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МИНИСТЕРСТВО ОБРАЗОВАНИЯ И НАУКИ РЕСПУБЛИКИ КАЗАХСТАН

ҚОСТАНАЙ МЕМЛЕКЕТТІК ПЕДАГОГИКАЛЫҚ ИНСТИТУТЫ
КОСТАНАЙСКИЙ ГОСУДАРСТВЕННЫЙ ПЕДАГОГИЧЕСКИЙ ИНСТИТУТ

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В сборнике опубликованы материалы III Международной научной конференции «Биологическое разнообразие азиатских степей».В докладах рассмотрены итоги исследований и перспективы сохранения биологического разнообразия степных экосистем, островных и ленточных лесов и водного-болотных угодий степной зоны Евразии, охраны природных территорий и популяций видов особого природоохранного значения, формирования экологической сети и вклада вузов в изучение биоразнообразия. Книга предназначена для ученых и практиков, работающих в области изучения и сохранения биологического разнообразия, преподавателей вузов, аспирантов, студентов, работников природоохранных учреждений.

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PEST MONITORING OF POPULATION DYNAMICS AND DISTRIBUTION OF HARMFUL GRASSHOPPERS IN NORTHERN KAZAKHSTAN

Мониторинг популяционной динамики и распространения вредных саранчовых в Северном Казахстане

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Introduction. Over 270 species and sub-species of grasshoppers have been recorded in Kazakhstan, only 15-20 of them [1] causing heavy damage in farmlands. Fauna of grasshoppers is presented mainly by *Calliptamus italicus (L*., 1758*)* - one of the most harmful species, *Dociostaurus maroccanus (*THUNB*., 1815),* and *Locusta migratoria (*L*., 1758)* [2]. Along with the gregarious grasshopper species (locusts) on the territory of the country, many nongregarious species (harmful grasshoppers) could be of economic importance. The most common species include: *Dociostaurus kraussi Ingen, Dociostaurus brevicollis (Ev.), Aeropus sibiricus (L.), Pararcyptera microptera microptera* (F.-W.), *Chorthippus albomarginatus* (DEG.) *and Stauroderus scalaris* (F.-W.), *Stenobothrus fischeri* (EV.) [3,4]. While for the gregarious species of locusts long migrations and invasions from one country to another are typical, the nongregarious species are permanent inhabitants of the steppe and cultural habitats though outbreaks of population density could occur depending on the weather conditions and the cyclic recurrence [5].

Locusts, as a specific group of herbivores, give rise to many problems. One of the most important is related to the frequency of their population outbreaks in space and time. Under such circumstances, sometimes it is very difficult to maintain the functioning of permanent locust monitoring [6]. In order to avoid significant losses, polyphagous pests, including harmful grasshoppers should always be a subject of phytosanitary control [7]. Locusts are associated by many only as dangerous pests, destroying crops. In fact, the locusts in the wild are important and integral component of ecosystems having impact on maintaining the sustainability of the steppes and their functioning. At low population densities locusts are nibbling the leaves at negligible level which is stimulating the growth of plants. They comsume only a small proportion of the plant and create a mass suitable for further use by other herbovorous animals, thus contributing to accelerate the cycle of matter and energy. Locusts themselves are food for many different animals - from segmented worms to mammals, birds, etc. [8].

Monitoring, especially in a period of low pest population density, is a prerequisite for an effective system of preventive measures. Unfortunately, the practice of locust control in the countries of Union of Independent States (UIS) and abroad shows that in most cases, once the outbreak subsided, interest in this problem is lost, and funding is truncated [9]. Monitoring of the harmful grasshoppers in Kazakhstan includes a number of activities, namely: early spring check-up of overwintered egg capsules, a spring survey of locust larvae, a summer survey of adults and autumn control surveys on egg laying. In addition, on the basis of the information collected on the number and distribution of these herbivores forecasts are being made (short-term, long-term), together with current planning of preventive and control measures.

In general, the diversity of species of harmful grasshoppers in Kazakhstan has been studied [3,9], but data about the dominant or economically important species for different habitatas are lacking. The purpose of the current study was to determine the species composition of harmful grasshoppers in natural and cultural cenoses of Northern Kazakhstan and to establish the predoninant species.

Material and Methods. The surveys were made in 2014-2016 in different regions in Northern Kazakhstan. Several methods were used for determining the species diversity of grasshoppers and their population densities in chosen habitatas [10-13]. To determine the population density of harmful grasshoppers in various habitats several methods were used:

1 - sweep net sampling - 100 single mowing (or 50 double) with sweep entomological net in three or four replications.

