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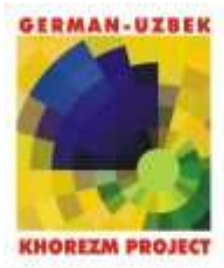

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No. 6

Soil organisms and entomocomplexes in Khorezm and Karakalpakstan (Uzbekistan)

by

Aloviddin Sh. Khamraev

Institute of Zoology, Academy of Sciences of Uzbekistan, Tashkent

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No. 6

Хоразм вилояти ва Қорақалпоғистоннинг тупроқ организм ва энтомокомплекслари

Аловиддин Хамраев

Реферат
Ўшбу мақолада, Орол денгизи бассейнида жойлашган, қўшни ҳудудлар – Хоразм вилояти ва Қорақалпоғистон автоном республикасининг энтомофаунаси тўғрисида, тупроқ фаунасининг умуртқапогонасиз ҳашаротларига махсус эътибор қаратган холда, маълумотлар берилган.
Мазкур маълумотлар мавжуд адабиетлардан ва муаллифнинг хали нашр этилмаган тадқиқотлари воситасида йиғилган манбалардан келтирилган.
Иккала худуд хам, Марказий Осиёнинг қишда совуқ буладиган, Қизилкум ва Қоракум чуллари билан ўралган, суғориладиган деҳкончилик ерларидан иборат. Бу ерда турли хил экосистемалар мавжуд булиб, характерли булган энтомокомплексларга ахамият берилган. Худудларда мавжуд, кайд этилган ҳашарот турлари ва бошка умуртқапогонасиз хашаротларнинг таърифий рўйхати илова тариқасида келтирилган.

No. 6

Почвенные организмы и энтомокомплексы Хорезма и Каракалпакстана

Аловиддин Хамраев

Резюме
В данной статье приводятся сведения об энтомофауне двух расположенных по соседству регионов бассейна Аральского моря – Хорезма и Каракалпакстана на основе литературных данных и из собственных неопубликованных источников, уделяя особое внимание фауне почвенных беспозвоночных. Эти регионы состоят из орошаемых территорий и окружены пустынями Кызылкум и Каракум с минусовыми температурами в зимний период. Они представлены различными экосистемами и были приведены ссылки на соответствующие энтомокомплекы. Аннотированный перечень зарегистрированных видов насекомых и других беспозвоночных описанных регионов приводится в Приложении.

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ABSTRACT

The insects of the two neighboring regions of Khorezm and Karakalpakstan in the Aral Sea Basin are listed and described based on literature data and own unpublished research, with a special emphasis on invertebrate soil fauna. Both regions consist of irrigated farmland surrounded by the central Asian winter-cold deserts of Kyzylkum and Karakum. They exhibit a series of different ecosystem types, and reference is made to the corresponding entomocomplexes. An annotated list of the registered species of insects and other invertebrates of the described region is provided as an Appendix.

Glossary

Sp.	Species (singular)
Spp.	Species (plural)

1 INTRODUCTION

The importance of soil and ground-inhabiting invertebrates is rather multi-faceted: they play an active role in soil formation; they accelerate decomposition of vegetative and animal remnants; and they influence the physical and chemical properties and thus the fertility of soils. Among them are many pests, parasites and disease-transmitting organisms with effects on plants, animals and humans. Important large taxa of soil invertebrates are arthropods (insects, spiders), oligochaetes (earthworms, nematodes) and snails. The insects among them belong to so-called entomocomplexes that have been defined as typical for different ecosystems. Furthermore, microorganisms of soils play an important role in the mineralization of nutrients as well as in nitrogen fixation from the atmosphere and are therefore important elements in the decomposer communities of the soils.

The lands considered by the project "Economic and Ecological Restructuring of Land and Water management in the Khorezm region" (Vlek et al. 2001; Martius et al. 2004) consist of the ruderal-desert or oasis farmlands of the Khorezm region in Uzbekistan. The desert-tugai zone of the surveyed region comprises a large number of rare, endemic and threatened species of insect fauna of the disappearing tugai forests, and desert and low-mountain landscapes are included in the Red Data Book of Uzbekistan.

This report therefore summarizes our present knowledge on edaphic (soil-inhabiting) organisms. It is mainly concerned with soil invertebrates, however, after giving an overview of the regional soil fauna, the presentation follows "entomocomplexes" related to the main vegetation found in the region and the largest chapter is dedicated to the fauna of irrigated land. Application-related aspects (effects of irrigation, pest control) are also discussed. Finally, microorganisms are briefly addressed. In the appendix, a (partly annotated) list of the registered species of insects and other invertebrates of the described region is provided.

2 DESCRIPTION OF THE AREA

The Uzbek province of Khorezm and the Republic of Karakalpakstan are located in the southern Aral Sea region. The Khorezm province is situated in the ancient Amu Darya river delta at about 100 meters above sea level. The terrain is flat with negligible depressions, barchan dunes, hillocks and ridges. The Republic of Karakalpakstan is located northwest of the Khorezm region and is separated from it by the Amu Darya river. In the southwest Karakalpakstan is bordered by Turkmenistan, and in the north by Kazakhstan and the southern part of the Aral Sea. Khorezm occupies roughly 630 000 ha of which 275 000 ha is irrigated land (Martius et al. 2004; Ibrakhimov 2004); the Karakalpakstan republic occupies 167 500 km^2, most of which (86%) is the Kyzyl Kum desert and the Ustyurt plateau, while only 14% of the total land area is situated in the river valley (Shamuratov 1979). The river valley has a general inclination towards the Aral Sea and is covered mainly with ridges and dune sands. Maximum valley elevations reach 100 m above sea level in the south and 54 m in the north. In the southeast separate mountain massifs exist, with the highest mountain being the Sultan-Uvais (473 m above sea level). In the Amu Darya delta there are many channels and small lakes with tugai (riparian) forest, reed thickets and boggy areas.

The climate in both Karakalpakstan and Khorezm is extremely continental. Winters are moderately cold, with little snow, and summers are hot and dry. The flat land is open to cold Arctic and polar masses of air. In the province of Khorezm the average temperature in January ranges between 3 and 5°C, and in July the average is 27.3° C. Minimum temperatures in the winter are as low as -32°C, while in summer the maximum temperatures reach 44°C. The average annual rainfall amounts 80-90 mm with the majority of precipitation occurring in March and April. Winters in Karakalpakstan are snow-free with an average temperature in January of -4.9°C in the south and -7.6°C in the north. In July, the average temperature is 28.2° in the south and 26.0°C in the north. Precipitation falls mainly during the winter-spring period (about 110 mm per year).

Most of the irrigated agricultural area in the Amu Darya valley and delta consists, according to the Uzbek/Russian classification, of alluvial marsh soils, grey meadow soils (which make up 60% of the total territory), and saline soils. As Khorezm consists mainly of irrigated farmland, about 64% of Khorezm soils are so called “irrigated alluvial meadow soils”. Sand-covered areas also exist (Hudoibergenov 1981; Kurboniyozov 1996). In the Kyzyl Kum desert primitive sandy serozems (sandy grey soils) predominate, while on the Ustyurt plateau grey-brown soils and takyric solonchaks (alkaline soils) are prevalent. The sandy areas of the Kyzyl

Kum are covered with sparse grass and desert shrubs (sedge (*Carex spp.*), xerophilous gramineous plants, wormwood (*Artemisia spp.)*, ephemerous plants, Calligonum *(Calligonum spp.)*, Saltwort (*Salsola richteri* Karel ex. Moq.), etc.); saxaul *(Haloxylon spp.)* is typical of arbuscular plants, and in the Amu Darya delta tugai vegetation exists (characterised by poplar (*Populus spp.)*, russian olive (*Elaeagnus angustifolia L.)*, tamarisk *(Tamarix spp.)*, and reed (*Phragmites communis*); Kamalov 1981). Geographical location and soil-climatic parameters of the South Aral Sea region determine the quantitative and qualitative distinctiveness of the fauna in this zone, particularly its edaphic and ground forms.

3 SOIL ORGANISMS

Among the studies covering the significant role of animals in soil-building processes of desert soils in Central Asia and their changing physical and chemical properties, the work of Dimo (1938) must be emphasized. Following his calculations for typical cases in desert and semi-desert soils, the number of adult forms of wood lice (Isopoda) alone reached 1,250,440 individuals per hectare by the end of summer. They dig as deep as 1 m into the soil which causes beneficial changes in the soil's physical properties.

The fauna of edaphic invertebrates inhabiting Karakalpakstan and Khorezm province is less species-rich than in foothill and mountain areas, but notable for its distinctiveness. The fauna of sandy deserts is particularly unique. Its abundance reaches a peak during the short spring period from the end of March up to the end of May. Some species are active during the afternoon in this period but dusk and night-active species predominate. Later on, from June until September, as daytime temperatures increase, the active periods of these animals shift towards night, and the number of commonly active species decreases.

The number of active species, particularly insects, starts to increase in early spring, reaching a maximum by the middle of May. From mid-June onwards, when the summer heat begins to dry out the vegetation, the number of active species is sharply reduced. In tandem with the development of the Kyzyl Kum desert pronounced changes in the composition and numbers of insects in biocenoses occur. The species diversity and interactions between different members of the biocenosis provide a certain balance in the ratio of harmful and useful species. The productivity of pastures depends on the level of activity and biomass of both of these groups. The entomofauna is closely connected to flora and vegetation, and edaphic and climatic parameters in the region must be reviewed.

4 INSECTS IN VARIOUS ECOSYSTEMS: ENTOMOCOMPLEXES

4.1 Entomocomplex of Ridge-Hillock Sandy Flatlands with *Ass. Haloxylon persicum + Calligonum eriopodum, C. leucocladum* on Loose-Sandy Gray Soils

This entomocomplex describes the biocenosis of insects with *ass. Haloxylon persicum + Calligonum eriopodum*. The plant species composition of the sandy desert, mostly characterised by a landscape with hills and ridges, is noted for the presence of specific and characteristic species of psammophytes. Sandy areas often alternate between patches of bare ground and vegetation patches consisting of tamarisk, saxaul, saltwort (*S. richteri*), *Astragalus* spp., *Carex physodes M.B.*, *Ferula, Ammodendron conollyi* Bge, *Alhagi* and *Calligonum* spp., etc.

The insect fauna of this entomocomplex includes over 450 species, among which phytophages are prevalent. The dominant taxa are Cicadellidae, Hemiptera, Diptera and Hymenoptera. The following species are characteristic inhabitants of sand: *Carabus* spp. (Carabidae), the large digging carabid *Scarites bucida* and the fleet, exceptionally nocturnal *Discoptera*; Histeridae, the small, brown, and almost spherical *Philothis* and *Ammostyphrus,* which is perfectly adapted to digging. Dynastidans are numerous, including white cockchafers *Chioneosoma*, yellow or brown *Achranoxia,* small pale-yellow *Leucoserica, Pseudadoretus* and *Trigonocnemis*, and brilliant chestnut-brown *Coptognathus attila* and *Eutyctus desertis*. Almost all are nocturnal and do not feed during the adult phase. In contrast, the small, white-down covered *Pharaonus* are active during daytime, feeding mainly on *Calligonum*. Of the borers, some species of the *Sphenoptera* are most typical, for example the large and black *Capnodis excisa* (*Calligonum*), and small grayish-bronze *Clema deserti* (*Aristida* L.). Of the Meloidae, the most common are red *Lytta coccinea* and *L. deserti*, yellow *Rhampholyssa steveni* and some species of *Mylabris*. Of the leaf-eating insects the commonest include *Aphilenia*, some *Cryptocephalus* and *Nyctiphantus* spp.. Among the weevils, the narrowly specialized *Mesostylus* and large *Cleonini* can be found *(Brachycleonus fronto* and *Leucochromus imperialis)*. The sand-inhabiting Tenebrionidae beetles are noted for their particular diversity. More than a hundred species belonging to 30 genera are known. Of them, about half are confined to sandy habitats. In the Kyzyl Kum desert a noticeably cambered[1] *Pisterotarsa gigantea* and the smaller and slightly flatter *P. kessleri* can be found.

The insects further include cockroaches (*Polyphaga pellucida, Arenivaga roseni* Brans.), crickets (Oecanthusturanicus), locusts (*Hyalorripis clausi, Leptopternis gracilis, Strumiger*

[1] Cambered = slightly arched or curved in form

desertorum), bugs *(Reduvius, Bytsinus fossor)*, cockchafers (*Pharaonus semenovi, Chioneosoma kisilkumense,* Tenebrionidae (*Cyphostethe komarovi, Sphenaria karelini, Piemelia verrucosa, Pisterotarsa gigantea, Blaps fausti, Trigonoscelis gigas*), Meloidae (*Mylabris pusilla*), capricorn beetles (*Prionus komarovi*), leaf-eating insects (*Nyctiphantus hirtus nocturnus*), snout-beetles (*Leucochromus imperialis*), ant-lions, etc. The orthopteroid fauna is represented by 35 species. The cockroaches (2 spp.) and locusts (18 spp.) are frequently found beneath shrubs.

In the vegetated patches colonies of termites are often found (*Anacanthotermes ahngerianus;* one of two termite species present in the region; Abdullaev et al. 2002). Here, this termite species damages natural pastures, destroying the plant cover and contributing to the formation of bare sites. This insect also damages the roots and trunks of saxaul, hindering its growth and sometimes destroying it (Luppova 1958; Pirnazarov 1970, 1971, 1971a, 1972, 1972a, 1973; Alimjanov 1972, Tsyplenkov 1970; Bey Bilenko 1972, Davletshina et al. 1979; Gapparov 1987; Latchininsky and Gapparov 1996; Gapparov 2001, 2001a, 2002, Boltabaev 1995; Bekjanov 1997, 1998, 1998a, 1998b).

In desert habitats the most important insects are noctuid (Noctuidae, approximately 200 species) and pyralid moths (Pyralididae, 180-190 species). The number of Casebearer moth species (Lepidoptera, Coleophoridae) is about half of the total noctuid species richness. There are 50 species of Geometridae, 38 species of Tortricidae and also about 38 species of Geleohiidae; the other families all have a low species richness. The desert zone of Uzbekistan, including its southern valleys, is inhabited by more than 700 species of lepidopterans in total. The *Rhopalocera* and *Heterocera* are particularly prominent with over 300 species. The genera *Anumeta*, *Anydophila* and *Armada* are abundant among the Noctuidae of the Kyzyl Kum.

4.2 Entomocomplex of Submontane Valleys with *Ass. Artemisia Turanica a*nd *Ephemer A. Diffusa* + *Salsola* on Grey-Brown Hard Soils

This entomocomplex describes the biocenosis of insects with *ass. Artemisia turanica, A. diffusa + Salsola orientalis + S. arbuscula*; and the biocenosis with *ass. Artemisia turanica, A. diffusa + Poa bulbosa + Carex physodes.* This biocenosis occupies submontane ancient alluvial valleys and elevations in the Kyzyl Kum. Ephemeroid associations of wormwood (*Artemisia*) species are the most widespread biogeocenosis of the gypsum desert. The entomofauna of the *artemisia*-ephemeroid biocenosis is rich both in terms of species diversity (over 250 species) and in abundance.

The core of this entomocomplex is formed by insects of the locust family, and by the orders of Homoptera, Proboscidea, Coleoptera (mainly Tenebrionidae, Geotrupinae and weevils), Lepidoptera (noctuids and Geometridae), Diptera (gall-midges), and Hymenoptera (ants).

The entomofauna of ephemeroid and *ass. Artemisia turanica* (on grey-brown hard soils) is poorer than that of the sandy desert. Species confined to hard soils, as well as those trophically connected to *ass. Artemisia diffusa, Salsola orientalis, A. turanica, Ferula assa foetida* and other plants are typical for these areas. The species of the family Histeridae, Lamellicornia beetles of the genera *Lethrus, Hemictenius, Aphodius, Coprislunaris,* and the species *Scarabaeus sace*r, as well as Tenebrionidae of the genera *Adesmia, Pachyscelis, Lasiostola, Gnatosia,* among others, and various herbivorous insects (*Theone costipennis, Ischyronota desertorum*) are all found in this area. Weevils (*Lixus, Stephanophorus*), Buprestidae *(Julodis variolaris*), and species of the genera *Sphingonotus* and *Calliptamus* (Bey-Bienko & Mishchenko 1951, Stolyarov 1967; Pirnazarov, 1973; Sharova 1981) are also present.

4.3 Entomocomplex of Outlying Mountains on Stone-Pebble Grey-Brown Soils

On the slopes of outlying elevations of the Kyzylkum in Karakalpakstan, *Artemisia terrae albae Krash.* and *Salsola arbuscula Pall* form sparse associations with Turan wormwood (*Artemisia turanica H. Krash*.), and on stony slopes with the other semi-shrubs. For such grass-/shrubland communities *Ferula assa-foetida L.* is typical. In such areas, the fowl-grasses *Poa bulbosa* L. and *Carex physodes* are well developed, as are tulips (*Tulipa spp*.), *Gymnosperma Less*, and *Ferula sp.*, which start to grow in spring.

Over 220 species of insects have been recorded in this biocenosis. The dominant taxa are cicadas, aphids, weevils, dipterans and hymenopterans. The insect fauna of remnant relief elevations comprises species typical for mountain and rocky habitats. For instance, the Agrididae include the genera *Sphingonotus* and others). Homoptera comprise 49 species, typical of which are *Agallia acuteangulata, Macrosteles quadripunctulatus, Limottetix striola* and others. Coleoptera in these areas comprise 17 species of Carabidae (including the “mountain and rock” genus *Taphoxenus)*, over 40 species of Scarabaeidae, over 55 species of Tenebrionidae (including the “mountain and rock” genera *Gnatosia, Penthicus,* and *Zophosis)*, 5 species of Meloidae, and 20 species of weevils. The species richness of Lepidoptera is high (over 60 species). Large species of plant-eating bugs of the family Coreidae (about 10 species) and Pentatomidae are common.

Eleven ant species have been recorded in this biocenosis by several authors (Dubovsky 1966; Bey-Bienko 1972; Mishchenko 1972; Emelyanov 1972; Puchkov 1972; Alimjanov 1972; Pirnazarov, 1973; Davletshina et al. 1979; Kryzhanovsky 1995, and others).

4.4 Entomocomplex of Solonchak Depressions with Black Saxaul, *Salsola Gemmascens-Halophitous* Associations on Solonetzic-Solonchak Grey-Brown Soil of Ancient Alluvial Deposits

The entomofauna of this biocenosis is rather diverse and is comprised of species trophically linked to background plants such *as Tamarix ramosissima, Lycium ruthenicum, Alhagi persarum*, and others. Among the characteristic elements in this biocenosis (dry riverbeds and depressions) are the nests of Turkestan termites (*Anacanthotermes turkestanicus*) and ants (*Tapinoma karavajevi, Camponotus turkestanicus, Messor aralocaspius,* among others).

Desert valleys with hard soils are heterogeneous in their soil composition, plant cover and fauna. These comprise many sites in Karakalpakstan (Kyzylkum), as well as takyrs particularly typical of ancient river deltas and submontane valleys, which are also recorded in inter-ridge depressions of sands. Solonchaks scattered across the former coast of the Aral Sea, where saline ground water comes to the surface, can be distinguished into a separate category.

The insect fauna of these deserts is less distinct than that of the sandy habitats. Many species inhabiting these areas are only seasonally present and migrate to desert-covered mountain areas. Since desert valleys with hard soils are more or less saline, the specific inhabitants of solonchaks play a significant role, namely, many carabids, Staphylinidae, Tenebrionidae and plant-eating beetles connected with solonchak vegetation. A relative poverty of species and a low insect abundance in comparison with sandy deserts and ephemeral landscapes is noticeable. Extensive areas of takyr soils are particularly lifeless, and are almost deprived of vegetation. In areas with abundant vegetation the fauna is more diverse and numerous.

The fauna of depressions with thickets of tugai vegetation is unique: Cicindelidae of the genus *Cicindela (C. littoralis, C. sublacerata*); Tenebrionidae (*Opatroides punctulatus*); several species of the genera *Gonocephalum* and *Belopus*; the genus *Aphodius* (Scarabaeidae), Staphylinidae, *Trichodes* (Cleridae), Buprestidae, and *Sphenoptera*. Leaf-eaters such as *Labidostomis, Cryptocephalus, Chrysochares asiatica* and others are found, in addition to weevils (*Megamecus, Platymycterus, Chlorophanus,* and *Sitona)*. Species associated with tamarisk, russian peashrub, camel thorn and other plants are typical for these areas.

The composition of the beetle family Carabidae, in particular *Cicindela* sp. and *Megacephala euphratica*, is much richer and diverse than that of other beetle groups. *Pogonus,*

Amara, Curtonotus and *Cymindis* are also numerous. The cracks in takyr soils are inhabited by *Siagona europaea*, *Cymbionotum* and others.

