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### **CRYPTOPHAGIDAE (COLEOPTERA) IN THE COLLECTIONS OF UKRAINE: SPECIES, SPECIMENS, AND COLLECTORS**

*The collections of Cryptophagidae beetles stored in the natural museums of Ukraine were studied: three academic and two university collections – State Museum of Natural History, National Museum of Natural History and I.I. Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine, Zoological Museum of T. Shevchenko Kyiv National University and Museum of Natural History of V. Karazin Kharkiv National University, and also author's work collection. The volumes and the state of their preservation have been analyzed. The representation of different species in collections, as a whole, and in relation to the Carpathian fauna is evaluated. In general, museum collections contain 1346 samples of Cryptophagids, in each of which – about 210-340 individuals, all of them are stored in separate boxes and punctured by entomologic needles. The author's collection includes 1657 specimens of 57 species, which are mostly stored on cotton mattresses. All six collections include 122 species of 16 genera, containing from 21 to 85 species of this family. Some samples in collections have been lost for various reasons, in 10 cases there are only needles with labels without the samples themselves, therefore, some species (eg *Cryptophagus nitidulus*, *C. hexagonalis*) are represented in collections conditionally, only in labels. At the revision of materials attention is paid to taxonomic changes, through which in the publications and in the actual material different species or generic synonymic names were used. The author also took into account the uniqueness of each of the collections, which was determined by several important parameters, including the number of samples that are presented exclusively in some of the museum of species and genera of the family, the number of samples and type specimens in collection. For most of these parameters the leader is the collection of Zoological Museum of T. Shevchenko Kyiv National University. All data is included in the author's database, which contains summaries of annotations containing collections of samples, names of regions and localities of collection, dates, collectors, or owners of the collection, and also notes with clarifications of places or details of reidentifications.*

**Key words:** *Cryptophagidae, collections, natural museums, species diversity.*

Collection specimens for taxonomy and checking the current distribution of species are extremely valuable, so their analysis should be one of the important components of the study of the fauna of Coleoptera and, in particular, Cryptophagidae. Such studies are common practice among Western and Ukrainian scientists. In particular, the work of S. Ribeiro-Costa with co-authors devoted to the study of collection specimens of beetles of zoological department of the Federal University of Paraná State of Brazil [21] should be noted, which includes the analysis of typical specimens of collection of the famous entomologist J. S. Moure [5]. Also, many scientific papers, including those relating directly to Cryptophagids, are based on a comparative analysis of own and museum collections [6, 19] or exclusively the museum collections [2, 3, 16].

Cryptophagidae is a unique object for monitoring, studying the variability and dynamics of biota, since they are diverse in species and generic composition and environmental preferences, many of them close the trophic chains and available in different types of communities [9]. We can study the diversity of fauna only through the accumulation of large

amounts of primary data, because there are always rare species, with a narrow range of biotope confinement and seasonal activity, species that change their natural habitats, etc. Therefore, when data on the composition and dynamics of biota are collecting, it is important to investigate the collection material that is collected over many generations of researchers, in different regions, biotopes and for different purposes. Collections gradually accumulate a fairly complete amount of data about fauna, which is often impossible to obtain during the period of activity of one researcher [24].

Cryptophagids correspond to the foregoing features, and such collections are extremely valuable, because, firstly, a large number of species is de facto known only from collections, secondly, we can check the correctness of specification of a particular species considering to the modern taxonomy of the group, and thirdly, the collections allow us to summarize data from large areas over a long period of time. Collections provide us information on fauna status and types of localities that may be destroyed before the research.

The purpose of this work was to summarize all information about the findings of Cryptophagidae species available in zoological and natural museums of Ukraine, which are confirmed by collecting specimens, and in necessary cases, reidentified.

### **Material**

Specimens from the following five museum collections are analyzed 1) collection of State Museum of Natural History of the NAS of Ukraine (Lviv); 2) collection of National Museum of Natural History at the NAS of Ukraine (Kyiv); 3) collection of State Museum of Nature of V.N. Karazin Kharkiv National University; 4) collection of Zoological Museum of Taras Shevchenko National University of Kyiv, and 5) collection of V. Lazorko, which is stored in the funds of the I.I. Schmalhausen Institute of Zoology of NAS of Ukraine (Kyiv).

For comparison, the author's collection is presented in the general table and in the description of each collection; a more detailed characteristics of the author's collection will be published in a separate work. In future this collection author plans to transfer to one of mentioned museums.

Designation of collections: SMNH, NMNH, MNKU, ZMKU, SIZK (acronyms according to: [25]) and KOC. Characteristics of collections are listed below in a separate section. In a number of cases, the nomenclature of genera and species has been modified according to modern nomenclature [12].

Analyzing the volume and composition of collections, the author pays attention to the Cryptophagids of the Carpathians and the presence of specimens from this territory among collections of museum samples. While reviewing collections, much attention was paid to these specimens in order to undertake further in-depth analysis of the fauna of the region in the time aspect, especially — to changes of species composition during the last century, based on museum exhibits and on original research by the author.

Table 1 contains summarized data for each collection, specifying the full name and acronym, the volume of the collection and its locality.

Author merged the detailed data on specimens in collections into a consolidated database in the form of a MS Excel table, which includes actual names and reidentifications, information about the region, place and date of collection, and collector or owner of the collection. The "Notes" field specifies the species name according to the original label and other details. The names of specific locations and exact dates of collection are encrypted with individual original encodings, some of which could not be interpreted.

