

REMARKS ON HIGHER-RANKED SYNTAXA WITH *ABIES ALBA* IN CENTRAL EUROPE: THEIR CONCEPTS AND NOMENCLATURE

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Abstract

Although the issue of classifying *Abies alba* woodlands has been tackled by many authors, the greatest influence had a trend-setting work of Braun-Blanquet (Braun-Blanquet et al. 1939): he described the suballiance *Abieti-Piceenion* Br.-Bl. in Br.-Bl et al. 1939. Another important conception was created later by Oberdorfer (1957) who later (1962) differentiated suballiances *Galio-Abietenion* and *Vaccinio-Abietenion*. The main difference concerns the taxonomical approach to *Abies* woodlands: according to Braun-Blanquet, the presence (or dominance) of *Abies alba* is not evaluated separately: montane coniferous forests with the relevant character species are classified into the suballiance *Abieti-Piceenion*, meant as opposite to the subalpine coniferous forests. By contrast, Oberdorfer treated woodlands with the high abundance/dominance of *Abies alba* and natural absence of *Fagus sylvatica* as distinct types of syntaxa and divided further the montane *Abies* woodlands according to their phytocoenotic differences. These two fundamental conceptions were used alternately by various authors, and not always in accordance with the original authors' intention. Therefore it is important to draw the attention of phytosociologists to differences resulting from the taxonomical concept chosen.

Key words: *Abies alba* woodlands, *Abietion albae*, *Abieti-Piceenion*, *Fagetalia sylvaticae*, *Galio-Abietenion*, *Vaccinio-Abietenion*.

Izvešček

Čprav so se s problematiko klasifikacije gozdov bele jelke ukvarjali številni avtorji, pa je bilo najvplivnejše delo Braun-Blanqueta (Braun-Blanquet et al. 1939), ki je opisal podzvezo *Abieti-Piceenion* Br.-Bl. in Br.-Bl et al. 1939. Drugi pomembni koncept je predstavil Oberdorfer (1957) in kasneje leta (1962) ločil podzvezi *Galio-Abietenion* in *Vaccinio-Abietenion*. Glavna razlika je v sintaksonomski uvrstitvi gozdov bele jelke: po Braun-Blanquetu prisotnost (ali dominanca) ni posebej ovrednotena, saj so montanski gozdovi iglavcev za razliko od subalpinskih z značilnimi vrstami uvrščeni v podzvezo *Abieti-Piceenion*. Nasprotno je Oberdorfer uvrstil gozdove z visoko abundanco/dominanco bele jelke (*Abies alba*) in naravno odsotnostjo bukve (*Fagus sylvatica*) kot dva ločena sintaksona in nato členil montanske jelove gozdove glede na fitocenološke razlike. Ta dva osnovna koncepta so izmenično uporabljali številni avtorji, vendar ne vedno v skladu z izvirnimi opisi avtorjev. Zato je pomembno opozoriti fitocenologe na razlike med tema dvema sintaksonomskima konceptoma.

Ključne besede: gozdovi bele jelke, *Abietion albae*, *Abieti-Piceenion*, *Fagetalia sylvaticae*, *Galio-Abietenion*, *Vaccinio-Abietenion*.

1. INTRODUCTION

In the frame of the taxonomical classification of Central European forest communities, the assessment of phytocoenoses with abundant/dominant *Abies alba* has a special place. The variety of inter-

pretations concerning the original conceptions of higher syntaxa with considerable participation of *Abies alba* is the appropriate subject for an overview (1) of the history of those syntaxa given together with remarks on (2) approaches to their taxonomical classification and (3) their nomenclature.

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2. METHODS

Author citations of syntaxa are given only in relevant cases. Plant names follow the list of Marhold et al. (1998). Nomenclatural assessment relies on the Code of phytosociological nomenclature (Weber et al. 2000). Comments are given only on are only problems concerning the conceptions of content and use of syntaxa with a considerable participation of *Abies alba* on the rank of suballiance/alliance and their nomenclature. Here I refer only to essential studies concerning European vegetation that set important trends of classification of *Abies alba* woodlands for other phytosociological works.

3. RESULTS AND DISCUSSION

3.1 The two conceptions in the literature

The history of higher-ranked syntaxa comprising phytocoenoses with abundant *Abies alba* or its predominance in the canopy of coniferous woodlands in Central European begins with, and is greatly influenced by, the work of Braun-Blanquet who described the suballiance “*Abieto-Piceion* Br.-Bl. 1939” (Braun-Blanquet et al. 1939: 13). Based on the concept of “character species”, all coniferous woodlands with *Picea abies*, *Abies alba*, *Pinus sylvestris* etc. were included in the class *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939 together with a large number of non-forest syntaxa (cf. Br.-Bl. et al. 1939). Central European coniferous forests of (high) mountain ranges of the Alps, Carpathians etc. were divided within the alliance *Vaccinio-Piceion* into two suballiances: (1) “Unterverband *Abieto-Piceion* Br.-Bl. 1939” and (2) “Unterverband *Rhodoreto-Vaccinion* Br.-Bl. 1926” (Braun-Blanquet et al. 1939: 13, 21).

Braun-Blanquet et al. (1939) confined the suballiance *Rhododendro-Vaccinienion* to the subalpine vegetation belt of the Central European mountains (Braun-Blanquet et al. 1939: 21). [Note that the term “subalpine belt” follows there the conception of German-speaking authors.] Thus it contained besides dwarf-shrub communities also coniferous forest communities, mostly “pure” subalpine *Picea abies* woodlands as well as woodlands with admixture (or dominance) of *Pinus cembra*, *Larix decidua*, *Pinus mugo*, *Pinus uncinata* Ramond (cf. Businský 1999). Such woods [with dominating *Picea abies*, *Pinus cembra*, *Larix decidua* (below the upper forest limit)] are commonly assigned to the upper montane belt (or supramontane belt or else oréal

belt) by Czech, Polish and Slovak geobotanists. Considering the included association *Lophozio-Piceetum*, *Soldanello-Piceetum*, *Mastigobryo-Piceetum* or “*Listera cordata-Hylocomium umbratum*-Assoziation” [described in Braun-Blanquet et al. (1939)], also *Abies alba* and *Fagus sylvatica* participated in the composition of these forest communities of the subalpine *Rhododendro-Vaccinienion*.

The suballiance *Abieti-Piceenion* was meant to continue in lower [i. e. “montane”] elevations below the *Rhododendro-Vaccinienion*, with *Abies alba* and other “montane” species (Braun-Blanquet et al. 1939: 13, 10). Considering the synoptic tables of Braun-Blanquet et al. (1939: 16–21) it becomes clear that within the “*Picea* woodlands” a high abundance (and sometimes even dominance) of *Abies* was possible. Also *Fagus sylvatica* appears frequently in the composition of stands of *Abieti-Piceenion*.

Further characteristics of *Abieti-Piceenion* and also of Braun-Blanquet’s concept of the suballiance are given in Braun-Blanquet et al. (1954).

Oberdorfer (1957) used Braun-Blanquet’s suballiance *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939, but classified it differently. Unlike Braun-Blanquet et al. (1939), Oberdorfer placed the suballiance among beech syntaxa of *Fagetalia* and *Fagion*. His concept of *Abieti-Piceion* was different as well, which is indicated also by the name of this unit: “Tannenmischwälder (Fichten-Buchen-Tannenwälder” [mixed fir forests (spruce-beech-fir forests)] (Oberdorfer 1957: 507). This shift in interpretation becomes apparent also with regard to subordinated syntaxa of the unit. Oberdorfer divided mixed fir forests into two groups: (1) “Assoziationsgruppe artenarmer Tannenmischwälder” and (2) “Assoziationsgruppe artenreicher Tannenmischwälder” (Oberdorfer 1957: 507, 510).

