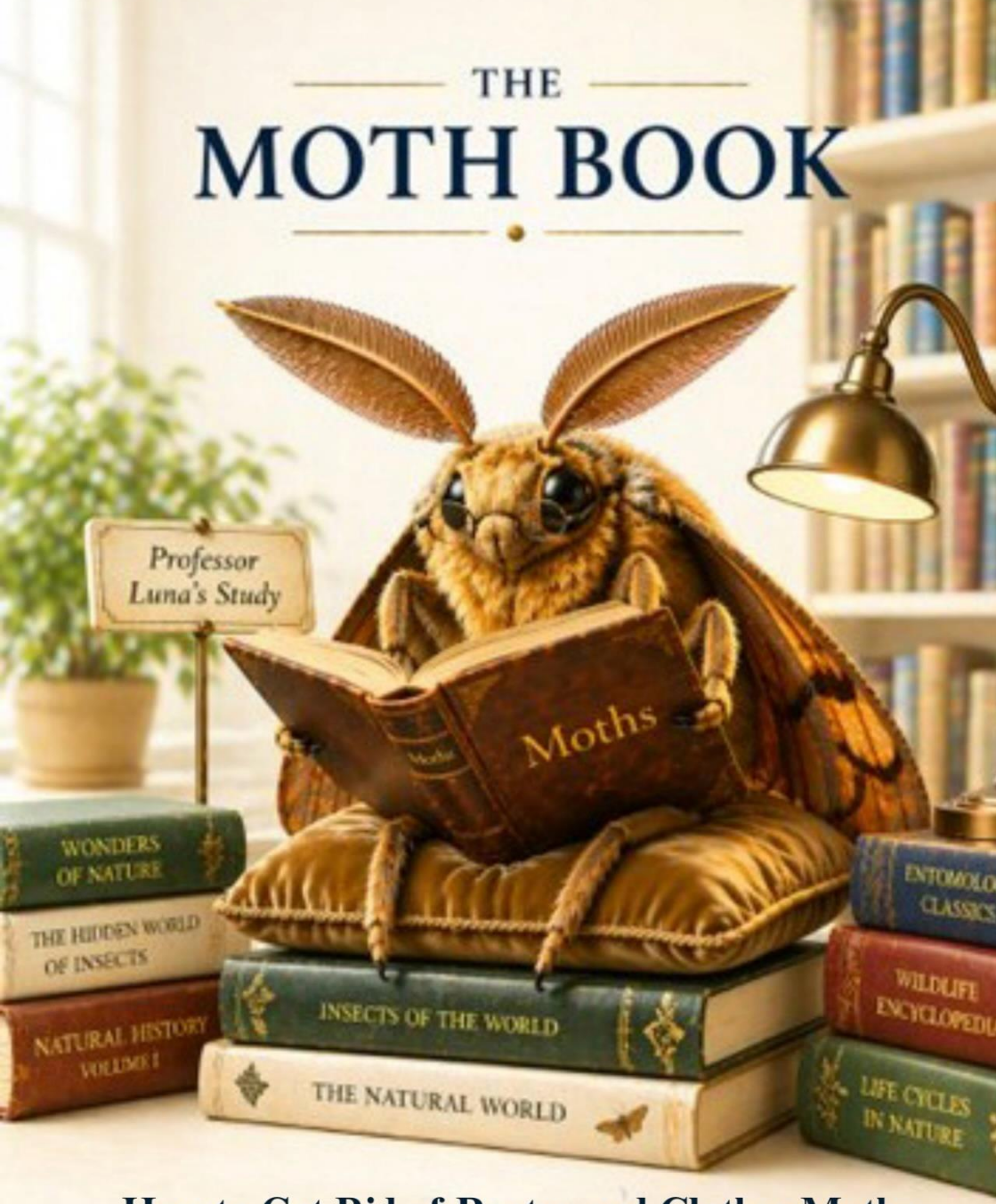
THE MOTH BOOK



How to Get Rid of Pantry and Clothes Moths & Amazing Moth Secrets

Author: Henry B. Moth

Before You Dive In

This eBook is free, and it is yours to keep, read, and pass on to anyone else fighting their own war on moths.

If a real book is better or easier to read the **Paperback Version** is available on Amazon.au.com which makes a proper keepsake for your own shelf, or a genuinely funny gift for someone who needs a moth-free wardrobe.

Or search amazon.au.com
The Moth Book: How to Get Rid of Pantry and Clothes Moths

Every paperback sold helps keep this eBook free for the next person. Enjoy the read.

A Few Readers Comments

"I managed to read 30 pages in one sitting. A miracle for me. I don't normally read books because I lose concentration and keep going back over what I've already read. I learned a lot about the different types of moths. Very impressive piece of work. Well done."
Garry M

"Found moths in my porridge oats. Read this book. Followed the instructions. Fixed and did read some of the other interesting stuff, quite fun"
Margaret T. Tauranga

"The book is free online" …Dave H., Christchurch

"Had been using moth balls for years. Read the moth ball chapter. Quite Scary"
Robyn F., Wellington

"My friend told me these things really work"
Jo W., Nelson

"I bought the book to find out what I needed to get rid of my moths in the Wardrobe. What it told me was exactly what I needed to do. Thank you Mr Pink"
Karin T. Auckland

"Henry B. Moth has transformed a dry subject into an entertaining and genuinely fascinating read. Funny, practical, memorable and refreshingly different. Once you start reading, you'll find it surprisingly hard to put down."
Grant P., Auckland

THE MOTH BOOK

How to Get Rid of Pantry and Clothes Moths

+ Amazing Moth Secrets

Henry B. Moth

Before You Begin...

You probably picked up this book because you have moths.

That's okay.

We're going to fix that first.

But here's my promise...
By the time you finish this book, you will be amazed at the magic in other moths' lives. It is astounding and fascinating.

Some moths deserve to be evicted from your pantry and wardrobe. Most don't!

In fact, some are among the most beautiful and extraordinary creatures on Earth.

Let's get rid of the pests first...
Then you can enjoy the fun and interesting stuff that you might even read or show your Kids and Grandchildren

I really hope you enjoy this read.

Copyright

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The moral right of the author to be identified as the author of this work has been asserted. (Not sure what this means?)

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A note on images. I have spent considerable time researching and verifying that every image used in this book is either in the public domain, correctly licensed for commercial use, or generated using AI image tools.

Despite my best efforts, errors can occasionally slip through. If you believe an image has been used incorrectly or without proper attribution, please contact me directly and I will correct it immediately and with genuine apologies.

Disclaimer

The information in this book has been compiled from fifteen years of genuine, hard-won, occasionally moth-covered experience in pest control across New Zealand and Australia. Every effort has been made to ensure it is accurate, practical, and useful.

That said, moths are unpredictable creatures. If you have followed every instruction in this book and still have moths, that is between you and the moths. We suggest a strongly worded letter.

Any errors, omissions, spelling wobbles, or moments where the science goes slightly wobbly are entirely the fault of the artificial intelligence that assisted with editing. Claude knows what it did.

The author accepts full responsibility for the jokes. Claude accepts full responsibility for everything else.

This book is intended as a practical guide for homeowners and does not constitute professional pest control advice. For severe, structural, or commercial infestations, please consult a licensed pest control professional who has the appropriate equipment and, ideally, a better sense of humour than most.

No moths were harmed in the writing of this book. Several were inconvenienced. The pheromone traps were non-negotiable.

Acknowledgements

Mr Pink’s genuine and heartfelt thanks to every customer, stockist, retailer, and supporter who has trusted us over more than thirty years in business. You kept the lights on, the traps stocked, and the moths at bay. This book exists because of you.

Thank you to the scientists, entomologists, and researchers whose work underpins everything in these pages. You study extraordinary creatures for not nearly enough recognition, and the rest of us are considerably better informed because of it.

And thank you to my daughter, who told me not to write this book, and was right about the TikTok thing, and wrong about the funny thing, and has been extremely gracious about both

This book would not exist without the generosity of some remarkable organisations and people who believe in knowledge — and good photographs of moths. Go play on their websites and/or donate to help them.

Manaaki Whenua — Landcare Research

Auckland War Memorial Museum

Te Papa Tongarewa

iNaturalist NZ

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Science Learning Hub

CSIRO … and others throughout the book

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About the Crazy Author

Before we dive in, you should know something about me: I am seriously dyslexic. If you spot the occasional spelling wobble, especially with those big fancy words, that is why. I have done my best, and I do care, but you really do not need to point them out. Every good book needs a few loose bits and it's scattered through it, purely to keep the PEDANTS entertained. What I lack in spelling prowess I make up for in moth-fighting expertise and an unhealthy obsession with Monarch butterflies.

If you do find mistakes, sorry that AI didn’t pick them up.

Also, the name Henry B. Moth is not exactly what my parents wrote on my birth certificate. It is my nom de plume, which is French for "I couldn't resist the pun." After spending fifteen years fighting moths, it felt entirely appropriate to adopt their surname. Know your enemy and all that.

If you are dyslexic like me, go and have a play on our other website. www.project30.org. You will see the stuff I am definitely more passionate about than moths and butterflies.

PS if your kids are struggling at school definitely do and have a look at the other website and maybe put up with the moths.

For the dyslexics I was going to say I would turn this into an audio book, but no, just read or get some to read the important stuff to you. Then go play on our other website www.project30.org. That’s where my other passion is, not just Moths and Butterflies.

If you don’t read anything else apart from the how to outsmart your moths, please read the bit about Monarch Butterflies and what you can do to help the planet, and they are good your Soul.

This book did take me about 15 years to write, with people ringing up or emailing me to find out what to do about their moths.

Yes 15 years so you could be decent enough to read it, well some of it. I used to say to my daughter “I don’t care” whether people read it or not. But she was right again, she said, “You do care” But “You don’t mind” if people read it or not. (their loss hehehehe)

Don't Read this Book if ……

"Don't write a book," my daughter said, shaking her head and rolling her eyes. "It's a whole new world out there, Dad. People want to learn what to do in two minutes."

Yes, we live in the age of TikTok tutorials and Instagram infographics, where complex problems are supposedly solved in the time it takes to microwave a cup of tea. But here is the thing about moth control: it is not a two-minute hack. It is an art, a science, and sometimes a comedy of errors that would make a sitcom writer very happy indeed.

So, what could I do to convince people to actually read this thing from start to finish? Make it funny. Make them smile. Make the journey so entertaining that they would forget they were becoming pest control experts while chuckling through the pages.

My daughter said "Dad, you can't be funny,".

I have spent the last fifteen years developing moth control solutions, and if that does not qualify me to write a humorous guide about these winged menaces, I do not know what does.

Over that time, I have heard every moth horror story imaginable, helped tens of thousands of frustrated homeowners across New Zealand and Australia, and learned that sometimes the best weapon against moths is a good laugh. Well, that and the right strategy.

What have You got Hold of?

This book is not your typical pest control manual filled with jargon and doom-mongering. Think of it as your personal moth-busting companion who happens to have a sense of humour and a passion for plain English.

Here is a shocking truth that might save you hundreds of dollars: you do not need an arsenal of expensive products to win this war. While pheromone traps are part of your defence strategy, they are just one weapon in the toolkit. This guide will show you what really works and what is just fluttering your money away.

Whether you are dealing with pantry moths who have turned your kitchen into their personal buffet, or clothes moths treating your wardrobe like an all-you-can-eat feast, we have got you covered. Our approach? Keep it light, keep it fun, but most importantly, keep it effective.

To Learn or Not to Learn

By the end of this guide, you will understand why most moth control methods actually work. You will know how to eliminate pantry moths without throwing away hundreds of

dollars of perfectly good food. You will have the exact step-by-step process for wardrobe moth eradication.

You will discover that adult moths do not actually eat anything, which is mind-blowing and changes everything. You will have money-saving prevention strategies that protect your home long-term, the truth about pheromone traps and how to use them properly, and a very clear understanding of why those flying moths you keep seeing might not even be the problem.

A Small Confession

I did tell you exactly how long I have been writing this book, I was going to make you read through the big, long book before you got the answers

I had a meeting with our Sales Director Karen the other day and she said thank you for teaching her how to get rid of clothes moths, it was brilliant, and by the way it works on all sorts of other critters too, not just moths, mosquitoes, the lot.

My Brain's Subconscious

And then the next morning I woke up with my brain's Subconscious working on stuff all night it said "**give the readers the solutions in the beginning of the book"** then waffle on about all the other stuff. If you want to know about the power of the Subconscious, Coincidences, Flukes and how Psychoneuroimmunology affects our health.

My real passion is not Moths and Butterflies. When you have had enough playing in this stuff, go play at our other website and find out what your Subconscious does to your life and other freaky stuff.www.project30.org.

My daughter was right.
But do not tell her

I am going to give you the solutions to your moths first and then the waffle second. A TikTok at the start, well, a five-minute to 10-minute read.

I hope the rest of the book will be fun and rewarding, especially when you get to the bit about hatching Monarch butterflies. A little green education never hurt anyone.

Mildly Important Stuff Before You Start

Removal of Glue from Your Cat

This is the question we get asked the most, how we get the **glue off**. And I think once it was off a cat. So please don't put the trap anywhere your cat, dog or other pets can get to them. Just a little reassurance the traps are completely safe and nontoxic, someone said the traps have the food value of Wettibix. But no please don't eat them.

So, this is how you get the GLUE OFF, **Vegetable oil**, yes it's that simple. People have tried all sorts of things that don't work. The manufacturer recommends vegetable oil. Test the material or fur first.

When You Can’t Peel the Paper

If you can't peel the backing paper off relatively easily, its usually just the hot weather making the glue too sticky. Pop the trap in the fridge for an hour or so — it firms the glue right up and the paper will come away easily.

The One Trap Rule

You only need one trap per pantry or cupboard area. One trap per ten square metres. More is absolutely not better. In fact, too many pheromone sources in one small space can actually confuse the moths, like a bloke walking into a room full of women all wearing the same strong perfume. Overwhelming and completely directionless. One fresh trap. That is it. And do not leave old traps sitting around alongside new ones. I love starting a sentence with And. Mr Lizzette (My English teacher), Bless his soul, said never start a sentence with And.

Moths Sunbathing

Moths are extraordinarily temperature sensitive. No breeding happens below 18 degrees Celsius. Depending on where you live, you may not need to monitor all year round, because the breeding cycle only activates when the temperature climbs above that magic number. Sorry to all you heat pump and air conditioning people. For you it may very well be a year-round situation.

What Other Companies Shouldn’t Do

This is from one of the world’s leading Moth trap manufacturers. The moth traps should be in sealed packs, not just unsealed boxes as the active ingredient will lose its effectiveness if not in a sealed pack.

From our manufacturers in China:

“The pheromone trap **do** need a foil pack, or the pheromone can be released slowly.

That normally cause two problems.

1. It is a long-term transportation between final customers and the moth trap factory, as the pheromone released slowly, the trap may lose or reduce its attraction performance to its target species when final customers get the traps.

2. A tiny pheromone can affect its target species activities, so when the trap on the shelf without foil bag, but release tiny pheromone slowly, moths from inside or outside the store will fly to that shelf or nearby.”

Translated from original.

That's why we need that foil bag to protect the glue trap and the pheromone.

Moth Ball Lovers Are Nuts

I wanted to do a funny cartoon for this but couldn't find anything funny about it.

Moth balls cause nausea, vomiting, abdominal pain, seizures, and coma. They can damage red blood cells, causing kidney damage and many other problems.

Why Do Children Eat Mothballs?

Mothballs look exactly like sweets or candy. A crawling toddler finds one on a wardrobe floor and puts it straight in their mouth. Children have been poisoned by wearing wool clothing stored with mothballs. They do not even need to swallow one — skin contact through wearing clothing stored with mothballs can cause poisoning.

Did you read the bit above about wearing clothing stored with mothballs? We can absorb the nasty stuff through our skin.

Aussies and Yanks Need to Catch Up

Kiwis flying ahead again.

New Zealand — Banned since 2014.

European Union and UK — Banned since 2008.

China — Domestic ban since 1993, though still exported. Very interesting.

USA — Regulated but not banned. Illegal to use outdoors or in non-airtight containers. Airtight containers? How will that work?

Australia — Restricted. Must be in child-resistant packaging. How crazy is this? *What happens when one opens the packaging?*

Re 2025 to 2026 Trend: Recent reports from the Australian Poisons Information Centres (131 126) show that while accidental paediatric **(Children)** ingestions — remain steady at roughly 30 to 50 cases annually per major state, there has been a push for tighter behind-the-counter restrictions to curb intentional misuse.

How Many Problems in the Whole Of Australia?

30 to 50 cases annually per major state, that doesn't sound so bad but, for the whole of Australia 180 to 220 cases annually. Now that sounds impressively bad.

In the United States, mothballs are regulated by the EPA. It is a federal offence — **yeah right!** — to use them in any way that deviates from the label, for example placing them in gardens to repel snakes or in attics for squirrels. I am sure little kids looking for candy will read the labels.

Poison Control Data: According to the American Association of Poison Control Centres (AAPCC), thousands of mothball-related calls are processed annually.

Now this is even more interesting

Well, I think so.

A significant portion of reported cases in the USA involves G6PD deficiency, a genetic condition more common in African American and Mediterranean populations.

In these individuals, even the smell of mothballs can trigger haemolysis — the destruction of red blood cells — leading to jaundice and kidney failure. **Come on America, what are ya doing?**

Inhalation Hazards: Many US cases result from secondary exposure — children sleeping in rooms where clothes were stored with mothballs but not properly aired out. The EPA currently classifies naphthalene as a Possible **Human Carcinogen**.

Equally interesting but more serious.

Reported total paediatric — children — exposures and poisoning: Approximately 4,000 children are exposed to mothballs annually. This does not include unreported exposures.

PART ONE -Let’s defeat your moths first

Let us turn you into a Moth buster

It’s all about Moth Birth Control

My daughter got her way the solutions are in the first part of the book.

The Infamous Pantry Moth

Photo by: Fvukajlovic. Licensed under Creative Commons CC-BY 4.0

My very own pet larvae

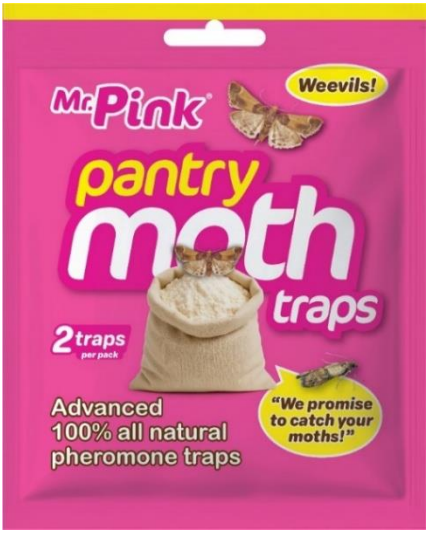
We recently had a customer who said that Google Lens said they had caught Brown Moths on their trap in the pantry. That's possible the treatment is the same as below. We do catch other things at times like cockroaches, other insects and cats.

Have you got these? You got pantry moth larvae.

First, we suggest you to use Mr Pink Pantry Moth traps: the no mess, perfectly safe, odourless solution to breaking the moth life cycle. The all-natural pheromone-based trap has absolutely no poison or pesticides, and it should get rid of or bring your moth infestation firmly under control.

I really didn’t want to make this book with ads, but you need to know what the good traps look like.

Not all moth traps are created equal.



Our Sparkly new pink artwork, same catching stuff but more Mr Pink

People are amazed how good these traps work, often instantly.

Pheromones are Your Secret Weapon?

The moth traps use pheromones to attract the moths. What are pheromones, you may ask? Pheromones are chemical signals that insects, animals, and even humans produce naturally to communicate with each other.

Think of them as nature's text messages, except instead of "running late, be there in five," the message is considerably more exciting and involves considerably less clothing. Female moths release these chemical signals specifically to attract a mate, and male moths have evolved antennae so finely tuned to detecting them that they can pick up a single molecule from metres away.

It is, when you think about it like, the most impressive dating app ever invented, and it has been running without a software update for 300 million years.

The synthetic pheromones in your Mr Pink trap work exactly like the natural ones. The male moth thinks yahoo, here we go, off to find this very attractive female. He follows the scent. He lands on the trap. That is the end of his love story, and the beginning of yours.

The pantry moth and the clothes moth are two completely different species, which means the pheromones used are different for each, and each trap only attracts its specific moth.

Do not put Clothes Moth Traps in your pantry, obviously not! But there are those who have

Do not put Pantry Moth Traps in your wardrobe, obviously not! But there are those who have.

