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Observations on *Sorbus* in Southwest Moravia (Czech Republic) and adjacent Austria II

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Sorbus graeca (SPACH) KOTSCHY is reported as occurring at three stations in the valley of the Dyje (Thaya), in both the Moravian and Austrian parts. The records are briefly commented upon. Basic data concerning morphology, variation, relationships, ecology, geographical distribution, phytocenology and ecobiology are also provided for other species previously known to occur in the area: *S. aria* (L.) CRANTZ, *S. torminalis* (L.) CRANTZ and *S. aucuparia* L.

KOVANDA M., 1997: Beobachtungen zu *Sorbus* in Südwestmähren (Tschechische Republik) und im grenznahen Österreich II.
Sorbus graeca (SPACH) KOTSCHY wird von drei Standorten im Thayatal sowohl im mährischen als auch im österreichischen Teil gemeldet. Die Funde werden kurz kommentiert. Grundlegende Daten zur Morphologie und Variation, zu den Verwandtschaftsverhältnissen, zur Ökologie, geographischen Verbreitung, Phytozönologie und Ökobiologie anderer *Sorbus*-Arten, die kürzlich im selben Gebiet beobachtet wurden (*S. aria* [L.] CRANTZ, *S. torminalis* [L.] CRANTZ und *S. aucuparia* L.), werden ebenfalls mitgeteilt.

Keywords: *Sorbus*, Southwest Moravia, Lower Austria, morphology, variation, relationships, ecology, geographical distribution, phytocenology, ecobiology.

Introduction

Southwest Moravia and, in particular, the Dyje (Thaya) valley, proved a rewarding terrain in terms of *Sorbus* diversity. A survey initiated in 1990 detected two new species and two species not previously reported from the area (KOVANDA 1996). Continuing investigation yielded one more species, *S. graeca* (SPACH) KOTSCHY, not previously recorded as occurring in either the Moravian or the Austrian parts of the valley. The records are briefly discussed. To complete the list, observations on species known to occur in the area prior to 1990 are provided.

S. austriaca (BECK) PRAIN et al., another new addition to the local *Sorbus* flora, has been dealt with elsewhere (KOVANDA 1997).

In total, nine *Sorbus* taxa of specific rank are now known from the area, i.e. more than in any other area of comparable size in either the Czech Republic or Austria. These comprise: *S. aucuparia* L., *S. torminalis* (L.) CRANTZ, *S. aria* (L.) CRANTZ, *S. danubialis* (JÁVORKA) PRODAN, *S. graeca* (SPACH)

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KOTSCHY and four species of hybrid origin, *S. austriaca* (BECK) PRAIN et al., *S. carpatica* BORBÁS, *S. hardeggensis* KOVANDA and *S. alnifrons* KOVANDA. It did not seem worthwhile to present dot maps for *S. torminalis* (L.) CRANTZ and *S. aucuparia* L. as these species, unlike the others, are found scattered throughout the area studied.

Herbarium material will be deposited in PR (Herbarium of the National Museum, Prague).

Sorbus graeca (SPACH) KOTSCHY in UNGAR & KOTSCHY Ins. Cypern 369, 1865

This species differs from *S. aria* (L.) CRANTZ in having smaller (rarely more than 5 cm long), broadly ovate to rotund, tough, coriaceous leaves with only (7-)8 - 9(-10) protruding veins on each side and larger fruits (up to 13 mm in diameter) with very few conspicuous lenticels. It has not previously been reported from the Thaya valley. It proved to be fairly rare there, having been found to date only in three localities, each supporting a few individuals only, on both limestone and granite, indicating that, as in *S. danubialis* (JÁVORKA) PRODAN, the geological substrate is of no consequence in the area under study. Aspect is equally of no consequence. Both shrubs and small trees (up to 4 m tall) are recorded. Flowering seems to be regular every year. Seedlings are extremely rare, testifying to the relic nature of the occurrence.

