

The genus *Empetrum* (Empetraceae) in Ukraine

ADAM BORATYŃSKI AND YAKIV PETROVICH DIDUKH

BORATYŃSKI, A. AND DIDUKH, Y. P. 2000. The genus *Empetrum* (Empetraceae) in Ukraine. *Fragmenta Floristica et Geobotanica* 45(1–2): 423–430. Kraków. ISSN 0015–931x.

ABSTRACT: Herbarium material studies and field investigations show that two taxa of the genus *Empetrum* L. occur in Ukraine – the dioecious *E. nigrum* L. and the monoecious *E. hermaphroditum* Hagerup. Maps of their geographical distribution in the Ukrainian Carpathians are presented.

KEY WORDS: *Empetrum*, taxonomy, chorology, ecology, Carpathians

A. Boratyński, Polish Academy of Sciences, Institute of Dendrology, Parkowa 5, PL–62–035 Kórnik, Poland; e-mail: borata@rose.man.poznan.pl; Y. P. Didukh, National Academy of Sciences of Ukraine, M. G. Kholodny Institute of Botany, Treshchenkivska 2, 02601 MSP, Kiev-4, Ukraine; e-mail: didukh@botan.kiev.ua

INTRODUCTION

The genus *Empetrum* L. is represented in Europe by two species – the dioecious *E. nigrum* L. and the monoecious *E. hermaphroditum* Hagerup, the latter treated as an independent species (e.g., Mirek *et al.* 1995) or subspecies *E. nigrum* subsp. *hermaphroditum* (Hagerup) Böcher (e.g., Webb 1972). Both occur in Central European mountains – the Alps, Sudety and the Carpathians – but *E. hermaphroditum* is more frequent than *E. nigrum*, especially at higher elevations. The latter species was observed first on peat-bogs, as a rule at lower altitudes (Favager 1959; Zarzycki & Guzik 1975; Meusel *et al.* 1978; Welten & Sutter 1982; Boratyński 1986; Boratyński & Vera de la Puente 1995).

Empetrum nigrum and *E. hermaphroditum* have not been recognized in Ukraine so far. Nor has the taxonomy of the genus *Empetrum* been revised in Ukraine, and the distribution of taxa is not known sufficiently (Kotov & Chopik 1960; Chopik 1976; Barbarich 1987). Only Zarzycki and Guzik (1975) published species distribution maps prepared on the basis of Polish herbarium materials (KRA and KRAM), which include some material from Ukrainian territory.

We were able to collect some new material of *Empetrum* in several locations of the Ukrainian Carpathians, and to study Ukrainian, Polish and Czech herbaria. The field investigations gave an opportunity make a brief description of the ecological conditions in which *E. nigrum* and *E. hermaphroditum* occur in the Ukrainian Carpathians (Didukh & Boratyński 2000).

MATERIAL AND METHOD

The main features allowing *Empetrum nigrum* sensu stricto to be distinguished from *E. hermaphroditum* are the flowers and fruits. The latter species has monoecious flowers and preserves stamina at the base of the fruits, while *E. nigrum* is dioecious. Other characteristics, such as length and shape of sprouts, dimensions and length/width proportions of the leaves, and form of growth, were also helpful (Zarzycki & Guzik 1975; Boratyński 1986; Villar 1993; Boratyński & Vera de la Puente 1995). Material from KOR, KRA, KRAM, KW, KWU, KWHA, LW, LWD, PR, PRC and UU herbaria have been studied. Acronyms of herbaria follow Holmgren *et al.* (1990) and Vasser (1995).

RESULTS

Empetrum hermaphroditum prevailed in all of the herbarium collections studied. It is distributed mainly in the most elevated mountain ranges such as the Charnokhora, Svidovec and Buzhora (Fig. 1). In other localities only small populations were found, mostly of relict character. The species occurs in the high mountain, subalpine and alpine zones, mostly between 1700 and 1900 m altitude. Its lowest locations are reported at about 1400–1450 m on a small peat-bog below Prut falls in the Charnokhora Mts and at 1300–1400 m in the Bieshchady and Polonina Rivna Mts, while the highest one was found at about 2000 m, somewhat below the summit of Pop Ivan (Fig. 2). *E. hermaphroditum* forms, with *Vaccinium gaultherioides* Bigelow, the specific association *Empetro-Vacci-*

