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Population dynamics and integrated pest management

Dinâmica populacional e manejo integrado de pragas

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Have you ever wondered why population dynamics studies are important to integrated pest management?

These studies are extremely important, as they provide fundamental information on when and to what extent a given harmful organism may appear in crops. This guides decision-making regarding control measures at the most appropriate time, resulting in better pest management.

Although population dynamics are obtained in a specific location, they are very likely to show the same trends in other locations with similar environmental conditions to the study site. This makes it possible to launch predictions based on local studies.

Let's take the example of the South American rice water weevil, *Oryzophagus oryzae* (Costa Lima) (Coleoptera: Curculionidae), one of the major pests of irrigated rice that are active in spring/summer and inactive (dipause) in fall/winter. Figure 1 shows the population dynamics of adults and larvae of the insect, obtained at the Itajaí Experimental Station, through monitoring with light traps and counting larvae on the plants. The adult population fluctuation line (solid) represents the average for the period 2007/08 to 2023/24 (sixteen seasons). The larvae line (dotted) is from a study conducted in the 1979/80 season.

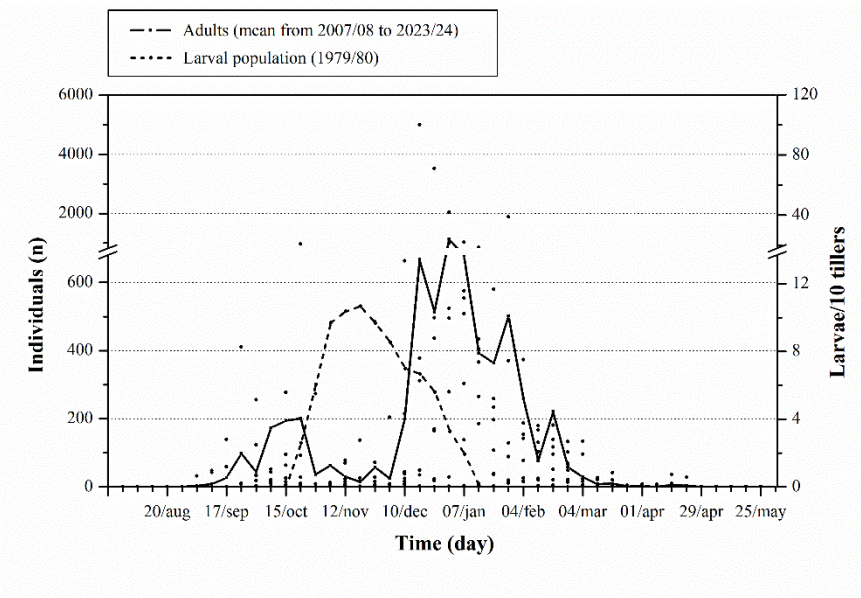
Note that there are two periods of intense adult collection. The first is around mid-October and reflects the movement of adults from hibernation sites to crops (since the light trap captures insects that are flying around the site). The second period is between late December and early February and reflects the movement of adults from crops to hibernation refuge. The period of greatest occurrence of larvae is from early November to mid-December and coincides with the reduction in the occurrence of adults.

What do these periods tell us?

First, until early October we will have little chance of having fields infested by water weevils. The departure of adults from hibernation sites does not depend on having crops planted. It does depend on the photoperiod and the temperature, as well as the atmospheric pressure, whose thresholds are only reached in mid-October.

Therefore, there is no point in applying insecticides to control rice water weevil before mid-October. There is also no point in using seed treatment for sowings before mid-September, as there will be no more residual product when the larvae begin to appear.

Figure 1 Population dynamics of adults and larvae of *Oryzophagus oryzae* in Itajaí, SC, Brazil, in the 2007/08 to 2023/24 seasons



The second moment tells us the number of insects that can be generated in the crop, which, in a simplistic approach, results in the next generation of 10 to 20 individuals per female that entered the field in October.

This second moment also tells us that thinking about applying insecticide to eliminate these pre-hibernating adults will be ineffective. First, due to the number of individuals present and the relatively long period of occurrence (about a month). Second, a large part of this population will be eliminated naturally during hibernation, with approximately 20% only returning in the following season.

That said, how should rice water weevil management be based on the insect's population dynamics?

First, plan which chemical control strategy will be adopted if necessary. There are three methods: seed treatment, insecticide spraying, and distribution of granulated insecticide in the irrigation water. Remember that the residual effect of seed treatment lasts around 40 days after sowing.

Then, observe or monitor the adult population in the plots from October onwards and, if necessary, decide to spray insecticide at the time of weed control.

Continue observing the field and, from mid-October onwards, plan to monitor larvae, starting around 20 days after sowing (or flooding, in the case of dry seeding). If monitoring indicates it, decide to distribute

granulated insecticides in the irrigation water.

These basic procedures are related only to the decision to chemically control the pest. However, within a pest management program, chemical control is just one more control strategy; several others can and should be integrated to reduce the number of water weevils or their damage to fields.

Conflicts of interest

This publication has no conflict of interest with any public or private entity.

Ethical considerations

We have avoided naming any institutions or individuals involved in any way in the presentation of this document.

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