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PHENOLOGY OF HERPETOBIONTES FAUNA (CARABIDAE) IN SOUTH-EAST KAZAKHSTAN

Abstract. Ground beetles (*Carabidae*) are a large group of nocturnal predatory beetles. There are about 25 known species in the world, of which about 1000 species are found in Kazakhstan: the main families are *Harpalus, Amara, Carabus, Pterostichus.*

Most ground beetles contribute to the environment by feeding on insects, mollusks, and worms, while others are the crop pests (e.g. wheat, barley, oats, millet, etc). These ground beetles can be classified as the main harming entomophages of the crops of South-East Kazakhstan agricultural landscapes.

In this work, complex research on the fauna, seasonal dynamics, distribution, and frequency of occurrence was conducted among ground beetles that inhabit agricultural landscapes near Almaty. In experimental bio groups, Barber pitfall traps filled with 1% acetic acid solution were used to collect the ground beetles. Each specimen and its place of collection, day were recorded on the electronic informational bank. During the comparative study of ground beetles from different agrocenoses, species diversity and the frequency (specimens taken from one trap) of occurrence of these species were taken into account.

Ground beetles were subdivided into 7 ecological groups, which are meadow-field (29%), woodland-meadow (22%), meadow-steppe (17%), and woodland (15%), as well as meadow-swamp (10%), eurytopic (5%), and coastal (2%). The dominance of the meadow-field group, as well as the relationship of ecological groups in nature, is the result of anthropogenic impact.

The most spread among 12 genera and 43 species of ground beetles is found to be representatives of *Harpalus* and *Amara* genera. C.*billbergi* (10%), *Ch.pallipes* (12,6%), *P. reflexicollis* (17%) happened to be the dominant species throughout the season. The increase in the number of ground beetles happened to be in the middle of June and the end of August.

Key words: Ground beetles, fauna, habitat, herpetobionts, phenology, seasonal dynamics.

Introduction. Ground beetles (Carabidae) form the basis of the fauna of predatory coleoptera – herpetobionts in the foothills. There are about 25 known species in the world, of which about 1000 species are found in Kazakhstan. Having a wide range of nutrition, ground beetles play an important role in ecosystems that are untouched or altered by human activities. Ground beetles are widely used as an excellent indicator of environment well-being in environmental studies for biological monitoring. Phenological studies of ground beetle communities have recently become widespread [2,11]; however, no such studies have yet been conducted on the territory of the foothills of Trans-Ili Alatau. Therefore, the aim of our work was to study the fauna and seasonal changes in the ground beetle population in the foothills of the Trans-Ili Alatau.

Material and technique. Field studies were carried out from early May to the third decade of September 2019 in the territory of the suburban massif «Vesna», located about 10 km west of Almaty. Before the formation of the suburban massif (1991), there was a hummock swamp; sporadic grass burns were observed in this territory. Ground beetles collected in the Barber pitfall traps [12], were placed in a line in the number of 20 pieces., with an interval of 1.2 m between the traps. The volume of the traps was 200 ml, and the diameter of the inlet was 8 cm; 1/3 of the trap`s volume was filled with a 1% solution of

acetic acid. 2820 trap-days were worked out. The reporting line was located parallel to the dirtroad, the average traffic on which is 2-4 cars per hour. The distance between the line of traps and the road is 4 m. There was a ameliorative ditch between the road and the reporting line, in which water was stored until the beginning of June. Willow (*Salix sp.*) was growing at the edges of the ameliorative ditch under the crowns of which there was an reporting line. Ground beetles were sampled twice a week. During the field research, 1029 beetles belonging to 43 species were collected. For identification of adults, tables from the «Identifier of Insects» were used [13,15] as well as keys of A. Jedlicka [16]. The habitats of species were specified according to the monography of O.L. Kryzhanovsky with coauthors. Two species were determined only up to the genus; therefore, the ecological characteristics for them are not given.

When classifying habitats, the method of M.G. Sergeyev was used [17], the names of the habitats are given in by the terminology of this author.

The similarity of the ground beetle population for each month was calculated by the Sorensen coefficient: Ks = 2c / a + b, where c is the number of all species; a is the number of species in one group; b is the number of species in another group.

The entire period of field research fits into the concept of climate summer, because a steady transition of the average daily temperature through the +10°C mark in 2019 was noted in early May, and in the fall such transition occurs in the first ten days of October. The values of temperature and humidity, the dates of the maximum monthly precipitation are recorded in the table. 1.

Results and discussion. In the study area, 43 species of ground beetles from 12 genera were noted (Table 2). The genera *Harpalus, Amara, Carabus, Pterostichus* are distinguished by the greatest species diversity (13, 10, 5, and 4 species, respectively).

