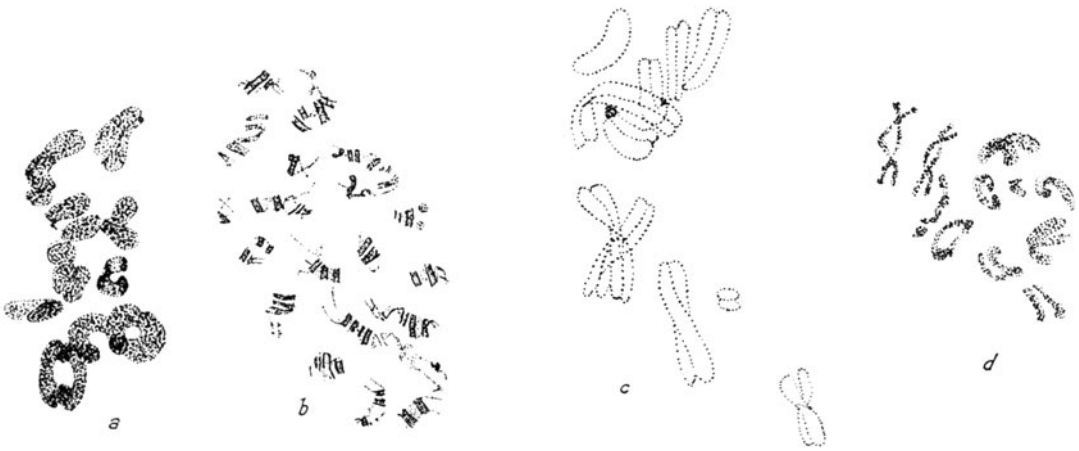

Chromosomen aus den verschiedenen Geweben der Heuschrecken. *a, b* aus *Oedipoda*, *c, d* aus *Anacridium*. *a* und *c* sind meiotische Chromosomen, *b* stellt die Chromosomen aus den Kernen der jede Hodenausstülpung umschliessenden Membran dar, *d* stammt aus Darmmuskelzellen.

junger *Chironomus*-Larven oder in verschiedenen Geweben derselben Larve oder aber den Malpighischen Organen von verschiedenen äusseren Bedingungen ausgesetzten Larven vergleicht, so sieht man, dass nicht nur ihre Länge und Breite, sondern auch ihre Bänderung, Spiralisierung, die Lage der heterochromatischen Regionen und des Nukleolus von Fall zu Fall variiert[1]. Selbst BEERMANN[2], der unsere Ansicht über die Variabilität der Strukturierung der Riesenchromosomen nicht teilt, gibt zu, dass Unterschiede von Gewebe zu Gewebe vorhanden sind, die er als Modifikationen bezeichnet. Man kann auch bei anderen in ihren Zellen Riesenchromosomen nicht enthaltenden Organismen ähnliche, wenn auch nicht so deutlich ausgeprägte Unterschiede in den Kernen verschiedener Gewebe beobachten. Sofern es sich um Unterschiede zwischen den Chromosomen verschiedener Gewebe handelt, ist deren Vergleich am leichtesten auf dem Metaphasestadium durchführbar. Es wird nämlich in diesem Fall nur ihre Länge, Breite und der Grad ihrer Nukleinisation verglichen. Als ein Beispiel mögen hier die Chromosomen aus verschiedenen Geweben der Heuschrecken aufgeführt werden. Die in den Teilungen der Geschlechtszellen beobachteten Chromosomen sind deutlich länger und breiter als die in somatischen Geweben vorkommenden und in endomitotischen Teilungen sichtbaren Chromosomen. Die in den Kernen der jede Hodenausstülpung umschliessenden Membran beobachtbaren Chromosomen der endomitotischen Teilungen sind besonders durch den Mangel an Nukleoproteiden im Vergleich zu den meiotischen ausgezeichnet (Abb.).

Da die Differenzierung eines bestimmten Chromosoms in einem bestimmten Gewebe einer gewissen Variabilität unterworfen ist und sich die Variationsbreiten desselben Chromosoms in verschiedenen Geweben teilweise überdecken können, ist in bestimmten Fällen Identität desselben Chromosoms möglich, sie ist aber nicht die Regel.

In der Literatur der letzten Jahre mehren sich die Angaben, dass mit besonderer Funktion nicht allein Änderungen quantitativer Natur, wie Polyploidisierung, eine Rolle spielen, sondern auch qualitative Veränderungen in Kernen sich differenzierender und spezialisierter Zellen häufig sind. Erinnert sei nur an die Untersuchungen von BARIGOZZI[1] oder an die Tatsache, dass selbst noch im Fettkörper von *Melophagus* entsprechend dem Fettgehalt des Plasmas die Kernstruktur wechselt[2]. Andere Fälle, in denen die Beziehungen zwischen Zelleistung und Besonderheiten im Kernbau besonders deutlich sind, zum Beispiel unterschiedliche Grösse von Chromosomen von Epidermis- und Rindenzellen[3] der gleichen Pflanze, die Besonderheiten der Spiralisation meiotischer Chromosomen oder die sogenannten pseudoendomitotisch sich verhaltenden Chromosomen in den Kernen trichogener Zellen bei *Corixa*[4]. Neben inneren Faktoren, wie in den oben aufgeführten Fällen, können bekanntlich auch äussere Faktoren auf die Struktur der Chromosomen einen tiefgreifenden Einfluss ausüben[5].

