

PEHR KALM'S DESCRIPTION OF THE PERIODICAL CICADA, *MAGICICADA SEPTENDECIM* L.¹

From Kongl. Svenska Vetenskaps Academiens Handlingar, 17: 101-116, 1756. Translated by Esther Louise Larsen (Mrs. K. E. Doak) of Crown Point, Ind., and submitted for publication by Professor J. J. Davis, Purdue University, Lafayette, Ind.

INTRODUCTION

In 1749, a heavy infestation of the periodical cicada occurred in Pennsylvania. Pehr Kalm, who was visiting there, described in detail the insect in its 18th century surroundings. His paper was published in Kongl. Svenska Vetenskaps Academiens, Handlingar, 17: 101-116, 1756, under the title "Beskrifning pa et slags Grashopper uti Norra America" (Description of a type of Grasshopper in North America). Because of the misleading title, it is doubtful that many scientists are aware of the existence of this early report on the periodical cicada. Kalm refers to the insect as a *type* of grasshopper, but he also says that it may well prove to be a cicada. The annual cicada, which Kalm and his contemporaries heard, was thought to be a vagrant periodical cicada. Although he was not clear on the taxonomy of the insect, his sharp observations have given us an accurate account of the infestation.

Among the many flying insects in North America there is a species of grasshopper which seems to merit special discussion because of its extraordinary characteristics.

The English refer to this species as locust, the Swedes, gråshoppor. The Latin name may well be *Cicada*, *maxilla utraque lineis octo transversis concavis; alarum margine inferiore lutescentis*.

This cicada would seem to be exactly the same species as that found in the Provence and Languedoc in France, which is illustrated and described by Mr. Reaumur in Memoires pour servir a l'Histoire des Insectes, T. V. *Mem.* IV. Tab. XVI. f. 1. 2. 5. 6. Many characteristics of the American insect are not noted in his description; thus it may prove to be entirely different.

The habitat of this insect is the greater part of North America where it occurs in Georgia, Carolina, Virginia, Maryland, Pennsylvania, New Jersey, New York, and New England. Later, when I travelled through the Land of the Iroquois to the large waterfall Niagara, I heard its squall in the woods daily, for no matter where it is it does not remain silent for long.

Before going further, I shall give a description of the insect's structure:

EDITOR'S NOTE: Here follows such a complete and lengthy description of the adult as to leave no doubt in the minds of 20th century entomologists that Pehr Kalm was describing the Periodical Cicada, *Magicicada septendecim* L. Some concluding statements are here reproduced.

The length of the entire insect including the wings is 1 digit, 5 lines. The length of the wing is 1 digit, 1 line, the maximum width 4 lines. There is some variation in size.

Almost directly in the center of the abdomen, but a little toward the back, there is a dart with which the insect breaks the bark of trees. It extends backward lying close to the abdomen. This shiny, brown needle-like appendage is $3\frac{1}{2}$ lines long. It is grooved lengthwise on the lower surface, and is shaped like a very sharp lancet on the end.

There are two short thick darts in the end of the tail, which are sharper near the end and slightly hairy. The insect may use these to lay its eggs since the one above was used for making holes in bark.

¹This translation of Pehr Kalm's observation on the periodical cicada made about 200 years ago is published now because of its unusual and timely interest. The brood referred to will reappear in eastern and central states in 1953.

These insects are extraordinary. They appear in astounding numbers with indescribable suddenness on certain years. Between the infestations years pass in which only an occasional insect is heard.

I happened to be in America on one of the years when a heavy infestation of this insect occurred. I, therefore, had an opportunity to study it closely.

In 1749, on the 22 of May, new style, these locusts or grasshoppers appeared in dreadful quantities in Pennsylvania. They had been lying in holes in the ground throughout the winter and spring like *Eurcae*, but on this day they crept out of their winter coats and came forth in summer dress. A tree could scarcely be found, in either forest or orchard, whose trunk was not entirely covered with them. Some had emerged from their pupal cases, others were emerging so they were half in and half out. Some had begun to try their wings. It was remarkable that on the previous day, that is the 21st of May, there were none. I had spent the two previous days in the woods collecting plants and insects, but I had not seen a single locust. Others had the same experience. The insects appeared simultaneously throughout the vicinity. On the first day of their arrival, I saw them in the woods along the Schuylkill River, and at tradesman P. Kock's country place which lies 13 miles from the river. It was said that the insects, which were still silent, would soon make such a din that one could scarcely hear because of them. This, I later found to be true.

For seventeen years these insects had not been seen, now they appeared in fantastic quantities throughout the land. Prior to emerging, the nymphs dwell in holes in the ground. I had often seen nymphs in the openings of these holes, but I had no idea what type of creatures they would become.

