

A NEW MOSQUITO.

BY HARRISON G. DYAR,

WASHINGTON, D. C.

***Culex mitchellæ*, new species.**

This form was collected by me in southern Georgia and Florida in temporary pools of fresh water. The adult resembles *sollicitans*, but the wing scales are wholly black, the first tarsal joint is devoid of a light colored median band and the light colored scales of the legs are pure white instead of yellow. Types, 61 specimens, U. S. National Museum, type No. 8407; one ♀ selected as the type is from Jacksonville, Fla., the larvæ in dirty recently dug holes along the railroad. Other localities are Green Cove Springs in temporary pools in the pines, Magnolia Springs in pools in swampy land, Kissimmee, in ditch, puddles and pools at the edge of swampy land, Pokatee, Fla., in a hole with old tin cans and rotton wood, and in the pine barrens of southern Georgia in a puddle by the railroad at a siding. The larva closely resembles that of *sollicitans*, but the air tube is considerably longer, being fully three times as long as wide, while the spines of the comb are unusually long and thorn-shaped.

It gives me pleasure to name this species in honor of Miss Evelyn G. Mitchell.

Class I, HEXAPODA.

Order XI, ORTHOPTERA.

THE COULEE CRICKET OF CENTRAL WASHINGTON. (PERANABRUS SCABRICOLLIS THOMAS.)

BY ROBERT E. SNODGRASS,

STANFORD UNIVERSITY, CAL.

(PLATES I AND II.)

“Coulee Cricket” is a name that may be appropriately given in the state of Washington to the large cricket-like Locustid, *Peranabrus scabricollis* Thomas, that lives in such immense bands in the northern half of Douglas county. The name is fitting because the insects are found principally in or about the dry cañons known as *coulees*, the chief of which are two great gorges named Grand Coulee and Moses Coulee.

The insects are large, fat, soft-bodied creatures, about an inch and a half in length and of a dark reddish-brown color. The males (fig. 1) have very short wings used for stridulating only; the females (fig. 2) are wingless.

They live in bands of many hundred thousands, perhaps millions of individuals and have lately become a menace to crops. In most places they live on desert or "scab-land" areas where there is nothing of importance for them to destroy. Some of the bands, however, are migratory, and during the last few years have made their way into cultivated parts, doing considerable damage to unprotected fields of young wheat, and of course threatening with destruction any country in their line of march — for they clear off nearly everything as they advance.

One of these moving bands coming toward Waterville from the south side of the Badger mountains was visited by the writer the first part of June in 1903. A stationary band living about a mile and a half east of Coulee City was visited during the latter part of June in 1902, and the same site was visited again in June of 1903, but there were then no crickets to be found there. The crickets were observed also during July of 1902 from Coulee City south along the east side of Grand Coulee as far as the railroad station of Adrian.

Nothing has yet been recorded concerning the hatching of the eggs or the growth of the young crickets. By the first of June, however nearly all reach maturity and adult life continues from then until the middle of July.

The adult crickets are fat and lazy-looking creatures, living on the ground and in the low bushes of the arid region they inhabit. The majority of them keep moving about most of the time, but, except when migrating, they go in no general direction and the confines of the band remain pretty definite. On the other hand, many may be seen remaining motionless for a long time, especially while sitting in the bushes.

Their customary gait is a slow walk, but when disturbed they jump. Their rate of progression when on an ordinary walk is about ten feet a minute. When they jump they cover at one leap from three to four inches. They have no fear of a person and only get out of one's path to avoid being stepped on. If allowed to do so they will climb all over one's clothes and even to the top of one's hat. Workmen that learn to disregard them often become covered by them while working or standing in an infested field.

The males and females do not differ in their ordinary habits, except that most of the time the males perform a chirping stridulation with their short wings. The females are wingless and consequently silent. The usual chirps of the male are uttered in regular and rather slow succession, averaging between 90 and 100 a minute. One, while stridulating for three minutes, made 97, 97 and 96 chirps a minute respectively. When disturbed, they stridulate sharply and rapidly in short, quick series of chirps having a decidedly angry tone.