Moths Do it, Monkeys in the Zoo Do it

Here is a fact that often stops everyone in their tracks: adult moths do not have mouths. They cannot eat anything. And Ai said to leave this bit out, but I think it's funny. Moths only have one opening, remember they do not have mouths. That one opening is for reproducing.

Moths don't have Mouths, …It's the larvae that do the damage

The moths lay eggs which develop into larvae that grow and eat your food. They can chew minute holes through plastic, paper, and cardboard packaging, and people are often genuinely surprised to find an infestation in what appeared to be an unopened product. They are dedicated little creatures; I will give them that.

Pantry moths will contaminate almost all dry foods including cereal, grains, beans, nuts, flour, dried fruit, seeds, spices, porridge, pet food, herbs, and yes, even chocolate and sweets. Nothing dry and edible is beneath their consideration.

Dried pet food is one of the worst culprits. If you store pet food in the garage or a separate area, you need a Mr Pink Pantry Moth trap there as well.

You know you have an infestation when you see moths flying out of cupboards, or when you spot what looks like fine cobwebbing inside food packets. You may also find larvae, which look like tiny worms, or pupae, which look a bit like a fly maggot.

Also check the threads on screw-top jars and the grooves on clip-on lids. Moths love laying eggs in those little grooves because they know perfectly well that nobody ever thinks to look there.

OCDers, It is Not a Huge Clean

It is probably not a huge clean unless you are OCD like me.

Before placing your trap, do the cleaning or if you hate cleaning get someone else to do it but give them strict instructions. There is a video on our website.

If you have adjustable shelves, check the little holes in the sides of the pantry. You will very likely find what looks like cobwebs in some of them. Those are larvae. Clean every hole out with a toothpick or something similar. Some people find this oddly satisfying, a bit like the world's most justifiable pimple-popping exercise. You do what works for you.

Now look in the cracks where the shelves join the walls, above and below, and check the ceiling and floor of the pantry. Larvae are commonly found in all these spots because moths specifically choose the places you are least likely to clean. With your toothpick or similar, work along all these areas. Then afterwards wipe everything down thoroughly with your preferred cleaning product.

Don't Be Stupid

Don’t throw out your food. Here is something that is going to save you a small fortune and possibly a minor nervous breakdown. You do not need to throw out your entire pantry.

I have watched people in the grip of moth-related panic fill three bin bags with perfectly good food, spend two hundred dollars replacing it, and then find moths again three weeks later because the actual source was a forgotten bag of bird seed in the garage.

Panic is expensive and almost always misdirected. Before you start making dramatic gestures toward the recycling bin, take a breath.

Here is the other thing nobody ever tells you, and I want you to sit with this for a moment before you react. You have been eating moth eggs your entire life. So has everyone you have ever shared a meal with only sometimes cooked.

They are microscopic, they are present in commercially produced flour, rice, cereals, and grains as a completely normal feature of the food supply, and your stomach acid destroys them before you have finished swallowing. You have not been harmed. You will not be harmed. The eggs you have already eaten are not the problem. The eggs that are hatching in your pantry right now are the problem. Focus your energy there.

How Not to be Stupid

Definitely throw out anything with larvae actively crawling in it, anything heavily contaminated that you cannot face eating, opened packages that moths have clearly been enjoying, and honestly, anything that gives you the absolute creeps. You are allowed to draw that line wherever feels right.

You can save anything in tin cans or glass jars with intact seals, because moths cannot get through those. You can save unopened packages that show no signs of infestation. And for anything in between, here is your secret weapon.

Freeze their Balls

Place any questionable item in the freezer for overnight or a couple of days. This kills eggs (tiny balls), larvae, and pupae at all stages, completely and reliably. After that, the food is perfectly safe to eat.

You have eliminated the threat without wasting anything at all. It costs nothing, takes thirty seconds to organise, and works every time.

Where to Stick the Sticky Thing

Once you have done the cleaning and the toothpick work, place one Mr Pink Pantry Moth trap in the pantry area. One trap. Not several. The pheromone needs to create a single clear signal that male moths can follow. Multiple traps create confusion, not carnage.

You will find the pantry moth problem becomes less and less over time. Continue to monitor with Mr Pink Pantry Moth traps depending on the temperature and the season. Clear traps mean you are winning. A moth on the trap means you still have something to address, which is exactly the information you need.

The Even More Infamous Clothes Moth Triple Trouble

Photo by: Olaf Leillinger. Licensed under Creative Commons CC-BY-SA 2.5.

Photo by: Patrick Clement. Licensed under Creative Commons CC-BY 2.0.

And these little blighters we caught at our friend's place.

These moths only eat expensive stuff. Sometimes really expensive stuff. Which is what made us hesitant, because we needed a total solution before, we could sell it with a clear conscience.

Many years ago, before we took on the Clothes Moths, we did a fair bit of research into what was available to solve this problem — both on the internet and commercially — only to find that nobody really knew what to do.

Here's what nearly stopped us selling Clothes Moth traps altogether.

Most other sellers hand you a trap and leave you to it. You're sort of left in the lurch with only a partial solution. You put the traps in, catch a heap of moths, and think — yahoo!

Don't yahoo just yet.

There is the dirty little secret the others don't tell you: there are a couple of extra steps. Read on. Option 1 and 2.

You don’t need to identify the moths just put a Mr Pink moth trap nearby and you will find out if they are the ones that eat your clothes. The traps will not catch the others.

If you really want the waffle on these moths go to Really Get to Know the Wardrobe Wreckers

Why are clothes moths more infamous than pantry moths? Because they eat mostly expensive things. That is essentially the whole reason. A pantry moth infestation costs you food.

A clothes moth infestation costs you the cashmere jumper your mother brought back from Scotland, the silk scarf you saved up for, and the wool rug that cost more than your first car. They have exquisite taste and absolutely zero shame about it.

The Traps are bigger than they Look

We are going to use Mr Pink Clothes Moth traps: the no mess, perfectly safe, odourless solution to breaking the clothes moth life cycle. All-natural pheromone-based, no poison, no pesticides.

Oops, another ad. But our traps do work, every single time 100% we have never had a failure.

Our Sparkly new pink artwork, same catching stuff but more Pink.

Our Sparkly new pink artwork, same catching stuff but more Pink.

Who Is Actually Doing the Damage

Here is the fact that stops everyone in their tracks: adult moths do not have mouths. They cannot eat. They do not eat your clothes. What eats your clothes is the larvae, the tiny caterpillar-like creatures that hatch from moth eggs and immediately begin feeding.

The larvae look a bit like small fly maggots making their way purposefully around your wardrobe, feeding up big time on anything made of natural fibre. They are, it must be said, fairly gross. Though not quite as gross as an actual fly maggot. Small mercies.

Generally, it is wool, cashmere, cotton, silk, linen, and other natural fibres that get eaten.

Sometimes They Eat Your Undies

Synthetics are not entirely immune. If a garment has been worn and put away unwashed — think gym clothes, underwear, anything with sweat or body oils on it — moth larvae will chew straight through the synthetic fabric to get to whatever you left there. The organic residue on the fabric is enough to make it worth their while.

The Trap Tells You Everything

The Mr Pink clothes moth traps will help break the breeding cycle and, crucially, tell you whether you have a problem. One moth on your trap. That is all it takes. One moth means there is a breeding population somewhere. If you have caught moths on the trap, or if you have holes appearing in your clothes, you need to take further action. There is really no way around this.

Aussie Clothes Moth Traps, Really Smelly

Many of our Aussie cousins and mates are being sold, in my opinion, really awfully smelly— a plastic cassette that sits in your wardrobe continuously releasing an insecticide vapour, and an awful smell, all around your clothing.

The active ingredient is Transfluthrin, a synthetic pyrethroid insecticide designed to slowly evaporate inside enclosed spaces such as wardrobes and cupboards. These products are approved for sale and, used as directed, meet the regulator's requirements.

Here's my issue, and it's a personal preference rather than a laboratory finding. That vapour is released into the very space where your clothes live — the clothes that then sit against your skin all day, every day. And I'd simply rather not have a pesticide quietly evaporating onto my jumpers when there is a way to catch moths that releases nothing onto your clothing at all.

That is the whole appeal of a Mr Pink pheromone traps. It attracts the moths to the trap and to nowhere else. No vapour. No spray. No mystery smell in your good coat. Nothing on your skin.
Remember the mothball chapter? Now, I am not saying this is the same thing, because the chemistry is completely different but it did leave me with a lasting preference.

If I had known what was going on in Australia, we would have crossed the Tasman much sooner.

Option One: Bomb It!

Open your drawers and wardrobe, separate the hanging clothes as much as possible so air can circulate between them, close the wardrobe door or seal off the space, and let off an insect bomb or flea bomb.

Read the instructions, take all precautions as stated on the product, then go out for a couple of hours. When you come back, open all the windows and ventilate thoroughly. This kills everything crawling around in your wardrobe, including the moth larvae doing the damage.

Option Two: The Automatic Thingy

The nuclear option, but safer, use an automatic insect control system with natural pyrethrins, or the stronger synthetic version if you are happy to go down the less green path. These devices are readily available from supermarkets and hardware stores. You set them to spray a measured amount at timed intervals, typically every twelve to twenty-four hours. This kills all the creepy crawlers, including the moth larvae, on a continuous basis until the infestation is cleared.

The Never-Ending Story

Once you have treated the wardrobe, get fresh Mr Pink Clothes Moth traps and monitor. If it is summer, your traps should be clear. If it is winter, your traps should be clear. Clear traps mean you can turn the automatic sprayer off and simply monitor going forward.

If you catch moths again, yes even one moth, turn the sprayer back on until the traps are clear again. Continue using Mr Pink Clothes Moth traps to monitor once all the moths have been eliminated, and to make absolutely sure the problem does not creep back.

Winter Woolly Baggers

Are you a Winter Woolly Bagger? If not, you should be. The principle is beautifully simple and costs you nothing except a box of zip-lock bags and one night of freezer space. Before you pack away your woollens for summer, pop them in zip-lock bags and stick them in the freezer overnight.

This kills any eggs or larvae that have had the audacity to set up home in your favourite jumper while you were wearing it. Then seal the bags back up and store them just like that for the whole summer.

No moths can get in. No eggs can hatch. No larvae can eat. Your cashmere emerges in autumn exactly as you left it, hole-free and deeply grateful. It is the simplest, cheapest, most effective seasonal storage trick in this entire book, and the only qualification required is owning a freezer big enough to fit a jumper. Which, if you are a Winter Woolly Bagger, you absolutely make room for.

One Trap Is All It Takes Per Room

Yes, this is a repeat, just a reminder. That is, it for the home wardrobe situation. One trap per room. Not one per shelf. Not one per drawer. One per room or area. Remember the confused bloke in the room full of identical perfume? One clear signal works. A dozen competing signals achieve nothing except a lighter wallet.

Washing and Heat Treatment

Any items that can be machine washed should be washed at 60 degrees Celsius minimum. This kills all life stages of carpet beetles reliably and completely. Items that cannot be washed can be dry cleaned, left in direct summer sun for a full day —in direct sun is sufficient to kill eggs, larvae, and adults. The freezer trick works here too: a couple of days at minus 18 degrees kills everything.

A Note for Commercial Operators

Over the years we have had quite a few enquiries from woollen and natural fibre clothing manufacturer, woollen carpet and rug sellers, and all manner of similar businesses. The procedure is exactly the same as above. Just do not overdo the number of traps. One trap per ten square metres.

You might ask why. It is a bit like melatonin: more is genuinely not better, and past a certain point it actually becomes counterproductive. Oops melatonin my other cap sneaked in.

PART TWO: - Know your Enemy – The ones you've been blaming by mistake

Really Get to Know the other Wardrobe Wreckers

Unlike their attention-seeking pantry cousins, clothes moths are the introverted ninjas of the moth world. They prefer the quiet solitude of your wardrobe and rarely venture out into the open. You might have a serious infestation and never actually see an adult moth flying around. They are sneaky like that.

There are over 1,650 species of moth in New Zealand and only three of them eat your clothes. Three. The rest are outside doing their ecological jobs, completely unbothered by your knitwear. But those three are entirely committed to the task and very good at it.

We know all three are operating in New Zealand homes because we caught them. On the same trap. In the same wardrobe. With clothing damage right there as evidence. The Mr Pink clothes moth trap catches all three species, which matters because most standard traps are formulated only for the Webbing Clothes Moth. If your previous trap was catching nothing and you still had damage, now you know why.

The Webbing Clothes Moth (Tineola bisselliella) is the international superstar of textile destruction. Golden or buff coloured, six to eight millimetres long, with a permanently startled expression it has thoroughly earned. Its larvae spin silky webbing tunnels through wool, carpets, fur, and clothing — often the first sign something is wrong before the holes appear.

The Case-bearing Clothes Moth (Tinea pellionella) is equally destructive and possibly sneakier. Its larvae build a small portable case from silk and stolen fabric fibres and drag it from meal to meal. If you find what looks like a tiny sleeping bag made of wool in your wardrobe, you have found your culprit.

The Black Monopis Moth (Monopis) has the greatest common name in the history of pest identification: the Dead Sheep Moth. Its larvae evolved to feed on carcasses, birds' nests, and dried animal remains in paddocks. Your wool rug is essentially the same thing in a considerably nicer setting. Darker than the other two, with blackish-grey forewings and a distinctive pale marking along the back, it is striking for something under two centimetres long.

It is found throughout New Zealand and Australia and was caught on our trap alongside the other two with clothing damage present. We believe this may be the first time it has been documented in this context in New Zealand in print.

One useful distinction: unlike its colleagues, the Black Monopis is attracted to light. If you have been finding unfamiliar dark moths near your lamps at night and assuming they were harmless garden visitors, it is worth a second look.

Other Fabric Felons

You have done everything right. You have deep-cleaned the wardrobe. You have set the traps. You have frozen the what you can and washed everything you can before storing it. Sunlight drying or airing can help.

Before you conclude that the moths have outwitted you, consider this: sometimes it is not moths at all.

There are other creatures in your home that cause exactly the same kind of damage, live in exactly the same places, and get blamed far less often because moths have better PR and a longer criminal record.

This chapter is about those creatures, because misidentifying your pest is expensive regardless of which pest it is.

Meet the rest of the rogue's gallery.

Carpet Beetles

The Great Moth Impersonators

We are moth people and hear Carpet beetle stories quite often. If you want to see what they look like, please Google them.

If I had a dollar for every time someone blamed moths for damage caused by carpet beetles, I could retire somewhere pleasant and spend my days doing absolutely nothing related to pest control.

Carpet beetles are responsible for an enormous proportion of fabric damage in New Zealand homes, and they receive almost none of the credit, or blame, depending on how you look at it.

The reason they escape notice is simple: they cause identical damage to clothes moths, live in identical places, and are even harder to spot because the adults are tiny, round, and spend most of their time near windows rather than skulking in wardrobes.

People see the damage, assume moths, treat for moths, wonder why nothing improves, and never consider that they may have been fighting the wrong creature the whole time.

What They Look Like

The adult carpet beetle is a small, round beetle, usually only 2 to 4 millimetres long, often with a mottled pattern of white, brown, and black scales on its back that makes it look like a tiny, confused tortoise.

You will most commonly find adults on windowsills and near light sources, because unlike clothes moths they are attracted to light. If you are finding small round beetles near your windows in spring and summer, that is your first clue.

The larvae, however, are what you really need to recognise. They are the ones doing the damage, just as with moths.

Carpet beetle larvae are 4 to 5 millimetres long, oval-shaped, and covered in distinctive bristly hairs that make them look like tiny bad-tempered hedgehogs. This is the key difference from moth larvae, which are smooth and pale and worm-like. If the thing you are finding in your carpet or clothing is hairy, it is a carpet beetle larva. If it is smooth, it is a moth larva. That single observation tells you everything you need to know about which battle plan to follow.

What They Eat

Essentially the same menu as clothes moths, which is why the damage is so easily confused. Wool, silk, fur, feathers, leather, and felt are all fair game. They will also eat dead insects, which clothes moths generally will not, and they are somewhat less fussy about natural versus synthetic fibres if those fibres are contaminated with food, sweat, or body oils.

One significant difference: carpet beetles tend to graze across fabric surfaces, creating irregular bald patches or thinned areas rather than punching through to make distinct holes. Clothes moths tend to eat through, making more defined holes. If the damage looks like something has been systematically eating across the surface of the fabric rather than through it, lean toward carpet beetles.

Where You Will Find Them

Carpet edges are their stronghold. Specifically, the edges under heavy furniture, along walls that rarely get foot traffic, under beds, and behind curtains. These are the undisturbed zones where carpet beetle larvae thrive because nobody vacuums there nearly often enough.

They are also fond of upholstered furniture, stored fabrics, and — and this is one that surprises people — bird nests. If you have birds nesting in or near your roof, you may have a regular supply of carpet beetles entering your home from that source.

The birds bring in feathers and organic material, the beetles establish themselves in the nest, and then they wander. Check for bird nesting activity if you have a persistent carpet beetle problem that keeps returning despite thorough treatment.

How to Tell Carpet Beetles from Clothes Moths

The Quick Test

Location of adults: Adult clothes moths avoid light and are found in dark corners of wardrobes. Adult carpet beetles are attracted to light and found on windowsills. This is the fastest test.

Larvae appearance: Carpet beetle larvae are hairy and bristly. Moth larvae are smooth and pale. Catch one if you can and look at it closely.

Damage pattern: Carpet beetles graze across surfaces creating bald patches. Moths eat through fabric creating holes. Look at the shape of the damage.

Location of damage: Carpet beetles tend to focus on carpet edges and the underside of rugs. Moths cause more widespread wardrobe damage. Where the damage is concentrated tells you a lot.

Getting Rid of Carpet Beetles

The good news is that if you have already followed the clothes moth elimination process as per earlier in the book, you are most of the way there. The strategies overlap significantly. The main differences are worth knowing.

Vacuum as Though Your Life Depends on It

For carpet beetles specifically, the vacuum is your most important weapon. Focus relentlessly on carpet edges — right up against every wall in every room, particularly in areas that do not get much foot traffic.

Get under furniture. Get under rugs. Get along every baseboard. Carpet beetle larvae hate disturbance. Regular, thorough vacuuming is not just a cleaning measure here, it is a direct attack on the population.

Immediately empty the vacuum outside after every session. Larvae are viable in the bag or canister, and you do not want them back in your home.

Lift the Carpet Edges

This step is non-negotiable and most people skip it. Carpet beetles love living underneath carpet edges, particularly in corners and along walls where the carpet is rarely disturbed. Gently lift the carpet edge and look underneath. You are looking for larvae, the shed skins they leave behind as they grow, frass, and adult beetles. If you find evidence, vacuum thoroughly underneath, including the floor beneath. This is where a significant proportion of the population lives and it is the area most missed during treatment.

The Powder Treatment

Here is where carpet beetle treatment diverges most noticeably from moth treatment. Carpet beetles respond very well to insecticidal powder applied along carpet edges and in affected areas. Flea powder, available from any supermarket or hardware store, works effectively on carpet beetle larvae and is considerably easier to source

than specialist carpet beetle products. Sprinkle it along carpet edges, work it gently into the carpet fibres with a brush, leave it for 24 to 48 hours, then vacuum thoroughly.

Diatomaceous earth is the natural alternative, available from garden centres. It works by physically damaging the waxy coating on the larva's body, causing it to dehydrate. It is slower than insecticidal powder but effective with repeated application and entirely safe around children and pets once it has settled.

Prevention Going Forward

Regular vacuuming is the single best long-term defence against carpet beetles. They cannot establish populations in areas that are frequently disturbed. Weekly vacuuming with particular attention to edges and under furniture will prevent reinfestation more reliably than any other single measure.

Keep windowsills clean. Adult beetles congregate near light sources and windowsills are their preferred gathering point. Catching adults before they move into the home proper gives you an opportunity to interrupt the cycle before larvae are established.

If you have birds nesting in or near your roof and carpet beetle problems keep returning, address the nest situation. It is almost impossible to maintain a carpet beetle-free home if there is an active nesting site providing a continuous supply.

Silverfish: Sneaky little s…..

Fast, silvery, and deeply unpleasant to find in your bathroom at midnight. But far less destructive than moths.]

You have almost certainly seen a silverfish. They are the fast, flat, silver-grey insects that shoot out from behind the bathroom cabinet when you turn the light on at midnight, moving with the alarming speed of something that absolutely knows it should not be there.

They are, for the record, completely harmless to humans and considerably less destructive than either moths or carpet beetles. But they deserve a mention because they do cause some material damage and people often mistake them for something more serious.