In Austria, *S. graeca* (SPACH) KOTSCHY has so far been reported from Lower Austria (Leopoldsberg near Vienna, Hainburger Berge, Leithagebirge) and S Burgenland (Bernstein and Redschlag) (see KÁRPÁTI 1960, RECHINGER 1970, JANCHEN 1977). POLATSCHEK (cit. sec. KUTZELNIGG 1994) reports it from Rauchkofel near Lienz, Osttirol. I saw a collection referable to this species made by Mag. G. JAKUBOWSKY on Pfaffenberg and Hexenberg (Hainburger Berge). Reports from Moravia (including Brno, Třebíč, Znojmo and Mikulov, KUTZELNIGG 1994) refer to *S. danubialis* (JÁVORKA) PRODAN (see KOVANDA 1992, 1996). The species was recently found in the Moravian Karst (KOVANDA, unpubl.). Stations in the Thaya valley include (Fig. 1):

Czech Republic
(1) upper margin of Liščí skála rocks, near Podmolí, S, 380 m
(2) outcrops of rocks 1.5 km N of Papírna, near Hnanice, W, 360 m

Austria
(3) Schoberberg, upper margin of rocks, W, 360 m

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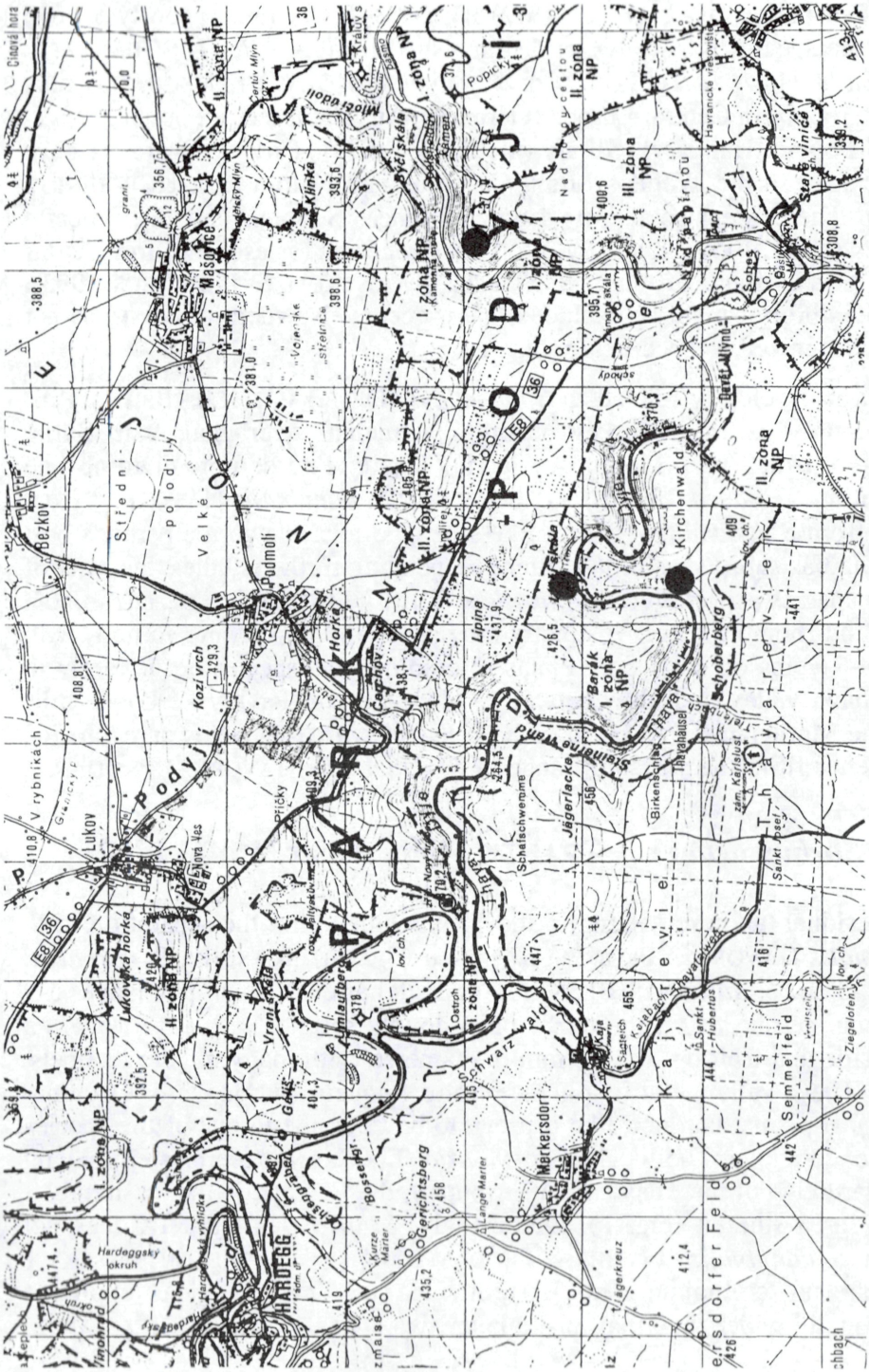

