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ERIGERON ATTICUS VILL. *(ASTERACEAE)* IN THE UKRAINIAN CARPATHIANS

K e y w o r d s: Erigeron atticus*, Ukrainian Carpathians, population, threatened species, conservation*

Abstract

A locality of *Erigeron atticus* on the rocks of Dantsyr Mt. in the Chornohora Range is confirmed. The species has not been reported in the main Ukrainian floristic compendia. Exact location and coenotic conditions of the locality are presented. The taxonomic position and morphological characters of *E. atticus* are analyzed and population parameters described. The population is extremely low-numbered and declining. The species should be included into the new edition of the Red Data Book of Ukraine as critically endangered (CR).

Introduction

According to Ukrainian [4, 8], Carpathian [3, 11, 34] and European [20] checklists, identification manuals and floras, only one representative of the high-mountain *Erigeron* L. species occurs in the Ukrainian Carpathians, namely *E. alpinus* L., known from the Chornohora, Chyvchyny, Marmarosh, and Svydovets Mts. However, several of other species belonging to that genus are reported from different mountain systems of Central and South-Eastern Europe [20, 35—36].

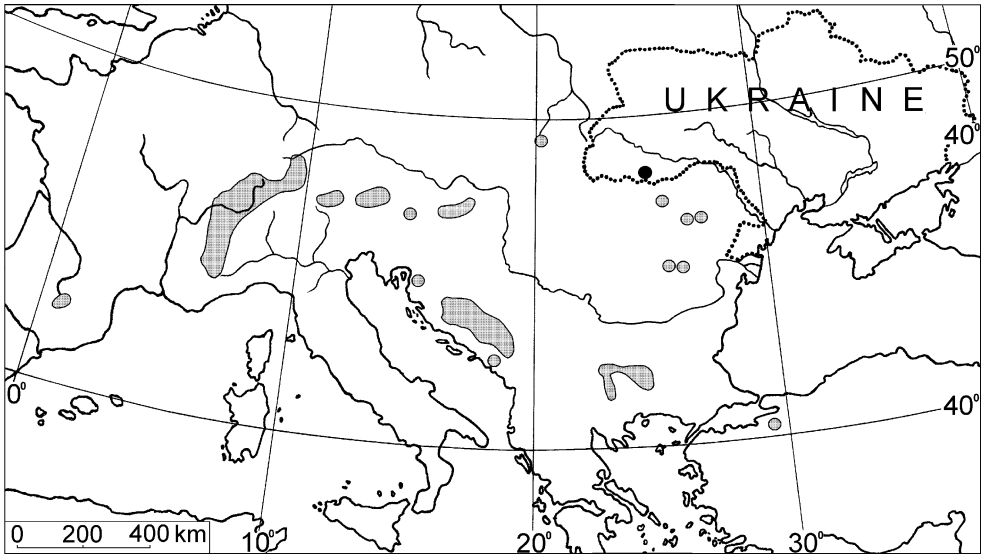

Fig. 1. Distribution of *Erigeron atticus* Vill. Symbols indicate: ● — locality in the Chornohora Mts., ▒ — the rest of the species range (according to H. Meusel & E.J. Jager [1992] and W. Huber [1993], modified)

Four of them — *E. glabratus* Hoppe & Hornsch. ex Bluff & Fingerh., *E. nanus* Schur (*E. hungaricus* (Vierh.) Pawl.), *E. uniflorus* L., and *E. atticus* Vill. — are known from the Carpathians in Poland, the Slovak Republic, and Romania [18, 28, 30—31], and some of their localities are situated not far from the Ukrainian border. The suggestion that they may occur also in Ukraine seems reasonable, and *E. uniflorus* was considered most probable of them [4, 8]. The common distinguishing characters of these high-mountain species vs. the *Erigeron acer* L. group are: shorter pappus (only 1.5—2.0 times longer than the achene) and longer ligules (over 2 mm exceeding the disk florets). Therefore, the species listed above were referred to a separate section *Macroglossae* Vierh. [2, 35] or subsection *Macroglossi* (Vierh.) Pawl. [31].