Although in an older work of Oberdorfer (1949a) the *Abieti-Piceenion* was listed within the *Vaccinio-Piceion*, this comment was added: “dazu kommt als Unterverband mit tannenreichen Mischwaldges. *Abieto-Piceion* (viel besser zum *Fagion*)” (Oberdorfer 1949a: 17). Likewise Oberdorfer (1950) wrote: “Schließlich darf eine Übergangsgesellschaft vom Fichtenwald zum Buchenwald nicht unerwähnt bleiben. Sie nähert sich dem *Piceeto-Abietetum praealpinum* Oberd. 1949 im *Abieto-Piceion*-Unterverband und zeigt schon die engsten Beziehungen zu den Gesellschaften des *Fagion*-Verbandes, dem wir erwähnten Unterverband eher anschließen möchten als den *Vaccinio-Piceion*-Gesellschaften (Oberdorfer 1949).” (Oberdorfer 1950: 45). After all, Oberdorfer (1949b) assigned

the *Abieto-Piceetum* of Wutachschlucht (included in the “*Abieto-Piceion*-Unterverband”) directly to the “*Fagion*-Verband”.

Later, Oberdorfer (1962) differentiated two new suballiances:

1. “Unterverband: *Vaccinio-Abietion* (*Abieti-Piceion* Br.-Bl. 39 p. p.), artenarme Tannen-Fichtenwälder
Assoziationen: *Luzulo-Abietetum* Oberd. 57 (West-schwarzw.), *Vaccinio vitis-idaeo-Abietetum* (Reinh. 44) Oberd. 57 (Ostschwarzw.)” [Oberdorfer (1962): 37; the class *Vaccinio-Piceetea*];
2. “Unterverband: *Galio-Abietion* (*Abieti-Piceion* Br.-Bl. 39 p. p.), artenreiche Fichten-Tannenwälder
Assoziationen: *Abietetum suevicum* Oberd. 57 (SFW), *Pyrolo-Abietetum* Oberd. 57 (Ba), *Galio-Abietetum* nov. comb. (*Galio-Piceetum* Bartsch 40 und *Piceetum montanum* Br.-Bl. 39 zusammengefaßt)“ [Oberdorfer (1962): 40; the class *Quercu-Fagetea*].

However, Oberdorfer did not give much additional information on the characteristics of these suballiances. Fortunately, the previous study of Oberdorfer (1957, see above) helps to clarify the picture. Therefore it seems that Oberdorfer described new syntaxa and did not divide the *Abieti-Piceion* Br.-Bl. in Br.-Bl. et al. 1939 into his suballiances that were in fact defined independently of Braun-Blanquet’s conception (see below in chapter 3.3).

As early as 1963, Ellenberg adopted Oberdorfer’s suballiance *Galio-Abietenion*, where Ellenberg included mainly “subcontinental” *Abies alba* forests, where *Fagus sylvatica* is absent due to climatic reasons (Ellenberg 1963: 260). Thus, he followed more or less the same conception as Oberdorfer (1957).

Soó (1963: 145) raised the original suballiance “*Abieti-Piceion* Br.-Bl. 39” to the rank of the alliance: *Abieti-Piceion* (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1963. More noticeable is the assigned phytocoenotic content, which can be inferred from Soó’s synonyms to *Abieti-Piceion*:

“Syn.: *Vaccinio-Piceion* Br.-Bl. 38 Unterverb. *Vaccinio-Abietion* Oberd. 61, *Fagion* Luquet 26 Unterverb. *Abieti-Piceion* (Br.-Bl.) nach Hartmann und Oberdorfer, *Oxalidion acetosellae* Krajina 33 p. p.” (Soó 1963: 145).

Regarding the names, Soó understood the phytocoenotic content of the alliance *Abieti-Piceion* equal to the *Vaccinio-Abietion* Oberdorfer 1962 (using the form “*Vaccinio-Abietion* Oberd. 61”) or, according to the older version towards the suballi-

ance *Abieti-Piceion* in the concept of Hartmann and Oberdorfer [none of the relevant works is cited] included in *Fagion sylvaticae* Luquet 1926. The suballiance *Galio-Abietenion* Oberdorfer 1962 was not mentioned at all by Soó (1963).

Soó (1964: 285) repeated the raising of the *Abieti-Piceion* Br.-Bl. in Br.-Bl. et al. 1939 to the rank of alliance in the same form again and with the same synonyms.

Finally, Soó (1971: 177) expressed his concept of the former suballiance of Braun-Blanquet clearly: “*Abieti-Piceion* Br.-Bl. 39 (*Vaccinio-Abietion* Oberd. 57)”. However, the author citation “Oberdorfer 1957” was incorrect.

Hadač (1965) described a new alliance *Abietion albae* Březina et Hadač [in Hadač 1962] ex Hadač 1965 comprising fir-dominated woodlands of Northeastern Slovakia. According to him, such forests without *Fagus sylvatica* developed naturally in the region of the lee side of the Tatra Mountains with a continental climate (cf. Hadač 1965: Belianske Tatry Mountains, Pieniny Mountains, Levočské vrchy Mountains). Hadač thus followed Oberdorfer (1957), but he treated the included Western Carpathian forest communities as a separated higher syntaxon equivalent to the *Galio-Abietenion* Oberdorfer 1962 (Hadač 1962: 592–593).

Oberdorfer et al. (1967) did not present many changes as compared with the earlier work of Oberdorfer (1962), but the description was somewhat more detailed:

“Unterverband: *Galio-Abietion* Oberd. 62 (*Abieti-Piceion* Br.-Bl. 39 p. p.), artenreiche Fichten-Tannenwälder höherer Lagen mit opt. *Galium rotundifolium* und *Lonicera nigra*.

Assoziationen:

- *Galio-Abietetum* Oberd. 62, Ostschwarzwald, östliches Alpenvorland, Alpen, kalkarme (‘nadelholzförndende’) Böden oder subkontinentale Kaltlagen.
- *Pyrolo-Abietetum* Oberd. 57 (*Abietetum melampyretosum silvatici* Kuoch 54) auf kalkhaltigen Tonböden.” (Oberdorfer et al. 1967: 58).

Within the *Vaccinio-Abietenion*, only some additional information to the included associations was given (Oberdorfer et al. 1967: 53).

Oberdorfer (1970) made only minor changes as compared to Oberdorfer (1962), Oberdorfer et al. (1967): the synonym “*Abieti-Piceion* Br.-Bl. 39 p.p.” was assigned only to the suballiance *Vaccinio-Abietenion*, but not to the *Galio-Abietenion*.

Abies woodlands were treated also by Ellenberg & Klötzli (1972). They included all forests with

abundant *Abies alba* (and without *Fagus sylvatica*) into a separate alliance *Piceo-Abietion*, “Verband der laubwaldähnlichen Fichten-Tannenwälder” (Ellenberg & Klötzli 1972: 925). The name was not validly published:

Piceo-Abietion Ellenberg et Klötzli 1974, all. prov. (Art. 3b, Weber et al. 2000), original form of the name: “*Piceo-Abietion* prov.” – Ellenberg et Klötzli (1972: 925).

The alliance was not much used in later literature sources.

