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Distribution of the subgenus *Psyllophora* (Degl.) Peterm. (*Carex* L.) in Ukraine

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Abstract: It has been established that species of the subgenus *Psyllophora* (Degl.) Peterm. (*Carex* L.) are characterized by very disjunctive areas and the limited regional distribution (*Carex pauciflora* Lightf. and *C. rupestris* All.), or are known from a few localities only (*C. obtusata* Liljebl.). Dioecious species of this subgenus (*C. dioica* L. and *C. davalliana* Smith), reach the eastern and southern limits of their distribution in Ukraine, where they are the most widespread. However, a big number of their localities have been already lost.

Key words: *Carex obtusata*, *C. rupestris*, *C. pauciflora*, *C. dioica*, *C. davalliana*, chorologic peculiarities, Ukraine

1. Introduction

Substantiation of the scientific principles of nature conservation, in particular, plant biodiversity, is one of the most urgent problems today which cannot be solved without a detailed investigation of distribution, structural features and sozological status of rare plant species. Especially, it concerns the genus *Carex* L. (Cyperaceae Juss.), which is one of the largest genera in the flora of the world (Takhtajan 1987; Egorova 1999; Govaerts *et al.* 2007) and in Ukrainian flora (Mosyakin & Fedoronchuk 1999). According to different authors, it comprises about 2.000 species (Goetghebeur 1998; Starr & Ford 2009), including 180 species in the flora of Europe (Chater 1980). In Ukraine, the genus *Carex* is represented by 4 subgenera with 43 sections and 96 species (Danylyk 2012). The smallest subgenus *Psyllophora* (Degl.) Peterm. contains only 5 species, included in the Red Data Book of Ukraine (Didukh 2009). Regardless of their sozological status, these species have been studied insufficiently. In particular, the data on their distribution in Ukraine are fragmentary and need clarification. Determination of the basic features of their distribution is a precondition for the introduction of effective protection measures . Thus, the present research is vital for ensuring the survival of these species.

The aim of our study was to determine the chorologic peculiarities of representatives of the subgenus *Psyllophora* in Ukraine: *Carex obtusata* Liljebl., *C. rupestris* All., *C. pauciflora* Lightf., *C. dioica* L. and *C. davalliana* Smith.

2. Material and methods

The data on the species distribution come from field research and a critical revision of literature sources and herbarium collections of Ukrainian scientific institutions, such as: Ivan Franko National University of Lviv (LW), State Museum of Natural History of the National Academy of Sciences of Ukraine, Lviv city (LWS), Institute of the Ecology of the Carpathians of the National Academy of Sciences of Ukraine, Lviv city (LWKS), M.G. Kholodny Institute of Botany of the National Academy of Sciences of Ukraine, Kyiv city (KW), Yuriy Fedkovych Chernivtsi National University (CHER) and Uzhhorod National University (UU). Also the herbarium materials from the W. Szafer Institute of Botany of the Polish Academy of Sciences in Krakow (KRAM) were used.

Based on the received data, the maps of species localities were made with the use of UTM grid (Universal Transverse Mercator) method (Kurtto *et al.* 2004). Each point on the map corresponds to the location of the species in the area of 50 x 50 km.

3. Results

Representatives of the subgenus *Psyllophora* belong to various area groups as well as they differ by their chorologic features in the territory of Ukraine.

Carex obtusata is a forest species, which grows on dry grassy slopes, dry meadows and in dry pine and birch forests. In Ukraine, it is common in Roztochia, Opillia and Western Polissia within two administrative regions (Fig. 1). The species is known from only two localities within the Lviv region, namely, Chornyi Kamin (Yavoriv district, Ivano-Frankove village) (Mądalski 1937 LWS) and Dubyna (Brody district, vicinity of Brody town) (Shelest 1956). Also, its single locality has been found in the Zhytomyr region on the rock Kraszewski (Andrienko 1986 KW; Orlov 1994 KW).

