



# *CEPAEA VINDOBONENSIS* (FÉRUSSAC, 1821) (GASTROPODA: PULMONATA: HELICIDAE) IN CENTRAL, NORTHWESTERN AND WESTERN POLAND

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**ABSTRACT:** *Cepaea vindobonensis* (Fér.), occurring in south-eastern Europe, is a xerothermophile associated with carbonate or carbonate-silica substratum. In Poland it has natural localities in the south-east. Its distribution in the other parts of the country was studied and up-dated based on literature data and museum materials. Its presence on the flood plains of the Vistula and Odra river systems in C., NW. and W. Poland is a result of water dispersal from sites with mainly carbonate substratum. Its further spread from there may be due to accidental dispersal by humans.

**KEY WORDS:** *Cepaea vindobonensis*, dispersal, river systems, alluvial deposits

## INTRODUCTION

*Cepaea vindobonensis* (Férussac, 1821) is a south-eastern-European species. Its range extends from the Northern Caucasus, Crimea and the Balkan Peninsula through Austria, the Czech Republic and Slovakia to Poland (POLIŃSKI 1924, RIEDEL 1988). In Poland it is found in the south-east (RIEDEL 1988, WIKTOR 2004). Besides, there are fairly numerous records from other parts of the country: the valleys of the Vistula, Warta and Odra river systems (JANKOWSKI 1933, RIEDEL 1988, WIKTOR 2004), some of them rather far to the north-west (see distribution maps in POLIŃSKI 1919, 1924, ROMER 1930, 1934 and WIKTOR 2004).

Examination of the literature reveals that, depending on the region, *C. vindobonensis* occupies different habitats (see e.g. KRAUSE 1873, SCHOTTMÜLLER 1912,

MÜLLER 1920, POLIŃSKI 1924, BOETTGER 1926, MŁODZIANOWSKA-DYRDOWSKA 1928, URBAŃSKI 1933, 1935). In south-eastern Poland the species is associated with dry, sunny, calcareous habitats. Outside this area it is found in radically different situations, e.g. flood plains of big rivers and lake shores, and some of the data suggest an ephemeral character of such populations (cf. KRAUSE 1873, SCHOTTMÜLLER 1912). POLIŃSKI & DEMEL (1921), JANKOWSKI (1933), URBAŃSKI (1935) and KAŹMIERSKI (1972) pointed to the possibility that the occurrence of *C. vindobonensis* in such sites could result from dispersal by water from carbonate bedrock localities onto flood plains. New data on the distribution of *C. vindobonensis* in Poland make it necessary to re-consider the problem and propose the mechanisms of species migration.

## MATERIAL AND METHODS

Distribution of *C. vindobonensis* in selected regions of Poland (Fig. 1) was re-considered and updated based on literature data and museum collections

(Museum and Institute of Zoology, Polish Academy of Sciences, Warsaw, Natural History Museum, Wrocław University, Institute of Systematics and Evolution of

Animals, Polish Academy of Sciences, Cracow, Adam Mickiewicz University, Poznań). All localities were plotted on a UTM map (Fig. 2).

The data were divided in three parts. Part I includes the list of published literature records of *C. vindobonensis*. The information is arranged according to voivodeships and chronologically within each voivodeship. Part II is the list of sites based on master's degree dissertations, arranged in the same way as in Part I. Comments given by the respective authors on their records and/or information sources are given under "Remarks" in Parts I and II. Part III is the locality list based on museum collections. Geographical coordinates are given for each locality (when only a city is mentioned, the coordinates given refer to the city centre).



Fig. 1. Voivodeships of Poland included in the study (light grey): DLN –Dolnośląskie, KUP – Kujawsko-Pomorskie, LBS – Lubuskie, LUB – Lubelskie, ŁDZ – Łódzkie, MAŁ – Małopolskie, MAZ – Mazowieckie, OPL – Opolskie, PDK – Podkarpackie, PDL – Podlaskie, POM – Pomorskie, SLK – Śląskie, SWT – Świętokrzyskie, WLK –Wielkopolskie, WMA – Warmińsko-Mazurskie, ZPM – Zachodniopomorskie