Table 1

## Brief information about the investigated collections

Acronym	Whole name (city)	Volume of the collections
SMNH	Collection of State Museum of Natural History (Lviv) [колекція Державного природознавчого музею НАН України (м. Львів)]	71 species, 224 specimens
KOC	K. Ocheretna's collection (Uzhhorod)	57 species, 1657 specimens
NMNH	Collection of the National Museum of Natural History at the National Academy of Sciences of Ukraine (Kyiv)	50 species, 214 specimens
ZMKU	Collection of Zoological museum of T. H. Shevchenko Kyiv National University	85 species, 304 specimens
MNKU	Collection of Museum of Natural History of V. N. Karazin Kharkiv National University	21 species, 341 specimens
SIZK	Collection of V. Lazorko in funds of the I. I. Schmalhausen Institute of Zoology of National Academy of Sciences of Ukraine (Kyiv)	48 species, 263 specimens

## Brief description of zoological collections

The following are descriptions of the five investigated museum collections stored in the Natural Museums of Lviv (SMNH), Kyiv (NMNH, ZMKU, SIZK) and Kharkiv (MNKU), as well as the description of the author's collection (KOC) stored in Uzhhorod.

*Collection of NMNH (Kyiv)*

The collection includes 214 specimens belonging to 50 species of 10 genera. Another 4 species (7 specimens) belong to other families of the superfamily Cucujoidea<sup>1</sup>. This collection includes the collections of J.H. Hochhuth in the middle of the XIX century. The collection was investigated with the support of A. Martynov. The vast majority of specimens derives from Kyiv and its neighbourhood. The history of the collection originates from the entomological collections of the Kyiv Pedagogical Museum [26], collected by various researchers, in particular by J.H. Hochhuth [7], and described by M. Cherkunov [4]. There are no modern descriptions of the collection (description of the collections of J.H. Hochhuth is expected: A. Martynov, personal message). The general view of the box and its labels is shown in fig. 1; the Cryptophagidae specimens from this collection with authorial labels are presented in fig. 2.

*Collection of SMNH (Lviv)*

The collection is mounted in two boxes, along with representatives of other families of the superfamily Cucujoidea – Erotylidae, Languriidae and others. In general, the collection was collected and arranged during the period of the 19th and early 20th centuries, in particular, many species were collected by the then director of the SMNH Marian Łomnicki. The collection was investigated with the support of V. Rizun. This collection includes 224 specimens from 71 species of 13 genera of the family, which belong to 2 subfamilies. Between materials of this collection there are 15 species from the Carpathian region. The collection has not been described yet, but in works of M. Łomnicki there are separate

<sup>1</sup> These are the families Languriidae – specimens of genera *Leucohimatium* (2 species) та *Macrophagus* (1 species); Corylophidae – specimen of genus *Orthoperus* (1 species)

references to the species that were collected by him personally and stored in the funds of the museum [13, 14].



*a*



*b*

Fig. 1. The collection of Cryptophagidae in NMNH, collected by I.H. Hochhuth: *a*, a label on a box; *b*, general view of the box with collections of silken-fungus beetles. Photo by the author.



Fig. 2. Samples of Cryptophagidae from the J.H. Hochhuth's collection which is stored in NMNH of Ukraine as the oldest museum items with the representatives of this group of beetles in natural museums of Ukraine: *a*, collection sample of the species *Cryptophagus saginatus*; *b*, collection sample of the species *C. badius*; *c*, the original label of *C. badius* written by the Hochhuth's hand; *d*, the original label of *C. saginatus* written by the Hochhuth's hand. Photo by A. Martynov.

#### **Collection of SIZK (collection of V. Lazorko) (Kyiv)**

This academic collection of Cryptophagids is the only one stored in SIZK. The collection was gathered by V. Lazorko during the 1920- 1960's and given to the Institute of Zoology of the Academy of Sciences of the Ukrainian SSR [20]. The collections until 1939 mainly comprises the territory of Lviv and Ivano-Frankivsk Oblast; specimens collected after 1944 come from Austria, Poland and Sweden; in 1948, the researcher emigrated to Canada, so there are no later collections from Europe. The samples are mounted in two large boxes, which contain 263 individuals of 48 species of 6 genera; they are stored together with the beetles from other families Erotylidae, Languriidae and Latridiidae. The collection was researched with the support of V. Korneyev. The collection has not been described in any of the works, in particular, it is not mentioned in the recent review of the collections of SIZK [1].

#### **Author's collections (Uzhhorod)**

The collections include 1657 specimens belonging to 13 genera and 57 species of two subfamilies. Most of the collection is stored on entomological mattresses, some individuals are mounted in the box. Specimens were collected on the territory of Uzhhorod, Perechyn, Velykyy Bereznyi, Volovets, Mizhhirya and Tiachiv Raions. On the basis of these collections, two articles have been prepared – the species composition of the family on the Carpathian foothills [10] and the species of the genus *Cryptophagus* of the Mountain Valley Borzhava [11], but a detailed description of the species collected by the author will be published in separate work.

### **Collection of ZMKU (Kyiv)**

This collection is an important source of information and an assemblage of factual material on the Cryptophagids of Bukovina and other districts of the former Austria-Hungary. It was investigated with the support of M. Bilyashivsky. The collection is in ZMKU approximately since 1947, due to the redistribution of museum collections – as contributions after World War II<sup>2</sup>. The collection was collected by O. Marcu and K. Penecke; it contains 304 specimens, which belong to 85 species of 12 genera of Cryptophagidae. Also, the collection includes species from other families previously considered as Cryptophagidae<sup>3</sup>. Collection materials require a minor renewal of labels due to changes in the taxonomy of the family and the presence of species which belong to other families. The collection has a considerable value for the study of Carpathian Cryptophagids. Detailed information about the specimens will be published by the author in separate article [18].

