

intervals the bird was not seen, but occasionally the old roost was occupied. The fall migrations were started in all of the years the bird was observed, before the ninth of September. In the summer of 1920 the little goatsucker did not return so far as I was able to discern. Had it met with mishap on its long journey—fallen prey perhaps to some hawk, or shot down by some fowler? Or had it fallen in at last with her Prince Charming and gone off with him to an equally humble domicile on the top of some city building, there to deposit her two speckled eggs from which would eventually come a progeny of baby nighthawks.

How remarkable it seems that the love of home is so strong in a bird's heart that it will return year after year to the very spot which has become endeared to it. But even more remarkable is the instinct implanted in its little brain to return without deviation to its former abode, and without an apparent effort in determining its proper course over hills and valleys, forests and streams. As Bryant says of the waterfowl:

“There is a Power whose care
Guideth thy way along the pathless coast,
The desert and illimitable air,
Lone wandering but not lost.”

THE PHILOSOPHY OF BIRDS' NESTS AND COMPARATIVE CALOLOGY IN CONSIDERATION OF SOME LOCAL NIDICOLUS BIRDS

FRANK L. BURNS

(Continued from September, 1924, Bulletin)

(9) Among the Passerine birds, such species as the Horned Lark, Bobolink, Ipswich and Lark Sparrows, Ground Warblers and Pipits are natural walkers and ordinarily build countersunk nests (i.e., hollows scratched in the earth or leaves).

The Lark Sparrow and Towhee occasionally nest in bushes. The Cowbird is also a walker and this may account for its preference for ground or near ground nests in which to drop its eggs.

Reference has been made elsewhere to the atavistic tendency of the Starling to nest upon the ground in some localities. The Starling is a walker. The Brown Thrasher and Robin are

both hoppers and runners, and both occasionally build a counter-sunk nest, though normally arboreal nesters.

The Black and White Warbler lines its nest with black rootlets and horsehairs, while the nearby Worm-eater may have its nest in much the same situation but does not have the same beat in feeding habits; lines its nest with the characteristic reddish flower stems of the hair moss. This species shows a remarkable love for its chosen haunts, though it will desert burnt over or poultry infested areas; an undisturbed carpet of forest leaves being essential to its existence. Probably no other bird in this section is more independent of civilization. Rarely even a horsehair is found in its nest and in more than 100 nests examined the lining was as above described.

This bird always removes the leaves from the site, sometimes scratching a slight hollow in the mound and the partly decayed-leaf nest is sunk to the rim, protected by the leaf drift above, if built on the side of a ravine, in appearance a miniature cave.

The Oven-birds' nest is usually domed, the substructure sunken in the carpet of leaves to the level of the lower edge of the entrance. The manner of construction varies little from that of the ordinary bird architecture. The outer framework of the superstructure is bent over and continued around the nest proper from the interior. I have observed the first frail straws of the tumbling weed erected by 11 a. m. and the whole edifice completed in two days.

It is noteworthy that so many nests of this type are frequently covered; those of the Junco, Water-Thrush, Black and White, Worm-eating and Kirtlands' Warblers, naturally by means of the site, and the Meadowlark, Grasshopper and Bachmans' Sparrows and Oven-bird, arched or domed by the exertions of the birds themselves. The Meadowlark pulls down and entangles the tops of the meadow grass above its nest and sometimes raises a covered way or grass tunnel some two or three feet from its nest probably by lowering its head and skulking.

Hopping is a natural mode of progression of the arboreal birds, but an unsatisfactory form of locomotion on the ground, hence it may be argued that ground nesting and feeding of this type must have continued a long time to produce walkers, and that the same habits of the Vultures, Marsh Hawk, Burrowing Owl and Flicker, would indicate a comparative recent date.

(10) In the Blue-winged, Golden-winged, Nashville, Kentucky and Mourning Warblers and the Maryland Yellow-throat, we have species a little less terrestrial perhaps than the average confirmed ground nester and more given to bush hopping. All of these species are accustomed to raise their nests ever so little above the ground and to build a more bulky and more or less loose nest in which forest leaves form the base. For want of a better designation I shall call this the husk type.