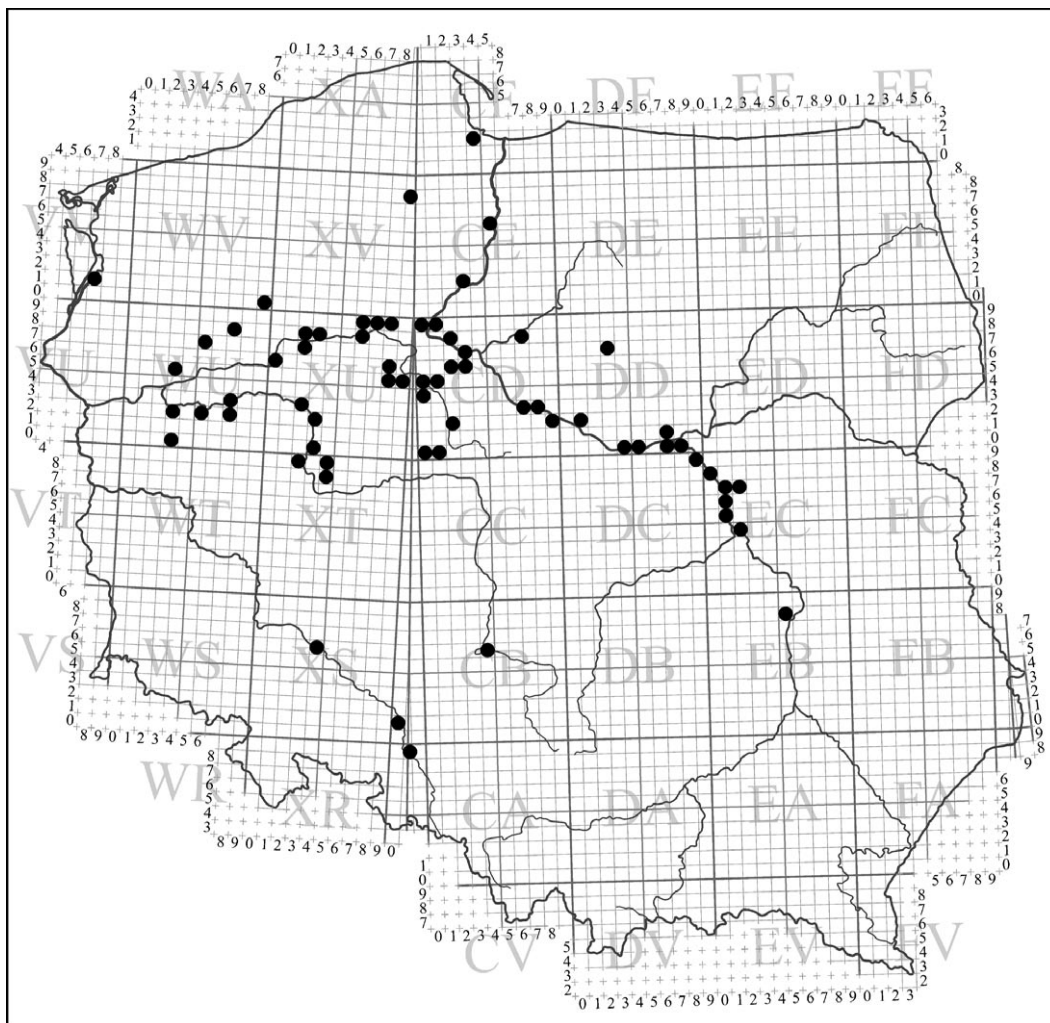


Fig. 2. UTM map with localities of *C. vindobonensis* listed in the text



## LOCALITY LIST

## I. PUBLISHED LITERATURE RECORDS

**Zachodniopomorskie**

DOHRN (1862: 214–215)

Locality: environs of Szczecin (53°25'N, 14°33'E).

Remarks: In 1855 the species was found in "Park Hökendorf" ca. 2.5 km from Szczecin. Then Dr. A. Hensche found several specimens near the original place of occurrence. The population was small and liable to perish during an unfavourable year or as a result of human disturbance. It should be possible to monitor future changes.

MARTENS (1870: 142)

Locality: Szczecin (53°25'N, 14°33'E).

Remarks: In a letter dated March 26th, 1869 Dr. A. Lehmann mentioned the occurrence of *Helix vindobonensis* in Szczecin.

DOHRN (1871: 17)

Locality: environs of Szczecin (53°25'N, 14°33'E).

Remarks: The species occurred in large numbers in "Park Hoeckendorf". It survived winters hiding under leaves, moss, bark of trees or in the soil. It spread on the left bank of the Odra near Szczecin.

LEHMANN (1873: 116)

Locality: Klęskowo near Szczecin (53°22'N, 14°38'E).

Remarks: Species found by H. Dohrn in 1855 in Klęskowo near Szczecin.

GEYER (1909: 46)

Locality: environs of Szczecin (53°25'N, 14°33'E).

Remarks: "Park Hoeckendorf".

BOETTGER (1926: 17, 18)

Locality: environs of Szczecin (53°25'N, 14°33'E).

Remarks: *C. vindobonensis* was introduced in 1855 in "Park Hökendorf" near Szczecin, then on the left bank of the Odra near Szczecin. The site in "Park Hökendorf" had been mentioned earlier, in 1873. In 1894 E. Friedel observed that the population was becoming extinct. According to E. Holzfuss the locality in Szczecin had ceased to exist.

GEYER (1927: 92)

Locality: on Lake Zamkowe near Wałcz (53°15'N, 16°27'E).

FRASE (1930: 92)

Locality: Załom near Wałcz (53°06'N, 16°04'E).

ARNDT (1931: 147)

Locality: on Lake Załomie (53°05'N, 16°04'E).

JAECKEL (1950: 85)

Locality: Człopa near Lake Załomie (53°05'N, 16°07'E).

Remarks: *C. vindobonensis* occurred near Człopa, on the S. shore of Lake Załomie, where fossil shells were also found besides live specimens.

URBAŃSKI (1956a: 190)

Locality: Klęskowo near Szczecin (53°22'N, 14°38'E).

Remarks: A south-eastern-European snail *C. vindobonensis* was successfully acclimatised in a garden in Klęskowo in the Szczecin suburbs.

URBAŃSKI (1957c: 330)

Locality: Klęskowo near Szczecin (53°22'N, 14°38'E).

**Pomorskie**

SCHUMANN (1881: 325)

Locality: environs of Gdańsk (54°21'N, 18°40'E).

Remarks: S. Clessin listed *Helix austriaca* in his publication "Excursions-Mollusken-Fauna". The species was encountered near Gdańsk. Clessin did not indicate any other person who could confirm information on the locality.

CLESSIN (1884: 211)

Locality: environs of Gdańsk (54°21'N, 18°40'E).

Remarks: The snails occurred on dry grass, shrubs and walls. The species was seldom found near Gdańsk.

RIEDEL (1988: 234)

Locality: environs of Gdańsk (54°21'N, 18°40'E).

Remarks: The occurrence near Gdańsk was doubtful.

**Kujawsko-Pomorskie**

KRAUSE (1874: 61)

Locality: environs of Bydgoszcz (53°07'N, 18°00'E).

FRIEDEL (1885: 49)

Locality: Toruń (53°02'N, 18°36'E).

PROTZ (1896: 260)

Locality: Sartowice near Świecie (53°26'N, 18°34'E).

PROTZ (1897: 103)

Locality: Sartowice (53°26'N, 18°34'E).

SCHUMANN (1905: 32)

Locality: Sartowice near Świecie (53°26'N, 18°34'E), environs of Bydgoszcz (53°07'N, 18°00'E).

Remarks: In 1894 the species was found in Sartowice near Świecie by A. Protz, in 1873 – in the environs of Bydgoszcz by A. Krause.

GEYER (1909: 46)

Locality: environs of Sartowice on the Vistula (53°26'N, 18°34'E).

Remarks: Snails from limestone bedrock (dry sites) had white shells; whitish-yellowish shells were found in humid sites. The species rarely showed variation (*palescens* and *expallescens*). It occurred in sunny sites, on dry valley slopes, among shrubs.

SCHOTTMÜLLER (1912: 92)

Localities: Ostromecko (53°09'N, 18°13'E), Mozgowino (53°10'N, 18°13'E), environs of Bydgoszcz, S. side of the Bydgoski Canal (53°07'N, 18°00'E), Wałdowo Królewskie (53°09'N, 18°14'E).

Remarks: The easternmost locality was situated on the right shore of the Vistula, between Ostromecko and Mozgowino, opposite to Fordon. Other sites were found on the S. side of the Bydgoski Canal and in Wałdowo Królewskie, ca. 55 km W. of Ostromecko.

BŁĘDOWSKI & DEMEL (1913: 934)

Locality: Sartowice (53°26'N, 18°34'E).

GEYER (1917: 82)

Locality: Sartowice (53°26'N, 18°34'E).

POLIŃSKI (1919: 273)

Locality: along the Vistula valley in the environs of Toruń (53°02'N, 18°36'E).

