# Black Scale Control

## supply of natural enemy developed by using pest as foster host on noneconomic plants

Stanley E. Flanders

**Oleanders planted** along the side of a citrus orchard—toward the prevailing midday winds—can serve as insectaries for the production of the African parasite, *Metaphycus helvolus*, a natural enemy of black scale introduced into California in 1937 by the University of California.

The black scale in southern California generally is kept under satisfactory control by this natural enemy but in certain areas—as in the Piru district of Ventura County—the scale becomes so abundant at times that treatment is considered necessary.

Five years after the African parasite was first propagated in an insectary at Fillmore and turned loose, the black scale disappeared throughout the Piru area.

No spraying, fumigation, or parasite releases were necessary in the years of 1942 and 1943. The scale—a food supply of the parasite—was reduced to such a low point that the parasite practically disappeared. The black scale came back and became damaging before the parasite could regain control and therefore insecticides were applied.

The use of insecticides may reduce black scale in many groves to the point where the parasite population is prevented from becoming reëstablished and regaining control of the scale.

This effect has been counteracted to a great extent by a growers' coöperative insectary at Fillmore, which has released over five million parasites during the past 10 years.

Oleanders—a favorite food plant of black scale—have been used for many years by the insectary at Fillmore for the propagation of black scale and the parasite, *Metaphycus helvolus*. The stock supply of oleanders which is grown near the insectary is practically free of black scale at all times—few scales being protected from attack by the parasite.

### Rates of Increase

The climate of the Piru district is such that black scale on citrus is single brooded with all individuals practically equal in stage of growth. Consequently, from about September to April, all the scale on citrus is suitable for the reproduction of the parasite. Because of the scale condition during this period, the parasite is able to develop about eight generations to one of the host.

When scale is plentiful, the parasite population increases with remarkable rapidity. During the summer months when the scale is not in condition for successful attack by the parasite, a high proportion of the parasites die before they can find scales in which to lay eggs.

The number of black scales determines the number of parasites and the number of these parasites that survive the summer lean period is determined by their abundance during the preceding winter. An extremely effective control of black scale is followed by outbreaks which may be damaging.

In areas where natural enemies are handicapped either by seasonal lack of hosts or by insecticides, the use of foster host insects on noneconomic plants as a means of preventing damage to adjacent economic plants may be utilized. The success of such agricultural practice is predicated on detailed knowledge of the pest-parasite relations in the field.

Black scale is required for the continuous existence of the African parasite in the citrus orchards, and the parasite must exist in the citrus orchards to keep the black scale under control.

The grower in the Piru district may find it advisable to use black scale as a foster host in order to maintain a steady production of the parasite and thus prevent the scale in his grove from reaching damaging numbers.

To be effective as foster hosts the oleanders must be well watered so that the shoots and leaves are succulent and the ground cover of dry leaves beneath creates a humid environment suitable for the rapid development of black scale. It is this humid, equable climate under the

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**Row of three-year-old oleander bushes planted along west side of orange grove to serve as insectaries for the continuous production of the parasite—*Metaphycus helvolus*. *Inset* Localized infestation of black scale on oleander. This colony of scale developed under a ground cover of dead leaves where it was protected from the parasite.**

# Breeding of Mares

## management and accurate records may increase percentage of live foals

Perry T. Cupps

**Breeders of horses** often are disappointed at the small percentage of live foals they obtain from breeding mares.

Horses are less efficient producers of young than other types of farm animals as the average foal crop is 45% to 55% of the mares bred while the average calf crop is 70% to 80%.

Breeding and management practices may be partially responsible for this low efficiency.

Breeding of horses tends to be seasonal because of the natural tendency for mares to breed only part of the year. Most mares manifest estrous cycles only during the spring and early summer although a few may have cycles at any season of the year. Also, breeders commonly breed their mares in the spring in order that foals may be born soon after the first of the year. Usually, the age of the animal is calculated as of the first of January, putting the foal born late in the season at a disadvantage.