What They Look Like

Silverfish are unmistakable once you have seen one. Flat, teardrop-shaped, covered in silvery metallic scales, with three distinctive tail bristles at the rear and long antennae at the front.

They move in a fast, wriggling motion that has been variously described as fish-like, unsettling, and the reason I now always turn the bathroom light on before entering. They are 12 to 20 millimetres long and entirely wingless.

What They Eat

Paper, cardboard, and book bindings. Wallpaper paste and the starch in wallpaper itself. The starch in cotton and linen fabric, which is where they occasionally cause fabric damage. Glue, particularly in book spines. Dead insects.

Their own shed skins, which is efficient if you choose not to think about it too carefully. They will not touch wool, silk, or the materials that moths and carpet beetles' target.

The fabric damage they cause is usually surface grazing rather than holes — they eat the surface sizing or starch finish off cotton and linen, leaving irregular yellowish or transparent patches rather than actual holes.

If you are finding this kind of surface damage on cotton or linen rather than on wool or silk, and you are finding it in damp areas rather than in your wardrobe, silverfish are a strong candidate.

Where They Live

Anywhere damp and dark. Bathrooms and laundries are their preferred territory. Under sinks. Behind tiles. In wall cavities near plumbing. In basements and garages with moisture problems. They need a humid environment to survive and will die quickly in dry conditions, which are perfectly comfortable in your well-ventilated wardrobe.

They are also drawn to paper and books, particularly in storage. Old boxes of books kept in damp conditions are a silverfish paradise and a source of ongoing damage to paper and bindings.

Getting Rid of Silverfish

These little beggars are primarily a moisture problem wearing an insect costume. The most effective long-term solution is reducing humidity in the areas where they live. Fix any leaking pipes. Improve ventilation in bathrooms and laundries. Use a dehumidifier in persistently damp areas.

Remove their preferred hiding spots by sealing gaps around pipes and fixing loose tiles. Without the humidity, they cannot survive, and no amount of treatment will solve a silverfish problem permanently if the underlying moisture issue remains.

For direct treatment, diatomaceous earth applied along skirting boards and in dark corners is effective and safe. Sticky traps placed in areas where you are seeing them will catch adults. Cedar-lined storage for paper items and books will deter them. Keeping bathroom and laundry areas well-ventilated and dry after use makes those spaces significantly less attractive.

The honest assessment of silverfish is this: they are unpleasant to encounter and capable of damaging paper, books, and the surface of cotton fabrics, but they are not in the same league as moths or carpet beetles when it comes to the scale and cost of damage they cause. If your only problem is silverfish, count yourself relatively fortunate. Deal with the moisture, use diatomaceous earth, and they will retreat.

The Woollen Carpet Controversy

If you have ongoing, persistent problems with clothes moths or carpet beetles, and you have woollen carpets, I need to say something that you are not going to want to hear.

You are fighting a losing battle

Not because you are doing anything wrong. Not because the treatments do not work. But because you have permanently installed the one thing these pests need most — food — wall to wall across every floor in your home, and no amount of treatment will change that fundamental fact. You can manage the population. You can keep it under control with sustained effort. But you will never be free of it, because the food supply is structural and inexhaustible.

The Case for Synthetic Carpets

Modern synthetic carpets — nylon, polyester, polypropylene — are completely unattractive to clothes moths and carpet beetles under normal circumstances. They do not eat synthetic fibres. They cannot digest them. A home with synthetic carpets removes an entire breeding ground from the equation and simplifies the pest control situation enormously.

Synthetic carpets are also generally cheaper than wool, more durable in high-traffic areas, far more resistant to staining, and available in every colour, texture, and style you could want. They do not fade as quickly in sunlight. They dry faster if they get wet. They do not require specialist cleaning. And moths will not touch them.

I am not in the carpet business and have no commercial interest in what you put on your floors. But I have spent fifteen years watching people fight endless, expensive battles with moths and carpet beetles in homes with woollen carpets.

I have watched those same people achieve immediate and permanent relief after replacing them. The evidence of my own experience is clear on the subject.

If You Are Keeping Your Wool Carpets

That is entirely your choice and there are legitimate reasons to keep them. Wool is warm, sustainable, naturally fire-resistant, and feels genuinely good underfoot. If you decide to keep it, you need to accept that ongoing vigilance is the permanent condition of your life and organise accordingly.

Vacuum thoroughly at least once a week, with specific attention to every edge and every area under furniture. Move furniture every few months and vacuum underneath it properly. Check carpet edges regularly for any sign of activity. Keep moth traps in rooms with wool carpet year-round as an early warning system. Have the carpets professionally cleaned annually.

Strategic furniture placement matters too. Heavy furniture sitting flat on wool carpet creates large undisturbed zones that are essentially moth and beetle incubators. Furniture with legs rather than flat bases allows some air circulation. Shifting furniture even slightly every few months breaks up established colonies before they become serious infestations.

This is not impossible. Plenty of people maintain wool carpets without serious pest problems. It simply requires consistent effort over time rather than occasional bursts of panic cleaning when damage appears. Decide whether that commitment fits your life, and plan accordingly.

Knowing Your Enemy: The Summary

The damage is the same. The locations are often the same. But the creatures causing it, and therefore the most effective responses, are different enough that correct identification saves you time, money, and considerable frustration.

If adults are found near windows and on windowsills: carpet beetles. If adults are found skulking in dark wardrobe corners: clothes moths. If damage is on carpet edges and upholstered furniture: think carpet beetles first. If damage is in hanging clothes and stored woollens: think clothes moths first. If damage is surface grazing on cotton and linen in damp rooms: silverfish. If larvae are smooth and pale: moths. If larvae are hairy and bristly: carpet beetles.

Get the identification right and everything that follows becomes straightforward. Get it wrong and you will be cleaning the wrong places, treating with the wrong products, and wondering why the problem persists despite everything you have done.

You now have the complete picture of every fabric pest you are likely to encounter in a New Zealand home. Moths, carpet beetles, silverfish — their appearance, their habits, their damage, and their weaknesses.

Part Three: The Real Magic in the Good Moths

The beauty and astonishing facts that you can read to your Children and Grandchildren.

I really hope you enjoy the next stuff!

Right. The immediate crisis is under control. Now let us find out who these creatures are, why they do what they do, and how to make sure they never get comfortable in your home again. The more you understand about moths, the better you get at fighting them. And some of this, I promise you, is genuinely fascinating.

Mothing Is the New Bird Watching

Turns out we are not the only ones getting weirdly obsessed with moths. There is an entire global movement of people photographing them, and it has a name: mothing. Yes, really.

During National Moth Week alone, over 168,000 moth sightings were shared on iNaturalist by nearly 31,000 people across the world, covering more than 8,400 species. Somewhere in Türkiye, someone photographed a stunning pink moth that has only ever been recorded twelve times in the history of the platform.

So next time someone gives you a funny look for caring this much about moths, you can tell them mothing is basically the new bird watching, except your subjects show up at your porch light for free and never fly south for winter.

Take your kids to iNaturalist and play.

A Word on Value

This book could save you thousands of dollars and I am not exaggerating even slightly. A single cashmere jumper can cost two hundred dollars. A quality wool rug? Easily a thousand. Replacing a pantry full of contaminated goods? Another few hundred. Professional pest control? Do not even get me started.

For less than the cost of a fancy coffee you are getting fifteen years of hard-won expertise delivered with as much humour as I can manage. Think of it as the best investment you will make this year, except for a really good cheese toastie maker.

Still Here? Excellent

You have been warned that this is not a two-minute read. You know the author is dyslexic, possibly slightly mad, and absolutely obsessed with both eliminating bad moths and protecting good ones. You understand you are about to invest a little time in becoming a proper moth-control expert and learning some useful stuff to save our planet. Don’t ya love it when the Ps and Bs get mixed.

I Bet You Didn't Know This!

Picture the scene. September 1945. The war is over. The world is beginning, cautiously and gratefully, to imagine peacetime. And in a room at Harvard University, one small moth is about to achieve something no general, scientist, or world leader managed across six years of global conflict. It is about to change the English language forever.

Our protagonist was not seeking glory. It was not making a statement. It was doing exactly what moths do: looking for somewhere warm and interesting to have a little rest.

What it found was the Harvard Mark II Aiken Relay Calculator, a room-sized computer roughly the dimensions of a tennis court and considerably less fun to play with. To a moth, it must have looked like the most elaborate, warmly buzzing piece of modern art ever constructed.

It settled between Relay Number 70 on Panel F. The machine stopped. The calculations ceased. The digital future of humanity was placed on hold by an insect the size of your thumbnail.

The first 'computer bug' a Moth - taped into Grace Hopper's logbook, September 9, 1945

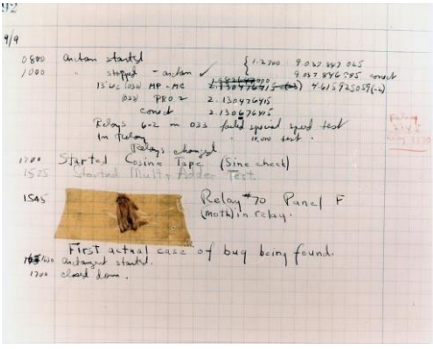


Image courtesy of Naval Surface Warfare Center, Dahlgren, VA via Wikimedia Commons

Grace Hopper at the UNIVAC keyboard, June 1967. Licensed under Creative Commons CC-BY-SA 3.0.

Enter Grace Hopper

Enter the brilliant Grace Hopper, Rear Admiral in the United States Navy and pioneer of computer science. Faced with a malfunctioning mechanical brain, she and her team did what any good engineer does: they looked for the problem. They found it. There, wedged in the machinery with the absolute confidence of a creature that did not understand why this was unacceptable, was the moth.

It was removed with tweezers and taped into the official logbook. Beside it, in handwriting that has since become one of the most reproduced notes in computing history, someone wrote: "First actual case of bug being found."

From that day forward, any mysterious malfunction has been called a bug, and fixing it became debugging. The next time your laptop crashes at the exact moment you have not saved your work, spare a thought for that small,

adventurous moth. It may have been the first, but it was certainly not the last.

It is the most famous thing a moth has ever done, and the moth did not survive to enjoy the recognition. This seems about right.

Moths Scienced

Moths belong to the order Lepidoptera, from the Latin and Greek for scaly wing. This order is the second largest insect group on Earth, with over 160,000 described species. Here is something that might surprise you. Butterflies make up only five percent of that family. They are essentially day-flying moths with better public relations.

Think about that for a moment. Butterflies get all the glory — the pretty gardens, the children's books, the positive associations. Meanwhile, moths do most of the actual pollination work at night and get blamed for every hole in every jumper. It is the ultimate PR failure.

Now you are up to the pretty stuff.

Kahuku, The Monarch Butterfly

One of the Most Spectacular Things on Earth

Read on and I still shake my head about the little bag of slush.

Let’s spread the wonder and beauty.

What is the connection with moths and butterflies.

A person who buys a moth trap to protect their cashmere collection might also, given the right encouragement, grow beautiful butterflies. For you, your children, grandchildren …and Great, Great, Great, Grand Children watch something extraordinary happen in the garden. Me being silly!

I know the Great, Great, Great, Grand Children is something. Let me explain if you don’t get it. If you start this maybe a legacy for you GGGGG Children, hundreds of years into the future if you teach the love and fascination of Monarchs

I maintain that the Monarch butterfly is the most compelling argument I know for paying attention to the natural world at the domestic scale.

Kahuku, Monarch Fuss

The Monarch butterfly, Danaus plexippus, is New Zealand's largest butterfly, with a wingspan of up to 110 millimetres. Those vivid orange and black wings are not decorative. They are a warning.

The caterpillars feed exclusively on swan plants, and Milk weed in other parts of the world, which contain toxic compounds that accumulate in the butterfly's body and make it poisonous to most predators.

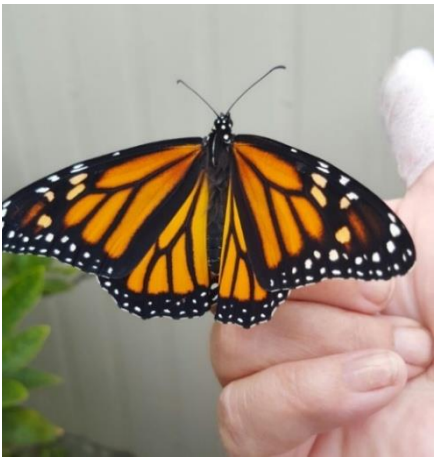
If you are in other parts of the world, **Welcome!** do this Monarch thing wherever you are or wherever there are Monarchs.

On with the story, if a bird that eats a Monarch and survives the experience learns very quickly not to eat another one. The orange and black colouring is the advertisement of that toxicity. It says: you know what I am, and you know what happens if you eat me. Most predators take the hint.

The Monarch arrived in New Zealand in the mid-1800s, believed to have blown across from New Caledonia and Australia via cyclones, arriving without help, without introduction, without anybody planning for it. (I did not know this!)

It simply appeared one day, found swan plants, found the climate broadly agreeable in the warmer parts of the country, and stayed. It is now considered a native species, a distinction it shares with almost nothing else that arrived in New Zealand after human settlement.

The Monarch earned its native status the hard way, by surviving on its own terms in an unfamiliar country for over 150 years.



A beautiful Female Monarch

An equally beautiful Male Monarch, spot the difference 2 spots

Not sure about the sore thumb?

New Zealand's largest butterfly. It got here by itself. We should probably help them now.

Is It a Boy or a Girl

The butterfly is sitting on your finger. Wings opening and closing slowly. Looking at you with the mild curiosity of something that has just dissolved into liquid and rebuilt itself from scratch. This is an excellent moment to work out what you have got.

It is easier than you think. Look above.

Look at the lower wings. The hindwings. If the butterfly is a male, you will see a small black spot on each one, sitting on a vein near the centre of the wing. One spot per wing. Two spots in total, one on each side. The female has no spots. None at all. Clean wings, nothing.

That is the entire identification process. Your butterfly is either spotty, or it is not.

Those spots are not decoration. They are scent glands, patches of specialised scales called stigmata that release pheromones during courtship. The male has a built-in cologne dispenser on each wing, which he deploys while flying close to a female to make himself more appealing. Whether she finds this charming is, as with most courtship rituals, entirely up to her.

The spots have a slightly soft or fuzzy edge rather than a sharp clean outline. Once you know what you are looking for you will see them immediately and wonder how you ever missed them.

If you want a second confirmation, look at the veining across both wings. Female Monarchs have thicker, darker, more pronounced black veins. The male's veins are finer and more delicate. This difference is harder to see without something to compare it to, so if you can only check one thing, check for the spots.

One practical tip for anyone raising Monarchs indoors. When a butterfly has just emerged and is still drying its wings, it is sitting still and the hindwings are easy to examine. Check then, before it is moving and less cooperative. Many people who raise Monarchs keep an informal tally of males and females released each season. It turns out to be more satisfying than it has any right to be.

The Baby Arrives

The Monarch lifecycle is the same four-act story we covered in the early chapters of this book on Moths, eggs hatching into larvae, larvae pupating, adults emerging.

The difference is that in this version, the larva wears spectacular striped pyjamas in yellow, black, and white, and the adult that emerges is so beautiful that people specifically design their entire gardens around attracting it.

A female Monarch can smell a swan plant from two kilometres away. She lays between 300 and 400 eggs in her lifetime, placing them individually on the underside of new growth, each one cream-coloured, ridged, and smaller than a sesame seed.

After five days or so the egg darkens as the caterpillar inside develops, and then the tiny larva eats its way out, consumes the eggshell for nutrients, and immediately starts eating the swan plant. This is a creature that begins its life by eating its own house and then looks for more. You must admire the commitment.

What follows is approximately two weeks of eating so committed and so continuous that it is difficult not to respect the focus involved. The caterpillar grows through five instars, shedding its skin each time it outgrows it, and in ideal conditions it grows to roughly 2,700 times its birth weight during this phase.

If a human infant grew at the same rate, they would weigh several tonnes before their first birthday. The caterpillar also produces, during this phase, a considerable quantity of frass, which is the technical entomological term for caterpillar droppings, poop.

This is mentioned here because anyone raising Monarchs indoors will need to be comfortable with the word and especially the reality it describes. There is a lot of it. Far more than you would expect from something that small. Plan accordingly.

When the caterpillar is ready to pupate, it wanders for a few hours looking for the right spot, attaches itself by its tail to a silk button, hangs in a J-shape for a day or so, then sheds its caterpillar skin one final time to reveal the chrysalis beneath.

The chrysalis is jade green with a row of gold dots near the top that look as though they were placed there by a jeweller. I am not exaggerating this for effect. Every person who sees a Monarch chrysalis for the first time — and the hundredth time — says something to the effect of are those real. The answer is yes. Nobody is entirely sure why they are there. It is one of the small mysteries that makes the natural world considerably more interesting than it has any obligation to be.

Brace yourself. Because what happens inside that neat little green parcel is so scientifically outrageous that I need you to really think about it.

The Bag of Slush

The Scientific Outrage Inside Every Chrysalis

Just think about this and how fantastic it is!!!

The caterpillar does not become a butterfly. It becomes a bag of slush first. Not metaphorical slush. Actual liquid. Every organ it ever had — its gut, muscles, nervous system, every cell — breaks down completely. Scientists call it imaginal soup. I prefer bag of slush. More accurate, considerably more descriptive.

There are no wings in that bag of slush. No legs, no antennae, no butterfly waiting patiently inside like a Russian doll. Just liquid, hanging quietly, looking for all the world like absolutely nothing interesting is happening.

Then DNA does something so complicated that scientists still argue about the details, and out comes a Monarch butterfly. Same creature. Completely different animal. Built from scratch, from a bag of slush, in about ten days.

All this happens in your garden, and you and your family can watch it.

The next images deserve a page of their own, I was thinking of a page each.

The chrysalis really does have gold dots. Science is still working on the why. The wings and legs in their now see through capsule.

Freedom!! about to make the world a better place.

After around ten days, the chrysalis darkens. When it is almost black, you can see the butterfly's wing pattern through the casing, the orange and black visible inside like stained glass. Then, very quickly, the chrysalis splits, and the butterfly pulls itself out. Its wings are crumpled and wet. It hangs for several hours, pumping fluid through the wing veins, expanding and drying them in the air. And then, when it is ready, it flies.

This is the moment. If you are there when it happens, and you need to be paying attention because it happens fast, you will understand why I have been talking about Monarch butterflies.

It is one of the most genuinely extraordinary things you can witness in an ordinary New Zealand garden. It costs nothing except a swan plant and some patience. And it is better, in its way, than almost anything else a Tuesday morning can offer.

Just Plant a Butterfly

Plant a swan plant or several. That is the beginning and very nearly the end of the instruction. Swan plants, Gomphocarpus fruticosus, are available from most garden centres from spring onwards. They like sun and reasonable drainage. They do not require specialist knowledge or attention.

A female Monarch can detect them from two kilometres away, and if there are Monarchs in your area, they will find your plant. It is not a question of whether. It is a question of when.

Buy more swan plants than you think you need. This is the universal advice of everyone who has ever grown them, and it deserves to be stated plainly: a plant that looks substantial on Tuesday can be a bare stem by Friday. Monarch caterpillars eat with a ferocity that must be witnessed to be believed.

Three plants is a reasonable starting number. More is better. If you run out of swan plant midway through a caterpillar's development, you will need to source more very quickly, because a caterpillar without food will wander off in search of it, usually into somewhere inconvenient, like behind a bookcase or inside a shoe.

The main threats to your caterpillars are wasps and birds. Social wasps are particularly destructive and will take caterpillars from plants with ruthless efficiency during the summer months.

A mosquito net draped over the plant provides good protection at minimal cost. You can also bring caterpillars indoors once they have reached a reasonable size, housing them in a netted enclosure with fresh swan plant cuttings standing in water.

Important: cover the water container so caterpillars cannot fall in. Keep the enclosure warm and out of direct sunlight.

I built several big screen frames works about 3m long x 2m wide by 2m high. Some of the bloody wasps still got in and had to be dealt with.

Chrysalises Say Don’t touch Me

It’s hard to hear when they say it but do not touch it. The chrysalis stage requires no intervention whatsoever.

Do not move it unless you absolutely must. Then try not to.

Do not attempt to help the butterfly emerge if it appears to be struggling, because the effort of emergence is precisely what pumps fluid into the wings, and a butterfly that has been helped prematurely will have wings that never properly expand and cannot fly.

Nature knows exactly what it is doing here. Your job is to get out of the way and watch.