Fig. 1: Detailed distribution of *Sorbus graeca* in the Thaya region. Grid = 1 km. – Kleinräumige Verbreitung von *Sorbus graeca* im Thayatal. Raster = 1 km.

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The distribution of *S. graeca* (SPACH) KOTSCHY is rather poorly known since the species is not always distinguished from *S. aria* (L.) CRANTZ, *S. danubialis* (JÁVORKA) PRODAN or *S. umbellata* (DESF.) FRITSCH. It occurs with certainty in Central Europe (Germany, Austria, Czech Republic, Slovakia, S Poland, Hungary), S Italy (including Sicily), Turkey, Cyprus (I have collected it in the Troodos Mts.), Caucasus and N Iran (e.g. KUTZELNIGG 1994). There are also reports from S France, S Spain and the Balearic Islands (DÜLL 1959). Recently it has been reported (as escaped) from as far north as the Island of Gotland, Sweden (HÖGSTRÖM & FÅHRAEUS 1993). The possibility cannot be excluded that it occurs elsewhere where it has not been recognized as specifically distinct.

S. graeca is closely related to *S.umbellata* (DESF.) FRITSCH (Balkan Peninsula, Italy, Crimea, Turkey, Georgia, Armenia, Azerbaian, Iran, Syria, Lebanon, Israel, Iraq, Morocco, Algeria). There is no definite dividing line separating *S. graeca* (SPACH) KOTSCHY (and *S. danubialis* [JÁVORKA] PRODAN) from *S. umbellata* (DESF.) FRITSCH. The former two are perhaps best classified as subspecies of the latter but, pending further studies, the rank of minor species is preferred. *S. umbellata* (DESF.) FRITSCH has ovate-rhombic to rotund-rhombic leaves distinctly lobulate in the upper third to half, with only 4-7 veins on each side. Plants resembling this species occur rarely in the Thaya valley and elsewhere in S Moravia (e.g. Pavlovské kopce hills and the Moravian Karst) but here have leaves with 7-11 veins on each side and better fit in the variation range of *S. danubialis* (JÁVORKA) PRODAN.

Sorbus aria (L.) CRANTZ Stirp. Austr. 1: 46, 1762

The residual taxon remaining in the Thaya valley after the separation of *S. danubialis* (JÁVORKA) PRODAN, *S. graeca* (SPACH) KOTSCHY, *S. carpatica* BORBÁS and *S. austriaca* (BECK) PRAIN et al. has ovate to elliptic leaves 5-9 cm long, serrate to (in the upper part) doubly serrate, with 9-11 veins on each side and fruit up to 9-11 mm in diameter, with many minute lenticels. In the Thaya valley, it at first glance seems frequent, but on closer examination most plants that look like it prove to be referable to one of the species mentioned above. The localities of *S. aria* (L.) CRANTZ are clustered along a short stretch of the Thaya and its tributary, the Fugnitz, in the western half of the area studied (Fig. 2). Interestingly, *S. aria* (L.) CRANTZ does not follow *S. danubialis* (JÁVORKA) PRODAN and *S. graeca* (SPACH) KOTSCHY downstream to Znojmo. This is surprising, since its ecological amplitude is distinctly wider than that of the latter two species: *S. aria* (L.) CRANTZ

