Far Eastern Entomologist
Дальневосточный энтомолог

Journal published by Far East Branch of the Russian Entomological Society and Laboratory of Entomology, Federal Scientific Center of the East Asia Terrestrial Biodiversity, Vladivostok

Number 541: 1-16 | ISSN 1026-051X (print edition) ISSN 2713-2196 (online edition) | February 2026

https://doi.org/10.25221/fee.541.1
https://elibrary.ru/xnaxze
https://zoobank.org/References/52E12DB5-6FD7-46E0-82A8-8D9B5257C2D1

ASSEMBLAGES OF DUNG BEETLES (COLEOPTERA, SCARABAEOIDEA) LIVING IN THE DUNG OF WILD ANIMALS IN RUSSIAN FAR EAST. COMMUNICATION 2. DUNG BEETLES INHABITAT IN THE DUNG OF WILD BOAR (*SUS SCROFA*)

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Summary. In the south of the Russian Far East an assembly of dung beetles inhabiting wild boar (*Sus scrofa*) dung has been studied. Data on the species composition, population dynamics, and number and biomass of the dung beetles are presented. A comparison of dung beetle assemblages inhabiting wild boar and sika deer dung under identical spatiotemporal conditions, formed from a common species pool, reveals similar species compositions in these associations. However, their structure and the dynamic processes occurring within them differ significantly. This is reflected in a richer species composition and the number of species of individual functional groups in sika deer dung, differences in dominant species, seasonal distribution patterns of abundance and biomass (including peak values of these indicators for individual dung beetle functional groups), and aggregated overlapping temporal aspects of the ecological niches of coprophilous beetles. These differences are probably related to the size and structure of the excrement of vertebrate animals, the presence of specific attractive substances in the droppings of wild boar, which is associated with omnivorousness.

Key words: dung beetles, assembly, seasonal dynamic, niches interception, biodiversity, Primorskii krai, Russia.

С. А. Шабалин. Ассамблеи жуков-навозников (Coleoptera, Scrabaeoidea) обитающих в помете диких животных Дальнего Востока России. Сообщение 2. Навозники, обитающие в помете кабана (*Sus scrofa*) // Дальневосточный энтомолог. 2026. N 541. С. 1-16.

Резюме. На юге Дальнего Востока России изучена ассамблея навозников, обитающих в помете кабана (*Sus scrofa*). Приведены данные о видовом составе, динамике населения, численности и биомассе навозников. Сравнение ассамблей навозников, обитающих в помете кабана и пятнистого оленя в идентичных пространственно-временных условиях, и формирующихся на базе общего видового пула, показывает, что видовой состав этих ассоциаций сходен, однако особенности их структуры и динамические процессы, протекающие в них, имеют существенные различия. Это выражается в более богатом видовом составе и числе видов отдельных функциональных групп в помете пятнистого оленя, в различиях доминирующих видов, особенностях сезонного распределения численности и биомассы (включая пиковые значения этих показателей для отдельных функциональных групп навозников), а также в совокупных показателях перекрытия временных аспектов экологических ниш копрофильных жесткокрылых. Указанные различия, вероятно, связаны с размерами и строением экскрементов позвоночных животных, наличием специфических привлекающих веществ в помете кабана, что связано со всеядностью.

INTRODUCTION

This publication is a continuation of a series devoted to the examination of dung beetle assemblages inhabiting the dung of wild animals in the Russian Far East. We have considered only some assemblies of these beetles in dung some domestic animals, such as sheep, cow, and horse (Shabalin, 2020, 2021, 2022a, 2024). The assemblage of dung beetles living in the dung of wild animals was examined only using the example of the sika deer (Shabalin, 2025a). Using the example of the dung beetle assembly from the dung of the sika deer, it was found that comparisons of assemblies of dung beetles that inhabit wild and domestic mammals that the species composition of these assemblies, and the dynamic processes taking place in them have significant differences. Beetles, inhabitants of the droppings of omnivorous animals such as wild boar, have not previously been studied in this aspect. Accordingly, it is of interest to study the assemblage of dung beetles that inhabit wild boar dung and compare it with that in sika deer dropping, which will allow us to assess the role of trophic selection and the influence of the local pool of species on the structure of assemblies. The purpose of this work is to study dung beetles that inhabit wild boar dung in the Safari-park (south of Primorskii krai, Shkotovskii district) and compare the results with data previously obtained in the same locality and at the same time on the dung of sika deer (Shabalin, 2025a) to identify the features of the morphology and dynamics of the assemblies coprophages, determined by the type of droppings of mammals in Primorskii krai.

