

Determination of Species Richness Levels of Individuals of Ground Beetles (Coleoptera: Carabidae) In Northwestern Uzbekistan

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Abstract: The article analyzes the levels of species richness of ground beetles (Coleoptera: Carabidae) distributed in Northwestern Uzbekistan. The research was carried out during 2018–2025 in natural and anthropogenic habitats of the region. During the study, 150 observations were conducted at 75 sampling sites, and a total of 3930 specimens belonging to 104 taxonomic units were collected. Based on the collected material, the levels of species richness were assessed using a five-point scale depending on the abundance and density of individuals. The results showed that the majority of the fauna consists of rare and moderately distributed species. Species of the first category accounted for 10.6 %, the second category for 50 %, the third category for 33.6 %, and the fourth category for 5.7 %. No species belonging to the fifth category were recorded. The obtained results are important for assessing the bioecological state of the carabid fauna of Northwestern Uzbekistan and the characteristics of their distribution across different habitats.

Keywords: Ground beetles, Coleoptera, Carabidae, fauna, biodiversity, species richness, population density, ecology, habitat, Northwestern Uzbekistan.

Introduction: Every living organism tries to produce offspring once or several times during its life cycle. This, in turn, is repeated in the same way. However, the number, density, or biomass of individuals varies from season to season. In the work of zoogeographic kingdoms on our planet, insects are of great importance not only due to the large number of species and the density of individuals.

METHODS

Studies were conducted in the territory of North-Western Uzbekistan during 2018-2025 in all seasons.

During the research, observations and accounting work were carried out at 75 points located in various natural and anthropogenic biotopes of the territory. A total of 150 counts were conducted, as a result of which 3930 insect samples belonging to 104 taxonomic units were collected. Based on the collected materials, the species richness and biotopic complexes of the beetle fauna distributed in the natural and anthropogenic territories of North-Western Uzbekistan were analyzed. Data on the richness models and biotopic characteristics of the collected samples are presented in Table 1.

Table 1.

Information on richness models and biotopic complexes of insect samples collected from natural and anthropogenic territories of North-Western Uzbekistan during 2018-2025

№	Studied area	Coordinate	Material collection repetitions	Imago		L	Total
				♀	♂		
1.	Ustyurt	50	150	424	343	223	990

2.	Kyzylkum Desert	50	150	426	336	131	893
3.	Agrobiocenosis	75	200	613	483	297	1393
	Lower Amu Darya Biosphere Reserve	50	150	225	221	208	654
Total		225	650	1688	1383	859	3930

RESULTS

Proposes a more rational option for determining the richness levels of biological diversity of all collected biosamples, although their calculation is somewhat more complex: Measured on a 5-point scale when calculated with the total collected collection materials.

I score (single) - from 1 to N0.2, II score (very rare type), - from N0.2 + 1 to N0.4, III score (moderately common type), - from N0.4 + 1 to N0.6, IV score (multiple type) - from N0.6 + 1 to N0.8, the last V score (very many) - from N0.8 + 1 to N0.8. N = to the total number of collected species (3930). The results of monitoring low hills are presented in Table 2. [1,2,].

Table 2

Levels of richness of individuals of the buzzing beetle fauna of North-Western Uzbekistan

№	Type	Location detected		Number of samples		
		Bionosis	Coor	Numbers	%	Score
•	<i>Omophron limbatum</i> F., 1828	1	2	57	1.45	3
•	<i>Megacephala euphratica armeniaca</i> Cast., 1834	1	1	35	0.89	3
•	<i>Cicindela contorta</i> F. – W., 1828	1	1	140	3.56	3
•	<i>C. deserticole</i> Fald., 1836	1	2	70	1.78	3
•	<i>C.galathea</i> Thieme., 1881	2	2	7	0.17	2
•	<i>C. Lacteola</i> Pall., 1776	2	2	13	0.33	2
•	<i>C. (L.) littorals</i> F. 1787	1	2	123	3.12	2
•	<i>C.melancholica</i> F., 1798	1	2	28	0.71	2
•	<i>C. nox</i> Sem., 1886	1	2	58	1.47	3
•	<i>C. oblique fasciata</i> Ad., 1817	1	2	40	1.01	3
•	<i>C. orientalis</i> Dej., 1825	3	3	28	0.71	2
•	<i>C. sturmi</i> Men., 1832	3	3	7	0.17	2
•	<i>C.sublacerata</i> Sols., 1974	1	2	28	0.71	2
14	<i>Calosoma alagirisum</i> Gehin., 1835	1	2	40	0.101	3
15	<i>C. auropunctatum</i> subsp.dzungaricum Gebl., 1835	1	2	146	3.71	4
16	<i>C. imbricatum desertikola</i> Sem., 1897	1	2	79	2.01	3
17	<i>C. olivieri</i> Dej., 1831	1	2	17	0.43	2
18	<i>C. reitteri</i> Roe., 1896	3	5	15	0.39	2
19	<i>Cymbionotum plectulum</i> H.Bates., 1874	1	2	149	3.79	4
20	<i>Siagonaeuropaea</i> Dej., 1826	1	2	9	0.22	2