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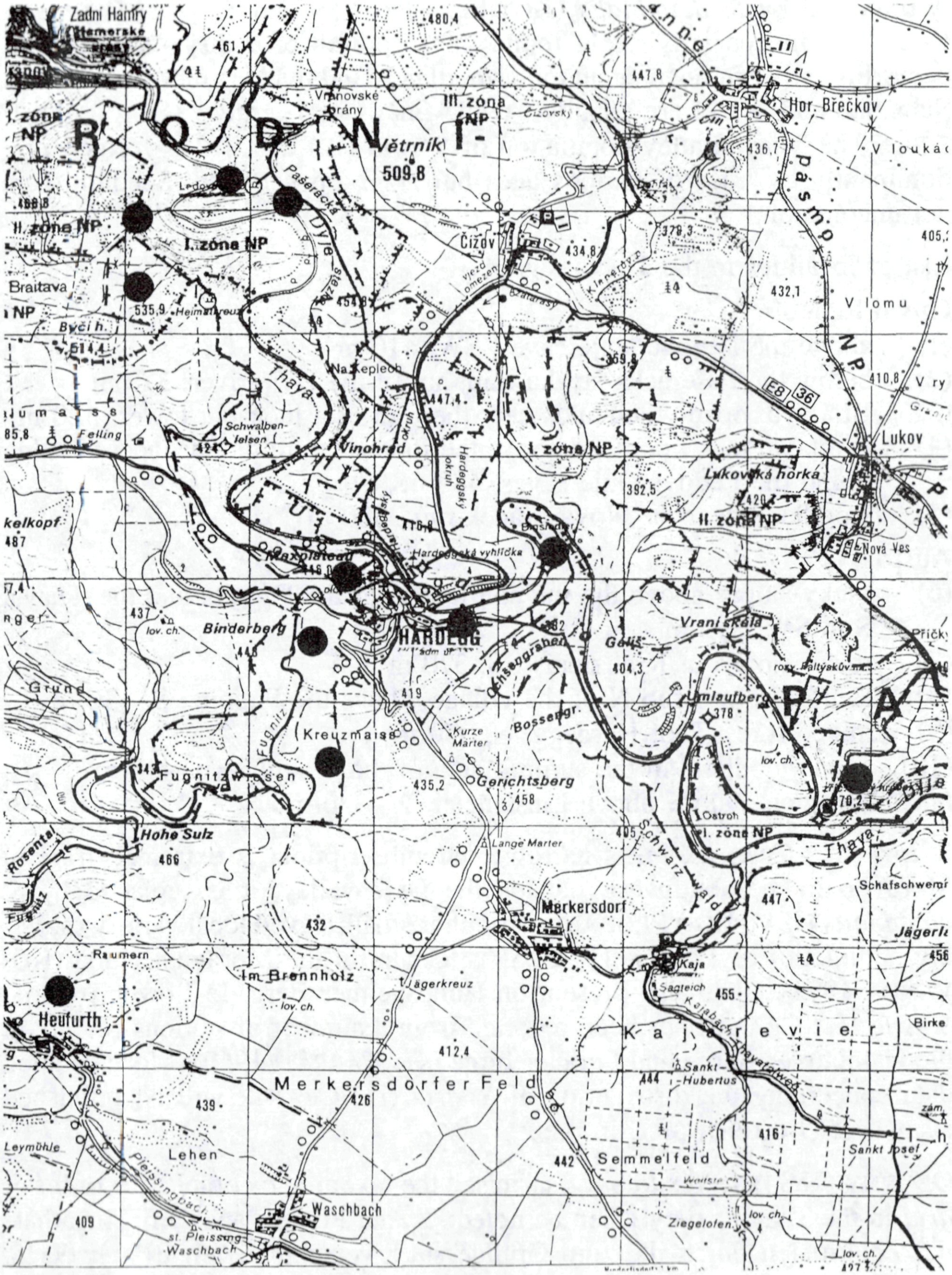

Fig. 2: Detailed distribution of *Sorbus aria* in the Thaya region. Grid = 1 km. – Kleinräumige Verbreitung von *Sorbus graeca* im Thayatal. Raster = 1 km.

