Staphylinids (Coleoptera, Staphylinidae) of Ukrainian metropolises

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Introduction

The most important representatives of natural and transformed biocoenoses are insects. The cities are not exceptions, especially large ones, in which the urban biocoenoses are the specific environment for many species of Insecta. Among them, the largest order is beetles (Coleoptera), in which staphylinids (Coleoptera, Staphylinidae) is one of the dominating groups both by species composition and abundance. Fauna and biology of staphylinids, especially in natural ecosystems are subjects of numerous studies, including for the territory of Ukraine (Frank & Aln Kee-Long, 2011; Nasir et al., 2012; Grebenikov & Ankin, 2015; Parmain et al., 2015; Kanau et al., 2016; Bietz et al., 2018; Lutska, 2019; Salntiska & Solodovnikov, 2019). By contrast to some other beetles (for example Carabidae), there are not many studies on staphylinids in urban landscapes of Europe; the data on them are poor even at faunistic level. More or less detailed studies of the species composition of staphylinids, their abundance and species richness of many species of beetles have been undertaken for a number of cities of Central Europe (Klaussnitzer et al., 1980, 1982; Klaussnitzer, 1986, 1990; Franzén, 1992a, 1992b; Magura et al., 2013), Belarus (Molodova, 1991; Halinowskii & Shapuro, 2007) and Russia (Shalaev & Dogdanov, 2008), with 30–140 species recorded for each. These studies mainly focused on the main issues of faunisticians, and to a lesser extent – ecological peculiarities and biotopic distribution of species. However, these studies allowed interesting data to be obtained and preliminary evaluation to be made of Staphylinidae in the conditions of urban biocoenoses.

The available studies on staphylinids of Ukraine (also by contrast to well studied species of ground beetles) are fragmented. They superficially describe some structures of the communities in particular cities – Kyiv, Dnipro, Kharkiv (Dekhtyarova, 2002; Faly & Glotov, 2012; Petrenko, 2005; Nazarenko & Petrenko, 2007; Komaromi et al., 2018). Nonetheless, in general the staphylinids in urban biocoenoses of Ukraine are studied somewhat better than for example lamellicorn beetles (Scarabaeidoidea) and clown beetles (Histeridae) (Puchkov et al., 2017, 2018). Furthermore, the comparative analysis of the fauna in different cities of Ukraine is available only for some ground beetles (Puchkov et al., 2019), and is completely absent for other species of beetles. Therefore, better understanding of the peculiarities of formation of the staphylinid fauna in the conditions of a metropolis requires not only in-depth analysis of ecologic-faunistic structure of communities of this group of beetles within one city, but also comparative surveys of the fauna in several localities.

The objective of our study was elaboration of species composition of Staphylinidae in urban biocoenoses of three cities of Ukraine, with analysis of peculiarities of their fauna, characterization of the ecological structure of their communities.

Material and methods

The basis of the study was formed by our own collections and observations in the cities Dnipro (2010–2015), Kyiv and Kharkiv (2017–2019) during surveys on the species composition and ecological structure of beetle communities which occur in the herpetobium ( litter fauna) of the cities’ main green zones. In Kharkiv the records were obtained from city parks, Kharkiv Forest Park, plantations in the central part of the city (Pushkinskaia street, the territory of the Scientific and Research Center of Forestry and Agro-Forest Melioration named after H. N. Vysotsky), plantations in the peripheral parts of the city (territory of the Botanical Garden of the H. S. Skovoroda Kharkiv National Pedagogic University and partly the housing complex Saltovka), gardens of private houses on the outskirts of Dnipro and Kyiv. The main purpose of the study was to obtain a list of species from different communities of any species of beetles of Carabidae), there are not many studies on staphylinids in urban landscapes. They superficially describe some structures of the communities in particular cities – Kyiv, Dnipro, Kharkiv (Dekhtyarova, 2002; Faly & Glotov, 2012; Petrenko, 2005; Nazarenko & Petrenko, 2007; Komaromi et al., 2018). Nonetheless, in general the staphylinids in urban biocoenoses of Ukraine are studied somewhat better than for example lamellicorn beetles (Scarabaeidoidea) and clown beetles (Histeridae) (Puchkov et al., 2017, 2018). Furthermore, the comparative analysis of the fauna in different cities of Ukraine is available only for some ground beetles (Puchkov et al., 2019), and is completely absent for other species of beetles. Therefore, better understanding of the peculiarities of formation of the staphylinid fauna in the conditions of a metropolis requires not only in-depth analysis of ecologic-faunistic structure of communities of this group of beetles within one city, but also comparative surveys of the fauna in several localities.

