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One New Species of the Genus *Edraianthus*, and a Change in Taxonomic Status for *Edraianthus serpyllifolius* f. *pilosulus* (Campanulaceae) from the Balkan Peninsula

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Abstract*—**A new species, ***Edraianthus pulevicii (Campanulaceae), endemic to the Durmitor mountain range (SE Dinaric Alps, Montenegro, Balkan Peninsula) is described and illustrated. Additionally, specific rank is proposed for *E. serpyllifolius* f. *pilosulus* from the Komovi Mts. (NW Prokletije mountain range, Montenegro, Balkan Peninsula), ***E. pilosulus***. Both are morphologically similar to *E. serpyllifolius* s. s., all having spathulate leaves. *Edraianthus pulevicii* differs from *E. serpyllifolius* s. s. in having distinctly crenate as well as much longer and broader basal and cauline leaves with indumentum on the upper side, hairs on the leaf margin and leaf surface oriented towards the leaf base, broader and longer bracts, and revolute calyx lobes reflexed at the apex. *Edraianthus pilosulus* is morphologically similar to both *E. serpyllifolius* and *E. pulevicii* but differs from the former in having more or less dense hairs on the upper side of the leaves, and from the latter in having considerably smaller basal and cauline leaves with no or sparse crenation, hairs on the leaf margin and the leaf surface oriented towards the point, and narrower bracts. A new systematic treatment is supported by chloroplast DNA sequence data and AFLP fingerprinting data. A distribution map and a key to *Edraianthus* taxa with spathulate leaves are provided and the name ***Edraianthus sutjeskae*** is validated.

***Keywords*—**Campanulaceae, cryptic speciation, Dinaric Alps, *Edraianthus*, endemism, Prokletije mountain range

Edraianthus A. DC. (Campanulaceae) includes approximately 13 herbaceous species (e.g. Kuzmanov 1976; Lammers 2007a; 2007b). The majority of the taxa are considered to be stenoendemics (Turrill 1929). As one of the taxonomically and biogeographically most interesting and polymorphic genera of the Balkan flora, there are already three monographs of the genus (Wettstein 1887; Janchen 1910; Lakušić 1974). Recently, the genus was the subject of extensive molecular phylogenetic and phylogeographic studies which brought some new insights into phylogenetic relationships and systematics both among the genera closely related to *Edraianthus* (Park et al. 2006; Roquet et al. 2008) and within the genus *Edraianthus* itself (Stefanović et al. 2008).

Within the genus, Mayer and Blečić (1969), following Janchen's systematic treatment of the genus, proposed three sections based on the shape of the basal and stem leaves and bracts and number of flowers in terminal clusters: (a) sect. *Edraianthus* (= sect. *Capitati* Wettst.) – *E. graminifolius* (L.) A. DC. s. l., *E. tenuifolius* (Waldst. & Kit.) A. DC., *E. dalmaticus* A. DC. and *E. serbicus* (A. Kern.) Petrović with long, linear to linear-lanceolate, ciliate basal leaves, sessile flowers either solitary or in terminal clusters closely subtended by large leaf-like bracts, (b) sect. *Uniflori* Wettst. emend. Janch. (= sect. *Uniflori* Wettst. p. max. p., sect. *Strigosi* Janch.) – *E. wettsteinii* Halacsy & Bald., *E. pumilio* (Port.) A. DC. and *E. dinaricus* (A. Kern.) Wettst. with basal leaves rather short, linear, more or less densely hirsute above and glabrous beneath, and flowers solitary and closely subtended by leaf-like bracts, and (c) sect. *Spathulati* Janch. (= sect. *Uniflori* Wettst. p. min. p.) – *E. serpyllifolius* (Vis.) A. DC. and *E. serpyllifolius* f. *pilosulus* Beck with short, spathulate and ciliate basal leaves and flowers solitary and subtended by small leaf-like bracts. In his monograph on the genus *Edraianthus*, Lakušić (1974) recognized another two taxa from section *Spathulati*, *Edraianthus sutjeskae* s. s. Lakušić (nom. inv.) and *E. sutjeskae* subsp. *maslesae* Lakušić (nom. inv.), narrow endemics known only from the canyon of the Sutjeska river and its tributaries in E Bosnia and Herzegovina (SE Dinaric Alps), but never validly published. Later (Lakušić 1988) he placed this section in the subgenus *Visiania* (nom. inv.). *Edraianthus glisicii* Černjavski & Soška was not treated by Janchen (1910) since it was described subsequently by Černjavski and Soška (1937), another narrow endemic restricted to the Tara canyon in the Durmitor Mts. (SE Dinaric Alps, NW Montenegro) with solitary and large flowers. In contrast to the other taxa from this section with spathulate leaves, it has rather long, linear to linear-lanceolate, ciliate basal leaves and long bracts. Lakušić (1974) originally placed this species in section *Capitati*, but afterwards (1988) moved it to subgenus *Visiania*. According to the results of the molecular phylogeny of *Edraianthus* based on noncoding plastid DNA sequences, Stefanović et al. (2008) and Surina et al. (unpublished data) found that neither section *Spathulati* nor subgenus *Visiania* is monophyletic. Two separate lineages, one from the Durmitor Mts. and the other from the Komovi Mts. (NW Prokletije mountain range, NE Montenegro), sister to the *E. graminifolius* group, were identified. Due to its spathulate or spathulate-lanceolate leaves and solitary flowers, those populations are morphologically most similar to *E. serpyllifolius*, a taxon restricted to the subalpine and alpine belt of the Central and SE Dinaric Alps from Croatia to Albania. Additionally, results of the AFLP fingerprinting data confirmed their unique systematic position.

In light of those findings, a new species, *E. pulevicii* sp. nov., is described here, a change of taxonomic status of *E. serpyllifolius* f. *pilosulus* Beck, *E. pilosulus* stat. nov., is proposed, and the name *Edraianthus sutjeskae* Lakušić is validated.