### **Collection of MNKU (Kharkiv)**

The collection contains 341 individuals, representing 21 species of 12 genera. The largest number of individuals is collected in the eastern Oblasts of Ukraine (Kharkiv, Luhansk, Sumy, etc.), as well as in Russia, Germany, Italy, and Austria. Species are identified by A. Droghvalenko; he also supported this investigation. In the collection there are two specimens, collected by E. Reitter. The collection contains specimens of 7 species from the Carpathians, 5 of which are collected in the mountainous regions of the Zakarpattia Oblast, one is from Lviv Oblast (*Ootypus globosus*) and one is from Hungary (*Caenoscelis sibirica*).

### **General characteristics of the collections**

**Content of the collections.** In total, all museum collections contain 115 species, but data about 10 species is limited exclusively to labels (specimens are lost). Accordingly, in the five studied academic and educational collections, Cryptophagids are represented by 105 species (Table 2). The total number of species of the family per collection varies from 21 (MNKU) to 85 (ZMKU). None of the collections has a complete composition of species that are found on the territory of Ukraine.

Table 2 contains data on collectible specimens, the number of samples of every species in each collection and information about the presence of gatherings from the Carpathian region. The order of taxa in the table is alphabetical; names of species are listed according to the modern nomenclature. Numerals indicate the number of individuals of the corresponding species in each of the collections: the number in brackets refers to individuals from the Carpathian region, without brackets – the specimens collected outside the Carpathians, asterisk designates lost specimens.

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<sup>2</sup> After the World War II, the peace treaty (1947) stated the inadmissibility of contributions, and the Geneva Convention (1949) prohibits their charging (by Wikipedia).

<sup>3</sup> These are *Diplocoelus fagi*, 7 specimens (Biphylidae); *Cryptophilus integer*, *Leucohimatium arundinaceum*, *Macrophagus robustus*, and *Toramus pilifer*, 8 specimens (Languriidae).

Carpathian segment. In total (including data in the literature) 116 species have been confirmed for the Carpathian region. Among them 78 species, as noted above, confirmed for the Carpathians by voucher specimens.

Table 2

## The presence of species in collections in total and (in parenthesis) from Carpathians

Species	Zoological collections						Sum	
	NMNH	SMNH	SIZK	KOC	MNKU	ZMKU	S <sub>all</sub>	S <sub>carp</sub>
<i>Antherophagus caucasicus</i> Reitter, 1878	-	-	-	-	17	-	17	-
<i>A. fursovi</i> Lyubarsky, 1991	-	-	-	-	4	-	4	-
<i>A. pallens</i> (Fabricius, 1781)	5	7 (2)	-	(23)	18 (6)	10	71	31
<i>A. silaceus</i> (Herbst, 1792)	2	1	-	(36)	17 (3)	1	60	39
<i>A. similis</i> Curtis, 1835	-	-	-	(11)	13 (3)	-	14	13
<i>Atomaria (Agathengis) affinis</i> Sahlberg, 1834	-	-	-	(83)	-	1	84	83
<i>A. (A.) alpina</i> Heer, 1841	-	1*	-	(2)	-	-	3	2
<i>A. (A.) atrata</i> Reitter, 1875	-	-	-	(30)	-	-	30	30
<i>A. (A.) badia</i> Erichson, 1846	-	-	1	-	-	-	1	-
<i>A. (A.) bella</i> Reitter, 1875	-	-	(1)	-	-	-	1	1
<i>A. (A.) bicolor</i> Erichson, 1846	-	-	-	-	-	1(2)	3	2
<i>A. (A.) carpathica</i> Reitter, 1875	-	1*	(1)	(17)	-	-	19	18
<i>A. (A.) diluta</i> Erichson, 1846	1	(1)	-	(27)	-	2	31	28
<i>A. (A.) elongatula</i> Erichson, 1846	-	-	-	(16)	-	-	16	16
<i>A. (A.) fimetarius</i> (Fabricius, 1792)	5	1	1	(15)	-	(4)	26	19
<i>A. (A.) impressa</i> Erichson, 1846	-	1*	-	-	-	2	3	-
<i>A. (A.) linearis</i> Stephens, 1830	3	3	1 (6)	(26)	-	(4)	43	36
<i>A. (A.) longicornis</i> Thomson, 1863	-	1*	-	-	-	1	2	-
<i>A. (A.) nigrirostris</i> Stephens, 1830	-	1	5 (2)	(21)	-	(3+1*)	32	26
<i>A. (A.) nigriventris</i> Stephens, 1830	6	1	-	-	-	2	9	-
<i>A. (A.) puncticollis</i> Thomson, 1868	-	-	-	(13)	-	-	13	13
<i>A. (A.) pulchra</i> Erichson, 1846	-	2*	(1)	-	-	4	7	1
<i>A. (A.) soror</i> Ganglbauer, 1899	-	-	(1)	-	-	-	1	1
<i>A. (A.) umbrina</i> (Gyllenhal, 1827)	2	1	(1)	(9)	-	(4)	17	14
<i>A. (Atomaria) analis</i> Erichson, 1846	-	4 (1)	3	(33)	-	10 (2)	53	36
<i>A. (A.) apicalis</i> Erichson, 1846	5	1 (1)	6 (2)	(43)	-	(5)	63	51
<i>A. (A.) atra</i> (Herbst, 1793)	3	6	1 (1)	(65)	-	1	77	66
<i>A. (A.) atricapilla</i> Stephens, 1830	2	2 (1)	-	-	-	3	8	1
<i>A. (A.) attila</i> Reitter, 1878	-	-	-	(28)	-	-	28	28
<i>A. (A.) basalis</i> Erichson, 1846	2	-	-	-	-	-	2	-
<i>A. (A.) fuscata</i> (Schönherr, 1808)	7	15 (3)	4 (3)	(39)	-	(4)	75	49
<i>A. (A.) fuscipes</i> (Gyllenhal, 1808)	3	3	-	(20)	-	1	27	20
<i>A. (A.) gibbula</i> Erichson, 1846	6	1	-	-	-	6	13	-
<i>A. (A.) grandicollis</i> Brisout de Bameville, 1882	-	-	-	-	-	1*	1*	-
<i>A. (A.) gravidula</i> Erichson, 1846	4	-	-	-	-	(5)	9	5
<i>A. (A.) gutta</i> Newman, 1834	-	2	1	-	-	1	4	-
<i>A. (A.) mesomela</i> (Herbst, 1792)	6	1*	-	-	-	1	8	-
<i>A. (A.) morio</i> Kolenati, 1846	-	1	-	-	-	2	3	-
<i>A. (A.) munda</i> Erichson, 1846	5	16	-	-	-	1	22	-
<i>A. (A.) nigripennis</i> (Kugelann, 1794)	8	2	-	-	-	1	11	-
<i>A. (A.) ornata</i> Heer, 1841	-	1*	-	-	-	7	8	-
<i>A. (A.) peltata</i> Kraatz, 1853	-	1	1	-	-	1*	3	-
<i>A. (A.) plicata</i> Reitter, 1875	-	-	-	-	-	6	6	-

