

THE 17-YEAR CICADA:

A Four-Year "Mistake"?

By Henry S. Dybas

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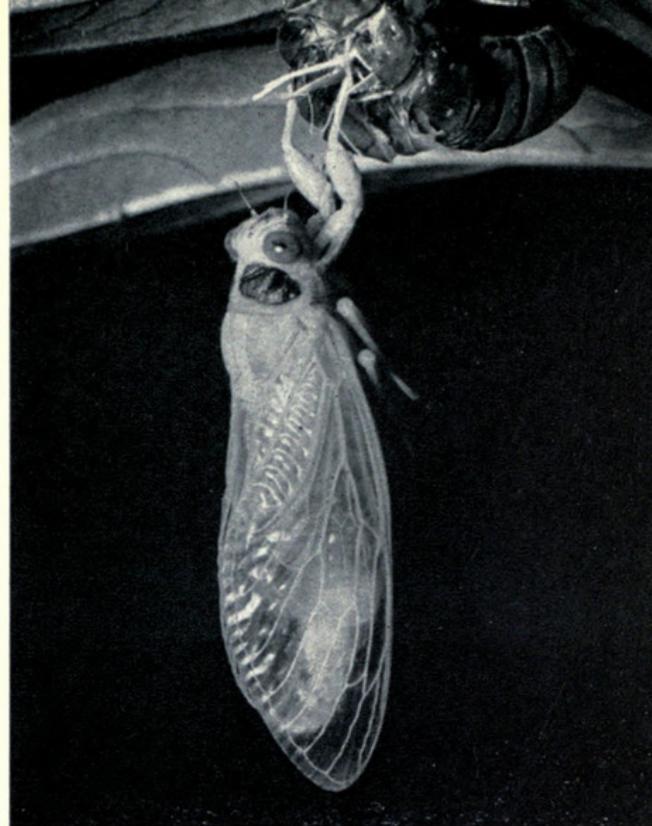
Very early this June, we began to receive calls at the Museum about the emergence of 17-year cicadas, commonly called "locusts." We soon realized that off-year cicadas were emerging in many parts of the Chicago area in unprecedented numbers, four years ahead of schedule. Nothing on this scale had ever been reported in the hundreds of technical papers written about these insects. Something very unusual was happening.

The emergence of periodical cicadas in 17-year cycles is well-documented. An entry in Thomas Jefferson's *Account Book* for the year 1775 mentions their appearance in Virginia that year and recalls their previous emergence in 1758. Emergences in 1741 and 1724 and are also cited on the testimony of a Dr. Walker. Other early observers independently reached the same conclusion as Jefferson that "it appears then that they come out periodically once in 17 years." Even today, 200 years later, this is by far the longest life cycle known in insects.

The 17-year periodical cicada populations in eastern North America do not all emerge above ground at the same time. Each has its own particular 17-year schedule and its own geographic territory. Jefferson's brood (called Brood II by entomologists) occurs on the Atlantic seaboard from Connecticut to North Carolina. It last appeared in 1962 and is scheduled next in 1979. The only northern Illinois brood is Brood XIII, which last emerged in 1956 and is due in four years (1973). In the South, the same cicadas—as nearly as anyone can tell by looking or listening to them—appear on a 13-year schedule. Like the 17-year variety, these occur in different broods, each emerging in its own particular year. No intermediate cycles of 14, 15, or 16 years have ever been found.

The precise interval of 17 years between successive emergences has been repeatedly confirmed so many times in all the known populations of periodical cicadas that it permits long term predictions of a kind virtually unique in field biology. Dr. Monte Lloyd of the University of Chicago and I were able to plan our 1962 field work in Virginia well in advance, with complete confidence that the cicadas would appear exactly on schedule—and they did.