Of this the nest of the Blue-wing is typical, of broad blades of coarse tussock grass, clean dead forest leaves pointing upward and inward, occasionally coarse strips of wild grape-vine bark, forming a deep cup-like nest in which the bird's head and tail almost meet over its back; lined with shreds of the same bark, finest on top, and laid across instead of bent in a circle.

The golden gleam of the Kentucky Warbler as it threads its dainty way midst the luxuriant swamp vegetation, coupled with its full, musical whistle, so unlike that of any other of our local Warblers, impresses one of its Southern origin.

Neither Bartram, Barton, Wilson, nor Audubon met with it in all this region where in the past 50 years it has become so abundant. In its recent extension of range did it push up along the Atlantic coast or infiltrate through the mountain passes from the Mississippi? There seems to be little geographical variation in the composition of its nest. It builds a rather bulky nest of somewhat ragged forest leaves, usually followed by an inner shell of bright, clean leaves, lined with black rootlets. I have observed a bird in the female plumage singing as lustily as the male.

The Maryland Yellow-throat is most at home near an oozy bog, though it sometimes haunts the cool borders of an upland thicket. In the former situation the cornucopia-like nest is usually a few inches above the mud in a clump of boneset, gentian, goldenrod or swamp grass. The cornucopia shape is inevitable in all instances where a tall plant growth is selected. The first layer of coarse swamp grass and weed stems pushed between the close standing stems forms the mould of an inverted cone. A less common type is a rather flat basket affair built and lined with grass and is always built in meadow grass which affords no support for the usual type. A male frequenting my berry patch for three summers always sang: "Fred! Where's sister? Where's sister?"

(11) The arched or domed nest effected by many of the smaller terrestrial birds for the purpose of concealment may not be a very high type, but the domed or gobular nest of the rather low-ranging tree-hoppers doubtless expresses the higher type of the essentially ground-feeding species, and the facility with which some of its builders turn to cavity nesting shows that this type is more closely connected with the latter than the pensile type.

The Magpie of Europe and America builds a large, gobular nest of coarse sticks in tree or bush, plastering it well up the sides with mud and lining it with rootlets, grasses, bark, hair, or pine needles. The House Sparrow only occasionally builds its bulky nest of trash on the branches of trees, for it is a backslider, preferring cavities or covered sites. The nest, however, even if only consisting of the ordinary hen feather lining, generally conforms to the domed type. It is a most virile species. I shot a newly mated male daily for a week in order to prevent a single female from nesting in a Martin's box, and only succeeded at last by killing the much-mated female.

The House and Bewick's Wrens also have yielded to the lure of cavity or sheltered nesting, though often retaining the domed feature.

The Marsh Wrens build a round ball of rushes or grasses, with side entrance, some three or four feet above the water, fastened to the growing reeds, and line it with cattail and willow bloom, or fine grasses, sometimes feathers.

(12) The mason-birds according to some European authorities moisten the earth with saliva to make it adhesive. While it is probable that the gobs of mud receive more or less tempering in the mouth of the builder, yet the small amount of saliva employed carries much viscosity.

The *genera Sayornis* contain notable masons while retaining something of the felt-making habits of some of the Flycatchers. The Phoebe builds a mud nest with an admixture of grasses or mosses, occasionally black rootlets; lined with hair, bristles, cotton, thistledown or plant fibre.

In the writer's own time the Phoebe has spread out from the spring-houses and wooden bridges to the railroad culverts in the Chester valley. Porch plates, deserted buildings, quarry shelves and claybanks, also, have largely supplanted the ancestral nest plastered upon the face of the cliff.

The shape and construction varies according to position: if

attached to the side of an overhanging rock it is semicircular and mainly composed of mud pellets mixed with moss; if on a flat beam or post it is more nearly circular and flat, and sometimes little mud is used. Perhaps the most difficult and inexplicable situation noticed was balanced nicely on the edge of a thin board forming the cross brace over a small, roofed reservoir spring. For several previous seasons the nest had been attached to the smooth walls, the birds finding entrance only by means of the slightly ajar door.

Another pair nesting on the plate of the cellar wall of a deserted cabin, where the joists divided it into several compartments; like John Burroughs' Phoebe, these birds seemed unable to relocate the exact site chosen and laid the foundations of several nests, completing and laying in two, exhibiting an inferiority in this respect to the Purple Martin, Domestic Pigeon and perhaps other species nesting in compartments.