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of Kharkiv (Oleksiivka). Their characteristic is completely presented in studies published earlier (Fedory et al., 2018; Koromarin et al., 2018; Putchko et al., 2019). In Dnipro the insects were collected in the territories of some of the city’s parks (Park named after 40 Years of the Liberation of Dnipropetrovsk, Yuri Gagarin Park, Volodia Dubinin Park), Botanical Garden of the Oles Honchar Dnipro National University, and in the ravines located within the city (Tunnelna, Aeroportovskaya Ravines), in the areas of the city’s periphery – in the woodland along the Pobeda Embankment, and forests around the city (Volesko village, Dniprovsko-Oritsky Nature Reserve). Characteristic of certain areas are given in the works of the authors (Faly, 2014; Faly & Brygadyrenko, 2014, 2015; Brygadyrenko & Korolev, 2015; Brygadyrenko, 2016; Faly et al., 2017).

In addition, for faunistic comparison, collections of staphylinids from separate urbocenoses of Kyiv were used (Petrenko, 2005; Nazarenko & Petrenko, 2007).

During the studies, we mainly used soil pit-fall traps (plastic cups of 200 ml capacity filled with 10% solution of acetic acid). The extractions of the material were taken with 10–15 days intervals since late April to early November. In each biotope, 10–30 traps were set. Additionally, the beetles were recorded and collected on itineraries around the city. For the evaluation of the species similarity of insects from certain areas, we used Jaccard coefficients of species similarity presented as a percentage, and the number was determined using absolute values (total number of caught beetles), and the number of specimens by 10-catch days or 10 traps a season.

By the level of number (taking into consideration the captured specimens – around 2,000–5,000 in each city), four groups were distinguished: endemomorph (or abundant, over 10% of the total number of caught beetles), common (or dominant, 1–10%), subdominant (or not common, but constantly found, 0.3–1%), rare (0.1–0.3%) and occasional (or singular, one to five specimens throughout the period of collecting). In smaller extractions (for separate urbocenoses where the total number of captured beetles equaled 1,500 spec.), endomorphs were recognized as the species the share of which exceeded 20% of the total number of beetles in the area, dominants – 3.0–19.9%, subdominants – 0.5–2.9%, rare – 0.2–0.5%, occasional – less than 0.2%. The first three groups (regardless of the number of selection) in the study were considered as common for one or more selected territories. For the evaluation of the species similarity of insects from metropolises (Table 1) on the basis of both our observations and a whole range of data from the literature (Tikhomirova, 2009), the number of all beetle families in them.

The ecological characteristic of staphylinids is given not only for typical species (mainly on the example of their abundance in the urban ceneses of Kharkiv as the most surveyed territory) on the basis of both our observations and a whole range of data from the literature (Tikhomirova, 2009), the number of all beetle families in them.

Results and discussion

Rove beetles (Coleoptera, Staphylinidae), noted in the epigeal habitat of urban ceneses, are one of the dominant groups of coleopterans. In the territory of Kharkiv, according to the records of epigeal beetles in 2017–2018, in taxonomical relation they were inferior only to ground beetles (Carabidae, around 90 species) and snout beetles (Carabidae, 53 species) (Koromarin et al., 2018), but taking into account data of 2019 – only their share of staphylinids equaled 10–30% of the total number of beetles of the epigeal habitat of one or another urban ceneses (compiled with 30–35% for snout beetles and 12–18% for ground beetles).

In total, in the studies of urban ceneses of Kharkiv, Dnipro and Kyiv, according to our own and the literature data (Dekhtyareva, 2002; Petrenko, 2005; Nazarenko & Petrenko, 2007), over 140 species from 66 genera were recorded (Table 1). However, actual data are given for 126 species, because separate representatives of genera Akochara, Anotybus, Atheta, Blehia, Carpelinus, Gyrohypnus, Heterothops, Ichnosaena, Lathrobium, Mycetophorus, Omalius, Oxypoda, Plathystethus, Queides, Sepsophilus, Stenus, Taegius, Xantholinus and especially some representatives of the Aleocharinae subfamily have not been identified so far. Therefore, we can confidently presume that the list of staphylinids of the surveyed metropolises in total will increase to 150–160 species. The largest genus was Philonthus, within which 17 species were observed. Genera Anotybus and Xantholinus were represented by species each, whereas of Taegius – five. Among Aleochara, Blehia, Lathrobium, Queides, Sepsophilus and Taegius, 4 species were recorded. Five more genera (Atheta, Gabrias, Oxypoda, Rugilis, Stenus) were represented by three, and the rest – one-two species. Taking into account that a number of species are so far identified only at the level of genus and even subfamily, the species composition of staphylinids in each metropolis can increase by no less than 20%. Such diversity is not a surprise, taking into account the size of the family, broad ranges and high ecological flexibility of many species. For example, for the Kazan alone (Russia), 141 species of staphylinids have been recorded (Shulaev & Bogdanov, 2008).

