

***That's Wild* Season 2**

Behind the Buzz | Discovering Singapore's Insect Diversity

[00:00:00] **Elliott:** Hello and welcome to *That's Wild*, a podcast series brought to you by the National Parks Board. I'm Elliott, and I'll be your host for this series, where we'll be talking to special guests from the nature community about topics surrounding biodiversity conservation in our City In Nature. Today, we're shrinking down to explore a world that we don't often notice unless they show up somewhere in our rooms. That's right, we'll be diving into the fascinating world of insects. Before you reach for your bug spray, let me invite you to take a pause and lend your ears to insect enthusiasts, Mao Sheng, Lumin, and Sebastian, who will be talking about the immense diversity of insects here in Singapore. Please introduce yourself, guys.

[00:00:42] **Lumin:** Hello. My name is Lumin. I like all kinds of insects, but most of my experience is in Butterflies and Odonates, which consists of Dragonflies and Damselflies.

[00:00:52] **Sebastian:** Hi. I'm Sebastian, currently working at the National Parks Board, in the Conservation Division in the Central Catchment Nature Reserve. I've a keen interest in insects before joining the National Parks Board.

[00: 01:01] **Mao Sheng:** Hi, I'm Mao Sheng. I'm an entomologist and a curator from the Lee Kong Chian Natural History Museum, NUS, and I like all kinds of insects, especially the ones that people fear the most.

[00:01:12] **Elliott:** Quite a wide range of backgrounds we have here, and also interest in different types of groups of insects.

Maybe just give me an idea of the diversity of insect species we have in Singapore. What are some interesting species that you guys know of and have observed before?

[00:01:25] **Sebastian:** Well, we do have a few that people are very familiar with. So we have the members of the Lepidoptera—the butterflies, the moths. We have members of Hymenoptera—your bees, wasps and ants. We also have common things like your Orthoptera—your grasshoppers, crickets, etc. I'll leave Mao Sheng to deal with the more obscure orders, but I think something that we never see that often, the Neuroptera, a personal favorite of mine. They're the lace wings, antlions and owlflies.

[00:01:52] **Sebastian:** Their names stem from their lacy wings, so actually, when you look into them in close detail, you can see that (their wings have venations). It's very pretty, yeah.

[00:01:59] **Elliott:** Right, what kind of common insects do they resemble the most? For those that aren't familiar with lace wings.

[00:02:04] **Sebastian:** I don't really think they resemble anything. They just stand out on their own. When you see it, it's very pretty, it's very lacy. You can see it's like a pattern and a lace, lacy kind of dress. The wings are very pretty.

[00:02:19] **Lumin:** Yeah, if people were to see them, they would probably think it's some long fly, or like a flying ant or something. Yeah, like a flying green bean, right?

[00: 02:25] **Mao Sheng:** Flying green bean, okay, that would be a good way to compare.

[00:02:28] **Elliott:** How about some of the underrepresented species, Mao Sheng?

[00:02:30] **Mao Sheng:** We can look at, say your earwigs, certain silverfishes, right? Not the ones at home that eat your books. And then, of course, my favourite group is actually your cockroaches and your termites. The diversity is actually quite high, like, let's say for termites—we can say that there are about 65 species of termites in Singapore. And cockroaches, we have about at least 25 species.

[00:02:54] **Elliott:** And I guess when people think about cockroaches, we think about those that we find at home, right? But the diversity is a lot more than just what they call the German and American Cockroaches, which are the ones we find at home right?

[00:03:05] **Mao Sheng:** So, like, let's say for those in residential estates, those urban areas, right? There are typically about four or five pest species, and this is something that is very common around the world. But in those in the forests itself, there's a lot more. And of course, I think recently, we got to know that there are these Emerald Green Cockroaches, and then cockroaches that are iridescent, cockroaches that are shaped like a pill—what we call a Pill Cockroach.

[00:03:30] **Lumin:** I would like to highlight Diptera, the true flies, because when people think of flies, they only think of mosquitoes, the house flies, the ones they usually see in their houses that's bugging them. But recently, I've been exploring some predatory flies, like the Robber Flies and the Mantid Shore Flies. Imagine a very small fly, but with mantis claws. And what they do is they go around on muddy surfaces, and they will dig out larvae of other flies like midges and mosquitoes, and they've been explored in other parts of the world in terms of their effectiveness in combatting malaria. So I think flies—because of how big the group is—their diversity is amazing.

