

## The Grasshopper Tribes

Don't you often wonder where they come from? The swarms of grasshoppers in the late summer?

Charlie says he walked across a field last night where he believes there were as many grasshoppers as there were blades of grass.

Just think of it! and yet they do not seem to do any harm.

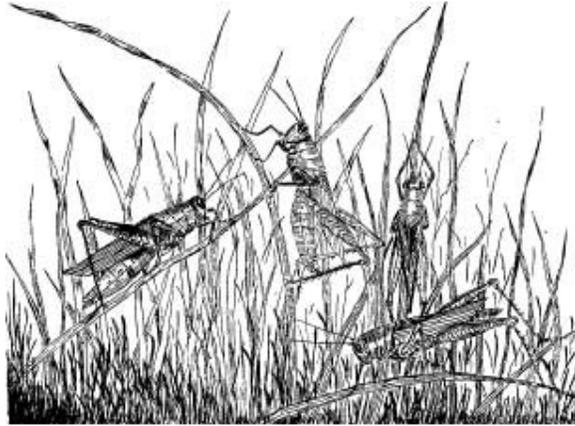
In some places, however, they do a great deal of harm.

They come flying in swarms that darken the sun, and they settle on the trees and the crops and eat up every green thing. There is nothing a Western farmer dreads so much as the passing of the grasshoppers.

Grasshoppers are funny little fellows, and we like them—when there are not too many of them.

Summer would not seem quite like summer unless we heard the grasshoppers shrilling.

There are a great many species of them, and we have placed them in two divisions,—The Shorthorned Grasshoppers and The Longhorned Grasshoppers.



---

## The Shorthorned Grasshoppers

They have no horns, of course, but some have short antennæ that stick out like little horns, and those we call shorthorned.

The right name for the shorthorned grasshoppers is locusts.

We call another insect a locust, but the shorthorned grasshoppers are the true locusts.

Some say it was these locusts that John the Baptist ate with his honey in the wilderness.



A good many people in different parts of the world still eat locusts.

They are said to be good food when roasted, but I would rather eat roasted peanuts.

Come here, little locust, and let us look at you.

Now, stand still, and show us your short "horns."

See its eyes!

Yes, May, they are compound eyes, but I do not know how many facets they have.

What a funny little rabbit face it has.

See it move its little mouth parts.

It bites bits out of the leaves and chews them up very fast.

Has it teeth? May is asking.

Well, yes, but not like our teeth. Sometime you must see the mouth parts of the grasshopper under the microscope. They are very interesting.

Mollie says the locust has a cape on.

John says the cape is the top of its thorax.

## **Questions:**

When do you find swarms of grasshoppers?

What is the right name for shorthorned grasshoppers?

Who ate locusts with his honey in the wilderness?

What sort of eyes does the shorthorned grasshopper have?

What does the locust eat?

## THE SHORTHORNED GRASSHOPPERS LEGS



Frank has been counting its legs; he says it has six.

See it walk. It uses all six legs to walk with.

But it does something besides walk with its hind legs.

Yes, it jumps with them. How long and large they are! Now watch it jump.

See! It draws those long hind legs close up to its body, then suddenly straightens them out—and away it goes as though it had been shot from a spring board.

John says its hind legs work just like a spring, and so they do. It can leap several times the length of its body. Amy thinks it should be called a grass-jumper instead of a grasshopper.

Suppose we all look carefully at the locust's long hind leg, segment by segment.

What, John? You do not know what a segment is?

Well, a segment is the part between two joints. The joints are where the leg bends, you know.

May proposes that we draw a picture of the long hind leg.

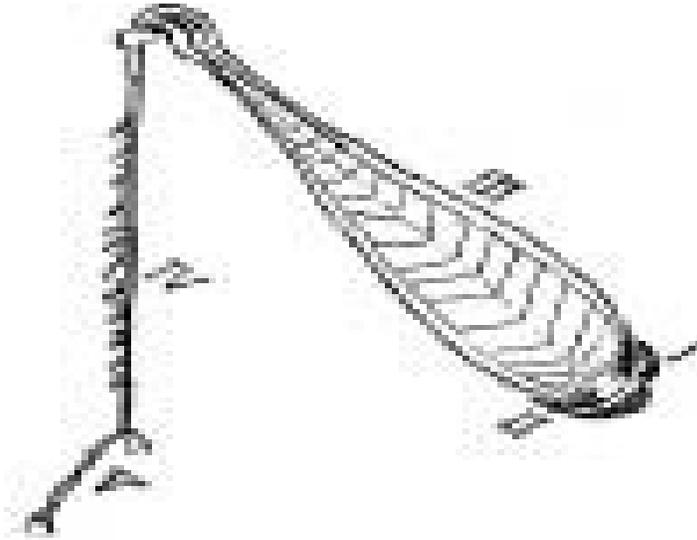
It will be fun to try.

There are two tiny segments close to the body.

If you are not careful, you will find only one.

You must look sharp to see both of them.

How well Charlie has drawn his! He has both the little segments.