Table 1

| Species composition of staphylinids in three metropolises of Ukraine |
|---------------------------------------------------------------|
| **Genera species** | **Kiev** | **Kharkiv** | **Dnipro** |
| Achenium depressum (Gravenhorst, 1802) | – | – | 1 |
| Acidota cruenta (Mannerfelt, 1830) | 1 | – | – |
| Aleochara bipustulata (Linnaeus, 1761) | – | 1 | 1 |
| A. curtula (Cresson, 1777) | – | 1 | – |
| A. lautogota (Gyllenhall, 1810) | – | 2 | – |
| A. laura (Gyllenhall, 1775) | – | 1 | 1 |
| A. rugosus (Fabricius, 1775) | – | 1 | 1 |
| A. sculpturatus (Gravenhorst, 1806) | 1 | – | – |
| Anotybus sp. | 1 | 1 | 1 |
| Arpedium quadratum (Gravenhorst, 1806)* | 1 | – | – |
| Asteromimus immaculatus (Stephens, 1833) | – | – | 1 |
| A. procerus (Gravenhorst, 1806) | – | 1 | – |
| A. rosai (Fabricius, 1790) | – | 1 | – |
| Atheta laticeps (Thomson, 1856)* | – | 1 | – |
| A. perla (Mulsant & Rey, 1873)** | – | – | 1 |
| Atheta sp. | – | 1 | 1 |
| Blastos forcasus (Olivier, 1811)** | – | 1 | – |
| B. procordius Erichson, 1840** | – | – | 1 |
| B. tricornis (Herbst, 1784) | – | 2 | – |
| B. unicumus (Gemm, 1825)** | – | 1 | 1 |
| Blehia sp. | – | 1 | – |
| Brandusia marina (Mulsant & Rey, 1853) | – | – | 1 |
| Bryoseopus cerasus (Gravenhorst, 1806) | 1 | – | – |
| Carpelinus sp. | – | 1 | 1 |
| Cephalocephalus (Linnaeus, 1767) | 1 | – | – |
| Dacelia fallax (Kraatz, 1876)* | – | 1 | – |
| Dinacrae opulentus (Erichson, 1837) | – | 1 | – |
| D. angustula (Gyllenhall, 1810) | – | – | 1 |
| Drysimia castanea (Fabricius, 1873) | 3 | 3 | 3 |
| Drysimia elata (Linnaeus, 1758) | 1 | – | – |
| Falagria stictodora (Gravenhorst, 1806) | 2 | – | 2 |
| Falagria minuta (Stephens, 1832)** | 1 | – | – |
| Gabrias nigritulus (Gravenhorst, 1802) | – | 1 | – |
| G. ocellatus (Kolenati, 1873) | 2 | – | – |
| G. saffragani (Olivier, 1811) | – | – | 1 |
| Gabronsula thermarum Aubé, 1850 | – | – | 1 |
| Gaserotes pectinipes (Fabricius, 1777) | – | 1 | – |
| Gymnusa brevicollis (Paykull, 1800) | – | 1 | – |
| Gymnosoma fracticornis (Muller, 1776) | 1 | – | – |
| Gabrias sp. | 1 | 1 | – |
| Heterothops sp. | – | 1 | – |
| Hypnoglossus angulare (Gaurigliauer, 1895) | – | 1 | – |
| Hybrotus nigricollis (Paykull, 1800) | 2 | – | – |
| Ichneumonas splendida (Gravenhorst, 1806) | 1 | – | – |
| Ichneumonas sp. | – | 1 | – |
| Lathrobium brunipes (Fabricius, 1792) | 1 | – | 1 |
| L. flavipes Hochstal, 1851** | – | 2 | – |
| L. fulvipenne (Gravenhorst, 1806) | – | – | 1 |
| Lathrobium sp. | 1 | 1 | – |
| Leptacanthus batae (Gyllenhall, 1827) | – | – | 1 |
| Leptacanthus gracilis (Gravenhorst, 1802) | – | – | 1 |
| Leptinotus flavolineatus Hochstal, 1849 | – | – | 1 |
| Lordothinus esculenta (Erichson, 1839) | – | – | 1 |