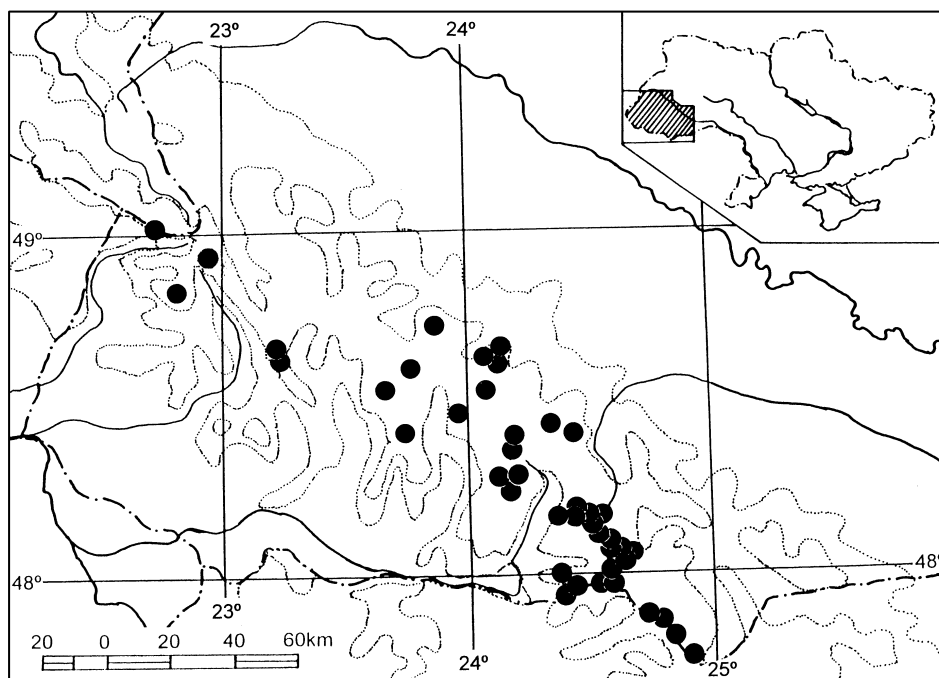


Fig. 1. Distribution of *Empetrum hermaphroditum* Hagerup.

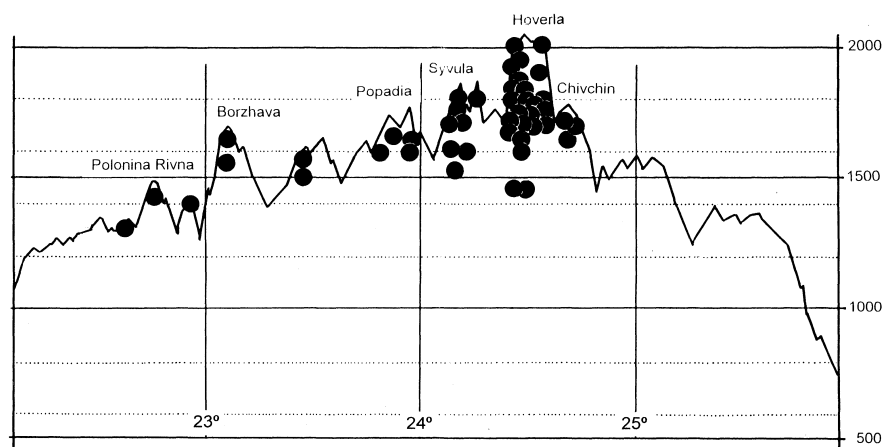


Fig. 2. Vertical distribution of *Empetrum hermaphroditum* Hagerup in the Ukrainian Carpathians.

nietum, which covers sloping mountain sides, mostly convex and north-facing (Fig. 3), especially exposed to wind and frosts. It also enters plant communities with *Loiseleuria procumbens* (L.) Desv. and can be found on peat-bogs and on rocks among *Pinus mugo* Turra thickets.

Empetrum nigrum occurs in two types of habitats. The first of them are peat-bogs, mostly of high moor character, formed on flat terrain in stream valleys at elevations between 500 and 1000 m. The second type are subalpine communities of *Vaccinium vitis-idaea* and *V. myrtillus* developed on rocks at the summits of mountains. The species also sometimes grows in subalpine *Pinus mugo* communities. Populations of *Empetrum nigrum* are not so numerous as *E. hermaphroditum* and are more scattered (Fig. 4).

