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Molluscs of the Krkonoše Mts. (Czech Republic)

Lucie Juřičková[1] & Vojen Ložek[2]

[1]*Department of Zoology, Faculty of Science, Charles University, Viničná 7, CZ-12844 Praha 2, Czech Republic; e-mail: lucie.jurickova@seznam.cz*
[2]*Laboratory of Environmental Geology, Institute of Geology AS CR, Rozvojová 269, CZ-16500 Praha 6, Czech Republic*

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As a result of recent malacological research of 47 sites combined with commented list of earlier published and unpublished data 90 mollusc species were found in the Krkonoše Mts. altogether. In comparison to snail communities from comparable mountain ranges of the Bohemian Upland the mollusc fauna of Krkonoše is rather poor both in species and in a number of fully developed woodland assemblages. The richest molluscan assemblages occur in the Krkonoše foothills. The subalpine and particularly alpine belts are permanently very poor in molluscan diversity due to highly acidic soils and bedrock.

Key words: Mollusca, Krkonoše Mts., faunistic

Introduction

The Krkonoše Mts. (=Giant Mts.) are the highest mountain range of Bohemia and their peak Sněžka Mt. with its altitude of 1602 m is also the highest point of the whole Sudetes. The Krkonoše Mts. consist of two contrasting lithologies – the larger southern part is built of Proterozoic mica schists, gneisses and phillites which are fringed by Palaeozoic low-grade metamorphosed schists, phillites and limestones; the northern part of the range is dominated by acidic granites. A few Tertiary basalt intrusions of minor extent occur within a crystalline complex. General relief pattern of the Krkonoše Mts. comprises large summit plateaus at elevations of 1300–1500 m, dissected by deeply incised glacial cirques and troughs as well as by steep-side erosional valleys. Glacial landforms are characterised by fresh outcrops of bedrock, whereas slopes of cool humid climate that becomes progressively important with increasing elevation. Acidic cambisols dominate the submontane belt (400–800 m) grading into spodo-dystric cambisols and ferro-humic podsols in the mountain and supramountain belt (800–1200 m). There are alpine soils (acidic ranker, lithosol) on flat summit plateau and extensive peat bogs, which have developed since the onset of postglacial Climatic Optimum to the Recent.

At present, the whole range is dominated by Norway spruce that is native to the supramountain belt and to mountain beech-spruce forests of the mountain belt. The submountain belt was formerly characterised by mixed woodland with a high proportion of deciduous trees, which have been, however, replaced by spruce plantations since the 18th century. In the eastern part of Krkonoše primeval forests have been already largely devastated by intensive exploitation during the14 th and 15th centuries.

In a view of the above mentioned circumstances, the present day Krkonoše Mts. includes only a low number of areas providing favourable conditions for the mollusc fauna. This is particularly true of forest habitats, to which the main body of snail species was formerly confined. For this reason, it is not surprising that extensive areas of this mountain range are inhabited only by a few ecologically tolerant species.

History of research

Though the Krkonoše Mts. are the most widely known mountains with the highest peak of the Czech Republic the intensity of malacological research was not proportional to their importance.

The first records of snails from the area of the Krkonoše Mts. were published in the second half of the 19th century (Reinhardt 1874, Cypers 1885, Merkel 1894, Uličný 1892–1895, Thamm 1887). These oldest data were resumed by Köhler (1908). Not until 50 years later Brabenec started a systematic research of the mollusc fauna of the Krkonoše Mts. especially in their eastern part – Rýchory (1967a,b, 1970). The data from the Polish part of Krkonoše Mts. were summarised by Wiktor & Wiktor (1968) and Wiktor (1985).

The findings of the arcto-alpine species *Vertigo arctica* and *Columella columella* in Malá Sněžní jáma (Merkel 1894, Wiktor 1968) and the description of a new subspecies endemic in the Krkonoše Mts. *Cochlodina dubiosa corcontica* (Brabenec 1967a,b) are of prime importance from the biogeographical point of view. The occurrences of other species are commented below.

Some occasional unpublished collections are dated to the last 10 years (Beran, Dvořák, Horsák, Juřičková, Picka,

Vaněk). Recent researches run from 2004 to 2005. The molluscan fauna of the Krkonoše Mts. was previously characterised by Ložek & Juřičková (2007).

Methods

The review of literature on the area and unpublished records were given. Forty-seven sites were studied in 2004 and 2005 to complete the representative network of sites (see below). Combined standard five litre samples of litter and topsoil were collected from some sites. The samples were dried, washed, and organic material was – after repeated drying – sorted into separate size categories. Slugs and dendrophilous species were collected by visual search because they did not occur in litter samples. Freshwater molluscs were collected by using a bowl-shaped sieve (mesh size 0.5 mm) from water vegetation or sediments. Molluscs from the samples were sorted and determined (in some species of the families Arionidae, Agriolimacidae, and the genus *Aegopinella* by dissection) under a binocular microscope. The species names follow Juřičková et al. (2007).

Recently researched sites

In the locality list below the data are given in the following order: locality number, locality name, geographical co-ordinates, altitude, date of investigation, and characteristic of site. Fig 1 shows the distribution of localities.

1. Velká Kotelní Jáma; 50°44'57" N; 15°32'22" E; 1150 m; 28 Jun 2004; clone of *Padus avium* in the bottom of the glacide cirque.
2. Velká Kotelní Jáma; 50°45'09" N; 15°32'12" E; 1390 m; 1 Aug 2005; the spring – *Adenostyles alliariae*, limestone rock.
3. Velká Kotelní Jáma; 50°45'05" N; 15°32'23" E; 1360 m; 1 Aug 2005; the humid patch with *Adenostyles alliariae*, *Aconitum plicatum*, *Veratrum lobelianum*, *Anemone narcissiflora* etc.
4. Alluvium of the stream near tourist pathway to the Kotelní Jáma; 50°44'52" N; 15°32'20" E; 1100 m; 28 Jun 2004; *Adenostyles alliariae*, *Veratrum lobelianum.*
5. Jizerka River valley near hotel Skála; 50°41'53" N; 15°31'35" E; 690 m; 28 Jun 2004; *Acer pseudoplatanus* and *Petasites kablikianus* in the alluvium.
6. Jizerka River valley between Vítkovice and U Brádlerů; 50°41'08" N; 15°32'11" E; 510 m; 28 Jun 2004; alluvium with *Fraxinus excelsior*, *Petasites albus*, *Leucojum vernum* etc.
7. Bílá Skála (Rychlovský Hrádek) near the Jizerka River; 50°39'19" N; 15°31'45" E; 500 m; 28 Jun 2004; limestone quarry wall.
8. Labský Důl – Schustlerova Zahrádka; 50°45'55" N; 15°32'53" E; 1150 m; 29 Jun 2004; *Padus avium*, *Acer pseudoplatanus*, *Daphne mezereum.*
9. Labský Důl – Harrachova Jáma; 50°45'16" N; 15°33'39" E; 1150 m; 4 Aug 2005; dwarfish *Picea abies* and *Sorbus aucuparia*, *Betula pendula*, *Vaccinium.*
10. Labský Důl – valley under Harrachova Jáma; 50°45'16" N; 15°33'39" E; 1150 m; 4 Aug 2005; *Picea abies*, *Sorbus aucuparia*, *Vaccinium.*
11. Medvědí Potok stream – on the way from Medvědí bouda; 50°45'50" N; 15°35'25" E; 1170 m; 29 Jun 2004; *Petasites albus*, *Salix caprea.*
12. The road to the Špindlerova Bouda; 50°45'27" N; 15°37'04" E; 780 m; 29 Jun 2004; *Salix caprea* and *Petasites albus.*
13. Labe River valley near Řopík; 50°44'29" N; 15°36'23" E; 730 m; 29 Jun 2004, 30 Jul 2005; alluvium around the bunker – *Fraxinus excelsior*, *Acer pseudoplatanus*, *Petasites albus*, *Cicerbita alpina.*
14. Labe River valley between Řopík and Labský Důl; 50°44'41" N; 15°36'03" E; 700 m; 29 Jun 2004; spruce forest with *Petasites albus.*
15. Alluvium of the Bílé Labe River near confluence with