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tends to avoid the upper margins of cliffs and rocky steppes that are clearly preferred by *S. danubialis* (JÁVORKA) PRODAN and *S. graeca* (SPACH) KOTSCHY. Indeed it is rarely found in the presence of these two species, occurring rather in open deciduous woodlands and thickets of various types. Substrate and aspect are equally irrelelevant as in *S. graeca* (SPACH) KOTSCHY. The Thaya valley population of *S. aria* (L.) CRANTZ is formed predominantly by trees of various ages but none are very old. Seedlings are not uncommon.

List of localities in the Thaya region

Czech Republic

(1) above the Ledové sluje caves, SW, 410 m
(2) below the Pašerácká stezka trail, above the Dyje river, 370 m
(3) Braitava: open woodlands near the ruin of a look-out tower, 520 m
(4) Braitava: in a woodland above the footbridge in the meander running round the Ledové sluje caves, 480 m
(5) woodland near the Nový hrádek ruin, 380 m

Austria

(6) rocky slopes above the the confluence of the Fugnitz and the Thaya, S to SW, 350 m
(7) rocky slopes of Kreuzmaiss, S, 370 m
(8) Heufurth, in scrub N of the village, above the Fugnitz, S, 430 m
(9) mixed forest E of Hardegg, N, 350 m
(10) open woodland in the summit area of the Maxplateau, 440 m
(11) scrub on a slope above Einsiedelei, W, 320 m

S. aria (L.) CRANTZ, in its narrower circumscription, is extremely rare in Moravia. In the southwest, outside the Dyje valley, it is replaced by *S. danubialis* (JÁVORKA) PRODAN. A peculiar small-leaved local variety (possibly apomictic) of *S. aria* (L.) CRANTZ occurs in the Moravian Karst (KOVANDA 1992).[1] It is also present on Hundsheimer Berg. In Lower Austria, *S. aria* (L.) CRANTZ has been reported from a number of stations mainly in the Hainburger Berge and Leithagebirge (see KÁRPÁTI 1960). More detailed data concerning the distribution of *S. aria* (L.) CRANTZ will be published elsewhere (JAKUBOWSKY, in prep.).

OBORNY (1884) seems to have surmised the taxonomic complexity of his *S. aria* in the Thaya valley when he noted: "... die Pflanze aus dem Thajathale bei Znaim sich durch die zum Grunde stark verschmälerten Blätter der *S.*

[1] A tendency towards aposporous development of the embryo sac has been demonstrated on material of *S. aria* (L.) CRANTZ from the Bohemian Karst (JANKUN & KOVANDA 1988).

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arioides MICHALET nähert."[2] He also quotes a personal communication by Rudolf von Uechtritz that *S. aria* occurs "im Zwittawathale in einer Form, die an *S. graeca* LODD. mahnt."

Sorbus austriaca (BECK) PRAIN et al. Index Kewensis Suppl. 3: 168, 1908

This species has been recorded at 17 sites in the Thaya valley (nine in the Czech Republic, eight in Austria). For a detailed study, see KOVANDA (1997).

Sorbus torminalis (L.) CRANTZ Stirp. Austr. 2: 45, 1763

The only representative of subg. *Torminaria* and the only European *Sorbus* with leaves turning first red and only later orange, yellow and finally brown is found scattered in Central and S Moravia (except for unwooded areas, KOVANDA 1992) and in Lower Austria (KUTZELNIGG 1994). In the Thaya valley it is frequent in open deciduous woodlands on all kinds of substrates, both basic and acidic, but its frequency decreases somewhat from west to east. As in other parts of its distribution area, it is most often found as a solitary tree (some rather old), seldom in groups of a few specimens. The shrubby habit is an exception and is encountered only in thickets and on rock outcrops, which are clearly not preferred as habitats.

