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FACULTY OF AGRICULTURAL

History of bio pesticide

Biological are used to control pests, pathogens, and weeds by a variety of means. Microbial biocontrols may include a pathogen or parasite that infects the target. Alternatively, they might act as competitors or inducers of plant host resistance. Biochemical biocontrols can also act through a variety of mechanisms. Some act by inhibiting the growth, feeding, development or reproduction of a pest or pathogen. Still other biocontrols may be used to form a barrier on the host, so as to act as a feeding or infection inhibitor.

Plant extracts were likely the earliest agricultural biocontrols, as history records that nicotine was used to control plum beetles as early as the 17th century. Experiments involving biological controls for insect pests in agriculture date back as far as 1835, when Agostine Bassi demonstrated that w hite-muscadine fungus (*Beauveria bassiana*) could be used to cause an infectious disease in silkworm. Experiments with mineral oils as plant protectants were also reported in the 19th century. During the rapid institutional expansion of agricultural research during the early 20th century, an ever-growing number of studies and proposal for biocontrols were developed.

The first, and still most, widely used biocontrols included spores of the bacteria *Bacillus thuringiensis* (Bt). I n 1901, Bt was isolated from a diseased silkworm by Japanese biologist Shigetane Ishiwata. Ernst Berliner in Thuringen, Germany, then rediscovered it ten years later in a diseased caterpillar of flour moth. The Bt pathogen was classified in 1911 as type species *Bacillus thuringiensis* and remains the most widely used biocontrols to this day. In the early 1920 s, the French began to use Bt as a biological insecticide. The first commercially available Bt product, Sporeine, appeared in France in 1938. In the US in the 1950 s, widespread use of biocontrols began to take hold as a host of research on Bt efficacy was published.

In the latter half of the 20th century, research and development continued at a low level because of the widespread adoption of cheaper but more toxic synthetic chemical insecticides. During this time, new products were developed and applied; especially in niche markets where petroleum based chemicals were not registered, not effective, or not economical. For example, in 1956, the Pacific Yeast Product Company developed an industrial process known as submerged fermentation, which allowed production of Bt on a large scale. In

1973, *Heliothis* NPV was granted exemption from tolerance and the first viral insecticide, Elcar received a label in 1975. In 1977, *Bacillus thuringiensis* var. *israelensis* (toxic to flies) was discovered, and in 1983 the strain *tenebrion is* (toxic to beetles) was found. In 1979, the U.S. EPA registered the first insect pheromone for use in mass trapping of Japanese beetles. In the 1990s, researchers began testing kaolin clay as an insect repellent in organic fruit orchards. It was made commercially available, particularly for use in organic systems, in 1999.

Biological development for the control of plant diseases has undergone a similar transformation. During the early 20th century, studies of soil microbiology and ecology had led to the identification of many different microorganisms that act as antagonists or hyperparasites of pathogens and insect pests. A number of these were shown to be useful in field-scale inoculations, but few were developed commercially because of the rapid adoption of chemical pesticides during that time period. Commercial success stories from the 1980s and 1990s include products containing*Agrobacterium radiobacter* for the prevention of crown gall on woody crops and *Pseudomonas fluorescen s* for the prevention of fireblight in orchards where the streptomycin had been overused and resistant pathogen populations were abundant. In the greenhouse and potting mix industry, products containing a variety of microbes that suppressed soilborne pathogens were introduced into the market.

As the costs of overusing such synthetic chemicals became apparent, there was resurgence in academic and industrial research related to biocontrols development. And with the rapid expansion of organic agriculture during the past decade, adoption rates have rapidly increased. Because of this, development of new and useful biocontrols has continued to increase rapidly since the mid-1990 s. In fact, more than 100 biocontrols active ingredients have been registered with the U.S. EPA Biologicals division since 1995. Many of these have been introduced Biologicals division since 1995. Many of these have been introduced commercially in a variety of products. Many of the active ingredients currently approved for use in the U.S.A. can be found in publicly available databases.

Some examples of bio controls developed in more recent years

***Agrobacterium radiobacter* Strain K84**

Agrobacterium radiobacter Strain K84 is a naturally occurring bacterium found in many soils and in plant root zones. This biocontrols is used in the greenhouse and nursery environment to control crown gall, an important plant disease.

Bacillus spp.

Bacillus licheniformis, B. pumilus, and *B. subtilis* are naturally occurring soil bacteria with fungicidal properties that together have become one of the fastest growing biocontrols in today's market. Successes include uses as seed treatments or dressings, foliar application and soil-applied control of diseases in a variety of crops.

Coniothyrium minitans

Coniothyrium minitans is a naturally occurring fungus used commercially to control common *Sclerotinia* plant diseases through parasitism of the resting structures of the pathogen.

Paecilomyces fumosoroseus and P. lilacinus

Paecilomyces fumosoroseus is a naturally occurring fungus used in a greenhouse environment to control several species of insects including whiteflies, thrips, aphids, and spider mites. *Paecilomyces lilacinus* is used to control nematodes that attack plant roots in field crops including many vegetables, fruit, turf, and ornamental crops.

***Trichoderma* spp.**

Trichoderma spp. is another biocontrols technology developed in the 1990 s that has been widely commercialized in recent years. *Trichoderma*is a genus of fungi that helps to control plant disease by stimulating plant host defenses and growth, and, under certain conditions, parasitizing harmful fungi within the plant root zone.

Azadirachtin

Azadirachtin is an insect growth regulator derived from neem tree seeds. Known to affect some 200 species of insects, *azadirachtin* disrupts insect feeding and inhibits its ability to molt as it changes from the pupa to adult stage.

Beauveria bassiana

Beauveria bassiana is a naturally occurring soil fungus that grows as white mold. This insect pathogen can be used to control a wide range of target pests, which become infected and develop white muscadine disease, killing the pest within a matter of days.

Cydia pomonella *granulo virus* (CpGV)

CpGV is a natural pathogen of the codling moth, a major pest of tree fruits such as apples and pears. Developed through research begun in the 1980's, commercial use of CpGV in both organic and conventional systems has gained in popularity over the last ten years as codling moth has displayed resistance to many traditional insecticides.

Dysphania ambrosioides

An extract of the plant *Dysphania ambrosioides (*syn. *Chenopodium ambrosioides)* is used to control a number of sucking insect pests such as aphids, leafhoppers, whiteflies, and mites in citrus, grapes, tree nuts, and vegetables. This product breaks down the pest's exoskeleton, adversely affects its respiratory system, and interrupts its ability to navigate (find food).