[00:04:15] **Mao Sheng:** So the other one that I can think of is actually what we know as your Pill Scarab Beetles. Their names already suggest that these beetles will actually roll themselves into a ball. So why these guys are cool is because, you know, among Singaporeans, we think of beetles as the

ones that are always flying into the house and knocking into the windows, which is very annoying. But we do have another Scarab Beetle, known as the Pill Scarab. These guys are actually possibly the inspiration for the Golden Snitch in Harry Potter. So we do have this species around, but as for the exact species, we still do not know them yet. We still need to wait for experts to help identify them.

[00:04:50] **Sebastian:** A group of insects that I think people usually encounter, but they don't know that they are insects, the Archaeognatha, the Bristletails. Usually when we walk on nature trails, in nature areas, you might come across them, but they actually resemble humped shrimps. Shrimps on land. They're a bit humped. So actually, it's an insect, but you'll be like, what's that? That's not an insect. But it's very obvious to identify when you see these three tails of different lengths, with the centre tail being the longest. So they're actually insects of a very ancient origin, because they are not able to fly. So they just crawl around along nature trails, along your railings, along the trees. So yeah, this group – you can keep a lookout.

[00:05:29] **Lumin:** For myself, my answer will be a bit surprising, especially to those in the nature community. But I think Stick and Leaf Insects are a surprising group of insects that people would be surprised that there is in Singapore, because to me, the majority of people that go out onto their nature walks right, they only see the things that appear in front of them, or like are easily spottable. So of course, these insects – their literal naming is built upon their insane camouflage would be something that's very shocking to them once they spot it, especially for the leaf insect. The stick insects are a bit more believable to some people, but leaf insects are something they will see only in the books, the documentaries. But in Singapore, we have two species that's reliably seen, which is the Gray's Leaf Insect and the Chris Ang's Leaf Insect. And it takes a good eye to spot them, for sure, but once they see them, I'm sure their eyes will be widened.

[00:06:21] **Elliott:** Any species that you guys might be a bit cautious of, or wary of, or maybe a bit scared of?

[00:06:27] **Sebastian:** In the Singapore context?

[00:06:29] **Elliott:** Yeah, in the Singapore context.

[00:06:30] **Mao Sheng:** I'd usually say, just be a bit wary of the potential wasps. There are different kinds of nests, like your Paper Wasps, your Hornets. These guys can pose a potential danger if you actually disturb their nests. So I think those are the ones that I would be wary of.

[00:06:45] **Sebastian:** I don't think we are actually scared of them, but sometimes we are scared of the situation that resulted in them being provoked, because normally, they are just going about doing their own business. But sometimes it's like, if some element triggers them, they might actually become defensive, and come after us.

So I have a personal experience, not in Singapore, but I think I was in India. And I was like, doing a nature trip, and I saw a Crested Honey Buzzard that flew low. So I was like oh, bird! Is it gonna perch soon? Let me follow it. So as I followed it, I suddenly heard a lot of buzzing behind me, and then, I suspect this bird went to attack the beehive. I think it's the Giant Honeybee. And then it ran away with the food, and I walked into the path of the beehive, and it started chasing me because I heard them buzzing around my ear, and they started to aggregate behind me. Then I ran all the way, yeah, back to the room. Things like this, I'm not scared of the bees, but like when they are provoked by other means and start to chase us indiscriminately, then I'll be scared, yeah.

[00:07:44] **Elliott:** But you didn't get stung.

[00:07:46] **Sebastian:** Thankfully not, yeah, I ran like crazy.

[00:07:48] **Lumin:** Even though I love insects now, I actually grew up with the fear of things flying into me. So it took me a while to get over the fear of like, moths, butterflies, bees, all this. But currently, I still have this small fear of grasshoppers, crickets; especially the large Javanese grasshopper. They're like, they're very unpredictable. If you disturb them, where would they fly to? Maybe onto me, maybe into my face. That's why I'm still a bit wary of them when I walk past them in the nature trails.