Doubtless birds locate their homes by means of familiar objects, and this is also true of other animals. The apiarist finds it advisable to group hives in multiples not exceeding five, with a bush or tree near each group, to give each hive an individuality and prevent the bees from "drifting."

The Magpie exhibits more of the plasterers' skill in the application of mud to its structure, and mud is only incidental to the Jays, which as a rule belong to the brush-making type. Once I discovered several yards of white satin ribbon stolen from the wash, festooned about a Blue Jay's nest in a lilac bush. Contrary to the general description of those who have made only a superficial examination of the Crows' nest, it uses mud binder similar to the European Crow.

The Blackbirds and Grackles use mud in large quantities. The Florida Grackle varies in the incorporation of twigs, Spanish moss and cow manure, or flags, sphagnum moss and pine needles.

The Barn Swallow's domicile is not unlike that of the Phoebe. Formerly a cave or crevice nester, early in the history of Colonial times it became an inhabitant of the great barns, fixing its nest to the interior walls, beams and rafters of the mows, and later excluded from the interior, nesting on the overshoot plates or in open sheds.

Ridgway found its nests in Nevada attached to the ceilings of small caves. Coues observed a small colony in the Northwest occupying little holes and crevasses in the face of a bank, and re-

marks upon its preference in artificial situations for a corner or angle as a modification of the primitive hole-nesting habit.

The Barn or Chimney Swallow (*H. rustica*) of Europe, probably originally nested in rock caves, possibly hollow trees, adapted itself in early times to the wide, old-fashioned chimney and later to the interior of buildings. Its nest is similar to that of our own Barn Swallow. The Phoebe and Barn Swallow secure a very durable nest by mixing mud and straw. I have examined man-made walls of similar composition — clay, chopped straw, and of course stone — in buildings fully 200 years old and can testify as to its durability.

The Cliff Swallow is the master builder of this type. Formerly an inhabitant of the cliff to which it attached its bottle nest of mud or clay, it now selects the exterior walls of a barn or mill and plasters its nest close up under the eaves. Both sexes gather the bits of mud, temper it well by working the jaws and deposit it in pellets to form its peculiar nest in a matter of less than a week's time. It prefers unpainted surfaces and it has been suggested that a scantling nailed up near the eaves will aid it materially, especially on painted boards. Dr. Coues pretends to trace the most elaborate retort-shaped receptacle back through less perfected purse-like structures to a primitive walling up of chinks or crannies on the face of cliffs and in materials employed notes the progressive steps from a mere deposit of soft material in a hollow to the projected walls beyond the base of support.

The Wood Thrush builds in a crotch or out on a limb of a forest tree at an average height of eight feet. The female works in the early morning, completing in about five days. A layer of damp leaves, then a layer of mud, weed stalks, grasses or bark strips, occasionally some twigs; lined generally with dark rootlets. This species as yet has been little affected by civilization and in consequence has revealed little versatility.

The Robin ranges from the ground to 30 feet in fruit or shade trees and frequently nests on porch plates, window sills, sheds and open boxes. The female does practically all of the work with mud and grasses; the male sometimes offers to help her with a straw which she is very apt to reject, and it is a pretty sight to see her standing in the partly finished nest all aquiver, moulding the structure by breast pressure and partly raised wings as she whirls like an animated potter's wheel. I

have observed an individual make 21 trips for material in two hours and complete the nest in three days.

The Robin is proverbially among the most intelligent of birds, yet it is so much the creature of instinct that when it has barely completed a nesting cycle and commenced a new, it will sometimes thrust in the open mouth of a clamorous fledgling a bit of grass gathered for the new nest; the cry of the young momentarily aroused the feeding instinct and the parent behaved like a very absentminded person.

(13) The Red-winged Blackbird builds an interlaced basket in clumps of reeds or rushes, or occasionally in forks of bushes; composed of coarse grasses and bark strips, lined with fine grass.

