

ducks, geese and swans of North America, Stackpole Co. and Wildl. Inst., Harrisburg, Pa., 1942; McCartney, The Fulvous Tree Duck in Louisiana, Louisiana Wildl. and Fisheries Comm., New Orleans, 1963). My observation confirms that wild male Fulvous Tree Ducks, like male Black-bellied Tree Ducks share incubation.—EDWARD L. FLICKINGER, U.S. Fish and Wildlife Service, Victoria, TX 77901. Accepted 15 July 1974.

**Cases of birds reducing or eliminating infestations of tobacco insects.**—The tobacco hornworm (*Manduca sexta*) and tobacco budworms (*Heliothis virescens* and *H. zea*) commonly attack growing tobacco and are controlled by chemicals. I have observed that birds sometimes eliminate or substantially reduce local infestations of these insects. Six such cases are here reported, involving six species of birds. These observations were made near Oxford, Granville Co., North Carolina, during the summer of 1972.

I made observations between 05:00 and 09:00 and between 17:00 and 21:00. The food of the birds was usually determined in the field with aid of  $7 \times 35$  binoculars and knowledge of where the birds were feeding. Some birds were collected and contents of their digestive tracts examined using a stereomicroscope. I made counts of larval populations to determine the extent of infestations and predatory activities of birds and approximated ages of larvae from sizes of fecal pellets and areas of leaf damage.

On 3 July I saw three Common Crows (*Corvus brachyrhynchos*) walking in a 1.2 ha tobacco field. I examined 200 plants in various parts of the field; 16 (8%) had hornworm damage. I found two larvae, both in the early fifth instar, which I moved to plants I could easily watch from concealment. On the second day of watching I saw a crow remove one larva. I found no hornworm larvae reaching the prepupal stage in this field. This field was surrounded by woodland, and the three crows remained nearby throughout the 1972 growing season. The crop received no chemical treatment for insect control, and the farmer was satisfied with his yield.

On 26 July I found two Mockingbirds (*Mimus polyglottos*) feeding on tobacco hornworm larvae in an 0.8 ha tobacco field. Examination of 200 plants revealed that 36 (18%) had hornworm damage. Larvae were gone from 17 of the 36 (47%) plants. Judging from the extent of damage the larvae were removed chiefly at the earlier stages of growth. This tobacco was treated with insecticide on 27 July, thus terminating my study. The field was next to a farmstead and nearby nesting habitat for Mockingbirds.

On 24 August I saw four Eastern Bluebirds (*Sialia sialis*) feeding on tobacco budworm larvae near the edge of a 1.8 ha tobacco field. In the area adjacent to that where the birds were foraging, 32 of 100 plants had larvae in their seed heads. In the area where the birds were foraging, 14 of 100 plants contained larvae. Damage to the plants provided evidence that additional larvae had been present. Thus, the larvae had been removed from 18 of 32 (56%) plants. The larvae were in the third or later instars.

House Sparrows (*Passer domesticus*) were seen foraging on tobacco plants on 5 July. I was unable to find a single larva in the 0.6 ha tobacco field, though six of eight nestling House Sparrows collected from nearby nests had one or two hornworm larvae in their digestive tracts. The nine larvae found in these birds were all small, in the second or late first instar. There were old buildings suitable for use by House Sparrows on three sides of the tobacco field, and 11 nests were found. This field was not treated with insecticides, and it received no detectable damage from insects.

A local farmer reported to me experiences that led him to depend on birds for control of insects on his tobacco. He noted the presence of hornworms on his tobacco late in

a week during the summer of 1968 and made plans to apply insecticide the following Monday. During the weekend he saw a flock of birds in the field, and on the following Monday no hornworm larvae could be found. When I spent 5 hours on the mornings of 2 and 3 August on this farm watching for feeding birds, I saw Red-winged Blackbirds (*Agelaius phoeniceus*) in the field. Fresh larval droppings beneath a plant visited by a Red-wing indicated that there had been an active hornworm larva on the plant a short time earlier. I found no hornworm larvae in an examination of 100 plants. There was a small marsh and a breeding population of Red-winged Blackbirds beside this tobacco field. This farmer annually grows 4–6 ha of tobacco, and he has used no insecticide on tobacco since he saw the birds in 1968.

On 29 June I saw a small flock of Common Grackles (*Quiscalus quiscula*) fly from a tobacco field. Two of them carried large hornworm larvae. In a search of the tobacco field, I found no hornworm larvae, though 27 of 150 (18%) plants had leaf damage and below that hornworm droppings, indicating that larvae had grown on the tobacco to the fourth and fifth instars.

In a previous study, Stewart (J. Econ. Entomol. 62:956–957, 1969) reported removal by House Sparrows of all of 2000 tobacco hornworm larvae not earlier falling to the ground after they had been placed on the plants in an attempt to rear them. Similarly, Thurston and Prachuabmok (J. Econ. Entomol. 64:1548–1549, 1971) indicated that most larvae were removed by Common Grackles after the larvae had been placed on tobacco plants in tests of bird predation.

