



Biology of clickbeetles (elateridae) that damage saxaul in the desert zone of the South-East of Kazakhstan

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Abstract

By the results of studying the species composition in the south-east of Kazakhstan in the desert zone in 2016 – 2017, the authors have identified coleoptera pests from the family of clickbeetles (*Elateridae*) that damage the roots of saxaul. During their research, the authors have reliably established the following types of clickbeetles (*Elateridae*): *Agriotes meticulosus* Cand., *Aeoloides griseus* Germ., *A. hey deni* Reitt., *A. rossi* Germ., *Cardiophorus pellitus* Schw., *C. mutabilis* Gurjeva, *C. chivensis* Step., and *C. nigropunctatus* Cand. This article describes the biological features of these species and provides the phenological calendar.

Keywords: species composition, coleopterans, clickbeetles, pests, saxaul

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INTRODUCTION

Desertification of the ecosystems is one of the most pressing global issues of our time. This phenomenon has become a permanent factor of instability of many economies around the world. The main landscapes of the desert areas are occupied by natural pastures and saxaul forests. As a result of haphazard use of the natural desert areas, as well as other environmental changes (frequent droughts, changes to the climate), the process of desertification is intensive. Currently, preservation of vegetation and biodiversity of this unique natural complex may be a solution to many problems (The program of fighting desertification in Kazakhstan for the period of 2005 – 2015, 2005; Sychev & Kozhabekova, 2007).

In the desert and semi-desert zone of Kazakhstan, saxaul is very important, along with pasture plants. Saxaul makes 52 % of the forest resources. Along with many factors (abiotic and anthropogenic), development of saxaul crops is largely influenced by phytophagous insects, including the mass reproduction of coleopterans. Many specialized species are trophically bound by all organs (generative, vegetative, roots) of saxaul. In addition, some polyphages and oligophages have a great effect on the growth and survival of seedlings of the crops, especially in the first to third years of the life of saxaul. In this respect, Kazakhstan is

now facing the acute problem of protecting crops and natural saxaul forests from harmful species of coleopterans, which are biocenotically and practically important (Koksharova, 1983; Sinadsky, 1964; Kostin, 1973; Marikovskiy, 1955; Serkova, 1958; Taranov, 1984).

MATERIAL AND METHODS

The research was performed in the desert in the south-east of Kazakhstan. Field materials were collected in the summer period of the current year on the site and in the adjacent territory according to the generally adopted traditional methods (Fasulati, 1971; Paliy, 1979; Dobrovolsky, 1969).

The data for the research were mainly obtained from the results of daily excursions of the warm season of the year 2016 along the same route, during which species of beetles were caught, their relative abundance was assessed, and macro photographs were taken.

For monitoring purposes, they were unified if possible. The following methods were used: sweeping net method (25 times), shaking off from plants, manual collection (25 chosen plants). For collecting insects that

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are active at twilight and during the night, nets and collectors were used. For catching soil insects, pits in the soil were used with the overall area of 50 x 50 cm (100x100 cm in special cases), 50 cm deep. During or after collection, insects were killed with ethyl acetate, and maggots were kept in 70 % alcohol. The killed insects were transported on special mattresses and in bags. Their types were identified in accordance with the instruction in the laboratory conditions. While preparing the article, own collections were studied.

RESULTS AND DISCUSSION

In 2016 – 2017, as a result of entomological studies, significant original material was obtained about the fauna and the biology of the main harmful species of clickbeetles that were trophically associated with saxaul, and constituted the basis of root pests. They live in various landscapes.

There are 400 families and more than 10 thousand species of clickbeetles worldwide. These are small, medium, or large beetles 10 to 20 mm long, with oblong and a more or less flattened body. Many species are brown or black, have a metallic sheen, and often have silver or gray hairs (Arias, 2007).

They are mainly characterized by the presence of the hopping mechanism, which is formed by the prothorax and mesothorax. The beetle arms the mechanism once its back is against any surface; to roll over, the beetle arches the prothorax to the dorsal side, so that the body rests on the pronotum and the rear half of elytra. The base of antennae is located in front of the eyes; the antennae are composed of 11 segments; the antennae are filiform, serrate, lenticular, or comb-shaped. The pronotum has corners more or less drawn back. In most species, Elytra have dotted striae. The abdomen consists of five, rarely six abdominal sternites. The tarsuses consist of five segments. Due to the ability to jump, which is generally unique to the insects, but with a distinctive click when the hopping mechanism is triggered (see description) to roll to its normal position, the name “clickbeetles” has been given. The scientific name “*Elateridae*” comes from ancient Greek ἐλατήρ, which means “pursuer” or “thrower” given due to their ability to jump (Gurieva, 1989; Bezemer et al., 2003; Blackshaw & Vernon, 2006; Hemerick et al., 2003; Ericsson et al., 2007; Hicks & Blackshaw, 2008; Jonson et al., 2008).