The population of ground beetles of the research territory is characterized by a multi dominant structure. The dominant species, each of which accounts for more than 10% of the total number of collected beetles, includes three species: *Carabus billbergi* (10%), *Chlaenius pallipes* (12.6%) and *Poecilus reflexicollis* (17%). Three species are classified as subdominant, the relative proportion of which is from 5 to 10%: *Nebria coreica, Harpalus jureceki* and *Harpalus ussuriensis* (6.1, 6.0, 5.8% of the total number of collected ground beetles, respectively). Also, the relative occurrence of 13 species ranged from 1 to 5%, and representatives of 24 species added up to no more than 1% in collections.

During the characterization of habitat composition in field studies, all species of ground beetles belonged to two habitat groups: latitudinal and longitudinal. In the studied biotopes, the most represented ones are the Trans-Palaearctic boreal woodland/forest-steppe and nemoral species (Table 3). Anthropogenic species are characterized by a large number of species from widespread groups. This is due to the intrazonal nature of anthropogenic landscapes [18]. A significant number of nemoral species is justified by the geographical location of the researched biotope.

Table 1-Climatic indicators in the research area (2019)

Month	Temperature, °C					Precipitation			
	Monthly average norm	Actual average	Deviation from the norm	Maximum (Date / value)	Minimum (date / value)	Norm, mm	Actual precipitation, mm мм	% of norm	Date of maximum precipitation/amount, mm
May	11.7	12.2	+0.5	31/29.5	14/0.3	58	74	128	9/21,0; 17/24,0
June	17.7	19.0	+1.3	16/30.5	5/9.6	82	84	102	17/17,0; 22/32,0
July	21.1	21.8	+0.7	15/35.5	1/11.5	144	119	83	19/27,0; 27/61,3
August	19.4	20.4	+1.0	8/30.4	30/9.2	154	149	97	9/23,0; 10/19,0 13/26,0; 14/22,0
September	13.2	14.3	+1.1	2/26.2	29/3.7	89	54	61	10/12,6; 24/15,6

Table 2 - Quantitative and qualitative characteristics of ground beetles in the studied biotope

№ № i/o	Species	Month and decade													Total	% of total population	Habitat	Ecological group	Relation to humidity
		May			June		July			August			Septem-ber							
		1	2	3	1	2-3	1	2	3	1	2	3	1	2					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Nebria coreica Solsky, 1875			1	1	15	1				8	6	15	16	63	6,1	N	C	G
2	Carabus arvensis Herbst, 1784	1		3	2	3	1	1	1	3					15	1,5	BW	W	M
3	C. billbergi Mannerheim, 1827	4	15	27	18	16	1	3	3	9	4		2	1	103	10	N	W	M
4	C. granulatus Linnaeus, 1758	2	1	7	5	8	4	8	4	2				3	44	4,3	P	E	M
5	C. canaliculatus Adams, 1812								1						1	0,1	BW	W	M
6	C. tuberculosus Dejean, 1829	2	2	6	8	13	4	3	1	2				1	42	4,1	BWF	W	M
7	Poecilus fortipes Chaudoir, 1850			1	1		2		3	1	1	1			10	1	BWF	M-S	M
8	P. reflexicollis (Gebler, 1830)	3	2	8	23	73	17				11	15	14	11	177	17,2	BWF	M-F	M
9	Pterostichus niger (Schaller, 1783)	3	3	5											11	1,1	BWF	M-S	M
10	P. microcephalus Motschulsky, 1860		6		11	3	1				2		1		24	2,3	N	W-M	G
11	P. nigrita (Paykull, 1790)										1				1	0,1	P	M-S	G
12	P. prolongatus A. Morawitz, 1862							1	1	5	3	2		1	13	1,3	N	M-S	G
13	Calathus halensis (Schaller, 1783)							2	1	2	9	8	3		25	2,4	P	M-S	X
14	Synuchus congruous (A. Morawitz, 1862)											12			12	2,4	P	M-F	M
15	S. vivalis (Illiger,1798)									4					4	0,4	P	W	M
16	Synuchus sp.								1		20	11	9	3	44	4,3			
17	Amara aeneola Poppius, 1906												1		1	0,1	BWF	M-F	X
18	A. communis (Panzer, 1797)	1		1								1			3	0,3	P	W-M	M
19	A. coraica Kolbe, 1886	1													1	0,1	BWF	W-M	X
20	A. magnicollis Tschitscherine, 1894	3			1										4	0,4	P	W-M	M
21	A. obscuripes H. Bates, 1873	2	6												8	0,8	N	W-M	X
22	A. tibialis (Paykul, 1798)	2													2	0.2	BW	W-M	X
23	A. ussuriensis Lutshnik, 1935		2		1		2	2			2		1		10	1	BWF	W-M	M
24	A. minuta (Motschulsky, 1844)										2				2	0,2	BWF	M-S	X
25	A. amplipennis Baliani, 1943											1			1	0,1	N	M-S	G
26	Amara sp.		1	3											4	0,4			
27	Trichotinchus coruscus Tschitscherine, 1895									2					2	0,2	N	W	M
28	Harpalus capito A. Morawitz, 1862													1	1	0,1	N	M-F	M
29	H. eous Tschitscherine, 1901									3					3	0,3	BWF	M-F	X
30	H. griseus (Panzer, 1797)								1	8	18	12	5	3	47	4,6	P	M-F	X
31	H. jureceki (Jedlicka, 1928)							1		6	25	13	10	7	62	6	N	M-F	X

