# The chromosomes of Anodonta anatina (Linnaeus, 1758) and Unio pictorum (Linnaeus, 1758) (Mollusca, Bivalvia: Unionidae)

by

G.A. VAN GRIETHUYSEN (1), B. KIAUTA (1) and L.J.M. BUTOT (2)

(1) Institute of Genetics, University of Utrecht, Utrecht, Netherlands and (2) State Institute for Nature Conservation Research (RIVON), Zeist, Netherlands

RIVON-Communication No 312

## INTRODUCTION

In his paper on the male meiosis of *Sphaerium corneum* Keyl (1956) stated that the high chromosome numbers and relatively small nuclei make a satisfactory cytotaxonomic analysis of the Unionidae impossible. This is probably the reason that none of the European unionids has ever been studied cytotaxonomically. In view of the great phenotypical variation and complicated infraspeciation in the genera *Anodonta* and *Unio* (cf. Haas, 1940) the lack of any attempt of a cytological approach to the taxonomic problems in this family is all the more remarkable. Nevertheless, as early as 1941 Franz suggested hybridisation, serology and cytotaxonomy to be the most appropriate approaches to the problems of the inter- and infraspecific separation within these genera.

So far only two workers have dealt with the cytology of the Unionidae. Lillie (1901) has studied the American species *Lasmigona (Pterosyna) complanata* (Rafinesque) (under the name of *Unio complanata*, which, incidentally, is not a synonym of the European *Pseudanodonta complanata* (Rossmässler, 1835)) and reported its haploid chromosome number as n = 16. Stroganova (1963) studied the spermatogenesis of *Anodonta anatina* (Linnaeus, 1758) (= *A. piscinalis* Nilsson, 1822), but did not report any chromosome numbers, nor did she publish any analysable photographs or karyograms. From her illustrations neither the karyotypic morphology nor the chromosome number of the Russian population studied, can be ascertained.

For these reasons we believe it worthwhile to report briefly on our observations on Dutch material, though, apart from the chromo-

some number and a few notes on the morphology of the mitotic metaphase chromosomes, nothing can be said as to the meiotic behaviour.

## ACKNOWLEDGEMENTS

The mussels were collected by Mr. C. Karnekamp, Diemen, who kindly put the material at our disposal. The work has been carried out in the Institute of Genetics, University of Utrecht, Netherlands. Our thanks are due to the Head of the Dark Room of the institute, Mr. Dick Smit and to the photographer, Mr. Piet Brouwer, who have taken care of the drawings and photographs respectively.

## MATERIAL AND METHODS

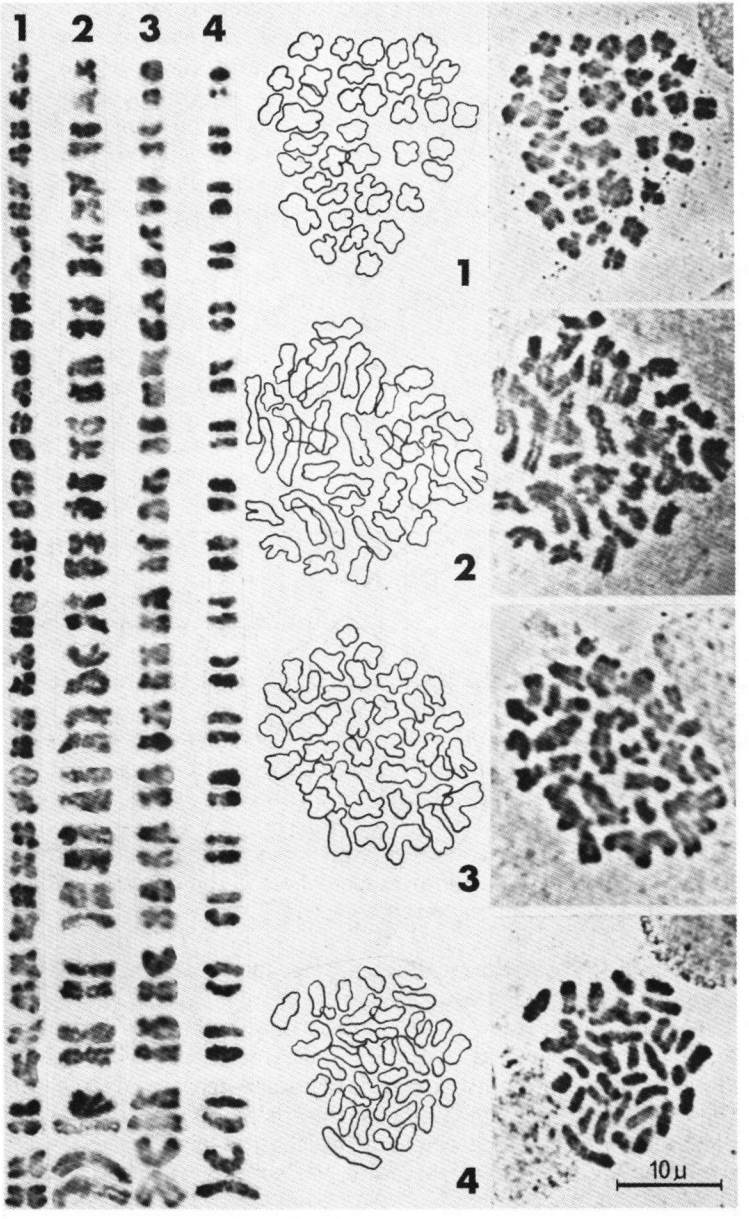
The mussels were collected at Diemen, in the Diemen Lake, (Province of Noord-Holland, Netherlands) in September, 1967 and were kept in an aquarium at room temperature until dissection in February, 1968.