The one next the body we will mark I, and we will call it the coxa.

The next little one we will mark II, and that we will call the trochanter.

The long, strong one, III, we will call the femur.

The next one, long and narrow, we will mark IV, and call the tibia.

All the rest of the leg, made of several short segments, we will call the tarsus, and we will mark it V.

Now how are we to remember all those hard names?

Here is a jingle that perhaps will help us:—

*Coxa* first, and then *trochanter*,  
Number three the *femur* stands,  
After this, the long, straight *tibia*,  
And last of all the *tarsus* comes.

Now let us see who can learn it first.

Charlie says we are taking a good deal of trouble over the hind legs of a grasshopper.

## Questions:

How many legs does the grasshopper have?

The grasshopper does something besides walk with its hind legs, what is it?

What is a segment?

How many segments are next to the body?

Fill in the blanks below.

*Coxa* first, and then \_\_\_\_\_.

Number \_\_\_\_\_ the *femur* stands,

After this, the long, straight \_\_\_\_\_.

And last of all the \_\_\_\_\_ comes.

What is the long, strong segment called?

## MORE ABOUT GRASSHOPPERS LEGS.



Very true, Mr. Philosopher, but let me tell you something.

When we have learned the names of the segments in the grasshopper's hind leg, we have learned the names of the segments in the legs of all insects.

You see all the legs are made on one common plan, and it is very convenient, as you will soon see, to have the parts named.

What a fine set of drawings of the grasshopper's hind leg we have!

Why do you suppose the coxa and trochanter are so small?

Yes, John, it is in order that the leg can move easily.

The grasshopper can turn its leg in almost any direction because of these small upper segments.

It can put its leg up over its head if it wants to. Next to the little coxa and trochanter is the longest and largest segment in the grasshopper's leg; I suppose nobody remembers its name.

Listen to little Nell,—"number three the *femur* stands."

So it does, and what a very useful femur it is!

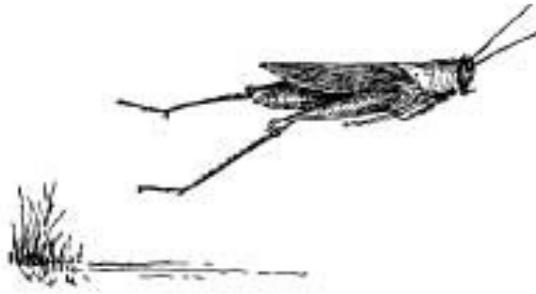
If it were not for the long femur and the long, slender tibia, the grasshopper would not be a grasshopper—it could not hop at all.

Watch the grasshopper, and see how he uses those long segments to jump with.



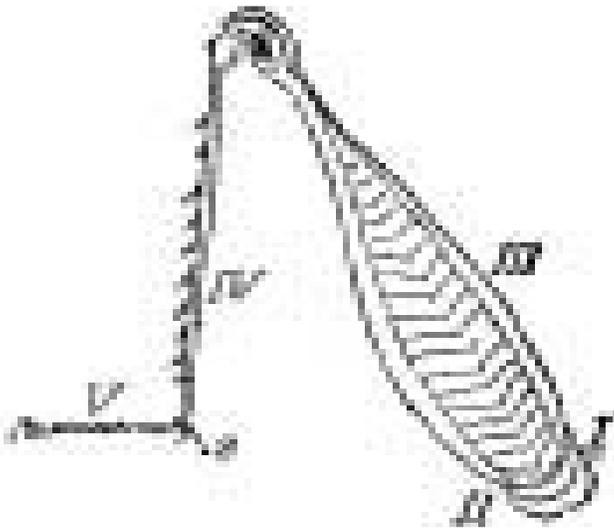
First he draws the tibia close up to the femur—now he is off!

He just straightened those long hind legs out with a jerk, and away he went!



What do you suppose the two little sharp spines at the end of the tibia are for?

What, May? You did not see any spines?



Look again.

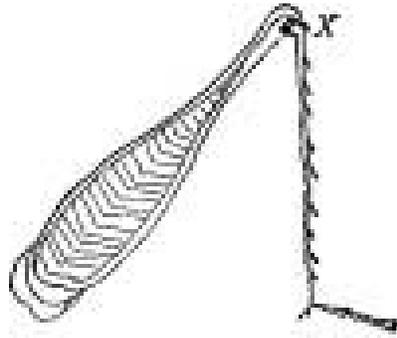
See, Charlie has drawn them very plainly in his picture of the grasshopper's leg. Mark them *s*, Charlie.

Now we must all look at Charlie's picture.

He says he thinks he knows what the spines are for—they are to keep the grasshopper from slipping when he makes his leap forward.

I have no doubt Charlie is right.

May wants us to look at the beautiful little hinge x where the femur and the tibia are fastened together.



Let us mark it X.

See the little ball on the end of the tibia. How well it fits into the hollow on the end of the femur.

In order to see this hollow or groove, you must look on the under side of the leg.

Yes, John, it reminds us of the ball-and-socket joint, only this is a hinge joint, and does not move in so many directions.