Continuation of table 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
32	H. ussuriensis Chaudoir, 1863							4	6	6	23	16	4	1	60	5,8	N	Л-П	X
33	H. tschiliensis Schauberger, 1929										1			1	2	0,2	N	M-F	X
34	H. rubripes (Duftschmid, 1812)				1										1	0,1	N	M-F	X
35	H. pusillus Motschulsky, 1850	6	6												12	1,2	BWF	W-S	X
36	H. bungii Chaudoir, 1844	23	8	8	6							2			47	4,6	N	M-F	M
37	H. tarsalis Mannerheim, 1825				1										1	0,1	BWF	W-M	M
38	H. xanthopus Gemminger et Harold, 1868		1		3								1		5	0,5	BW	M-W	M
39	H. nigrans A. Morawitz, 1862	2		2			2					1			7	0,7	BWF	M-W	M
40	H. crates H. Bates, 1883	4	2	2	4	3									15	1,5	P-N	M-S	X
41	Chlaenius pallipes Gebler, 1823	1	1	16	18	28	5	4	8	28	14		4	3	130	12,6	N	E	M
42	Licinus setosus (J. Sahlberg, 1880)							1	1			2	3		7	0,7	BWL	W-M	M
43	Cymindis daimio H. Bates, 1873									2					2	0,2	N	M-S	X
	TOTAL	60	56	90	104	162	40	30	83	144	103	73	52	1029					

Note. Latitudinal groups of habitats: BW - boreal woodland, BWL - boreal woodland/forest-steppe, P – polyzonal, N - nemoral. Ecological groups: S - swamp, M- meadow, W - woodland, F - field, C - coastal, S - steppe, E - eurytopic. Relation to humidity: G - hygrophile, M - mesophile, X - xerophile.

An analysis of own material, as well as textbook data, shows that among the ground beetles population of the studied territory, 7 ecological groups can be distinguished, of which meadow-field (29%) and woodland-meadow (22%) groups of species were the most numerous. A significant contribution to the population is made by meadow-steppe (17%) and woodland (15%) species. Less than the others were noted meadow-swamp (10%), eurytopic (5%) and coastal (2%). The predominance of meadow-field species, as well as the presence of a rather uneven combination of ecological groups of different nature, in our opinion, is a consequence of a high degree of anthropogenic pressure. Mesophiles dominate (51%) in relation to humidity; the proportion of xerophiles (37%) is also large, and the proportion of hygrophilous is only 12%. Analysis of the dynamics of the number of ground beetles showed that beetles are active throughout the entire warm period of the year; their number in traps, at the beginning of May, was about 30 individuals/10 trap-days and remained approximately at this level until mid-June. The first marked peak in the number of individuals in the traps was observed in mid-June, and the second in the middle of August (162 and 131 individuals 10 trap-days, respectively); small bursts of activity were also observed in early June, early August and mid-September. The greatest decline in the number of beetles (up to 13 individuals / 10 trap-days) was observed in the second half of August. The number of species recorded during the count ranged from 6 (in the second half of May) to 13 (in the first half of June, in the first half and at the end of August, as well as at the beginning of September) (figure 1).

