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V.S. Abukenova

Karaganda Buketov University, Karaganda, Kazakhstan
Corresponding author: abu-veronika@yandex.ru

On the anniversary date from the scientific heritage of professor N.G. Skopin

50 years have passed since the publication of the work of Nikolay Georgievich Skopin, Professor of the Department of Zoology, Karaganda State University "Darkling beetles (Coleoptera, Tenebrionidae). Questions of comparative morphology and system. A review of the fauna of Kazakhstan". This is a sufficient period of time to understand, overestimate or forget the scientific works of the scientist. In this article, we have made a modest attempt to highlight the scientific heritage of our senior mentor and scientist, the teacher of our teachers. The first rector of the Karaganda State University, Evney Buketov, highly appreciated the entomological research of N.G. Skopin and initiated the preparation of the mentioned final work. Skopin's research focused on the systematics of a very complex group, and as a tenebrionidologist, he was both talented and authoritative in his field. His name is forever associated with the history of the study and classification of darkling beetles. The effectiveness of his system of identification by larval characteristics and male genitalia has been demonstrated in the distinction between separate genera and species. N.G. Skopin described 32 superspecies taxa and even more species. It is important to note that a number of these taxa while remaining valid, retain the surname Skopin in their nomenclature. Foreign specialists turned to him for his expert opinion on the identification of Tenebrionidae species and other coleopterological material. The world's most prominent entomological museums boast a plethora of specimens amassed and identified by Skopin.

Keywords: entomology, Coleoptera, Tenebrionidae, fauna, taxonomy, Kazakhstan, Faculty of Biology of Karaganda State University, Department of Zoology.

The study of darkling beetles (family Tenebrionidae) in Kazakhstan has its origins in the research conducted by academician P.S. Pallas. Further studies of the beetles belonging to this family in Central Asia and Kazakhstan were conducted by numerous entomologists during the first half and middle of the last century. A brief historical review is given in the dissertation of A.V. Bogachev [1]. Recent research findings pertaining to the group, collection material, and regional faunistic works of tenebrionidologists can be consulted on the websites of the Institute of Zoology of the Republic of Kazakhstan and the Zoological Institute of the Russian Academy of Sciences [2-3].

In Central Asia and Kazakhstan, darkling beetles are among the most widespread and conspicuous insects. The appearance of these beetles is so diverse that it is difficult to assign them to one family. Among them there are forms with wide-oval and elongated, strongly convex and strongly flattened bodies. The eliters have ribs and are punctate or smooth. Being cosmopolitans, these beetles prefer tropical and arid regions. According to trophic preference the majority of members of the family are phytophagous, but there are also saprophagous, necrophagous, xylophagous and others. Professor of Karaganda State University Nikolay Georgievich Skopin, one of the prominent tenebrionidologists of the USSR, devoted a lot of time to the study of this group in Kazakhstan. The study of the morphology and ecology of members of this family was the focus of N.G. Skopin's life's work, as the identification of many species is challenging and presents a substantial scientific enigma. The surname Skopin can be seen in many scientific articles published over the last 60 years and devoted to the problems of taxonomy, phylogeny and ecology of darkling beetles. In addition to being referenced in the bibliography, it is also found in the nomenclature of genera and species. For example, Skopin is mentioned 116 times in a recent article "Review of genus group names in the family Tenebrionidae (Insecta, Coleoptera)" [4]. N.G. Skopin's works are often referred to when writing reviews on darkling beetles, describing new species, revising tribes, etc. [5–8]. These examples

demonstrate the recognition of N.G. Skopin's works in the international scientific community and their importance for faunistics, the most important branch of entomology.

N.G. Skopin was born on December 17, 1913 in the family of a tailor in Kuibyshev (Samara). After his father died, the family moved to Tashkent, where Nikolai went to secondary school. In 1930 he entered the Technical School of Plant Protection. After graduating, he was sent to work in Kazakhstan, in the Kyzylorda region. A year later, having passed external exams, Nikolai Skopin entered the second biology course at the Central Asian State University (CASU) in Tashkent, founded with the participation of the greatest scientists of the century — zoologist D.N. Kashkarov, zoologist-geographer L.S. Berg, soil scientist N.A. Dimo and others.

He graduated with honours in 1938. He was sent to work in the Plant Quarantine Inspectorate of the People's Commissariat of Agriculture of the USSR. In 1940 N.G. Skopin came to Kazakhstan at the invitation of the Republican Tropical Station in Alma-Ata. He worked as an assistant, senior lecturer at the S.M. Kirov Kazakh National University. He was promoted to associate professor at the university after the candidate dissertation defense. Subsequently, Skopin proceeded to pursue his scientific endeavours at the Kazakh Research Institute of Plant Protection, where he assumed the leadership role of the Laboratory for the Study of Forest Pests. Thereafter, he assumed the leadership role of the Entomology Department at the Institute.