Materials and Methods

Morphological analyses were carried out on herbarium specimens deposited in Natural History Museum Rijeka (NHMR), WU and BEOU,

TABLE 1. Descriptive statistics and measurements (in mm) of 27 vegetative and 13 floral characters used in the present analysis of *Edraianthus* taxa with spathulate leaves. Character acronyms are listed in the appendix.

	E. serpyllifolius					*E. pulevicii*					*E. pilosulus*					*E. sutjeskae*				
Character	N	min	**M**	max	SD	N	min	**M**	max	SD	N	min	**M**	max	SD	N	min	**M**	max	SD
Stem																				
St-H0	105	10.1	**39.4**	99.7	1.7	70	7.3	**35.8**	84.2	14.5	21	16.4	**38.5**	68.5	13.7	18	28.2	**75.3**	126.1	24.7
Rosette leaf																				
Lb_W0	56	1.2	**2.3**	3.1	0.1	83	1.2	**3.4**	4.6	0.7	25	1.2	**2.0**	2.7	0.4	25	1.5	**2.4**	3.8	0.5
Lb_W1	56	0.1	**2.3**	14.9	0.2	83	0.9	**3.0**	4.2	0.6	25	1.1	**1.8**	2.7	0.4	25	1.5	**2.3**	3.6	0.4
Lb_L	56	5.8	**17.9**	30.6	0.9	83	8.4	**31.9**	52.9	9.1	25	10.2	**16.1**	24.6	4.3	25	16.0	**31.4**	57.1	10.3
Cauline leaf																				
Le_W0	104	0.2	**1.0**	1.6	0.0	70	0.9	**1.5**	2.5	0.3	21	0.5	**0.9**	1.2	0.2	18	0.7	**1.1**	2.2	0.3
Le_W1	104	0.9	**1.8**	2.8	0.0	69	1.3	**2.5**	4.1	0.5	21	1.2	**1.8**	2.3	0.3	18	1.1	**2.1**	2.8	0.5
Le_W2	104	0.8	**1.7**	2.8	0.0	67	1.1	**2.3**	3.6	0.5	21	1.0	**1.5**	1.9	0.3	18	1.0	**2.0**	2.8	0.5
Le_L0	104	4.0	**10.7**	18.6	0.3	68	8.6	**18.8**	31.9	4.2	21	6.0	**12.2**	19.2	3.1	18	9.5	**17.6**	24.8	4.3
Le_L1	104	0.9	**8.5**	15.9	0.3	69	1.0	**13.9**	26.9	5.8	21	5.0	**11.0**	16.9	2.9	18	6.6	**13.3**	19.9	3.7
Inner invol. bract																				
B1_W0	92	0.6	**1.1**	1.6	0.0	39	1.3	**2.1**	3.7	0.6	23	0.5	**1.0**	1.4	0.3	18	0.8	**1.1**	1.3	0.2
B1_W1	92	1.0	**1.6**	2.4	0.0	39	2.5	**3.4**	4.9	0.6	23	1.0	**1.4**	1.9	0.2	18	1.2	**1.7**	2.2	0.2
B1_W2	92	0.7	**1.1**	1.6	0.0	39	1.1	**1.8**	2.3	0.3	23	0.7	**1.0**	1.4	0.2	18	1.0	**1.4**	2.1	0.3
B1_H0	92	2.6	**5.8**	9.9	0.2	39	5.4	**8.8**	13.3	2.2	23	5.1	**7.2**	10.7	1.7	18	3.5	**7.4**	11.9	2.5
B1_H1	92	0.6	**1.2**	2.9	0.1	39	0.8	**1.8**	5.6	1.0	22	0.6	**1.1**	2.8	0.5	18	0.8	**3.7**	9.0	2.5
B1_H2	92	2.6	**5.8**	9.9	0.2	39	5.4	**8.8**	13.3	2.2	23	5.1	**7.2**	10.7	1.7	18	3.5	**7.4**	11.9	2.5
Central invol. bract																				
B2_W0	94	0.5	**1.1**	1.8	0.0	17	0.9	**1.7**	2.5	0.4	23	0.6	**1.0**	1.4	0.2	18	1.0	**1.3**	1.7	0.2
B2_W1	94	0.9	**1.8**	2.7	0.0	17	2.6	**3.4**	4.3	0.5	23	1.1	**1.5**	1.9	0.2	18	1.4	**1.9**	2.7	0.4
B2_W2	94	0.7	**1.2**	2.3	0.0	17	1.4	**2.0**	2.9	0.5	23	0.8	**1.2**	1.5	0.2	18	1.1	**1.7**	2.4	0.4
B2_H0	94	4.2	**7.1**	12.9	0.2	17	7.4	**10.3**	14.0	2.0	23	5.4	**8.3**	14.0	2.2	18	5.4	**8.5**	12.9	2.2
B2_H1	94	0.6	**1.5**	5.3	0.1	17	1.4	**2.5**	5.6	1.2	23	0.5	**3.2**	10.9	3.3	18	1.0	**5.1**	10.0	2.3
B2_H2	94	4.2	**7.1**	12.9	0.2	17	7.4	**10.3**	14.0	2.0	23	5.4	**8.3**	14.0	2.2	18	5.4	**8.5**	12.9	2.2
Outher invol. bract																				
B3_W0	93	0.8	**1.2**	1.6	0.0	59	0.9	**2.1**	3.3	0.6	19	0.7	**1.0**	2.1	0.3	18	0.9	**1.3**	2.2	0.3
B3_W1	93	1.2	**1.8**	2.6	0.0	59	2.3	**3.4**	5.3	0.6	20	1.1	**1.4**	1.7	0.2	18	1.4	**2.0**	2.7	0.4
B3_W2	93	0.8	**1.3**	2.2	0.0	59	1.3	**1.9**	3.0	0.4	20	0.9	**1.2**	1.6	0.2	18	0.7	**1.9**	2.6	0.5
B3_H0	93	4.7	**8.5**	14.8	0.2	59	5.8	**12.1**	17.3	2.6	20	6.3	**9.8**	15.9	3.0	18	5.6	**10.0**	16.8	3.1
B3_H1	91	0.7	**1.6**	9.2	0.1	59	0.9	**1.9**	4.8	0.7	19	0.6	**4.4**	14.3	4.5	18	0.8	**6.2**	12.9	3.1
B3_H2	93	4.7	**8.5**	14.8	0.2	58	5.8	**12.2**	17.3	2.6	20	6.3	**9.8**	15.9	3.0	18	5.6	**10.0**	16.8	3.1
Calyx																				
Ca_W0	104	2.2	**3.9**	7.5	0.1	70	5.3	**7.1**	8.9	0.8	23	1.9	**3.3**	4.0	0.5	13	3.1	**6.2**	9.3	2.0
Ca_W1	104	1.3	**2.1**	3.6	0.0	70	2.2	**3.2**	4.5	0.6	23	1.2	**1.8**	2.2	0.3	13	1.8	**2.9**	4.1	0.8
Ca_W2	104	0.5	**1.2**	1.9	0.0	70	0.9	**1.5**	2.4	0.3	23	0.7	**1.0**	1.3	0.2	13	1.1	**1.5**	2.1	0.4
Ca_H1	104	2.9	**4.8**	6.9	0.1	70	3.7	**6.5**	9.4	1.1	23	3.3	**5.0**	7.4	1.1	13	3.0	**6.0**	7.5	1.2
Corolla																				
Co_W0	65	2.4	**4.5**	6.3	0.1	64	5.3	**8.0**	12.7	1.7	22	2.1	**4.1**	5.8	1.0	2	3.1	**3.2**	3.3	0.1
Co_W1	67	4.2	**9.8**	13.0	0.2	64	10.4	**16.3**	20.8	2.1	22	8.7	**13.4**	17.7	2.2	2	9.0	**9.1**	9.3	0.2
Co_W2	71	2.6	**4.9**	7.0	0.1	64	5.0	**7.4**	11.0	1.2	22	4.6	**6.2**	8.5	0.9	2	4.1	**4.4**	4.7	0.5
Co_H1	66	11.1	**16.7**	24.1	0.4	64	15.0	**23.2**	28.2	2.9	22	15.3	**22.6**	28.0	3.4	2	15.1	**16.6**	18.1	2.1
Co_H2	71	4.7	**7.8**	12.4	0.2	64	5.1	**9.7**	12.6	1.4	22	7.3	**9.9**	13.8	1.9	2	7.1	**7.9**	8.7	1.2
Style																				
St_L	89	3.6	**13.3**	18.9	0.3	66	11.5	**20.9**	26.4	2.9	19	13.2	**17.4**	22.3	2.3	2	10.2	**10.8**	11.3	0.8
Anther																				
An1_L	81	0.5	**4.9**	7.2	0.1	67	5.1	**6.8**	8.7	0.9	19	3.5	**5.6**	6.8	0.8	.	.	.	.	.
An2_L	38	0.5	**1.4**	2.6	0.1	42	0.9	**1.9**	2.9	0.5	9	1.1	**1.4**	1.9	0.3	.	.	.	.	.
An3_L	25	1.0	**1.5**	2.4	0.1	35	0.6	**1.8**	2.9	0.5	3	1.4	**1.8**	2.1	0.4	.	.	.	.	.