Overall, in May, 119 specimens of ground beetles of 22 species from 7 genera were collected. In June, 266 specimens of beetles of 16 species from 8 genera were collected. In July, 102 specimens of beetles of 19 species from 10 genera were collected. In August, 330 specimens of beetles of 29 species from 11 genera were collected, and in September 125 copies of beetles of 19 species from 10 genera were collected. Throughout the entire period of research, two species dominated - *Ch. pallipes* and *P. reflexicollis*. In the first part of summer (May-July), the qualitative composition of the dominant species is significantly different from that in the second part (August-September), when representatives of the genus *Harpalus* are present among the dominant species (table 3). Ground beetles from different genera experience seasonal confinement. So, the number of species of the *Amara* genus is at its maximum in May; in June-July, the number of species decreases to 1-2 species, in August there is an increase in the number of species from 183 to four. In September, two species from the genus *Amara* appeared. The genus *Carabus* was represented by three to five species every month, which does not allow to show the

trusted change in number of species in May - September. The number of species of the genus *Harpalus* increases in August, and representatives of this genus hit the maximum of species diversity among others (figure 2).

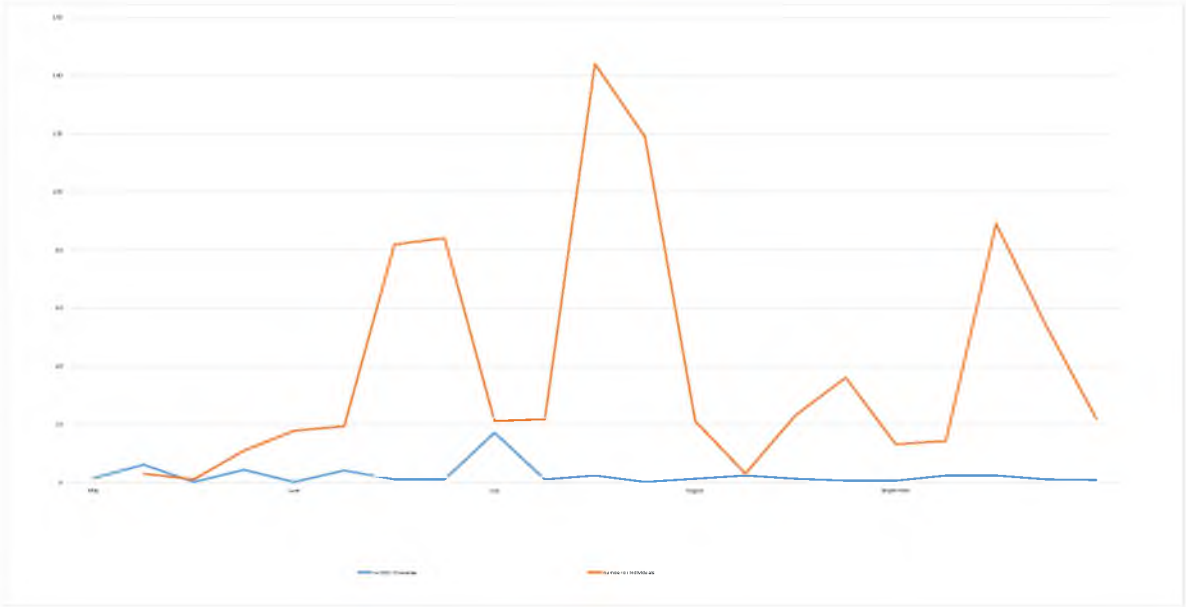

Figure 1 - Seasonal dynamics of ground beetle activity in May–September 2019
(along the ordinate – the number of species and the number of beetles per 10 trap-day)

Table 3-Seasonal dominance of certain species of ground beetles,% of the total number of individuals

Species	May	June	July	August	September
Carabus billbergi	34	13	-	-	-
C. granulatus	-	-	17	-	-
Chlenius pallipes	14	17	16	13	-
Nebria coreica	-	-	-	-	25
Harpalus griseus	-	-	-	13	-
H. jureceki	-	-	-	13	14
H. ussuriensis	-	+	-	14	-
Poecilus reflexicollis	8	36	16	-	20

