Fumigants & Pheromones

Digital Newsletter Delivered by Insects Limited, Inc. *Issue 159*

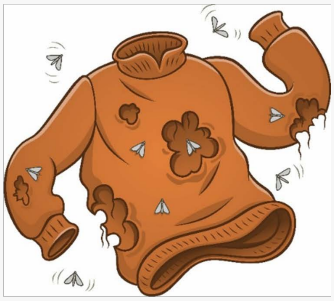
Top Clothes Moth Cities in the USA in 2020

Pat Kelley, BCE
President of Insects Limited

By no means was 2020 a typical year by anyone's imagination, but the insect pests that plague us went on like everything was just fine. So, when we looked back at the year concerning which cities in the U.S. have the worst clothes moth problems, we saw many cities stay in the same ranking spot while a few others moved down on the list.

This made way for several new players in this destructive race.

This is the 4th year in a row that Insects Limited released a ranking of the top 15 clothes moth cities in the United States. Let's take a closer look at the Who's Who of clothes moth cities.



For 2020, the top two cities for clothes moth remain unchanged as **New York City** and **Boston remain the two hottest spots in the U.S.** These top 2 rankings have been locked in since the rankings began in 2017. **Cincinnati** was a big surprise this year as it has never been in the rankings but soared up into the # 3 spot this past year. **Philadelphia** dropped down two spots to #5, while **Los Angeles** held tight to 4th place on the list.

A record number of seven new cities were added to the list that were not on this list in 2019. **Phoenix** had never been ranked previously and jumped into the # 7 slot. **Atlanta** at # 8 had only been ranked once previously where it was at #15 in 2018 but had dropped off of the list in the following two years. **Orlando** rounded off the top 10 in 2020 but had only been ranked once before at the #14 spot in 2017. **Providence**, RI had never been ranked before and hurdled into the # 12 rank. **Portland**, OR had been ranked at the #15 spot during the years of 2016 and 2017, but then was unranked during the next two years until returning at # 14 in 2020. Finally, **Austin,** TX had never been on this list and just squeezed into it this past year at the # 15 spot.

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Generally speaking, the Eastern Seaboard of the U.S. remains a stronghold for clothes moths all of the way from Maine into Florida.

In the Midwest U.S., **Minneapolis** dropped four spots to # 9 while **Chicago** dropped five spots to #11.

In the Western U.S., **Santa Fe** kept up the streak of New Mexico cities making the rankings during every year that the rankings have been done. Find the entire list of the rankings below.

The cities that fell off of the list this year include San Francisco, previously ranked 8th, Denver, previously ranked 9th, Houston, previously ranked 11th, Washington DC, previously ranked 12th, Cleveland, previously ranked 13th, Seattle, previously ranked 14th, and Albuquerque, NM, previously ranked 15th.

What can I do about clothes moths?
Knowing what to look for is essential in identifying clothes moth activity. Finding and eliminating the moths early in an infestation can prevent years of battling these pests if they get out of control in your home. Pheromone traps are a good means of identifying and locating problems but knowing the telltale signs of the frass and webbing from the larvae eating the clothing and rugs can prove extremely valuable in early detection. Check out some great YouTube videos that can help. Here are links to a few of those:

Clothes Moth Biology Video Links

Life Cycle of Clothes Moths on a Wool Rug
Signs of Clothes Moth Damage
Identifying Clothes Moths by their Frass
Top Five Facts About Clothes Moths
Clothes Moth Identification
Clothes Moths Destroy a Wool Sweater

Clothes Moth Pheromone Trap Links

GreenWay Clothes Moth 2-pack
Insects Limited Clothes Moth 5-Pack
Insects Limited Clothes Moth 10-Pack

Entomologist Patrick Kelley gives a **quick identification guide** for casemaking clothes moths. This will help you identify which clothes moth species that you have prior to trying our **professional grade pheromone traps**. This guide breaks down the differences between webbing clothes moths and casemaking clothes moths. Clothes moths of both species feed on wool, fur, feathers, mohair, animal hair and other animal fibers. They can infest museums, homes and businesses.

Where will they go next?

Webbing clothes, Tineola bisselliella, appear to continue to be on a rapid rise in many metropolitan areas. Research has suggested that the webbing clothes moth does not come into our homes and businesses from natural reservoirs (E.g. bird nests, dead animals) but instead travels from person to person1. This type of behavior is called synanthropic, which means the clothes moths benefit from an association with humans and the habitats that humans create. As we pass along our wool rugs, blankets, sweaters, fur coats, and feather pillows, etc. to family members, friends, or other means of trade, we also move the moths from location to location. The densely populated northern portion of the Eastern Seaboard (Maine to Washington DC) again accounted for over 70% of the clothes moth sales for the entire country. As people move about the country, they carry the clothes moths with them, so even if your city isn't on this list now, be prepared because they still might be coming your way soon!