Carex rupestris is a rock species. Its distribution is limited by the Ukrainian Carpathians, where the species is known from eight localities only (Fig. 2). Most of

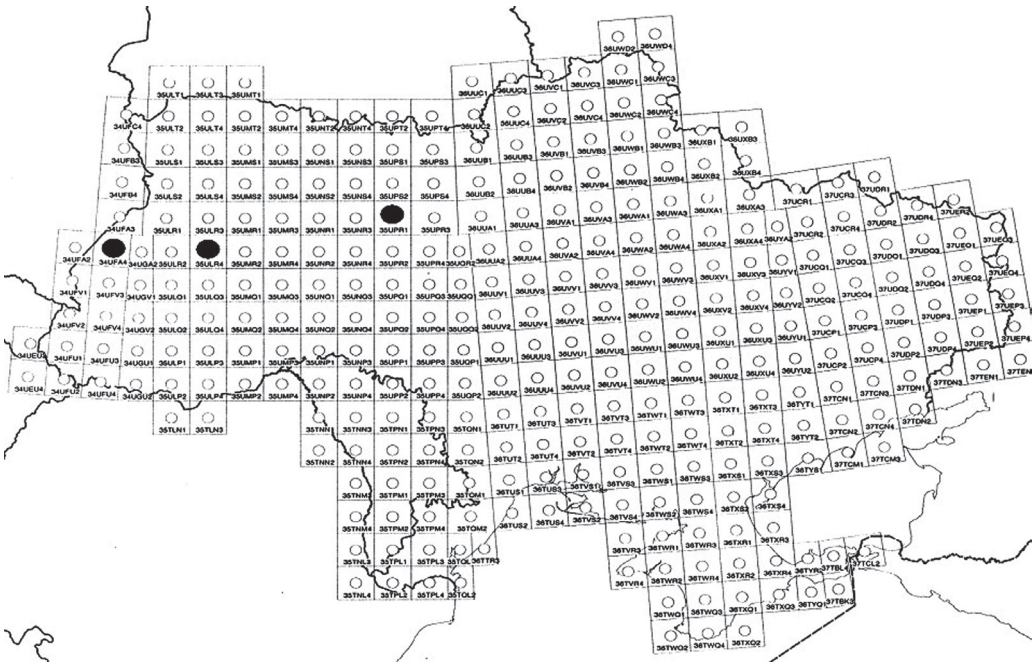

Fig. 1. Distribution of *Carex obtusata* Lijebl. in Ukraine

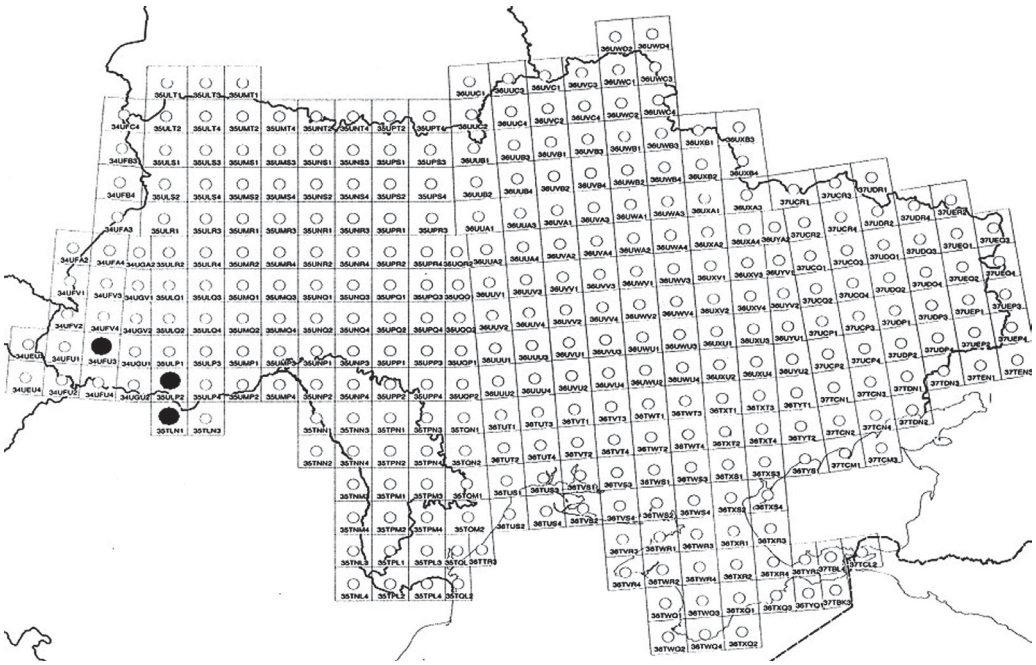

Fig. 2. Distribution of *Carex rupestris* All. in Ukraine

them are in the Chornohora massif, namely, on Pietros (Mądalski 1936 LWS), Stepanets (Mądalski 1930 LWS), Smotrych (Mądalski 1935 KRAM), Velykyi Kozel (Kozij 1930 LWS; Mądalski 1930 KRAM; Danylyk & Sosnovska 2011 LWKS) and Shpytsi Mts. (Danylyk 1994 KW; Danylyk & Sosnovska LWKS 2011). For the first time, *C. rupestris* was found on the Smotrych Mt. by B. Pawłowski (Pawłowski 1931; Pawłowski 1929 KRAM). Some isolated localities are known from the Borzhava (Zhyd-Magura Mt.) (Malynovskyi 1949 LWS) and Chyvchyny massives (Hnetiesa Mt.) (Mądalski 1935 LWS; Pawłowski 1933 KRAM). The species forms small isolated populations that are mostly highly fragmented into separate localities. Their state depends to a large extent on the succession, in particular, rock overgrowth by forest and shrub species, resulting in the change of environmental conditions (Izmestieva & Danylyk 2011).

Carex pauciflora is a rare species that grows in the alpine, subalpine and forest zones under the conditions of excessive moisture, mainly in meso-oligotrophic bogs. In the territory of Ukraine, it occurs in the Carpathians and Central Polissia, within three administrative regions: Ivano-Frankivsk, Zakarpattia and Zhytomyr (Fig. 3). Within the Ivano-Frankivsk region it is known mainly from the Chornohora massif, in particular: Cybulnyk locality, between Pozhyzhevska and Breskul Mts. (Danylyk & Ocheretianyi 1988 LW; Danylyk & Sosnovska 2012 LWKS), the bog