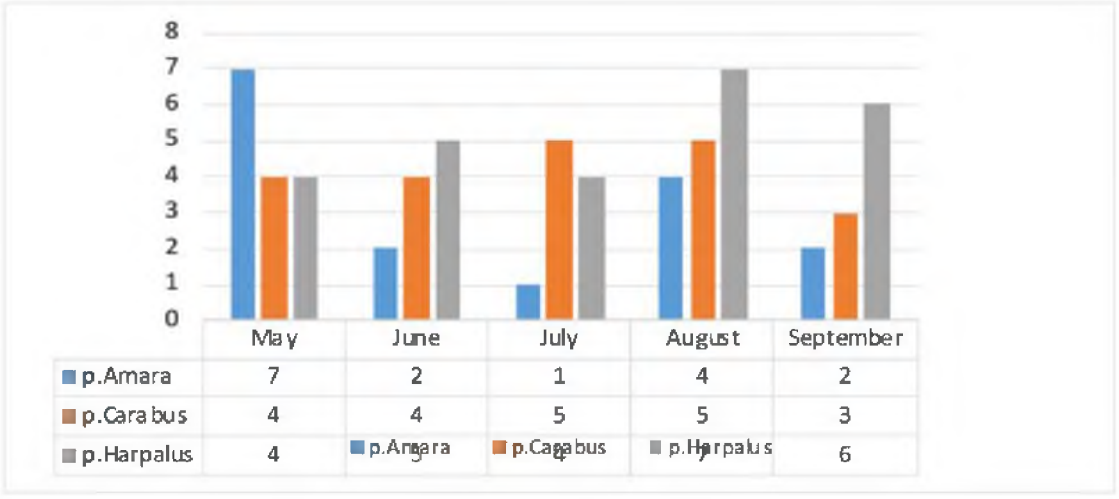

Figure 2 - Seasonal dynamics of the number of species of the genera *Amara, Carabus,* and *Harpalus*
(along the ordinate – the number of species)

Some species of ground beetles had been found only for one month. So, only in May, such species as *Amara coraica, A. magnicollis, A. obscuripes, Amara tibialis, Harpalus pusillus, Pterostichus nigrita* were collected. Only in June *Harpalus rubripes* and *H. tarsalis* were trapped. Only in August *Amara amplipennis, A. minuta, Cymindis daimio, Harpaluseous, Pterostichus niger,* and *Synuchus congruus* were collected. Two species: *Amara aeneola, Harpalus capito* are characterized by the autumn type of activity; they are found in traps only in September. Thus, only in May, 16% was met, and only in August 14% of the total number of ground beetles were registered on the counting site. The similarity between the lists of species of different months is quite big. The greatest similarity is observed between the "neighboring" months (for example, between July and August - 88%). The similarities in June – August (70%) and July – September (79%) pairs are slightly lower. The minimum similarity between the fauna is of May and the second half of summer, but even here it is above 55%.

It should be noted that representatives of approximately 50% of species were found only during 1-3 counts. Low occurrence in most cases coincides with a low number of representatives of this species. Thus, the abundance of the two "May" species *A.obscuripes* and *H.Pusillus* (occurrence of 8% in both cases) was 8 and 12 specimens. The most striking exception is *S.congruus*, whose specimens fell into soil traps only once, during the count from August 25 to 29, in the number of 12 specimens. More than a third of the total number of species was found in 8–40% of counting. Species found in more than 40% of counting (*Carabus billbergi, C. granulatus, C. tuberculosus, Chaenius pallipes, Nebria coreica, Poecilus reflexicollis*) are classified by us as background species. It is noteworthy that in the second decade of July the abundance of such species is minimal, and the abundance happens to be the end of June and the first half of August (figure 3). In general, for background species, two peaks of abundance are observed during the season.

Our studies allow us to conclude that the specific fauna of ground beetles of the neighbourhood of the foothills of Trans-Ili Alatau is quite interesting in zoogeographic terms, including a complex of both wide-area and nemoral species. In environmental terms, the bulk of beetles is represented by species of the meadow complex with a significant influence of woodland elements.

In general, ground beetles have two activity peaks: in mid-June and mid-August. Despite the relatively even species representation of ground beetles in traps during the season, six species display activity only in May or, respectively, only in August. Species showing activity only in the middle of summer were not found.

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Абай атындағы ҚазҰПУ, Алматы, Қазақстан

ГЕРПЕТОБИОНТТАР (CARABIDAE) ФАУНАСЫНЫҢ ОҢТҮСТІК–ШЫҒЫС ҚАЗАҚСТАНДАҒЫ ФЕНОЛОГИЯСЫ

Аннотация. Өсімдіктерді қорғауда қолданылған заманауи, болашағы бар бағыт - зиянкестермен күресуде табиғи жауларын қолдану болып табылады. Биогеоценоздарда топырақ горизонтын мекендеушісі, агроценоздарда жиі кездесетін маманданбырылмаған энтомофагтардың бірі - жыртқыш герпетобионттар.

Біздің климаттық жағдайдағы кездесетін жыртқыш герпетобионттардың фаунасының негізін – барылдауық қоңыздар немесе карабидтер (Carabidae) құрайды. Бұл туыстың бүкіләлемдік фауна бойынша 25000, ал Қазастан аумағында 1000-ға жуық түрі белгілі.

Қоректену спектрінің кең болуына байланысты барылдауық қоңыздар, табиғи және адамның шаруашылық жұмыстары нәтижесінде экожүйеге тигізетін зиянды әсерлерін реттеуде маңызды рөл атқарады. Қоршаған орта жағдайының индикаторы ретінде барылдауық қоңыздар биологиялық мониторинг және экологиялық зерттеулерде кеңінен қолданылады.