Several dozens of specimens were dissected, but only in a few of them any mitotic activity could be observed. In the freshly expelled glochidia (December, 1967) no cell divisions could be found either. The glochidia were examined a few hours up to four days after expulsion.

It has been observed in the course of the work that optimal cell divisions are found only in relatively young specimens.

Our cytological observations are based upon some 50 microphotographs of both species, obtained from preparations of only two animals. Their shell dimensions were as follows: *Anodonta anatina:* length 42.9 mm, height 27.9 mm, thickness 11.6 mm. The same measurements for *Unio pictorum* are 39.2, 17.7 and 12.0 mm respectively. The animals were cut open while submerged in tap water, the foot was removed, and small portions of the gonad tissue were transferred to the slide. In young animals the brownish gland is compact and can be easily found. In older mussels, on the other hand, the generative tissue is dispersed throughout the foot and is overgrown by connective and fat tissue. There are no differences as

Figs. 1-4. Polar views of mitotic metaphases and karyograms of *Unio pictorum* (figs. 1-2) and *Anodonta anatina* (figs. 3-4). X 1500.


1
2
3
4
1
2
3
4
10 µ

to the macroanatomical structure and position of the gland in the two species studied. For fixing and staining the lacto-acetic-orceine squash method was used as described by Butot & Kiauta (1966).

The photographs were taken by a Zeiss automatic photomicroscope using phase contrast lenses, 100 x oil immersion objective (n.a. 1.25), 8 x oculars, green filter and Agfa IFF panchromatic film. The positives were printed originally at a scale of 2250 and in this paper are reduced to the scale of 1500 x.

## OBSERVATIONS

The diploid chromosome number of both species studied is 2 n = 38, but no clear meiotic figures were available in our material.

The figures of mitotic metaphases and the karyograms are given in figs. 1-4 (*Unio pictorum:* figs. 1-2, *Anodonto anatina:* figs. 3-4). The mitotic metaphase chromosomes are of decreasing magnitude. Their lengths are given in Table 1.

| Species | Karyogram No. | Longest pair ($\mu$) | Shortest pair ($\mu$) | Mean value ($\mu$) | |
|---|---|---|---|---|---|
| | | | | longest | shortest |
| *A. anatina* | 3 | 5.3 | 1.7 | 5.6 | 1.6 |
| | 4 | 5.9 | 1.5. | | |
| *U. pictorum* | 1 | 4.0 | 1.6 | 5.8 | 1.9 |
| | 2 | 7.6 | 2.2 | | |

Table 1. Length of the mitotic metaphase chromosomes in *Anodonta anatina* and *Unio pictorum*.

