EGYPTIAN ALFALFA WEEVIL

... *biological control possibilities*

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INTRODUCTION OF THE larval parasite *Bathyplectes curculionis* (Thomson) into the Yuma Valley was one of the first counter measures taken against the Egyptian alfalfa weevil (*Hypera brunneipennis* (Boheman)) following its discovery in the U.S.A. The colonization material was obtained from Utah's Salt Lake Valley where the parasite had been successfully introduced from Southern Europe against the alfalfa weevil (*Hypera postica* (Gyllenhal)) early in this century.

The introduction of *B. curculionis* into the Yuma Valley was a success, and the parasite subsequently spread with *H. brunneipennis* into California. However, it has not been very effective against the weevil in most of California's infested alfalfa-producing areas. It is of only minor significance in the severely hot, low desert valleys, and though more abundant in the milder coastal areas, it has not kept the weevil from attaining damaging status there. This is also true in the Central Valley.

Climate appears to have had an important limiting effect on *B. curculionis*. Extreme heat and aridity have perhaps been the most critical factors. The considerable fatal encapsulation of the parasite's eggs by blood cells of the larval *H. brunneipennis* has further limited its effectiveness. But there is evidence that *B. curculionis* is overcoming the weevil's encapsulating ability and, as time passes, it will probably have an increasing impact on the weevil, particularly in the areas of milder climate. However, it seems unlikely that *B. curculionis* can by itself effect generally satisfactory biological control of *H. brunneipennis* in areas of major weevil infestation. Therefore, an effort is being made to introduce additional parasites of the weevil into California.

These introductions were initiated about 10 years ago, but progress has been slowed by limitations in manpower and logistical support. Nevertheless, at least three new parasite species appear to have been established and others have been, or are being colonized. Furthermore, strains of *B. curculionis* have been obtained from the hot-arid areas of Iraq and Iran, and are being propagated for future colonization. The new parasites that have been obtained over the past decade include: *Patasson* sp., an egg parasite; *Bathyplectes anurus* (Thomson), *B. stenostigma* (Thomson) and *Tetrastichus erdoeisi* (Domenichini), larval parasites; *Dibrachoides druso* (Walker), a parasite of the pre-pupae and pupae; and *Microctonus aethiops* (Nees), *M. colesi* Drea, and an unidentified *Microctonus*, parasites of the weevil adults.

Most of the parasites were obtained by University of California entomologists from the Middle East (Egypt, Iraq and Iran). Additional material has been obtained from the USDA Parasite Introduction Laboratory, Moorestown, New Jersey. Extensive direct colonizations of parasites were also made by USDA personnel in Southern California in the early- and mid-1960's. All of the USDA parasite material, except *M. colesi*, was derived from stocks originally obtained in Europe.

Limitations in personnel and support funds have made it impossible to conduct intensive post-colonization surveys to determine the establishment, success, increase, spread, and efficacy of the several introduced wasps. However, a survey in San Diego County in 1968 showed *Dibrachoides druso* was widely established, but was not particularly effective against the weevil. Its status in the Imperial Valley, where it was heavily colonized in 1961 and 1962, has not been investigated.

Two other species appear to be locally established in Alameda County. These are *Tetrastichus erdoeisi* and *Bathyplectes anurus*, which have been repeatedly recovered from a small alfalfa field at the University's Gill Tract in Albany. Of the two, *T. erdoeisi* appears to have gained the greatest momentum. At times it has been readily swept from the field, and on several occasions it has parasitized more than 50 per cent of reared field-collected weevil larvae. This parasite is now under intensive propagation in the insectary and has been heavily colonized at a number of localities in central and northern California.

Promising parasite

Bathyplectes anurus is a very promising parasite. It was readily collected at intermediate and high elevations (4000 to 8000 feet) in Iran and on occasion parasitized more than 80 per cent of the reared weevil larvae. Since the climates in which *B. anurus* occurs in Iran approximate those of California's Central Valley and northeastern counties, it should eventually thrive in these areas. On the other hand, it probably will not be of importance in the low desert valleys since it does not appear to occur in similar areas in the Middle East (e.g., the lowlands of Iraq and Iran, and the Nile delta of Egypt).