[00:08:15] **Sebastian:** Jumpscare.

[00:08:16] **Lumin:** Yeah!

[00:08:17] **Elliott:** I've actually met a lot of people who spend a lot of time in the field. You know they're not really afraid, besides wasps, right? Wasps are a real hazard, and Hornets. A lot of them are afraid of, you know, katydids and crickets and grasshoppers, because they jump a lot. And I have a friend who is deathly afraid of Katydid because he got bitten by one, and he swears that that hurt the most out of all the different bites he's gotten. I don't know how he got bitten, but it was apparently chewing on his finger. And there are some carnivorous Katydid, right? Some Katydid are carnivorous, right?

[0008:47] **Lumin:** Have you seen the Raspy Cricket before?

[00:08:49] **Elliott:** No...

[00:08:50] **Lumin:** It's huge! I saw one recently. It's a cricket. Then the antenna is hella long. And you never know if it will jump on you or not, because I had one that was jumping after me before when I was trying to photograph it, I was like, constantly shifting backwards as it jumped towards me.

[00:09:08] **Elliott:** Can we describe how big it is for the audience? Because they can't see.

[00:09:09] **Lumin:** The largest one I saw was palm sized. In Singapore, the orange ones especially.

[00:09:17] **Elliott:** The reason why I ask this question is because a lot of us grew up with this unhealthy fear of insects, right? We're taught to be afraid of insects in general. If you see it in the house, you get rid of it, right? So what are some common myths about insects that you guys think need to be debunked?

[00:09:31] **Lumin:** I believe the biggest common myth is that everything is out there to get you for sure. So a lot of people think, like a lot of insects will come and *kajiao* you, will come and bite you, just because they want to. But no, the insects, they are so small. We are hundreds of times bigger than them, there's no way they will come at us just because they could. They're going to die more likely, we do more damage to them than they do to us. It's only like those few, like blood suckers, like mosquitoes and the biting midges that will come at us for blood. But other than that, they're just protecting themselves, especially for the bees, the hornets, and the wasps. If you leave them alone, they will also leave you alone. So they're really never out there to get you.

[00:10:15] **Elliott:** Any other myths?

[00:10:16] **Sebastian:** I have a very random myth, I think it mainly stems from the European side where earwigs do not enter your ears.

[00:10:25] **Elliott:** Do we have earwigs here?

[00:10:26] **Sebastian:** We have Earwigs here, but I think more commonly in temperate countries, they usually like to enter people's homes because it's warmer, and then people always have this fear that, oh, when I sleep, if there's an Earwig, it's going to enter my ear, but nah, they don't want to do anything to you. And then you see these pincers that they have, the forceps. They are actually mainly for the males to toss one another around to fight for supremacy, and it's not going to harm any one of us.

[00: 10:51] **Elliott:** These pincers are on the back?

[00:10:53] **Sebastian:** At the abdomen, yeah, at the end of the abdomen, they have a big, nice pincer.

[00:10:57] **Mao Sheng:** I think usually people just think insects are meant to be disgusting or dirty, like you said. That's because of the term 'creepy crawlies'. But most of them are actually quite clean. In the case of looking at, say, flies also like, yeah, of course, maybe like, House Flies, Blow Flies, those are the ones that could be vectors of diseases, but majority of the flies are actually quite fine. Yeah.

[00:11:18] **Elliott:** I've also heard that cockroaches are quite clean, but I don't know how true that is.

[00:11:21] **Mao Sheng:** If cockroaches being clean, that one was because usually, when it comes to cockroaches, let's say the American Cockroach or German Cockroaches, these guys will always tend to clean themselves because they need to navigate through the environment, right? So they need to keep their antennas clean. But yes, potentially they may still carry some kind of diseases or bacteria on them because of where they are seeking their food - like rubbish dumps, decomposing organic material. But yes... yes and no? I guess to that myth, they will keep themselves clean, but at the same time, they still can carry some potential bacteria on them.

[00:11:52] **Elliott:** Following up from that, insects and other animals all have a role to play in our ecosystems. What are some important roles that insects play that maybe we take for granted?