MATERIAL AND METHODS

The collection of beetles, both in wild boar droppings, was carried out in the south of Primorskii krai (Shkotovskii district) in the vicinity of Shkotovo (43°32′ N, 132°40′ E) on the Safari-park in enclosures using substrate removal (Shabalin, 2021) from April 3 to October 8, 2020, once every ten days. The species identification of Coleoptera was carried out using the Key to Insects of the Far East (Berlov, 1989), review works (Kabakov, 2006), and considering new faunal finds (Shabalin & Berlov, 2008; Shabalin, 2018; Shabalin *et al*., 2024). The collection of the Federal Scientific Center for Biodiversity, Far Eastern Branch, Russian Academy of Sciences, was used as comparative material. Over the entire period of the study, 43.5 L of dung were removed and distilled and more than 1324 specimens of coprophilous scarabaeoid coleoptera were collected and identified. Taxon names are given according to the Catalog of Palaearctic Coleoptera (Dellacasa *et al*., 2016; Nikolajev *et al*., 2016; Ziani & Bezděk, 2016).

Functional groups are distinguished by a combination of trophodynamic relationships of beetles and their size classes. Types of trophodynamic relationships are given according to I. Hanski & Y. Cambifort (1991): dwellers are beetles that live in the thickness of manure; tunnelers are beetles that make passages under a pile of substrate and store provisions for larvae, and rollers are beetles that roll balls of dung.

The following size classes of beetles are accepted: small (s), up to 4.7 mm; medium (m), from 4.7 to 8.0 mm; and large (l), more than 8 mm (Shabalin, 2023). To calculate biomass indicators, original data were used (Shabalin, 2023), considering the regional specifics of the fauna. The overlap of ecological niches of beetles was assessed using formulas (Colwell & Futuyama, 1971; Hanski, 1978; Yu & Orloci, 1990):

$$PS_{ik} = 1 - \frac{\sum_j \left| p_{ij} - p_{kj} \right|}{2} \qquad (1), \text{ and}$$

$$PS_{ik} = \sum_j \min\left(p_{ij}, p_{ik}\right) \qquad (2),$$

where PS_{ik} is the overlap of ecological niches for species i and k, p_{ij} is the share of species i at point in time j, and p_{kj} is the share of species k at point in time j. In formula (1), the complete overlap of ecological niches takes values equal to 0; the absence of overlap equals 1. In formula (2), complete overlap takes a value equal to 1, and the absence of overlap takes a value equal to 0. Threshold values are defined for the first formula as less than 0.8 and, for the second, more than 0.1. Calculations were performed in EstimateSWin910, Past 4.12, and Excel 2007 programs. When analyzing the seasonal aspects of a beetle population, species diversity refers to the number of species active at the adult stage of development.

RESULTS

Species composition, functional groups. A total of 1324 individuals of beetles belonging to 10 species were collected and identified, the list of which is given below.

Family Scarabaeidae, subfamily Scarabaeinae: *Caccobius* (*Caccobius*) *brevis* Waterhouse, 1875, *Caccobius* (*Caccophilus*) *christophi* Harold, 1879, and *Onthophagus* (*Onthophagus*) *bivertex* Heyden, 1887.

Family Scarabaeidae, subfamily Aphodiinae: *Acrossus superatratus* (Nomura & Nakane, 1951), *Agrilinus ater* (DeGeer, 1774), *Aphodaulacus koltzei* (Reitter, 1892), *Aphodaulacus nigrotessellatus* (Motschulsky, 1866), *Esymus pusillus* (Herbst, 1789), *Labarrus sublimbatus* (Motschulsky, 1860), and *Phaeaphodius rectus* (Motschulsky, 1866).

The expected species diversity in the studied assembly of Coleoptera was assessed using the Chao2 and Mao Tao functions (Fig. 1); the values obtained at the terminal points of the functions were 10.94 and 10.92 species; and the identified diversity was 91.46 and 91.57% of that theoretically expected, respectively. The share of identified species in the assembly of dung beetles inhabiting wild boar dung in the Safari-park is 13.33% of the fauna of these beetles in the south of Sikhote-Alin Mountains (Shabalin, 2022b).

Coleoptera are classified into three functional groups based on trophodynamic relationships and size classes. The most well represented groups are dwellers the medium size class (4 species), in the groups of small size class dwellers and tunnelers medium sized only 3 species were recorded in each group.

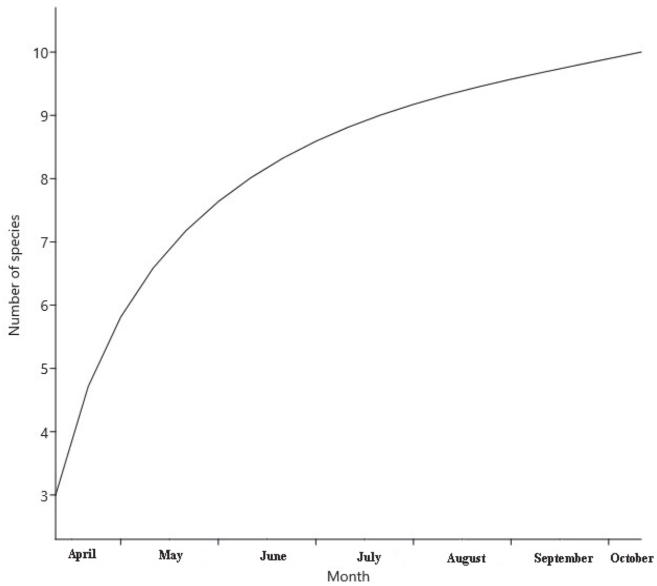

Fig. 1. Accumulation curve (Mao Tao) of dung beetle species.

