

BIRDS as Predators of Destructiv



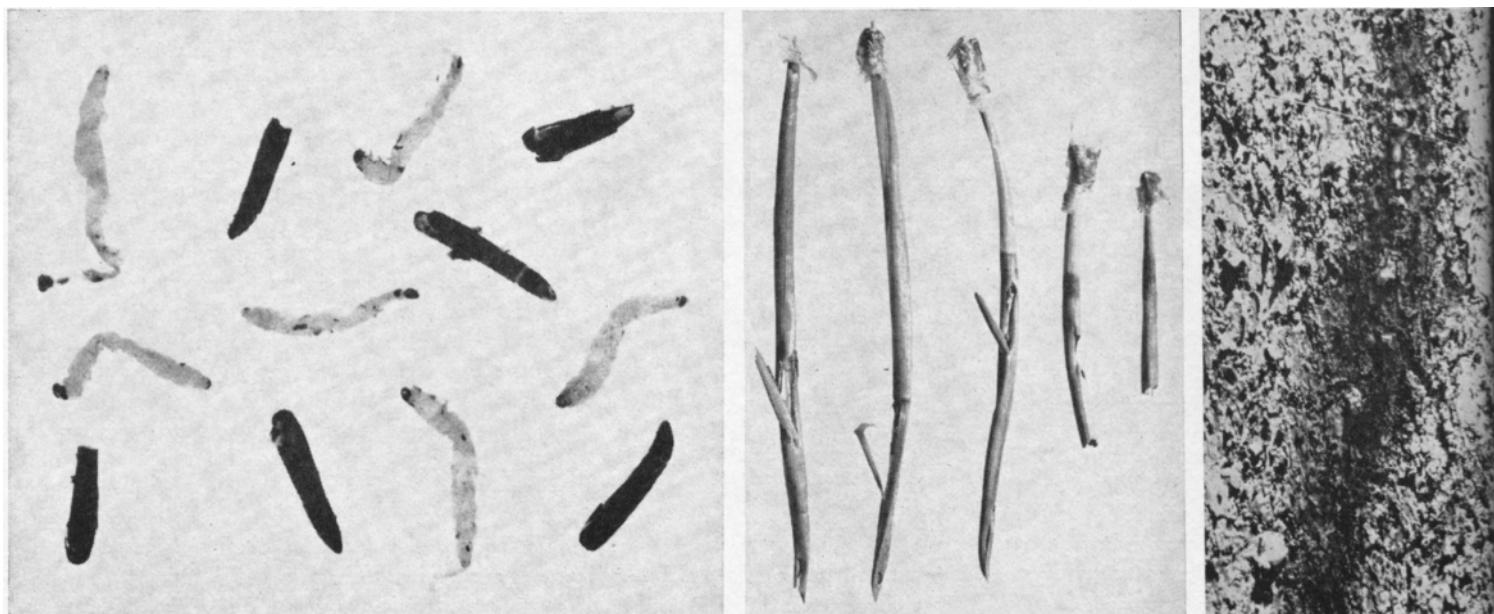
D. L. DAHLSTEN
S. G. HERMAN

Contents of one chickadee stomach showing needle miner larvae and associated needle fragments. Photo by F. E. Skinner.

Birds can be a substantial regulatory influence toward the suppression of destructive insects in California's forests, according to this report from the Division of Biological Control, Department of Entomology and Parasitology, U.C., Berkeley. The Mountain Chickadee reduced an overwintering (and epidemic) population of lodgepole needle miner in Mono County by 30% during the winter of 1961-62. Grosbeaks were also observed feeding on the sawfly larvae in the Mount Shasta area. The role of the woodpecker in reducing bark beetle infestations is also being studied at Blodgett Experimental Forest, El Dorado County, as part of this long-term ecological research project to determine feeding habits and factors influencing population levels of various forest birds.

IN THE WINTER of 1961-62, the U.C. Division of Biological Control initiated a long-term study of the avian predators of the lodgepole needle miner, *Recurvaria* sp. In a small but epidemic infesta-

Needle miner larvae and pupae, left photo, recovered from the crop of a Cassin's Finch. Miner larvae, right photo, from four lodgepole pine needles to left were removed by Mountain Chickadees; larvae from needle on right were removed by a Cassin's Finch. Photos by F. E. Skinner.



e Forest Insects

tion of this insect in Mono County, the Mountain Chickadee, *Parus gambeli*, was found to be the most effective of nine species known to feed on the needle miner. The lodgepole needle miner is a small, mottled gray moth about $\frac{1}{4}$ inch long. Larvae mine the needles of lodgepole pine and consume the mesoderm. This larval activity kills the needle, thereby causing partial defoliation. One generation of this insect occurs every two years, and both winters are spent in the larval stage.

