worm-like fashion, until it reaches suitable soil where its sharp point drives downward, dragging the seed to its winter resting place.

Many seeds develop sticky or hooked appendages of spines, hooks or awns that catch on to the fur of a passing rabbit, dog or sheep and hitchhike a ride for a while before they drop off or are brushed off. Autumn fields are filled with the waiting seeds of burdock, cockle-burr, stick-tight, Spanish needles, goose grass and many others.

Some plant appendages can cause painful suffering and even death. The stiff cruel spikes of such plants as the grapnel, African devil's horn or the feathergrass of Russia can work themselves deeply into an animal's flesh. When this happens where the flesh is especially sensitive or the barb cannot be removed, infection and death can follow.

Seeds are transported by animals in many other ways. The tempting fruit of the wild black cherry, the succulent gooseberry or bright red dogwood are always in demand among the birds, which swallow them whole. The seeds of these fruits or drupes as they are called are indigestible and protected by a strong covering. They pass through the food-canal of the bird and are deposited many miles away.

Bright-eyed bluejays and tufted titmice are tireless planters of nuts and grain, tucking them away in secret holes in trees and crevices where they are soon forgotten and left to sprout in the spring.

Then of course there are the busiest planters of all—red, grey and black squirrels which bound after acorns, beechnuts, walnuts and other nuts. Each bushy-tailed, short-memoried fellow seems to know what he's doing as he hunches over the hole he digs in the ground, drops his seed, gives it a pat, and goes away, leaving a potential tree snug in the ground.

Man, of course, is probably the most efficient seed planter of all in today's present world, with his scientific methods that produce great harvests of hybrid wheat, golden corn, orange pumpkins and other prosperous fruits of autumn. Yet, unwittingly, he also continues to transport the more humble seeds of nature—burrs stuck to his clothes after an afternoon's walk through the woods, blackeyed Susan and ragweed seeds tucked in crannies of his much-traveled car, and dandelion, yarrow, bouncing Bet and shepherd's purse seeds riding as stowaways on ships and planes.

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AGRICULTURE

Control Japanese Beetle

➤ JAPANESE BEETLE DISEASE, which is doing about $25 million damage every year in the eastern part of the United States, is moving west, but U.S. Department of Agriculture scientists in Illinois are getting ready to fight it.

For the first time, says USDA bacteriologist Harlow W. Hall of the Northern Utilization Laboratory, Peoria, Ill., spores (a dormant stage) of the milky disease bacterium *Bacillus popilliae,* have been produced in liquid nutrients as a method of killing the beetles. This is a major advance toward low cost biological control of these pests.

USDA

JAPANESE BEETLES—Disease caused by Japanese beetles does about $25 million damage every year in certain parts of the eastern United States. But for the first time, spores of a milky disease bacterium have been produced in liquid nutrients, presenting a method for beetle control.

In the first successful production of *Bacillus popilliae* spores in liquid media, Dr. William C. Haynes and Lenora J. Rhodes added activated charcoal to the medium.

This nutrient solution also contained corn sugar, yeast extract, potassium phosphate and tryptone, a substance made from protein by enzymatic digestion.

The yield of laboratory-produced spores in the present experiment is only about three percent. USDA scientists have found that the spores survive long periods of drying and exposure to temperatures that are fatal to bacterial cells.

Although the yield of spores is low and still impractical from an industrial standpoint, the laboratory accomplishment marks progress over the present method of adding milky disease spores to the soil. These spores must be produced in diseased beetle grubs, each inoculated with a hypodermic needle. This method, of course, is not practical for producing spores in the quantities needed by farmers and plant pest control officials.

Very few microbiological insecticides are now being mass produced by way of fermentation processes.

One of the best known, a report in Chemical and Engineering News, Aug. 30, 1965, stated, is based on the bacterium *Bacillus thuringiensis,* which is used to control insects such as the cabbage looper and the alfalfa caterpillar.

Other biological pest controls include insect attractants, insect parasites and predators, and pest-resistant plants.

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