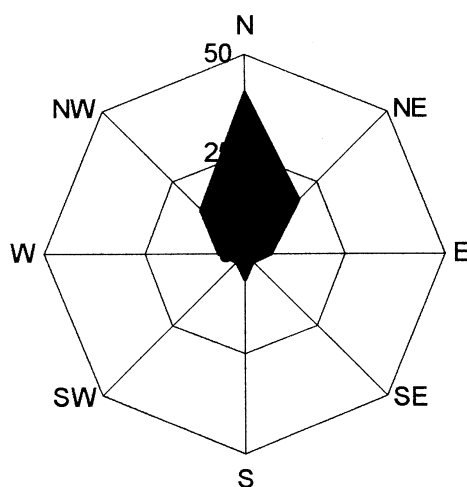


Fig. 3. Exposition of localities of *Empetrum hermaphroditum* Hagerup (on the basis of the authors' field observations and data gathered from herbarium labels).

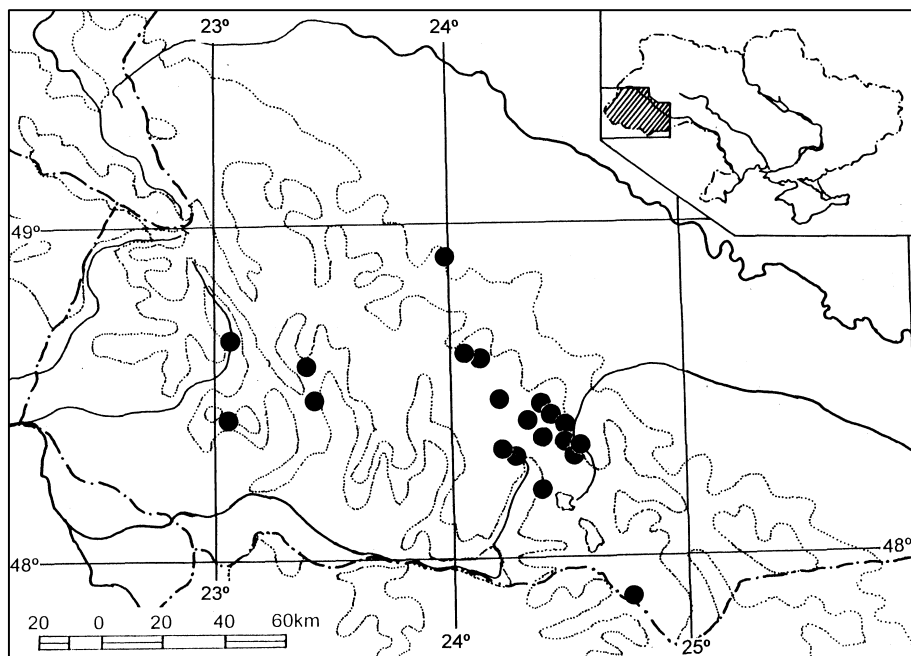


Fig. 4. Distribution of *Empetrum nigrum* L.

The vertical distribution of *Empetrum nigrum* extends from 500 m elevation at Pod Borem peat-bog in Strutich Vizhni near Dolina and 650 m at Glukhan' peat-bog near Sinevir village, up to about 1700 m at the summit of Mt. Doboshanka in the Gorgany Mts (Fig. 5). The localities of *E. nigrum* also are relict in character. A number of them can easily be destroyed by peat exploitation.

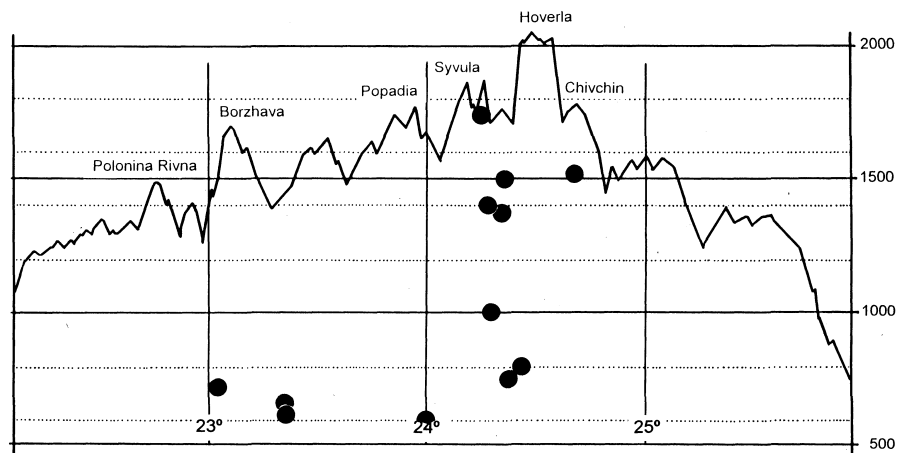


Fig. 5. Vertical distribution of *Empetrum nigrum* L. in the Ukrainian Carpathians.