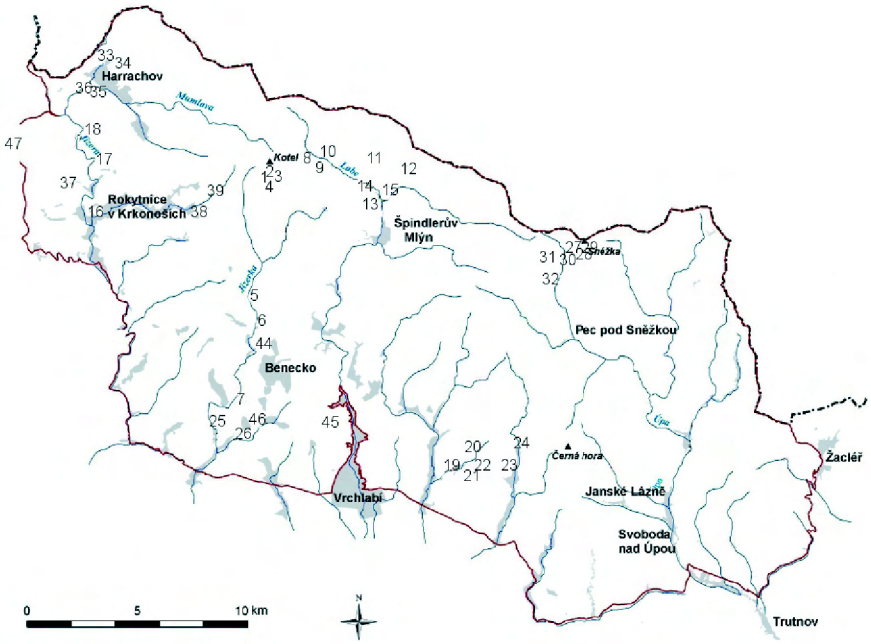

Fig. 1. The distribution of recently researched sites in the Krkonoše Mts. The numbers of sites conform to numbers used in the list of sites.

the Labe River; 50°44'32" N; 15°36'26" E; 670 m; 29 Jun 2004; *Petasites albus*, *Cicerbita alpina*, *Sorbus aucuparia*, *Alnus incana*, *Acer pseudoplatanus.*

16. Huťský Potok stream in Rokytnice near the cave; 50°43'24" N; 15°25'48" E; 500 m; 30 Jun 2004; limestone talus slope – *Alnus glutinosa*, *Fraxinus excelsior*, *Ulmus glabra*, *Corylus avellana*, *Mercurialis perennis*, *Petasites albus* etc.

17. Prudký Ručej stream – affluent of the Jizera River above Rokytnice nad Jizerou; 50°44'45" N; 15°25'13" E; 580 m; 30 Jun 2004; *Acer pseudoplatanus*, *Fagus sylvatica*, *Picea abies*, *Sambucus racemosa*, *Rubus*, *Cicerbita alpina.*

18. Dlouhý Potok stream affluent of the Jizera River above Rokytnice nad Jizerou; 50°45'19" N; 15°24'42" E; 600 m; 30 Jun 2004; *Acer pseudoplatanus*, *Fagus sylvatica*, *Picea abies*, *Abies alba*, *Salix caprea*, *Rosa pendula*, *Cicerbita alpina*, *Lunaria rediviva*, *Petasites albus.*

19. Peklo quarry NE from Lánov; 50°38'10" N; 15°40'12" E; 540 m; 31 Jul 2005; limestone quarry – *Populus tremula, Salix caprea, Sanguisorba minor.*

20. Pekelský Potok stream near Havířská Bouda; 50°38'22" N; 15°40'42" E; 580 m; 31 Jul 2005; steep valley – *Acer pseudoplatanus*, *Fagus sylvatica*, *Alnus glutinosa*, *Urtica dioica*, *Impatiens noli-tangere*, *Paris quadrifolia*, *Aegopodium podagraria*, *Petasites albus.*

21. The pathway to the old quarry near Bínerova Bouda (Lánov); 50°37'50" N; 15°40'57" E; 540 m; 31 Jul 2005; *Acer pseudoplatanus* in spruce forest.

22. The old quarry E from Lánov; 50°37'54" N; 15°41'05" E; 630 m; 31 Jul 2005; the old quarry grows up by *Populus tremula*, *Salix caprea*, *Larix decidua*, *Asplenium ruta-muraria*, *Thymus*, *Origanum* etc.

23. The limestone quarry W from Černý Důl; 50°38'09" N; 15°42'12" E; 540 m; 31 Jul 2005; the way along the upper bench of the quarry – *Populus tremula*, *Salix caprea*, *Tussilago farfara.*

24. Železný Potok stream near Černý Důl; 50°38'58" N; 15°42'49" E; 730 m; 31 Jul 2005; the humid alluvium at the confluence of the Železný Potok and Čistá streams – *Acer pseudoplatanus*, *Alnus glutinosa*, *Fagus sylvatica*, *Petasites albus*, *Urtica dioica.*

25. Jizerka River 500 m N of the pond in Štěpanice saw mill; 50°38'49" N; 15°30'40" E; 460 m; 1 Aug 2005; alluvium of the Jizerka River – *Fraxinus excelsior*, *Acer pseudoplatanus*, *Alnus glutinosa*, *Petasites albus*, *Impatiens noli-tangere*, *Urtica dioica.*

26. The ruin of the Horní Štěpanice castle; 50°38'23" N; 15°32'23" E; 500 m; 1 Aug 2005; *Fagus sylvatica*, *Acer pseudoplatanus*, *Picea abies*, *Larix decidua*, *Ulmus glabra*, *Urtica dioica*, *Mercurialis perennis*, *Actaea spicata*, *Galium odoratum* etc.

27. Obří důl – Rudník – abandoned mine Helena; 50°43'54" N; 15°43'74" E; 1360 m; 2 Aug 2005; particularly in limestone – *Lilium martagon* etc.

28. Obří důl – Rudník – limestone gash; 50°43'52" N; 15°43'54" E; 1300 m; 2 Aug 2005; native spruce forest with beech.

29. Obří důl – Rudník stream; 50°43'50" N; 15°43'54" E; 1200 m; 2 Aug 2005; xeric rock – *Thymus.*

30. Obří důl – Rudník stream; 50°43'49" N; 15°43'56" E; 1200 m; 2 Aug 2005; the talus slope under the limestone rock – *Salix caprea*, *Fagus sylvatica*, *Sorbus aucuparia*

31. Obří důl – Čertova Zahrádka; 50°43'29" N; 15°43'17" E; 1100 m; 2 Aug 2005; the neck of the avalanche path on porphyries – *Acer pseudoplatanus*, *Anemone narcissiflora*, *Cicerbita alpina.*

32. Obří důl – the wetland near the chapel; 50°43'27" N; 15°43'36" E; 930 m; 2 Aug 2005.

33. Parking 1 km N from Harrachov; 50°47'16" N; 15°25'16" E; 650 m; 3 Aug 2005; cultural spruce forest with beech and crane.