and field collections were preserved in a solution of 96% ethanol and glycerol (1:1). Three taxa recognized morphologically with spathulate leaves were studied: *E. serpyllifolius* f. *pilosulus* from Durmitor (83 specimens) and the Komovi Mts. (25 specimens) in Montenegro, *E. serpyllifolius* s. s. from the Herzegovinian Mts. in Bosnia and Herzegovina and Mt. Orjen in Montenegro (191 specimens), and *E. sutjeskae* from Sutjeska canyon in Bosnia and Herzegovina (26 specimens). Morphological characters were measured using a Leica Qwin and ImageJ1.38x programs, and a Leica DMLS stereomicroscope. Data were processed in the statistical package Statistica 5.1 for Windows (Statsoft 1996).

Basal leaf upper surfaces of the three *Edraianthus* taxa with spathulate leaves were investigated using a scanning electron microscope (SEM): *E. serpyllifolius* f. *pilosulus 481* (NHMR!) from the Durmitor Mts., *E. serpyllifolius 401* (NHMR!) from the Herzegovinian Mts., *E. serpyllifolius* f. *pilosulus 488* (NHMR!) from the Komovi Mts., and *E. sutjeskae 478* (NHMR!) from E Herzegovina. To restore the turgescent state of the herbarium material, leaves were rehydrated with diluted detergent for several hours. The leaves were afterwards rehydrated in FDA (formaldehyde dimethyl acetal) for 24 hr and dried in CO_2. The material was mounted on stubs with double sided sticky tape, sputter-coated with gold, and investigated using JEOL JSM-6390 SEM.

To ascertain the chromosome number of *E. serpyllifolius* f. *pilosulus* from the Durmitor Mts., living plants were transferred to the Botanical Garden of the University of Vienna. A voucher is deposited in NHMR. Actively growing root tips were collected and pretreated with 0.1% colchicine, fixed in 3:1 ethanol:acetic acid for 24 h at room temperature, and stored at –20°C until use. For further chromosome preparation and analysis we followed Weiss et al. (2002).

DNA extractions were made from silica gel-dried leaf material gathered in the field following the CTAB protocol of Doyle and Doyle (1987)

with the following modifications: after precipitation with isopropanol and subsequent centrifugation, the DNA pellet was washed with 70% ethanol, dried at 37°C, and resuspended in TE buffer. The quality of the extracted DNA was assessed on 1% TAE-agarose gels. AFLPs were amplified following Dixon et al. (2008).