Needle miner

Mountain Chickadees are small (see photo), almost exclusively insectivorous residents of high-altitude coniferous forests from British Columbia south to northern Mexico and east to Texas. The usual nesting site is a hole, previously excavated by a woodpecker, in standing dead trees or snags. A female may lay from six to nine eggs, and occasionally up to 12, indicating a rather high breeding potential.

During breeding in the spring, these birds are found in pairs. Family groups are commonly seen after the fledging of the young. In the six to eight months of winter, chickadees characteristically

These three Mountain Chickadees were trapped in a mist net, banded and released for further observation. Photo by R. Stallcup.



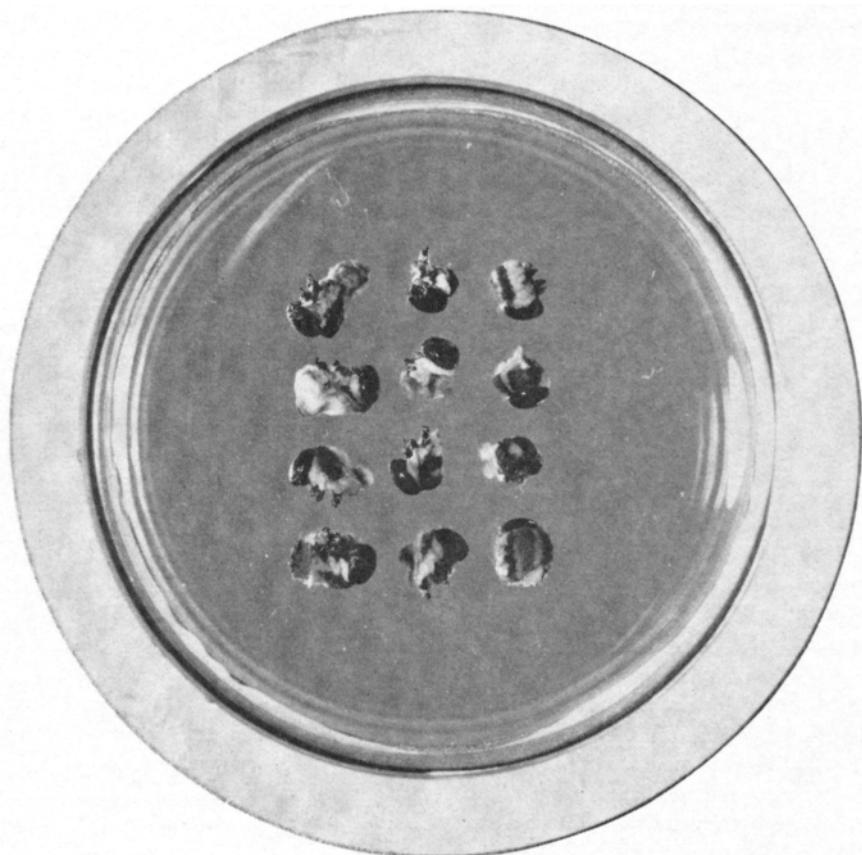
travel in bands of 25 to 50 individuals. Groups of over 100 are not uncommon in areas of needle miner abundance.

Large numbers of chickadees were observed foraging in the needle miner infestation near Sentinel Meadow in Mono County in early November, 1961. Stomach samples taken from ten of these birds showed that needle miner larvae accounted for over 90% of the volume of total organic matter. Higher percentages of needle miner larvae were obtained later in the winter.

Head and thorax of sawfly larvae rejected by Evening Grosbeaks; birds consumed only the abdomens. Photo by F. E. Skinner.

Chickadees, as well as another predator, Cassin's Finch, *Carpodacus cassini*, feed on needle miner larvae only during the second overwintering period. Each predator has a characteristic method of extracting the larvae from the needles. Chickadees usually break the convex surface of the needle near the base of the larval mine and peel a narrow strip of tissue toward the apex of the needle to extract the exposed larva. Cassin's Finches, on the other hand, snip off the

Experimental nest box in position on a lodgepole pine. Photo by K. P. Shea.



end of an infested needle to obtain the larva (see photo).

The feeding habits of chickadees during nesting are unusual because the parent birds evidently continue feeding on needle miner larvae and pupae while the young are being fed other larger, more succulent lepidopterous larvae from aspens near the margins of extensive lodgepole pine stands. Chickadee stomach samples also containing needle miner larvae were collected in March, 1963, at Tuolumne Meadows, Yosemite National Park. This is the site of another needle miner infestation.