34. Alluvium of the the Kamenice River NE from Harrachov; 50°46'53" N; 15°25'49" E; 690 m; 3 Aug 2005; spruce forest with *Acer pseudoplatanoides* and *Fagus sylvatica.*

35. Pilařovo Údolí valley under Harrachov; 50°46'21" N; 15°24'19" E; 610 m; 3 Aug 2005; Spruce forest with *Acer pseudoplatanoides* and *Fagus sylvatica*, *Petasites albus*, *Urtica dioica.*

36. Confluence of the Mumlava and Jizera Rivers; 50°45'39" N; 15°23'50" E; 565 m; 3 Aug 2005; *Acer pseudoplatanus*, *Fagus sylvatica*, *Picea abies*, *Petasites albus*, *Urtica dioica.*

37. Havírenský Potok stream1 km W from Vilémov; 50°44'01" N; 15°24'01" E; 530 m; 3 Aug 2005; *Acer pseudoplatanus*, *Fagus sylvatica*, *Picea abies*, *Petasites albus*, *Urtica dioica*, *Allium ursinum*, *Impatiens noli-tangere.*

38. Stream E from Rokytnice nad Jizerou; 50°43'36" N; 15°29'13" E; 530 m; 3 Aug 2005; *Acer pseudoplatanus*

39. Huťský Potok stream NE from Rokytnice; 50°44'02" N; 15°29'43" E; 790 m; 3 Aug 2005; spruce forest with *Acer pseudoplatanoides* and *Fagus sylvatica.*

40. The ruin of the Nístějka castle; 50°40'28" N; 15°26'48" E; 420 m; 3 Aug 2005; *Acer pseudoplatanus*, *Fagus sylvatica*, *Picea abies.*

41. Český Potok stream in Špindlerův Mlýn; 50°44'03" N; 15°36'21" E; 730 m; 4 Aug 2005; spruce forest with young *Sorbus aucuparia*, *Acer pseudoplatanus* and *Petasites albus.*

42. Medvědí Ručej stream NW from Špindlerův Mlýn; 50°43'57" N; 15°35'19" E; 870 m; 4 Aug 2005; *Fagus sylvatica, Picea abies.*

43. Krakonošova Strouha near Špindlerův Mlýn; 50°43'43" N; 15°34'57" E; 825 m; 4 Aug 2005; seepage in spruce forest with *Fagus sylvatica*, *Acer pseudoplatanus*, *Petasites albus*, *Allium ursinum*, *Impatiens noli-tangere.*

44. Alluvium of the Hamerský Potok stream near the pond 1 km W from the Labe River; 50°41'04" N; 15°32'19" E; 690 m; 5 Aug 2005; the ruin of the house – *Fagus sylvatica*, *Acer pseudoplatanus.*

45. The limestone quarry NW from Vrchlabí; 50°38'58" N; 15°35'41" E; 640 m; 5 Aug 2005; mined out quarry in spruce forest.

46. Lhotecký Potok stream NE from Štěpanice; 50°38'51" N; 15°32'49" E; 550 m; 5 Aug 2005; spruce forest with *Fagus sylvatica*, young *Acer pseudoplatanus*, *Rubus*, *Petasites albus.*

47. Hvězda near Kořenov; 50°44'48" N; 15°22'02" E; 960 m; 20 Aug 2006; top of the hill – *Picea abies*, *Fagus syl-*

vatica, *Sorbus aucuparia*, *Festuca ovina*, *Rubus idaeus*.

Results

Altogether 90 mollusc species were found in the Krkonoše Mts.: 7 species of freshwater snails, 4 species of bivalves and 79 species of land snails and slugs. The number constitutes 37.5% of the Czech Republic mollusc fauna. The list of molluscs at recently recorded sites shows Table 1.

The list of molluscan species from the KRNAP (i.e. Krkonoše National Park)

The list includes all mollusc species (hints in the literature and recent researches). Some of the species that occur just abroad the area of the KRNAP as well as some of the problematic species (probably inaccurate determination) are presented in a separate list. Species are aligned systematically according to Juřičková et al. (2007). Occurrences in KRNAP are commented.
The names of investigators chronologically: R – Reinhardt, C – Cypers, K – Köhler, B – Brabenec, Be – Beran, H – Horsák, D – Dvořák, P – Picka, V – Vaněk, L – Ložek, J – Juřičková.

Aciculidae
Platyla polita – Kunčice (C), Bílá skála in Jizerka River valley (L, J); more sites are situated abroad of the KRNAP area. Individually in leaf litter of limestone cliffs.

Lymnaeidae
Galba truncatula – Vrchlabí environs (K), Maxův Potok stream, Jánské Lázně (B), Víchová, Úpa River in Horní Maršov, Pekelský Potok stream (J). Straggly occurence in streams of larger valleys and in springs of lower areas.
Radix peregra s. str. – frequently in Rýchory: Peklo valley near Lánov, Vápenice valley near Vrchlabí (B), Vrchlabí environs (K), springs near Rokytnice, Víchová, Jilemka stream, Vrchlabí (Be), Úpa River in Horní Maršov (J), Jizerka River valley near Vítkovice and Štěpanice (L, J). Common in streams and stream pools.
Lymnaea stagnalis – the only site: Sluneční stráň pool near Horní Lánov (V). Common species of lower altitudes of the Czech Republic, but rare in the mountains.

Acroloxidae
Acroloxus lacustris – the only site: Jilemka stream near the estuary of the Jizera River (Be). Straggly in lower altitudes of the Czech Republic, but rare in the mountains.

Planorbidae
Planorbis planorbis – Harta near Vrchlabí (C), Sluneční stráň pool near Horní Lánov (V). Straggly in lower pars of the Czech Republic, but rare in the mountains.
Anisus leucostoma – Harta near Vrchlabí (K). Probably more common in stream pools.
Ancylus fluviatilis – Harta near Vrchlabí (C), Bělá stream near Vrchlabí (K), Jánské Lázně (B), Huťský Potok stream, Jilemka stream, Jizera River, Labe River and streams near Vrchlabí, spring near the Rokytnice station railway, Cedron stream in Dolní Štěpanice (Be), Úpa River in Horní Maršov (J). Probably more widely distributed in streams.

Carychiidae
Carychium minimum – Albeřice (Suchý důl), near Kalná voda (B), Jizerka River valley near Vítkovice and Bílá Skála, Medvědí Potok stream (L, J), Pekelský Potok stream (J). The old data did not distinguish *C. tridentatum* and *C. minimum*. Straggly in lower altitudes.
Carychium tridentatum – common in humid habitats in valleys. Specimens from the Dlouhý potok and Prudký Ručej streams, alluvial forest of Labe River near Řopík (L, J), and Labský důl (J) correspond to the mountain form *C. tridentatum elongatum*.

Cochlicopidae
Cochlicopa lubrica – humid habitats especially in valleys (K, B, L, J). Also in the central part of the mountain e.g. Schustlerova zahrádka in Labský důl (J).
Cochlicopa lubricella – the quarry near Rýchorská bouda (B) and the old quarry E from Lánov (J) only. Subxerothermic species that can potentially occur in open limestone habitats.

Orculidae
Sphyradium doliolum – Harta near Vrchlabí (C), Svoboda nad Úpou valley (B). This species can potentially occur in limestone habitats in the south and southeast part of the Krkonoše Mts.