MÜLLER (1920: 185)

Localities: Ostromecko (53°09'N, 18°13'E), Mozgowino (53°10'N, 18°13'E), environs of Bydgoszcz, S. bank of the Bydgoski Canal (53°07'N, 18°00'E), environs of Świecie (53°25'N, 18°27'E), Występ (53°12'N, 17°64'E).

Remarks: A. Krause was one of the first authors to report the occurrence of this species near Bydgoszcz, in his 1874 paper; he was followed by E. Schottmüller (1912).

POLIŃSKI (1924: 246)

Localities: in the Vistula valley, Toruń (53°02'N, 18°36'E), Sartowice (53°26'N, 18°34'E), Bydgoszcz (53°07'N, 18°00'E) – along the canal as far as Nakło on the Noteć (53°09'N, 17°36'E), Szpetal opposite Włocławek (52°67'N, 19°07'E).

BOETTGER (1926: 16)

Localities: along the Vistula to Toruń (53°02'N, 18°36'E) and Sartowice (53°26'N, 18°34'E), environs of Bydgoszcz (53°07'N, 18°00'E), along the Bydgoski Canal to Nakło on the Noteć (53°09'N, 17°36'E).

DYRDOWSKA (1926: 64)

Localities: environs of Bydgoszcz (53°07'N, 18°00'E), Pakość (52°48'N, 18°06'E), Kołuda Mała (52°43'N, 18°07'E).

GEYER (1927: 92)

Localities: Bydgoszcz (53°07'N, 18°00'E), Nakło on the Noteć (53°09'N, 17°36'E), Sartowice (53°26'N, 18°34'E).

MÜLLER (1927: 112)

Locality: environs of Ślesin (53°10'N, 17°43'E).

MŁODZIANOWSKA-DYRDOWSKA (1928: 37)

Localities: Strzelewo (53°10'N, 17°46'E), between Strzelewo (53°10'N, 17°46'E) and Ślesin (53°10'N, 17°43'E), in the Noteć valley between Nakło on the Noteć (53°09'N, 17°36'E) and Bydgoszcz (53°07'N, 18°00'E), E. shore of Lake Pakoskie (52°46'N, 18°06'E), between Janikowo (52°45'N, 18°05'E) and Kołuda Mała (52°43'N, 18°07'E), Suchatówka (52°55'N, 18°29'E), between Toruń (53°02'N, 18°36'E) and Gniewkowo (52°54'N, 18°25'E), on the Bydgoski Canal, on Lake Gopło (52°34'N, 18°21'E).

Remarks: *C. vindobonensis* was found in Strzelewo in the Noteć valley by A. Krause in 1873. In 1912 E. Schottmüller stated that Krause's locality had been destroyed because numerous brick yards were built there. In the same year Schottmüller mentioned the presence of the species between Nakło and Bydgoszcz in the Noteć valley, between Strzelewo and Ślesin. Młodzianowska-Dyrdowska found it on the eastern shore of Lake Pakoskie, on shrubs between Janikowo and Kołuda and on the Bydgoski Canal; she pointed to the necessity of checking the presence of *C. vindobonensis* in Suchatówka between Toruń and Gniewkowo.

FRASE (1930: 118)

Locality: environs of Bydgoszcz (53°07'N, 18°00'E).

Remarks: Frase (1930: 118) states that Schottmüller (1912: 92) mentioned a site near Bydgoszcz where he found "*Helix austriaca*".

URBAŃSKI (1932: 43)

Locality: on Lake Ostrowieckie near Żnin (52°49'N, 17°51'E).

EHRMANN (1933: 145)

Locality: Nakło on the Noteć (53°09'N, 17°36'E), Bydgoszcz (53°07'N, 18°00'E).

URBAŃSKI (1933: 90)

Locality: on Lake Ostrowieckie near Żnin (52°49'N, 17°51'E).

Remarks: The species occurred on the S. shore of Lake Ostrowieckie, which had rare plants: *Stipa joannis* Čelak., *Adonis vernalis* L., *Anemone silvestris* L., *Verbascum phoeniceum* L., *Campanula bononiensis* L., *Campanula sibirica* L. Specimens of *C. vindobonensis* were collected by professor A. Wodziczko.

URBAŃSKI (1935: 110, 111)

Localities: Sartowice (53°26'N, 18°34'E), Wilczkowo (52°52'N, 17°44'E), N. shore of Lake Duże Żnińskie (52°52'N, 17°43'E), shore of Lake Trląg (52°46'N, 18°06'E), between Janikowo (52°45'N, 18°05'E) and Kołuda Mała (52°43'N, 18°07'E), between Strzelewo (53°10'N, 17°46'E) and Ślesin (53°10'N, 17°43'E), banks of the Bydgoski Canal near Strzelewo (53°10'N, 17°46'E), on Lake Ostrowieckie (52°49'N, 17°51'E).

Remarks: The largest colony in Wielkopolska lived on the sunny slopes on Lake Ostrowieckie, overgrown by *Adonis vernalis* L., *Campanula sibirica* L., *Stipa joannis* Čelak.

KUNTZE & NOSKIEWICZ (1938: 271)

Localities: Along the Vistula from the Bug mouth to the environs of Toruń (53°02'N, 18°36'E) and Bydgoszcz (53°07'N, 18°00'E), on Lake Gopło (52°34'N, 18°21'E).

Remarks: along the Vistula *C. vindobonensis* occurred locally in patches.

URBAŃSKI (1938a: 18, 19)

Localities: N. and S. shores of Lake Duże Żnińskie (52°52'N, 17°43'E), shores of lakes near Żnin



(52°51'N, 17°45'E) and Inowrocław (52°48'N, 18°16'E), Trląg (52°43'N, 18°06'E), Kołuda Mała (52°43'N, 18°07'E), Janikowo (52°45'N, 18°05'E), from the Vistula bend to the Noteć valley.

Remarks: Localities Trląg, Kołuda Mała, Janikowo were reported by J. W. Szulczewski in June, 1934.

WODNICZKO et al. (1938: 39, 123)

Locality: environs of Bydgoszcz (53°07'N, 18°00'E), on Lake Trląg (52°46'N, 18°06'E) near Kołuda Mała (52°43'N, 18°07'E).

URBAŃSKI (1948: 87)

Locality: on Lake Ostrowieckie (52°49'N, 17°51'E).

JAECKEL (1950: 85)

Locality: environs of Toruń (53°02'N, 18°36'E), SE. shore of Lake Ostrowieckie (52°49'N, 17°51'E).

BERGER (1958: 72)

Locality: Noteć valley between Nakło (53°09'N, 17°36'E) and Bydgoszcz (53°07'N, 18°00'E).