Their food may be said to consist normally of plants. In some places they completely strip the vegetation of leaves and blossoms, and, where migrating leave behind them a great tract of devastation. On the other hand, individuals in stationary bands may be watched for a long time and never be seen to eat of the plants they inhabit. Where such bands exist the vegetation shows no evidence of the presence of the insects. Although their appetite for plant food is thus rather erratic, and hard to account for in its variation, they have a liking for flesh that is insatiable and which, owing to the absence of other means for satisfying it, commonly leads to cannibalism. It is a frequent sight to see one or several individuals eagerly devouring one of their comrades, the latter generally not yet dead. They apparently never attack and disable a healthy individual, but, whenever one becomes injured or weakened from any cause his neighbors at once turn upon and devour him alive. Mercy or feeling for another's pain are sentiments they have no notion of. Since an individual does not die until almost completely destroyed, many gruesome sights may be seen. Such fragments as a head, one side of the body, the ovipositor and a leg or so remain alive, and the palpi and ovipositor move about and the legs kick until all is devoured.

A female was observed eagerly feeding on the viscera of a male who was lying on his back. She was pulling the intestine out through a hole in the side of the male's abdomen regardless of the kicking and struggling of the victim. Presently another male came along and shared in the feast, the poor male that was having his vitals pulled out of his body struggling still more desperately, but this did not appear to affect the appetites of his devourers. Soon the female pulled off a leg and sucked out the contents through the open end with great relish. Then she went back to feeding through the hole in the abdomen.

In another interesting case a male was seen carrying off a live head and thorax with most of the alimentary canal attached. Two other

individuals made pursuit, one catching hold of the protruding viscera and pulling out a long piece of intestine. The other pursuer immediately grabbed the other end of the piece and for a while they had a fierce tug of war for possession. Finally one gave up and the other ate the capture. Then both hurried again after the first one but he had made good his evasion.

Such cannibalistic sights are common. If an individual is injured and thrown among the others he is at once attacked and eaten. But fresh meat of any sort is devoured with equal avidity. During the early part of the mornings there are generally to be seen a large number of half dead females being eaten. The females apparently weaken and die on the morning after they lay their eggs. These spent females form the breakfast of a large number of the well ones.

The crop contents of several individuals taken in the midst of a cannibalistic meal consisted of a dark brown, pulpy mass. Many other crops taken from specimens of the Coulee City band contained the same sort of mass. In fact, only one was found containing vegetable matter—a green, pasty mass easily recognizable as plant food. Only one or two individuals were ever seen here feeding on vegetation; they appeared to subsist almost entirely on one another, especially on the females that succumbed in the mornings. This, however, as before stated, is not true of all the bands. Those in the Badger Mountains were seen voraciously feeding on vegetation, and in several places young wheat fields have been completely destroyed by them.

The large band that in the summer of 1902 was living about a mile and a half east of Coulee City was apparently a stationary colony. Residents in and about Coulee City said the crickets had been at the same place in about the same numbers for years back. They knew nothing of migratory habits in connection with them. The writer observed the females laying eggs here in abundance during June of 1902. When the site of the colony was visited again during the same month in 1903 not a cricket was to be found. Nobody knew anything about them except that they had not been seen as customary in other years. But no one could state whether they had hatched out in the spring and had later moved off, or whether the eggs never hatched. What actually became of this band is still to be determined.

The migratory bands live on the west side of Grand Coulee and have mostly started from the southern end of Moses Coulee. The writer visited one of these travelling hordes that had made its way in a

northeast direction across the Badger Mountains to within six or seven miles of Waterville by the 9th of June, 1903. A force of men was at work in front of them constructing a low fence to prevent their farther advance toward the wheat fields a mile or so beyond at the base of the mountains. These crickets were said to have travelled fifteen miles during the three weeks previous. Two years ago they came up out of the southern part of Moses Coulee and caused the farmers a great deal of trouble about Southside. Their migration this year toward Waterville from Southside over the Badger Mountains is their first visit to this region.

