

INVERTEBRATE NEST ASSOCIATES OF THE PRAIRIE WARBLER

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To judge from the literature, one aspect of birds' nests that has received little attention from American ornithologists is that of the invertebrate animals to be found in them. Yet it is obvious that in addition to the possible value to the ecologist of a study of such circumscribed biotic assemblages, a species' nests should provide one of the chief sources of information concerning that bird's relations with ectoparasitic and commensal mites and insects.

During the summer of 1952, as one facet of a long-term study of the natural history of the Prairie Warbler (*Dendroica discolor*) on a 200-acre tract near Bloomington, Indiana, I attempted to collect all invertebrates from nine warbler nests. At least 20 species, 19 of them arthropods, occurred; every nest contained one or more species, seven harbored three or more, and one held seven. Three of the invertebrates are parasitic on birds, and one or more of these were present in seven of the nests. The facts that young fledged from six of these seven nests and that most lived to attain adult size are some evidence that parasitization of nestlings by the three species found does not always result in immediate death for the hosts. The circumstances of the failure of the seventh nest suggest that death of the nestlings was caused by parasites. (I have observed some 115 other nests of the Prairie Warbler, each throughout its period of active use; if parasites were present, any injurious effects on adults and young were not detected.)

The collecting was accomplished, at the suggestion of Professor Frank N. Young, through the use of the Berlese funnel. This device consists of a sheet metal, box-like receptacle about a foot square, open at the top; instead of having a conventional flat bottom, the box tapers below to form a funnel and spout. The entire instrument stands on legs which raise it so that the lower tip of the spout is a few inches above the floor. Lying flat across the plane where the sides of the box begin to constrict into the funnel, i.e., where the bottom would regularly be, is a coarse-meshed screen. On the screen is laid a piece of thin cardboard of a diameter slightly greater than that of the nest to be examined, and on this cardboard rests the inverted nest. As the nest dries, its inhabitants leave it, move on to the cardboard, and reaching its edge fall through the funnel into a container of 70 to 85 percent alcohol placed to receive them. Nests were taken immediately after the birds ceased using them and kept

in closed paper bags. Before the container of alcohol was put in place, the cardboard was inserted beneath the spout, the bag shaken vigorously over the top of the box to dislodge animals that might already have left the nest, and the cardboard placed on the screen as described. Covering the open top of the funnel prevented escape of flying insects that passed the pupal stage in the nest; equally important, it minimized the risk of accidental introduction of animals into the funnel.

While the subject of this paper is the nine nests and their invertebrate contents, such a discussion would have little meaning without a brief description of the local breeding habitat of the Prairie Warbler, its nest sites and construction materials, and the duration of the phases of its nesting cycle. This is especially true because published facts concerning the bird's life history are scanty and often do not agree with my own data.

In the hilly, unglaciated Karst terrain near Bloomington, upland plant communities not now directly affected by human use consist principally of second-growth woodland at or approaching the climax of mixed beech-maple and oak-hickory, and of eroded, abandoned fields in various stages of succession back to climax. Warbler territories are confined to the relatively open fields. In some instances trees are moderately abundant, but most are small and they never form a canopy. The tract under investigation is nearly surrounded by cultivated land or pasture; within its bounds are patches of field of from 2 to 10 acres in area, cut off from each other by bits of woods and transected by rows of trees along old fence lines. On most territories, trees are scattered at random, but in a few fields have been planted rows of black walnut (*Juglans nigra*), black locust (*Robinia Pseudo-Acacia*), and sugar maple (*Acer saccharum*), and in one, Virginia and white pines (*Pinus virginiana* and *P. Strobus*). (Plant nomenclature throughout follows Charles C. Deam, *Flora of Indiana*, Indianapolis, 1940.)

Relative frequency of trees can best be indicated by a count made on a typical Prairie Warbler territory with an area of 3.5 acres, very close to both the 1952 average and mean. Of 2263 trees, the commonest were redbud (*Cercis canadensis*), 728; sassafras (*Sassafras albidum*), 490; American elm (*Ulmus americana*), 240; flowering dogwood (*Cornus florida*), 184; shining sumac (*Rhus copallina*), 163; sugar maple, 99; black cherry (*Prunus serotina*), 88; ashes (*Fraxinus* spp.), 88; eastern red cedar (*Juniperus virginiana*), 66. Fifty percent of the trees on this territory were five feet or less in height, 90 percent 15 feet or less; many of the potentially tall trees, such as the

elm, were of low vitality and consequently were dwarfed. Principal grasses were broomsedge (*Andropogon virginicus*) and more scattered patches of purpletop (*Triodia flava*), prairie three-awn grass (*Aristida oligantha*), and Canada bluegrass (*Poa compressa*). Prominent herbs were pussytoes (*Antennaria plantaginifolia*), daisy (*Chrysanthemum Leucanthemum*), and goldenrod (*Solidago* sp.). Tangles of raspberry (*Rubus occidentalis*) and blackberries (*Rubus* spp.) were common.