There are also many Staphylinidae, particularly on solonchaks. Dynastidans (Scarabaeidae) are less unique. Of them, relatively numerous are scarabaeids, especially *Aphodius*, as well as the larger *Scarabaeus* and *Chironitis*. Some *Lethrus* can be found in valleys, although they are more typical for foothills and mountains. The most numerous cockchafers are *Cyphonotus testaceus*, *Magotrogus,* and less often one finds *Pentodon and Hemictenius*; of the Buprestidae the large *Julodis variolarisis* is found, and *Sphenophora* are also rather numerous. The plant-eating Tenebrionidae constitute the prevailing part of the entomofauna not only in species richness, but also in biomass. The most typical genera in these landscapes are *Colposcelis, Microdera, Adesmia, Trigonoscelis, Pimelia, Blaps, Penthicus,* and *Belopus* on solonchaks; *Scleropatrum* and *Paranemia* in submontane areas together with some species typical of adyrs (i.e.; sloping sites). Meloidae, especially those of genus *Mylabris*, abound. Of Capricorn beetles, some species such as *Prionus turkestanicus* are typical; in areas with ferule growth, however, *Plocaederes scapularis* is characteristic. Weevils are diverse. In sites with rich vegetation *Lixius* and *Larinus* have been recorded. Also typical are several species of Tanymecinae *(Phacephorus, Tanymecus, Megamecus*), as well as species of other subfamilies (Alimjanov 1972, Pirnazarov 1972, Davletshina et al. 1979, Bekbergenova 2000, Abdullaev et al. 2002).

4.5 Entomocomplex of Tree-Shrub (Riverside) and Grass (Lakeside) Tugai on Alluvial Soils

The insects of tugai forests (forests restricted to riverbanks; Treshkin et al. 1998) are noted for their relatively high richness and diversity. As a result of industrial and agricultural activities in the past few decades, the area of the tugai forests has significantly shrunk in the floodplains of the Amu Darya and Syr Darya, the largest rivers in Central Asia. Illegal deforestation, burning and plowing of the tugai for temporary agricultural lands have resulted in secondary salinization, desertification, and soil erosion, and will eventually result in complete degradation of these lands. All these have been accompanied by the destruction of unique plant and animal communities which inhabit the tugai ecosystems. The distribution ranges of many species have shrunk catastrophically, while others are on the brink of extinction. Particularly tragic is the destiny of the tugai forests in the lower reaches of the Amu Darya, in Karakalpakstan, where the remaining forests patches are dying due to lack of water. Insignificant areas of tugai forest have

been preserved along the Kashkadarya and Surkhandarya rivers, as well as in Zaravshan, where a nature reserve has been established.

This situation has most affected stenobiont insect species, in particular Lepidoptera, which are trophically linked to the tree species *Populus pruinosa Schrenk* and *P. euphratica* Oliv.. As they are stenophages, their range in Central Asia corresponds to the distribution of poplar tugai forests and groves. The latter are confined to the flood-lands of the rivers running across valleys, floodland terraces at 200-500 m above sea level. Sometimes tugai forests spread along canals into the desert, which were formerly virgin lands, but are now covered by newly developed villages and irrigated areas. Because of their ranges, it is recommended that rare Lepidoptera of the tugai forests are included in the Red Data Book of Uzbekistan. These rare Lepidoptera can be divided into two groups. The first group includes rare Turanian endemics, whose range consists of strips along rivers, while the second group is comprised of insects with a wider range, Irano-Turanian species with mosaic-like distributions. They both show however an extremely local distribution and marked decrease in numbers (in parallel with deforestation).

Paragluphisia oxiana Djakonov, (1927). This is a representative of the monotypic genus of the family *Notodontidae* which is included in the Red Data Book of the USSR and Tajikistan. Typical habitats are mixed *Populus–Elaeagnus* thickets consisting of tamarisk, arborescent saltwort, and perennial grasses: eriantus, reed, liquorice, dog-bane, camel's thorn and others.

Streblote fainae Gerasimov, (1931). This is a representative of a small southern Palaearctic genus (10 species) of the family Lasiocampidae. It is included in the Red Data Book of Tajikistan and has been reported from several habitats in Tajikistan (lower reaches of the River Vahsh in the Tigrovaya Balka nature reserve and lower reaches of the River Kafirnigan) and in Uzbekistan (the Surkhandarya River south of the town of Denau; in the vicinity of station Boldyr, the upper reaches of the River Amu Darya; the mid-stream to the east of Dayahatyn; and the lower reaches of the Shavat canal near the city of Urgench).

For the successful conservation of rare species of Lepidopterans in the tugai forests it is generally necessary to study their distribution and the intricacies of their biology and mating behaviour in more detail.

The most important measures for the protection of floodplain tugai forests must be the adequate agricultural policy of the local authorities, strengthening the control of nature-protecting agencies, prohibition of unauthorized logging, and a strict fire regime in all preserved tugai areas.

Specific species of a number of families are typical inhabitants of tugai flora. Most of them are connected with the tugai vegetation, first and foremost with *Populus* and Tamarisk. Of

the inhabitants of *Populus,* some inhabit its wood, e.g. large and beautiful Buprestidae species (*Ancylocheira salomonis, Eurythyrea oxiana* and *Capnodismiliaris*) and smaller *Melanophila picta*, as well as cerambycids (*Xylotrechus namanganensis)*, while others feed on its leaves, such as *Cryptocephalus, Parnops glasunovi, Atomyria sarafschanica* and *Bedelia angustata.*

More numerous are species inhabiting Tamarisk, such as Buprestidae (*Cyphosoma turcomanicu*m) and several species of *Sphenoptera* and *Acmaeoder*a; leaf-eaters *(*the endemic *Jaxartiolus baeckmannianus*; *Cryptocephalus undulatus, C. tamaricis, Pachybrachis, Stylosomus* and *Diorhabda elongata),* and weevils (*Liocleonus clathratus, Coniatus* and *Corimalia)* are also found.

There are also specific inhabitants of the other tugai trees (for example *Elaeagnus* L.), such as the main pest *Xylotrechus grumi*.

Together with phytophages, many predatory beetles exist, among which there are endemics to Central Asia, for example, *Cicindela nox, C. illicebrosa, Mnuphorus sp., Panagaeus relictus, Chlaenius dimidiatus,* and *Brachinus bayardi.* For the tugai species, Tenebrionidae are less typical species, although among them there are specific species, e.g., *Penthicus semenovi* inhabiting the substrate under the tamarisk. The vanishing species, *Eremoxenus chan*, a member of the tropical genus of the family Brentidae, which inhabits areas along the Amu Darya River and in Karakalpakstan, merits special attention.

Grass tugai, in which licorice is dominant, is a transitional flora from typical tugai to the desert groupings, in which camel's thorn, zygophyllaceous plants, some cereals and saltwort are of notable importance. Of beetles, the following have been recorded here: Carabidae, above all the smaller species ones, *Amara, Trichocellus, Syntomas*, as well as *Lebia holomera*. Some dynastidan insects are found such as *Adoretus nigrifrons, Oxytyrea cinctella*, Tenebrionidae (*Opatroides punctulatus, Gonocephalum, Scleropatrium, Penthicus rufescens)*; and sometimes, the larger insects *Adesmia* and *Trigonoscelis*. Most of the above-mentioned species are recorded in the other vegetation formations as well: many of them have adapted to cultured lands. On cultured lands, more specific are complexes of plant-eating beetles. Numerous weevils (Coleoptera, Curculionidae) inhabit licorice, namely, *Chloebius immeritus, Megamecus chlorophanus,Platymycterus.* Other weevils are found on the grass *Caryopsis* sp., such as *Bruchidius glycyrrhizae*, *B. tuberculipygus*, as are members of the Family Buprestidae (*Sphenoptera beckeri, S. ignita*). There are also the thorn- and leaf-eaters *Diorhabda persica, Pachybrachys probus*, and among the weevils, *Corigethus trapezicollis*. Some species of Meloidae also abound.

4.6 Invertebrates of irrigated lands

Soils and the soil fauna of irrigated lands shelter representatives of various groupings. In particular, 34 species of nematodes have been recorded on the plant *Sorghum cernuum* (Tulaganov 1958). Nematode species registered in cabbages number 22; in alfalfa, 41; carrots, 34; potatoes, 43; tomatoes, 27; and melons, 38. In total, the representatives of nematode fauna recorded in agricultural crops of Karakalpakstan, according to Tulaganov (1958), reached 70 species. In subsequent years, studies on the nematodes on rice and in root soils in this region have revealed 95 species of nematodes in this area alone (Utambetov et al. 1982; see Annex for annotated list).

In the Ellikkala district of Karakalpakstan alone, 27 species of nematodes belonging to 18 genera, 10 families, 5 orders and 2 subclasses were recorded in cornfields around plant roots (Erezhepova & Utambetov 1991).

In the soil of the region under survey, the following species of earthworms (Lumbricidae) have been recorded: *Aporrectodea caliginosa caliginosa Sav., A. jassyensis Mich., A. caliginosa trapezoides Dug., Dendrobaena byblica Ros.,* and *Octolasion lacteum Örl.* (Dimo 1945).

Free-living mites participate in processing dead plant matter including dead roots. Mites from the taxa Oribatei and Acaridae can transmit fungal diseases in agricultural plants and therefore may have effects on plant distribution and density. Predatory *Mesostigmata* mites are effective regulators of the numbers of Acaridae and spider mites, which are pests of cotton and other agricultural crops. They also actively feed on soil nematodes and phytonematodes. The fauna and ecology of soil-inhabiting mites and some other invertebrates in irrigated soils of Karakalpakstan have been studied by Koshchanova (1986). Research in the soils of irrigated lands of Karakalpakstan revealed 97 species of mites. Oribatid mites of the surveyed soils comprise 46 species (Table 4.1). The highest specific diversity of oribatid mites has been recorded in cotton fields (23 species); the lowest in excessively irrigated soils along the banks of drainage water collectors (1 species) and in rice fields (4 species).

Table 4.1 Species composition (+, ++, +++ presence (with indication of relative dominance); - absence) of Oribatida (oribatid mites) on cultured soils under different crops in Karakalpakstan (from Koshchanova 1986). Sp. nov. = new species

Mite species	Marshy site (sewer canal)	Field			Grapes	Apple orchard
		Rice	Cotton	Alfalfa		
Family *Brachychthoniidae* (Balogh 1943)						
1. *Syncthonius elegans* (Forsslund 1957)	-	-	-	+	-	-
2. *Liochthonius sellnicki* (S.Thor 1930)	-	-	-	+	-	-
Family *Epilohmanniidae* (Oudemans 1923)						
3. *Epilohmanniia cylindrical* (Berlese 1904)	-	-	+++	+	+++	+
Family *Nothridae* (Berlese 1896)						
4. *Nothrus silvestris* (Nicolet 1855)	-	-	+	-	-	-
Family *Nathermannidae* (Sellnick 1928)						
5. *Nanhermannia nana* (Nicolet 1955)	-	-	+	-	-	-
Family *Damaeidae* (Berlese 1896)						
6. *Epidamaeus sp.*	-	-	+	-	-	-
Family *Belbidae* (Willmann 1931)						
7. *Belba sp.*	-	-	+	-	-	-
8. *Metbelba sp.*	-	-	+	-	-	-
Family *Damaeolidae* (Grandjean 1965)						
9. *Damaeolus ornatissimus* (Csiszar 1962)	-	-	+	+	-	-
Family *Microzetidae* (Grandjean 1936)						
10. *Microzetes arenarius* (D.Krivolutsky 1966)	-	-	-	-	-	+
Family *Carabodidae* (C.L.Koch 1837)						
11. *Carabodes sp.*	-	-	+	-	-	-
Family *Tectocepheidae* (Grandjean 1953)						
12. *Tectocepheus velatus* (Michael 1880)	-	-	+	+	-	-
13. *T.alatus* (Berlese 1913)	-	+	+	-	-	-
Family *Suctobelbidae* (Grandjean 1954)						
14. *Suctobelbella hammeri* (D. Krivolutsky 1965)	-	-	+	-	-	-
15. *S.acutidens* (Forsslund 1941)	-	-	+	-	-	-
16. *S.dargoltsiana* (D.Krivolutsky 1966)	-	-	+	+	-	-

Mite species	Marshy site (sewer canal)	Field			Grapes	Apple orchard
		Rice	Cotton	Alfalfa		
17. *S. subtrigona* (Oudemans 1916)	-	-	-	-	+	-
18. *Suctobelbella sp.*	-	-	+	-	+	-
19. *Suctobelba trigona* (Michael 1888)	-	-	-	+	-	-
20. *Suctobelba* sp.	-	-	-	-	+	-
Family *Oppiidae* (Grandjean 1954)						
21. *Quadroppia quadricarinata* (Michael 1885)	-	-	++	++	+	-
22. *Oppiella nova* (Oudemans 1902)	-	+	++	+	++	+
23. *Oppia bicarinata* (Paoli 1908)	-	-	-	+	-	-
24. *O.concolor* (C.L.Koch 1844)	-	-	+	-	-	-
25. *O. minutissima* (Sellnick 1950)	-	-	+	-	-	-
26. *O. krivolutskyi* (Kulijev 1966)	-	-	+	-	-	-
27. *O. unicarinata* (Paoli 1908)	-	-	-	+	-	-
28. *O. clavipectinata* (Michael 1885)	-	-	-	-	+	+
29. *O. cylindrical* (Pèrez-Ińigo 1964)	-	-	-	+	+	-
30. *Oppia nukusia* (Shtanchaeva 1984 sp.nov.	-	-	-	+	+	+
31. *O. sadbinia* (Shtanchaeva 1984 sp.nov.	-	-	-	+	+	+
Family *Hydrozetidae* (Grandjean 1954)						
32. *Hydrozetes amudariensis* (Koshchanova 1984 sp.nov.)	+++	+++	-	-	-	-
Family *Passalozetidae* (Grandjean 1954)						
33. *Passalozetes africanus* (Grandjean 1932*)*	-	-	-	-	+	+
Family *Oribatullidae* (Thor 1929)						
34. *Oribatula tibialis* (Nicolet 1855)	-	-	-	+	+	-
35. *Zygoribatula frisiae* (Oudemans 1900)	-	-	+	-	+	+
Family *Scheloribatidae* (Grandjean 1953)						
36. *Scheloribate fimbriatus* (S.Tour 1930)	-	-	-	-	+	+
Family *Haplozetidae* (Grandjean 1936)						
37. *Protoribatea capucinus* (Berlese 1908)	-	-	+++	+	+++	+++
Family *Ceratozetidae* (Jacot 1925)						
38. Caratozotes *sp.*	-	-	-	-	+	+
39. *Diapterobates oblongus* (C.L.Koch 1879)	-	-	+	-	-	-
Family *Mycohatidae* (Grandjean 1953)						
40. *Minunthozetes pseudofusiger* (Schweizer 1922)	-	-	-	+	-	-

Mite species	Marshy site (sewer canal)	Field			Grapes	Apple orchard
		Rice	Cotton	Alfalfa		
41. *Puncteribates punctux* (C.L.Koch 1839)	-	-	-	+	-	-
Family *Chamobatidae* (Thor 1938)						
42. *Chamobates sp.*	-	-	+	-	-	-
Family *Oribatellidae* (Jacot 1925)						
43. *Tectoribates ornatus* (Schuster 1953)	-	-	-	-	+	+
Family *Galumnidae* (Grandjean 1936)						
44. *Galumna sp.*	-	+	-	-	-	-
Family *Phthiracaridae* (Perty 1841)						
45. *Hoplophthiracarus pavidus* (Berlese 1913)	-	-	-	+	-	-
Family *Euphthiracaridae* (Jacot 1930)						
46. *Rhysotritia ardua* (C.L.Koch 1841)	-	-	-	-	+	-
Total number of species recorded	1	4	25	16	18	12

The Mesostigmata mite fauna includes 41 species. None of the biotopes surveyed is known for any strict specificity of its species composition. The assemblages of Mesostigmata mites in irrigated lands of Karakalpakstan as well as those of the rural ecosystems of the non-irrigated farmlands widespread in Karakalpakstan are comprised mainly of forms that are widespread in the Palaearctic (Table 4.2).

The most diverse acarofauna is found in the soils of cotton fields (39 species of mites). 34 species of mites have been found in the soils surrounding grapevines, 32 in the soils of apple orchards, and 20 in rice fields. The highest population density was recorded in perennial alfalfa plantations (Laskova & Koshchanova 1980; Petrova & Koshchanova 1981; Koshchanova 1981, 1983, 1984, 1985, 1986; Bogach & Koshchanova 1982; Koshchanova & Krivolyutski 1984; Koshchanova & Shtanchaeva 1984; Shtanchaeva & Koshchanova 1984; Bogach & Koshchanova, 1985; Krivolyutski et al. 1985).

Apterigote insects are mostly soil inhabitants. Apterygota are widespread throughout the territory of the region, some species being recorded most often in manure or decomposing organic matter. They usually constitute the largest part of the soil-inhabiting animals. Hence, based on data obtained on virgin lands, Apterygota constitute 2/3 of the soil-inhabiting animal

population; in cotton soils, 1/3; and in soils of grapes, 1/4 of the total soil population (Kiriyanova 1936).

According to Koshchanova et al. (1997) and Kulumbetova (1998), the following species of the Order Collembola (springtails) have been recorded in the soils of agroecosystems of Karakalpakstan: *Ceratophisella succinea Cush, Folsomia inoculata Stach, F. quadrioculata Tubberg, Isotomorus palustris Muller., Lepidocirtus sp., Pscudosinella alba Paccard., Podura aquatica L., Onychiurus sp. Tallberg., Sminthurides aquaticus Bcurlet, S.viridis L.*.

Koshchanova et al. (1997) furthermore recorded the following arthropod species in the soils of agroecosystems in Karakalpakstan: *Eosentomon transitorum Berel* (Order Protura)*, Campodea Staphilinus* Wectv*., Jepyx dux* Scot (Order Diplura)*, Ctenolepisma transcapica* Esch*., Lepisma saccharina* L*., Thermobia domestica* Pack (Order Thysanura).

Of the Blattodea, the species *Polyphaga saussurei* Dohrn has been recorded in open areas under crops in the burrows of edaphic animals (Alimjanov 1972, Kulumbetova 1998a).

Of the Dermaptera*, Labidura riparia* Pall and *Forticula tomis* Kol are often recorded as pests in cotton fields and in fields of other crops in Khorezm and Karakalpakstan.

The Order Orthoptera in Uzbekistan, including the southern Aral Sea region (Khorezm province and the Republic of Karakalpakstan), is represented by a high diversity of species belonging to the groups of true grasshoppers, crickets, fen-crickets and true locusts. They abound in agricultural fields and virgin lands. They are typically recorded in undergrowth mainly in the pre-adult phases of development and while overwintering.