Remarks: The material was collected by A. Wiktor.

GOSTYŃSKA (1959: 18)

Locality: Kulin (52°40'N, 19°08'E).

Remarks: The nature reserve in Kulin (right bank of the Vistula between Dobrzyń and Włocławek) occupies a part of the Vistula valley slope, SW-, S- and SE-facing. The steep slopes, elevated high above the Vistula level, favour preservation of xerothermic plant populations. Empty shells of *C. vindobonensis* were found here.

DZIABASZEWSKI (1967: 101)

Locality: on the Noteć, SE. shore of Lake Ostrowieckie (52°49'N, 17°51'E).

Remarks: On the Noteć River *C. vindobonensis* has a continuous fragment of its distribution range, combined with numerous localities on the Vistula. It was observed to reproduce in these areas.

KAŹMIERSKI (1972 (56, 57)

Localities: on the Noteć, on Lake Ostrowieckie (52°49'N, 17°51'E), along the Vistula.

Remarks: *C. vindobonensis* occurs in areas adjacent to the Noteć River. The species has colonies isolated from the main range, which are distributed along the Vistula. These originate from specimens transferred with the river current.

DROZDOWSKI (1975: 207)

Locality: Kulin near Włocławek (52°40'N, 19°08'E).

Remarks: *C. vindobonensis* occurred on a xerothermic slope in Kulin. The inclination of the slope was up to 65°, the substratum dry and the vegetation comprised steppe plants i.a. *Stipa joannis* Čelak., *Anemone silvestris* L., *Linosyris vulgaris* Cass., *Scorzonera purpurea* L. *Inula hirta* L., *Dictamnus albus* L.

DROZDOWSKI (1978: 16)

Localities: Kulin near Włocławek (52°40'N, 19°08'E), Smolno near Toruń (53°04'N, 18°25'E), Wilczkowo near Żnin (52°52'N, 17°44'E), Chomiaża Księża near

Lake Żnińskie (52°50'N, 17°51'E), Trląg (52°43'N, 18°06'E), Kołuda Mała (52°43'N, 18°07'E), Janikowo near Inowrocław (52°45'N, 18°05'E), Sartowice near Świecie (53°26'N, 18°34'E), environs of Bydgoszcz (53°07'N, 18°00'E).

Remarks: The continuous range of occurrence of *C. vindobonensis* comprises the south-eastern part of Poland. In the remaining area there are only isolated sites. The localities found in the Kujawsko-Pomorskie region were scattered along water courses.

DROZDOWSKI (1980: 332)

Locality: Kulin (52°40'N, 19°08'E).

KADULSKI (1982: 203, 211, fig. 7)

Locality: Vistula valley between Toruń (53°02'N, 18°36'E) and Bydgoszcz (53°07'N, 18°00'E), northwards as far as Świecie (53°25'N, 18°27'E).

Remarks: *C. vindobonensis* is found along forest edges and in scrub.

RIEDEL (1988: 234)

Locality: Świecie (53°25'N, 18°27'E).

Remarks: *C. vindobonensis* occurs in the Vistula valley reaching the environs of Świecie.

WIKTOR (2004: 278)

Locality: environs of Świecie (53°25'N, 18°27'E).

### Wielkopolskie

POLIŃSKI & DEMEL (1921: 4, fig. 4)

Locality: "White shore" of Lake Mikorzyńskie (52°20'N, 18°08'E).

Remarks: Sparse populations of the species, found on sunny slopes in the Vistula valley, most probably originate from specimens which reached the lower river section.

POLIŃSKI (1924: 246)

Locality: Lake Mikorzyńskie (52°20'N, 18°08'E).

BOETTGER (1926: 16)

Locality: Poznań (52°25'N, 16°58'E).

DYRDOWSKA (1926: 64)

Localities: environs of Poznań (52°25'N, 16°58'E), on Lake Mikorzyńskie (52°20'N, 18°08'E).

MŁODZIANOWSKA-DYRDOWSKA (1928: 36)

Localities: Kórnik (52°15'N, 17°06'E), Poznań-Szeląg (52°25'N, 16°58'E), Poznań-Wilczy Młyn (52°25'N, 16°58'E), on Lake Mikorzyńskie (52°20'N, 18°08'E).

Remarks: In 1920 A. Jakubski reported a new locality in the Kórnik forest, where he found 10 live specimens of *C. vindobonensis*; he plotted it on the map of the Polish fauna. In 1928 Młodzianowska-Dyrdowska reported localities in Szeląg on the Warta near Poznań (forested slope near the Winiarskie forts) – the occurrence of the species was observed on: IV/1922, 17/VII/1923, 11/VI/1924, 10/IX/1924 in Wilczy Młyn (wood on the Warta) and on 12/VII/1923, 16/VIII/1924 on Lake Mikorzyńskie.

URBAŃSKI (1932: 43)

Localities: "Zwierzyniec" forest near Kórnik (52°15'N, 17°06'E), hills on the road from Miasteczko (53°06'N, 17°01'E) to Brzostowo near Wyrzysk (53°06'N, 17°02'E).

URBAŃSKI (1933: 90, 92)

Localities: Poznań-Szeląg (52°25'N, 16°58'E), Poznań-Wilczy Młyn (52°25'N, 16°58'E), Puszczykowo (road to Łęczycza) (52°17'N, 16°51'E), between Łukowo (52°38'N, 16°53'E) and Starczanowo near Oborniki (52°36'N, 16°57'E), hills by the road from Miasteczko (53°06'N, 17°01'E) to Brzostowo near Wyrzysk (53°06'N, 17°02'E).

Remarks: J. Rafalski found the species in the locality by the road from Miasteczko to Brzostowo.

URBAŃSKI (1935: 109–110, fig. 6)

Localities: Poznań-Szeląg (52°25'N, 16°58'E), Poznań-Wilczy Młyn (52°25'N, 16°58'E), Puszczykowo (52°17'N, 16°51'E), "Zwierzyniec" forest near Kórnik (52°15'N, 17°06'E), forest between Łukowo (52°38'N, 16°53'E) and Starczanowo (52°36'N, 16°57'E), Sieraków (52°39'N, 16°06'E), SW. shore of Lake Lutomskie (52°38'N, 16°07'E), E. shore of Lake Śremskie (52°36'N, 16°03'E), between Morzewo (53°05'N, 16°54'E) and Dziembowo (53°04'N, 16°50'E), between Miasteczko (53°06'N, 17°01'E) and Brzostowo (53°06'N, 17°02'E).

