PHENETIC VARIABILITY OF *ACONITUM LASIOCARPUM* (RCHB.)
GÁYER (RANUNCULACEAE): EXTENSION
OF TAXONOMIC AND GEOGRAPHIC BORDERS

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ABSTRACT

A. lasiocarpum has provoked a long-standing debate over its systematic and geographic status. Present taxonomic and chorological studies offer a proposal for the solution of these problems. In their result, a taxon described by Zapałowicz (1908) was rediscovered, now treated as *A. lasiocarpum* subsp. *kotulae* comb. nov. It occurs far beyond hitherto admitted borders of *A. lasiocarpum* subsp. *lasiocarpum*, reaching the Sanok–Jasło Basin, the Tatra Mts. and Babia Góra Mt. in the Western Carpathians, and Podolye on Ukraine. A hybrid between *A. lasiocarpum* and *A. variegatum* subsp. *variegatum* was also described for the first time. The nothospecies, *A. × pawlowskii* nothosp. nov., occurs in scattered localities in the Western Carpathians: in Poland (Beskid Niski, Tatras, Gorce Mts. and Babia Góra Mt.) and in Slovakia (Slovenské Rudohorie, Nizke Tatry Mts. and Muranska Planina Plateau), within the range of *A. variegatum* subsp. *variegatum*. The new (notho) taxa enable more precise shaping the geographical borders of both *A. lasiocarpum* subsp. *lasiocarpum* and *A. variegatum* subsp. *variegatum* in the Carpathians.

KEY WORDS: Carpathians, chorology, hybrid, nothoserries *Acotoxicum*, numerical taxonomy, series *Toxicum*.

INTRODUCTION

Genus *Aconitum* L. encompasses in Europe ca. 35-45 species, several subspecies, and a poorly known number of hybrids, mostly critical taxa. Linnaeus (1753) described 5 species in the genus *Aconitum*. The foundations of modern taxonomy of the genus were established by French (A.P. Candolle 1817) and German (H.G.L. Reichenbach, e.g. 1823-27) botanists in the first half of the 19th c. Later, the taxonomic system was supplemented by, among others, Gáyér (1909), Rapaics (1907), and Polish botanist Zapałowicz (1908). In his work *Conspectus florae Galiciae criticus* he critically evaluated flora of the Carpathians. Only in the *A. variegatum* – group (see Götz 1967) he recognized 19 taxa, however, at present, these are mostly of no taxonomic value.

One of these taxa was *A. paniculatum* Lam. var. *podolicum* Zapał. (1908), mentioned by Paczoski (1927) in *Flora Polski* vol. III, and then completely neglected (e.g. Kucowa 1985). The diagnostic traits of the taxon (*pedicelli densius subglanduloso patente pilosi vel plus minus glabri, ovaria 3 pube-*

scientia) are similar to *A. lasiocarpum* (Rchb.) Gáyér (1911), a taxon which has provoked a long-standing discussion on its geographic, and especially taxonomic status (e.g. Michalko 1955).

In our critical studies on the genus *Aconitum* L., subgenus *Aconitum* in the Carpathians we have found, based on material collected from a wide geographical range, both in herbarium material as well in the field, OTUs of *A. lasiocarpum* phenotypically deviated from the type (in this Zapałowicz's *A. paniculatum* var. *podolicum*). They could represent the hybrids between *A. lasiocarpum* and *A. variegatum* subsp. *variegatum* (see Krzakowa and Szweykowski 1976, Zieliński 1982, Joachimiak et al. 1999).

The aim of the present paper is to clarify in terms of taxonomy and chorology the status of those uncertain forms of *A. lasiocarpum*. To do this, one of us (J.M.) has described in a uniform manner all available in the Carpathian herbaria specimens (OTUs) of *A. lasiocarpum* and its derivative forms. The OTUs then were elaborated by using methods of numerical taxonomy. In result we might typify a hybrid between *A. variegatum* L. subsp. *variegatum* and *A. lasiocarpum* (Rchb.) Gáyér, i.e. *A. × pawlowskii*, and make a new combination *A. lasiocarpum* subsp. *kotulae*.

In the paper the following taxonomy of *Aconitum* genus, sectio *Aconitum* was adopted:

Abbreviations:

CA – Correspondence Analysis; DF – Discriminant Function; DFA – Discriminant Function Analysis; OTU – Operational Taxonomic Unit

genus *Aconitum* L. (see Starmühler 1998a)

subgenus *Aconitum*

sectio *Aconitum* in Poland

subsectio *Aconitum*

series *Aconitum*

A. variegatum L. subsp. *variegatum* var. *variegatum*

series *Toxicum* (Rchb.) Mucher

A. degenii Gayer. subsp. *degenii* [= *A. paniculatum* Lam., nom. illeg.]

A. lasiocarpum (Rchb.) Gayer subsp. *lasiocarpum*

A. lasiocarpum subsp. *kotulae* (Pawł.) Starmühler and Mitka comb. nov.

A. × gayeri Starmühler (*A. degenii* × *A. lasiocarpum*)

nothoserries *Acotoxicum* Mucher

A. × hebegynum DC. (*A. degenii* × *A. variegatum*) (see Starmühler 1997)

A. × pawlowskii Mitka & Starmühler nothosp. nov.

(*A. lasiocarpum* × *A. variegatum*)

MATERIALS AND METHODS

The material used in this work have originated mainly from the Herbaria of Poland, Ukraine, Czech, Slovakia, Hungary, Austria and Romania (BP, CL, GJO, GZU, KO, KRA, KRAM, LW, LWA, PR, PRC, SAV, WU), and from the private collections gathered during field trips in the Eastern Carpathians (Bieszczady, Czarnohora, Rodna Mts., the names of physical-geographical units after Kondracki 1989).

Each herbarium specimen (OTU) was described with the use of simple, carefully chosen qualitative characters, concerning the structure of generative (elements of flowers) and

vegetative organs (e.g. hairiness and shape of helmets and bracteoles, see Table 1). To achieve the goal of this work only OTUs belonging to *Aconitum lasiocarpum*, *A. variegatum* subsp. *variegatum*, and those of uncertain status (called hereafter "intermediate") were selected from the database. This amounts to 198 OTUs selected.

Qualitative characters having different, closely defined states are called multistate qualitative (Sneath, Sokal 1973, Stace 1993). Every character may be coded in the form of binary (0-1) state. For example, the character "hairiness of carpel" has five states (Table 1) and its state "singular hair" receives the form "00100". In total, 62 character states were taken into consideration (Table 1). So, in other words, every OTU was described by a 62-element, zero-one vector.

Classification of OTUs, using Ward's minimum variance cluster method (Ward 1963), based on City-block (Manhattan) distance, and their ordination with the use of a CA (Jongman et al. 1987), were carried out. The latter method enable the ordination of OTUs in a multidimensional space (hyper-space according to Stace 1993). In the result, the objective information on phenetic relationships among all OTUs along the first three axes was obtained. To evaluate the specificity of the taxa distinguished, a DFA (e.g. Jeffers 1978) was applied, based on the first three axes of CA as variables. In DFA the knowledge on taxonomic status of each OTU was *a priori* imposed, coming from previous subjective determinations, which were corroborated by the classification procedure. The procedure enabled the observed (*a priori* imposed) and predicted (from DFA) classifications to be compared in the form of a classification matrix (Table 2). The goodness of fit between observed and predicted frequencies was tested with the use of a Chi-squared test (Sokal and Rohlf 1969).

