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THE GENUS LEIOPUS AUDINET-SERVILLE, 1835 IN WESTERN UKRAINE AND THE INVADING OF MEDITERRANEAN-PONTIC SPECIES LEIOPUS FEMORATUS FAIRMAIRE 1859 (COLEOPTERA: CERAMBYCIDAE: ACANTHOCININI)

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The Genus Leiopus Audinet-Serville, 1835 in Western Ukraine and the invading of mediterranean-pontic species Leiopus femoratus Fairmaire 1859 (Coleoptera: Cerambycidae: Acanthocinini).- Andrew M. Zamoroka[1], [2] And Yaroslav I. Kapelyukh[3].- *Here we present the results of the Leiopus distribution study conducted in Western Ukraine. We identified three Leiopus species, including Leiopus nebulosus (Linnaeus 1758), Leiopus linnei Wallin, Nylander & Kvamme, 2009, and Leiopus femoratus Fairmaire 1859. The L. femoratus species was recorded in Western Ukraine for the first time. Also, we found that L. femoratus was widely distributed throughout the main physiographic regions of Western Ukraine, including Podillya Eminence, Pre-Carpathian Lowland, Carpathian Mountains, and Pannonian (Trans-Carpathian) Lowland. It can be suggested that this species expands its distribution northward due to the Global Warming events. Additionally, the recently described L. linnei was also identified in this study. This species is widely distributed in Western Ukraine, and it is more common than its sibling species L. nebulosus. The latter represents an important finding, since the previous studies identified L. nebulosus as the only species present in this region. Finally, the key to identification of Leiopus taxa in Ukraine is given.*

Key words: *Cerambycidae, Leiopus, Leiopus nebulosus, Leiopus linnei, Leiopus femoratus, Western Ukraine*

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Рід Булавоніг (Leiopus Audinet-Serville, 1835) в Західній Україні та інвазія середземноморсько-понтійського виду Leiopus femoratus Fairmaire 1859 (Coleoptera: Cerambycidae: Acanthocinini). - А.М. Заморока, Я.І. Капелюх *- У статті представлені результати досліджень розповсюдження видів роду Leiopus в Західній Україні. Встановлено, що на даній території розповсюдженими є три види: Leiopus nebulosus (Linnaeus 1758), Leiopus linnei Wallin, Nylander & Kvamme, 2009, та Leiopus femoratus Fairmaire 1859, причому, L. femoratus є новим для цих теренів. Він широко розповсюджений в усіх фізико-географічних районах Західної України: на Подільській височині, Передкарпатті, Карпатах і Закарпатській низовині. З'ява тут L. femoratus зумовлена розширенням його ареалу на північ, індукованим процесами глобального потепління. Окрім того, ми виявили також присутність в Західній Україні нещодавно описаного зі Швеції виду L. linnei, і встановили, що він є значно розповсюдженим за свій сестринський вид L. nebulosus. Оскільки у раніших працях, для Західної України наводився лише один вид – L. nebulosus, а у фауні України не числився L. linnei, то ми уклали короткий визначник видів роду Leiopus в Україні.*

Ключові слова: *Cerambycidae, Leiopus, Leiopus nebulosus, Leiopus linnei, Leiopus femoratus, Західна Україна*

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Introduction

The genus *Leiopus* Audinet-Serville, 1835 is comprised of approximately 20 species that are distributed throughout the remote regions of Palearctic in the Northen Hemisphere and Neotropics in the Southern Hemisphere [11, 23]. This disjunction was caused by the reclassification of Nearctic *Leiopus* species, and by moving most of them to *Sternidius* Le Conte, 1873 and *Liopinus* Linsley & Chemsak, 1961 genera and to the several others related genera [19].