In his synopsis of vascular plant communities of Central Europe, Passarge (1978: 183) listed *Abies alba*-suballiances, although he did not refer to any of the original works:

1. “*Vaccinio-Abietion* Oberd. 62 em.”.
2. “*Luzulo-Abietion* (Br.-Bl. et Siss. 39) nom. nov. (Syn. *Abieto-Piceion* Br.-Bl. et Siss. 39 p. p.)”. It is clear that Passarge replaced the older name *Abieti-Piceion* Br.-Bl. in Br.-Bl. et al. 1939 by the new name *Luzulo-Abietion* (Br.-Bl. in Br.-Bl. et al. 1939) Passarge 1978. But according to my knowledge, there was no need to create a nomen novum for the older name (cf. Art. 39: Weber et al. 2000).
3. “*Oxalido-Abietion* Brez. et Hadač 62 em. nom. nov.”. Here Passarge surely meant *Abietion albae* Březina et Hadač in Hadač 1962, nom. nud. Since the rule for creating names with a change in rank is effective since 1979 (Weber et al. 2000: 752), Passarge’s name *Oxalido-Abietion* could be used, but would still remain not validly published (cf. Art. 2b: Weber et al. 2000).

In the frame of synopsis of the forest and scrub communities of Southern Germany edited by E. Oberdorfer, Seibert (1992: 63) indicated only one synonym for the *Vaccinio-Abietenion* Oberdorfer 1962: “*Abieto-Piceion* Br.-Bl. 39 in Br.-Bl. et al. 39 p. p.”, and Müller (1992b: 233) synonymized the *Galio rotundifolii-Abietenion* Oberdorfer 1962 only with *Piceo-Abietion* Ellenberg et Klötzli 1972. Thus, only minor changes are made in comparison with the previous survey of Oberdorfer (1970). A closer relation of the original suballiance *Abieti-Piceion* to *Vaccinio-Abietenion* than to *Galio-Abietenion* is emphasized in this way once again.

Wallnöfer (1993) included all (*Picea*-) *Abies* woodlands in only one alliance “*Abieti-Piceion* (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1964, Montane artenreiche Fichten- und Fichten-Tannenwälder” classified within *Vaccinio-Piceetea*. The alliance “*Abietion albae* Březina et Hadač in Hadač ex Hadač et al. 1969” was treated as a syntaxonomic synonym,

the suballiances *Galio-Abietenion* Oberdorfer 1962 and *Vaccinio-Abietenion* Oberdorfer 1962 were simply integrated into the *Abieti-Piceion*. Wallnöfer (1993) included in the *Abieti-Piceion* also *Picea* phytocoenoses without any considerable participation of *Abies alba* – thus closely following the concept given by Braun-Blanquet et al. (1939, 1954).

Theurillat et al. (1995) used only the name *Abieti-Piceion* Br.-Bl. in Br.-Bl. et al. 1939. Considering the characterization they give, these authors followed strictly the conception of Braun-Blanquet (Braun-Blanquet et al. 1939).

An interesting solution of classification of *Abies* woodlands is published in a recent survey of Czech forests. The separate suballiance *Galio-Abietenion* Oberdorfer 1962 is kept (Husová 2000), but *Vaccinio-Abietenion* Oberdorfer 1962 is not differentiated. *Abies* woodlands, which would fit into *Vaccinio-Abietenion* are grouped together with ordinary *Fagus* woodlands of *Luzulo-Fagion* (cf. Husová & Moravec 2000). Such a solution was indicated already by Oberdorfer (1957: 507): “Die artenarmen Tannenmischwälder vermitteln den Anschluß an das *Luzulo-Fagion*”.

Exner (2007: 184) used the alliance name of Soó “*Abieti-Piceion* (Br.-Bl. 1939) Soó 1963 s. 1.”. Although *Abieti-Piceion* was used there similarly to Braun-Blanquet (Braun-Blanquet et al. 1939), i. e. montane *Picea* and *Abies* woodlands were put together, the alliance was restricted to base-rich soil. Exner synonymized the alliance only with “*Galio rotundifolii-Abietion* (Oberd. 1962) Riv.-Mart. 1987”. The suballiance *Vaccinio-Abietenion* Oberdorfer 1962 was not recognized in the frame of the other alliance *Vaccinio-Piceion* (Exner 2007: 200).

3.2 The use of the higher-ranked syntaxa with *Abies alba*

As the literature overview has shown, two different approaches for assessment of “beechless” fir forests and their taxonomical classification on the level of alliances and suballiances. These approaches are bound with these major names: *Abieti-Piceion* Br.-Bl. in Br.-Bl. et al. 1939 (= *Abieti-Piceion* (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1963/1964), *Vaccinio-Abietenion* Oberdorfer 1962, *Galio-Abietenion* Oberdorfer 1962 and *Abietion albae* Březina et Hadač ex Hadač 1965.

The first approach was formulated by Braun-Blanquet et al. (1939). The main characteristic of this approach is the emphasis on chosen character

species which results in splitting the coniferous and the dwarf-shrub phytocoenoses of Central Europe into a group of subalpine and a group of montane phytocoenoses with either subalpine or montane character species of *Vaccinio-Piceetea* (cf. Braun-Blanquet et al. 1939). The occurrence of *Abies alba* within the coniferous forests and its abundance do not play a decisive role.

The second approach was established by Oberdorfer (1962), and is represented also by works of Kuoch (1954), Oberdorfer (1957), Ellenberg (1963), Hadač (1965), Ellenberg & Klötzli (1972). These authors also consider the floristic composition of forests communities, but *Abies alba* woodlands [more or less beechless due to natural conditions, cf. Seibert (1992), Müller (1992) and authors given above] are recognized as different from *Picea abies* woodlands, which are thus separated also syntaxonomically. This approach was reflected by labelling associations “*Abietetum*”, sometimes even in re-naming of some “*Piceetum*”-associations to “*Abietetum*” –associations because this was deemed to be more “appropriate” (cf. Oberdorfer 1957, 1962, Ellenberg & Klötzli 1972). However, such re-naming is forbidden according to the nomenclatural rules of the Code (Weber et al. 2000). Following the separation of species-poor and species-rich *Abies alba* woodlands (cf. Oberdorfer 1957), Oberdorfer (1962) put the first group of communities back into the *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 1939, but the separation of *Picea* and *Abies* phytocoenoses was maintained. An overview of the approaches of Braun-Blanquet and Oberdorfer is given in Table 1.

From among the *Abies alba* suballiances and alliances, the simplest is situation bound to the *Abietion albae* Březina et Hadač ex Hadač 1965. The alliance was described and defined by Hadač (1965): it comprises the *Abies* woodlands from the surroundings of the Tatras, distributed in the region of the lee side of the Tatras with a continental climate (of an inner mountain character). According to Hadač (1965), these ecological conditions caused

the absence of *Fagus sylvatica* and development of woodlands dominated by *Abies alba* in that region.

