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Weather Influences Insect Pest Abundance

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Local weather patterns can have a significant impact on the abundance of insect pests in vegetable crops, particularly in the desert where weather extremes are the norm. Components of weather, mainly temperature, moisture, and wind can either promote insect population growth or cause populations to decline. As we approach the normal cool weather of winter, growers can expect insect activity to decrease. Why is that?

Temperature is the driving force behind insect development, physiological growth and behavior. Unlike many animals, insects are poikilothermic ("cold-blooded"); that is, they are unable to regulate their body temperature and their internal temperature varies along with that of the ambient environmental temperature.

Consequently, insect pests such as sweet potato whiteflies *Bemisia tabaci*, diamondback moths, *Plutella xylostella*, and western flower thrips, *Frankliniella occidentalis*, develop rapidly when temperatures average ~85 °F and can complete a life cycle in about 2 weeks. Similarly, these pests develop much slower under cooler, winter growing conditions, often requiring 3 weeks of more to complete immature development.

In contrast, optimal temperatures for development among aphid species important in leafy vegetables grown in the southwest (e.g., green peach aphid, *Myzus persicae*) is around 55-60 °F. Under ideal weather condition, aphids can complete a generation in as little as 10 days. That's why they are most troublesome during the winter and early spring.

Under extreme hot (> 120°F) or cold temperatures (<32 °F), insect growth and development is greatly restricted, and often lethal. Because heavy freeze events are rare in the southwestern U.S, insect mortality during the winter is typically low compared with growing regions further north.

Other biological and behavioral activities such as walking, flight, reproduction, feeding and oviposition are similarly influenced by temperatures. For example, the invasive bagrada bug (*Bagrada hilaris)* most actively feeds and reproduce on broccoli plants during mid-afternoon when temperatures average around 95 °F, whereas they tend to be absent on plants during the early morning when temperatures dip below 70 °F. Bagrada bugs are truly a warm-season pest. Another reason we rarely see them in the winter.

Moisture also plays a critical role in insect development, especially in the desert southwest. Many insect pests encountered in desert vegetable crops do not require free moisture to survive. They obtain water through their food supply. For instance, *Liriomyza* leafminers spend their entire egg and larval stages inside melon or lettuce leaves, extracting water and nutrients from plant tissue.

However, relative humidity or lack thereof, can influence insect growth and behavior by affecting the insect's ability to regulate water loss. Low humidity is often detrimental to insect development and can cause insects to become desiccated and die. However, most insects found in desert crops have adapted physiological and behavioral mechanisms to prevent dehydration.

Of course, rainfall can be quite deleterious to insects. The most striking example of this occurs following thunderstorms encountered in August and September where heavy monsoon rains can cause significant mortality to whiteflies on melon crops and thrips on lettuce. As a rule of thumb, cool, wet extremes in weather are the most detrimental to insects because they can promote disease, slow growth rates and interrupt feeding activities. However, there are exceptions to the rule. One insect pest, the seed corn maggot, thrives under these conditions. Melon crops are very susceptible to seed corn maggot during wet, cool spring weather in which seed germination is slowed or delayed and the maggots can attack the seeds before they emerge causing significant stand loss.

Although wet winter conditions can be detrimental to the winter survival of many of our key insect pests, the extra moisture can have an indirect effect on insect abundance by promoting the growth of weeds and desert vegetation. This additional vegetation can provide a food source for insects such as aphids, thrips, and false chinch bugs that can build up large numbers that eventually disperse on surrounding crops. Excessive weed populations caused by monsoon and winter rains can also serve as reservoirs for viruses like CYSDV, INSV, and potyviruses.

Wind can indirectly influence insect abundance on vegetable crops by disrupting foliar insecticide applications. However, wind can occasionally directly impact insect mortality by enhancing desiccation, particularly under hot, dry conditions. Perhaps more importantly, wind can directly influence insect dispersal and colonization. It is well documented that insect populations can travel large distances on wind currents.

Sweet potato whiteflies annually infest desert vegetables each fall after dispersing out of recently harvested cotton or melon crops. Just a light breeze can carry these tiny pests several miles downwind in a few hours. Green peach aphids rely almost exclusively on wind to infest desert vegetables. Essentially, aphid populations disappear each summer because of hot temperatures, only to reappear on desert crops in November, arriving from coastal and inland mountains on southerly fall wind currents out of the N-NE.

Diamondback moths are also known to migrate hundreds of miles on wind currents, and this is largely how they infest desert brassica crops each fall. Because brassica crops and weeds are not found in the desert during the summer, diamondback moth populations cannot survive our summers. Recent research suggests that moths appear on crops in September as they are carried up from mainland and Baja Mexico. on heavy winds associated with monsoon and tropical storms. Of course, diamondback moths also sneak into desert cropping systems on infested transplants.

Conclusion

There is no doubt that weather plays a major role in determining insect population abundance because of the direct and indirect impact it has on their biological development, behavior and food supply. These interactions have been studied by entomologists for many years and are well understood. In many respects, predicting insect abundance in vegetable crops is like predicting the weather, but without satellite imagery.