Table 4.2 Species composition (+, ++, +++ presence (with indication of relative dominance); - absence) of Mesostigmata (mesostigmatic mites) on cultured soils under different crops in the Nukus district of Karakalpakstan (by Koshchanova 1986) Sp. nov. = new species

Mite species	Marshy site (collector)	Field		Apple orchard	Grapes
		Rice	Cotton		
Family *Parasitidae* (Oudemans 1901*)*					
1.*Parasitus kraepelini* (Berlese 1904*)*	-	+	-	-	-
2. *P.hyalinus* (Willmann 1949)	+	-	+	-	+
Family *Veigaiaidae* (Oudemans 1939)					
3. *Veigaia nemorensis* (C.L.Koch 1839*)*	-	-	+	-	-
Family *Ameroseiidae* (Berlese 1919) (Evans 1961)					
4.*Ameroseius lidiae* (Bregetova 1977)	+	+	+	+	+
5. *A.eumorphus* (Bregetova 1977)	-	+	-	-	-
6. *A.furcatus* (Karg 1971 (aberr.)					
7. *A.gilarovi* (Petrova et Koshchanova sp.nov.	-	-	++	+	+
Family *Aceosejidae* (Baker et Wharton 1952 (*sensu* Evans 1958))					
8. *Neojordensia levis* (Oudemans et Voigts 1904*)*	+	+	-	-	+
9. *N.sinuata* (Athias-Henriot 1973)	+	+	-	-	-
10. *N.meritricha* (Athias-Henriot 1973)	-	+	-	-	+
11. *Lasioseius confuses* (Evans 1958)	-	+	-	-	-
12. *L.yousefi* (Athias-Henriot 1959)	-	+	+	-	-
13. *L.oryzaephilus* (Petrova et Koshchanova 1984 sp.nov.)	+	++	-	-	-
14. *Platyseius subglaber* (Oudemans 1902)	+	+++	-	-	-
15. *Leioseius bicolor* (Bergese 1918)	-	-	+	-	-
16. *Cheiroseius serratus* (Halbert 1915)	-	+	-	-	-
17. *Ch.nepalensis* (Evans et Hyatt 1960)	+	-	-	-	-
18. *Ch.necorniger* (Oudemans 1903)	+	-	-	+	+
19. Proctolaelaps pygmaeus (Műller 1860)	-	+	-	+	-
20. *P.ventrianalis* (Karg 1971)	-	-	-	-	+
21. *Arctoseius semiscissus* (Berlese 1892)	-	-	+	-	-
22. *A.cetratus* (Sellnick 1940)	-	-	+	-	-

Mite species	Marshy site (collector)	Field		Apple orchard	Grapes
		Rice	Cotton		
23. *A.brevicheles* (Karg 1969)	-	+	-	-	-
Family *Phytoseiidae* (Berlese 1916)					
24. *Amblyseius bicaubus* (Wainstein 1962)	-	+	-	+	+
25. *A.zwoelferi* (Dosse 1957)	-	+	-	+	-
26. *Amblyseius sp.*	-	+	+	+	-
Family *Rhodacaridae* (Oudemans 1902)					
27. *Rhodacarellus silesiacus* (Willmann 1936)	-	-	+	-	-
28. *Rhodacarellus sp.*	-	-	-	+	-
29.*Dendrolaelaps zwoelferi* (Hirschmann 1960)	+	+	++	+	+++
30. *D.lobatus* (Shcherbak et Chelebiev 1977)	+	-	-	-	-
31. *D.fallax* (Leitner 1949)	+	-	-	-	-
32. *Dendrolaelaps sp.*	-	-	+	-	-
Family Macrochelidae (Vetzthum 1930)					
33. *Macrocheles scutatus* (Berlese 1904)	+	-	-	-	-
Family Laelaptidae (Berlese 1892)					
34. *Hypoaspis aculeifer* (Canestrini 1983)	-	-	-	+	+
35. *H.angustis* (Karg 1965)	-	+	-	+	+
36. *H.praesternalis* (Willmann 1949 (aberr.))	-	+	-	+	+
37. *Cosmolaelaps sp*.	-	-	-	+	-
38. H. (*Euandrolaelaps) karawaiewi* (Berlese1903)	-	+	+	-	-
Family Zerconidae gen.sp.					
Family *Uropodidae* (Berlese 1892)					
39. *Trichouropoda spatulifera* (Moniez 1892)	-	-	+	+	+
40. *Trichouropoda sp.*	-	-	-	+	-
Total number of species recorded	12	21	13	17	12

The specificity of true grasshoppers can be judged by their distribution across areas and crops. They are mostly comprised of the genus *Tettigonia* L. (*T. caudata* Cn*., T. albifrons, T. viridissima)*. Grasshoppers of the genera *Metrioptera (Metrioptera tamerlana* Sauss) and *Pletycleis (P.escaleria* Bol*., P. intermedia* Serv.) are present. Crickets (Gryllidae) are generally

nocturnal insects inhabiting mainly humid areas. *Melanogrillus desertus* Pall is often recorded in cotton fields feeding on cotton seedlings; *Gryllus burdigalensis* Latr. is more rarely recorded. Mole crickets (Gryllotalpidae) live in the soil; *Gryllotalpa unispina* Sauss and *G.gryllotalpa* L. are widespread in irrigated areas of the survey region. Tetriginidae inhabit the soil and soil surface, more specifically they are found in spaces between clods, at the root neck of plants, among detritus, in cracks and in soil depressions. Species recorded by Alimjanov (1972), namely *Terrix subulata* and T.*tartara* U., were observed in alfalfa and adjoining areas. The true locusts (Acrididae) in the area under survey show high species diversity, but the species listed in Table 4.3 are considered pests in irrigated lands.

Table 4.3: Locust species known as pests in irrigated lands

Species	**Occurrence as pest**
Oxya fuscovitatta Marasch	Rice fields
Anacridium aegyptium L.	Cotton fields
Calliptamus italicus L.	Cotton and alfalfa fields
Pyrgomorpha conica destri B.Bien	Alfalfa fields
Chorthippus turanicus Tarb.	Alfalfa fields
Aiolopus thalasinus T.	Cotton and alfalfa fields
Locusta migratoria migratoria L.	Cotton and other crops

In addition to the above-mentioned locust species in irrigated lands, the following species were also recorded: *Dociastaurus maroccanis* Thnb*., D. kraussi* Ing*., Oedaleus decarus* Germ., *Pyrgodera armata* F.W., *Miscirtus wagneri* Kit., *Oedipoda coerulescens* L., *Acrotylus insubricus* Scop., *Sphingonotus nebulosus* F.-W., *S. satrapes* Sauss., *S. carinatus* Sauss., and *Hyalorrhipis clausi* Kitt (Alimjanov 1972).

Homoptera consists of several suborders. Both larval and nymphal instars of the suborder Auchenorrhyncha develop in the soil.

According to the data of Sborshchikova (1970) and Kozhevnikova (1997), the following species of leafhoppers were recorded in rice fields: *Dolphax striatella* Fall., *Psammatetix atriatus., P. dubovskyi* (Fall)., *Cicadella viridis* L., *Balclutha rhenana* Wgh., *Macrosteles laevis* (Rib)., *M.quadripunetulatus* (Kbm)., *M. razvjazkinae* Dub., *M.tieberi* (Rib)., *Aconurella prolixa* (Leth)., *Cicadulla divaricata* Rib., *Kelisia pannonica* Mats*., Leodelphax striatellus* (Fall)., *Toya propinqua* (Fieb)., *Pentastiridius Pallens* (Germ L.)., *P. formicarius* (Mit).

Of the aphid suborder (Aphididae) in Khorezm and Karakalpakstan several root aphids were recorded (Table 4.4).

Table 4.4: Root aphids recorded from Khorezm and Karakalpakstan (Alimjanov and Kan 1985)

Species	**Occurrence as pest**
Smythurades betal Westw	Cotton
Forda trivialis Pass.	Cereals
F. hirsute Mordv.	Cereals
Byrsocrypta ulmi	Cereals
B. hirsuta Baker.	Cereals and rice
Geoica lucituga Lehn.	Grapes
Gobaishia pallida Lehn.	Cereals
Anoelia corni F.	Cereals
Brachycaudus helichrysi Calt.	Peach trees
B. cardui L.	Roots of composites

The following species of Pseudococcidae (order Coccoidea) were recorded on the roots of agricultural plants in the irrigated zones of the surveyed region: *Psudococcus comstocki* Kuw, *Rhizococcus zygophylli* Arch, *Peliococcus turanicus* Kir and *Phenacoccus pumilus* Kir.

The Order Hemiptera (true bugs) abounds near roots and in the soil around vegetative detritus. According to the observations of Alimjanov (1972) and Khamraev (unpubl.), alfalfa fields and adjoining areas, as well as weeds in cotton fields, provide a wintering ground for insects, where their average density reaches over 10-15 individuals per square meter. Insects of the Order Thysanoptera, *Thrips tabaci* Lind., *Haplothrips tritici* Kurd., *H. aculaetus* Fabr. and some other insects overwinter in the larval and adult stages in cracks and under lumps of soils in wheat plantations and other plantations (Yahontov 1953).

The Order Coleoptera (beetles) is the largest in terms of abundance. Their soil-inhabiting forms comprise the main group of soil entomofauna. Carabidae (beetles) are of high practical importance. In most cases, they are predators both in the adult and larval forms, thus consuming a great number of small arthropods, many of which are crop pests. In a cotton plantation in 2001-2002 we recorded over 25 species of Carabidae, such as *Cicindela decempustutata* Men., *C. littoralis* F., *C. sublacerata* Sols., *Scarites terricola* Bon., *Clivina ypsilon* Dej., *Tachys angustulus* Rtt., *Brascus punctulatus* Dej., *B. quadriplagiatum* Mots., *B. varium* Ol., *Ophonus griseus* Pang., *Harpalus distinguendus* Dej and others.

The beetles of the family Staphylinidae represent a significant part of the soil insect communities with high abundances across all ecosystems. Table 4.5 gives the species diversity of Staphylinidae in rice fields in Karakalpakstan.

Table 4.5. Staphylinid beetles recorded in agroecosystems of rice fields in Karakalpakstan (from Bogach and Koshchanova 1982)

Species	**Zoogeographic distribution**	**Feeding type**
Carpelimus bilineatus	Holarctic	Phytophage
Carpelimus corticinus	Holarctic	Phytophage
Carpelimus gracilis	Palaearctic	Phytophage
Platystethus cornutus	Palaearctic, South Asia	Saprophage
Platystethus nitens	Europe, Caucasus, Central Asia, Siberia	Saprophage
Bledius hinnulus	Mediterranean, Central Asia	Phytophage
Bledius glasunowi	Central Asia	Phytophage
Bledius sp.	Central Asia	Phytophage
Scopaeup sp.	Central Asia	Predator
Throbalium dividuum	Mediterranean, Caucasus, Central Asia	Predator
Achenium quadriceps	Central Asia, Iran	Predator
Philonthus dimidiatipennis	Europe, Mediterranean, Caucasus, Trans-Caspian, Central Asia, Mongolia	Predator
Philonthus formosus	Caucasus, Central Asia	Predator
Heterothops laeticolor	Caucasus, Central Asia	Predator
Amischa sp.		Euryphage
Oxypoda opaca	Palaearctic	Euryphage

According to Bekbergenova (2000), the density of staphylinid beetles in the southern Aral Sea region reaches 9 individuals per 10 m^2 of alfalfa fields; in maize fields 26; rice, 56; potato, 16; garden (apple, quince and others), 23; but it is highest along canals and sewer canals, with 43 individuals per 10 m^2.

The Elateridae are widespread. Their early stages develop in the soil, while the adults are surface-living. No data exists for Khorezm, but the following Elateridae have been recorded in cotton fields in the Bukhara region: *Agriotes meticulosus* Cand., *A.caspicus* Heyd., *Aeoliides grisescens* Germ., *A. rossi* Erm., *Drasterius turcomanus* Cand., *Pleonomus tereticollis* Men., *Melanotus avitus* Cand., *Platynuchus blanolus* Sols., *Pl. nigropunctatus* Motsch., *Neotrichophorus turanicus* Cand. (Khamraev 1992).

Coccinellid beetles and their larvae, and to some degree pupae, are quite frequently recorded in the plant litter. Especially in the years of cotton aphid mass breeding, the number of coccinellids in the soil and plant litter layer of weeds surrounding cotton plantations can reach 16.4 individuals per m^2 (Alimjanov 1972).

Scarabaidae, in the pre-adult stage, inhabit soils, rotten wood, and the faeces of warm-blooded animals. The adult insects live in the soil and at the soil surface through almost their whole life cycle. They breed mainly in undeveloped lands, alfalfa fields, gardens and parks, land boundaries and waysides (Table 4.6). Although they are scarcely found in cotton plantations, a

large number of scarabaeid larvae are found in the soils surrounding these plantations (Table 4.6).

Table 4.6: Average density (individuals per m^2 and 10-day sampling interval) of scarabaeid larvae in the soils of weed fields surrounding cotton fields (from Alimjanov, 1972). Note: I, II, III are ten-day sampling intervals of the corresponding month.

Site	April			May			June			July
	I	II	III	I	II	III	I	II	III	I
1	16.0	41.6	22.4	16.0	0	0	-	0	0	0
2	-	3.2	35.2	48.0	-	9.6	-	-	0	3.2
3	-	22.4	92.0	54.4	6.4	0	-	0	0	0
4	-	-	3.2	9.6	12.8	0	3.2	0	0	0
5	-	-	9.6	6.4	3.2	0	3.2	0	0	0
6	-	-	0	0	16.0	0	0	0	0	0
7	-	-	3.2	6.4	12.8	0	0	0	0	0
8	-	-	16.0	9.6	0	0	3.2	9.6	0	0

Site	July		August			September			October		
	II	III	I	II	III	I	II	III	I	II	III
1	0	0	0	16.0	0	0	6.4	9.6	16.0	16.0	0
2	3.2	0	0	28.8	0	0	25.6	12.8	28.8	19.2	9.6
3	3.2	0	-	0	3.2	0	0	12.8	9.6	-	16.0
4	3.2	0	3.2	0	0	3.2	0	0	3.2	3.2	-
5	0	0	0	-	6.4	3.2	3.2	-	0	3.2	0
6	0	0	3.2	3.2	-	3.2	3.2	-	6.4	3.2	9.6
7	0	0	19.2	0	3.2	-	3.2	12.8	3.2	3.2	3.2
8	0	0	3.2	0	0	0	6.4	-	-	-	-

Tenebrionidae in Karakalpakstan have a high species diversity and are frequently recorded in various environments, for instance on sandy desert soils, deserts with hard soils, solonetz and saline soils (Pirnazarov 1973), as well as in areas under crops and their boundaries. In collections from the soils of cotton fields and their weed environments in Khorezm and Karakalpakstan (Khamraev unpublished), the following species of Tenebrionidae have been recorded: *Opatroides punetalatus* Brull., *Dailognatha nasuta* Men., *Gonocephalum rusticum* Ol., *Opatrum sabulosum* L., *Calyptopsis laveipennis* Rtt., *Blaps halophita* Fisch., *Oodescelis polita* Strum., *Stalagmoptera laticollis* Sols., *Dila laevicollis* Gebl., *Zophosis punctata nitiga* Gebl., *Gnathosia schrenkei* Gebl., *G. glabra* F.W.

Alleculidae, at the stages of eggs, larvae and pupae, also develop in the soil. Their larvae, as well as the larvae of Tenebrionidae and Elateridae, are pests of the shoots and root systems of

plants. The genera *Omophlus Sol.* and *Omophlina* (Alleculidae) are widespread and frequently recorded. For example, *Omophlus pilicollis* Men. is distributed throughout the region.

Meloid larvae (Meloidae) live in soils, sometimes occupying burrows of other insects, and they are parasites of locusts and bees. The adult meloids are phytophages and, when present in large numbers, can damage cultured and ornamental plants. Mass outbreaks of these beetles were observed in the Amu Darya valley. In early summer they voraciously consume the leaves of perennial grassy vegetation and bushes. The beetles are well known under the local name of *Alakulyuk;* the name being related to the fact that the insects concentrate in flocks on plants and frighten other organisms off with their smell.

The larvae of some species of Cerambycidae develop in the soils of irrigated lands, for example, *Plagionotus floralis* Pall. in the plant roots, and specifically near alfalfa root systems. *Prionus turkestanicus* Sem. in the larval stage develops in the soil near the root systems of wheat and barley.

Chrysomelidae gemerally use the soil for oviposition, larval development, their pupation and/or wintering of adult individuals. In particular *Colaphellis höfti Men.* overwinters in the soil. The overwintering adults appear on plants such as mustard, cabbage and other vegetables from the Cruciferae family, and wild-growing plants. The eggs are laid in cracks and under clods at the base of plants. Pupation of the larvae also occurs in the soil. *Entomascelis adonidis Poll.* overwinters in the soil throughout all stages of development (Avanesova 1968). *Lema melanopus* L. at the adult stage overwinters under the lumps of soil and in cracks in the surface of the ground.

The Halticinae are a special group of very mobile, leaf-eating beetles. Their development and breeding is closely connected to the soil. Only during feeding and pairing do the adult individuals, and in some species the larvae, stay on plants. The following Halticinid species are widely distributed: *Podagruca malvae III.* and *Pod. menetries Fold*, *Psylliodes attenuota* Koch, flea beetles of the genera *Haltica* Mull and *Longitarsus* Latz.; *Chaerocnema hortensis* Geottr. and *C. oridula* Gyll, which are widespread on grain and fodder cereals.

Weevils (Curculionidae) are one of the most abundant groups. Mass breeding of weevils in conditions of irrigated agriculture (such as alfalfa) show *Sitona, Phitonomus variabilis*, Curculionidae and *Tychius*. *Sitona* Cerm spp. develop in the ground. Their abundance at premature stages on alfalfa during the spring-and-summer period exceeds that of all other soil-inhabiting insects put together. The widespread species are as follows: *Sitona cylindricollis* Fahrs., *S. humeralis* Steph., *S.longulus* Gyll., *S.calbosus* Gyll., *S. inops* Gyll., *S.crynitus* Hebst., *S. fronto* Fst., etc. (Alimjanov 1951). Curculionidae are widespread in the region under survey,

except for *Sitona and Phitonomus variabilis*. Curculionidae occur in relatively low numbers but are noted for a high species diversity. *Hygronomus sinuaticollis* Fst. overwinters at the larval stage on roots of rice and in an arable layer of rice fields. On beetroot fields species such as *Tanymecus palliatus* T., *Chromonotus confluens* Fahrs., *Temnorrhinus brevirostris* Gyll, *Stephanophorus subtuscus* Fst., etc. (Chiang Than Jian 1979) have been recorded.

The Neuroptera are represented by Myrmeleonidae (ant lions), the larvae of which develop in funneled holes in sandy soils, and Mantispidae, whose larvae parasitize the egg cocoons of spiders. The larvae of ant lions are usually observed at the edges of land under crops, along roads and footpaths and irrigation networks, but mainly where the ground is loose with a mixture of sand.

Order Lepidoptera. Of the Cemiastomidae, *Cemisstoma scitella* L. is one of mass pests of leaves of apples, pears, quince, sweet cherry, cherry, plums and other fruit crops. Its' pupae overwinter under soil clods. The pupae of *Plutella maculipennis* Curt., from another family, Plutellidae, overwinter in friable transparent cocoons among the remaining cabbage stumps, in leaf litter, and on weeds.

Of the Gelechiidae, *Pectinophora malvella* Hubn mainly overwinters in the soil during the larval stage, at a depth of 3-8 cm.

Tortricidae are represented by a number of species which in part or completely overwinter in the ground and near soil. Therefore, the larvae of *Laspeyresia pomonella* L. remain for overwintering both under the bark of trees, in storehouses, in the topsoil and under soil clods. Another example, cocooned caterpillars of *L. funebrana*, overwinter in the plant detritus under trees and under soil clods (Azimov 1993).

Family Psychidae. The caterpillars of this family are polyphages that live in casings, in web sacks externally covered with pieces of leaves, small stalks, earth particles, etc. In occasional mass outbreaks they damage crops and plants. The most well known species is *Amicta armena* Heyl. The caterpillar of this insect is polyphagous (they feed on leaves of various plant species). Caterpillars quite often appear in large numbers on wild-growing plants, and then in spring (April–May) they move to areas under crops; thus causing much damage to cotton and alfalfa. Pupation of caterpillars occurs in summer in the ground. At the end of summer the adult butterflies emerge. The caterpillars of the new generation are born the same year and simultaneously with feeding they quickly build up their sacks, inside which they overwinter in the soil. Psychidae develops within one year in one generation. It is distributed in the northern areas of Uzbekistan and adjoining areas of Kazakhstan.

Pyrialidae live in diverse conditions at larval and pupal stages: in the rolled leaves of trees, stalks, fruits, in stored products, as well as in the ground and near-soil conditions. In the region under review, the species of genera *Hypsopydia* Hbr.*, Pytausta* L.*, Salebrio* Z. and several other genera live in this fashion. Caterpillars of *Loxostege nudalis* Nb. have been recorded in many cultured plants, including cotton. Having reached the last stage, the caterpillar moves down from the plants and pupates in the upper layer of the ground. Caterpillars of *Hypsoprigia costalis* F. develop in diverse conditions: in stacks, inside premises, on the surface and at various depths in the ground. The pupae of some species of Lycaenidae stay in the soil.

Sphingidae pupate in cavities in the soil, where they also overwinter. Among them, the very beautiful and rare species, *Proserpinus proserpina* Pall., requires protection and thus should be included in the Uzbek Red Data Book.

One of the largest families in the Lepidoptera or butterflies is the family Noctuidae (owlet moths), with about 35 000 species worldwide (Wilson et al. 1997). In the Commonwealth of Independent States (CIS) territory, approximately 2500 species of noctuids (Pospelov, 1989) have been registered (Kozlov & Oliger 1991). In noctuids, as in all Lepidopterans, the feeding stage is the larval stage (the caterpillar). Most noctuids pupate in the ground, usually in a special earthen bed prepared by the caterpillar before pupation, but many also pupate on the ground surface.

The noctuid caterpillars are usually divided into 2 groups based on their feeding habits:

- Those that cut leaves, live in the ground and feed on the subsoil parts of plants (Subfamily Agrotinae);
- Terrestrial caterpillars, which eat the emergent parts and bodies of plants, with caterpillars that pupate in the ground. All of them belong to 8 subfamilies: Hadeninae, Acontiinae, Melicleptriinae, Plusiinae, Catocalinae, Cuculinae, Hepeninae, and Ipimorphinae.

Rahimov (1997) has recorded 53 species of noctuids in irrigated agriculture in Khorezm, of which 7 species belonged to the "cutting" category (Agrotinae) and 46 species to the "terrestrial" category. Their distribution into the fields of different crops is shown in Table 4.7.

Table 4.7: Distribution of noctuids on different crops in Khorezm (from Rakhimov 1997).