There is no significant difference in the total length of the chromosomes between the two species.

The arm ratios could be determined only with great difficulty. Their values, as obtained from the karyograms on figs. 1-4, are given in fig. 5. In *Anodonta* the longest chromosomes have clearly a higher arm ratio than in *Unio*. Apart from this, the chromosomes are very similar in both species. It is remarkable that the highest and lowest ratios too, occur in both species at the same or almost the same places.

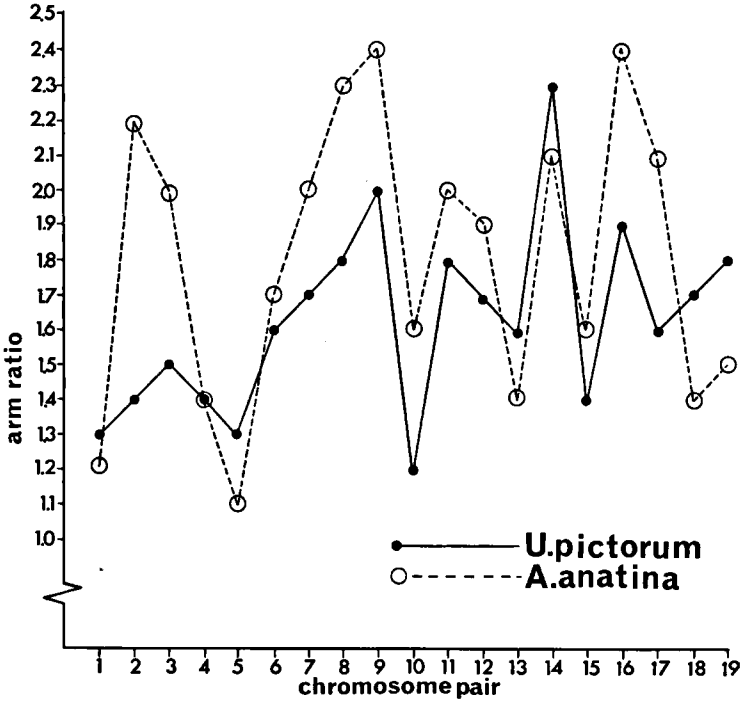



Fig. 5. Arm ratios of mitotic metaphase chromosomes of *Unio pictorum* and *Anodonta anatina*.

## DISCUSSION

The position of the centromere in the 2nd and 3rd pairs and in the 17th and 18th pairs (in direction of decreasing magnitude) of the mitotic metaphase chromosomes is the only obvious morphological difference between the karyotypes of *Unio pictorum* and *Anodonta anatina*. For this reason it seems unlikely, at least at present, that any significant cytological differences exist between different races and/or populations of the same species. As to the chromosome number of *Lasmigona complanata* the count of Lillie (1901) needs confirmation.

It seems, at present, that the Unionidae are very uniform cytologically. With the present state of our knowledge, it is to be

expected that classical comparative cytotaxonomy could reveal only minor variations in the chromosome morphology of lower taxa within this family.

## REFERENCES

BUTOT, L.J.M., & B. KIAUTA, 1966. Notes on the cytology of Rissoacea I. Cytotaxonomical conditions in some Hydrobiidae and Assimineidae. Basteria 30 : 21-34.

FRANZ, V., 1941. Anodonta-Bemerkungen im Anschluss an meine Anodontenarbeit von 1939. Arch. Moll. 73: 201-220.

HAAS, F., 1940. A tentative classification of the palearctic Unionids. Zool. Ser. Field Mus. Nat. Hist. 24 : 115-141.

KEYL, H.G., 1956. Beobachtungen über die männliche Meiose der Muschel Sphaerium corneum. Chromosoma 8 : 12-17.

LILLIE, F.R., 1901. The organization of the egg of Unio, based on a study of its maturation, fertilization and cleavage. J.Morph. 17 : 227-292.

STROGANOVA, N.S., 1963. Some pecularities of spermatogenesis in some double folding molluscs (Unio, Anodonta, Mya). Vestn. Mosk. Univ. Ser. Biol., No. 6: 25-34.