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Summary

The chromatic configurations in many cases show certain differences from tissue to tissue and in different developmental stages of the same tissue. Some of these differences are of cyclic nature and appear to be related to the cell function. These morphological variations observed in the chromatic configuration in different types of cells may be the cause rather than the result of different functions.

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Evolutionary Changes in the Chromosome Complement of the Amelinae (Orthoptera : Mantodea)

In the course of a chromosomal survey of Middle-East Mantids it was observed that all species of the genus *Ameles* which were examined, as well as its close relative *Apteromantis*, fit into an evolutionary series as evidenced

by their karyotypes. In addition an intra-specific cytological polymorphism was discovered in the two species of *Ameles* which were investigated on an extensive scale. A more comprehensive population study is now under way, this note including only some preliminary results.

In the Table the chromosomal series of four species are summarized. All of them possess a large submetacentric X chromosome, the sex-determining mechanism being XO:XX. *Apteromantis bolivari* was studied by MATTHEY[1] from one specimen and found to have 28 autosomes, all apparently acrocentric. The same may be true for *Ameles abjecta* (WHITE[2]) although no figures of spermatogonial metaphases or side views of metaphase I were published. The most extensively studied species, *Ameles heldreichi*, shows three chromosomal types occurring side by side. Type A has 26 autosomes, two of which are metacentric. Type B has 27 autosomes, one of them metacentric, whereas type C has 28 acrocentric autosomes. Finally a single male nymph from Cyprus, probably belonging to *Ameles cypria*, was found to have 24 autosomes, four of them metacentric.

Most interesting, of course, is type B of *Ameles heldreichi* with an even diploid chromosome number. In the diploid set only one metacentric and its two acrocentric homologues are present. The behaviour of these three chromosomes in meiosis is striking since they regularly form an autosomal trivalent (Fig. 2) disjoining in anaphase I exactly like the sex-determining trivalent known in a large number of the Mantinae. The two acrocentrics move to one pole and the metacentric to the opposite one. Four types of gametes are expected and these are realised in observing secondary spermatocytes.

It is quite easy to differentiate between the three types of *Ameles heldreichi* by observing the configuration of the elements in the first metaphase of meiosis (Figures 1–3). Bivalents which are formed from two acrocentric chromosomes are always rod-shaped; those formed from two metacentrics are ring-shaped while a trivalent appears as a huge V-shaped element. In the analysis of the larger part of the sample acetic-orcein and aceto-carmine squashes were used. The cytological classing by first metaphases was satisfactory but in many cases also spermatogonial counts were made and sectioned material was utilized. In spermatogonial metaphase plates of types B and A one or two metacentric autosomes, respectively, are readily identified by their size and form resembling that of the X chromosome.

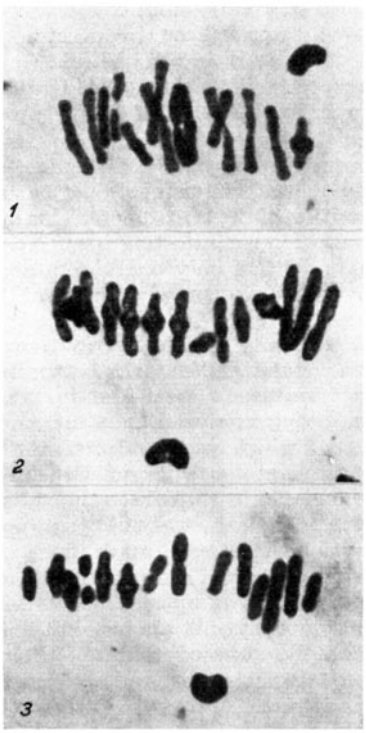
Apart from this type of variation one of the shorter autosomes may be metacentric, instead of acrocentric, in a few individuals. This change must be ascribed to a shift in the position of the centromere. This intrachromosomal reorganization, manifesting itself most clearly at first metaphase, affects only one chromosome in a set and thus gives rise to an asymmetrical bivalent or trivalent.

Ameles heldreichi has a wide distribution in Eastern-Mediterranean countries. In Israel it is found everywhere except in the Southern desert and in the semidesert areas. Our material, analyzed thus far, comprises 225 individuals, 6 of which were collected in Turkey, the remainder in several localities in Israel. Taking the whole sample together it will be seen that 120 individuals (53·3%) belong to type A, 97 (43·1%) to type B and 8 (3·6%) to type C. The type made up exclusively of acrocentric elements is the rarest and was, accordingly, found only in the larger samples. The heterozygous type and the homozygous type A are common in all populations. It should be stressed that no difference, morphological or cytological, was found between the material from Israel and from Turkey, the distance being some 1200 km. This would point to an ancient origin of the intraspecific cytological variation.