The tibia can move towards the femur and away from it on this hinge.

When our little friend gets ready to jump, he draws the tibia close up to the femur. When he jumps, he pushes the femur quickly away from the tibia.

If you watch the grasshoppers, you will soon understand just how they use their hind legs in jumping.

The tarsus bends easily.

It has three joints.

The last segment is a cunning little foot.

## QUESTIONS:

Why do you suppose the coxa and trochanter are so small?

Next to the little coxa and trochanter is the longest and largest segment in the grasshopper's leg; what is its name?

What do you suppose the two little sharp spines at the end of the tibia are for?

What kind of joint attaches the femur and tibia?

What actions does the grasshopper take to be able to jump?

## GRASSHOPPER FOOT

What is John doing?

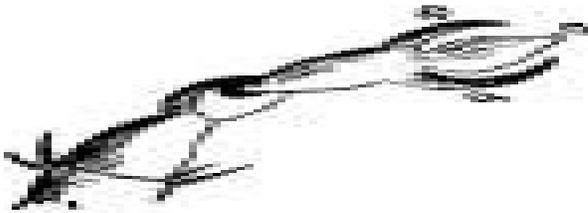
He is looking at the grasshopper's foot through the magnifying glass. Wise John!

Let us all look.

Yes, Charlie, we will try to draw it.

Mollie has hers drawn already. Do not hurry too much, Mollie. You cannot draw well if you hurry.

See the sharp claw on each side of the foot.



Let us mark these claws *a* and *b*.

Between them is a flat little pad which we may as well mark *c*.

May says her picture looks like a crazy pond lily.

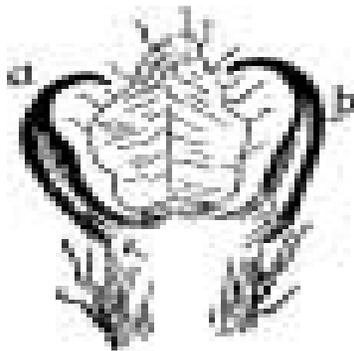
Let us see, May. Well, it *is* rather funny.

If I were you, I should try again. Any child can learn to draw who will keep trying.

Touch the grasshopper's foot with the tip of your finger.

How the little foot clings to you!

It clings by the two little claws that have caught in your skin, and that hold fast.



What do you suppose the little pad between the claws is for?

It is important, I can tell you.

John says he has heard there is a little pad in the fly's foot that enables it to walk on glass.

Yes, and it is the same with the grasshopper.

The little pad between the claws is fringed with hairs.

You can see them with a good magnifying glass.

Out of the tip of each hair comes a little drop of sticky liquid.

This fastens the foot to any smooth surface.

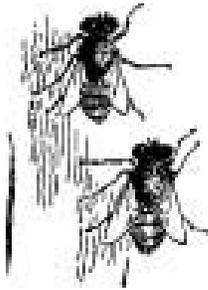
Many insects have these sticky hairs on their foot pads.

When a fly walks up a window pane, it does it by gluing its feet, one after the other, to the glass.

I don't wonder you laugh.

No, Mollie, the glue does not harden and hold it fast.

The fly can easily pull its foot loose. The grasshopper cannot walk on glass quite as well as the fly. Its foot pads do not cling so well.



Would you not like to know the name of these curious little foot pads?

We call the foot pad a *pulvillus*.

Some insects do not have sticky hairs on the pulvillus.

There are beetles that simply put the pulvillus so flat against a smooth surface that it stays there by the pressure of the air above.

Some people think that is the way the pulvillus on the fly's foot acts.

Perhaps it acts both ways, sucking fast and sticking by hairs.

John wants to know if the beetle's pulvillus does not act just like the "sucker" that boys make.

The sucker, you know, is a round piece of leather with a string attached to the middle.

When the leather is wet and laid flat on the floor or on a smooth stone, all the air below it is pushed out, and the air above presses so hard that a boy cannot pull the leather up from the floor.



You can peel it up from one edge and let the air under easily enough, and then a baby could lift it.

When the insect wants to move, it peels its foot loose.

It can do this very quickly.

## QUESTIONS:

What do you suppose the little pad between the claws is for?

The little pad between the claws is fringed with \_\_\_\_\_.

What comes out of the tip of each hair on the grasshoppers foot?

Describe how does a fly walks up a window pane?

What is the name of the grasshoppers curious little foot pads?

Do all insects have sticky hairs on the pulvillus

## GRASSHOPPER INFORMATION

Mollie wants to know what all these little sharp spines on the back of the tibia are for.

Let us look at them.

There is a double row of them.

Do they not look a little like a comb?

I suspect that is what they are, the grasshopper's comb.

Insects are very neat little folks.

They are always cleaning their wings and their legs and their antennæ and their bodies.

The spines on their legs are very convenient for that.

Charlie says he thinks the grasshopper's legs are as good as a whole box of tools.

So they are, and you have not yet heard all they can do.

The funniest is to come.