Species	Agroecosystems			
	Cotton fields	Maize fields	Alfalfa fields	Rice fields
*I.*Subfamily Noctuidae				
1. Agrotis segetum Den et Schiff	+	+	-	-
2. A.exclamationis L.	+	+	+	-
3. Euxoa agricola Bsd	+	-	-	-
4. Xestia c-nifrum L	+	-	+	-
5. Agrotis ipsilon Hufn.	+	-	-	-
6. Agrotis lasserei Chr.	-	+	-	-
7. Dichagyrris flammatra Den et Schiff	+	-	-	-
II. Subfamily Hadeninae				
8. Discestra trifolii Hufn.	+	+	+	-
9. Laconobia blenna Hugner	-	+	+	-
10.Leucanis zea Duponchel	+	+	+	-
11.Leucania obirena Gr.	-	-	+	-
12.Mythimna l-album L.	-	-	+	-
13.Mythimna vitellina Hb.	-	+	-	-
14.Hadula sabulorum Alph.	-	-	+	-
15.Cardepia sp.	-	+	-	-
III. Subfamily Cucullinae				
16.Cucullia biornata F.d.W.	+	-	+	-
17.Cucullia sp.	-	+	-	-
IV. Subfamily Ipimorphinae				
18.Spodoptera exigua Hb.	+	-	+	-
19.Oria musculosa Hb.	-	+	+	-
20.Platypergea albina Eversn.	-	+	-	-
21.Pseudohadena indigna Chr.	-	-	+	-
22.Caradrina sp.	+	-	+	-
V. Subfamily Acontiinae				
23.Emmelia trabealis Scop.	-	+	+	-
24.Acontia luctuosa Den et Schiff	+	+	-	+
VI. Subfamily Plusiinae				
25.Autographa gamma L.	+	+	+	-
26.Trichoplusia ni Hb.	+	-	-	-
27.Cornutiplusia circumflexa L.	-	-	+	-
28.Plusia festucae L.	+	-	-	+
29.Macdounnoughia confusa Stph.	-	+	-	-
30.Plusia gutta Guenee	-	+	-	-
31.Chrysodexis chalcutes Esp.	-	-	+	-
VII. Subfamily Catocalinae				
32.Astiotes neonympha Esp.	-	+	+	-
33.Euclidia munita Hbn.	-	-	+	-
34.Grammodes rogenhoferi Bohatsch	+	-	+	-
35.Grammodes algira L.	-	-	-	-
36.Catocala puerperal Giorna.	-	-	-	+
37.Catocala sp.	-	+	-	-
38.Catocala deducta EV.	-	+	-	-
39.Aleucanitis sp.	+	+	-	-
40.Aleucanitis caucasica Koll.	-	+	+	-
41. Aleucanitis flexuosa Men.	+	-	+	-
42. Aleucanitis kusnezovi Zohi.	-	-	+	-

Species	Agroecosystems			
	Cotton fields	Maize fields	Alfalfa fields	Rice fields
43.Psedophia syriaca Bugnion.	-	-	+	-
VIII. Subfamily Hypeninae				
44.Acantolipes regularis Hbn.	-	+	+	-
45.Anumeta fractistrigata Alph.	-	+	-	-
46.Pericyma albidentaria Frr.	-	+	+	-
47.Palpangula cestina Stgr.	-	+	-	-
IX. Subfamily Melicleptriinae				
48.Helicoverpa armigera Hb.	+	-	-	-
49.Heliothis viriplaca Hufn.	-	+	+	-
50. Heliothis nubigera H.-S.	-	-	+	-
51. Heliothis peltigera Den et Schiff.	+	+	+	-
52.Heteragraha fabrilis Piinge.	-	-	+	-
53. Armada paraceorum Men.	-	+	-	-
Total number of species	20	28	30	4

Order Hymenoptera

The larvae of many Hymenopteran species pupate in the soil.

Tenthredinidae in the irrigated zone of the region comprise a relatively small number of species. An example is *Caliroa limacina* Rtf., whose larvae build cocoons in the upper layer of the soil after completing feeding on the plant.

Ichneumonidae (parasitic wasps) show a high species diversity in the irrigated zone of Uzbekistan. These species parasitize crop pests, and are of great importance in the regulation of the numbers of their hosts, including those inhabiting soils and near soils. The following species of Ichneumonidae, the parasites of caterpillars and pupa of winter noctuid and other leaf-cutting insects, as well as the terrestrial noctuids, are: *Amblytebes quinquesinctus* Kriech; *Barylypa (Amabilis) ruta* Holmg*; B.delector* Thunb*; Barichncumon sp.; Ctenichneumon panzeri* Wesm*; Diadegma tianshanica* Kok*; D. (Meloboris) velox* Holmg*; Enicospilus tournieri* Sn.U.*, E.ramidulus* L.*, E.rossicus* Kok.*, Ichneumon sorcitorius* L.*, Netelia fuscicor gis* Holmg.*, N.testalla* Grav*; Sinoforus xanthostomus* Grav and others (Zhumanov 1995).

Pteromalidae are parasites of the group of "cutting" noctuids. Those found in the surveyed area are: *Catolaccus ater* Ratzeburg.*, C. crassiceps* (Masi); *Pteromalus sp*. and others.

Sphecidae make their nests in the soil along road edges, ravines, and elevated banks of ditches, etc. They store caterpillars, larvae and spiders, upon which their larvae feed. This group of wasps comprises the following species: *Podalonia affinis, P. atrocyanea, P. ebenina, P. tygei, P. hirsita, Ammophila mucipsa Mor., A. elongata Mor*; *Astata fufipes Macs., Atizus Koenigi* F.M.*, Oxybelus lamellatus* Ol. and many others cited in the annotated list (Azimov 1993).

Bees (Apidae) of the irrigated zone of Uzbekistan comprise three distinguishable groups: single bees, social bees and cuckoo bees. Due to their way of life, many species of single and some social bees are connected with the soil. Solitary bees, also known as earth bees (genus *Andrena* F.), comprise several species in the irrigated zone of the region under survey. They make nests in the ground with branchy locations of cells. The most frequent species include *Andrena carbanaria* L., *A. Aulica, F. mor., A. discophora*, *F. mor*., and *A. funebris* Paund. The latter two species pollinate apple trees (Yakhontov 1946).

Ants (Formicidae) are important in the area because of their abundance of forms and their abundance in the wild. The nests of ants are extremely diverse and can be found in the soil, under stones, in wood or in trees. Some ants are polyphages, others are carnivorous; herbivorous forms and plant seed harvesters also exist. Less than thirty species of ants have been recorded for Khorezm and Karakalpakstan, (preliminary, unpublished data). Ants constitute an almost constant component of soil-inhabiting invertebrate communities.

Order Diptera. In the irrigated zone of the region under survey, the larvae and pupae of a large number of Nematocera and Brachycera (including Orthorrhapha and Cyclorrhapha) inhabit soils and subsoil zones. The frequency of occurrence and numbers vary both over separate stations and seasons.

Mosquitoes (Culicidae) are divided into malarial (*Anopheles*) and non-malarial mosquitoes. Of the non-malarial mosquitoes, most irritation is caused by species of the genus *Aedes*, the larvae of which oviposit into periodically waterlogged soil. The mass species in the region under review is *Aedes caspius* Pall. The adult mosquitoes can maintain and transmit pathogenic agents of viral, bacterial and parasitic diseases through their bite.

From the Family Psychodidae, the larvae of genus *Psychoda* can be found inhabiting decomposing matter and in soft clayish silts with a mixture of organic matter.

Cecidomyiidae can be divided into three groups by their feeding pattern: gall-forming, saprophages and predators. The last two groups inhabit soils and subsoil layers rich in mineral matter. The larvae of a number of species are pests of grain, alfalfa and wood breeds. They pupate in the soil.

The larvae of Nemestrinidae are endoparasites of locusts and scarabid larvae. Larvae hatch from the eggs and start actively searching for a host. They can live without food for as long as 15 days. Having penetrated into the host, they molt and, upon finishing feeding, leave the dead host to pupate in the soil.

Tabanidae belong to the complex of bloodsucking insects from the suborder Bracycera (short horned flies). The water-living larvae are voracious predators. Pupation of mature larvae takes place in the soil upper layers. The flight period of Tabanidae typically ranges from May to late September.

The predatory Asilidae family develop in the soil in the larval stage. Little is known about Asilidae in the oasis zone in the region under review, but judging by the occurrence of the adult forms the group consists of many species.

The Family Chamaemyiidae also belongs to the flies found in the area. The most widespread and common species are *Leucopis ninae* Tan (for biology cf. Gaimari and Turner 1996a, b, 1997) and *L. glyphinivora Tanas*, the larvae of which feed on many species of aphids (from 50 to 70) on different plants. They are common in agroecosystems and their pupae overwinter in the soil.

Muscidae consist of diverse biological groups: phytophagous saprophages, coprophages, parasites and predators. In the soil and subsoil layer of the irrigated zone, larvae developing in manure or decomposing plant residues may be encountered (Alimjanov 1972).

Tachinidae, in the larval stage, parasitize insects, mainly butterfly larvae. The species of one genus (*Pollenia*) parasitize earthworms. Tachinidae are widespread throughout the region and comprise a great number of species with rather diverse ways of life and a quite specific food selection; many species are carnivorous. The parasitism by Tachinidae is exclusively internal. Many species of Tachinidae, namely, *Tachina rohdendorphi* Zim*., Exorista larvarum* L., *E. xanthaspis* Hd*., E.civilis* R-D*., Gonia bimaculata* Rond*., G. cilipida* Rond*., G. capitata* R.-D. and others are parasites of insects pests, particularly Lepidopterans, and are of thus great practical importance for biological pest control (Zhumanov 1995). Tachinidae which develop inside soil-inhabiting insects, and which are widespread in the region under review, belong to different biological groups and their importance as regulators of the host numbers thus varies widely.

5 SOIL MICROORGANISMS

The different physiological groups of microorganisms in soil are active participants of the biological cycling of matter, providing the mineral nutrients necessary for crop growth. It is the microbes which decompose the organic matter left over from dead plants and crop residues and mineralize it into the nutrients needed by agricultural crops. Studying the microbiological processes in the soils of the Southern Aral Sea region revealed that a considerable regrouping of microorganisms participating in the transformation of organic and mineral forms of nitrogen depending on the cultivated agricultural crop and soil type has taken place. Ammonificators prevail in meadow and meadow-alluvial soils under the crops of vegetables, rice, and alfalfa, while in meadow-takyr (virgin) soils, actinomycetes prevail.

Microbiological processes in the soils of the Southern Aral Sea region are influenced by nutrients and water-soluble salts. The high salt content promotes a decrease in the number of non-sporiferous species of microorganisms and an increase in the percentage of Bacilli within the general number of ammonificators, and a reduction of humus content in the soil. The number of microorganisms in the soils of the Southern Aral Sea region changes over seasons. For example, the number of ammonificators considerably increases in spring under vegetable cultures.

Microflora in the soils of rice fields in conjunction with phases of the development of rice was studied on the basis of the activity of various physiological groups (Otenova 1999). The number of microorganisms on MPA (beef extract agar) medium in the fields under survey was high. In the first few days after flooding, an increase in the number of bacteria growing on MPA was recorded. Then it dropped insignificantly, remaining at the same level up to the end of the rice vegetation period. Nitrogen-fixating organisms are frequent inhabitants of the soils in rice fields. In conditions prior to the sowing of rice and in the first days after flooding, nitrogen-fixing *Azotobacter* grew in Ashby medium. Ten days after flooding the percentage of growth decreased to 60% and a month later in crops it sharply decreased. However at the end of the rice vegetative period the growth of *Azotobacter* in Ashby medium again increased.

Similar results were observed and in actinomycetin on a starch-ammoniac agar. Sulphate-reducing bacteria were present in their lowest numbers right after flooding took place, since oxidized conditions were maintained in the soil.

The flooding of rice fields with water causes a sharp change in the water content, degree of aeration and heat distribution in the soil, and consequently affects the life conditions for microorganisms. Immediately after flooding, the number of not only anaerobic, but also aerobic microorganisms increased in the soil layer. Further, the number of aerobes is gradually reduced,

but they do not completely disappear from the soil during the entire vegetative period of rice growth (Table 5.1).

Table 5.1: The number of microorganisms in experimental fields (10 days after submerging the fields in water) according to different physiological groups (Otenova 1999). MPA means beef extract agar, while KA is potato agar.

Field #	Soil layer (cm)	MPA (ammonifixators)	Ashby (nitrogen-fixers)	KA	Sulphate-reducing
1	0-5	$110x10^6$	90%	$12x10^5$	No growth
	5-10	$120x10^5$	87%	$30x10^5$	11x10
2	0-5	$260x10^5$	90%	$28x10^5$	No growth
	5-10	$170x10^5$	85%	26x10	3x10
3	0-5	$180x10^5$	90%	47x10	4x10
	5-10	$9x10^5$	82%	35x10	4x10

The superficial layer at 0-5cm and the 5-10cm horizon were analyzed. As the data of Table 5.1 show, no significant difference in the microbial population was recorded.

Intensive economic activities are now expanding across terrestrial landscapes. Annually, by using land improvement techniques for degraded or unsuitable land, the areas suitable for agriculture expand. With the goal of constantly increasing agricultural crop yields a large amount of organic and mineral fertilizers as well as a varied cocktail of chemical preparations are applied. The action of these substances on soil biological processes is relatively unknown, while consequences of their long-term application have not yet been explored .

Soil invertebrates can, in many cases, be used as indicators signifying changes in biological processes. Studies on the action of mineral fertilizers and various types of chemical agents on soil animals has revealed the specificity of their reaction, stipulated by the whole complex of abiotic and biotic factors. However, the impact of land improvement and fertilizers on the soil fauna, particularly in Central Asian states, has to date been scarcely investigated and only sketchy data are available. For example, as Yakhontov (1953) observed, a sharp increase in the numbers of larvae of *Amphimallon solstitalis* L. can be found in the soil over a timespan of three years, apparently caused by fertilizing fields with manure and sod.

Applying mineral fertilizers disturbs the usual ratio between the concentration of solutions in the soil and causes insects to dehydrate, especially at the larval stage. This is because the fertilizers cause a change in the natural osmotic pressure in pests, which often results in death.

6 CONCLUSIONS

For an increase in soil fertility and crop yields, first and foremost the regulation of the soil microflora and meso- and macrofauna and their interrelations with agricultural crops is necessary, because soil fertility and other crucial factors are mediated by the biological processes provided by the activity of the soil biota.

The Aral Sea crisis is one of the many large man-made ecological and humanitarian disasters in the history of mankind. The dessication of the Aral Sea, desertification of the flood lands in the Amu Darya delta, increased mineralization of waters and salinization of the soils have all left a deep imprint on soil conditions, including the structure and density of groups of soil biota.

The current critical state of soils in the southern Aral Sea region exposed to the effect of diverse ecological factors requires a new approach to studying soil and ways of optimizing soil fertility. Crop production on natural soils in the region is impossible without the application of a complex of measures which improve the properties of saline soils.

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7 APPENDIX: Annotated list of invertebrates inhabiting soils and near-soil areas in Khorezm province and the Republic of Karakalpakstan

This list was compiled by Professor Dr. Aloviddin Sh. Khamraev, Tashkent. Note that ecological information is provided for some taxa (e.g. for nematodes, for the suborder Aphididae, and for the family Tenebrionidae).

Roundworms

The list of nematode species recorded on rice and in soil around the roots:

1. Anaplectus granulosus Bastian 1865.
2. Plectus cirratus Bastian 1865.
3. Plectus geophilus de Man 1880.
4. Plectus parietinus Bastian 1865.
5. Proteroplectus assimilis (Bütschli1873) Paramonov 1964.
6. Proteroplectus acuminatus (Bastian 1865) Paramonov 1964
7. Proteroplectus cornus (Maggenti 1961) Paramonov 1964
8. Proteroplectus inquirendus (Andrassy 1958) Paramonov 1964.
9. Proteroplectus longicaudatus (Bütschli 1873) Paramonov 1964.
10. Proteroplectus parvus (Bastian 1865) Paramonov 1964.
11. Proteroplectus rhizophilus (de Man 1880) Paramonov 1964).
12. Proteroplectus tenius (Bastian 1865 Paramonov 1964.
13. Proteroplectus varians (Maggenti 1961) Paramonov 1964.
14. Chronogaster longicollis (Daday 1899) Andrassy 1968.
15. Chronogaster typicus (de Man 1921) de Coninck 1935.
16. Bastiania longicaudata de Man 1880.
17. Rhabdolaimus terrestris de Man 1880.
18. Monhystera dispar Bastian 1865.
19. Monhystera filiformis Bastian 1865.
20. Monhystera macrura de Man 1880.
21. Monhystera microphthalma de Man 1880.
22. Monhystera paludicola de Man 1881.
23. Monhystera similis Bütschli 1873.
24. Monhystera vulgaris de Man 1880.
25. Cylindrolaimus communis de Man 1880.
26. Prodesmadora circulata (micol 1913) Micoletzky 1925.
27. Tobrilus gracilis (Bastian 1865) Andrassy 1959.
28. Tobrilus pellucidus (Bastian 1865) Andrassy 1959.
29. Prismatolaimus intermedius (Bütschli 1873) de Man 1880.
30. Mononchus truncatus Bastian 1865.
31. Dorylaimus stagnalis Dujardin 1845.
32. Paradorylaimus filiformis (Bastian 1865) Andrassy 1969.
33. Laimydorus agilis (de Man 1880) Siddigi 1969.
34. Laimydorus dadayi (Thorne et Swanger 1936) Andrassy 1969.
35. Laimydorus pseudostagnalis (Micoletzky 1927) Siddigi 1969.
36. Mesodorylaimus bastiani (Bütschli 1873) Andrassy 1959.
37. Thornia steatopyga (Thorne et Swanger 1936) Meyl 1954.
38. Eudorylaimus ettersbergensis (de Man 1885) Andrassy 1959.

39. Nygolaimus intermedius (de Man 1880) Andrassy 1959.
40. Eudorylaimus labiatus (de Man 1880) Andrassy 1959.
41. Eudorylaimus monohystera (de Man 1880) Andrassy 1959.
42. Eudorylaimus muchabbatae (Tulaganov 1949) Andrassy 1959.
43. Eudorylaimus microdorus (de Man 1880) Andrassy 1959.
44. Eudorylaimus sulphasae (Tulaganov 1949) Andrassy 1959.
45. Eudorylaimus tritici (Bastian 1865) Andrassy 1959.
46. Aporcelaimellus obtusicaudatus (Bastian 1965) Altherr 1968.
47. Enchodelus macrodorus (de Man 1880) Thorne 1939.
48. Dorylaimoides elegans (de Man 1880) Thorne et Swanger 1936.
49. Dorylaimoides limnophilus (de Man 1880) Andrassy 1959.
50. Alaimus primitivus de Man 1880.
51. Rhabditis (Ch.) filiformis Bütschli 1873 (Osche 1952).
52. Rhabditis pellio (A.Schneider 1866) Bütschli 1873.
53. Mesorhabditis monohystera (Bütschli 1873) Dougherty 1955.
54. Panagrolaimus hygpophilus Bassen 1940.
55. Panagrolaimus longicaudatus Sumenkova 1965.
56. Panagrolaimus rigidus (A.Schneider 1966) Thorne 1937.
57. Panagrolaimus spondyli Körner 1954.
58. Panagrolaimus subelongatus (Cobb 1914) Thorne 1937.
59. Panagrolaimus peruensis (Steiner et Christie 1939) J.B.Goodey 1963
60. Panagrolaimus armatus (Thorne 1937) Rühm 1956.
61. Panagrolaimus multidentatus (Ivanova 1958) Goodey 1963.
62. Panagrolaimus sp.
63. Macrolaimus hamatus Thorne 1937.
64. Panagrobelus topayi Andrassy 1960
65. Cephalobus persegnis Bastian 1865
66. Cephalobus thermophilus Meyl 1953.
67. Eucephalobus oxyuroides (de Man 1876) Steiner 1936.
68. Eucephalobus stritus (Bastian 1865) Thorne 1937.
69. Heterocephalobus basilogoodeyi Brzeski 1961.
70. Heterocephalobus elongates (de Man 1880) Andrassy 1967.
71. Heterocephaobus filiformis (de Man 1880) Andrassy 1967.
72. Heterocephaobus laevis (Thorne 1937) Andrassy 1967.
73. Acrobeloides buetschlii (de Man 1884) Steiner et Buhrer 1933).
74. Acrobeloides nanus (de Man 1880) Anderson 1968.
75. Chiloplacus lentus (Maupas 1900) Thorne 1937.
76. Chiloplacus symmetricus (Thorne 1925) Thorne 1937.
77. Aphelenchus avenae Bastian 1865.
78. Paraphelenchus my celiophthorus J.B.Goodey 1958.
79. Aphelenchoides besseyi Christie 1942.
80. Aphelenchoides coffeae (Zimmermann 1898) Steiner 1937.
81. Aphelenchoides cyrtus Paesler 1957.
82. Aphelenchoides dactylocercus Hooper 1958.
83. Aphelenchoides helophilus (de Man 1880) T.Goodey 1933.
84. Aphelenchoides kuehnii Fischer 1894.
85. Aphelenchoides parietinus (Bastian 1865) Steiner 1932.
86. Aphelenchoides saprophilus Franklin 1957.
87. Aphelenchoides subparietinus Sanwal 1961.
88. Aphelenchoides subtenuis (cjbb 1926) Steiner et Buhrer 1932.
89. Paraphelenchoides limberi (Steiner 1936) Haque 1967.