However, already Tschermak, who had studied differences in the distribution of tree species in the Alps, published also an analysis of the vegetation cover of the Western Carpathians (Tschermak 1944). He described a special “inner region” within the Western Carpathians with a continental “Zentralgebirgsklima” [inner mountain climate]. He located this region between the main ridges of the mountain ranges of the Tatras and the Nízke Tatry Mountains and approximately between the towns of Ružomberok and Poprad. Forests of this region Tschermak characterized by the total absence of *Fagus* and mostly scattered occurrence of *Abies* and on the contrary, by the dominance of *Picea abies* and the high abundance of *Larix decidua* and *Pinus cembra*, which creates also stands at the upper forest limit. Tschermak’s concept of the inner Carpathian (continental) climate became one of the basic concepts of the Slovak forest typological school founded later by Zlatník. Such vegetation patterns were noticed already earlier e. g. by Fekete & Blattny (1914), Sillinger (1933), Svoboda (1935a, 1935b, 1939). However, Tschermak’s knowledge of tree species distribution was insufficient, since he did not mention the *Abies* woodlands described by Sillinger (1933), Domin (1934) and Hadač (1965). Those stands are still today preserved in fragments. Absence of *Fagus* at the southern foots of the Tatras (in the Popradská Kotlina Basin), and stands formed by dominant *Picea abies*, but also *Abies alba* were the reasons for differentiating a special “continental” woodlands area without beech within the Central Western Carpathians (Zlatník 1957, Šmarda 1961a, Hadač 1965, Neuhäusl & Neuhäuslová-Novotná 1968, Hadač et al. 1969, Hančinský 1972, Zlatník 1975, 1978, Vorel 1986, Šomšák 1986, Šomšák et al. 1993, Plesník 1995). This interpretation was supported by palynological studies (cf. Jankovská 1972, 1991).

However, older data given by Šmarda (1961b) and recent research of the forest stands in the

Table 1: Original concepts of *Abies alba* woodlands classification.

Tabela 1: Izvirna koncepta klasifikacije jelovih gozdov.

	Braun-Blanquet et al. (1939)	Oberdorfer (1962)	
subalpine belt	(<i>Rhododendro-Vaccinienion</i>)	–	–
montane belt	<i>Abieti-Piceenion</i> <i>Picea</i> and <i>Abies</i> (or mixed) woodlands	<i>Vaccinio-Abietenion</i> species poor <i>Abies</i> woodlands	<i>Galio-Abietenion</i> species rich <i>Abies</i> woodlands

Popradská Kotlina Basin and adjacent regions (cf. Flachbart 2007, Kučera 2008a, b, partly Kanka 2008) disprove statements that *Fagus* is missing due to natural factors (continental climate, lack of rainfalls) in woodlands of that “continental” region [partly indicated already by the palynological works of Krippel 1963, 1986]. Thus, the actual field state of *Abies alba* (and *Picea abies*) stands described originally as beechless ones is apparently opposed to the original description of the alliance *Abietion albae* Březina et Hadač [in Hadač 1962] ex Hadač 1965 [or *Abietion albae* Březina et Hadač [in Hadač 1962] ex Hadač et al. 1969]. Those woodlands of e. g. the Belianske Tatry Mountains, the Levočské Vrchy Mountains, and the Spišská Magura Mountains, change their nature by the recent expansion of *Fagus sylvatica* to its former habitats (cf. Flachbart 2007, Kučera 2008a, b) and should be syntaxonically classified among the ordinary (*Abies*-)*Fagus* syntaxa of the order *Fagetalia sylvaticae* Walas 1933. [The order *Fagetalia sylvaticae* Pawłowski ex Pawłowski et al. 1928 is not validly published: cf. Art. 3f of the Code (Weber et al. (2000).] With regard to this revision, further research oriented towards the evolution of *Abies alba* woodlands (and also montane *Picea abies* stands) in Austria, Germany and Switzerland, and a closer examination of their recent development might bring new findings relevant to syntaxonomical classification, especially with the consideration of *Fagus sylvatica*.

As written above, the reason for the differentiation of a separate alliance *Abietion albae* Březina et Hadač [in Hadač 1962] ex Hadač 1965 was the occurrence of the *Abies alba* woodlands in the inner region of the Western Carpathians without *Fagus sylvatica*. Since such a fact is not proved in the field by recent research, there is no reason to use the alliance name when regarding natural *Abies* phytocoenoses. If the Swiss, German and Austrian *Abies* woodlands referred by Ellenberg & Klötzli (1972), Seibert (1992), Müller (1992) etc. are of natural character, then *Abietion albae* (Hadač 1965, Hadač et al. 1969) cannot be treated as a synonym either of *Abieti-Piceenion*/*Abieti-Piceion* as given by Šomšák (1985), Wallnöfer (1993) or *Galio-Abietenion*/*Vaccinio-Abietenion*.

Among the later published works, the classifications of Theurillat et al. (1995) or Seibert (1992) and Müller (1992) reflect well the original conceptions of *Abieti-Piceenion* vs. *Vaccinio-Abietenion*/*Galio-Abietenion* defined by Braun-Blanquet et al. (1939), and Oberdorfer (1962) (explained above). It is appropriate to consider whether the syntaxon was

established on the mutual contrast of the montane and the subalpine phytocoenoses (*Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939), or whether only montane woodlands with *Abies alba* were taken into consideration, further differentiated by their phytocoenotic content (*Galio-Abietenion* Oberdorfer 1962, *Vaccinio-Abietenion* Oberdorfer 1962). The two suballiances of Oberdorfer could be integrated into the *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939, but the phytocoenotic content of the latter suballiance is even wider (cf. Braun-Blanquet et al. 1939), as partly indicated by Wallnöfer [1993: 315, however, the alliance *Abieti-Piceion* (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1964 was restricted there only to species-rich coniferous forests].

It seems that there exist different approaches to the phytocoenotic concept of a syntaxon name in different countries, coming from a tradition of the use of the name in a relevant country. While the German authors (cf. Seibert 1992, Müller 1992) followed the limitation of the suballiance *Abieti-Piceenion* to *Vaccinio-Abietenion* (“... bodensaure Fichten-Tannenwälder”: Seibert 1992: 63) given by Oberdorfer et al. (1967) and Oberdorfer (1970), the Austrian authors (Wallnöfer 1993, Exner 2007) defined an ecological content of the suballiance in the opposite way: towards the suballiance *Galio-Abietenion*. Surely, a certain variance in the use of a syntaxon name by various authors is understandable, but all syntaxonomists have to follow the original author who described the relevant syntaxon and defined its phytocoenotic content.

3.3 Notes on nomenclature

The rule that for each syntaxon a nomenclatural type has to be published was established not until 1976 – in the first edition of the Code of phytosociological nomenclature (Barkman et al. 1976). Thus, the suballiance *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939 was not typified in the original description. Syntaxonomical content of the name could be thus assessed only by the general description of its author [Braun-Blanquet et al. (1939): 10–21]. The *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939 remained without a nomenclatural type until the publication of the survey of Willner et al. (2007). There Exner (2007) used the alliance name *Abieti-Piceion* (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1963 and as a lectotype was in the study (Willner et al. 2007) chosen the “*Piceetum montanum* Br.-Bl. in Br.-Bl. et al. 1939”. However, the authors did not apply the

phytosociological Code properly: this can be assessed from various statements of the survey. The above mentioned typification faces the following problems:

