IS THERE ROOM FOR BIOLOGY IN QUARANTINE?

Patrick V. Vail

The current criterion for insect quarantine treatments in many countries is probit 9 (i.e., 99.998% mortality). This concept is usually used without due consideration for commodity infestation levels or types (multiple or solitary) or survival on the harvested commodity. Historically, probit 9 was based on security levels required for tropical fruit fly species. However, other quarantined insects such as codling moth, *Cydia pomonella* (L.), often infest commodities at very low levels. Packing house culling further reduces these populations. In addition, inherent insect survival and reproductive potential on these commodities after harvest is quite low. When infestation levels at harvest alone are considered, several of the currently approved quarantine treatments appear to be extremely conservative based on potential for survival and reproduction. Tables are provided showing the probability of a potential mating pair of codling moths occurring in a shipment of walnuts, cherries, or nectarines based on infestation levels, volumes shipped, and mortality relationships for survival below this level.

These commodities are currently shipped to overseas markets where codling moth is quarantined, but only after being fumigated with methyl bromide at levels allowing no more than one survivor out of 35,000 codling moth eggs or larvae treated regardless of the quantity being shipped. With our approach, only in-shell walnuts would require a disinfestation treatment providing a very high level of control. Cherries would not require a disinfestation treatment. Nectarines in export quantities would require a treatment or the quantity to be shipped could be reduced slightly, thus eliminating the need for a disinfestation treatment.

Our approach permits flexibility without sacrificing quarantine security. Adjustments can be made based on quantities to be shipped in a given space and time to a given location. Levels of infestation can also be accurately determined by sampling techniques on a shipment-by-shipment basis and adjustments to the levels of control that are needed can be made. Such adjustments could lead to lower methyl bromide use/emissions reductions. Obviously, sampling procedures and size are critical elements in this biological approach. Natural survival rates also vary among hosts and under various storage conditions; this parameter also affects the level of control needed. The movement and fate of the commodity in the importing country can have considerable influence on risk. By reducing the volume shipped or the infestation rate, treatment may not be

necessary, or the level of control required would be significantly reduced compared with current requirements.

The needs and concerns of the researcher, the exporter, and the importing countries can be met more intelligently and with more responsibly in the following ways. The threshold limit for the maximum number of codling moth allowed to survive in a given quantity of host product, to be shipped in a given space and time, should be <1 mating pair. At $\underline{P}$ = 0.05, an average of 0.5062 codling moth is permissible, regardless of host. Biological data for the pest-host relationship (e.g., production control practices, infestation and natural survival rates), the quantity of product being considered for shipment, and its distribution upon arrival as reported by Moffitt (1989), should be considered.

Systems approaches to quarantine include development of more quantitative biology data, modification of shipment volume, arrival times, and the distribution of the commodity upon arrival. All of these data suggest that quarantine treatment should be based on survival and that, in some situations, treatment is not needed at all.