Raw AFLP data were collected and aligned with the internal size standard using ABI Prism GeneScan analysis software 3.7.1. (Applied Biosystems, Foster City, California). The GeneScan files were imported into Genographer v. 1.6.0 (available at http//hordeum.oscs.montana.edu/genographer) for scoring the fragments.

In the 40 individuals successfully analyzed, we scored 337 AFLP fragments, of which four were excluded after comparison between the replicated individuals. The error rate (Bonin et al. 2004) before the exclusion of unreliable characters was 0.2%. The results of the scoring were exported as a presence/absence matrix. Using the program SplitsTree 4 (Huson and Bryant 2006), a neighbor-net diagram was produced from Nei-Li distances (Nei and Li 1979). To obtain bootstrap support values for branches, 1,000 pseudoreplicates were employed. Details on the plant material are provided in the Appendix.

Results

Populations of *E. serpyllifolius* f. *pilosulus* from the Durmitor and Komovi Mts. are both morphologically very similar to *E. serpyllifolius* s. s., all having spathulate leaves and solitary flowers densely subtended by small leaf-like bracts. However, detailed morphological analyses showed considerable differences in several morphological characters among the populations (Table 1). *Edraianthus serpyllifolius* f. *pilosulus* from the Durmitor Mts. differs from *E. serpyllifolius* s. s. in having distinctly crenate as well as much longer and broader basal and cauline leaves with indumentum on upper side, which in *E. serpyllifolius* s. s. is lacking completely (Međedović 1981; see also Šoljan 1983), hairs on the leaf margin and leaf surface oriented towards the leaf base, broader and longer bracts and revolute calyx lobes reflexed at the apex (Table 1, Figs. 1, 2G, H,4). Like all other taxa within *Edraianthus* (e.g. Löve 1973; Međedović 1980; Van Loon and Kieft 1980, Međedović 1981; Tessitore et al. 1994), this population has the chromosome number $2n = 32$.

Edraianthus serpyllifolius f. *pilosulus* from the Komovi Mts. (Figs. 1, 2E, F; Table 1) is morphologically similar to both *E. serpyllifolius* s. s. (Figs. 1, 2B, C; Table 1) and *E. serpyllifolius* f. *pilosulus* from the Durmitor Mts. but differs from the former in having more or less dense hairs on the upper side of the leaves and much longer corolla lobes, and from the latter in having considerably smaller basal and cauline leaves with no or sparse crenation, hairs on the leaf margin and the leaf surface oriented towards the apex, and narrower bracts. According to our observations, the presence or absence of indumentum is the most constant and reliable morphological feature to differentiate *E. serpyllifolius* f. *pilosulus* from the Komovi Mts. and *E. serpyllifolius* s. s.

Morphological differentiation is congruent with the results of cpDNA sequence data (see Stefanović et al. 2008) and AFLP fingerprinting data. In the neighbor-net network of AFLP phenotypes (Fig. 3), four groups with high bootstrap support were formed: *E. serpyllifolius* s. s. from the Herzegovinian Mts. and Mt. Orjen (SE Dinaric Alps), *E. sutjeskae* from the Sutjeska canyon, and two well separated groups of *E. serpyllifolius* f. *pilosulus* from the Durmitor and Komovi Mts. Therefore, a new species is proposed, *E. pulevicii* sp. nov. for the population from the Durmitor Mts., and a change in taxonomic status of *E. serpyllifolius* f. *pilosulus*, *E. pilosulus* stat. nov., from the Komovi Mts.

Taxonomic Treatment

Edraianthus pulevicii Surina & D. Lakušić, sp. nov. *Edraianthus serpyllifolius* (Vis.) DC. f. *pilosulus* auct. non Beck, Wiener Illustrierte Garten-Zeitung 18: 287–299. 1893.—TYPE: MONTENEGRO. Dinaric Alps, Durmitor mountain range, Mt. Prutaš, NE slopes, 43°07′28″N 19°00′17″E, 2350 m, 24 Jul 2007, *Surina 345* (holotype: NHMR!; isotypes: WU!, BEOU!).

Fig. 1. Bracts, sepals and petals of *Edraianthus* taxa with spathulate leaves: *E. serpyllifolius* f. *pilosulus* from the Durmitor and Komovi Mts. (Kom Vasojevički), and *E. serpyllifolius* s. s. from the Mt. Orjen. Scale: 1 cm.