Empetrum nigrum

SPECIMENS EXAMINED. **BUZHORA.** Babun Pusztara (= Babia Pusztara), *leg. Khrshanovskiy*, 1946 (KW); Volovec, Pusztara peat-bog, *leg. Kontny*, 1946 (LWD); *ibidem*, 750 m, *leg. Chopik*, 1968 (KW). **GORGANY.** Mt. Khomiak (Chomiak), *leg. E. Turczyński*, 1880 (LWD); *ibidem*, slopes, *leg. Kuzyarin*, 1986 (LWD); *ibidem*, 1500 m, *Vaccinium myrtillus*-*V. vitis-idaea* community in *Pinus mugo* thicket, *leg. Boratyński*, 1997 (KOR); *ibidem*, 1350 m, *Vaccinium myrtillus*-*V. vitis-idaea* community on rocks, *leg. Boratyński*, 1997 (KOR); Mt. Doboshanka (Doboszanka), 1720 m, turf on rocks, *leg. Środoń*, 1938 (KRAM); Mt. Synyachka (Synyaczka), 1400 m, in *Vaccinium myrtillus*-*V. vitis-idaea* community, *leg. Boratyński*, 1997 (KOR); Koločava, 617 m, in turfosis secus riam in vico Koločava – Imšady, *leg. Lánska*, 1933, 1936 (PR, PRC); Sinevir – Nehrovec, 650 m, Glukhan' peat-bog, *leg. Boratyński & Didukh*, 1998 (KOR); Mt. Tyapes near Koločava, on *Sphagnum* clumps in *Pinus mugo* thicket on rocks, *leg. Vajnaij*, 1965 (LWD); Nadwórna, village Bistrica, Javirchik range, *leg. Morozyuk*, 1970 (KW); Mt. Berezna, near Zelene, *leg. Krys'*, 1968 (KWA); Zelene, Bredulec range, pine forest on rocks, *leg. Melnichuk*, 1949 (LWD); Chernik village, Bredulec range, *leg. Morozyuk*, 1970 (KW); Osmoloda, Molgawa peat-bog, *leg. Fotyniuk*, 1935 (LWD); *ibidem*, *leg. Bedej*, 1962 (LWD); Perechinsk, Limnica river valley, *leg. F. Griń*, 1941 (KW); Mt. Synyak (Siniak), Małe Tarterowe, *leg. E. Wołoszczak*, 1888 (KRAM); Mt. Jajko, *leg. Herbach*, ? (LW); Dolina, Strutych Vyzhny (Strutycz Wyżny), "Pod Borem" peat-bog, *leg. B. Pawłowski*, 1921 (KRA); *ibidem*, *leg. Seidl*, 1930 (LW); *ibidem*, *leg. Iwanickij*, 1930 (LWD); *ibidem*, *leg. J. Wendeclerówna*, 1934 (LW); *ibidem*, *leg. Mlicivska*, 1951 (LW). **CHARNOKHORA.** Peat-bog above Worokhta, *leg. excursion*, 1910 (KRA); *ibidem*, commonly, *leg. Środoń*, 1939 (KRAM); Maliy Bakhonchik, near sawmill in Worokhta, pine-spruce forest on peat-bog moor, *leg. Kharkiewich*, 1961 (KWA); *ibidem*, *leg. Chopik*, Dubovik, 1967 (KW); *ibidem*, peat-bog in Prut valley 5 km above Worokhta, 800 m, *leg. Boratyński & Didukh*, 1998 (KOR); Zheniec (Żeniec), in pine forest, on Prut river bank, *leg. Środoń*, 1934 (KRAM). **SVIDOVEC.** Jasinya, Charne Bagno (Czarne Bagno) moor above Charna Tisa (Czarna Tisa) river, *leg. Bradis*, 1947 (KW); *ibidem*, *leg. Komendar*, 1953 (KW); *ibidem*, *leg. Chopik*, 1966 (KWA); *ibidem*, *leg. Barbarich*, 1967 (KW); *ibidem*, 750 m, *leg. Chopik*, Verenko & Ornst, 1970 (KW); *ibidem*, 800 m, *leg. Lovelyus*, 1984 (KW); *ibidem*, *leg. S. Mosyakiy*, 1985 (KW); *ibidem*, *leg. Zagulskiy & Davidyuk*, 1986 (LW); Mt. Menčul, comitati Maramoras, ad pagum Jasinia, 1000 m, *leg. Margittai*, 1926 (PRC). **CHIVCHIN – MARMAROS MTS.** Mt. Mokryn, 1520 m, peat-bog moor on mountain ridge, *leg. Pawłowski*, 1934 (KRA). **NOT LOCALIZED.** Velike Kulniki village near Dolina, *leg. Melnichuk* 07.08.1949, LWD.

