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1995

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On the composition of species of the Asian Clams *Corbicula* in the Lower Rhine Mollusca: Bivalvia: Corbiculidae

Artzusammensetzung von Körbchenmuscheln *Corbicula* im Niederrhein

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Mit 1 Tabelle und 2 Abbildungen

(Manuskripteingang: 18. April 1994)

Keywords: Mollusca, Bivalvia, *Corbicula*, composition of species, abundance, Lower Rhine

Kurzfassung

In den letzten Jahren haben sich verschiedene limnische Neospezies in europäischen Flußsystemen etabliert. Unter ihnen befinden sich auch einige Formen der vornehmlich im ostasiatischen Raum und im tropischen Afrika verbreiteten Bivalvia-Gattung *Corbicula* MÜHLELDT 1811. Im Rhein wurden bisher zwei Formen festgestellt – *Corbicula fluminea* (O. F. MÜLLER 1774) und *Corbicula fluviatilis* (O. F. MÜLLER 1774) –, deren taxonomischer Status bisher noch konträr diskutiert wird. Diese „Spezies“ finden sich in unterschiedlicher Häufigkeit in dem Gewässer, so daß dieser Artikel nun einige Informationen über die aufgefundenen Formen und deren relative Häufigkeit im Angespül des Niederrheines bei Rheinberg, Kreis Wesel, geben soll.

1. Introduction

Since the mid 1980th members of the family Corbiculidae were found in central Europe in increasing numbers. This family is mainly distributed in the australasian region and is also found in Africa. The northwesternmost range is Anatolia, where *Corbicula fluminalis* (O. F. MÜLLER 1774) occurs. In Europe there is supposed to exist recent populations in the Caucasus Mountains (ILLIES 1978). While nowadays this species is extinct in central Europe, it is regarded as a leading species sensu lato of the interglacial period 230,000 years ago (SCHÜTT 1990).

The populations of *Corbicula fluminalis* in the Near East are stable if not declining (KINZELBACH 1992), while two east asian species have been introduced in central european rivers probably via North-America. The River Rhine probably has been colonized in 1989 (BIJ DE VAATE 1991).

2. Description of species

This paper should not discuss the controversial taxonomic validity of the single forms of *Corbicula*, thus the treated forms *C. fluminea* and *C. fluviatilis* are not acknowledged throughout (MORTON, 1977). Despite the question, if *C. fluminea* and *C. fluviatilis* are true species, it seems, that both forms occur together more or minder unmixed. The origin of the two forms is East Asia, especially China, from where they have been displaced to North America.

2.1 *Corbicula fluminea* (O. F. MÜLLER 1774)

This species is characterized by its irregular concentric ledges, which are separated by broad intervals. These borders have a density of 7–8 per cm (ALF 1992). The interior of the shell is white, sometimes tinged with blue. The shape of the shells is slightly asymmetric.

2.2 *Corbicula fluviatilis* (O. F. MÜLLER 1774)

The shell of this species is somewhat higher than broad, with a proportionally inflated umbo. The concentric ledges are regular with small intervals, so that there are 13–15 per cm (ALF 1992)¹.

¹ It is presumed, that the given description of *Corbicula fluminalis* refers to the *C. fluviatilis* of KINZELBACH 1991. The figure in ALF 1992 shows similarity with KINZELBACH'S *fluviatilis*, and a comparison with material of the collection of the University of Bielefeld supports this assumption.