Where the crickets were checked by the fence they became densely massed and the vegetation was here utterly ravished by them. One could discern from a distance a striking contrast on the opposite sides of the fence. Evidently the insects here travelled for food.

During the morning and the early part of the afternoon the members of this travelling community behaved the same as those of the stationary Coulee City band. But the men at work along the fence confidently stated that between three and four o'clock in the afternoon the crickets would begin to travel, and that soon the ground would be covered by a dense crawling mass of the insects all moving steadily along in one direction. This prediction the writer saw verified the same day.

In any band the members are most of the time moving about but they simply go back and forth in any direction. Here, however, a little after three o'clock in the afternoon, many of the crickets were to be seen walking continuously along in a northeast direction. Toward four o'clock the number moving thus had greatly increased, while shortly after four not an individual was stationary — all were moving silently and steadily along in an unswerving course to the northeast. An average rate of progress was ten or twelve feet a minute. Feeding had entirely ceased and all individuals that were in the bushes came down to the ground which now became crowded. If any one lagged he was simply hustled along by those coming behind. Soon they became so massed that it was impossible for any one of them to go in any other direction than that of the crowd or even to stand still. Near the fence, which was placed across the predicted line of march the scene was something marvellous. Over thousands of square feet the crickets were simply massed together, there being on much of this crowded area actually a cricket to every

square inch of surface. About fifteen crossed any given point every minute. Between two points two inches apart one hundred and fifty crossed in five minutes, and, by another count ninety in three minutes, either giving thirty in one minute. This would be fifteen in single file. When they reached the fence they systematically turned to the right, *i. e.*, to the east, whether the ground sloped uphill or downhill, and travelled parallel with the fence. A few tried to climb over.

The fence consisted merely of six-inch boards set on edge, banked with earth on the side away from the crickets, and topped with a strip of tin projecting about an inch toward them and bent slightly downward. Many miles of this had been constructed in the Badger Mountains and it effectually kept the crickets back from the wheat fields in the valley below. By means of ditches and holes dug along the inner side of the fence enormous numbers of the insects were captured and killed. The moving horde simply flowed over the edges of these holes like some viscid liquid poured out upon the ground. Those on the rim of a hole were helplessly shoved over and in by the crowd coming behind, and in turn were followed by those that pushed them in. Thus they piled up until wagon-loads of them accumulated. Each hole soon contained a wriggling squirming, angry mass of life that extinguished itself through the fierce fighting and mutual smothering of the individuals thus heaped upon one another.

The average daily life of an adult individual is about as follows: The first half of the morning is spent in feeding, in walking about, or in silent meditation. From about ten o'clock until noon mating takes place between the males and females. During this act the male is beneath the female. The former while courting the female chirps continually with his wings and, advancing backward and obliquely sideways toward the female from in front, tries to push his abdomen beneath hers. Sometimes the female makes no resentment but often the male has his patience sorely tried. One was observed for twenty minutes attempting to make a female accept him before she finally did so.

Although the male is the active party during courtship the fertilization of the female depends on an act of her own. The ovipositor is directed downward or its tip braced against the ground; the opening of the bursa copulatrix behind the eighth sternum is then brought against the tip of the male's abdomen. After about five minutes a large white mass of tough albuminous matter is ejected by the male

into the bursa copulatrix of the female. The pair then separates but the white mass hangs from the abdomen of the female as a large bilobed appendage and apparently causes her much annoyance.