Empetrum hermaphroditum

SPECIMENS EXAMINED. **BIESZCZADY.** Mt. Pikuj com. Bereg, in subalpinibus, 1400 m, *leg. Margittai*, 1917 (PRC); *ibidem*, *leg. Popov*, 1930 (KW); *ibidem*, *leg. Khrshanovskiy*, 1946 (LWD); Bonin, Husyne village, (Mt. Pikuj), *leg. Chopik*, 1955 (KW); Mt. Kińczyk Bukowski, *leg. Chopik & Ornst*, 1969 (KW). **POLONINA RIVNA.** N slopes, *leg. Chopik*, 1956 (KW). **POLONINA BORZHAVA.** Mt. Stogi, on rocks with *Vaccinium*, *leg. Melnichuk*, 1949 (LWD); Velikiy Verkh, 1550 m, *leg. ?*, 1927 (PR); *ibidem*, 50–70 m below summit, subalpine belt, *leg. Barbarich*, 1947 (KW); *ibidem*, *leg. Melnichuk*, 1949 (LWD). **GORGANY.** Mt. Bratkowska (na Bratkowskiej w Stanisławowskich Karpatach), *leg. Wołoszczak*, 1886 (KRAM); Mt. Doboshanka (Doboszanka) *leg. Wołoszczak*, 1886 (KRAM); Mt. Grofa near Osmoloda, at tree-line on S slope and at summit, *leg. Sichak & Maksimchuk*, 1987 (LW); Mt. Ihrovec, Ihrovishche (Ihrowiszczce), 1780 m, N slopes, *leg. Środoń*, 1939 (KRAM); Mt. Jawornik near Mikulichyn (Mikuliczyn), on rocks, *leg. Turczyński*, 1884 (KWBG); Mt. Kanch near Sinevirska Polana, 1500 m, (in monte Kancz prope vicum Sinovir), *leg. Lánska*, 1933 (PR); *ibidem*, 1550 m, rocks among *Pinus mugo* thicket, *leg. Boratyński & Didukh*, 1998 (KOR); Mt. Negrovec near Sinovir, 1500 m, (in monte Negrovec prope oppidum Sinovir), *leg. Lánska*, 1931, 1932 (PRC); Mt. Polonina Krasna near Sinovir, 1500 m, (in monte Polonina Krasna prope oppidum Sinovir), *leg. Lánska*, 1931 (PRC); Mt. Sywula, (na Sywuli przy Mszańce), *leg. Wołoszczak*, 1890 (KRAM); Mt. Polonina Charna, above stream Jalovec, 1600 m,

