Chapter 9

Larval Feeding Behavior and Host-Plant Resistance in Maize

Terry F. Branson

I. Larval Feeding Behavior

It is difficult to study the feeding behavior of subterranean insects. To gain the kind of knowledge readily obtained with insects that live on aerial parts of plants often requires methods that are laborious and time-consuming. As a result, many gaps remain in our understanding of the feeding behavior of *Diabrotica* larvae.

1.1. Larval Mobility

Suttle et al. (1967) studied the mobility of larvae of *Diabrotica virgifera virgifera* LeConte in a field containing rootworm eggs. They removed the top 15 cm of soil in plots of varying sizes (radii of 25 cm–1 m), replaced it with sterilized soil, and planted maize (*Zea mays* L.) in the middle of the plots. It was supposed that any larvae recovered from the plots would have migrated from the surrounding infested soil. Root systems of some plants were dug about a month after planting and examined for larval feeding. Also, some maize plants in the plots were caged for adult emergence. A flaw in this technique is that rootworm eggs are often found at depths greater than 15 cm (Gustin, 1979), and Branson et al. (1982b) found that in some soils, all eggs are found below 20 cm.

Short and Luedtke (1970) also studied mobility of larvae of *D. v. virgifera*. They established experimental plots 4.6 m long and 20 cm–2 m wide in a field known to be infested with rootworm eggs. Each plot was enclosed by metal sheeting to a depth of 20 cm and fumigated for 2 days.
with methyl bromide to kill rootworm eggs. Maize was then planted down the center of the plots so that plants were 10 cm–1 m from unfumigated soil. After 2 months, the root systems were rated for rootworm damage and the plots caged for beetle emergence. This technique should be modified so samples are removed from the fumigated plots to determine whether all eggs have been destroyed.

Chiang (1973), briefly and without detail, described another method for studying larval mobility. He placed soil plugs containing rootworm eggs into an uninfested field and planted maize at different distances from the plugs.

None of these studies accounted for the distance that maize roots grew between the time of planting and egg hatch, so that the distances that larvae were presumed to have traveled to reach the maize roots are incorrect.

1.2. Feeding Sites

The sequence of attack on the developing root systems of maize plants was determined for larvae of *D. barberi* Smith and Lawrence* by Apple and Patel (1963), for larvae of a mixed population of several *Diabrotica* spp. of Guatemala by Melhus et al. (1954), and for larvae of *D. virgifera zeae* Krysan and Smith in Mexico by Branson et al. (1982b). All these researchers used the same basic technique, namely, excavating root systems of maize on successive dates, a few days to a week apart, beginning before the initial attack and ending with the cessation of larval feeding.

Roots develop at the bases of successively higher internodes of the maize plant at roughly weekly intervals, so that by digging roots each week one can follow the general sequence of larval attack on the developing root system. The root systems are excavated along with a surrounding 20–30-cm cube of soil, the excess soil is shaken from the plant, the root systems are soaked for several hours in water containing a detergent and then washed with a water spray under sufficient pressure to remove the remaining soil. The clean root system can then be examined for feeding damage. On some well-developed systems, it may be necessary to remove the roots, one whorl at a time, to determine which whorls are damaged.

1.3. Host Range and Host Adequacy

Several investigators conducted host-range studies with larvae of *Diabrotica* spp. by caging suspected hosts in the field and identifying the adults as they emerged (Melhus et al., 1954; Branson and Ortman, 1967a, b, 1970, 1971; Branson et al., 1982b). Cages are erected a few days to a

*[Before 1983, *D. barberi* was called *D. longicornis* (Say) or *D. l. barberi.*]