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This Week's Citation Classic®

Selander R K. Sexual dimorphism and differential niche utilization in birds.
Condor 68:113-51, 1966.
[Department of Zoology, University of Texas, Austin, TX]

Quantitatively documenting marked sexual differences in foraging behavior correlated with bill-size dimorphism, this research demonstrated that, in the absence of other species capable of exploiting the same food resources, males and females of the Hispaniolan woodpecker have diverged ecologically and morphologically to a degree equivalent to that achieved on the mainland by pairs of species. [The *SCI*® indicates that this paper has been cited in more than 290 publications.]

Ecological Radiation of the Sexes

R.K. Selander
Institute of Molecular Evolutionary Genetics
Pennsylvania State University
University Park, PA 16802

In the 1960s, I was studying grackles and was concerned with the behavioral and ecological aspects of sexual dimorphism,[1] which, as a graduate student at the University of California at Berkeley, I had often discussed with my mentor, F.A. Pitelka.[2] Darwin had attributed most sexual variation in birds and other animals to sexual selection, but he had noted a couple of examples of bill-size dimorphism that apparently evolved by natural selection to facilitate differential foraging by males and females. My grackles showed sexual differences in feeding behavior; but because bill size is proportionately scaled to body size, it could be interpreted as a secondary consequence of sexual selection for overall body size dimorphism.

One day at the American Museum of Natural History, I pulled out a tray of specimens of the endemic Hispaniolan woodpecker and noted a large sexual difference in bill size. Although females are only 9 percent smaller than males in body size, their bills are 21 percent shorter. And, I soon discovered similar patterns of sexual dimorphism in the species of woodpeckers endemic to Puerto Rico, Martinique, and Cuba.

Studying the foraging behavior of the Hispaniolan woodpecker was the easiest and most enjoyable piece of research I have done. In May 1963, I flew to Santo Domingo, rented a car, and drove to a ranch once owned by the dictator Rafael Trujillo, where, as it turned out, the woodpecker was one of the more common birds. My research protocol was simple: I watched an individual and described the first feeding motion it made; then I observed another individual, and so on. Within 15 minutes, I knew I had a winner, because there were conspicuous sexual differences in foraging behavior; for example, 35 percent of the records for males, but only 9 percent of those for females, involved probing. Later, a comparable study of a continental woodpecker in which bill length is only 9 percent dimorphic showed relatively minor differences in feeding behavior.

This paper, and T.W. Schoener's report,[3] in 1967, of sexual differences in microhabitat occurrence and insect prey size in an insular lizard, have been heavily cited because they extended the concept of adaptive radiation to the intrapopulation level and added a new dimension to foraging theory. And, we had introduced a new area of research that helped to legitimize the activities of many ornithologists and other naturalists. After all, it is much better to be able to explain to your molecular biologist colleagues that you are studying "differential niche utilization" than to have to admit that you watch birds or collect lizards just for the hell of it. Soon people were finding ecological differences between the sexes in all sorts of animals. Years later, R. D. Sage and I[4] inadvertently discovered a striking case in a cichlid fish living in isolated ponds in the Coahuila desert—but here the polymorphism in feeding apparatus and associated behavior is independent of sex.

I could have milked this line of research for several years; but by the time my paper appeared, my interests had turned to genetics, due in large part to the encouragement of Wilson S. Stone. In 1966, the realization that protein electrophoresis could be used to measure allelic variation at structural gene loci suddenly opened up the possibility of studying the population genetics of any species of organism.[5] My laboratory started with the house mouse, and in 1969 we published the first of several hundred papers in which we used multilocus enzyme electrophoresis to analyze the genetic structure of populations of animals, plants, and bacteria.[6]

1. **Selander R K.** On mating systems and sexual selection. *Amer. Naturalist* 49:129-41, 1965.
2. **Pitelka F A.** Geographic variation and the species problem in the shore-bird genus *Limnodromus*. *Univ. Calif. Publ. Zool.* 50:1-108, 1950.
3. **Schoener T W.** The ecological significance of sexual dimorphism in size in the lizard *Anolis conspersus*. *Science* 155:474-7, 1967. (Cited 150 times.)
4. **Sage R D & Selander R K.** Trophic radiation through polymorphism in cichlid fishes. *Proc. Nat. Acad. Sci. USA* 72:4669-73, 1975.
5. **Lewontin R C.** Electrophoresis in the development of evolutionary genetics: milestone or millstone? *Genetics* 128:657-62, 1991.
6. **Selander R K, Hunt W G & Yang S Y.** Protein polymorphism and genic heterozygosity in two European subspecies of the house mouse. *Evolution* 23:379-90, 1969. (Cited 275 times.) [See also: **Selander R K.** Citation Classic. *Current Contents/Agriculture, Biology & Environmental Sciences* 11(8):14, 25 February 1980. Reprinted in: *Contemporary classics in plant, animal, and environmental sciences.* (Barrett J T. comp.) Philadelphia: ISI Press, 1986. p. 316.]

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