[00:12:00] **Sebastian:** Well, they are an important food source for a lot of our native biodiversity, especially birds and reptiles. Yeah, whether native or not, they're still food to our birds.

[00:12:09] **Mao Sheng:** I think another one is actually maintaining the soil fertility, because we know we want to have many trees, greenery all around us, but in order for them to grow the trees, you need to have a very good soil. So some of these insects are actually responsible for keeping the soil more fertile, and also aerated as well.

[00:12:26] **Lumin:** For me, it's their various roles in agriculture, especially pollination and pest control. Pollination is a big deal because we all know our plants are built upon mostly insect pollination. They rely on them to spread their genes far and wide. And this has been the case for hundreds of millions of years, and we are taking it for granted as we put our pollinators at risk, our native bees especially, when they're doing the work of many other honey bees. And for the case of pest control, a lot of people don't really know about, like, how big of a deal wasps are in agriculture. Because, if you think of any single pest, like, for example, mealybugs, aphids, there's always going to be a few wasp species that will be out there to get them for you. And all this is for free, you don't have to spend any manpower costs, or whatever, to get rid of the aphids.

[00:13:23] **Elliott:** I think that's a really good point about the agricultural aspect of things. Just to give the listeners an idea, what are some crops that we know of that are pollinated by all these bees and whatever other insects?

[00: 13:33] **Lumin:** At the top of my head, it's the plants that are buzz pollinated, especially like Brinjal, Eggplant, Tomatoes. The buzz pollination is when a bee goes to the flower and it buzzes at a certain frequency, enough for the pollen to fall off onto the bee. This is very important, because no other insect will probably be able to reach that vibration frequency in order to get the pollen. Then the plant won't be able to spread its pollen, right?

[00:14:00] **Elliott:** I'd like to go back to the point that Sebastian made, that they're food for a lot of different animals, but they're also food for humans, right? In some countries. And I'm going to direct this towards you, Mao Sheng, because I know that you like to experiment eating insects. So maybe we could touch a bit more on that, yeah.

[00: 14:14] **Mao Sheng:** Where do I even start? Like how many...

[00:14:15] **Elliott:** Wherever you want.

[00:14:18] **Mao Sheng:** So I think we do know about edible insects now being approved, already, right? But I guess there is still a need for more education and more awareness with regards to eating edible insects. True, edible insects actually do not only just provide protein, but they also do provide some kind of dietary fibre, right? Because of the chitin right, so it's very similar to like eating your prawns, eating your crabs. So edible insects will be like eating both protein and dietary fibre at the same time. And I guess it's also understandable why usually people like in Singapore, a modern city, we are not used to eating edible insects because of the availability of other food - like your chicken, your beef, fishes, and prawn. So it's like we have so much food. Why do we need to resort to eating edible insects? But on the more hidden side of things, or something more historical, is that in the past, there were actually Singaporeans who travelled all the way to JB in order to eat termite queens because there is a so-called... say some kind of medicinal value to cure arthritis, you know, to help with personal health reasons. And also looking back many years, edible insects have always been around, right? And our neighbouring countries like Thailand, Cambodia, maybe certain parts of Malaysia, they also have been eating insects for long periods of time really. So, eating insects itself is actually not really, say, something that is too novel. I think it's just maybe the culture in Singapore that has given us this mindset, you know, that this is something novel to us.

[00:15:44] **Elliott:** I think one example that I can think of, that we still are eating, but maybe unknowingly, is Cordyceps. I mean cordyceps is a fungus that kind of infects insects, right? Then in TCM shops you see the Cordyceps, and it looks like a bug and then when we grew up, we were told that "oh no, it's a fungus." But actually it is a bug right?

[00:16:03] **Mao Sheng:** Part fungi. Yeah, It was quite interesting because I met this aunty, and I was like "you know you have eaten insects before?" And I showed it to her and said "you know, you have eaten Cordyceps". Then she was shocked. She was like "oh my, I've been eating them for so long?"

And the other thing also to add on is, when it comes to, let's say, red velvet cake, right? Those are actually coming from your cochineal bugs. So you kind of like, have been indirectly eating bugs for quite some time, really, when you eat your favourite desserts.

