normal cell[5], at least so far as the domestic fowl is concerned.

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Received September 19; revised November 7, 1966.

[1] Luft, J. H., *J. Biophys. Biochem. Cytol.*, **9**, 409 (1961).
[2] Reynolds, E. S., *J. Cell Biol.*, **17**, 208 (1963).
[3] Munger, B. L., *Lab. Invest.*, **11**, 885 (1962).
[4] Munger, B. L., *Amer. J. Anat.*, **103**, 275 (1958).
[5] Munger, B. L., Caramia, F., and Lacy, P. E., *Z. Zellforsch.*, **67**, 776 (1965).
[6] Björkman, N., Hellerström, C., Hellman, B., and Petersson, B., *Z. Zellforsch.*, **72**, 425 (1966).
[7] Machino, M., *Nature*, **210**, 853 (1966).
[8] Lacy, P. E., *Amer. J. Med.*, **31**, 851 (1961).
[9] Herman, L., Sato, T., and Fitzgerald, P. J., *Electron Microscopic Anatomy*, 59 (Academic Press, 1964).
[10] Dierthelen-Lièvre, F., *Bull. Biol. Fran. Belgique*, **99**, 3 (1965).
[11] Kurosumi, K., *Intern. Rev. Cytol.*, **11**, 1 (1961).
[12] Mikami, S., and Ono, K., *Endocrinology*, **71**, 464 (1962).
[13] Björkman, N., and Hellman, B., *Acta Anat.*, **56**, 348 (1964).

Mite Chromosomes: an Exceptionally Small Number

ALTHOUGH the chromosomes of thousands of plants and animals have been investigated and chromosome numbers found to vary widely, the overall trend has been toward the evolution of a moderate number in most taxa. Very few species have been reported to have as few as $n=2$ chromosomes. Jackson[1] reported the flowering plant *Haplopappus gracilis* to be $n=2$ and most cytology textbooks indicate that the nematode *Parascaris equorum* (= *Ascaris megalocephala*) possesses one pair of chromosomes in germ line cells. In the latter species, however, the two chromosomes fragment into numerous small chromosomes in the soma, and therefore the germ line chromosomes are considered aggregate bodies[2]. In the Insecta some coccid members of the tribe Iceryini have a haploid number of two chromosomes and unfertilized haploid eggs develop parthenogenically into males[3]. Sokolov[4] found two species of water mites (*Eylais rimosa* and *Eylais setosa*) to be $n=2$, but these species do not display haploid parthenogenesis. The rarity of reported cases of such a low chromosome number throughout the plant and animal kingdoms prompted us to report the following data.

The mites, *Harpyrhynchus brevis*, and their eggs were obtained from chipping sparrows (*Spizella passerina*) from the University of California, Hopland Field Station, Mendocino County, California. Eggs of *H. brevis* are oviposited singly, each attached by a short stalk to the skin of the bird in the region of the head and neck. Embryos of different ages were prepared for chromosomal examination by the squash technique and aceto-orcein stain. Only the white, opaque eggs containing young undifferentiated embryos gave usable chromosome preparations, whereas eggs with yellow-orange embryos were too far advanced for chromosomal investigation. Many embryos and hundreds of cells were analysed and all had two or four chromosomes in a cell, but only one type to each embryo (Fig. 1, *A* and *B*). Chromosome lengths varied depending on the stage of mitosis and usually measured 2–3μ at metaphase. One chromosome (or one pair in the diploid cells) was slightly longer than the other. No primary or secondary constrictions nor any other consistently recognizable features were found on the chromosomes. It is undetermined, at present, whether these chromosomes are monocentric or holocentric. Two attempts to characterize harpyrhynchid chromosomes by X-ray fragmentation experiments have failed because of dosimetry problems. These mites are parasites of birds and incidence of oviposition appears to be seasonal. Because of this and the difficulty of obtaining large numbers

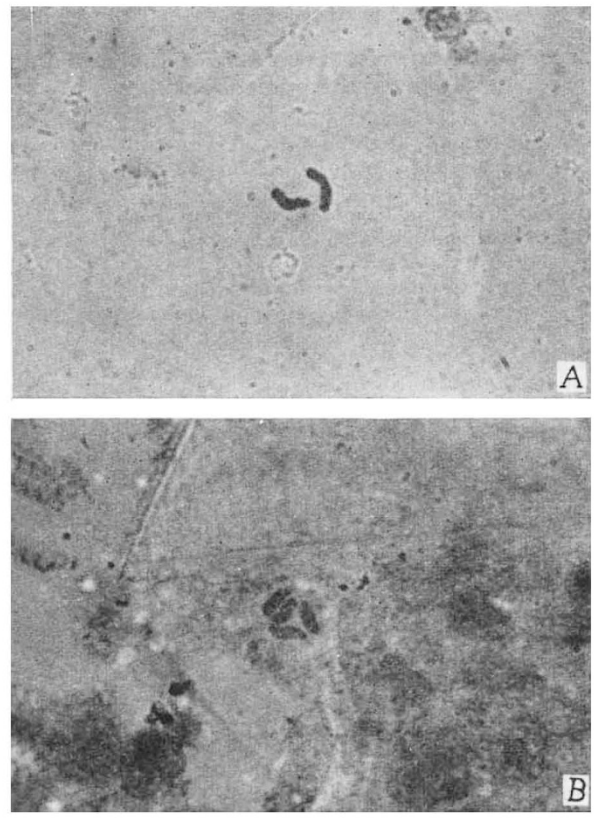

Fig. 1. Embryonic cells of *Harpyrhynchus brevis*. (*A*) Haploid and (*B*) diploid chromosome complements. Chromosomes 2–3μ long.

for experimental analysis, it appears likely that the nature of the centromere in these chromosomes will remain unknown for some time unless laboratory colonies of the species can be established.

Harpyrhynchus brevis and a second species of the same genus were found parasitizing the same individual host bird. We did not recognize any differences in chromosome number, morphology, or size between the two species. Nevertheless, they can be distinguished readily by external morphological criteria and differ greatly regarding ovipositional and other behavioural characteristics.

Haplo-diploidy is common in many mite families and is the dominant sex determining mechanism in one family (Tetranychidae) included in the same sub-order (Eleutherengona) as the Harpyrhynchidae. The co-existence of haploid and diploid embryos, however, does not in itself prove arrhenotoky. Brown and Bennett[5] have shown that in the diaspine scale *Pseudaulacaspis pentagona* male embryos begin as diploids but the paternal chromosomes are eliminated during late cleavage stages and, thus, males develop thereafter as true haploids. Nevertheless, this type of chromosome behaviour is uncommon in embryos of most organisms and it is probable that *Harpyrhynchus brevis* is arrhenotokous.

This work was supported in part by the U.S. National Institutes of Health.

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Received October 24, 1966.

[1] Jackson, R. C., *Science*, **126**, 1115 (1957).
[2] Swanson, C. P., *Cytology and Cytogenetics*, 596 (Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1957).
[3] Hughes-Schrader, S., *Adv. Genetics*, **2**, 127 (1948).
[4] Sokolov, I. I., *Trud. Leningrad. Obshch. Estestvois., Otd. Zool.*, **72**, 124 (in Russian, 1954).
[5] Brown, S. W., and Bennett, F. D., *Genetics*, **42**, 510 (1957).