

The carabid beetles (Coleoptera: Carabidae) of the Republic of Tuva and their faunistic and ecological affinities

Фаунистические и экологические особенности фауны жужелиц (Coleoptera: Carabidae) Республики Тува

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КЛЮЧЕВЫЕ СЛОВА: Республика Тува, жужелицы, фаунистика, биогеография, экология.

ABSTRACT: Up to the present, the carabid fauna of the Republic of Tuva has been very insufficiently known. Based on large amount of material collected in the last 50 years, a list of Tuvan carabids, including 226 species representing 47 genera, is given. An analysis of ecological structure of Tuvan carabids indicates prevalence of species living in open, dry biotopes, and considerable number of halophiles, whereas the proportion of forest species is much more lower than in adjacent territories of Siberia. Remarkable features of the Tuvan carabid fauna are the low percentage of species with wide distribution in the Palaearctic and a high percentage of species distributed in semiarid and arid landscapes of Eurasia, as well as the presence of species of Middle Asian distributional pattern. The east-west stretching Tannu-Ola Range serves as a meridional faunistic filter for steppe species, and, simultaneously, is a major centre of speciation. In addition, *Trechus saglensis*, *T. shinganensis*, and *T. seserligensis* spp.n. are described.

РЕЗЮМЕ: До настоящего времени фауна жужелиц Тувы была изучена очень слабо. На основании обширных материалов, собранных в Туве на протяжении последних 50 лет, составлен фаунистический список жужелиц Тувы, включающий 226 видов, относящихся к 47 родам. Анализ экологической структуры тувинской фауны жужелиц показывает преобладание видов, приуроченных к открытым сухим местообитаниям, со значительной долей галофилов, тогда как процент лесных видов значительно меньше по сравнению с прилегающими территориями Сибири. Заметной особенностью фауны жужелиц Тувы является низкий процент видов с широким распространением в Палеарктике и высокая доля участия видов, приуроченных к семееаридным и аридным ландшафтам Евразии, а также присутствие сред-

неазиатских фаунистических элементов. Хребет Ташну-Ола, тянувшийся в меридиональном направлении на юге Тувы, служит фаунистическим фильтром для монгольских степных видов, и одновременно является главным центром видообразования в регионе. В дополнении даны иллюстрированные описания *Trechus saglensis*, *T. shinganensis* и *T. seserligensis* spp.n.

Introduction

The territory of the Republic of Tuva is circumscribed by several great mountain systems: in the west, by the Altai Mts.; in the north and east by the Western and Eastern Sayan Mts., respectively; and in the south, by the east-west stretching Tannu-Ola range. The highest elevation recorded in the Republic is 3,970 m (Mount Mongun-Taiga). In the vast, arid lowlands surrounded by these mountain ranges, steppe, salt lake, salt flat, and even semidesert habitats occur.

Special works on Tuvan carabid fauna are absent. Some species were described from this country [Poppius, 1907; Shilenkov, 1982a; Gottwald, 1993], or mentioned for its territory in taxonomical revisions [Netolitzky, 1942-1943; Mordkovich, 1969; Kataev, 1984a, 1984b, 1987, 1989, 1990a, 1990b; Hieke, 1972a, 1972b, 1973, 1975, 1976, 1978, 1983, 1988, 1996; Kryzhanovskij, 1979; Shilenkov, 1975b, 1982a, 1982b, 1982c, 1990; Verestshagina, 1984, 1989; Komarov, 1991; Fedorenko, 1992, 1994a, 1994b, 1994c] and checklist of Carabidae of Russia and adjacent lands [Kryzhanovskij et al., 1995].

Much more information on carabid fauna of adjacent territories is obtainable: Altais [Gebler, 1830, 1833, 1847-1848; Iablokoff-Khnzorian, 1971; Shilenkov, 1982a, Shilenkov, Sokolov, 1987; Kovrigin, 1984; Khmelkov, Kovrigin, 1985; Matalin, 1988; Kabak, Makarov, 1992; Belousov, Kabak,

1991, 1995, 1996], southern part of Krasnoyarsk Province [Sahlberg, 1880; Maeklin, 1881; Lutshnik, 1924; Shilenkov, Korshunov, 1985], Baikal-Transbaikal geographic region [literature is gathered in Shilenkov, 1994], Mongolia [Faldermann, 1833, 1835; Mandl, 1965a, 1965b, 1966, 1968, 1969, 1973; Jedlička, 1964, 1966, 1967, 1968a, 1968b, 1968c, 1969; Mlynar, 1971, 1974; Kryzhanovskij, 1975; Emetz, 1976; Shilenkov, 1975a, 1976, Moravec, 1992]. In another work, the high altitude carabid fauna of South Siberia was discussed [Shilenkov, 1992].

Geographically, the sampling in the territory of Tuva is extremely uneven, and records are essentially lacking from northeastern and southeastern parts, where large mountain systems without a network of roads are situated. Nevertheless, a review of the carabid fauna is presented, based on the large amount of material from the Republic of Tuva that has been accumulated over the past 50 years and is deposited in several different museums and private collections mentioned below (collectors names are given in parentheses).

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An analysis of the faunistic list of Tuvan Carabidae

A total of 226 species of carabids, representing 47 genera, is now recorded from the Republic (Table 1). An additional 229 species, representing 32 genera, have been recorded from adjacent areas from the southern part of Krasnoyarsk Province in the north and to NW Mongolia in the south, and probably occur also in Tuva. For comparison, from the Baikal-Transbaikal geographic region 496 species and subspecies are now recorded [Shilenkov, 1994], and about 350 species are mentioned in the literature from Mongolia.

The rather small number of species recorded from Tuva could be explained by three reasons: 1, the territory of the Republic is smaller in comparison to adjacent geographic regions mentioned above, and

does not possess as diverse environments, 2, the Tuvan carabid fauna is still insufficiently known, many parts of the territory are absolutely not investigated, 3, the mountain systems circumscribing the territory of Tuva serve as faunistic filters. Probably, all three reasons have taken place in the formation of Tuvan carabid fauna.

In the analysis of the faunistic list of Tuvan carabids, the absence of some genera and even taxa of a higher level, mentioned from the adjacent territories, stands out. The following taxa are not yet recorded from the territory of Tuva: family Trachypachidae; subfamily Brachyninae; tribes Clivinini and Broscini; genera *Pelophila* and *Leistus* (Nebrini); *Calosoma* (Carabini); *Diacheila* and *Blethisa* (Elaphrini); *Patrobus* (Patrobini); *Synuchus* (Sphodrini); *Anisodactylus*, *Acupalpus*, *Bradycellus* (Harpalini). Most of the species from these taxonomic groups have wide distributions in the Palaearctic or even in Holarctic Region.

Close inspection of the list in taxonomical order allows the record of the following distinctive properties of Tuvan carabid fauna.

Only 5 species of tiger beetles are recorded. For comparison, 13 species inhabit the Baikal-Transbaikal geographic region.

The genus *Carabus* is represented by 17 species, half of them having wide distributions in the taiga zone of Siberia. Two subspecies are endemics of the Tannu-Ola Mts., and one is an endemic species of W. Sayan Mts. Three species of the genus are characteristic of the steppe zone of Mongolia and Siberia. In contrast, species typical of the zonal Euro-Kazakhstanian steppes (*Carabus sibiricus* Fisch., *C. cribellatus* Ad.) as well as some hygrophiles and inhabitants of open terrains (*C. maeander* Fisch., *C. clathratus* L., *C. tuberculosus* Dej.) do not occur in Tuva.

The genus *Bembidion* is the largest in the number of species (39 species). Some subgenera are lacking from Tuva: *Philochtus*, *Semicampa*, *Plataphodes*, *Hirmoplathus*. Two species (*Bembidion* (*Notaphus*) *pedestre* Motsch. and *Bembidion* (*Asioperaphus*) *smirnovi* Kryzh.) are restricted to the kettle steppe of NW Mongolia and adjacent territories of Southern Altai and Tuva. Three species (*Bembidion* (*Chlorodius*) *almum* J.Sahlb., *Bembidion* (*Peryphus*) *insidiosum* Solsk. and *Bembidion* (*Testedionum*) *kokandicum* Solsky) penetrate to Tuva from the mountain regions of Middle Asia.

Half of the species from the genus *Poecilus* belong to the subgenus *Derus*, and their representatives are associated with steppe regions. The absence of hygrophilous *Pterostichus nigrita* Payk. and *P. vernalis* Panz. should be mentioned, and only one species of the subgenus *Cryobius* was recorded.