Valloniidae:
Vallonia costata – Rýchorský dvůr and the quarry near Rýchorská bouda, confluence of the Úpa and Malá Úpa Rivers (B), the ruins of Horní Štěpanice and Nístějka castles (J). Relatively rare in human affected habitats.
Vallonia pulchella – Zlatý Potok stream in Rýchory (B), the old quarry E from Lánov (J). Rare in the Krkonoše Mts.
Vallonia excentrica – Bělá stream valley near Vrchlabí (K), near Kalná voda, Temný Důl, Peklo valley near Lánov (B). *V. pulchella* from Harta near Raubbach (C) was probably *V. excentrica* (Köhler 1908).
Acanthinula aculeata – Jánské Lázně, Zrcadlový Důl, Vavřincův Důl (B), Dlouhý Potok and Prudký Ručej streams, Jizerka River valley near Vítkovice and Bílá Skála, Bílé Labe, and Labe River near Řopík (L, J), Schustlerova Zahrádka in Labský důl (L, J), Obří důl – Rudník, Havírenský Potok stream near Vilémov, the ruin of Nístějka castle (J); relatively common in alluvial forests and humid parts of deciduous forests.

Vertiginidae
Columella edentula – common on vegetation of river valleys and humid habitats in forests (K, B, L, J). Albino population near Labský Vodopád (R).
Truncatellina cylindrica – Černý Důl (K); the old quarry E from Lánov and Nístějka castle (J). Rare in Krkonoše Mts.
Vertigo pusilla – Maxův Potok stream valley, Svoboda nad Úpou valley, Vavřincův Důl, Javoří Důl, confluence of Úpa and Malá Úpa Rivers (B), Bílá Skála near Jizerka River,

Rokytnice – the cave, Prudký Ručej and Huťský Potok streams (L,J), confluence of the Mumlava and Jizera Rivers, the ruin of Nístějka castle (J). Scattered occurrences under rocks and talus slopes, especially in limestone.
Vertigo substriata – Herlíkovice (R); Žlebský důl near Velká Úpa River (B), Jizerka River valley near Vítkovice (L, J). Species of humid mountain forests, surprisingly rare in the Krkonoše Mts.
Vertigo pygmaea – the meadow near Kalná voda (Rýchory) (B), the old quarry E from Lánov, Havírenský Potok stream near Vilémov (J). Relatively rare in human affected habitats.
Vertigo alpestris – Úpa River valley near Kreuzschenke (R), Bílá skála near Jizerka River, Rokytnice – the cave (L, J), the ruins of Horní Štěpanice and Nístějka castles (J). Probably more common.

Enidae
Ena montana – common in Rýchory and E Krkonoše (B), otherwhere especially in limestone (R, K, B, H, L, J) – from lower parts to highlands.
Merdigera obscura – Bělá stream near Vrchlabí (K); Svoboda nad Úpou valley (B), the ruin of Horní Štěpanice castle (J); probably more frequently on limestone.

Clausiliidae
Cochlodina laminata – relatively common in Rýchory: Lánov, Strážný, Mísečky, Huťský Vodopád cascade etc. (B, V, L, J), some old data (R, K, C) are probably related to *C. dubiosa corcontica* (small forms – Köhler 1910). In natural forests.
Cochlodina dubiosa corcontica – neoendemic taxon of Krkonoše Mts. Common in natural forests: Rýchory, east and south Krkonoše, Harrachov, Špindlerův Mlýn, occasionly in foothills of Krkonoše (B, V, H, P, L, J). The old data of small forms of *C. laminata* or *C. commutata* (C, K) are probably related to this taxon.
Cochlodina orthostoma – the only site Maxův Potok stream (B), in some sites close to the border of KRNAP. Relatively rare species in the whole area of the Czech Republic.
Ruthenica filograna – the ruin of Maxova Bouda and estuary of Maxův Potok stream (B). Epigeic species more common southwards of Krkonoše Mts.
Macrogastra ventricosa – estuary of Sněžný Potok stream in Rýchory, Svoboda nad Úpou valley, Hrádek near Temný Důl, Zrcadlový Důl, Javoří Důl, Těsný Důl, spring near Spálený Mlýn, Bílý Potok stream near Dolní Dvůr (B), under Bílá Skála near Jizerka River (L, J).
Macrogastra plicatula – common in rocky forests, foothills of rocks from lower sites to subalpine zone (R, C, K, B, H, V, L, J). The most common species of the family Clausiliidae in the Krkonoše Mts.
Clausilia parvula – on limestone rocks: Bílá Skála near Jizerka River, Rokytnice – cave (L, J), estuary of Maxův Potok stream, Křižovatka, Peklo valley near Lánov (B), Raubbach near Vrchlabí (C); the ruins of Horní Štěpanice and Nístějka castles (J). This species penetrates to the Krkonoše Mts. from southern foothills along the rivers.
Clausilia dubia – similar to previous species but rarer: Úpa River valley near Křižovatka (R), Maxův Potok stream valley, Vavřincův důl, Křižovatka (B). Surprising paucity of sites.
Clausilia cruciata – dendrophilous species of mountain forests, relatively common in natural sites: Žácleřský Hřbet, Rýchorský Dvůr, under Rýchorská Studánka, Jánská Hora, Hrádek near Temný Důl, Zrcadlový Důl, Vavřincový Důl, Javoří Důl, Obří Důl, Žlebský Důl, Zelený Důl, Křižovatka, Jelení Potok stream, spring under Spálený Mlýn, Čistá valley – Černý Mlýn, Strážné, valleys of Dřevařský Potok, Bílé Labe and Červený Potok streams, Dívčí Lávky, Medvědí Důl, Labský Důl, near Vosecká Bouda, Bílý Potok stream near Dolní Dvůr (B), Jánský Potok stream (H), Dlouhý Potok stream, alluvium of Labe River near Řopík (L,J); Úpa River valley (R), Bedřichov (K) Pilařovo valley near Harrachov, confluence of Mumlava and Jizera Rivers (J). Typical species of Czech boundary mountains, especially in the Šumava Mts. and Hrubý Jeseník Mts.
Clausilia pumila – species of epigeon in humid forests and alluvial forests of lower parts of Krkonoše. More frequent in Rýchory: Jánské Lázně, Peklo valley near Lánov (B), Vermířovice (V), alluvium of Labe River near Řopík (J) – the highest situated sites of this species in the Czech Republic.
Laciniaria plicata – on rocks and walls, especially limestone; common in Rýchory: near Jánské Lázně, Křižovatka, Peklo valley near Lánov, Vápenice stream valley (B), Bílá Skála near Jizerka River (L, J), on limestones near Rokytnice (L, J), Vrchlabí and Černý důl (C, K), Havírenský Potok stream near Vilémov, the ruins of Horní Štěpanice and Nístějka castles (J). This species penetrates to the Krkonoše Mts. from southern and south-eastern foothills.
Alinda biplicata – common in more trophic forests and human affected habitats, especially in Rýchory and eastern Krkonoše Mts. (B), occasionally at other sites mainly in southern part of the Krkonoše Mts. (K, V, H, L, J).

Succineidae
Succinella oblonga – the valley of Sněžný Potok stream, the quarry near Rýchorská bouda, the valley near Svoboda nad Úpou, Peklo valley near Lánov (B), the old quarry between Vrchlabí and Lánov (K). Occasionally in secondary humid habitats.
Succinea putris – more frequent in Rýchory: the valley near Svoboda nad Úpou, valley of Černohorský Potok stream, Peklo valley near Lánov (B), upper part of Vrchlabí, Bělá stream (K), valley of Jánský Potok stream (H) – in humid habitats, especially in lower parts of the Krkonoše Mts.

Punctidae
Punctum pygmaeum – common species in forests and open habitats including the subalpine zone e.g. Kotelní jáma (K, B, L, J).

Discidae
Discus ruderatus – typical species of mountain forests, especially under the bark of trees and tree stumps. Common in Rýchory (B), occasionally at other sites (K, L, J), surprisingly at one synanthropic site in Špindlerůn Mlýn (P).

Discus rotundatus – common species of forests and open habitats including human affected sites (K, B, H, D, L, J).