2 - counting speciemens using wire frames 50 x 50 cm (0.25 m^2). On each of the studied habitats, depending on the area, a set of 8-16 frames were used.

3 - a visual count of the insects in the field of view using transects. Each transect was 10 meters long and a total of 20 transects were used. The transects were situated 100-300 m apart from each other. GPS (GARMIN eTrex 30) was used to take the coordinates of the chosen plots in natural and agricultural habitatas according to the procedure [14].

Results and Discussion. In a previous study for Northern Kazakhstan a total of 40 identified species of grasshoppers belonging to 24 genera from 2 families have been reported [3]. During the current surveys in Shortandy, Burabay, Tselinograd, Atbasar and Zerenda districts of Akmola region, Bayanaul and Kashyrskom districts of Pavlodar region, Altynsarinskom, Karabalyk and Auliekolskom districts of Kostanay region, Kyzylzharsky, Zhambyl, Tayynshinskom and Akkayynskom districts of Northen Kazakhstan a total of 9 major species of harmful grasshoppers have been identified (tabl.1).

Table 1 - Species composition and frequency of occurrence of harmful grasshoppers in Northern Kazakhstan (average for 2014-2016).

#	Species	Regions			
		Pavlodar region	Akmola region	Kostanay region	Petropavl region
1	*.Stenobothrus fischeri* (EV., 1848)	+++	++++	++++	+++
2	*Aeropus sibiricus sibiricus* (L., 1767)	+++	+	+	+
3	*Dociostaurus kraussi kraussi* (INGEN., 1897)	+++	+++	++	-
4	*Dociostaurus brevicollis* (EV., 1848)	++++	++++	++++	+++
5	*Oedaleus decorus* (GERM., 1817)	++	++	+	+
6	*Chorthippus albomarginatus albomarginatus* (DEG., 1773)	++++	++++	++++	++++
7	*Podisma pedestris* (L., 1758)	+++	+++	++	+
8	*Pararcyptera microptera microptera* (F.-W., 1833)	++++	++++	+++	++
9	*Staurodesus scalaris* (F.-W., 1846)	++	++	-	+

Note: + - encounterred once; ++ - rearly encounterred; +++ - frequently encounterred; ++++ - regularly encounterred.

Based on their frequency of occurrence, evaluated in fields of Northern Kazakhstan three grasshopper species were considered as more outstanding: *Pararcyptera microptera microptera, Dociostaurus brevicollis* and *Podisma pedestris.* These species were found in all surveyed cenoses – pastures, hayfields, etc. The rest of the species were found less frequently. Regarding the distribution of the grsshopper species in different natural and cultural habitats, the results revealed that the population density per 1 m^2 was variable (tabl. 3). Thus, in 2014 and 2015 there was an increase in their numbers. The population density was higher in grassy habitats.

In cultivated fields with oilseed and leguminous crops, the population density of grasshoppers was very low or none. A certain preference to habitats with perennial grass and fields with grain crops was observed. It was noted that grasshoppers were migrating to other crops only in cases when grasses or cereal crops were lacking or deteriorated. Meanwhile, during the vegetation period in 2013-2014, the amount of precipitation in Northern Kazakhstan was 15-20% higher than normal. In this context, the state of pastures, hayfields, fallow lands improved, creating favorable conditions for the herbivores to feed on cereal plant habitats.

Table 2 - Average population dnesity of harmful grasshoppers in different habitats in Northern Kazakhstan (average for 2014-2016).

#	Agrocenosis, habitat areas	Population density per m^2 (range variations) by regions							
		Akmola region		Pavlodar region		Kostanay region		Petropavl region	
1	2	3		4		5		6	
1	Pastures and hayfields	10-22	16.0	15-30	22.0	12-20	16.0	8-15	11.0
2	Disused fields	10-20	15.0	15-25	20	12-18	15.0	8-12	10.0
3	*Triticum aestivum* L.	8-10	9.0	12-15	13.0	10-15	12,0	6-10	8.0
4	*Triticum durum* DESF.	5-7	6.0	10-12	11.0	8-10	9.0	4-8	6.0
5	*Hordeum sativum* JESSEN	8-12	10.0	12-15	13.0	9-15	12.0	6-10	8.0
6	*Avena sativa* L.	6-15	11.0	10-20	15.0	8-16	12.0	5-10	7.0
7	*Onobryhis viciafolia* (SCOP.)	2-4	3.0	2-5	3.0	2-5	3.0	0-1	0.5
8	*Medicago sativa* L.	0-2	1.0	0.5-2	1.0	0.0	0.0	0.0	0.0
9	*Galega orientalis* LAM.	0.0	0.0	0-2	1.0	0.0	0.0	0.0	0.0
10	*Brassica napus* L.	0-2	1.0	0-3	2.0	0.0	0.0	0.0	0.0
11	*Linum usitatissimum* L.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	*Lens culinaris* MEDICUS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	*Pisum sativum* L.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	*Helianthus annus* L.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	*Phleum sp.*	5-7	6.0	10-12	11.0	8-10	9.0	4-8	6.0
16	*Sorghum x drummondii (STEUD.) MILLSP. & CHASE*	6-15	10.0	10-20	15.0	8-16	12.0	5-10	7.5