[00:16:30] **Elliott:** The dye, is it?

[00:16:31] **Mao Sheng:** Correct, it's the dye.

[00:16:32] **Lumin:** Also, all the ants that get into your cup of water.

Elliott: Oh yeah, extra protein!

Lumin: Yeah!

Nature Nuggets (Recommendations segment)

[00:16:37] **Elliott:** It's time for Nature Nuggets! In the spirit of our podcast titled *That's Wild*, we wanted to ask our guests to recommend something wild that they've come across or enjoyed and that you can check out yourself too.

[00:16:53] **Lumin:** For myself, I would like to recommend clip-on lenses for your phone, because it's a budget friendly option as compared to the huge camera gears you see people use to take of insects. And for me, I believe phone photography with the clip on macro lens is a very flexible option, because you can just be walking freely, and then if you see something you want the photograph, you just take out your phone and your clip on lens and you just shoot. And because it's such a small setup, it helps you be more flexible also in what angles you want to take of the subject

[00:17:40] **Sebastian:** Okay, so after you take a photo and you do not know what they are, let me introduce some field guides that we have in Singapore. We have various insect field guides. They're very accessible. We have *The Butterflies of Singapore*. We have, I think, *The Damselflies and Dragonflies of Singapore*. We also have the *Bees of Singapore*, and, even more recently, *The Spiders of Singapore*. So yeah, these are very good references, even if you do not go and shoot them. Just flipping a few pages, seeing all these colorful insects and arachnids is very soothing to the soul.

[00:18:16] **Mao Sheng:** So adding on to what Sebastian has mentioned, we do have this Singapore Pokedex, right - The Singapore Biodiversity Online. So you know, with the photos that you have taken, you actually can compare it with what you see on the website, and see, you know, whether it is a species that has been discovered or species that's waiting to be discovered. And also, with that, you know, I would kind of like, being a fan myself, just go and play Pokemon. Pokemon itself is basically a virtual world of like, doing biodiversity research, like going around, you get pictures, you get to understand what's their biology. And a fun fact – Pokemon is actually born out of bug catching!

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[00:18:59] **Elliott:** I'd like to touch a bit more on the threats that insects face, in particular in Singapore. Do we know of any particular groups that face threats here?

[00:19:14] **Mao Sheng:** This is a bit hard to say, because sometimes when it comes to biodiversity and conservation, before we want to conserve, we need to know what we are actually protecting. So one of the main challenges that us entomologists face is that we do not know how many species are out there, and what are the different species. Maybe, in general, we know, oh yeah, there's this earwig, this owlfly, but we don't know what are the species, or what names are given to them. So sometimes it becomes a challenge for us to really determine what is the species diversity in an area that we actually want to conserve. So that is actually one of the challenges.

[00:19:51] **Elliott:** So in Singapore, basically, we need a lot more research done on insects.

[00:19:55] **Mao Sheng:** Yes, correct.

[00:19:56] **Sebastian:** For me, I echo Mao Sheng's point that there's too many out there and too little that we know. We call this the impediments to insect conservation. Because when you think of taxonomists, people who name insects or describe insects, a lot of them are getting older. And now, because with all the novel survey techniques, we are getting a lot more insect discoveries. So it's a pity that they are out there, but we have no one to actually properly identify, separate them and describe them. Actually, for separation, we have DNA now to help to speed up the process, but there are many specimens just waiting to be described and to have a proper name to them, so that we can find out more about what they do, and then we can package all this information to these species to be able to protect them and to know about them. And also, because the insects are not exactly the most charismatic species, so usually conservation efforts do not directly go to them. Like funding – would you rather fund a very charismatic looking tiger versus this butterfly versus this earwig? So yeah, the interest is not as strong as compared to other cosmetic vertebrate species. So I think that's one threat.