Gastrodontidae
Zonitoides nitidus – humid alluvial forests and wetlands near Lánov, Jánské Lázně, and Vrchlabí (K, B), Bílé Labe stream near estuary (L, J), Jizerka River valley near Štěpanice saw mill (J). Probably more frequent along the rivers.

Euconulidae
Euconulus fulvus – common in the Krkonoše Mts. (R, C, K, B, H, L, J).

Vitrinidae
Vitrina pellucida – common in forests and open habitats (K, B) including the subalpine zone e.g. Schustlerova Zahrádka (L,J).
Semilimax semilimax – frequently in humid habitats in forests and alluvial forests (B, L, J).
Semilimax kotulae – frequently in Rýchory and eastern Krkonoše (B), Těsný Důl, Jánský Potok stream (H), Labský Důl valley, Železný Potok stream near Černý Důl, Rudník in Obří Důl, Huťský Potok stream near Rokytnice, Krakonošova Strouha near Špindlerův Mlýn, Lhotecký Potok stream near Štěpanice, confluence of Mumlava and Jizera Rivers, Hamerský Potok stream (J) – probably common in spruce forests including cultural ones. Pure populations.
Eucobresia diaphana – frequently in Rýchory (B), occasionally along streams from foothills to a mounain zone including ruderal habitats (B, L, J).
Eucobresia nivalis – rare species of humid alluvium: Pekelský Potok stream near Havířská Bouda, Železný Potok stream in Černý Důl, Hamerský Potok stream (J). Previously probably neglected species of humid habitats.

Zonitidae
Vitrea diaphana – Herlíkovice (R), Bělá stream, Jankův Kopec near Vrchlabí (K), frequently in Rýchory: Vavřincův Důl, Žlebský Důl, Křižovatka, Vápenice valley near Vrchlabí, valleys of Tetřeví and Zlatý Potok streams (B), Jizerka River valley near Vítkovice and Bílá Skála (L,J), Pekelský Potok stream near Havířská Bouda, the ruin of Horní Štěpanice castle (J) – occasionally in forest leaf litter.
Vitrea subrimata – Bedřichov near Špindlerův Mlýn (R, C); but (K) did not find, three sites in Rýchory, frequently near Jánské Lázně and Pec pod Sněžkou (Temný, Zrcadlový, Vavřincův, Javoří, Žlebský, Obří Důl – Rudník), Křižovatka, Koželský Potok stream, Huťský waterfall (B), alluvium of Labe River near Řopík, Dlouhý potok and Prudký Ručej streams, Schustlerova Zahrádka in Labský Důl, Velká Kotelní Jáma (L,J), Krakonošova Strouha near Špindlerův Mlýn. Probably more frequent in pure populations.
Vitrea crystallina – frequently in Rýchory: Jánské Lázně, valley of Jelení Potok stream, spring near Spálený Mlýn, Peklo valley near Lánov, Vápenice near Vrchlabí, quarries near Strážný, valley of Kotelský Potok stream (B), occasionally near Bedřichov and Horní Lánov (K), Dlouhý Potok stream, alluvium of Labe River near Řopík, valley of Jizerka River near Vítkovice (L,J), Pekelský Potok stream near Havířská Bouda, the old quarry E from Lánov, Havírenský Potok stream near Vilémov, Krakonošova Strouha near Špindlerův mlýn (J). Common in humid habitats along the streams.
Vitrea contracta – the first site in the Krkonoše Mts. was found in the old quarry E from Lánov (J).
Aegopinela pura – common in the KRNAP including subalpine zone (e.g. Velká Kotelní Jáma (L, J), Obří Důl (B, J)).
Aegopinella minor – frequently in Rýchory: Jánské Lázně, valley of Černohorský Potok stream, Hrádek, Huťský vodopád cascade, valley of Zlatý Potok stream (B), rare otherwhere: Rokytnice – cave (L, J), Pekelský and Hamerský Potok streams, Horní Štěpanice – the ruin of castle (J). Correct determination calls for the dissection.
Perpolita hammonis – common in the Krkonoše Mts. based on old (K) and recent records (B, L, J) including subalpine zone e.g. Velká Kotelní jáma (L, J). However, populations of this species are pure.
Perpolita petronella – five sites in Rýchory: Jánská Hora, Javoří Důl, Žlebský Důl, Luisino Údolí, valleys of Tetřeví and Zlatý Potok streams (B), Schustlerova Zahrádka in Labský Důl (L, J), Dlouhý Potok stream, Železný Potok stream in Černý Důl, Krakonošova Strouha near Špindlerův Mlýn (J). Relict species of late glacial and early holocene.
Oxychilus cellarius – common in Rýchory: along Jánské Lázně, Žlebský Důl, Křižovatka, spring near Spálený Mlýn, valley of Čistá stream, valley of Vápenice stream, quarry near Strážný, Dolní Dvůr (B), Rokytnice – cave, Prudký Ručej stream, Schustlerova Zahrádka in Labský Důl, valley of Labe River near Řopík, confluence of Bílé Labe and Labe Rivers (L, J), talus slopes near Vrchlabí, quarry between Vrchlabí and Horní Lánov, near Černý Důl and Velká Úpa (B,K). Common especially in human affected habitats.
Oxychilus depressus – Jánská hora, Hrádek, limestone quarries near Strážný, surrounding of Huťský Vodopád cascade (B), Obří Důl – Rudník and Čertova zahrádka, outlook tower Hvězda.

Daudebardiidae
Daudebardia rufa – Úpa River valley upon Pec pod Sněžkou (Šandera in: Uličný 1892–1895), Bílá Skála near Jizerka valley (L,J). Sporadically in leaf litter of the valley bottom.

Limacidae
Limax cinereoniger – common in forests (B, H, L, J). (*L. bielzi* from Rýchorská studánka, (B) was revised as *L. cinereoniger* in collection of National museum in Prague). Unusual color form was found in the locality 38 (see Fig. 2).
Malacolimax tenellus – Rýchorská Studánka, Maxův Potok stream and Bartlův Les in Rýchory, Jánské Lázně, Peklo valley near Lánov, Bílé Labe River valley (B), Jánský Potok stream (H), Medvědí Potok stream near Medvědí

Fig. 2. Unusual colour form of *Limax cinereoniger* was found west from Rokytnice nad Jizerou.

Bouda, Rokytnice – cave, Prudký Ručej and Dlouhý Potok streams (L,J), probably common in spruce forests.
Lehmannia marginata – probably common in spruce forests (R, K, B, H, L, J).
Lehmannia macroflagellata – Bílé Labe River valley, Hřímavý Potok stream valley (B), Jelení Potok stream valley (B), valley of Labe River near Řopík (L, J) Labský důl – valley under Harrachova jáma, 1 km N from Harrachov, outlook tower Hvězda near Kořenov (J) – probably more common in forests. The distribution of this species in the Czech Republic summarised by Horsák & Dvořák (2001).

Agriolimacidae
Deroceras agreste – occasionally in Rýchory and round Jánské Lázně (B).
Deroceras reticulatum – Pec pod Sněžkou (D), Horní Maršov, Havírenský Potok stream near Vilémov (J) – in human affected habitats.
Deroceras laeve – Jánské Lázně (B), Medvědí Potok stream near Medvědí Bouda (L, J), Havírenský Potok stream near Vilémov (J) probably more frequent in humid habitats.
Deroceras praecox – the only site – Antonínův údol in Rýchory (B), probably more frequent.