90. Megadorus megadorus (Allen 1941) J.B.Goodey 1960.
91. Ektaphelenchus tenuidens (Thorne 1935) Thorne in Rühm 1956.
92. Bursaphelenchus talonus (Thorne 1935) J.B.Goodey 1960.
93. Tylenchus davainei Bastian 1865.
94. Ditylenchus dipsaci (Kühn 1857) Filipjev 1936.
95. Ditylenchus interinedius (de Man 1880) Filipjev 1936.

Phylum *Arthropoda*

Class *Arachnoidea*
Order *Scorpionida* – scorpions

96. Buthus eupeus C.Koch.
97.Orthochirus scrobiculosus Cr.
98.Lityphants paykullianus Walk.

Order *Araneina* – spiders
99. Eresus sandallatus Mart. Et Goese
100. Eresus niger Walcken.
101. Stegodyphus lineatus Latz.
102. Latrodectus mactans tredecimduttatus Rossi.

Araneidae – Orb web spiders
103. Lariniades tolium Schrank.
104. L. patagiatus Clerk.
105. Agalenatea redii (Scop.)
106. Araneus tartaricus Kron
107. A. grossus Kock

Soil mites:

Oribatei mites
Family *Brachychthoniidae Balogh 1943*
108. Syncthonius elegans Forsslund 1957
109. Liochthonius sellnicki (S.Thor 1930)

Family *Epilohmanniidae Oudemans 1923*)
110. *Epilohmanniia cylindrical (Berlese 1904)*

Family *Nothridae Berlese 1896*
111. *Nothrus silvestris Nicolet 1855*

Family*Nathermannidae Sellnick 1928*
112. *Nanhermannia nana (Nicolet 1955)*

Family *Damaeidae Berlese 1896*
113. *Epidamaeus sp.*

Family *Belbidae Willmann 1931*
114. Belba sp.
115. Metbelba sp.

Family *Damaeolidae Grandjean 1965*
116. Damaeolus ornatissimus Csiszar 1962

Family *Microzetidae Grandjean 1936*
117. Microzetes arenarius D.Krivolutsky 1966

Family *Carabodidae C.L.Koch 1837*
118. Carabodes sp.

Family *Tectocepheidae Grandjean 1953*
119. Tectocepheus velatus Michael 1880
120. T.alatus Berlese 1913
Family *Suctobelbidae Grandjean* 1954
121. Suctobelbella hammeri (D.Krivolutsky 1965)
122. S.acutidens (Forsslund 1941)
123. S.dargoltsiana (D.Krivolutsky 1966)
124. S.subtrigona (Oudemans 1916)
125. Suctobelbella sp.
126. Suctobelba trigona (Michael 1888)
127. Suctobelba sp.

Family *Oppiidae Grandjean 1954*
128. Quadroppia quadricarinata (Michael 1885)
129. Oppiella nova (oudemans 1902)
130. Oppia bicarinata Paoli 1908
131. O.concolor C.L.Koch 1844
132. O.minutissima Sellnick 1950
133. O.krivolutskyi Kulijev 1966
134. O.unicarinata Paoli 1908
135. O.clavipectinata Michael 1885
136. O.cylindrical Pèrez –Iñigo 1964
137. Oppia nukusia Shtanchaeva 1984 sp.nov.[x])
138. O.sadbinia Shtanchaeva 1984 sp.nov.[x])

Family *Hydrozetidae Grandjean 1954*
139. Hydrozetes amudariensis Koshchanova 1984 sp.nov.[x])

Family Passalozetidae Grandjean 1954
140. *Passalozetes africanus Grandjean 1932*

Family *Oribatullidae Thor 1929*
141. *Oribatula tibialis Nicolet 1855*
142. *Zygoribatula frisiae (Oudemans 1900)*

Family *Scheloribatidae Grandjean 1953*
143. *Scheloribate3 fimbriatus S.Tour 1930*
Family *Haplozetidae Grandjean 1936*
144. *Protoribatea capucinus Berlese 1908*

Family *Ceratozetidae Jacot 1925*
145. *Caratozotes sp.*
146. *Diapterobates oblongus (C.L.Koch 1879)*

Family *Mycohatidae Grandjean 1953*
147. *Minunthozetes pseudofusiger (Schweizer 1922)*
148. *Puncteribates punctux (C.L.Koch 1839)*

Family *Chamobatidae Thor 1938*
149. *Chamobates sp.*

Family *Oribatellidae Jacot 1925*
150. *Tectoribates ornatus (Schuster 1953*)
Family *Galumnidae Grandjean 1936*
151. *Galumna sp.*

Family *Phthiracaridae Perty* 1841
152. *Hoplophthiracarus pavidus (Berlese 1913)*

Family *Euphthiracaridae Jacot 1930*
153. *Rhysotritia ardua (C.L.Koch 1841*)

Mesostigmatic mites
Family *Parasitidae Oudemans 1901*
154. *Parasitus kraepelini Berlese 1904*
155. *P.hyalinus (Willmann 1949*)

Family *Veigaiaidae Oudemans* 1939
156. *Veigaia nemorensis (C.L.Koch 1839)*

Family *Ameroseiidae (Berlese 1919) Evans 1961*
157. Ameroseius lidiae Bregetova 1977
158. A.eumorphus Bregetova 1977
159. A.furcatus Karg 1971 (aberr.)
160. A.gilarovi Petrova et Koshchanova sp.nov.[x])

Family *Aceosejidae Baker et Wharton 1952 (sensu Evans 1958)*
161. Neojordensia levis Oudemans et Voigts 1904)
162. N.sinuate Athias-Henriot 1973
163. N.meritricha Athias-Henriot 1973
164. Lasioseius confuses Evans 1958
165. L.yousefi Athias-Henriot 1959
166. L.oryzaephilus Petrova et Koshchanova 1984 sp.nov.[x])
167. Platyseius subglaber (Oudemans 1902)
168. Leioseius bicolor (Bergese 1918)
169. Cheiroseius serratus Halbert 1915
170. Ch.nepalensis Evans et Hyatt 1960
171. Ch.necorniger (Oudemans 1903)
172. Proctolaelaps pygmaeus (Műller 1860)
173. P.ventrianalis Karg 1971
174. Arctoseius semiscissus (Berlese 1892)
175. A.cetratus (Sellnick 1940)
176. A.brevicheles Karg 1969

Family *Phytoseiidae Berlese 1916*
177. Amblyseius bicaubus Wainstein 1962
178. A.zwoelferi (Dosse 1957)
179. Amblyseius sp.

Family *Rhodacaridae Oudemans 1902*
180. Rhodacarellus silesiacus Willmann 1936
181. Rhodacarellus sp.
182.Dendrolaelaps zwoelferi Hirschmann 1960
183. D.lobatus Shcherbak et Chelebiev 1977
184. D.fallax Leitner 1949
185. Dendrolaelaps sp.

Family *Macrochelidae Vetzthum 1930*
186. Macrocheles scutatus (Berlese 1904)

Family *Laelaptidae Berlese 1892*
187. Hypoaspis aculeifer (Canestrini 1983)
188. H.angustis Karg 1965
189. H.praesternalis Willmann 1949 (aberr.)
190. Cosmolaelaps sp.
200. H. (Euandrolaelaps) karawaiewi (Berlese 1903)

Family *Zerconidae gen.sp.*

Family *Uropodidae Berlese 1892*
201. Trichouropoda spatulifera (Moniez 1892)
202. Trichouropoda sp.

Acaroidea mites
203. Acarus tyrophagoides Zach
204. A. mirabilis vol

205. A. farrus O.
206. Tyrophagus perniciosus Zach
207. Tyrophagus putrescentiae Schr
208. Rhyzoglyphus echinopus Fum.et Rob

Family *Scutacaridae*
209. Scutacarus longitarus Berl
210. Bakerdania centriger C.
211. Bakerdania sp.

Family *Tarsonemidae*
212. Tarsenemus sp.
Class *Myriapoda*
Order *Chilopoda*

Family *Lithobiidae*
213. Lithobius vinciguerrae Silv
214. L. cutipes Attems

Family *Geophilidae*
215.Geophilus signatus Kessl.
216. G. angustiventris Kessl.
217. Mesocanthus porosus sel
218. Bothriogaster sp.

Family *Scolopendridae*
219. Scolopendra aralocaspia Kessl.

Class Entognata
Order *Collembola*
220. Ceratophisella succinea Cusin
221. Folsomia inoculata Stach
222. Folsomia quadrioculata Tulberg
223. Isotomurus palustris Muller
224. Lepidocirtus sp.
225. Pseudosinella alba Paccard
226. Sminthurides aquaticus Bourlet
Order *Protura*
227. Eosertomon transitorum Berl

Order *Diplura*
228. Campodea staphilinus Wectv.
229. Japyx dux Scor

Class *Insecta*
Subclass *Apterygota*
Order *Thysanura*
230. Ctenolepisma transcapica Esch.
231. Lepisma sacarina L.
232. Thermobia domestica Pack

Subclass Pterygota
Infraclass Paleoptera
Order Ephemeroptera

233. Baetis Fuscatus
234. Baetis buceratus
235. Baetis (nigrobaetis) muticus
236. Baetis stipposus
237. Baetis fissus
238. Caenis macrura
239. Clon dipterum L.
240. Ecdyonurus fluminum Eth.
241. Epeorus torrentium Eth.
242. Ephemerella ignita
243. Habrophlebia fusca Eth
244. Heptagenia coerulans Wolgh.
245. Heptagenia perflava
246. Neoephemera tshernovae
247. Oligoneuriella renana Imh
248. Ordella halterata Camp.
249. Ordella macrura

ORTHOPTEROIDEA
Order *Blattoptera*
Family *Polyphagidae*
250. Polyphaga pellucida Reitt.
251. P. sausseri Pall.
252. Arenivaga roseni Brancs.

Order *Isoptera* – termites
253. Anacanthotermes turkestanicus Jacobs.
254. A. ahngerianus Jacobs.

Order *Embioptera*

Family *Embidae*
255. Embia tartara Kuz.

Order *Phasmoptera*

Family *Clitumnidae*
256. Ramulus bituberculatus Redt.

Order *Orthoptera*
Family *Tettigonidae*
257. Tettigonia caudata Charp.
258. T. viridissima L.
259. Semenoviana plotnicovi W.
260. Platycleis escalerai Bol.
261. Pl. intermedia Serv.

262. Pl. fatima W.
263. Pl. vittata Ch.
264. Decticus albifrons F.
265. Conocephalus discolor Th.

Family *Gryllidae*
266. Melanogrillus desertus Pall.
267Gryllus bimaculatus De Geer
268. G. frontalis Fieb.
269. G. burdigalensis Latr.
270. G. bolivari W.
271. G. bucharicus B. Bienko.
272. Tartarogryllus tartarus Sauss.
273. Bothrophylax semenovi Mir.

Family *Gryllotalpidae*
274. Gryllotalpa gryllotalpa L.
275. Gryllotalpa unispina Sauss.

Family *Tetrigidae*
276. Tetrix tartara Bol.
277. T. subulata L.

Family *Acrididae*
278. Anacridium aegyptium L.
279. Calliptamus italicus L.
280. C. tartarus Costa
281. C. barbatus cephalotes F.-W.
282. C. turanicus Tarb.
283. Atrichotmethis semenovi Zub.
284. Pezotmethis tartarus Sauss.
285. Ramburiella turcomana F.-W.
286. Dociostaurus maroccanus Thumb.
287. D. tartarus Uv.
288. D. kraussi nigrogeniculatus Tarb.
289. Chorthippus apricarius L.
290. Ch. biguttulus L.
291. Ch. dorsatus Zett.
292. Ch. angulatus Tarb.
293. Oedipoda miniata atripes B.-Bien.
294. O. coerulescens L.
295. Sphingoderus carinatus Sauss.
296. Aiolopus thalassinus F.
297. S. savignyi Sauss.
298. S. carinatus Sauss.
299. S. elegans Mistsh.
300. S. maculatus maculatus Uv.
301. S. miramae Mistsh.
302. Trinchus turcmenus B. Bienko.
303. T. desertus B. Bienko.
304. T. campanulatus F. W.
305.Strumiger desertoruum calcaratum B. Bienko.
306. Dericorys albidula Serv.
307. D. annulata roseipennis Redt.
308. Pyrgomorpha conica deserti B. Bienko.
310. Egnatoides desertus desertus Uv.
311. Egnatius apicalis Stal.
312. Acrida oxycephala Pall.
313. Truxalis nasuta L.
314. Ochrilidia hebetata hebetata Uv.
315. Duroniella kalmyka Ad.
316. D. gracilis Uv.
317. Eremippus miramae Tarb.
318. E. simplex Ev.
319. Locusta migratoria migratoria L.
320. Oedaleus senegalensis Krauss.
321.Acrotylus insubricus inficitus Walk.
322. Helioscirtus moseri moseri Sauss.
323. Hyalorrhipis clausi Kitt.
324. Leptopternis gracilis Uv.
325. Oxya fuscovitatta Marasch

Order *Dermaptera*

Family *Forficulidae*
326. Anechura asiatica Sem.
327. Forficula tomis Kol.

Family *Labiduridae*
328. Labidura riparia Pall.

HEMIPTEROIDEA

Order *Homoptera* -
Suborder *Cicadinea*

Family *Dictyopharidae*
329. Aphilonema sp.

Family *Derbidae*
330. Malenia mesasiatica Dub.

Family *Cixiidae*
331. Pentastridius leporinus L.
332. P. pallens Germ.
333. P. formicarius (Mit)
334. Hyalestes obsoletus Sign.

Family *Delphacidae*
335. Kelesia unicolor H.S.

336. Calligypona striatella Fall.
337. Chloriona unicolor H.S.
338. Chloriona sp.

Family *Issidae*
339. Hysteropterum asiaticum Leth.
340. H. bicorne Kuzn.

Family *Tettigometridae*
341. Tettigometra costulata Fieb.
342. T. obliqua eremi Lindb.
343. T. varia Fieb.

Family *Flatidae*
344. Phantia chrystophi Rus.

Family *Cicadidae*
345. Auchenorrhincha sp.
346. Cicadatra querula Pall.
347. C. ochreata Pall.
348. C. alhageos Kol.
349. Melampsalta sinnatipennis Osh.
346. M. inserta Horv.
347. Cicadetta albeola Ev.
348. C. musiva Germ.

Family *Aphrophoridae*
349. Poophilus nebulosus Leth.
350. P. nebulosus turanicus Osh.
351. Philaenus spumarius L.

Family *Cicadellidae*
352. Macropsis cyanescens Dub.
353. Macropsis sp.
354. Agallia acuteangulata Zachv.
355. Melicharella sp.
356. Adelungia calligoni Osh.
357. Platyproctus sp.
358. Batracomorphus irroratus Lew.
359. Eupelix cuspidata F.
360. Paradorydium aristidae Zachv.
361. Kycbasca bipunctata Osh.
362. Empoasca meridiana Zachv.
363. E. flavescens F.
364. Chlorita sp.
365. Tamaricella ribauti Zachv.
366. Zygina asiatica Kuzn.
367.Goniognathus sanguinisparsus Hpt.
368. Goniognathus sp
369. Opsius discessus Horv.
370. O. tigripes Leth.
371. O. pallasi Leth.
372. O. versicolor Dist.
373. Pseudophlepsius binotatus Sign.
374. Eremophlepsius sexnotatus Kuzn.
375. Neosliturus tenellus Bak.
376. N. haematoceps MR
377. N. fenestratus H.S.
378. Recilia schmidtgeni Wgn
379. Balclutha mitjaevi Dlab.
380. B. rosea Scott.
381. Toya minutissima Dub.
382. Macrosteles quadripunctulatus Kbm
383. Aconura sp.
384. Platymetopius albus Lindb.
385. P. chloroticus Put.
386. P. pardalis Emel.
387. Platymetopius sp.
388. Symphypyga albignotata V. Kuzn.
389. Stenometophiellus sigillatus HPt.
390. Paralimnus angusticeps Zachv.
391. Psammotettix striatus L.
392. P. binotatus Dlab.
393. P. comitans Emel.
394. P. alienus Dlab.
395. P. narzikulovi Dlab.
396. P. provincialis Rib.
397. Limotettix striola Fall.
398. Laburrus handlirschi Motsch.
399. Laburrus sp.
400. Achrus nigronervosus Lindb.
401. A. robustus Hpt.
402. A. albicosta Kuzn.
403. Eucelis lineolatus Brulle.
404. Pseudolestes sp.
405. Austragalia sinuata zachwatkini Wielb.
406. Exitianus faciculatus Meb.
407. Exitianiis sp.
408. Paramacroceps leopordinus H Pt.
409. Paramesus reticulatus Horv.
410. Paramesus sp.
411. Hecalus glaucescens Fieb.
412. Cyanidius cyanescens Emel.
413. Diarca sp.
414. Candylotes sp.
415. Oliazellus fulvus Kuzn.
416. Handianus ephedrae Emel.
417. Brachyprasopa umnovi Kuzn.
418. Laodelphax striatella Fall.

Suborder *Aphididae* – root aphids
419. Smynthurodes betae Wests – on cotton
420. Forda trivialis Pass – on cereals
421. Forda hirsute Mordv – on roots of cereals
422. Byrsocrypta Ulmi L. – on roots of cereals
423. B. hirsuta Baker Baker – on roots of cereals and rice
424. Geoica lucituga Lehn – on roots of grapes
425. Gobaishia pallida Lehn – on roots of cereals
426. Anaecia corni F. – on roots of cereals
427. Brachycaudus helichrysi Colt. - on roots
428. B. cardui L. – on roots of Compositae
429. Mozdvilkomemor pilosus Mord – on roots
430. Eriosomo lanigerum Hausm
431. Kaltenbachiella palli da Halid
432. Tetraneura ulmi L.
433. T. africana Goot
434. T. coerulescens Pass
435. T. hirsute Baker
436. Forda hirsute hirsute Mordv
437. F. hirsute mordvilkoi Pass
438. Rhopalosiphum insertum Walk
439. Rh. rutiabdominalis Sasaki
440. Brachyunguis anuraphoides Nevs
441. Brachyunguis elongata Nevs
442. Brachyunguis elatior Nevs
443. Dysaphis cratacgi
444. Dysaphis tmicis Min.
445. Dysaphis mirosiphon Nevs

Pseudococcidae
446. Rhizococcus zygophylli Arch.
447. Peliococcus turanicus Kir
448. Phenacoccus pumilus Kir
449. Paratrionymur halocharis Kir
Order *Hemiptera*
Family *Corixidae*
450. Sigara concinna Fieb.
451. S. limitata
452. Tarajala brevicornis Reut.

Family *Nabidae*
453. Nabis ferus L.
454. N. palifer Seid.
455. N. viridis Brulle.
456. N. rugosus L.
457. Halonabis sareptanus Dohrn.

Family *Gerridae*
458. Gerris costai H-S.

Family *Anthocoridae*
459. Anthocoris pilosus Jak.
460. Orius niger Wolff.
461. O. ribauti Wagn.
Family *Miridae*
462. Orthops kalmi L.
463. Lygus pratensis L.
464. L. gemellatus L.
465. L. pachycnemis Reut.
466. Adelphocoris lineolatus Coeze
467. Deraeocoris punctulatus Fall.
468. Campylomma diversicornis Rtt.
469. Atomophora alba Reut.
470. Tuponia elegans Jak.
471. T. pallida Jak.
472. T. roseipennis Reut.
473. Atomoscelis sp.
474. Stenodema turanicum Rtt.
475. S. laevigatum L.
476. S. tripsinosum Reut.
477. Exaeretus meyeri Frey.
478. Solenoxyphus sp.
479. Brachycoleus scriptus F.
480. Poeciloscytus vulneratus Panz.
481. Plagiognatus alpinus Rtt.
482. Agnocoris rubicundus Faii
483. Lygus rugulipennis Popp.
484.Notostira elongata Geoffr.
485. Orthops basalis Costa
486. Orthotylus eleagni Jak
487. O. flavosparsis C.Sahle
488. Exaeretus meyeri Frey
489. Poeciloscytus (Polymerus) cognatus Fieb.
490. P (Polymerus) vulneratus Panz
491. Stenodema calcaratum Fall.
492. Trigonotylus ruficornis Goffr.
493. Megacoclum brevirostre Reut.

Family *Tingidae*
494. Tingis leptochyla Horv.
495. Monosteria discoidalis Jak.
Family *Reduviidae*
496. Reduvius testaceus H.S.

497. R. disciger Horv.
498. R. christophi Jak.
499. R. fedtschenkianus Osh.
500. R. semenovi Jak.
501. R. elegans Jak.
502. Rhinocoris monticola Osh.
503. Rh. niger H.S.
504. Oncocephalus brachymerus Reut.
505. Vachiria deserta Beck.
506. Ectomocoris ululans Rossi.
507. Holotrichius sp.
508. Stenolemus bogdanovi Osh.