TABLE 1. Qualitative character states of *Aconitum* OTUs used in CA and Ward's minimum variance cluster method.

1.	inflorescence rigid < 5 cm long	32.	helmet with singular hair
2.	inflorescence rigid > 5 cm long	33.	helmet slightly pubescent
3.	between 2 and 4	34.	between 33 and 35
4.	inflorescence ramified, dense	35.	helmet densely pubescent
5.	inflorescence ramified, loose	36.	helmet conical
6.	pedicel glabrous above bracteoles	37.	helmet hemispherical
7.	pedicel with singular hair above bract.	38.	helmet obtuse
8.	pedicel slightly pubescent above bract.	39.	perigonium glabrous
9.	between 8 and 10	40.	perigonium with singular hair
10.	pedicel densely pubescent above bract.	41.	perigonium ciliate
11.	pedicel extremely densely pubescent	42.	perig. moderately pubescent
12.	pedicel glabrous below bracteoles	43.	perigonium densely pubescent
13.	pedicel with singular hair below bract.	44.	three carpels
14.	pedicel slightly pubescent below bract.	45.	four carpels
15.	between 14 and 16	46.	five carpels
16.	pedicel densely pubescent below bract.	47.	carpels glabrous
17.	bracteole in lower half of pedicel	48.	carpels pubescent at suture
18.	bracteole ca. in the middle of pedicel	49.	carpels slightly pubescent
19.	bracteole in upper half of pedicel	50.	between 49 and 51
20.	bracteole glabrous	51.	carpels densely pubescent
21.	bracteole ciliate	52.	filaments glabrous
22.	bracteole slightly pubescent	53.	filaments pilose
23.	between 21 and 22	54.	nectaries curved
24.	bracteole densely pubescent	55.	nectaries erected
25.	bracteole minute, acicular	56.	nectaries reach helmet
26.	bracteole linear	57.	nectaries do not reach helmet
27.	bracteole lanceolate	58.	leaves "variegatum" type*
28.	bracteole spatulate	59.	leaves "stoerkianum" type
29.	bracteole obovate	60.	between 59 and 61
30.	bracteole lobate	61.	leaves "cernuum" type
31.	helmet glabrous	62.	leaves "tauricum" type

* shape of leaves according to Reichenbach (1823-27)

Fig. 1. Phenogram of 198 *Aconitum* OTUs; Ward's method of classification and City-block distance; 1 – *Aconitum variegatum* subsp. *variegatum*, 2 – "intermediate" group, 3 – *A. lasiocarpum* subsp. *lasiocarpum*.

In effect of numerical analyses two results were obtained: 1) classification (Ward's clustering) and ordination (CA) of all OTUs to assess their phenetic relationships, and 2) the information inherent in the first three axes of CA was used in establishing the position of particular clusters (taxa) on the plane defined by discriminant functions, and in assessing their cohesiveness (specificity) by means of the classification matrix (Fig. 1, Table 2).

All calculations were made with statistical package STATISTICA (StatSoft, Inc., 1984-1995).

RESULTS

Numerical analyses

Classification of OTUs (Fig. 1) shows two main clusters divided then into several minor groups. The left cluster consists exclusively of *A. variegatum*. The right is composed of *A. lasiocarpum* and an "intermediate" group. The general difference between the main clusters is in hairiness: the left cluster with glabrous and the right one with glandular hairs. It corresponds to taxonomic division of subsectio *Aconitum* into

two series: ser. *Aconitum* (*A. variegatum* – glabrous) and ser. *Toxicum* (*A. lasiocarpum* – with glandular hairs, see Mucher 1993a). In the right cluster there are also putative hybrid OTUs which belong to nothoserries *Acotoxicum* Mucher 1993b.

The inner diversification of the "intermediate" group (right side of the diagram – see Fig. 1) depends mainly on type of hairiness of carpels. In this group carpels may be found both pilose on suture (characteristic of *A. variegatum* subsp. *variegatum*) and entirely pubescent (characteristic of *A. lasiocarpum*, see also Fig. 5A, D). Thus, hereafter among "intermediates" two subgroups will be distinguished in relation to this trait.

The OTUs were then ordinated with the use of CA method. The first three axes of CA summarize 28.32% of the total variation. Information on similarities among OTUs, as this procedure revealed, was next used in DFA, where the OTUs scores along the first three axes of CA served as variables. Wilk's lambda of the DFA equals 0.059 ($p<0.0001$). The ordination of OTUs along discriminant function 1 and 2 (DF 1 and DF 2 – Fig. 2) shows position of the "intermediate" group between *A. lasiocarpum* and *A. variegatum*. However, in this group the OTUs with carpels pubescent on suture form

TABLE 2. Discriminant function analysis – classification matrix of OTUs; observed – based on *a priori* imposed classification, predicted – from DFA.

Discriminant Analysis	Classification matrix – observed vs. predicted (p=0.25) classification					
Taxon	Percentage of correctly classified	"intermediate" – carpels entirely pubescent	<i>A. variegatum</i> subsp. <i>variegatum</i>	<i>A. lasiocarpum</i> subsp. <i>lasiocarpum</i>	"intermediate" – carpels pilose on suture	Total (observed)
"intermediate" – carpels entirely pubescent	63.16	36	2	9	10	57
<i>A. variegatum</i> subsp. <i>variegatum</i>	98.85	0	86	0	1	87
<i>A. lasiocarpum</i> subsp. <i>lasiocarpum</i>	90.00	2	0	27	1	30
"intermediate" – carpels pilose on suture	79.17	4	0	1	19	24
Total (predicted)	84.85	42	88	37	31	198

Fig. 2. Ordination of 198 *Aconitum* OTUs along the first two discriminant function (DF) of discriminant function analysis (DFA). As variables the OTUs scores in a three-dimensional space of correspondence analysis (CA) were used; 1- "intermediates" with carpels entirely pubescent, 2 - *A. variegatum* subsp. *variegatum*, 3 - *A. lasiocarpum* subsp. *lasiocarpum*, 4 - "intermediates" with carpels pilose on suture, 5 - the border between OTUs with 5 and 3 carpels, separated along DF 1; triangles - carpels pilose on suture, circles - carpels entirely pubescent; the arrow shows a gradient in OTUs pubescence along DF 2.

the distinct cluster. Generally, DF 1 discriminates the OTUs with 3 or 5 carpels, and DF 2 discriminates the OTUs depending on their hairiness, especially of pedicels and helmets (Fig. 2).

DFA correctly classified 84.9% of OTUs (Table 2). *A. variegatum* was misclassified only in one case, what gives 98.8% of OTUs correctly classified, and OTUs of *A. lasiocarpum* were incorrectly put to other taxa in 10% of cases (i.e. 3 OTUs misclassified). Classification matrix of DFA also revealed the distinctiveness of the subgroups within the "intermediate" group. The "intermediate" OTUs with entirely pilose carpels were mismatched mainly with *A. lasiocarpum* and those with "carpels pilose on suture" with "entirely pubescent". However, the specificity of subgroups is high and result in 63-79% of correct classifications (Table 2).

A Chi-squared test for goodness of fit between predicted and observed frequencies of OTUs in particular groups gave $\chi^2 = 8.273$, $p < 0.04$. It means that distributions compared differ significantly. This was mainly due to discrepancy between observed and expected frequencies in the subgroup "intermediate" with carpels entirely pubescent, 63.2% with correctly classified OTUs (Table 2).