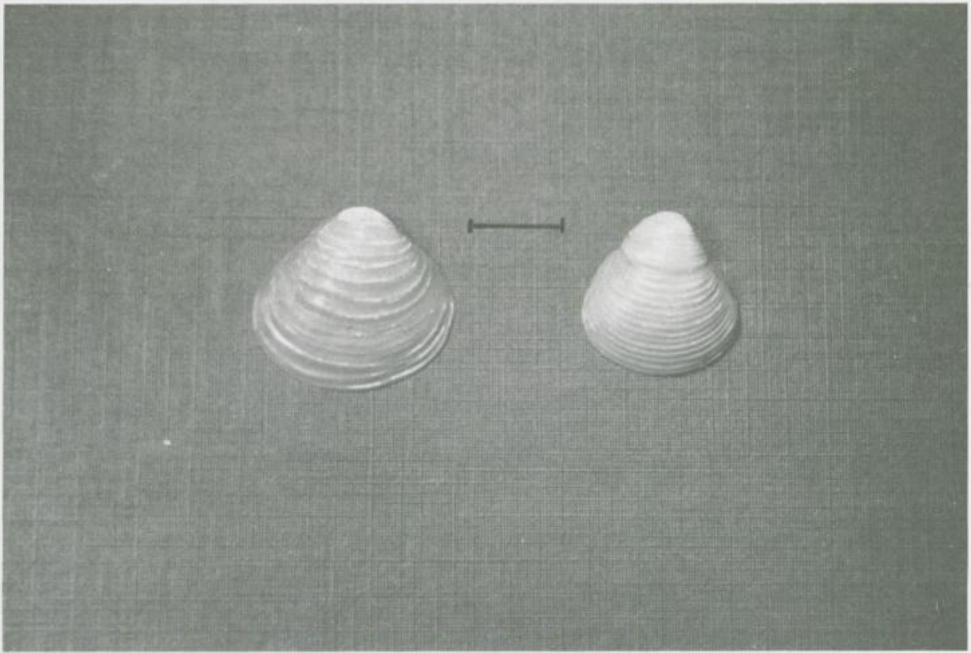


Figure 1. *Corbicula fluminea* (left) and *C. fluviatilis*, right valves from exterior, scale bar represents 1 cm

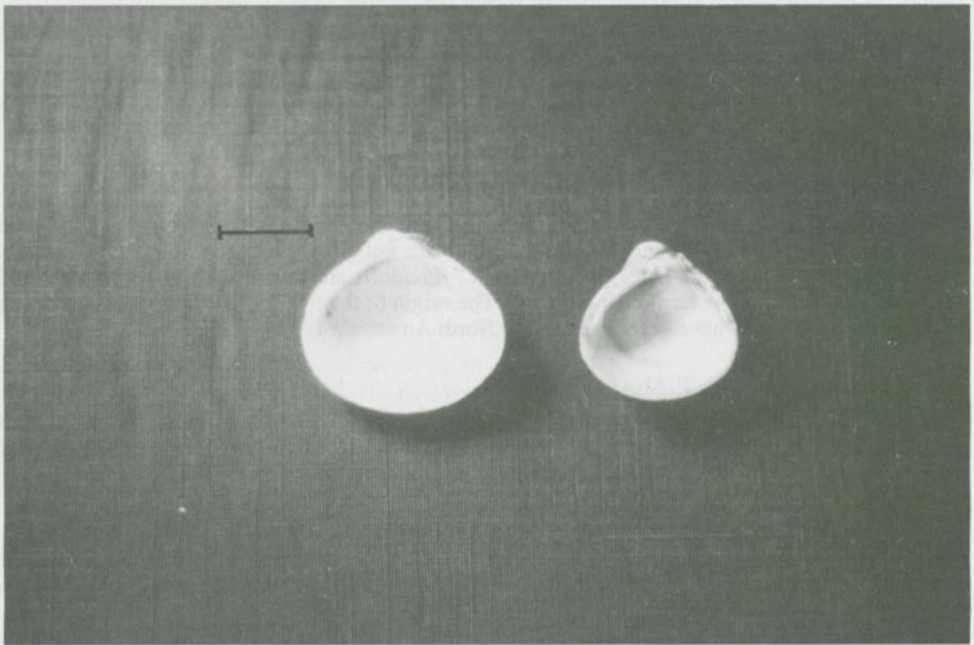


Figure 2. *Corbicula fluminea* (left) and *C. fluviatilis* right valves from interior, scale bar represents 1 cm

The coloration of the interior part of the valve is strongly blue-lilac. The umbo is conspicuously bent forward, stressing the asymmetry of the shell.

An illustration of both species is given in figure 1-2.

