Number and Behaviour of Chromosomes in *Aphiochaeta xanthina* Speiser

The study of chromosomes in *Diptera* offers several interests, also because of the variety of processes observed during spermatogenesis. The most important cases can be summarized as follows:

(1) Meiosis with chiasmata (Culicinae[1], some other *Nematocera*, as e.g. *Dicranomyia*, *Tendipes*[2], etc.);

(2) meiosis with pairing, but completely devoid of chiasmata (*Penthetria*, etc.[2], *Phryne*[3]), or with chiasmata only in sex chromosomes (*Drosophila melanogaster*[4]);

(3) meiosis without pairing, or with pairing without chiasmata restricted to small segments (*Melophagus*[5] and other parasitic forms).

Fig. 1.—Metaphase plate of gangliar cell (enlargement 1200:1).

It may be added that for *Phryne fenestralis*[6] we know that lack of chiasmata corresponds to lack of crossing-over: a similar correspondence fails to be so clear in the male of *D. melanogaster*[7]. The present investigation on the chromosomes of *Aphiochaeta xanthina* Sp. (Phoridae) is justified by the ease with which this species can be kept in culture and submitted to genetical research[8]. Meiosis of *Aphiochaeta* has been previously investigated by TOKUNAGA[9], who found 5 chromosomes in the diploid cells. This counting is not supported by the present investigation. Nevertheless, we do not dispute TOKUNAGA's results, because it is uncertain whether the material studied by us and by TOKUNAGA belongs to the same species.

Our observations are based on smears, stained both with aceto-carmine and with acetic orcein, and deal with the mitosis of gangliar and gonial cells in both sexes, and with the male meiosis.

(1) Somatic mitosis has been studied in larval ganglia, recording separately the males and females, owing to the differences (size, etc.) between sexes.

The metaphase shows 10 telomitic elements of uniform length (about μ 4–5) (Fig. 1). They have a strong terminal attraction, thus forming V-shaped groups, where the attracting ends are often evidently crossed or slightly separated (Fig. 2). Exceptionally, the metaphase chromosomes can be overcontracted, always 10 in number, and without somatic pairing (Fig. 3). The telophases are sometimes so clear as to show that the number of elements assembling at each pole is 10. Between male and female cells, no difference in chromosome number or shape can be detected.

Fig. 2.—Metaphase plate of gangliar cell (enlargement 1200:1).

The chromatin of the resting nucleus is filamentous, and does not show any heteropycnotic mass. A nucleolus

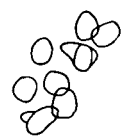

Fig. 3.—Prometaphase of gangliar cell: overcontracted chromosomes (enlargement 1200:1).

is often visible. The gonial mitoses show the same phaenomena as the gangliar nuclei.

(2) Meiosis. Leptotene and zygotene do not show any interesting features. Pachytene, on the contrary, is peculiar for its clearness: five great filaments are present, with chromomeres generally not easily distinguishable.

Fig. 4.—Pachytene (enlargement 1200:1).

In some portions, not localized, the pairing is incomplete (Figs. 4, 5). No heteropycnotic mass is visible.

Fig. 5.—One element of pachytene (enlargement 1200:1).

[1] H. G. CALLAN and G. MONTALENTI, J. Gen. *48*, 119 (1947).
[2] E. B. WOLFF, Chromosoma *2*, 192 (1941).
[3] E. B. WOLFF, Chromosoma *4*, 148 (1950).
[4] C. D. DARLINGTON, Genetics *19*, 95 (1934). – K. COOPER, J. Morph. *84*, 81 (1949).
[5] K. COOPER, J. Morph. *84*, 81 (1949).
[6] K. COOPER, Proc. Nat. Acad. Sci. *27*, 109 (1941).
[7] H. BAUER, Biol. Zbl. *65*, 108 (1946).
[8] C. BARIGOZZI and L. SEMENZA, Amer. Nat. *000*, 123 (1952). – L. SEMENZA, Rend. Ist. Lomb. Sci. Lett. (in press).
[9] C. TOKUNAGA, Jap. J. Genet. Sup. Vol. *2*, 69 (1949); Jap. J. Genet. *24*, 128 (1949); D. I. S. *24*, 79 (1950).

The diplotene is typical, and all gemini show some chiasmata, which, at the end of the stage, appear fully terminalized. Figure 6 shows an intermediate stage, where terminalization is already strong.

Fig. 6.—Diplotene (enlargement 1200:1).

The micrograph of Figure 7 presents a diakinesis with 5 gemini: all extremities are still in contact. Only in one body at the right, a chiasma is visible.

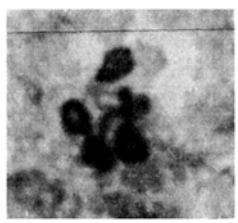

Fig. 7.—Late dyakinese (micrograph; enlargement 1500:1).

