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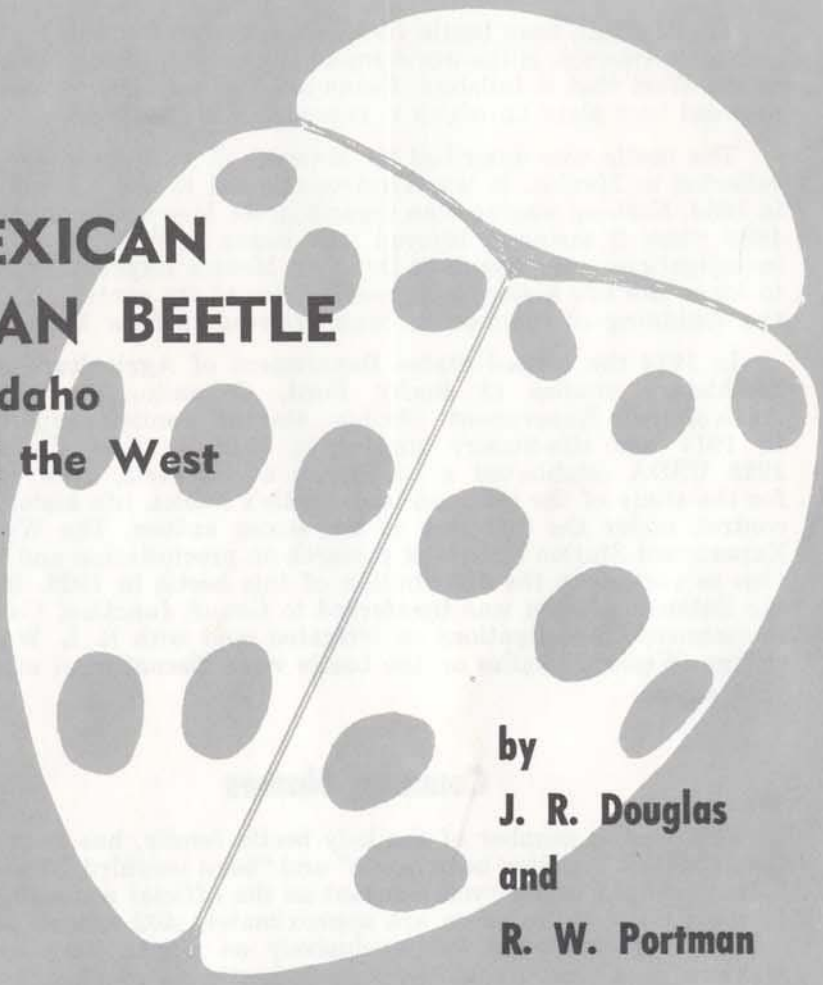

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J. R. Douglas and R. W. Portman*

The Mexican bean beetle (*Epilachna varivestis* Muls.) a native of North America, is the worst insect enemy of beans in those parts of the West that it inhabits. Beans are the only known cultivated or weed host plant on which it reproduces in the West.

The beetle was described by Mulsant in 1850 from specimens collected in Mexico. It was first recognized in the United States in 1864. Nothing was written regarding its destructive habits until 1883 when it seriously injured wax beans in Colorado. By 1913 investigations were begun at the New Mexico Experiment Station to learn the life history and possibilities of its control. This was the beginning of commercial bean growing in New Mexico.

In 1914 the United States Department of Agriculture started life-history studies at Rocky Ford, Colorado. The Colorado Agricultural Experiment Station started control experiments in 1917 and life-history studies in 1918 at Fort Collins. In 1923 USDA established a laboratory at Estancia, New Mexico, for the study of the Mexican bean beetle's habits, life history, and control, under the direction of the senior author. The Wyoming Experiment Station instituted research on precipitation and irrigation as factors in the distribution of this beetle in 1928. In 1935 the Estancia station was tranferred to Grand Junction, Colorado, to commence investigations on irrigated land with R. L. Wallis in charge. Western studies on the beetle were discontinued after the 1938 season.

Common Names

This pest, a member of the lady beetle family, has been called "bean beetle," "spotted bean beetle" and "bean ladybird." The name "Mexican bean beetle" was adopted as the official common name. In the United States there are approximately 402 species of lady beetles. Only 2 species feed exclusively on plants. They are the Mexican bean beetle and the squash beetle (*Epilachna borealis* Fab.) which occurs in the Southeast. All other species of the lady beetle family are predacious and feed largely on aphids and the eggs of insects.