Some mentions in the publications from the 1930—1940s also suggest that *E. alpinus* is not the only high-mountain representative of the genus *Erigeron* in the Ukrainian Carpathians. For example, in his notes of new floristic finds from the Chornohora Mts. G. Kozij briefly reported a locality of *Erigeron atticus* and stated that he «collected it in 1929 on steep rocks of Dantsyr Mt. in the dwarf pine zone at the elevation of about 1500 m. The plant is very rare in the Chornohora as well, because only some scarce individuals occur at that station» [23, p. 521]. Later on B. Pawlowski used that information when he characterized and compared the floras of different regions of the Carpathians [29]. But in his further publications where he analyzed in detail the distribution of different *Erigeron* species in the Carpathians [30, 31] that author omitted these data. Probably they were considered uncertain and were completely ignored later.

However, recently I discovered a specimen (N 103215) in the Herbarium of the I. Franko Lviv National University (*LW*), which was originally determined as *Erigeron*

carpaticus Griseb. & Schenk. It was collected in 1929 on Dantsyr Mt. in the Chornohora by G. Kozij and definitely refers to his publication cited above [23]. Without a doubt, the specimen represents *E. atticus*. Moreover, while scanning J. Madalski's personal collection kept at the Herbarium of the W. Szafer Institute of Botany, Polish Academy of Sciences, Krakow (*KRAM*), I came across four sheets (N 501661—501664) with undetermined plants collected by J. Madalski in 1929—1930 in the same locality «on crevices and rocks of the wall of Dantsyr». The sheets contain 11 fertile individuals belonging to *E. atticus* as well. In July 1998 we also found that plant *in situ* in the same place but did not manage to determine it properly then.

The objective of this study is to confirm the information about *Erigeron atticus* in the Ukrainian Carpathians, to describe the range, taxonomic position and morphology of that species, and to characterize its locality and population in the Chornohora.

Erigeron atticus (= *E. villarsii* Bellardi = *E. carpaticus* Griseb. & Schenk = *E. glandulosus* sensu Cariot = *E. Alpinus* L. var. *atticus* (Vill.) Fiori = *Trimorpha attica* (Vill.) Vierh.) is a high-mountain species with a disjunctive range (fig. 1) occurring in the Eastern Pyrenees, Alps, Carpathians, north of the Balkan Peninsula (the Velebit, Dinara, Orjen, Durmitor, Pirin, and Rodope Mts.), and north-east of Asia Minor (the Uludag Mts.) [1, 16, 22, 24, 27, 35, 36]. It is rather common in the Western Alps, Dinara and Rodope Mts. However, only some isolated populations are known in the Carpathians from the High and Belianske Tatra Mts. (Western Carpathians, Slovak Republic) [18, 31, 32]; the Rodnei, Ceahlau and Giurgeului Mts. (Eastern Carpathians, Romania); and the Bucegi and Piatra Craiului Mts. (Southern Carpathians, Romania) [28]. Its localities are restricted to rocks and rocky grasslands within 1100—2400 m above sea level (a.s.l) and represent mostly the syntaxonomic orders *Caricetalia curvulae* and *Seslerietalia coeruleae* [22, 27, 36]. There are indications that the species is calciphilous and occurs mainly on neutral to subacidic soils [19, 22, 30].

Material and Methods

Further material is based on the results of field research performed in 1998 and 2005 on Dantsyr Mt. in the Chornohora Range. The exact location of the site was determined with a Garmin *eTrex* Global Positioning System (GPS) navigator with the accuracy of measurements within 25 meters.

Observations on phenology and life form, as well as the assessment of population parameters and recruitment were made during on-site research. Description of the life form is also based on in-situ observations, the examination of the subterraneous parts of plants and watching the off-site development of young individuals transplanted to the author's plot in Lviv. Species abundance was evaluated according to the grades of J. Braun-Blanquet's scale [14].

Morphological and biometric data were obtained *in situ* or on herbarized plants collected by the author or deposited at herbaria of the I. Franko Lviv National University (*LW*) and the W. Szafer Institute of Botany, Polish Academy of Sciences, Krakow (*KRAM*). Morphological description of *Erigeron atticus* refers to the

Chornohora plants and may slightly differ from the information provided in other publications.

Taxonomy of the genus *Erigeron* is presented according to the system worked out by F. Vierhapper [35] and modified by B. Pawlowski [31].

The content of calcium in the soil was determined by the complexonometric method [9].

The collected specimens are deposited at the Herbarium of the M.G. Kholodny Institute of Botany, Kyiv (*KW*) and the Herbarium of the State Natural History Museum, Lviv (*LWS*).