21	<i>Coryzacinifrons</i> Rtt. 1955	1	1	6	0.15	1
22	<i>Carabus (Ulocarabus) stschorovskii</i> Sols, 1874	1	2	45	1.14	3
23	<i>Clivina ypsilon</i> Dej., 1829	1	2	4	0.101	1
24	<i>Dyschirius apicalis</i> Putz., 1846	1	2	21	0.53	2
25	<i>D. arcifer</i> Zn., 1928	1	2	9	0.22	2
26	<i>D. caspius</i> Putz., 1866	1	2	21	0.53	2
27	<i>D. cylindricos</i>	1	2	22	0.55	2
28	<i>D. extensus</i> Putz., 1846	1	2	4	0.101	1
29	<i>D. humereatus</i> Chaud., 1850	1	2	38	0.96	3
30	<i>D. Lucidus</i> Putz., 1846	1	2	5	0.12	1
31	<i>D. luticola</i> Chaud., 1850	1	2	62	1.57	3
32	<i>Dyschirius pusillus</i> Dej., 1825	1	2	71	1.8	3
33	<i>D. salinus</i> Schaum., 1843	1	2	8	0.20	2
34	<i>D. strumosus</i> Dej., 1825	1	2	6	0.15	1
35	<i>D. syriacus</i> Putz., 1868	1	2	7	0.17	2
36	<i>D. zimini</i> Zn. 1928	1	2	13	0.33	2
37	<i>Scarites angustus</i> Chaud, 1855	4	4	177	4.50	4
38	<i>Scarites bucida</i> Pall., 1776	1	2	47	1.19	3
39	<i>S. cylindronotus</i> Fald., 1836	1	2	76	1.93	3
40	<i>S. eurytus</i> F.-W., 1825	1	2	52	1.32	3
41	<i>S. planus</i> Bon., 1813	4	4	23	0.58	3
42	<i>S. terricola</i> Bon., 1813	1	2	7	0.17	2
43	<i>Broscus punctatus</i> Dej. 1823	1	2	13	0.33	2
44	<i>B. semistriatus</i> F. – W., 1823	1	2	20	0.50	2
45	<i>B. semistriatus asiaticus</i> Ball., 1871	1	2	9	0.22	2
46	<i>Craspedonotus margelanicus</i> Krants 1834	1	2	6	0.15	1
47	<i>Bembidion (Pogonidium) laevibase</i> Rtt., 1902	1	2	118	3.002	3
48	<i>B (Chlorodium) alium</i> J.Sahlb., 1900	1	2	42	1.06	3
49	<i>B. (Ch). Luridicorne</i> Sols., 1874	1	2	9	0.22	2
50	<i>B. (Notaphocampa) niloticum</i> Dej, 1831	2	2	110	2.79	3
51	<i>B. (Emphanes) latiplaga</i> Chd. 1850	1	1	154	3.91	4
52	<i>B. (E.) tenellum ssp. buchariplaga</i> Nat., 1943	1	2	71	1.806	3
53	<i>B. (Semicampa) gassneri</i> Net., 1922	2	2	54	1.37	3
54	<i>B. (P.) atlanticum ssp. magaspillum</i> Valk., 1871	2	2	27	0.68	3