between Hoverla and Breskul Mts. (Kagalo & Sytchak 1995 LWKS; Danylyk & Sosnovska 2012 LWKS), Hoverla Mt. (Mądalski 1927 KRAM; Danylyk 1995 LWKS), the bog located at the foot of Mala Hoverla Mt. (Danylyk & Sosnovska 2012 LWKS), locality Zarosliak in the vicinity of Vorokhta village (Danylyk & Sosnovska 2012 LWKS) of Nadvirna district etc; Verkhovyna district: Hadzhyna locality (Danylyk 1993 LWKS), Kizi-Ulohy locality (Mądalski 1927 LW; Danylyk 1994 LWKS) and others. Some localities are known from the Chyvchyny massif, namely, the Rotundul and Hnetiesa Mts. of Verkhovyna district (Chorney, Velychko & Budzhak 2003 CHER). In the Zakarpattia region, it is widespread in the territory of Gorgany: the bog Negrovets of Mizhhiria district (Fodor 1957 UU; Kagalo 1986 LWKS; Danylyk & Sosnovska 2012 LWKS), the vicinity of Osmoloda village of Rozhniativ district (Zelenchuk 1987 LW); Svydovets massif: Zhandarmy Mt. (Kardash & Gynda 1986 LW; Danylyk & Sosnovska 2012 LWKS), Dragobrat and Gereshaska localities (Danylyk & Sosnovska 2012 LWKS) of Rakhiv district; and Pokutsko-Marmaros massif: Pip Ivan Mt. of Rakhiv district (Danylyk 1994 LWKS).

The bog "Gvozd" (Olevsk district of Zhytomyr region) is considered the first locality of *C. pauciflora* in the territory of Ukrainian Polissia (Tiuremnov 1927 KW). Some literature data on the species distribution come from different authors (Krechetovych 1940; Smyk & Bortniak 1984; Grygora 1987; Orlov 2005). In particular, O. Orlov (2005) points out five localities of *C. pauciflora* within the Zhytomyr region. However, according to the herbarium and literature data, only two localities of the species in the vicinity of Chervonka and Kovanka villages of Ovruch district (Central Polissia) are supposed to exist (Andrienko 1982 KW) (Orlov 2005; Andrienko 2010).