Species	Zoological collections						Sum	
	NMNH	SMNH	SIZK	KOC	MNKU	ZMKU	S <sub>all</sub>	S <sub>carp</sub>
<i>A. (A.) pusilla</i> (Paykull, 1798)	10	4	–	(27)	–	7	48	27
<i>A. (A.) rubella</i> Heer, 1841	–	–	(1)	–	–	–	1	1
<i>A. (A.) testacea</i> Stephens, 1830	9	6	3	(31)	–	4	53	31
<i>A. (A.) turgida</i> Erichson, 1846	3	2 (1)	–	–	–	10	16	1
<i>A. (A.) unifasciata</i> Erichson, 1846	4	–	–	–	–	3	7	–
<i>A. (A.) versicolor</i> Erichson, 1846	1	–	–	–	–	–	1	–
<i>A. (A.) zetterstedti</i> (Zetterstedt, 1838)	–	1*	–	–	–	1	2	–
<i>Caenoscelis ferruginea</i> (Sahlberg, 1820)	–	1	1	(8)	2	2	14	8
<i>C. sibirica</i> Reitter, 1889	–	–	1	–	3	–	4	–
<i>C. subdeplanata</i> Brisout de Barneville, 1882	–	–	–	–	–	1*	1*	–
<i>Cryptophagus acutangulus</i> Gyllenhal, 1827	4	14	14 (1)	(85)	–	1 (3)	122	89
<i>C. axillaris</i> Reitter, 1875	–	–	–	(28)	–	(3)	31	31
<i>C. badius</i> Sturm, 1845	4	1*	(3)	–	–	2	10	3
<i>C. baldensis</i> Erichson, 1846	–	1*	–	–	–	–	1	–
<i>C. cellaris</i> (Scopoli, 1763)	2	21+1*	9	–	–	7	40	–
<i>C. corticinus</i> Thomson, 1863	–	1	2	–	–	–	3	–
<i>C. croaticus</i> Reitter, 1879	–	1*	3	–	–	3	7	–
<i>C. cylindrellus</i> Johnson, 2007	–	3	–	–	–	3	6	–
<i>C. dentatus</i> (Herbst, 1793)	8	16 (7)	2	(46)	–	(5)	84	58
<i>C. denticulatus</i> Heer, 1841	–	–	23 (12)	–	–	–	35	12
<i>C. dilutus</i> Reitter, 1874	–	–	1	(5)	–	–	6	5
<i>C. distinguendus</i> Sturm, 1845	1	5	1 (1)	(27)	–	10	45	28
<i>C. dorsalis</i> C.R.Sahlberg, 1819	–	5	12	–	–	5	22	–
<i>C. fallax</i> Balfour-Browne, 1953	–	2	(5)	–	–	1	8	5
<i>C. falcozi</i> Roubal, 1927	–	–	(1)	–	–	–	1	1
<i>C. fasciatus</i> Kraatz, 1852	–	–	–	–	–	1 (1)	2	1
<i>C. fuscicornis</i> Sturm, 1845	1	–	–	(35)	–	(1)	37	36
<i>C. hexagonalis</i> Tourmier, 1872	–	1*	–	–	–	–	1*	–
<i>C. jakowlewi</i> Reitter, 1888	–	–	4	–	–	–	4	–
<i>C. labilis</i> Erichson, 1846	1	–	–	–	–	–	1	–
<i>C. lapidicola</i> Reitter, 1880	–	–	–	–	–	1*	1*	–
<i>C. lapponicus</i> Gyllenhal, 1827	–	–	4	(56)	–	1	61	56
<i>C. laticollis</i> Lucas, 1846	7	10 (3)	2	(79)	–	5	106	82
<i>C. lycoperdi</i> (Scopoli, 1763)	1	3	4	(16)	–	3	27	16
<i>C. lysolmi</i> Munster, 1932	–	–	(1)	–	–	–	1	1
<i>C. micaceus</i> Rey, 1889	–	–	–	(4)	–	–	4	4
<i>C. montanus</i> Brisout, 1863	–	–	–	(64)	–	(1)	65	65
<i>C. nitidulus</i> Miller, 1858	–	–	–	(15)	–	1*	15+1*	15
<i>C. pallidus</i> Sturm, 1845	–	1	2	(28)	–	1 (7)	39	35
<i>C. pilosus</i> Gyllenhal, 1827	1	3	7 (6)	–	–	7	24	6
<i>C. populi</i> Paykull, 1800	4	–	1	–	–	–	5	–
<i>C. pubescens</i> Sturm, 1845	6	3	2	–	–	5	16	–
<i>C. puncticollis</i> P. H. Lucas, 1846	–	2	–	–	–	–	2	–
<i>C. punctipennis</i> Brisout, 1863	–	–	–	(63)	–	–	63	63
<i>C. quercinus</i> Kraatz, 1852	–	2	1	(68)	–	3	74	68
<i>C. reflexicollis</i> Reitter, 1876	–	(1)	–	(10)	–	–	11	11
<i>C. reflexus</i> Rey, 1889	–	–	–	(37)	–	–	37	37
<i>C. saginatus</i> Sturm, 1845	7	–	16	(2)	–	7	32	2
<i>C. scanicus</i> Linnaeus, 1758	2	2 (1)	4 (2)	(88)	–	13 (2)	114	93
<i>C. schmidti</i> Sturm, 1845	1	1*	(5)	–	–	5	12	5