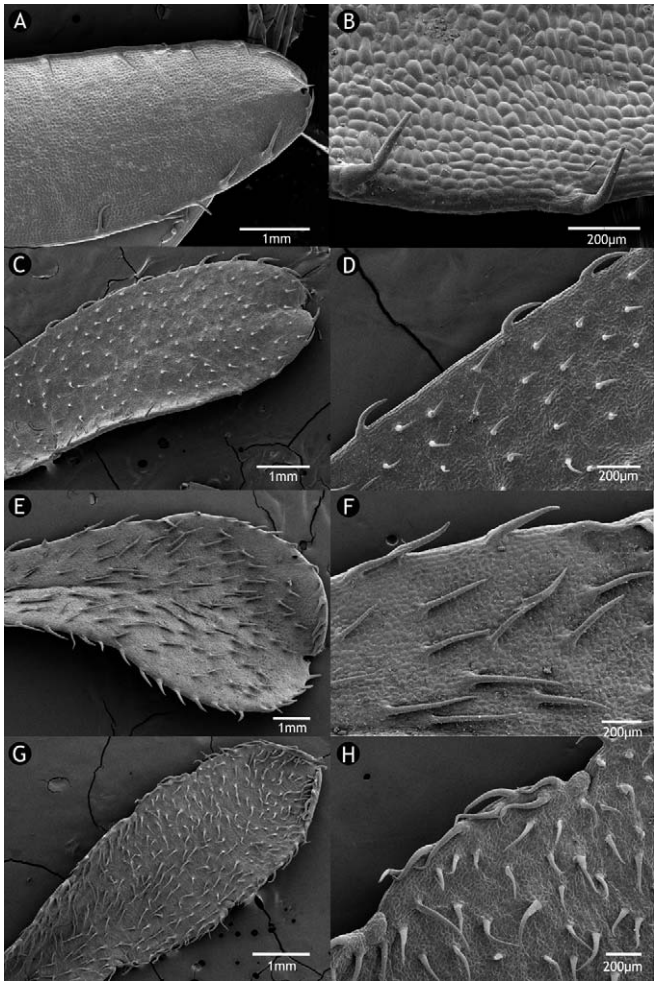

FIG. 2. Scanning electron microscope photographs of basal leaf upper surface of *Edraianthus* taxa with spathulate leaves. A, B. *Edraianthus serpyllifolius* s. s. (Bosnia and Herzegovina, Čvrsnica mountain range). C, D. *E. sutjeskae* (Bosnia and Herzegovina, Sutjeska canyon). E, F. *Edraianthus serpyllifolius* f. *pilosulus* (Montenegro, Komovi mountain range). G, H. *Edraianthus serpyllifolius* f. *pilosulus* (Montenegro, Durmitor mountain range).

Edraianthus pulevicii ab *E. serpyllifolio* s. s. foliis distincte crenatis, basalibus et caulinis multo longioribus et latioribus, supra pilosis, margine pilis retroflexis obsitis, bracteis latioribus et dentibus calycinis margine et apice revolutis differt, ab E. *pilosulo* foliis rosulatis et caulinis non crenatis, sicut eis

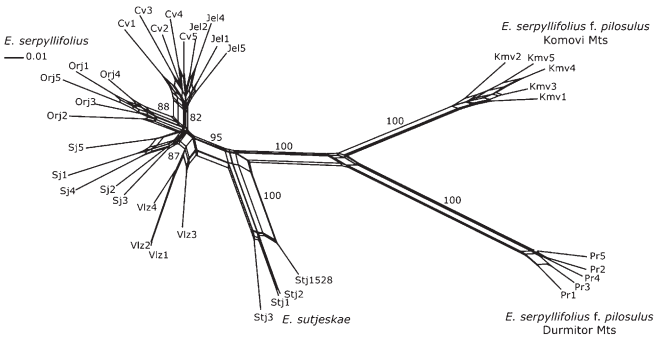

FIG. 3. A neighbor-net of AFLP phenotypes belonging to four groups of taxa of *Edraianthus* with spathulate leaves. Numbers are bootstrap values higher than 80% (1,000 replicates); labels are indicated in the appendix.

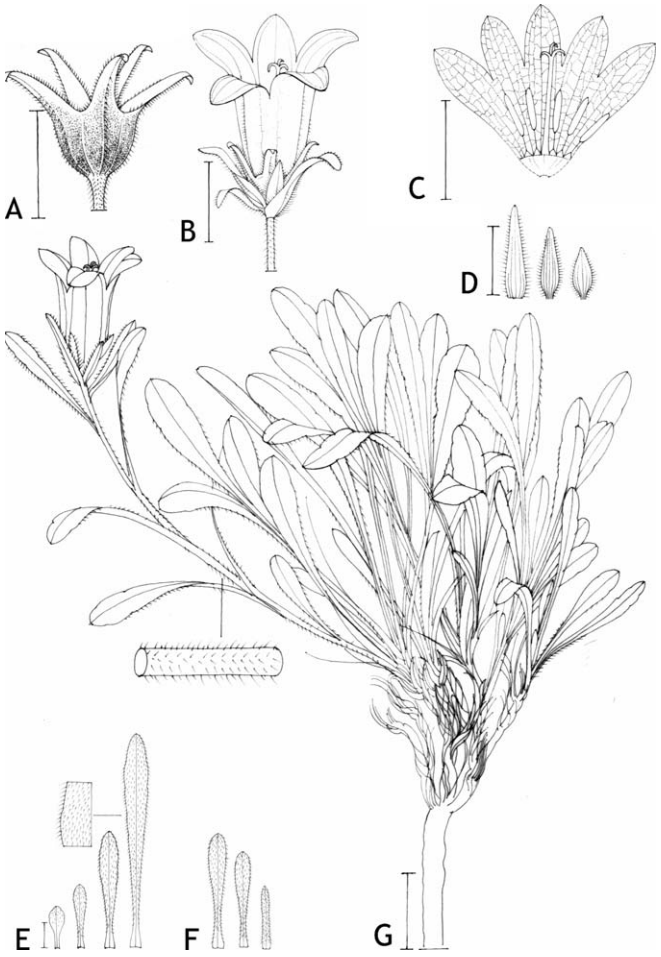

FIG. 4. *Edraianthus pulevicii*. A. Calyx (corolla removed). B. Flower. C. Dissected corolla (calyx removed). D. Bracts (outer left, inner right). E. Basal (rosette) leaves (inner and outer). F. Cauline leaves (lower left and upper right). G. Habit (holotype). Scale: 1 cm. Drawing by Arndt Kästner.

bractearum aliquantum longioribus latioribusque, pilis marginalibus apicem versus pronis.

