Natural Enemies in Place of Poisons

BIOLOGICAL CONTROL BY NATURAL ENEMIES, by Paul DeBach. *Cambridge University Press, $14.95; paperback, $5.95; 323 pp., illus.*

Charles Darwin noted that populations of organisms are regulated by what he called the "hostile forces of nature": predators, parasites, diseases, climate, weather, and food shortages. When a population rises to a level that causes humans to regard it as pestiferous, the reason is usually that food is so bountiful and weather and climate so benevolent that the effects of predators, parasites, and pathogens become—from our viewpoint—insufficient. Sometimes we cause such situations by providing potential pests with an abundance of food plants or animals or by transporting a potential pest (like the European corn borer) to a new locale without transporting its predators, parasites, and pathogens. Or else we provide food where the climate and weather favor the pest but do not favor its parasites, predators, and pathogens.

Changing the effects of climate and weather on the pest (for example, planting corn later) is usually called cultural control; changing the effects of parasites, predators, and pathogens is called biological control, which is the main subject of DeBach's book. There are two principal methods: importing enemies that attack the same or related organisms elsewhere and assisting existing enemies by cultural or other means.

DeBach has written what I'd call a biological adventure book; one that probably should be read by every person who has something to say about the distribution of funds for biological research. He begins by explaining how pests can be fostered through the misuse of chemicals and how difficult it is to know how much control is being accomplished by their natural enemies. Then he recounts the sometimes magnificent adventures of early explorers for useful parasites and predators and describes a whole series of early and modern efforts at biological control—cases that most people have forgotten because they worked. When chemical control is successful you remember because you have to know what to buy and how to apply it next time; with biological control you forget because there is no next time.

Finally DeBach considers how to maximize biological control through research, how the public can utilize biological control, related methods of using resistant plants and altering cultural practices, and how to escape the pesticide dilemma.

Most pests are insects, and so are most of their enemies; so biological control is largely the domain of entomologists. DeBach is an entomologist, and so am I, and both of us were intrigued early in our careers by lectures we heard on biological control: in his case by Harry Smith and in mine by Alvah Peterson. DeBach followed his early inclinations and became a biological control expert. I did not. Nor did any of my fellow students at Ohio State University, and I have often wondered why.

One reason is that we were not living in California. In this book DeBach tells us that Hawaii and California have long been the strongholds of biological control in the United States, partly, I suspect, because they are in a sense both islands (California, in regard to its citrus industry), so their pest problems have a contained aspect that may have kept people convinced of the efficacy of biological control methods.

Another reason is that biological control was literally being smothered during the 1950s by the advent of family after family of chemical pesticides. Students in Alvah Peterson's biological control class openly spoke of him as old-fashioned, and most of them thought that biological control was a pipe dream of pre-pesticide days. Chemical control in the 1950s was decidedly new-fashioned, as well as quick and effective. No one even mentioned pollution in those days, and if a new chemical was unusually potent, it was merely viewed as part of the excitement of technology. After all, to live in these complex times, one had to know enough not to step in front of traffic and such things; proper use of deadly poisons was just another part of the game.

There is no way the influence of chemical pesticide companies on entomology departments during my graduate-student days can be overemphasized. National entomology meetings sometimes seemed like one long series of hospitality suites rented by the pesticide people, and I remember having the same feeling about them that I developed about the poolroom in my little home town—a place where, if you went, you'd probably enjoy it, but down deep in your soul you knew it was having an evil effect. Anyone who wondered why there were no large audiences listening to the papers (the presentation of which provided at least the academic speakers with funds to attend the meetings) didn't understand the lure of those hospitality suites and the free liquor served there.

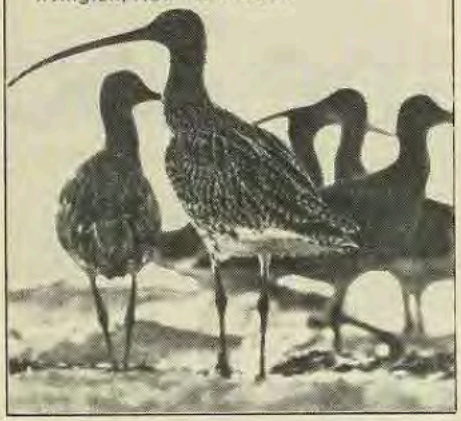
More insidious, perhaps, were the votes cast by hordes of direct and indirect representatives of the pesticide companies who filled the meeting halls. I doubt that a pesticide representative ever had difficulty obtaining funds to travel to an entomological meeting. I will never forget sitting absentmindedly in the general session of the meeting of the Entomological Society of America in Philadelphia, lazily looking over my program for the most valuable session to attend and suddenly realizing to my horror that a resolution to censure a journal, its editor, and an author had just been offered and accepted almost unanimously without significant debate. The

stated reason for this churchlike antiheretical behavior was that the author had said some things reflecting on economic entomologists. In fact he had written an antipesticide article.

Scientific societies are usually not exclusive; anyone interested in the organisms or problems involved can join. As a result, some societies become top-heavy with sentimental amateurs, others with crackpot splinter groups of various sorts. The entomologists were simply overwhelmed by chemical pesticide interests.