Skopin collected extensive material on darkling beetles and other insects on expeditions with colleagues to high mountain, steppe, semi-desert and desert regions of Kazakhstan. The processing of collection material was reflected in articles on insect pests, particularly sawflies and lepidopterans [9].

The second University of Kazakhstan, opened in Karaganda in 1972, needed experienced teaching staff, and N.G. Skopin was invited to join the Karaganda State University. Here he combined teaching and researching several insect groups.

In 1975 N.G. Skopin completed his dissertation on the systematics of darkling beetles. The rector of Karaganda University, Evney Arstanovich Buketov, took a great interest in N.G. Skopin's scientific career and contributed to the progress of his dissertation. Buketov's memories of his meetings with Skopin are described in the book "Yevnei Buketov: the tragedy of a bright destiny" [10]. In the same year, 1975, in Leningrad, Skopin defended his doctoral dissertation "The darkling beetles (Coleoptera, Tenebrionidae). Questions of comparative morphology and system. A review of the fauna of Kazakhstan" [11]. This was the inaugural significant dissertation research conducted in the field of entomology at Karaganda University.

Skopin was well known as a systematist in German and British scientific circles, and his work was frequently published in the Annales Historico-Naturales Musei Nationalis Hungarici (Hungary). His help in the identification of Tenebrionidae species and other coleopterological material was sought by foreign specialists.

The study of comparative morphology and ecology of larval forms of Tenebrionidae brought the scientist the greatest fame and allowed him to form an original opinion on the composition of tribes of the family and their relationships. Various revisions of the Western Palaearctic darkling beetles have been made by Skopin. He completely revised the generic composition of many Central Asian genera of the tribe Pimeliini and devoted much time to the study of Central Asian species of *Tentyria, Anatolica, Microdera* and others [12–16].

Systematists had noted inconsistencies between classifications based on adult and larval morphology of darkling beetles. The identification of larval stages has frequently been regarded as more precise due to the enhanced study of larval morphology. Consequently, Skopin's taxonomic studies, which were based on the peculiarities of larval structure, attracted a great deal of attention [17]. In Skopin's works, it was demonstrated that in cases where the separation of genera within distinct tribes is challenging using imaginal characters, it is preferable to employ larval characters. For instance, the "structure of the hypopharyngeal sclerome" or "abdominal glands" can serve as diagnostic indicators. Skopin proposed the division of the tribe Blaptini into subtribes Blaptina and Prosodina. Based on the characteristic features of the larval structure of the subtribe Blaptina, four morpho-ecological groups were distinguished, allowing us to clarify the classification of imaginal forms [18–25].

In addition, N.G. Skopin collaborated with the eminent tenebrionidologists G.S. Medvedev, A.V. Bogachev and S.M. Yablokov-Khizoryan on the revision of Central Asian species belonging to the Helopini tribe. In order to clarify the taxonomic classification of darkling beetles, key regroupings were made according to morphological criteria and modifications, including the type of structure of the

spermatheca and aedeagus, amongst other characteristics. The structure of larvae of different ages was also used as an additional criterion.

As a systematist, N.G. Skopin made a significant contribution to the study of the fauna and ecology of the tribe Platyscelidini, utilising data on species from Kazakhstan and other regions. The tribe Platyscelidini comprises species that are endemic to mountainous regions, representing a significant centre of biodiversity. The majority of species within this tribe are endemic to Kazakhstan and Central Asia, yet the study of these species remains limited. Notably, the study not only described Platyscelis species from Kulja (Xinjiang Uygur Autonomous Region, People's Republic of China), but also led to the discovery of new species from the tribe [26, 27]. The genus *Somocoeloplatys* Skopin, 1968 of the tribe Platyscelidini, endemic to the Western Tien Shan, was determined and named, and the position of species of the genus *Oodescelis* was clarified. The author further summarised the available data on the ecology of the species of the tribe and created identification tables [28, 29].

N.G. Skopin's interests were wide-ranging, and entomological expeditions were a frequent occurrence. He devoted considerable time and effort to the identification and description of novel species of insects. The students' primary recollections concerning these expeditions were the considerable distances traversed and the substantial number of test tubes filled with beetles.