Results

Location and coenotic conditions. A small population of *Erigeron atticus* was found on the eastern slope of Dantsyr Mt. in the Chornohora Range, Ukrainian Carpathians. It is situated in the Hoverla Forestry of Carpathian National Nature Park in the Ivano-Frankivsk Region. Its geographical coordinates are as follows: 48°08»37.9''N and 24°32»36.0''E. The site lies in the subalpine zone on the altitude of 1530 m a. s. l. on steep sandstone rocks with ca. 55 ° mean angle of inclination. Vegetation covers about 70 %. The species composition with corresponding grades of abundance is: *Erigeron atticus* — +, *Alnus viridis* (Chaix) DC. — 1—2, *Pinus mugo* Turra— 2, *Festuca airoides* Lam. — 1, *Juniperus communis* L. subsp. *alpina* (Suter) Celak. — 1, *Calamagrostis villosa* (Chaix) J.F. Gmel. — 2, *Galium album* Mill. subsp. *suberectum* (Klok.) E. Michalkova — +, *Campanula polymorpha* Witasek — +, *C. glomerata* L. — +, *Cirsium erisithales* (Jacq.) Scop. — +, *Achillea sricta* Schleicher ex Gremli — +, *Saxifraga paniculata* Mill. — +, *Linum extraaxillare* Kit. — +, *Thymus alpestris* Tausch ex A.Kerner — +, *Scabiosa lucida* Vill. subsp. *barbata* E.I. Nyarady — +, *Silene dubia* Herbich — +, *Lilium martagon* L. — +, *Laserpitium alpinum* Waldst. & Kit. — +, *Sedum fabaria* W.D.J. Koch — +, and *Trichostomum brachydontium* Bruch — +.

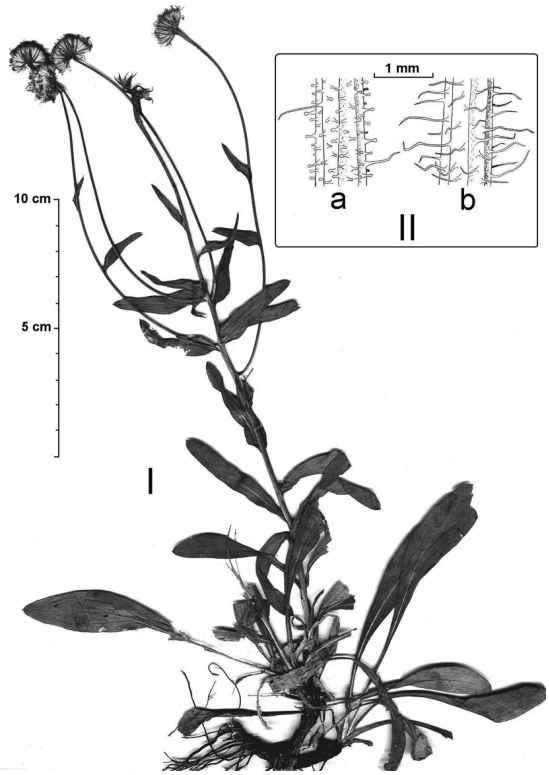

Fig. 2. I — herbarized sample of a fertile individual of *Erigeron atticus* Vill. from the Chornohora Mts.; II — indumentum on the stem of: a — *Erigeron atticus*, b — *E. alpinus* L.

Erigeron atticus occurs in well-insolated sites confined to rock ledges and crevices. Though the bedrock is built of sandstone, it contains some calcite inclusions. The soil is subacidic with pH (H_20) = 5.38. The content of calcium amounts to 16.3 mg-equivalents per 100 g of soil that is rather high for the Chornohora. Some of the species in the community are calciphilous, e.g. *Linum extraaxillare* and *Silene dubia*.

Morphology and taxonomy of *Erigeron atticus*. Rhizome horizontal, brown, ca. 4 mm thick, densely covered with adventitious roots (fig. 2, *I*). Leaf rosettes develop only in sterile individuals or ramets. Flowering stem solitary (rarely 2), robust, erect or ascending, sulcate, 20—40 cm high, branched in the upper half. Basal leaves mucronulate, oblong-obovate, 5—12?1.0—1.5 cm in size, attenuate at the base, with a narrow petiole. Cauline leaves mucronulate to acute, narrowly elliptic or lanceolate, numerous. Capitula several or numerous, 14—23 mm wide, forming a corymbiform panicle or corymb.