***The list of top cities was compiled based on the total number of sales of clothes moth pheromone traps into the greater metropolitan areas of each ranked city between January 1 – December 31, 2020.*

Resource:

1Krüger-Carstensen, B., & Plarre, R. (2011). Outdoor trapping and genetical characterization of populations of the webbing clothes moth Tineola bisselliella (Lepidoptera: Tineidae) in the broader area of Berlin. *Journal of Entomological and Acarological Research*, 43(2), 129-135.

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Species Spotlight - The Cowpea Weevil *(Callosobruchus maculatus)*

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The cowpea weevil *(Callosobruchus maculatus)* is a stored product insect pest that infests and feeds on stored legumes, such as cowpeas (black-eyed peas), chickpeas, lentils, mung beans, adzuki beans, and dried peas.

Although weevil-like, cowpea weevils are not true weevils. They belong to the bean weevil and seed beetle subfamily Bruchinae which is now a part of the leaf beetle family Chrysomelidae. Adults are small (3-4mm long) with long legs and long antennae. They have mottled reddish brown coloration with two blackish spots on the wing covers. Their wing covers do not completely cover their abdomen leaving parts exposed.

Male cowpea weevil (Callosobruchus maculatus) (left) and female cowpea weevil (right). Notice the difference between the body shape and antenna length.

Adults do not feed and are short lived living for 10-14 days. A female cowpea weevil can lay around 100 eggs on the surface of beans which hatch in about 4-8 days. Emerged larvae will burrow into a legume to feed and develop from within. After a week or two, the cowpea weevil will emerge out of the legume as an adult completing their life cycle in as little as 21 days.

Unlike other stored product insects, cowpea weevil adults can be found in two morphological forms: one with wings and capable of flight and the other without wings and flightless. The flightless form is common while food and environmental conditions are optimal. As conditions become more unsuitable, such as from high larval density or high temperatures, the winged form becomes more common. This morphological change may help facilitate cowpea weevil dispersion to more suitable areas such as growing seeds in the field.

Cowpea weevil (Callosobruchus maculatus) damage to chickpeas.

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The Worst Pest Invasion of Stored Products in Recorded History (With Pictures!) – Part 1

Quinn Schroeder
Fumigants & Pheromones Guest Contributor

The staff of Insects Limited had the pleasure and the opportunity to work alongside Quinn Schroeder during his time in the industry. We observed his abilities to think through situations as a keen observer, questioning occurrences that might seem normal to others. Even though we are very happy for him, unfortunately, Quinn left the industry and is now in his third year as a medical student in Phoenix, AZ.

We were however very excited when he contacted us asking if he could contribute to the Fumigants & Pheromones Newsletter by writing informative essays on a broad range of topics including ecology, biology, and biomedicine.

Please enjoy this article and keep an eye out for more from Quinn Schroeder.

Do you have an elusive family of mice giving your pest control operator headaches? Rest peacefully knowing he's not up against 126,000 mice!

A few years back, while navigating the back allies of Google Scholar, I came across an entry that referenced a 1922 manuscript. An internet search for it came up nearly empty. The book had been out of print for the better part of a century, but its synopsis intrigued me, so I forked over $20 for the only copy available. The fabric-bound covers were bare, and the firsthand accounts on the pages between were just as monotone. The book's mannerism was overcast and informative, but the grotesque black and white photos enthused me. I felt compelled to blow off the dust and share this forgotten narrative with a modern perspective.

Just after morning's break, in Crystal Brook, South Australia, the mainland's southcentral state, a young lad trots around stacks of bagged wheat and grabs a waterfilled bucket out of the ground with last night's casualties. Dead mice! Hundreds of them in this bucket alone. He decants the water and transfers the bodies into a large sack, then refills the bucket with fresh water and places it back in the hole. Each bucket sits positioned into openings between a wall that encircles the wheat stacks.

His morning stroll also involves retrieving any carcasses that did not make it into his traps. Sometimes the perpetrators get stuck between the sheet metal walls and die of heart attack, or are crushed from falling bags, or even cannibalized by their contemporaries. Other times they may succumb to the deadly gas injections from the night before. The boy is responsible for retrieving all dead bodies, and for the last couple of months, his routine involves precisely this. It takes him hours and is mundane but vital to control the situation.