The larvae of these beetles also have their own name — “wireworms”. They are called so due to the strongly elongated, sometimes very thin body with a hard shiny cover. The body is cylindrical with the length of 17 – 20 mm, the width of 2 – 4 mm; the beetles are polyphagous, and take very long to develop. Larvae may include obligate carnivores and omnivores, with prevailing carnivorousness or phytophagy (feeding on plants). Many larvae of phytophages that live in the soil are

serious pests of agricultural, horticultural and forest crops.

Wireworms are mainly soil pests. They harm plants of the *Agriotes*, *Selatosomus* and *Melanotus* families. Widely spread are brown clickbeetles – *Agriotes obscurus* L., striated clickbeetles – *A. lineatus* L., steppe clickbeetles — *A. gurgistanus* Fald., sowing clickbeetles – *A. sputator* L., gray clickbeetles – *Agrypnus murinus* L., shining clickbeetles – *Selatosomus aeneus* L., zhalpak clickbeetles – *S. latus* F., black clickbeetles – *Athous niger* L., and brown-legged clickbeetles – *Melanotus brunnipes* Germ (Tarnawski, 2000; Ormanova, 2004).

On pasture plants in the deserts of the south-east of Kazakhstan, there are eight species of clickbeetles: *Agriotes meticulosus* Cand., *Aeoloides grisescens* Germ., *A. heydeni* Reitt., *A. rossi* Germ., *Cardiophorus pellitus* Schw., *C. mutabilis* Gurjeva, *C. chivensis* Step., and *C. nigropunctatus* Cand.

Sowing clickbeetle – *Agriotes meticulosus* Cand., Family – *Elateridae*, tribae – *Agriotini*, subtribae – *Agriotina* (Casari, 2008). They are spread in Europe, Northern Siberia, and the Caucasus; in the South of Kazakhstan — in the Kyzyl-Kum desert, to the east of the Syr Darya, the Karatau foothills, the Muyunkum, and the Balkhash area. Morphological features. The length of the beetles is 6 – 9 mm; the width is 1.8 – 2.8 mm. The color of the larvae is yellowish, the length is 20 mm, the width is up to 1.5 mm, and the shape is oblong.

Biological peculiarities. The beetles are awoken in early April. In the middle of May, females start laying eggs into the soil, making small pits to the depth of 20 – 60 mm. Females' fertility is 10 eggs. Shortly after laying eggs, they die. The egg phase lasts 5 – 7 days, depending on the temperature of the soil. Hatching of larvae occurs in early May. The larvae also feed on the leaves of eurotia and develop for about 20 days. Over the entire period of life, a female lays up to 200 eggs. The duration of eggs' development is 25 – 60 days. Larvae have the length of 3 – 6 mm. Development of the nymph lasts for 3 – 4 days. New generation beetles hatch out in early June.

Sowing clickbeetles are widely spread in the sowing plots and massively reproduce. From the beginning until the end of the summer, the beetles are massively met. New generation beetles hatch out in early June. They eat 30 – 50 % of the leaves of saxaul, accumulating on a single shrub in the number of up to 20 – 25 insects. Mostly old plants get damaged. The larvae develop in the soil, gnawing on the roots of saxaul.

CONCLUSION

As a result of studying the biology of clickbeetles (*elateridae*) that damage saxaul in the south-east of Kazakhstan in the desert area, the authors have identified the following types: *Agriotes meticulosus*

Cand., *Aeoloides griseus* Germ., *A. hey deni* Reitt., *A. rossi* Germ., *Cardiophorus pellitus* Schw., *C. mutabilis* Gurjeva, *C. chivensis* Step., and *C. nigropunctatus* Cand. The harmful species and their biological characteristics have been described. A phenological calendar and the time of chemical treatment have been given for sowing clickbeetle — *Agriotes meticulosus* Cand.

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