Seasonal aspects of changes in species composition. The activity of imago beetles is observed from the beginning of April and continues until the first ten days of October. From the first ten days of April to the first den days of May small sized dweller *Aphodaulacus koltzei*, and medium sized dwellers (*Phaeaphodius rectus*, *Aphodaulacus nigrotessellatus*, and *Agrilinus ater*) is found in the collections. In the second ten days of May, small sized dweller *Esymus pusillus* is added to it. In the third ten days of May medium sized tunnelers (*Caccobius christophi*, and *Onthophagus bivertex*), medium sized dweller (*Acrossus superatratus*) and small sized dweller (*Labarrus sublimbatus*) appear. From the first ten days of April to the third ten days of May, the number of species increases, from 3 to 9 species. The maximum taxonomic diversity of beetles inhabiting in the wild boar dung in the Sikhote-Alin Mountains is noted in the third ten days of May (9 species). From the first ten days of June a decrease in species diversity occurs. Thus, in this period only 1-2 species of dwellers and 1-2 species of tunnelers were activity. From the second ten days of June to third ten days of September, taxonomic diversity consists of species with an extended period of adult activity (*Caccobius christophi*, *Caccobius brevis*, *Labarrus sublimbatus*, and *Phaeaphodius rectus*). From the third ten days of September to the first ten days of October, diversity decreases sharply. In this period only, medium sized dweller *Phaeaphodius rectus* was activity. In the first ten days of October, with a strong decrease in daytime temperatures, beetle activity stops (Fig. 2).

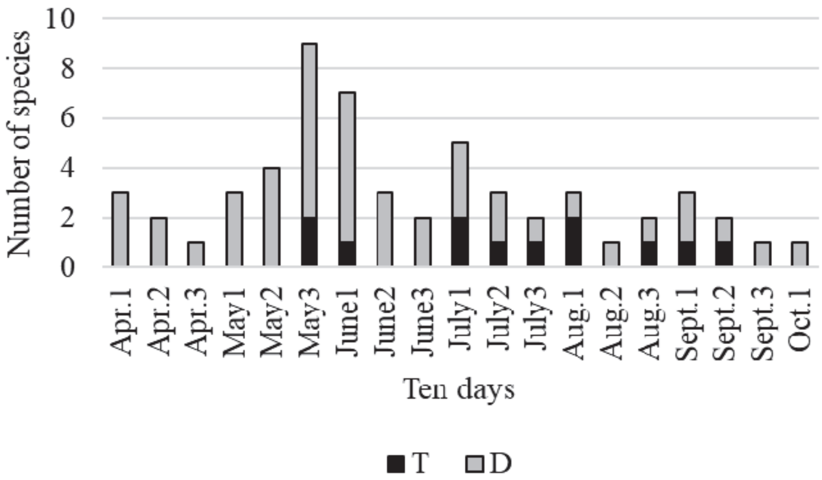

Fig. 2. Seasonal dynamics of the number of species. Trophodynamic groups: T – beetles making passages under a pile of substrate and storing provisions for the larvae, D – beetles living in the depth of manure.

Number and seasonal aspects of its changes. In the conditions of the Safari-Park, during the growing season, three peaks of increase in the number of coprophilous scarabaeoid beetles are observed in wild boar dung, with their number exceeding 80 individuals / L. The first, most significant, peak, with a total number of dung beetles of 108.68 individuals / L, falls on the first ten days of May; the second, with lower rates (94.5–102.4 individuals / L), is in the third ten days of

May – first ten days of June (Table 1); and the smallest, third peak, is in the first ten days of July (with a total number of 94.5 individuals / L). The first peak is formed primarily due to the high performance of the small dweller *Aphodaulacus koltzei* (102.0 individuals / L); the second is due to the high abundance of the same species and small sized dwellers *Esymus pusillus*, and *Labarrus sublimbatus*; and the third peak (Table 2) is solely due to the midsized dweller *Labarrus sublimbatus* (91.5 individuals / L).

Table 1. Number of dung beetles (specimens / L) in the wild boar dung by ten-day periods (first ten days of April – first ten days of July)

Species	Decades									
	Apr.1	Apr.2	Apr.3	May1	May2	May3	June1	June2	June3	July1
C. christophi	–	–	–	–	–	0,80	0,50	–	–	0,50
C. brevis	–	–	–	–	–	–	–	–	–	1,50
O. bivertex	–	–	–	–	–	0,40	–	–	–	–
A. superatratus	–	–	–	–	–	0,40	–	–	–	–
A. ater	–	–	–	2,00	–	0,40	0,50	–	–	–
A. koltzei	5,00	26,80	13,33	102,00	1,00	36,40	37,50	1,50	–	–
A. nigrotessellatus	3,00	–	–	–	1,00	0,40	0,50	–	–	–
E. pusillus	–	–	–	–	4,00	16,80	18,50	–	–	0,50
L. sublimbatus	–	–	–	–	–	24,40	20,00	18,00	5,00	91,50
Ph. rectus	1,00	0,40	–	4,67	8,00	22,40	17,00	2,00	0,50	0,50