The Chestnut-sided Warbler is rather more of a fibre-felter of superior workmanship without getting the same result as the vegetable felter, since the felting is on the exterior only. I have found here only two nests, one in a wild huckleberry and the other in a blackberry bush. The nest is made of stalks and fibre of the silverleaf, lined with split strips of same and some horse hairs. The Tennessee, Myrtle, Bay-breasted, Magnolia and Prairie Warblers build a similar nest near the ground.

A law governing the elevation of the nesting site has been offered by Averill, in which birds with long pointed wings may nest high or low, but the short and round winged are low nesting, seems to bear the test in most instances.

(14) The pendant basket felters include all of the Vireos as typical arboreal feeders. Our four local species all build penile nests of similar construction, deep-cupped and slightly contracted at rim. The Red-eye is by far the most abundant, generally building in the terminal fork of a long branch, 3 to 10, sometimes 30 feet up. The nest is of fine strips of the inner bark of oak or chestnut, and of wild grape-vine bark, sometimes a few forest leaves; studded externally with bits of paper from hornets' nests, bleached and punky wood, plant fibre, pieces of dead leaves or egg cases of the geometrical spider, secured with spiders' silk, lined with finer shreds of grape-vine bark, occasionally fine stems of the tumbling grass; the whole interwoven and compressed into a usually thin, compact shell remarkably inconspicuous in nesting time and durable enough to withstand the weather for two years. I found one nest in the yard lined with white hen feathers. The Yellow-throat in some localities studs its nest with lichen, though I have not found it so here;

and the White-eye makes use of more paper, both of hornets' and man's manufacture, than the "Preacherbird," which led Wilson to dub it the "Politician," and it supplies a grass lining a little more frequently.

The Warbling Vireo nests in old maples about homes, averaging considerably higher and uses a greater quantity of grasses.

The Vireo group is consistent in the hanging nest; some species vary according to locality in the more or less fibre, or in materials like birch bark, pine needles or horsehair. It has been asserted that the male carries the material for the female to arrange and that the nest is complete in three days.

The local Acadian Flycatcher, now so scarce, builds a frail semi-pensile nest of fine grass and weed stems, occasionally bark strips, hickory and black oak blossoms, maple blossom stems and bark fibre, bound with spiders' silk; a small, conspicuous, semi-transparent cup with loose ends hanging down untidy; lined with fine grasses or blossoms, and placed in the forks of a beech sapling, 8 - 10 feet. In Hardin County, Iowa, the nest is made of the vetching vine interwoven with a few grasses and oak catkins. It is evident that this species has not thoroughly learned the art of pendant nestbuilding.

Bendire describes three types of nests, the first and most common decorated with male aments of different forest trees; second, in which these blossoms are dispensed with, and last where the nest is built entirely or in large part of different kinds of tree moss.

(15) The nest of the Baltimore Oriole has been rightly considered one of the most ingenious examples of North American bird architecture, not only because of the lines of beauty in its deeply-pouched and pendulous structure and its exposition of the natural art of weaving, crude though it be in comparison to the handicraft of man; but also because of the difficulties overcome in the adjustment of the pliable fibre to meet the strain incident to a partial overhead attachment and the whipping of the bough.

The nest is placed near the extremity of slender branches of the sycamore, walnut, willow, maple or apple trees, mostly 20 to 40 feet up in practically inaccessible situations, though one was found only five feet above the ground.

Sometimes the structure is suspended by the rim between

forked branches; others may be attached to some twigs extending part way down the side, but the rim partly or wholly unsupported.

A nest of superior workmanship, taken in 1921, was supported in the rear by two contiguous branchlets, to which it was attached by loops of twine and horsehair, the rim unsupported. The material is almost entirely of long black horsehairs, with a few strands of cotton twine and silvery-white vegetable fibre.

The pre-colonial nest was doubtless composed of the fibrous bark of decayed native plants, which in this section gave place in Wilson's time to flax, hemp, tow, hair, and wool, partly felted and partly interwoven into a kind of cloth, sewed through and through with long horsehairs; much better material on the whole than now available, since the average nest is of bark fibre of dead plants like the milkweed, silverleaf, poke, nettle, etc., together with cotton, worsted and silk twine—black, white, red, yellow, and blue—and the diminishing supply of horsehair. String is of course a comparatively new and somewhat refractory substance productive of snarls and unsightly entanglements. The nest is lined variously with shreds of grapevine bark, split grass stems or horsehairs.