Species	Zoological collections						Sum	
	NMNH	SMNH	SIZK	KOC	MNKU	ZMKU	S <sub>all</sub>	S <sub>carp</sub>
<i>C. scutellatus</i> Newman, 1834	8	4	40	(67)	–	6	125	67
<i>C. setulosus</i> Sturm, 1845	6	1	1	–	–	1 (2)	11	2
<i>C. simplex</i> Miller, 1858	–	1*	–	–	–	1*	2	–
<i>C. straussi</i> Ganglbauer, 1897	–	–	–	–	–	1	1	–
<i>C. subdepressus</i> Gyllenhal, 1827	–	1	–	(25)	–	1	27	25
<i>C. subfumatus</i> Kraatz, 1856	–	(1)	8	(32)	–	7	48	33
<i>C. uncinatus</i> Stephens, 1830	–	–	–	(17)	–	5	22	17
<i>Curelius dilutus</i> Reitter, 1883	–	–	–	–	–	1*	1*	–
<i>C. exiguus</i> (Erichson, 1846)	9	1	–	(9)	6	1	26	9
<i>Ephistemus globulus</i> (Paykull, 1798)	16	7 (2)	–	–	91	1 (3)	120	5
<i>Henoticus serratus</i> (Gyllenhal, 1808)	4	1	–	(13)	6	1	25	13
<i>Hypocoprus laridioides</i> (Motschulsky, 1839)	–	–	–	–	5	–	5	–
<i>Micrambe abietis</i> (Paykull, 1798)	1	1	5	(7)	–	4	18	7
<i>M. perrisi</i> (Brisout de Barneville, 1882)	–	–	–	–	–	7	7	–
<i>M. ulicis</i> (Stephens, 1830)	3	–	–	(5)	–	2	10	5
<i>M. (Micrambinus) bimaculata</i> (Panzer, 1798)	4	–	6	–	–	–	10	–
<i>Ootyplus globosus</i> (Waltl, 1838)	–	–	–	(6)	2 (1)	–	9	7
<i>Paramecosoma melanocephalum</i> (Herbst, 1793)	2	1+1*	1	(14)	–	1*(4)	24	18
<i>Pteryngium crenatum</i> (Fabricius, 1798)	–	1	1	(25)	(1)	3	31	26
<i>Spaniophaeus termitophilus</i> (Kieseritzky, 1936)	–	–	–	–	3	–	3	–
<i>Spavius glaber</i> (Gyllenhal, 1808)	3	3	–	(19)	1	6 (1)	33	20
<i>Sternodea baudii</i> Reitter, 1875	–	(1)	–	(2)	–	2	5	3
<i>S. lederi</i> Reitter, 1876	–	–	–	–	–	1*	1	–
<i>S. miki</i> Reitter, 1888	–	–	–	–	6	1*	7	–
<i>S. raddei</i> Reitter, 1876	–	–	–	–	1	1*	2	–
<i>Telmatophilus brevicollis</i> Aubé, 1862	–	1*	–	–	23 (1)	(5)	30	6
<i>T. caricis</i> (Olivier, 1790)	3	1*	–	(4)	7 (2)	6	23	6
<i>T. sparganii</i> (A. Ahrens, 1812)	–	(1)	–	–	21	1*	23	1
<i>T. typhae</i> (Fallén, 1802)	3	1+1*	–	(33)	78	1 (4)	121	37

The remaining 39 species are known for the Ukrainian Carpathians only from literature. Among them, 21 species were mentioned simultaneously in the articles of M. Łomnicki [13, 14] and J. Roubal [22], 2 species (*Atomaria scutellaris*, *Caenoscelis sibirica*) mentioned only in J. Roubal, 7 – only in the works of M. Łomnicki, 1 species (*Atomaria norica*) is in the works of M. Nowicki [17], L. Miller [16] and M. Łomnicki [13], another species (*Cryptophagus confusus*) – only in the work of S. Tenenbaum [23]. Almost all of these species are known in collections, but those specimens derive from other regions: in particular, 30 of the 39 species mentioned above were discovered by the author among collections outside the Carpathians (Table 2).

## Discussion

Sequentially consider the following important features of the collections: their content and volume, indexes of value, peculiarities of collections from the Carpathians, personal collections and migrations of collections, a brief overview of the most famous collectors.