If you are doing the inside mothering job, when the butterfly is ready to be released, take it outside on a warm day and hold it gently on your finger. It will sit for a moment, testing the air, getting its bearings. And then it will fly.

There is a specific feeling that comes with this moment, particularly if you have raised the butterfly from an egg and watched every stage of its development.

I am not going to describe it at excessive length. I will simply say that it is very good.

What is killing Our Babies

Monarch butterfly populations in New Zealand have declined significantly in recent years, and the reasons are multiple: habitat loss, pesticide use, a parasitic protozoan called OE that causes butterflies to emerge with deformed wings, predation by introduced wasps, and the simple scarcity of swan plants in gardens that are increasingly planted for appearance rather than any ecological function.

Each garden that contains a swan plant is a small piece of Monarch habitat. Each caterpillar that successfully pupates and emerges as a healthy butterfly is a genuine contribution to a population under real pressure.

This is not a grand conservation gesture. It is one plant, in one garden, in one suburb. But the Monarch population in New Zealand is made up of exactly those individual plants and individual butterflies, accumulated across thousands of gardens, and each one matters in a way that is real even when it is modest.

Plant a swan plant. Watch what arrives. Raise a caterpillar if you get the chance. Release the butterfly when it is ready. Tell somebody what you saw. That is the entire programme, and it is available to anyone with a garden, a balcony, or a sufficiently large pot.

This is a Monarch butterfly egg and a newly hatched butterfly. This is the size of the caterpillar when the bloody wasps cut them in half and take them back to the nests.

North America Monarchs Fantastic Journey

Every autumn, something happens in North America that makes every other animal achievement look frankly pedestrian.

Monarch butterflies, weighing less than a paperclip, lift off from Canada and the northern United States and fly up to 4,500 kilometres to a single mountain range in central Mexico.

The oyamel fir forests of Michoacán, to be precise. They have never been there before. Not one of them.

The butterflies that make this journey are the great-grandchildren of the butterflies that made it last year, four generations removed, and yet they arrive at the same trees.

Just so you get this. 4,500 kilometres …… The butterflies that make this journey are the great-grandchildren of the butterflies that made it last year, four generations removed, and yet they arrive at the same trees.

Sometimes, according to people who study these things with the slightly stunned expression of scientists who cannot quite believe what they are looking at, the same individual trees.

They fly at heights of up to 3,000 metres, riding thermal currents with the casual confidence of creatures who have been doing this for millions of years, which they have.

They navigate using a combination of the sun, the Earth's magnetic field, and a time-compensated internal clock that adjusts their direction as the sun moves across the sky.

When they arrive in Mexico, millions of them pack into the forest so densely that the trees turn orange and the branches bend under their weight.

They cluster together through winter, barely moving, burning almost no energy, waiting for spring. Then they wake up, mate, and begin the journey north again. No individual butterfly completes the full round trip.

They pass the baton, generation by generation, across a continent, and somehow it works every single time.

Watch the Monarchs on YouTube

Watch with your loved ones or by yourself

The Magical, Mesmerizing Migration of Monarch Butterflies (TED)

Focus: Storytelling and Conservation. Photographer Jaime Rojo shares breathtaking visuals of monarch colonies in Mexico and discusses the latest research into how they navigate.

Monarch Migration and Metamorphosis (National Geographic)

Focus: Life Cycle & Cinematic Visuals. Part of the Incredible Animal Journeys series, this video provides high-definition footage of the butterfly's transformation and the start of its long trek.

Inside the Monarch Butterfly Migration Mystery (60 Minutes)

Focus: In-depth Reporting. Anderson Cooper explores the Sierra Madre mountains in Mexico to witness the "aerial journey" and investigates how these insects find their way to a place they have never been.

🎓 Educational & Scientific Explanations

Monarch Butterfly - Wonders of Life (BBC)

Focus: Navigation Science. A short but fascinating look at how monarchs use an "internal clock" and the position of the sun to navigate even on cloudy days.

Millions of Monarchs: A Journey Through the Winter Home (World Wildlife Fund)

Focus: Ecology & Habitat. Scientist Court Whelan takes you into the "groves" of central Mexico to explain the importance of these overwintering sites.

On Tiny Wings: The Monarch Migration (Florida Museum)

Focus: Conservation. Features experts discussing the spring migration north and practical ways viewers can help protect the species.

🧒 For Kids & Classrooms

Monarch Butterfly Migration Explained for Kids

Focus: Simple Facts. An easy-to-follow guide for young learners that explains the "why" and "how" of the migration with fun visuals.

How do monarch butterflies know where to migrate? (Mystery Science)

Focus: Inquiry-based Learning. A mini lesson that answers a specific student question about the mystery of monarch navigation.

The Amazing Monarch Life Cycle

Focus: Time-lapse. Narrated by the "Singing Zoologist," this video features brilliant time-lapse footage of the caterpillar-to-butterfly transformation, which is the precursor to the migration.

Pro-tip: If you want to see the migration in real-time, search for "Monarch Butterfly Migration Map 2024/2025" on YouTube during the fall (September–October) or spring (March–April) to find citizen science updates!

New Zealand Monarchs are Smart

New Zealand has its own Monarch migration, though our butterflies have looked at the North American version and sensibly decided that 4,500 kilometres is a bit much. Each autumn, Monarchs in New Zealand gather and move north, heading for warmer overwintering spots in the upper North Island, Northland in particular.

They cluster in the same trees year after year, sometimes in their thousands, which is a spectacle worth going out of your way to see and which most New Zealanders have absolutely no idea is happening forty minutes down the road.

The distances are modest by international standards, a few hundred kilometres at most, but the navigation is just as mysterious, the clustering just as dense, and the whole business just as improbable when you consider that the creature doing it weighs less than a paperclip and has a brain the size of a pinhead.

New Zealand Monarchs also benefit from our swan plants being available for longer than their North American cousins enjoy milkweed, which means our population can breed for more of the year. They are, in short, doing ok here, which is even more reason to plant a swan plant, leave it alone, and let them get on with it.

It is Quite Hard doing it Inside

But it shows you care and you will be remembered forever by your Children, Great Greats and even your neighbours.

The Hatchery

They seem to like Mr Pink Clothes pegs.

So complex and so beautiful

and they seem to love watermelon

The Inside Job

So, you want to bring them inside. Of course you do. You have watched the wasps dismantle three caterpillars in one afternoon with the cheerful efficiency of creatures that feel absolutely no remorse about it, and you have decided. Enough. You are taking this operation indoors.

You are going to do this properly. Welcome to the Monarch nursery business, a pursuit that is equal parts rewarding, occasionally heartbreaking, surprisingly messy, and perfect for children of any age, including adults who refuse to acknowledge that they are basically children the moment a chrysalis is involved.

The honest truth about raising Monarchs indoors is that it sits somewhere between easier than people say and harder than it looks, which is not a tremendously helpful answer but is at least an accurate one. It is entirely doable.

People do it successfully all over New Zealand every summer. It requires attention, reasonable hygiene, more swan plant than you will ever think you need, and the specific discipline of keeping your hands to yourself at critical moments. More on that shortly.

What You Actually Need

You need an enclosure. Butterfly castles, which are mesh cages with a zip opening, are available online and from some garden centres. A mesh laundry hamper from the two-dollar shop does the same job for considerably less money and has the added advantage of being large enough to actually move around in, which the caterpillars appreciate.

The mesh is not optional. You need airflow. A glass tank or sealed container builds up humidity, encourages disease, and will cause you grief. Breathable mesh gives your caterpillars the warmth and shelter they need without the conditions that make them sick.

You need swan plant. More than you have. More than you think you have. More than seems reasonable for a creature that small. A single large caterpillar in its final days before pupating will reduce a substantial swan plant to a bare stick in a timeframe that has to be witnessed to be believed.

Buy three plants before you start. Accept that you will probably need more. Always keep a spare plant outside under netting so you have something to raid when the enclosure plant is stripped at seven in the evening and the garden centre is closed.

Keep the swan plant stems in small cups of water inside the enclosure so the leaves stay fresh. Cover the tops of those cups with foil or a cloth so that a caterpillar cannot fall in. This sounds like the kind of precaution that only becomes obvious after something goes wrong. It is exactly that kind of precaution. Cover the cups.

The Hygiene Situation

This is the part that nobody leads with because it is not the glamorous side of butterfly husbandry, but it is the most important practical advice in this entire section. Clean the enclosure every single day. Remove the frass, which is the technical and deeply polite word for caterpillar droppings, and of which there is a quantity that will genuinely surprise you given the size of the creature producing it.

Remove any wilted leaves, any dead plant material, any moisture that has accumulated at the bottom. A dirty enclosure is a diseased enclosure, and a diseased enclosure produces butterflies with deformed wings that cannot fly, which is one of the more distressing outcomes available to you in this process.

The disease most encountered in New Zealand Monarch populations is called OE, a parasitic infection that is already present in the wild population and that spreads rapidly in captive conditions where caterpillars are in close contact.

You cannot cure it once a caterpillar has it. You can only prevent it from taking hold by keeping the enclosure scrupulously clean and not overcrowding. A few caterpillars raised well will give you better results than a lot of caterpillars raised in a busy, dirty enclosure. This is not a numbers game. It is a quality operation.

The Hands-Off Rule

There are specific moments in the Monarch lifecycle when the caterpillar or butterfly is so fragile that human contact can kill it, and these moments are predictable enough that you can plan around them if you know what to look for.

A caterpillar that has gone completely still and is hanging in a J shape from the top or side of the enclosure is about to become a chrysalis. This process begins within twenty-four hours of the J forming. Do not touch it. Do not move it. Do not reorganise the enclosure around it.

Do not pick it up to show someone. Walk away. Go and make a cup of tea. Come back in an hour. The transformation from caterpillar to chrysalis takes only a matter of minutes and happens so fast you will almost

certainly miss it regardless of how attentively you watch, which is nature's way of keeping you humble.

When the chrysalis is darkening and the butterfly's wing pattern is visible through the casing, emergence is imminent. This is one of the most extraordinary things you will ever see in a domestic setting, and it happens very quickly.

Again, do not help. A butterfly that appears to be struggling to get out is not struggling in the way that requires your assistance. The physical effort of pulling itself out of the chrysalis is what pumps fluid through the wing veins and inflates the wings to their full size.

A butterfly that has been helped of its chrysalis prematurely will have crumpled, permanently deformed wings and will never fly. It looks like it needs help. It does not need help. It needs you to put your hands in your pockets and watch.

After the butterfly emerges it will hang from the empty chrysalis case for several hours, wings slowly expanding and drying. A small piece of watermelon at the bottom of the enclosure or some sugar water on a cotton ball gives it something to feed on while it sorts itself out. Do not rush this stage. Do not attempt to release it while the wings are still soft.

What Goes Wrong and What It Means

A butterfly with deformed or drooping wings that cannot fly has almost always encountered one of two problems: OE infection picked up in an unclean enclosure, or interference during emergence. Both are preventable.

Neither is fixable once it has happened. The kindest thing you can do for a butterfly that cannot fly is place it somewhere warm with access to sugar water and flowers and let it live out its brief life in as much comfort as the circumstances allow.

If caterpillars are dying before they reach the chrysalis stage, check your enclosure hygiene first, then check whether your swan plant might have been treated with any kind of pesticide or insecticide before you bought it. Nursery plants are sometimes treated, and this will kill caterpillars quickly and mysteriously. Grow your own from seed if you can, or source plants from a supplier you trust.

If your chrysalises are turning black and collapsing rather than darkening normally before emergence, this is almost always OE or bacterial infection from a dirty enclosure. It is gutting to find. The only response is a thorough clean, a fresh start, and better hygiene going forward.

The Success Rate Question

The internet contains wildly different claims about how successfully people raise Monarchs indoors, ranging from near total success to near total heartbreak, and both are genuinely achievable depending on how carefully the process is managed.

Experienced raisers who are rigorous about hygiene and enclosure conditions report very high success rates. Beginners who overcrowd the enclosure, skip the daily cleaning, and cannot resist handling the caterpillars report considerably worse outcomes.

The other thing worth knowing honestly is that some research suggests captive raised Monarchs may be less robust than wild raised ones, with slightly worse flight strength and migration success.

This does not mean indoor raising is pointless. It means doing it well matters, and that releasing a few healthy, strong butterflies is more valuable than releasing many weak ones. Keep your numbers modest. Five to ten caterpillars at a time are plenty for a first season. Do it properly and see how you go before scaling up.

Is It Worth It

For children, without any qualification at all, yes. The experience of watching a striped caterpillar dissolve into a bag of biological slush and reassemble itself as a butterfly and then holding that butterfly on your finger while it tests its wings for the first time, is the kind of memory that stays with a child for their entire life. It is better than almost anything a screen can offer and it happens in your kitchen. You cannot put a price on that, and I am not going to try.

For adults who think they are doing it for the children but are completely captivated themselves, also yes. Obviously yes. There is no shame in this. The chrysalis has gold dots on it.

The practical summary is this. Get a mesh enclosure. Buy more swan plants than you think you need. Clean the enclosure every single day without exception. Do not touch the caterpillar when it is in J position.

Do not help the butterfly out of the chrysalis. Release it on a warm day when its wings are fully dry and it is sitting on your finger with the alertness of something that has just figured out it can fly.

Then watch it go. That is the whole point, and it is entirely worth it.

Sorry Butterflies

This Is a Moth Book

If you are reading this book with your kids and they are wondering where all the butterflies are, don't worry — New Zealand has some beautiful ones.

For a wonderful butterfly experience, visit the Science Learning Hub website run by the University of Waikato. Just search for **"Science Learning Hub New Zealand butterflies"** and you'll find a fantastic collection of photos and information about our native butterflies.

It's colourful, interesting, and a great place for curious young explorers to learn more.

I thought this was interesting

Butterflies make very poor fossils. They have no bones or other hard parts that can easily survive long enough to fossilise. Because of this, scientists can’t use fossils to track exactly when butterflies first arrived in Aotearoa New Zealand.

Instead, researchers study things like genetics, species relationships and the plants butterflies depend on to help piece together their history.

If you visit the Science Learning Hub site and look for their page on **New Zealand butterfly origins**, you may even find a downloadable surprise that explains how scientists think our butterflies reached these islands.

It’s a great reminder that even delicate creatures like butterflies can have surprisingly adventurous histories.

Remarkable Moths of Aotearoa (NZ)

Whose babies don't eat your stuff

A Country of Moths that Exist Nowhere Else on Earth

New Zealand has approximately 1,700 moth species. Around ninety percent are found nowhere else on Earth. Ninety percent.

That is one of the most remarkable concentrations of endemic moth species on the planet, flying around our native bush at night, doing things that science has only partially documented and in some cases has not yet named.

New Zealand separated from the Gondwana supercontinent roughly 80 million years ago, taking its insects with it. Those insects then evolved in glorious isolation for tens of millions of years.

The result is a moth fauna full of creatures that look and behave unlike anything else in the world, eating plants that grow nowhere else, living lifecycles so unusual that entomologists still argue about how to classify them.

Our primitive moth species have helped scientists understand the evolutionary history of the entire Lepidoptera order worldwide. Not just locally interesting. Globally significant.

Over 110 species are currently threatened with extinction. Some exist only on a single mountainside. Some have been reduced to almost nothing by wasps, rats, and possums. New Zealand's native moth fauna is one of the great underappreciated conservation stories of our time.

Win a $100 Note with a Moth

Spot the moth, it is very cool and it must be important if it's on the $100 note, read on

Follow @mrpinknz on Facebook for give aways and occasionally $100 notes with their beautiful moths.

Most people have never noticed the moth on the $100 note. See if you can spot it before reading the next paragraph.

Go get a hundred dollar note, if you happen to have one handy, or Google it. Look at the lower left corner. There, in quiet, dignified detail, sits the South Island zebra moth, *Declana egregia*, also known as the lichen moth.

It is small. It is strikingly patterned in black and white. It eats blackberry, lichen, lancewood and five-finger. And it is the only moth in New Zealand distinguished enough to appear on legal tender, which is a remarkable

achievement for a creature whose relatives have spent the preceding chapters being treated as domestic criminals.

The lichen moth earns its place on the currency by being genuinely beautiful. Its wing pattern is so precisely arranged in black and white that when it rests on a lichen-covered branch, which is exactly where it spends most of its time, it simply disappears. Not approximately. Not sort of. It vanishes. You could walk past one at eye level and see nothing but bark.

Every marking on those wings exists because, somewhere in the distant past, it helped a moth survive long enough to reproduce. Beauty in nature is often usefulness wearing a better coat.

There is also a North Island cousin, *Declana atronivea*, which performs the same remarkable camouflage trick in northern forests. Same disappearing act, different island. The South Island species made it onto

the banknote. The North Island species received respectful mention in the *Te Ara Encyclopedia of New Zealand*, which is probably just as satisfying if you are a moth with no interest in financial systems.

The lichen moth is worth meeting because it reminds us of something important. In this book we have been battling a handful of troublesome moths in our homes, but those few are only a tiny fraction of the moths that exist. Out of roughly 160,000 moth species in the world, only a handful cause problems for people.

The rest are quietly going about their lives in forests, fields and gardens.

The lichen moth belongs to that much larger and far more peaceful group.

So, the next time someone hands you a hundred dollar note, take a moment before you spend it. Look down at the small moth printed in the corner. Most people have never noticed it.

If you spotted it before reading on, congratulations. You have just joined a very small club of people who have actually looked closely at New Zealand money.

In a small way, that is also the story of New Zealand's native moths: extraordinary creatures hiding in plain sight, almost entirely unnoticed by the people who share their country with them.

Remember to follow @mrpinknz on Facebook and go in the draw to win a moth and a $100 note a couple of times a year.

Next important thing, wherever possible on the following images look for the measurement scale, some are huge some are tiny.

The Giant of The Night

Puriri Moth (*Aenetus virescens*)
Māori name: Pepe tuna

Wingspan: 100–150 mm…that is seriously big

Photo: Auckland War Memorial Museum. Licensed under Creative Commons CC-BY 4.0.

Host plants
Puriri, māhoe, putaputawētā, lancewood and several other native trees

Magic Stuff
Beautiful in a quiet, natural sort of way, the Puriri moth is only fully appreciated when you have the privilege of seeing one up close — or even better, resting gently on your hand.

The Puriri moth is New Zealand's largest native moth and the largest native winged insect in the country. Females can reach a wingspan of about 150 millimetres, roughly the width of this page.

What makes this moth extraordinary is its life story. After hatching, the caterpillar eventually climbs a tree and tunnels deep into the trunk, creating a J-shaped burrow. Inside that tunnel it lives for **two to five years**, feeding quietly while the tree slowly tries to heal the wound.

Then, after years hidden inside the wood, the adult moth finally emerges.

And now comes the astonishing part.

The adult moth lives for **about forty-eight hours**.

It has no mouthparts and cannot eat. Its entire mission is to find a mate and scatter eggs across the forest floor before its short life ends.

Five years in a tree… for forty-eight hours of freedom.

If a large green moth appears at your light on a warm spring night, don’t panic. Stand still and look carefully. You are looking at a creature that spent years preparing for a moment you might otherwise miss.

The Tree Tunnel Engineer

Puriri moth caterpillar (*Aenetus virescens*)

Host plant
Puriri, māhoe, lancewood and several other native trees.

Photo by: jt. Licensed under Creative Commons CC-BY 4.0.
Source: iNaturalist.

Magic Stuff
This caterpillar spends most of its life inside a tree.

After hatching it climbs a tree trunk and chews a J-shaped tunnel into the wood. This tunnel becomes its home for the next two to five years.

At night it quietly pokes its head out to feed on leaves before reversing back inside.

Five years building the tunnel.
About forty-eight hours as a moth.

Some Moths Are Batty

The NZ Bat Dung Moth (Archyala opulenta)

The moth in question is Archyala opulenta. It does not have a common name, which tells you something about how little attention this extraordinary creature has received.

Photo: Manaaki Whenua — Landcare Research. Licensed under Creative Commons CC-BY 4.0.

The specimen was collected by E.S. Gourlay in November 1924. The modern high-resolution photograph was later taken for the New Zealand Arthropod Collection.

Photo by: New Zealand Arthropod Collection (NZAC), Manaaki Whenua – Landcare Research. Licensed under Creative Commons CC-BY 4.0.

Magic Stuff

There is a moth in New Zealand whose entire existence depends on a bat having a good day. Not metaphorically. Literally. If the bat does not eat, the moth does not breed. If the bat disappears, the moth disappears with it.

We are going to fix that.

