

## Yellow Jacket control for the Beekeeper

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### Part 1 Creepy buggers

One beautiful spring morning, I was walking around my backyard honeybee hives, when from a space between railroad ties in a retaining wall I saw a large Yellow Jacket emerge and fly off. My husband (fellow beekeeper) and I had noticed quite a few Yellow Jackets going after both honey and bees each time we inspected our hives, but they had not been beyond controlling with an entrance reducer and flyswatter. On that morning, I had a flyswatter in hand, and waited within reach for another Yellow Jacket to emerge. One did, I quickly struck, and mostly missed. The Yellow Jacket immediately and with perfect aim, unlike mine, streaked for and landed on my swatter holding hand. Then while biting constantly (yep that hurts) stung my finger three times (hurts more). It was all over in less than 5 seconds. I had dropped the swatter, flung hot coffee all over myself while trying to smack the Yellow Jacket with my opposite hand, and still had been stung in slow enough motion I could actually count the plunges of the stinger.

I had been stung by Yellow Jackets previously many more times than I can count. And like all those other times, my hand swelled, and hurt, and bruised, and felt horrible for a week. In the mean time I plotted my revenge, and decided that I would dig up the colony and be rid of it completely. My son was roped into the mission, and both of us went down one morning some two weeks or so later. Decked out in long sleeves, beekeeping jackets and hoods, two layers of gloves, fluffy thick ski pants, and boots we felt pretty safe from any Yellow Jacket sting. And we were. What we were not safe from was the nightmares we would both have afterwards.

Shovels and flying insect spray at hand we began to dissect the nest site. It took three hours. Three hours! I used the cans of insect spray. I used up all insect powder, and granules, and two gallons of gasoline, and bleach, and well...everything toxic I had anywhere in the house to douse the Yellow Jacket nest as we shovel by shovel full uncovered the colony. (Yeah, I know – I was well past caring about the environmental toxic dump I was creating) It was a horror movie. Tens of thousands of Yellow Jacket occupants squirmed and wriggled on every level. I'd spray them before my son would dig down another level. Then repeat, and repeat again, and again. I ran out of toxic liquids after we had dug a trench one foot wide by four feet deep by eight feet long...and we had not found the end of the colony. We reburied it all, covered it with a

sheet of plywood and buried the edges of that in a foot of dirt. I left it that way for months—too creeped out to touch it.

That same year, later in the fall, we experience our first confirmed honeybee hive kill by Yellow Jackets. I planned how to prevent more kills over the following winter and felt very ready, until the following honey extraction period. We were pulling frames, and boxes of frames of honey from our hives when very quickly the hives came under attack by Yellow Jackets. There was some robbing by other bees as well, and overall it was a big mess of us trying to remove honey frames, kill Yellow Jackets, and cover the hives and boxes of honey without smashing too many bees. The whole time, what seemed like more and more Yellow Jackets showed up and we witnessed several bees snatched off the top bars of open hives. After removing the honey that day, we reduced all the entrances down to about two inches hoping it would reduce robbing. A week later when we returned to inspect those hives. One was completely empty, with piles of dead bees out front on the ground. Other hives were clearly depleted to the point that we had to combine and feed. We thought it was more our fault and more or less a robbing problem. We had seen a lot of Yellow Jackets, but assumed the bees had been over stressed, robbed, too weak to fend off Varroa, and too beat up by us taking honey.

Then it happened the following year as well. This time, we thought we were even more prepared. We had trapped for Yellow Jackets starting early, and often throughout the year. We caught lots of them using meats, sweets, and pheromone baits. We put entrance reducers on before the honey harvest and then, when we took the honey, we were much more clean and efficient, pulling it only once in late July. By the end of September the hives were strong, Varroa were at very low levels, and it had started to reach freezing temperatures overnight. We felt that surely Yellow Jacket colonies would be reduced by the weather, and we swatted the few that we saw. Our hives began October 2015 with about 100 pounds of honey each, plus we had two frames of honey banked per hive. We were feeling very proud of ourselves!