Juniperus thicket, leg. ?, 1948 (LWD); Zaplata ad Pagum Porohy, In montibus circuli Stanislaopolensis, in cacumine alpis, leg. Herbach, 1834 (LW). **CHARNOKHORA**. Mt. Bałcatuł, leg. Ślędziński, 1875 (KRA, KRAM); Mt. Breskulec, 1800, *Empetro-Vaccinietum* on NW slopes, leg. Boratyński & Didukh, 1998 (KOR); Czarnohora, leg. Rehmann, 1865 (LWD); leg. Kulczyński, 1925 (LW); leg. Wróblewski, 1926 (KOR); leg. Kozij 1930 (LWD, KW); Mt. Dancerz, W slopes, leg. Kozij, 1930 (KW, LWD); *ibidem*, 1700 m, leg. ?, 1962 (LW); *ibidem*, 1650 m, *Empetro-Vaccinietum* on NE slopes, leg. Boratyński & Didukh, 1998 (KOR); Mt. Dżembronia, peat-bogs in *Pinus mugo* thicket in alpine belt, leg. Łobazewski, ? (LWD); *ibidem*, on ridge by the way to Pohorylec, leg. Zelenchuk, 1956 (LWD); Mt. Gadżyna (Gadzhyna), leg. Shevchuk, 1960 (LWD); Mt. Homul (Gomuł), near Zhabie, N slopes, leg. Artemchuk, 1962 (KW); *ibidem*, leg. Kharkevich, 1965 (KW, KWHA); *ibidem*, on rocks at summit, leg. Kardash, 1986 (LW); Mt. Hoverla, W slopes, leg. Malinovskiy, 1952 (LWD); *ibidem*, N slopes, leg. Berko, 1961 (LWD); Mt. Mala Hoverla, NE slopes above upper tree line, leg. Zagulskiy, 1987 (LW); Mt. Hoverla, N slopes near Prut-falls, 1450m, on granite rocks in *Pinus mugo* thicket, leg. Boratyński & Didukh, 1998 (KOR); glacial kettle between Mt. Hoverla and Mt. Breskulec, 1700 m, peat-bog in basal part of kettle, leg. Boratyński & Didukh, 1998 (KOR); Mt. Kizie Ulohy (in pratis montanis poloniny dictis Kizie Ulohy), leg. Mądalski, 1927 (KRAM, KW, LW); Mt. Velke Kozly (Wielkie Kozły), leg. Berko, 1961 (LWD); *ibidem*, 1700 m, a rocky ridge, leg. Boratyński & Didukh, 1998 (KOR); *ibidem*, 1900 m, *Empetro-Vaccinietum* on NW slopes, rocks, leg. Boratyński & Didukh, 1998 (KOR); Mt. Maryshevska Velka (Maryszewska Wielka), leg. Rehmann, ? (LW); Nesamovite (Niesamowite) Lake below Mt. Turkul, 1850 m, on rocks, leg. Boratyński & Didukh, 1998 (KOR); Mt. Petros, alpine belt, leg. Komendar, 1952 (KW); *ibidem*, at summit, leg. Malinovskiy, 1964 (LWD); *ibidem*, NE slopes, leg. Komendar, 1968 (KW); Pohane Misce – one of the Charnokhora summits, cushions of mosses in *Pinus mugo* thicket, leg. Ślędziński, 1874 (KRAM, KRA); Mt. Pip Ivan (Pop Iwan), 1740 m, SW slopes, leg. Komendar, 1952 (KW); *ibidem*, on slopes, leg. Barbarich, Goncharov & Kukalo, 1954 (KW); *ibidem*, N range, 1800 m, *Pinus mugo* thicket, leg. Boratyński, 1997 (KOR); *ibidem*, 2010 m, on rocks below summit, leg. Boratyński, 1997 (KOR); Mt. Pip Ivan – Waskul (Pop Iwan – Waskuł), leg. Zapalowicz, 1881 (KRAM); Pozhyzhevsk (Pożyżewska), leg. Miczyński, 1939 (KRAM); *ibidem*, NE slopes in clumps of *Sphagnum* among *Pinus mugo* thicket, leg. Zelenchuk, 1960 (LWD); *ibidem*, leg. Ermachenko, 1964 (LWD); *ibidem*, leg. Lazebna, 1967 (LWD); *ibidem*, 1600 m, leg. Myakushko & Chopik, 1968 (KW); *ibidem*, leg. ?, 1968 (KWU); *ibidem*, NW slopes, leg. Stankevich, 1969 (KWHA); *ibidem*, Cebulnik, on rocks, leg. Tasenkewich, 1977 (LWD); Mt. Smotrich (Smotrycz), above *Pinus mugo* thicket belt, leg. Ślędziński, 1875 (KRA); *ibidem*, N slopes above Dzhembronia, 1700 m, rocks among *Pinus mugo* thicket, leg. Boratyński, 1997 (KOR); *ibidem*, 1750 m, leg. Boratyński, 1997 (KOR); Mt. Shpyci (Szpyci) near Zhabie (Żabie), leg. Witwicki, 1865 (KRAM); *ibidem*, leg. Ślędziński, 1875 (KRA); *ibidem*, leg. Kozij, 1935 (KRAM); *ibidem*, leg. Vajnaij, 1958 (LWD); grassy slopes in glacial kettle between Mt. Szpyci and Kozly, 1700 m, leg. Pawłowski, 1937 (KRA). **SVIDOVEC**. Mt. Polonina Archichna near Tyachevo, Kedrin range, peat-bog, leg. Kharkevich, 1957 (KWHA); Mt. Dragobrat, 1760 m, leg. Deyl, 1931 (PRC); *ibidem*, on rocks, leg. Malinovskiy, 1954 (LWD); Mt. Apsheneska near Rakhov, E slopes, leg. Krys', 1970 (KWHA); Mt. Bliznica, 1600 m, NE slopes, leg. Bradis, 1947 (KW); *ibidem*, peat-bog moor, leg. Gryń, 1947 (KW); *ibidem*, ridge near Mt. Bliznica, leg. Gryń, 1947 (KW); *ibidem*, leg. Barbarich, 1947 (KW); *ibidem*, 1600 m, among *Juniperus nana* scrub, leg. Zapyratova, 1947 (KW); *ibidem*, leg. Melnik, 1947 (KW); *ibidem*, 1700 m, NE slopes, leg. Kosec, 1950 (KW); *ibidem*, 1800 m, NW slopes, leg. Kosec, 1950 (KW); *ibidem*, high-mountain meadows, leg. Stojko, 1956 (LWD); *ibidem*, rocky slopes below summit, leg. Kharkevich, 1967 (KWHA); Mt. Cherniec, 1530 m, on clumps of *Sphagnum* in *Picea abies* scrub, leg. Zelenchuk, 1955 (LWD); Mt. Zhelemen' on Vysoke (Wysoke) Poloniny, 1300 m, in saxis montanis, leg. Jirásek, 1873 (PR). **CHIVCHIN – MARMAROS MTS**. Chivchin (Czywczyn), rocks on S slopes, leg. Vajnaij, 1958 (LWD); *ibidem*, leg. Chopik, 1963 (KWHA); *ibidem*, rocks on NE slopes, leg. Chopik & Verenko, 1969 (KW); *ibidem*, E slopes, leg. Zagulskij, 1985 (LW); *ibidem*, N slopes, Preluka, leg. Zagulskij, 1987 (LW); Mt. Gnitesa, on rocks, leg. Berko, 1961 (LWD); *ibidem*, subalpine meadows on Rumanian border, leg. Chopik, 1963 (KWHA); *ibidem*, leg. Vajnaij, 1971 (LWD); Mt. Komanowa, on summit, leg. Kluskówna & Walas, 1934 (KRA); *ibidem*, 1731 m, *Empetro-Vaccinietum*, leg. Pawłowski, 1936 (KRA); Mt. Lozdun, 1656 m, on summit,

