



SEEDHEADS TRANSCRIPT

Episode 2: BOB WILDFONG English

SeedHeads is produced for audio listening and we encourage you to listen to the recording if you're able to, because it will include sounds and inflection that aren't included in the transcript. This transcript was generated by a combination of speech recognition software, human transcribers, and translators, and it may contain errors. Please check the audio if you have questions about content.

Steph Benoit

Hey, welcome to SeedHeads, the cross-pollinating podcast where our Canadian seed heroes, tell their stories, share their how-to tips, and talk about the seeds they love. I'm your host, Steph Benoit, coming to you from Vancouver, BC, on the unceded and ancestral territories of the x^wməθk^wəyəm (Musqueam), Skwxwú7mesh (Squamish), and Selilwitulh (Tsleil-Waututh) Nations.

Steph Benoit

Welcome back! Today we are lucky enough to be continuing our conversation with Bob Wildfong, Director of Seeds of Diversity and veteran seed saver. If you haven't had the opportunity to listen to my conversation with Bob in the last episode, about the basics of seed saving in the cucurbit family, then stop what you are doing and go back and listen to it because it lays a really great foundation for the conversation. We're having today. I hope you enjoy.

Steph Benoit

Alright, welcome back Bob. Thank you so much for coming back and joining us once more.

Bob Wildfong

Thanks, it's great to be back.

Steph Benoit

So, Bob last week, we talked a little bit about the basics of growing and saving seeds from the squash family and this week we're going to keep that conversation going with a little bit more of a specific focus on hand pollination. So, to begin with, why would someone even want to hand pollinate this family – the melons, watermelons, cucumbers, zucchini, squash plants, all of these guys?

Bob Wildfong

Well, the big challenge we talked about last time was the fact that bees will carry pollen from one flower to another. So, if you have, say, pumpkins and zucchini growing in your garden, the bees will get up before you do-- sometimes four o'clock in the morning, even before the sun comes up-- and they'll fly back and forth from the two different kinds of squash, visiting every flower looking for pollen. Pollen is what bees eat, it's their food. If you think of bees as vegetarians it's because they only eat pollen, it's their entire food source. And they love squash pollen because if you have ever looked inside a squash or zucchini flower and seen that great big, it's called an anther, it has the big yellow thing that has yellow powder all over it, there's quite a lot of pollen there.

And that's enough pollen to feed several bees for the whole day, but they are fuzzy. These are very fuzzy and they pick up the pollen all over them. When you get up really early in the morning and look at them doing this work, they almost look yellow; the bees are covered with yellow pollen.

What happens is the pollen drops off in the other flowers as they go from one to the other and by the time you get up, the bees will already have mixed the pollen between the pumpkin flowers and the zucchini flowers. So, if you were to take a sample of pollen from one of those zucchini flowers, it would be some zucchini pollen in there and some pumpkin pollen in there and that means every seed that gets pollinated might be pollinated with a zucchini grain of pollen or it might be pollinated with a grain of pumpkin pollen but you don't know which. You also can't tell when you look at the seeds after you harvest them; you can't tell which is which. Some of them will grow into pumpkins, some of your seeds will grow into zucchinis, and some will grow into half and half which are no good.

'Zumpkins' are not worth growing so, you really want to try to avoid that. So, how can you solve this? You could try to post signs in your garden saying "please bees stay on your side" or you could put little bags over top of all the flowers and keep the bees out.

But the problem with that is the flowers actually need bees to pollinate them. Squash flowers, and this goes for all members of the family including watermelons and cucumbers, they're unusual in that they have separate male and female flowers. What that means is some flowers can make pollen but they can't make a fruit. And there are other flowers that can make a fruit, but they have no pollen.

And of course, plants don't know about being male or female, both of these kinds of flowers exist on every plant so you can't say the plant is a boy or a girl. It's not, that doesn't make any sense as far as the plant is concerned. But we think of it this way, that some of the flowers are male, they have pollen, and some of the flowers are female because they have fruit.

How does the pollen get from one flower to the other? Well, it's bees. And if you were to put a little bag over top of every flower to keep the bees out, so they didn't cross your pumpkins and zucchini, you would also be stopping them from pollinating the flowers at all and you would get nothing. So, you need to somehow get the right pollen from one flower to another flower of the same kind. And that's why we call it hand pollination because you get to go play bee and move the pollen from one flower to another by hand.

Steph Benoit

It's always a nice opportunity to play bee. I feel like we don't get that enough in our adult life.