Table 2. Number of dung beetles (specimens / L) in the wild boar dung by ten-day periods (the second ten days of July – the first ten days of October)

Species	Decades								
	July2	July3	Aug.1	Aug.2	Aug.3	Sept.1	Sept.2	Sept.3	Oct.1
C. christophi	–	0,50	2,00	–	4,00	0,50	2,00	–	–
C. brevis	0,33	–	0,50	–	–	–	–	–	–
L. sublimbatus	21,67	8,00	3,00	5,50	22,50	0,50	–	–	–
Ph. rectus	0,33	–	–	–	–	0,50	3,00	0,50	13,00

The number of tunnelers during the growing season were quite low. Only in the third ten-day period of August was a slight increase observed, reaching 4 specimens / L, due to medium sized *Caccobius christophi*. In this period accounts for 29.56 % of the total annual number of beetles of this group.

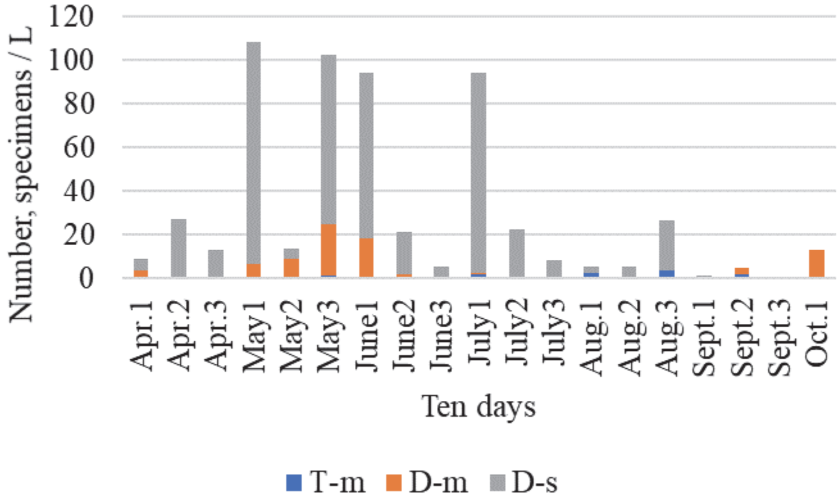

Fig. 3. Seasonal population dynamics. Trophodynamic groups: T – beetles making passages under a pile of substrate and storing provisions for the larvae; D – beetles living in the depth of manure. Size classes: m – medium; s – small.

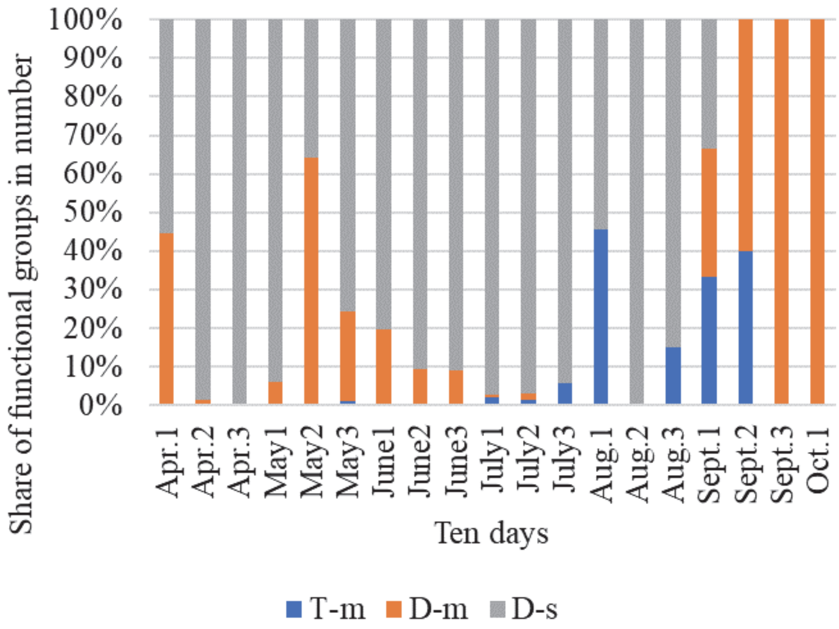

Fig. 4. Proportion of functional groups in the number of beetles. Designations of months and functional groups of beetles are the same as in fig. 3.