leg. Mądalski, 1934 (LWD); Mt. Neneska, 1820 m, leg. Bradis & Zapjatova, 1948 (KW); *ibidem*, 1700 m, on rocks, leg. Chopik, Verenko & Ornst, 1970 (KW); Mt. Petros near Kvasy (Rakhov), leg. Kharschanskiy, 1946 (LWD); *ibidem*, 1950 m, at summit, leg. Malinovskiy, 1948 (LWD); *ibidem*, 1900 m, leg. Don, 1957 (KWU); *ibidem*, rocks at summit, leg. Vajnaij, 1957 (LWD); *ibidem*, leg. Klinishyn, 1987 (LWD); Mt. Pip Ivan (Pop Iwan prope vicum Trebušany), 1650–1940 m, solo granitico, leg. Deyl, 1933 (PR); *ibidem*, rocky slopes covered with *Sphagnum*, leg. Kharkevich, 1946 (KWU); *ibidem*, rocks covered with *Sphagnum* on N slopes, 1800 m, leg. Kosec, 1946 (KW); *ibidem*, 1950 m, leg. Slobodyan, 1947 (LWD); *ibidem*, N, rocky slopes, leg. Kharkevich, 1968 (KWHA); Mt. Rozheska (Rożeska), near Kwasy, below summit, leg. Zagulskiy, 1984 (LW); Mt. Zhandarm (Żandarm) near Rachow, among meadows with *Sphagnum* on N slopes, leg. Kardash, 1986 (LW). **NOT LOCALIZED.** Urochishche Chorna Balka (Uroczyszcze Czorna Bałka), leg. ?, 1962 (KWU).

Acknowledgements. This work is a result of the Polish–Ukrainian Executive Program of scientific and technical cooperation, financed by the Committee for Scientific Research (Poland) and the National Academy of Sciences (Ukraine). The authors are grateful to the herbaria curators for their kind assistance during the study.