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| Genera, species | Kyiv | Kharkiv | Dnipro |
|-----------------|------|--------|--------|
| X. laevigatus Jacobsen, 1849 | 1    | -      | 1      |
| X. longiventris Heer, 1859 | -    | 2      | 3      |
| X. tricolor (Fabricius, 1787) | 1    | -      | 1      |
| Xantholinus sp. | -    | 1      | -      |
| Z. injerus Gravenhorst, 1802 | 1    | 2      | -      |
| Zyrus funebris (Gravenhorst, 1806) | 1    | 2      | -      |
| Note: * indicates the species is reported for Ukraine in the both editions of the catalogues of staphylinids of the Palearctic (Smetana, 2004; Schülke & Smetana, 2015). ** * - species is not reported for Ukraine in the first edition of the catalogue of staphylinids of the Palearctic (Smetana, 2004). |

Discoveries of some species of staphylinids were interesting in faunistic aspect. In the first edition of the Catalogue of Palearctic Coleoptera (Smetana, 2004), 16 species of Staphylinidae recorded in our study were not mentioned for Ukraine (Table 2). However, later data on some of these species were taken into account, and in the last catalogue of staphylinids of the Palearctic (Schülke & Smetana, 2015), eight species remained unreported for Ukraine: *Arpedium quadratum* (Gravenhorst, 1806), *Attela laticeps* (Thomson, 1856), *Meden apiculatus* (Kraatz, 1857), *Ocaulea rivularis* Muller, 1851, *Philonthus salinus* Kiesenwetter, 1844, *Quedius invae* Grisielli, 1924, *Tortixus pedator* (Gravenhorst, 1806), *Xantholinus gallicus* Coiffait, 1896 (Table 1). This does not mean that they had not been reported for Ukraine earlier, but rather indicates that the authors of the catalogues made insufficient analysis of some of the literature sources, most of which were unfortunately published in limited regional editions (mainly abstracts of papers given at conferences in Ukrainian and Russian). Therefore, *Philonthus salinus* was reported for Zaporizhia Oblast (Velykyi Luh National Park), *Arpedium quadratum*, *Ocaulea rivularis*, *Quedius invae* and *Xantholinus gallicus* – for the outskirts of Kyiv, and *Attela laticeps* – for Dnipro-Orel Nature Reserve and the outskirts of Dnipro and Odessa (Tylulholuki Regional Landscape Park) Oblasts (Nazarenko & Petrenko, 2007; Faly et al., 2011, 2013; Faly & Glotov, 2012). Their discovery was expected rather than surprising, because according to the recent catalogue (Schülke & Smetana, 2015) they have been reported for practically all Ukraine’s neighbouring countries – Hungary, Poland, Slovakia, Moldova and South European Russia. The records of *Meden apiculatus* and *Tortixus pedator* can be considered new for Ukraine, though confirming the novelty of their discovery requires checking a number of regional lists of staphylinids (especially by a number of studies by A. A. Petrenko), as moreover they were also reported in most of Ukraine’s neighbouring countries.

For the separate metropolises the species diversity was much lower, but the number of recorded species practically did not differ. In the epsilon habitat of urban censuses of Kharkiv and Kyiv, 68 species were recorded in each (belonging to 44 and 38 genera respectively) and 67 (39 genera) in Dnipro (Table 1). Some differences were observed in the number of common species of staphylinids. The highest number was observed in Dnipro (28), whereas in the urban censuses of Kyiv and Kharkiv their number was considerably lower – 20 and 18 species respectively (Table 1). At the same time, among them, in all the metropolises, two species (*Staphylus caesareus* and *Drosia canaliculata*) should be identified to eudominants. In urban censuses of Dnipro, the abundant species were also *Philonthus intermedius* and *Xantholinus longiventris*, and in Kharkiv and Kyiv – *Oxypus nitens*. The dominants and subdominants were represented by 18–28 species. Almost two-thirds of staphylinids of the cities were identified to rare and occasional elements.