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Figure 1—Sixteen Black spots on a copper-colored field is the emblem of the adult Mexican bean beetle. Eggs (a), larva (b), pupa (c) and adults are shown in natural position on the underside of the bean leaf. Enlarged.

Description and Life Cycle

The Mexican bean beetle (Figure 1) is a copper-colored, hard-shelled, round-backed beetle with 16 black spots on its back. It is about ¼ inch long and about 1/5 inch wide. The eggs are orange-yellow and are deposited on their ends in masses of from 40 to 60, with an average of 53, on the lower surface of the leaf. The ability of this beetle to reproduce rapidly under favorable conditions is remarkable. A female may deposit an egg-mass every 2 to 3 days. As many as 1796 eggs have been deposited by a single female, while the average is about 900. This beetle is relatively free of parasites or predacious insects. The eggs usually hatch in 8 to 11 days during the summer in southcentral Idaho.

The young larva is lemon-colored and when first hatched is about 1/20 inch long. A few hours after hatching the larvae begin to feed together in a group for a few days and then they spread over the plant. As it grows, the larva molts or sheds its skin 3 times. When full-grown it is about ⅓ inch long and about half as wide. The larva is covered with branched spines which give it a fuzzy appearance. During the summer, in the Magic Valley, the larval period ranges from 20 to 25 days, depending on the temperature. The full-grown larva attaches itself to the lower surface of the leaf upon which it has been feeding and becomes shorter but larger around the body, preparatory to pupation.

The pupa or inactive stage, which is also lemon-colored, is attached to the leaf by means of the fourth larva skin. The length of the pupal period in Magic Valley ranges from 7 to 10 days. When the beetle emerges from the pupa it is light lemon-colored

and shows no black spots on the wing covers. These spots soon appear, however, and after a week or 10 days the beetle gradually becomes copper-colored. The total development period from egg to beetle in Magic Valley would probably range from 35 to 45 days, with an average of 40 days. In southern Idaho one generation and a partial second may be produced during the bean season.

Nature of the Injury

The Mexican bean beetle and its larva have mouthparts adapted for chewing. The adults or beetles feeding from below, eat ragged areas in the lower surface of the leaf but often cut through the upper surface, giving the foliage a lace-like appearance (Figure 2). The larvae also feed on the lower surface of the leaf but do not cut through the upper surface. In feeding, the lower surface of the leaf is scraped up and compressed by the mouthparts as the juices are swallowed. The solid material is left on the leaf in small windrows or strips. Leaves that are completely skeletonized dry up and drop or blow from the plant while the efficiency of other leaves is reduced. Feeding is mainly on leaves, but the young pods and even the stems will be attacked and destroyed. When insects are numerous, an injured plant appears completely dried out.

The extent of injury depends upon the number of insects per acre, the time of their appearance in the fields in relation to the size of the plants, the condition of the plants, and seasonal variations. Under a heavy infestation complete defoliation will result early in the season so that only a few pods will be produced per plant, provided nothing is done to prevent destruction. One farmer who harvested an unprotected field obtained less than 18 pounds of beans per acre.

Figure 2—The characteristic lace-like appearance of the bean leaf where the adult Mexican bean beetle has been working. The adult and the larva both have chewing mouthparts. Enlarged.