Remarks: *C. vindobonensis* had colonies isolated from the main range and distributed along the Vistula. These originated from specimens brought with the river current. The longest "island" of occurrence of the species stretched along the Vistula between the Bug mouth and Sartowice in Pomorze. The "island" was connected with the sites in Wielkopolska by the Noteć and the Bydgoski Canal. Near Poznań only empty shells were found, suggesting that the species had become extinct there relatively recently. It was likely that two centres of occurrence existed in Wielkopolska: one on the Noteć, connected with the localities in the Vistula valley, another stretching along the Warta river.

URBAŃSKI (1938a: 18, 19)

Localities: Sieraków (52°39'N, 16°06'E), SE. of Jaroszewo (52°37'N, 16°06'E), SW. shores of Lake Lutomskie (52°38'N, 16°07'E), shores of Lake Śremskie (52°36'N, 16°03'E), left bank of the Warta near Międzychód (52°36'N, 15°53'E), environs of Poznań (52°25'N, 16°58'E), Oborniki (52°39'N, 16°49'E), "Zwierzyniec" forest near Kórnik (52°15'N, 17°06'E), Puszczykowo (52°17'N, 16°51'E), between Morzewo (53°05'N, 16°54'E) and Dziembowo (right bank of the Noteć) (53°04'N, 16°50'E).

Remarks: In the environs of Jaroszewo the species occurs in ditches along the highway and on pine forest edges. On the shore of Lake Lutomskie it is found on xerothermic plants, i.a. *Veronica austriaca* L., *Stachys*

*germanica* L., whereas on the shore of Lake Śremskie it is sporadically observed i.a. on *Rosa canina* L., *Rosa glauca* Vill., *Prunus spinosa* L. In Puszczykowo numerous fresh shells were found in May 1936. Specimens from the environs of Morzewo and Dziembowo were collected by J. Rafalski. Along the Noteć the species reaches as far as the German border.

WODNICZKO et al. (1938: 39, 255, 297, 320, 352)

Localities: Poznań-Sołacz (52°25'N, 16°58'E), Poznań-Szeląg (52°25'N, 16°58'E), Poznań-Wilczy Młyn (52°25'N, 16°58'E), Puszczykowo (52°17'N, 16°51'E), Ludwikowo (53°05'N, 17°24'E), by the highway running to Jaroszewo (52°37'N, 16°06'E), on sunny NE. slopes on Lake Lutomskie (52°38'N, 16°07'E), on shores of Lake Śremskie (52°36'N, 16°03'E), on the Warta banks between Łukowo (52°38'N, 16°53'E) and Starczanowo (52°36'N, 16°57'E).

Remarks: *C. vindobonensis* occurred on dry, sunny slopes and in damp scrub on the Warta banks. The sunny slopes were overgrown by *Rosa canina* L., *Prunus spinosa* L., *Lithospermum officinale* L., *Vicia dumetorum* L. Live specimens of *C. vindobonensis* were found in Puszczykowo, empty shells in Szeląg, Wilczy Młyn and Sołacz. The species has a continuous range in Wielkopolska, on the Vistula and along the Noteć. It becomes increasingly rare in Wielkopolska. In many places only empty shells can be found, e.g. near Poznań, on the Warta banks between Łukowo and Starczanowo.

URBAŃSKI (1947d: 21)

Locality: environs of Puszczykowo (52°17'N, 16°51'E).

Remarks: Empty shells of *C. vindobonensis* were found near Puszczykowo. The snail had become extinct there quite recently. The number of its isolated sites in Wielkopolska at the northwestern fringes of its range is decreasing.

URBAŃSKI (1954: 176)

Localities: environs of Kórnik (52°15'N, 17°06'E), near Poznań (52°25'N, 16°58'E).

Remarks: The species is becoming extinct in the environs of Poznań.

URBAŃSKI (1955: 108, 109)

Localities: Puszczykowo (52°17'N, 16°51'E), environs of Poznań (52°25'N, 16°58'E), "Zwierzyniec" forest on Lake Kórnickie (52°14'N, 17°05'E).

Remarks: Empty shells of *C. vindobonensis* which usually inhabits dry, sunny scrub and forest edges were found near Puszczykowo. This snail has its northwestern distribution border in Wielkopolska. Near Poznań it seems to be on the verge of extinction, since only empty shells were found in many places. Live specimens are known from the Zwierzyniec forest on Lake Kórnickie.



URBAŃSKI (1956b: 29)

Locality: between Sieraków (52°39'N, 16°06'E) and Jaroszewo (52°37'N, 16°06'E).

Remarks: The locality of *C. vindobonensis* by the highway from Sieraków to Jaroszewo is one of the westernmost records in Wielkopolska.

DZIABASZEWSKI (1967: 101)

Localities: Poznań (52°25'N, 16°58'E), Poznań-Szeląg (52°25'N, 16°58'E), Poznań-Wilczy Młyn (52°25'N, 16°58'E), Puszczykowo (by the highway to Łęczyca) (52°17'N, 16°51'E), between Łukowo (52°38'N, 16°53'E) and Starczanowo near Oborniki (52°36'N, 16°57'E), on Lake Kórnickie (52°14'N, 17°05'E) between Miasteczko (53°06'N, 17°01'E) and Brzostowo near Wyrzysk (53°06'N, 17°02'E).

Remarks: In Poznań *C. vindobonensis* was found on the 15th and 16th of July 1964 in the Citadel, between the cemetery and the forts. The site is much shaded by trees and shrubs. In Wielkopolska the species occurs in scattered, insular localities.

KORALEWSKA-BATURA & DZIABASZEWSKI (2000: 229, 230)

Localities: Radolinek between Czarnkowo and Trzcianka (52°58'N, 16°51'E), Poznań (52°25'N, 16°58'E).

Remarks: In Poznań the site of *C. vindobonensis* is located in the New Town district, near Hetmańska Str., on the right bank of the Warta, ca. 25 m away from the river. The site, ca. 800 m<sup>2</sup> in area, holds the following plant species: *Silene tatarica* Pers., *Trifolium arvense* L., *Trifolium pratense* Schleb., *Artemisia campestris* L., *Calamagrostis epigeios* (L.), *Poa angustifolia* L., *Festuca rubra* L., *Tanacetum vulgare* L., *Oenothera biennis* L., *Artemisia vulgaris* L., *Salix purpurea* L., *Populus alba* L., *Salix fragilis* L., *Salix alba* L.

DZĘCIOŁOWSKI & JANYSZEK (2002: 291, 299)

Locality: Poznań (Citadel, called Winiary Fort) (52°25'N, 16°58'E).