Only 7 species of *Agonum* have been found, whereas in the Baikal-Transbaikal geographic region 31 species have been recorded.

In the large genus *Amara* (24 species), many species with wide Transpalearctic and Euro-Siberian

Table 1. Classification, distribution and ecology of Tuvan carabids.
Таблица 1. Классификация, распространение и экология жуков-жужелиц Тувы.

List of species	Distribution	Ecological group	Special ecological preferences
FAMILY: CARABIDAE			
Subfamily: CICINDELINAE			
Tribe: CICINDELINI			
<i>Cicindela (Eumecurus) obliquefasciata</i> Ad., 1817	SP	xerophil., halophil.	
<i>Cicindela (Lophyridia) littoralis peipingensis</i> Mandl, 1934	MO(SP)	xerophil., halophil.	
<i>Cicindela</i> (s.str.) <i>hybrida</i> L., 1758	ES	meso-xerophil.	psammophil.
<i>Cicindela</i> (s.str.) <i>nitida</i> Licht., 1796	MO	xerophil., steppicol.	psammophil.
<i>Cicindela</i> (s.str.) <i>restricta</i> Fisch., 1825	SI	meso-xerophil.	psammophil.
Subfamily: CARABINAE			
Supertribe: NEBRIITAE			
Tribe: NEBRIINI			
<i>Nebria (Eunebria) limbiger</i> Sols., 1874	CA	hygrophil., reophil.	
<i>Nebria (Boreonebria) rufescens</i> (Stroem, 1768)	HO	hygrophil., sylvicol.	
<i>Nebria (Boreonebria) nivalis</i> (Payk., 1798)	HO	hygrophil., alpicol.	
<i>Nebria (Boreonebria) subdilata</i> Motsch., 1844	PA	hygrophil., reophil.	
<i>Nebria (Boreonebria) rubrofemorata</i> Shil., 1975	AS	hygrophil., reophil.	
<i>Nebria (Reductonebria) altaica</i> Gebl., 1847	AS	hygrophil., reophil.	
<i>Nebria (Catonebria) catenulata</i> Fisch., 1822	PA(SI)	hygrophil., reophil.	
Supertribe: NOTIOPHILITAE			
Tribe: NOTIOPHILINI			
<i>Notiophilus</i> (s.str.) <i>aquaticus</i> (L. 1758)	HO	hygro-mesophil.	partly alpine
<i>Notiophilus</i> (s.str.) <i>germinyi</i> Fauv. 1863	ES	mesophil., praticol.	
<i>Notiophilus (Latviaphilus) reitteri</i> Spaeth, 1899	SI	mesophil., humicol.	
Supertribe: CARABITAE			
Tribe: CARABINI			
<i>Carabus (Eucarabus) arvensis jurgitae</i> Deuve, 1993	AS(TP)	mesophil., humicol.	
<i>Carabus</i> (s.str.) <i>granulatus</i> L., 1758	TP	hygrophil., sylvicol.	
<i>Carabus (Morphocarabus) aeruginosus</i> Fisch., 1822	SI	mesophil., humicol.	
<i>Carabus (Morphocarabus) spasskianus</i> Fisch., 1822	SI	mesophil., humicol.	
<i>Carabus (Morphocarabus) aeruginosiformis</i> ssp. <i>microputus</i> Berlov et Shil., 1996	TO(SA)	mesophil., humicol.	
<i>Carabus (Morphocarabus) henningi</i> Fisch., 1817	SI	mesophil., humicol.	
<i>Carabus (Morphocarabus) odoratus</i> Motsch., 1844	SI	mesophil., humicol.	partly alpine
<i>Carabus (Morphocarabus) chaudoiri</i> Gebler, 1847	SI	mesophil., humicol.	
<i>Carabus (Morphocarabus) regalis</i> Fisch., 1822	SI	mesophil., humicol.	
<i>Carabus (Trachycarabus) sibiricus</i> Fisch., 1822	EA	xerophil., steppicol.	
<i>Carabus (Aulonocarabus) canaliculatus</i> Ad., 1812	SI	hygrophil., sylvicol.	
<i>Carabus (Diocarabus) loschnikovi</i> Fisch., 1823	SI	mesophil., humicol.	partly alpine
<i>Carabus (Diocarabus) slovtzovi mugurensis</i> Gottw., 1993	TO(SS)	hygrophil., alpicol.	
<i>Carabus (Diocarabus) massagetus</i> Motsch., 1844	SS	mesophil., humicol.	
<i>Carabus (Oreocarabus) vladimirskyi</i> Dej., 1830	MO	xerophil., steppicol.	
<i>Carabus (Scambocarabus) kruberi</i> Fisch., 1822	MO	xerophil., steppicol.	

Table 1 (continuation).
Таблица 1 (продолжение).

List of species	Distribution	Ecological group	Special ecological preferences
<i>Carabus (Pachystus) cribellatus</i> Ad., 1812	EA	xerophil., steppicol.	
<i>Carabus (Pachycranion) schoenherri</i> Fisch., 1822	SI	mesophil., humicol.	
<i>Carabus (Carabulus) tuvensis</i> Shil., 1996	SA	mesophil., humicol.	
<i>Carabus (Eupachys) glyptopterus</i> Fisch., 1827	MO	xerophil., steppicol.	
Supertribe: ELAPHRITAE			
Tribe: ELAPHRINI			
<i>Elaphrus (Arctelaphrus) lapponicus</i> Gyll., 1810	HO	hygrophil., sylvicol.	
<i>Elaphrus (Neolaphrus) splendidus</i> Fisch., 1828	PA	hygrophil., limnophil.	
<i>Elaphrus (Neolaphrus) sibiricus</i> Motsch., 1844	PA	hygrophil., limnophil.	
<i>Elaphrus</i> (s.str.) <i>riparius</i> L., 1758	TP	hygrophil., limnophil.	
Supertribe: LORICERITAE			
Tribe: LORICERINI			
<i>Loricera pilicornis</i> (F., 1775)	HO	hygrophil., sylvicol.-paludicol.	
Supertribe: SCARITITAE			
Tribe: DYSCHIRIINI			
<i>Dyschirius fossifrons</i> Putz., 1866	MO	hygrophil., limnophil.	partly halophil
<i>Dyschiriodes aeneus</i> (Dej., 1825)	TP	hygrophil., limnophil.	
<i>Dyschiriodes globosus</i> (Hbst., 1783)	TP	hygrophil., limnophil.	
<i>Dyschiriodes nitidus</i> (Dej., 1825)	TP	hygrophil., limnophil.	
<i>Dyschiriodes nigricornis</i> (Motsch., 1844)	TP	hygrophil., limnophil.	
<i>Dyschiriodes politus</i> (Dej., 1825)	HO	hygrophil., limnophil.	
<i>Dyschiriodes reitteri</i> (Kult., 1949)	MO	hygrophil., limnophil.	
<i>Dyschiriodes salinus striatopunctatus</i> (Putz., 1846)	SP(SP)	hygrophil., halophil.	
<i>Dyschiriodes subarcticus</i> (Lindr., 1969)	HO	hygrophil., limnophil.	
Supertribe: TRECHITAE			
Tribe: TRECHINI			
<i>Epaphius shushensis</i> Belousov et Kabak, 1995	SA	mesophil., humicol.	
<i>Trechus korotyaevi</i> Shil., 1982	TO	hygrophil., alpicol.	
<i>Trechus saglensis</i> Shil., sp.n.	TO	hygrophil., alpicol.	
<i>Trechus shinganensis</i> Shil., sp.n.	TO	hygrophil., alpicol.	
<i>Trechus seserligensis</i> Shil., sp.n.	TO	hygrophil., alpicol.	
Tribe: TACHYINI			
<i>Tachyta nana</i> (Gyll., 1810)			
Tribe: BEMBIDIINI			
<i>Asaphidion cupreum</i> Andr., 1925	PA	hygro-mesophil.	
<i>Bembidion (Bracteon) argenteolum</i> Ahr., 1812	ES	hygrophil., limnophil.	
<i>Bembidion (Bracteon) foveum</i> Motsch., 1844	HO	hygrophil., limnophil.	
<i>Bembidion (Bracteon) lapponicum</i> Zett., 1828	HO	hygrophil., limnophil.	
<i>Bembidion (Bracteon) conicollae</i> Motsch., 1844	PA	hygrophil., limnophil.	
<i>Bembidion (Bracteon) velox</i> (L., 1761)	TP	hygrophil., limnophil.	
<i>Bembidion (Eurytrachelus) vitiosum</i> Gemm. et Har., 1863	PA	hygrophil., limnophil.	
<i>Bembidion (Chlorodium) alnum</i> J.Sahlb., 1900	MA	hygrophil., reophil.	