[00: 20:59] **Lumin:** Off the top of my head, I think butterflies and Odonates, the threats that they face are a bit more well studied in Singapore. Especially for Odonates, because their needs are so specific they need clean water, and not just any clean water; some species prefer streams, some species prefer still water... and one species I can think of is the Green Metal Wing, *Neurobasis chinensis*, it's a huge damselfly. Okay, it's huge for a damselfly, and it's one of our biggest. It is currently extinct in Singapore because it inhabits rocky streams, rocky fast flowing streams. And you tell me, where in Singapore currently do we have fast, rocky flowing streams, right? So their last known habitat was, I think, in MacRitchie. And that was the last known place that the Green Metal Wing was found. And for butterflies, their needs are also pretty specific. They need host plants to breed. They need nectarine plants. But the most important aspect is definitely the host plants, because butterflies are picky. A lot of species feed on one or two plant species only.

[00:22:07] **Mao Sheng:** From my point of view, we always talk about human-wildlife conflict. So for me, I would include insects into the wildlife as well. So the thing is...how is it going to be indirectly affecting the insects? That possible threat is because, you know, when people have new areas, you want to grow plants, and then you always have these demarcations like, oh, this area is the human area, right? Any insects that come inside will be wiped out. Who knows, maybe the insect that you're wiping out could actually be a potential new species, but you also wouldn't even know what its role is. Could it actually be there? Like, say, some of the hover flies, right? It's actually there, to visit your flowers and pollinate them. At the same time, hoverflies, the young ones, the maggots – yeah, usually the term maggots, we think, oh, they are always very dirty. But these maggots are actually useful. They will actually help to prey on, say, some of the aphids or some of the white flies. So, just having to know what insects are out there, getting to know them, you can know how you can actually coexist with them. So like, you do your stuff, you help me do my gardening, and I'll just help to water the plants, give fertilisers, something like that.

[00:23:23] **Elliott:** And we mentioned that for insects, it's quite hard to persuade people to appreciate them a bit more. We talked a lot about how they're so important to us, but would that be the strategy to kind of get more people interested in insects, or are there other ways?

[00:23:36] **Mao Sheng:** I think this is what some of us, maybe the young entomologists are doing, actually reaching out there sharing photographs of all the different insects that they've found. From the very charismatic ones, of course, sometimes some of the weird looking ones, strange looking or cool looking ones, right? And I do get to see, you know, some of the younger kids getting interested to find out what the insects they found are, you know, what they can learn about it, what's their role. So having to generate interest, I think that is something that we need to continue on in order to make sure that future generations, they can actually be our successors, and can help to maintain biodiversity and conservation.

[00:24:12] **Elliott:** And it sounds like any help is welcome, right? Because. There's a lot more research to be done. So we know that citizen science is a big thing nowadays for all types of taxa, all types of animals, plants, but for insects. You know, what are some interesting, you know, citizen science initiatives that we have in Singapore?

[00:24:27] **Lumin:** Not an initiative like solely in Singapore, but I am a big fan of the app iNaturalist. It's a global platform that people use to key in their observations. And then researchers from there can actually, like tap in on the data that's already easily available online. They can just search a species in a certain area, and then voila, there's this much records there. Then they can infer from the data. And personally, I use iNaturalist to keep track of my own species count also. So yeah, iNaturalist is great. Please use it!

[00:25:03] **Sebastian:** Think for people who just want to start out, to learn a bit more about the whole citizen science programmes. I think the National Parks Board (NParks) actually do run several citizen science programmes. So actually you can join the mailing list, or you can check out the NParks website, because it may not just be solely for insects. I mean, we have the butterfly watch, we have the dragonfly watch. It also expands to some of the bird watches, like Garden Bird Watch, Heron Watch, or even the nationwide Bioblitz. And then for youths that actually are interested to help in insect conservation or to, like, venture into this field, from year to year, we actually do also run youth stewards for nature, where youth can actually take part with some of our programmes. So if they're interested in a very specific project type, project topic, they can actually look at the list of projects, and then they are able to see what interests them, and they can sign up. So I saw that for 2025 there's actually some kind of insect themed projects, such as developing insect friendly gardens, enhancing a dragonfly pond, for example. So there are plenty of opportunities out there for interested people to start.