They usually come out of their holes at night and climb trees and the stems of plants. The nymphal cases, which split on top as the insects emerge, are discarded, but remain attached to trees and plants until blown to the ground or washed away by rain. The ground underneath the trees is often covered with discarded pupal cases. Newly emerged insects dry their wings before attempting flight. Chickens are greedy about the insects just as they creep out of their holes. They are especially appetizing to birds at this stage. This may be the reason why the Creator has foreordained that they should appear at night, so they may not be destroyed by birds before they have reached the stage where they can fly away. I do not know if they dig the holes themselves in which the nymphs lie, or if they avail themselves of those dug by various types of earth boring dung beetles. They burrow the ground, no matter how hard, wherever the excrement of horses is found. It is highly unlikely that dung beetles account for all the holes utilized by these insects.

On the 25th day of May the insects were heard in the trees. It should be noted that they rarely ever are seen on the ground. They now made such a roar and din in the woods they they could be heard for great distances. If two persons happened to meet they would have to shout in order to hear each other. If they were any distance apart it would be necessary to strain the voice to capacity in order to determine what was being said.

The secretary to the government, Mr. Peters, stated that the day the insects emerged, a large number in the process of working their way upward were found at a depth of 12 feet by a man who was digging a pit. Mr. Willing, who was mayor of Philadelphia that year, said he happened to be in the country when the insects were appearing. He saw, with his own eyes, an abundance of these insects 4 feet below the surface where a pit was being dug. They were busy burrowing their way upward toward the light. The hole they make is smooth and round as if it had been made with an auger. Their food habits are not known, but it is believed that they eat soil during the nymphal stage. After they emerge they have not been seen eating anything.

The general opinion is that these insects appear in these fantastic numbers

every seventeenth year. Meanwhile, except for an occasional one which may appear in the summer, they remain underground.

There is considerable evidence that these insects appear every seventeenth year in Pennsylvania.

In the Wikaco parish register for the year of 1715, the Swedish dean and rector, Mr. And. Sandel, who later became Dean of Hedmora, made the following entry:

"During the month of May, there came out of the ground a particular fly or grasshopper which the English call locusts. They appeared everywhere even on hard roads. A shell completely covered the mouth, body and feet. It seems strange that they could make a hole through the ground while covered with a shell. After coming out of the ground they emerged from their shells, and flew away settling in the trees. There they made an extraordinary sound from morning 'til night. Since they were so numerous throughout the country, cowbells could scarcely be heard in the woods because of the noise. The insects slit the bark of the branches and trees and deposited the worms. In spite of this the trees did not show any injury the following year. Swine and chickens eat the insects. The heathens eat them, especially just after they emerge. The newly emerged insect is fried a little and then eaten. This may be the same type of insect as that which John the Baptist is said to have eaten. The insects lived until June and then they died."

Dean Sandel served the Wikaco congregation from and during the year 1702 to the end of June, 1719, but with the exception of 1715, no mention is made of grasshoppers or locusts. He surely would have mentioned them again had they appeared in this unusual fashion. The church register shows that Dean Sandel was meticulous in keeping records. All of the old Swedes said there had been no infestation for many years before or after the one mentioned above.

Seventeen years later, in the year 1732, the next infestation occurred. The Swedish church register did not enlighten me. It ignored this and much else. The current rector, it would seem, was not very observant. However, Mr. Benjamin Franklin gave me some records, which were kept over a period of years in Philadelphia, by an Englishman named Breintnal. His observations on the subject for the year 1732 are as follows: "Early in May, the locusts began to come out of the ground. The 12th of May, they were still coming and there was an indescribable quantity. By the 19th they were strong enough to mate, after which they began to bore into the trees and lay their eggs. On the 22nd they flew about in large swarms. On the 24th locusts were still coming out of the ground, but by June 13th very few remained."

Breintnal began his observations at the beginning of the year 1731, and finished them the 11th of November, 1745, when he pitifully ended his days. Although he was exceedingly observant during all this time, and in complete charge of all his faculties, no other mention is made of these locusts or grasshoppers. The Swedes and others insist that, with the exception of an occasional one here and there in the woods, they were not seen in any quantity until the 22nd of May, 1749, when they appeared in large swarms.

I can not say, from my own observations, how long they remained in Pennsylvania in these dreadful numbers, as I set out upon a journey, north to Canada, at this time. According to all reliable sources they continued in large numbers for about six weeks and then disappeared. The observations of Dean Sandel and Breintnal are in agreement with this.