55	T.(P.) turkestanicusCsiki, 1923	1	2	55	1.39	3
56	T.(P.) centriustatus Rtt, 1894	2	2	22	0.55	2
57	Pagonus virens Men. 1849	1	2	41	1.04	3
58	Pogonistus (Syrdenus) grayiWoll., 1862	1	2	39	0.99	3
59	Chlaenius (tricliliochlaenius) stoveni Quens., 1806	1	2	28	0.71	2
60	Ch. (Chlaenites) inderiensisMotsch., 1858	1	2	13	0.33	2
61	Ch (Ch.) spoliatus Rossi., 1790	1	2	9	0.22	2
62	Ch. (s.str.) festivus Pariz., 1796	1	2	19	0.48	2
63	Ch. (Ch.) tristisSchall., 1783	1	2	24	0.61	2
64	Badister (s.str) anomalus Perris.,	1	2	7	0.17	2
65	Pt. (P) subcoeruleus Quens., 1896	1	2	46	1.17	3
66	Pt. (Angoleus) nitons chaud., 1850	1	2	6	0.15	1
67	Pt. (Derus) innatusGlas., 1908	1	2	13	0.33	2
68	Agonium (s.str.) atratumDuft., 1812	1	2	19	0.48	2
69	A.(s.str.) extensum Men., 1849	1	2	55	1.39	3
70	A.(s.str.) punctibaseRtt., 1894	1	2	6	0.15	1
71	A.(Europhilus) chivense Lutchn., 1934	1	2	14	0.35	2
72	Tephoxenus gracilis Zubk., 1833	1	2	13	0.33	2
73	CalathusambiguusPayk., 1790	1	2	9	0.22	2
74	Amara (s.str.) aenea Deg., 1774	1	2	93	2.36	3
75	A.(s.str.) ovata F., 1792	1	2	59	1.50	3
76	A.(s.str.) similata Gyll.,1810	1	2	14	0.35	2
77	A.(C.) ingenua Duft., 1812	1	2	9	0.22	2
78	A.(C.) tescicola Zimm., 1831	1	2	5	0.12	1
79	A.(Amathitis) faedtschenkoi Tach., 1898	1	1	55	1.39	3
80	A.(Bradytus) apricaria Payk., 1790	1	1	6	0.15	1
81	Curtonotus propinquus Men., 1832	1	2	8	0.203	2
82	Zabrus morio Men., 1832	1	2	156	3.96	4
83	Machozetes concinnus Dohrn., 1885	1	2	17	0.43	2
84	M.lehmanni Men., 1849	1	2	6	0.15	1
85	Carenochirus titanus Sols., 1874	1	2	8	0.203	2
86	DitomussemycylindricusPioch. 1872	1	2	14	0.35	2
87	Deptus vittatus F.-W., 1824	1	2	17	0.43	2
88	Acionopus(Haplacinopus) striolatusZubk., 1833	1	2	13	0.33	2
89	Ophonus.(Pseudoophonus)	1	2	147	3.74	4

	griseusPanz., 1792					
90	O.(Pseudoophonus) calceatusDuft., 1812	1	2	15	0.38	2
91	Harpalus (s.str.) distinguendus Duft., 1812	1	2	106	2.69	3
92	H.(s.str.) sublaevigatusTschitsch 1898	1	2	7	0.17	2
93	Dicheirotichus ustulatus Dej., 1829	1	2	49	1.24	3
94	Anisodactylus (Hexatrichus pseudoaeneus Dej., 1829	1	2	24	0.61	2
95	MnuphorussellatusGeb1 1843	1	2	8	0.203	2
96	MetabletusFuscomaculatusMotsch., 1844	1	2	19	0.48	2
97	M.negrita Woll. 1854	1	2	63	1.63	3
98	M.polituus Rtt. 1950	1	2	36	0.91	3
99	Cymindis (s.str.) accentifera Zoubk 1833	1	2	7	0.17	2
100	C. (Iscariotes) triangularis Rtt. 1897	1	2	8	0.203	2
101	Agatus flavipes Sols., 1874	1	2	16	0.40	2
102	Discoptera komarovi Sem 1889	1	2	29	0.73	3
103	Zuphium bactrianum Dan., 1893	1	2	9	0.22	2
104	Zuphium olens Rossi 1790	1	2	23	0.58	2
Total		4	60	3930	100	5

Thus, in order to assess the level of abundance of Northern-Western Uzbekistan by the number and density of beetle species in different biotopes, an

assessment was made based on the number of samples collected from their natural and anthropogenic territories during 2018-2025. (Table 3)

Table 3

Results of the abundance level of beetles of Northern-Western Uzbekistan

Wealth scale	Number of samples	Number of types	%
I score (single) - from 1 to N0.2	1–6	11	10.6
II score (rare type) - from N0.2 + 1 to N0.4	7–36	52	50
III score (permanent type) - from N0.4 + 1 to N0.6	37–213	35	33.6
IV score (multiple) - type N0 from 6 + 1 to N0.8	214–1276	6	5.7
V score (very high) -N0.8 + 1 to N	1277–7623	-	0
Total	3930	104	100