Mr. Grasshopper sings his song with his hind legs!

He rubs the inside of his femurs against the outside of his wings.

There is a row of very fine spines down the inside of the femur for the use of the little fiddler.

He scrapes away with these on his wing covers.

Yes, Ned, his femur is his violin bow, and his wing cover is his violin.

The noise he makes does not sound much like a violin, little Nell thinks.

No, indeed, it does not.

It is the shrilling sound we hear in the grass in the summer time.



It is only the male grasshopper that sings.

The little lady grasshopper sits still and listens to him.

Now, let us look at the other legs.

The front pair are the smallest.

Can you find the little coxa and trochanter?

Yes, Charlie, we will draw the little front leg.

Let us number the segments as we did those of the hind leg.

See, the femur is larger than the other segments, but it is small as compared to the femur of the hind leg.

The tibia is shorter, too, than the tibia of the hind leg.

The little tarsus is like the tarsus of the hind leg with its claws and its pulvillus, only, of course, it is smaller.

The middle pair of legs is like the front pair, only larger.

Now, see how the legs are placed on the grasshopper's body.



The front pair are directed forward. When the insect walks, they pull.

The middle and hind legs are directed backward. When the insect walks, they push.

Well, little legs, you all have your own work to do, and you surely do it very well.

## QUESTIONS:

What do you think the little sharp spines on the back of the tibia are for?

Grasshoppers are always cleaning their wings and their legs and their  
\_\_\_\_\_ and their bodies.

How does the grasshopper sing?

Is it the male or female grasshopper that sings?

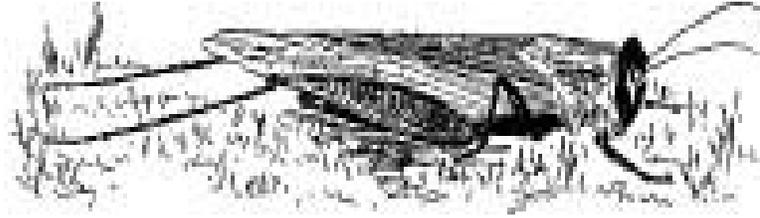
What do the front pair of legs do when the grasshopper walks?

Are insects clean or dirty?

## GRASSHOPPER WINGS

I wonder how you would like to look at the grasshopper's wings for a little while.

Here is one with large wings.



See how they lie along each side of the body.

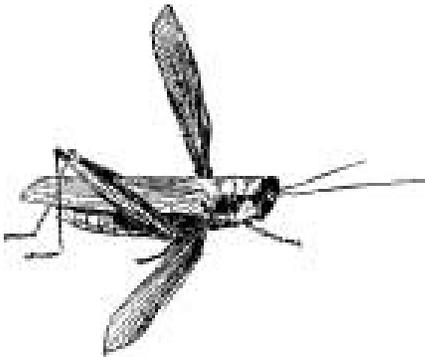
They come together on top like the ridge of a sloping house roof.

Yes, May, they are the roof to the grasshopper's body, and they help to protect it.

Let us gently spread them out.

Ah! these roof wings are not what the locust flies with at all.

See, folded up under them is a pair of delicate gauzy wings.



If we are careful, we can spread them out.

We will use this dead grasshopper that Charlie has found.

What pretty wings! So dainty! And how cleverly they are folded up, like little fans.

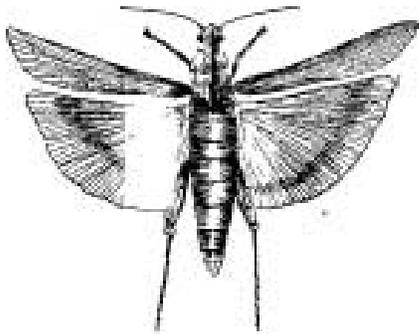
Who would imagine such delicate gauzy wings were folded away under the hard, stiff roof wings.

The roof wings are called wing covers, because they cover up these pretty inner wings.

The locust does not fly with the wing covers.

It spreads them out wide to get them out of the way.

It flies with the inner wings.



How pretty the flying wings are when they are spread out!

See, over there goes a grasshopper whose flying wings are bright yellow.

And there goes another with red flying wings.

Some of the grasshoppers are almost as pretty as butterflies when they are flying.

They show their gay inner wings only during flight.

As soon as the grasshopper comes to rest the inner wings close of themselves.

The wing joints act like springs.

The grasshopper does not have to think about shutting up its wings.



John says it has a spring in its wing covers too.

Open the wing cover.

There, it locks itself, as it were, and stays open without any effort on the part of the grasshopper.

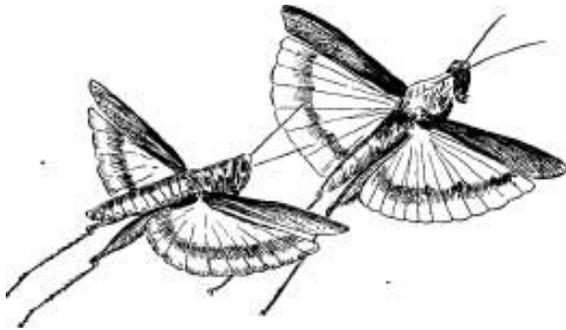
You see the grasshopper wants its wing covers to stay open and out of the way of the inner wings when it flies.