It is not evident what the function of this albuminous mass is, but it looks like simply a plug to close the bursa copulatrix. In the male a great mass of tubular accessory glands open into the ejaculatory duct and it must be these glands that secrete the albuminous mass.* The female often keeps the tip of her abdomen elevated to prevent the mass from dragging on the ground, for, being sticky when fresh, it becomes covered with bits of leaves and grains of sand. She attempts to rid herself of it by bending her head beneath the abdomen and chewing it off. Others assist her by eating at it until after a short time it is gone. Seldom is one seen in the afternoon with the mass adhering while it is commonly present on females in the morning between ten and twelve o'clock. No cases of mating were ever observed in the afternoon.

Most of the afternoon is spent by the members of non-migratory bands in the same way as the early part of the morning. At about five o'clock, however, in both stationary and migratory bands, the females begin laying eggs and continue to do so until late in the evening. While ovipositing the female most commonly assumes an upright position, standing upon her hind legs beside a small bunch of grass and grasping the blades with the other legs for support (Fig. 3). The ovipositor is carefully forced down into the ground to its base. Strong peristaltic contractions of the abdomen now take place for a minute or so and then the ovipositor is withdrawn. Immediately, however, it is either poked down again into the same hole or thrust into a new place beside the first one. Thus the female continues placing a few eggs in one hole, a few in another and so on until a great many are laid about the roots of the same clump of grass. Often she quits one place and goes off some distance to another. In the migrating bands the females have much difficulty in depositing their eggs on account of the jostling and pushing of those moving past. Sometimes a female while ovipositing rests on the ground in the natural position and inserts the ovipositor by drawing the tip forward beneath her and then thrusting it downward into the ground.

The eggs are not inclosed in a case, each being entirely free and

* See Internal Anatomy of *Peranabrus scabricollis* by R. E. Snodgrass — Journal New York Entom. Soc., XI, p. 186, pl. XII, Fig. 8.

separate from the others. They are discharged from the tip of the ovipositor, passing slowly along its entire length, one at a time, by a slight movement of the blades upon one another. The latter spread apart at the tip as the eggs pass out.

After laying her eggs the female apparently weakens and dies during the day following. Early in the mornings there may be seen a great many weak or half dead females lying about or being devoured by the other members of the band. Nearly all the remnants of others that have been eaten during the morning are also of females, as is attested by the uneaten ovipositors.

About the middle of July, it is said, the crickets all die off, and this ends their history for the year. Toward the end of the season there must be a great preponderance of males, for the males were not observed to die off daily with the females. Nearly all males being eaten by others were injured individuals. In the migrating bands the next year's brood begins where the parent brood of the year before died off.

Only one natural enemy of the crickets was noted. This was a large black Pompilid, *Palmodes moris* Kohl., which during the season of 1902 inhabited in considerable numbers the outskirts of the Coulee City band. The wasps were seen everywhere flitting restlessly about amongst the crickets but no attacks on the latter were observed. One wasp was discovered in the act of dragging a female cricket over the ground to her burrow. The cricket was either dead or paralyzed to such a degree that it exhibited no sign of life and the wasp had her mandibles inserted into its head. On reaching the burrow the cricket was left outside for a few minutes while the wasp hurried below as if to see that all was properly prepared. She then came up and hauled the cricket down head foremost. Immediately afterwards she returned to the surface and flew away leaving the burrow uncovered.

Many wasps were seen filling the mouths of their burrows; but in only one such dug open was a cricket found. This was a female with the head upward. During the summer of 1903 not a wasp was seen anywhere.

No destructive remedy has as yet been successfully applied to these crickets. Experiments made by Professor C. V. Piper on inoculating them with the South African grasshopper fungus were unsuccessful as have been all other attempts to introduce this disease. The insects could probably be killed by rolling, burning, or by turning loose

turkeys and hogs amongst them, and they would certainly eat poisoned meat, but all of these methods are impracticable.

The only successful method of combatting the moving bands is that of fencing and dilating. The fences as already described effectively stop their advance, but to fence in all of the country that it is possible for the crickets to travel into would be an expensive undertaking. A great many can be trapped in the ditches but a few score-wagon loads of dead crickets does not appreciably diminish the number of the living.