### ***Content and volume estimations of the collections***

At the present moment, we can assume that this study covers almost all large collections of silken fungus beetles that are stored in the natural museums of Ukraine. The volume of known collections, according to the author, is at least 90% of the possible volume of all collections that can be found in Ukraine. The collections with a plenty of gatherings from the Ukrainian Carpathians are particularly valuable because it is as a region with a unique diversity of natural landscapes and habitats, and this influences on a significant diversity of its fauna, including Cryptophagidae.

The museum collections described in this work contain information on 1346 individuals of 115 species of 16 genera of the Cryptophagidae family, mainly from the territory of Ukraine, and adjacent territories of neighboring countries, particularly the Carpathians, the East European Upland and the Caucasus. Also, it should be noted that 10 species of the general list are not represented by actual specimens, and collections contain only their labels. Two species of the genus *Atomaria* (*A. alpina* and *A. grandicollis*), 1 species of the genus *Caenoscelis* (*C. subdeplanata*), 5 species of the genus *Cryptophagus* (*C. baldensis*, *C. hexagonalis*, *C. lapidicola*, *C. nitidulus*, *C. simplex*), 1 species of the genus *Curelius* (*C. dilutus*) and 1 species of the genus *Sternodea* (*S. lederi*). Separately, the author's collection includes 1657 specimens of Cryptophagidae, which belong to 13 genera and 57 species, 9 of which are represented exclusively in this collection.

There still remains an open question about the presence of Cryptophagidae in the part of the personal collections of C. Hormuzaki, K. Zelinka, E. Botezat, O. Marcu, K. Penecke, dated from 1872 to 1937 years; such collections could be found in the zoological collections of Yurii Fedkovych Chernivtsi National University [8], National Museum of Natural History of the NAS of Ukraine (besides the collection of J.H. Hochhuth), and Zoological Museum of Lviv National University between the funds.

### ***Indices of value of the collections***

The author considers it expedient to consider the following estimates of the value of the collections on the basis of five criteria:

1) the number of specimens; if taking into account exclusively the collections analyzed in this work, the number of specimens varies from 214 (collection of the National Museum of Natural History) to 341 specimens (collection of the Museum of Natural History of V. Karazin Kharkiv National University);

2) the number of species; the number of species of the family leads from 21 (collection of the Museum of Natural History of V. Karazin Kharkiv National University) to 85 species (collection of the Zoological Museum of T. Shevchenko Kyiv National University);

3) the number of genera; the largest number of genera is presented in the collection of the Zoological Museum of Kyiv University and in the collection of the State Museum of Natural History of the NAS of Ukraine (both collections contain 12 genera), the smallest – in the collection of V. Lazorko in the funds of the I.I. Schmalhausen Institute of Zoology of the NAS of Ukraine (6 genera);

4) the number of unique species is the number of species that are represented only in some of the collections, comparing to other analyzed collections, for example, in the collection of SMNH there are 6 species of Cryptophagids (e.g., *Cryptophagus subdepressus*, *C. reflexicollis*), which are known only from this collection;

5) the number of type specimens is a very important indicator, but there are no specimens in the analyzed collections that would have a label marked as a "type."

An additional criterium may be the number or part of specimens, the age of which is more than 100 years (older than 18-19 centuries), and the presence of old personal collections, because they play an important role in the evaluation of time changes in the fauna of the family.

The following collections are the principal ones under these parameters (tab. 3):

- by the number of specimens – a collection of the Museum of Natural History of V. Karazin Kharkiv National University (341 specimens), a collection of the Zoological Museum of T. Shevchenko Kyiv National University (304 specimens) and the collection of V. Lazorko in the funds of the Institute of Zoology of the NAS of Ukraine (263 specimens);
- by number of species – collection of the Zoological Museum of T. Shevchenko Kyiv National University (85 species) and the State Museum of Natural History of the NAS of Ukraine (71 species);
- according to the uniqueness of collections, a collection of the Zoological Museum of T. Shevchenko Kyiv National University holds the leading position: there are 12 species known only from this collection, the 2nd and 3rd collections are: the collection of V. Lazorko from the funds of the Institute of I.I. Schmalhausen Institute of Zoology of the NAS of Ukraine (10 species) and the collection of the Museum of Natural History of V. Karazin Kharkiv National University (6 species).

Table 3

Indices of uniqueness of museum collections of Cryptophagids

Species	Zoological collections					
	NMNH	SMNH	SIZK	KOC	MNKU	ZMKU
Species from the Carpathians	0	15	17	57	7	23
All of the species	50	71	48	57	21	85
Number of genera	9	12	6	13	11	12
Number of samples	214	224	263	1657	341	304
Number of unique species	3	2	10	7	6	12

#### Carpathian gatherings in collections

The richest for the number of species from the Carpathians – is the author's collection (57 species), the second one is the collection of ZMKU (23 species), the third most significant is the collection of V. Lazorko in IZAN (48 species in general and 17 carpathian species).

We have the following distribution of most common species collected in the Carpathians:

- presented simultaneously in four collections – three species (*Atomaria fuscata*, *A. apicalis*, *Cryptophagus scanicus*);
- presented simultaneously in three collections – six species (*Antherophagus pallens*, *Atomaria linearis*, *A. nigrirostris*, *A. umbrina*, *A. analis*, *Cryptophagus acutangulus*, *C. dentatus*);
- presented simultaneously in two collections – 21 species, 10 of which are presented in five collections of six (including the author's collection) (*Atomaria silaceus*, *A. fimetarius*, *A. atra*, *Cryptophagus distinguendus*, *C. laticollis*, *Paramecosoma melanocephalum*, *Pteryngium crenatum*, *Spavius glaber*, *Telmatophilus caricis*, *T. typhae*).