Cespitose perennial. Rhizome stout, woody, branched, up to 20 cm long. Stems single or numerous, simple, (2.5)3–5 (-8.4) cm, erect to ascending, more or less hairy, with papery or fibrous leaf remains at the base. Cauline leaves few or up to 10, obtuse, rarely retuse, lower spathulate, (9.7-)14.2(-19) × (1.6-)2(-2.7) mm, and upper spathulate to spathulate-ligulate, (11.9-)16(-18.1) × (1.8-)2.2(-2.7) mm, subsessile, glabrous or rarely sparsely hairy above, ciliate. Basal (rosette) leaves numerous, (8.37-)33.4(-62.9) × (1.2-)4.1(-7.5) mm, spathulate to spathulate-ligulate, petiolate, more or less distinctly crenate with cilia oriented towards leaf base, hairy above with hairs oriented towards leaf base. Flowers solitary and terminal. Bracts (2-)3(-6), obtuse, shorter than the flower, glabrous or hirsute on veins, margin hirsute to hirsute-tomentose, sometimes with sparse indumentum above on the apex, brownish- to purple-violet at the base, sparsely subtending the flower; outer lanceolate-ovate to ligulate-oblong, (5.8-)13.4(-17.3) × (1.8-)2.6(-5) mm, inner lanceolate to ovate-oblong, (4-)8.6 (-13.2) × (1.2-)3(-5) mm. Calyx (8.4-)12(-15) × (5.7-)7.6(-10.4) mm, reddish-violet to dark purple; calyx tube half-globose, glabrous, hirsute on veins, calyx lobes oblong-lanceolate, (3.7-) 7.1(-9.4) × (2.2-)3.5(-5.5) mm, obtuse, about as long as tube, more or less revolute, reflexed at the apex, ciliate, commonly

with setulose or ciliate appendages. Corolla campanulate, (15-)21.6(-28) mm, glabrous or hirsute on veins, divided to 1/2.5–1/2, bluish to violet-blue. Style 1, (11.5-)16.7(-26.4) mm long, stigma (2-)3(-4) lobed, decurrent; stamens 5, inserted on disc, anthers (5-)6.4(-8.7) mm long, filaments (0.9-)2.4(-3) mm long, lower part distinctly dilated to deltoid shape. Seeds numerous, elliptic-oval, light brown (1.3-)1.5(-1.7) × (0.7-)1(-1.2) mm. Figures 1, 2G, H, and 4.

Chromosome Number—$2n = 32$

Additional Specimens Examined—MONTENEGRO. Dinaric Alps, Durmitor Mountain Range: Komarnica canyon, Boljske grede, northern exposition, 7 Jul 1989, *Stevanović & Jovanović 1168/89* (BEOU!); between Škrčka jezera lakes and foothills of Mt. Grude, 2,000 m, 18 Jul 1992, *Stevanović 496/92* (BEOU!); between Mts. Velika Previja – Terzin bogaz – Mala Previja, 22 Jul 1992, *M. Niketić 556/92* (BEOU!); NW slopes of Mt. Šljeme, rock crevices, 1,800 m, 10 Aug 1994, *Stevanović 1380/94* (BEOU!); Mt. Šljeme (furca), rock crevices, 2,350 m, 8 Jul 1996, *D. Lakušić & Conti 909/96* (BEOU!); Mt. Bobotov kuk, Sedlo settle, grassland, 2,450 m, 13 Jul 1997, *D. Lakušić et al. 6104* (BEOU!); Mt. Šljeme (eastern peak), grassland, 2,454 m, 14 Jul 1997, *D. Lakušić & Tomović 6025* (BEOU!); Mt. Prutaš, northern slopes, rock crevices, 2,350 m, 28 Sept 2005, *Blokar & Surina 344* (NHMR!); Mt. Šljeme, Kotao towards Mt. Savin kuk, rock crevices, 2,100 m, 12 Jul 2007, *D. Lakušić 24574* (BEOU!); Mt. Bobotov kuk, between Velika Previja and Škrčki pogled, rock crevices, 2,386 m, 13 Jul 2007, *D. Lakušić 24575* (BEOU!).

Phenology—Flowering specimens have been observed from July to August (September).

Etymology—The new species is named in honor of Prof. Vukić Pulević, a Montenegran botanist who significantly contributed to the knowledge of the Dinaric and the Balkan flora.

Distribution and Habitat—Until now the newly described species has only been found in the Durmitor mountain range (SE Dinaric Alps, Montenegro, Fig. 5). It inhabits shaded and moist rock crevices of limestone, snow bed margins, screes and rocky grasslands in the subalpine and alpine belt between 2,100 and 2,500 m.

A relevé as the sigmatistic approach (Braun-Blanquet 1964; Westhoff and van der Maarel 1973) from the type locality: rock crevices; relevé area: 6 m^2, aspect: N, slope: 80–90°; coverage: 20%. *Edraianthus pulevicii* 1.2, *Potentilla clusiana* 1.2, *Aubrieta columnae* ssp. *croatica* +.2, *Edraianthus graminifolius* +.2, *Saxifraga oppositifolia* +.2, *Sesleria juncifolia* +.2, *Silene parnassica* +.2.

Edraianthus pilosulus (Beck) Surina & D. Lakušić stat. nov. *Edraianthus serpyllifolius* f. *pilosulus* Beck, Wiener Illustrierte Garten-Zeitung 18: 293. 1893.—TYPE: MONTENEGRO. Prokletije mountain range, Komovi Mts.: Mt. Kom Kučki, July 1886, *I. Szyszylowitz* (lectotype, here designated: W 1886–11859!).