### Lubuskie

FRASE (1930: 117)

Locality: Kęszycza near Międzyrzecz (52°25'N, 15°31'E).

CZUBIŃSKI & URBAŃSKI (1950: 48)

Locality: Zielomyśl (52°32'N, 15°46'E).

JAECKEL (1950: 85)

Localities: Kęszycza near Międzyrzecz (52°25'N, 15°31'E), Skwierzyna (52°36'N, 15°30'E), Wołogoszcz (52°59'N, 15°51'E).

Remarks: Sites in Kęszycza near Międzyrzecz and in Skwierzyna were found by R. Frase.

URBAŃSKI (1961: 155)

Locality: Zielomyśl (52°32'N, 15°46'E).

Remarks: In Zielomyśl *C. vindobonensis* occurs on xerophile plants. The locality is its northernmost record.

DZIABASZEWSKI (1967: 101)

Localities: Międzyrzecz (52°26'N, 15°35'E), Strzelce Krajeńskie (52°52'N, 15°32'E).

STĘPCZAK (1981: 154)

Locality: Zielomyśl (52°32'N, 15°46'E).

### Mazowieckie

LINDHOLM (1908: 224)

Locality: Otwock near Warsaw (52°07'N, 21°19'E).

BŁĘDOWSKI & DEMEL (1913: 934)

Localities: Otwock near Warsaw (52°07'N, 21°19'E), Płock (slopes of Cathedral Mountain) (52°33'N, 19°42'E).

GEYER (1917: 82)

Locality: Otwock near Warsaw (52°07'N, 21°19'E), Płock (52°33'N, 19°42'E).

Remarks: *C. vindobonensis* is expanding along the Vistula River.

POLIŃSKI (1917: 30, 62)

Locality: Płock (slopes of Cathedral Mountain) (52°33'N, 19°42'E).

Remarks: W. Poliński did not find *C. vindobonensis* either in Otwock or in the museum collections in Warsaw, and thus suspected that the species had been misidentified by A. Ślósarski. Poliński described four specimens of *C. vindobonensis* from the collections of the Museum of Industry and Agriculture in Warsaw, collected in 1904 in Płock. In 1913 K. Demel (BŁĘDOWSKI & DEMEL 1913) pointed to a locality of the species on the slopes of the Cathedral Mountain w Płock. Poliński regarded *C. vindobonensis* as a permanent component of the Vistula-related fauna in Płock.

POLIŃSKI (1924: 246)

Localities: Otwock (52°07'N, 21°19'E), on the Świder River, Modlin (52°27'N, 20°40'N), Płock (52°33'N, 19°42'E).

FELIKSIĄK (1933: 55)

Locality: Warsaw (52°12'N, 21°02'E).

Remarks: A locality of *C. vindobonensis* was found on the left bank of the Vistula near the River Pumping Station. Empty shells were found in wet areas on 18.10.1930, 22.08.1931, 17.06.1932.

JANKOWSKI (1933: 100, 101, 103)

Localities: Warsaw (Citadel slopes, Młociny district, Saska Kępa district – the Vistula outwash, Wilanów district – cemetery) (52°12'N, 21°02'E), Mt. Kalwaria (cemetery, near Saint Anthony Chapel) (51°59'N, 21°14'E).

Remarks: A. Jankowski believed that *C. vindobonensis* was alien to Warsaw, accidentally introduced with seeds or plants, or by birds. The localities near the Vistula were places in which any species brought by the river during floods, even from very remote sites, could live. The Vistula transports various objects from the upper section of the river, e.g. environs of Kazimierz, where the species is abundant. The Praga

plain (including sites: Saska Kępa district – the Vistula outwash, Wilanów district – cemetery) with its mean altitude of ca. 85 m a.s.l., exists by virtue of fluvial deposits. It is forested in the north, and the remaining parts are meadows, peatbogs and sand dunes. As a result of the area being drained, it is not a natural habitat. The Warsaw plain (including sites: Mt Kalwaria – cemetery near Saint Anthony Chapel, Citadel) was completely developed within the 1916 city boundaries, except for a few gardens, and now provides no adequate habitats for *C. vindobonensis*.

KUNTZE & NOSKIEWICZ (1938: 271)

Locality: S. of Warsaw (52°12'N, 21°02'E).

Remarks: Along the Vistula *C. vindobonensis* occurs in isolated localities.

MICHEJDA & URBAŃSKI (1958: 351)

Locality: Płock (52°33'N, 19°42'E).

ABRASZEWSKA-KOWALCZYK et al. (2002: 17).

Locality: Brudzeński Landscape Park (between Cierszewo and Biskupice) (52°59'N, 19°59'E).

Remarks: *C. vindobonensis* occurred in a dry xerothermic scrub.

#### **Łódzkie**

BERGER (1958: 71)

Locality: Węże (51°05'N, 18°47'E).

BERGER (1961: 89)

Locality: Węże (51°05'N, 18°47'E).

#### **Dolnośląskie**

MERKEL (1894: 85)

Locality: Wrocław (51°06'N, 17°02'E).

#### **Opolskie**

MERKEL (1894: 85)

Locality: Zakrzów near Gogolin (50°30'N, 18°02'E).

GEYER (1909: 46)

Locality: Zakrzów near Gogolin (50°30'N, 18°02'E).

POLIŃSKI (1917: 10)

Locality: Environs of Gogolin (50°30'N, 18°02'E).

POLIŃSKI (1919: 273)

Locality: Along the Odra River as far as Opole (50°40'N, 17°57'E).

EHRMANN (1933: 145)

Locality: Gogolin (50°30'N, 18°02'E).

GEYER (1927: 92)

Locality: Gogolin (50°30'N, 18°02'E).

POLIŃSKI (1924: 246)

Locality: Along the Odra valley as far as Opole (50°40'N, 17°57'E).

#### **List of publications providing general information on the distribution of *C. vindobonensis***

(The data pertain to the territory of Poland prior to and after 1918, considering the changes of district and region names).

LEHMANN (1870: 96)

Region: Pomerania (no exact localities).

Remarks: The species was found there by Dr. H. Dohrn.

HILBERT (1908: 161)

Region: Western Prussia, Eastern Prussia (no exact localities).

POLIŃSKI (1924: table 4)

Region: Eastern part of the Pomeranian Lakeland (no exact localities).

EHRMANN (1933: 145)

Region: Western Prussia, "Province of Poznań" (no exact localities).

URBAŃSKI (1938b: 204)

Region: Wielkopolska (no exact localities).

Remarks: J. Urbański regards *C. vindobonensis* as accidentally introduced in Wielkopolska, e.g. with shipments of plants; its survival or extinction in the region depends on humans.

