EVERYTHING YOU NEED TO KNOW ABOUT WHITE GRUBS

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White grubs are highly destructive pests of turfgrass in home lawns and golf courses. Following the philosophy that understanding one's enemy is the first step in defeating him, my graduate students and I have been investigating several aspects of white grub biology, including mating behavior, factors affecting distribution and severity of grub problems, damage thresholds, and use of milky disease to control species other than the Japanese beetle. Most of our research is with masked chafer and Japanese beetle grubs, but our findings are generally applicable to other grub species.

When masked chafer adults emerge in the early summer, they engage in interesting mating rituals. Females produce a powerful chemical sex attractant that is highly attractive to males. When solvent rinses of female beetles, or the females themselves, are put into traps, they can be used to lure males to traps. Research is underway to identify the attractant. Possible applications of this work include development of baits for mass trapping or for timing insecticide applications, or for assessing beetle and grub populations in a particular lawn or fairway for the purpose of control decisions.

Eggs of masked chafers and Japanese beetles absorb water from the soil during their development. Our research has shown that the eggs are unable to survive in soils containing less than 11% moisture. Newly hatched grubs are also very vulnerable to heat and drought. Female beetles can assess soil moisture levels, and are attracted to moist or irrigated areas for egg-laying. Grub populations in non-irrigated turf may suffer high mortality in drought years.

Soil moisture also affects the severity of grub damage once their feeding begins. Our work has shown that the impact of feeding on quality and yield of Kentucky bluegrass is much greater on non-irrigated than on well-watered turf. This points to an important interaction between grub injury and drought stress. Watering tends to help turf to withstand grub injury. The severity of grub problems in a particular year appears to be related to rainfall patterns and the degree of drought stress in the late summer.

Milky disease of white grubs is caused by certain spore-forming bacteria. When the spores are ingested by the feeding grub, the bacteria invade the body cavity, turning the blood milky-white and eventually killing the grub. Milky

disease is an environmentally safe and may be a long-lasting alternative to chemical pesticides in some situations. However, commercial milky spore formulations are specific for the Japanese beetle, and will not kill grubs of other species. Moreover, our research suggests that infectivity of commercial formulations is relatively low in field situations, so that the time required to attain economic control may be prohibitive.

Field populations of masked chafer grubs that were naturally infected with milky disease were found in Kentucky. The strain of bacteria infecting these grubs is distinct from that which infests Japanese beetle grubs. Research was undertaken to determine if the masked chafer milky disease agent could be exploited as a biological insecticide. Laboratory experiments indicated that the bacteria could be formulated, stored, handled, and applied in the same manner as commercial milky spore powder, and that the preparations were highly infective to masked chafer grubs. Initial field tests have been promising. There is no biological reason why a commercial milky spore product that is effective against masked chafer grubs cannot be developed, but additional research on how to best exploit this biological control is needed.

Feeding preferences of white grubs are under investigation. This research indicates that tall fescue is just as suitable as Kentucky bluegrass as a resource for masked chafer grubs. This suggests that the relatively lower amount of grub damage suffered by fescue is probably due to tolerance, i.e., outgrowing or not showing the grub damage, rather than unsuitability of fescue as food. Perennial ryegrass and hard fescue seem to be especially palatable to chafer grubs. Preliminary tests suggest that fescue endophyte may have some adverse effects on grubs.

Additional information regarding recent performance of conventional insecticides and nematodes against white grubs was reported.