

EGYPTIAN ALFALFA WEEVIL

Alfalfa stem damaged by alfalfa weevil (right), as compared with normal undamaged stem (left).



- *the threat to California alfalfa*
- *population, and ecology research*
- *biological control possibilities*
- *breeding resistant alfalfa*
- *chemical control*

The five articles included here summarize research to date on the Egyptian alfalfa weevil, *Hypera brunneipennis*, which poses a major threat to most of the state's 1,140,000 acres of alfalfa, and has already caused losses to growers of more than \$6 million on a total alfalfa-hay crop valued at \$197,000,000 (in 1970). *H. brunneipennis* is not to be confused with its more widely known relative, *H. postica*, which has been an economically important weevil pest for many years, but has been reduced to minor status in some areas through biological control. The Egyptian alfalfa weevil arrived accidentally through the southeastern corner of California in the late 1930's, and became universally distributed over the south coastal plain. It spread slowly, but in recent years has been identified in many of the lowland alfalfa growing valleys of central and northern California—and is expected to expand over the entire Central Valley. As the studies included here indicate, much further research is necessary before an integrated program involving biological control, resistant alfalfa varieties, cultural control and effective chemical control (or combinations of all) can become practical.

... the threat to California alfalfa

ROBERT VAN DEN BOSCH

VERN L. MARBLE

TWO ECONOMICALLY IMPORTANT WEEVILS, the alfalfa weevil, *Hypera postica* (Gyll) and the Egyptian alfalfa weevil, *H. brunneipennis* (Boh.) occur in California alfalfa. Both are exotic species that were accidentally introduced into the United States during this century. *Hypera postica* has been a pest of alfalfa in California since the 1920's, when it spread from Utah across the Great Basin into the northeastern (trans-Sierran and Cascade) area of the state. Subsequently, it crossed the Sierra Nevada and appeared in the area bordering San Francisco Bay and in the Livermore and the northwestern San Joaquin Val-

leys. However, in these lowland areas, biological control effected by the imported parasite, *Bathyplectes curculionis* (Thoms.), reduced the pest to very minor status. But in the northeastern counties where the parasite is not so effective, the weevil has been a serious pest for many years. A hostile summer climate has apparently prevented deep penetration of *H. postica* into the Great Central Valley.

The Egyptian alfalfa weevil arrived in California via a different route and at a later date than its relative. It was apparently accidentally introduced in the middle 1930's into Arizona's Yuma Valley, which abuts the southeastern corner of California. At first it showed little affinity for alfalfa and seemingly posed no threat to that crop. But then after spreading into the Imperial and Coachella Valleys

of California, it was found in alfalfa and subsequently became a serious pest in the Imperial Valley. Following its penetration of the low desert valleys, *H. brunneipennis* quickly worked its way to the coast. It was first reported from this area in San Diego County in 1950, and thereafter spread rather rapidly to the north, being recorded in San Bernardino County in 1954 and San Luis Obispo County in 1956. It is now universally distributed over the south coastal plain, where it causes serious damage to alfalfa at a number of localities each year.

Prior to the 1960's there was no indication that *H. brunneipennis* had moved into alfalfa north of San Luis Obispo, or that it had invaded the Central Valley. However, alfalfa weevils were reported in abundance near Salinas, Monterey



Field severely damaged by infestation of Egyptian alfalfa weevil.

County in 1963. At the time, the species involved was thought to be *H. postica*. Then in 1965, some damaging infestations of alfalfa weevil were reported from the upper Sacramento Valley (Butte, Tehama, Sutter, Yuba, and Sacramento Counties). The weevils were again thought to be *H. postica*. But when alfalfa weevils were found in 1966 near Porterville, Tulare County—an area remote from any previously known infestation of *H. postica*—suspicion arose that this infestation and those in the Salinas and Sacramento Valleys might be *H. brunneipennis*.