At the end of a 17-year cycle, periodical cicadas characteristically appear in such enormous numbers that they satiate all the birds and other predators and still leave a comfortable surplus for reproduction. Biologists believe the tightly-synchronized mass emergence is a key element in this insect's survival. If the same number of cicadas were



An adult 17-year cicada suspended from the nymph skin from which it has just emerged. It emerges in the evening and by morning will have darkened and will fly to the treetops. (Photo by Lee Jenkins.)

spread out over several years, the argument goes, they would probably nearly all fall victim to their enemies, leaving few for reproduction. All kinds of predators—other insects, snakes, racoons, skunks, grackles and crows—seem to ignore everything except feeding on cicadas. One night I had to interrupt my studies to forcibly take my dog back to the car because he was gorging himself so on emerging cicadas that I became concerned.

Cicada numbers can be estimated with considerable accuracy by counting emergence holes in the ground. In the last emergence in the Chicago area, we found 133,000 per acre (about 200 by 200 feet) in the upland woods in our study area. In the adjacent floodplain we found the record number of a *million and a half per acre!*

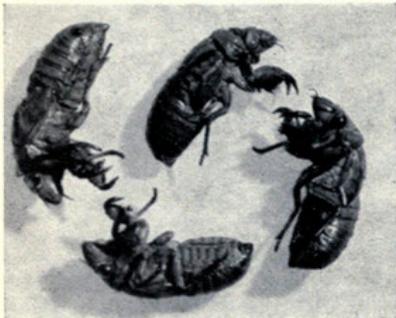
The periodical cicada should not be confused with the annual cicadas which produce the characteristic "buzz-saw" sound in the treetops on hot summer days. These are predominantly black and green and do not have the red eyes and orange wings of the periodical cicadas. They are annual in the sense that some individuals appear every year but require a number of years, presently unknown, to develop underground.

Occasionally, individual periodical cicadas come out during the wrong year. Since the 1956 emergence in northern Illinois, we have recorded about a dozen stragglers in the Chicago area. They obviously represent only a trivial fraction of the local population and also may be at a great disadvantage compared to cicadas coming out in a normal emergence year in that they rarely survive the attacks of their enemies long enough to leave any offspring.

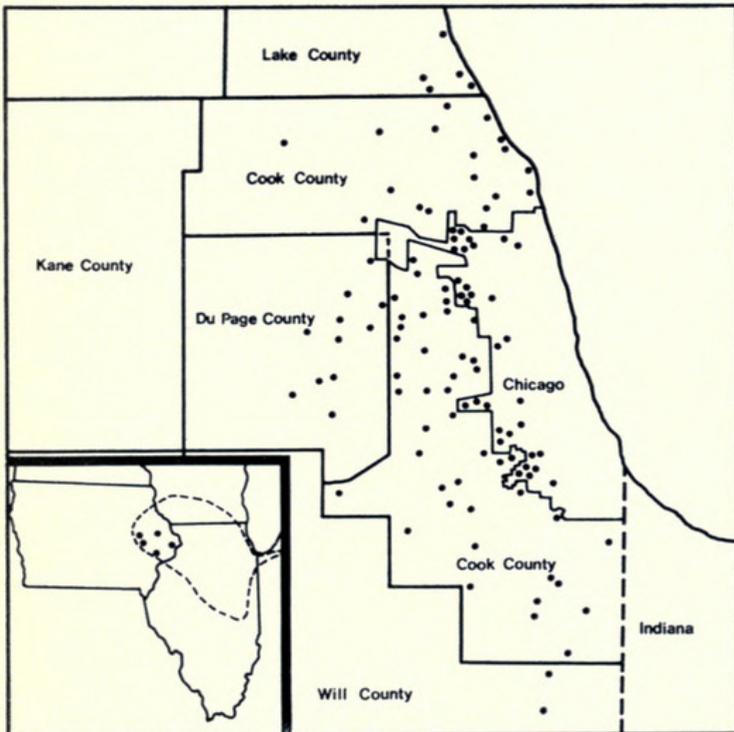
This June it quickly became apparent that the emerging

cicadas were too numerous to be stragglers. Through the mass media, we asked individuals for information on periodical cicada activity in their neighborhoods and we got an astonishing response. More than 500 persons ranging in age from five to 86, took the time to supply us with information or specimens. Chicago and more than 80 communities ringing it were represented. Many reported only a few specimens but others reported thousands. One pair of keen observers in Hinsdale, a 10-year-old girl and her brother of 9, wrote me that they collected 2,350 nymph skins in a small area and offered a shoe-box-full as proof. (We accepted and confirmed the count.)

