Biosystematics: Putting Pests in Their Places

It's easy to summarize the goal of biological control: to foil the pest without fouling the environment.

But to accomplish this goal, we must have a thorough understanding of the crop pest. We must know our enemies—and, in turn, know *their* enemies—so that we can find a way to put the latter to work for us.

This approach calls on the science of biosystematics to understand, say, where a specific insect fits into the bigger picture in nature. If we can make an accurate connection between a particular insect and related insects, we obtain a solid foundation of collective knowledge from which to predict how the newcomer will behave.

We then have a head start on pinpointing this new insect's enemies or finding ways to use it to control other insects.

For example, if we know a targeted crop pest originated in the Mediterranean region, we know where to search for its natural enemies. Or if we can predict an insect's life cycle, we can make a smart guess about where to search for it. And if we know that one member of a group of wasps is effective against a crop-damaging beetle or worm, then we can look for other helpful members in that same group.

Effective biological control of crop pests depends completely on making these types of connections. When we take advantage of a systematic view of accumulated knowledge, we don't have to start from scratch with each new pest. Fortunately, scientific tools—such as the ability to compare insects' DNA—are simplifying our search for the relationships between different insects, so we can more quickly increase our arsenal of natural weapons against crop pests.

One concern about biological control agents is the element of risk—the fear that once a beneficial insect has been introduced into a new environment and eliminated its target pest, it will turn to other sources of food, such as a crop or other desirable plants.

Happily, nature has provided us with a valuable safeguard: There are host range limits beyond which an insect will not go. So if we use a predatory insect that's always feasted on tomato worm larvae, it's not going to suddenly switch to a diet of tomatoes. An insect with mouth parts evolved for sucking can't promptly switch to chomping.

In fact, there's a complicated hierarchy of events that must occur for a parasite or predator to go after even the pest it has evolved to attack. If the parasite can't identify the habitat that the pest is in or find the plant where the pest is lurking—or if it dislikes that particular life stage of the pest—it's all over; the parasite doesn't do anything.

A growing knowledge of that type of specificity helps speed our selection of beneficial organisms and avoid undertaking research on predators or parasites that might attack nontarget species.

Still, we don't rely blindly on existing knowledge to protect us against possible good-guys-turned-bad bugs. Potential biocontrol agents are studied extensively in quarantine before their release into the environment.

For example, if an insect will be used to control a weed, we might put it in a greenhouse with a large variety of selected plants to see if it attacks anything other than the target weed. To the extent that we understand the weed systematics, we can make intelligent choices on the plants to test.

Our job is to try to protect crops, rangeland, and livestock from pests. There was a time when we mainly used insecticides that simply killed all the insects out there—beneficial or otherwise. We've learned from past experience that's not going to work.

As we move away from a scattershot approach, we need more specific ways to control pests. To the extent we understand where a particular pest fits in the world, we can devise specific means for managing it. Our understanding of this specificity begins with biosystematics.

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