Since the cultural fields are not the main target of grasshoppers, natural habitats were chosen as trial plots for determening the ratio between population densities of the established species. The results of the observations revealed that the populations of nongregarious species of grasshoppers in pastures, fallow lands and habitats were concentrated in hot spots. Even at a distance of several kilometers of pasture areas the density of these species varied from 0.2-5 per m^2 to 10-15 per m^2. The margines of the hot spots were determined with the aid of GPS.

A combination of the method of transects with the method of entomological sweep net counts was applied to determine the dominant species of grasshoppers. Each transect was 10 m long and a total of 10 transects were used for a separate site. For each transect 10 seeps were made. This approach was practical and easy to apply, providing data about the species composition, population density, ratio between species, etc. In order, a species is considered dominant if it constitutes over 16% of the total population density of the species evaluated, and subdominant - from 4 to 16%. In regards to this division, the dominant grasshopper species in our study (fig. 1) were *Dociostaurus brevicollis, Pararcyptera microptera microptera and Podisma pedestris*, while *Stenobothrus fischeri, Aeropus sibiricus, Dociostaurus kraussi kraussi, Oedaleus decorus* and *Chorthippus albomarginatus albomarginatus* were considered subdominant species.

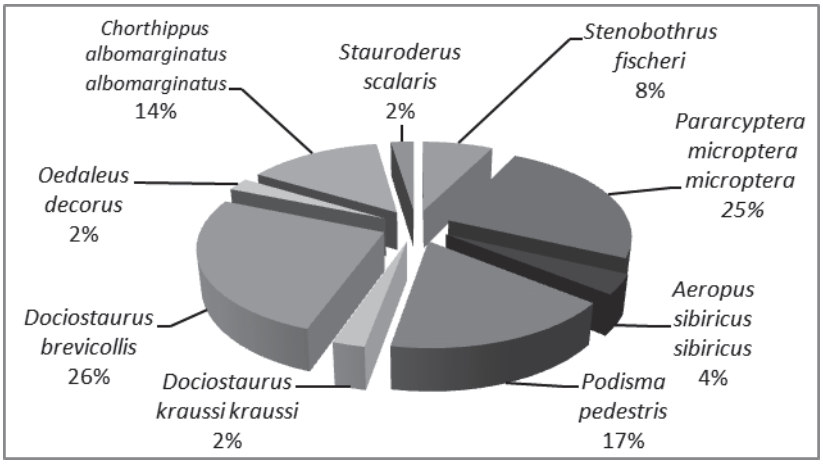

Figure 1 - Ratio between harmful grasshopper species in Northern Kazakhstan, (average for 2014-2016).

Surveys in spring for establishing the population density of egg capsules releaved similar situation (tabl. 4). Dominant species were *Pararcyptera microptera microptera, Dociostaurus brevicollis)* and *Podisma pedestris,* which made up respectively 23,6%, 26,5 and 19,1%, of the mixed population. The rest of the species were subdominant with 2,9 to 10,3% of the mixed population of egg capsules. The proportion of healthy eggs was 81.6% and of the affected in some way eggs - 18.4%. The average density of egg capsules was 5.6 per m^2.

Table 4 - Species composition and population density of grasshoppers egg capsules during the spring surveys (average for 2014-2016).