Bob Wildfong

You could dress up for the occasion if you want, there are costumes. And, you don't have to be up at four o'clock in the morning. You can do it at any time, but we'll talk about how that works.

Steph Benoit

Perfect. Then, what about the biology of this family makes it hard or easy to hand pollinate? I'm thinking, specifically, kind of, about the flowers.

Bob Wildfong

Yeah, I would definitely start with squash. The reason is that the squash flowers are much much larger than, say, cucumber flowers or other kinds watermelon or muskmelon flowers. Go take a look at a cucumber flower and see how big and wide open it is. Have a look at the bottom of the flower and on some of them, you'll see there's just a little tiny stem, and on some of them, you'll see a little tiny cucumber.

That's the first way that you can figure out which of them make the pollen and which of them make the fruit. If it has a little tiny cucumber at the base of the stem, that's what we call the female flower; it can't make pollen. And if it doesn't, if it's just a little tiny short stem, then it's making pollen. But notice also, cucumber flowers are just about the size of a quarter.

If you look inside, you can barely see the pollen, you can barely see anything. The anther that makes the pollen inside is literally the size of the point of a pencil. It's a very tiny thing. Now go look at a zucchini flower or a pumpkin flower and it's exactly the same. Exactly the same in shape, exactly the same in the fact that on some of them you'll just see a little short stem--those are the male flowers that only make pollen--and some of them you'll see a little tiny pumpkin, right there the bottom of the flower. Or, if it's a zucchini, it'll look long and skinny like a little zucchini; if it's an acorn squash, it will have little bumps on it; and if it's a butternut squash of look like a little pear shape.

Those are the female flowers, but the difference between those in the cucumber is that they're ten times bigger. The part that makes the pollen is like the eraser end of the pencil, much easier to see, much easier to hold with your fingers. The scale of it allows you to not only see what you're doing but also to handle it with your fingers. We will talk about how to hand pollinate squash but if you wanted to try this with cucumbers, you do exactly the same thing. If you want to do it with muskmelons or watermelons you would do exactly the same thing, but it would be way harder just because of the size of the flowers. They're very small and most of the time, in my experience, it doesn't really work, but that doesn't mean you shouldn't try it.

Steph Benoit

What materials do you need for the hand pollination process?

Bob Wildfong

You're going to need an early morning when you can get up and out to your squash patch, which is easy if it's right by your house and it might not be so easy if you live far away from where you grow things. So, take that into account that you're going to have to be there for, you know, about an hour, early in the morning.

Steph Benoit

How early is early?

Bob Wildfong

Well, it doesn't have to be 4 o'clock, when the bees get up, anytime that's comfortable for you. Before 10 o'clock is probably best.

Steph Benoit

Okay, I can live with that.

Bob Wildfong

Also, you have to be at the same place the evening before because you have to set this up beforehand. And it has to be an evening and a morning when it doesn't rain. Doesn't work in the rain. It has to be nice and dry. So, you can probably do that. Bring along some masking tape or some clothespins, something that you can use to hold the flowers closed.

I like to use the clothespins; they work pretty well. And also, make sure you have a hand because you're hand pollinating. That should do it; that's all you need.

Steph Benoit

Okay. So, you've got a hand, you've got an early morning. What's the next step? Take us through the process.

Bob Wildfong

Okay, it starts, one evening. What happens is the flowers, both the male and the female, they open up really early in the morning and that's when the bees move pollen back and forth. They wait until the flowers open up. So, in the evening, you will be looking for flowers that are ready to open. And this takes a little bit of practice. You might want to just, maybe, mark a few flowers in the evening and look at them the next morning.

Try this a few times just to get the hang of what they look like. The flowers do open up, always, first thing in the morning and they kind of look like they're, sort of, starting to get some yellow colour the evening before. And they are usually about the same size. As they grow up, they get to be a certain, large size and they turn yellow and that's when they're going to open the next morning. You have to kind of learn how to tell which of those, which of them are going to open the next day.

The idea is that you put a clothespin on those flowers so they can't open or you put some painters tape or masking tape across the tips. They're pointy, the pedals are all kind of formed into a point before they open up and you can easily put a piece of tape across that tip or a clothespin to hold them closed.

Then, you go to bed. You get up the next morning and you go look and find your clothespins and find your taped flowers; you will discover that they're bursting, they're, sort of, crinkled up at the sides, trying to open up, but the clothespins holding them closed. And that's a good sign because it means the bees haven't gotten there yet. Bees will be flying all around, carrying pollen to the other flowers, but yours will still have the, in the male flowers, they will still have pollen in there. And in the female flowers, they won't have any pollen yet.