From this point forward, at least in this book, *Archyala opulenta* will be known as **the bat dung moth**. Because that is precisely what it is, and if that does not deserve a proper name then nothing does.

This small but handsome moth, coloured in shades of ochre and dark purplish brown, was first described in 1926 from specimens collected in the upper Maitai Valley near Nelson. It has since been found in Northland as well. That is the entire known range of this species. Not just its New Zealand range. Its entire world.

What makes the bat dung moth truly remarkable is what its caterpillars eat.

Not leaves, not wood, not your wool jumper.

They feed on the droppings of the **short-tailed bat**, one of New Zealand's only native land mammals and one of the most unusual bats anywhere on Earth.

The relationship is very simple.
No bats → no bat droppings → no bat dung moth.

The adult moths are on the wing in November, which is about the only time you might ever see one, and even then, only if you happen to be in the right valley in Nelson or the right part of Northland at exactly the right moment.

The Department of Conservation currently lists the species as **Data Deficient**, which in scientific language means: we know this moth exists, we know it is rare, and we are not yet entirely sure how worried we should be.

Given what we know about the bats it depends on, the honest answer may be **quite worried**.

The Escape Artist, – Fred the Thread

Māori name: No widely recorded traditional name
Wingspan: 10–12 mm, Tiny!

Photo by: Birgit E. Rhode, Manaaki Whenua — Landcare Research.
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Host plants

Wire rush (*Sporadanthus ferrugineus*) and occasionally other native rush species.

Magic stuff

If the Puriri moth is the giant of New Zealand moths, the Houdini moth is the escape artist.

This tiny moth lives an almost completely hidden life. The caterpillar hatches on a native rush plant and almost immediately burrows into the stem. From that moment on it lives entirely inside the plant, feeding and growing in secret where almost nothing can see it.

Inside the rush stem the caterpillar slowly tunnels through the plant tissue, protected from predators and the weather outside. If you were to carefully cut open the stem you

might discover the narrow tunnel where it has been quietly living its entire life.

New Zealand entomologist Robert Hoare, who discovered this remarkable species, once described the caterpillar in a playful poem as **"Fred the Thread."** The name fits perfectly. The caterpillar is long, thin and pale, looking almost like a living thread hidden inside the plant stem.

For months Fred the Thread remains safely inside his green tunnel. When the time comes to transform, the pupa wriggles its way toward the surface of the stem and prepares for its final trick.

Soon a tiny moth emerges from inside the plant and escapes into the open air. After spending its entire life hidden inside a plant stem, it finally flies free.

It is a remarkable disappearing act, and a very fitting story for a moth named after the great escape artist **Harry Houdini**.

Fred the Thread

Fred the Thread is the caterpillar of a native moth (Houdinia flexilissima) and is quite possibly the world's thinnest caterpillar.

Dr Robert Hoare reads a poem he wrote about the native moth (Houdinia flexilissima), whose larva is known as Fred the Thread. The poem is from Robert's book **Six-legged Things and Scaly Wings**: An anthology of New Zealand insect verse (mostly about moths).
https://store.mapress.com

When not writing poetry, Robert is an invertebrate systematist with Manaaki Whenua – Landcare Research.

Dr Robert Hoare said

"I have a little poem about Fred the Thread, which I wrote"

I have a friend (his name is Fred)

He's thinner than a cotton thread

His colour is an orange-red

He doesn't feed on jam or bread

But Sporadanthus stems instead.

To get the rest of the poem and other interesting stuff buy Robert's book

The Rush Stem Tunneller

Houdini moth caterpillar (*Houdinia flexilissima*)

Host plant
Wire rush (*Sporadanthus ferrugineus*)

Photo by: Birgit E. Rhode, Manaaki Whenua — Landcare Research.
Licensed under Creative Commons CC-BY 4.0.

Magic Stuff
This caterpillar spends its entire life hidden inside a plant stem.

Soon after hatching it burrows into the stem of a native rush plant and begins tunnelling through the soft tissue inside.

Safe within the plant it feeds and grows where very few predators can reach it.

Eventually it transforms into a tiny moth that emerges from the stem, completing one of the most secretive life cycles in New Zealand insects.

The Daytime Show-Off

Magpie Moth (*Nyctemera annulata*)
Māori name: Pepe rere ātaahua

Wingspan: 40–50 mm

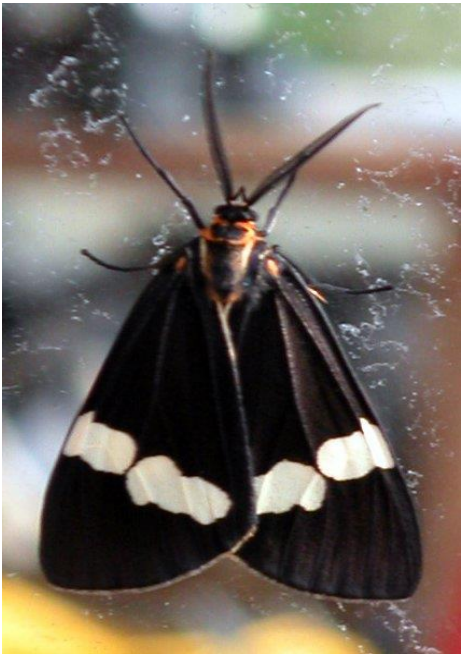

Photo by: Bevan Weir. Licensed under Creative Commons CC-BY-SA 3.0.

Host plants
Ragwort, groundsel and other plants in the daisy family

Magic Stuff
Most moths are quiet, sensible creatures that wait for darkness before flying. The magpie moth clearly never received that memo.

This striking black-and-white moth flies boldly in the middle of the day, fluttering around gardens, paddocks and roadsides as if it has decided it might as well be a butterfly.

Its dramatic colours are not just decorative. The caterpillars feed on ragwort, a plant that contains toxic chemicals. Instead of being harmed by the toxins, the caterpillars store them in their bodies. Birds quickly learn that eating a magpie moth tastes about as pleasant as chewing an old boot.

Because of this built-in chemical defence, the magpie moth doesn’t bother hiding. It flies openly in daylight, advertising the fact that it is not worth eating.

So, if you see one drifting through your garden on a sunny afternoon, don’t panic. It isn’t a pest. It is simply one of New Zealand’s more confident moths enjoying a daylight flight.

The Ragwort Punk

Magpie moth caterpillar (*Nyctemera annulata*)

Host plant
Ragwort and other plants in the daisy family

Photo by: Tony Wills. Licensed under Creative Commons CC-BY 2.5

Magic Stuff
Bright orange and black hairs make this caterpillar look a bit like a tiny punk rocker.

Those colours are a warning. The caterpillar eats ragwort, a poisonous plant, and stores the toxins in its body.

Birds quickly learn that eating one is a bad idea.

So instead of hiding, this caterpillar wanders confidently around the ragwort plant wearing its warning colours.

The Kōwhai Muncher

Kōwhai Moth (*Uresiphita polygonalis*)
Māori name: (no widely recorded traditional name)

Wingspan: 30–40 mm

Photo
by: JMK. Licensed under Creative Commons CC-BY-SA 3.0

Host plants
Kōwhai and other plants in the pea family

Magic Stuff
If you have ever looked at a kōwhai tree and noticed the leaves being enthusiastically nibbled, there is a good chance the kōwhai moth caterpillar was responsible.

The caterpillars are bright green with bold black and white markings, and they feed happily on kōwhai leaves. Sometimes they gather in small groups and can make a tree look as if it has hosted a rather enthusiastic caterpillar picnic.

Fortunately, kōwhai trees are tough and usually recover quickly, growing a fresh set of leaves not long afterwards.

The adult moth, however, looks completely different from its leafy green caterpillar stage. Instead of green camouflage it appears in shades of yellow and brown with delicate patterns across its wings.

So, the next time you see a kōwhai tree looking slightly chewed, don’t worry too much. It may simply be part of the life story of a moth that started life as a leaf-munching caterpillar and will eventually flutter away into the night.

The Kōwhai Leaf Muncher

Kōwhai moth caterpillar (*Uresiphita polygonalis*)

Host plant
Kōwhai and other plants in the pea family

Photo by: Siobhan Leachman. CC0 Public Domain.

Magic Stuff
If you see kōwhai leaves looking slightly chewed, this caterpillar may be responsible.

The bright green body with bold black and white markings makes it easy to spot as it feeds on kōwhai leaves.

Sometimes several caterpillars gather on the same tree and enjoy a rather enthusiastic leaf-eating session.

Fortunately, kōwhai trees usually grow a fresh set of leaves not long afterwards.

The Giant Copper Looper

Giant copper looper (*Tatosoma agrionata*)
Māori name: (no widely recorded traditional name)

Wingspan: 35–45 mm

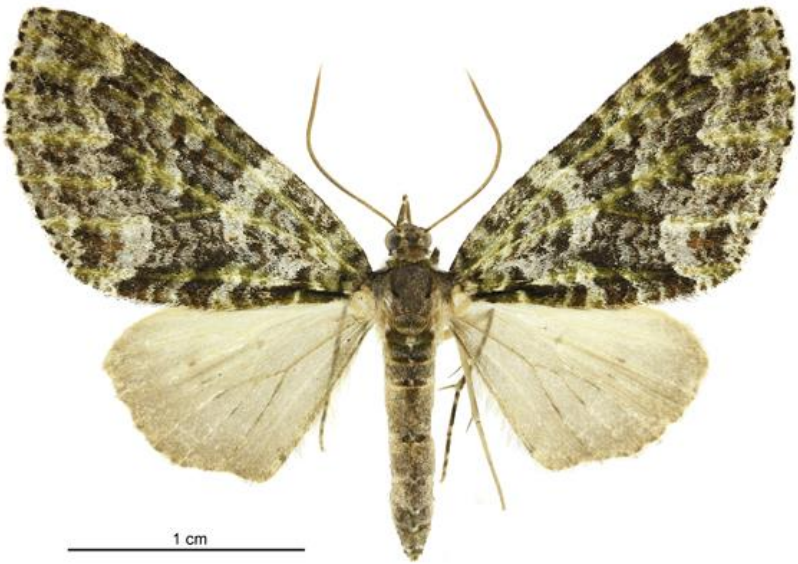

Photo by: Birgit E. Rhode, Manaaki Whenua — Landcare Research.
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Host plants
Native plants including mānuka and kānuka

Magic stuff
At first glance the giant copper looper looks as if someone has polished its wings with a tiny bit of metal. Depending on the light, the wings shimmer with copper and green tones that can make the moth look almost jewel-like.

Like many moths in the geometrid family, its caterpillar is an “inchworm.” Instead of crawling like most caterpillars, it moves in a looping motion, bringing its back legs forward and stretching out again as if it is carefully measuring the branch.

When resting, the caterpillar often holds itself stiff and straight, perfectly mimicking a small twig. Predators scanning the branch for lunch simply see another piece of plant and move on.

It is a clever disguise. Looking like a stick is a surprisingly effective survival strategy when half the forest is made of sticks.

The Feathered Flyer

Plume moth (Family *Pterophoridae*)
Māori name: (no widely recorded traditional name)

Wingspan: 18–30 mm

Photo by: Birgit E. Rhode, Manaaki Whenua — Landcare Research.
Licensed under Creative Commons CC-BY 4.0.

Host plants
Various plants depending on the species, including bindweed, daisies and several native plants

Magic stuff
At first glance a plume moth hardly looks like a moth at all. When resting it stretches its wings out sideways so that its body forms a neat T-shape, like a tiny flying clothes hanger.

Look more closely and the wings appear to be split into narrow feathery plumes rather than solid wings. These delicate divisions give the moth its name and help it blend perfectly with thin stems and grasses.

When a plume moth lands on a plant it often holds itself stiffly upright, looking remarkably like a dry piece of grass or a twig. Predators scanning the plant for insects often overlook it completely.

Despite their delicate appearance, plume moths are surprisingly capable fliers. On warm evenings they drift slowly through gardens and fields, looking less like insects and more like small pieces of floating plant fluff.

It is one of those insects that makes you look twice, just to be sure your eyes are telling the truth.

The Bark Imposter

Lichen moth (*Declana atronivea*)
Māori name: (no widely recorded traditional name)

Wingspan: 35–45 mm

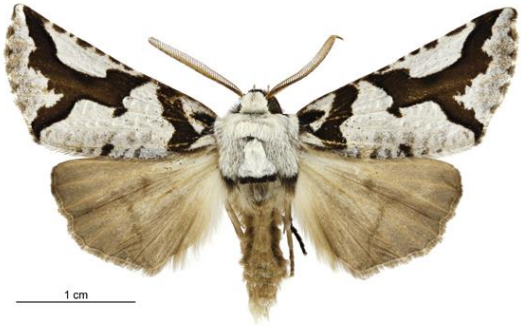

Photo by: Birgit E. Rhode, Manaaki Whenua — Landcare Research.
Licensed under Creative Commons CC-BY 4.0.

Host plants
Various native forest plants including māhoe and other broadleaf trees

Magic Stuff
If camouflage were an Olympic sport, this moth would be bringing home a gold medal.

The lichen moth spends most of its time resting on tree trunks where its wings blend almost perfectly with patches of lichen and rough bark. The grey, black and white patterns look so much like the natural markings on a tree that even a careful observer can walk straight past it without noticing a thing.

This disguise is not just decorative. Birds and other predators hunt by sight, so looking exactly like part of the tree is a very effective way to stay alive.

During the night the moth becomes active, flying quietly through forest clearings and gardens before returning to a tree trunk to disappear again by morning.

It is a simple survival trick: if you look exactly like the tree you are sitting on, very few things will think to eat you.

The Disappearing Artist

Lichen moth caterpillar (*Declana atronivea*)

Host plant
Various native forest plants including māhoe and other shrubs

Photo by: Tony Steel. Licensed under Creative Commons CC-BY-SA 4.0.

Magic Stuff
This caterpillar survives by being extremely difficult to see.

Its colours and patterns help it blend with bark, moss and lichen on tree trunks.

When it stops moving it can be almost impossible to spot against the forest background.

Remaining unnoticed is its best defence in a forest full of hungry birds.

The Twig Pretender

(*Pseudocoremia suavis*)
Māori name: (no widely recorded traditional name)

Wingspan: 30–40 mm

Photo by: Possums' End. Licensed under Creative Commons CC-BY 4.0. Source: iNaturalist.

Host plants
Various native trees and shrubs including mānuka, kānuka and other forest plants

Magic Stuff
Some caterpillars hide by blending into leaves. This one takes camouflage to a whole new level.

The caterpillar of the forest looper is an inchworm, meaning it moves in that familiar looping motion that

looks like it is carefully measuring the branch. When it stops moving, something remarkable happens.

It freezes completely still and holds its body stiff and straight, sticking out from the branch like a tiny twig.

To a hungry bird scanning the plant for insects, it simply looks like another small piece of the branch. Even when the wind moves the leaves around it, the caterpillar remains perfectly rigid, continuing its impressive performance as a convincing stick.

Eventually the caterpillar transforms into a modest brown moth that flies quietly through forests at night.

It may not be the most colourful moth in New Zealand, but it proves that sometimes the best survival strategy is simply pretending to be part of the furniture.

The Twig Pretender (*Pseudocoremia suavis*)

Host plant
Various native trees and shrubs including mānuka and kānuka

Photo by: Phil Bendle. Licensed under Creative Commons CC-BY-SA 3.0.

Magic Stuff

When this caterpillar stops moving it looks exactly like a small twig.

Instead of crawling like most caterpillars, it moves in a looping motion, which is why these insects are often called inchworms.

When danger appears, it freezes and sticks straight out from the branch, perfectly copying a tiny stick.

To a hungry bird it simply looks like part of the plant.

The Emerald Night Flyer

Emerald looper (*Chloroclystis filata*)
Māori name: (no widely recorded traditional name)

Wingspan: 20–30 mm

Photo by: Donald Hobern. Licensed under Creative Commons CC-BY 2.0.

Host plants
Various native shrubs and small forest plants

Magic Stuff
Most people imagine moths as dull brown insects that appear around porch lights at night. The emerald looper politely disagrees.

This small moth wears soft shades of green across its wings, allowing it to blend beautifully with leaves and forest vegetation. When resting during the day it often sits quietly among foliage where its colour makes it surprisingly difficult to notice.

Like many members of the geometrid family, its caterpillar is an inchworm. Instead of crawling like most caterpillars,

it moves in a looping motion, bringing its back legs forward and stretching out again as if it is measuring the branch.

These tiny green caterpillars are also masters of disguise, often matching the colour of the leaves they feed on so closely that they seem to vanish when they stop moving.

It is a reminder that some of the most beautiful insects in New Zealand forests are also some of the easiest to overlook.

The Pasture Night Flyer

Grass grub moth (*Wiseana cervinata*)
Māori name: (no widely recorded traditional name)

Wingspan: 30–40 mm

Photo by: Birgit E. Rhode, Manaaki Whenua — Landcare Research.
Licensed under Creative Commons CC-BY 4.0.

Host plants
Grasses and pasture plants

Magic Stuff
Farmers across New Zealand know this moth, although most of them first meet it in its less popular stage.

The caterpillar of the grass grub moth lives underground where it feeds on the roots of pasture grasses. Large numbers of these larvae can damage paddocks, leaving patches of grass weakened or dying.

At night during spring and early summer the adult moths emerge and take to the air in large numbers. If you have

ever seen a swarm of moths fluttering over a paddock on a warm evening, there is a good chance these were grass grub moths beginning the next generation.

Unlike many of the colourful moths in this section, the grass grub moth is plain, with soft brown wings that help it blend into the landscape.

It may not win any beauty contests, but it plays a significant role in New Zealand’s pasture ecosystems and has kept farmers paying attention for generations.

The Underground Root Muncher

Grass grub caterpillar (*Wiseana cervinata*)

Host plant
Grasses and pasture plants

Photo by: Pluto Hooper. Licensed under Creative Commons CC-BY. Source: iNaturalist NZ.

Magic Stuff
This caterpillar spends most of its life underground.

Hidden in the soil, it feeds on the roots of grasses and pasture plants. Farmers know it well because large numbers can damage paddocks.

After months living below the surface the caterpillar eventually transforms into a brown night-flying moth.

Most people only ever see the moth, never realising that its earlier life was spent quietly beneath their feet.

The Forest Carpet

Carpet moth (*Helastia corcularia*)
Māori name: (no widely recorded traditional name)

Wingspan: 25–35 mm

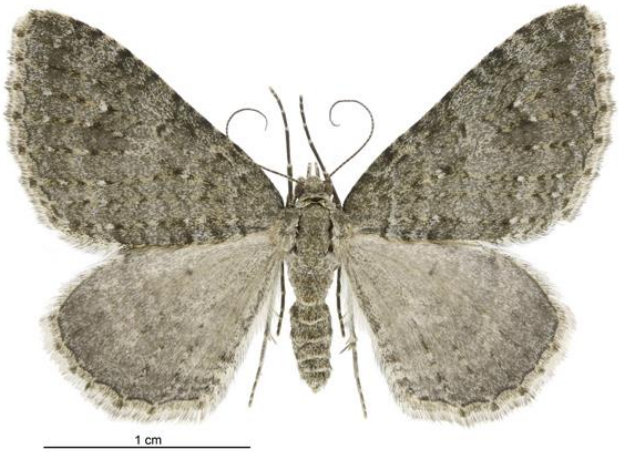

Photo by: Birgit E. Rhode, Manaaki Whenua — Landcare Research.
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Host plants
Various native forest plants and shrubs

Magic Stuff
If you have ever looked closely at the bark of a tree and noticed the delicate patterns of lichen, moss and tiny cracks, you already have an idea of how this moth survives.

The forest carpet moth carries an intricate pattern of greys, browns and soft silvery tones across its wings. When it settles on tree bark those markings blend beautifully with the natural textures of the forest.

During the day it usually rests quietly on trunks or branches where its camouflage makes it extremely difficult to spot. At night it becomes active, fluttering through forest edges and gardens before settling again by morning.

Like many members of the geometrid family, the caterpillar moves in the familiar looping “inchworm” style, stretching forward and pulling the back of its body along as if measuring the branch.

It is not a large or flashy moth, but when you notice one resting against the bark of a tree you realise how perfectly nature can match colour, pattern and survival.