TWO INTERESTING MANTIDS FROM THE UNITED STATES.

BY A. N. CAUDELL,

WASHINGTON, D. C.

(PLATE III.)

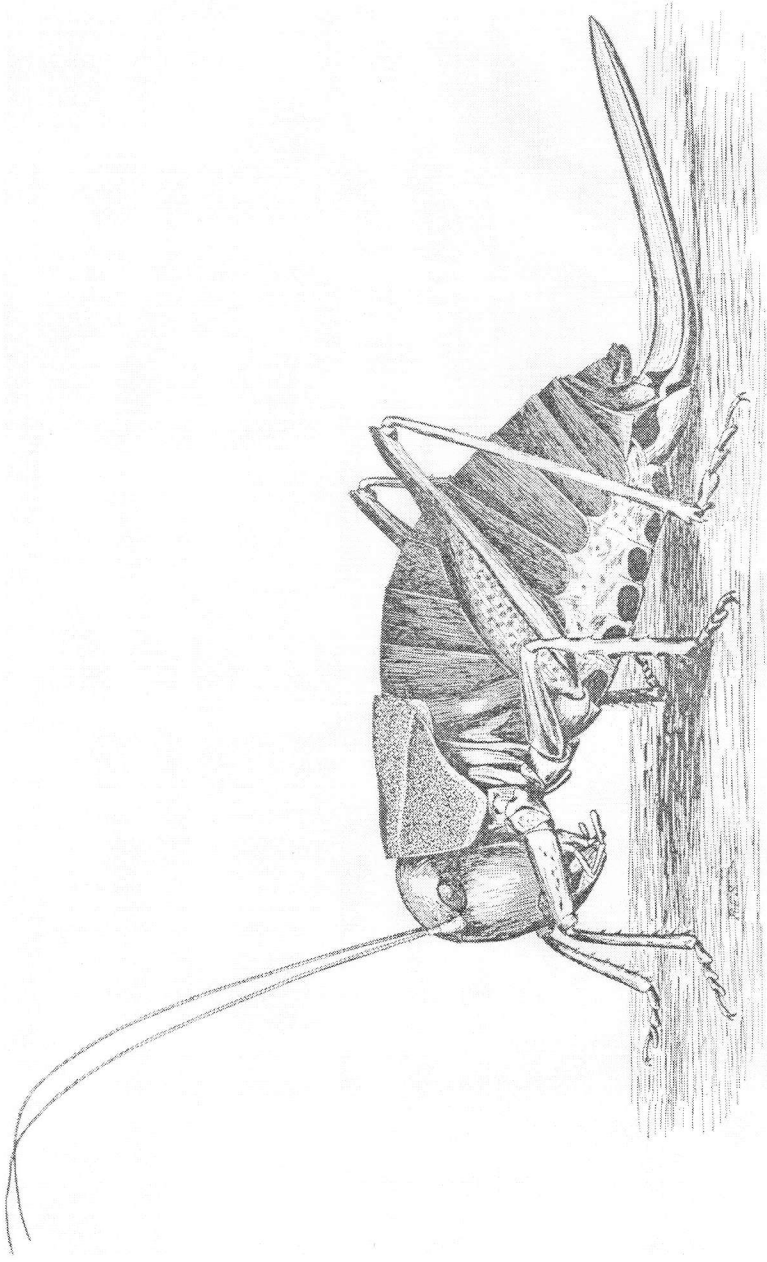
Among the members of the order Orthoptera occurring in the southern part of the United States, making collecting in that region so interesting as well as profitable, are the two species herein considered. Both being rare, one hitherto unrecorded from our fauna, the following notes, with accompanying figures, need no excuse.

Brunneria borealis Scudder. (Plate III, Fig. 3.)