Prairie Warblers place the very great majority of their nests in deciduous trees ranging in height between 3 and 25 feet. About half of the sites selected are sheltered by Virginia creeper (*Parthenocissus quinquefolia*) or grape (*Vitis vulpina*). Favored trees are sugar maple, American elm, flowering dogwood, and sassafras; but many other species are resorted to. Almost all nests are located in forks, perhaps half of them placed against the main trunk at a point where a small branch diverges. The average height of 47 nests observed in 1952 was 10.45 feet, the mode about nine feet.

The cup-shaped nest is typically made up of three parts, a bulky foundation and outer shell, an inner cup, and a thin lining. The outer shell, composed largely of the soft, cottony bast fibers of the milkweed (*Asclepias syriaca*) and fragments of the epidermal layer of the grape, is often bound together by spider webs and in July by bits from insect cocoons. Cast snake skins, particularly those of the locally common rough green snake (*Ophiodrys aestivus*), are sometimes wound around the exterior of the outer shell. The inner cup is made of a substantial layer of down taken almost entirely from the fruits of broomsedge and pussytoes. The final lining is the most variable element of the nest; common materials are axes of the inflorescence of purpletop, rootlets, small feathers, and occasionally hairs of the eastern cottontail (*Sylvilagus floridanus*). One such nest after drying weighed 3.9 grams, the outer shell alone weighing 2.45 grams. Its dimensions were 62 millimeters total diameter at the top, 63 millimeters total diameter halfway between top and bottom, 43 millimeters cavity diameter at the top, 56 millimeters total height, and 35 millimeters cavity depth.

A pair of Prairie Warblers which succeeds in bring off young (one of my pairs succeeded only on the sixth nest, and five attempts are not at all unusual) uses the nest for 28 days or more from the time it is begun until the nestlings leave. Construction usually takes three days, longer if weather conditions are adverse; after building, the female remains idle at least one day. She then lays one egg on each of four successive days (occasionally there are three- and five-egg sets) and begins to incubate. Incubation lasts from 12 to 13

days; on the morning of the tenth day after the first egg hatches, all young fledge and disperse from the immediate vicinity. In most cases the nest then loses all stimulus value for the adults and they do not return to it.

The following account of the nine nests examined treats their sites, the stages attained in the nesting cycle, and the dates on which the warblers ceased to use the structures. All nests were of typical construction unless otherwise indicated.

1. Nest 2 feet 8 inches high, concealed by grape, in a four-foot redbud. Five eggs laid, all hatched. Two nestlings disappeared four days after hatching; their weights on the third day of life revealed a failure to gain at a normal rate. Remaining three nestlings found dead under nest on ninth day, June 11. Of some 100 nestling Prairie Warblers that I have studied and that have been destroyed before fledging, only one other body has been recovered. Since five maggots of the genus *Protocalliphora* were collected here, it seems possible that the parasites were the cause of death and that the parents ejected the bodies.

2. Nest 23 feet high, four feet from the trunk on horizontal limb of 40-foot hackberry (*Celtis occidentalis*). History unknown until June 26, when three young fledged.

3. Nest 2 feet 9 inches high, in witch's broom on four-foot hackberry. Four eggs laid; all hatched, and all young fledged July 4.

4. Nest 14 feet 1 inch high, fastened precariously to trunk of 20-foot black locust. Although built by same female that built nest 1, this was atypical in its shallow, saucer-like shape and in materials used. (Compare its dimensions with those previously stated: 69 millimeters total diameter at top, 55 millimeters total diameter halfway between top and bottom, 51 millimeters cavity diameter at top, 48.5 millimeters total height, and 26 millimeters cavity depth.) Outer shell almost devoid of milkweed fibers, made instead of stiff material from grape and from grasses. No appreciable inner cup; lining composed of same material as outer shell. Three eggs laid and two hatched; one nestling disappeared, and for some time nest contained unhatched egg and remaining nestling. Egg gone by July 12, when nestling fledged.

5. Nest 15 feet high in fork of 20-foot black walnut. Four eggs laid; all hatched, but young were destroyed and removed by unknown predator when nine days old, July 17.

6. Nest 19 feet above base of 24-foot flowering dogwood growing in a sink hole. Outer shell unusual in that numerous fragments of last year's sugar maple leaves were used. Four eggs laid; all hatched, and all young fledged July 26.

7. Nest 8 feet 10 inches high in 11-foot redbud. Four eggs laid; all hatched, and all young fledged July 29.

8. Nest 23 feet above base of 30-foot flowering dogwood growing in a steep ravine. Three eggs laid; two hatched, and the other remained in nest until two young fledged on July 31.

9. Nest 17 feet 4 inches high in new growth at top of black walnut. Three eggs laid; all hatched, and all young fledged August 13.

