8		<i>Adelphocoris</i>	<i>quadripunctatus</i>	1
9		<i>Eurycolpus</i>	sp	1
10		<i>Lygus</i>	sp	1
11	Pentamonidae	<i>Carpocoris</i>	<i>seidenstiickeri</i>	1
12		<i>Eurydema</i>	<i>gebleri</i>	1
13		<i>Pentatoma</i>	<i>borealis</i>	1
14		<i>Pentatoma</i>	<i>minor</i>	1
15		Unidentified	-	8
16	Unidentified	-	-	8
		Total		31

2015				
Order	Family	Genus	Species	Number of species
1	Miridae	<i>Polymerus</i>	<i>cognatus</i>	1
2		<i>Eurycolpus</i>	sp	1
3		<i>Lygus</i>	sp	1
4	Lygaeidae	<i>Rhyparochromus</i>	<i>pini</i>	1
5	Alydidae	<i>Megalotomus</i>	<i>ornaticeps</i>	1
6		<i>Alydus</i>	<i>calcaratus</i>	1
7	Rhopalidae	<i>Myrmus</i>	<i>miriformis</i>	1
8		<i>Corizus</i>	<i>hyoscyami</i>	1
9		<i>Stictopleurus</i>	-	2
10	Pentamonidae	<i>Carpocoris</i>	<i>seidenstiickeri</i>	1
11		<i>Eurydema</i>	<i>gebleri</i>	1
		Total		12

Appendix. Continued

2014				
Order	Family	Genus	Species	Number of species
1	Formicidae		-	3
2	Apidae	Bombus	-	18
3		Apinae	-	3
4		Apis	sp	1
5	Apoidea	-	-	2
6	Argidae	Arge	ustulata	1
7		Arge	sp	1
8	Tenthredinidae	Athalia	rosae ruficornis	1
9		Nematinae	sp	1
10	Bethylidea	-	-	1
11	Braconidae	-	-	3
12	Ichneumonidae	Campopleginae	-	2
13		Dusona	-	2
14		Exetastes	-	2
15		Exochus	sp	1
16		Licorininae	sp	1
17		Rynchobanchus	sp	1
18		unidentified	-	8
19	Cimbicidea	-	-	1
20	Megachilidae	Coelicxys	sp	1
21				1
22	Crabronidae	Crabroninae	-	2
23		Ectemnius	sp	1
24	Gasteruptiidae	Gasteruption	-	1
25	Halictidae	Halictinae	-	5
26	Vespidae	-	-	2
27	Pteromalidea	-	-	1
28	Unidentified	-	-	6
Total				73

2015				
Order	Family	Genus	Species	Number of species
1	Apidae	Bombus	sp	2
2		Apis	sp	1
3		Epeolus	sp	1
4		Amegilla	sp	1
5		Xylocopa	appendiculata circumvolans	1
6		Apinae	-	2
7	Andrenidae	Andrena	sp	1
8	Apoidea	-	-	4
9	Chrysididae	Chrysis	sp	1
10	Colletidae	Hylaeus	sp	1
11		Colletes	sp	1
12	Crabronidae	-	-	1
13	Formicidae			3
14	Sphecidae	Ammophila	sp	1
15	Halictidae	Halictus	sp	1
16		Halictinae	sp	2
17	Ichneumonidae	Campopleginae	-	2
18		Dusona	-	1
19		Netelia	-	1
20		-	-	5
21	Gasteruptiidae	Gasteruption	-	1
22	Tenthredinidae	Tenthredo	-	1
23	Torymidae	-	sp	1
24	Megachilidae	-	sp	1
25	Unidentified	-	-	4
Total				41