So it just opens them, and there they are.

It moves the inner wings very fast indeed when it is flying. It would not do at all for them to be fastened open.

If it did not move them, it could not fly. The wings fairly *whirr*, they go so fast. They beat against the air, and thus the grasshopper is pushed along through the air.

As soon as it is done flying it stops moving the wings, and they instantly close of themselves.



Then it unlocks the wing covers and they shut down over the inner wings. They shut down very tightly. They overlap, as you can see, just below where they are fastened to the insect's body. Thus they form a very good roof.



What wonderful wings the grasshopper has!

And there is something more to be said about them.

Some species of locusts use their wings as musical instruments. When they wish to, they rub the upper end of the inner wings against the upper end of the wing covers when they are flying.

This makes the crackling sound we sometimes hear when the locusts fly.

## **QUESTIONS:**

What are folded up underneath the roof wings?

What does the locust fly with?

Does the grasshopper have to think about shutting its wings

Describe what happens when a grasshopper has finished flying.

How does the insect make the crackling sound we sometimes hear when the locusts fly.

## YOUNG LOCUSTS

What is that, Mollie? You have caught a locust that has no wings at all?

Who can guess why?

Ah, yes, our wise John says he thinks it is because it is a young one.

What makes you think so, John?

I know, you remembered the larva of the dragon fly and of the May fly.



Those larvæ had no wings at first, but the wings grew, and finally at the last moult they were full-sized.

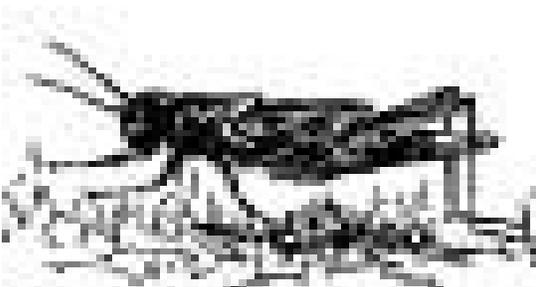
When first hatched, the locust larva is like the full-grown locust, only, of course, it is very small, and it has no wings at all.

It is a little dot of a thing with an enormous head.

Here are three clinging to a blade of grass.

Are they not funny little rascals!

The baby locust eats and grows and moults until, finally, the wings begin to show as little pads at its sides.



It is easy to find these half-grown grasshoppers in the middle of the summer.

Here is one that little Nell has caught.

See its wing pads.

Mollie says they are rudimentary wings.

It continues to eat and grow and moult, and the little wings are moulted off with the rest of the skin—for the wings of the insect are only modified parts of the skin.

But there are new and larger wings underneath, and these grow and are moulted off with the next skin, until, at last, the grasshopper is full-grown, with full-grown wings.



It will not moult any more after that.

When full-grown, the females lay their eggs.

Where do you suppose they lay their eggs?

Some of them make a hole in the ground.

The end of the abdomen is very strong and sharp, and the locust can make a hole with it quite easily.

When the hole is made, then the eggs are laid in it, and the locust covers the opening to the hole with a sticky substance to keep out the wet.

The eggs usually lie in the ground all winter.

Just think of the locust eggs there are under our feet as we cross the fields!

Millions and millions of little eggs are hidden in the ground.

Early in the next summer the little eggs hatch, and then tiny locusts creep up out of the earth and go hopping about everywhere.

Most of the full-grown locusts die in the fall.

As you know, the young ones have no wings, and this is why there are so few winged locusts early in the summer.

Some locusts make their holes in fence rails or in old stumps.

It is the locusts, or shorthorned grasshoppers, that sometimes come in swarms that darken the sun.

There is nothing the Western farmer dreads so much as a swarm of locusts.

I have heard how the grasshoppers came in Kansas one year.

They appeared all of a sudden in countless millions.

They were piled up against the fences clear to the top.

They swarmed into the houses, and in places on the railroad track they were piled so deep the trains could not run through them.

Think of a railway train being stopped by grasshoppers!

They stripped every leaf from the trees and left them as bare as in winter.

They ate up every blade of grass.

But in the East they do not do so much damage, though they sometimes cause the farmers serious loss. When summer comes we may listen to their cheery din with pleasure.

I am sure we shall enjoy the merry sounds of the grasshoppers all the more now that we know something about how they are made, and something about the little fellow that makes them.

**TO DO:**

Fill in the blanks

1. When first hatched, the locust \_\_\_\_\_ is like the full-grown locust, only, of course, it is very small, and it has no \_\_\_\_\_ at all.

It is a little dot of a thing with an enormous \_\_\_\_\_.

