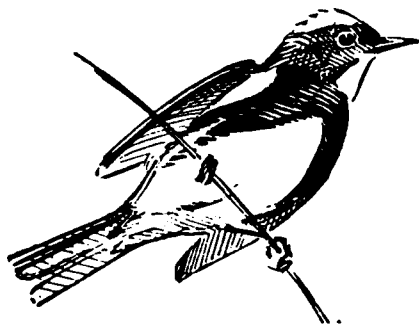


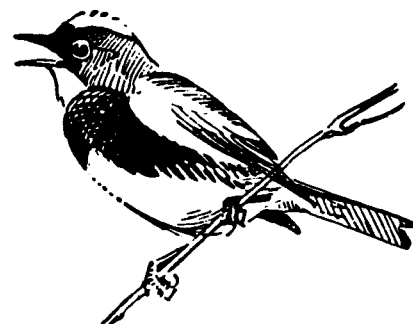
Calico Scale on Walnuts

problem of soft scales on walnut increasing but natural enemies still exert suppressing influence on calico scale

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Audubon's warbler—*Dendroica auduboni*—is probably one of the three commonest birds in California in winter time.



The Audubon's warbler and a wasp parasite work together to hold the calico scale—potentially destructive on walnuts—under control. This occurs even under conditions where—because of the tendency of the newer insecticides to interfere with natural enemies—other unarmored scale population has increased.

The calico scale—*Lecanium Cerasorum* Cockerell—was probably introduced into the San Francisco bay area from the Orient. In 1930, isolated cases were found of the insect killing fruiting wood in walnut orchards in the San Joaquin Valley, and by 1933 it was generally distributed in the area. At that time, the pest population was reported to show wide fluctuations, with only a few scales one year and the next year an infestation causing serious damage. In some cases the scales became so thick they were piled up one on top of the other. Parasites largely controlled the scale in the bay region but not in the valley districts, although a number of the insects were killed.

In the winter of 1955–56, there was a large overwintering population of the calico scale in the experimental orchard at Linden. This seemed to be more noticeable in the plots that had received a combination spray of DDT and OMPA. The DDT had been directed against the codling moth—*Carpocapsa pomonella* (L.)—and the OMPA against the walnut aphid—*Chromaphis juglandicola* (Kltb.). The density of the scale population apparently increased with increased amounts of OMPA.

In February, when the overwintering calico scales begin to grow, they take on a characteristic waxy pattern which easily differentiates them from other soft scales, such as the frosted scale—*Lecanium pruinosum* Coq.—and the Euro-

pean fruit lecanium—*L. corni* Bouché. They also develop more rapidly than these two scales. Field surveys—on February 8 and 16, 1956—showed that the calico scale population remained about constant. A decline in the population, however, was noted in March, and the scales continued to disappear until only a few were left. This occurred in a relatively short time, as indicated by the fairly uniform size of the impressions—a waxy white outline—left by the scales.

Earlier investigations—conducted in the same orchard where the present studies were undertaken—showed that the Audubon's warbler was responsible for the disappearance of the scales. At that time, after observation—through field glasses—of the birds feeding upon a group of branches, a count was made which showed that out of 1,093 scales all but 63 had been eaten and that most of those remaining had been parasitized. Although the Audubon's warbler is present in the orchards until mid-April, feeding on the calico scale is apparently

Walnut twig showing whitish impressions left by young developing calico scales eaten by Audubon's warblers. A single scale escaped and was parasitized by *Blastothrix longipennis* Howard, as is evident by the emergence hole in the scale body.



confined to the period of growth when the scale produces the waxy pattern.

The Audubon's warbler has been called the whirligig of perpetual motion, and it is this quality that makes it possible for the bird to be so effective in destroying the scale population. This effectiveness is illustrated in the accompanying photograph of a twig—collected on May 24, 1956—showing the whitish impressions left by young developing scales that were eaten—sometime during the first half of March—by Audubon's warblers. Out of the many scales present in the winter, only one survived and it was parasitized, as is evident by the emergence holes in the scale body.

In the spring the degree of parasitism in the remaining scales in the several OMPA treatments was determined and was found to range from 96% to 100%. The parasite was identified as *Blastothrix longipennis* Howard, but it has not yet been distinguished from *sericea* Dalm.

Despite any action of insecticides, natural agencies still appear to exert an important suppressing influence on the calico scale. Because of the effectiveness of the Audubon's warbler and the *Blastothrix longipennis* Howard, not only has the population increase of this insect been less marked than that of other scales—such as the frosted scale—but there has also been no apparent injury inflicted by it in any of the orchards examined.

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The earlier investigations which revealed that the Audubon's warbler attacks the calico scale were made by Homer Lowe, at that time Entomologist with the Anderson Ranch, Linden.