[00:26:04] **Mao Sheng:** Since you're promoting NParks, I will promote the museum side! Yes, this actually, with regards to the citizen science, I mean with let's say some of the students, you can come to the museum you can see all the different insects that are actually being pinned. But it's not only just the museum, there are labs also in like, say, in NTU, in NUS. There are different projects ongoing. They can actually reach out and say, you know, how can I participate? Or, how can I contribute to the research? And from there, you know, you can actually garner more interest, further the interest, with regards to the insects that they are actually looking at.

[00:26:34] **Lumin:** Oh, sorry, I'd like to add on also, other than iNaturalist, there's also, I mean, social media. Nowadays. There are a lot of nature groups in Singapore, like the Singapore wildlife sightings Facebook group, where people post their sightings. And once in a while, there will be some people that post some unknown, obscure insect, and then it will get all the researchers excited. And I also want to add on that I'm volunteering with the Woodlands Botanical Garden. It's a community garden initiative that's focused on wildlife friendly gardening, and it also aims to help breed the near threatened Common Birdwing and the Common Rose, but in the process of protecting these two species, it also helps create an environment for many, many other animals as well, not just insects and people can get involved with the like the planting, like the photography, and many more on this. And it's not just like people from the science field. It's like people that just want to help, be it the residents there, people that are just getting interested. And it's just regular citizens, and I believe it's a great initiative and a good example of citizen science that way.

[00:27:40] **Elliott:** What's the coolest thing that has come out of some of these citizen science programmes?

[00:27:46] **Mao Sheng:** I think one of the recent ones was a friend of mine from the museum. You know? He was like, walking through his HDB block, and he was like “this insect itself, is it something very cool?” Then he showed me the picture of it, and was like, this is an owlfly. I was like, why is the owlfly in the urban area? So that is actually one of the cool sightings so I was like trying to figure out where it came from, right? Then from the area we see that there's no forested area, so how did it actually end up there? And then we get to know more about owlflies, right, and that is actually a very good contribution, and then he actually submitted to the Singapore Biodiversity records. If you want to see an owlfly, you can actually imagine it as like a Damselfly, wings folded. But the unique thing is that usually Damselfly antenna is very short, but for Owlfly, the antenna is actually extra long, and the eyes are actually quite huge, very similar to a Dragonfly. So, yeah, usually, most people will actually mistake that the Owlfly as a dragonfly or damselfly. But once they see the antenna, they know, oh, yeah, it's an Owlfly, it's something that is very uncommonly seen.

[00:28:48] **Elliott:** It sounds like a fantasy kind of creature.

[00:28:51] **Mao Sheng:** Wait till you see its larvae. Oh, wow, That is even more fantastic.

[00:28:56] **Lumin:** It's like a living hair clip!

[00:28:58] **Mao Sheng:** Yes, also huge jaws, flat body, and it just looks like some final boss in some game, you know.

[00:29:05] **Lumin:** If you make it like 100 times bigger.

Mao Sheng: Yeah.

[00:29:07] **Lumin:** On like the iNaturalist side that I think, in April, there was this Golden Birdwing that appeared in Singapore Botanic Gardens. It was first posted on iNaturalist, and then some butterfly people were just like, this does not look like a Common Birdwing at all. And then the next day, everyone rushed down to botanic gardens to look for the Golden Birdwing, and it appeared on Straits Times. So this is a good example of how discoveries can be made on iNaturalist and other social media platforms. If you've seen our Common Birdwing, which is a large black and yellow butterfly, the Golden Birdwing is not that much different, honestly. It just has some missing spots on the hind wing, or the ear, which is the yellow part. And also the key feature that separates it from the Common Birdwing is, on the hind on the yellow patch of the hind wing, it has black dustings, there's like literal black powder looking kind of patterns, instead of the clear yellow that the Common Birdwings has. Yeah.

[00:30:04] **Elliott:** We've really showed that insects are indeed really fascinating. I'd just like to close off with one last question, how can we better coexist with insects, especially those that we commonly

fear? And you know, what role does public perception play in how we treat insects in our environment?