2. The baby locust \_\_\_\_\_ and \_\_\_\_\_ and \_\_\_\_\_ until, finally, the wings begin to show as little \_\_\_\_\_ at its sides

3. What are the wing pads called on half grown grasshoppers?

4. Where do you suppose female locusts lay their eggs?

5. How does the female locust keep her eggs dry?

6. When do the eggs hatch?

7. When do the adult locusts die?



---

## The Longhorned Grasshoppers



Probably it was the longhorned grasshoppers that Charlie saw so many of in the meadow.

Look, next time, Charlie, and see if the swarms that start up before you have not long, slender antennæ.

See, here is one.

Its antennæ are like threads, and they are longer than its body.

If you were to look at its tarsus, you would find it had four joints instead of three.

Otherwise, the longhorned, or meadow grasshoppers are very much like the locusts, or shorthorned grasshoppers.

John says he thinks the meadow grasshoppers are more slender and delicate in shape.

That is true, as a rule, though there are some species of the locusts that are as slender as the longhorned grasshoppers.

But there is one thing about these longhorned fellows that will amuse you.

Some of them have ears on their front legs!

It is not uncommon for insects to have hearing organs on their front legs.

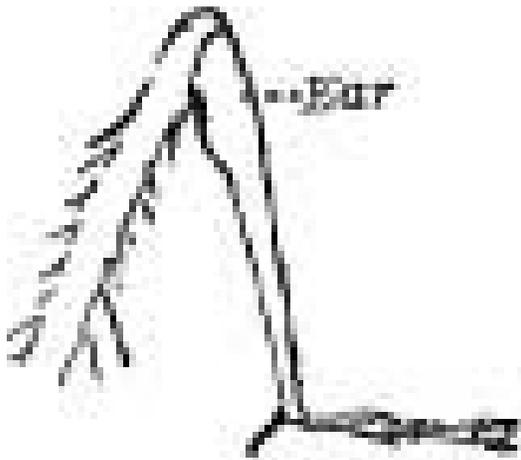
You know what an ear is. It is something to hear with. The hearing part of our own ears is way inside, out of sight.

The outer part of the ear, that we can take hold of, is only a sort of funnel to gather up the sound, and we could still hear if this part of our ears were cut off.

Way back inside the ear is a little curtain, or eardrum, made of a thin membrane.

When sounds enter the ear they cause the eardrum to tremble or vibrate, and this excites the nerve of hearing that is behind the eardrum.

Now some grasshoppers have a little flat membrane on the tibia of each front leg. It is an eardrum. Behind it is the nerve of hearing. When sounds strike the eardrum it vibrates and excites the nerve of hearing.



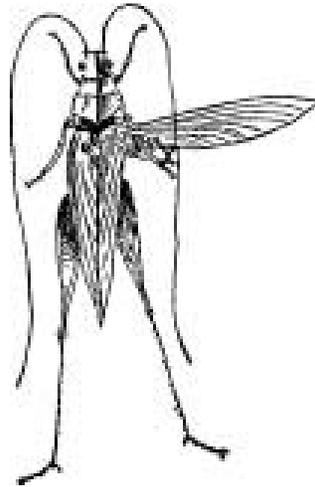
So you see the insects have *ears*, though they have no funnel-like outsides to them.

So, after all, there isn't so *very* much difference between the way the grasshoppers hear, and the way we hear, although they do hear with their legs.

Yes, Ned, it is about the same thing when they hear with sensitive spots on their antennæ.

The sounds strike the sensitive spots, which are tiny eardrums, and cause the nerves that come to them to hear.

You see, after all, an ear is only a membrane able to vibrate when sounds strike it and a nerve sensitive to those sounds.



It does not matter much where the ear is located. Our ears are on either side of our head, and so are the ears of all the higher animals.

But the ears of the insects are more useful to them when on the antennæ, or the legs, or some have them on the abdomen. An ear is an ear wherever it happens to be, and the insects hear well enough with theirs.

## **QUESTIONS:**

What do longhorned grasshoppers have on their front leg?

Describe how the grasshopper ear works.

Where else might you find tiny eardrums on the grasshopper?

Explain how the shorthorned and longhorned grasshopper differs.

## LONGHORNED GRASSHOPPER INFORMATION

In many species of the longhorned grasshoppers, the male has a curious musical instrument on his wing covers, close to where they grow from the body.

Little Mr. Grasshopper sings to his lady-love by rubbing the upper parts of the wing covers together. You see the round places at X,—those are the modified parts of the wing cover, by means of which he can make his music.

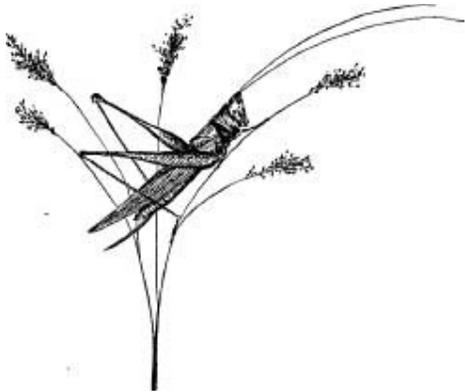
What is that, May? Your grasshopper has a long sword at the end of its body?