The insects slit the fine moist bark of small branches with the ovipositor, which later penetrated deep into the branch, depositing eggs or other material. As a result, large numbers of branches dried up. A type of mucus is deposited on the branch by the ovipositor at the time of penetration. Although the bark on the young twigs of nearly all trees may be slit, the insects seem to prefer that

of oak and apple. The ovipositor can not penetrate thick rough bark. The year following the infestation, large quantities of branches died and fell to the ground because of this bark injury. I could detect no other damage, but some said entire trees dried up. This might well happen to young trees where all the bark is tender and can be penetrated by the ovipositor. Permanent damage might result if too many young twigs on a large tree were destroyed just before a hot spell, or a long dry one.

It is generally believed that the insect shreds the bark in order to deposit eggs. I can not say for certain if this is the case, although it would seem to be so. My departure from Pennsylvania, just after the insects had emerged and prior to the completion of their cycles, did not permit me to investigate. Neither larvae nor pupal cases have been observed following the infestation. What has become of them? It would seem that on the same year or the succeeding one, pupal cases would appear in at least the same number as the parent insects. We may assume that each insect lays more than one egg, yes, even hundreds, if it resembles other insects. Even if each individual laid only three or four eggs and all of these hatched at once, the locality suffering from an infestation would be overwhelmed. In a short time, trees and plants within range would be completely destroyed. However, the Almighty Creator has other plans for them, and one rarely sees even a single pupal case in the year following the infestation. In the light of these observations, might it not be possible that they go deep into the ground and feed there for a time before becoming dormant cocoons or pupae. After a definite period of time, or under favorable conditions, might they not wake up and come forth from their hiding places? There is still much to be learned about the life histories of insects.

During the period of infestation, Indian women and children collect the insects in baskets and carry them home. They are then fried and eaten as a delicacy. Although the savages eat these insects, they are not the same as those which were eaten by John the Baptist in the desert. This can be seen from the observations of Dr. Hasselqvist, and in a letter from Archibuter and Knight von Linné to Joh. Flodman. The letter is included in his disputation, "John the Baptist's clothing and food," and an illustration of the grasshopper of the East is given. Obviously people in various parts of the world eat insects. The practice is neither strange nor unusual, unnatural nor impossible. The Indians have a related custom. When young wasps are still in their cells and large enough for small wing development, but still white in color, they are eagerly collected by the savages, who fry them and then eat them with great relish.

Various creatures such as swine, chickens and birds of the forest, particularly the shrike, are greedy for these grasshoppers. Chickens would not fly to their roosts at night when they were emerging, but stood and waited on the sod in order to seize them as they came out of hiding.

A peculiarity of these insects is that they do not emerge simultaneously in such shocking quantities in all places. For example, the year the whole of Pennsylvania was swarming with them, not a single one was heard of in New England. This was also true of other localities. When I left Pennsylvania in May, 1749, I was afraid my ears would be ruined by the noise and the disturbance they made in the trees. The same hum and din reverberated in the woods in part of New Jersey, but as I travelled toward New York the noise diminished. Beyond Albany, I heard only an occasional one, and I frequently travelled a whole day without hearing any. The inhabitants of Albany had not heard any more than usual. It was nine years since their last heavy infestation.

The following year, 1750, during April, May and June, I travelled through large sections of New Jersey and Pennsylvania. Frequently, I travelled all day through the forests without hearing a single insect although I listened carefully for them. Where had the insects gone that had filled all these woods a year ago?

In travelling to New York from Trenton, I met an old man of that community, who said he had not heard one of these insects that entire spring. Although according to him, they had been more numerous than the leaves the previous spring. That same summer I travelled through most of the province of New York to Albany and the Land of the Iroquois, I heard only an occasional humming in the trees. An infestation occurred in New England in the spring of 1750. Just as the insects were emerging, but before they had dried their wings, there was a heavy night frost which killed most of them. Consequently the noise, in the woods that summer, was not as loud as usual.

Several old Swedes living in Pennsylvania and New Jersey said that the year following these infestations was marked by an infestation of leafworms. Because of these pests the forests were entirely leafless during the month of June. They concluded that the worms came from the eggs which had been layed under the bark of the trees by the grasshoppers the previous year.

If such an infestation of worms always occurs on the year following the grasshopper infestation, I can not say. I found nothing on it in the Swedish church records, in the observations of Breintnal or other writings. It is true that this did happen during my visit to America. In May, 1750, such astounding quantities of leafworms appeared on the trees in Pennsylvania that I had never seen the like. At another time I shall have the honor of presenting to Kongl. Vetenskaps Academien a complete description of them. I shall show that these worms can not claim the grasshoppers as their parents but belong to an entirely different group. I collected some of the worms and fed them leaves until they had undergone metamorphosis. Out of these worms came a species of *Phalaena*, not grasshoppers. The handiwork of the Almighty Creator is easily recognized in the lives of these small creatures.
