Details of these isolations and further studies will be published elsewhere.

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Why Do Insects Have Six Legs?

WITH few exceptions, adults of the several million species of insects reputed to be in existence have three pairs of legs. This implies that this particular number of legs has some very general adaptive significance, or, to put it another way, in the vast majority of insects any deterioration in the genetic complex responsible for the production of three pairs of legs is promptly and effectively selected against.

Why three pairs of legs, and not two? Evidence from comparative morphology of the arthropods supports the concept that insects were derived from many-legged ancestors, perhaps centipedelike in appearance. Presumably the hexapod condition arose by gradual reduction of the number of legs. The reduction went no farther than three pairs, because locomotion on two pairs of legs is not efficient for a small animal encased in an exoskeleton. Normally, the insect walks by lifting two legs on one side and the middle leg on the other, sweeping these forward simultaneously and placing them down together, thus completing a single step. The other three legs furnish a tripod support while the step is taken. The center of gravity shifts out of the base of the tripod near the end of each step, and the insect falls onto the three legs just placed down. Thus, as the insect walks, it falls from one solid tripod support to another. Maintaining balance is an important problem in locomotion, and the smaller the animal, the more difficult it is. An illustration of one of the principles involved is shown by the ease with which a long stick can be balanced vertically on the end of one's finger, as compared with the difficulty of balancing a pencil. A contributing factor to this is that the pencil falls more quickly than the long stick. A large mammal has a comparatively long time to make the corrections necessary to maintain balance in the more precarious quadrupedal or bipedal locomotion, whereas a small insect has much less time, possibly not enough for nerve-controlled responses to operate. Another important factor in the difficulty of maintaining balance is the relative inflexibility of the trunk of the insect. Mammals can maintain balance by small, extremely varied movements of the trunk, and the even more flexible tail is an important balancing organ in many mammals. Insects can walk with one or two legs destroyed, but locomotion is then a slower and more uncertain process.

There are many aquatic, swimming insects which, as adults, cannot walk. The three pairs of legs invariably present in these forms could be explained on a similar adaptive basis, by assuming that in the terrestrial ancestors of these forms the number of walking legs was stabilized at six, and then that different auxiliary but important functions were assigned to different pairs of legs, such as antennae-cleaning, stridulating, elytra-cleaning, etc. Selection pressure then would operate to retain all three pairs. A similar explanation could be applied to other primarily nonwalking insects.

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Book Reviews

Population Genetics and Animal Improvement: As Illustrated by the Inheritance of Egg Production. I. Michael Lerner. New York: Cambridge Univ. Press, 1950. 342 pp. $5.50.

Although the author assumes that the reader has only an elementary knowledge of genetics and statistics, this book is primarily addressed to teachers, investigators, and advanced students of animal genetics. The treatment is nonmathematical. The biometric foundations of the book rest almost wholly on Sewall Wright and Lush and his school. The undercurrent of genetic theory is dominated largely by Mather's concept of polygenic inheritance (i.e., that genes acting on economic traits such as egg production are inherited in the Mendelian manner, but that variation due to them is small in relation to the total). The author's recent researches in the area of population genetics of egg production provide the principal source of illustrative material. Egg production is taken as the model trait to illustrate the principles of population genetics.

The first 4 of the 15 chapters in the book are introductory in nature. Chapter 2 gives a historical survey of the literature on the inheritance of egg production. The author points out the fallacy of the Mendelian approach which has been used to study the inheritance of egg production. He then sets forth arguments for the newer, more acceptable "polygenic" approach. Chapter 3 is devoted entirely to a biological analysis of egg production in the fowl. The 5 physio-