High numbers (more than 80 individuals/L) of dwellers were noted from the first ten days of May to the third ten days of May – first ten days of June, as well as in the first ten days of July, which is 19.22, 34.51, and 16.35% of their annual numbers, respectively (Table 1, 2). A significant share of the annual number of dwellers inhabiting in wild boar dung in Sikhote-Alin Mountains falls on the periods from the third ten days of May to the first ten days July (Fig. 3, 4). For the functional group of dwellers of the medium size class, population peaks were noted from the third ten days of May – first ten days of June. This spring peak in the number of medium sized dwellers is due to high rates of *Phaeaphodius rectus*. Small dwellers had three population peaks. First of its were noted in the first ten days of May, second in the third ten days of May – first ten days of June, and third – in the first ten days of July. The first two peaks are associated with high numbers of *Aphodaulacus koltzei*, and the last with *Labarrus sublimbatus* (Table 1, 2).

Biomass and seasonal aspects of its changes. In the collection of beetles under consideration, three peaks in the rise in biomass values were noted in the first ten days of May, the third ten days of May – first ten days of June, and the first ten days of July. The first and last peaks are characterized by high values for small size dwellers, while the second peak is characterized by jointly high values of small sized and medium sized dwellers (Fig. 5, 6).

The peak rise in the biomass of medium sized tunnels was noted in the third ten days of August; this period accounts for 31.91% of their annual biomass, mainly due to high values of *Caccobius christophi* (Table 3, 4).

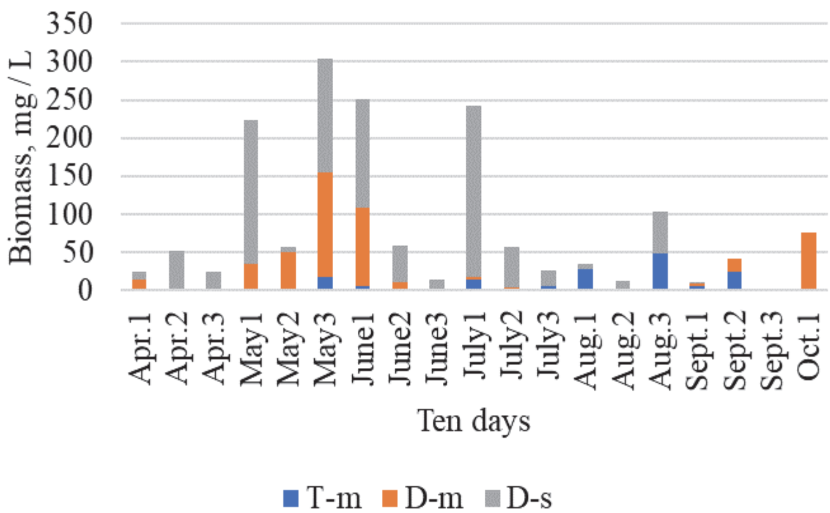

Fig. 5. Seasonal dynamics of biomass. Designations of months and functional groups of beetles are the same as in fig. 3.

Table 3. Dynamics of specific biomass of dung beetles (mg / L) in the wild boar dung by ten-day periods (first ten days of April – first ten days of July)

Species	Decades									
	Apr.1	Apr.2	Apr.3	May1	May2	May3	June1	June2	June3	July1
C. christophi	–	–	–	–	–	9,76	6,10	–	–	6,10
C. brevis	–	–	–	–	–	–	–	–	–	8,72
O. bivertex	–	–	–	–	–	7,60	–	–	–	–
A. superatratus	–	–	–	–	–	4,27	–	–	–	–
A. ater	–	–	–	8,46	–	1,69	2,12	–	–	–
A. koltzei	9,25	49,58	24,67	188,70	1,85	67,34	69,38	2,78	–	–
A. nigrotessellatus	9,36	–	–	–	3,12	1,25	1,56	–	–	–
E. pusillus	–	–	–	–	5,12	21,50	23,68	–	–	0,64
L. sublimbatus	–	–	–	–	–	59,54	48,80	43,92	12,20	223,26
Ph. rectus	5,82	2,33	–	27,16	46,56	130,37	98,94	11,64	2,91	2,91

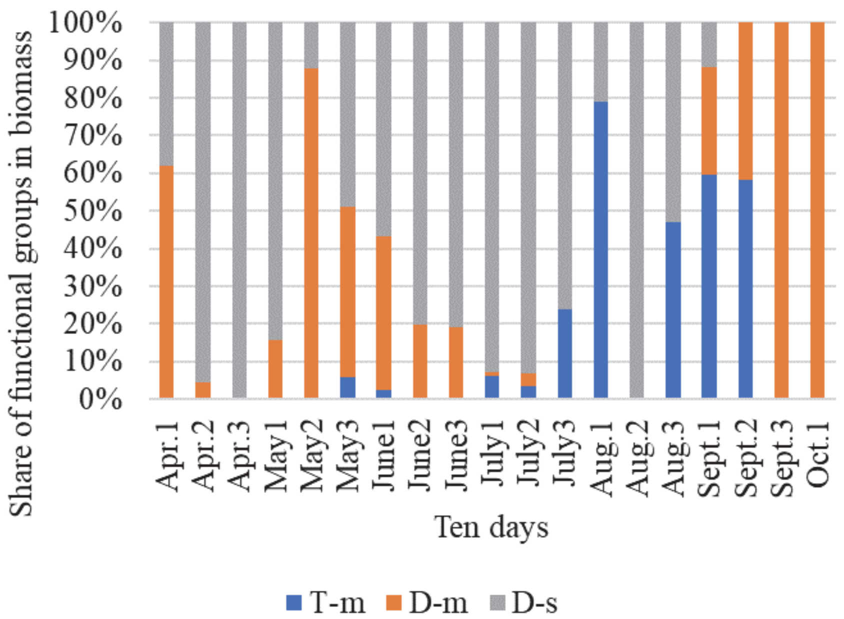

Fig. 6. Proportion of functional groups in biomass. Designations of months and functional groups of beetles are the same as in fig. 3.