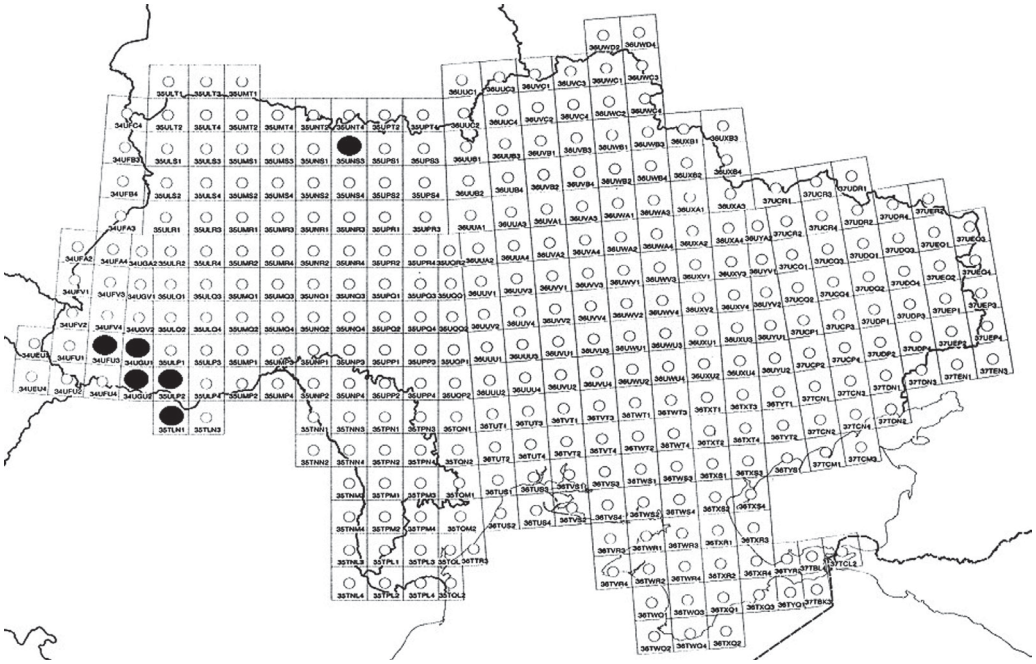

Fig. 3. Distribution of *Carex pauciflora* Lightf. in Ukraine

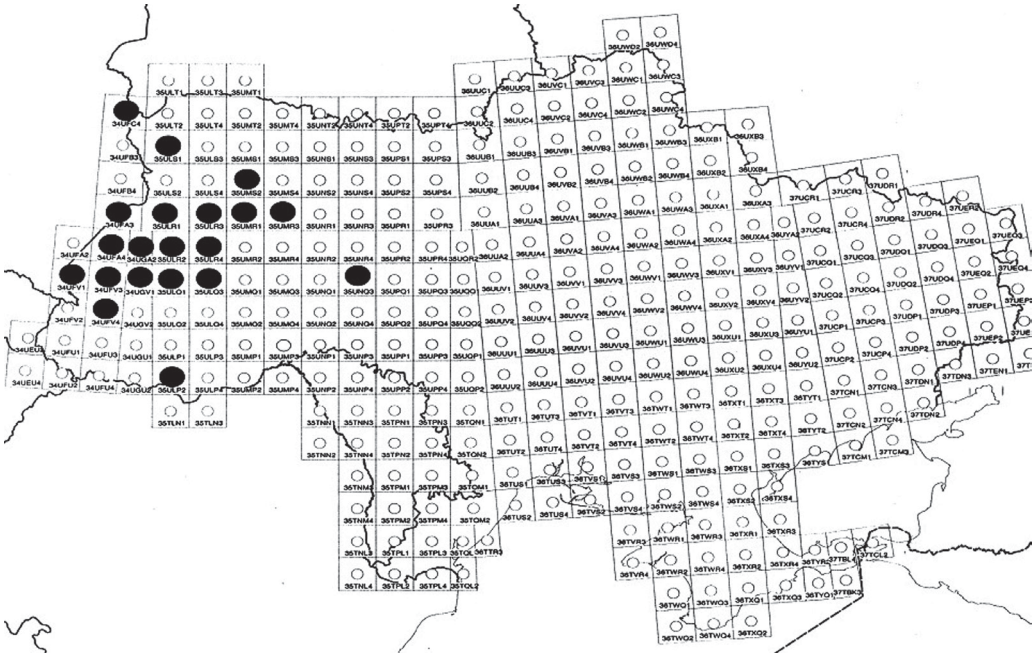

Fig. 4. Distribution of *Carex davalliana* Smith in Ukraine

Carex davalliana is the representative of boggy ecotypes. It is widespread in the territory of Male Polissia, Roztochia-Opillia, Western Forest-Steppe zone, Prycarpathia and the Carpathian Mountains, within 9 administrative regions (Fig. 4). According to the herbarium data there are many localities of this species in the Lviv region, in particular: Khlopchytsi village of Sambir district (Mądalski 1928 LWS), Stoianiv village of Radekhiv district (Melnychuk 1949 LWS), Zeliv village of Yavoriv district (Kuziarin 2007 LWS), the vicinity of Granytsia village of Gorodok district (Kuziarin 1993 LWS), the vicinity