Zoological Institute of the Russian Academy of Sciences (ZIN RAS) houses an extensive collection of Coleoptera, comprising species of Geotrupidae. These beetles have long attracted the attention of collectors and nature lovers due to their bizarre appearance and biological peculiarities. Among them there is a specimen of a new species *Lethrus karatavicus* Nikolajev et Skopin, 1971, discovered by professor Skopin in the upper reaches of the Karachik River on the Kara-Tau Ridge (South Kazakhstan), and described by him together with the Kazakh entomologist G.V. Nikolayev (Fig. 1) [30].

Figure 1. Collectors specimen INS_COL_0000099 of Lethrus karatavicus Nikolajev et Skopin, 1971 with label. From the collection of beetles (Coleoptera) of ZIN RAS (after www.zin.ru/Animalia/Coleoptera).

Dorcadion (Acutodorcadion) zhaisanicum Shapovalov, 2007) is of special importance among the type specimens of the family Cerambycidae in the collections of ZIN RAS. This is the holotype of the new species described by A.M. Shapovalov in 2007 based on materials of N.G. Skopin from 1963. The species was found in the Jaisan Mountains (northwestern part of the Chu-Ili Mountains), South Kazakhstan (Fig. 2) [31]. Materials of field collections of N.G. Skopin of ground beetles (Carabidae) are stored in large scientific collections of the world. To illustrate, a specimen of *Amara kosagatschi* Hieke, 1988, originating from southeastern Kazakhstan (Chunja, a district of Kos-Agach), serves as the holotype for this species, and is currently housed in the collection of beetles (Coleoptera) at the renowned Museum of Natural History (Berlin, Germany). The German specialist F. Hieke elucidated the taxonomic position of the Skopin collections' specimens.

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Figure 2: General view and label of the collection specimen INS_COL_CER_0000035 Dorcadion (Acutodorcadion) zhaisanicum Shapovalov, 2007 from the collection of beetles (Coleoptera) of ZIN RAS (after www.zin.ru/Animalia/Coleoptera).

The species *Amara (Cribrara) skopini* Hieke is described as materials from Northwestern Kazakhstan, area of Lake Koskul. The species name was given by entomologist F. Hieke in honor of the collector and systematist N.G. Skopin. The holotype of this species is kept in the collection of ground beetles in ZIN RAS. The author's paratypes from the same habitat are presented in the Museum of Natural History (Berlin, Germany) [32].

Like many renowned systematists, N.G. Skopin had a unique scientific style that helped him achieve his professional goals and overcome challenges. According to his students and colleagues, he was not an easy person to communicate with and a difficult companion in scientific work. N.G. Skopin has published more than 50 scientific papers, which is a comparatively modest output by today's standards. Nevertheless, his articles are frequently cited by specialists from various countries. His collection materials have become a standard in comparative systematics and are considered classics in the world's leading museums.

Professor Skopin was unable to proceed with the composition of his planned treatise, "Identification key to insects of Central Kazakhstan", and the "Review of the Tenebrionidae (Coleoptera) fauna of Kazakhstan", due to a period of severe illness and death that afflicted him in 1979.

Nevertheless, the work of N.G. Skopin on revising the family Tenebrionidae remains very important. It's worth noting that some of Skopin's morphological generalisations for different taxa have been confirmed in modern molecular genetic studies. In light of the data pertaining to the morphology of larvae, N.G. Skopin contended that there was a need to distinguish the genus *Lithoblaps* from other genera in the subtribe Blaptina. This classification of genera has been well-supported and aligns with the phylogenetic model based on genetic markers [33]. Skopin's classification system, based on the use of certain morphological characters and the structure of the male sexual system, after many years of rejection, is accepted by some specialists today. This is evidenced by its use for the subtribe Blaptina [34].

By assessing the reliability of the author's descriptions and the validity of classification groups over 50–60 years, we can see how many of the 32 superspecies taxa described by Skopin have already been revised and re-evaluated due to revisions of the family [35, 36, 37].

However, a sufficient proportion of the taxa with the surname Skopin is valid and has been included in various studies. To illustrate this point, we can turn our attention to the small genus *Sternotrigon*, which belongs to the tribe Pimeliini. This genus was first proposed by Skopin in 1973, and since then it has become the focus of intense research by Chinese and Mongolian scientists. The distribution of new species from this genus in the Asian region is currently being elucidated [38]. Information concerning the geographical distribution of species within the genus *Sternotrigon*, along with the location of relevant holotypes and paratypes, is accessible on the Global Biodiversity Information Facility platform. This data can be utilized without restrictions by systematists conducting research in this field. Nucleotide sequences have also been obtained for some species of genus *Sternotrigon*. This information is stored in the European Nucleotide Archive (EMBL-EBI) and is of interest to the International Barcode of Life project (iBOL) [39].