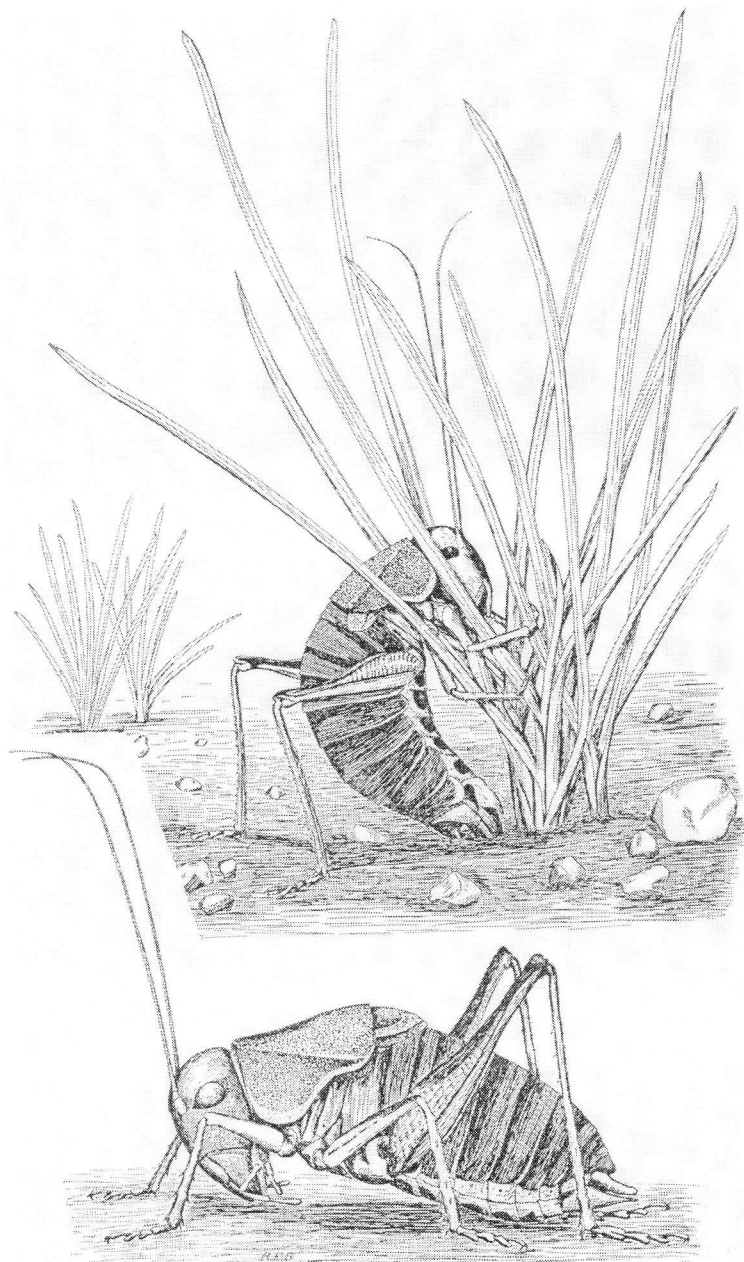
Brunneria borealis Scudd., Can. Ent., XXVIII, 212 (1896); Cat. Orth. U. S., 13 (1900).

This species was described from a female nymph from the Gulf Coast of Texas, but in the original description mention is made of an adult female in the museum of Comparative Zoölogy at Cambridge. These two specimens have been examined. Besides these two specimens I have seen two adult females in the collection of N. Banks, taken in Brazos county, Texas, and one adult female is in the National Museum from Louisiana, taken by J. B. Coleman at Cowley in October, 1903. This latter specimen is the one figured. The male seems to have never been reported. It will very surely have elytra and wings about two thirds as long as the abdomen, thus agreeing with the other known species of the genus.

These females are very closely allied to the South American species *brasiliensis*, but the supraanal plate is somewhat more elongate, meas-



The Coulee Cricket.



The Coulee Cricket.