Because *B. anurus* has a very high reproductive capacity, it is hoped that widespread establishment can be effected from rather small colonizations. For example, the population now occurring in the alfalfa planting at Albany was established from a colonization stock of only six mated females. These females were liberated in June of 1969, and by the early spring of 1970, F-1 adults were sufficiently abundant to be readily collected by sweep net. In weevil larval rearings made from collections taken on four different occasions in February and March, 20 per cent of the *Bathyplectes* cocoons obtained were those of *B. anurus*. The parasite was recovered again in the spring, 1971, and appeared to have increased in abundance.

Microctonus aethiops is also a very promising parasite. It attacks the weevil adult and ultimately kills it. A significant aspect of the *M. aethiops* attack is that, during its larval development, the

parasite destroys the reproductive organs of the host weevil. Thus, in parasitized weevil females, egg production is prevented. In the eastern U. S. where *M. aethiops* is widely established on the alfalfa weevil (*H. postica*), the parasite appears to have played a key role in the recent decline of the weevil populations there.

Microctonus aethiops was also rather heavily colonized in Southern California and to a lesser extent in the central and northern parts of the state in the 1960's. However, it has not yet been possible to carry out an intensive survey to determine whether it has become established, and if so, the extent of its impact on *H. brunneipennis*.

Microctonus colesi

Microctonus colesi, a native of the eastern U. S., has only been colonized in small numbers and is not believed to be established in the field. The unidentified *Microctonus* species has only recently been received from Italy, and has not yet been colonized. The egg parasite, *Patasson* sp. was colonized in very small numbers several years ago, and has not been recovered. The larval parasite, *Bathyplectes stenostigma* was released in very small numbers last year and no effort has been made to recover it. Only very limited colonizations of the Middle-Eastern larval parasite, *B. curculionis*, have been made, but more extensive liberations are planned for the spring of 1971.

Progress in the biological control of *H. brunneipennis* has been slow, but the prospects for future benefits are encouraging. The speed with which maximum pressure of the introduced parasites can be brought to bear against the weevil will depend directly upon the amount of effort devoted to the program—and this in turn will be affected by the amount of internal and extra-mural support given the project.

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EGYPTIAN ALFALFA WEEVIL ... breeding resistant alfalfa

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THE USE OF ALFALFA VARIETIES resistant to the alfalfa weevil (*Hypera brunneipennis* (Boh.)) offers a sure, inexpensive means of controlling this pest. Results of work conducted at the University of California and elsewhere show that development of varieties resistant to the alfalfa weevil is possible. However, unlike resistance to the spotted alfalfa aphid, where wide differences in reactions were found among plants tested, only relatively small differences in the levels of resistance have been found among plants tested for the alfalfa weevil. These small increments in the levels of resistance will probably have to be combined into a higher level through generations of cross breeding and selection. The number of generations necessary is not known, but a lower number may be possible if use of such varieties is combined with an adequate level of biological control and good crop management.

A program designed to develop varieties resistant to the alfalfa weevil has been in progress for over 10 years in the eastern United States under the leadership of the U. S. Department of Agriculture's Agricultural Research Service. This program was successful in developing good selection techniques, and a resistant variety, "Team," which is too dormant for maximum production in most areas of California.

The first weevil resistance work in California was begun in 1965 with plant selections made in San Diego County and crosses between California varieties and non-adapted, weevil-resistant plants. Plant testing and selection were accelerated in 1968 as successful methods developed by USDA in the eastern United States were applied. However, since the weevil species, its associated behavioral patterns, and other factors were different in the East, it was found that weevil collection and storage and other methods had to be modified.

Imperial Valley

In the Imperial Valley, where the weevil has been an important pest for many years, adult weevils are collected in large numbers around homes and in trees as they leave the fields in the spring looking for a suitable place to aestivate. These spring-collected weevils are stored at room temperature until about December after which they are stored at 40°F and used for testing until June. Fall collections have also been made. These weevils are usually harder to find, but their mortality is lower and, in early tests, have proven to be more reliable.

Elite breeding clones, already containing resistance to other important pests in California, were the first material to be classified with the new breeding techniques. If resistance could be found in this material, the time needed to develop a new variety could be reduced. To classify plants ¼-inch disks were punched from leaves, weighed, fed to weevils, weighed again, and the percentage of

Greenhouse plant resistance screening test where adult alfalfa weevils are feeding on young alfalfa seedlings. Flats (left to right) are: seedlings ready for testing; weevil cage on flat; and cage with cover to darken the cage for uniform feeding.