Table 1 (continuation).
Таблица 1 (продолжение).

List of species	Distribution	Ecological group	Special ecological preferences
<i>Bembidion (Chlorodium) difforme</i> (Motsch., 1844)	MO	xerophil., steppicol.	
<i>Bembidion (Metallina) lampros</i> (Hbst., 1784)	ES	mesophil., arvicol.	
<i>Bembidion (Notaphus) obliquum</i> Sturm, 1825	TP	hygrophil., limnophil.	
<i>Bembidion (Notaphus) pedestre</i> (Motsch., 1844)	WM	hygrophil., halophil.	
<i>Bembidion (Notaphus) semipunctatum</i> (Don., 1806)	TP	hygrophil., limnophil.	
<i>Bembidion (Notaphus) varium</i> (Ol., 1795)	TP	hygrophil., limnophil.	
<i>Bembidion (Emphanes) axillare</i> (Motsch., 1844)	MO	hygrophil., halophil.	
<i>Bembidion</i> (s.str.) <i>humerae</i> Sturm, 1825	ES	hygrophil., paludicol.	
<i>Bembidion</i> (s.str.) <i>mandli</i> Net., 1932	PA	mesophil., humicol.	
<i>Bembidion</i> (s.str.) <i>quadrimaculatum</i> (L., 1761)	ES	praticol.-arvicol.	
<i>Bembidion (Plataphus) altaicum</i> (Geb., 1833)	PA	hygrophil., reophil.	
<i>Bembidion (Plataphus) gebleri</i> (Geb., 1833)	AA	hygrophil., reophil.	
<i>Bembidion (Plataphus) coelestinum</i> (Motsch., 1844)	SS	hygrophil., reophil.	
<i>Bembidion (Plataphus) lenense</i> Popp., 1906	AA	hygrophil., reophil.	
<i>Bembidion (Trichoplataphus) deplanatum</i> Mor., 1862	PA	hygrophil., reophil.	
<i>Bembidion (Trichoplataphus) hastii</i> C.R.Sahlb., 1827	HO	hygrophil., reophil.	
<i>Bembidion (Asioperyphus) altestriatum</i> Net., 1934	PA	hygrophil., reophil.	
<i>Bembidion (Asioperyphus) infuscatum</i> Dej., 1831	SI	hygrophil., limnophil.	
<i>Bembidion (Asioperyphus) lunatum</i> (Duft., 1812)	ES	hygrophil., limnophil.	
<i>Bembidion (Asioperyphus) ovale</i> (Motsch., 1844)	SI	hygrophil., limnophil.	
<i>Bembidion (Asioperyphus) smirnovi</i> Kryzh., 1979	WM	hygrophil., limnophil.	
<i>Bembidion (Peryphanes) dauricum</i> (Motsch., 1844)	HO	hygrophil., sylvicol.	
<i>Bembidion (Peryphanes) grapii</i> Gyll., 1827	HO	mesophil., humicol.	
<i>Bembidion (Ocydromus) scopulinum</i> (Kirby, 1837)	AA	hygrophil., reophil.	
<i>Bembidion (Peryphus) femoratum</i> Sturm, 1825	ES	hygrophil., limnophil.	
<i>Bembidion (Peryphus) insidiosum</i> Solsk., 1874	MA	hygrophil., limnophil.	
<i>Bembidion (Peryphus) jedlickai</i> Fass., 1945	SS	hygrophil., reophil.	
<i>Bembidion (Peryphus) mackinleyi scandicum</i> Lindr., 1943	TP(HO)	hygrophil., reophil.	
<i>Bembidion (Peryphus) obscurellum turanicum</i> Csiki, 1928	CA(HO)	praticol.-arvicol.	
<i>Bembidion (Peryphus) consummatum</i> Bates, 1873	PA	hygrophil., reophil.	
<i>Bembidion (Peryphus) petrosum</i> Geb., 1833	HO	hygrophil., reophil.	
<i>Bembidion (Testediolum) kokandicum</i> Solsky, 1874	MA	hygrophil., reophil.	
Tribe: POGONINI			
<i>Pogonus</i> (s.str.) <i>iridipennis</i> Nic., 1822	TP	hygrophil., halophil.	
<i>Pogonus</i> (s.str.) <i>luridipennis</i> (Germ., 1822)	SP	hygrophil., halophil.	
<i>Pogonus (Pogonoidius) punctulatus</i> Dej., 1828	EA	hygrophil., halophil.	
<i>Pogonistes</i> (s.str.) <i>rufoaeneus</i> (Dej., 1828)	EA	hygrophil., halophil.	
Supertribe: PATROBITAE			
Tribe: PATROBINI			
<i>Diplous depressus</i> (Geb., 1829)	EA	hygrophil., reophil.	
Tribe: DELTOMERINI			
<i>Platydiolus rufus</i> Chaud., 1878	SI	hygrophil., reophil.	

Table 1 (continuation).
Таблица 1 (продолжение).

List of species	Distribution	Ecological group	Special ecological preferences
Supertribe: PTEROSTICHITAE			
Tribe: PTEROSTICHINI			
<i>Poecilus (Poecilus) fortipes</i> Chaud., 1850	EA	meso-xerophil.	
<i>Poecilus (Poecilus) gebleri</i> Dej., 1828	MO	xerophil., steppicol.	
<i>Poecilus (Poecilus) versicolor</i> (Sturm, 1824)	ES	mesophil., praticol.-arvicol.	
<i>Poecilus (Derus) hanhaicus</i> (Tschit., 1896)	MO	xerophil., steppicol.	
<i>Poecilus (Derus) major</i> (Motsch., 1844)	MO	xerophil., steppicol.	
<i>Poecilus (Derus) ravus</i> (Lutshn., 1922)	MO	xerophil., steppicol.	
<i>Pterostichus (Platysma) eschscholtzi</i> Germ., 1824	EA	hygrophil., sylvicol.	
<i>Pterostichus (Platysma) tescorum</i> (Tschit., 1898)	MA	hygrophil., limnophil.	
<i>Pterostichus (Platysma) niger planipennis</i> R.Sahlb., 1844	EA(TP)	hygrophil., paludicol.-sylvicol.	
<i>Pterostichus (Lyperophorus) mirus</i> (Tschit., 1894)	SS	hygrophil., sylvicol.	
<i>Pterostichus (Lyperophorus) interruptus</i> Dej., 1828	EA	mesophil., humicol.	
<i>Pterostichus (Plectes) drescheri</i> Fisch., 1821	AS	mesophil., humicol.	
<i>Pterostichus (Pledarus) gibbicollis</i> (Motsch., 1844)	SS	mesophil., arvicol.	
<i>Pterostichus (Badistrinus) laticollis</i> (Motsch., 1844)	EA	hygrophil., limnophil.	
<i>Pterostichus (Phonias) diligens</i> (Sturm, 1824)	ES	mesophil., humicol.	
<i>Pterostichus (Phonias) morawitzianus</i> (Lutsh., 1922)	EA	mesophil., humicol.	
<i>Pterostichus (Phonias) strenuus</i> (Panz., 1797)	SS	mesophil., humicol.	
<i>Pterostichus (Cryobius) lucidus</i> (Motsch., 1844)	SA	mesophil., humicol.	partly alpine
<i>Pterostichus (Steropus) maurusiacus</i> Mnnh., 1825	SI	mesophil., humicol.	
<i>Pterostichus (Bothriopterus) adstrictus</i> Eschs., 1823	HO	mesophil., humicol.	
<i>Pterostichus (Petrophilus) magus mongolicus</i> (Motsch., 1844)	SI	mesophil., humicol.	
<i>Pterostichus (Petrophilus) dilutipes</i> (Motsch., 1844)	SI	mesophil., humicol.	
<i>Pterostichus (Petrophilus) turanensis</i> Jedl., 1959	SA	hygrophil., arvicol.	
<i>Pterostichus (Petrophilus) seriatus</i> Chaud., 1850	AS	hygrophil., alpicol.	
<i>Pterostichus (Petrophilus) monticoloides</i> Shil., 1995	AS	mesophil., humicol.	partly alpine
Tribe: AGONINI			
<i>Agonum (s.str.) gracilipes</i> (Duft., 1812)	TP	meso-xerophil.	
<i>Agonum (s.str.) impressum</i> (Panz., 1797)	TP	hygrophil., paludicol.	
<i>Agonum (s.str.) sahlbergi</i> (Chaud., 1850)	MA	hygrophil., mesophil.,	
<i>Agonum (s.str.) sexpunctatum</i> (L., 1758)	ES	hygrophil., mesophil.,	
<i>Agonum (s.str.) bicolor</i> Dej., 1828	AA	mesophil., humicol.	
<i>Agonum (Europhilus) fuliginosum</i> (Panz., 1809)	TP	hygrophil., paludicol.-sylvicol.	
<i>Agonum (Platynus) assimile</i> (Payk., 1790)	TP	hygrophil., sylvicol.	
Tribe: SPHODRINI			
Subtribe: CALATHINA			
<i>Calathus (Neocalathus) melanocephalus</i> (L., 1758)	ES	mesophil., praticol.-arvicol.	