Taxonomy

Among OTUs from "intermediate" subgroup the most specific are those having carpels pilose on suture. Possessing features of both *A. variegatum* (carpels pilose on suture) and *A. lasiocarpum* (glandular hair) they may be regarded as a hybrid group belonging to nothoseries *Acotoxicum* (Table 3). The proposed name for the nothospecies is *A. × pawlowskii*, the hybrid between *A. lasiocarpum* and *A. variegatum*. The second subgroup in the "intermediate" group is less specific and generally resembles *A. lasiocarpum*. The distinctiveness of this second group lies in glabrous or weakly pubescent pedicels, in comparison to *A. lasiocarpum* which has pedicels strongly glandular pubescent (Table 3, Fig. 5A, B, B1). There is a continuous transition between glabrous and pubescent OTUs in this group along DF 2 (Fig. 2), however the end-

points generally do not overlap. So we treat the subgroup with glabrous pedicels and pubescent carpels in the rank of a subspecies, i.e. *A. lasiocarpum* subsp. *kotulae* (see Typification and new combination part and Discussion).

Geographical distribution

A. lasiocarpum subsp. *kotulae* occurs more or less continuously in the Carpathians between rivers Visso (Vişeu) - Biały Czeremosz and Wisłoka - Ondava (Fig. 3). It occurs in the Maramaros Mts., in lower parts of Czarnohora and Svidovec Mts., where it may migrate onto the Transcarpathia along the Czarna Tisa river (see Appendix). More westernward the

Fig. 3. Geographical distribution of *Aconitum* taxa in the Carpathians; 1 - towns (Kr. - Cracow, L. - Lvov, K. - Košice, C. - Czernivce, Br. - Bratislava, B. - Budapest, I. - Iassy, Bu. - Bucuresti), 2 - localities of *A. × pawlowskii*, 3 - range of *A. lasiocarpum* subsp. *kotulae*, 4 - part enlarged in Fig. 4.

TABLE 3. Morphological and cytogenetical (after Joachimiak et. al., 1999 and Ilnicki, unpubl.) traits of *Aconitum* taxa studied; (?) – feature not known or predicted.

Taxon	<i>Aconitum lasiocarpum</i> subsp. <i>lasiocarpum</i>	<i>Aconitum lasiocarpum</i> subsp. <i>kotulae</i>	<i>Aconitum</i> × <i>pawlowskii</i>	<i>Aconitum variegatum</i> subsp. <i>variegatum</i>
Sytematics	SERIES <i>TOXICUM</i>		NOTHOSERIES <i>ACOTOXICUM</i>	SERIES <i>ACONITUM</i>
Geographical distribution in the Carpathians	Eastern Carpathians and Beskid Niski (Western Carpathians)	Eastern and Western Carpathians	Western Carpathians	Western Carpathians
Status	Eastern-Carpath. subendemic	Carpathian subendemic	West. – Carpathian endemic	element of temperate Europe
MORPHOLOGY				
Pubescence	glandular pubescence			glabrous
Carpels	3 entirely pubescent		3-5 pilose at suture	
Pedicels	pubescent	glabrous (at least below bracteoles)	pubescent (at least above bracteoles)	glabrous
CYTOGENETICS				
Amount of heterochromatin	Variable, rather small	?	?	variable, from small to big
homo-/heterozygosity – size of heterochromatic segments of the 1 st pair of chromosomes	heterozygosity; difference in size in NOR	heterozygosity (?)	?	homozygosity, big in NOR
homo-/heterozyg. in occurrence of satellite on the 1 st pair of chromosomes	heterozygosity	heterozygosity (?)	homo- and heterozygosity (?)	homozygosity-occurrence on both chromosomes

taxon may be found in the Forest Carpathians on Ukraina (Eastern Bieszczady Mts. and Polonina Czarna) and in the Western Bieszczady Mts. (Poland). It crosses the Eastern Carpathians and in Poland is to be found in the Beskid Niski, the Jasło-Sanok Basin and in Slovakia in the Bukovske vrchy Mts. (Figs 3, 4). It forms isolated localities in SW Podolye outside the Carpathians. In Poland it also occurs in the isolated localities in the Tatras (Starmühler 1998b) and their

foreland, and on Babia Góra Mt. (Fig. 4). It was also found in a remote locality in the Southern Carpathians on the Christian Mt. near Braşov (see Fig. 3 and Appendix).
The range of the hybrid *A. × pawlowskii* exists, as a rule, inside of the range of *A. variegatum* subsp. *variegatum*, i.e. in the Western Carpathians (Fig. 4). It has many localities in the Tatras, from where it moves along streams flowing out from the mountains to the Pogórze Spisko-Gubałowskie Foreland

Fig. 4. Chorology of *Aconitum* taxa in the Northern Carpathians; 1 – *Aconitum lasiocarpum* subsp. *kotulae*, 2 – *A. × pawlowskii*, 3 – range of *A. lasiocarpum* subsp. *lasiocarpum*, 4 – range of *A. variegatum* subsp. *variegatum* in Poland.

(Walas 1938). It is also to be found in scattered localities in the Beskid Niski, Góry Sanocko-Turczańskie Mts., the Jasło-Sanok Basin, and in Slovakia in the Ondavska vrchovina Mts., on the Muranska Planina Plateau and in the Slovenské Rudohorie – see Fig. 3 (probably also in the Slovensky raj Mts.).

DISCUSSION

The results of numerical analysis clearly show the existence of a hybrid taxon *A. × pawlowskii* nothosp. nov. In the Tatras B. Pawłowski (1956) described a taxon very similar to a newly established nothotaxon, i.e. *A. variegatum* subsp. *kotulae*. The problem is that 1) in the protologue of his taxon Pawłowski stated that carpels are "*glaberrimis post anthesin*", the trait typical of *hebegynum* DC. (*A. degenii* × *A. variegatum*), which does in fact not occur in the Tatras, 2) as synonyms of the taxon he showed "*A. cammarum* Jacq. var. *koscieliskanum* Zap. p.p. et var. *beskidense* Zap.?" (1908), to be congruent with *A. lasiocarpum* subsp. *kotulae* comb. nova, and 3) locus typicus given by Pawłowski ("*Tatri, vallis Koprova*") also shows on *A. lasiocarpum* subsp. *kotulae* comb. nova (see Appendix). Hence, because of above statements we decided to split *A. variegatum* subsp. *kotulae* onto two (notho) taxa: the hybrid *A. × pawlowskii* nothosp. nov. and *A. lasiocarpum* subsp. *kotulae* comb. nov.