Flowering is irregular and unpredictable. If it does occur, it is usually prolific but relatively few fruits are formed. Seedlings are frequent. The species is locally characteristic of the association Sorbo torminalis-Quercetum (SVOBODA) BLAŽKOVÁ 1962 with *Achillea millefolium* L. s. l., *Alyssum saxatile* L., *Bupleurum falcatum* L., *Centaurea triumfettii* ALL., *Euphorbia polychroma* A. J. KERNER, *Fragaria vesca* L., *Galium glaucum* L., *Genista tinctoria* L., *Primula veris* L. s. l., *Melica nutans* L., *Silene nutans* L., *Tanacetum corymbosum* (L.) SCHULTZ-BIP., *Vincetoxicum hirundinaria* MED., etc. in the herb layer.

The distribution range of *S. torminalis* (L.) CRANTZ encompasses, with many disjunctions, Europe (northwards to N England, Denmark and NE

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[2] S. arioides MICHALET is a hybrid *S. Mougeotii* SOYER-WILLEMET & GODRON × *S. chamaemespilus* (L.) CRANTZ. Described from the French Jura (see GRENIER & GODRON 1901), it was formerly reported also from Vorarlberg, Austria. Its presence in the Thaya valley is impossible on ecological and phytogeographical grounds.

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Poland), SW Asia (Turkey, Caucasus, N Iran, Lebanon, Israel) and N Africa (Morocco, Algeria).

Within this distribution area, *S. torminalis* (L.) CRANTZ varies widely in terms of leaf shape and indumentum as well as fruit shape and size. While variation in the characters of the fruit (whether globose, subglobose, ovoid, obovoid, or sometimes almost cylindrical) seems to be purely individual and not correlated with geographical distribution, such correlation can be traced, albeit not always very distinctly, in certain characters of the leaves.

The leaf shape is subject to unusual variation even within an individual. Extremes of the variation range have been described as f. *caucasica* DIAPULIS (syn.: *S. orientalis* SCHÖNBECK-TEMESY – leaves with hardly any lobes) and f. *perincisa* (BORBÁS & FEKETE) BECK (leaves with the lowest pair of lobes completely separated). The latter was described (in the rank of species) from Hungary where it seems to be fairly widespread (see KÁRPÁTI 1960) and has also been recorded in Poland (SZULCZEWSKI 1951) but seems to be rather Southeast European in its distribution. It is not known to occur in Moravia and has never been found in the Thaya valley.

Typically, leaves of *S. torminalis* (L.) CRANTZ are tomentose on both sides in the juvenile state but glabrous or nearly so at maturity. While the indumentum of the upper side vanishes before or during the flowering time, it disappears more slowly beneath and may sometimes persist until autumn. This is particularly the case in warm, sunny habitats and in the more southern parts of the range. This is not to say, however, that the type form is absent from these areas, or, vice versa, that the tomentose form does not extend any further north. Leaves completely glabrous on both sides from the start are extremely rare.

The form with persistent tomentum is usually referred to as f. (or var.) *semitorminalis* (BORBÁS) JÁVORKA (e.g. KÁRPÁTI 1960, DÜLL 1961, KUTZELNIGG 1994). This is probably wrong, since BORBÁS described this taxon as a variety of *S. latifolia* PERS., i.e. of a hybrid *S. aria* × *S. torminalis*. Indeed some reports of the tomentose form may be referable to the hybrid taxon. The correct name is apparently f. *mollis* BECK which is based on material of *S. torminalis* from Lower Austria. The form probably arises polytopically as a response to habitat conditions. There is much intergradation however and a clear-cut separation is not possible, hence the rank of forma is adopted. There is no particular correlation between the characters of leaves tomentose or glabrescent beneath and the various leaf shapes. DÜLL (1961) reports var. *semitorminalis* from as far north as Thuringia, Germany.

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S. torminalis (L.) CRANTZ of the Thaya valley has the leaves often finely hairy in the lower part of the underside even in autumn, though completely glabrous leaves are not at all rare. Typical f. *mollis* BECK with leaves tomentose beneath has so far been recorded only above Einsiedelei, in the Austrian part of the valley. It has not been found on the Moravian side of the river and is not known to occur elsewhere in Moravia.