3. Sampling range and composition of species

The examined material was collected on a sandbank near the township Rheinberg-Orsoy (FRG) on the left bank of the River Rhine. The sampling took place from this site up to the landing place of the Rhine ferry Orsoy-Walsum around kilometre mark 793. The two samplings were executed in November 1992 and in March 1993. In autumn '93 only shells of the discribed sandbank near the town centre of Orsoy were collected. The bank showed plentiful flowed material because of the Low water level of the river. All valves of *Corbicula* spread abroad were collected for examination. The flowed material also consisted of other shells of Mollusca, among them several Bivalvia species were found. Save the *Corbicula* species, in part still alive, mentioned above empty shells of *Dreissena polymorpha* (PALLAS 1771), *Sphaerium corneum* (LINNEAUS 1758), *Pisidium henslowianum* (SHEPPARD 1823), *Pisidium supinum* SCHMIDT 1851, *Anodonta anatina* LINNEAUS 1758 and *Unio pictorum* (LINNEAUS 1758) could be identified. Some specimens of *A. anatina* and *U. pictorum* seemed to be still alive or they had died a short time ago.

In spring 1993 *A. anatina* appeared in some cracked valves. Among the Bivalvia the Corbiculids were the most abundant, in an estimation more than 50 per cent of the pieces washed ashore.

The two bigger species *A. anatina* and *U. pictorum* each were represented by less than 10 specimens.

See table 1 for further information about the examined Corbiculid species collected in March '93 (in brackets November 1992).

4. Analysis of the collected material

The examined shells of *Corbicula* do not show any deformities. They are specified as members of the two in No. 2 described species, in contrast to other literature, where they are named as the oriental *Corbicula fluminalis*. They obviously differ in the uniform concentric borders and their higher density in the found material in comparison with *Corbicula fluminalis*. The two species show the following characteristics:

The average shells of *Corbicula fluminea* are 18 mm broad, the biggest specimens have a breadth of 22 mm and a height of 20 mm. The convexity is about 15 mm. The approximate age of the bigger individuals is 3 years, referring to the age classes ascertained at the Potomac River population in the USA (BIJ DE VAATE 1991).

The proportions of the valves of *Corbicula fluviatilis* are somewhat different. The shells are 17 mm broad and 17.5 mm high in maximum, whereat the convexity amounts to 13 mm. This specimen is about 3 years old (see above).

Therefore the devoted dependence of height to breadth shows a curve of *C. fluviatilis* which is located above that of *C. fluminea*. This fact fulfils the demanded distinction of the upper description of species. The lack of cross-links concerning proportions and bordering as well stresses an occurrence of both species in the lower River Rhine. As a result of the voluminous sample in March 1993, *C. fluminea* seems to be more abundant in this area than *C. fluviatilis*, the proportion between the two species is 3 : 1. This result makes it possible to draw the conclusion that *C. fluminea*

Table 1. Surview on the examined material, collection 3.93 and 11.92 (in brackets) 2 in part still alive

	total number		<i>C. fluminea</i>		<i>C. fluviatilis</i>	
single valves	101	(15)	79	(14)	22	(1)
double valves	97	(14)	66	(13)	31	(1)
complete animals ²	17	(12)	16	(8)	1	(4)
total	215	(41)	161	(35)	54	(6)

² in part still alive

has a higher abundance. However, the certain amount of chance in the composition of the flowed material makes it impossible to predict the real abundance of both species. Using the χ^2 -test, an equal distribution of *C. fluviatilis* and *C. fluminea* has to be refused with a = 1 % error propability. Indeed, the sample in autumn '92 stresses a higher abundance of *C. fluminea*, but the sampling size was too small to draw further conclusions. The material used for statistical examination is listed in table 1.

At least it seems interesting that *Corbicula* species amount a considerable quantity of shells on the river bank, they were even more abundant than *Dreissena polymorpha*, another species of Bivalvia of respective size, which had invaded the River Rhine in the last century (TITTIZER et al., 1993). To solve one of these questions, further examinations seem to be necessary.

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Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Decheniana](#)

Jahr/Year: 1995

Band/Volume: [148](#)

Autor(en)/Author(s): Leistikow Andreas

Artikel/Article: [On the composition of species of the Asian Clams Corbicula in the Lower Rhine Mollusca: Bivalvia: Corbiculidae 111-114](#)