Table 1 (continuation).
Таблица 1 (продолжение).

List of species	Distribu- tion	Ecological group	Special ecological preferences
Subtribe: SPHODRINA			
<i>Pseudotaphoxenus dauricus</i> (Fisch., 1823)	MO	xerophil., steppicol.	
<i>Reflexisphodrus refleximargo</i> (Reitt., 1894)	MO	xerophil., steppicol.	
Tribe: AMARINI			
<i>Amara</i> (s.str.) <i>aenea</i> (Deg., 1774)	ES	mesophil., praticol.-arvicol.	
<i>Amara</i> (s.str.) <i>anxia</i> Tschit., 1898	MO	xerophil., steppicol.	
<i>Amara</i> (s.str.) <i>biarticulata</i> Motsch., 1844	EA	meso-xerophil.	
<i>Amara</i> (s.str.) <i>communis</i> (Panz., 1797)	TP	mesophil., humicol.	
<i>Amara</i> (s.str.) <i>coraica</i> Kolbe, 1886	PA	meso-xerophil.	
<i>Amara</i> (s.str.) <i>elliptica</i> Heyd., 1885	MO	xerophil., steppicol.	
<i>Amara</i> (s.str.) <i>erratica</i> (Duft., 1812)	HO	mesophil., praticol.	partly alpine
<i>Amara</i> (s.str.) <i>famelica</i> Zimm., 1832	SP	hygro-mesophil.	partly alpine
<i>Amara</i> (s.str.) <i>hammarstroemi</i> Popp., 1907	MO	mesophil., humicol.	partly steppicol.
<i>Amara</i> (s.str.) <i>magnicollis</i> Tschit., 1894	PA	meso-xerophil.	
<i>Amara</i> (s.str.) <i>morio bamidunya</i> Bates, 1878	CA(EA)	xerophil., steppicol.	
<i>Amara</i> (s.str.) <i>ogloblini</i> Lutsh., 1934	SS	mesophil., praticol.	
<i>Amara</i> (s.str.) <i>similata</i> (Gyll., 1810)	TP	mesophil., praticol.-arvicol.	
<i>Amara</i> (<i>Celia</i>) <i>microphthalma</i> Baliani, 1943	AS	hygrophil., alpicol.	
<i>Amara</i> (<i>Celia</i>) <i>rupicola</i> Zimm., 1831	MO	xerophil., steppicol.	
<i>Amara</i> (<i>Celia</i>) <i>saginata</i> Men., 1847	PA	meso-xerophil.	
<i>Amara</i> (<i>Paracelia</i>) <i>quenseli</i> (Schoenh., 1806)	HO	meso-xerophil.	partly alpine
<i>Amara</i> (<i>Bradytulus</i>) <i>hanhaica</i> Tschit., 1894	MO	xerophil., steppicol.	partly alpine
<i>Amara</i> (<i>Bradytus</i>) <i>aurichalcea</i> Germ., 1824	SI	meso-xerophil.	
<i>Amara</i> (<i>Bradytus</i>) <i>majuscula</i> (Chaud., 1850)	TP	mesophil., praticol.-arvicol.	
<i>Amara</i> (<i>Percosia</i>) <i>infusca</i> Putz., 1866	MO	xerophil., steppicol.	
<i>Amara</i> (<i>Amathitis</i>) <i>silfverbergi</i> Hieke, 1996	MO	xerophil., steppicol.	partly halophil.
<i>Amara</i> (<i>Amathitis</i>) <i>parvicollis</i> Gebl., 1833	EA	mesophil., praticol.-arvicol.	
<i>Amara</i> (<i>Amathitis</i>) <i>stulta</i> Lutshn., 1935	MO	hygrophil., halophil.	
<i>Curtonotus</i> (s.str.) <i>brevicollis</i> (Chaud., 1850)	EA	xerophil., steppicol.	
<i>Curtonotus</i> (s.str.) <i>convexusculus</i> (Marsham, 1802)	ES	xerophil., steppicol.	partly halophil.
<i>Curtonotus</i> (s.str.) <i>dauricus</i> (Motsch., 1844)	AA	meso-xerophil.	
<i>Curtonotus</i> (s.str.) <i>fodinae</i> (Mnnh., 1825)	EA	meso-xerophil., arvicol.	
<i>Curtonotus</i> (s.str.) <i>harpaloides</i> (Dej., 1829)	EA	meso-xerophil., arvicol.	
<i>Curtonotus</i> (s.str.) <i>shinanensis</i> (Habu, 1953)	PA	xerophil., steppicol.	psammophil.
<i>Curtonotus</i> (s.str.) <i>torridus</i> (Panz., 1797)	HO	hygrophil., alpicol.	
<i>Curtonotus</i> (s.str.) <i>tschitscherinellus</i> (Hieke, 1990)	MO	xerophil., steppicol.	
Supertribe: HARPAUTAE			
Tribe: HARPALINI			
Subtribe: ACUPALPINA			
<i>Trichocellus</i> (<i>Oreoxenus</i>) <i>mannerheimi</i> (R.F.Sahlb., 1844)	HO	mesophil., humicol.	
<i>Trichocellus</i> (s.str.) <i>parallelus</i> (Reitt., 1898)	MO	xerophil., steppicol.	
<i>Dicheirotichus abdominalis</i> (Motsch., 1844)	MO	hygrophil., halophil.	

Table 1 (continuation).
Таблица 1 (продолжение).

List of species	Distribution	Ecological group	Special ecological preferences
Subtribe: HARPALINA			
<i>Daptus vittatus</i> Fisch., 1823	SP	hygrophil., halophil.	
<i>Pseudoophonus (Platus) calceatus</i> (Duft., 1812)	TP	meso-xerophil., arvicol.	
<i>Harpalus acupalpoides</i> Reitt., 1900	MO	xerophil., steppicol.	
<i>Harpalus aequicollis</i> Motsch., 1844	MO	xerophil., steppicol.	
<i>Harpalus affinis</i> (Schränk, 1781)	TP	mesophil., praticol.-arvicol.	
<i>Harpalus amariformis</i> Motsch., 1844	MO	xerophil., steppicol.	
<i>Harpalus amplicollis</i> Men., 1848	EA	xerophil., steppicol.	
<i>Harpalus anxius</i> (Duft., 1812)	ES	meso-xerophil.	
<i>Harpalus brevis</i> Motsch., 1844	EA	xerophil., steppicol.	
<i>Harpalus brevicornis</i> Germ., 1824	MO	xerophil., steppicol.	
<i>Harpalus dispar splendens</i> Gebl., 1830	EA	hygrophil., halophil.	
<i>Harpalus distinguendus</i> (Duft., 1812)	ES	mesophil., praticol.-arvicol.	
<i>Harpalus egorovi</i> Lafer, 1989	PA	mesophil., praticol.	
<i>Harpalus ellipticus</i> Ball., 1878	EA	xerophil., steppicol.	
<i>Harpalus erosus</i> Mnnh., 1825	SS	meso-xerophil.	
<i>Harpalus froelichi</i> Sturm, 1818	EA	xerophil., steppicol.	
<i>Harpalus fuscipalpis</i> Sturm, 1818	HO	xerophil., steppicol.	
<i>Harpalus hirtipes</i> (Panz., 1797)	EA	xerophil., steppicol.	
<i>Harpalus latus</i> (L., 1758)	TP	mesophil., humicol.	
<i>Harpalus lumbaris</i> Mnnh., 1825	MO	xerophil., steppicol.	
<i>Harpalus macronotus</i> Tschit., 1893	MO	xerophil., steppicol.	
<i>Harpalus obtusus obtusus</i> Gebl., 1833	MO(AA)	xerophil., steppicol.	
<i>Harpalus pallidipennis</i> Mor., 1862	PA	meso-xerophil.	
<i>Harpalus pusillus</i> Motsch., 1850	MO	xerophil., steppicol.	
<i>Harpalus rufiscapus</i> Gebl., 1833	EA	xerophil., steppicol.	
<i>Harpalus servus</i> (Duft., 1812)	EA	xerophil., steppicol.	
<i>Harpalus sinuatus</i> Tschit., 1893	MO	xerophil., steppicol.	
<i>Harpalus smaragdinus</i> (Duft., 1812)	ES	meso-xerophil.	
<i>Harpalus torridoides</i> Rtt., 1900	SI	hygrophil., limnophil.	
<i>Harpalus viridanus</i> Motsch., 1844	MO	xerophil., steppicol.	
<i>Harpalus vittatus</i> Gebl., 1833	MO	xerophil., steppicol.	
<i>Harpalus xanthopus</i> Gemm. et Har., 1868	TP	mesophil., humicol.	
<i>Harpalus udege</i> Lafer, 1989	PA	mesophil., praticol.	
<i>Neophygas microcephalus</i> (Fald., 1835)	MO	xerophil., steppicol.	
<i>Microderes nanulus</i> (Tschit., 1898)	MO	xerophil., steppicol.	
<i>Ophonus (Metophonus) histrix</i> Reitt., 1900	MO	xerophil., steppicol.	
Tribe: LICININI			
<i>Licinus (Tricholicinus) setosus</i> (J.Sahlb., 1880)	PA	mesophil., humicol.	
<i>Badister (s.str.) fenestratus</i> Sem., 1906	MA	mesophil., humicol.	