In total, of the 122 species of Cryptophagidae recorded in the investigated collections (along with the author's collection), 78 species (64%) occur in the Carpathian region, while

the remaining 44 species are represented in collections only by specimens from territories outside the Carpathians.

Some species of the general list of the Carpathian Cryptophagids, which are not confirmed by museum specimens, have unequivocal evidence of the presence in the Carpathian region in literature or available among the author's collections. One of the most complete lists of fauna of the region is the articles of M. Łomnicki [14] and J. Roubal [22]. In the text of both works there are 21 species from the list, 7 species are indicated only by M. Łomnicki, and 2 – only by J. Roubal. Other reviews are less in amount and most of them do not contain unique species (with the exception of the works of M. Nowicki [17] and L. Miller [16] [*Atomaria norica*], and the works of S. Tenenbaum [23] [*Cryptophagus confusus*]).

#### ***Personal collections and "migrations" of the collections***

Among the investigated collections, the collections, created by the famous collectors O. Marcu, K. Penecke, J.H. Hochhuth and M. Łomnicki, have a particular value, because we can see the taxonomy, diagnostics and nomenclature of family species in the sense of the highly qualified entomologists of that time.

The collection of O. Marcu has a difficult history of "migration" in the times during and after World War II, in particular, it has experienced the conveyance from territory of Austria-Hungary, in particular to Chernivtsi, and then to Kyiv. The collection of J.H. Hochhuth changed its location in several different institutions, including the first Kyiv Gymnasium, the Kyiv Pedagogical Museum, the Zoological Museum of T. Shevchenko Kyiv National University, the Zoological Museum of the Academy of Sciences of Ukraine, the Institute of Zoology of the Academy of Sciences of the USSR and the National Museum of Natural History of the NAS of Ukraine [26].

Everything testifies the remarkable attention of colleagues and custodians of funds to the preservation of collections and this provides an opportunity to compare past and present fauna and knowledge about it. Such examples demonstrate that at all times and periods of academic and university difficulties the collections are regarded as one of the highest values, and entomologists of that time were made utmost efforts to preserve the collections, despite changes in the borders of the states, the status of institutions and their financing.

#### ***Famous collectors***

Collections of Cryptophagids are created due to the work of dozens of collectors of different times, different countries and institutions, both academic and educational. Among them, it is important to note the following constellation of researchers:

- Bartenev, Aleksandr Fedorovich (1953-2015), Ukrainian entomologist, specialist in coleopterology, especially Cerambycidae, worked in Department of Zoology and Animal Ecology, Kharkiv National University, there are 4 records in database about 5 specimens of 3 species from Crimea and Baikal, which are stored in MNKU collection;
- Donets-Zakharzhevsky, Dmytro Andriyovich (1784-1871), Ukrainian scientist and collector, a descendant of famous noble Zakharzhevsky family, an honorary citizen of Zmiiv. The database contains 8 records of 11 samples of 6 species from Hungary, France, Germany and Ukraine (Kharkiv region), which are stored in the MNKU;
- Drovalenko, Aleksandr Nikolayevich (born in 1966), Ukrainian entomologist, head of the department of invertebrates of the Museum of Natural History of V. Karazin Kharkiv National University, specialist in coleopterology. In the database are 44 records of 138 specimens of 10 species of Cryptophagidae, collected mainly in the Kharkiv region, Crimea and Podillya, and specimens are stored in the MNKU;

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- Hochhuth, Jögnann Heinrich (1810-1872), Ukrainian naturalist, first of all entomologist, in the database there are 57 records of 180 specimens of 50 species of Cryptophagids mainly from different localities of the Kyiv region; specimens are stored in NMNH;
  - Grama, Viktor Mykytovych (born in 1937), Ukrainian entomologist, specialist in coleopterology, especially Hydrophiloidea. The database contains 17 records of 23 specimens of 6 species of Cryptophagidae from Kharkiv region and Belgorod Oblast, specimens are stored in NMNH;
  - Krynytsky, Ivan Andriyovych (1797-1838), Ukrainian zoologist, Professor of Kharkiv University, specialist in entomology and malacology, in particular, the author of a number of taxa. The database contains 4 records of 4 species of Cryptophagidae collected on the environs of Kharkiv during 1830-1831. Specimens are stored in MNKU;
  - Lazorko, Volodymyr (1909-1990), Ukrainian (later Canadian) entomologist, specialist in coleopterology, especially Cerambycidae. The database has 158 records (in fact, the entire complete collection of Cryptophagidae in SIZK) of 263 specimens of 48 species from a wide range of regions, including the the Carpathians, Podillya, Austria and Sweden. Specimens are stored in SIZK;
  - Lgocki, Henryk (1861-1917), Polish entomologist, specialist in coleopterology, in the database there are 2 records of 2 species of Cryptophagidae from Podillya and Prykarpattya, which are stored in SMNH;
  - Łomnicki, Marian Alojzy (1845-1915), Polish entomologist, specialist in coleopterology, in the database there are 7 records of 7 species of Cryptophagidae in SMNH, which we are associated with the name of M. Łomnicki (direct evidence, including label inscriptions, is not available, but this is supposed on the basis of his publications and dates of the collection of known specimens in the SMNH);
  - Marcu, Orest (1898-1973), Romanian entomologist, specialist in coleopterology, the database contains 136 records of 304 specimens of 85 species, which are collected or identified by O. Marcu. In fact, this is almost whole collection of Cryptophagidae in ZMKU;
  - Medvedev, Sergey Ivanovich (1899-1979), Ukrainian entomologist, specialist in coleopterology, especially Scarabaeidae, and the larvae of beetles. The database contains 21 record of 27 specimens of 8 species of Cryptophagidae from Kharkiv region, Luhansk region, Crimea, Dnieper Ukraine. Specimens are stored in MNKU;
  - Penecke, Karl Alfons (1858-1944?), Austrian geologist, paleontologist and entomologist, specialist in coleopterology, in particular Curculionidae. The database contains 136 records of 304 specimens of 85 species of Cryptophagids from Bukovina and the other territory of former Austria-Hungary, which are stored in ZMKU in the collection of O. Marcu and K. Penecke;
  - Reitter, Edmund (1845-1920), Austrian entomologist, specialist in coleopterology. In the database there are 2 records of 2 species of Cryptophagidae. One specimen is from Austria (Carinthia) and second one is from Crimea (Feodosiya), which are stored in the MNKU. Both labels are rewritten, not original;
  - Rosenhauer, Wilhelm Gottlieb (1813-1881), German entomologist, specialist in coleopterology, in particular systematics and taxonomy. The database contains 2 records of 4 specimens of 2 species of Cryptophagids from Austria and Germany stored in NMNH among the specimens of the J.H. Hochhuth's collection;
  - Solodovnykova, Vira Serhiyivna (1930-2004), Ukrainian entomologist, specialist in coleopterology, especially Curculionidae; there are 6 records in database of 6 specimens