The estrous or reproductive cycle is divided into several periods but only two can be distinguished from the behavior of the animal. One period, estrus, is the time at which the mare will accept the stallion. The other period, called diestrum, is the part of the cycle when the mare is not receptive to the male. The length of these periods is variable between individuals and in one individual from one cycle to the next.

Estrus has an average duration of six days and a range of from two to eleven days. Occasionally a mare will remain in estrus for a longer period of time.

In addition to the extreme variations in the length of the heat period, some individuals will show a split period; the animal being in heat for a day or two then out of heat for one or two days then back in heat again. These animals may be very difficult to settle. Some individuals do not show any signs of estrus—the so-called silent heat. Although the reproductive organs may be functioning properly, the mare may refuse the stallion.

The egg is usually shed from the ovary the day before the end of heat. It lives only a short time, six to twelve hours. The spermatozoa also live a very short time in the reproductive tract, with the average fertile time being between 24 and 36 hours.

Because the period of estrus is so variable and the life of the germ cells so short, it becomes apparent that fertile matings under standard management will not occur in all cases. In fact, settling the mares by one breeding or during one heat period is apt to be the exception rather than the rule.

The mares may also manifest estrus without ovulation. An animal may show all the external signs of heat but since no egg is shed she will remain sterile even though she is bred repeatedly. Heat without ovulation is more likely to occur in very young and very old animals and at the beginning and end of the breeding season.

The owner and breeder may be able to increase the breeding efficiency of his animals by observing them closely and keeping records of the cycles of the individual animals since each will tend to establish its own pattern. For example, if a mare has an estrus period of three days the optimum time for breeding is the second day. If she has an estrus period of seven days the optimum time for breeding is the fifth day. If she is bred on the second day chances for conception are very small.

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## PASTURES

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nual cost item in the studies. On the average, a little over 60% of the total cash and labor cost was for water and irrigation labor. Water costs ranged from approximately $2 per acre on land in certain irrigation districts to over $20 where pumping was done from considerable depth. The labor cost of irrigating varied from less than $3 per acre to more than $17 per acre, due to differences in the method of irrigation, size of head and efficiency of the irrigation system.

Over 90% of the pasturage obtained by coöperators in the studies was during eight months—March through October inclusive. Total animal-unit months of pasturage for the four years of the studies averaged 10.0. Under favorable conditions, well-managed irrigated pastures in the Central Valley of California should produce at least 12 animal-unit months of feed at a total cost not over $30 per acre—as of 1948—which would result in a cost per animal-unit month of $2.50 or less.

Although most pastures in the studies were used by dairy cattle, a few records were obtained on gains in weights of lambs and steers. These indicated that a gross gain, excluding mortality, of between 400 and 500 pounds of lamb or beef is commonly produced from an acre of irrigated pasture after allowances for any supplemental feeds.

Several coöperators in the Colusa County study harvested Ladino clover seed from a portion of their acreage. This is a relatively new practice which paid quite well for some growers during wartime high seed prices. However, it appears that seed production will become a specialized business in itself, not combined with a balanced livestock program, since about 2½ to three months of feed are lost in the middle of the pasture season.

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## BLACK SCALE

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leafy ground cover that makes the oleander a good insectary for the production of the African parasite.

In a hot dry climate the black scale thrives only on the branches resting on the moist ground and covered by fallen leaves. In such an environment the scale exists in all stages of development, more or less protected from such parasites as *Metaphycus helvolus.*

Many, if not most, of the young scale, however, crawl up and toward the light so that they settle down on the exposed parts of the plant. It is these wanderers from the hidden colony under the leaves that serve as hosts for the African parasite and thus maintain a continuous population of parasites for controlling the black scale on the adjacent citrus trees.

The number of oleanders needed per acre of citrus will vary according to the needs of individual groves.

The planting of large acreages solely to one species of plant tends to produce a less favorable balance in nature than that which occurs in a natural mixed planting. The planting of oleanders in a citrus grove, therefore, is a return to a more natural state and better natural control.

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