1. Note 2 of the Article 27 (Weber et al. 2000) specifies that a name whose rank has changed has to contain a reference to the original syntaxon name only on or after 1 Jan 2000. Future editions of the Code will show if this definition will remain unchanged. Until then, the name *Abieti-Piceion* (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1963 could be used freely.
2. The name *Piceetum montanum* Br.-Bl. [1938, nom. nud.] ex Br.-Bl. et al. 1939 should be assessed as not validly published. The synoptic table of this association (Braun-Blanquet & al 1939: 14–15) was compiled of 7 relevés of Braun-Blanquet and 6 relevés published by Beger. However, since the original single relevés were not listed, the validity of this name cannot be assessed clearly.
 - 2a. The survey of Braun-Blanquet et al. (1939) does not include a list of references. Thus, syntaxa based only on references to other literature sources cannot be regarded as validly published at all. The content of all the cited references becomes clear only when the reader already knows these works.
 - 2b. Lists of species in synoptic tables are not complete, even with regard to the article 7 of the Code (Weber et al. 2000) requiring that all species with constancy above 20 % have to be included. The synoptic tables of Braun-Blanquet et al. (1939) contain only selected species: in the first place chosen characteristic species of corresponding syntaxa (association, alliance, order) are given, in the second place the differential species against relevant syntaxa are indicated, and in the last place some taxa labelled mostly as “Begleiter hoher Stetigkeit” [accompanying species with high constancy] are listed. Here rarely taxa with constancy II are mentioned, sometimes even taxa with constancy III or higher are missing. Within the communities of *Rhodoreto-Vaccinion* in the sense of Braun-Blanquet et al. (1939), more species with constancy class II and above are missing:

Piceetum tatricum normale und *P. tatr. myrtilletosum*: the synoptic table is compiled only from relevés of *Piceetum normale* published by Polish authors (the years 1925 and 1927 are incorrect), missing species

are for example *Aconitum firmum*, *Dentaria glandulosa*, *Carex digitata*.

Piceetum tatricum flicetosum: 24 species of constancy II, III and IV are missing.

Pinetum mughii carpaticum: the synoptic table consists of relevés of communities on carbonate background only, taxa with constancy II, III and also V are missing, e. g. *Daphne mezereum*, *Chrysanthemum rotundifolium*, *Gymnocarpium dryopteris*, *Gentiana asclepiadea*, *Polygonatum verticillatum* and others.

Due to the very low number of species with constancy class II or III, there is a very high probability that also other syntaxa described by Braun-Blanquet et al. (1939) only by synoptic tables with references to other original works are not validly published according to article 7 of the Code. Only some synoptic tables of the work of Braun-Blanquet et al. (1939) were compiled only from not published relevés: *Piceetum transalpinum*, *Aremonio-Piceetum*, *Lophozio-Piceetum*, *Soldanello montanae-Piceetum*. Thus, these associations could be treated as if they were published validly, as there seems to exist no way of proving their original species content.

Whether the synoptic table of the association *Piceetum montanum* Br.-Bl. ex Br.-Bl. et al. 1939 is a sufficient original diagnosis according to the article 7 of the Code (Weber et al. 2000) is difficult to determine. In accordance with this article, all species listed three times and more in original relevés have to be included in a synoptic table in Braun-Blanquet et al. (1939: 14). However, Braun-Blanquet et al. used only an unspecified 6 of 8 relevés published by Beger (1922). Moreover, the table of Beger (1922: 49–50) does not contain taxa of the ground layer, therefore bryophytes are listed without corresponding values of constancy by Braun-Blanquet et al. (1939: 15).

If the *Piceetum montanum* Br.-Bl. ex Br.-Bl. et al. 1939 [i. e. *Piceetum montanum galietosum rotundifolii* Br.-Bl. et al. 1939] is treated as a nomen invalidum (Art. 2b → Art. 7) and is at the same time considered as weakly characterized, then *Piceetum montanum (galietosum rotundifolii)* Br.-Bl. et al. 1954, nom. illeg. (Art. 34a) would be the appropriate element for closer definition of the older name. [The nomenclatural type for the latter name has to be chosen from relevés 3–14, Table IX of Braun-Blanquet et al. (1954)].

Although Oberdorfer (1957) used Braun-Blanquet's name *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939, their concepts of this suballiance are not identical [cf. Oberdorfer 1957: 507–517]. For this reason, labelling the syntaxon as *Abieti-Piceenion*

sensu Oberdorfer 1957 non Br.-Bl. in Br.-Bl. et al. 1939 according to the recommendation 46 J of the Code (Weber et al. 2000: 758) could be considered.

Soó (1963: 145) used the name “*Abieti-Piceion* Br.-Bl. 39”. Since Braun-Blanquet (Braun-Blanquet et al. 1939: 13) described the syntaxon as a suballiance “*Abieto-Piceion* Br.-Bl. 1939”, Soó raised it to the rank of alliance: *Abieti-Piceion* (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1963.

Surprisingly, the Code (Weber et al. 2000: Art. 27, Note 2) specifies explicitly that unambiguous reference to the earlier publication containing the “basonym” (cf. Weber 2003: 402) used for raising a rank is needed only on or after 1 Jan 2002. According to my opinion, a change of rank has to comprise direct reference to the original publication of the name also in antecedent years because an author has to know the concept of original authors of the syntaxa and naturally shall have to include the original work in literature references. [I do not doubt that Soó had seen the work.] Thus, the name *Abieti-Piceion* of Soó (1963) would be (once) regarded as a not validly published name. The interpretation as invalid name might be supported by article 2b of the Code:

Abieti-Piceion (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1963, nom. inval. (?), (nom. nud.)

In his later work, Soó (1964: 285) raised the rank of *Abieti-Piceion* Br.-Bl. in Br.-Bl. et al. 1939 in the same way. The differences concern the language used (Hungarian) and, more important, the reference to the original work of Braun-Blanquet et al. (given as “Braun-Blanquet, J. (szerk.): Pro-drome des Groupements Végétaux 1–7. – Montpellier, 1933–1940”), hence the reference of the newly-ranked name was “better” than in Soó (1963), where such reference is missing. The publication of status novus of *Abieti-Piceion* Br.-Bl. in Br.-Bl. et al. 1939 by Soó (1964) should be preferred:

Abieti-Piceion (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1964.

The original author citation “Br.-Bl. 39” could be considered as a kind of bibliographic error (cf. Weber et al. 2000: 745).

Oberdorfer (1962) introduced two suballiances: *Vaccinio-Abietenion* Oberdorfer 1962 (*Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939 p. p.) and *Galio-Abietenion* Oberdorfer 1962 (*Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939 p. p.). It could seem that this was an act of division of the suballiance of Braun-Blanquet into new suballiances [and thus, art. 24 of the Code (Weber et al. 2000) applies]. But care-

ful consideration of original descriptions and diagnoses given by Braun-Blanquet (Braun-Blanquet et al. 1939) and Oberdorfer (1962) shows, that identifying of *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939 with either *Vaccinio-Abietenion* Oberdorfer 1962 or *Galio-Abietenion* Oberdorfer 1962 is controversial. Therefore, it is advised that the publication of *Vaccinio-Abietenion* and *Galio-Abietenion* by Oberdorfer (1962) be regarded as a description of two new names (syntaxa) and not as a division of the suballiance *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939. After all, such interpretation follows also the description given by Oberdorfer (1962: 37, 40).

According to the Code (Weber et al. 2000: Art. 15), the application of a syntaxon is determined by its nomenclatural type. Defining types for each of Oberdorfer’s suballiances is therefore important.

In *Vaccinio-Abietenion* Oberdorfer 1962 (Oberdorfer 1962: 37) two associations were included: (1) “*Luzulo-Abietetum* Oberd. 57” and (2) “*Vaccinio (vitis-idaeo)-Abietetum* (Reinh. 44) Oberd. 57”. The latter name was not validly published: *Vaccinio vitis-idaeo-Abietetum* Oberdorfer 1957, nom. inval. (Art. 3m). Only the first name could be chosen therefore as a nomenclatural type for the *Vaccinio-Abietenion* Oberdorfer 1962:

Nomenclatural type: Oberdorfer (1957: 507), ass. *Luzulo-Abietetum* Oberdorfer 1957, lectotypus hoc loco.