Family *Lygaeidae*
509. Lygaeus equestris L.
510. L. rubriceps Horv.
511. Nysius graminicola Kol.
512. Emblethis griseus Wolff.
513. E. verbasci F.
514. E. ciliatus Horv.
515. E. denticollis Horv.
516. Emblethis sp.
517. Engistus salinus Jak.
518. E. exanguis Stal.
519. Artheneis alutacea Fieb.
520. Geocoris fedtschenkoi Reut.
521. Henestaris halophilus Burm.
522. Hyalocoris pilicornis Zak.
523. Oxycarenus pallens H.S.
524. Lamprodema maurum F.
525. Piocoris scutellatus Mont.
526. Ortholomus punctipennis H-S.

Family *Pyrrhocoridae*
527. Scantius struarium L.
528. S. aegyptius L.
529. Pyrrocoris apterus L.

Family *Coreidae*
530. Coranus aegyptius F .
531. Coreus marginatus L.
532. Centrocoris volxemi Put.
533. Coriomeris vitticollis Reut.
534. Dicranomerus marginatus Ferr.
535. D. ferghanensis Horv.
536. Camptopus lateralis Germ.
537. Enoplops eversmanni Jak.

Family *Corizidae (Rhopalidae)*
538. Corizus limbatus Reut.
539. C. hyoscyami L
540. Liorhyssus hyalinus F.
541. Rhopalus parumpunctatus Schill.
542. Rh. distinctus Sign.
543. Stictopleurus unicolor Jak.
544. Maccevethus persicus Jak.
546. Brachycarenus tigrinus Schill.
547. Chorosoma schillingi Schill.

Family *Cydnidae*
548. Aethus pilosulus Klug.
549. A. nigronervosus F.
550. Byrsinus fossor M. R.
551. Sechirus morio L.
552. Amaurocoris candidus Horv.
553. Microporus virgata F.
Family *Pentatomidae*
554. Carpocoris pudicus Poda
556. C. fuscispinus Boh.
557. Dolycoris penicillatus Horv.
558. Codophila varia F.
559. Aelia furcula Fieb.
560. Tarisa elevata Reut.
561. T. fraudatrix Horv.
562. T. virescens H. S.
563. T. pallescens Jak.
564. Brachynema germari Kal.
565. Graphosoma lineatum L.
566. Holcostethus nitidus Jak.
567. Odontotarsus impictus Jac.
568. O. angustatus Jak.
569. Desertomenida quadrimaculata Horv.
570. D. albula Kir.
571. Cellobius abdominatis Jak.
572. Menaccarus transparens Jak.
573. Eurygaster integriceps Put.
574. Graphosoma consimile Horv.
576. G. italicum Muell.
577. Apodiphus integriceps Horv.
578. Euridema ornata L.
Order *Thysanoptera* – Thrips
579. Thrips tabaci Lind
580. Scolothrips acoriphagus Jakh.
581. Haplothrips arthrophyti Jakh.
582. Haplothrips tritici Kurd.
583. Haplothrips aculaetus Fabr.

COLEOPTEROIDEA

Order *Coleoptera*

Family *Cicindelidae*
584. Cicindela turkestanica Ball.
585.C. decempustulata Men.
586. C. littoralis F.
587. C. obliquefasciata Ad.
588. C. sublacerata Sols.
589. C. lunulata Ol.

Family *Carabidae*
Subfamily *Carabinae*
590. Calosoma sycophanta L.
591. C. deserticola Sem.
592. Callisthenes glasunovi Sem.
593. C. algiricum Geh.
594. C. auropunctatum dzungaricum Gebl.
595. C. denticolle Gebl.
596. Carabus sogdianus Sem.
597. Anthia mannerheimi Chaud.
Subfamily *Nebrinae*
598. Nebria limbigera Sols.
599. N. psammophila Sols.
600. Scarites angustus Chd.
601. S. bucida Pall.
602. S. terricola Bon.
603. Sc. eurytus Fisch.
604. Clivina ypsilon Dej.
605. Clivinia sp.
606. Dyschirius chalceus Er.
607. D. syriacus Putz.
608. D. pusillus Dej.
609. D. luticola Chd.
610. D. rufimanus Fleisch.
611. D. cylindricus transilvanicus Fleisch.
612. Machozetus concinnus Dohrn.
613. M. lehmanni Men.
Subfamily *Trechinae*
614. Perileptus areolatus Creutz.

Subfamily *Bembidiinae*
615. Tachyta decolorata Chd.
616. Tachys angustulus Rtt.
617. T. vittatus Mots.
618. T. scutellaris Steph.
619. T. centriustatus Rtt.
620. T. cf. turcestanicus Cs.
621. Broscus punctatus Dej.
622. Bembidion tenellum pseudoplaga Net.
623. B. latiplaga CHD.
624. B. quadriplagiatum Mots.
625. B. varium Ol.
626. B. niloticum hamatum Kol.
627. B. scythicum Dan.
628. B. saxatile flavipalpe Net.
629. B. atlanticum megashilum Walk.
630. B. silemi Net.
631. B. aspericolle Germ.
632. B. quadripustulatum Serv.
633. B. minimum F.
634. B. buchariplaga Net.
635. B. eurdicorne Sols.
636. Asaphydion abnormicolle Heyd.
Subfamily *Pogoninae*
637. Pogonus gilvipes Dft.
638. P. orientalis Dej.
Subfamily *Harpalinae*
639. Acinopus laevigatus Men.
640. Pseudoophonus calceatus Dft.
641. Paraphonus hirsutulus Dej.
642. Ophonus chlorizaus Sols.
643. O. pubescens Muell.
644. O. griseus Pang.
645. Harpalus distinguendus Dej.
646. H. pseudoserripes Rtt.
647. H. rubripes Dft.
648. H. sublaevigatus Tschit.
649. H. tenebrosus transcaspicus Tschit.
650. H. smaragdinus Duft.
651. Stenolophus persicus Mannh.
652. Acupalpus elegans Dej.
653. A. flaviceps Mots.
654. A. maculatus Schaum
655. Trichocellus obscuricollis Rh.
656. Dicheirotrichus sp.
Subfamily *Pterostichinae*
657. Poecilus cupreus L.
658. P. longiventris Sols.
659. Calathus ambiguus Sahlb.
660. C. melanocephalus L.
661. Pseudotaphoxenus jevencus Pall.
662. Taphoxenus goliath Fald.
663. T. gracilis Zubk.
664. Pterostichus liosomus Men.
665. Agonum menetriesi Fald.
666. Europhilus micans Nic.
667. Platynus dorsalis Pontop.
Subfamily *Zabrinae*
668. Zabrus morio Men.

669. Amara aenea Deg.
670. A. saxicola Zimm.
671. A. ingenua Duft.
672. A. turkestana Kryzh.
673. A. fedtschenkoi Tschit.
Subfamily *Chlaeniinae*
674. Chlaenius extensus Mnnh.
675. Ch. spoliatus Rossi
676. Ch. tenuilimbatus Ball.
678. Ch. festivus Pz.
Subfamily *Oodinae*
679. Oodes helopioides F.
Subfamily *Cymindinae*
680. Cymindis andreae Men.
681. C. quadrisignata Men.
682. C.rufescens Gebl.
683. C. solskii B. Jak.
684. Daes ales Sem.& Zn.
Subfamily *.Lebiinae*
685. Lebia cyanocephala Hoffm.
686. L. trimaculata Vill.
687. L. cruxminor L.
688. L. menetriesi Ball.
Subfamily *Brachiinae*
689. Brachinus adelus Khnz.
690. B. explodens Dft.
691. B. bipustulatus Quens.
692. Mastax thermarum Stev.
693. Carenochirus titanus Sols.
694. Daptus pictus F. W.
695. Metabletus fuscomaculatus Motsch.
696. Zuphium olens Rossi
697. Apristus cf. schmidti Kirsch.
698. Syntomus fuscomaculatus Mots.
699. Microlestes corticalis Duf.
700. M. politulus Rtt.
701. Mesolestes cf. paracentheris Mots.
702. Egadroma marginata Dej.

Family *Histeridae*
703. Saprinus subvirescens Men.
704. S. turkestanicus Schm.
705. S. interruptus Payk.
706. S. maculatus Rossi.
707. S. niger Motsch.
708. Hister quadrinotatus Scr.
709. Hister uncinatus Jll.

Family *Silphidae*
710. Necrophorus satanas Rtt.
711. N. humator Goese
712. Thanatophilus ferrugatus Sols.
713. Silpha obscura L.

Family *Staphylinidae*
714. Achenium quadricers
715. Acrotona fungli
716. Aleochara diversa L. Sached
717. Aleochara clavicjrnis Redt.
718. Amischa sp.
719. Atheta longula
720. Bledius glasunow
721. Bledius transcaspius
722. Brachyusa concolr
713. Carpelimus sp.
714. Carpelimus bilineatus
715. Carpelimus corticinus
716. Carpelimus gracilis
717. Corpopylus pennifer Motsh.
718. Corpopylus schuberthi
719. Cryptobium collare
720. Creophitus maxillosus L.
721. Conosoma flavus Iskak
722. Conosoma lineata
723. Cratarea solskyi Epp.
724. Falagria collaris
725. Falagria suleatula
726. Falagria medvedevi Kasch.
727. Heterothops melanocerus
728. Heterothops willbergi
729. Heterothops laeticolor
730. Haploglossa sp.
731. Leptobium gracilis
732. Medon nidicola Kasch.
733. Medon fusculus Munh.
734. Mylaena intermedia
735. Microglotta nidicola Fairm.
736. Phyllodrepa caucasica
737. Phyllodrepa turanica
738. Phylontus quisquilarius Cyll.
739. Phylontus variabilis
740. Phylontus formosus
741. Phylontus dimidiatipennis
742. Phylontus aeneus Rossi.
743. Phylontus splendens F.
744. Phylontus scibae Fauv.
745. Platystetus nitens
746. Platystetus cornutus
747. Platystetus arenarius Geoffr.
748. Platyprosopus eloogatus
749. Paederus tuscipes Curt.

750. Oxypoda togata Er.
751. Oxypoda spaethi Bernh.
752. Oxypoda sp.
753. Oxypoda opaca
754. Oxetelus rugosus F.
755. Oxytelus bcrnchaeri Cangll.
756. Oxytelus nitidulus Crav.
757. Scopaeus sp.
758. Scopaeus laevigatus
759. Scopaeus armeniacus
760. Throbalium dividuum
761. Tachyporus sp.
762. Trogophloeus fulginosus
763. Trogophloeus sp.
764. Xylodromus zassuhini Kirh.

Family *Malachiidae*
765. Eulobonix turkestanicus Krtz.
766. Chaetomalachius sp.

Family *Cleridae*
767. Trichodes axillaris F-W.
768. T. apriarius L.
769. T. spectabilis Kr.
770. T. quadriguttatus Ad.
771. Clerus mutillarius F.

Family *Scarabaeidae*
Tribe *Laparosticti*
772. Glaresis beckeri Sols.
773. Pleurophorus apicipennis Rtt.
774. Lethrus pygmaeus Ball.
775. L. rosmarus Ball.
776. Lethrus sp.
777. Scarabaeus sacer acuticollis Motsch.
778. Gymnopleurus aciculatus Gebl.
779. G. mopsus Pall.
780. Synapsis tmolus F.-W.
781. Copris hispanus F.
782. C. lunaris L.
783. Chironitis hungaricus phoebus Rtt.
784. Ch. moeris Pall.
785. Onthophagus amyntas Ol.
786. O. atramentarius Men.
787. O. haroldi Ball.
788. O. gibbosus Scr.
789. O. semicornis Oz.
790. Aphodius fimetarius L.
791. A. brunneus Klug.
792. A. flavimargo Rtt.
793. A. immundus Gr.
794. A. kisilkumense Sols.
795. A. klugi A. Schr.
796. A. kraatzi Har.
797. A. lividus Ol.
798. A. multiplex Rtt.
799. A. pruinosus Rtt.
800. A. punctipennis Er.
801. Aphodius sp.
802. Pleurophorus apicipennis Rtt.
803. Rhyssemodes orientalis Rtt.
804. Eremazus cribratus Sem.
805. E. unistriatus Muls.
806. Brenskea coronata Rtt.
807. B. varentzovi Sem.
808. Anomala oxiana Sem.
Tribe *Pleurosticti*
809. Amphicoma regeli Ball.
810. A. kuschakewitschi Ball.
811. Chioneosoma gorilla transoxiana Sem.
812. Ch. kisilkumense Sem.
813. Ch. komarovi Tsch.
814. Ch. peetzi Sem.
815. Ch. porosum Fisch.
816.Ch. rostowtzovi Sem.
817. Ch. tschitscherini Sem.
818. Xanthotrogus fortis Rtt.
819. Amphimallon solstitialis L.
820. Madotrogus glabricollis Rtt.
821. Leucoserica arenicola Sols.
822. Polyphylla adspersa Mots.
823. Blitopertha variabilis Ball.
824. Cyriopertha massageta Kirsch.
825. C. glabra Gebl.
826. C. massageta Kirsch.
827. Pharaonus semenovi Rtt.
828. Hemictenius latitarsus Rtt.
829. H. scutellaris Rtt.
830. Anisoplia sp.
831. Adoretus comptus Men.
832. A. nigrifrons Stev.
833. Pentodon bispinifrons Rtt.
834. P. dubius Ball.
835. Podalgus infantulus Sem.
836. Phyllognathus hauseri Rtt.
837. Oryctes punctipennis Motsch.
838. O. turkestanicus Minck.
839. Epicometis turanica Rtt.
840. Oxythyrea cinctella Schaum.
841. Stalagmopygus albella Pall.
842. Potosia agglomerata Sols.
843. P. turkestanica cyanea Kr.

844. P. bogdanovi Sols.
845. P. karelini herminae Rtt.
846. P. marginicollis Ball.
847. Cetonia aurata L.

Family *Dermestidae*
848. Dermestes coronatus Stv.
849. D. bicolor F.
850. Attagenus byturoides Sols.
851. Attagenus byturoldes Sols.
852. Attagenus lobatus
853. Attagenus flavidus
854. Dermestes frischi Kugel.
855. Trogoderma versicolor Creutz.

Family *Elateridae*
856. Agriotes meticulosus Cand.
857. A. caspicus Heyd.
858. Aeoloides bicarinatus Rtt.
859. A. hauseri Rtt.
860. A. grisescens Germ.
861. A. rossi Germ.
862. A. turcomanus Rtt.
863. Drasterius bimaculatus Rossi.
864. Melanotus heydeni Schm.
865. M. acuminatus Rtt.
866. Heteroderes sarmaticus Motsch.
867. Neotrichophorus turanicus Rtt.
868. Pleonomus tereticollis Men.
869. Cardiophorus bucharicus Sem.
870. C. longulus Er.
871. C. nigricollis Er.
872. C. nigropunctatus Cand.
873. C. pellitus Sch.
874. C. varipennis Schw.
875. Ampedius reitteri Sem.

Family *Buprestidae*
876. Eurythyrea oxiana Sem.
877. Acmaeodera sp.
878. Acmaeoderella canescens Sem.
879. A. adamantina Rtt.
880. Anthaxia sp.
881. Sphenoptera orichalcea Pall.
882. S. beckeri Dobrn.
883. S. gracilis B. Jak.
884. S. halybae Men.
885. S. potanini B. Jak.
886. S. punctatissima Rtt.
887. S. rauda B. Jak.
888. S. turkestanica B. Jak.
889. Melanophila picta Ball.
890. Lampetis argentata Mnnh.
891. Lampra sp.
892. Capnodis merearis Ball.
893. C. exisa Men.
894. Cyphosoma turcomanicum Kr.
895. Chrysobothris deserticola Sem. et Richt.
896. Ch. globulicollis Rtt.
897. Ch. jakovlevi Sem.
898. Meliboeus reitteri Sem.
899. Agrilus sp.
900. Cylindromorphus sp.
901. Julodis variolaris Pall.
902. J. euphratica Cast.

Family *Nitidulidae*
903. Nitidula sp.

Family *Meloidae*
904. Meloe brevicollis Panz.
905. M. cicatricosus Leach.
906. Cerocoma schaefferi L.
907. C. schreberi F.
908. Rhampholyssa steveni F.-W.
909. Mylabris quadripunctata L.
910. M. magnoguttata Heyel.
911. M. calida Pall.
912. M. audonini Mass.
913. M. elegantissima Zoubk.
914. M. frolovi Germ.
915. M. koenigi Ol.
916. N. magnoguttata Pall.
917. M. pusilla Ol.
918. M. sedecimpunctata Gebl.
919. M. scabiosae Ol.
920. M. schrenki Gebl.
921. M. staudingeri Heyd.
922. M. tekkensis Heyd.
923. M. triangulifera Heyd.
924. Litta coccinea Men.
925. Zonitis flava F.
926. Z. bipunctata Pall.
927. Lydulus albopilosus Sem.
Family *Alleculidae*
928. Podonta daghestanica Rtt.
929. Omophlus pilicollis Men.
930. Steneryx dejani Fald.

Family *Tenebrionidae*

Table 7.1: Distribution of *Tenebrionidae* in Karakalpakstan (from Pirnazarov 1973)

#	Species	Sandy deserts				Deserts with solid soils				Solonetz and solonchak				Synanthropic forms
		Dunes and unstable sands	Moderately stable sands	Stable sands	Highly stable sands	Clay soils	Pebble soils	Stony soils	loamy sands	Solonetz	Solonchak	Takyrs	Tugai	
	Tribe *Ulomini*													
1.	*Cataphronetis tenuicornis Rtt.*				+							+		
2.	*C. quadricollis Rtt.*									+				
3.	*C. hauseriana Rtt.*				+							+		
	Tribe *Tenebrionini*													
4.	*Tenebrio obscurus F.*													+
5.	*T. molitor L.*													+
6.	*Belopus filiformis Motsch.*										+	+		
7.	*B. csikii Rtt.*				+	+	+		+			+		
8.	*B. ocularis F.*											+		
9.	*Boromorpnus opaculus Rtt*					+								
	Tribe *Helopini*													
10.	*Hedyphanes coerulescens Fisch.-W.*					+			+		+			
11.	*H. besseri Fald.*		+						+					
12.	*Catomus fragilis Men.*					+			+					
	Tribe *Crypticini*													
13.	*Crypticus zuberi Mars.*		+	+	+	+	+	+	+	+			+	
14.	*C. latiusculus Men.*	+	+		+									
	Tribe *Dissonomini*													
15.	*Dissonomus tibialis Rtt.*					+	+		+	+				
16.	*D.longulus A.Bog.et Kryzh*								+					
17.	*Aphaleria pygmaea Fisch.-W.*	+	+											
	Tribe *Opatrini*													
18.	*Dilamus fausti Rtt.*										+	+		
19.	*D.grandicers A.Bog.et Kryzh.*				+					+				
20.	*Scleropatrum hirtulum Bdi*				+	+					+			
21.	*S.breviusculum Rtt.*				+				+					
22.	*S.seidlitzi Rtt.*		+		+				+					
23.	*Conocephalum scutulosum Fald.*		+	+										
24.	*G.pubiferum Rtt.*					+	+		+					
25.	*G.schneidert Rtt.*				+					+				
26.	*G. rusticum Ol.*		+	+	+	+			+	+	+	+	+	
27.	*Opatroides punctulatus Br.*			+	+	+	+		+		+			
28.	*Penthicus dilectans Fald.*				+				+		+		+	
29.	*P. semenovi Rchdt.*				+					+				
30.	*P.pinguis Fald.*					+	+	+	+					
31.	*P.rufescens Muls.et Rey*			+		+	+							
32.	*Melanesthes laticollis Gebl.*	+												
33.	*M.hirsuta Rtt.*						+		+	+	+			

#	Species	Sandy deserts				Deserts with solid soils				Solonetz and solonchak				Synanthropic forms
		Dunes and unstable sands	Moderately stable sands	Stable sands	Highly stable sands	Clay soils	Pebble soils	Stony soils	loamy sands	Solonetz	Solonchak	Takyrs	Tugai	
34.	*Clitobius ohlongiusculus Fairm.*				+						+			
35.	*Adavius fimbriatus Men.*	+	+											
36.	*Psammestus dilatatus Rtt.*	+	+											
37.	*Caediexis arenicola Lebed*		+											
	Tribe *Melanimini*													
38.	*Anemia dentipes Ball.*		+	+	+				+		+			
39.	*A. fausti Sols.*		+	+	+				+					
	Tribe *Pachypterini*													
40.	*Pachypterus serrulatus Rtt.*										+			
	Tribe *Blaptini*													
41.	*Prosodes anguswata Zoubk.*						+		+	+				
42.	*P.solskyi Fst.*								+					
43.	*Tagona macrophthalma Fisch.-W.*	+	+	+										
44.	*Blaps titanus Men.*					+	+		+					
45.	*B.gausti Seidl.*	+	+	+										
46.	*B.pruinosa Fald.*	+	+	+	+					+				
47.	*B.parvicollis Zoubk.*			+	+				+					
48.	*B.letüifera pterotapha Fisch.-W.*						+							
49.	*B. seriata Fisch.-W.*								+					
50.	*B.holconota Fisch.-W.*		+	+		+	+		+					
51.	*B.inflexa Zoubk.*					+								
	Tribe *Pimellini*													
52.	*Argyrophana caspia Sem.*	+	+											
53.	*Sternodes caspicus Pall.*	+												
54.	*Diesia sexdentata Fisch.-W.*		+	+					+					
55.	*Platyesia karelini Fisch.-W.*	+	+											
56.	*P.medvedevi Skop.*	+	+											
57.	*Idiesa fischeri Men.*													
58.	*Trigonoscellis muricata Pall.*		+	+					+					
59.	*T. echinata Fisch.-W.*						+							
60.	*T.seriata Men.*				+	+			+					
61.	*T. punctipleuris Rtt.*			+		+								
62.	*T. gemmulata Men.*		+	+					+					
63.	*T.sublaebicollis Rtt.*	+	+											
64.	*T.gigas Rtt.*	+	+	+										
65.	*Sternoplax deplanata Kryn*			+	+				+	+	+			
66.	*Sternoplax affinis Zoubk.*													
67.	*Lasiostola pubescens Pall*			+		+	+		+	+				
68.	*L.heterogena Fisch.-W.*					+	+							
69.	*L.carinata Kr.*								+					
70.	*Pterocoma brericollis Men*						+							
71.	*Ocnera pilicollis Fald.*					+	+		+					