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His sack is waterlogged, with fluids leaking through the stitching voids – a mixture of last night's water, blood, and byproducts. He is careful not to breathe in the fumes. Usually, he drags his heavy burlap sack to the burn-pile, or maybe a trench for burial to rid the air of the lingering stench. Instead, this morning, per his manager's request, he dumps the contents adjacent to the wheat stacks. Each sack-full adds a little more to the growing pile of carcasses. He returns to the wall and repeats the process many more times. ***In only a day, he amasses 126,000 rodents*** **from this site alone!** After his efforts, a cast of eight workers in their rustic corduroy suits and wide-brimmed fedoras coalesce around the boy, behind the pile he has built (Figures 1A). Debris left over from the stacks can be seen in the background – once tidied bags are now piles of loose wheat.

Figure 1A (Left): 126,000 mice caught at Crystal Brook, South Australia. ***Figure 1B (Right)*****:** A similar case in Lascelles, Victoria, the mainland's southeastern state, where 500,000 mice were caught in four nights.

This holocaustic polaroid is a fulcrum in pest-vs-product history – the only known invasion of this magnitude! As horrid as the situation appears, it is not an outlier nor a one-off, but rather a representation of a plague besieging agrarian estates. It is early 1917, summertime in temperate Australia, and the country is in the midst of 'the greatest battle man has had to fight against stored grain pests anywhere and at any time,' as one historian points out. Alarming numbers of rodents are being extinguished at hundreds of locations around the country, similar to this site in Victoria (Figure 1B above). A war within a war is underway. Some men take up arms on the frontlines while others fight to secure the food supply.

Ninety-nine years after this period of agroeconomic depression, Fumigation Service & Supply and Insects Limited hosted their 12th International Fumigants & Pheromones Conference in the stunning city of Adelaide, South Australia – just a short drive south of Crystal Brook. Manufacturers, grain traders, investigators, and field technicians gathered to discuss hot topics throughout the industry, each bringing nuggets of expertise from their areas of the world. Attendees entertained state-of-the-art gadgets, in-depth analyses on the latest research topics, and practical solutions to combat pest attacks in food facilities – including rodent management. Australia had come a long way in just a century.

For several decades now, Aussies have rightfully boasted themselves global exporters of bona fide cereal grains, devoid of imperfections or contaminants, and on par with any other supplier worldwide – a poster child for purity by international standards. Nationwide decrees have been written into law to ensure their crops' protection – lauding that 'no wheat berry be left behind.' Strict rules make it easier to eliminate rodents and insects while transitioning from farm equipment to shipping vessels. Australia's cleanliness has rightfully earned it a chest-puffing reputation, but as the opening story depicted, the Land Down Under was once the global underdog; a victim of ill-timed intercontinental instability, domestic neglect, pest-provoking conditions, and downright poor luck.

Today we live in privileged times. First world citizens have grown numb to the hygiene of processing facilities and foodstuffs, the outcome of a century of protection regulations, audits, and research-supported installments. Developed nations are indebted to pest control companies, corporate and family-owned, which have carried out much of the heavy lifting. More than ever before, ingredients are wholly unadulterated by the time they reach the consumer. Products endure such refined physical, pneumatical, and chemical processing that a miller can fillet a wheat kernel into flour within minutes. Sifting and sorting that flour in precise combinations creates unique mixtures that can expand several inches into a sourdough bread loaf or harden to a crisp for a thin-crust pizza – just add water and set the oven to 400oF. Pest invasions of the past play an essential role in shaping the food industry seen today.

Let's return to the assault at large. One must wonder what led to such rapid and extreme chaos in 1917? Why were the rodents unbearable in Australia but not in other wheat-growing nations? How had storage depots flipped from minimal pest invasion to 100,000+ rodents killed each night? Four significant "strikes" confronted the Aussies throughout this plague.

Before 1917, bags of wheat hot off the field went to the nearest depot, whereupon laborers assembled them into grid systems for temporary storage (Figures 2 and 3). If time and materials permitted, the men blanketed the stash with iron roofing to keep out the rain and tarped it along the sides. Foreign governments purchased the wheat within several months, and the stacks were deconstructed quicker than they arose.