An empty nymph skin is tough, lasts a long time, and is the best evidence for emergence. The skin represents the stage that develops underground enclosed in an earth cell and sucks sap from tree roots. Normally, in the 17th year, the nymph emerges from the ground, leaving a smooth,



Empty nymph skins are evidence for the emergence of 17-year cicadas. These skins are approximately natural size.



Each dot represents a community reporting emergence of premature 17-year cicadas in June, 1969. A dot may indicate one or many reports, some consisting of hundreds of specimens. Communities which reported cicadas are listed on Page 12, although some may have been accidentally overlooked in this preliminary listing. The range of Brood XIII is shown in the inset (left) by dashed lines. Dots indicate premature 1969 cicadas in Iowa.

round hole about 1/2-inch diameter, and crawls up a nearby tree trunk or plant stem. It fixes itself firmly, the skin splits down the middle, and the soft, creamy white adult, with red eyes and black patches on the back, emerges. The crumpled wing pads are pumped out and wings fully expanded, the body becomes hardened and colored, and the next morning the adult works its way to the treetops, leaving the empty nymph skin behind. The shells eventually drop to the ground very near where they had originally developed underground. In previous studies, Dr. Lloyd and I worked out techniques for extracting much information from measurements of the skins and from their numbers and distribution.

The fact that the cicadas appeared 13 years after the previous (1956) emergence could suggest they were 13-year cicadas (and they were so interpreted in one newspaper article) but there is no history of a 13-year brood in this area and the emergence was 100 miles north of the nearest 13-year brood. Cicadas can expand their ranges only very slowly and there is no possibility that this could represent a recent undetected range expansion of 13-year cicadas.

It is inconceivable that this June emergence could represent a previously unknown brood of 17-year cicadas in the Chicago area. It would have appeared in 1935 and most recently in 1952 and there are no records of such a brood. In a densely populated area such as this it could not have escaped notice.

The only remaining conclusion is that these are genetically 17-year cicadas derived from the 1956 emergence of Brood XIII that have emerged in 13 years, four years ahead of schedule. Thanks to the cooperation of many people who supplied information, the evidence for this is very strong. First, all reports are from within the known range of Brood XIII. Secondly, most people who had lived at their present address in 1956 reported that cicadas had emerged from the same places in 1956. They have come out in record numbers for an off-year, but in much smaller numbers than in a normal cicada year. The assumption is that only a part of the underground population has made a four-year mistake. We will test this by complete nymph skin counts in certain defined areas this year and we will return each year through 1973 to find out what percentage of the underground population was affected this year.

What is the significance of this premature emergence? The fact that different broods of 17-year cicadas are out of phase with one another in different geographical areas suggests that similar events have happened in the past giving rise to new broods which would continue to emerge on 17-year cycles, but different from those of the parent broods. Then, of course, the life-cycles of southern 13-year cicadas and northern 17-year cicadas also differ. In our thinking about the possible evolutionary paths of these insects, Dr. Lloyd and I postulated that it was more likely that some environmental factor (like a period of extreme weather, for instance) affected the development of cicada nymphs by four years, than by some other interval. We were only making an educated guess, however, and never

really expected to have a ringside seat at such a phenomenon, if, indeed, that is what happened in June.