of Trudovach village of Zolochiv district (Kuziarin 2002 LWS), the vicinity of Rava-Ruska town of Zhovkva district (Zelenchuk 1986 LWS), Kulychkiv village of Sokal district (Danylyk 1986 LW), Bolozhyniv village of Busk district (Zelenchuk 1986 LW) etc. Recently, we have confirmed two localities of this species in Roztochia, in particular, on the bog

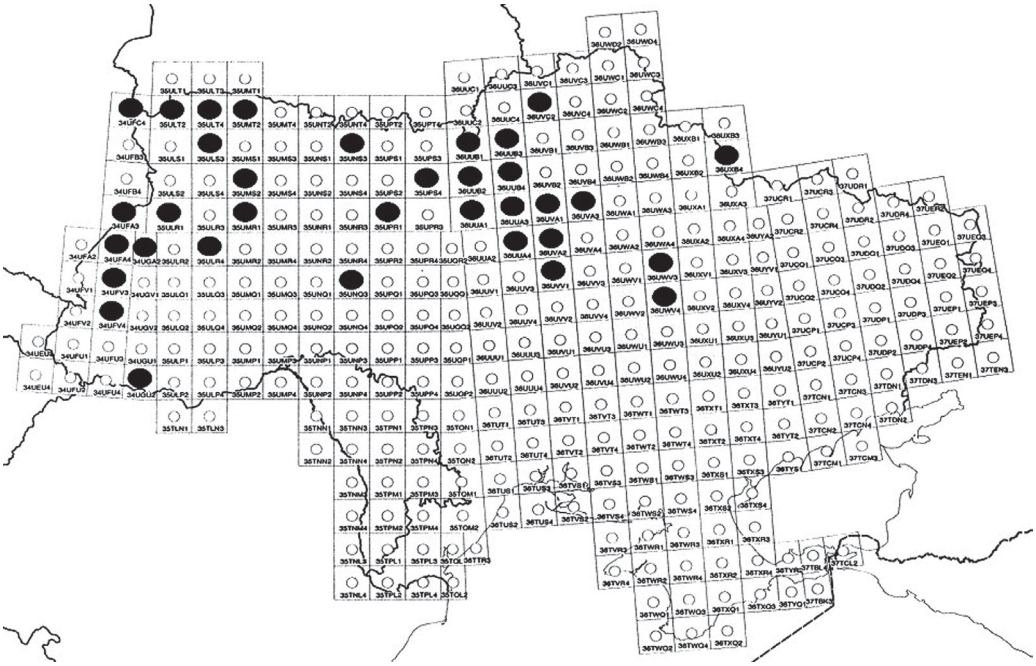

Fig. 5. Distribution of *Carex dioica* L. in Ukraine

Zalyvky (Yavoriv district, Lviv region) and on the mesotrophic bog in the vicinity of Khlivchany village (Socal district, Lviv region) (Danylyk & Sosnovska 2011 LWKS). Also, some *C. davalliana* populations have been found in the Bushchansk reserve (Rivne region) and Shatsk National Nature Park (vicinity of Melnyky village, Volyn region) (Danylyk & Sosnovska 2011 LWKS).