According to Fauna Europaea database [12], there are seven species of genus *Leiopus* found in Europe. However, it must be noted that this database does not include the recently described *Leiopus linnei* Wallin, Nylander & Kvamme, 2009 [32]. Thus, the total number of *Leiopus* species in Europe should be considered as eight. More specifically, four of these

eight species are the local endemics, and the remaining four species are spread equally throughout all Europe. The endemics group includes *Leiopus andreae* Sama 1994 and *Leiopus syriacus* Ganglbauer 1884 that are both present in Cyprus, *Leiopus insulanus* Slama 1985 that is common in Crete, and *Leiopus settei* Sama 1983 that is found in Apennine Peninsula. The Europe-wide distributed species include *Leiopus nebulosus* (Linnaeus 1758) and *L. linnei* that are found throughout all Europe including Ural and Caucasus Mountains, *Leiopus femoratus* Fairmaire 1859 that is present in the Northern Mediterranean and Black Sea basins, and now in Central Europe, and finally *Leiopus punctulatus* (Paykull 1800) found in the Northern and Eastern Europe.

The distribution data for *Leiopus* in Ukraine were mainly presented by studies of I. Zahaykevych [29, 30] and A. Bartenev [2]. Both studies mention three *Leiopus* species present in Ukraine. These include *L. femoratus* from Crimean Mountains, *L. nebulosus* from the forest and the forest-steppe zones in Ukraine, and finally *L. punctulatus* from the Northeastern Ukraine. Previously, only *L. nebulosus* was shown to be present in Western Ukraine. However, the current study established that there are in fact four *Leiopus* species found in Ukraine, and three of those four species are present in Western Ukraine. Specifically, *L. linnei* and *L. femoratus* were identified in Western Ukraine. Here, the first record of *L. linnei* was made by polish entomologists [14], who revised the collection materials dated from the XIX-XX centuries available at the Polish research institutes.

Methods

In this study we analyzed our own Cerambycids collections and collections available at the State Museum of Natural History in Lviv (SMNH); Nature Reserve "Medobory" (NRM) in Hrymailiv, Ternopil reg.; Halych National Park (HNP) in Halych, Ivano-Frankivsk reg.; Pre-Carpathian National University (PNU) in Ivano-Frankivsk.

Abbreviations: *loc*. – locality; *vlg*. – village; *twn*. – town; *dstr*. – district; *reg*. – region; *coll*. – collector, *NR* – Nature Reserve, *NP* – National Park.

Ukrainian Regions administrative subordination and abbreviations used in the text: CE – Chernivtsi reg.: *Kho*. – Khotyn dstr., *Nov*. – Novoseltsya dstr., *Zas*. – Zastavna dstr. CK – Cherkasy reg.: *Zhas*. – Zhashkiv dstr. CR – Crimean Autonomous Republic: *Kra*. – Krasnoperekopsk dstr. IF – Ivano-Frankivsk reg.: *Hal*. – Halych dstr., *Hor* – Horodenka dstr., *Ivf*. – City of Ivano-Frankivsk, *Roh*. – Rohatyn dstr., *Snya*. – Snyatyn dstr., *Tlu*. – Tlumach dstr., *Tys*. – Tysmenysya dstr., *Ver*. – Verkhovyna dstr., *Yare*. – Town of Yaremche. KM – Khmelnytsk reg.: *Kam*. – Kamyanets-Podilsky dstr., *Vin*. – Vinkivtsi dstr. LV – Lviv reg.: *Bro*. – Brody dstr., *Bus*. – Busk dstr., *Hrd*. – Horodok dstr., *Lvi*. – City of Lviv, *Mos*. – Mostyska dstr., *Per*. – Peremyshlyany dstr., *Pus*. – Pustomyty dstr., *Sko*. – Skole dstr., *Yavr*. – Yavoriv dstr., *Zhyd*. – Zhydachiv dstr., *Zol*. – Zolochiv dstr. RV – Rivne reg.: *Kiv*. – Kivertsi dstr. TE – Ternopil reg.: *Ber*. – Berezhany dstr., *Bor*. – Borschiv dstr., *Buch*. – Buchach dstr., *Hus*. – Husyatyn dstr., *Kre*. – Kremenets dstr., *Ter*. – Ternopil dstr., *Trb*. – Terebovlya dstr., *Chor*. – Chortkiv dstr., *Pid*. – Pidvolochysk dstr., *Zal*. – Zalischyky dstr., *Zbo*. – Zboriv dstr. VN – Vinnytsya reg.: *Moh*. – Mohyliv-Podilski dstr. VO – Volyn reg.: *Sha* – Shatsk dstr. ZK – Zakarpattia reg.: *Vyn*. – Vynohradiv dstr., *Uzhg*. – Uzhgorod dstr.