KÁRPÁTI (1960) lists no fewer than 26 formae based on the leaf shape, six based on the fruit shape and three based on the leaf indumentum, mostly described by himself based on material from Hungary.

Sorbus aucuparia L. Sp. Pl. 477, 1753

In Central Europe, *S.aucuparia* L. tends to be rare in dry, warm regions, whereas in South Europe it is largely confined to the mountains.

In the Thaya valley it is distributed more or less evenly throughout the area but is not particularly frequent (as it is in other parts of the Bohemian-Moravian Uplands) even though acid substrates, that are preferred elsewhere, vastly prevail. Apparently, the local climate is too warm for it to be any commoner. The habitats of *S. aucuparia* L. are woodlands, both deciduous and coniferous, of most types, clearings and tracts of rocky boulders and their margins, such as in the Ledové sluje caves and Kamenné moře. The soils occupied by the species are acidic, dry to moderately moist, and humus-rich. Seedlings abound. As in other parts of the distribution area, phytocenological characteristics are vague, the species occurring, invariably as an admixture, in a variety of syntaxa. In the adjacent part of Moravia, outside the valley proper, it is commonmly planted along roads.

S. aucuparia L. is a Euro-Siberian species extending westwards to Iceland, eastwards to the river Ob and southwards to Spain, Corsica, Sicily and N Greece (KUTZELNIGG 1994).

A parallel to the tomentose form of *S. torminalis* (L.) CRANTZ can be traced in this species. It should be pointed out that the leaflets of the type only rarely become completely glabrous on both sides towards autumn in the way usually described in various floras and monographs. Some remnants of indumentum can almost always be found on the underside. In the warm and particularly in the more southern parts of the distribution area the leaflets usually remain hairy to tomentose beneath. The indumentum of buds, annual twigs and branches of the inflorescence also persists longer. The density of the indumentum and the speed with which it is lost, however, vary consid-

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erably even at one locality. Note that young seedlings are as a rule more densely hairy than adult specimens.

The hairy form was described from near Budapest as a separate species *S. lanuginosa* KITAIBEL. Most modern authors (e.g. KÁRPÁTI 1960, DÜLL 1961, KUTZELNIGG 1994) treat it as a variety. It has been reported as occurring in Lower Austria (DÜLL 1961, JANCHEN 1977, no definite locality given), Hungary (KÁRPÁTI 1960), Slovakia (KÁRPÁTI 1960, MÁJOVSKÝ 1992), Switzerland (DÜLL 1959), Croatia (KÁRPÁTI 1960) and Rumania (BUIA 1956, KÁRPÁTI 1960). DÜLL (1959) and SMEJKAL (1981) report it summarily from Moravia, the Czech Republic, without any precise locality. As it is not separated from the type either in the density of the indumentum or in its geographical distribution, the rank of forma is preferred.

In the Thaya valley, the underside of the leaflets is generally more densely hairy than in other parts of Moravia but no plants whose leaflets could be termed tomentose or even lanuginous beneath have so far been recorded.

The opposite end of variation in the density of the indumentum, conveniently called subsp. *glabrata* (WIMMER & GRABOWSKI) CAJANDER, is very well characterized morphologically, ecologically and geographically. This is a plant of the European mountains and the far north, differing also in features of the flower and fruit. Contrary to commonm belief, it is not homogeneous taxonomically. This is not a suitable place to go into details. It suffices to say that plants from the Carpathians are not identical with those from the Sudeten Mts. and both differ from those occurring in the Alps.

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Appendix

List of German topographical names (in current use before 1945):

Braitava	Braitauer Wald
Dyje	Thaya
Hnanice	Gnadlersdorf
Kamenné moře	Steinernes Meer

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Ledové sluje	Eisleiten
Liščí skála	Fuchsstein
Mikulov	Nikolsburg
Nový hrádek	Neuhäusl
Papírna	Papiermühle
Pašerácká stezka	Schmugglersteig
Pavlovské kopce	Pollauer Berge, Nikolsburger Berge
Podmolí	Baumöhl
Svitava	Zwittawa
Znojmo	Znaim

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