The correct identification of the two weevils is difficult because no reliable structural differences have been found to separate them. The most useful differences are ecological, physiological and behavioral, and are not easily determined under field conditions.

Porterville discovery

The Porterville discovery precipitated a series of physiological tests involving weevils from scattered areas, in the hopes that a clue could be found to their identity. These tests involved parasitization of the weevils by *Bathyplectes curculionis* and an analysis of the ultimate fate of the wasp's egg in the parasitized weevil larvae. It had long been known that the eggs of *B. curculionis* were often encapsulated in *H. brunneipennis* by blood cells, while in *H. postica* this immunity reaction did not occur. In the test series, weevil larvae from Porterville, Durham (Butte County), Elmira (Solano County), Albany and Berkeley (Alameda County) and Castroville (Monterey County) heav-

ily encapsulated the *B. curculionis* eggs. This was a strong indication that the weevil larvae were *H. brunneipennis*, and supported the impression that the infestations increasingly encountered in the Salinas and Sacramento Valleys, the San Francisco Bay Area, and the lower San Joaquin Valley were of this species. Observation of the aestivating habits (i.e., aggregation under tree bark), cooing of the weevils in the aerial parts of the plants, and occurrence of the infestations in the deep reaches of the Central Valley where *H. postica* has never been recorded, has provided further evidence that the new weevil populations are *H. brunneipennis*.

Ominous development

This is an ominous development, because it will only be a matter of time before *H. brunneipennis* spreads over the entire Central Valley, and into the various other low-lying valleys of central and northern California. The signs of its impact are already evident. In the early 1960's losses to alfalfa weevils and the cost of their control amounted to less than a half million dollars annually. Today the amount is much greater and more difficult to estimate.

The results of an Agricultural Extension Service statewide survey taken in 1970 indicate that the cost of alfalfa weevil control by insecticides and the value of the hay lost was more than \$6 million as compared with a total alfalfa-hay crop value that exceeded \$197,000,000 during that year. Many growers have indicated their normal first cutting tonnage which varies between 1¼ to 2 tons

per acre, was reduced up to 50%. Agricultural Extension Service farm advisors estimated that approximately 500,000 acres were affected to some extent by the weevil in 1970. According to the State Department of Agriculture, about two-thirds of these annual costs and losses are attributable to *H. brunneipennis*.

Total losses

Total losses and costs exceeded one-quarter million dollars in each of the counties of Siskiyou, Glenn, Merced, Stanislaus, and Tulare. To date, little damage has occurred in the large alfalfa producing areas of Fresno, Madera, Kings and Kern Counties, although the weevil is known to be present in all of these areas. The most severe losses have occurred in Imperial, San Joaquin and Yolo Counties, where the weevil has become firmly established and conditions have been particularly favorable for its rapid increase. In each of these counties total costs attributable to the weevil exceeded \$1 million in 1970.

In Yolo County a detailed analysis of the devastating economic impact of this insect was made on 12,100 acres (approximately 25% of the County's alfalfa acreage). It was established that damage and associated costs totaled \$422,000, or about \$35.00 per acre. This is a staggering loss when one considers that weevil activity is essentially limited to the first and second alfalfa cuttings. But it is a clear warning of what may be in store for much of California's alfalfa once *H. brunneipennis* saturates the Great Central Valley. In other words, the weevil poses a major threat to most of the State's 1,140,000 acres of alfalfa and it may well cause even greater multimillion dollar annual losses within a very few years.

Major crisis

California alfalfa is faced with a major crisis just as it was 15 years ago with the spotted alfalfa aphid but, as with that pest, a solution is attainable. However, its realization will require an intensive, coordinated effort by growers, researchers and Extension personnel. Included in this issue are reports of studies currently being conducted on the weevil, and research plans for the future.

Robert van den Bosch is Professor and Entomologist, Division of Biological Control, Department of Entomology and Parasitology, University of California, Berkeley. Vern L. Marble is Extension Agronomist, U.C., Davis.