Three days after that last inspection, I had to return to the apiary to pick up some equipment and as I drove up I thought I saw a bee swarm around and above several of the hives. But, when I got closer, what I found was a full on assault by thousands or tens of thousands of Yellow Jackets. There were bees in the air as well, but I clearly saw bees being snatched in flight and flown away. The hives were covered in Yellow Jackets, packed together and running in and out of the small reduced entrances. I jumped into my protective gear, and threw open the lid of the first hive of a 6 hive row. The hive was as full of Yellow Jackets as it had been three days before with bees. The second hive in the row was the same. In both those hives, the brood and honey, and much of the comb was gone. The bottom screened boards were over an inch deep in decapitated honeybee bodies. Out front of the hive were piles and piles more of dead

bees. The third and fourth hives were also full of Yellow Jackets, and each had a fist size clump of bees crammed in a corner. I pulled those bees by the frames and relocated them into a nuc. I got really lucky and saw a Queen in one of those clusters! The final two hives had just started to be attacked by the Yellow Jackets. They were both still full of bees. Most of the Yellow Jackets were on the bottom screened board and top inner cover where I brushed them away. I then closed up the entrances.

There were several other hives in the yard in about the same condition, so I quickly removed the Yellow Jackets and completely closed off the entrances. It was a chilly overcast day, of about 45°F. I knew there were bees out, and I felt bad that they would probably die not being able to get back in their hives. But, I had to stop the Yellow Jackets from entering as well. Completely. I left the hives closed for nearly a week. We had several freezing nights, and quite a lot of rain/sleet. So after those days I opened a ½ inch entrance in all my hives and left it that way for the winter. We had a rather warm winter, and fortunately I had plenty of honey banked (which I fed all the hives in late January). All the remaining hives of that last fall made it through to spring.

Over the fall and winter of 2015/16 I went on the research warpath to learn as much about Yellow Jackets as I could, and find a way to stop them from decimating our beehives. I read material on line, bought and read general entomology books, bought and read wasp books, chatted with many beekeepers as well as my father-in-law (a retired PhD in entomology), and researched studies and Yellow Jacket control programs from around the world. For the following information in this writing pertaining to Yellow Jackets, I used the books, and online resources as documented in the bibliography. But, in complete transparency, I also used maybe a couple of dozen smaller websites: online encyclopedias, online stories, online newspaper articles, etc. as support or color material that I then tried to always corroborate with the references in the bibliography.

## Part 2 Know your enemy

I thought I knew all that I needed to know about Yellow Jackets. I knew they are not bees; don't look like bees, don't act like bees, can sting repeatedly unlike honeybees, can be trapped in wasp traps, and as I witnessed – eat bees or maybe the honey...or, well...like I said, I knew enough. Then I read a book about them and began to understand why I had a big beekeeping problem in relationship to Yellow Jackets. To explain this reaction, I will start with a very simple version of the Yellow Jacket life and yearly cycle. Of several Yellow Jacket species in North America, it is the Western Yellow Jacket (from now on WYJ) that is most prevalent in the Inland Northwest/Eastern Washington State region; and the central figure for the rest of this writing.

In the first warm days of spring, over-wintered WYJ queens emerge, mostly alone, from protected places beneath fallen brush and leaves, or underground. They spend the first

few days eating as much as possible and then start to build a very small papery nest under eaves of buildings, rock outcroppings, or in small subterranean cavities. They lay worker eggs, care for the larvae, and continue to build strength by eating both plant and insect food sources. After the first of the workers are hatched, they take over the brood and foraging work. The queen WYJ will then remain with the nest for the rest of her life span. Later in the year, when the colony reaches maximum capacity, the queen lays what will become the next year queens. They hatch in the fall, mate and then finally seek out a place to over-winter.

WYJs are opportunistic feeders, eating fruit, insects, carrion, dogfood, etc. Brood however, need to be fed protein from insect larvae. The brood then create and regurgitate a carbohydrate excrement that is fed to the adults. The larger the colony the more voracious the foraging. Which of course increases the population, and thus the irritability and combativeness of the foraging adults. Yellow Jackets typically forage within a ¼ mile radius of their colony, so the larger the colony the stronger the irritability of the competing foragers. When the next generation queens are at the larval stage, the protein foraging is at its peak, often creating frenzied feeding and organized attacks of forage. Loud noise, and heavy activity will alert the WYJ to food sources beyond its normal range. When forage disappears, the surviving adults can and do turn to eating of their brood, until they are also gone and the nest is finished.