Table 1 (continuation).
Таблица 1 (продолжение).

List of species	Distribution	Ecological group	Special ecological preferences
Supertribe: MASOREITAE			
Tribe: MASOREINI			
<i>Masoreus wetterhalli</i> (Gyll., 1813)	SP	xerophil., steppicol.	
Tribe: CORSYRINI			
<i>Corsyra fusula</i> Fisch., 1825	EA	xerophil., steppicol.	
Supertribe: LEBIITAE			
Tribe: LEBIINI			
Subtribe: LEBIINA			
<i>Lionedya mongolica</i> (Motsch., 1850)	MO	xerophil., steppicol.	
<i>Lebia</i> (s.str.) <i>cruxminor</i> (L., 1758)	TP	meso-xerophil.	
Subtribe: DROMIINA			
<i>Dromius</i> (s.str.) <i>quadraticollis</i> Mor., 1862	TP	mesophil., arboricol.	
<i>Paradromius</i> (<i>Manodromius</i>) <i>ruficollis</i> (Motsch., 1844)	PA	mesophil., arboricol.	
<i>Synthomus mongolicus</i> (Motsch., 1844)	MO	xerophil., steppicol.	
<i>Synthomus truncatellus</i> (L., 1761)	ES	xerophil., steppicol.	
<i>Microlestes minutulus</i> (Goeze, 1777)	TP	mesophil., praticol.-arvicol.	
<i>Microlestes schroederi</i> Holdh., 1912	EA	meso-xerophil.	
<i>Apristus striatus</i> (Motsch., 1844)	PA	hygrophil., reophil.	
Subtribe: CYMINDINA			
<i>Cymindis</i> (<i>Baicalotarus</i>) <i>rivularis</i> Motsch., 1844	MO	xerophil., steppicol.	
<i>Cymindis</i> (<i>Chaetotarus</i>) <i>pilosissima dshungarica</i> Jedl., 1967	WM(MO)	xerophil., steppicol.	
<i>Cymindis</i> (<i>Paracymindis</i>) <i>rostowtzeni rostowtzeni</i> Tschit., 1896	WM(WM)	xerophil., steppicol.	
<i>Cymindis</i> (<i>Menas</i>) <i>faldermanni</i> Gistl., 1839	EA	xerophil., steppicol.	
<i>Cymindis</i> (<i>Pseudocymindis</i>) <i>collaris</i> Motsch., 1844	PA	meso-xerophil.	
<i>Cymindis</i> (<i>Tarsostinus</i>) <i>binotata</i> Fisch., 1820	EA	xerophil., steppicol.	
<i>Cymindis</i> (<i>Tarulus</i>) <i>vaporariorum</i> (L., 1758)	TP	mesophil., humicol.	partly alpine

Geographical range patterns: HO — Circumholartic, AA — Asia-American, TP — Transpalaeartic, ES — Euro-Siberian, SI — Siberian, PA — Eastasian (palaeartic), SS — South Siberian, AS — Altai-Sajanian, SA — Sajanian, TO — Tannu-Olan, MA — Middle Asian, EA — Eurasian steppe, MO — Mongolian, WM — West Mongolian, SP — South Palaeartic, CA — Central Asian. (total distribution of species in parenthesis).

Ecological groups: full names see table 2.

distribution are absent (*A. eurynota* Panz., *A. familiaris* Duft., *A. lunicollis* Schiod., *A. nitida* Sturm, *A. apricaria* Payk. etc.), but steppe (*A. anxia* Tschit., *A. biarticulata* Motsch., *A. elliptica* Heyd., etc.) and halophilous species (*A. silfoerbergi* Hieke, *A. stulta* Lutshn.) are well represented.

Harpalus is the second largest genus in Tuva (31 species). The peculiar elements of the Tuvan fauna are the halophilous *Harpalus dispar splendens* Gebl., which has its easternmost limit of its distribution in Tuva, as well as the steppe species *H. servus* Duft., which does not reach the Baikal region. On the other hand, widely distributed

species like *H. calathoides* Motsch., *H. zabroides* Dej., *H. quadripunctatus* Dej. and *H. rubripes* Duft. were not recorded. Presence of the Mongolian steppe species *Microderes nanulus* Tschit. and *Neophygas microcephalus* Fald., is very typical of the Tuvan fauna, the latter species inhabiting even cultivated fields in Tuva.

Very remarkable is the find of the Middle Asian species *Badister fenestratus* Sem. in the forest zone on the southern slope of Tannu-Ola Mts.

Only a few species of tribe Lebiini have been recorded. However, 7 species of *Cymindis*, including two endemics of NW Mongolia and the extreme

south of Siberia (*Cymindis pilosissima dshungarica* Jedl. and *C. rostowtzevi rostowtzevi* Tschit.) occur in Tuva.

The Ecological Structure of the Tuvan Carabid Fauna

The distribution of carabids in the environment depends mainly on climatic factors, type of vegetation and soil. The width of ecological niche of each species is defined by its tolerance. Whereas the stenotopic species can be easily assigned to a particular ecological group, this is often difficult in relation to the species with wide ecological demands. Nevertheless, even the eurybionts exhibit particular tendencies in the choice of their biotopes. Geographical variability of ecological preferences must be allowed for any classification of biotopes, and for the corresponding ecological groups. Such classifications will in any case have a local (regional) character.

Ecological groups of carabids as applied in this work are represented as a series, corresponding to both longitudinal and vertical zonation (Table 2). Humidity is treated as the main ecological factor, whereas the type of vegetation and soil plays a secondary role. In many cases ecological classification of species can be a very difficult problem, because they may have wide distributions in different kinds of biotopes or live at the boundary of biotopes (ecotones). To partly avoid this problem I combined some groups with each other. Hygro-mesophiles were combined with paludicoles and sylvicoles in group called "paludicoles-sylvicoles", praticoles and arvicoles as "praticoles-arvicoles", meso-xerophiles

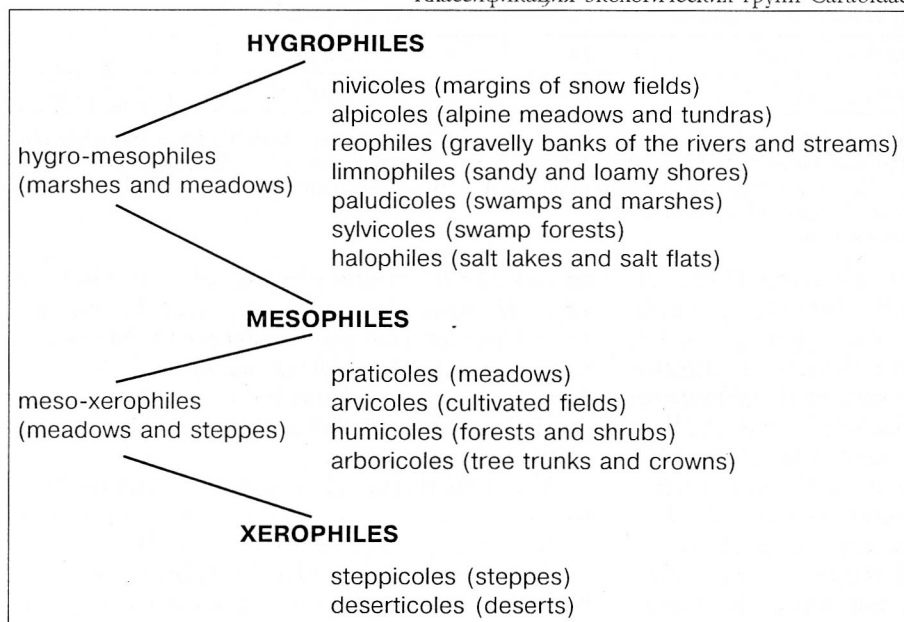
with steppicoles as "praticoles-steppicoles" (Table 3). Such generalizations are better representations of the basic tendency in ecological preferences of carabids.