Additional Specimens Examined—MONTENEGRO. Prokletije Mountain Range, Komovi Mts.: Komovi Mts., 1 Aug 1873, *Pančić 9542* (BEOU!); Mt. Kom Kučki, 1886, *Szyszylowicz 11859* (W!); Mt. Kom Kučki, 1 Aug 1890, *Baldacci 1249* (WU!); Mt. Kom Kučki, above the alp Ljuban, 26 Jul 1898, *Baldacci 1845* (WU!); Mt. Kom Vasojevićki, NW slope, 1,600 m, 5 Jul 1916, *Janchen 2680* (WU!); Mt. Kom Vasojevićki, 3 Oct 1991, *Stevanović, D. Lakušić & Niketić 2765/91* (BEOU!); Mt. Kom Vasojevićki, above the alp Štavna, 42°41′43″N 19°40′43″E, 1,973 m, 15 Jul 2006 *Stevanović & D. Lakušić 20953* (BEOU!). Mt. Kom Kučki, W & S slopes, 42°40′50″N 50°19′38″E, 1,900–2,400 m, 22 Aug 2006, *Schönswetter & Frajman* (WU!); Mt. Kom Kučki, in the vicinity of the alp Ljuban towards settlement Rogami, 42°41′44″N 19°38′49″E, 1,800–2,100 m, 23 Aug 2006, *Schönswetter & Frajman* (WU!); Mt. Kom Vasojevićki, the summit, 25 Jul 2007, *Bardy & Schönswetter* (WU!); Mt. Kom Kučki, SE slopes above Međukomlje, 42°40′38″N 19°38′49″E, 2,220 m, 26 Jul 2007, *Surina 488* (NHMR!).

Conservation Status—Since both taxa are known only from a few adjacent localities in the Durmitor mountain range (*E. pulevicii*) and Komovi Mts. (*E. pilosulus*), and their estimated area of occupancy is smaller than 10 km^2 (Fig. 5), they both meet the criteria for being critically endangered (CE; IUCN Red List of Threatened Species v. 3.1, available at http://www.iucnredlist.org/info/categories_criteria2001).

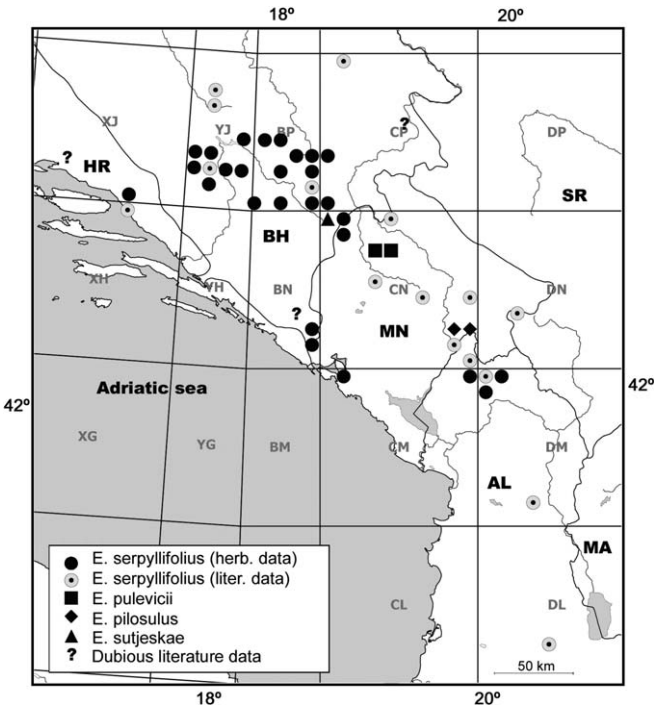

Fig. 5. Distribution of *Edraianthus* taxa with spathulate leaves. The distribution is mapped using an underlying 10 × 10 UTM coordinate grid 100 × 100 km (UTM Grid zone 34, spot correspond with basic square 10 × 10 km). HR – Croatia. BH – Bosnia and Herzegovina. MN – Montenegro. AL – Albania. MA – Macedonia. SR – Serbia.

Edraianthus sutjeskae Lakušić ex Surina & D. Lakušić—TYPE: BOSNIA AND HERZEGOVINA. Dinaric Mts., Sutjeska Gorge, Vratar, 11 August 1925, *K. Maly* (lectotype, here designated: SARA 40751!).

Edraianthus sutjeskae was originaly described in 1974 by Lakušić in his monograph of *Edraianthus.* Although the protologue included a Latin diagnosis and a photogram, the name of the taxon was not validly published since neither type specimen, collector's name, nor collection date were designated, thus violating Art. 37.1. of the Vienna code (McNeill et al. 2006). Later, during the siege of Sarajevo from 1991–1995, the herbarium at the Institute of Botany, University of Sarajevo (IBUS), where the specimens of *E. sutjeskae* were stored, was completely destroyed.

Discussion

Earlier monographers (Wettstein 1887; Janchen 1910) and systematists (e.g. Kuzmanov 1976; Greuter and Raus 1983) did not observe taxonomically significant polymorphism in leaf, involucrum and calyx shape, and indumentum density in *E. serpyllifolius.* Plants with conspicuous indumentum from the Komovi Mts. were collected by I. Szyszylowicz in 1886 (Beck and Szyszylowicz 1888) and treated only as a form: *E. serpyllifolius* f. *pilosulus* (Beck 1893). However, this taxon, according to the cited locality (Komovi Mts.), had already been recog-

nized by R. Visiani (in Nyman 1882), probably on the basis of material collected by J. Pančić in 1873 from the same locality (Pančić 1875), as *E. serpyllifolius* subsp. *thymifolius* sine descr. In his monograph of the genus *Edraianthus*, Lakušić (1974) originally ranked this taxon as a subspecies of *E. serpyllifolius*. Subsequently, he realigned it within newly proposed genera, first as *Protoedraianthus pilosulus* (Lakušić 1988) and than as *Visiania pilosula* (Lakušić 2001). However, in neither case was an adequate explanation and/or diagnosis offered, nor were the rules of nomenclature followed, so neither name was validly published. A recently published molecular phylogeny of the genus (Stefanović et al. 2008) does not support Lakušić's systematic treatment.

The data on the geographical distribution of *E. pilosulus* (≡ *E. serpyllifolius* f. *pilosulus* auct. non Beck) are a bit confusing. Based on estimates from the literature, *E. pilosulus* is distributed on mountain ranges of Vojnik, Komovi, and Durmitor in Montenegro, and Maglić, Volujak, Zelengora, Crvanj, and Čvrsnica (Mt. Mali Vran) in Bosnia and Herzegovina (e.g. Rohlena 1942; Lakušić 1974; Međedović 1981; Bjelčić et Mayer 1983). However, our intensive and detailed field investigations did not confirm any of these localities, except for the Komovi Mts., nor did the results of molecular analyses (see Stefanović et al. 2008; Fig. 3).