The color of the exterior is of little moment though experiments have demonstrated that the bird is not color blind. Many of our older ornithologists seemed to foster the belief that the best constructed nests are the result of older and more experienced birds, an observation very important if true. The male sometimes carries material and makes a show of helping, but the female is the real builder and usually completes the nest in a week.

The nest of the Bullocks resembles that of the Baltimore Oriole, but as a rule is less pensile. Audubon's, Scott's, Hooded, and Arizona Hooded more nearly approach that of the Orchard; all containing green, wire-like grass, dry fibre of the yucca or the like.

The semi-spherical, green wire-grass cradle of the Orchard Oriole swings from the boughs of the apple, pear, or willow at a lower level than that of its more brilliantly plumaged relative, and surpasses it in pristine beauty, if not in the ingenuity displayed in overcoming the numerous engineering difficulties. Scarcely two situations are exactly alike, ranging from the horizontal crotch in which the nest is supported from the bot-

tom, to the twig-encrusted fork in which the nest swings free from its hammock-like lashings at the rim.

Wilson remarked that when it is located in the long pendant branches of the weeping willow, the nest is made much deeper and of slighter texture, the circumference is marked by a number of these pensile withes that descend on each side like ribs, supporting the whole. These branches being sometimes 12 or even 15 feet long, have a long sweep in the wind and render the first of these precautions necessary. This Oriole disdains the refuse of civilization, for it plucks from the living grass the long flexible stems to build its stout walls and to knit and sew in a most substantial manner until the texture is similar to that of a grass mat. It is lined with feathers, thistle down, or according to Wilson, the down from the seed of the sycamore. In the South it is said to be less bulky and occasionally of gray tree moss, lined however with the green wire-grass so frequently found elsewhere in the body of the nest. Both sexes assist and complete in three or four days.

The Baya Weaverbird fabricates a nest of uniformly interwoven tendrels or fibrous roots, starting with a solidly-woven rope, opening into a globular chamber and contracting to a perpendicular entrance tube, and an Indian Tailorbird unites two growing leaves by stitching the edges together with fibre to form a pocket for its nest.

Conclusion: It is not to be expected that the constructive work of our birds would agree in more than a general way with any system devised for classification, but it should reveal something of phylogenesis, the origin or ancestry of the various groups.

It may be assumed that the nests assembled under the heads of earth and rock cavities, earth burrow and platform (part), probably represent early or original terrestrial types. The platform (Pigeons and Raptores), agglutinated (Swifts), felted (Hummingbirds), were probably early cliff dwellers, though the assumption that the latter originated in the vast rock piles of Tropical America may not be well founded. The Woodpeckers may belong to this division also, though the evidence favors the arboreal, to which evidently belong all other types described here; the countersunk nest especially being a departure from the arboreal habit.

It will be observed that while much is to be learned of the

domestic economy of all species, it is evident that there is a similarity in position and composition of nests according to families, especially of the lower orders. Progressive upward there appears an increasingly great deviation in position, construction, composition, and architecture of nests. In the great families of Flycatchers, Sparrows and Warblers, especially, great diversity exists, though the species of a genera are very apt to construct similar, and subspecies, indistinguishable nests taking into consideration individual and geographical variations. Species associated in colonies with the same environmental conditions naturally conform to a certain standard, while solitary species seem to develop more individuality in the local sense.

Civilization is responsible for changes in the nesting habits of many of our birds, while others have not been affected appreciably. It is not the love of civilization that has induced so many birds, especially those building open nests, to breed near the abode of man, but the quite natural desire to escape better-known or more feared enemies. It is a misfortune that we have no account of the nesting habits of a number of our birds most affected by the settlement of the country, before the change was practically effected. It must be remembered that this part of the country had been cultivated a century and more before Alexander Wilson and John Audubon attempted the biographies of our most familiar birds.

When the first settlers leveled the great forest and the Chimney Swift lost its ancestral home, the change in its domestic economy must have been as abrupt as it was obligatory. The transformation of the nesting habits of the Barn and Cliff Swallows was probably more gradual and agreeable, since the species must have been very local and restricted to the few available nesting sites. It is strange that although many individuals of several species of the natural cavity sort early adopted man-made substitutes, only one other species, the Purple Martin, has entirely forsaken its natural nesting site.