The animals collected were determined by specialists to whom they were referred by C. F. W. Muesebeck of the Division of Insect

Detection and Identification, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture. Obviously the coöperation of these men and particularly the kindness of Dr. Muesebeck were indispensable to the preparation of this paper. In addition to taxonomic information, the material that follows includes the names of determining specialists; where known, the numbers of each species identified from the various nests and the invertebrates' stages of development; and the food habits of each species, where such habits might account for its presence in the nest. For the Acarina, E. W. Baker was good enough to provide the information last mentioned; C. W. Sabrosky did the same for the fly, *Protocalliphora metallica* (Tns.). Frank N. Young gave generous advice concerning ecological relationships.

MOLLUSCA

Gastropoda (snails)

Pulmonata

Pupillidae

Gastrocopta armifera (Say), determined by J. E. P. Morrison. One in nest 1.
Casual.

ARTHROPODA

Arachnida

Acarina (mites), determined by E. W. Baker.

Dermanyssidae

Bdellonyssus sylviarum Castrini and Fanzago. Two in nest 4, 13 in nest 6, 3 in nest 7, 10 in nest 9. Parasitic on the birds.

Phytoseiidae

Amblyseius sp. Two in nest 9. Predaceous, e.g., on small plant-feeding species.

Tarsonemidae

Tarsonemus sp. One in nest 4, 1 in nest 5. Fungus feeder.

Tydeidae

Tydeus sp. One in nest 5. Predaceous on small insects and mites and their eggs.

Trombiculidae

Trombicula alfreddugesi (Oudemans). Unknown numbers in nests 3 and 7. Parasitic on the birds.

Oribatulidae

Oribatula subgenus *Zygoribatula* sp. One in nest 1, 1 in nest 5. Relationship unknown.

Ceratozetidae

Trichoribates sp. One in nest 3. Debris or fungus feeder.

Insecta

Collembola (springtails)

Not determined. Unknown number in nest 4. Scavengers or feeders on bacteria or other microorganisms.

Neuroptera

Hemerobiidae (brown lacewings)

- Hemerobius* sp., determined by S. Parfin. One larva in nest 5. Predaceous on small insects.
- Corrodentia (bark lice)
- Liposcelidae
- Liposcelis* sp., determined by A. B. Gurney. Five adults in nest 7, 2 adults in nest 8. Scavenger on decayed animal and plant material.
- Thysanoptera (thrips)
- Phlaeothripidae
- Haplothripinae, determined by Miss Kellie O'Neill. Two larvae in nest 5, 1 adult female in nest 8. Relationship unknown.
- Hemiptera (bugs)
- Anthocoridae
- Genus and species not determinable, R. I. Sailer. One nymph in nest 4. Predaceous, e.g., on other insects.
- Coleoptera (beetles)
- Chrysomelidae
- Chlamys* sp., determined by O. L. Cartwright. One, stage unknown, in nest 5. Plant feeder.
- Lepidoptera (butterflies and moths)
- Tineidae
- Genus and species not determinable, H. W. Capps. Twenty-two early stage larvae in nest 3, 45 early stage larvae in nest 8. Scavenger on dead or decayed animal and plant material.
- Diptera (flies)
- Psychodidae
- Psychoda alternata* Say, determined by A. Stone. One in nest 9. Scavenger on decaying organic material, possibly a coprophage.
- Psychoda* sp., determined by A. Stone. One in nest 3. See remarks immediately above.
- Itonididae
- Clinodiplosis* sp., determined by R. H. Foote. One adult female in nest 5, 1 adult female in nest 9. Females possibly present for oviposition. Larval habits vary greatly; probably scavenger, for some larvae of this family feed on bird excrement.
- Milichiidae?
- Tentative determination to family by W. W. Wirth. Five larvae in nest 3. Probably plant feeders.
- Calliphoridae
- Protocalliphora metallica* (Tns.), determined by C. W. Sabrosky. Ten larvae from nest 2 pupated and emerged as 6 females and 4 males. "The larvae of these flies are obligatory, blood-sucking maggots, and feed externally upon the nestlings, retiring into the nest to pupate, or dropping to the ground to do so." The Prairie Warbler is one of 54 species of birds from which this fly is recorded. (C. W. Sabrosky, *in litt.*)
- Protocalliphora* sp. probably *metallica* (Tns.), determined by W. W. Wirth. Five larvae in nest 1.
- Hymenoptera
- Formicidae (ants)
- Monomorium minimum* (Buckley), determined by M. R. Smith. One worker in nest 6, 1 worker in nest 7. Workers gather honeydew and secretions of extrafloral nectaries; probably casual.

Summary.—Invertebrates were collected in Berlese funnels from nine nests of the Prairie Warbler. All nests were built in 1952 near Bloomington, Indiana; local breeding habitat, nest sites and building materials, and duration of the nesting cycle are described. At least 20 species of animals, 19 of them arthropods, were found, and they are named to the extent that determination was possible. One nest contained one species, one nest two species, two nests three species, three nests four species, one nest five species, and one nest seven species. An attempt is made to account for the presence of the invertebrates in terms of their feeding habits. One or more of three species known to be parasitic on birds were present in seven of the nests; young fledged from six of these nests, but the death of the nestlings of the seventh may have been caused by the parasites.—

R. R. 10, N. Fee Lane, Bloomington, Indiana, January 23, 1954.