Results

This study presents the data describing the distribution of *Leiopus* species in Western Ukraine. The data was obtained using the revised collection material and publically-available resources. The distribution data is organized and presented in accordance the main physiographic regions of Western Ukraine, namely the East Pannonia lowland (the Trans-Carpathian Lowland), Eastern Carpathian Mountains (Ukrainian Carpathians), Pre-Carpathian Lowland, Volyn and Podillya Eminences, Small Polissya Lowland and Western Polissya Lowland.

Leiopus nebulosus Linnaeus, 1758

Eastern Pannonia Lowland: 1 spec., 08.VII.2009, near twn. Vynohradiv, Vyn., ZK, coll. R. Panin; 1 spec., 04.V.1960, near coty of Uzhgorod, Uzhg., ZK, coll. I. Zahaykevych (SMNH). Eastern Carpathian Mountains: 1 spec., 24.VII.1911, near vlg. Tukhlya, Sko., LV (SMNH); 1 spec., 06.VI.1951, near vlg. Dora, 1 spec., 15.VII.1951, near vlg. Yamna, Yare., IF, coll. I. Zahaykevych (SMNH); Carpathians [30]. Precarpathian Lowland: 1 spec., 11.VI.2004, loc. Zrub, near vlg. Vyshniv, Roh., IF, coll. A. Zamoroka [31]; 1f, 09.VI.1884, near vlg. Hodyni, Mos., LV [14]; 1m, 3-15.07.1883, near twn. Halych, Hal, IF [14]. Volyn and Podillya Eminences: 1 spec., 29.V.2007, on the oak logs, near vlg. Stradch, Yavr., LV, coll. R. Panin; 1 spec., 06.VII.1999, near vlg. Butsyky, Hus., TE, coll. Ya. Kapelukh; 1 spec., 19.06.2000, loc. "Maslyatyn", near vlg. Dibrova, NR "Medobory", Kre, TE, coll. Ya. Kapelukh; 1 spec., 13.06.2004, Vikno Forestry, square #37, near vlg. Vikno, NR "Medobory", Hus., TE, coll. Ya. Kapelukh; 1 spec., loc. "Vovchnetski Hory", near city of Ivano-Frankivsk, Ivf., IF [21]; 1 spec., near city of Lviv, Lvi., LV (SMNH); 1 spec., near twn. Ivano-Frankove, Yavr., LV, 1 spec., near vlg. Bryukhovychi, Lvi., LV (SMNH); NR "Roztochya", Yavr., LV [25]; 1f, 2m, 19.VI.1875, near city of Lviv, Lvi., LV [14]; 1m, 02.VI.1007, near vlg. Lomachyntsi, Vin., KM [14]; 1m, 02.VI.1997, near twn. Mohyliv-Podilsky, Moh., VN [14]; near vlg. Novosilky, Zol., LV (SMNH); near vlg. Klishkivtsi, Khot., CE [28]; 1m, near city of Ternopil, TE [14, 26]; near vlg. Tovste, Hus., TE [20]; near vlg. Synkiv, Zal., TE [20]. Small Polissya Lowland: 1

spec., near vlg. Charnushvychi, Pus., LV; 1 spec., VI.1959, near vlg. Humnyska, Bus., LV, coll. I. Zahaykevych (SMNH). Western Polissya Lowland: 1 spec. 23.V.1990, 1 spec. 07.V.2000, 2 spec. 24.V.2001, spec. 01.VI.2006, loc. "Vutva", near vlg. Pischa, Sha., VO [18]; 1 spec., 26.VI.1954, near vlg. Kivertsi, Kiv., RV, col. I. Zahaykevych (SMNH).