References

- BARBARICH A. I. 1987. Empetraceae. – In: JU. P. PROKKUDIN, D. N. DOBROCHAEVA, B. V. ZAVERUKHA, B. I. CHOPIK, V. V. PROTOPOPOVA & L. I. KRITSKA (eds), *Opredivitel' vysshikh rastenij Ukrainy* ["Vascular plants of Ukraine"]. 138 pp. Naukova Dumka, Kiev (in Russian).
- BORATYŃSKI A. 1986. Chronione i godne ochrony drzewa i krzewy polskiej części Sudetów, Pogórza i Przedgórze Sudeckiego [Protected and deserving protection trees and shrubs of the Polish part of the Sudety Mts. with its prealps]. 2. *Empetrum nigrum* L. s.l. – *Arbor. Kórnickie* **31**: 21–37 (in Polish with English summary).
- BORATYŃSKI A. & VERA DE LA PUENTE M. E. 1995. The Empetraceae on the Iberian Peninsula. – *Willdenowia* **25**: 39–53.
- CHOPIK V. I. 1976. Visokogirna flora Ukrain's'kikh Karpat ["Alpine flora of the Ukrainian Carpathians"]. 270 pp. Naukova Dumka, Kyiv (in Ukrainian).
- DIDUKH YA. P. & BORATYŃSKI A. 2000. Ekologo-cenotychni osoblivosti *Empetrum* L. v Ukrajinі ta v Pol'shchi ["Ecological and coenotical peculiarities of *Empetrum* L. in Ukraine and Poland"]. – *Ukrainian Phytosoc. Collect. Ser. C. Phytoecology* **1**(15): 26–31 (in Ukrainian with English summary).
- FAVAGER C., RICHARD J. L. & DUCKERT M. M. 1959. La Camarine noire *Empetrum nigrum* et *Empetrum hermaphroditum* en Suisse. – *Berichte Schweiz. Bot. Ges.* **69**: 249–260.
- HOLMGREN P. K., HOLMGREN N. H. & BARNETT L. C. 1990. Index herbariorum. Part I. The herbaria of the world. Ed. 8. – In: *Regnum Vegetabile*. **120**. x + 693 pp. The New York Botanical Garden, Bronx, New York.
- KOTOV M. P. & CHOPIK V. I. 1976. Osnovnye cherty flory i rastitelnosti Ukrain'skikh Karpat. – In: A. P. MARKEVICH (ed.), *Flora i fauna Karpat* ["Flora and fauna of the Carpathians"], pp. 3–33. Akademia Nauk SSSR, Moskva (in Russian).
- MEUSEL H., JÄGER E., RAUSCHERT S. & WEINERT E. 1978. Vergleichende Chorologie der Zentraleuropäischen Flora. **2**. xi + 418 pp. (Text) and pp. 259–421 (Karten). Gustav Fischer, Jena.
- MIREK Z., PIĘKOŚ-MIRKOWA H., ZAJĄC A. & ZAJĄC M. 1995. Vascular plants of Poland: a checklist. – *Polish Bot. Stud. Guideb. Ser.* **16**: 1–303 (in English and Polish).
- WELTEN M. & SUTTER R. 1982. Atlas de distribution des Pteridophyte et de Phanerogames de la Suisse. **1**, 716 pp. Birkhäuser, Basel, Boston, Stuttgart.

- VASSER S. P. (ed.). 1995. Herbaria Ucrainiae. 124 pp. Academia Nationalis Scientiarum Ucrainiae, Institutum Botanicum Nomine N. G. Cholodni, Kiev.
- VILLAR L. 1993. *Empetrum* L. – In: S. CASTROVIEJO, C. AEDO, C. GÓMEZ CAMPO, M. LAÍNZ, P. MONT-SERRAT, R. MORALES, F. MUÑOZ GARMENDIA, G. NIETO FELINER, E. RICO, S. TALAVERA & L. VILLAR (eds), Flora iberica. **4**, pp. 526–528. Real Jardín Botánico, C.S.I.C., Madrid.
- WEBB D. A. 1972. *Empetrum* L. – In: T. G. TUTIN, V. H. HEYWOOD, N. A. BURGESS, D. M. MOORE, D. H. VALENTINE, S. M. WALTERS & D. A. WEBB (eds), Flora Europaea. **3**, p. 14. Cambridge University Press, Cambridge.
- ZARZYCKI K. & GUZIK J. 1975. The Crowberry – *Empetrum nigrum* L. and *E. hermaphroditum* (Lange) Hagerup in Poland. – Fragn. Flor. Geobot. **21**(4): 423–431.