Соңғы жылдары барылдауық қоңыздар тұқымдасының фенологиялық зерттеулері кеңінен жүргізілуде. Дегенмен, Іле Алатауының тау бөктерінде мұндай зерттеулер әлі жүргізілген жоқ. Сондықтан біздің жұмысымыздың мақсаты Іле Алатауының тау бөктеріндегі барылдауық қоңыздардың фаунасы мен маусымдық өзгерістерін зерттеу болып табылады.

Далалық зерттеу жұмыстары 2019 жылдың мамыр айының басынан қыркүйек айының екінші жартысына дейін Алматыдан батысқа қарай 10 км жерде орналасқан «Весна» қала сыртындағы массивті аймақта жүргізілді. Дала жағдайында барылдауық қоңыздарды жинауға Барбер тұзағы қолданылды.

Далалық зерттеулердің барлық кезеңі климаттың жаз айына сәйкес келді, себебі 2019 ж. мамыр айының басында орташа тәуліктік температура тұрақты + 10°С болса, ал күзде мұндай температурага ауысу қазан айының алғашқы он күнінде байқалды.

Далалық зерттеулер кезінде табылған барылдауық қоңыздардың барлық түрлері екі таралу аймагы тобына жататыны анықталды. Зерттелген биотопта орманды-орманды дала және жазық транспалеарктикалық бореальды түрлер көп кездесті. Антропогендік ландшафттар ауқымды ареалды топтардың көптеген түрлерімен сипатталады. Бұл

антропогендік ландшафттардың аймақішілік сипатына байланысты. Неморальдық түрлердің саны зерттелетін биотоптың географиялық орналасуымен түсіндіріледі.

Барылдауық қоңыздар санының динамикасын талдау нәтижесі көрсеткендей, ауа райы жылынуымен бұл қоңыздардың белсенділігі артатындығы байқалды; мамыр айының басында қойылған 10 тұзаққа бір тәулікте түскен қоңыздың саны 30 дана, бұл көрсеткіш маусымның ортасына дейін жалғасты. Тұзаққа түскен қоңыздар санының ең жоғарғы бірінші көрсеткіші маусымның ортасында болса, ал екінші жоғарғы көрсеткіші - тамыздың ортасында байқалды (тәулікте 10 тұзаққа 162 және 131 дана); маусым мен тамыз айының басында және қыркүйек айының ортасында барылдауық қоңыздардың белсенділігінде шағын ауытқулар байқалды.

Қоңыздар белсенділігі мен санының күрт төмендеуі (тәулікте 10 тұзаққа/13 дана) тамыздың екінші жартысында байқалды. Санау кезінде тіркелген түрлердің саны 6-дан (мамырдың екінші жартысында) 13-ке дейін (маусымның бірінші жартысында және тамыздың соңында, сондай-ақ қыркүйектің басында) белсенділігінде ауытқулар байқалады.

Зерттелген Іле Алатауы тау бөктеріндегі барылдауық қоңыздардың фаунасы зоогеографиялық тұрғыдан қызығушылық танытты, оның ішінде кең таралу аймақты және неморальды түрлері кеңінен таралған. Экологиялық тұрғыдан алғанда, қоңыздардың негізгі бөлігі шалғынды түрлер болып табылады.

Барылдауық қоңыздардың маусым мен тамыз айының ортасында екі рет белсенді кезеңі байқалды. Маусым ішінде тұзаққа түскен қоңыздардың ішінде алты түрінің белсенділігі мамыр және тамыз айында байқалды. Ал жаздың ортасында белсенділік танытатын түрлер байқалмады.

Түйін сөздер: барылдауық қоңыз, фауна, ареал, герпетобионт, фенология, маусымдық динамика.

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ФЕНОЛОГИЯ ФАУНЫ ГЕРПЕТОБИОНТОВ (CARABIDAE) В ЮГО-ВОСТОЧНОМ КАЗАХСТАНЕ

Аннотация. Одним из наиболее перспективных направлений в современной защите растений является использование для подавления вредителей их естественных врагов. К числу наиболее распространенных в агроценозах неспециализированных энтомофагов относятся хищные герпетобиоиты - обитатели напочвенного горизонта биогеоценоза.

Основу фауны хищных герпетобионтов в наших природно-климатических условиях составляют жужелицы, или карабиды (Carabidae) в мировой фауне известно не менее 25 000 видов из этого семейства. На территории Казастана определено около 1000 видов.