Carex dioica is a rare boreal bog species which is widespread in Polissia (Male and Western Polissia, in particular), Podillia, Roztochia-Opillia, Forest-steppe zone, Prycarpathia and in the Carpathians (Fig. 5). *C. dioica* is characterized by a significant distribution in Ukraine in comparison with other species of the subgenus. It is known from 13 administrative regions. Up to now, a bog "Zgar" of Lityn city (Vinnytsia region) has been considered as the most southern, isolated locality of the species (Andrienko & Priadko 1980). However, recently, the authors have found its new habitat in the highland of Svydovets massif (the Carpathians) (Danylyk, Borsukevych & Sosnovska 2012 LWKS). Most of the localities are concentrated in the territory of Western Polissia, namely, within the Volyn region: Zabolottia village of Ratne district (Barbarych 1949 KW), Zhytnytsia village of Kamin-Kashyrskyi district (Bradis 1971 KW), Skulyn village of Kovel district (Andrienko 1981 KW) (Andrienko & Partyka 1984) and Galuziia village of Manevychi district (Andrienko 1971 KW). In 2002, the species was also found in the northern part of Cheremskyi Nature Reserve, on the bog Cheremske (Konischuk 2003 KW) and on the mesotrophic sedge-sphagnum bog in the vicinity of Zamostia village (Konishchuk 2002 KW) (Konischuk 2004) of Manevychi district. During the field research in 2009-2012, four new localities of *C. dioica* have been discovered in the Shatsk district (including the Shatsk National Nature Park), namely: the bog on the south-eastern shore of lake Luky, in the vicinity of Zatyshia village (Kuziarin 2011 LWS), the bog located 1.6 km south of the Melnyky village, near lake Karasynets (Kuziarin 2011 LWS), the bog on the north-eastern shore of lake Pulemets, in the vicinity of Pulemets village (Danylyk & Sosnovska 2012 LWKS) and the bog "Unychi" in the vicinity of Melnyky village (Honcharenko, Danylyk & Sosnovska 2012 LWKS) (Izmestieva & Danylyk, 2012). We have also confirmed its locations on the bog "Koza-Berezyna" in the Rivne Natural Reserve (Andrienko 1973 KW; Danylyk & Sosnovska 2011 LWKS) and in the Bushchansk reserve (Andrienko 1983 KW; Danylyk & Sosnovska 2011 LWKS) of Rivne region.

According to the literature data and herbarium collections, *C. dioica* is known from the territory of Lviv region, namely Brody district: Ponykovytsia village (Fotyniuk 1954 LWS), Gorodok district: Granytsia village (Kuziarin 1993 LWS), Radekhiv district: Lopatyn village (Kozij 1954 LW), Sambir district: Luky village (Mądalski 1930) etc. However, only four localities of the species in this region are supposed to exist, namely: Khlivchany village of Sokal district (Zelenchuk 1987 LW; Danylyk & Sosnovska 2012 LWKS), Verhnie Visotske and Verhnie Gusne villages of Turka district (Kovpak & Pidgrebelnyi 2000 LWKS), Ivano-Frankove village of Yavoriv district (Kagalo 1987 LWKS; Danylyk & Sosnovska 2012 LWKS) and in the vicinity of Granytsia village of Gorodok district (Kuziarin 2009 LWS).

A number of *C. dioica* localities of Zhytomyr region (Central Polissia) was indicated by different authors (Smyk & Bortniak 1984; Orlov 2005). In opinion of O. Orlov (2005), there are 2 existing habitats of the species in Ovruch region, namely, in the "Didove ozero" reserve and in the vicinity of Kovanka village (Andrienko, Priadko & Popovych 1982 KW).

The species was also found on a mossy bog in the Kremenets city of Ternopil region (Kotov & Telychko 1954 KW). Last collections of *C. dioica* in Kyiv region have been known from 1975-1977, from the bog "Romanivske" (Andrienko & Priadko 1980). An isolated locality occurs at the eastern border of its range, in the vicinity of Glybyn village of Krasnopil district and Sumy region (Kalynychenko 1833 KW). According to the herbarium data, most of the species habitats in the territory of Forest-Steppe zone (Cherkasy and Poltava regions) and East Polissia (Chernigiv region) have been already lost and some literature data on its distribution (Bairak & Stetsiuk 2005; Lukash 2008 etc.) need clarification.

4. Discussion

The results of chorological analysis show quite uneven distribution of the subgenus *Psyllophora* in Ukraine. Such species as *C. pauciflora* and *C. rupestris* are characterized by very disjunctive areas and the limited regional distribution. *Carex pauciflora* is a rare, relict, arctic-boreal-alpine species (Chater 1980; Egorova 1999). Its main distribution area in Ukraine is situated in the Carpathians. Information given in the last edition of the Red Data Book of Ukraine (Didukh 2009), concerning distribution of the species in the Chernivtsi region, has not been confirmed (Chorney *et al.* 2010). According to our results, the species is widespread in the territory of Chornohora (about 20 localities), Gorgany (9 localities) and Svydovets massives (7 localities). The southern boundary of *C. pauciflora* range in the Ukrainian Carpathians comprises several isolated localities in the Chyvchyny and Pokutsko-Marmaros massives. In general, about 21 localities are supposed to be existing now. The Carpathian populations are stable and viable, while in the territory of Polissia they are

critically endangered. The species is protected in the Carpathian Biosphere Reserve and in the Carpathian National Nature Park.