Yes, that is its ovipositor. Ovipositor means "egg-placer."

With this long, sharp ovipositor the grasshopper can roughen the bark of twigs or make holes in the stems of plants or in the earth.

Then the eggs are guided down through the long ovipositor to the place prepared for them, and fastened there by a gummy substance.



Only the female grasshoppers have the long, sword-shaped ovipositor.

The ovipositor of the locust is not long and sword-like.

It is short, but it is strong and sharp, and you remember how the locust uses it to dig with.

Yes, indeed, Mollie, there are a great many species of locusts and grasshoppers, and some of them are very beautiful.

In hot countries they sometimes grow to an enormous size.

May is asking why they make molasses.

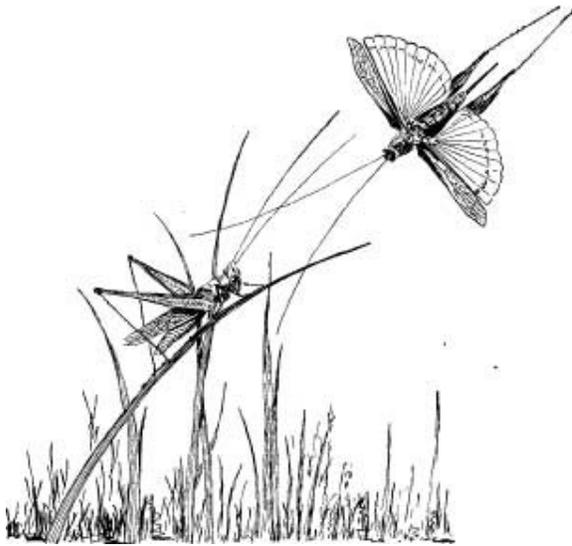
No, Ned, of course it isn't molasses. Children call it molasses because it looks like it.

Now, May, where does it make its molasses?

In its mouth, you say, and then it spits it out on your finger.

What? You don't like its old molasses on your finger?

No, of course not.



It smells bad, and it is sticky and disagreeable to the touch, and if you happen to put your finger in your mouth it has a nasty taste.

John says he hates to touch the grasshopper on account of this molasses.

You *all* do?

Well, I guess that is why it makes its molasses; it doesn't want you to touch it.

It doesn't want birds to eat it, or other insects to bother it, and so it smears them with this ill-smelling, sticky liquid.

Some birds eat it, however, in spite of its molasses.

Turkeys do.

## QUESTIONS:

Describe the grasshopper's ovipositor.

What does the word "ovipositor" mean?.

What is the ovipositor used for?.

Describe the sticky liquid made by the grasshopper..

How does the sticky liquid help the grasshopper?

Describe the ovipositor of the locust.

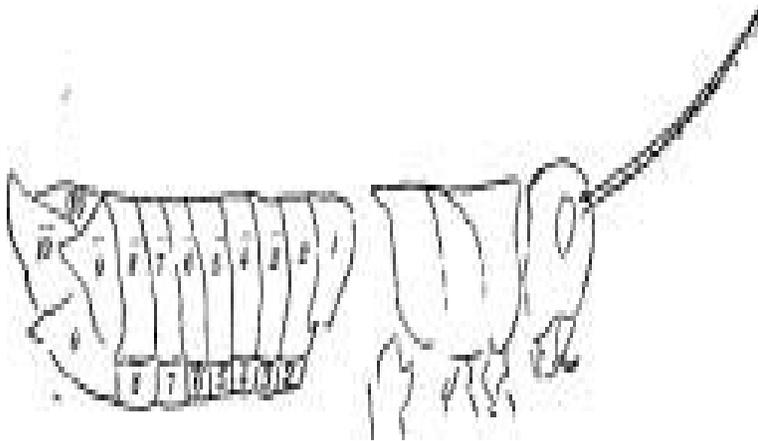
## GRASSHOPER BODY

If I thought you were not tired of hearing how grasshoppers are made, I should tell you some more.

John says he would like to know some more.

Well, then, I will tell you about their rings.

You can see the rings of the grasshopper people very plainly in their abdomens.



Here is a picture of a grasshopper. It is not all drawn. The legs and wings are not shown, and the abdomen is drawn by itself so you can see it easily.

There are ten rings, you see.

The rings are covered with a hard, horny substance.

This horny substance is what makes the body of the insect so stiff. It would be soft but for the chitin, as the horny substance is called.

It is better for the insect to have a chitinous covering.

If you had no bones, you would be glad to have your skin hardened with chitin.

You see how it is, you wear your skeleton inside. Your skeleton is of bones; it is an inside skeleton.

The grasshoppers and all the insects wear their skeleton outside. It is made of chitin; it is an outside skeleton.

Insects have no bones.

They do not need any. They are kept stiff by the chitin.

Each ring in the insect's abdomen is made of four pieces, the back piece, the side pieces, and the under piece. You can see the back piece and one side piece in the picture, but you cannot see the other side piece nor the under piece without turning the insect over.

The rings are made in pieces so the insect can move.