Table 4. Dynamics of specific biomass of dung beetles (mg / L) in the wild boar dung by ten-day periods (the second ten days of July – the first ten days of October)

Species	Decades								
	July2	July3	Aug.1	Aug.2	Aug.3	Sept.1	Sept.2	Sept.3	Oct.1
C. christophi	–	6,10	24,40	–	48,80	6,10	24,40	–	–
C. brevis	1,94	–	2,91	–	–	–	–	–	–
L. sublimbatus	52,87	19,52	7,32	13,42	54,90	1,22	–	–	–
Ph. rectus	1,94	–	–	–	–	2,91	17,46	2,91	75,66

For small dwellers, increases in biomass indicators have been established in the first ten days of May, and the first ten days of July. The fist peak account 18.84% of the annual biomass of this group, primarily due to the high abundance of *Aphodaulacus koltzei*, but the second peak account 22.36% of the annual biomass of this group, primarily due to the high abundance of *Labarrus sublimbatus*. Increases in the biomass of medium sized dwellers were noted in the third ten days of May – first ten days of June. This, most significant, peak accounts for 52.06% of the annual biomass of beetles of this group. The peak of biomass in this group is associated with high rates of *Phaeaphodius rectus* (Table 3, 4).

Distribution of species by abundance. The distribution of species in the space log of the number of specimens – the rank of species graphically looks like a straight line (Fig. 7). The resulting linear model with a sufficiently high coefficient of determination corresponds to a geometric series or niche interception hypothesis. It is known that such a geometric model is closest to the series of significance of species for individual assemblies that are part of communities, when the dominance of a small number of species is clearly expressed (Giller, 1988), and a significant part of the species is represented by only a small number of individuals. In addition, a geometric series can express the outcome of competition for niche capture between a limited number of species (Whittaker, 1980), depending on the same environmental resources.

Overlapping ecological niches. The overlap of temporal aspects of ecological niches for tunnelers in wild boar dung in general, considering threshold values, was established for 1 pair of species (out of the maximum possible combination, 3 pairs), of species belong to the same size groups (33.33% of the maximum possible combination): *C. christophi – C. brevis.*

For dwellers, such an overlap of temporal aspects of ecological niches were obtained for 15 pairs of species out of the maximum possible combination of 27 pairs. Generations *Phaeaphodius rectus* divided into spring (s) and autumn (a). Considering the differentiation of beetles by size classes, 7 pairs of species are presented (25.93% of the maximum possible combination), for which there is a significant overlap of temporal aspects of ecological niches: *A. superatratus – A. ater*, *A. superatratus – A. nigrotessellatus*, *A. superatratus – Ph. rectus* (s), *A. ater – Ph. rectus* (s), *A. koltzei – E. pusillus*, *A. nigrotessellatus – Ph. rectus* (s), and *E. pusillus – L. sublimbatus*.

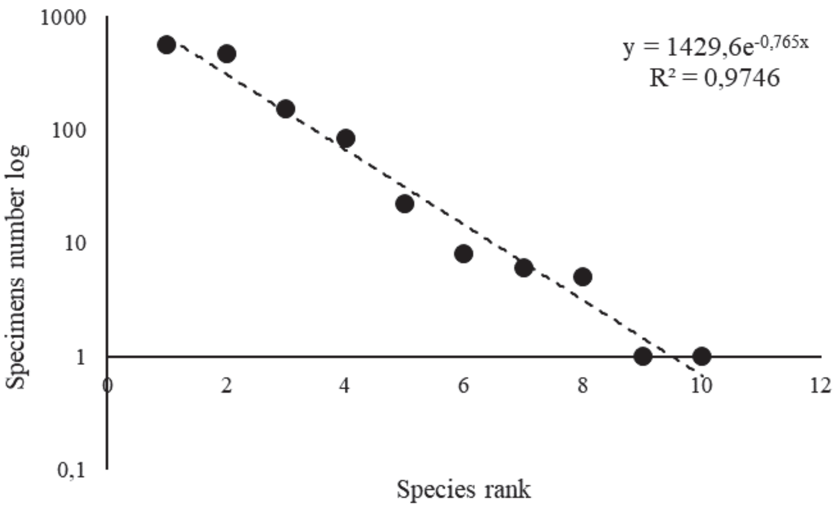

Fig. 7. Rank distribution of species.