[1] R. MATTHEY, Arch. J.-Klaus-Stift. *24*, 114 (1949).
[2] M. J. D. WHITE, J. Genet. *42*, 143 (1941).

Species	Origin	No. of individuals examined	2n ♂	No. of acrocentric autosomes	No. of metacentric autosomes	Metacentric X	No. of chromosome arms	Metaphase I morphology	Author
Apteromantis bolivari Wern. . . .	Morocco	1	29	28	–	1	30	all bivalents rod-shaped	MATTHEY (1949)
Ameles abjecta Cyr.	Southern France		29	28	–	1	30		WHITE (1941)
Ameles heldreichi Br. type C . . .	Israel	7	29	28	–	1	30	all bivalents rod-shaped	Author
	Turkey	1							
Ameles heldreichi Br. type B . . .	Israel	94	28	26	1	1	30	one trivalent, all bivalents rod-shaped	Author
	Turkey	3							
Ameles heldreichi Br. type A . . .	Israel	118	27	24	2	1	30	one ring-shaped bivalent, remainder rod-shaped	Author
	Turkey	2							
Hypothetic			26	22	3	1	30		
Ameles ? cypria Uv.	Cyprus	1	25	20	4	1	30	two ring-shaped bivalents, remainder rod-shaped	Author

An attempt was made to elucidate the probable adaptive value of the different chromosomal types by investigating seasonal changes in their frequencies. This analysis, which is being continued, has so far revealed significant differences between the frequencies of the karyotypes in spring and autumn populations, respectively.



Figures 1–3.–*Ameles heldreichi*, first metaphases of meiosis. Acetic-orcein squashes. × 1900.

Fig. 1.–Type A, one ring-shaped and 12 rod-shaped bivalents.
Fig. 2.–Type B, one trivalent and 12 rod-shaped bivalents.
Fig. 3.–Type C, 14 rod-shaped bivalents.

The Amelinae thus afford a striking instance of a variation in chromosome numbers according to the so-called ROBERTSON's "Law", the number of chromosome arms remaining constant. It seems plausible that the process is actively going on at present since its intermediate stages are preserved intra-specifically, probably owing to differences in the adaptive values of the types involved.

It must be expected that active chromosome evolution, conforming to ROBERTSON's principle, should produce structural heterozygotes of this type, but these were rarely observed. This is the first record for Mantids but similar conditions were reported for a few natural populations of other Orthopterans. Unfortunately most published accounts are based on rather scarce material. A small population of *Hesperotettix viridis*, variable in chromosome numbers, was found by MCCLUNG[1] to include several individuals with trivalents. In *Loxoblemmus arietulus* an intraspecific variation was described[2] and later confirmed[3]. In this case, too, the even chromosome number is maintained by a trivalent. An unpublished thesis[1], mentioned in a recent review on the cytogenetics of the Orthopteroid insects[2], deals with a particular population of *Circotettix undulatus* the members of which also show this kind of polymorphism; the same being true for *Trimerotropis sparsa*[3]. Among ten individuals of three species of the genus *Jamaicana*, which are related according to ROBERTSON's "Law", a single heterozygous one was found[4]. Outside the Orthoptera the Anguiid lizards of the genus *Gerrhonotus* should be mentioned[5]. Although in this instance no meiotic stages with a trivalent were observed, the chromosomal variation within the species investigated suggests that a similar polymorphism might exist.

As regards the group of Mantids the importance of ROBERTSON's rule in their chromosomal changes is indicated by the existence of two additional instances of the same type of intra-specific polymophism as described above. This polymorphism was found in another, yet undetermined, species of *Ameles* and in *Iris oratoria* (author, unpublished).

A full account of this work will be published elsewhere.

I wish to express my gratitude to Dr. E. GOLDSCHMIDT for her interest and helpful criticism. Several taxonomic problems were discussed with Dr. B. P. UVAROV, F. R. S., to whom my sincere thanks are due.

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Résumé

Observations sur la variation intra-spécifique du nombre des chromosomes dans deux espèces du genre *Ameles*. On décrit ici 3 types chromosomiaux apparaissant chez *A. heldreichi*. Les chromosomes de ces 3 types, de même que ceux de 4 espèces apparentées à *A. heldreichi* ont d'une façon constante 30 bras. L'évolution chromosomique s'effectue selon le principe de ROBERTSON et est probablement très active puisque on trouve des états intermédiaires: des individus hétérozygotes pour un élément métacentrique et deux éléments acrocentriques. Les 3 types cytologiques décrits par nous en Israël se retrouvent dans une population d'*A. heldreichi* provenant de la Turquie.

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Is there any Quantitative Relationship Between the Synthesis and the Breakdown of Nucleic Acids in Living Cells?[1]

In a recent paper, STEVENS, DAOUST, and LEBLOND[2] advocated, on the basis of their tracer experiments, the

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[2] C. E. STEVENS, R. DAOUST, and C. P. LEBLOND, J. biol. Chem. *202*, 177 (1953).