Boettgerillidae
Boettgerilla pallens – Kraví Vrch near Svoboda nad Úpou, Jánské Lázně, Peklo valley near Lánov (B), Jánský Potok stream (H), Pec pod Sněžkou (D), Jizerka River valley, Dlouhý Potok stream, Medvědí Potok stream under Medvědí Bouda, valley of Labe River near Řopík (L,J), Horní Maršov, Železný Potok stream, Horní Štěpanice – ruin of the castle (J). Common in lower parts of the Krkonoše Mts.

Arionidae
Arion rufus – occasionally in lower parts in valleys (R, C, K, B, L, J).
Arion lusitanicus – Jánský potok valley between Černá Hora and Svoboda nad Úpou (H), Pec pod Sněžkou (D), Horní Maršov (D, J), Jizerka River near Štěpanice saw mill, Pilařovo Údolí valley near Harrachov (J), for the present sporadically in human affected habitats of lower parts.
Arion fuscus – common in forests from lower parts to the subalpine zone (B,H,L,J).
Arion distinctus – valley of Maxův Potok stream, Rýchorský Dvůr (B), Horní Maršov (D, J), valley of Labe River near Řopík, confluence of Bílé Labe and Labe Rivers (L, J). Common in human affected sites.
Arion fasciatus – Horní Maršov (D, J) – hemisynanthropic species probably more frequent in human affected habitats.
Arion silvaticus – probably „*A. hortensis* var. *alpicola* Fér.“ (K), Pec Pod Sněžkou – Pražská and Dvorská Bouda (D), Jizerka valley near Skála hotel, confluence of Bílé Labe and Labe Rivers, Prudký Ručej stream (L, J), Pekelský Potok stream near Havířská Bouda, Jizerka valley near Štěpanice saw mill, Pilařovo Údolí valley near Harrachov (J) – probably more common in forests.

Hygromiidae
Xerolenta obvia – steppe species of secondary habitats. In the Krkonoše Mts. occasionally: limestone quarries near Černý důl (K), valley of Čistá stream upon Černý důl (B).
Monachoides incarnatus – forests and human affected habitats. Common in the Krkonoše Mts. (K, B, H, L, J). Rare in higher altitudes.
Urticicola umbrosus – the only site in the Krkonoše Mts.: Jizerka valley near the Štěpanice saw mill (J).
Trochulus hispidus – many sites around Vrchlabí (C, K) and Velká Úpa (K), spring near Spálený Mlýn, Vápenice stream valley near Vrchlabí, quarries near Strážný (B), Rokytnice – the cave, Jizerka valley near Vítkovice and Bílá Skála (L,J), Havírenský Potok stream near Vilémov (J).
Trochulus sericeus – lower Vrchlabí (C), Liščí hora (K). Common in Rýchory: round about Jánské Lázně, Černohorský potok valley, Vavřincův Důl, Javoří Důl, Temný Důl, Žlebský Důl, Křižovatka, Malá Úpa valley, Čistá stream valley near Černý Důl, Peklo valley near Lánov, Klínový Potok stream, Bílý Potok stream near Dolní Dvůr (B), Špindlerův Mlýn (P), valley of Labe River near Řopík, Bílé Labe valley (L, J), Peklo quarry NE from Lánov, Jizerka River valley near Štěpanice saw mill, Hamerský Potok stream, limestone quarry NW from Vrchlabí, Lhotecký Potok stream near Štěpanice (J). Note: *T. sericeus* and *T. hispidus* are related species, which occur allopatrically or allotopically. Both species prefer human affected habitats.

Helicidae
Arianta arbustorum – common species from lower parts to the subalpine zone – e.g. Kotelní Jáma (K, C, B, J).
Helicigona lapicida – talus slopes, stony walls, rocks. Common near Vrchlabí, Černý Důl (K), on Jizera River between Jablonec and Rokytnice (C), estuary of Maxův Potok stream, Klínový Potok stream, Dolní Dvůr – near church (B), Špindlerův Mlýn (P), Rokytnice – the cave, Bílá Skála near Jizerka River (L,J), Peklo quarry NE from Lánov, the old quarry E from Lánov, the ruins of Nístějka and Horní Štěpanice castles, limestone quarry NW from Vrchlabí (J) Scattered in suitable habitats, pure populations.

Isognomostoma isognomostomos – around Vrchlabí (C), Rýchory: Jánské Lázně, Křižovatka, Tetřeví and Zlatý Potok streams (B), Jánský Potok stream (H), Rokytnice – the cave, valley of Jizerka near Vítkovice, valley of Labe River near Řopík (L, J), the ruin of Horní Štěpanice castle, Lhotecký Potok stream NE from Štěpanice (J). Scattered in talus slopes of forests.
Causa holosericea – Velká Úpa (Křižovatky), Špindlerův Mlýn (K), Bílé Labe estuary (C), Maxův Potok estuary, under Sokolka – Rýchory, Jánský Potok stream, Hrádek near Temný důl, Vavřincův Důl, Obří Důl, Žlebský Důl, Vlčí Důl, Zelený Důl, Křižovatka, valleys od Jelení Potok and Malá Úpa streams, Červený Potok stream valley, Labský Důl, Koželský Potok stream valley, Huťský Vodopád cascade, Dolní Dvůr, Tetřeví Potok stream (B), Rokytnice – cave, Prudký Ručej and Dlouhý Potok streams (L,J), valley of Labe River near Řopík, Obří Důl – Rudník, Čertova Zahrádka (J). Occasionally in forest talus slopes, pure populations. Species typical of oligothrophic habitats in higher altitudes.
Cepaea hortensis – mostly in lower situated human affected habitats: Vrchlabí, Lánov, Černý Důl, Velká Úpa (K), Rokytnice – the cave, Jizerka River near Vítkovice (L, J), three sites in Rýchory: Jánské Lázně, Černohorský Potok stream valley, Vavřincův Důl, Javoří Důl, Křižovatka, Peklo valley near Lánov, Strážné, Tetřeví and Klínový Potok streams (B), Peklo quarry near Lánov, Jizerka River near Štěpanice saw mill, the ruin of Štěpanice castle, Havírenský Potok stream near Vilémov, Hamerský Potok stream (J).
Helix pomatia – mostly in lower situated human affected habitats (K), Rýchory: Maxův Potok stream valley, near Jánské Lázně, Peklo valley near Lánov, Dolní Dvůr – near church, Bílý Potok stream near Dolní Dvůr (B), Jánský Potok stream (H), Horní Maršov (J), Rokytnice – the cave (L, J), Peklo quarry near Lánov, the old quarry E from Lánov, the limestone quarry W from Černý Důl, Kamenice NE from Harrachov, Havírenský Potok stream W from Vilémov (J); rare inside the mountains.

Sphaeriidae
Pisidium personatum – the spring under Sokolka, estuary of Zlatý Potok stream in Rýchory, Dlouhé Údolí valley near Královec (B), Černý Důl (H), stream near railway station in Vrchlabí (Be), Úpa upon Horní Maršov (J), Jizerka River under Vítkovice, Labe under Schustlerova Zahrádka in Labský Důl, (L, J), Pekelský Potok stream near Havířská bouda (J).
Pisidium casertanum – Rýchory: the spring under Sokolka, estuary of Zlatý Potok stream; Jánské Lázně, Čistá stream near Černý důl, meadow near Královec (B), Labe River and streams in Vrchlabí, Rokytnice (Be), the pool under Rýchorky (J), Jizerka River near Vítkovice and Štěpanice (L, J); *P.casertanum* f. *roseum* in peat pools near Luční Bouda in the Krkonoše ghats (R, C), but (K) did not find. Both species are probably more common in the Krkonoše Mts.
Pisidium subtruncatum – the stream near the railway station in Vrchlabí, Jilemka River and Cedron stream in Dolní Štěpanice (Be). Probably more sites.
Pisidium nitidum – Labe River in Vrchlabí (Be). Possibly more sites in lower parts.

