vae per head, but susceptible to large numbers of larvae.

Growing sunflower plants in a greenhouse and subjecting them to a population of adult moths at the proper time would seem to be a feasible technique for development of resistant inbred lines and also for testing hybrids. Although techniques for rearing sunflower moths on artificial media have been known since the late 1960s, the vigor of our artificially reared moths declines rapidly, apparently due to small colony inbreeding, and we have not been successful in mass production of eggs or larvae. Diapause (dormancy) has been artificially induced by a combination of short daylight periods and lower temperature during the third to fifth instars. Larger colonies and development of techniques for storing diapausing pupae are needed. Also we need to be able to break diapause to make large numbers of adult moths available, when needed to coincide with plant development.

Development of sunflowers resistant to the sunflower moth appears possible based on presently available test results, but better technical procedures are needed for maximum progress.

Benjamin H. Beard is Research Geneticist and Research Leader, Oilseed and Industrial Crops Production, Agricultural Research Service, U.S. Department of Agriculture and Lecturer, Agronomy and Range Science, University of California, Davis. Elmer C. Carlson is Specialist, Department of Entomology, U C Davis. Anthony C. Waiss, Jr. is Supervisory Research Chemist, Western Regional Research Center, Agricultural Research Service, U.S. Department of Agriculture, Berkeley. Carl Elliger is Research Chemist, Western Regional Research Center, Agricultural Research Service, U.S. Department of Agriculture, Berkeley. John M. Klisiewicz is Research Plant Pathologist, Oilseed and Industrial Crops Production, Agricultural Research Service, U.S. Department of Agriculture, Plant Pathology Department, U C Davis. Alan Johnson is former Graduate Research Assistant, Agronomy and Range Science, U C Davis; now Research Director, Kamprath Seed Co., Bakersfield. Bock Chan is Plant Physiologist, Western Regional Research Center, Agricultural Research Service, U.S. Department of Agriculture, Berkeley.

The adult sunflower moth is generally described as gray to brown, about 11 to 13 mm long, and with a wing spread of 21 to 27 mm. In California the female is larger than the male. Eggs are laid singly or in small clusters of 4 to 10 eggs, within or among sunflower disk florets, 3 to 6 days after the ray flowers open. The eggs are elliptical, finely reticulated, 0.63 to 0.80 mm long and 0.23 to 0.27 mm in diameter. When first laid the eggs are pearly white but after a day or two change to brownish yellow. Larvae, 1 to 1.5 mm long, usually emerge in 48 to 96 hours. Mature larval length is 16 to 18 mm, achieved about 19 to 28 days after hatching and passage through 4 or 5 instar stages. Mature larvae spin a silken thread, lower themselves to the ground, spin cocoons in the soil, and enter the pupal stage. Some reports indicate cocoons also can be found among or within the sunflower achenes. There may be one to four, or more, reproductive cycles each year. During early summer cycles, mature larvae spin light airy cocoons, but those going into diapause (overwintering) spin much heavier cocoons. Development of sunflower varieties or hybrids resistant to the seed-destroying larvae of the sunflower moth seems promising, but efforts have been stymied by erratic populations of moths in the field and difficulty in rearing moths for artificial testing for resistance.

Research briefs

UC Animal Behaviorist Ed Price, UC Davis, displays a lamb-kid pair being raised in isolation from other sheep and goats. As adults, they will be studied to determine how much each takes on the characteristics of the other.

Animal behaviorist Ed Price has paired sheep with goats and is raising each pair in isolation to determine the effects this will have on their behavior as adults. The objective: determine the relative influences of heredity and learning in the developmental process.

He also is looking for characteristics in bull calves that correlate with sexual motivation as adults. This would allow culling poor prospects without investing time and expense involved in raising them to maturity.

Another study is under way to determine the mothering ability of cows with twins compared with those having single calves.

Deer-sheep combination improves range use

There is little significant competition between deer and sheep for most kinds of range forage, a summary of 19 years of research, primarily at the Hopland Field Station, shows.

W. M. Longhurst and other wildlife and range scientists conclude that dual stocking of a range with deer and sheep makes more efficient use of all classes of forage than with either species alone.

The diet of deer consisted of approximately 60 percent browse, 20 percent forbs, and 20 percent grass. Sheep consumed 6 percent browse, 9 percent forbs, and 85 percent grass.

Deer and sheep overlap most in their diets when both are eating grass during the wet months of the year. There is minimal competition for browse and forbs, says Longhurst.