Take the clothespins and the tape off and look inside, and this is really cool to see. Look at one of the male flowers with the pollen that you had taped closed and look at another flower and see how much pollen those bees took because your taped flower will have a whole bunch of sticky powdery yellow stuff in there and the other flowers will be stripped bare. All that pollen is gone because the bees have been very busy and they've taken all the pollen away already. The easiest way to do this is to pick the male flowers right off.

They only have one job to do, they provide the pollen and when they've done that job, they're done. So, pick them off anyway. You carry the male flowers around the garden, find the female flowers, and brush the pollen off inside it. The female flower has a, something that looks like a little toadstool, sort of a flat surface on the top and you can just brush the pollen onto there and then put the clothespin or the tape back on, to close up the petals.

And that keeps bees from getting in and either stealing that pollen or putting other pollen in. And then you do the most important thing, in my opinion, is

you take a ribbon, which I didn't put on our ingredient list, you need a ribbon to tie that around the stem of the female flower because you have to wait, for at least a month or so, before that squash grows up.

Now, you know, that all the seeds in that squash were pollinated from the pollen that you took that, those male flowers from. But how are you going to find that squash again? That's why you mark it, you mark it with a red ribbon or something just, sort of, loosely tie it around the stem. And then when you go back to harvest your seeds, those are the squash that you'll harvest the seeds from. How many of these male flowers do you need? As many as you can get. In our last episode, we talked about having a good strong population of plants. And that means, you want pollen from as many plants as possible and you want to have, at least, if you can, at least pollinate one squash on every plant. So you're taking pollen from every plant and you're fertilizing a squash on every plant.

And that way you're collecting the genetics from all your plants, in all your seeds. Not just from one plant. Not just from the two biggest ones, but from all the plants that you have after you've made sure that they're all healthy.

Steph Benoit

Do you brush the pollen from multiple male plants on to just one of the female flowers or would you just do like a one-to-one sort of pollination?

Bob Wildfong

It's good to actually mix it all up so that the pollen for every squash comes from several other plants. So you're taking all the male flowers, mixing the pollen together, and fertilizing all of the female flowers with that mixture. And the reason is that every seed in your squash, and in every plant, is fertilized by a different grain of pollen.

So, you want things to get as mixed as possible. You would like all the seeds in every squash to be potentially fertilized by a grain of pollen that came from any of the other plants in the row. And that means every seed will have a little bit more diversity within it. Every seed that you plant will be able to mix in all of those, sort of, invisible genes we talked about in the last episode, the genes for drought tolerance or for disease resistance or insect resistance. Spreading those around makes a much healthier group of plants.

And, so, spreading the pollen and getting it as mixed up as possible is really the best thing for the variety as a whole.

Steph Benoit

You kind of touched on this when you were talking about wanting to label the flowers with a little piece of string or whatever else that you hand-pollinated, but if two types of squash cross-pollinate, that you don't want, will you be able to tell that by looking at the fruit from that year?

Bob Wildfong

No, and that's a really interesting myth. There's a myth, and I've heard it many times, that if you have, say, pumpkins and zucchini growing in the same yard, and one of your zucchinis looks kind of extra big and round, it must be because it was pollinated by the pumpkin over there. Wrong. That doesn't happen.

The zucchini will grow the way it does because of what was in its seed and not because of the way it was pollinated. Pollen only affects the genetics of the baby that's inside every seed. So, if you look at that pumpkin that you've harvested and all the seeds in there, the pumpkin is part of the plant that it grew from. And even the shape of the seeds, that's part of the plant that it grew from. It's actually part of the fruit. The part that's the next generation, the baby, is the inside of the seed.

It's the material that's inside the seed. That's the only part that's a hybrid. And so, it's impossible to tell by looking at the fruit whether any cross-pollination has happened; it'll look exactly the same. And, it's impossible to tell by looking at the seed whether any cross-pollination is happened. Even the hybrid seeds will look exactly the same as the purebred seeds.

So, no, you can't tell. The only way to tell is by testing what's inside the seed and the only way we have doing that is to plant them and see what happens. So it's next year. Now, how did that happen that you had some zucchini in your garden and some pumpkins nearby, and some of that zucchini kind of grew kind of big and pumpkin-ish?

Is it from the crossing from the pumpkin? No, it's what happened last year. Somehow that particular plant got crossed by a pumpkin last year and you're only seeing it this year. We look around and we look for something to blame

and we see the pumpkins and we say, "Oh, it must have crossed." That's not how it works.

