

THE CLEANING HABITS OF A KATYDID

DURING the winter of 1927-28 I had under observation a meadow katydid *Orchelimum agile* De Geer which I captured just before winter came on. This katydid was kept in a quart glass jar covered with a piece of thin muslin. It was given daily fresh pieces of lettuce leaf. Now and then orange juice was offered it by moistening the end of a broom straw with it, and tiny grains of moist sugar were given it in the same manner. The little insect seemed quite at home, and became a pet with all the household. Its dainty cleaning habits soon excited the attention and admiration of all, and many interesting notes on this behavior were obtained. All sentient creatures have a highly developed sense of cleanliness. In some instances the deposition of the excreta is a matter of considerable attention, as in the case of the domestic cat and of many birds caring for their helpless nestlings. In addition to this a nice sense of bodily cleanliness is observed, and the lowliest insects may have this sense in an eminent degree. The little katydid in question proved so interesting in this respect and showed such niceties of judgment in the matter that I shall give the details of the various operations.

The ordinary grasshopper or katydid is veritably a nearly rigid box of chitin, with three legs on each side and a pair of wing-covers. Beneath the external wing-covers or tegmina are the true membranous flying wings. The antennae or feelers consist of two fine capillary, many-jointed, sensitive structures which are attached between the eyes, and constantly play like whips around the insect. In the case of the katydids they greatly exceed the entire length of the body. Men probably do not know all the functions of these sensitive antennae, but we know enough to feel certain that they enable the insect to adjust itself with much nicety to its immediate surroundings. To be sure the moon is not within a katydid's reach, but what does a katydid care about lunar distances or stellar magnitudes? He worries alone about the details of his immediate world, which he can step on or reach with foot or antenna. Unquestionably they play a part in enabling him to judge distances, and he well knows that anything within reach of his antennae is not far away from his feet.

These delicate, restless antennae come in for much careful cleaning. Now and then he pulls one down with his front foot so that he can bring it to his mouth parts. It is then run very

slowly through his mouth parts from the base to the apex. As it is moved toward the apex, it bows out in an ever-enlarging loop until the tip is reached and released. The other antenna is now washed in the same manner. In pulling the antennae down to the mouth, the left front leg is used for the left antenna, and the right is used for its corresponding antenna. Since the antennae are inserted near the top of the head at a considerable distance above the mouth parts, it is evident that a goodly length of the basal portion can not be drawn through the mouth. This does not worry the little katydid in the least. It now moistens the tarsal joints of the front leg beneath and draws the foot again and again over the unwashed portion, beginning well back of the eyes and coming down upon the antennae, exactly as a cat washes its face. From time to time the moistening is repeated, for the little insect is not satisfied with a mere superficial dry brushing. This dispenses with the antennae. The face and eyes are now washed. This is necessarily done only with the front legs, for they alone can reach the upper portions of the face. The movements are precisely like those of a cat or a fly doing the same thing. First the tarsal joints beneath are moistened, then the foot is brought far up back of the eyes, and swept downward to the mouth with a smooth, even draw several times repeated. The tarsal joints are again moistened and the movements repeated. There are times when it is obvious the insect is making every effort to reach as far back upon the top of its head as it is anatomically possible with its fore feet. Each front leg must be used for its own corresponding side of the head, for the feet or hands as one chooses to call them can reach but little beyond the frontal area toward the other side of the head. With these nicely adjusted washing movements the eyes can be cleaned, and even the sides of the head and face by careful manipulation of the angle of the femur and tibia.

It was a long time before I saw the middle pair of legs used in the cleaning operations, and I had concluded that they could play very little part in such matters. I found I was much mistaken. Nature suddenly refuted my dogmatism with one of the most beautiful illustrations of the part they, too, play in this matter of body-hygiene.

One day I saw the little katydid bring its hind leg and thigh far out one side until the thigh was at about right angles with

the body. It was a very stiff and awkward position and apparently not a comfortable one for the insect. It had something in mind, however, so I watched intently its every movement. It now proceeded to moisten the tarsal under surfaces of its middle leg on that side. This done, it very deftly brought the foot up and far back upon the long, fat thigh of the extended hind leg, and drew it downwards smoothly toward the tibia. Alternate moistening and stroking movements were usually the rule. The feet of this middle leg were brought back well toward the body and drawn over a good portion of the outer area of the hind thigh by careful adjustments of the movements. It was a marvelous instance of a studied adaptation to the difficulties of the situation, yet it was all done with a nicety of judgment and precision that called for the highest admiration. Now we shall see how the hind legs are used in this problem of body-hygiene. Ah, here comes another masterly handling of the various anatomical features, excelling even the nicely adjusted movements of the middle legs used in cleaning the thighs of the rather inaccessible hind legs.