[00:30:20] **Sebastian:** I think, to be patient and to retain your childlike curiosity. You know, when you're young, you go around touching everything and get scolded by your parents. I think children are fearless that way. And same for insects. They could be like, what's this insect? What's that insect? The first response is never fear. I mean, at least that's what I think for children. So if adults can retain this child-like curiosity, you can actually, instead of fearing it, you can be like, Oh, what's this? And be patient. Of course, not like, oh, no, something entered my house. Get it, get it out. You can just go like, what is this? Take a closer look. Oh, it's actually very pretty for a beetle, yeah. So, I mean, if you can retain this curiosity, if you actually research more about it and you take a closer look, you can actually find a new fascination for this. And you can still coexist with them because you can help it along its way, instead of just removing it with a spray. And with all this, if everyone has this kind of mentality to be more appreciative of insects, it will actually shape the whole community to actually want to learn more about insects, instead of fearing them.

[00:31:18] **Mao Sheng:** So yeah, learning not to fear insects, right? But let's say there's a person who's actually more fearful of insects, so it's like what Lumin has mentioned, those insects there, get to know that they are actually not there to harm you in the first place. And also get to know where your fear could actually be coming from. And really, I think some of the students, or some of the teachers even, or some of the folks I talked to, they are kind of not sure where the fear actually comes from? And you know, like, let's say for the case of cockroaches, right? You know, you see a cockroach there, yes, of course, it's valid that you will get fearful of them, but they are just there, and then the moment you go close, they will just tend to run away, right? So having to know where your fear is coming from and understanding that you know, those insects are just there, you know, maybe just bypassing, they're just trying to find their way around. And then you just need to shoo them away. You don't need to really go about having to straightaway exterminate them.

[00:32:11] **Lumin:** To add on to Mao Sheng and Sebastian, I believe there are four levels of public perception of insects. So the first level is just they don't understand, or they don't know what the insect is, so they're just a bit wary of it, but they're still curious about it. So these are usually like children, because they are born without fear. They will go to it, but sometimes they still have this innate sense that, okay, maybe we shouldn't touch this thing, but they'll still want to find out what it is, right? So I believe that one is the easiest to help reinforce like the good perception of insects.

Then there's the level two, which is the fear is passed down from, like your parents, for example, or like some other friends that may have had a bad experience with the insects. Then they themselves will also spread these, like, like myths and the fear to other people, because that's what they've been taught, and they've never been told the right things.

Then there's level three, which are the people that actually experienced those traumatic experiences, like, for example, being stung by a wasp. So no matter how much you say, oh, wasps won't go up to get you. They are actually just defensive. They won't believe you, because they will say something like, like, oh, the wasp stung me even though I'm not doing anything. But they're not aware of what they're doing, or maybe they were actually, like, in the vicinity of a wasp's nest or whatnot, and that one is still a bit hard to change. You need to, like, really, really be patient with them.

Then there's level four, the people that just hate insects, that one, that one, there's no saving it. And for the public relationship with insects, I believe since the olden times, I quote this from my partner, Jing Xuan, that, like the relationship between insects and people, right, is transactional. We have this perception that there are "good insects and bad insects". So the good insects are the insects that are of use to us, like, for example, in pollination, all those bees. They will definitely know that it's good for us. Then there's the butterflies, that is, they do things like being pretty I guess. Then there's the bad insects, which usually involves the insects that bite us, like mosquitoes. But it also includes insects that people don't know or they don't think are of use to us, like, for example, a majority of beetles, they think they exist, just because they exist, they don't do anything for us, and then they're just there to be annoying, especially when they fly into our house. So they group this under bad insects. And I think people need to understand that everything exists for a reason in this world, everything came about because they adapted to something. They have a use in the environment. They have a role to play, and not everything should be based on what their use is to us humans.

[00:34:48] **Elliott:** Those are some very philosophical answers to those questions. There's a lot for us to think about. But before we wrap up, just want to say thank you to all three of y'all. Maybe we can say bye to the audience by making some insect sounds.

ALL OF THEM

Insects SFX

[00:35:03] **Elliott:** Thank you for listening to this episode of *That's Wild*. If you'd like to hear more, tune in for more episodes on Spotify, Apple podcasts and YouTube, and if you like our content, don't forget to show your support by hitting the Follow button and giving us a five star rating. Bye!

[00:35:17] **ALL OF THEM:** Bye!