Significant differences were seen in faunistic comparison of the staphylinid fauna of the different cities. The lowest similarity was observed between the populations of staphylinids of urban censuses of Dnipro and those of Kyiv and Kharkiv (15.3% and 17.5% respectively according to Jaccard’s coefficient). The similarity of the staphylinid faunas of Kyiv and Kharkiv was more than twice as high (36.0%) as in the previous two pairs of cities. Such differences, seem to be due to geographic peculiarities of the regions – forest-steppe (Kyiv, Kharkiv) and steppe (Dnipro) zones, conditioning the distribution of one or the other species with different ecological characteristics and ranges. A similar pattern was seen when comparing only the common species. However, the parameters of similarity were higher, especially between the common staphylinids of Kyiv and Kharkiv (73.9%). The level of similarity of Staphylini.
dae of Dnipro with those of Kyiv and Kharkiv already equaled 28.2% and 37.1%, i.e. was twice as high as in comparison of all the species of staphylinids. To a large extent this is due to the fact that the majority of common species are eurybiotic or forest (in a broad sense) species, occurring in various biotopes over a large territory. Within the transformed bioeconomies an interesting fact is also that the faunistic specificity was seen in staphylinids of the urban territory and the neighbouring agroecosystems of field crops. Comparing our own data on fauna of staphylinids of urban cenoses of Dnipro with those of field crops of the North subzone of the steppe (Dnipropetrovsk oblast, Synelnykovskyi district) according to the data of Sumurov (2009), the faunistic similarity was low (around 30%). Certain differences in species diversity and number of staphylinids were observed also in different biotopes of a single city. This can be seen especially clearly on the example of Kharkiv (Table 2, 4).

### Table 2

Species composition and abundance of staphylinids in different urban cenoses of Kharkiv (mean for 2017–2019)