Steph Benoit

Can I use these tips for hand pollination for plant families like tomatoes or others that you might also be interested in doing hand pollination on?

Bob Wildfong

Absolutely. The whole concept is that plants make pollen and then the part that makes the fruit receives the pollen, and we say it gets fertilized by that pollen. And it works the same way for every kind of plant. It's just that the shapes are different.

So, whereas, with squash, it's actually pretty straightforward to do the hand pollination. You have, the part that makes the fruit is in one flower, the part that makes the pollen it's in a different flower. And so you can tape them shut and hand pollinate them when you want. That's actually pretty easy as far as hand pollination goes. If you want to, say, cross two different kinds of tomatoes – which is a really interesting thing to do and it gets into another whole area of plant breeding – but say you have a nice compact, tomato, and a nice short stem but it has little teeny tomatoes.

And you'd like to get that kind of stem, with great big mouth-watering tomatoes. Then why not cross a tomato that has nice big mouth-watering tomatoes with another one that has a short stem. What I've described for hand pollination is basically what you would do; you would take pollen from one and use it to fertilize a tomato on the other.

But it's a little more tricky because tomatoes are self-pollinating. It means that every flower makes pollen and makes a fruit. So, you have to go to an extra step of opening up the flower and taking out the pollen making parts, and then you have to go to it the other flower, get the pollen, and do the hand pollination on a fairly small flower.

It's not that hard. Lots of people do it in their gardens and backyards, and you can find examples of this, YouTube has lots of examples of making hybrid tomatoes. It takes patience and it takes a little bit of fine motor control, but the concept is just exactly what we said was squash. What's nice about squash is the flowers are big and that makes them easy to work with. It's a good place to start if you're interested in doing controlled pollination.

Steph Benoit

And I think something that's so fun about, kind of, diving into this area of seed saving is that it's both a science and an art. And, once you know how to get consistent, true to type seeds, once you master that, a huge part can be having fun experimenting with different breeding lines and seeing what you can cross and seeing what you can get. Do you have any advice to an aspiring plant breeder who's interested in taking that next step and taking the leap into plant breeding?

Bob Wildfong

Yep, my best advice for that is just remember one thing, is that we have all of our food plants from amateur breeders. Thousands and thousands of years ago, we had wild plants to eat and I guess that's what we ate. But every now and then, somebody found a plant that was a little bit better or they selected a better strain of seeds because they noticed that some plants were bigger more tasty, you know, more colourful, whatever it was. And they had the intuition of keeping the seeds from those plants and having better plants next year. You take the entire history of agriculture with just regular growers, regular farmers, regular gardeners, you know, scientists – until about a hundred years ago – and we made apples, and we made watermelons, and all of the modern foods that we eat are made by amateur plant breeders.

So, it's not hard. It takes good skills of observation, it takes a really good knowledge of your plants. You have to know what you like and, you have to be able to recognize that and capture that when you see it, and if you can do that, then you've got half of plant breeding right there. Yeah, as you said, it's an art and a science.

The science is really handy to have; once the science of plant breeding was understood, it accelerated. And, for sure, no disrespect to plant breeders, if you do understand the science of it, then you can do all of that plant selection a lot more efficiently. And, you know, you might not want to wait for 10,000 years to do your own plant breeding, you might want to do it in a couple of years. So, read up on the science and understand how the genetics works and understand, you know, the male and female flowers and all of those technical things, but that won't help you to be a plant breeder because the art is the same art that allows you to grow the plants. If you can't grow a squash, you can't save seeds from a squash; and if you can get a watermelon to ripen, you're not going to be able to breed watermelon.

So, all of the art that you have learned as a grower is crucial and that actually feeds your ability to recognize what's exciting about a new variety and what might be what you want to create. So, those two things. they go together, but, you know what, the most diligent and skilled observer will be able to do much better plant breeding than a person who has just learned the science out of a book. Just, save seeds, save the seeds that you think are best and learn about them; and you'll be able to do it, plant breeding's not hard.

Steph Benoit

It's very encouraging and very inspiring to me to remind myself sometimes that, yeah, as you said, thousands of years of plant breeding was done without any undergrad degree in agronomy or plant bio or anything like that. It's uh, it's empowering stuff.

Bob Wildfong

Yeah, and it's fun. It's a whole aspect of gardening that just makes all the rest of it even more exciting.

Steph Benoit

And then suddenly 20 years go by and you're still working in it.

Bob Wildfong

Yeah, and, well, and still learning. And that's what, that's why it's so great because you could spend many lifetimes doing this and still have new things that are fun to find out.