Problematic records and species close to the border of the KRNAP

Radix ovata – Jizera near Mladkov (Jilemnice) Vejnar in Uličný (1892–1895), Dlouhé údolí near Královec (B) – probably confusion with *R. peregra*.
Granaria frumentum – Raubbach – limestone rocks near Vrchlabí (C), but nobody found this species later (K, L, J). Occurrence of this xerophilous species in the Krkonoše Mts. is improbable.
Balea perversa – close abroad to the KRNAP: Vlčí skála near Hertvíkovice (B).
Oxychilus glaber – Liščí hora, Bělá near Raubbach (Vrchlabí) (C), but (K) did not found it again. Probably confusion to *O. depressus*.
Petasina unidentata – Labský důl (C), but this species has never been found in Krkonoše again. Probably confusion to some species of genus *Trochulus*.
Helicodonta obvoluta – Dolní Vrchlabí (C) – improbable occurrence.

Molluscan assemblages

The most important habitats of the Krkonoše Mts. from the malacological point of view are Sudeten cirques and boulder screes (Fig. 3) and mountain forests. Unfortunately, malacocoenoses of these habitats are relatively poore.
The most important arcto-alpine species *Vertigo arctica* and *Columella columella* occur only in the polish part of the Krkonoše Mts., moreover *V. alpestris* was not found recently (Wiktor & Wiktor 1968, Wiktor 1985, Wiktor & Flasar 2005). In the Czech part of the Krkonoše Mts. no arcto-alpine species were found. *Aegopinella pura*, *Columella edentula*, *Vitrea subrimata*, *Arianta arbustorum* occur in cirques, *Carychium tridentatum*, *Oxychilus depressus*, *Perpolita petronella*, *Acanthinula aculeata*, *Causa holosericea* in boulder screes with common eurytopic species *Euconulus fulvus*, *Punctum pygmaeum*, *Vitrina pellucida*, and *Perpolita hammonis*.

Fig. 3. In Obří důl avalanche path Čertova zahrádka occur seven snail species including *Oxychilus depressus*.

In the Krkonoše Mts., the majority of area was covered by cultural spruce forest characterised by low number of acidotolerant species, especially in mushrooms. Typical species of this habitat type are *Limax cinereoniger*, *Malacolomax tenellus*, *Lehmannia marginata*, *Arion fuscus* (Figs 4 and 5), *Perpolita hammonis*, and *Euconulus fulvus*, which occur in similar habitats anywhere in the Czech Republic. In addition to it, mountain acidotolerant species *Discus ruderatus* (Fig. 6), *Semilimax kotulae*, and *Lehmannia macroflagellata* occur under the bark of spruce trees or stumps in the Krkonoše Mts. Richer forest malacocoenoses are confined to scattered fragments of natural mountain forests with beech and sycamore maple. Typical species of this habitat are an endemic subspecies of the Krkonoše Mts. *Cochlodina dubiosa corcontica* (Fig. 7) and other dendrophilous species – *Clausilia cruciata* (Fig. 8), *Macrogastra plicatula*, and *Ena montana*. Typical species for the epigeon of mountain forests are *Aegopinella pura*, *Vitrea subrimata*, *Monachoides incarnatus*, *Causa holosericea*, and *Arianta arbustorum*.

Species of higher nutritious requirements occur in humid river or stream valleys with alders, ash, elm and rich vegetation covers (*Petasites*, *Lunaria*, *Urtica* etc.). These types of habitat are characterised by higher species richness (e.g. *Carychium tridentatum*, *Columella edentula*, *Acanthinula aculeata*, *Vitrea crystallina*, *Perpolita petronella*, *Eucobresia diaphana*, *E. nivalis*, *Semilimax semilimax*, *Vertigo*

Fig. 4. Common species of the Krkonoše Mts. cultural spruce forests *Lehmannia marginata*.

Fig. 5. Common species of the Krkonoše Mts. cultural spruce forests *Arion fuscus*.

Fig. 6. *Discus ruderatus* – species typical for the mountain forests, especially under the bark of spruce.

Fig. 7. *Cochlodina dubiosa corcontica* – an endemic taxon of the Krkonoše Mts.

substriata, *V. pusilla*, *Clausilia pumila*, *Macrogastra ventricosa*, *Cochlodina laminata*, *Alinda biplicata*).
The richest malacocoenoses occur in scattered limestone parts of the Krkonoše Mts. In addition to the above, this area is inhabited by some sensitive forest species e.g. *Platyla polita*, *Vitrea diaphana*, *Sphyradium doliolum*, *Ruthenica filograna*. Characteristic landscape elements of this range are cliffs and talus slopes inhabited by *Clausila parvula*, *Laciniaria plicata*, *Vertigo alpestris*, *Helicigona lapicida*, *Isognomostoma isognomostomos*. The calcium rich habitats of castle ruins also inhabit rich malacocoenoses. (Fig. 9).
Some synanthropic (*Arion distinctus*, *A. fasciatus*, *Deroceras reticulatum*), catholic (*Trochulus hispidus*, *T. sericeus*, *Cepaea hortensis*), and thermophilous (*Vitrea contracta*, *Helix pomatia*) species are characteristic for human impact habitats in the Krkonoše Mts. foothills or river valleys. At present, the invasive species *Arion lusitanicus* was found at two sites, although spreading of this species is probable in lower altitudes. Only fragments of open habitat assemblages (*Vallonia pulchella*, *V. costata*, *Cochlocopa lubricella*, *Vertigo pygmaea*, *Xerolenta obvia*) occur in lower parts of the Krkonoše Mts.

Fig 8. *Clausilia cruciata* – species typical for the mountain forests.

Fig. 9. Rich snail assemblage inhabit the ruin of Horní Štěpanice castle.

The aquatic species *Radix peregra*, *Galba truncatula*, *Ancylus fluviatilis*, and *Pisidium casertanum* often inhabit streams and upper parts of rivers. Molluscs of ponds and other water bodies are rare in the whole area.

Discussion

In comparison to the part of the Krkonoše Mts. in Poland, the Czech part is richer in a number of species (68 species in Poland / 90 species in the Czech Republic) (Wiktor & Wiktor 1968). It is important to note that the list of species compared by Flasar from the literature (Wiktor & Flasar 2005) was not criticaly revised. He mentioned some species, which occur abroad the KRNAP or some problematic species (see above).
In comparison to snail communities from comparable mountain ranges of the Bohemian Upland, the mollusc fauna of Krkonoše is rather poor both in species and in a number of fully developed woodland assemblages. Recent evidence reveals that this poverty is due to following principal reasons:
The mutual interaction of severe climate, acidic rock and soil material has negatively influenced life conditions of the mollusc fauna since the beginning of Holocene warming. A number of Postglacial thermophilous immigrants expanding from their refugia in the Alpine (*Aegopis verticillus*, *Cochlodina commutata*, *Itala ornata*, *Macrogastra badia* as well as *Petasina unidentata* or *Aegopinella nitens*) or Carpathian regions (*Faustina faustina*, *Monachoides vicinus*, *Macrogastra tumida*, *Vitrea transsylvanica*) invaded the southern Sudetian foothills, but did not enter upper Sudetes. Only *Cochlodina dubiosa corcontica* and *Eucobresia nivalis* also colonised the central part of the Krkonoše Mts. In this context, it is worth mentioning that even the well preserved large beech forests in the adjacent Jizerské Hory Mts. are also poor in molluscs, which confirms the natural character of the malacofaunal poverty of the whole Krkonoše-Jizerské hory area.
However, there are also long-term human activities that have disturbed the natural habitats since the Medieval Ages. Dense primeval forests have been exploited, cleaned and disturbed by grazing since the 14th century so

that at the beginning of the 17th century they were largely devastated. Large valleys were continuously settled, and dispersed cottages were built on the valley sides and on the summit plateaus. Later, a former mixed forest was replaced by spruce plantation that dominated the range up to present. They were heavily damaged by industrial air pollution during the second half of the 20th century, which is also responsible for overall soil acidification.