DISCUSSION

The total number of individuals of click beetle species of North-Western Uzbekistan was determined by V.F. Paliem, 1961, 1965, and Yu. The principles of

measurement on a 5-point scale were adopted when calculating the total collected collection materials, developed by A. Pesenko. The region's whistles corresponded to 4 points on a 5-point scale, depending on environmental conditions and the biology of

carabides. [3, 4]. First point (single rounds) *Coryza carinifrons*, *Clivina ypsilon*, *D. extensus*, *D. Lucidus*, *D. strumosus*, *Craspedonotus margelanicus*, *Pt. (Angoleus) nitons*, *A. (s.str.) punctibase*, *A. (C.) tescicola*, *A. (Bradytus) apicaria*, *M. lehmanni* каби 11 та тип (10.6%). Second score *Cicindela galathea*, *C. sturmi*, *C. Lacteola*, *C. (L.) littoralis*, *C. melancholica*, *C. orientalis*, *C. sublacerata*, *Calosoma olivieri*, *C. reitteri*, *Siagonae uropaea*, *Dyschirius apicalis*, *D. arcifer*, *D. caspius*, *D. cylindricos*, *D. salinus*, *D. syriacus*, *D. zimini*, *Scarites terricola*, *Brosicus punctatus*, *B. semistriatus*, *B. semistriatus asiaticus*, *B. (Ch.) luridicorne*, *T. (P.) centriustatus*, *Chlaenius (trichochlaenius) stoveni*, *Ch. (Chlaenites) inderiensis*, *Ch. (Ch.) spoliatus*, *Ch. (s.str.) festivus*, *Ch. (Ch.) tristis* Schall, *Badister (s.str.) anomalus*, *Pt. (Derus) innatus*, *Agonium (s.str.) atratum*, *A. (Europhilus) chivense*, *Tephoxenus gracilis*, *Calathus ambiguous*, *A. (s.str.) similata*, *A. (C.) ingénue*, *Curtonotus propinquus*, *Machozetes concinnus*, *Carenochirus titanus*, *Ditomus semicylindricus*, *Deptus vittatus*, *Acionopus (Haplacinopus) striolatus*, *O. (Pseudoophonus) calceatus*, *H. (s.str.) sublaevigatus*, *Anisodactylus (Hexatrachus) pseudoaeneus*, *Mnuphorus sellatus*, *Metabletus Fuscomaculatus*, *Cymindis (s.str.) accentifera*, *C. (Iscariotes) triangularis*, *Agatus flavipes*, *Zuphium bactrianum*, *Zuphium olens* 52 тип new types (50%) Third score *Omophron limbatum*, *Megacephala euphratica armeniaca*, *Cicindela contorta*, *C. nox*, *C. oblique fasciata*, *C. deserticole*, *Calosoma alalgirium*, *C. imbricatum desertikola*, *Carabus (Ulocarabus) stschorovskii*, *Dyschirius humereatus*, *D. luticola*, *Dyschirius pusillus*, *D. humereatus*, *Scarites bucida*, *S. cylindronotus*, *S. eurytus*, *S. planus*, *Bembidion (Pogonidium) laevibase*, *B. (Chlorodium) alium*, *B. (Notaphocampa) niloticum*, *B. (E.) tenellum ssp. buchariplaga*, *B. (Semicampa) gassneri*, *B. (P.) atlanticum ssp. maga*, *T. (P.) turkestanicus*, *Pogonus virens*, *Pogonistus (Syrdenus) grayi*, *Pt. (P) subcoeruleus*, *A. (s.str.) extensum*, *Amara (s.str.) aenea*, *A. (s.str.) ovate*, *A. (Amathitis) faedtschenkoi*, *Harpalus (s.str.) distinguendus*, *Dicheirotichus ustulatus*, *M. negrita*, *M. polituus*, *Discoptera komarovi* 35 types (33.6%) is collected. Тўртинчи балл *C. auropunctatum subsp. dzungaricum*, *Cymbionotum plctulum*, *Scarites angustus*, *B. (Emphanes) latiplaga*, *Zabrus morio*, *Ophonus. (Pseudoophonus) griseus* 6 species (5.7%) were identified.

CONCLUSION

As a result of the conducted research, 104 species of click beetles (Coleoptera: Carabidae) were identified in the territory of North-Western Uzbekistan, and a total of 3930 samples were collected. The degree of richness of the species' individuals was assessed on a 5-point scale. According to the analysis results, it was

established that rare and moderately distributed species predominate in the fauna of the territory. The number of species included in the first score was 10.6%, species included in the second score - 50%, species included in the third score - 33.6%, and species included in the fourth score - 5.7%. A large number of species included in the fifth score were not recorded. The obtained results are important for assessing the bioecological state of the beetle fauna of North-Western Uzbekistan and studying the features of their distribution by biotopes.

Thus, it was established that there are no types of the fifth score.

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