Wheat was money, and with exportation in high demand, cashflow trumped savings. In previous years, international trade alliances naturally accepted Australia's overflow wheat but instead shut down most of their ports while World War I was in full swing [Strike 1!]. The 1915 harvest rewrote Australia's almanacs. Farmers sickled 180 million bushels at the stalk, crushing the previous year by 42%! (It took only 30 million bushels to feed its citizens). 1916 and 1917 bested these numbers still. Wheat yields were skyrocketing [Strike 2!!]. The country's shallow pockets filled in a fortnight as crop productions increased with neither the structural capabilities nor the workforce to support them. Where to put the excess wheat became a serious conundrum, and with more wheat than mouths to feed, Australia fell behind the 8-Ball. Families could easily stock appropriate rations in a cupboard; why have expensive silos and elevators? Amid war and overproduction, for the first time, a need arose to handle and condition the remaining crop, but established systems for this did not exist [Strike 3!!!]. Like mister nozzles releasing water out of a high-pressure manifold, hundreds of makeshift depots were built on a whim to reduce congestion in the wheat trafficking system. And the mice took notice!

All civilizations have been shackled by famines that dwindle the food supply. But coincidentally, the issue here was overabundance, more food than the nation could handle, which jammed the wheat trade and led to social unrest. With most global commerce still shut down, an exodus of wheat was unavailable, as two-and-a-half years' worth of the crop accumulated and sat dormant.

More numerous and overloaded than ever before, these virgin sites provided rodents with a new avenue to lodge and feed. Mice swarmed out of the countryside in waves of "teeming millions" to feast on the wheat, weakening the stacks at their base and imploding the depots (Figure 4). In just a few months, the mice terrorized hundreds of sites in this manner. In their minds, they had hit the lottery and were living in excess. Food. Family. Shelter. Some depots tried cleaning and re-bagging, but it was an exhausting effort. Others shoveled up the wheat, pests and all, and sent it to coastal terminals. The worst of sites cut their losses altogether and buried or burned the grain.

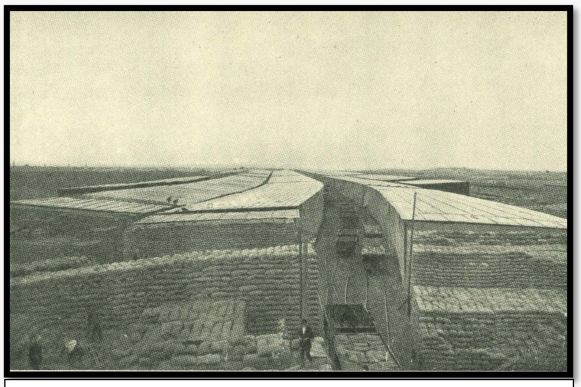

Figure 2: A depot containing 6,000,000 bags of wheat in roofed stacks in Brooklyn, Victoria during the 1916-1917 season.

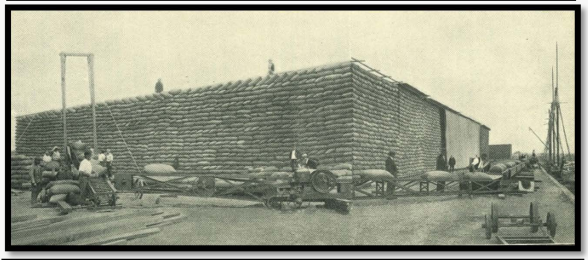

Figure 3: Wheat stacking at Port Adelaide, South Australia, 1918.

Entire storage facilities tumbled to the ground each day and exposed the kernels to the heavens, soils, and pests of all types. It also rained more than any recent year, which accentuated the damage [Strike 4!!!!]. Mass amounts of exposed wheat swelled with moisture and decayed even faster. Horrid odors whisked through the air, a concoction of dead mice and spoiled grains, creating "conditions so bad that often strong men were overcome with nausea, and had to drop out."