The suballiance *Galio-Abietenion* Oberdorfer 1962 included three associations (Oberdorfer 1962: 40): (1) “*Abietetum suevicum* Oberd. 57”, (2) “*Pyrolo-Abietetum* Oberd. 57”, (3) “*Galio-Abietetum* nov. comb. (*Galio-Piceetum* Bartsch 40 und *Piceetum montanum* Br.-Bl. 39 zusammengefaßt)”. The nomenclatural status of those syntaxa is according to the Code (Weber et al. 2000) as follows:

- *Abietetum suevicum* Oberdorfer 1957, nom. inval. (pro syn.), Art. 3a,
- *Pyrolo-Abietetum* Oberdorfer 1957, nom. inval. (pro syn.), Art. 3a,
- *Galio-Abietetum* Oberdorfer 1962*, nom. inval., Art. 3m, [Art. 2b].

*[Note: Any kind of a later validly published *Galio [rotundifolii]-Abietetum* based on the work of Oberdorfer is a later homonym of the association *Galio rotundifolii-Abietetum* Wraber 1955 ex Wraber 1959 validly published by Wraber (1959) from Slovenia. However, following the proposal of Oberdorfer (1967: 40) and the rules of the Code (Weber et al. 2000) the name *Galio rotundifolii-Piceetum* J. Bartsch et M. Bartsch 1940, nom. invers. should be used instead of *Galio-Abietetum* Oberdorfer 1962.]

Seen from this perspective, the superordinated syntaxon was not published validly as well: *Galio-Abietenion* Oberdorfer 1962, nom. inval., Art. 2b.

In this case, the interpretation of the recommendation 46D of the Code in Weber et al. (2000: 757) according to which “The validation is effected by a valid publication of the syntaxon name with a sufficient original diagnosis containing the name-giving taxon (taxa), or with an unambiguous reference to such an effectively published diagnosis, or the syntaxon name is published as correct name (not only in synonymy).” is disputable. Oberdorfer (1962) used only invalid names, he did not list “correct” names with reference to original diagnoses. It is questionable to simply replace the author citation “Oberdorfer 1957” with “Oberdorfer 1962” and consider the names as validly published. Nomenclatural types of this suballiance listed by Willner et al. (2007: 238) or earlier by Husová (2000: 178, as “*Pyrolo-Abietetum* Oberdorfer 1962”) would be considered therefore as irrelevant. As it is unambiguous that the name *Galio-Abietenion* of Oberdorfer was surely validated earlier by some author who fulfilled all the conditions given in the Code (Weber et al. 2000), choosing the nomenclatural type for *Galio-Abietenion* Oberdorfer 1962 is therefore omitted here to avoid publication of a superfluous validation of the name.

Later, Rivas-Martínez raised *Galio-Abietenion* Oberdorfer 1962 to the rank of alliance. As I do not have the original work of Rivas-Martínez published in 1987 at hand, the synopsis of Rivas-Martínez et al. (2001) shall serve preliminarily for the purpose of determining the nomenclatoric proposals of Rivas-Martínez. The following specification could be found there:

“*Galio rotundifolii-Abietion albae* (Oberdorfer 1962) Rivas-Martínez 1987

[*Piceo-Abietion* Ellenberg & Klötzli 1972 (pro syn., art. 3a), *Galio-Abietenion* Oberdorfer 1962 (corresp. name), *Abieti-Piceenion* Br.-Bl. in Br.-Bl., Sissingh & Vlieger 1939 (corresp. name)]” (Rivas-Martínez et al. 2001).

The authors listed the older name *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939 as corresponding name (cf. Weber et al. 2000: 743). If the original suballiance of *Galio-Abietenion* Oberdorfer 1962 was really syntaxonomically corresponding with the suballiance *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939, it was questionable to use the name *Galio rotundifolii-Abietion albae* (Oberdorfer 1962) Rivas-Martínez 1987 on the alliance level when much earlier the name of Soó was available: *Abieti-Piceion*

(Br.-Bl. in Br.-Bl. et al. 1939) Soó 1964 [or *Abieti-Piceion* (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1963; see the comment above to Soó (1963, 1964)].

4. CONCLUSIONS

The two dominant approaches to the syntaxonomical classification of woodlands with a substantial abundance of *Abies alba* and at the same time without considerable occurrence of *Fagus sylvatica* were established by Braun-Blanquet (Braun-Blanquet et al. 1939) and Oberdorfer (1962). Also Hadač (1962) described a separate group of *Abies* woodlands. Later authors used mostly the names *Abieti-Piceenion/Abieti-Piceion*, *Vaccinio-Abietenion*, *Galio-Abietenion* and *Abietion albae* or their combinations in various ways, but not always in accordance with the original concepts of their description. Although the application of the name of a syntaxon is determined by means of its nomenclatural type (Weber et al. 2000: 750), also the choice of a nomenclatural type should respect the concept of a name, especially for syntaxa described long ago before the Code of phytosociological nomenclature was published.

The concept of the suballiance *Abieti-Piceenion* of Braun-Blanquet (Braun-Blanquet et al. 1939, 1954) is based on phytocoenotic differences of coniferous woodlands between the montane and the “subalpine” vegetation belts. Unlike this approach, Oberdorfer (1962) divided montane *Abies* woodlands with natural absence of *Fagus* into *Galio-Abietenion* and *Vaccinio-Abietenion*, following their ecological and phytocoenotic variance. When using some of the mentioned suballiances, a researcher has to take into consideration the original concept and content of the name used; following a tradition of the use of name different from its original publication is not the appropriate way. This applies also to the nomenclatural assessment of syntaxa names. Since natural absence of *Fagus sylvatica* as the reason for description of the *Abietion albae* Březina et Hadač ex Hadač 1965 was not confirmed by recent research, classification of *Abies alba* woodlands could be expressed either by using:

1. *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939 [= *Abieti-Piceion* (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1963/1964] or
2. *Galio-Abietenion* Oberdorfer and/or *Vaccinio-Abietenion* Oberdorfer 1962.

There is only a limited possibility to combine these two approaches. The alliance *Galio rotundifo-*

lii-Abietion albae (Oberdorfer 1962) Rivas-Martínez 1987 is not of much use, if it equates to *Abieti-Piceenion* Br.-Bl. in Br.-Bl. et al. 1939, i. e. the older alliance name *Abieti-Piceion* (Br.-Bl. in Br.-Bl. et al. 1939) Soó 1963/1964.