Involucral bracts oblong-lanceolate, dark brown, sometimes with light margins, 0.8—1.5 mm wide. Florets trimorphic, i.e. there are three types of them: 1) outer — ligular, female, 2) intermediate (forming a concentric row) — tubular, filiform, also female, 3) inner — tubular as well, but thicker, longer, hermaphrodite. Trimorphic florets, i.e. presence of a row of filiform pistillate tubular florets, are also characteristic for all other species of the genus *Erigeron* sensu stricto (excluding *Conyza* Cass. and *Phalacroloma* = *Stenactis* Cass.) occurring in Ukraine, namely *E. alpinus, E. orientalis* Boiss., and the *E. acer* group. For that reason some authors placed them in a separate taxon of subgeneric or even generic rank — *Trimorpha* [2, 4, 35].

Ligules purple-violet, 2.5—3.0 mm longer than tubular florets. Teeth of corolla in hermaphrodite florets suffused with dark lilac. Achenes light brown, angulate, 2.5—3.0 mm long, covered with silvery sericeous pubescence. Pappus dirty white, 3.5—4.0 mm long.

The main distinguishing character of *Erigeron atticus* is a peculiar type of indumentum. Both sides of leaves, stem, and especially peduncle and involucra, are densely covered with short (0.15—0.5 mm) stipitate glandular hairs. Longer (0.5—1.2 mm) crispate eglandular hairs occur as well, but they are very sparse (fig. 2, *II*, *a*). The type of pubescence is of significant taxomomic value. Prevalence of glandular hairs gave reasons to place *E. atticus* in a separate subsection *Glandulosae* Vier. [35] or series *Glandulosi* (Vier.) Pawl. [31] that includes some other species occurring in the mountains of Eurasia, e. g. *E. gaudinii* Brugg., *E. krylovii* Serg., *E. kunawurensis* Jager [2, 27]. Among them only *E. gaudinii* occurs in Europe, namely in the Alps and Northern Apennines. It is closely related to *E. atticus* but has a rather narrow range, which in some regions overlaps with that of the latter [22, 35].

Other European montane *Erigeron* species, e.g. *E. alpinus*, belong to another subgeneric taxon — subsection *Hirsutae* Vier. [35] or series *Hirsuti* (Vier.) Pawl. [31]. They have long and dense hirsute to crispate eglandular hairs (fig. 2, *II*, *b*). In addition to its peculiar indumentum, *Erigeron atticus* differs from other European high-mountain species of the genus in its considerable height. In its habit (fig. 2, *I*) it somewhat resembles multicapitular *E. alpinus* subsp. *intermedius* (Schleicher) Pawl. [20] but the

latter is much smaller and rarely exceeds 25 cm in height, while the measured flowering individuals of *E. atticus* from the Chornohora are 28 cm high on average.

Life history, phenological development and population parameters. *Erigeron atticus* is a short-rhizomatous herbaceous perennial. Its life history resembles that of *Arnica montana* L. (*Asteraceae*) [6], though clonal reproduction is not that common in *E. atticus*. The annual rate of clonal growth ranges within 2.5—3.2 mm. Rhizome branching starts already in the pre-fertile stage that lasts 2—3 years. Fertile individuals typically are represented by a non-rosettous flowering shoot and 2—4 sterile rosettous modules growing rather compactly. Flowering function persists for 2—3 subsequent years. A short post-fertile period may occur as well. Disintegration of clonal fragments accompanied with senescence may happen at the late stage of life history. Though this somewhat prolongs the lifespan, daughter fragments do not exhibit any traits of rejuvenation. Thus, the life history is unidirectional and the lifespan is not long, ranging within 4—6 years.

Recruitment of the population is provided by seed reproduction. Despite of adaptation to anemochory (pappus), the seedlings and young sterile individuals are concentrated close to the parental plants.

Anthesis takes place in late July — early August and dissemination occurs at the end of August or in September.

In July 1998 I found and assessed only two noticeable population loci of *Erigeron atticus*, but quite probably it could occur also in some other inaccessible parts of the rocks. The total area of both loci accounted for only ca. 2 m^2. At that time the population numbered 12 fertile and 38 sterile adult individuals. Over 100 seedlings occurred as well.

Next survey of the locality was carried out in August 2005 and showed that only one locus remained and the numbers of the population had declined significantly to 3 fertile, 12 sterile individuals, and about 20 seedlings. The population area has shrunk to ca. 0.5 m^2.

Erigeron atticus is confined to unshaded sites and its seedlings occur mostly in the patches with scarce vegetation or in microloci with barren soil caused by erosion. The species is markedly heliophytous and needs some gaps in the plant cover for effective recruitment, especially for the establishment of seedlings. Such special conditions are essential for the replenishment of some low-competitive species [12, 13].