URBAŃSKI (1947a: 71)

Region: Wielkopolska (no exact localities).

Remarks: In Wielkopolska the species is becoming increasingly rare.

URBAŃSKI (1947b: 21)

Regions: Pomerania, Kujawy, Wielkopolska (no exact localities).

URBAŃSKI (1947c: 71).

Region: Wielkopolska (no exact localities).

Remarks: The depauperation of the Wielkopolska fauna relates mostly to forest-dwellers. Other victims are some species with different ecological requirements, such as *C. vindobonensis*, a species of dry, warm scrub and airy forest edges. It is becoming increasingly rare.

JAECKEL (1950: 85)

Region: "Province of Poznań" (no exact localities).

URBAŃSKI (1957a: 71)

Region: Wielkopolska (no exact localities).

Remarks: *C. vindobonensis* is an open country species of dry, warm scrub and airy forest edges. It is one of the victims of faunal extinction in Wielkopolska.

URBAŃSKI (1957b: 207)

Regions: along the Vistula River, Wielkopolska, on the Noteć River (no exact localities).

URBAŃSKI (1964: 24)

Region: Wielkopolska (no exact localities).

Remarks: The species is becoming extinct in Wielkopolska.

JACKIEWICZ & KORALEWSKA-BATURA (2000: 223)

Region: Wielkopolska (no exact localities).





KORALEWSKA-BATURA & DZIABASZEWSKI (2000: 229)  
Regions: Eastern Pomerania, along the Vistula valley  
SKUJIENÉ (2002: 5)

Regions: northern and northwestern Poland (no exact localities).

WIKTOR (2004: 278)

Regions: part of the Pomeranian Lakeland, Wielkopolsko-Kujawska Lowland (no exact localities).

## II. LOCALITIES FROM MASTER'S DISSERTATIONS

### Pomorskie

KOŁODZIEJ (1970: 64)

Localities: Gniew (53°50'N, 18°50'E), Tymawa (53°50'N, 18°50'E).

Remarks: *C. vindobonensis* was collected in Gniew on 16.08.1969, in Tymawa on 10.08.1969 among young willows on the Vistula bank.

### Kujawsko-Pomorskie

KOŁODZIEJ (1970: 64)

Localities: along the Vistula as far as Sartowice (53°26'N, 18°34'E), on the Noteć and Bydgoski Canal (cited after URBĄŃSKI 1935).

### Mazowieckie

KOŁODZIEJ (1970: 64)

Locality: along the Vistula.

Remarks: *C. vindobonensis* has isolated, local occurrences along the Vistula up to the Bug mouth (cited after URBĄŃSKI 1935).

### Dolnośląskie

JURCZYK (1960: 21)

Locality: Wrocław (51°06'N, 17°01'E).

Remarks: cited after MERKEL (1894)

### Opolskie

JURCZYK (1960: 21)

Locality: Gogolin (50°30'N, 18°01'E).

Remarks: cited after MERKEL (1894)

## III. LOCALITIES BASED ON MUSEUM COLLECTIONS

### A. Museum and Institute of Zoology, Polish Academy of Sciences, Warsaw

#### Kujawsko-Pomorskie

Label: "det. A. Riedel, Kulin ad Włocławek, high Vistula bank, dry slopes [52°40'N, 19°08'E], 27.V.1954, leg. A. Riedel" – 3 specimens.

Label: "Dobrzyń on the Vistula, Zamkowa Mt. (right bank) [52°38'N, 19°20'E], 9.08.2008, leg. D. Mierzwa, det. D. Mierzwa" – 2 specimens.

Label: "Włocławek (right bank) [52°39'N, 19°06'E] 9.08.2008, leg. D. Mierzwa, det. D. Mierzwa" – 2 specimens.

#### Wielkopolskie

Labels: "Kujawy, district Konin: between Łężyn and Mikorzyn, white shore of the Mikorzyńskie Lake [52°20'N, 18°18'E], 20. VII 1918, leg. W. Poliński"; "coll. Wł. Poliński, 228/37" – 17 specimens.

#### Mazowieckie

Label: "Zakroczym north of Warsaw [52°26'N, 20°38'E], collected by J. Z. Różycki, 1926, identified by W. Poliński" – 1 specimen.

Label: "Warsaw, slope of the Citadel on the Vistula (vegetated) [52°18'N, 20°56'E], V 1928, collected by A. Jankowski" – 1 specimen.

Label: "Płock, Vistula bank [52°33'N, 19°42'E], 2. VI. 38, leg. R. Skobejko, det. Dr St. Feliksiak, 123[gift]/38[year]" – 4 specimens.

Label: "Warsaw near Syrena club upstream of the Poniatowski bridge, left bank of the Vistula, osier bed [52°18'N, 20°56'E], 29. VII 1939, leg. A. Goljan, det. Dr St. Feliksiak, 102[gift]/39[year]" – 1 specimen.

Label: "1957, det. A. Riedel, 208[gift]/34[year], 28-V-31 Zakroczym, high Vistula bank, grassy gorge slopes [52°26'N, 20°38'E], leg. M. Wienlich" – 3 specimens.

Label: "Górki, flood plain at Świder outlet to the Vistula (right bank), nature reserve area [52°06'N, 21°12'E], leg. D. Mierzwa, 25.05.2005, det. D. Mierzwa" – 2 specimens.

Label: "Skurcza, Vistula flood plain (right bank), by road No 801 [51°49'N, 21°25'E], 19.05.2006, leg. D. Mierzwa, det. D. Mierzwa" – 3 specimens.

Label: "Wilkówiec ad Czerwińsk on the Vistula, slopes of the Vistula escarpment, 15.08.2006 [52°23'N, 20°23'E], leg. T. Huflejt et A. Liana, det. D. Mierzwa" – 3 specimens.

Label: "Wyszogród, high grass, shrubs on the Vistula escarpment [52°23'N, 20°12'E], 15.08.2006, leg. T. Huflejt et A. Liana, det. D. Mierzwa" – 1 specimen.

Label: "Zakroczym, Vistula flood plain (right bank), 500 m west of the bridge on the Vistula River [52°26'N, 20°38'E], 10.08.2006, leg. D. Mierzwa, det. D. Mierzwa" – 3 specimens.

Label: "Zakroczym, Vistula escarpment, slopes overgrown with trees near Rybacka street [52°26'N, 20°38'E], 15.08.2006, leg. T. Huflejt et A. Liana, det. D. Mierzwa" – 3 specimens.

Label: "Murzynowo, high shrubs on the Vistula slopes [52°35'N, 19°30'E], 20.08.2006, leg. T. Huflejt, det. D. Mierzwa" – 2 specimens.