The second taxon proposed here, *A. lasiocarpum* subsp. *kotulae* comb. nov. clearly differs from *A. lasiocarpum* subsp. *lasiocarpum* in glabrous or less pubescent pedicels and helmets. The DFA and Chi-squared test revealed that this taxon is the least specific among taxa considered. This is a result of its similarity in other traits to *A. lasiocarpum* subsp. *lasiocarpum*. Geographically, it crosses the hitherto presumed borders of *A. lasiocarpum* subsp. *lasiocarpum*, being found, for example, in the Tatras. *A. lasiocarpum* subsp. *kotulae* comb. nov. occurs predominantly in the Eastern Carpathians, however it has some island stations outside the main range, e.g. north of the Dniestr river in Podolye (Fig. 3, Appendix). These localities are within the range of so called the Volhynian-Podolye refugium (Szafer 1923). This forest-steppe region, rich in flora of various geographical elements (e.g. Carpathian, Siberian, and Pontic) may possess both Tertiary (Pliocen), pre-Holocene (interglacial) and Holocene historical elements. Probably *A. lasiocarpum* subsp. *kotulae* comb. nov. is connected with a group of Carpathian forest species (e.g. *Dentaria glandulosa*, *Senecio nemorensis* agg., *Symphytum cordatum* and *Aposeris foetida* – see Szafer 1923), which may be relics even of the last interglacial (Gajewski 1937).

The most western locality of *A. lasiocarpum* subsp. *kotulae* comb. nov. is given from the Babia Góra Mt. in the Western Beskids. It is based on only one specimen determined by Zapalowicz (1908) as *A. cammarum* Jacq. var. *beskidense* (see Appendix). It is striking that the taxon was not further given by anyone from this locality. It suggests that the taxon may be extinct here or specimen's label mismatch.

The relatively high taxonomic rank of *A. lasiocarpum* subsp. *kotulae* comb. nov. is validated in the light of criteria put forward by Skalický (1982): distinct morphological traits or transitional ecological zone with intermediate forms. The taxon morphologically differs from densely pubescent *A. lasiocarpum* subsp. *lasiocarpum* and forms populations of various phenetic characters (Fig. 5B, B1), probably depending on the genetic history of origin (F1 hybrids or introgressive forms). The second criterion seems to be even more fulfilled. *A. lasiocarpum* subsp. *lasiocarpum* occurs in the Carpathians

(e.g. in the Bieszczady Mts.) in pure populations predominantly above upper forest limit in subalpine tall-herb community *Trollio-Centauretum* (Mitka, Jodłowski 1997; Mitka, Zemanek 1977). On the other hand, *A. lasiocarpum* subsp. *kotulae* comb. nov. is to be found in lower elevations in quite different ecological conditions, e.g. in montane boggy alderwood *Alnetum*, in ecotone beechwood/montane alderwood (*Fagetum/Alnetum*) and in ecotone beechwood/submontane ashwood (*Fagetum/Fraxinetum*).

The scattered localities of *A. × pawlowskii* nothotaxon nov. are to be found as a rule in the Western Carpathians in Poland and Slovakia in regions relatively rich in (sub)Eastern-Carpathian flora (Hendrych and Hendrychová 1979). It is expected that in these regions should also occur *A. lasiocarpum* s.l. The detailed inspection of the nothospecies occurrence at its north-western border (Fig. 4) reveals that its distribution is closely related to *A. variegatum* subsp. *variegatum*. Taking this into consideration the eastern border of *A. variegatum* subsp. *variegatum* in the Polish Carpathians should be revised. Now, it is seen that it goes along the Wisłok river in the Beskid Niski. Otherwise, previously there were given more eastern localities of *A. variegatum* subsp. *variegatum* from Polish (Eastern) and Ukrainian Carpathians, but all of them need critical evaluation (Mitka, Jodłowski 1997). Probably in those areas there is no *A. variegatum*, but instead may rather occur here its hybrids, i.e. *A. × pawlowskii* and *A. × hebegynum* (for further discussion see Mitka, Zemanek 1997).

The most remote, isolated locality of in the Southern Carpathians (the Christian Mt.) is also worthy to mention. It does not lie in the range of *A. variegatum* subsp. *variegatum*, but rather within South-European *A. variegatum* subsp. *nasutum* (Fischer ex Rchb. emend. Rupr.) Götz. The specimen was collected in 1894 by L. Walz (CL) and determined by Gayer in 1909 as *A. paniculatum* var. *podolicum* Zap. and by Mucher in 1992 as *A. × molle*. This locality convinces that the taxon may also be spread in the Southern Carpathians and may to be a quite common floristic element of the Carpathians. Also, the note of Grințescu (1953) on frequent occurrence of *A. gracile* subsp. *grosserratum* f. *beskidense* (a synonym, see below) in Transylvania credits this statement. *A. lasiocarpum* subsp. *kotulae* is similar to newly described *A. × bartokianum* (Starmühler 2000, in print), which is a hybrid between *A. toxicum* subsp. *toxicum* and *A. variegatum* subsp. *nasutum*. However, it differs from *A. lasiocarpum* s.l. on long (above 6 mm) bracteoles with branching veins, a trait typical of *A. toxicum* s.l.

TYPIFICATION AND NEW COMBINATION

Aconitum lasiocarpum subsp. *kotulae* (Pawl.) Starmühler and Mitka stat. et comb. nova

Basionym: *A. variegatum* L. subsp. *kotulae* Pawl. 1956 in Flora Tatr. Rośliny naczyniowe: 275.

Synonyms: *Aconitum paniculatum* Lam. var. *podolicum* Zapalowicz 1908 in *Conspectus Florae Galiciae* vol. II: 221; *A. hebegynum* auct. (in Gayer 1909). *A. beskidense* (Zap.) Gayer (1911). *A. cammarum* Jacq. var. *koscieliskanum* Zap. p.p. et var. *beskidense* Zap. (1908). *A. gracile* Rchb. subsp. *grosserratum* (Gayer) Grințescu (1953) f. *beskidense* Zap.

Locus typicus: Tatry Wysokie [High Tatras]: dol. Koprova – skraj lasu, ok. 1300 m; 19.8.1925; leg. B. Pawłowski (KRAM-Pawłowski 320228 – Neotypus).

Icones: Fig. 5B1.

[Podolye]: Przy drodze z Dobrowódki do Kamionki Wielkiej na b.[rzegu] lasu (pow. Kołomyjski), 2.09.1880; leg. A. Śleńdziński (KRAM 132168 – Paratypus).

Icones: Fig. 5B.

[Eastern Carpathians, Western Bieszczady Mts.]: Bereżki, S część (na N od Ustrzyk Górnych), Bieszczady, przy szosie na brzegu lasu z *Alnus incana*; 12.8.1999; K. Oklejewicz (KRA – Paratypus).

Diagnosis: Pedunculis infra bracteolae paene glabris et supra bracteolae glanduloso pubescentis vel totus glabris; ovaria tria – quinta undique glanduloso pubescentia (Fig. 5B, B1).

Description: Planta perennis, radix tuberosa, inflorescentia laxa versus subsimplex; folia paene glabra vel solo margine pauce ciliata et venae laminae superiore pauce crispule pubescentes, digitato tri-, quinque-partitis, segmentis tri, quadri fido-laciniatis, cassis 1.5-3.0 cm long., latitudine distincte longiores, raro semicircularis aut latior quam alta, glabris versus glanduloso pilosis, rostrata; tepala coerulaea, externe glanduloso-pubescentes; bracteolae 2,5-6(-12) mm, lanceolatae vel lineare-lanceolatae, glabris vel margine pilosis, in 2/3-4/5 pedunculo; pedunculis infra bracteolae paene glabris (pauce diffuso glanduloso pilosis, nonumquam parte deflexus) vel totus glabris; nectariis erectis, calcare nectarium apicem cassidis non attingens; cuculli calcare recurvum; ovaria tria-quinta undique glanduloso pubescentia; semina transverse undulato cristata; filamenta glabra vel paule pilosa.