| Species | City parks | Forest-park | Plantations on the outskirts | Plantations in the center | Area of private housing | Share of the species, % |
|---------|------------|-------------|------------------------------|--------------------------|-------------------------|-------------------------|
| Alesochora bipunctata Linnaeus, 1760 | – | – | 1 | 1 | – | 0.13 |
| A. laevigata Gyllenhal, 1810 | – | – | 2 | 1 | – | 0.32 |
| Alesochora sp. | 1 | – | 1 | 1 | – | 0.13 |
| Aleocharinae gen. sp. | 2 | 2 | 1 | 2 | 2 | 2.16 |
| Anoplius irregularis Gravenhorst, 1806 | 1 | 1 | 1 | 2 | 2 | 2.23 |
| A. imestus Graven, 1806 | 1 | – | 1 | – | – | 0.09 |
| A. rugosus Hochhuth, 1849 | 1 | 1 | 1 | 1 | – | 0.13 |
| A. rugosus Fabricius, 1775 | 1 | – | – | – | – | 0.04 |
| A. sculptureatus Gravenhorst, 1806 | 1 | 1 | – | 1 | 1 | 0.13 |
| Astenes proceraeus Gravenhorst, 1806 | – | – | 1 | 1 | – | 0.09 |
| Astropusus admi Rossi, 1790 | 1 | – | 1 | 1 | – | 0.13 |
| Atelus sp. | 1 | 1 | 1 | 1 | – | 0.16 |
| Drausilla canaliculata Fabricius, 1787 | 2 | 1 | 3 | 3 | 3 | 23.87 |
| Ennas hirtus Linnaeus, 1758 | – | – | 1 | – | – | 0.04 |
| Gabrius oseticus Kolenati, 1846 | 1 | 1 | 2 | 2 | – | 0.78 |
| Gavrobrotus thermannii Aubé, 1850 | – | – | 2 | 1 | – | 0.23 |
| Gauropsus fuscipes (Fabricius, 1787) | – | – | – | – | 1 | 0.04 |
| Gyropus sp. | – | – | – | – | 1 | 0.04 |
| Heterochrorn sp. | – | – | 1 | 1 | – | 0.09 |
| Ichneumon sp. | – | – | 1 | 1 | – | 0.09 |
| Lathrobium brunipennis (Fabricius, 1792) | – | 1 | – | – | – | 0.04 |
| Lepisthus flavicinctus Hochhuth, 1849 | 1 | – | – | 1 | – | 0.19 |
| Mycetophorus sp. | – | – | – | 1 | – | 0.04 |
| Oxypoda brunipennis Fabricius, 1781 | 1 | 2 | 2 | 1 | 1 | 1.04 |
| O. niteris Schiavik, 1781 | 1 | 2 | 2 | 3 | 2 | 5.03 |
| O. polypus Fabricius, 1781 | 1 | 1 | – | – | – | 0.16 |
| O. elongatus Fabricius, 1800 | 1 | 2 | 1 | 1 | 1 | 0.55 |
| Omalaus likeule Paykull, 1789 | 2 | 1 | 1 | 1 | – | 0.55 |
| O. muscicola Thomson, 1860 | 1 | – | – | 1 | – | 0.16 |
| Ortholestes marinus Linnaeus, 1758 | 1 | 1 | – | – | 1 | 0.09 |
| Ophiusa punctulata (Goeze, 1777) | 1 | – | – | – | 1 | 0.04 |
| Oxypoda sp. | 1 | – | 1 | 2 | 1 | 0.58 |
| Pseudopuras fuscipes Curtis, 1826 | 1 | 1 | 1 | – | – | 0.13 |
| P. littoralis Gravenhorst, 1802 | – | – | 1 | 1 | – | 0.07 |
| Philonthus carbonarius Gravenhorst, 1802 | 1 | 1 | 1 | 1 | – | 0.26 |
| P. cobeanus Sturm, 1832 | – | – | 1 | – | – | 0.07 |
| P. decorus Gravenhorst, 1802 | 2 | 2 | 1 | 1 | 1 | 1.77 |
| P. lepida Gravenhorst, 1802 | – | – | 1 | 1 | – | 0.26 |
| P. polita Linnaeus, 1758 | 1 | – | 1 | – | – | 0.07 |
| P. spinipes Sharp, 1874 | – | – | – | – | 1 | 0.13 |
| P. succinctus Thomson, 1860 | 1 | – | – | – | 1 | 0.09 |
| Platyphantes sp. | – | – | – | 1 | – | 0.07 |
| Platysttesius sternicornus Olivier, 1785 | 1 | 1 | 1 | 2 | 1 | 0.46 |
| Raganus subtilis Erichson, 1840 | 1 | 2 | 1 | 2 | 1 | 1.21 |
| Sepedophilus testaceus (Fabricius, 1793) | 1 | 1 | 1 | 1 | – | 0.13 |
| Staphylusius caecaenae Cederhjelm, 1798 | 3 | 3 | 1 | – | 1 | 46.69 |
| S. erythropterus Linnaeus, 1758 | 1 | 1 | – | – | – | 0.19 |
| Sternus cyanolucris Scopoli, 1763 | 1 | 1 | 1 | 1 | – | 0.23 |
| Sternus sp. | – | – | 1 | – | – | 0.04 |
| S. melanocnephalus Fabricius, 1793 | – | – | 1 | 1 | – | 0.04 |
| Tachyporus bipunctatus Fabricius, 1775 | 1 | – | 2 | 1 | 1 | 0.23 |
| T. nitidulus Fabricius, 1781 | 1 | – | 1 | 2 | – | 0.78 |
| T. scutellus Graven, 1803 | 1 | – | 1 | – | – | 0.13 |
| T. soletus Erichson, 1839 | – | – | 1 | 1 | – | 0.09 |
| Tachytporus melanurus Heer, 1839 | 1 | – | 2 | 1 | 1 | 0.62 |
| T. spinipes sp. | – | – | – | – | 1 | 0.04 |
| Xantholinus longivespertini Heer, 1839 | 2 | 1 | 2 | 2 | 2 | 2.91 |
| X. tricolor (Fabricius, 1787) | – | – | 1 | – | – | 0.04 |
| Zyraeus flavicans Gravenhorst, 1806 | 1 | 1 | 2 | 2 | 1 | 1.35 |
| Z. lugens Gravenhorst, 1802 | 1 | 1 | 2 | 2 | 1 | 1.67 |

*Note:* Number of species: total/ common 37/7 28/8 40/11 41/9 24/7 60/18 100.00%.