Due above-mentioned reasons, there can be no doubt that in contrast to natural state the present day mollusc communities are markedly impoverished. This is particularly true of the mountain forests whose original snail communities might resemble those of the Hrubý Jeseník Mts. where Alpine and Carpathian elements are also nearly missing, although they live in the adjacent foothills. The subalpine and particularly alpine belts have been permanently very poor in molluscs due to highly acidic soils and bedrock, which corresponds to similar observations on analogous ecosystems in other mid-European ranges.

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Table 1. Presence of each species in different localities under study. The numbers of sites in the first time conform to numbers of used in the text. Numbers in the table – number of specimens in the litter sample; + means presence in the site.

number of site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Carychium minimum											+									85				
C. tridentatum						30		1	1				+			+	+		+					+
Radix peregra						14																		
Galba truncatula																			+					
Cochlicopa lubrica						7		3			+	+	+		+	+				1		+		+
Cochlicopa lubricella																						+		
Trunc. cylindrica																						+		
Columella edentula			1			5							+			+				13				+
Vertigo pygmaea																						+		
Vertigo substriata						1																		
Vertigo alpestris																								
Vertigo pusilla																+	+							
Vallonia costata																								
Vallonia pulchella																						+		
Acanthinula aculeata						1		5					+				+	+						
Ena montana							+									+			+					
Merdigera obscura																								
Cochlodina laminata						1																		
C. corcontica							+						+			+					+			
Clausilia parvula							+									+								
Clausilia pumila													+											
Clausilia cruciata													+					+						
Macrogastra plicatula						13	+						+			+	+	+	+	3		+	+	+
M. ventricosa																								
Laciniaria plicata							+									+			+			+	+	
Alinda biplicata						5										+			+	29	+	+	+	+
Succinea putris																			+					
Discus rotundatus						3					+		+		+	+	+	+	+	11		+		+
Discus ruderatus													+				+	+						
Punctum pygmaeum	3					6		22					+				+		+	+				+
Euconulus fulvus					+	2	+	2			+		+	+			+	+		16		+	+	+
Arion rufus													+			+			+					
Arion lusitanicus																								
Arion subfuscus										+			+							+		+		+
Arion silvaticus															+		+			+				
Arion distincus														+	+					+				+
Limax cinereoniger						1				+			+	+	+		+	+						+
Lehmannia marginata										+			+				+	+				+		
L. macroflagellata										+				+										
Malacolimax tenellus											+					+	+			+	+	+		+
Deroceras laeve											+													
D. reticulatum																								
Boettgerilla pallens					+						+		+					+						+
Vitrina pellucida					+	12		9			+					+		+	+	43		+		+
Eucobresia nivalus																				2				+
E. diaphana						38							+		+	+								
Semilimax kotulae										+														+
S. semilimax						1							+					+		1				
Perpolita hammonis	1					4					+	+		+			+			12				

Table 1. Continued.

number of site	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Carychium minimum																				+		+	
C. tridentatum	+										+	+	150										
Radix peregra	+																						
Galba truncatula																							
Cochlicopa lubrica	+	1									+	+	2			2							
Cochlicopa lubricella																							
Trunc. cylindrica																3							
Columella edentula		7	9			4						+	10	+					+	+		+	
Vertigo pygmaea													2										
Vertigo substriata																							
Vertigo alpestris		19														16							
Vertigo pusilla												+				7							
Vallonia costata		22														1							
Vallonia pulchella																							
Acanthinula aculeata				1									10			1							
Ena montana																5							
Merdigera obscura		4																					
Cochlodina laminata																1							
C. corcontica	+	12		6												1			+				
Clausilia parvula		18														8							
Clausilia pumila																							
Clausilia cruciata											+	+											
Macrogastra plicatula	+	4		3		8					+	+	12	+	+	3			+	+		+	
M. ventricosa	+																						
Laciniaria plicata		29											16			21							
Alinda biplicata	+	2											8										
Succinea putris																							
Discus rotundatus	+	+	8	7	+	80	10		+	+	+	+	24	+	+	17		+		+	+	+	+
Discus ruderatus											+	+						+	+				+
Punctum pygmaeum	+	43	3	2		171	3						10	+		45			+			+	
Euconulus fulvus	+	+	12	5		6	2		+	+	+	+	1	+	+	9	+	+	+	+		+	+
Arion rufus													+				+		+	+			
Arion lusitanicus	+										+												
Arion subfuscus		+	+	+		+	+	+		+	+	+	+		+	+	+	+	+			+	+
Arion silvaticus	+										+												
Arion distincus	+										+		+										
Limax cinereoniger	+			+					+	+		+	+	+	+			+		+		+	+
Lehmannia marginata				+					+	+			+		+			+	+			+	
L. macroflagellata									+														+
Malacolimax tenellus		+		+					+			+	+	+	+	+		+	+	+			
Deroceras laeve													+										
D. reticulatum													+										
Boettgerilla pallens	+	+																					
Vitrina pellucida	+			5	+	15					+										+		
Eucobresia nivalus																				+			
E. diaphana													2										
Semilimax kotulae			1									+			+				+	+		+	
S. semilimax	+	3		3		4	2		+		+	+	4	+		1		+			+	+	
Perpolita hammonis	+	4	2			1	4							+				+		+	+		+

Table 1. Continued.

number of site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Perpolita petronella								16										+						+
Aegopinella pura	1	2	3	2		3		5			+		+			+	+	+		63				
Aegopinella minor																				1				
Vitrea crystallina						49							+							21		+		+
Vitrea subrimata	1																+	+						
Vitrea diaphana																				3				
Vitrea crontracta																						+		
Oxychilus cellarius								3			+		+		+	+				2				
O. depressus																								
Zonitoides nitidus																								
Trochulus hispidus						4										+								
Trochulus sericeus							+						+						+	1				
Monach. incarnatus					+	1	+				+		+		+	+	+	+		1		+		+
Urticicola umbrosus																								
Arianta arbustorum			1			1	+						+			+	+	+	+	2				+
Helicigona lapicida							+									+			+			+		
Causa holosericea													+			+	+	+						
Isog.isognomostomos						2	+						+			+								
Cepaea hortensis						1										+			+					
Helix pomatia																+				1		+	+	
Pisidium casertanum						4																		
Pisidium personatum						3		1												1				

Table 1. Continued.

number of site	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Perpolita petronella																			+				
Aegopinella pura	+	+	6	3		+	2				+		39						+	+	+	+	
Aegopinella minor		+																		+			
Vitrea crystallina													1						+				
Vitrea subrimata				11															+				
Vitrea diaphana		1																					
Vitrea crontracta																							
Oxychilus cellarius	+	+									+		10	+		6				+		+	
O. depressus						1	3																+
Zonitoides nitidus	+																						
Trochulus hispidus													2										
Trochulus sericeus	+																			+	+	+	
Monach. incarnatus	+	+									+	+	5			5				+	+	+	
Urticicola umbrosus	+																						
Arianta arbustorum	+	+	3			2						+	1	+		2	+			+		+	+
Helicigona lapicida		+														15					+		
Causa holosericea				2			1																
Isog.isognomostomos		+																				+	
Cepaea hortensis	+	+											1							+			
Helix pomatia										+			1										
Pisidium casertanum	+																						
Pisidium personatum																							