NOTES AND COMMENTS

SEX-CHROMOSOME IN HONEY-BEE

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Since the first papers on the cytology of the honey-bee by Petrunkewitsch (1901), Meves (1907), Doncaster (1907) and especially Nachtsheim (1913) until that by Sanderson and Hall (1948) it has been generally accepted that *Apis mellifera* L. (honey-bee) had females with 32 chromosomes and males with 16. Recently F. J. Manning (1948–1950) described the discovery of a sex-chromosome and other important cytological details in *Apis*.

As this matter is of great importance, modifying the concepts of sex-determination in the honey-bee, we have prepared slides of testes of drones and found the following observations on the spermatogenesis of *Apis* by Manning to be correct: (a) there is a heteropycnotic chromosome; (b) this chromosome, called X-chromosome by Manning, does not go to the poles in the II meiotic division but is eliminated (fig. 1), and thus the spermatozoa have only 15 chromosomes; (c) in some phase of the maturation division chromosome counts show 8 or 9 chromosomes (in sections) and with acetic orcein smears it is easily seen that these chromosomes are at least double. Such pairing was earlier observed by Nachtsheim (1913), Doncaster (1907), and Meves (1907), but its occurrence was not found by Sanderson and Hall (1948).

Manning made two important statements regarding oogenesis: (a) he observed that the female has 31 chromosomes (and not 32 as believed before); (b) he originated the hypothesis that 4 nuclei are formed, two with 16 and two with 15 chromosomes, the latter becoming polar nuclei. These claims of Manning seem to us well conclusive. Regarding this cytological behavior one must assume that the sex in the honey-bee is determined by arrhenotoky plus a mechanism superimposed on it. If one assumes maleness of X-chromosome and femaleness of the autosomes, the sex in the honey-bee may be represented by a scheme of genic balance where X/15A is ♂, producing spermatozoa with 0/15A, and X/30A is ♀ producing eggs with X/15A.

It is interesting to note that such a mechanism permits the possibility of maternal inheritance, without recurring to cytoplasmic effects, because only females transmit X-chromosomes to both sons and daughters, while the males lose them in the second spermatocyte division.

We think that the failure of earlier investigators to observe the X-chromosome was a consequence of considering any cytological abnormality resulting from alterations of temperature. Thus the X-chromosome may actually have been seen, but was classified together with real abnormalities.

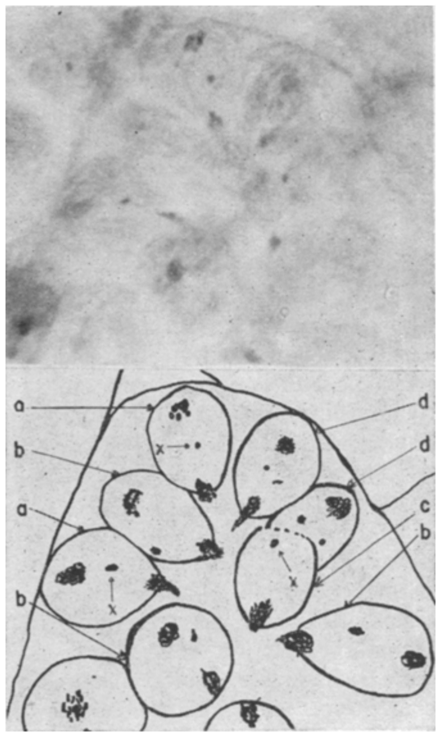

FIG. 1. Elimination of the X-chromosome in *Apis mellifera* L.

Telophase II in spermatocytes of *Apis mellifera* L. showing the extrusion of one nucleated bud and the elimination of the X-chromosome (Sections with 12μ, stained with Heidenhain's Iron Hematoxylin). The drawing was made on a photocopy, which was then dissolved; details not visible in the photo were added in accordance with direct observations in the microscope. Cells visible in the microphoto are lettered *a;* in these two cells and in the cells with letters *b* and *c* the X-chromosomes do not go to the poles, but remain in the equator as a diad. The cell *c* was cut and its second pole was in the next section. In the two cells *d* the X-chromosome is divided, but both daughter chromosomes remain in the equator, and do not enter in the spermatid nucleus.

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PRINCIPLES OF ANIMAL ECOLOGY[1]

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This important compendium of ecological principles, generously documented, is divided into five parts: history of ecology, analysis of the environment, populations, communities, and evolution. The book is well illustrated, well indexed, and excellent in format. It contains an exceptionally useful bibliography of 71 pages. The scope of the work which the authors undertook is truly impressive, and the result stands without equal as a summation of ecological knowledge.

By now this book has been reviewed in several different journals, and no additional description of it seems necessary. In an earlier review (Auk, 68, January issue, 1951), I ventured to comment more extensively on the book as a whole and specifically on the section dealing with communities. The present review will deal only with the last section, entitled "Ecology and Evolution" and written by A. E. Emerson.

This section, 132 pages in length and a book in itself, is divided into five parts: ecology and genetic variation, ecology and isolation, adaptation, natural selection, and evolution of interspecies integration. The part on natural selection is the longest and its subheadings are preadaptation and habitat selection, selection pressure, competition, adaptive radiation and convergent evolution, ecological position and homeostasis, regressive evolution, retardation of evolution, and organismic levels and selection. An earlier section, "Biotic Factors in Relation to Individuals" (pp. 227–262), written by Allee and Schmidt, serves in large part as a good introduction to the chapters on evolution. There is, however, a considerable overlap in treatment of parasitism and mutualism between the two sections.

Because none of the other major topics dealt with in this book has been so widely under discussion in the recent literature, the section on evolution is the most vulnerable to critical scrutiny. Its organization, while appropriate, suggests no important departure from earlier treatments of much the same material, except for the ecological emphasis. This applies to concepts and principles more than to examples, of which there are many unfamiliar and interesting ones. In fact, the absence of reference to certain concepts currently under discussion suggests that much of the material may have been at least organized if not written before the appearance of the last decade's bulky literature on evolution. Some examples of such concepts are panmixia, polytypic species, and evolutionary rates in general, not just retardation and regression as discussed by Emerson.

There are many comments, unavoidably rather assertive and therefore appropriately challenging, which will raise questions in the minds of readers; some important examples of this may be cited since a comprehensive critique of the work as a whole is almost out of the question.

Page 605: "Much nonadaptive evolution at the infraspecies and species level may take place through the action of isolating factors in the absence of selection." An analysis of this statement leaves one uncertain as to how strongly the author meant it, but let us take it literally, as most readers will, I believe, even though, in the preceding sentence, selection is said to be the primary factor in divergent evolution. Whether there can be *much* nonadaptive evolution seems now to be so big a question that this statement, divested of immediate reference to specific cases and cast free of certain other relevant matters, as it is in context, sounds important but says little. Later (page 608) the author admits difficulties in identification of cases illustrating non-adaptive divergence of populations isolated merely topographically. What is more important, there is a confusion here of non-adaptive divergence at the subspecies level and *supposedly* nonadaptive diverg-

[1] W. C. Allee, A. E. Emerson, O. Park, T. Park, and K. P. Schmidt. Principles of animal ecology. W. B. Saunders Co., Philadelphia and London, 1949: i–xii, 1–837, figs. 1–263. $14.00.