While watching the katydid engaged in its usual leisurely singing, I saw it stretch its hind legs well out behind it. The body was raised enough to allow one hind leg, with the tibia closed snugly against the femur, to be thrust beneath it until the foot was within reach of the mouth parts. The under surface of the tarsal joints was then moistened. The leg was now extended backwards, and moved around in a series of groping kicks until the opposite hind leg was found. When it had located it with its foot, it began deliberate rubbing movements over the inner side and top of the thigh, drawing the foot along smoothly toward the tibia each time, but not over the tibia. The moistening act was repeated, followed by additional cleaning strokes of the hind femur, in spite of the somewhat difficult movements involved in bringing the hindermost foot to the mouth each time. At another time the tarsal joints of the hind leg were made to stroke the upper surface of the wing-covers, beginning at a point near the middle and pushing the feet along toward their tips. On several occasions the thigh of the hind leg was hugged close to the body and rubbed vigorously, as if to scratch the sides of the body, but whether this was intended to clean the inner side of the thigh or the side of the body or whether only

to allay irritation is not entirely plain. The tarsal joints of the hind tibia are sometimes used to rub along the sides of the abdomen as far as the anal structures.

The posterior portion of the abdomen with the cerci and related structures comes in for an intensive overhauling now and then. It is no easy matter to bring the tip of the abdomen to the mouth parts, but by sharply bowing it down and under the insect can thrust the abdomen far forward until the mouth parts are reached. Owing to the general rigidity of the chitinous exoskeleton the head has very limited movements in any direction. The mouth parts can reach the fore and middle legs well up the femur, and can be used directly on these structures in the moistening and cleaning operations. Most other parts of the body must be moistened and cleaned indirectly, by employing the tarsal joints. The marvelous thing about the whole process is the thorough and practical manner in which it is all done. The katydid knows all the limitations of its various body-structures and appendages and appears to work with a complete knowledge of the degree of their extensibility in every direction, and the extent to which each leg can be employed in reaching any other part of the body.

Some parts of the body are quite inaccessible to the little katydid owing to the immobilities of its chitinous exoskeleton. No ordinary katydid has yet found it convenient to reach the basal portion of the tegmina and the musical organs situated here, or the upper portion of the pronotum. These are as inaccessible to the poor katydid as the middle of the shoulders and back are to a human. A scientist once said to me that his back had never been actually washed in twenty-five years, but simply wore itself clean with perspiration and friction of the clothes worn. A katydid's back is just as inaccessible with his rather immobile suit of chitinous armor, and no doubt he knows it too.

To my mind there is as much evidence in the katydid of an innate free will or exercise of choice in the matter of keeping clean as there is when men wash their own bodies. It makes no difference whether it be the act of a katydid or cat or man himself, the aims and functions of each are one and the same. It is done for comfort and for health. Somehow the lowly katydid, as we choose to call it, knows the sum and substance of it all, personal comfort and hygiene, as well as man himself. It is a principle of life just as much as social organization with the bees,

or family organization with the birds. Comfort and cleanliness are phases of self-preservation, and constitute a fundamental law of life. An unsocial insect as the katydid must make it an individual matter; but among the bees and men it becomes a part of the general social plan and play of an efficiently organized social life. It is here projected from the individual to the social consciousness with infinite variations. The bird has its own personal hygiene, but it has in addition a mind for the hygiene of the nest and the nestlings until they can develop this consciousness and helpfulness themselves. It is all one of the beautiful expressions of life and its supreme necessities, amounting even to an art of judgment and adjustment as in the case of the little katydid.

All insects have their specific and appropriate cleaning habits. It appears to be a universal behavior with life. The lowliest ameba would seem to have its likes and dislikes, its appreciations of comforts and discomforts, the useful and the useless in its metabolisms and behaviors. One can expect infinite variations of the theme with every species, because there are eternally different degrees of form and function, freedom and limitation. It is one of the vital principles of life, and a man could spend his entire days upon the subject, for every creature is a law unto itself. While some katydids and grasshoppers run their antennae through their mouth parts to clean them, others step upon them and draw them beneath their feet. Being a fundamental necessity of life, involving as it does the comfort and health of a creature, one can expect this behavior to present wonderful and varied manifestations, involving always the fundamentals of refined judgments and efficient movements.

It is probably no idle play of life, but one of the supreme necessities of successful existence, to keep well oiled and lubricated and groomed. The fundamental concept of comfort and health appears to be the activating motive. Sanitation, hygiene, at every turn in life, appear to have entered the consciousness of the individual and the species. Cleanliness appears to be an innate mood, as if it were well known that a clean body may thwart bacterial or fungous invasions. There are probably esthetic considerations in it as well. It would be interesting to know all the properties of the juices of the mouth parts, as a cleansing agent, as a lubricating oil, as a bactericidal wash. As we have our mosquitoes and fleas and mites to trouble us, so do all other creatures

have their parasite troubles. If we anoint ourselves with this and that to soften our skins or drive away our pests, no doubt the katydid has leanings in the same direction—in the direction of comfort and peace—as positive as our own.

The poisoning methods of man to rid his premises of such pests as the cockroach have taken advantage of the cleaning tendencies of this insect. When powdered sodium fluoride is scattered over their runs, they become more or less dusted with it, and get it upon their feet. In trying to rid themselves of this irritant dust it is transferred to their mouths and enough is ingested to prove fatal to them, even though it would never be consumed voluntarily as a food substance.

One wonders how the little katydid has so thoroughly learned all the accessibilities and inaccessibilities of its anatomy. If it has learned it by personal experience, gaining facility by repetition, then it is like men apt at learning and as intelligent as we who claim the powers of reasoning. If it is all an inherited grace, then we know nothing of life and its potentialities and evolutions. The more I know of the graces and arts of katydids the more do I see them as creatures of good practical judgments and free will such as I would pronounce for the normal behaviors of men.

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