DISCUSSION

The results obtained are the second in the Russian Far East to study the assemblages of dung beetles inhabiting in the dung of wild animals. The results allow us to compare assemblies of dung beetles in sika deer and wild boar droppings (Shabalin, 2025a), considering the fact that the observations were carried out in identical geographical conditions and time frames. It should be noted that species of the family Geotrupidae previously noted in the droppings of sika deer were not found in the boar droppings. The assemblage of inhabitants of sika deer dung is more taxonomically diverse, with 14 species recorded, while in wild boar dung there are only 10 species. All species in wild boar droppings, with the exception of *Aphodaulacus nigrotessellatus*, were also noted in sika deer droppings. The species composition of dung beetles found in boar dung is represented primarily by generalists. Only one species, *Aphodaulacus nigrotessellatus*, is a specialized inhabitant of carnivorous mammal dung. Perhaps the omnivorous nature of wild boars has led to the presence of special attractive components that attract this species of beetle. The wild boar droppings also show a low number of functional groups of beetles. Only 3, while the droppings of the sika deer or domestic animals contain 4 or 5-6 such groups. Large tunnels previously noted in sika deer droppings were not found in the boar droppings. The obtained data on the population of beetles in local assemblages confirm the results of a previously conducted analysis of the food specialization of dung beetles in the Russian Far East (Shabalin, 2025b). The food specialization of dung beetles inhabiting in the droppings of wild animals in the Russian Far East are significantly poorer in species than the droppings of farm animals. In addition, the species composition of beetles noted in the droppings of sheep and deer occupies an intermediate position. On the one hand, it is richer and more original than the droppings of predatory animals and wild boars, and on the other hand, it is significantly poorer and more banal than cows and horses. Such peculiarities in the number of dung beetle species may be due to the nutritional characteristics (anatomy and structure of the digestive system) of vertebrates that produce dung.

Our data on the number of dung beetle species inhabiting wild boar dung are intermediate. On the one hand, wild boar dung in the Russian Far East contains more species than in the Great Plains of North America (Whipple & Hoback, 2012), where only two species were recorded from the corresponding substrate. On the other hand, the assemblage of wild boar dung inhabitants in the Russian Far East is poorer in species than in Spain (10–19 species; Martín-Piera & Lobo, 1996; Grzechnik & Cabrero-Sanudo, 2025), the Netherlands (24 species; Heijerman, 1990), India (42 species; Satiandran *et al*., 2017), and South Korea (19 species; Hong *et al*., 2025). It is known, that the dung beetle communities of Palearctic temperate biomes are mostly attracted to herbivore dung, even though a strong attraction to human dung has also been noted. European species, in particular, only sporadically occur in carnivore or wild omnivore dung and infrequently consume carrion (Martín-Piera & Lobo, 1996; Barbero *et al*., 1999). Our data confirm this pattern since wild boar dung have much less species than those of herbivorous ungulates. In southern regions, dung beetles are more likely to exhibit copro-necrophagy (Barbero *et al*., 1999). This is likely why more species were observed in wild boar droppings in South Korea (Hong *et al*., 2025) than in our study.

Beetles were observed in the droppings of wild boar and sika deer from the beginning of April, but the activity of beetles in the droppings of sika deer continued until the second ten days of October, and in the droppings of wild boar only until the first ten days of the same month. The maximum species diversity in sika deer droppings was observed in the first and second ten days periods of July, while in wild boar droppings it peaked three ten days periods earlier, in the third ten days of May and the first ten days of June. If in the droppings of a wild boar the onset of beetle activity is associated with two species *Phaeaphodius rectus*, and *Aphodaulacus koltzei*, then in the droppings of a sika deer the onset of beetle flight is associated exclusively with the latter species, and *Phaeaphodius rectus* appears only from the third ten days of April. It is noteworthy that the species diversity in wild boar droppings is low from the second ten days of June to October, compared to sika deer. The maximum taxonomic diversity of beetles inhabiting sika deer and wild boar dung is a typical for the Sikhote-Alin Mountains. This period falls at the late spring – mid-summer.

In general, peaks in the number of beetles in the assemblies under consideration occur mainly during different periods with fluctuations. So, if in sika deer droppings the spring peak in the number of beetles is falls on the second ten days of May, then in wild boar droppings springer peaks were observed on the first ten days of May, and on the third ten days May – first ten days of June; the summer peak in wild boar droppings was noted in the first ten days of July and, in sika deer droppings this peak was not observed. In addition, these peaks, although formed mainly due to the high number of dwellers, are due to increases in the numbers of predominantly same species in the spring. However, summer peak expressed in wild boar droppings is associated with a high number of small sized dwellers *Labarrus sublimbatus*. This species has been observed in sika deer droppings, but at fairly low numbers, preventing a peak in population.