Label: "Łomna, Vistula flood plain (left bank) [52°23'N, 20°47'E], 22.08.2006, leg. A. Eibich, det. D. Mierzwa" – 3 specimens.

Label: "Łomna Las, Vistula flood plain (left bank) [52°22'N, 20°47'E], leg. D. Mierzwa, 24.08.2006, det. D. Mierzwa" – 3 specimens.

Label: "Warszawa, Vistula flood plain (right bank), between Railway Bridge and Poniatowski Bridge [52°18'N, 20°56'E], 30.04.2008, leg. D. Mierzwa, det. D. Mierzwa" – 3 specimens.

Label: "Ostrówek, Vistula flood plain (right bank) [51°59'N, 21°14'E], 15.07.2008, leg. D. Mierzwa, det. D. Mierzwa" – 4 specimens.

Label: "Przyłek near Zwolen [51°18'N, 21°45'E], 15.07.2008, leg. T. Huflejt, det. T. Huflejt" – 2 specimens.

Label: "Otwock Wielki, Vistula flood plain (right bank) [52°03'N, 21°16'E], 26.07.2008, leg. D. Mierzwa, det. D. Mierzwa" – 3 specimens.

Label: "Toruń, Glinki district [52°57'N, 16°33'E], 15.08.2008, leg. A. Liana, det. D. Mierzwa" – 1 specimen.

#### **B. Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Cracow**

##### **Łódzkie**

Label: "Łódzkie" – 2 specimens.

#### **C. Natural History Museum, Wrocław University**

##### **Pomorskie**

Label: "Gotuń Lake between Wdzydze and Olpuch, district Kościerzyna [54°01'N, 17°58'E], leg. A. Wiktor, 20.07.1973" – 6 specimens.

##### **Kujawsko-Pomorskie**

Label: "Samostrzel. Dry slope with coniferous forest by the road to Bnin [53°09'N, 17°27'E], leg. et det. A. Wiktor, 17. VII 1952" – 5 specimens.

Label: "Ślesin near Bydgoszcz, dry slope over a railway track [53°10'N, 17°42'E], leg. et det. A. Wiktor, 1952" – 4 specimens.

#### **D. Zoological Collections, Adam Mickiewicz University, Poznań**

##### **Pomorskie**

Label: "Tymawa, osier bed [53°49'N, 18°49'E], 10. VIII 69, leg. det. St. Kołodziej" – 1 specimen.

Label: "Gniew, osier bed by the Vistula River [53°50'N, 18°50'E], 16. VIII 69, leg. det. St. Kołodziej" – 2 specimens.

## **DISCUSSION**

In Poland *C. vindobonensis* has a continuous distribution range in the south-east (cf. map 173 in WIKTOR 2004) and an array of scattered, more or less isolated localities outside this area (cf. Fig. 2). Within the continuous part of its range – the south-eastern uplands – its localities are associated with carbonate rock outcrops (glaize, limestone and dolomitic limestone). The preferred habitats in that part of the range are south-east-, south-, south-west-, east- and west-facing slopes with xerothermic vegetation. The scattered localities in the other part of the range are mainly grouped along large river valleys, where the species mostly lives on alluvial deposits. Only very few sites are outside the river systems (cf. Fig. 2). The distribution of *C. vindobonensis* in this part of the range is largely compatible with the geochemical map of alluvial deposits, showing calcium content in Poland: it is found on deposits with high calcium content. Already some of the early authors suggested a possibility of river dispersal to explain the isolated and sometimes ephemeral character of the river valley populations (KRAUSE 1873, SCHOTT-MÜLLER 1912, POLIŃSKI & DEMEL 1921, JANKOWSKI 1933, URBAŃSKI 1935, KAŻMIERSKI 1972).

Combining the distribution maps, the habitat data, the geological character of the substratum and the data on shell anomalies (MIERZWA 2009a, b, c) it is easy to envisage a repeated dispersal resulting in formation of ephemeral and sometimes also permanent

populations along the river valleys. The bedrock in the carbonate localities within the continuous distribution range is often erosion-cut by water courses. High water flows, which cause quicker erosion of rocks and earlier alluvial deposits, cause also a downstream dispersal of land snails, including *C. vindobonensis*. Most often, such dispersal takes place during floods, spring thaws and during heavy rains; it favours invasion of new areas. During the low flow periods the snails are deposited on the river banks or on alluvial islands (sand deposits). The latter habitats, because of their transitional nature, are only periodic, and transport of snails from such islands onto flood plains is probably rare.

Difficulties implied in occupying the flood plains have a variety of reasons related to topography, mobility, predation and chemistry of the substratum. The river banks may be scarred and locally high and steep (Figs 3, 4). Locally extensive flood plains form a natural obstacle to survival of *C. vindobonensis* (Fig. 5), mainly because of its limited mobility. Bird predation is very likely. Where the newly occupied locations do not meet the biogeochemical requirements, only ephemeral populations are formed. Their extinction is probably often caused also by heavy pollution and by the mainly anthropogenic nature of river banks. An example is the periodic occurrence of *C. vindobonensis* on the left bank of the



Fig. 3. A scarred and steep river bank (Photo D. MIERZWA)

Vistula River, in the Saska Kępa district in Warsaw (JANKOWSKI 1933).

In its river valley localities, *C. vindobonensis* usually occurs within the flood plains (I, II – closer to the river, only sometimes III) and on escarpments formed by the river, cutting through deposits. It is most often found on the following plants: *Glechoma hederacea* L.,

*Chelidonium majus* L., *Rumex acetosa* L., *Plantago major* L., *Rubus fruticosus* L., *Sambucus nigra* L., *Quercus rober* L., *Acer plattanoides* L. and *Salix alba* L., and is especially frequent on stems and leaves of *Solidago virgaurea* L. and *S. canadensis* L. These plants often occur on alluvial deposits.



Fig. 4. A high and steep river bank (Photo D. MIERZWA)



Fig. 5. An extensive flood plain (Photo D. MIERZWA)



Fig. 6. *Cepaea vindobonensis* with deformed shell (Photo D. MIERZWA)

As the snails move to flood plain II and III, the frequency of individuals with deformed shells increases (MIERZWA 2009b, c). Deformations and defects involve the lip or the whole shell and are observed mainly in adults (Fig. 6). In all likelihood the plains farther from the river do not meet the biogeochemical requirements of the species.

The few localities farther from the river valleys (cf. Fig. 2) can not be explained by direct river transport. They may be a result of accidental dispersal by man, from the already colonised flood plains.

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