Distribution and habitat: Poland, Ukraine, Slovakia and Romania, mostly in the Eastern Carpathians and their forelands, in eastern part of Western Carpathians and in the Tatras and on the Babia Góra Mt. (Figs 3, 4). In forelands it grows in thickets or forests of *Carpinion* alliance in wet places and in mountains along torrents and in ecotones: montane alderwood/submontane ashwood (*Alnetum incanae/Carici remotae-Fraxinetum*) and beechwood/montane alderwood (*Dentario glandulase-Fagetum/Alnetum incanae*), rarely in tall-herb communities of *Adenostylon* alliance or in wet meadows of *Calthion* alliance; between 280-850 (1300) m.

Etymology: *A. lasiocarpum* subsp. *kotulae* is named in honour of B. Kotula (1849-1898), a distinguished researcher of the flora of the Carpathians and Alps, where he died in an accident. The name proposed by Pawłowski (1956).

Relation to other taxa: related to *A. lasiocarpum* (Rchb.) Gayer on thoroughly pilose carpels (Fig. 5A), however it has glabrous or slightly pubescent pedicels and helmets (Fig. 5B, B1).

Aconitum × *pawlowskii* Mitka & Starmühler *nothospecies nova*

(*A. lasiocarpum* × *A. variegatum*)

Locus typicus: Tatry [Tatra Mts.]: pod Raptawickimi Turniami (dol. Kościeliska) od półn., ok. 1300 m, piargi wapienne; 3.9.1923; leg. B. Pawłowski (KRAM-Pawłowski 320221 – Holotypus).

Icones: Fig. 5C1.

[Western Carpathians]: Doły Sanocko-Jasielskie, Targowiska k. Krosna, w łęgu *Carici-remotae-Fraxinetum*; 9.9.1998; leg. J. Mitka, K. Oklejewicz (KRA – Paratypus).

Icones: Fig. 5C.

Synonyms: *A. variegatum* L. subsp. *kotulae* Pawł. (1956) p.p.; *A. cammarum* Jacq. var. *koscieliskanum* Zap. p.p.; *A. hebegynum* DC. p.p. (in Gayer 1909).

Diagnosis: pedunculis glanduloso pilosis et ovaria tria – quinta introrsum (suturae ventralis) pilosa (extra singulare pili undique inmixtis acceptare) – Fig. 5C, C1.

Description: Planta perennis, radix tuberosa, inflorescentia laxa versus subsimplex; folia paene glabra vel solo margine pauce ciliata et venae laminae superiore pauce crispule pubescentes, digitato tri-, quinque-partitis, segmentis tri, quadri fido-laciniatis, cassis 1.5-3.0 cm long., latitudine distincte longiores, raro semicircularis aut latior quam alta, glanduloso pilosis versus paene glabra (pilis glandulosae et glandulae singuli inmixtis), rostrata; tepala coerulaea, externe fere glabra vel glanduloso-pubescentes; bracteolae 2,5-6(-12) mm, lineare-lanceolatae, lanceolatae ad ovato-lanceolatae, glabris vel margine pilosis, in 2/3-4/5 pedunculo, raro infra flores;

Fig. 5. Helmets, carpels and pedicels: A – *A. lasiocarpum* (Rchb.) Gayer subsp. *lasiocarpum*, Bieszczady Zach., Pszczeliny, nad p. Wołosaty, Alnetum, 590 m, 12.9.1995; J. Mitka (KRA); B – *A. lasiocarpum* (Rchb.) Gayer subsp. *kotulae* (Pawł.) Starmühler and Mitka, [Podolye]: Przy drodze z Dobrowódki do Kamionki Wielkiej na b.[rzegu] lasu (pow. Kołomyjski), 2.09.1880; leg. A. Śleńdziński; KRAM 132168 (Paratypus), B1 – Tatry Wysokie [High Tatras]: dol. Koprwa – skraj lasu, ok. 1300 m; 19.8.1925; B. Pawłowski (KRAM-Pawłowski 320228) (Neotypus); C – *A. x pawlowskii* Mitka and Starmühler – [Western Carpathians]: Doły Sanocko-Jasielskie, Targowiska k. Krosna, w łęgu *Carici-remotae-Fraxinetum*; J. Mitka, K. Oklejewicz; 9.9.1998; KRA (Paratypus); C1 – Tatry [Tatra Mts.]: pod Raptawickimi Turniami (dol. Kościeliska) od półn., ok. 1300 m, piargi wapienne; 3.9.1923; B. Pawłowski; KRAM-Pawłowski 320221 (Holotypus); D – *A. variegatum* L. subsp. *variegatum*, Kaszuby, rezerwat rz. Raduni; 17.9.1998; B. Zemanek (KRA); E – glandular hair.

pedunculis supra bracteolae glanduloso pubescentis et infra bracteolae glanduloso (nonnumquam parte deflexus) pilosis; nectariis erectis, calcare nectarium appicem cassidis non attingens; cuculli calcare recurvum; ovaria tria-quinta ad suturam glanduloso pubescentia; semina transverse undulato cristata; filamenta fere glabra vel pauca pilosa.

Distribution and habitat: hitherto known from Poland and Slovakia (Fig. 3, 4). It occurs in thickets or forests of *Tilio-Carpinetum* or *Carici remotae-Fraxinetum* and in mountains along torrents and in montane alderwood *Alnetum*; up c. 1380 m.

Etymology: *A. × pawlowski* is named in honour of B. Pawłowski (1898-1971), Polish botanist, a distinguished researcher of the mountain flora of Europe.

Relation to other taxa: related to *A. variegatum* L. on carpels pilose on suture (Fig. 5D) and to *A. lasiocarpum* on glandular pubescens pedicels or/and helmets (Fig. 5A).

THE KEY FOR DETERMINATION OF *A. VARIEGATUM*, *A. LASIOCARPUM* AND *A. × PAWLOWSKII*

1. Helmet ca 3 times as high as wide, conical-cylindrical; nectary-spurs spirally curved; leaves with very broad segments not divided to the base – subgen. *Lycotconum* (DC.) Petermann

1* Helmet 0.5-2.5 times as high as wide, conical to hemispherical or obtuse; leaves with narrow or with broad segments (then divided to the base)

2. Carpels pilose on suture (some singular hairs scattered around carpel accepted)

3. Filaments densely pilose, pedicels glabrous – *A. variegatum* L. subsp. *variegatum* var. *variegatum* (Fig. 5D)

3* Filaments glabrous or sparsely pilose

4. Pedicels glabrous – *A. variegatum* L. subsp. *variegatum* var. *variegatum* (Fig. 5D)

4* Pedicels glandular pubescent – *A. × pawlowski* Mitka and Starmühler (Fig. 5C, C1)

2* Carpels entirely pubescent (see also 2**)

3. Carpels 5, tepals persistent, leaves with linear segments – subgen. *Anthora* (DC.) Petermann

3* Carpels 3 (-5) tepals deciduous, leaves with broader segments

4. Spur of the nectaries capitatus or half bent, carpels sterile – nothosect. *Acopellus* Mucher

4* Spur of the nectaries backward bent or semispiral coiled, carpels fertile

5. Pedicels below bracteoles glandular pilose

6. Nectaries reach the top of the helmet – *A. × gayeri* Starmühler (*A. degenii* × *A. lasiocarpum*)

6* Nectaries do not reach the top of the helmet – *A. lasiocarpum* (Rchb.) Gayer subsp. *lasiocarpum* (Fig. 5A)

5* pedicels below bracteoles glabrous or with singular hair – *A. lasiocarpum* (Rchb.) Gayer subsp. *kotulae* (Pawl.) Starmühler and Mitka (Fig. 5B, B1)

2** Carpels glabrous or pubescent mainly on the backside

3. Spur of the nectary capitatus or almost acephalous – subgen. *Aconitum* sect. *Napellus* (Wolf) DC. and nothosect. *Acopellus* Mucher

3* Spur of the nectary backward bent or semispiral coiled – subgen. *Aconitum* ser. *Toxicum* (Rchb.) Mucher and nothoser. *Acotoxicum* Mucher.