Thus we see the fundamental legacy of the past and its relevance to the present when we turn to Professor Skopin's entomological research. We would like to assume that the traditions of classical university science of Karaganda University will be continued further, supported by young specialists.

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В.С. Абукенова

Мерейтойлық күніне орай профессор Н.Г. Скопиннің ғылыми мұрасынан

Қарағанды мемлекеттік университетінің зоология кафедрасының профессоры Николай Георгиевич Скопиннің «Жуки-чернотелки (Coleoptera, Tenebrionidae). Вопросы сравнительной морфологии и системы. Обзор фауны Казахстана» атты еңбегінің жарық көргеніне 50 жыл өтті. Бұл ғалымның ғылыми еңбектерін түсіну, қайта бағалау немесе ұмыту үшін жеткілікті уақыт. Мақалада аға тәлімгеріміз және көрнекті ғалым, педагог және энтомологтың ғылыми мұрасын көрсетуге тырыстық. Қарағанды мемлекеттік университетінің бірінші ректоры Евней Букетов Н.Г. Скопиннің энтомология бойынша зерттеулерге қосқан үлесін жоғары бағалап, аталған қорытынды еңбекті дайындауға бастамашы болған. Ең күрделі топтардың бірін жіктеумен жұмыс істей отырып, профессор өзін таксономия саласындағы көрнекті маман ретінде көрсетті. Ғалымның есімі қара түстес қоңыздарды зерттеу және жіктеу тарихымен мәңгі байланысты. Оның дернәсілдік белгілерге және сыртқы жыныс мүшелерінің құрылымына негізделген сәйкестендіру жүйесі жеке тұқымдастар мен түрлерді ажыратуда тиімді болды. Скопиннің зерттеу нәтижелері бойынша ғылым үшін 32 жаңа таксондар сипатталған. Осы таксондардың бірқатары жарамды бола отырып, олар өз атында Skopin фамилиясын сақтайды. Шетелдік мамандар оған қара түс қоңыздар мен басқа колеоптерологиялық материалдарды анықтау кезінде сараптамалық бағалау үшін жүгінеді. Әлемдегі ең ірі энтомологиялық мұражайлар өз коллекцияларында Скопин жинаған және бірізденген үлгілерді сақтап отыр.

Кілт сөздер: энтомология, Coleoptera, Tenebrionidae, фауна, таксономия, Қазақстан, Қарағанды мемлекеттік университетінің биология-география факультеті, зоология кафедрасы.

В.С. Абукенова

К юбилейной дате из научного наследия профессора Н.Г. Скопина

Прошло 50 лет с момента публикации работы профессора кафедры зоологии Карагандинского государственного университета Николая Георгиевича Скопина «Жуки-чернотелки (Coleoptera, Tenebrionidae). Вопросы сравнительной морфологии и системы. Обзор фауны Казахстана». Это достаточный срок для того, чтобы понять, переоценить или забыть научные вклады ученого. В этой статье предпринята попытка осветить научное наследие нашего старшего наставника и выдающегося ученого, педагога и энтомолога. Первый ректор Карагандинского государственного университета, Евней Букетов, высоко оценивал вклад Н.Г. Скопина в исследования по энтомологии и инициировал подготовку упомянутого итогового труда. Работая над систематикой одной из самых сложных групп, профессор зарекомендовал себя как выдающийся специалист в области таксономии. Его имя навсегда связано с историей изучения и классификации жуков-чернотелок. Используемая им система идентификации по личиночным признакам и строению гениталий самцов оказалась эффективной для выделения отдельных родов и видов. По результатам исследования Скопина, было описано 32 таксона новых для науки. Ряд этих таксонов, оставаясь валидными, сохраняет в своем названии фамилию Skopin. Зарубежные специалисты обращались к нему за экспертной оценкой при идентификации чернотелок и другого колеоптерологического материала. Крупнейшие энтомологические музеи мира хранят в своих коллекциях образцы, собранные и идентифицированные Скопиным.

Ключевые слова: энтомология, Coleoptera, Tenebrionidae, фауна, таксономия, Казахстан, биолого-географический факультет Карагандинского государственного университета, кафедра зоологии.

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Information about author

Abukenova Veronika Sergeevna — Candidate of Biological Sciences, Associate professor, Department of Zoology, Karaganda Buketov University, Karaganda, Kazakhstan; e-mail: abu-veronika@yandex.ru