Although genetically well differentiated, a population of *E. sutjeskae* with rather elongated cauline and rosette leaves, and sometimes sparsely developed indumentum (Fig. 2C, D) is morphologically similar to *E. serpyllifolius* s. s. Based only on morphological data, as Međedović (1981) already stated, the distinction of the two taxa is hardly justified. Chloroplast sequence data (Stefanović et al. 2008) render this population as a sister taxon to *E. serpyllifolius* s. s., while some karyological and palynological peculiarities of this taxon were observed by Međedović (1981). Unpublished AFLP fingerprinting data (Surina et al.) suggest the possibility of its hybrid origin. Nevertheless, its phylogenetic and taxonomic status remain uncertain.

Key to *Edraianthus* Taxa with Spathulate Leaves

1. Margins and upper surfaces of basal leaves with hairs (indumentum) oriented towards leaf base; bract margins hirsute to hirsute-tomentose; calyx lobes revolute and regularly reflexed at the apex . . . . . *E. pulevicii*
1. Margins and upper surfaces of basal leaves with straight hairs, or hairs oriented towards the apex, or basal leaves without indumentum; bract margins ciliate; calyx lobes flat 2
   2. Bract margins with short cilia, bract apex rounded; stems (28-)50–90(-118) mm; basal leaves (16-)21–40(-57) mm . . . . . *E. sutjeskae* (incl. subsp. *maslesae*)
   2. Bract margins with distinctly prolonged cilia, bract apex acuminate; stems (10-)23–52(-72) mm, basal leaves (10-)13–20(-25) mm 3
      3. Basal leaves with indumentum on upper surface . . . . . *E. pilosulus*
      3. Basal leaves glabrous on upper surface . . . . . *E. serpyllifolius*

Conflicting patterns of genetic and morphological variation in the *E. serpyllifolius* group are either a result of ancient interspecific hybridization events followed by genome introgression, and range shifts, contractions and expansions as responses to climate change, lineage sorting, or they might be due to extensive morphological homoplasy. Further research is underway to unravel the putative hybrid origin and systematic position of selected *Edraianthus* taxa.

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Appendix 1. List of morphological characters and their acronyms used in the present analysis.

Stem. Stem height, St_H0. **Leaves**. *Rosette leaf*. Maximal width, Lb_W0. Width in the upper quarter, Lb_W1. Total length, Lb_L. *Cauline leaf*: Base width, Le_W0. Maximal width, Le_W1. Width in the upper quarter, Le_W2. Total length, Le_L0. Distance between the largest leaf width point and the leaf base, Le_L1. *Involucral bracts: Inner* – Base width, B1_W0. Maximal width, B1_W1. Width in the upper quarter, B1_W2. Total length, B1_H0. Distance between the largest width point and the base, B1_H1. Distance between apex base and the bract base, B1_H2. *Central* – base width, B2_W0. Maximal width, B2_W1. Width in the upper quarter, B2_W2. Total length, B2_H0. Distance between the largest width point and the base, B2_H1. Distance between apex base and the bract base, B2_H2. *Outer* – Base width, B3_W0. Maximal width, B3_W1. Width in the upper quarter, B3_W2. Total length, B3_H0. Distance between the largest width point and the base, B3_H1. Distance between apex base and the bract base, B3_H2. **Calyx**. Diameter, Ca_W0. Base width, Ca_W1. Width in the upper quarter, Ca_W2. Total length, Ca_H1. **Corolla**. Base width, Co_W0. Maximal width, Co_W1. Width of lobe base, Co_W2. Total height, Co_H1. Lobe height, Co_H2. **Style**. Length, St_L. **Anther**. Anther length, An1_L. Filamentum length, An2_L. Height of filamentum base, An3_L.

Appendix 2. Information on taxa sampled, localities, labels, collector, date and the herbarium used in the AFLP fingerprinting.

Edraianthus serpyllifolius: Dinaric Alps, Mt. Čvrsnica – Veliki Vilinac (Bosnia and Herzegovina), **Cv**, *Ž. Modrić and B. Surina, 6.7.2006, 401* (NHMR). Dinaric Alps, Mt. Čvrsnica – Jelenak (Bosnia and Herzegovina), **Jel**, *B. Surina, 21.7.2006, 403* (NHMR). Dinaric Alps, Mt. Velež – Velika Velež (Bosnia and Herzegovina), **Vlz**, *B. Surina, 22.7.2006, 404* (NHMR). Dinaric Alps, Mt. Biokovo – Sveti Jure (Croatia), **Sj**, *D. Mihelj, 1.7.2004*, (ZA). Dinaric Alps, Mt. Orjen – Zubački Kabao (Montenegro), **Orj**, *Ž. Modrić and B. Surina, 4.7.2006, 402* (NHMR). ***Edraianthus sutjeskae***: Dinaric Alps, Sutjeska canyon – Vratar (Bosnia and Herzegovina), **Stj**, *B. Surina, 20.7.2007, 478* (NHMR). Dinaric Alps, Sutjeska canyon – Vratar (Bosnia and Herzegovina), **Stj1528**, *V. Stevanović and D. Lakušić, 17.7.2006, 20938* (BEOU). ***Edraianthus pulevicii***: Dinaric Alps, Durmitor mountain range – Prutaš (Montenegro), **Pr**, *B. Surina, 24.7.2007, 481* (NHMR-holotype!). ***Edraianthus pilosulus***: Prokletije mountain range, Komovi Mts. – Kom Kučki (Montenegro), **Kmv**, *B. Surina, 26.7.2007, 488* (NHMR).