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FENETYCZNE ZRÓŻNICOWANIE *ACONITUM LASIOCARPUM* (RCHB.) GÁYER
(*RANUNCULACEAE*): ROZSZERZENIE GRANIC TAKSONOMICZNYCH I GEOGRAFICZNYCH

STRESZCZENIE

A. lasiocarpum (tojad wschodniokarpacki) wzbudza od dawna kontrowersje dotyczące statusu systematycznego i geograficznego. Prezentowane rezultaty badań taksonomicznych i chorologicznych dostarczają propozycji rozwiązania tych problemów. W ich wyniku został na nowo odkryty takson opisany przez Zapałowicza (1908), obecnie ujęty jako *A. lasiocarpum* subsp. *kotulae* comb. nov. (tojad Kotuli). Występuje on daleko poza dotychczas przyjętymi granicami *A. lasiocarpum* subsp. *lasiocarpum*, sięgając Dołów Sanocko-Jasielskich oraz Tatr i Babiej Góry w Karpatach Zachodnich i Podola na Ukrainie. Opisano także po raz pierwszy mieszańca pomiędzy *A. lasiocarpum* (tojad wschodniokarpacki) i *A. variegatum* subsp. *variegatum* (tojad dzióbaty). Gatunek mieszańcowy *A. x pawlowskii* nothosp. nov. (tojad Pawłowskiego) występuje w rozproszonych stanowiskach w Karpatach Zachodnich: w Polsce (Beskid Niski, Tatry, Gorce i Babia Góra) i na Słowacji (Rudawy Słowackie, Niżne Tatry i Murańska Planina), wewnątrz zasięgu *A. variegatum* subsp. *variegatum*. Opisane (noto)taksony umożliwiają bardziej dokładne określenie granic zasięgowych zarówno *A. lasiocarpum* subsp. *lasiocarpum*, jak i *A. variegatum* subsp. *variegatum* w Karpatach.

SŁOWA KLUCZOWE: chorologia, Karpaty, mieszaniec, notoseria *Acotoxicum*, seria *Toxicum*, taksonomia numeryczna.

APPENDIX

SPECIMINA VISA:

Aconitum lasiocarpum (Rchb.) Gáyer subsp. *kotulae* (Pawl.) Stariühler and Mitka

POLAND

Beskid Niski Mts.: Jawornik k. Komańczy, nad potokiem, Fagetum; 22.8.1994; K. Oklejewicz (KRA). – Spalona, las jodłowy; 1.10.1994; K. Oklejewicz (KRA). – Gorzyce, na stromym brzegu rz. Wisłok o eksp. W, w zaroślach; 9.9.1998; J. Mitka, K. Oklejewicz (KRA). – Stasiany, pot. Jasiołka, ziołorośla z *Telekia speciosa*, 500 m; 4.9.1996; J. Jodłowski, J. Mitka (KRA). – Wola Niżna, olszynka nad pot. Jasiołka; 30.8.1999; J. Mitka (KRA). – Dukla, Cergowa Góra, na stromym zboczu N, w jaworzynie *Phyllitido-Aceretum*; 8.9.1998; J. Mitka (KRA). – Dukla, stromy N stok części E Cergowej

Góry (zarośla i skałki). 20.8.1928; K. Piech (KRAM). *Jasło-Sanok Basin*: m. Czaszynem a Tarnawą Dolną, przy szosie na skraju lasu, FG2632; 13.8.1993; K. Oklejewicz (KRA). *Tatra Mts.*: Tatry Zach. (West-Tatra), S Zakopane, am Wege vom der Dolina Strążyska (Strążyska-Tal) zum Giewont, E-Hang des Łysanki, N 49°15,64', E19°59,35', 1150 m alt.; Hochstaudenflur im Quellwasser; 14.8.1997; U. & W. Starmühler (Herb. Starmühl., TNS). – Tatri Occid., in valle "Miętusia", in graminosis; 4.9.1932; J. Walas (CL, GZU). – Tatry Zach.: Dol. Małej Łąki, niższa część doliny, w lesie na kamieńcu; 29.08.1954; T. Tacik (KRAM). – Tatry Zachodnie, Dolina Małej Łąki nad potokiem; 19.8.1984; V. Wasilewska (ZTS). – Tatry Zach.: Dol. Małej Łąki, 987 m; 11.8.1960; R. Rajchel (KRA). – Tatry Zach., Dolina Małej Łąki u stóp Hrubego