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6. REFERENCES

- Barkman, J. J., Moravec, J. & Rauschert, S. 1976: Code of phytosociological nomenclature. *Vegetatio* 32: 131–185.
- Beger, H. K. E. 1922: Assoziationsstudien in der Waldstufe des Schanfiggs. *Mitteilungen aus dem Botanischen Museum der Universität Zürich* XCVI, 148 pp.
- Braun-Branquet, J., Sissingh, G. & Vlieger, J. 1939: *Prodromus der Pflanzengesellschaften: Prodrome des Groupements végétaux*. Hauptred. J. Braun-Blanquet. Fasz. 6. Klasse der *Vaccinio-Piceetea* (Nadeholz- und Vaccinienheiden-Verbände der eurosibirisch-nordamerikanischen Region). *Comité International du Prodrome Phytosociologique*, März 1939, 124 pp.
- Braun-Blanquet, J., Pallmann, H. & Bach, R. 1954: *Pflanzensoziologische und bodenkundliche Untersuchungen im Schweizerischen Nationalpark und seinen Nachbargebieten*. II. *Vegetation und Böden der Wald- und Zwergstrauchgesellschaften (Vaccinio-Piceetalia)*. *Ergebnisse der wissenschaftlichen Untersuchungen des schweizerischen Nationalpark*. IV (Neue Folge), 200 pp.
- Businský, R. 1999: *Taxonomická studie agregátu Pinus mugo a jeho hybridních populací* [Taxonomic essay in the *Pinus mugo* complex and its hybrid populations]. *Acta Průhoniana* 68: 123–143.
- Domin, K. 1934: *Jedliny u Tatranské Kotliny v Bielských Tatrách*. *Věda přírodní* 6–7: 161–164.
- Ellenberg, H. 1963: *Einführung in die Phytologie [von H. Walter]*. Band IV. Teil 2. *Vegetation Mitteleuropas mit den Alpen in kausaler, dynamischer und historischer Sicht*. Eugen Ulmer, Stuttgart, 948 pp.
- Ellenberg, H. & Klötzli, F. 1972: *Waldgesellschaften und Waldstandorte der Schweiz*. *Mitteilungen der Schweizerischen Anstalt für das forstliche Versuchswesen* 48 (4): 587–930.
- Exner, A. 2007. *Piceetalia* Pawł. 1928. In: Willner, W. & Grabherr, G. (eds) et al. *Die Wälder und Gebüsche Österreichs*. 1 Textband. Elsevier, München. pp. 184–208.
- Fekete, L. & Blattny, T. 1914: *Die Verbreitung der forstlich wichtigen Bäume und Sträucher im ungarischen Staate*. Erster Band. *Commissionverlag von August Joergers' Witwe & Sohn, Selmecbánya*, X, 850 pp.
- Flachbart, V. 2007: *Bezbukové oblasti na Slovensku – skutočnosť alebo fikcia?* In: Rizman, I. (ed.): *Lesnícka typológia a zisťovanie stavu lesa vo väzbe na trvalo udržateľné obhospodarovanie lesov: Zborník príspevkov a prezentácií z odborného seminára konaného 3. 12. 2007 na NLC vo Zvolene v elektronickej forme [CD-ROM]*. NLC – Ústav lesných zdrojov a informatiky, Zvolen.
- Hadač, E. 1965: *Poznámky k syntaxonomii karpatských jedlin*. *Biológia (Bratislava)* 20 (8): 592–599.
- Hadač, E., Březina, P., Ježek, V., Kubička, J., Hadačová, V., Vondráček, M. et al. 1969: *Die Pflanzengesellschaften des Tales “Dolina Siedmich prameňov” in der Belaer Tatra*. *Vegetácia ČSSR*, B 2: 344 pp.
- Hančinský, L. 1972: *Lesné typy Slovenska*. *Príroda*, Bratislava, 307 pp.
- Husová, M. 2000: *Podsvaz: Galio-Abietenion* Oberdorfer 1962. In: Moravec, J. (ed.), Husová, M., Chytrý, M. & Neuhäuslová, Z.: *Přehled vegetace České republiky*. Svazek 2, *Hygrofilní, mezofilní a xerofilní opadavé lesy [Vegetation Survey of the Czech Republic. Volume 2, Hygrophilous, mesophilous and xerophilous deciduous forests]*. *Academia, Praha*, pp. 178–184.
- Husová, M. & Moravec, J. 2000. *Svaz: Luzulo-Fagion* Lohmeyer et Tüxen in Tüxen 1954. In: Moravec, J. (ed.), Husová, M., Chytrý, M. & Neuhäuslová, Z.: *Přehled vegetace České republiky*. Svazek 2,

- Hygrofilní, mezofilní a xerofilní opadavé lesy [Vegetation Survey of the Czech Republic. Volume 2, Hygrophilous, mesophilous and xerophilous deciduous forests]. Academia, Praha, pp. 184–201.
- Jankovská, V. 1972: Pyloanalytický příspěvek ke složení původních lesů v severozápadní části Spišské kotliny. *Biológia (Bratislava)* 27 (4): 279–292.
- Jankovská, V. 1991: Vývoj vegetačního krytu podtatranských kotlin od konce doby ledové po současnost. *Zborník prác o Tatranskom národnom parku* 31: 73–84.
- Jarolímek, I., Šibík, J. (eds) et al. 2008: Diagnostic, constant and dominant taxa of the higher vegetation units of Slovakia. Veda, Bratislava, in press.
- Kanka, R. 2008: *Lesy Belianskych Tatier*. Veda, Bratislava. 250 pp.
- Krippel, E. 1963: Postglaciálny vývoj lesov Tatranského národného parku. *Biologické práce IX/5*: 44 pp.
- Krippel, E. 1986: Postglaciálny vývoj vegetácie Slovenska. Veda, Bratislava. 312 pp.
- Kučera, P. 2008a: Buk v Doline Siedmich prameňov. Štúdie o Tatranskom národnom parku 9 (42). In red.
- Kučera, P. 2008b: Buk na severovýchode Popradskej kotliny. *Bulletin Slovenskej botanickej spoločnosti* 30 (2): 213–226.
- Marhold, K. (ed.), Goliašová, K., Hegedúšová, Z., Hodálová, I., Jurkovičová, V., Kmeťová, E., Letz, R., Michalková, E., Mráz, P., Peniašteková, M., Šipošová, H., Ťavoda, O. et al. 1998: *Papra orasty a semenné rastliny*. In Marhold, K., Hindák, F. (eds) et al. *Zoznam nižších a vyšších rastlín Slovenska*. Veda, Bratislava. pp. 333–687
- Müller, Th. 1992b: 4f. Unterverband: *Galio rotundifolii-Abietenion* Oberd. 62. In: Müller, Th, Oberdorfer, E. & Seibert, P.: *Süddeutsche Pflanzengesellschaften*. Teil IV. Wälder und Gebüsche. A. Textband. Herausgegeben von E. Oberdorfer. Gustav Fischer, Jena, pp. 233–237.
- Neuhäusl, R. & Neuhäuslová-Novotná, Z. 1968: Pokus o rekonstrukci přirozené vegetace popradské části Spišské kotliny. *Preslia* 40 (4): 362–386.
- Oberdorfer, E. 1949a: *Pflanzensoziologische Exkursionsflora für Südwestdeutschland und die angrenzenden Gebiete*. Eugen Ulmer, Stuttgart, pp. 14–18 (Übersicht der höheren Vegetationseinheiten, Eurosibirische Region).
- Oberdorfer, E. 1949b: *Die Pflanzengesellschaften der Wutachschlucht*. Beiträge zur naturkundlichen Forschung in Südwestdeutschland 7 (1948/49): 22–60.
- Oberdorfer, E. 1950: Beitrag zur Vegetationskunde des Allgäu. Beiträge zur naturkundliche Forschung in Südwestdeutschland 9 (2): 29–98.
- Oberdorfer, E. 1957: *Süddeutsche Pflanzengesellschaften*. Gustav Fischer, Jena, XVIII, 564 pp.
- Oberdorfer, E. 1962: *Pflanzensoziologische Exkursionsflora für Süddeutschland und die angrenzenden Gebiete*. Eugen Ulmer, Stuttgart, pp. 19–42 (Systematische Übersicht der süddeutschen Vegetationseinheiten (Assoziationen und höhere Einheiten)).
- Oberdorfer, E. 1970: *Pflanzensoziologische Exkursionsflora für Süddeutschland und die angrenzenden Gebiete*. Eugen Ulmer, Stuttgart, pp. 22–41 (Systematische Übersicht der Vegetationseinheiten (Assoziationen und höhere Einheiten)).
- Oberdorfer, E., Görs, S., Korneck, D., Lomeyer, W., Müller, Th., Philippi, G. & Seibert, P. 1967: *Systematische Übersicht der westdeutschen Phanerogamen- und Gefäßkryptogamen-Gesellschaften*. Ein Diskussionsentwurf. Schriftenreihe für Vegetationskunde 2: 7–62.
- Passarge, H. 1978: Übersicht über mitteleuropäische Gefäßpflanzengesellschaften. *Feddes Repertorium* 89 (2–3): 133–195.
- Pawłowski, B., Sokołowski, M. & Wallisch, K. 1928: *Zespoły roślin w Tatrach. Część VII. Zespoły roślin i flora doliny Morskiego Oka*. – Die Pflanzenassoziationen des Tatra-Gebirges. VII. Teil. Die Pflanzenassoziationen und die Flora des Morskie Oko-Tales. *Bulletin International de l'Académie Polonaise des Sciences et des Lettres, Classe des Sciences Mathématiques et Naturelles, Série B: Sciences Naturelles N° Supplémentaire II*: 205–272.
- Plesník, P. 1995: Fytogeografické (vegetačné) členenie Slovenska. *Geografický časopis*, 47 (3): 149–181.
- Rivas-Martínez, S., Fernández-González, F., Loidi, J., Lous, M. & Penas, A. 2001 [online]: *Syntaxonomical checklist of vascular plant communities of Spain and Portugal to association level*. *Itinera Geobotanica* 14: 5–341 [cit. 2008-06-18]. Available on internet: http://www.ucm.es/info/cif/book/checklist/checklist_a.htm.
- Seibert, P. 1992: Klasse: *Vaccinio-Piceetea* Br.-Bl. in Br.-Bl. et al. 39. In: Müller, Th., Oberdorfer, E. & Seibert, P.: *Süddeutsche Pflanzengesellschaften*. Teil IV. Wälder und Gebüsche. A.