The peak in the number of medium sized tunnelers in both assemblies under consideration occurs in August and is associated with *Caccobius christophi*. The peaks in the numbers of both medium sized and small dwellers differ in number and occur in different periods, and are due to increases in the numbers of predominantly different species. Thus, in sika deer droppings, the spring peak in the number of medium sized dweller is associated with *Agrilinus ater*, and the autumn peak with *Phaeaphodius rectus*, in wild boar droppings, the spring peak is associated with the latter species, but the autumn peak is not represented at all. As for small sized dwellers, the spring peak in sika deer droppings is associated with *Esymus pusillus*, and *Aphodaulacus koltzei*, while the summer peak is not present at all. In wild boar droppings, the spring peak is associated with the last species, while the summer peak is associated with *Labarrus sublimbatus*.

The biomass of beetles living in dung of wild boar and sika deer is characterized by peak values at approximately the in different time. The presence of a functional group of large tunnelers in the sika deer droppings has a significant impact on this. Thus, peak biomass levels in sika deer dung occur exclusively in the second ten days of July and are associated with large tunnelers, but in the droppings of wild boars in the first ten days of May, the third ten days of May – first ten days of June, and the first ten days of July and are associated with small and medium size dwellers. While the peak biomass values of medium sized tunnelers and small dwellers are approximately the same, differing only by ten days and associated with the same species in both wild boar and sika deer droppings, the peak biomass values of medium sized dwellers have significant differences. Thus, the spring peak in the biomass of medium sized dwellers in wild boar droppings occurs at the third ten days of May – first ten days of June and is associated with *Phaeaphodius rectus*, but in sika deer droppings this period occurs at the second ten days of May, and associated with *Acrossus superatratus*, and *Agrilinus ater*. At the same time, the autumn peak of biomass indicators of medium sized dwellers in wild boar droppings is not expressed at all. Such differences in peak biomass values cannot be attributed to local weather or geographic conditions, since beetle collections were carried out in a single location.

The rank distribution of species in the considered assemblies corresponds to a geometric series or niche interception hypothesis. However, lower exponents were obtained for sika deer dung, which corresponds to a sharper slope of the function line and a more pronounced dominance of a small number of taxa. Considering the overlap of temporal aspects of the ecological niches of dung beetles are comparable to a slight increase this volume in the wild boar.

The above comparisons of dung beetle assemblies inhabiting in dung of wild boar and sika deer dung show that, although these assemblies are located in the same place, they were formed on the basis of a common pool of species and have a similar species composition of beetles, but the structural features of these assemblies, as well as those dynamic processes occurring in them, have significant differences. This is expressed in a poorer species composition and number of species in individual functional groups in wild boar droppings, differences in dominant species, features of the seasonal distribution of abundance and biomass (including peak values of these indicators for individual functional groups of dung beetles), and aggregate indicators of the overlap of temporal aspects of ecological niches of coprophilous scarabaeoid beetles. Apparently, these differences are due to a number of factors, among which we should note the anatomy and structure of the digestive system of vertebrates that produce dung. The morphology of the dung of wild boar and sika deer also differs significantly in both volume and shape.

Large wild boar excrement dehydrates over a long period of time, retaining its attractiveness to beetles for longer. This becomes most relevant with the establishment of high positive temperatures. Sika deer droppings are small in size and dehydrate faster than wild boar droppings, but are able to rehydrate and become attractive to beetles again. Since a dense crust forms on the surface of wild boar when it is on the soil, which prevents the evaporation of moisture from the thickness of the manure, it is accessible to beetles for a long time. In addition, the large size of wild boar dung, when compared to sika deer dung, makes it possible to maintain smoothed hydrothermal conditions for a longer time, and it remains attractive to coprophilous beetles for a long time.

CONCLUSION

Comparisons of assemblies of dung beetles that inhabit wild boar and sika deer dung in identical spatiotemporal conditions and form on the basis of a common pool of species show that the species composition of these assemblies is similar, but their structural features and the dynamic processes taking place in them have significant differences. This is expressed in a richer species composition and number of species in individual functional groups in sika deer dung, in differences in dominant species, features of the seasonal distribution of abundance and biomass (including peak values of these indicators for individual functional groups of dung beetles), and aggregate indicators of overlap of temporal aspects ecological niches of coprophilous Coleoptera. The above differences are probably associated with the size and structure of excrement of vertebrate animals, the presence of specific attracting substances in wild boar droppings associated with omnivorousness. Large wild boar excrement dehydrates over a long period of time, retaining its attractiveness to beetles for longer. Sika deer droppings are small in size and dehydrate faster than wild boar droppings, but are able to rehydrate and become attractive to beetles again. Since a dense crust forms on the surface of wild boar when it is on the soil, which prevents the evaporation of moisture from the thickness of the manure, it is accessible to beetles for a long time. In addition, the large size of wild boar dung, when compared to sika deer dung, makes it possible to maintain smoothed hydrothermal conditions for a longer time, and it remains attractive to coprophilous beetles for a long time.

ACKNOWLEDGEMENTS

The research was carried out within the state assignment of Ministry of Science and Higher Education of the Russian Federation (theme No. 124012400285-7).

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