#	Species	Sandy deserts				Deserts with solid soils				Solonetz and solonchak				Synanthropic forms
		Dunes and unstable sands	Moderately stable sands	Stable sands	Highly stable sands	Clay soils	Pebble soils	Stony soils	loamy sands	Solonetz	Solonchak	Takyrs	Tugai	
72.	*O.lepidacanta Fisch.-W.*		+	+										
73.	*Trachyderma traingularis Fst.*		+	+										
74.	*Pachyscelis galinae G.Medv.*					+			+					
75.	*Podhomala lucidula Kr.*			+	+				+					
76.	*Pimelia cephalotes Pall.*				+	+	+		+	+				
77.	*P.verucosa Fisch.-W.*				+	+			+	+				
78.	*Pisterotarsa gigantea Fisch.-W.*	+	+											
79.	*P.kessleri Sols.*		+	+										
	Tribe *Lachnogyini*													
80.	*Lachnogya squamosa Men.*		+	+					+					
81.	*Netuschilia hausert Rtt.*					+			+					
	Tribe *Cnemeplatiini*													
82.	*Cnemeplatia atrops Costa*					+								
	Tribe *Akidini*													
83.	*Sarothropus depressus Zoubk.*		+											
84.	*S.fallax G.Medv.*		+											
85.	*Cyphogenia limbata Fisch.-W.*		+											
86.	*C.gibba Fisch.-W.*					+	+	+	+					
87.	*C.aurita Pall.*					+	+	+	+					
	Tribe *Leptodini*													
88.	*Leptodes raimovi G.Medv.et Pir.*					+								
89.	*L.boisduvali Zoubk.*					+								
	Tribe *Stenosini*													
90.	*Oogaster lehmanni Men.*					+	+		+	+				
91.	*Dichillus retteri Sem.*		+											
92.	*D.tenebrosus Rtt.*					+	+							
93.	*D.seminitidulus Sols.*					+			+					
94.	*D.fausicornis Rtt.*					+	+		+	+				
	Tribe *Epitragini*													
95.	*Sphenaria elongata Men.*		+											
96.	*S.hauseri Rtt.*		+											
97.	*S.menetriesi Rt. Sem.*		+											
98.	*Triphosphaena suturalis Sem.*		+											
99.	*Leptosphaena rubripes Rtt.*		+											
100	*Cyphostethe antonovi Sem.*		+											
101	*C. komarovi Rtt.*		+											
	Tribe *Tentyrlini*													
102	*Gnatosia schrenki Gebl.*					+			+					
103	*G.karelini Fald.*					+	+		+	+				
104	*Dailognatha nasuta Men.*					+	+		+					
105	*Colposcelis longicoliis Zoubk.*					+	+		+	+				
106	*C.jachontovi A.Bog.*						+	+						

#	Species	Sandy deserts				Deserts with solid soils				Solonetz and solonchak				Synanthropic forms
		Dunes and unstable sands	Moderately stable sands	Stable sands	Highly stable sands	Clay soils	Pebble soils	Stony soils	loamy sands	Solonetz	Solonchak	Takyrs	Tugai	
107	*Anatolica deserticola Skopa*					+	+		+					
108	*A.gibbosa Stev.*													
109	*A.angustata Stev.*	+	+											
110	*Psammocryptus minutus Tausch.*	+	+		+				+	+	+			
111	*Microdera minax Rtt.*	+	+											
112	*M.gracilis Eschsch.*	+	+						+					
113	*M.convexa Tausch.*								+					
114	*M. globulicollis Men.*					+	+	+	+					
115	*Tentyria gigas Fald.*								+					
116	*Alcinoeta helopioides Men.*	+	+											
	Tribe *Erodiini*													
117	*Diaphanidus volganus Sem.et A.Bog.*	+	+	+	+		+		+	+				
118	*Arthrodosia orientalis Fst.*								+					
119	*A.schusteri Rtt.*		+	+		+	+		+					
120	*A.intermedia Rtt.*		+	+										
	Tribe *Zophosini*													
121	*Zophosis punctata nitida Gebl.*													
122	*Z. scabriuscula Men.*													
123	*Z.rotundata Men.*			+			+		+					
	Tribe *Adesmiiri*													
124	*Adesmia panderi Fisch.-W.*					+						+		
125	*A.pulcherrima lehmanni Men.*			+					+	+	+			
126	A.gebleri Gebl.		+	+	+				+					

Family *Cerambycidae*

931. Prionus komarovi Dochrn.
932. P. turkestanicus Sem.
933. Turcmenigena varentzovi Muls.
934. Plocaederus scapularis F.-W.
935. Chlorophorus faldermanni Fald.
936. Dorcadion turkestanicus Kr.
937. Asias Jakobsoni Backm

Family *Chrysomelidae*
938. Melosoma populi L.
939. Altica deserticola Wse
940. Labidostomus senicula Krtz.
941. L. schneideri Wse.
942. L. stenostoma Wse.
943. Smaragdina viridis Krtz.
944. Antipa nigriventris Lef.
945. A. silensis Wse.
946. A. macropus
947. Clytra quadripunctata L.
948. C.atraphaxidis Pall.
949. C.rufina
950. C.andulatus Sultr
951. C.glasunovi
952. Cryptocephalus semiargenteus Rtt.
953.Cryptocephalus melanoxanthus Sols.
954. Cryptocephalus bipunctatus L.
955. Pachybrachys nigropunctatus Sffr.
956 P. jacobsoni Suffr.
957. P. timbridatus Suffr.
958. P. glycyrrhizae Ol.
959. Aphilenia interrupta Wse.
960. A. ornata Rtt.
961. A. parvula Wse.
962. Chrysochares asiaticus Pall.
963. Chrysolina sacarum Wse.
964. Colaphellus apicalis Gebl.
965. C. hoefti Men.
966. Entomoscelis adonidis Pall.
967. Galeruca interrupta armeniaca Wse.
968. Xenomela dohrni Sols.
969. Theone costipennis Kirsch.
970. T. silphoides Dalm.
971. Nyctiphantus hirtus nocturnus Sem.
972. Diorhabda persica Fald.
973. D. elongata Brulle
974. Phyllotreta pallidipennis Rtt.
975. Phyllotreta armoraciae Koch.
976. Ph.halaxyloni Schapiro
977. Ph.undulata Kutsch.
978. Ph.vittula Rdtb.
979. Ph.nemorum L.
980. Ph.atra F.
981. Ph.crucitera
982. Ph.furcata
983. Longitarsus melanocephalus Deg.
984. L. pellucidus Foudz.
985. L. suturalis rubenticollis All.
986. Chaetocnema tibialis Ill.
987. Ch. scheffleri Kutsch.
988. Ch. aridula Gyll.
989. Ch. heikertinger Lub.
990. Ch. hortensis Geoffr.
991. Ch. Breviuscula Fald.
992. Macromonycha apicalis Ciebl.
993. Ischyronota conicicollis Wse.
994. I. desertorum Wse.
995. I. elevata Rtt.
996. Comorotoscena unicolor Log.
997. Lema melanopus L.
998. L. suvorovi Oglobi
999. L. tristis Herbst
1000. Thelyterotarsus mininus Elbs.
1001. Stylosomus nigrifrons Fleiesch.

Family *Curculionidae*
1002. Nastus squamosus Heyd.
1003. Phyllobius schneidi
1004. Polydrosus obliquatus Fst.
1005. Cionus olivieri Rosensch.
1006. Alcides karelini Boh.
1007.Otiorhynchus morosus Fst.
1008. Schelopius planifrons Fhrs.
1009. Mesostylus hauseri Fst.
1010. Parastylus truchmenus Fst.
1011. P. argentatus Rtt.
1012. Myllocerus benignus Fst.
1013. M. heydeni Fst.
1013. M. cephalotes Fst.
1014. Polydrosus sp.
1015. Eusomus beckeri Fst.
1016. Sitona callosus.
1017. S. cyrindricollis Fahrs.
1018. S. lineatus L.
1019. S. puncticollis Steph.
1020. Chlorophanus caudatus Fahrs.
1021. Ch. simulans Fst.
1022. Pachymerus lugongii Mots.
1023. Diglossotrox steveni Gyll.
1024. Megamecus variegatus Gebl.
1025. M. nubeculosus Fairm.

1026. M. urbanus Gyll.
1027. Tanymecus argentatus Gebl.
1028. Phacephorus nebulosus Fahrs.
1030. Ph. rubeculosus Fairm.
1031. Corigetus capito Fst.
1032. C. exquisitus Fst.
1033. C. setulifer Rtt.
1034. Platymycterus armiger Fst.
1035. P. trapeziicollis Ball.
1036. P. turkestanicus Fst.
1037. Chloebius immeritus Boh.
1038. Ch. latifrons Fst.
1039. Ch. imbritus Boh.
1040. Ch. semipilosus Rtt.
1041. Ch. sterbai Rtt.
1042. Ch. steveni Boh.
1043. Deracanthus fedtschenkoi L. Arn.
1044. D. karelini Gyll.
1045. D. komarovi Fst.
1046. D. solskyi Fst.
1047. Eustenopus lanuginosus Fst.
1048. Eustenopus sp.
1049. Lixus desrtorum Gerb.
1050.L. algirus L.
1051. L. ascanii L.
1052. L. astraehanicus Fst.
1053. L. circtumcinctus turkestanicus Fst.
1054. L. elegantulus Boh.
1055. L. hirticollis Men.
1056. L. flavescens Boh.
1057. L. incanescens Boh.
1058. L. kraatzi Cap.
1059. L. sulphureovittis Branes.
1060. L. subulatus Fst.
1061. L. subtilis Sturm.
1062. L. strangulatus Fst.
1063. Leucochromus imperialis Zoubk.
1064. Chromonotus confluens Fhrs.
1065.Ch. menetriesi Fst.
1066. Ch. vittatus Zoubk.
1067. Trichocleonus leucophyllus Fisch.
1068. Conorrhynchus faldermanni Fahrs.
1069. Temnorhinus hololeucus Pall.
1070. Brachycleonus fronto Fisch.
1071. Chromosomus fischeri Fahrs.
1072. Ch. albolineates Men.
1073. Menecleonus anxius Gyll.
1074. M. lasigranatus Fairm.
1075. M. signaticollis Gyll.
1076. M. simplicirostis Chev.
1077. Stephanophorus verrucosus Gebl.
1078. S. lagopus Fahr.
1079. S. subfuscus Fst.
1080. Botynoderes carinatus Zoubk.
1081. B. farinosus Fahr.
1082. B. foveicollis Gebl.
1083. B. obsoletefasciatus Men.
1084. B. obliquefasciatus Men.
1085. B. punctiventris Germ.
1086. B. vexatus Gyll.
1087. Epexochus lehmanni Men.
1088. Ammocleonus quadrimaculatus Motsch.
1089. Chromoderus fasciatus Muell.
1090. Liocleonus clathratus Ol.
1091. Mecaspis darwini Fst.
1092. Pachycerus desertorum Fst.
1093. Xanthoprochilus nomas Pall.
1094. Cyphocleonus cenchrus Pall.
1095. C. tigrinus Panz.
1096. Rhinocyllus conicus Frol.
1097. Bagous sp.
1098. Tychius flavus Beck.
1099. T.femoralis Bris.
1100.Lepidotychius morawitzi Beck.
1101. Lepidotychius sp.
1102. Sibinia taschkentica Fst.
1103. Arthrostenus sp.
1104. Macrotarrhus bartelsi Boh.
1105. Hypera sp.
1106. Phytonomus variabilis Hrbst.
1107. Ph. farinosus Pch.
1108. Ph. fasciculatus Hbst.
1109.Coniatus schrencki Gebl.
1110.C. steveni Cap.
1111.Ceuthorrhynchus caucasica Ksch.
1112.C. aeneicollis Germ.
1113.C. coarctatus Gyll.
1114.Ocladius salicorniae Ol.
1115.Elasmobaris alboguttatus Bris.
1116.Ulobaris loricata Boh.
1117.Baris memnonia Boh.
1118.B. scolopacea Germ.
1119.B. sibirica Fst.
1120.Eremochorus concinnus Boh.
1121.E. varius Boh.

NEUROPTEROIDEA

Order *Neuroptera*
Family *Myrmeleonidae*

1122.Myrmelion formicarius L.
1123.Myrmecaerulus gr. major
1124.Palpares salidus Gerst.
1125.Neuroleon sp.
1126.Acanthaclisis pallida Mc L.

Family *Mantispidae*
1127.Mantispa styriaca Poda

Family *Ascalaphidae*
1128.Libelloides macaronius Scop.

MECOPTEROIDEA

Order *Mecoptera*
Family *Bittacidae*
1129. Bittacus tipularius L.

Order Lepidoptera

Family *Tortricidae*
1130. Salsolicola eremobia Flkv.
1131. S. rjabovi V. Kuzn.
1132. S. stshetkini V. Kuzn.
1133. Aethes xanthina Flkv.
1134. Laspeyresia pomonella L.
1135. L. leucogrammana Hfm.
1136. L. funebrana Tr.

Family *Psychidae*
1137. Oiketicus quadrangularis Chr.
1138. Oiketicus (Amicta) sp.
1139. Amicta armena Heyl

Family *Plutellidae*
1140. Plutella maculipennis Curt.

Family *Gelechidae*
1141. Pectinophora malvella Hubn

Family *Heliozellida*e
1142. Cemiostoma scitella L.
1143. Antispila rivillei Stt.

Family *Pyralidae*
1144. Hypsopygia costalis Hbr.
1145. Salebria sp.
1146. Pyrausta sanguinalis L.
1147. P. purpuralis L.
1148. P. aurata Scop.
1149. Constantia sp.
1150. Lepidogma tamaricalis Mn.
1151. Ostrinia nubilalis Hbn.
1152. Loxostege nudalis Hb.

Family *Geometridae*
1153. Tephrina arenacearia Den.et Shiff.

Family *Sphingidae*
1154. Laothoe philerema Djak.
1155. Macroglossum stellatarum L.
1156. Sphingonaepiopsis kuldjaensis Graes.
1157. Rethera komarovi Christ.
1158. Proserpinus proserpina Pall.
1159. Hyles hippophaes Esp.
1160. H. euphorbiae L.
1161. H. zygophylli O.

Family *Lasiocampidae*
1162.Eriogaster henckei Stgr.

Family *Noctuidae*

Table7.2 - Noctuids in the Khorezm oasis (from Rakhimov 1997 and Bekjanov 1998)

Noctuid species	**Natural landscapes**	**Man-made landscapes**
Subfamily *Hypeninae*		
1. Phynchodoontodes ravalis H-S	+	-
2. R.Soricalis Pung.	+	-
Subfamily *Cetocalinae*		
3. Catocala elocata Esp.	+	-
4. C. puerpera giorna	+	+
5. C. lupina H.-S.	+	-
6. C. optima Stgr.	+	-
7. C. neonympha Esp.	+	+
8. C. deducta Ev.	-	+
9. Clytie syriaca bug.	+	+
10.C. illunaris Hbn.	+	-
11.Pericyna albidentaria Frr.	+	+
12.Anydrophila imitatrix Christ	+	-
13.A. mirifica Ersxh	+	-
14.A. simiola Pung.	+	-
15.Gonocpileia munita Hbn.	+	+
16.Drasteria tenera Stgr.	+	-
17.D. sesquilina Stgr.	+	-
18.D. aberrans Stgr.	+	-
19.D. caucasica Kol.	+	+
20.D. flexuosa Men.	+	+
21.D. kusnezovi John.	+	+
22.Anumeta paipangularis Pung.	+	-
23.A. spilota Ersch.	+	-
24.A. henkei Sigr.	+	-
25.A. cestis Men.	+	-
26.A. cestina Stgr.	-	+
27.A. fractistrigata Alph.	+	+
28.A. dentistrigata Stgr.	+	-
29.A. fricta Christ.	+	-
30.Dysgonia rogenhoferi Bht.	-	+
31.D. algira I.	-	+
32.Iranada secunda Ersch.	+	-
33.Armada panaceorum Men.	+	+
34.A.clio Stgr.	+	-
35.Tarachephia huebert Ersch.	+	-
36.Pandesma robusta Wlk.	+	-
37.Apopestes spectrum Esp.	+	-
38.Autophila maculifera Stgr.	+	-
39.A. gracilis Stgr.	+	-
40.Acamholipes regularis Hbn.	+	+
41.Tyta luctuosa Den. et Schiff.	+	+
Subfamily *Chloephorinae*		
42.Earias chlorana L.	+	-
43.E. chlorphyllana Stgr.	+	-

Noctuid species	**Natural landscapes**	**Man-made landscapes**
Subfamily *Piasiinae*		
44.Chrisodeixis chalcites Esp.	+	+
45.Trichoplusia ni Hbn.	+	+
46. Macdunnoughia confusa Steph.	+	+
47. Autographa gamma L.	+	+
48.Plusia festucae L.	+	+
49.Cornutiplusia circumflexa L.	+	+
Subfamily *Acontiinae*		
50.Glossodice polygramma Dup.	+	-
51.Eublemma gratiosa Ev.	+	-
52.E .parva Hbn.	+	-
53.Acontia lucida Hfn.	+	-
54.Emelia trabealis Scop.	+	+
Subfamily *Acronictinae*		
55.Simyra nervosa Den.et Schiff.	+	-
56.Acronicta psi L.	+	-
Subfamily *Bryophilinae*		
57.Cryphia raptricula Den.et Schif	+	-
58.C.maeonis Ld.	+	-
Subfamily *Stirinae*		
59.Mycteroplus puniceago Bsd.	+	-
Subfamily *Heliothinae*		
60. Schinia scutosa Den.et Schiff.	+	-
61. Heliothis maritima gras.	+	-
62.H. viriplaca Hfn.	+	+
63.H. peltigera Den.et Schiff.	+	+
64.H. nubigera H.-S.	+	+
65.H. fieldi Ersoh.	+	-
66.Helicoverpa armigera Hbn.	+	+
Subfamily *Cucullinae*		
67.Cuculia boryphora F.-W	+	-
68.C. improba Christ.	+	-
69.C. narienensis Stgr.	+	-
70.C. hemidiaphana Grs	+	-
71.C. biornata F.-w	-	+
72.Calophasia lunula Hfn	+	-
73.Amphipyra tragopoginis Clt	+	-
Subfamily *Noctuinae*		
74.Euxoa conspicua Hbn	+	-
75.Agrotis segetum Den.et Scniff	+	+
76.Agrotis exlamationis L.	+	+
77.Agrotis ipsilon Hfn	+	+
78.Agrotis crassa Hbn	+	-
79.Agrotis obesa Bsd	+	-
80.Agrotis lasserrei Oberth.	+	+
81.Dichagyris multicuspis Ev	+	-
82.Dichagyris flammarta Den.et Scniff	+	+
83.Dichagyris forficula Ev	+	-
84.Parexarnis sollers Christ	+	-

Noctuid species	**Natural landscapes**	**Man-made landscapes**
85.Noctua orbona Hfn.	+	-
86.Xestia c-nigrum L.	+	+
Subfamily *Hadeninae*		
87.Discestra trifolii Hfn	+	+
88.D. stigmosa Christ.	+	-
89.D. cociabilis Gras.	+	-
90.Hadula ptochica Puhg	+	-
91.H. sabulorum Alph.	+	+
92.Saragossa siccanorum Stgr.	+	-
93.Lacanobia splendens Hbn.	+	-
94.L. oleracea L.	+	-
95.L. praedita Hbn.	+	+
96.L. suasa Den.et Schiff	+	-
97.L. blenna Hbn.	+	+
98.Mythimna vitellina Hbn.	+	+
99.M. distinca Moore.	+	-
100.M. l-album L.	+	+
101.Leucania zeae Dup.	+	+
102.L. loreyi Dup.	+	-
103.L. obirena Gr.	+	-
Subfamily *Ipimorphinae*		
104.Mervia kuznetzovi Dar	+	-
105.Xylena exsoleta L.	+	-
106.Pseudohadena siri Ersch.	+	-
107.P. laciniosa Christ.	+	-
108.P. chenopodiphaga Ramb.	+	-
109.P. immunda Ev.	+	-
110.P. indigna Christ.	-	+
111.Marsipiophora cristophi Ersch.	+	-
112.Pinacoplus didymogramma Ersch.	+	-
113.Arenostola semicana Esp.	+	-
114.Oria musculosa Hbn.	+	+
115.Spodoptera exiqua Hbn.	+	+
116.Platyperigea albina Ev.	+	+
117.Heterographa fabrilis piing.	-	+

Family *Papilionidae* –

1163. Hypermnestra helios Nick.
1164. Papilio machaon centralis Stgr.

Family *Pieridae*
1165. Pieris brassicae ottonis Roeb.
1166. P. canidia palaearctica Stgr.
1167. P. rapae debilis Alph.
1168. P. krueperi devta Nicv.
1169. Zegris fausti Chr.
1170. Colias erate erate Esp.