Обладая широким спектром питания, жужелицы играют важную роль в естественных и измененных хозяйственной деятельностью человека экосистемах. Жужелицы как прекрасный индикатор состояния природной среды широко используются в экологических исследованиях для целей биологического мониторинга.

Фенологические исследования сообществ жужелиц получили в последнее время широкое распространение. Однако на территории предгории Заилийского Алатау подобных исследований до сих пор проведено не было. Поэтому целью нашей работы явилось изучение фауны и сезонных изменений населения жужелиц в предгорьях Заилийского Алатау.

Полевые исследования проводились с начала мая по третью декаду сентября 2019г. на территории дачного массива «Весна», расположенного примерно в 10 км западу от Алматы. Жужелицы собирались в ловушки Барбера.

Весь период полевых исследований укладывается в понятие климатического лета, т.к. устойчивый переход среднесуточной температуры через отметку +10°С в 2019 г. отмечен в начале мая, а осенью такой переход происходит в первой декаде октября.

При характеристике ареального состава все найденные нами виды жужелиц были отнесены к двум ареальным группам: широтной и долготной. В исследованном биотопе наиболее представлены транспалеарктические бореальные, лесные-лесостепные и неморальные виды. Для антропогенных ландшафтов характерно большое количество видов из широкоареальных групп. Это связано с интразональным характером антропогенных ландшафтов. Значительное количество неморальных видов объясняется географическим положением исследованного биотопа.

Анализ динамики численности жужелиц показал, что жуки активны на протяжении всего теплого периода года; их численность в ловушках уже в начале мая составляла около 30 экз./ 10 ловушко-суток и оставалась приблизительно на этом уровне до середины июня. Первый выраженный пик численности особей в ловушках отмечался в средине июня, а второй – в средине августа (162 и 131 экз. 10 ловушко-суток соответственно); небольшие всплески активности наблюдались также в начале июня, начале августа и в середине сентября. Наибольший спад численности жуков (до 13 экз./10 ловушко-суток) отмечен во второй половине августа.

Количество видов, отмеченных во время учетов, колебалось в пределах от 6 (во второй половине мая), до 13 (в первой половине июня, в первой половине и в конце августа, а также в начале сентября).

Проведенные нами исследования позволяют заключить, что фауна жужелиц окрестностей предгории Заилийского Алатау достаточно интересна в зоогеографическом отношении, включая в себя комплекс как широкоареальных, так и неморальных видов. В экологическом плане основная масса жуков представлена видами лугового комплекса с существенным влиянием лесных элементов.

В целом у жужелиц отмечены два пика активности: в середине июня и в середине августа. Несмотря на относительно ровную видовую представленность жужелиц в ловушках в течение сезона, шесть видов проявляют двигательную активность только в мае или, соответственно, только в августе. Видов, проявляющих активность только в середине лета, не отмечено.

Ключевые слова: жужелицы, фауна, ареал, герпетобионт, фенология, сезонная динамика.

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REFERENCES

[1] Kryzhanovskij O.L., Belousov I.A., Kabak I.I. et al (1995). A checklist of the ground beetles of Russia and adjacent lands (Insecta, Coleoptera, Carabidae). Sofia; Moscow: Pensoft, p281. [In Russian].

[2] *Ananina T. L.* (2006) Ground beetles of the western macro slope of the Barguzin Range [Zhuzhelitsy zapadnogo makrosklona Barguzinskogo khrebta]. Ulan-Ude: Publishing House of the BSC SB RAS, p192. Ulan-Ude [In Russian].

[3] *Grechanichenko T.E., Guseva N.A.* (1999). Structure and dynamics of the population of ground beetles (Coleoptera, Carabidae) of the meadow steppe [Struktura i dinamika naseleniia zhuzhelits]// Zoological Journal. Vol. 78, edition 4. pp442-450. [In Russian].

[4] *Kiselev I.E.* (1997). Dynamics of the structure of the population of ground beetles (Coleoptera, Carabidae) of urbanized landcapes of the city of Saransk in the Middle Volga Region environment [Dinamika struktury naseleniia zhuzhelits (Coleoptera, Carabidae) urbanizirovannykh landshaftov goroda Saranska v usloviiakh Srednego Povolzhia]: Abstract. dis. ... cand. bio. sciences. M., p17. [In Russian].

[5] *Lapshin L.V.* (1970). Seasonal population dynamics in the steppe and Orenburg forest-steppe environment [Sezonnaia dinamika chislennosti zhuzhelits v stepi i na obrabatyvaemykh zemliakh v usloviiakh Orenburgskoi lesostepi] // Materials IV scientific. conf. zoologists of pedagogical inst. Gorky: Gorky state ped inst., pp199-200. [In Russian].