The Lichen Artist

Common lichen moth (*Declana floccosa*)
Māori name: (no widely recorded traditional name)

Wingspan: 35–45 mm

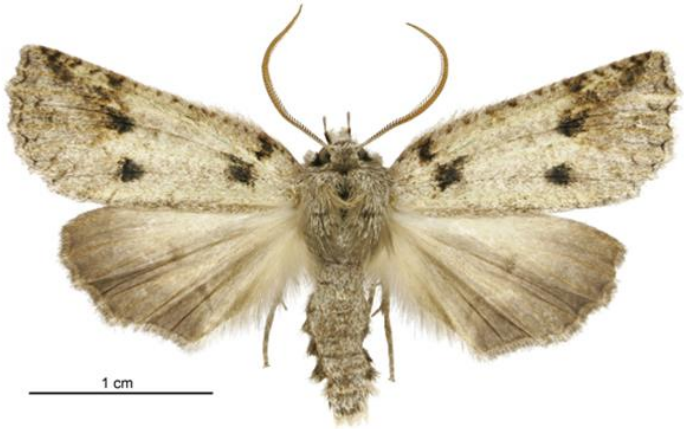


Photo by: Birgit E. Rhode, Manaaki Whenua — Landcare Research.
Licensed under Creative Commons CC-BY 4.0.

Host plants
Various native forest plants including māhoe and other broadleaf trees

Magic Stuff
Many moths rely on camouflage to survive, but the lichen moth takes this idea to a very artistic level.

Its wings are patterned with soft greys, creams and dark markings that look remarkably similar to patches of lichen growing on tree bark. When the moth settles on a trunk during the day, it can almost disappear into the background.

To a passing bird scanning the tree for insects, it simply looks like another patch of natural texture on the bark.

At night the moth becomes active, quietly flying through forest clearings and gardens before settling again on a tree where its camouflage protects it until morning.

Nature has many clever disguises, but looking exactly like a patch of lichen is one of the most effective.

The Evening Drifter

Pink looper (*Epyaxa rosearia*)
Māori name: (no widely recorded traditional name)

Wingspan: 30–40 mm

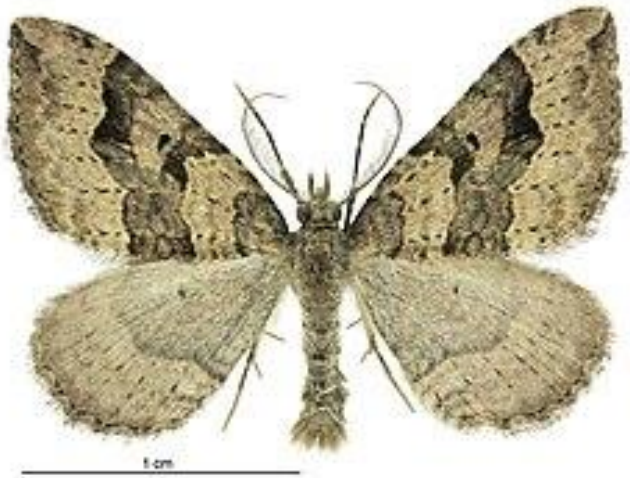


Photo by: Donald Hobern. Licensed under Creative Commons CC-BY 2.0

Host plants
Various shrubs and low-growing plants including clovers and native herbs

Magic Stuff
This gentle little moth carries soft shades of pink, cream and brown across its wings, giving it a surprisingly delicate appearance for a night-flying insect.

During the day it usually rests quietly among vegetation where its colours blend beautifully with dried leaves and stems. When evening arrives it becomes active, fluttering

lightly through gardens and open spaces in search of nectar and a mate.

Like many geometrid moths, its caterpillar is an inchworm that moves in the familiar looping motion, stretching forward and pulling the rest of its body along as if measuring the branch.

Mr Pink would like it officially noted that this moth is, in fact, pink. This discovery has done nothing to reduce his long-standing belief that pink is clearly one of nature’s better ideas.

Sometimes the most beautiful moths are the ones that appear softly at dusk and vanish again before most people notice they were ever there.

Cool Wet Caterpillars

The Moth Book was finished (again), and a couple of days ago I went to see my friends and their daughter Deborah.

Meet Deborah

She has a background in freshwater ecology and works at Earth Sciences New Zealand, where she leads the Biosecurity Flagship Programme. Her research covers botany, ecology and restoration, and she leads government funded and commercial projects focused on tackling aquatic weeds and invasive species, and developing new approaches to restoring our lakes.

In plain terms, while the rest of us are worrying about moths in our pantry, Deborah and her team are out there fighting full scale invasions in our lakes and oceans, the kind of pest problems where the pest is taking over an entire waterway.

Earth Sciences New Zealand

Earth Sciences New Zealand is the trusted expert in earth, water and climate science for Aotearoa New Zealand. Formed on 1 July 2025 through the merger of GNS Science and NIWA, the organisation is generating critical science solutions to help build a safer, stronger and more prosperous future, helping communities thrive on our changing and challenging planet.

If you want to know more about how our freshwater ecosystems work, and the people quietly keeping an eye on them, this is the team. Look them up. Our waterways are better off because of the work they do.

https://www.earthsciences.nz/

Don’t You Love Coincidences

Deborah asked the obvious question. Have we got the aquatic moth in the book? At the time, we did not. So, we went looking, found one, and it turns out we had already half written about it without realising. We had stolen a section from the Aussie part of this book. We have our very own underwater moth larvae, and Australia has the same or similar. Like the pavlova, I think we had it first.

A Caterpillar with Gills

Right, hold onto something, because there is a New Zealand moth that looked at the entire moth lifestyle, wings, porch lights, fluttering about looking vaguely lost, and decided none of that was for it. This one wanted to go swimming.

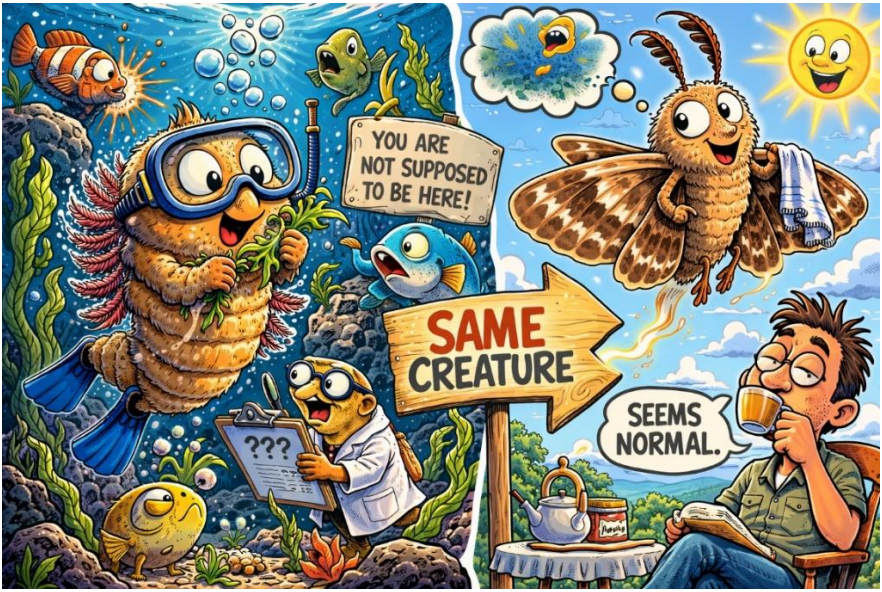
Meet Hygraula nitens, the Pond Moth. The adult is nothing flashy, about 25 millimetres across, the kind of small brown moth that turns up at your window on a summer night and gets barely a glance. But ignore the adult.

The caterpillar is the one doing something really special and so cool. It lives underwater. Properly underwater, in lakes and slow-moving streams, breathing through little tentacle-like gills along its body, like it took one look at the rest of the family tree and thought, nah, I’ll be like a fish instead.

It even builds itself a tiny portable case out of pondweed stuck together with silk, and trundles along the bottom eating aquatic plants, including native plants and several of the introduced weeds everyone else in New Zealand is desperately trying to get rid of.

So somewhere out there, right now, there is a caterpillar in scuba gear quietly doing pest control on invasive weeds, and munching on native plants, but few people have heard of it. It lives nationwide, right down to the Chatham Islands, and freshwater scientists frequently find them when plants are abundant.

Then, when it is good and ready, it climbs out, pupates, and emerges as a perfectly ordinary looking small moth that flies about at night and turns up at lights, sometimes a fair distance from any water, giving no clue whatsoever that it spent its childhood as a gilled caterpillar in a homemade pondweed bunker.



A Couple More Cool NZ Caterpillars

The Living Sleeping Bag

The Bag moth caterpillar (*Liothula omnivora*)

Host plant
Many different trees and shrubs

Photo by: Tony Wills. Licensed under Creative Commons CC-BY 4.0. Source:https://commons.wikimedia.org

Magic Stuff
This caterpillar spends its entire childhood inside a small portable case.

Soon after hatching it builds a protective bag from silk and tiny pieces of twigs, leaves and bark. It carries this little case everywhere it goes.

Only the caterpillar's head and legs stick out as it slowly moves along the branch feeding on leaves.

When danger appears it simply pulls itself back inside the case like someone retreating into a sleeping bag.

The case grows larger as the caterpillar grows, making it one of the strangest moving "twigs" you might ever see in a garden.

Why it Matters Beyond Being Interesting

New Zealand's native moths pollinate plants at night that no other creature pollinates. They are food for kiwi, morepork, kaka, and dozens of other native birds. They break down dead wood and leaf litter into soil. They move nutrients through ecosystems in ways that are still being understood. They are not peripheral to the functioning of our native forests and grasslands. They are part of the mechanism.

We do not need to be entomologists to care about this. We just need to understand that the world functions better with more species in it than with fewer, and that right now New Zealand is losing native moth species that took millions of years to evolve at a rate that gives us very little time to act. The good news is that individual households can make a genuine difference.

Our Mates and Family Across the Ditch

Blinking Aussies gotta be bigger than us Kiwis and almost more interesting.

If you are sort of reading this with your Kids or Grandies please Google the images and see what different aspects look like.

The Australian Monarch

Same Butterfly, Completely Different Life

You have just read about our New Zealand Monarchs doing their sensible, measured thing: staying mostly local, overwintering in a few sheltered coastal spots, and breeding happily on swan plants up and down the country. Lovely. Restrained. Very New Zealand.

Now let us talk about the Australian version. Because the Australian Monarch has looked at the same basic lifecycle and decided to do something considerably more dramatic with it.

In Australia the Monarch is officially called the Wanderer butterfly, Danaus plexippus, and the name is not an exaggeration. Where our New Zealand Monarchs stay relatively close to home, Australian Wanderers migrate. Properly migrate.

They cover hundreds of kilometres twice a year, navigating by the sun and the Earth's magnetic field, clustering by the thousand at overwintering sites, and returning to the same trees year after year with a navigational precision that continues to baffle the scientists who study it.

Australia has had Monarchs since approximately 1871, the same period they arrived in New Zealand, both populations believed to have blown in from New Caledonia on cyclonic storms. Same origin. Same species. One hundred and fifty years later, the two populations have ended up living quite differently, shaped by the very different landscapes and climates they found themselves in.

The Journey South and Back Again

The trigger for the Australian migration is temperature. As late summer cools into autumn, falling temperatures induce a state called diapause in the adult butterflies, a kind of reproductive standstill in which they stop breeding and start moving. Australian Monarchs that have been breeding inland through the warm months begin heading east and south toward the coast.

They are not running from the cold, exactly. They are heading for specific places that will keep them alive through winter: sheltered valleys with the right trees, nearby nectar sources, and critically, the continued presence of milkweed plants.

How the Hell Do They Know

What makes this genuinely extraordinary is that these butterflies have never made this journey before. Not one of them. The individuals setting off in autumn are the offspring, or grandchildren, of the butterflies that made the journey the previous year.

The route is not learned. It is not passed on by watching older butterflies. It is encoded in the genome: a navigational inheritance that switches on when days shorten and temperature drops, guiding a creature weighing less than a paperclip across hundreds of kilometres to a valley it has never visited.

They arrive at their overwintering sites around April, clustering on the same trees their ancestors used, sometimes so densely that branches bend under the weight. During the cold parts of the day they hang motionless in great trembling masses, wings folded, conserving energy.

When midday warmth arrives they stir, take flight, visit nearby flowers, bask in the winter sun, then resettle as the afternoon cools. Active dormancy: not quite hibernating, not quite fully alive in the summer sense, sitting somewhere purposeful in between.

They Have Central Heating

The clustering itself is remarkable beyond the spectacle. The aggregate body heat of thousands of butterflies packed onto the same tree raises the local temperature by a measurable amount. The cluster is its own heating system.

Butterflies on the outside run cooler and burn less energy. Those deeper in stay warmer. Individual butterflies shift position over time, cold outer ones working inward, warmer inner ones moving out, maintaining a collective warmth no individual could sustain alone.

They are, without central coordination or any awareness of the larger system they are part of, running a communal thermostat.

Magic Trees

Here is the detail that stops most people mid-sentence when they hear it for the first time.

The Monarchs return to the same trees. Not the same general area. Not the same type of tree. The same individual trees, year after year, across generations of butterflies that have never been there before.

Overwintering sites in south-eastern Australia have been documented across the Sydney Basin, the Hunter Valley, and the Mount Lofty Ranges near Adelaide. Research published in 2019 identified thirty-three known or historically recorded sites across New South Wales, South Australia, Victoria, and even one on Flinders Island off the Tasmanian coast.

Every one of these sites shares the same characteristics: sheltered from prevailing wind, trees with rough bark suited to gripping, nearby milkweed, and access to nectar. The butterflies are not picking these sites at random. They are selecting for specific features, guided by criteria that have been refined over generations until the search image is essentially perfect.

The clustering begins in approximately April, and the butterflies remain, largely dormant, until around August or September. Then something changes. The males become active first, moving around the trees in the warming spring air.

The females begin to stir. Mating takes place at the overwintering site and then, very quickly, it is over. The females depart first, leaving the overwintering trees to find fresh spring growth of milkweed on which to lay the first eggs of the new season.

Succeeding generations breed their way back across the continent through spring and summer until the full warm-weather range is reoccupied. And then autumn comes again, the temperature drops, and the whole extraordinary cycle begins once more.

Monarchs have Ai way before us Humans

The navigation question is one that scientists have been chewing on for decades, and the answers that have emerged are, if anything, more remarkable than the mystery they replaced.

Australian Monarchs, like their North American cousins, use the sun as a compass. They orient their flight relative to the sun's position to maintain a consistent direction. This is impressive on its own. What makes it truly extraordinary is what happens when the sun moves.

The sun is not stationary. It moves across the sky throughout the day, tracing an arc from east to west, and a simple solar compass that does not account for this movement would have the butterfly flying in circles before noon. The Monarch does not fly in circles. It compensates for the sun's movement in real time using an internal circadian clock that is located, with beautiful biological specificity, not in the brain but in the antennae.

Scientists do Weird Stuff

Scientists demonstrated this by removing the antennae from migrating Monarchs and replacing them with antennae from non-migratory individuals. The transplanted butterflies immediately lost the ability to orient directionally. Restore the correct antennae and directional flight returns. The timekeeping mechanism that calibrates the solar compass is physically housed in the antenna. The antenna is not just for smelling. It is also, it turns out, a chronometer.

There is also evidence that Monarchs can detect the Earth's magnetic field, providing a backup navigation system for overcast days when the sun compass is unavailable. How they detect the field is still being investigated.

What is clear is that a butterfly with a brain the size of a pinhead is running at least two independent navigation systems simultaneously and integrating them into a flight path that reliably covers hundreds of kilometres to a specific valley in a specific part of Australia.

This has been happening since before anyone thought to ask how.

The Generation That Lives Eight Times Longer

One of the most underappreciated facts about Monarchs is that they are not all the same butterfly. Not in any functional sense.

Summer breeding generations live for around five or six weeks. They emerge, feed, find a mate, lay eggs, and die. Their entire adult life is a sprint. Built for reproduction, not endurance.

The migratory generation is a completely different animal. It lives for up to eight months. It does not reproduce on emergence. Its internal chemistry has shifted: the reproductive drive is suppressed, replaced by a fat-building imperative that has the butterfly feeding heavily to accumulate reserves for the journey and the long winter dormancy ahead.

Its hormonal profile, muscles, and behaviour are all different. Same species, same genes — but those genes are expressed in an entirely different way in response to shortening days and cooling temperatures.

The same individual that sets out on the autumn migration in April will, if it survives, still be alive the following September — having spent five months in a New South Wales valley hanging from a tree, barely moving. It will then mate, and the female will fly off to lay eggs, having lived eight times longer than the summer generation before and after it.

Evolution built two completely different lifestyles into one genome and put a thermostat on them. Below a certain temperature: long life, no breeding, migrate. Above it: short life, breed constantly, die. Same butterfly. Same DNA. The switch is the season.

The Decline That Deserves More Attention

Monarch populations in North America have declined by around eighty percent since the 1980s. The western population, which overwinters on the California coast, has declined by ninety-five percent. The species was listed as endangered by the International Union for the Conservation of Nature in 2022. This is widely known and widely discussed.

What is less widely known is that Australian populations appear to be declining too. The evidence is not as comprehensive as it should be, partly because the volunteer tagging programme that ran for decades and produced much of what we know about Australian Monarch behaviour was discontinued some years ago, leaving a significant gap in the data.

Moths and Butterflies Australasia now maintains a database and encourages citizen scientists to submit sightings, but the systematic long-term monitoring that would allow confident trend analysis is still being rebuilt.

What researchers can say is that the signals are not encouraging. Climate variability is disrupting the seasonal cues that trigger migration and overwintering behaviour. Urban expansion is removing breeding habitat. Agricultural intensification is reducing milkweed availability across large parts of the inland range.

The overwintering sites are fixed and specific, which makes them vulnerable: if the milkweed around a known site is removed, or if development changes the wind patterns and shelter, a site that Monarchs have used for generations can become unsuitable.

The good news, and there is genuine good news here, is that individual gardens genuinely matter. Australian Monarchs breed on two main milkweed species: Gomphocarpus fruticosus, the narrow-leaved cotton bush, and Gomphocarpus physocarpus, the broad-leaved version with the distinctive inflated seed pods.

Both are available from garden centres. Both are easy to grow in the right conditions. A garden with milkweed in a suburb along the Monarch's range is a breeding site. Every caterpillar that completes its development and emerges as a healthy adult is a real contribution to a population that needs it.

What You Will See If You Look

If you are in south-eastern Australia between April and September and you know where to look, you can find overwintering clusters of Monarchs in the Sydney Basin, the Hunter Valley, and around Adelaide.

Some sites have hundreds of butterflies. Some have thousands. They are not advertised in the way that the Mexican overwintering forests are, which is partly a matter of scale and partly a matter of Australia not yet having fully reckoned with what it has.

On a cold morning the clusters look almost static, the butterflies hanging with folded wings, their orange undersides muted in the winter light. Wait until midday. As the temperature climbs the clusters begin to stir, individual butterflies detaching and drifting upward, the whole mass gradually loosening into flight.

On a warm winter day at a good site you can stand in the middle of several thousand Monarchs flying around you in the winter sunlight, navigating by the sun through antennae that contain a clock, bound for the same trees their parents used and their grandchildren will use, running a lifecycle so intricately calibrated to the Australian seasons that every element of it, from the fat reserves of the migratory generation to the communal warmth of the cluster, feels less like biology and more like engineering.

Plant the milkweed. Submit your sightings. Go and find an overwintering site if you can. This is happening in Australia right now, in ordinary suburban valleys and rural roadsides, unremarked and mostly unwatched, and it is one of the more genuinely remarkable things this country has to offer.

The same butterfly that arrived on a cyclone from New Caledonia a hundred and fifty years ago and decided Australia was worth staying in is still here, still navigating, still finding the same trees. It has been doing this without assistance, without acknowledgement, and without any particular expectation of either.

Pay Attention!

Picture the scene. You have just declared war on your moths. You have deep-cleaned your pantry. You have evicted the larvae from your wardrobe. You have set your traps and taken back control of your home like the moth-busting hero you now are. You are feeling good. Righteous, even.

And then an Australian friend says: "Oh, you think your moths are bad? Let me tell you about ours."

And you sit down. Because once an Australian starts talking about their wildlife, you are going to be there for a while, and you are going to want to be comfortable.

New Zealand has around 2,000 moth species. It is a respectable number. A solid moth fauna, nothing to be embarrassed about. Australia, however, has approximately 22,000 described moth species, with scientists estimating the true total could reach 30,000 once they have finished cataloguing the ones that nobody has formally named yet.

That is not a moth fauna. That is a moth civilisation, complete with its own extraordinary history, its own remarkable characters, and its own deeply improbable biological achievements.

