LETTERS

Africanized Honeybees

The stakes are high in agriculture and apiculture where the effects of the impact of Africanized honeybees (*Apis mellifica scutellata*) are largely unknown and where the pollination benefits of the European honeybee to U.S. food crops are placed conservatively at $19 billion a year (*1*). Other considerations would increase this figure (*2*).

In May 1985, five apicultural organizations appealed to the Secretary of Agriculture to establish the post of Federal Extension Apiculturist to provide information on a host of problems affecting modern apiculture, among them, the impending Africanized bee problem (*3*). For budgetary reasons, the Administration declined (*4*). The aphorism "penny wise and pound foolish" captures the essence of this particular case of economic myopia.

As reported widely in the press, federal and state agricultural authorities began acting after the discovery of the first established colony of *A. m. scutellata* on 23 July in Kern County, California, although the species was "discovered" nearly 1 month earlier. Much can happen with a tropical social insect in 1 month. Winston, in a study performed in French Guiana, observed that after *A. m. scutellata* colonies were dequeened, new laying queens were found in 20 to 28 days (in 44 percent of colonies), with a mean of 6.9 viable queen cells and 1.8 swarms per colony (*5*). Whatever the reasons were for the delay of action in California, it is most unfortunate.

Also as widely reported by the news services, 400 square miles (1035.9 square kilometers) were quarantined. Since this area is a square, a swarm has only to travel a radius (r) of 10 miles (16.1 kilometers) to reach the edge of the quarantined zone. The effective zone of quarantine (actually, a circle inscribed within the square) is therefore shrunk to 314 square miles, 85.8 square miles less than the official zone of quarantine.

I have defined three categories of potential swarm dispersal. Category A is from 0 to 15 miles (0 to 24.1 kilometers); category B is from 15 to 80 miles (24.1 to 128.7 kilometers); and category C is greater than 80 miles.

Category A. In 1975, *A. m. scutellata* were found on the uninhabited Ile de Gran Connetable, 20 kilometers (r = 12.4 miles) off the coast of French Guiana (*6*). If the purpose of a quarantine is to contain all possible swarms, then the quarantined zone in California is clearly too small. A swarm has only to duplicate the distance to Ile de Gran Connetable, and it will be outside the quarantined area.

Category B. Flight ranges were calculated for *A. m. scutellata* on the basis of sugar loads of workers in different types of swarms (*7*). A range of mean flight distances was estimated (r = 42.2 to 89 kilometers). A range of maximum flight distances was estimated (r = 65.7 to 121 kilometers). These potential distances demonstrate that the quarantined zone may be undersized.

Category C. Taylor (*6*) indicates that *A. m. scutellata* swarms in East Africa may move 100 miles (r = 160 kilometers). An unconfirmed report (*8*) describes a long-distance swarm in northern Brazil being followed for 290 kilometers (180 miles). Again, these potential distances indicate that the quarantined zone may be insufficient.

I can appreciate the "no-win" situation the authorities in Kern County are in. It cannot be known in the short term whether or not the quarantined zone has been successful; and yet, at any time it can be known to have failed (simply by the discovery of *A. m. scutellata* outside the zone). It is irrelevant how many *A. m. scutellata* colonies are located and destroyed either within or outside the zone; what is important is the hypothetical swarm that is not found, escapes the zone, settles in a lush, isolated pocket, overwinters, and proceeds undisturbed through the next reproductive season, dispersing swarms in several directions. This hypothetical swarm is the one least likely to be identified with certainty. For these reasons I urge that the initial area of search and quarantine in California be greatly expanded.

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Computer Science Funding

We were struck by Daniel E. Koshland, Jr.'s, recent editorial (21 June, p. 1387) concerning peer review and science funding. We have been analyzing similar problems for the Computer Science Board, which will soon be issuing a report about the expected impact of limited funding in this rapidly growing field (*1*).

Computer science, which is a relatively young academic discipline, is having many problems similar to those described in Koshland's editorial, but because of explosive student growth and continuing expansion of faculty positions, combined with a transition to an increasingly experimental orientation within the discipline, the problem of slow growth of budgets for basic research has been particularly severe.

Current and planned expansion of production of new Ph.D.'s in computer science, who are in great demand for both industrial and academic positions, is now threatened by lack of growth in funding. Since 1978 there has been a growth in academic computer science personnel of between 13 and 22 percent a year, while constant-dollar federal funding for basic research in computer science has risen only an average of 6.7 percent a year during this period. Worse, since 1982, percentage increases in constant-dollar federal obligations for basic research in computer science have been smaller than those in all other major scientific disciplines, even discounting growth in the field.

We believe it is essential that universities, industry, government, and scientists recognize, not only the severe costs to scientific and engineering fields caused by anticipated low federal funding levels for basic research for the remainder of the decade, but also the special needs of those disciplines that are in a period of transition and major expansion of research personnel in response to national needs.

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1. *Imbalance Between Growth and Funding in Academic Computer Science: An Impending Crisis*, a report endorsed by the Computer Science Board and prepared by the Computer Science Board's Committee on Research Funding in Computer Science.