The great West is most fortunate in having intimate studies of many species and subspecies before civilization effaced so many of the natural harbors. Awaiting the inevitable changes of the breeding habits of Vaux's Swift, Western Martin and other species to conform with changes long since made by allied Eastern species, we may expect further adaptations in our local birds, especially the Osprey, Swallow, Creeper, and the like,

identical or only subspecifically distinct from the European, to demonstrate that great versatility is the common heritage of domestic as well as foreign birds.

In America the Osprey can afford to colonize as its food is yet unlimited. In the West it sometimes places its nest on rock spires, but nowhere has it been compelled to seek a site upon disused chimneys or ruined walls, such as the European form sometimes adopts. The European form of the Brown Creeper, also greatly surpasses the American form in nesting adaptability.

There recently appeared in a popular bird magazine an apparently authentic record of a Hermit Thrush building upon a porch plate, the first instance known to the writer of this wood-loving species departing from type. We know positively that 300 years ago there was not a single Robin in Pennsylvania to thus situate its nest because there were no buildings. The earlier ornithologists of a century past regarded a departure from the tree site very unusual; yet a goodly number now build yearly in all available building sites; in fact it has become so common that a pseudo ornithologist once informed the writer that he was confident that we had two kinds locally, the "House" and the "Field" Robin, because they built entirely different nests.

No doubt the tops of hollow trees and the Colonial chimneys had something in common from the viewpoint of the Swift. Certainly the Robin does not mistake the dressed and painted building timbers for the natural limb.

I cannot see that the use of the bill as a building tool greatly handicaps the bird in building, but on the contrary, I believe that the eye at the base of the tool itself is a great convenience to the bird in building as well as in feeding.

The size, shape and structure of the bill correlates with the food habits and with the exception of such groups of the Woodpeckers, bears little or no relation to the character of the nest. Examples are common enough of the great diversity in working tools productive of similar results: the Puffin, Kingfisher and Bank Swallow are equally expert burrowers; the Heron, Eagle and Cuckoo all produce the platform type; the needle-like bill of the Hummingbird, the flat bill of the Western Wood Pewee and the short conical bill of the Goldfinch, regularly manufacture the felted nest; the Broad-bill, a rather primitive type of the Passerine order, found in the Indian region, is said to construct a pendulous nest not inferior to that of the Oriole. The Hum-

mingbird, Gnatcatcher and Wood Pewee with very unlike bills, manage to thatch their nests with tiny bits of lichen very satisfactorily.

It is evident even in the inadequate descriptions of the nests of a single locality that the birds as a class display a wide range of constructive ability; many are as primitive as that of the reptiles; others more elaborate than the best quarters of the mammals and comparable only to the wonder-work of the inferior class of insects. It is constantly assumed in this paper that ground, earth and rock cavity-nesting is usually the most primitive, and that earth burrow, felted, woodhewn, and agglutinated types are in most instances more closely correlated with the first forms than with the cupped brush, its variations, and the pendant and woven types; though the arboreal platform may be in some instances a modification of the extraneous materials or lining of a ground or burrowing nest, and in other instances the primitive type of the arboreal nester which in all probability never built upon the ground.

It would appear from numerous instances given that the nesting cycle is not the result of individual reason but largely of purely instinctive impulses in orderly sequence leading logically from one to another until the cycle is broken or runs its entire course. Many though not all, apparently eccentric or inexplicable actions during the nesting time become clear if this is kept in mind.

Perhaps the reasons already advanced for nest-building seem inadequate when applied to the male and it may well be that his part is performed with no other object in view than to be near his mate.

The rather dogmatic generalizations of Conklin, who learnedly remarks that instincts are complex reflexes, which like structures of an organism, have been built up, both ontogenetically and phylogenetically, under stress of the elimination of the unfit, so that they are usually adaptive; is comprehensive.

Adaptability (flexibility or plasticity, as some prefer to write it) as applied to the nesting habits of so many of our birds is an established fact, yet no one who has studied the living bird intimately is in a position to deny the consciousness of the individual, since it has, as Finn points out, much the same faculties for acquiring knowledge as ourselves.