Leiopus linnei Wallin, Nylander & Kvamme, 2009

Eastern Carpathian Mountains: 1f, 1898-1900, loc. "Kizi", Mt. chain Chornohora, near vlg. Bystrec, Ver., IF [14]; Volyn and Podillya Eminences: 1 spec. 28.V.2011, on the branch of *Carpinus betulus* L., near vlg. Hutysko, Ber., TE, coll. A. Zamoroka; 12f, 3m, 30.V-19.VI.1875, 4f, 2m, 20-27.VI.1884, 27.VI.1885, 18.VI.1886, 1f, 02.VI.1994, near city of Lviv, Lvi., LV [14]; 1f, 10.VI.1934, near vlg. Vorotsiv, Yavr., LV [14]; 1m, 01.VII.1941, near vlg. Bryukhovychi, Lvi., LV [14]; 12f, 12m, near city of Ternopil, Ter., TE published by M. Rybiński [26] as *L. nebulosus* –; [14]; 51f, 62m, 07-25.VI.1935, near vlg. Lysynchyky, 3f, 5m, "Obizhova", Zal., TE [14]; 1m, 30.V.1877, near vlg. Prylypche, Zas., CE [14]; 1f, 04.VI.1993, near vlg. Krutyliv, Hus., TE, published by D. Kubisz and colleagues [17] as *L. nebulosus* [14]; 1f, 24.VI.1996, near vlg. Kytayhorod, Kam., KM published by D. Kubisz and colleagues [17] as *L. nebulosus* [14]; 1f, 1m, 04.VI.1997, near vlg. Lomachynci, Vin., VN [14].

Leiopus femoratus Fairmaire, 1859

Eastern Carpathian Mountains: 1 spec. 15.V.2011, inside wooden house, twn. Yaremche, Yare., IF, coll. V. Tymochko. Pre-Carpathian Lowland: 1 spec. 22.VII.2010, Halych NP, near vlg. Medynya, Hal., IF, coll. A. Zamoroka. Volyn and Podillya Eminences: 1 m, 08.VI.2004, near vlg. Hrymayliv, Hus., TE, coll. Ya. Kapelyukh (NRM); 1 spec. 14.V.2009, Halych NP, near vlg. Kukilnyky, Hal., IF, coll. A. Zamoroka (HNP); 1 spec., 27.VII.2004, loc. "Vovchynetski Hory", near city of Ivano-Frankivsk, Ivf., IF, coll. A. Sirenko (PNU).

Discussion

It was previously suggested that there were only three species of *Leopus* genus (*L. nebulosus*, *L. femoratus*, *L. punctulatus*) present in Ukraine, and only one species, *L. nebulosus*, was found in Western Ukraine. However, the recent study by J. Gutowski et al. [14] reported the presence of *L. linnei* in Ukraine, Poland and neighboring countries. Though *L. linnei* was recorded throughout all Europe to Ural and Caucasus Mountains, the exact areal of this species is still unclear and requires further studies.

J. Gutowski and colleagues obtained 175 specimens of *L. linnei* from 10 localities in Western Ukraine (see above), eight specimens from a single locality in Central Ukraine (4f, 4m, collected at the end of XIX century, near vlg. Sokolivka, Zhas., CK), and one specimen from Crimean Peninsula (1f, 07-10.VII.2009, near vlg. Krasnoarmiyske, Kra., CR) [14]. According to the available data *L. linnei* is present in Western Ukraine mostly within the borders of Podillya Eminence, and only one *L. linnei* record is known in the subalpine zone of Ukrainian Carpathians (Chornohora mt. chain). Our study confirms this trend. We recorded *L. linnei* within the physiographic region Opillya, which is the western part of Podillya Eminence.