As is evident from Table 3, the species of open, dry biotopes prevail in Tuva (praticoles-steppicoles represent 34.8%). The proportion of halophiles is also considerable (6.7%). The inhabitants of the forests are second in number (17.0%), and limnophiles (12.0%) and reophiles (9.8%) are moderate in number. Rather few species live on meadows and fields (9.8%). Finally, 8 species (3.6%) are typical of the alpine zone. For comparison, in the carabid fauna of the Baikal territory the steppicoles form 18.9% only, halophiles 2.3%, but humicoles 24.7%, the proportion of alpicoles is the same [Shilenkov, 1977].

The formation of any distribution area depends on the ecological preferences and dispersal powers of species. Each zoogeographic group (distributional pattern) has its own set of ecological elements (Table 3). For instance, among the alpicoles are both circum-holarctic, arcto-alpine species, and eualpine species endemic to the mountain systems of South Siberia.

Species with different distributional patterns can be considered together, as shown in Table 3. In the group of species with wide distributions in the Palaearctic and Holarctic the forest species are predominant (23.5%). Besides, many species of intrazonal biotopes (reophiles, limnophiles, paludicoles) and species of the anthropogenic complex are common here. In the group of species with restricted distributions in the mountains of South Siberia the forest (34.9%) and alpine (30.4%) species are

Table 2. Classification of ecological groups of Carabidae.
Таблица 2. Классификация экологических групп Carabidae.



sharply predominant. Finally, in the group with distributional patterns in arid and semi-arid landscapes of Eurasia the steppicoles (76.0%) and halophiles (18.7%) are prevailing.

A dendrogram showing similarity among different distributional patterns of Tuvan carabids was calculated with the data presented in Table 3 (Fig. 1). All groups are definitely combined in clusters including distributional patterns with similar ecological parameters and corresponding to their common formation in the landscapes of Eurasia and the entire Holarctic.

Table 3.
The number and the percentage (in parentheses) of species of different ecological groups in geographical range patterns of Tuvan carabids.

Таблица 3.
Число и доля (в скобках) видов различных экологических групп в разных типах ареалов жуков Тувы.

Geographical range patterns	alpi- coles	reo- philes	limno- philes	paludicoles- sylvicoles	humicoles- arboricoles	praticoles- arvicoles	praticoles- steppicoles	halo- philes	Total
Circumholarctic	2(10)	2(10)	4(20)	4(20)	4(20)	2(10)	2(10)		20(8.9)
Asia-American		3(60)			1(20)		1(20)		5(2.2)
Transpalearctic		1(3.7)	9(33.4)	4(14.8)	5(18.5)	4(14.8)	3(11.1)	1(3.7)	27(12.1)
Euro-Siberian			3(15.8)	1(5.3)	2(10.5)	8(42.1)	5(26.3)		19(8.5)
Siberian		1(5.6)	3(16.7)	1(5.6)	11(61.0)		2(11.1)		18(8.0)
East Asian		8(26.7)	5(16.7)	2(6.7)	5(16.7)	3(10.0)	7(23.3)		30(13.4)
Species with wide distribution, totally	2(1.7)	15(12.6)	24(20.2)	12(10.1)	28(23.5)				119(53.4)
South Siberian		2(23.6)		1(14.3)	1(14.3)	2(28.6)	1(14.3)		7(3.1)
Altai-Sajanian	2(23.6)	2(23.6)			3(42.8)				7(3.1)
Sajanian	1(25.0)				3(75.0)				4(1.8)
Tannu-Olan	4(80.0)				1(20.0)				5(2.2)
Species with local distribution, totally	7(30.4)	4(17.4)		1(4.3)	8(34.9)	2(8.7)	1(4.3)		23(9.9)
Middle Asian		3(42.8)	2(28.6)		1(14.3)	1(14.3)			7(3.1)
Species with Middle Asian area, totally					1(14.3)	1(14.3)			7(3.1)
Eurasian steppe						1(5.3)	15(78.9)	3(15.8)	19(8.5)
Southern Palearctic						1(16.7)	1(16.7)	49(66.6)	6(2.7)
Mongolian					1(2.3)		36(83.7)	6(13.9)	43(19.3)
West Mongolian			1(20.0)				3(60.0)	1(20.0)	5(2.2)
Central Asian							2(100.0)		2(0.9)
Species with Eurasian steppe area, totally			1(1.3)		1(1.3)	2(2.7)	57(76.0)	14(18.7)	75(33.6)
Species of all groups, totally	9(4.0)	22(9.8)	27(12.0)	13(5.8)	38(17.0)	22(9.8)	78(34.8)	15(6.7)	224 species

Geographical Range Patterns of Tuvan Carabids Fauna

Based on the types of geographical range patterns, all species can be arranged into four large groups: 1. Species with wide distributions in Palearctic or Holarctic region; 2. Endemics of mountain systems of South Siberia; 3. Species with wide distributions in mountain systems of Middle Asia; 4. Species of semi-arid and arid landscapes of Eurasia. Each group can be divided further into more specific distributional patterns.

1. Species with wide distribution in the Palearctic or Holarctic regions

1. Circum-Holarctic distributional pattern. Distributed over the entire Holarctic. 20 species.

2. Asian-American (Amphipacific) distributional pattern. Distributed in the territory of Siberia, as well as in the western part of Northern America. 5 species.

3. Trans-Palearctic distributional pattern. Have transcontinental distributions from the Atlantic to the Pacific Ocean. 27 species.

4. Euro-Siberian distributional pattern. Occupy all or most of Europe, and extend to the Baikal (sporadically Transbaikalia and Amur) region in Siberia in the east. 19 species.

5. Siberian distributional pattern. Distributed mainly in the taiga zone from northern or north-eastern Europe to Lena River valley, or farther to the east in some cases. 18 species.

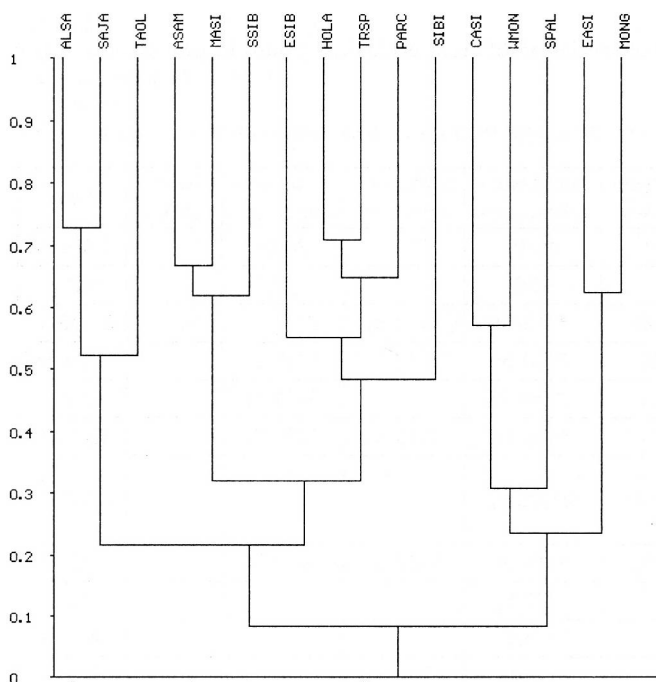


Fig. 1. Dendrogram of similarity of different distributional pattern of Tuvan carabids calculated with the data presented in Table 3.

Distributional patterns: ALSA — Altai-Sajanian, ASAM — Asia-american, CASI — Central Asian, PARC — East Asian, EASI — Eurasian steppe, ESIB — Euro-Siberian, HOLA — Circumholarctic, MASI — Middle Asian, MONG — Mongolian, SAJA — Sajanian, SIBI — Siberian, SPAL — Southern Palearctic, SSIB — South Siberian, TAOL — Tannu-Olan, TRPA — Transpalearctic, WMON — West Mongolian.