After the diakinesis, a strong contraction takes place which transforms each geminus into an oval body. The second division is characterized by 5 V-shaped elements, because the sister chromatids are still linked by means of the undivided centromere, which is located at the end of each chromosome (Fig. 8).

Fig. 8.—II Division: metaphase (enlargement 1200:1).

From these observations the following conclusions are justified:

(1) The diploid chromosome number is 10, the haploid being 5. All V-shaped bodies observed during the diploid mitoses must be interpreted as produced by a terminal synapsis between homologous chromosomes.

(2) All chromosomes are telomitic, and no difference among pairs can be observed. No sex chromosomes are distinguishable. Pairing is normal, and chiasmata occur at diplotene, which terminalize during diakinesis.

(3) The division of centromeres, in all studied cases, occurs in the second division.

(4) No heteropyknotic chromatin has been detected.

From all these facts, the chromosome phenomena during meiosis make it possible to ascribe *Aphiochaeta xanthina* to such *Diptera* as Culicinae and some other *Nematocera* whose meiosis is normal, comprising pairing and chiasmata. This leads us to expect normal disjunction and crossing-over.

The number of chromosomes determined in this material does not agree—as already remarked—with that found by TOKUNAGA, but we do not know whether the species *Aphiochaeta xanthina* was studied in his experiments.

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Riassunto

Gli autori descrivono i fenomeni cromosomici durante la mitosi e la meiosi maschile di *Aphiochaeta xanthina* Sp., e dimostrano che il numero aploide è 5. La meiosi maschile mostra appaiamento pachitenico e chiasmi al diplotene.

Non si sono notati cromosomi eterocromatici.

Die Beeinflussbarkeit sekundärer Geschlechtsmerkmale von *Oniscus asellus* durch die Gonaden

Die starke Abhängigkeit der sekundären Geschlechtsmerkmale von den Gonaden bzw. von deren Hormonen ist für die meisten Wirbeltiere eine seit langem gesicherte Tatsache. Bei den Wirbellosen, und speziell bei den Arthropoden, liegen die Dinge hingegen wesentlich anders[1]. Hier sprechen die vorliegenden Befunde entweder (Insekten) für eine von der Gonade weitgehend unabhängige Differenzierung dieser Merkmale, oder es liegen (andere Arthropodengruppen) noch so gut wie keine eindeutigen Ergebnisse vor. Die wenigen in dieser Richtung an Crustaceen durchgeführten Arbeiten blieben meist erfolglos[2] oder erlaubten doch keine sicheren Schlüsse[3]. Lediglich CHARNIAUX[4] gelang es kürzlich, zu zeigen, dass die normale Ausbildung der Oostegiten-Randbeborstung reifer ♀♀ von *Orchestia gammarella* offensichtlich in Abhängigkeit vom Ovar erfolgt.

Da eingehende genetische Untersuchungen über den Geschlechtsbestimmungsmodus der Landasseln[5] nun gezeigt hatten, dass gerade bei dieser Gruppe eine auffallende Heterogenität und zum Teil auch Labilität in der Geschlechtsdifferenzierung besteht, lag es nahe, Vertreter gerade dieser Krebse für operativ-experimentelle Untersuchungen heranzuziehen. Es wurde daher bei der Mauerassel *Oniscus asellus* versucht, durch Kastrations- und Transplantationsversuche einen tieferen Einblick in die ursächliche Bedingtheit der Geschlechtsunterschiede zu gewinnen. Da die Tiere Verletzungen des Körpers gegenüber recht empfindlich sind, bereitet die Operationstechnik gewisse Schwierigkeiten, die sich jedoch durch geeignete Methoden umgehen liessen. Trotzdem blieb die Absterberate in allen Versuchsreihen relativ hoch (60–90%), so dass mit ziemlich grossen Individuenzahlen gearbeitet werden musste, um zu einem Erfolg zu kommen.

Bisher konnten folgende Ergebnisse erzielt werden:

[1] W. v. BUDDENBROCK, *Vergleichende Physiologie*, Bd. 4 «Hormone» (Verlag Birkhäuser, Basel 1950).

[2] H. STAMATI, Bull. Soc. Zool. *13*, (1888). – H. PRZIBRAM, Arch. Entwicklungsmech. *43*, (1917).

[3] V. HAEMMERLI-BOVERI, Z. vergl. Physiol. *4*, 668 (1926). – M. L. LE ROUX, Bull. Biol. Suppl. *16*, 1 (1933). – H. G. CALLAN, J. exper. Biol. *17*, 168 (1940).

[4] H. CHARNIAUX, C. r. Acad. Sci. *234*, 2570 (1952).

[5] G. DE LATTIN, Z. Vererbungslehre *84*, 1 (1951); *84*, 536 (1953).