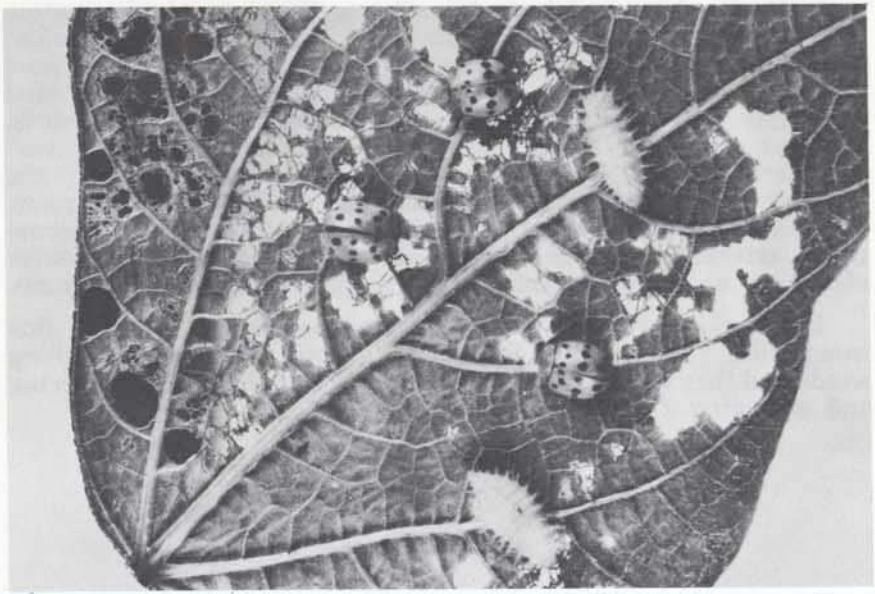

Figure 3—Mexican bean beetles hibernate during the winter months, seeking the Ponderosa pine forest zone in the southwest. Leaf piles under such trees provide ideal hibernation quarters.

Hibernation

In the eastern and southeastern states this beetle prefers pine needles and oak leaves on well-drained hillsides near bean fields in which to hibernate (Figure 3). Studies in New Mexico indicated that the Ponderosa pine forest zone is the natural hibernation quarters of this beetle in the Southwest. These sites become more favorable when oak trees are present in the association. Some pass the winter along fence rows, canals, ditch banks, and in and around the edges of fields and gardens, under rubbish and plant debris, or where deciduous leaves of trees have accumulated. Oak "motes" of *Quercus gambelii* growing along the western slope of the Wasatch Mountains in Utah are favorable hibernation quarters. Piles of leaves under these trees form highly satisfactory hibernation quarters. These piles of leaves permit the beetles to easily enter and leave and protect them from sudden temperature changes.

In the Southwest, tests with marked beetles showed that this insect flies either up or down the canyons with the prevailing winds and they use the canyons as migration paths, both in entering and emerging from hibernation.

Distribution In the West

The Mexican bean beetle commonly occurs in the states of Arizona, Colorado, Texas, Nebraska, Utah, and Wyoming. The closest known source of infestation for Idaho is the foothills and valleys west of the Wasatch Mountains in Utah.

Beans are the only host plant in Idaho on which this pest can reproduce. The best time to find the overwintered beetles is when the bean plants are small. At that time, the population is the lowest during the year. Due to our narrow bean rows and heavy foliage, the second best time would be the latter part of July and the first part of August. Since the larvae feed on the under surface of the leaf, the injury is not readily noted by the casual observer.

Due to the prevailing winds and lack of suitable hiberation quarters, the Mexican bean beetle probably will never be a major pest of beans in the bean producing areas of Idaho, as it is in some parts of Colorado, New Mexico, Utah and the infested areas east of the Mississippi and south of the Ohio rivers. It will be a nuisance pest like the Colorado potato beetle.

Eradication In California and Idaho

California and Idaho are the only states that have eradicated the Mexican bean beetle. Idaho has eradicated this pest in 3 different infestations and we hope in the fourth. This number-one pest of beans was found in California on July 22, 1946, in the little community of Montalvo, approximately 3 miles southwest of the county seat of Ventura. It took 5 years to eradicate this beetle and the over-all cost of the program was $981,352.

Table 1. — Mexican Bean Beetle Infestations in Idaho

Dates found	Location	County	Stages found	Eradicated and	Year	Cost of Eradication
8-15-54	Twin Falls	Twin Falls	All	Yes	1954	No money
60	Jerome	Jerome	All	Yes	1962	$3009
8-14-61	Boise	Ada	All	No	1963*	4176**
8-22-62	Twin Falls	Twin Falls	All	Yes	1962	709
					Total	$7893

*Six hundred gardens in Boise and Garden City were sprayed in 1961 and repeated in 1962 and only one garden in Boise was found infested in 1963, while several small gardens were found infested on July 1 and 3, 1964 in the same general area of the City.

**The cost up to 1964.

Table 1 shows the Mexican bean beetle infestations in Idaho. Four separate infestations have been discovered, one each in Ada and Jerome counties and two in Twin Fall.

The cost of the Idaho eradication programs was paid from Idaho Bean Commission funds.

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