This chapter exists for two reasons. First, because a significant number of readers of this book are Australian, and they deserve to know what extraordinary creatures share their continent alongside the four annoying species in their pantry. Second, because some of what Australia has produced in the moth department is so remarkable that it deserves an audience regardless of which side of the Tasman you happen to call home.

The Family That Took Over a Continent

Twenty-Two Thousand Species

Let us start with scale, because scale is everything when it comes to Australian moths.

The United Kingdom has around 2,500 moth species. New Zealand has 2,000. Australia has ten times that, distributed across a continent that ranges from tropical rainforest to red desert to alpine snowfields, and the moths have adapted to absolutely every single one of those environments with the cheerful biological determination of creatures who have been evolving for 300 million years and are not about to let a bit of geographical variety slow them down.

Many of these species exist nowhere else on Earth. Australia spent tens of millions of years in isolation, and its moth fauna developed along entirely its own lines, producing families, behaviours, and biological tricks that the rest of the world's moths simply never invented. Some of these are spectacular. Some are bizarre. Some are the kind of thing you read about and then must sit quietly for a moment before continuing.

The family Oecophoridae, known informally as the mallee moths, tells this story better than almost anything else. Mallee moths exist all over the world in modest, unremarkable numbers.

In Australia they encountered the vast eucalyptus forests, the extraordinary diversity of habitats, and apparently something very agreeable in the air, because they diversified with such enthusiasm that they are now the second largest family of organisms on the entire Australian continent. Not the second largest moth family.

The second largest family of any kind of organism. There are 5,500 known species, the overwhelming majority found nowhere else on Earth, ranging from dull brown species that feed modestly on dead leaf litter to spectacular creatures adorned with metallic gold and silver wing scales that look like tiny pieces of expensive jewellery rather than something that evolved in a gum tree.

And then there are the ones with the truly memorable dietary arrangements, but we will get to those shortly because they deserve their own moment.

The Bogong Moth

The Migration That Should Be World Famous and Somehow Is Not

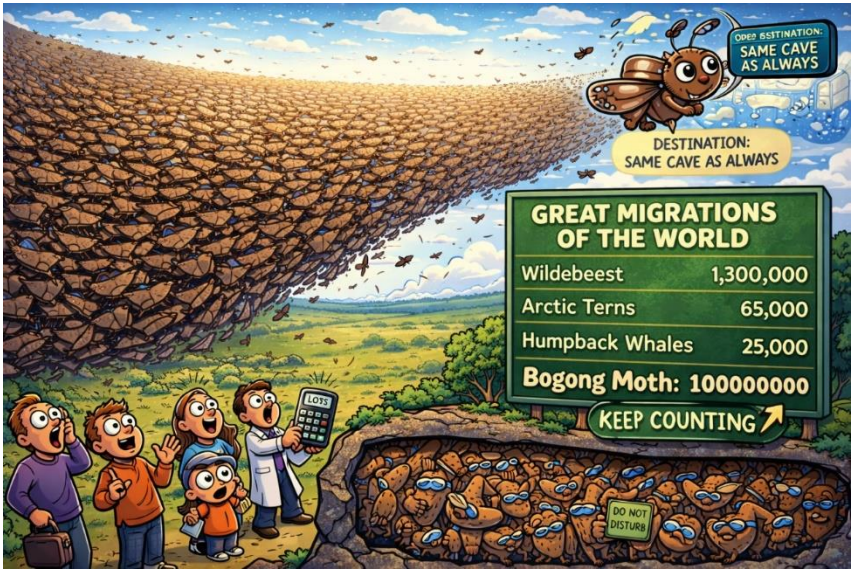
Photo by: Donald Hobern. Licensed under Creative Commons CC-BY 2.0. Source: https://commons.wikimedia.org

Here is a test. Ask any New Zealander to name a famous animal migration. They will probably say whales, or the bar-tailed godwit that flies non-stop from Alaska to New Zealand each year, which is genuinely extraordinary and worth knowing about.

Ask an Australian the same question and they will probably say whales as well, or maybe the Christmas Island red crab, because Australians have spent so long living next to astonishing wildlife that they have become somewhat blasé about it.

Almost nobody will mention the Bogong Moth. And this is a genuine injustice, because what the Bogong Moth does every year is one of the most spectacular migration events on the planet.

Every spring, somewhere between two and four billion Bogong Moths emerge from the semi-arid grasslands of southern Queensland, New South Wales, and Victoria. Four billion. The number is so large it resists intuitive understanding.



They emerge, orient themselves using the Earth's magnetic field and the patterns of the night sky, and fly up to 1,000 kilometres south to the granite caves of the Australian Alps, where they pack themselves onto the cave walls at a density of approximately 17,000 moths per square metre.

There they spend the summer in a dormant state called aestivation, which is essentially hibernation but in reverse: dormancy triggered by heat and drought rather than cold.

Then in autumn they wake up, turn around, fly 1,000 kilometres back to the plains, breed, lay eggs, and die. The same journey in reverse, guided by the same magnetic fields and stellar patterns, accomplished by a moth the size of your thumb.

The Moths use Magnets

About 25 specific caves in the Snowy Mountains region are known Bogong gathering sites, and the moths find them with a reliability that would be impressive in a creature ten thousand times their size. Scientists studying how they navigate have found evidence that they use the Earth's magnetic field, polarised light patterns, and possibly visual landmarks memorised during previous flights.

The research is ongoing, partly because the moths are doing something that should not work as well as it demonstrably does, and scientists find this professionally irritating in the most productive possible way.

Aboriginal Australian peoples have known about the Bogong gathering for tens of thousands of years. The caves were significant ceremonial gathering places, and the moths were an important and valued food source.

They were collected from the cave walls and roasted in hot ashes, their wings and legs removed, and the bodies eaten whole or ground into a paste that could be shaped into cakes and stored. Accounts describe the flavour as rich, nutty, and satisfying, with a high fat content that made them genuinely valuable nutrition in a landscape where calories could be difficult to find.

Before you dismiss this as interesting history and nothing more, be aware that Bogong Moths contain more fat per gram than almost any commercially farmed animal. Australia was running a high-protein, high-fat seasonal food festival in alpine caves every summer for millennia, and the rest of the world knew nothing about it.

There is one additional detail about Bogong Moths that I feel professionally obliged to share, because it is the kind of fact that lodges permanently in your brain. The soil of the Bogong's larval pastureland contains low levels of naturally occurring arsenic.

The moth larvae absorb trace amounts of this arsenic as they feed and carry it with them into the alpine caves as adults. When millions of moths die at the end of summer and decompose on the cave floors, the arsenic accumulates in the soil over generations, building up to concentrations that affect local cave chemistry and the organisms that live there.

The Mountain Pygmy Possum, which feeds heavily on Bogong Moths during their summer abundance, may be consuming meaningful quantities of arsenic as a completely normal part of its diet. This is Australia doing what Australia does: taking something that ought to be perfectly straightforward and adding a layer of chemical complexity that makes you stare into the middle distance for a moment before carrying on.

The Hercules Moth

Twenty-Seven Centimetres of Absolute Audacity

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Found only in the tropical rainforests of north Queensland and New Guinea, the Hercules Moth holds a record that requires no footnote, no qualification, and no asterisk. It has the largest wing surface area of any insect on Earth. Not one of the largest. The largest.

The wingspan of a large female regularly reaches 27 centimetres. A specimen collected in 1948 achieved 36 centimetres and made it into the Guinness Book of Records, where it remained unbeaten for decades. When the total wing surface of a large female is measured across all four wings, it comes to around 300 square centimetres.

This is not a moth. This is a piece of flying architecture that has decided, for reasons of its own, to be a moth.

The wings are warm brown with intricate patterns and a distinctive transparent window in each wing, like a stained-glass panel that someone forgot to put colour into. The male has long elegant tails extending from the hindwings.

The tips of the forewings on both sexes are curved and marked in a way that, from certain angles, bears a striking resemblance to the profile of a snake's head, complete with a convincing dark eye marking.

Whether this is genuine snake mimicry designed to alarm predatory birds, a coincidence that natural selection found useful and kept, or simply the Hercules Moth doing something visually dramatic for its own satisfaction, nobody is entirely certain. The moths are not sharing their reasoning.

The caterpillar spends two months eating voraciously in the rainforest canopy, accumulating fat reserves with the focused dedication of something that knows what is coming next. By the time it is ready to pupate it can weigh around 29 grams.

It spins a cocoon of silk and may remain inside for several months, sometimes for more than a year, waiting for conditions to be precisely right before emerging. When it finally does emerge as an adult moth, it has no functioning mouth.

This creature spent two months eating everything in sight, built itself a remarkable set of 27-centimetre wings, and then emerged into the world permanently unable to eat anything at all. It has two weeks to find a mate, reproduce, and die, running entirely on the fat reserves it accumulated during those two caterpillar months.

The female spends those two weeks releasing pheromones and laying up to 300 eggs. The male spends them flying on those extraordinary wings, guided by antennae of almost supernatural sensitivity, following pheromone trails from kilometres away, trying with complete dedication to fulfil his one biological purpose before his fuel runs out.

Two weeks. Twenty-seven centimetres of wingspan. No mouth. The Hercules Moth is simultaneously the most spectacular and the most poignant creature in this entire book.

The Rain Moth

Australia's Most Reliable Weather Forecaster

The Rain Moth is called the Rain Moth because it only emerges from its underground tunnels after heavy rain, or when heavy rain is imminent. Farmers across southern Australia have known for generations that seeing the first

Photo by: Donald Hobern. Licensed under Creative Commons CC-BY 2.0. Source: https://commons.wikimedia.org

Rain Moths of the season means wet weather is coming, and they have been using this knowledge as a practical forecasting tool since long before anyone invented a barometer. The moths are reading atmospheric pressure, soil moisture, and environmental cues that we have not yet fully characterised, and they have been right about it for a very long time.

The Rain Moth is also the size of a small bird. Its wingspan reaches 16 centimetres, and its body length can reach 12 centimetres. When Australians say "big moth" they mean something that most of the rest of the world would need a moment to process.

The female Rain Moth holds the record for the highest egg-laying capacity of any non-social insect ever documented. One individual was found to have the biological potential to lay over 44,000 eggs. One moth. Forty-four thousand eggs. The Rain Moth does not do things by halves, and it is apparently not interested in your concept of moderation.

The larvae live underground for several years, feeding on tree roots up to 60 centimetres below the surface, boring through soil and roots with the patient determination of creatures that know they have plenty of time. They eventually pupate underground, and when conditions are right, the mobile pupae wriggle up to the surface.

After rain, in parts of rural Australia, you can find their discarded pupal cases sticking upright out of the ground like tiny flags, marking exactly where a Rain Moth emerged and departed. Aboriginal peoples ate them, roasted over fire.

Accounts describe a rich, nutty flavour with a texture somewhere between butter and something more interesting than butter. The Rain Moth has been feeding people in Australia for tens of thousands of years, announcing its arrival with a change in the weather, and leaving behind a field of tiny flags. It is enormously theatrical for a moth and I respect it deeply.

The Giant Wood Moth

The World's Most Famous Caterpillar

No chapter about Australian moths would be complete without the witchetty grub, which is simultaneously one of the most famous insects in Australia and one of the least often recognised as being, in significant part, a moth larva.

The term witchetty grub refers to the large, cream-coloured, wood-eating larvae of several species of cossid moths and ghost moths, primarily those in the genus Endoxyla. The grubs live in the roots of witchetty bushes and acacia trees, boring down up to 60 centimetres below the surface and feeding on root sap and wood pulp with a commitment that would be admirable in almost any other context.

They take several years to reach maturity. When they finally emerge as adult moths, they cannot eat. They live for only long enough to mate and lay eggs, after which they die, having accomplished what they came to do. The entire elaborate, multi-year underground lifecycle exists to produce a few days of adult moth.

For Aboriginal Australians, witchetty grubs have been a fundamental and highly valued food source for over 60,000 years, representing one of the richest concentrations of protein and fat available in arid Australia.

Eaten raw they are described as creamy and mild, with a taste compared to almonds or egg yolk. Roasted over coals, the outside crisps up and the inside becomes rich and nutty, widely described as tasting like prawns or chicken, which is either very reassuring or not reassuring at all depending on your starting position.

The closely related Giant Wood Moth, Endoxyla cinereus, is one of the heaviest moths in the world. The female can lay up to 20,000 eggs, scattering them across eucalyptus bark using a sticky secretion.

The newly hatched caterpillars are barely a millimetre long and disperse by dropping on silk threads that catch the breeze, which is a delightful image: thousands of tiny caterpillars floating away from their birth tree like very slow, very hungry dandelion seeds.

Where they land, they bore into the ground, spend a year feeding on roots, then bore upward into a eucalyptus trunk and spend another year or more excavating progressively wider tunnels as they grow, until the larva is 15 centimetres long inside the wood.

The adult female, when she finally emerges, has a wingspan of up to 25 centimetres and weighs up to 30 grams. She has no mouth. She has a few days. She glues her 20,000 eggs to a tree and dies.

There is something almost unbearably committed about the Giant Wood Moth's lifecycle. Years of patient solitary work in the dark interior of a eucalyptus tree, building toward a few brief days of reproduction in the sunlight. It is the most Australian story imaginable: enormous effort, spectacular outcome, very brief glory, absolutely no fuss about any of it.

The Pellucid Hawk Moth

The One with Invisible Wings

Photo by: Alpsdake. Licensed under Creative Commons CC-BY-SA 3.0.

Most moths, when they need to avoid being eaten, use camouflage. They sit on bark and look like bark. They fold their wings and look like a dead leaf. They have evolved to match their resting surfaces with extraordinary precision, and it works well enough that the strategy has been in continuous use for hundreds of millions of years.

The Pellucid Hawk Moth looked at this approach and decided it was far too pedestrian.

The Pellucid Hawk Moth has transparent wings. Not slightly see-through. Not translucent. Genuinely, optically transparent, like glass. When it first emerges from its cocoon its wings are briefly covered in scales like any normal moth.

Then it starts flying, and the scales fall off, and the wings become clear. From that point forward this moth is apparently flying on nothing, its fat bumblebee-like body suspended in mid-air by invisible machinery, which is precisely the effect it is going for.

What makes this genuinely extraordinary is the mechanism. The wing surface is covered in an array of structures at the nanoscale, protuberances so small that they operate at the level of light waves rather than anything a human eye could resolve.

These structures reduce light reflectance across the wing surface by approximately 50 per cent. A piece of glass reflects light and gives itself away. The Pellucid Hawk Moth's wings reflect almost nothing. They are not merely transparent. They are actively anti-reflective.

Engineers at several research institutions have been studying these wings with considerable excitement, because the nanostructure that makes them work has potential applications in anti-reflective coatings, optical devices, solar panels, and acoustic materials.

The moth has been engineering practical invisibility for millions of years. We are only now working out how to copy it.

The Pellucid Hawk Moth flies during the day, which means that if you are in the right part of north Queensland and you see what appears to be a large, unusually graceful bumblebee hovering near flowering plants, you may be looking at one of the most optically sophisticated creatures on the planet.

It will not acknowledge you. It has flowers to visit, and it is very busy.

The Scribbly Gum Moth

The One That Signs Its Work

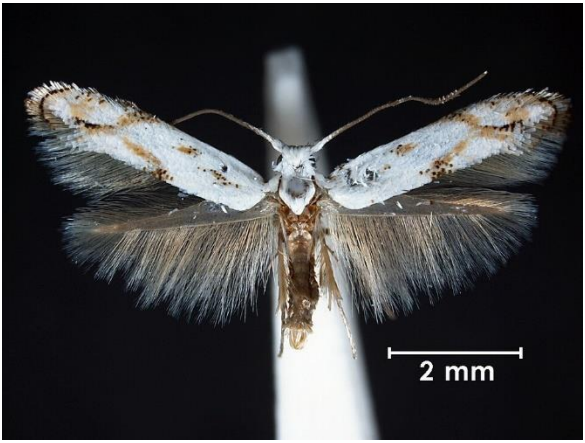


Photo: CSIRO. Licensed under Creative Commons CC-BY 3.0.

Photo by: Marg and Di Conrad. Licensed under Creative Commons CC-BY-SA 4.0.

If you have ever walked through smooth-barked eucalyptus trees in eastern Australia and noticed the looping, wandering lines etched into the pale bark, you have been reading moth biography without knowing it.

Those marks are mining tunnels, made by the larva of Ogmograptis scribula, the Scribbly Gum Moth. The larva feeds on the thin growing layer between the outer cork and the wood beneath, leaving a permanent record of its passage pressed into the bark.

The tunnel starts narrow as the young larva makes its first exploratory path outward, then widens on the return journey as it grows.

The result is that distinctive doubled, wandering line: the young larva going one way, the larger larva coming back.

Fresh tunnels are pale. Older ones darken as the bark grows and pushes them outward.

Every scribbly gum tree is covered in the life stories of generations of larvae, a permanent archive of every individual that has ever lived there.

For decades, Australians assumed these marks were made by beetle larvae. It was not until the 1930s that a CSIRO entomologist named Tom Greaves finally identified the true author.

The Scribbly Gum Moth exists nowhere outside Australia, having evolved alongside the eucalypts over millions of years, its entire lifecycle built around a single genus of tree that itself barely exists anywhere else.

The moth and the tree are so completely each other's that one seems almost unimaginable without the other. Nobody writes enough books about that kind of evolutionary love story.

The Australian Whistling Moth

The Territorial Disputes You Cannot Hear

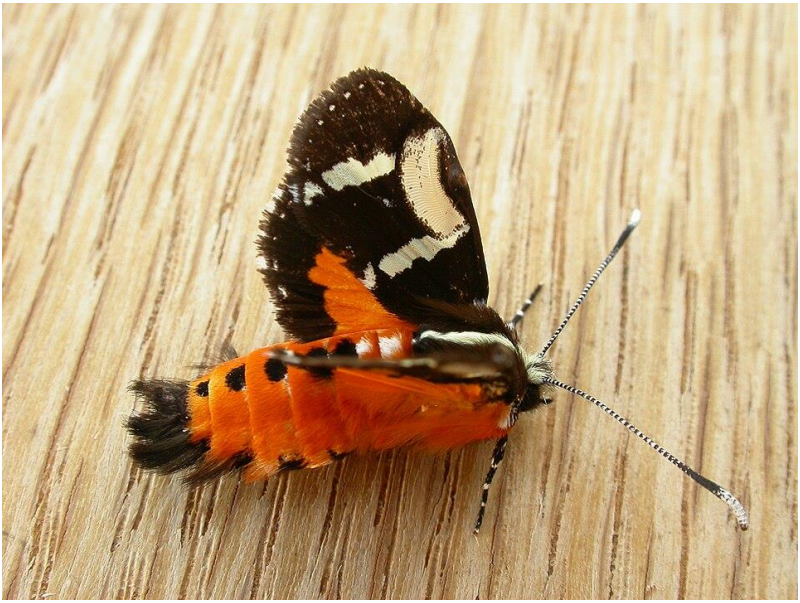


Photo by: Donald Hobern. Licensed under Creative Commons CC-BY 2.0

This requires a small amount of preparation before I tell you, because I want you to appreciate the full strangeness of it.

Most moths are nocturnal. Most moths do not establish territories. Most moths do not call from fixed positions for hours at a time. Most moths do not engage in extended aerial confrontations with rival males involving continuous sound production. Most moths, in short, behave like moths.

Hecatesia exultans, the Australian Whistling Moth, has not received this memo and appears to have no intention of doing so.

Male Whistling Moths establish territories on low vegetation in the middle of the day, in broad sunlight, and call continuously from their positions for hours at a stretch.

The calls are produced by specialised structures on their wings and are entirely in ultrasound, completely inaudible to humans. When a rival male enters the territory, both moths call without stopping while engaging in aerial confrontations: flying at each other, chasing, displacing, until one concedes and retreats.

Females visit calling males, assess them by criteria we do not fully understand, and mate with whichever male they find convincing.

Males maintain territories spaced roughly 15 to 25 metres apart, and the whole social system operates continuously in the ultrasonic range, just above human hearing, while people go about their ordinary days entirely unaware that an elaborate moth society is conducting its business at full volume all around them.

The fact that this is happening in Australian parks and gardens right now, audible to every bat in the vicinity and to absolutely no human being anywhere, is one of my favourite facts in this entire book. There are moths out there arguing about territory and attracting mates and running what is effectively a complex social system, and none of us can hear a single word of it.

The Moth with Jam Bat Sonar

An Arms Race Sixty-Five Million Years in the Making

Bats and moths have been at war since the Eocene. Bats evolved echolocation around 65 million years ago, which gave them the ability to hunt insects in complete darkness by bouncing ultrasonic pulses off their prey and interpreting the returning echoes with extraordinary precision. Moths, faced with a predator that could detect them perfectly in the dark, evolved ears.