Conclusions

Conservation considerations. According to published and herbarium data, *Erigeron atticus* is represented in the Ukrainian Carpathians by a single petrophytic population on Dantsyr Mt. in the Chornohora. It was low-numbered still in the 1920—1930 s, which is mentioned in the publications [23] and herbarium notes of that period. The population declines rapidly and is prone to complete extinction in the nearest future. It is threatened by unfavorable changes in coenotic conditions caused by gradual replacement of herbaceous vegetation by subalpine dwarf woodland with *Pinus mugo* and *Alnus viridis* or shrubs, e.g. *Juniperus communis* subsp. *alpina*. The

overgrowth of open petrophytic communities by dwarf woodland has intensified during the last decades when grazing ceased in that part of the Chornohora after it was accorded the status of the National Reserve. Consequently, the shading has increased, which impeded the population viability of *Erigeron atticus* and other heliophilous species. Hopefully, the fitness of *Erigeron atticus* can be enhanced by artificial thinning of the dwarf woodland and shrub vegetation on the nearby rocks in order to provide better insolation in the herb layer.

The Chornohora population of *E. atticus* is relict and confined to the edge of the species range (fig. 1). In addition, that locality is the only one situated on the northern macroslope of the Carpathians. All other Carpathian populations are restricted to the catchment area of the Danube River. *Erigeron atticus* probably migrated to the Carpathians in the Tertiary [34]. Further gradual shrinkage and fragmentation of its range could have resulted from alternating glacial/interglacial phases of the Pleistocene and subsequent climate changes in the Holocene [15]. According to the nunatak hypothesis, some alpine species might have survived in the Pleistocene even on considerable altitudes in their ice-free refugia [7, 21, 33]. The well-insolated rocky Dantsyr locality could possibly represent one of such sites that have harbored some high-mountain species, including *Erigeron atticus,* during oligothermic periods.

One of the causes of the extreme rarity of *E. atticus* in the Ukrainian Carpathians is almost complete lack of suitable calciferous rocky habitats in the high-mountain zone resulting from nearly total prevalence of the sandstone flysch in the region [5].

Erigeron atticus is rare or threatened throughout all the Carpathians. It is listed in national Red Lists of Romania [17] and the Slovak Republic [25], as well as some other checklists or compendia on conservation [26, 32], as rare, endangered or vulnerable. The Ukrainian population in the Chornohora is most threatened in comparison to populations in other countries of the Carpathian region where the species occurs. Because of its extremely low numbers, which is still declining, *Erigeron atticus* should be added to the new edition of the Red Data Book of Ukraine and categorized as critically endangered (CR).

The specific epithet «atticus» is rather misleading, because the species does not occur in Attica (part of Greece). Thus, some national names of the species do not follow the exact translations from Latin [1, 18]. Therefore, the Ukrainian name recommended for *Erigeron atticus* is «злинка залозиста», where the specific epithet (meaning «glandular») reflects the most distinguishing character of the species.

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ERIGERON ATTICUS VILL. (*ASTERACEAE*) В УКРАЇНСЬКИХ КАРПАТАХ

Підтверджено наявність оселища виду *Erigeron atticus* Vill. на скелях г. Данцир у Чорногорі, який не наводиться в основних українських флористичних зведеннях. Вказані точне місцезнаходження і ценотичні умови оселища. Проаналізовано таксономічне положення і морфологічні ознаки *E. atticus*, а також описано параметри популяції. Вона є вкрай нечисленною і продовжує скорочуватися. Вид слід включити до нового видання «Червоної книги України» як критично загрожений (CR).

Ключові слова: Erigeron atticus, *Українські Карпати, популяція, вразливі види, охорона*

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ERIGERON ATTICUS VILL. (*ASTERACEAE*) В УКРАИНСКИХ КАРПАТАХ

Подтверждено местонахождение вида *Erigeron atticus* Vill. на скалах г. Данцир в Черногоре, который не приводится в основных украинских флористических сводках. Указываются точное расположение и ценотические условия местопроизрастания. Проанализированы таксономическое положение и морфологические признаки *E. atticus*, а также описаны параметры его популяции. Она крайне малочисленна и продолжает сокращаться. Вид следует включить в новое издание «Красной книги Украины» как находящийся под критической угрозой (CR).

Ключевые слова: Erigeron atticus, *Украинские Карпаты, популяция, уязвимые видыохрана.*