#	Species	Number of egg capsules						Egg capsules per m^2
		Total	% of the mixed population	Of them				
				Healthy	% of the mixed population	Affected	% of the mixed population	
1	*Stenobothrus fischeri*	5.0	7.3	3.5	5.1	1.5	2.2	0.4
2	*Aeropus sibiricus sibiricus*	16.0	23.6	13.0	19.1	3.0	4.5	1.5
3	*Dociostaurus kraussi kraussi*	3.0	4.5	3.0	4.5	0.0	0.0	0.25
4	*Dociostaurus brevicollis*	13.0	19.1	10.5	15.4	2.5	3.7	1.08
5	*Oedaleus decorus*	2.0	2.9	2.0	2.9	0.0	0.0	0.08
6	*Chorthippus albomarginatus albomarginatus*	18.0	26.5	15.0	22.1	3.0	4.4	1.6
7	*Podisma pedestris*	2.0	2.9	1.7	2.5	0.3	0.4	0.2
8	*Pararcyptera microptera microptera*	7.0	10.3	4.8	7.1	2.2	3.2	0.6
9	*Stauroderus scalaris*	2.0	2.9	2.0	2.9	0.0	0.0	0.2
	Species complex	68.0	100	55.5	81.6	12.5	18.4	5.6

According to their bioecological features the harmful grasshoppers are divided into spring, early summer and summer species [4]. In the group of spring species of grasshoppers these were the nongregarious *Stenobothrus fischeri, Pararcyptera microptera microptera, Aeropus sibiricus sibiricus, Podisma pedestris Dociostaurus kraussi kraussi* and *Stauroderus scalaris,* in the group of early summer species - *Dociostaurus brevicollis, Oedaleus decorus,* and in the group of summer

species - *Chorthippus albomarginatus albomarginatus.* The data in Tables 5-6 give the results of the spring-summer and summer surveys of larvae and winged adults of harmful grasshoppers.

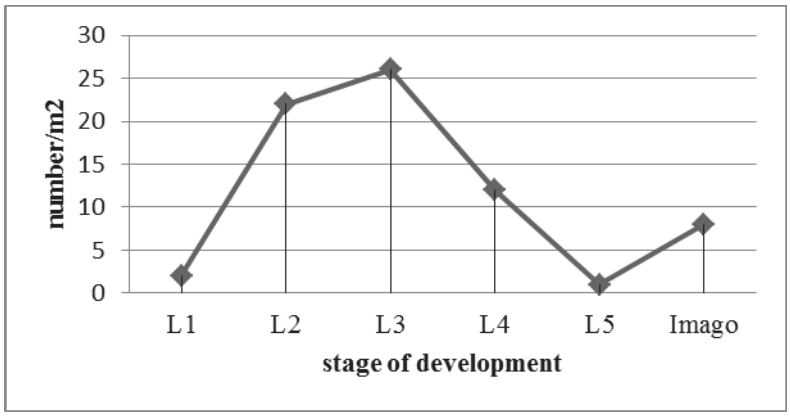

Figure 2 - Population density of larvae and adults of grasshoppers during the spring survey of the larvae (average for 2014-2016).

During the spring survey larvae of *Stenobothrus fischeri, Pararcyptera microptera microptera, Aeropus sibiricus sibiricus* and *Podisma pedestris* were found, and larvae of 2-nd and 3-th insatrs being prevalent (Fig. 2). Of these, the most numerous were larvae of *Pararcyptera microptera microptera* and *Podisma pedestris.* The total number of larvae from all of the samples was 93, and the average density per m^2 - 9.3. During the summer survey larvae of different instar and adults of all of the species were record, prevailing being the larvae from 4-th and 5-th instars and adults (Fig. 3). The most numerous were the species *Dociostaurus brevicollis* - 25,8%, *Pararcyptera microptera microptera* - 24,7%, and *Podisma pedestris* -15,1%.

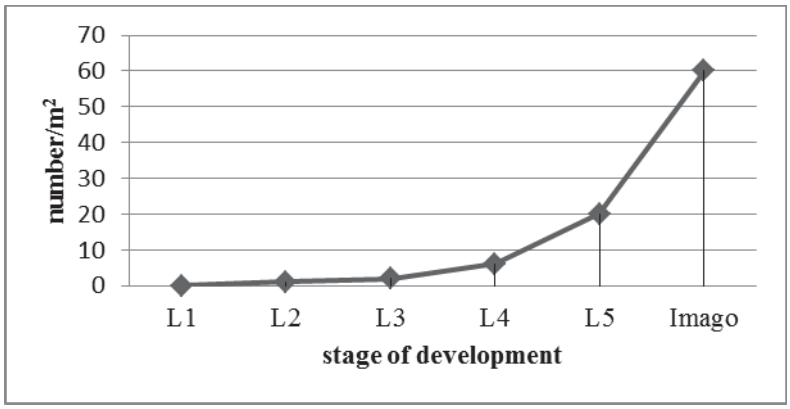

Figure 3. Population density of larvae and adults of grasshoppers during the summer survey of the winged adults (average for 2014-2016).