It must be noted that J. Gutowski et al. [14] used a significantly old collection from Western Ukraine (samples were mainly collected at the end of the XIX and beginning of the XX centuries). Despite the fact that some material was recently collected and published [14, 17], the additional studies are still required to clarify the present distribution range of *L. linnei*. In the light of our findings we suggest that *L. linnei* is more common in Western Ukraine than its sibling species *L. nebulosus*. Unfortunately, the distribution of *L. linnei* in other parts of Ukraine is difficult to conclude due to the lack of the data.

To date, 30 specimens of *L. nebulosus* obtained from 28 localities in Western Ukraine are known. This species is found in all physiographic regions of Western Ukraine. However, it is not as abundant there as *L. linnei*. According to Bartenev [2] *L. nebulosus* is widespread in all Ukraine except the physiographic zone steppe. *L. nebulosus* is common in Polissya, Carpathians, Forest steppe and Crimean Peninsula [2]. Similar data were published by Zahaykevych [29], who specified the range of *L. nebulosus* in Crimean Mountains [29]. However, since *L. linnei* was unknown at the time when these studies were conducted, it remains unclear whether their data described *L. nebulosus* or *L. linnei*.

Our study provides the first record of *L. femoratus* in Western Ukraine, as it was previously only known in Crimea Peninsula [2, 29]. In consistence with our data, *L. femoratus* was recently reported in Central and Eastern Ukraine [2, 3, 4].

According to the recent publications *L. femoratus* is distributed in Central Europe. We believe that the areal shifts northward in response to the Global Warming events as it occurs with many other species [8]. Up until the end of the XX century the known areal of *L. femoratus* included the areas of the Black Sea Basin (i.e. Bulgaria, Turkey, Southern Ukraine (Crimean Peninsula), Caucasus) [1]. Similarly, M. Danilevski and A. Miroshnikov [10] showed that the areal of *L. femoratus* is in the "South of Western Europe". Indeed, since the late 1990s *L. femoratus* was also recorded throughout Eastern, Central and Southern Europe. In 1997 it was found in Central Ukraine (Poltava Region), approximately 500 km northward from its previously known areal [2, 4]. Additionally, *L. femoratus* was recorded in the Southwest regions of Russia (Rostov Region and Krasnodar Territory). Here, the authors reviewed collections from 1927-1929, 1973, and 1982 and uncovered the *L. femoratus* specimens that were previously misidentified as *L. nebulosus* [5, 16]. In

1999 *L. femoratus* was reported in the Southeast France (Isere Department, Rhфne-Alpes). It was collected in 1995, and correctly identified only in 1998. Later, this species was recorded in other localities in the Southern France [7]. Additionally, Brustel et al. [7] indicated that *L. femoratus* could be also found in Italy. Indeed, the presence of *L. femoratus* in Italy (Northeastern Italy and Sicily Island) was confirmed in 2002 [24], and already by 2005 *L. femoratus* was known in the most parts of the Southern Italy. *L. femoratus* was also found in collections dating from 1908, where it was misidentified as *L. nebulosus* [5]. While within Slovenia regions neighboring the Italian border *L. femoratus* was not recorded, it was found abundant in Monfalcone (Italy) near the Italian-Slovenian border [6]. The recent findings of *L. femoratus* in surroundings of Belgrad in Serbia support its presence in Balkans (Curcic and al., 2003). In 2006 *L. femoratus* was reported in surroundings of Sighetu Marmației, which is in Northern Romania near Ukrainian-Romanian border [22]. In Hungary *L. femoratus* was recorded in 2010 (Hegyessy and Kutasi, 2010). In the West this species have distributed to southern districts of the Netherlands [28]. There are no data available regarding the distribution of *L. femoratus* in Austria, Switzerland, Germany, Poland, Czech Republic and Slovakia. In 2004 *L. linnei* was incorrectly identified [13] as *L. femoratus* in Lithuania [27].