of 3 species of Cryptophagidae from Kharkiv region, Crimea and Dagestan, which are stored in MNKU;

- Suffrian, Christian Wilhelm Ludwig Eduard (1805-1876), German entomologist, specialist in coleopterology, particularly Chrysomelidae. There are 3 records in the database of 10 specimens of 3 species of Cryptophagidae of Germany, which are stored in NMNH among the specimens of the J.H. Hochhuth's collection.

Unfortunately, there are no specimens from the collections of such well-known researchers and authors as J. Roubal, S. Tenenbaum, M. Nowicki, J. Müller and L. Miller was found. It is possible that they are stored in natural museums of other countries, such as Slovakia, the Czech Republic, Hungary, Poland or Austria.

### Conclusions

The analysis of the data presented in this review allows to confirm the following:

1. The collections described in this paper contain information on 122 species of 16 genera of the Cryptophagidae family, mainly from the territory of Ukraine, and the surrounding regions, the Carpathians, East European Upland and Caucasus. Among over 3000 copies in the general specimen list, including the author's collection, the proportion of new collections reaches 54% (n = 1657 specimens, 57 species).

2. Due to the collections accumulated today in the natural museums of Ukraine, we have objective data valid for verification concerning the existence in 115 species of Cryptophagidae in the concerned regions, and 10 species of this general list indicated on the labels, but not represented in collections by factual specimens.

3. The richest species composition is the collection of Cryptophagids is in the Zoological Museum of T. Shevchenko Kyiv National University, containing 304 specimens of 85 species, which also contains the largest number of species from the Carpathian region (23 species). The second place is the collection of V. Lazorko from the funds of the I.I. Schmalhausen Institute of Zoology of the NAS of Ukraine (17 species).

4. The collection of the Zoological Museum of T. Shevchenko Kyiv National University holds the leading place in the uniqueness of collections: there are 12 species that are known only in this collection. The second largest number of unique specimens is the collection of V. Lazorko (10 species).

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#### **Криптофагіди (Coleoptera) у колекціях України: види, зразки та колектори**

Досліджено колекції жуків з родини Cryptophagidae (Cucujoidea, Coleoptera), що зберігаються в природничих музеях України: трьох академічних та двох університетських (Державний природознавчий музей, Національний науково-природничий музей та Інститут зоології НАНУ, Зоологічний музей Київського національного університету, Музей природи Харківського національного університету), а також у робочих зборах автора. Проаналізовано обсяги колекцій та стан їхньої збереженості. Оцінено представленість різних видів у колекціях, як в цілому, так і стосовно фауни Карпат. Загалом в музейних колекціях зберігається 1346 екземплярів криптофагід, кожна з колекцій містить близько 210-340 особин, всі вони зберігаються в окремих коробках та наколоті на ентомологічні голки. Збори автора включають 1657 особин 57 видів, які, здебільшого, зберігаються на ватних матрациках. Загалом у всіх шести колекціях, включно з колекцією автора, налічується 122 види Cryptophagidae, що представляють 16 родів, у кожній колекції є від 21 до 85 видів цієї родини. Частина зразків криптофагід в колекціях безслідно втрачена з різних причин, в 10 випадках є лише голки з етикетками без самих зразків, тому окремі види (напр., *Cryptophagus nitidulus*, *C. hexagonalis*) представлені у колекціях умовно, лише етикетками. При ревізії матеріалів увагу приділено таксономічним змінам, через які у публікаціях та у фактичному матеріалі вжито різні видові та родові назви, які є лише синонімами. Автором оцінено унікальність кожної з колекцій, яку визначали за п'ятьма параметрами: кількістю зразків, які представлені виключно в окремій з музейних колекцій, кількістю видів та родів родини, кількістю зразків та типових зразків у колекції. За більшістю з цих показників лідером є колекція Зоологічного музею Київського національного університету. Всі дані включено до створеної автором єдиної бази даних, в якій наведено стислі анотації, що містять відомості про колекційні зразки, назви регіонів та місць збору, дати збору, колекторів або власників колекції, а також примітки з уточненнями місць або деталями перевизначень.

**Ключові слова:** криптофагіди, колекції, природничі музеї, видове різноманіття.