[6] *Lapshin L.V.* (1971). Seasonal activity of dominant species of ground beetles (Carabidae) in the woodland-steppe of Trans-Ura [Sezonnaia aktivnost dominantnykh vidov zhuzhelits (Carabidae) v lesostepi Zauralia] 1 // Zoological Journal. Vol.50, edition 6, pp825-830. [In Russian].

[7] *Potapova N.A.* (1972). Seasonal activity dynamics of ground beetles (Coleoptera, Carabidae) in the semi-desert of North-West Kazakhstan [Sezonnaia dinamika aktivnosti zhuzhelits (Coleoptera, Carabidae) v polupustyne Severo-Zapadnogo Kazakhstana] // Zoological journal. Vol. 51, edition 11. Pp 1651-1658. [In Kazakhstan].

[8] *Semenova O.V.* (1998). Seasonal population dynamics of ground beetles (Coleoptera, Carabidae) of the parking zone of an industrial city [Sezonnaia dinamika naseleniia zhuzhelits (Coleoptera, Carabidae) parkovoi zony promyshlennogo goroda] // Modern problems of population, historical and applied ecology: Materials from the conf. of young ecologists of the Ural region. Yekaterinburg: Yekaterinburg, pp257–258. [In Russian].

[9] *Sharova I.Kh., Denisova M.I.* (1997). Seasonal dynamics of woodland populations of ground beetles of the genus *Pterostichus* (Coleoptera, Carabidae) [Sezonnaia dinamika lesnykh populiatsii zhuzhelits roda Pterostichus (Coleoptera, Carabidae)] // Zoological Journal. Vol. 76, No. 4. pp418-427. [In Russian].

[10]*Sharova I.Kh., Filippov B.Yu.* (1999). Seasonal dynamics of the reproduction of dominant ground beetle species (Coleoptera, Carabidae) in the northern taiga near Arkhangelsk [Sezonnaia dinamika razmnozheniia dominantnykh vidov zhuzhelits (Coleoptera, Carabidae) v usloviiakh severnoi taigi pod Arkhangelskom] // Biodiversity of terrestrial and soil invertebrates in the North: Thes. report Int. conf. Syktyvkar: Publishing House of the Komi SC, UB of the RAS, pp209–210.

[11]*Sharova I.Kh., Filippov B.Yu.* (2003). Features of the life cycles of ground beetles (Coleoptera, Carabidae) in northern taiga environment [Osobennosti zhiznennykh tsiklov zhuzhelits (Coleoptera, Carabidae) v usloviiakh severnoi taigi] // Zoological journal. Vol. 82, No. 2. pp229–238. [In Russian].

[12]*Gilyarov M.S.* (1987). Count of the large invertebrates (mesofauna) [Uchet krupnykh bespozvonochnykh (mezofauna)] // Quantitative methods in soil zoology. M.: Nauka, pp9-26.

[13]*Lafer G.Sh.* (1989). Fam. Carabidae - Ground beetles // Identifier of insects of the Far East of the USSR. Vol. 3: Coleoptera, or beetles. L.: Nauka. Part 1. pp95-97. [In Russian].

[14]*Lafer G.Sh.* (1992). Fam. Carabidae - Ground beetles (supplement - genus *Agonum*) // Identifier of insects of the Far East of the USSR. St. Petersburg: Nauka. Vol. 3, part 2.P. 602-621. [In Russian].

[15]Lafer G.Sh. (1996). Fam. Carabidae - ground beetles. Supplement 3. // Key to insects of the Far East of Russia. Vladivostok. Vol. 3, Part 3. pp396-408. [In Russian].

[16]*Jedlicka A. (1962)*. Monographie des Tribus Pterostichini aus Ostasien (Pterostichi, Trigonotomi, Myadi) (Coleoptera, Carabidae) // Entomol. Abhandlungen. Born 1962 26, No. 21. P. 177–346. [In Russian].

[17]Sergeev M.G. (1986). Patterns of distribution of Orthoptera of North Asia. Novosibirsk: Nauka, p238.

[18]*Voronin A.G.* (1999). The fauna and complexes of ground beetles (Coleoptera, Trachypachidae, Carabidae) of the woodland zone of the Middle Ural (ecological and zoogeographic analysis). [Fauna i kompleksy zhuzhelits (Coleoptera, Trachypachidae, Carabidae) lesnoi zony Srednego Urala (ekologo-zoogeograficheskii analiz).] Perm: Publishing house Perm. Uni., p244. [In Russian].