Suppose each ring were made of one stiff piece like a finger ring. What a poor stiff, old grasshopper it would be! The rings are called segments.

Segment number one has only a back piece, you see.

All the other segments have four pieces.

Segments two, three, four, five, six, seven, and eight are alike.

Segments nine and ten are modified to form the ovipositor.

The segments are fastened together by skin. The skin is soft so the segments can move back and forth.

The segments can be crowded close together to shorten the abdomen.

The segments can be separated from each other to lengthen the abdomen.

There is no chitin in the skin between the segments. It is soft so the segments can move.

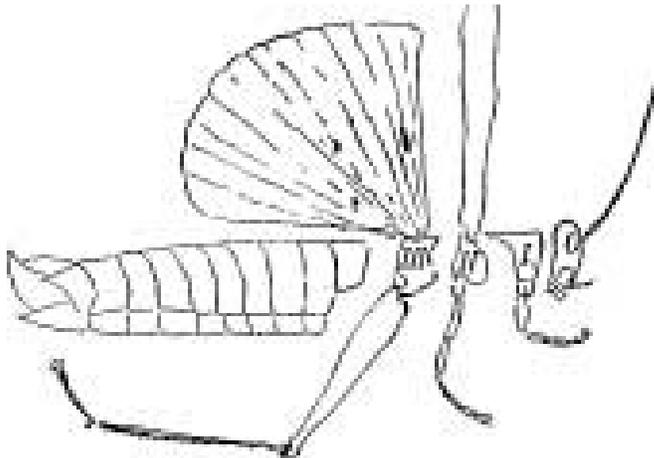
Do you know how a telescope is made?

The abdomen of the insect can lengthen and shorten somewhat like a telescope.

It is easy to see the rings in the abdomen of the locust or grasshopper.

Now, what about the thorax?

That, you tell me, has no rings.



Look again, and look carefully.

You will have to see another picture.

This is a picture of the head and thorax of the grasshopper. It is drawn to show the separate parts of the thorax.

Yes, John, the thorax has three segments. They are grown so close together you would not suspect it until you looked very close.

The front legs are fastened to the first segment.

What is fastened to the middle segment?

Yes, May, the middle pair of legs and the wing covers.

Mollie says the long hind legs and the flying wings are fastened to the third or hind segment.

Oh, you funny little folks! you are all made up of rings.

Yes, indeed, little Nell, the segments of the thorax are made of chitin; they are very stiff.

Ned thinks the segments of the legs are made of chitin too.

Their outside shell certainly is.

The whole outer shell of the insect is made of the horny chitin.

You hard little chitin-covered, segmented people, you are very different from us.

Ah! yes, May, they are like us in many ways.

Indeed, Mollie, insects do have brains.

They have muscles, too, to move their little bodies with.

We have muscles under our skin, you know. The muscles move our arms and legs and bodies.

If you clasp your fingers around your arm and then move your arm, you can feel the muscles.

The insects have muscles inside their chitinous shells. The muscles move their bodies.

The muscles are very, very strong.

They are stronger for their size than the muscles of a horse.

John, do you know how heavy a load a horse can pull?

Well, it cannot pull a load equal to the weight of its own body.

Now, listen to this,—almost any insect can pull a load that is five times the weight of its body!

Ah, yes, some insects can pull a much heavier weight than that. The honey bee, for instance, can pull a load twenty times as heavy as its body.

And think how our little insect friends can jump! Why, a kangaroo cannot begin to jump like a grasshopper.

No, indeed, Ned, the finest jumper in the world of men cannot begin to jump as well as a grasshopper, not even with the aid of a spring board. He is a mere baby in comparison.

Ah, yes, we can do a great many things better than the grasshoppers, but, you see, they can do some things better than we can.

What is that, John?

You want to know about the mouth parts of the grasshopper?

Suppose we leave the mouth parts.

They are difficult to understand. We have had a good many new names to learn lately.

What, May? You can't remember such hard words?

Oh, yes, of course you can.

You don't mind learning "rhinoceros," and "Mississippi," and "Popocatepetl," and "eenie, meenie, monie mike," and they are quite as hard as femur and tibia; and, besides, you have a femur yourself! Did you know it?

Your thigh bone, like the grasshopper's thigh, is called a femur.

Yes, Mollie, there is a bone in your leg called the tibia, and you have a tarsus in your foot.

So, after all, when you are learning hard words about insects you are learning a great deal besides, as you will find.

## QUESTIONS:

How many rings does the grasshopper have making up it's body?

This horny substance is what makes the body of the insect so stiff. It would be soft but for the \_\_\_\_\_, as the horny substance is called.

Where is the grasshopper skeleton?

Each ring in the insect's abdomen is made of \_\_\_\_\_ pieces, the back piece, the \_\_\_\_\_ pieces, and the under piece.

Why are the rings are made in pieces?

With what are the segments attached to each other?

What is fastened to the first segment of the grasshopper's thorax?

Where will you find a bone called the "tibia" in humans?

What is the bone in the grasshopper's thigh called?