The critical question is why chemical insecticides swamped biological control two or three decades ago. Most people probably believe that it was because they are cheaper, quicker, and more effective. I have also heard biologists say that it is because so much specialized and complex information is needed for effective biological control. Anyone who believes these things hasn't considered the enormous amount of money, manpower, and knowledge poured into chemical insecticides. DeBach says that it now costs at least $4,000,000 to research, develop, and market one new pesticide, whereas he recently discovered and imported two effective new parasites for less than $500, and some others have cost less than $100 each.

So there must be another, more powerful reason. I think it is simply that biological control generally does not involve products on which profits can be made, while chemical control does. Involve a product and a potential profit and American initiative will take over. Biological control not only does not entail a product, it requires massive government involvement. As a result, until such time as substituting biological for chemical control becomes clearly vital to the national security, the requirements for its implementation come very close to being considered downright un-American. Indeed, as DeBach notes, antipesticide people are commonly accused of being against free



enterprise. Paradoxical, isn't it?

In Hawaii the sugarcane planters were sufficiently few, powerful, and farsighted to get together and fund exploration for effective parasites before pesticides became available; they formed a parallel to the governmental action that will be necessary in most cases. In the case of the bacterial milky disease of the Japanese beetle, a product is involved: packets of bacterial preparations can be purchased and applied by the ordinary customer. Unfortunately, as DeBach notes, pathogens are not ordinarily highly effective control agents because they spread only when pest densities are higher than considered acceptable.

This book is full of good, solid facts, often so contrary to general impressions or the common intuition that one wants to start a "false impressions" game of the sort seen in family magazines. For example: (1) Most insects are pests. *False.* Fewer than 1 percent can be so classified and, just for openers, every one of them has several or many (DeBach says up to 100) known enemies, all of which are by definition beneficial. (2) Biological control hardly ever works. *False.* It nearly always works. That's why fewer than 1 percent of the insects are pests, and it's why the ecologists are always wondering what accounts for the widespread stability of natural populations. If they ever found out, we'd be much closer to success in biological manipulation of the few that do expand sufficiently to become pests.

It strikes me that the entomologists studying biological control are on some kind of remarkably convergent path with the general theoretical and experimental ecologists, and the sooner they get together, the better. (If the entomologists get there first, it won't be novel; they've already done it with the study of social life.) As DeBach points out, the best demonstrations of the effects of between-species competition are probably found in the field experiments performed during biological control efforts. Biological control experts are discovering some significant effects of species diversity, another pet problem of ecologists.

Despite my fair knowledge of, and respect for, biological control, some items in this book brought me up short. I always thought that the control of the coconut leaf-mining beetle in the Fiji Islands, effected by first drawing up a list of the required attributes and then seeking a parasite species that matched it, was a classic in how to proceed. But DeBach notes that it's better to import several parasites, even if they compete, than to rely upon one. It makes sense. The approach is simpler and cheaper (you don't have to determine beforehand which *one* will be best), several parasites may compensate for one another's weaknesses, and over the long term their competition is likely to improve their effects as a result of natural selection. And "long term," despite efforts to distinguish ecological and evolutionary time, may be no more than a few generations.

I was also astonished to discover that "an analysis of all worldwide importation projects prior to 1970 shows that some significant degree of success has been achieved with about 54% of all target pest species . . . substantial or complete success . . . with about 40%."

Despite its obvious intellectual attractiveness, I doubt that young Ph.D.'s will be much more encouraged today than I was eighteen years ago to believe that biological control is a lucrative field. DeBach gives figures on the direction of entomological research within entomology departments: "The majority of state universities or their experiment stations in the United States have departments of entomology but only a handful have even one man specializing in biological control research . . . all receive unsolicited donations for research principally from chemical companies." He goes on to note that "one of the largest departments (including the largest biological control research group) [received in donations] in . . . 1969 and 1970, $8,536.91 . . . for biological control research . . . $494,188.77 . . . for other entomological control research, predominantly on chemical pesticides."

DeBach doesn't flinch from placing the blame: "As long as we ignore, anywhere in the world, an effective natural enemy capable of controlling one of our major pests, we are postponing cheap, reliable and permanent control . . . yet we continue to do this with 95% of the world's insect pests. The cost of other treatments and crop loss in the interim may justly be charged against the entomological profession."

He is being more harsh than I would be. I want to spread the blame to include the voters, legislators, and academicians who ought to take a look at this book. I want especially to include among the academicians those of my fellow biologists who, when asked about worthy major projects by the National Science Foundation, continue to deny the need for anything like a federally supported biological survey or cadre of career researchers, studying the biology of (particularly) the thousands of insect groups, unknown but potentially important, scientifically orphaned, and doomed to remain so.

I have never forgotten reading in the *Reader's Digest* in the 1940s that insect pests would soon be no longer: DDT would eradicate them all. Nor can I forget my dairy farmer grandfather asking me earnestly ten years later (when I was a new Ph.D. in entomology) why insecticides no longer affected the flies in his barn. I should have replied, "Evolution, Grandpa, the same thing that keeps biological control working all by itself."

It is a tribute to our ecological ignorance that we have never purposely annihilated a single entire pest species anywhere by any means; nor have we clearly saved a single endangered species that we were annihilating accidentally or incidentally by our presence or activities. This doesn't say much for our potential ability either to keep our own species from becoming dangerously pestiferous or to prevent it from annihilating itself accidentally. One thing needed is more Paul DeBachs, and more books like this one.

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