Family *Danaidae*
1172. Danaus chrysippus L.
1173. Chazara enervata Alph.
1174. Ch. staudingeri O.B-H.
1175. P. sagina Ruehl
1176. Hyponephele interposita interposita Ersch.
1177. H. narica Huebn.

Family *Lycaenidae*
1178. Apharitis epargyros Ev.
1179. Praephilotes antraceas Chr.
1180. Lycaeides christophi Stgr.
1181. Aricia chinensis Murrau
1182. Polyommatus icarus persica Bien.

Order *Hymenoptera*
Family *Tenthredinidae*
1183. Allantus cinctus
1184. A. didymus
1185. Ametastegia glabrata
1186. Ardis brunniventris
1187. Cladius pectinicornis
1188. Dolerus rulogeniculatus
1189. Hoplocampa minuta

Family *Pamphiliidae*
1190. Lyda hieroglyphica
1191. L. erythrocephata
1192. Neurotoma iridescens

Family *Cephida*
1193. Cephus pygmaeus L.

Family *Platygastridae*
1194. Platygaster sp.
1195. Pyrgaspis haloxylonomyiae Koz.

Family *Chalcididae*
1196. Brachymeria intermedia Nees.

Family *Tetrastichidae*
1197. Tetrastichus sp.

Family *Aphididae*
1198. Diaeretiella rapae M'lnt

Family *Ichneumonidae*
1199. Amblyteles quinquesinctus Kriech
1200. Barylypa (Amabilis) ruta Holmg
1201. B. delector Thunb.
1202. Barichnoumon sp.
1203. Ctenichneumon panzeri Wesm.
1204. Diadegma tianschanica Kok
1205. D. (Meloboris) Velox Holmg
1206. Enicospilus tournieri Sn.U.
1207. E. ramidulus L.
1208. E. rassicus Kok
1209. Ichneumon sarcitorius L.
1210. Netelia fuscicornis Holmg
1211. N. testacea Grav.
1212. Sinoforus xanthostomus Grav

Family *Braconidae*
1213. Apantales Kazak Tel.
1214. A. telengai Tobias
1215. A. ruficrus Hal
1216. A. vanessae Reinh
1217. Chelonus oculator Pans.
1218. Ch. annilipes Hesm.
1219. Macrocentrus collaris Spin.
1220. Microgaster flavipalpis Brulle
1221. R. spectabilis Hall
1222. Rogas dimidiatus Spin.
1223. R. rossicus Kok
1224. R. didimator L.
1225. R. dicolor Spin.

Family *Pteromolidae*
1226. Catolaccus ater Ratzeburg
1227. C. crassiceps (Masi)
1228. Pteromalus sp.

Family *Eulophidae*

1229. Euplectrus flavipes Fonsc.

Family *Trichogrammatidae*
1230. Trichogramma evanescens Wesw

Family *Vespidae*
1231. Ammophila tudei luill
1232. A. campestris Jar.
1233. Delta dimidiapenni (Saun)
1234. Sceliphron destilla torum Jll
1235. Vespa orientalis L.
1236. Vespula germanica F.
1237. Polistes gollicus L.

Family *Encyrtidae*
1238. Phasmocera stimula Trjap.
1239. Psyllaephagus caillardiae Sug.
1240. Ps. ogazae Sug.

Family *Formicidae* - Ants
1241. Monomorium solomonis L.
1242. M. barbatulum Mayr.
1243. Tetramorium caespitum L.
1244. T. striativentre Mayret K. Ug.
1245.Phleidole pallidula arenarum Ruzs.
1246. Messor aralocaspius Ruzs.
1247. M. excursionis Kuzn. Ug.
1248. M. variabilis Kuzn. Ug.
1249. Crematogaster subdentata Mayr.
1250. Tapinoma karawajevi Em.
1251. Acantholepis melas Em.
1252. Camponotus turkestanicus Em.
1253. C. interjectus Mayr.
1254. C. turkestanus Andre
1255. Cataglyphis aenescens Nyl.
1256. C. cinnamomea dlusskyi K. Arn.
1257. C. pallida Mayr.
1258. C. setipes turcomanica Em.
1259. Formica fusca L.
1260. F. subpilosa Rut.
1261. Proformica deserta Kuzn. Ug.
1262. Solenopsis sp.

Family *Scoliidae*
1263. Scolia flavifrons F.

Family *Pompilidae*
1264. Dicyrtomellus kisikumi Red.
1265. Auplopus carbonarius

Family *Bethylidae*
1266. Sclerogibba sp.
Family *Sphecidae*
1267. Podalonia affinis
1268. P. atrocyanea.
1269. P. ebenina
1270. P. tygei
1271. P. hirsita
1272. Ammophila mucipsa Mor.
1273. A. elongata Fisch.
1274. Astata rufipes Mocs.
1275. Stizus koenigi F.W.
1276. Oxybelus lamellatus Ol.
1277. Cerceris arenaria L.
1278. Cerceris sp.
1279. Crossocerus strangulatus.
1280. C. quadrimaculatus
1281. Crabro filiformis
1282. Olgia modesta
1283. O. maracandica
1284. Palarus variegatus
1285. Lindenius albilabrus.
1286. Larra anathema

Family *Mutillidae*
1287. Tricholabiodes aegyptiaca Rad.
1288. Smicromyrme sp.

Family *Apidae*
1289. Apis mellifera L.
1290. Bombus terrestris L.
1291. B. hortorum L.
1292. Xylocopa valga Gerst.
1293. X. turanica Mor.
1294. X. rufa Friese.
1295. Andrena carbonari L.
1296. A. aulica F.Mor.
1297. A. flavipes Paug.
1298. A. funebris Paund.
1299. A. discophora F.Mor.
1300. A. semiflaxe Lebed.
1301. Nomia diversipes Labr.
1302. Halictus quadricinctus F.
1303. H. marginatus Brulle.
1304. H. nasicus F.Mor.
1305. Coelioxus conoidea Klug.

1306. Tetralonia tricincta Ersch.
1307. Amegilla delicota Sdl.
1308. Icteranthidium limbiferum F. Mor.
1309. Eucera tegularis F. Mor.
1310. E. pusilla F.Mor.
1311. E. clupeata Erichs.
1312. Cteranthidium fedtschenkoi F. Mor.
1313. Megachile nitidicollis F. Mor.
1314. M. villipes F. Mor.
1315. M. rubriceps F. Mor.
1316. Sphecodes pectoralis F. Mor.
1317. Pararhepites orobinus F. Mor.

Order *Diptera*

Family *Culicidae*
1318. Aedes caspius Pall.
1319. A. straminus
1320. A. nipadapsis

Family *Psychodidae*
1321. Phlebotomus papatasii Scop.
1322. Ph. caucasicus Marz.
1323. Sergentomia graecovi Chod.

Family *Bibionidae*
1324. Bibio hortulanus L.
1325. Sciaridae scaria Sp.

Family *Cecidomyiidae*
1326. Halocnemomyia Schnitnikovi
1327. Contarinia disertorum Marik.
1328. C. caraganicola Marik
1329. Asphondylia aelleniae Mam.
1330. Janetiella gemmicola Marik.

Family *Nemestrinidae*
1331. Nemesttinus capitio LW.
1332. N. marginatus LW.
1333. N. innotatus LW.
1334. Pynchocephalus amoenus Licht

Family *Mydidae*
1335. Eremomydas be Sem
1336. E. scham Sem
1337. E. emir Sem
1338. E. sultan Sem

Family *Therevidae*
1339. Thereva sp.
Family *Tabanidae*
1340. Tabanus bactrianus Ols.
1341. T. hunnorum Sz.

Family *Asilidae*
1342. Stichopogon chrysostoma Schin
1343. S. nigritus Par.
1344. S. ammophilus Lehr.
1345. Pegesimallus mesasiaticus Lehr.
1346. Apoclea helvipes LW.
1347. Satanas gigas Everson
1348. Stenopogon parcus LW.
1349. Stenopogon teteroneurus Mcg.
1350. Neomochterus farinosus LW.
1351. Ctenola molitrix LW.
1352. C. ruficornis v.d.Wulp
1353. Pholodicus spectabilis LW.
1354. Dasypogan diadema octonotatus

Family *Therevidae*
1355. Ammothereva masasiatica Zait
1356. A. gussakovskii Zait
1357. A. nigrofemorata Krob
1359. Aristothereva latifrons Frey
1359. A. variabilis Zait.
1360. A. eversmanni Zait.

Family *Bombyliiae*
1361. Villa hottentota L.
1362. V. quinquefasciata Mg
1363. V. ventruosa LW.

Family *Phoridae*
1364. Megaselia rufipes Fll
1365. Phalacrotophora fasciata Fll.

Family *Syrphidae*
1366. Paragus haemorrhous Mgn.
1367. P. tibialis Flln.
1368. P. bicolor F.
1369. P. compeditus Wied.
1370. Volucella pellucens L.
1371. V. zonaria Poda
1372. Eumerus amoenus Loew.
1373. E. kondarensis Stack.
1374. E. turanicola Stack.
1375. E. ursiculus Stack.
1376. Eumerus ferulae Stack.

Family *Chamaemyiidae*
1377. Leucopis glyphinivora Tanp.
1378. L. ninae Tan.
1379. L. pallidolineata Tan.

Family *Muscidae*
1380. Pyrellia cadaverina F.
1381. Orthelia cesarion Mgn.
1382. Musca domestica vicina Moq.
1383. M. autumnalis Deg.
1384. M. larvipara Portsch
1385. M. lucidula Wd.
1386. Muscina stabulans Fll.
1387. M. assimilis Fll.
1388. Morellia simplex L.
1389. M. hortorum Fll.

Family *Scatopagidae*
1390. Scopeuma stercoraria L.

Family *Tachinidae*
1391. Tachina rohdendorphi Zim.
1392. Exorista larvarum L.
1393. E. xanthaspis Hd.
1394. E. civilis R.-D.
1395. Gonia bimaculata Rond
1396. G. cilipida Rond
1397. G. capitata R.-D.
1398. Pseudagonia rufifrons Md
1399. Peletiera nigricornis Mg
1400. P. rubessens R.-D
1401. Spallanzania hebes Fabl.

Family *Calliphoridae*
1402. Pollenia rudis F.
1403. P. pseudorudis Rognes
1404. Stomorhina lunata F.
1405. Rhynocomya koschewnikovi Rond
1406. Senotaenia deserta Rond
1407. Asiometopia ujgura Rond

Family *Cerambycidae –*
1408. Prionus komarovi Dochrn.
1409. P. turkestanicus Sem.
1410. Turcmenigena varentzovi Muls.
1411. Plocaederus scapularis F.-W.
1412. Chlorophorus faldermanni Fald.
1415. Dorcadion turkestanicus Kr.
1416. Asias Jakobsoni Backm

Family *Chrysomelidae*
1417. Melosoma populi L.
1418. Altica deserticola Wse
1419. Labidostomus senicula Krtz.
1420. L. schneideri Wse.
1421. L. stenostoma Wse.
1422. Smaragdina viridis Krtz.
1423. Antipa nigriventris Lef.
1424. A. silensis Wse.
1425. A. macropus
1426. Clytra quadripunctata L.
1427. C.atraphaxidis Pall.
1428. C.rufina
1429. C.andulatus Sultr
1430. C.glasunovi
1431. Cryptocephalus semiargenteus Rtt.
1432.Cryptocephalus melanoxanthus Sols.
1433. Cryptocephalus bipunctatus L.
1434. Pachybrachys nigropunctatus Sffr.
1435. P. jacobsoni Suffr.
1436. P. timbridatus Suffr.
1437. P. glycyrrhizae Ol.
1438. Aphilenia interrupta Wse.
1439. A. ornata Rtt.
1440. A. parvula Wse.
1441. Chrysochares asiaticus Pall.
1442. Chrysolina sacarum Wse.
1443. Colaphellus apicalis Gebl.
1444. C. hoefti Men.
1445. Entomoscelis adonidis Pall.
1446. Galeruca interrupta armeniaca Wse.
1447. Xenomela dohrni Sols.
1448. Theone costipennis Kirsch.
1449. T. silphoides Dalm.
1450. Nyctiphantus hirtus nocturnus Sem.
1451. Diorhabda persica Fald.
1452. D. elongata Brulle
1453. Phyllotreta pallidipennis Rtt.
1454. Phyllotreta armoraciae Koch.
1455. Ph.halaxyloni Schapiro
1456. Ph.undulata Kutsch.
1457. Ph.vittula Rdtb.
1458. Ph.nemorum L.
1459. Ph.atra F.
1460. Ph.crucitera
1461. Ph.furcata
1462. Longitarsus melanocephalus Deg.

1463. L. pellucidus Foudz.
1464. L. suturalis rubenticollis All.
1465. Chaetocnema tibialis Ill.
1466. Ch. scheffleri Kutsch.
1467. Ch. aridula Gyll.
1468. Ch. heikertinger Lub.
1469. Ch. hortensis Geoffr.
1470. Ch. Breviuscula Fald.
1471. Macromonycha apicalis Ciebl.
1472. Ischyronota conicicollis Wse.
1473. I. desertorum Wse.
1475. I. elevata Rtt.
1476. Comorotoscena unicolor Log.
1477. Lema melanopus L.
1478. L. suvorovi Oglobi
1479. L. tristis Herbst
1480. Thelyterotarsus mininus Elbs.
1481. Stylosomus nigrifrons Fleiesch.

Family *Curculionidae*
1482. Nastus squamosus Heyd.
1483. Phyllobius schneidi
1484. Polydrosus obliquatus Fst.
1485. Cionus olivieri Rosensch.
1486. Alcides karelini Boh.
1487. Otiorhynchus morosus Fst.
1488. Schelopius planifrons Fhrs.
1489. Mesostylus hauseri Fst.
1490. Parastylus truchmenus Fst.
1491. P. argentatus Rtt.
1492. Myllocerus benignus Fst.
1493. M. heydeni Fst.
1494. M. cephalotes Fst.
1495. Polydrosus sp.
1496. Eusomus beckeri Fst.
1497. Sitona callosus.
1498. S. cyrindricollis Fahrs.
1499. S. lineatus L.
1500. S. puncticollis Steph.
1501. Chlorophanus caudatus Fahrs.
1502. Ch. simulans Fst.
1503. Pachymerus lugongii Mots.
1504. Diglossotrox steveni Gyll.
1505. Megamecus variegatus Gebl.
1506. M. nubeculosus Fairm.
1507. M. urbanus Gyll.
1508. Tanymecus argentatus Gebl.
1509. Phacephorus nebulosus Fahrs.
1510. Ph. rubeculosus Fairm.
1511. Corigetus capito Fst.
1512. C. exquisitus Fst.
1513. C. setulifer Rtt.
1514. Platymycterus armiger Fst.
1515. P. trapeziicollis Ball.
1516. P. turkestanicus Fst.
1517. Chloebius immeritus Boh.
1518. Ch. latifrons Fst.
1519. Ch. imbritus Boh.
1520. Ch. semipilosus Rtt.
1521. Ch. sterbai Rtt.
1522. Ch. steveni Boh.
1523.Deracanthus fedtschenkoi L. Arn.
1524. D. karelini Gyll.
1525. D. komarovi Fst.
1526. D. solskyi Fst.
1527. Eustenopus lanuginosus Fst.
1528. Eustenopus sp.
1529. Lixus desrtorum Gerb.
1530. L. algirus L.
1531. L. ascanii L.
1532. L. astraehanicus Fst.
1533. L.circtumcinctus turkestanicus Fst.
1534. L. elegantulus Boh.
1535. L. hirticollis Men.
1536. L. flavescens Boh.
1537. L. incanescens Boh.
1538. L. kraatzi Cap.
1539. L. sulphureovittis Branes.
1540. L. subulatus Fst.
1541. L. subtilis Sturm.
1542. L. strangulatus Fst.
1543. Leucochromus imperialis Zoubk.
1544. Chromonotus confluens Fhrs.
1546. Ch. menetriesi Fst.
1547. Ch. vittatus Zoubk.
1548. Trichocleonus leucophyllus Fisch.
1549.Conorrhynchus faldermanni Fahrs.
1550. Temnorhinus hololeucus Pall.
1551. Brachycleonus fronto Fisch.
1552. Chromosomus fischeri Fahrs.
1553. Ch. albolineates Men.
1554. Menecleonus anxius Gyll.
1555. M. lasigranatus Fairm.
1556. M. signaticollis Gyll.
1557. M. simplicirostis Chev.
1558. Stephanophorus verrucosus Gebl.

1559. S. lagopus Fahr.
1560. S. subfuscus Fst.
1561. Botynoderes carinatus Zoubk.
1562. B. farinosus Fahr.
1563. B. foveicollis Gebl.
1564. B. obsoletefasciatus Men.
1565. B. obliquefasciatus Men.
1566. B. punctiventris Germ.
1567. B. vexatus Gyll.
1568. Epexochus lehmanni Men.
1569. Ammocleonus quadrimaculatus Motsch.
1570. Chromoderus fasciatus Muell.
1571. Liocleonus clathratus Ol.
1572. Mecaspis darwini Fst.
1573. Pachycerus desertorum Fst.
1574. Xanthoprochilus nomas Pall.
1575. Cyphocleonus cenchrus Pall.
1576. C. tigrinus Panz.
1577. Rhinocyllus conicus Frol.
1578. Bagous sp.
1579. Tychius flavus Beck.
1580. T.femoralis Bris.
1581. Lepidotychius morawitzi Beck.
1582. Lepidotychius sp.
1583. Sibinia taschkentica Fst.
1584. Arthrostenus sp.
1585. Macrotarrhus bartelsi Boh.
1586. Hypera sp.
1587. Phytonomus variabilis Hrbst.
1588. Ph. farinosus Pch.
1589. Ph. fasciculatus Hbst.
1590. Coniatus schrencki Gebl.
1591. C. steveni Cap.
1592. Ceuthorrhynchus caucasica Ksch.
1593. C. aeneicollis Germ.
1594. C. coarctatus Gyll.
1595. Ocladius salicorniae Ol.
1596. Elasmobaris alboguttatus Bris.
1597. Ulobaris loricata Boh.
1598. Baris memnonia Boh.
1599. B. scolopacea Germ.
1600. B. sibirica Fst.
1601. Eremochorus concinnus Boh.
1602. E. varius Boh.

NEUROPTEROIDEA
Order *Neuroptera*
Family *Myrmeleonidae*
1603. Myrmelion formicarius L.
1604. Myrmecaerulus gr. major
1605. Palpares salidus Gerst.
1606. Neuroleon sp.
1607. Acanthaclisis pallida Mc L.

Family *Mantispidae*
1608. Mantispa styriaca Poda

Family *Ascalaphidae*
1609. Libelloides macaronius Scop.

MECOPTEROIDEA

Order *Mecoptera*
Family *Bittacidae*
1610. Bittacus tipularius L.

Order Lepidoptera

Family *Tortricidae*
1611. Salsolicola eremobia Flkv.
1612. S. rjabovi V. Kuzn.
1613. S. stshetkini V. Kuzn.
1614. Aethes xanthina Flkv.
1615. Laspeyresia pomonella L.
1617. L. leucogrammana Hfm.

Family *Psychidae*
1618. Oiketicus quadrangularis Chr.
1619. Oiketicus (Amicta) sp.

Family *Plutellidae*
1620. Plutella maculipennis Curt.
Family *Tineidae*
1621. Hapsifera luridella Zll.
1622. Episcardia caerulipennis Ersh.

Family *Pyralidae*
1623. Hypsopygia costalis Hbr.
1624. Pyrausta sanguinalis L.
1625. P. purpuralis L.
1626. P. aurata Scop.
1627. Constantia sp.
1628. Lepidogma tamaricalis Mn.
1629. Hypochalcia sp.
1630. Auxacia bilineella Rag.

Family *Geometridae*

1631. Tephrina arenacearia Den.et Shiff.

Family *Sphingidae*
1632. Laothoe philerema Djak.
1633. Macroglossum stellatarum L.
1634. Sphingonaepiopsis kuldjaensis Graes.
1635. Rethera komarovi Christ.
1636. Proserpinus proserpina Pall.
1637. Hyles hippophaes Esp.
1638. H. euphorbiae L.
1639. H. zygophylli O.