Regla; 25.8.1924; B. Pawłowski (KRAM). – Tatry Zachodnie, szlak z Przysłopia Miętusiego na Kobylarz, 1160 m n.p.m.; 6.9.1990; A. Miechówka (ZTS). – Tatrzański Park Narodowy, Dol. Olczyska; 21.8.1986 (ZTS). – Flora der Hohen Tatra, am Wege vom grossen Fischsee nach Javorina, häufig; 24.8.1897; F. Müllner (GJO). – Magas Tátra, Bialka völgy Javorina mögött, Nr. 216743; 18.9.1959; S. Jávorka (BP). – Flora Karpat., Galicia, in monte Tatra; 1896; A. Rehman (LY-Gandoger). – Tatry Zach.: Dol. Kościeliska, trawiasty brzeg potoku, 950 m; 15.8.1961; A. Pacyna (KRA). – Dolina Kościeliska w Tatrach; ?8.1852; F. Berdau (KRA). *Pogórze Spisko-Gubałowskie Foreland*: Podhale, Wzn. Gubałowskie, Kirowa Woda przed Roztokami, żwirowiska; 11.9.1956; E. Pancer (KRA). – Wzniesienie Gubałowskie; 26.8.1955; E. Pancer (KRA). – Zagrody, zarośla nad Czarnym Dunajcem; 26.8.1955; E. Pancer (KRA). *Góry Sanocko-Turczańskie Mts.*: Góra Sobień, na skraju Fagetum, 410 m; 4.9.1996; J. Jodłowski, J. Mitka (KRA). – Przełom Strwiąża m. Brzegami Dolnymi a Krościenkiem, wilgotne, ocienione zbocze N w lesie nadrzecznym, ok. 430 m; 19.7.1969; J. Kornaś, Z. Dzwonko (KRA). – Łukawica, pow. Lesko, polanka w lesie liściastym u stóp stromej ścianki nad Sanem; ok. 310 m; 21.7.1969; J. Kornaś, Z. Dzwonko (KRA). *Babia Góra Mt.*: Babia Góra; S. Kulczyński (?) [A. cammarum Jacq. var. beskidense Zapalowicz, 9.2.1908]; 14.8.1876; W.K. (KRAM). *Western Bieszczady Mts.*: Buk nad pot. Solinka, w Alnetum, 515 m; 4.9.1996; J. Jodłowski, J. Mitka (KRA). – Polanki k. Buka, pot. Solinka, 300 m za serpentynami w dół potoku, Fraxinetum, 475 m; 4.9.1996; J. Jodłowski, J. Mitka (KRA.). – Dołżyca, pot. Solinka, Fraxinetum/Alnetum; 520 m; 4.9.1996 (KRA). – Wołosate, pot. Wołosatka, 500 m powyżej stacji harcerskiej, przed granicą Parku, Alnetum; 14.9.1996; J. Jodłowski (KRA). – Wołosatka, las na potoku; ?1888; Kotula (LWA). – Wołosate, m. drogą a pot. Wołosatka, 810 m; 11.09.1995; J. Mitka (KRA). – Bereżki, pot. Wołosaty, Alnetum, 620 m; 12.9.1995; J. Mitka (KRA). – Bereżki, część S, przy szosie na skraju lasu; 12.8.1999; K. Oklejewicz (KRA). – między Bereżkami a Ustrzykami Górnymi, olszynki nad Wołosatym na wys. 620 m; 22.8.1956; A. Jasiewicz, K. Zarzycki (KRAM). – pot. Wołosaty, ziołorośla, m. Ustrzykami Grn. a Bereżkami; 20.8.1977; A. Ochrya (KRAM). – Stuposiany, pot. Wołosaty, k. mostu; 28.8.1996; J. Jodłowski (KRA). – Stuposiany, pot. Wołosaty, przy tablicy miejscowości, Alnetum; 28.8.1996; J. Jodłowski (KRA). – Stuposiany, zarośla przydrożne we wsi, wys. 560 m; 2.8.1960; A. Jasiewicz (KRAM). – Dwernik, na skraju olszynki nadrzecznej pod urwistym zboczem, na lewym brzegu Sanu, 510 m; 10.8.1979; J. Kornaś (KRA). – Dwernik, rz. San, ok. 800 m w górę rz. za mostem, Alnetum, 490 m; 3.9.1996; J. Mitka (KRA). – Dwernik, rz. San, Alnetum/Fraxinetum, 485 m; 4.9.1996; J. Mitka, J. Jodłowski (KRA). – Chmiel, rz. San, Alnetum/Fraxinetum, 485 m; 4.9.1996; J. Mitka, J. Jodłowski (KRA). – Dol. potoku Terebowiec; 12.8.1994; T. Winnicki (KRA). – Procisne, ok. 400 m za mostem w górę rzeki San, Alnetum z *Matteucia struthiopteris*, 515 m; 3.9.1996; J. Mitka, J. Jodłowski (KRA). – Tarnawa Wyżna, olszynka nad małym potoczkiem uchodzącym do Sanu; 13.9.1962; A. Jasiewicz (KRA). – dol. Mucznego, Alnetum incanae na dnie doliny nad potokiem; 4.9.1961; K. Zarzycki (KRAM). – m. Muczne a Tarnawą Niżną, przy szosie w olszynie Alnetum; 12.8.1999; K. Oklejewicz (KRA). – Polonina Caryńska; 5.08.1979; Obóz naukowy Koła Przyrodników UJ (KRA). – Polonina Wetlińska, m. Hnatowym Berdem (stok zach.) a

szlakiem turystycznym, młaka z *Cirsium waldsteinii*; 2.9.1999; J. Mitka (KRA). – Polonina Wetlińska, młaka u źródeł potoku m. Hnatowym Berdem a schroniskiem; 2.9.1999; J. Mitka (KRA).

SLOVAKIA

Wyhorlat Mt.: Wyhorlat, pod szczytem; 27.8.1963; J. Mičalko (SAV). – Wyhorlat, ex herbario doctoris Cornelii Hyzer; 21.8.1879 (BP). – In monte Vihorlat, 1074 m; 25.07.1936; F. Belšán (PRC). *Bukovské vrchy Mts.*: Rabia Skala 1150; 23.8.1995; J. Mitka, P. Bochenek, J. Terray (KRA). – Rabia Skala, cota 1168; 23.08.1963; J. Soják (KRAM). – Slov. orient. montes Poloninské Karpaty, in monte Rabia Skala supra pagum Nová Sedlica, 1160 m; 20.08.1963; J. Soják (PR). – Slov. orient. montes Poloniny, ad cacumen montis Čereniny supra pagum Zvala; 933 m; 21.08.1963; J. Soják (PR). – Na skale Rabia skala, trig. 1168 m; 18.07.1957; J. Šourek (PR). – Výslunna skála nad Runinou; 1150 m; 7.08.1957; J. Šourek (PR). – montes Poloniny, ad cacumen jugi inter pagos Zvala et Ruske, c. 1000 m; 21.08.1963; J. Soják (PR). – Nizke Poloniny, Runina, výslunne skály na Rabia skale, 1150 m; 6.08.1957; J. Soják (PR). *Tatra Mts.*: Dol. Koprowa – skraj lasu, ok. 1300 m, 19.8.1925; leg. B. Pawłowski; KRAM-Pawłowski 320228 (Paratypus).

UKRAINE

Eastern Bieszczady Mts.: Skole, g. Kudrjawiec; 3.8.1986; V.P. Tkaczyk (KAG.). *Polonina Carpathians*: Czarnohora Mts.: Jablonica, k. tartaku; 14.8.1888; E. Wołoszczak (KRAM). – Jasina, na kraji lesa při silnici do Jablonického průsmyku za Zimirem; 12.08.1934; M. Pulchart (PRC). – Nad Prutem ponížej Worochty; E. Wołoszczak; 17.8.1888; (KRAM). *Svidovec Mts.*: Svidovec, in silvatis vallis Trostienec pr. pag. Tiszaborkut; 21.8.1939; R. Soó (CL-Soó). – Ad Diana in valle rivuli Svidovecky potok; 1930; K. Domin, M. Deyl (PR). – Polonina Sterešora [Poł. Czarna]; 11.08.1929; K. Domin, M. Deyl (PR, PRC). – In valle Tisa ad opp. Kevallóv; 1929; K. Domin, M. Deyl (PR, PRC). *Maramaros Carpathians*: Am Dobonyos bei Sziget, in der Maramaross; ?; L. Vágner (WU-Kerner). – Am Dobonyos, in der Maramaross; ?; L. Vágner (WU). – Flora der Maramaross, an Wiesen u. buschigen Stellen in der Umgebung von Huszt; ?; I. Vágner (WU-Kerner). – W zaroślach na brzegu lasu przy drodze z Nosowa i Zawałowa do Hnitesy (pow. Bystrzycki), jedyny okaz; 1.9.1878; A. Śleńdziński (KRA). *Podolye*: Czerniwckaja obl., Buczaczkij raj., Tarnopolska obl., Stanisławka za Żyznomierzem; 1884; S. Truz (LWS). – Woroniaki, Kołtów k. Złoczowa, na skraju lasu, oddz. 80; Schultzman; data ?; (LW). – Woroniaki, Kołtów k. Złoczowa, na pn. skraju lasu "Dołżek", oddz. 80; 27.8.1937; J. Mądalski (KRAM). – Miodobory, Kamionki, pow. Skałacki, w gęstwinie leśnej; 24.08.1878; A. Śleńdziński (KRAM). – Przy drodze z Dobrowódki do Kamionki Wielkiej na b.[rzegu] lasu (pow. Kołomyjski), 2.9.1880; leg. A. Śleńdziński; KRAM 132168 (Neotypus). – m. Chocimierzem a Żukowem (pow. Horodenka Kołomyjska). 3.9.1880; A. Śleńdziński (KRAM). – Kniaźdów k. Kołomyji; M. Prichodskij; 7.9.1940; (LWS).