While the first sighting of *L. femoratus* in Western Ukraine occurred in 2004 in the Nature Reserve "Medobory" (Ternopil Region, Ukraine), the species was correctly identified only in 2011. Since the *L. femoratus* specimen deposited in the PNU collection in 2004 was collected near Ivano-Frankivsk (Ivano-Frankivsk Region, Ukraine), it can be suggested that *L. femoratus* was widespread on Podillya Eminence at least until that year. In 2009 and 2010, however, we caught two *L. femoratus* specimens in the Halych National Park, and one specimen was received from V. Tymochko in Carpathian National Park (Ivano-Frankivsk Region, Ukraine). Altogether, *L. femoratus* is now present in five localities representing the main physiographic zones of Western Ukraine, including Podillya Eminence, Precarpathian Lowland and Carpathians Mountains. Our data significantly increased the area of a known distribution of *L. femoratus*. We also believe that *L. femoratus* may be present in Zakarpattya Region, since it was found in other Regions of Western Ukraine and western neighboring countries, Hungary and Romania [15, 22]. In Ukraine all known localities of *L. femoratus* are situated south of 50° north latitude. However, since we found *L. femoratus* in boreal climate conditions in Ukrainian Carpathians, it can be hypothesized that the species could also be present further north from its currently known areal border. If our assumption is correct, then we could expect *L. femoratus* to be distributed northward into Belorussia and, possibly, even further to the Baltic Sea coast.

The key to identification for taxa of *Leiopus* Audinet-Serville, 1835 in Ukraine

Since *L. linnei* was not previously found in Ukraine, it was not included to the Key to Longhorned beetles of Ukraine. Below we present a Key to identifying this species.

1 (8). Bases of antennal segments 3-11 are rudy-fulvous colored ……..……..……2.

2 (4). The pronotum width to length ratio is 1:1. The pronotum disc is evenly punctuated and without smooth fields in its center ……..……3.

3 (2). The flat convex elytra area is located around scutellum. Elytra are covered by dense whitish-grayish pubescence. The glabrous and fulvous colored stripe is located on the second part of elytra. Small comma-shaped glabrous and fulvous colored macules are located on both sides of the shield. The same macules are located below the shoulder parts of elytra. Tiny round dark macules are scattered throughout all elytra. The body length is 7-11 mm. It is found in most areas of Ukraine …….*L. femoratus*

4 (5). The pronotum width to length ratio is 1:1.5. The pronotum disc is not evenly punctuated and with small smooth fields on its center ……. 6

6 (7). Frons is wide (1.23±0.16 mm) and protruding between the eyes. The last sternum of female abdomen is covered by dense long coarse hairs distally, towards posterior margin. The aedeagus has ventral ridge on it, which it is protruding and forming a distinct apical tip. The cuticle coloration is from dark fulvous to completely black. Elytra are covered by dense whitish-grayish or yellowish pubescence. There are two dark stripes present on elytra. Tiny round dark macules are scattered throughout all light part of elytra. The body length is 5.6-9.5 mm. It is found in most areas of Ukraine. ……..…….. *L. linnei*

7 (6). Frons is narrow (0.98±0.13 mm), and it is not protruding. The last sternum of female's abdomen is without long hairs. The hair coverage of the last tergum of male's abdomen is not dense. There is the glabrous field present on it. The end of aedeagus is smooth without a distinct tip. Elytra are covered by dense whitish-grayish or yellowish pubescence. There are two dark stripes present on elytra. The first is situated on the basis, and the second is found in the distant part of elytra. Numerous small round dark macules are scattered through all of elytra. The color of pronotum pubescence is yellowish without fulvous contrast macules. The body length is 5.2-9 mm. It is found in most areas of Ukraine. ……. *L. nebulosus*

8 (1). Bases of all antennal segments are black and covered by whitish pubescent. The cuticle is black. Elytra are smooth and lackluster. They are covered by dense black or brown pubescent with two contrast whitish stripes in the middle and at the top of

them. Numerous small round dark macules are scattered through all of elytra. The body length is 6-9 mm. It is found in Eastern Polissya, and it is likely present in Western Polissya and Eastern Ukraine. …….… *L. punctulatus*

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