Then they evolved countermeasures. Then bats evolved better echolocation. Then moths evolved better countermeasures. This process has been going on for longer than the Himalayas have existed and shows no sign of concluding.

Some Australian moths, upon detecting the ultrasonic signals of an approaching bat, produce ultrasonic clicks of their own that disrupt the bat's sonar. The bat's echolocation picture becomes confused, the moth's precise location becomes unclear, and the bat either aborts the attack or misses.

This is not camouflage. This is not hiding. This is active electronic jamming, evolved by an insect, operating at frequencies no human can detect, happening over Australian gardens and forests every single night.

Other moths take a different approach. Instead of jamming the bat's sonar, they broadcast ultrasonic warning signals that tell the bat, in terms the bat's nervous system recognises from previous bad experiences, that this moth tastes dreadful. The bat, which has indeed eaten a dreadful-tasting moth before and remembers it with feeling, veers off. The moth flies away. Honest advertising. Effective and cheap.

And then there are the moths that have worked out that if you broadcast the warning signal of a toxic moth, bats will avoid you whether you are toxic or not. These moths are bluffing. They have evolved acoustic mimicry: copying the ultrasonic distress calls of genuinely unpalatable species to benefit from a reputation they have not earned. The bat

cannot distinguish the genuine article from the impersonator. The con works perfectly. These moths are cheating at an arms race and getting away with it.

Most extraordinary of all: some moths produce anti-bat ultrasound without any ears, without any ability to detect approaching bats, and without any awareness whatsoever that they are doing it.

The sound-producing structures are built into their wings and activate automatically with every wingbeat, running a continuous predator-defence system that the moth has no conscious access to and no control over. Evolution equipped them with the technology, set it running, and did not bother to add an on/off switch. It works whether they need it or not, every time they fly, for their entire lives.

Australia contains examples of all of these strategies operating simultaneously, which means that on any given night, above your garden if you happen to be in Australia, there is an ultrasonic war being conducted on multiple fronts by creatures you cannot hear, using technologies you cannot perceive, in a conflict that has been ongoing since before humans existed. The moths are doing fine, since you ask.

They Build Houses and Decide Never to Leave

The Case Moths

Photo by: John Tann. Licensed under Creative Commons CC-BY 2.0.
Source: https://commons.wikimedia.org

Australia has at least 350 species of case moths, also called bagworm moths, and they represent one of the more philosophically unusual approaches to being a caterpillar that evolution has ever produced.

Upon hatching, the case moth larva immediately builds itself a house. It constructs a portable silk tube and decorates the outside with whatever is available: twigs, leaves, bark fragments, sand grains, grass stems, lichen. Each species has its own characteristic decorating style, consistent enough that you can identify the species from the case design alone, without ever seeing the moth itself. They are, in a very literal sense, signing their work.

The larva lives inside this case for its entire larval life, extending its head and thorax through the front opening to feed and travel, always dragging the case behind it.

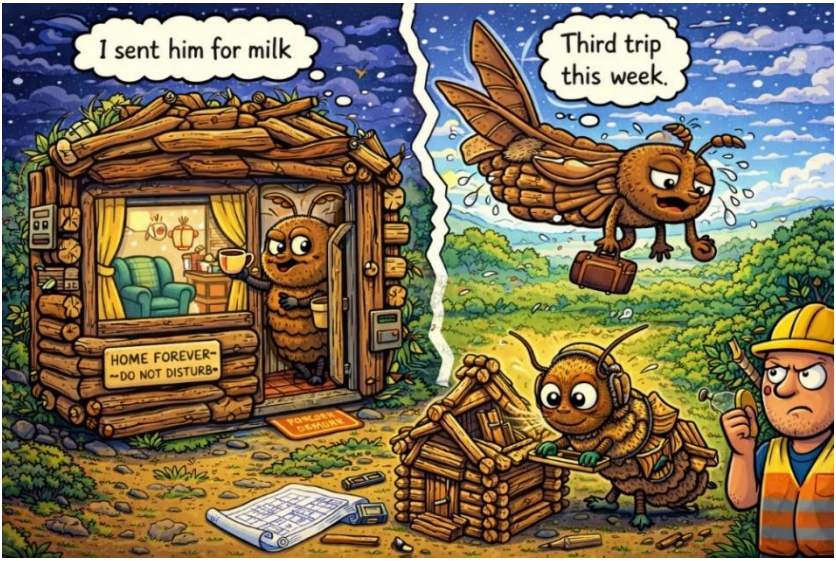
When threatened, it retreats inside completely. In larger species the case is strong enough to defeat most birds that attempt to break in. The caterpillar has built itself a portable fortress and takes this seriously.

In some species the female never leaves the case at all. Not as a caterpillar, not as a pupa, not as an adult moth. She pupates inside. She emerges as a winged adult inside.

She releases pheromones to attract a male, mates through the opening, lays her eggs inside, and dies inside. Her entire existence takes place within the silk tube she built as a newly hatched caterpillar. The male does all the flying. The female has, through millions of years of evolution, concluded that going outside is entirely unnecessary and delegated the task completely.

I find this both remarkably relatable and deeply thought-provoking. The Saunders' Case Moth, one of the largest Australian species, builds cases up to 13 centimetres long decorated with intricately arranged sticks, each placed with a precision that gives the finished structure the appearance of a miniature log cabin.

The caterpillar is doing joinery. Building something architectural, from scratch, using only silk and whatever it finds nearby, before it is old enough to know this is supposed to be difficult. The case moth is, in its quiet way, an extraordinary builder.



The Mallee Moths

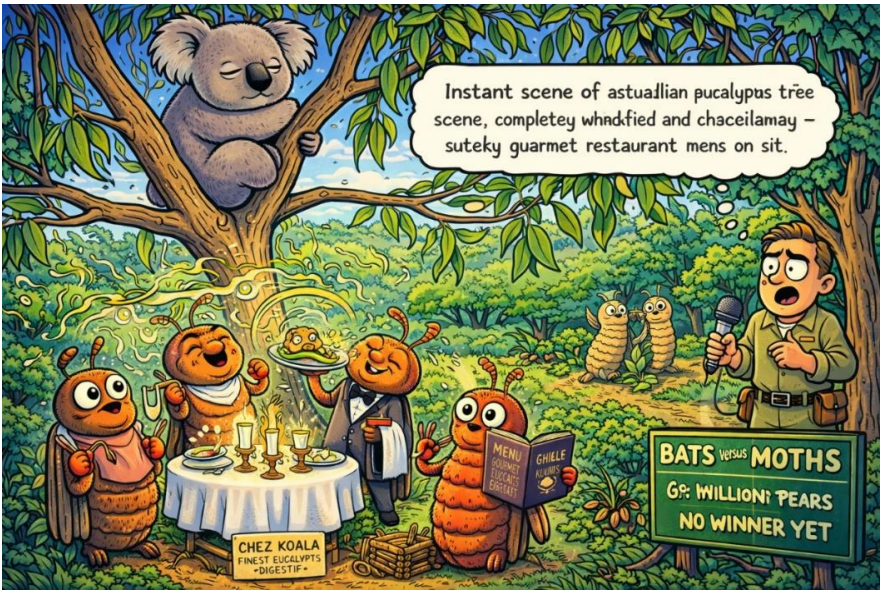
Remarkable Dining Arrangements

We established earlier that the mallee moth family has diversified in Australia to become the second largest family of organisms on the continent. Let us now discuss what some of those 5,500 species have decided to eat, because this is where Australian moths make their most dramatic departure from conventional moth behaviour.

Most moth larvae eat plants. Leaves, wood, roots, stored seeds. This is the standard arrangement, and everyone has made their peace with it. Some Australian mallee moths, however, surveyed the available food options and made choices that can only be described as imaginative.

Four species in the genus Telanepsia have larvae that feed exclusively on the dried droppings of koalas and possums. The droppings contain partially digested eucalyptus leaf matter, which the larvae extract nutrients from as a second stage of digestion. This is not opportunistic behaviour, not a case of making do with what is available.

These are specialist, dedicated, koala-dropping moths. They have evolved specifically to exploit this food source, they are very good at it, and they apparently find it entirely satisfactory. The koalas, for their part, are unaware of this arrangement and continue to go about their business.



Two species in the genus Trisyntopa have managed something even more remarkable. They feed on the droppings of parrots: specifically, the Golden-shouldered Parrot and the Hooded Parrot, both endangered species that nest in termite mounds in northern Australia.

The moths lay their eggs in the parrot nesting cavities, timed with extraordinary precision so that the moth larvae hatch at the same moment as the parrot chicks. The larvae then spend the entire parrot nesting period inside the mound, feeding on the chick droppings as they are produced, then pupate in the mound walls when the chicks fledge.

The moths' entire breeding cycle is locked, with millimetre precision, to the breeding cycle of an endangered parrot. When the parrot does well, the moth does well.

When the parrot's numbers decline, so do the moths. Conservation biologists have noted, with some interest, that the moths may benefit the parrots by keeping the nesting hollow clean, converting what would otherwise be accumulating waste into more moths, which then depart when the chicks do.

A relationship that began as parasite and host may have become something closer to mutual benefit. This happened in a termite mound in northern Australia, and it is one of the more quietly extraordinary ecological arrangements in the natural world.

Other mallee moth larvae have gone in a completely different direction and become carnivorous, feeding on scale insects and, in at least one documented case, on spider eggs. A moth larva that eats spider eggs. Australia really does contain everything, and it has no intention of being modest about it.

The Enigma Moth

The One That Broke the Classification System

In 2015, on Kangaroo Island off the coast of South Australia, an entomologist found a moth that caused a small crisis in taxonomy.

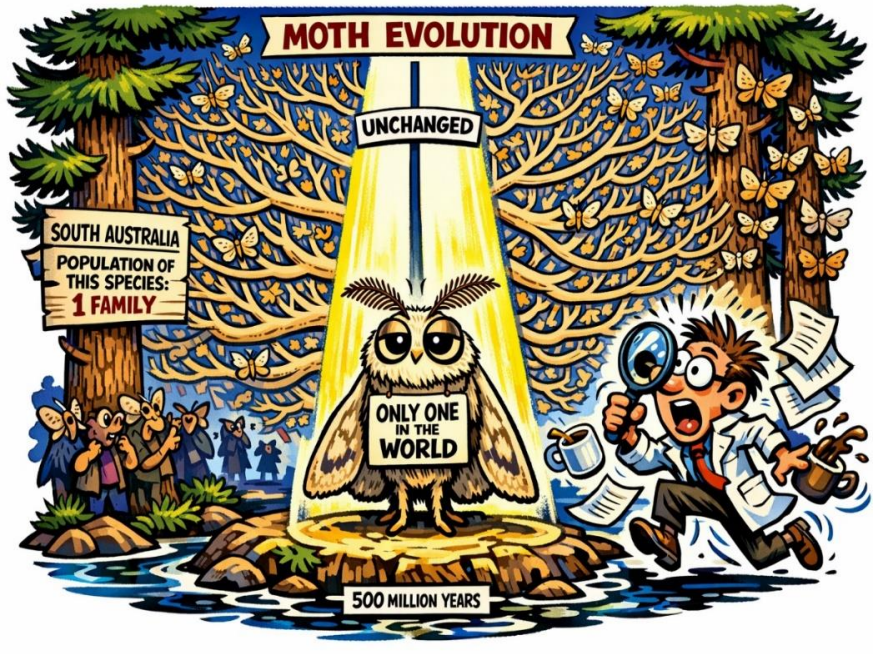
Aenigmatinea glatzella, subsequently named the Enigma Moth, was so unlike every other known moth that scientists examining it found themselves unable to place it in any existing moth family. Its mouthparts are primitive to a degree not seen in any other living moth.

Its reproductive structures are so archaic that they represent a form of moth anatomy not documented in the rest of the 160,000-species order. It is, in terms of moth biology, an anomaly of the first order. Scientists created a new family, Aenigmatineidae, specifically for it.

The Enigma Moth is the only known member of its family. There is nothing else like it anywhere in the world. It is, in its quiet way, entirely alone.

Its primitive features suggest it represents a very ancient lineage: a moth that has remained essentially unchanged while the rest of the moth order spent hundreds of millions of years evolving in every possible direction.

It is a piece of moth prehistory, found in a stand of native pine trees on an island off South Australia, going about its ancient business in complete obscurity until the day someone looked closely enough to realise that something that should not still exist, did still exist.



Australia kept it safe. Of course it did. Australia is the kind of continent that keeps things safe that the rest of the world has long since lost. The platypus. The echidna.

The Wollemi Pine, a tree known only from fossils for 200 million years until a botanist found a living stand of them in a canyon in New South Wales in 1994. Australia has a talent for preservation that borders on the supernatural, and the Enigma Moth is one of its quieter treasures.

The Female Impersonator

This is not technically a moth. But I cannot in good conscience write a chapter about Australian moths without mentioning the creature that has evolved specifically to exploit them, because it is one of the most audacious biological cons in the natural world.

The Bird-dropping Spider, Celaenia excavata, is an Australian spider that spends its days sitting perfectly motionless on leaves, disguised as a fresh splatter of bird droppings. It does this with such fidelity that birds, which are the spider's main predators, ignore it completely. During the day the spider is, as far as any bird is concerned, bird droppings. Nothing to see here.

At night, however, the Bird-dropping Spider has an entirely different strategy. It hangs from a short silk thread with its front legs extended, and it releases a chemical into the air. This chemical is a synthetic replica of the sex pheromone produced by female moths of specific local species.

Male moths, detecting what they believe with complete confidence to be a receptive female nearby, fly toward the source with the focused optimism of creatures who have very little time and very clear priorities. They fly close enough to be grabbed. The spider eats them. Its diet is almost exclusively male moths lured in by fake pheromone signals.

The Bird-dropping Spider has evolved to chemically impersonate a female moth well enough to consistently fool male moths that have themselves evolved extraordinarily sensitive and discriminating pheromone detection systems.

It has hacked the moth's own communication network and turned it into a trap. It sits in the dark, pretending to be a moth, catching moths that are trying to be moths, and eating them. During the day it pretends to be bird droppings. Both deceptions work reliably. The spider is running two simultaneous cons and has been doing so successfully for millions of years.

Australia looked at the relationship between moths and pheromones, understood it thoroughly, and then went ahead and evolved a spider that weaponised it. This is very on brand for Australia.

What This Means for Your War on Moths

This chapter is not a digression. It is context, and context changes everything.

The four moth species raiding your pantry and wardrobe are not representative of moths as a family. They are a tiny, specialised minority adapted over thousands of years to live alongside humans in the environments we create.

The rest of the family, 22,000 species in Australia alone, is doing something entirely different. Navigating by starlight and magnetic field across a thousand kilometres. Flying on invisible wings. Jamming bat sonar in real time. Building silk houses decorated with precision. Living underwater. Writing in eucalyptus bark. Synchronising lifecycles with endangered parrots. Feeding people in the outback, feeding bats in the rainforest, pollinating plants in the dark, supporting food webs most of the world has never heard of.

When you understand the full family these four inconvenient species belong to, your pest moths become what they are: small, manageable creatures with specific habits and specific vulnerabilities. You stop feeling overwhelmed and start feeling like someone who understands the situation. Which you now do.

And perhaps the next time you see a moth at a light on a warm evening, take a moment before shooing it away. It almost certainly has nothing to do with your wardrobe or your pantry, and everything to do with 300 million years of extraordinary biological history playing itself out in your garden, in the dark, while you were not watching.

It is just out there doing something remarkable. As usual.

- Remember: Australia has up to 30,000 moth species. Almost none of them have any interest in your home, your wardrobe, or your pantry. You are at war with a very small minority.

- If you live in or visit north Queensland, look up the Hercules Moth. Nothing fully prepares you for 27 centimetres of wingspan, but at least you will know what you are looking at.

- If you see what appears to be a large bumblebee hovering in slow, graceful circles near flowers in Queensland, it may be the Pellucid Hawk Moth. Its wings are genuinely transparent. Engineers are studying them. It is not aware of the attention.

- Look at smooth-barked eucalyptus trees. The wandering lines in the bark are moth life stories written in cork. Each doubled line is one larva, going out young and narrow, coming back older and wider.

- Be aware that on any evening in Australia, an ultrasonic conversation between moths is taking place all around you that you cannot hear. Moths are arguing about territory, attracting mates, and jamming bat sonar at frequencies above human hearing. The silence is not silence.

- The Bogong migration: four billion moths, 1,000 kilometres, navigated by starlight and magnetic field, every single year. This deserves to be more famous than it is. Tell people about it.

- If you find a neat tube of silk decorated with small sticks or leaves in your garden, it is a case moth larva

going about its business. Leave it alone. It is building something.

- Tell someone about the aquatic moth larvae. Tell them immediately. It is the kind of fact that needs to move.

- You have now met moths that navigate continents, moths that make their wings invisible, moths that jam radar, and moths that are hacked by spiders. The four species in your home are the least interesting moths alive. Defeat them with confidence.

Don't You Love Coincidences, Luck, and Flukes

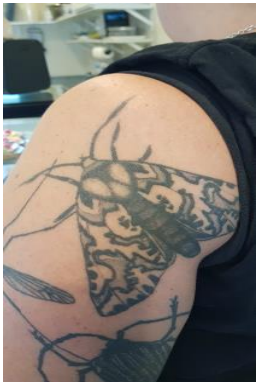
There is a particular kind of magic that happens when the universe decides to make a point. Scientists call it confirmation bias. I call it Coincidences, Luck, and Flukes. Remember our other website.

Yesterday I went to our local bakery. The food is good. They have one of our Pay it Forward jars on the counter, which is a whole other story at the other website — www.project30.org, since you asked — but the relevant part of this story begins with a lady waiting for her coffee who had the most extraordinary tattoos.

I asked her about them, as you do when someone is clearly proud of their ink and you are the sort of person who will talk to absolutely anyone about anything. She pulled up her sleeve, and there was a beautiful butterfly. We got chatting. Lepidoptera, as it turns out, has considerable appeal as body art.

And then the lady behind the counter heard us talking, looked up, and pulled up her own sleeve.

A moth.



Now that you are a bit more of a Moth Expert which moth is this?

An awesome beautiful, detailed, completely deliberate moth tattoo. And then another.

I know the above is not a butterfly!! If you know what it is, you are clever

It is a COOL tat

What moth is this?

Another of her beautiful tats.

I stood there holding my mince and cheese pies for my Grandson, and thought of all the bakeries, in all the towns, in all New Zealand.

I had to ask. Why a moth, when butterflies get all the glory and none of the bad press? Her answer was immediate and completely without hesitation.

"Because they are cool."

She then told me I should go on Instagram and search moth tattoos, because apparently there is an enormous community of people who feel the same way.

Perhaps we have been looking at moths all wrong. Perhaps the moths have better PR than I thought.

Now we are almost done!

Go and plant a swan plant or milkweed. You will not regret it.

It's like "Paying it forward", good for your Soul and Planet.

We are not into making profit from this book apart from hoping you will buy Mr Pink Moth Traps and Mr Pink Clothes Pegs.

Or just spread the word about Moths and Monarchs and if you found this book mildly interesting or funny tell people where to get the book for free or buy a hardcopy from Amazon.au.com

Kind Regards from

Henry B. Moth

Hoping you become richer in life, not just from saving your food and clothes from moths.

Enjoyed the Book?

If The Moth Book helped you win your own war on moths, or gave you a few facts to show off at dinner, consider grabbing a paperback for your own shelf.

It is a small book that punches well above its weight, part practical pest control, part love letter to some of the strangest, most spectacular creatures most people walk straight past.

It also makes a genuinely funny gift. Buy one for yourself, or for someone who needs to declare war on their own pantry moths, at www.mrpink.co.nz

Thank you for reading.

Finally. A book that actually tells you how to get rid of those pesky little moths in your wardrobe and your pantry.

Written by someone who has been there — surrounded by fluttering intruders, holding a bag of ruined flour, wondering where it all went wrong. This is the practical, straight-talking guide to winning the war on moths in New Zealand and Australian homes.

Inside you will find:

How to Get Rid of Your Moths

Simple solutions for pantry and wardrobe moths that actually work.

The Other Things Eating Your Clothes and Carpets

Because moths don't always act alone.

The Real Magic of Moths

Astonishing facts about their beautiful cousins to share with your kids.

No jargon. No nonsense. Just a clear plan, a good laugh, and a moth-free house.

Henry B. Moth

www.mrpink.co.nz