- Textband. Herausgegeben von E. Oberdorfer. Gustav Fischer, Jena, p. 53–80.
- Sillinger, P. 1933: Monografická studie o vegetaci Nízkých Tater. [Monographical Study of the Vegetation of the Nízke Tatry (Low-Tatra-Mountains in Czechoslovakia)]. Knihovna Sboru pro výskum Slovenska a Podkarpatské Rusi 6: 340 pp.
- Soó, R. 1963: Systematische Übersicht der pannonischen Pflanzengesellschaften VI. Acta botanica Academiae scientiarum hungariae 9(1–2): 123–150.
- Soó, R. 1964: A magyar flóra és vegetáció rendszertani-növényföldrajzi kézikönyve I.: I. Kötet, Általános rész – Magyarország növényföldrajza – Mohák – Harasztok – Nyitvatermők [Synopsis systematico-geobotanica florum vegetationisque hungariae I.: Tomus I., Pars generalis – Geobotanica hungariae – Bryophyta – Pteridophyta – Gymnospermatophyta]. Akadémiai Kiadó, Budapest, 592 pp.
- Soó, R. 1971: Aufzählung der Assoziationen der ungarischen Vegetation nach den neueren zönosystematisch-nomenklatorischen Ergebnissen. Acta Botanica Academiae Scientiarum Hungaricae 17 (1–2): 127–179.
- Svoboda, P. 1935a: O lesních společenstvech svazu bučin Liptovských holí a jejich sukcesi. Sborník Československé Akademie Zemědělské 10(4): 428–434.
- Svoboda, P. 1935b: O lesních společenstvech svazu smrčín, jejich sukcesi a zmlazování v Liptovských holích. Sborník Československé Akademie Zemědělské 10 (4): 435–443.
- Svoboda, P. 1939: Lesy Liptovských Tater. Studie o dřevinách a lesních společenstvech se zvláštním zřetelem k vlivům antropozoickým. Opera Botanica Čechica 1: 164 pp.
- Šmarda, J. 1961a: Vegetační poměry Spišské kotliny: Studie travinných porostů. Vydavateľstvo Slovenskej akadémie vied, Bratislava, 272 pp.
- Šmarda, J. 1961b: Příspěvek k poznání květeny povodí Belé a Hybice v Liptovské kotlině. Biologie (Bratislava) 16 (10): 762–766.
- Šomšák, L. 1985. Vaccinio-Piceetea Br.-Bl. in Br.-Bl. et al. 1939. In Mucina, L., Maglocký, Š. (eds) et al. A list of vegetation units of Slovakia. Documents phytosociologiques, N. S. IX: p. 175–220.
- Šomšák, L. 1986: Fir Forests of Northeastern Slovakia. Biologické práce XXXII/4: 148 pp.
- Šomšák, L., Viceníková, A., Marková, L. & Šoltés, R. 1993: Vegetačná mapa lesov Podtatranskej kotliny (Časť I). Zborník prác o Tatranskom národnom parku 33: 179–192.
- Theurillat, J.-P., Aeschimann, D., Küpfer, Ph. & Spichiger, R. 1995: The higher vegetation units of the Alps. Colloques Phytosociologiques XXI-II: 189–239.
- Tschermak, L. 1944: Ozeanität und Waldkleid in Gebirgen. Zeitschrift für das gesamte Forstwesen 70: 12–28.
- Vorel, J. 1986: Stupňovitost vegetace. In: Randuška, D., Vorel, J. & Plíva, K.: Fytcenológia a lesnícka typológia. Bratislava, Príroda, pp. 74–87.
- Walas, J. 1933: Roślinność Babiej Góry. Monografie naukowe 2: 68 pp.
- Weber, H. E., Moravec, J. & Theurillat, J.-P. 2000: International Code of Phytosociological Nomenclature. 3rd ed. Journal of Vegetation Science 11: 739–768.
- Wallnöfer, S. 1993: *Vaccinio-Piceetea*. In: Mucina, L., Grabherr, G., Wallnöfer, S. (eds) et al.: Die Pflanzengesellschaften Österreichs. Teil III. Wälder und Gebüsche. Gustav Fischer, Jena, pp. 283–337.
- Weber, H. E. 2003: Anleitung zur Revision und gültigen Veröffentlichung syntaxonomischer Namen bis zur Rangstufe der Assoziation. Tuxenia 23: 401–417.
- Willner, W., Grabherr, G. (eds) et al. 2007. Die Wälder und Gebüsche Österreichs. 1 Textband. Elsevier, München. 302 pp.
- Wraber, M. 1959: Gozdna združba jelke in okroglostne lakote v Sloveniji: (*Galieta rotundifolii-Abietetum* Wraber 1955). Prirodoslovno društvo v Ljubljani, Posebne izdaje I: 20 pp., 1 tab.
- Zlatník, A. 1957: Poznámky k původnímu složení a typologickému zařazení tatranských lesů. Sborník Vysoké školy zemědělské a lesnické v Brně, Řada C: Spisy Fakulty lesnické 3: 227–228.
- Zlatník, A. 1975: Tatranské lesy a krovité porasty. Zborník prác o Tatranskom národnom parku 17: 159–181.
- Zlatník, A. 1978: Lesnická fytcenologie. Státní zemědělské nakladatelství, Praha, 496 pp.

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