Рис. 1. Дендрограмма сходства различных типов ареалов жуужелиц Тувы, по данным табл. 3.

Типы ареалов: ALSA — Алтайско-Саянский, ASAM — Азиатско-американский, CASI — Центральноазиатский, PARC — Восточноазиатский, EASI — Евразийский степной, ESIB — Евросибирский, HOLA — Циркумголарктический, MASI — Среднеазиатский, MONG — Монгольский, SAJA — Саянский, SIBI — Сибирский, SPAL — южнопаlearктический, SSIB — южносибирский, TAOL — Танну-Оланский, TRPA — транспаlearктический, WMON — Западно-Монгольский.

6. East Asian distributional pattern. Widely distributed in the East-Asian (Palearkhaearctic in Russian zoogeographic literature) subregion of Palearctic region, penetrating to the Altai Mts. in the western direction. 30 species.

II. Endemics of South Siberian mountain systems

7. South Siberian distributional pattern. Distributed in the mountains from the Altai to the Transbaikal or Amur regions. 7 species.

8. Altai-Sajanian distributional pattern. Restricted in distribution to the Altai, and to the Western and Eastern Sayan. 7 species.

9. Sajanian distributional pattern. Endemics of the Western and Eastern Sayan Mts. 4 species.

10. Tannu-Olan distributional pattern. Endemics of the Tannu-Ola mountain ridge. 6 species.

III. Middle Asian mountain species

11. Middle Asian distributional pattern. Widely distributed in the mountains of Middle Asia, especially

in the Tian Shan, penetrating to Tuva, where most of them have an eastern limit of distribution. 7 species.

IV. Species of semiarid and arid landscapes of Eurasia

12. Eurasian steppe distributional pattern. Species with wide distributions in the steppe zone from Central or Southern Europe to the Baikal-Transbaikal geographic region, or even to Yakutia or the Amur region. 19 species.

13. Southern Palearctic distributional pattern. Widely distributed in the Mediterranean, Transcaucasus, Near East and Middle Asia, east to Baikal in Siberia. 6 species.

14. Mongolian distributional pattern. The majority of species are distributed in Mongolia and adjacent territories of China and South Siberia, reach the Altai in the west and the Transbaikal region, more rarely Primorie and North Korea in the east. 43 species.

15. Western Mongolian distributional pattern. Species with restricted ranges in the kettle steppes of NW Mongolia and adjacent territories of the Altai and Tuva. 5 species.

16. Central Asian distributional pattern. Have wide distributions in Central and Middle Asia, where species occur in mountains in the south and mostly in the lowlands in the north. 2 species.

It is interesting to compare the zoogeographic structure of the carabid faunas of the Tuva and Baikal regions (Table 4). Very characteristic of Tuva fauna is the low percentage of species with wide distribution (especially trans-Palearctic and Euro-Siberian) and high percentage of species distributed in semiarid and arid landscapes of Eurasia. This phenomenon can be explained not only by a drier climate, but also by the influence of the mountainous perimeter of the country, where the mountain systems of the Altai and Sayan play the role of faunistic filters for species with wide distribution, especially for praticoles-arvicoles. The other remarkable peculiarity of Tuva fauna is the presence of Middle Asian species, which do not reach the Baikal region.

The question of whether the Tannu-Ola Mts. form a barrier for meridional distribution of steppe species or not is also rather interesting. According to data at hand, some species, especially those belonging to the Mongolian distributional pattern, do not penetrate to the central Tuva kettle region. In contrast, a large number of steppe species have not been recorded yet on the southern slope of the Tannu-Ola (Table 5).

Table 4.
Comparison of different carabid distribution patterns of
Baikal region and Tuva (in %).
Таблица 4.
Сравнение доли различных типов ареалов жуужелиц в
фауне Байкальского региона и Тувы.

Distribution pattern	Baikal region	Tuva
Species with wide distribution in Palaearctic and Holarctic	52.1	39.8
South Siberian species	10.2	9.9
East Asian (Palaearkhaearctic) species	13.4	13.4
Species of the semiarid and arid landscapes of Eurasia	24.1	33.6
Middle Asian species	0	3.1

Table 5.
Role of Tannu-Ola Mts. as a faunistic filter in meridional
distribution of steppe carabid species in Tuva.
Таблица 5.
Роль гор Танну-Ола как фаунистического фильтра в ме-
ридиональном распространении видов жуужелиц в Туве.

Species recorded only on the northern slope of Tannu-Ola	Species recorded only on the southern slope of Tannu-Ola
<i>Curtonotus brevicollis</i> Chaud. <i>Harpalus aequicollis</i> Motsch. <i>Harpalus affinis</i> Schrank <i>Harpalus distinguendus</i> Duft. <i>Harpalus erosus</i> Mnnh. <i>Harpalus servus</i> Duft. <i>Harpalus sinuatus</i> Tschit. <i>Harpalus smaragdinus</i> Duft.	<i>Carabus glyptopterus</i> Fisch. <i>Bembidion pedestre</i> Motsch. <i>Bembidion smirnovi</i> Kryzh. <i>Pogonus punctulatus</i> Dej. <i>Reflexisphodrus refleximargo</i> Reitt. <i>Harpalus fuscipalpis</i> Sturm <i>Harpalus hirtipes</i> Panz. <i>Harpalus rufiscapus</i> Gebi. <i>Cymindis rostowtzeni</i> Tschit.

In conclusion, the Tannu-Ola Mts. are a major centre of speciation. On this mountain ridge, two endemic subspecies of *Carabus* and four endemic species of *Trechus* occur. A considerable number of additional new species are expected to be found there in the future, because the high elevated areas of the Tannu-Ola are insufficiently investigated.

Addendum

Three new species of *Trechus* from Tuva are described below. The following measurements were used for morphometry: HW — head width (with eyes), APW — apical prothoracic width, between apical angles, PW — maximum prothoracic width, BPW — basal prothoracic width, between hind angles, EW — maximum elytral width of both

elytra, PL — pronotum length, EL — elytral length from tip of scutellum to apex of elytra. SBL — standardized body length, is the sum of HL, PL and EL, BL — body length, measured from the tip of the longest mansibule to the tip of the longest elytra.

The other abbreviations: ISEN — Institute for Systematics and Ecology of Animals, Siberian Branch, Russian Academy of Sciences, Novosibirsk; ISU — Irkutsk State University, collection of V.G. Shilenkov; ZISP — Zoological Institute, Russian Academy of Sciences, Saint-Petersburg.

Trechus saglensis sp.n.

Figs 4–5.

MATERIAL. Holotype, ♂ (ZISP), TUVA: West Tannu-Ola Mts., Sagly, 23.VII.1986, I. Popova, E. Sergeeva, N. Motovnikova leg. Paratypes: 2 ♂♂ (ISU), collected together with holotype.

DESCRIPTION. Rather large species (BL — 3.7–3.9 mm; SBL — 3.25–3.45 mm). Body brownish testaceous, head darker, appendages yellowish.

Head normal, eyes of medium size, subconvex. Antennae filiform, surpassing base of pronotum by 3–4 apical segments and reach the 1st discal pore, 3rd segment 2.4 times as long as wide, 1.2 times as long as 2nd.

Pronotum subcordate, with moderately convex disk (PW/HW = 1.19–1.26; PW/PL = 1.32–1.39; BPW/APW = 1.00–1.07; PW/APW = 1.32–1.39; PW/BPW = 1.30–1.32); hind angles rectangular with gently rounded tips. Sides straight posteriorly and hardly excised just before hind angles. Base almost straight or faintly bisinuate, only slightly oblique on sides. Basal transverse impression well developed, basal foveae large and deep. Basal surface longitudinally rugulose. Lateral margin of moderate width, widenig in basal third.

