Genetics of Vestigial Wing in Honey Bees (*Apis mellifera* L.) and Maintenance of the Recessive Alleles by Natural Selection in the Haplo-Diploid System

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ABSTRACT

The vestigial winged drones in a honey bee (*Apis mellifera* L.) colony was observed. The vestigial winged drone cannot fly. The genetic study showed that the trait is controlled by a recessive allele.

Maintenance of the recessive allele by natural selection was examined. The recessive lethal allele can be rapidly eliminated in the haplo-diploid system by natural selection, unless the selective advantage of heterozygote over the wild type homozygote is greater than 1.0. The allele frequency theoretically can never be greater than 0.50 no matter how large the selective advantage of the heterozygote. Based on the average weight gain of the colonies, no appreciable heterosis was demonstrated.

The honey bee (*Apis mellifera* L.) is a social insect. In a colony of honey bees, there are the queen, a large number of workers, and a certain number of drones. The number of workers and drones present varies among colonies, and is dependent upon many factors. The queen and worker honey bees are females and are diploid; the drones are males, which are developed from unfertilized eggs. Thus the drones are haploid, and the drone progenies give gametic ratios of their heterozygous mothers. The fertilized egg can develop into either a queen or a worker dependent upon the quantity and quality of food they receive at the larval stage. If a larva hatched from a fertilized egg feeds on abundant royal jelly through its larval stage it will develop into a queen; on the other hand if the larva receives royal jelly for only the first three days followed by honey and pollen it will become a worker. The females in the honey bee colony are divided into two castes, the queens and the workers.

The queens and workers are highly dimorphic and display very different behaviors and physiologies. A queen normally lives from two to four years, and can produce thousands of female and male offspring. Workers live a much shorter time (about 6 weeks in the peak season and longer in the winter), but display many highly sophisticated behaviors. In the colony, they build nests, defend the have, clean the brood nest, nurse the brood, gather food, feed and groom the queen, and maintain the optimum temperatures of the hive in both winter and summer.

A drone is a highly specialized animal. His genitalia, proportional to his body size, are larger than those of almost all other animals (Morse 1975). His sole function is to mate, but he mates only once. In contrast, queen honey bees mate several times, and they mate in flight. After mating the queens stay inside

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