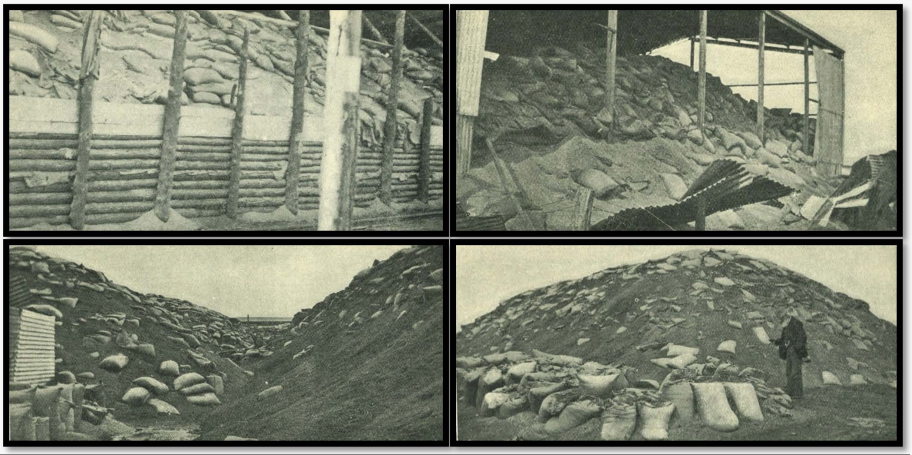

Figure 4: (Top Left): Collapsed stacks at Barellan, New South Wales. ***(Top Right and Bottom Left):*** Collapsed stacks, location unknown. ***(Bottom Right):*** Collapsed stacks in Crystal Brook, South Australia.

Today's food protection principles mimic those since the dawn of agriculture: the best forms of pest control prevent the pest from ever reaching a product. With that in mind, officials enforced a two-part scheme: 1) stop the mice coming in from the fields and 2) terminate the mice already inside the stacks. Many sites scurried to erect mouse-proofing barriers around the piles. Tall iron sheets were mounted in concrete footers running the perimeters.

But vermin often breached the obstacles by scaling up the walls or tunneling under the footers instead. Officials instructed workers to tidy-up the depots, but the orders were not well received, and compliance was lackluster. Most did not understand the importance, nor embraced the laborious tasks to keep the structures rodent-proof – akin to the same challenges many facilities and employees face today! Men filled burrows around the borders, removed carcasses daily to neutralize further rodent attraction, and buttoned up voids in the walls – monotonous chores for rugged countrymen working for small paystubs. Additionally, until they experienced it firsthand, usually too little too late, most men could not fathom the speediness at which depots crumbled when under attack. But when they maintained with their exclusion apparatuses, the mice numbers thankfully curtailed.

With the rodent influx addressed, the bleeding slowed, officials shifted to engineer new methods for exterminating the mice already inside, including the following: Walls opened every 25 feet, where a bucket of water was sunk into the ground. Rodents searching for a drink – marching in from the fields or wandering out of the wheat stacks – would fall into the buckets, overexert in a panic, and drown. Some sites combined this method with overnight fumigations. Men draped calico curtains over the stacks and injected hydrocyanic acid gas. When it could not kill the rodents, alternatively, it flushed them out and into the drowning buckets – like a hunter smoking a fox out of its den. Laborers spent long hours disposing of the bodies just as the young boy did in the opening story.

Adversity can be a true testament of a nation's merit and can drive innovation and prosperity if mistakes are understood, and a cure is prioritized. Australia bounced back from this catastrophe in the coming years. Wheat trading rebounded when the war cleared and ports reopened. In the decades to come, Australia followed suit of other developed nations and established storage facilities across its crop-growing states. The government allocated additional land to accommodate the annually increasing yields, which doubled as a safety net the next time an unforeseen event occurred.

The year of the mice was a roadblock indeed, even though historians give no estimation of the total amount of wheat lost. But it was only the beginning of an intensifying issue. This plague paved the way for one far worse. With sites still vulnerable and exposed, the doors stood wide open for other intruders, and a new wave of pests bombarded in. As the mice populations tapered off, the notorious weevil insect carved out a place in Australian history. The following year amounted to destruction far worse than what the rodents instigated – and it is the infamous reign of weevil, not the mice, credited as the alpha invaders of the era.

Story to be continued in Part 2

References and Supplemental Information:

Fumigants and Pheromones. Issue 118. Spring 2016.

Graver, J. V. S., & Winks, R. G. 1994. *A brief history of the entomological problems of wheat storage in Australia. In Stored Product Protection. Proceedings of the 6th International Working Conference on Stored Product Protection. Canberra, Australia: CAB International.*

Grey, Jeffrey. 2008. *A Military History of Australia* (3rd ed.). Melbourne, Victoria: Cambridge University Press.

Ratcliffe, F.N. Gay, F.J. and Fitzgerald, J.S. 1940. Wheat weevils and their control: a summary of existing information. Journal of the Council for Scientific and Industrial Research, 13, 229-239.

Winterbottom, D.C. 1922. Weevil in wheat and storage of grain in bags. A record of Australian experience during the war period (1915 to 1919). Government Printer, North Terrace, Adelaide, S.A., Australia, I 22p.