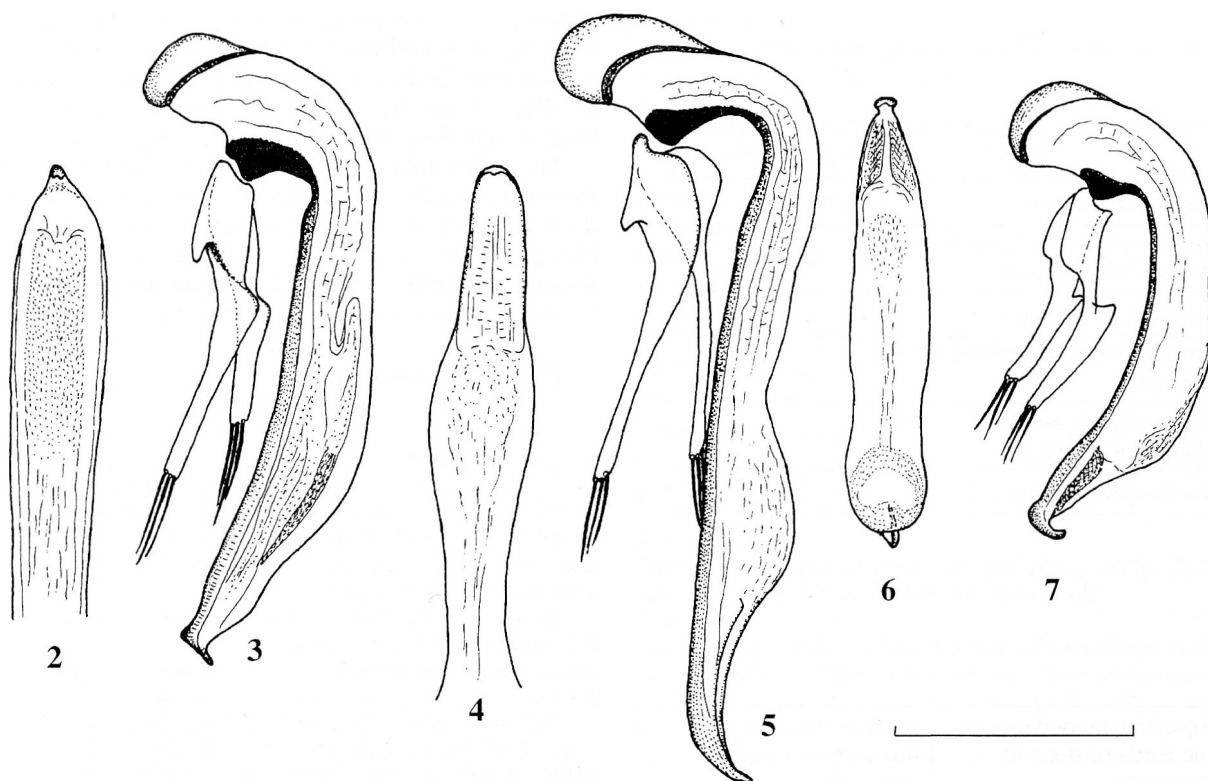
Elytra elongate, with rounded shoulders, their maximal width near the middle (EL/EW = 1.52–1.63; EW/PW = 1.46–1.57); disk subconvex. All striae distinct, with trace of punctures. Apical stria sharp and regularly curved, joining stria 5. Inner intervals subconvex, outer ones flat. Anterior discal pores at level between pores 3 and 4, posterior discal pores before pore 5 of umbilical series. Discal formula 19–22/52–54.

Microsculpture on head isodiametric but strongly reduced, on the disc of pronotum and elytra consists of transverse meshes, more dense on elytra.

Median lobe (Figs 4,5) large (1.4 mm), long and slender, almost straight, strongly curved at base and dilated in apical half, with long klaw-like bended apical part and large sagittal sclerit, without endofallus armature. Paramerae long and slender.

REMARKS. In the structure of median lobe very close to *T. teletskianus* Belousov et Kabak, but apical part is not so strong curved and more simmetrical dorsally. Elytra longer, with more defined striation. Head darker.

New species, as well as the following two described below, belongs to the group of *T. kuraicus* Shil. (= *T. alticola* Khnz.) characterized firstly by the structure of median lobe with large size, curved apical part and reduced endofallus armature. Moreover, the following described species belong here: *T. teletskianus* Belousov et Kabak, *T. dudkorum* Belousov et Kabak, *T. mongolorum* Belousov et Kabak, *T. angulifer* Belousov et Kabak, *T. mongolicus* Moravec.



Figs 2-7. *Trechus* spp.: 2,3 — *T. shinganensis* sp.n., 4,5 — *T. saglensis* sp.n., 6,7 — *T. seserligensis* sp.n.; 3,5,7 — aedeagus, left lateral view, 2,4,6 — median lobe, dorsal view. Scale 0.5 mm.

Рис. 2-7. *Trechus* spp.: 2,3 — *T. shinganensis* sp.n., 4,5 — *T. saglensis* sp.n., 6,7 — *T. seserligensis* sp.n.; 3,5,7 — эдеагус, вид слева сбоку, 2,4,6 — срединная доля, дорсально. Масштаб 0,5 мм.

Trechus shinganensis sp.n.

Figs 2-3.

MATERIAL. Holotype, ♂ (ISU), TUVA: Tandinskiy district, foothills of the East Tannu-Ola Mts., Shingan valley, *Populus* forest, pitfall traps, 1.VII.1986, S. Lostshev leg.

DESCRIPTION. Rather large species (BL — 4.0 mm; SBL — 3.55 mm). Body brownish testaceous, head darker, appendages yellowish.

Head normal, eyes of medium size, flat. Antennae filiform, surpassing base of pronotum by 3-4 apical segments and reach the 1st discal pore, 3rd segment 2.2 times as long as wide, 1.2 times as long as 2nd.

Pronotum subcordate, with moderately convex disk (PW/HW = 1.29; PW/PL = 1.25; BPW/APW = 0.96; PW/APW = 1.38; PW/BPW = 1.43). Lateral sides uniformly rounded to the small rectangular hind angles and hardly excised just before them. Base only slightly oblique on sides. Basal transverse impression well developed, basal foveae large and deep. Basal surface longitudinally rugulose. Lateral gutter narrow, slightly widened posteriorly.

Elytra elongate, with rounded shoulders, their maximal width near the middle (EL/EW = 1.53; EW/PW = 1.55); disk subconvex. Striation distinct, striae 1-4 clear to the apex of elytra, with trace of punctures, from stria 5 getting shallower. Apical striola sharp and regularly curved, joining stria 5. Inner intervals subconvex, outer ones flat. Anterior discal pores at level of pore 4, posterior discal pores before pore 5 of umbilical series. Discal formula 19/53.

Microsculpture on head isodiametric, on the disc of

pronotum and elytra comprised of very faint superficial transverse meshes, strongly reduced on elytra.

Median lobe (Figs 2,3) large (1.3 mm), gently bended medially, with strong curved basal part and short straight apical disk. Sagittal sclerite rather large. Endofallus armature absent. Paramerae long and slender.

REMARKS. In size and colour close to previous species, but pronotum narrower, outer striae shallower, microsculpture on head stronger. The aedeagi of both species are easily distinguished from each other.

Trechus seserligensis sp.n.

Figs 6-7.

MATERIAL. Holotype, ♂ (ISEN), TUVA: Piy-Khemskiy district, 5-7 km NW Seserlig, 1200-1300 m, 29.VI.1990, D. Logunov leg.

DESCRIPTION. Medium-sized species (BL — 3.5 mm; SBL — 2.93 mm). Body dark brownish, head black, legs yellowish, antennae reddish brown.

Head normal, eyes of medium size, faintly convex. Antennae rather short, surpassing base of pronotum by 3 apical segments and reach the 1st discal pore, 3rd segment 2.4 times as long as wide, 1.2 times as long as 2nd.

Pronotum subquadrate, with moderately convex disk (PW/HW = 1.21; PW/PL = 1.35; BPW/APW = 0.96; PW/APW = 1.25; PW/BPW = 1.30); anterior margin almost straight, with no prominent anterior angles. Sides straight posteriorly and hardly excised just before small obtuseangular hind angles. Base strongly oblique on sides. Basal transverse impression well developed, basal

foveae small and deep. Basal surface longitudinally rugulose. Marginal gutter narrow, widened in basal third.

Elytra rather short, subovate, with rounded shoulders, their maximal width near the middle ($EL/EW = 1.31$; $EW/PW = 1.66$); disk subconvex. Inner striae deep to the apex of elytra, with trace of punctures, outer ones shallow, striae 6 and 7 almost invisible. Apical striola short and abrupted anterad between striae 5 and 6. Inner intervals subconvex, outer ones flat. Anterior discal pores at level pore 3, posterior discal pores before pore 5 of umbilical series. Apical pore very large. Discal formula 19/50.

Microsculpture on head isodiametric, on pronotum and elytra consists of transverse meshes, strongly reduced on elytra.

Median lobe (Figs 6,7) of medium size (0.93 mm), step-like bent, with short curved apical disk, sagittal sclerit small, endofallus armature absent, but in apical part with two small longitudinal sclerits.

REMARKS. From all known species of *T. kuraicus* group easily differ by small size, short elytra, dark colour and large apical pore of elytra. Median lobe similar with *T. mongolorum* Belousov et Kabak, but more stout, shorter and strongly curved, with sclerits in apical part.

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