The life cycle of all the species of grasshoppers in Kazakhstan is similar - one generation per year, overwintering eggs are enclosed in capsule in the surface layer of soil, hatching larvae of most species occurs in spring or early summer, and at different time. Therefore, the hatching of larvae of the grasshoppers, even within the same area is very stretched over time. Most frequently, the duration of post-embryonic development is from 2 to 4 months.

Proper timing of chemical treatment of grasshoppers largely depends on the phenology of the pests. It is recommended the chemical treatments of grasshoppers, including nongregarious species to be directed to the larvae before turning into winged adults. In contrast to the gregarious species,

where a certain species is found in big agregations and the control measures could be focused only on its populations (e.g. *Calliptamus italicus*), for nongregarious grasshoppers pest monitoring is based on the population density of all the species present in a certain region.

Timely monitoring of grasshoppers habitats during crucial periods of their annual life cycle facilitates early detection of outbreaks in population density and adequate early warning and effective control measures. As a result frequency and intensity of localized outbreaks could be reduced and their progress into large-scale outbreaks could be prevented. It is important permanently to monitor population dynamics of grasshoppers and focus on preventive measures, including the use of low-hazard insecticides, biopesticides and biological methods.

Conclusions. In areas of Northern Kazakhstan 9 species of harmful grasshoppers were found in 2013-2014, all of them being quite common. The most numerous, found in all surveyed habitats, were *Pararcyptera microptera microptera, Dociostaurus brevicollis* and *Podisma pedestris.* The average population density of the different species considerably varried depending on the type of the habitat. In oilseed and leguminous crops, the population density of grasshoppers was lowest or they were absent. The highest population density was observed in perennial grass habitats followed by grain crops. Based on the population density of egg capsules, larvae and adults during the vegetation period the grasshoppers in Northern Kazakhstan were divided into three groups: the nongregarious *Stenobothrus fischeri, Pararcyptera microptera microptera, Aeropus sibiricus sibiricus, Podisma pedestris, Stauroderus scalaris* and *Dociostaurus kraussi* form the group of spring species of grasshoppers; *Dociostaurus brevicollis* and *Oedaleus decorus* - the group of early summer species, and *Chorthippus albomarginatus albomarginatus* was the only summer species.

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ДИНАМИКА ЧИСЛЕННОСТИ КОПЫТНЫХ МЛЕКОПИТАЮЩИХ В ОРЕНБУРГСКОЙ ОБЛАСТИ

Dynamics of population of hoofed mammals in the Orenburg region

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Дикие копытные животные, обитающие на территории области, составляют неотъемлемую часть ее природного богатства и входят в состав биологического разнообразия.

На территории Оренбургской области отмечено обитание 6 видов копытных млекопитающих: сибирская косуля, благородный олень, кабан, лось, сайга и лошадь Пржевальского. Это составляет 6,6% от фауны млекопитающих Оренбургской области. Четыре из перечисленных видов являются охотничье-промысловыми, а два относятся к категории редких. Поэтому постоянный контроль за численностью копытных млекопитающих является одной из приоритетных задач для современных природопользователей Оренбургской области.

Основной целью данного исследования явилось изучение численности копытных млекопитающих в Оренбургской области.

Динамику численности охотничье-промысловых видов составляли при использовании литературных источников, госдокладов «О состоянии и об охране окружающей среды Оренбургской области» с 1999 по 2016 гг. и данным Министерства лесного и охотничьего хозяйства Оренбургской области.

Кабан *(Sus..Scropha)* издавна населял дубовые леса предгорий Урала по рекам Ик и Самара[1].Однако к 1880-х годов кабаны появились в Адамовском, Домбаровском, Светлинском районах области, переселившись с Иргизских озер Актюбинской области Казахстана. В 1970-е годы, появившись в поймах рек Илека и Урала, кабаны оказались в пределах охотничьих угодий охотников и рыболовов. В последние годы кабан занимает приоритетное направление в организации охоты для многих охотничьих хозяйств в Оренбуржье.

В связи с этим основной лимитирующий фактор – доступность зимних кормов – снижен благодаря осуществлению активных биотехнических мероприятий, проводимых охотпользователями. Поэтому численность вида в области неуклонно растет и составляет около 9 тыс. особей (рис.1).

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