ROMANIA

Eastern Carpathians: Transsilv. distr. Bistrica-Nășăud, in valle Izvoru Roșu ad balneolum Valea vinului, c. 700-900 m; 20.8.1923; A. Borza (CL). – *Southern Carpathians*: Brasso [Brasov], Mt. Christian [det. Gayer IX 1909: A. *paniculatum* var. *podolicum* Zap.]; L. Walz; 4.8.1894 (CL). – In silvis alpinis Transilvaniae...; ?8.1887; Fuss (WU-Kerner).

Aconitum × *pawlowskii* Mitka & Starmühler the hybrid between *A. lasiocarpum* (Rchb.) Gayer and *A. variegatum* L.

POLAND

Beskid Niski Mts.: Targowiska k. Krosna, w łągu Carici remotae-Fraxinetum; 9.9.1998; leg. J. Mitka, K. Oklejewicz (KRA) (Paratypus). *Jasło-Sanok Basin*: m. Pisarowcami a Kostarowcami; 29.9.1989; K. Oklejewicz (KRA). *Góry Sannocko-Turczańskie Mts.*: Zagórz, zarośla nad Sanem; 24.8.1987; B. Rysz (BdPN). – Zagórz, zarośla nad Osławą; 17.9.1987; B. Rysz (BdBN). *Gorce Mts.*: dol. potoku Turbacz powyżej Huciska, ziolorośla nad potokiem w lesie bukowym, 810 m (ok. nietypowy szyp. owł.!); 1.9.1955; A. i J. Kornasiowie (KRA). – dol. pot. Turbacz powyżej Huciska, ziolorośla nad potokiem; 1.9.1954; A. i J. Kornasiowie (KRA-Kornaś). – *Tatra Mts.*: Tatry: pod Raptawickimi Turniami (dol. Kościeliska) od półn., ok. 1300 m, piargi wapienne; 3.9.1923; B. Pawłowski; (KRAM-Pawłowski 320221 – Holotypus). – Dolina Kościeliska koło ujścia; 5.8.1883 (KRAM). – Tatry, Kościelisko, bagienko nad Dunajcem; 11.8.1910; A. Żmuda (KRAM). – Z Doliny Kościeliskiej w Tatrach; ?8.1855; F. Berdau (KRAM). – Tatry Zach.: Dolina Miętusia, żwirowiska nad potokiem w pobliżu wylotu; 13.8.1967; A. Jasiewicz (KRAM). – In valle Miętusia in graminosis; 4.9.1932; J. Walas (KRA). – Tatry Zach.: Dol. Kościeliska, 930 m; 7.8.1961; A. Pacyna (KRA). – Tatry Zach.: Dol. Małej Łąki, 987 m; 11.8.1960; R. Rajchel (KRA). – Tatry Zach.: Dol. Małej Łąki, wyręby; 14.8.1945; J. Kornaś, A. Medwecka (KRA, KRA-Kornaś). – Tatry Zach.: Dol. Małej Łąki 935 m, kępa na potoku; 8.8.1961; R. Rajchel (KRA). – Tatry Zach.: Dol. Małej Łąki, niższa część doliny, w lesie na kamieńcu; 29.08.1954; T. Tacik (KRAM). – Montes Tatri Occidentales: pratum subalpinum Mała Łąka Wyżnia, in glareis stabilibus atque in graminosis ad glebam tenuem, substrato calcareo; 10.9.1970; H. Piękoś (KRA). – Tatry Zach.: Dol. Za Bramką, lewe ramie wideł, skraj lasu przy potoku, 1020 m; 23.8.1961; R. Rajchel (KRA). – Zakopane, dol. ku "Dziurze", usypisko, skały; 30.7.1914; Prażmowski (KRAM). – Tatry, Kałatówki; 31.7.1937; M. Łańcucka (KRAM). – Tatry, las na Grzybowcu; ?8.1946; K. Miczyński (KRAM). – Dolina Cho-

chołowska, nad potokiem na skraju lasu świerkowego, przed granicą TPN; 17.9.1999; J. Mitka (KRA). – Koło Doliny Chochołowskiej, Tylkowa; 23.8.1954; A. Jasiewicz (KRAM). – Flora Galicia, in monte Tatra; 1896; A. Rehman (LY-Gandoger). – Tatrzański Park Narodowy, Dol. Jaworzynki, wyschnięty potok, wys. 1200 m n.p.m.; 3.9.1986; T. Nowak (ZTS). – Galizien, Nord-Karpaten, Tatry Zachodnie (West-Tatra), S Zakopane, am Weg von der Dolina Strążyska (Strążyska-Tal) zum Giewont, SE-Hang des Łysanki, N 49°15,41', E 19°54,97', 1380 m alt.; Hochstaudenflur am *Picea abies*-Waldrand; 14.8.1997; U. & W. Starmühler (Herb. Starmühl., TNS). – Tatry: Strążyska pod Giewontem, w kosówce; 12.8.1911; A. Żmuda (KRAM). – Zakopane, Hala Strążyska, łąka w pobliżu strumienia; 8.9.1953; Słomińska (KRAM). – Tatry Zach.: ścieżka Nad Regłami; 2.9.1958; K. Szczepanek (KRA). – Podtatrze: las na lewym brzegu Olczańskiego Potoku poniżej Jaszczurówki, las olszowy ze świerkiem, miejscami podmokły; 18.8.1966; T. Tacik (KRAM). – In silvis Regle Dictum prope Zakopane; ?8.1858; F. Berdau (KRA). *Pogórze Spisko-Gubałowskie Foreland*: Spisz, Nowa Biała; 21.8.1931; J. Walas (KRA, KRAM). – Wzn. Gubałowskie, Zagrody, zarośla nad Czarnym Dunajcem; 26.8.1955; E. Pancer (KRA).

SLOVAKIA

Tatra Mts.: Dol. Koprowa (górna), zarośla mieszane; 19.8.1825; J. Trela (KRA). – Vysokie Tatry, Koprowa Dolina; 13.8.1966; K. Zachradnikova, M. Jasičova (SAV). – Belanské Tatry, Lysa Polana; 14.8.1966; K. Zachradnikova, M. Jasičova (SAV). – Vysoké Tatry, apud rivulorum Javorovy potok supra pag. Javorina, 1050 m; 15.8.1955; J. Dostál (PR). – Belaer Kalkalpen, Bahufer bei Podhady, 920 m, Nr. 60840; 7.8.1910; F. Pax (BP). *Nízke Tatry*: Dudlova skala; 8.9.1955; V. Kneblova (PR). *Slovenské Rudohorie Mts.* (Gömör): Dobsinai jegbevelong szkecenei völgy; 23.8.1911; D. Filarszky (BP). *Ondavska vrchovina Mts.*: Križovatka, 27.05.1970; A.G. (KO). *Muranska Planina Plateau*: Hrad Mt., 24.8.1959; ?; ?; (nr 13340 KO). – Údolie Dudlarky [ad Kamenná vrata]; 16.8.1984; V. Mikulaš (KO).