There have also been reports of birds making substantial contributions toward control of insects attacking corn. One of these involved the destruction during the winter by Common Flickers (*Colaptes auratus*) of 63.7% of the larvae of southwestern corn borers (*Diatraea grandiosella*) in an area of Mississippi where 54.4% of the stalks were infested (Black et al., Annals Entomol. Soc. Am. 63:701–706, 1970). Stewart (Auk 90:911–912, 1973) reported removal by Starlings (*Sturnus vulgaris*) of all larval corn earworms (*Heliothis zea*) and fall armyworms (*Spodoptera frugiperda*) on corn ears in areas of southcentral Virginia and northcentral North Carolina, with the birds not eating the corn.

In a continuing program of integrated control of insects attacking apples in Nova Scotia orchards, MacLellan (Canad. Entomol. 90:18–22, 1958; Canad. Entomol. 91:673–680, 1959; Proc. Tall Timbers Conf. Ecol. Manage. Animal Cont. Hab. 2:273–284, 1970) has found that Hairy and Downy Woodpeckers (*Dendrocopos villosus* and *D. pubescens*) regularly reduce infestations of codling moths (*Laspeyresia pomonella*) from a potential to a negligible threat.

The recent literature on the role of birds in control of forest insects is much more abundant than that on orchard and field crop insects. Bruns (Bird Study 7:193–208, 1960) reviewed research reports from England, Germany, the Netherlands, Czechoslovakia, and Russia, citing 68 references. Buckner (Ann. Rev. Entomol. 11:449–470, 1966) reviewed research on the role of vertebrates in control of forest insects and cited 109 references.

My experiences reported in this note lead me to think that there may be many unexploited possibilities for management practices using birds in control of undesirable insects. This conclusion is particularly applicable to conditions in North Carolina, where farm crops are often grown in small fields. With tobacco, management practices might include erection of nest boxes for bluebirds, planting crops near farmsteads and nesting populations of House Sparrows, planting crops near a marsh and a nesting population of Red-winged Blackbirds, and planting nesting cover for Mockingbirds. Most im-

portantly, chemical control should be delayed until it is apparent that birds cannot provide the desired degree of insect control.

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**Interactions between Forster's Terns and American Coots.**—Recently Burger (Wilson Bull. 85:449-451, 1973) documented competition for nest sites and aggression between Franklin's Gulls (*Larus pipixcan*) and American Coots (*Fulica americana*) nesting in a Minnesota marsh. I will present data collected at Delta, Manitoba on interactions between coots and Forster's Terns (*Sterna forsteri*), another larid nesting in the same sort of marsh habitat as Franklin's Gull (McNicholl, M.S. thesis, Univ. Manitoba, 1971). As was the case in Burger's study, several species nested among the larids, but most were never attacked by the tern. Black-crowned Night Herons (*Nycticorax nycticorax*) and American Coots were the only exceptions. The herons were attacked only while attempting to land in the colony (McNicholl, Auk 90:902-904, 1973); the coots were attacked as described below.

The tern colony, situated on seven "islands" of *Scirpus acutus* in a marsh bay, had nests placed on floating vegetation and muskrat (*Ondatra zibethicus*) houses. Coots nested both on solid ground along the edges of the bay and on floating mats on the *Scirpus* "islands." Six coot nests were on the "islands" in 1968 and eight in 1969, but most were not among the tern nests. Of the three that were among tern nests, two were closer to tern nests than the adjacent tern nests were to each other. Thus, coots tended to nest close to but not among terns, but were tolerated at close range by the terns. The selective advantage for the coots of nesting in the vicinity of the terns may be related to predator avoidance, as the terns and Yellow-headed Blackbirds (*Xanthocephalus xanthocephalus*) were efficient at keeping away avian predators (McNicholl 1973) by mobbing them, a behavior not practiced by coots. As these predators were usually kept from the entire bay, this advantage would be imparted to the coots whether or not they nested close to the terns. On the other hand, since coots were attacked if approaching tern nests (see below), it would be advantageous for the coots to nest away from the immediate vicinity of tern nests.

Although coots fed daily in open parts of the bay, I only once saw one attacked there by a Forster's Tern. In this case the tern had attacked the coot near the tern's nest just prior to the attack in the open bay. Similarly terns did not attack coots swimming slowly along the edges of the "island" feeding. However terns always attacked coots either approaching a tern nest directly or swimming in a deliberate manner (charging) toward the "islands." After my daily visits to the tern nest and in about 20 additional observations, coots of the three nests close to tern nests always approached their own nests from the side opposite the tern nest. Usually one tern attacked one coot, but once a coot was attacked by two terns simultaneously, and once by six terns. In two cases two terns attacked two coots simultaneously, that is both terns attacked both coots. Attacks consisted of swoops from above, usually resulting in the coot's either turning away or diving immediately. In one case a coot did not retreat immediately, and was struck several times on the head by the tern. This was the only case in which a tern actually struck a coot on the water. Once a flying coot was struck on the head and legs by a tern. This was the only case of an attack on a flying coot.