Carex rupestris is an arctic alpine circumpolar species, which distribution area covers arctic and subarctic zones of Eurasia and North America, as well as alpine and subalpine zones of the mountains of Northern hemisphere. In the mountain ranges of Europe, it is considered a rare species with a disjunctive area (Chater 1980; Wraber 1985; Nowak 1993). In Ukraine it grows mainly on the mountain slopes and rocky peaks in alpine and subalpine zones, at the altitudes of 1700-1900 m a.s.l.; it belongs to the components of highland communities. Its populations occupy only a small area (S=5 m^2) and consist of single patches, partially isolated by the small distance. The results of our field research correspond to the available literature sources (Malynovskyi & Melnytchuk 1951; Danylyk & Malynovskyi 1997 etc.) and herbarium data given above, regarding its limited distribution in Ukraine, i.e., in the Carpathians only.

Carex obtusata is a rare, relict, Eurasian-North American species with a disjunctive area of distribution (Chater 1980; Egorova 1999). In Ukraine, it is known from a few localities only (Mądalski 1938; Shelest 1956; Danylyk & Andrienko 1995). We failed to find new localities of this species so far. However, despite such a limited distribution it doesn't receive the appropriate protection. All the populations are small, isolated and therefore they need constant monitoring and inclusion in the nature conservation areas of Ukraine.

Dioecious species of the subgenus (*C. dioica* and *C. davalliana*) are the most widespread in Ukraine. *Carex davalliana* has the European distribution range and, in Ukraine, reaches its eastern limit (Chater 1980; Egorova 1999). It mainly occurs in the north-west part of its territory. Distribution of the species in the plain part of Chernivtsi region has not been confirmed (Chorney *et al*. 2010). However, its new locality in the Carpathians highland was found (Danylyk & Antosiak 1997). The literature data concerning distribution of the species in the territory of Polissia and Roztochia-Opillia (Danylyk 1994; Andrienko & Priadko 2006) have been mainly verified based on field research and a critical revision of herbarium collections mentioned above. Most of *C. davalliana* populations are of the normal type, and their habitats are included in the numerous nature conservation areas of Ukraine.

Carex dioica is an Eurasian species, distributed in the North and Middle Europe and Siberia (Chater 1980; Egorova 1999). In Ukraine, it reaches its southern limit of distribution. The main distribution area of the species comprises Western Polissia. There are some literature reports about separate localities of the species in the Sumy, Chernigiv, Khmelnytsk, and Cherkasy regions (Zerov 1938; Krechetovych 1940 etc.). However, they are considered to be extinct, because they have not been confirmed for more than 50 years. We have verified some literature data on the species distribution in the territory of Lviv, Volyn and Rivne regions (Knapp 1872; Andrienko & Priadko 1980; Krys &Vaynagii 1988; Zelenchuk 1991; Andrienko *et al.* 2006). Some new localities of the species have been found, in particular, in the Carpathians, in the territory of Western and Male Polissia. Nevertheless, the decrease in the number of *C. dioica* localities is observed today. According to the herbarium collections, about 35 localities have been lost during the last century, which poses a great threat to the species existence.

5. Conclusions

As a result of conducted research it has been established that most of the subgenus *Psyllophora* (Degl.) Peterm. (*Carex* L.) species are characterized by very disjunctive areas and the limited regional distribution in Ukraine (*Carex pauciflora* Lightf. and *C. rupestris* All.), or are known from a few localities only (*C. obtusata* Liljebl.). Despite the widespread distribution of dioecious species of the subgenus (*C. dioica* L. and *C. davalliana* Smith), a big number of their localities is considered to be extinct today. Thus, taking into the consideration the sozological status of the *Psyllophora* species and their chorological peculiarities in the territory of Ukraine, they need further detailed research and effective protection measures.

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