Average dynamic density of staphylinids (for 10 trap-days/for season) / overall number of the recorded beetles (spec.) 4.24 / 1424 4.01 / 1372 0.91 / 340 2.73 / 919 0.45 / 101 12.27 / 4156.
Aleochara laevigata, Xantholinus longiventris. 37 species were recorded (including only seven common) and quantitatively dominant was spec./10 traps over season. Here, similarly to the Forest-park, the only dominant species was O. nitens. Nine and eleven species respectively were identified among staphylinds in the plantations of the outskirts (40) and the center of city (41 species) and the richest fauna in taxonomical aspect was the one in the green "islands" in the territory of the city, small plots of green plantations (in this case – "islands" in the territory of the city, small plots of green plantations (in this case – territory of Forestry Institute and Botanical Garden of the KNPU), almost not trimmed and mowed, but having been irregularly watered) compared with city’s typical green lawns or garden squares actively visited by the population. A number of counts performed in typical open lawns and in garden squares showed the extreme poverty of the staphylinoid fauna (2–4 species) and their very low number (no more than 0.2 spec./trap-days). In this case, we observed a significant aggregative-insular effect due to the agricultural activity – constant cultivation and digging of soil, use of fertilizers and insecticidal treatments.

The data we obtained on the diversity and abundance of the fauna of staphylinids in urban cenoses of Kharkiv (Table 4) showed the extreme poverty of the staphylinoid fauna in areas of private housing (35.4–36.2%). Maximum similarity was observed when comparing the faunas of staphylinids of green areas of the outskirts of the city, i.e. very high in some small urban cenoses (with favourable microhydrothermal regime) and extremely low – in other areas affected by intense anthropogenic pressure (mainly by trampling which causes significant compaction and dessication of the soil). Low values of the diversity and dynamic density of staphylinids in areas of private housing also could be due to the agricultural activity – constant cultivation and digging of soil, use of fertilizers and insecticidal treatments.

The data we obtained on the diversity and abundance of the fauna of staphylinids at the level of genera, especially in the parks, were close to that for other cities of Central and Eastern Europe (Klausnitzer et al., 1982; Klausnitzer, 1990; Molodova, 1991; Halinouksi, 2006; Nazarenko & Petrenko, 2007; Shulaev & Bogdanov, 2008). At the same time, the peculiarities of the taxonomic composition and number of staphylinids in different city areas caused the comparatively high parameters of their faunistic similarity (Jaccard coefficients ranged within 35.4–68.8%, Fig. 1). The lowest faunistic similarity was observed for the comparison of the plantations of the center and the periphery of the city with that of areas of private housing (35.4–36.2%). Maximum similarity was observed when comparing the species composition of staphylinids in the plantations of the center and the outskirts (68.0%), and also a large city park and the Forest-park (66.7%). Similarity of the faunas of staphylinids of green areas of the outskirts and the center with the parks and forest countryside plots were average (41.7–51.0%, Fig. 1). These parameters can indicate the confinedness of some species of staphylinids to particular urbanized areas.

The range of ecological groups of common species of staphylinids of Kharkiv was quite poor (Table 4), but their quantitative characteristic can to some extent explain the peculiarities of abundance and faunistic similarity of staphylinids in different megalopolises. In terms of biotopic confi-
nerness, in most biocoenoses the polytopic elements dominated (over two thirds of species in some biotopes – up to 80–90% of the number of the family). The quantitative share of forest (Philonthus decors, Staphylinus caesareus), and forest-meadow and meadow-forest (Xantholinus longiventris, species of Zyras genus) species sometimes accounted for half of the staphylinid fauna, but only in the parks and suburban forest. Regarding the diet, as well as diversity and number, the typical carnivorous dominant-ed. Zoosaprophagous (Anotylus insecatus) and zooephytophagous (Olophrum assimile, Omalium rivulare) were represented mainly by subdomi-nant species.

Fig. 1. Dendrogram of faunistic similarity of staphylinids of the main urban cenoses of Kharkiv

Staphylinids are also hard to describe regarding the hygrothermal pre-ferendum, as the temperature and moisture in the litter and cracks in the soil and other substrates where Staphylinidae live significantly differ from such for above-ground conditions (for example two meters above the soil surface). Therefore, distinguishing these groups in relation to temperature and moisture is to some extent subjective and based on the analysis of general microclimatic conditions of one or the other stage, but taking into consideration the available literature data on the impact of these ecological factors onrove beetles (Tikhomirova, 1973; Kamao et al., 2016; Betz et al., 2018). According to thermal preferendum, mesothermophiles dominated (over the half of the species, around 70% of the number, mainly Drusilla candidulata, Gabrius cesetis, Staphylinus caesareus, species of Zyras genus). Conditional megathermophilous (species of Oxyopus genus, Philonthus decors, Ragulis trilis, Xantholinus longiventris) accounted for 6–20% of the number of staphylinids, especially in thinned-out areas. The share of four species of oligothermophyles (mainly Anotylus insecatus, Olophrum assimile and Omalium rivulare) did not exceed 5% of number of Staphylinidae, and their abundance was low in most biocoenoses. By biotopic confinedness, in most of the urban cenoses, polytopic ele-ments dominated, while forest and meadow-forest species dominated in parks. Theremopreferendum, mesothermophiles dominated (over the half of the species, around 70% of the number), and oligothermophyles were represented minimally. By trophic (both species composition and abundance) parameters, typical zoophages dominated, and zoosaprophages and zoophytophages were represented only by subdominant species. According to hygropreferendum, mesophytophiles dominated everywhere. The observed differences are related to the diversity of the conditions in each separate urban cenoses (peculiarities of the vegetation and type of soil and density and mechanical composition, moisture, pattern of anthropo-genic load), determining the structure of population of Staphylinidae.