Two study plots were established at Sentinel Meadow, Mono County, to study the use of artificial nesting sites. One plot was well within the infestation area, while the other (about two miles away), though ecologically similar, was virtually free of needle miners. Nest boxes were placed in each of these study areas at regular intervals, and those placed in the infestation area were used by the chickadees to a considerable extent. Nest boxes not only supplement the natural nesting sites, but they also make chickadee broods accessible for study (see photo).

Census figures for Mountain Chickadees showed more breeding pairs in the infested plot than in the noninfested plot. Chickadees remained more abundant throughout the postbreeding period in the infested plot.

Investigations were expanded in the summer of 1963, and 481 birds of 24 species were banded in the general vicinity of the two study plots. This number, including 128 adult, juvenal, and nestling chickadees, were color coded to indicate time and location of capture. It is hoped that the role of chickadee immigration on needle miner populations can be understood by future observation of these marked individuals. The color-banded individuals will provide information on longevity and dispersal habits.

Sawflies are a potential threat in California due to the increasing amount of land that is being devoted to forest plantations. The U.S. Forest Service alone has successfully established approximately 85,000 acres in plantations in the state, and planting is continuing at a rate of 15,000 acres per year. Sawflies closely related to our California sawflies are well known pests in conifer plantations in the eastern and southern United States. Recent reports from Modoc County (Knox Mountain) indicate that sawflies may be a problem of economic importance to growers managing natural regeneration for Christmas trees.

The avifauna of conifer plantations and other monocultures, is known to be very poor. In Germany, as well as other parts of Europe, artificial nesting sites have greatly increased the avian fauna. It is hoped that permanent nesting-box study plots can be established in several California plantations in the next year.

Avian predation was noted and preliminary life tables prepared recently from a study of pine sawflies in the *Neodiprion fulviceps* complex at Mt. Shasta, Siskiyou County. Three study areas were established at the base of Mt. Shasta in a brush field previously cleared for planting. Bird predation was not noted on the plots at 4,500 and 5,000 ft, where larval activity was completed by the first week of June, 1961. At the lower elevation, 4,000 ft, larval activity continued into the second week of July, 1961.

Evening Grosbeaks, *Hesperiphona vespertina*, were observed to feed on the sawfly larvae at the lower elevation only. Grosbeaks characteristically devoured larvae so that the head and part of the thorax—containing, perhaps, some distasteful substance—were not consumed (see photo). Stomach analyses will be made in future studies to further verify grosbeak predation. Body portions of the sawflies were counted on and beneath the ten study trees, but evidence of predation was found throughout lower elevations.

Grosbeak feeding was observed in the lower study area from June 30 to July 20. During the peak of activity (about July 7) from three to five grosbeaks could be observed at any one time. Counts of larval remains on and beneath the study trees ranged from four on July 3 to 81 on July 7, declining thereafter with a total of 166. Thus birds took a total of approximately 10% of all feeding larvae

available on the study trees. This was part of a total loss of 40% at the lower elevation compared to 30% losses of the same stage in both of the upper areas.

Evening Grosbeaks are fairly common in the forests of the higher mountains. Nesting occurs primarily in fir (*Abies*) forests. Conditions of this type are found at higher elevations on Mt. Shasta, although a few isolated, mature white firs were located near the lower elevation plot. Following further study of these birds it may be found desirable to encourage grosbeaks or other birds to nest in or near plantations.

The western pine beetle, *Dendroctonus brevicomis*, is considered the most important forest insect pest in California. Following hatching, the larvae of this insect burrow out into the bark, where they mature. Several species of woodpeckers are known to slough off bark and feed on the small white larvae.

Woodpeckers are being studied at Blodgett Experimental Forest where an outbreak of the western pine beetle is currently in progress. This investigation is a part of a research project on the population dynamics of the western pine beetle by the Division of Entomology and Acarology, U.C., Berkeley. A census of the number and species of woodpeckers is taken regularly. Also, the role that woodpeckers play in the population dynamics of these beetles is being investigated through X-ray analysis of bark samples. Exclusion studies and stomach analyses are also a part of the program.

Preliminary results from the 1964 field season indicate that woodpeckers may also be effective predators of the mountain pine beetle, *Dendroctonus ponderosae*. The mountain pine beetle does not burrow out into the bark as *D. brevicomis* does; however, studies initiated in the Division of Biological Control show that woodpeckers will probe beneath the bark for the mountain pine beetle.

It is hoped that through this study, the more effective predators will be determined; and that means of environmental manipulation can be found to increase populations of these birds. It is also vital to point out that the indiscriminate use of insecticides in our forests may, in some cases, seriously hamper the beneficial effect of the insectivorous avifauna.

Donald L. Dahlsten is Assistant Entomologist, and Steven G. Herman is Laboratory Technician II, Department of Entomology and Parasitology, Division of Biological Control, University of California, Berkeley.

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William W. Paul Manager
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