Steph Benoit

You mentioned that across the, that across North America, there's been a real decline in honeybees and some of the other former pollinators of squash. Do they have any pollinators that are sort of particular to this family?

Bob Wildfong

Actually, there are. I mentioned bumblebees in the last episode, but that's not actually the most important pollinator for squash. You'll often see bumblebees because they're big and noticeable, they're very fuzzy and so they get covered with pollen, and that makes them very efficient as pollinators. The squash makes so much pollen, they almost need a giant bumblebee full of fuzz to carry all that pollen back and forth. But the most important pollinator for squash is a, is the well named squash bee. It's a bee

called squash bee and it comes from the same place originally where squash comes from. Squash is originally from Central and South America.

It's a wild plant there and it diversified over millions of years. And at the same time, there was a particular bee that evolved in the same place, and it evolved an appetite for squash pollen. So, in that area of the world, there are all these wild squashes and they're all these wild squash bees which actually prefer squash pollen over any other kind. Now, we have them here, in Canada. Squash bees are native here, but they haven't always been. They live underneath the squash plant, normally. If you have zucchini growing someplace for a few years in a row, chances are, you have little squash bees living in the ground where you had those zucchinis or where you had those pumpkins. As long as you don't spray, you know, insecticides, they will they'll probably find your squash or pumpkin patch and live there. And what happens is they collect squash pollen, and they dig a hole in the ground, the females put balls of squash pollen in these holes and then lay eggs on the squash pollen.

And then when the eggs hatch, the little larvae eat the pollen – remember, bees are vegetarian and it's what, it's their food so even the babies eat pollen – they grow up, and then they hatch, and come out of that hole and lo and behold, hopefully, they find more squash. If you moved your squash to a different place, if you rotated your crop and you have your pumpkins a little bit further away, then they will fly – they have wings and they can fly around and they can smell your squash and they'll find it – and, sure enough, there you have squash bees all over again. And you can tell, look up a picture of squash bees, you can tell they look different from other bees. And the really cool thing is that during the day, the females live in the hole in the ground and the males sleep in the flowers.

Steph Benoit

That sounds so adorable.

Bob Wildfong

On a hot afternoon, look inside your pumpkin flowers or your squash flowers, any kind of zucchini flower, and you'll see these little bees that are about the size of a honey bee but they're a little bit of a different colour, they're kind of flatter on the back. Give it a little poke. And if they're squash bees, they'll be asleep. If they're a honeybee, they will fly away because honey bees work all day, they're workers, they don't sleep during the day. Squash bees sleep

during the day and you can dump them out, right on the palm of your hand, and they'll just sort of walk around a little bit kind of dazed because they're very sleepy in the daytime.

These are the males; only the males will be sleeping in the flowers. And males don't have stingers so you can hold that bee gently in your hand and show it to people. And show how amazing you are that you can hold to be in your hand, only squash bees you can get away with this. Here's the other interesting thing about squash bees is they were not originally native here.

So, how did they get here? And the answer is that squash are not native here either. The reason we have squash is that native farmers grew squash and they adopted it from, first in, the southern, Central America. And then further north, different groups of people, kind of, saw our neighbours to the north have, our neighbours to the South have, this interesting food and it's pretty good, "Hey, we should grow it too." And, squash was adopted further and further north until Native People in Canada were growing squash. And along throughout that history, the squash bees migrated north and north and north with the squash. And, I imagine, they probably adapted and became more cold tolerant as they did it so that our squash bees can survive the winter; whereas maybe the original ones can't, I'm not sure about that. But, here we have, a truly coexisting insect and plant that lived as a coexisting group. The squash needed the bee to pollinate and the bee needed the squash because the pollen was its only food. And now we have that in Canada too, the same two creatures living together.

So, look for them. Look for squash bees, you'll find them. They're always in your flowers.

Steph Benoit

Well, thank you so much for joining us and sharing your knowledge and sharing your passion. This has been really fun to listen to.

Bob Wildfong

Thanks so much.

Steph Benoit

SeedHeads is produced by The Bauta Family Initiative on Canadian Seed Security, a program of SeedChange. SeedChange's main office is located on the traditional unceded territory of the Algonquin

Anishnaabeg People. You'll find SeedHeads wherever you find your favourite podcasts. This work is made possible thanks to our amazing donors, and the incredible community of farmers and organizations we work with. To find episode transcripts and translations, learn more about our programs, and to support seed work in Canada, please visit seedsecurity.ca.