The conducted research allowed us to analyze the staphylinid fauna of urban cenoses of three metropolises of Ukraine and evaluate their faunistic similarity and briefly characterize the ecological structure. A number of faunistic aspects of the family (peculiarities of formation of taxonomic structure, ecological preferences of dominant species of staphylinids and spatial-temporal characteristic and biological peculiarities) nonetheless require elaboration.

Conclusion

Staphylinids of the epigeal fauna of Ukraine, despite their significant oligodominance, are characterized by rather diverse richness. In urban cenoses of Kyiv, Dnipro and Kharkiv, 140 species from 66 genera were record-ed. Total of 69 (43 genera) were observed in Kyiv, 67 (39 genera) in Dni-pro, 66 species (37 genera) in Kharkiv. In the latest catalogue of staphili-nids of the Palearctic (Schülke & Smetana, 2015), eight species found in our study had not been reported for Ukraine: Atheta quadritum (Gra-venhorst, 1800), Atheta laticeps (Thorson, 1856), Medon apocolis (Kratz, 1857), Ocalea rivularis Muller, 1851, Philonthus salinus Kiernsweutter, 1884, Quadus inverex Griddell, 1924, Tasgius pedator (Gra-venhorst, 1802), Xantholinus gallicus Coiffait, 1956 (Table 1), despite being recorded in the country earlier.

By the number of common species, 29 were found in Dnipro, 21 and 19 species in Kyiv and Kharkiv respectively. At the same time (in all me-galopolises), only two eudominant species were identified: Staphylinus caesareus and Drusilla candidulata. Dominants and subdominants were represented by 18–25 species. Almost two thirds of the staphylinid fauna of cities was identified to rare species. While comparing the fauna of staphylinids of different cities, the lowest similarity was seen between popu-lation of urban cenoses of Dnipro and those in Kyiv and Kharkiv (15.3% and 17.5% respectively by the Jaccard coefficient), whereas the similarity between Staphylinidae of Kyiv and Kharkiv was higher (36.0%). Compari-son of only common species showed higher parameters of faunistic similarity of the species: 73.9% for Kyiv and Kharkiv, and 28.2% and 37.1% for Dnipro and Kyiv and Dnipro and Kharkiv respectively.

The lowest diversity and abundance of staphylinids was seen in the area of private house (24 species, 0.45 spec.). In the Forest-Park, 28 species were recorded. The richest fauna in taxonomic aspect was in the plantations of the outskirts (40) and center of the city (41 species). 37 species of staphylinids were recorded in the city parks. Faunistic simi-larity for different urban cenoses equaled 35.4–68.8%. The lowest was revealed by comparison of plantations in the center and periphery of the city with those in the areas of private house (35.4–36.2%). Maximum parameters of similarity were observed between the areas of the center and outskirts of the city (68.8%), and also large parks and the Forest-Park (66.7%). Similarity of fauna of staphylinids of green areas of the outskirts and the center of the city with parks and forests in the outskirts was average (41.7–51.0%).

By biotopic confinedness, in most of the urban cenoses, polytopic ele-ments dominated, while forest and meadow-forest species dominated in parks. By hygropreferendum, mesothermophiles dominated (over the half of the species, around 70% of the number), and oligothermophyles were represented minimally. By trophic (both species composition and abundance) parameters, typical zoophages dominated, and zoosaprophages and zoophytophages were represented only by subdominant species. According to hygropreferendum, mesophytophiles dominated everywhere. The observed differences are related to the diversity of the conditions in each separate urban cenoses (peculiarities of the vegetation and type of soil and density and mechanical composition, moisture, pattern of anthropo-genic load), determining the structure of population of Staphylinidae.