Were there special factors operating on this last cicada cycle to make so many cicadas take a 13-year track instead of the normal one of 17 years? We don't know yet and perhaps we never will. However, we plan to compare general weather conditions since 1956 carefully with those of the 17 years prior to 1956 to see if there has been some conspicuous change. There is also a high concentration of reports from the residential suburbs ringing the city. This may be evidence of an important effect of the large metropolitan area on the local climate. Perhaps it is the effect of human disturbance (herbicides, pesticides, fertilizers). Per-

haps the concentration of reports merely reflects the high density of residents and gardeners in the suburbs. Many possibilities like these will have to be tested against our field data.

Can a premature emergence in numbers like these give rise to an incipient new brood—one that is out of phase with the parent brood and on its own schedule of emergence? We don't know. However, the June weather was not suitable for cicadas, which need sunshine and warm weather to form singing choruses and to reproduce. No choruses were reported and it is probably safe to say that no effective reproduction occurred and no new incipient brood was established.

Reports on the emergence of 17-year cicadas came from the following Illinois communities:

Addison
Argo
Bellwood
Berkeley
Berwyn
Black Hawk Heights
Broadview
Brookfield
Calumet City
Clarendon Hills
Chicago Heights
Crete
Chicago
Deerfield
Des Plaines
Downers Grove
East Hazelcrest
Elk Grove
Elmhurst
Elmwood Park
Evanston

Evergreen Park
Flossmoor
Glencoe
Glen Ellyn
Glenview
Glenwood
Harwood Heights
Hazelcrest
Highland Park
Highwood
Hinsdale
Hometown
Homewood
Justice
La Grange
La Grange Park
Lake Forest
Lemont
Lincolnshire
Lisle
Lombard

Lyons
Merrionette Park
Midlothian
Morton Arboretum
(North of Lisle)
Morton Grove
Mount Prospect
Norridge
Northbrook
Northfield
North Riverside
Oak Forest
Oak Lawn
Oak Park
Orland Park
Ottawa
Palatine
Palos Heights
Palos Hills
Palos Park

Park Forest
Park Ridge
Riverdale
River Forest
River Grove
Riverside
Riverwoods
Skokie
Steger
Stone Park
Tinley Park
Villa Park
Westchester
Western Springs
Wheeling
Willow Springs
Wilmette
Winnetka
Wood Dale
Worth

CALENDAR OF EVENTS

August hours: 9 a.m. to 6 p.m., Monday, Tuesday and Thursday; 9 a.m. to 8 p.m., Wednesday, Friday, Saturday and Sunday.

Through August 29 GUIDED PUBLIC TOURS Professional staff lecturers will provide free guided tours to visitors at 2 p.m., daily, Monday through Friday. A movie, "Through These Doors," which shows glimpses of behind-the-scenes activity at the Museum, will be shown at 3 p.m. in the Lecture Hall. Tours begin from the north entrance of Stanley Field Hall.

Through October 12 THE ART AND LIFE OF THE CUNA INDIANS Temporary exhibit explores the history and culture of this people who live on islands of the San Blas Archipelago off the coast of Panama. Although some aspects of modern civilization are now part of their lives, they have successfully maintained many of the customs and attitudes which are specifically their own. Hall 9 Gallery.

Through November 16 75th ANNIVERSARY EXHIBIT: "A SENSE OF WONDER, A SENSE OF HISTORY, A SENSE OF DISCOVERY" The free exhibit emphasizes the scope of the Museum's activities since its founding in 1893, following the World's Columbian Exposition. Choice specimens from the Museum collections and examples of current research programs by Museum curators are included in the exhibit. Hall 3.

Through August Summer Journey "INSECTS" The fascinating world of insects, which has the largest number of species in the animal kingdom, is the subject of the Raymond Foundation's current Journey for boys and girls. The free do-it-yourself tour program is open to any child who can read and write. Journey sheets and additional information are available at Museum entrances.

Would You Like To Help

Field Museum Membership continues to increase. It is up 73 per cent in the last three years and is now 16,500. More people need the Museum. We need more Members.

We are looking for women to interview prospective Members, telephoning three to five hours daily, four or five days a week. Salaried. Please call Mrs. Roder, 922-2410.

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