I wrote that the nest is finished. So you may wonder how I could have told the story about a huge colony in the spring that my son and I dug up. I was also confused. A quick search online, and you too can find information regarding Yellow Jacket (especially Southern Yellow Jacket) colonies that often over-winter and grow to huge proportions. But this did not solve my questions regarding the WYJ nor the existence of our huge backyard nest. Then I considered the local winter temperatures over the last several years. In our region, the last few years we have had warmer average temperatures through the fall and winter months. The 2014/15 and 2015/16 fall/winter average highs have been +1°F to +4.25°F and the corresponding average lows were warmer (data:<http://www.usclimatedata.com/climate/spokane/washington/united-states/uswa>). Could that be enough to make a difference for the overwintering of WYJ colonies? I also considered a few more options in answering my questions. Maybe, in general WYJ colonies do not winter-over, especially in our area, and the one I found was an anomaly. Or it could be a very local problem, as in where my hives are located. Perhaps what feels like more WYJs in and around my beehives is an oversensitivity on my part. Truth be told, I hate the little buggers. I hate being stung and my body's reaction to the venom. I hate the disruption when I am bar-b-Qing or pic-nicking. I hate what they do to my hives. It easily, could be me seeing a problem where one does not exist. Then again, there are the other beekeepers that have said, "Hey, what's up with all the Yellow Jackets!"

### Part 3 Honeybee vs. Western Yellow Jacket

When I compared the WYJ yearly cycle with our Honeybee yearly cycle it became obvious where problems arise, and how they arise, and gives incite towards solving some of the problems.

After a comparably similar period of low/no activity with both WYJ and Honeybees over the winter months, spring blooms and the earliest meeting of the two insects begins. The over-wintered WYJ queens begin foraging for small insects and nectar on the same plants/flowers as the honeybees forage. The WYJ colonies are normally very small at this point and of little danger to the growing honeybee colony. Once the first brood of the WYJ are hatched, they take over foraging duties, putting more and more WYJs in the vicinity of the honeybees. Honeybees are still way ahead in population, and only quick inspections are done by the beekeeper, leaving little opportunity for the WYJ to invade the honeybee hive.

Over the course of the summer months both the WYJ and the honeybee populations increase depending on both weather and foraging conditions. If optimal, then both colonies can grow rapidly. The WYJ feeds its brood larval insects. It finds these larvae both on plants and by following adult insects, like the honeybee, back to their colonies. The impact on the honeybee by the WYJ at this point is dependent on the proficiency of the guard bees and overall strength of the honeybee colony, and the strength and variety of forage for the WYJ. If there is easier to get food elsewhere, the WYJ is more likely to seek it before confronting the guard wall of a honeybee hive. This is the point where WYJ often come into conflict with people with food and drinks outside. The beekeeper often is doing longer inspections and manipulation of the beehive. The breaking of brood and honey comb can attract WYJ to the hive.

Toward the end of summer, the WYJ queen lays brood that will be next year's queens. Foraging WYJ workers prioritize quality food for these babies, seeking out plump, protein rich larvae to feed them. The population of the WYJ nest is as large and strong as it will be all year. Male brood has also been laid, and the hatched males create a need for even more food. Plant forage has decreased, and so have the small insects and caterpillars found on them. The WYJ increases its foraging range, taking on hard to procure meals. The honeybee enters a time of vulnerability, especially if the beekeeper is not aware of the danger. The honey crop is generally taken during the last weeks of summer. The beekeepers open up hives, create a great deal of commotion and activity in and near the hives, and inadvertently draw the WYJ to the apiary. Hives that may have swarmed can be less protected both in strength and population. Varroa may have increased and weakened the colony. And now the smell of honey, and broken brood comb is on the air – like ringing a dinner bell.

The new WYJ queens hatch and mate in the early fall months of September and October. Feeding of the queens and males is high priority. Most of the easier forage is gone so the pressure on honeybee hives can be extreme. If the hives are opened or honey is harvested during this period, attracting the WYJ to the hives, then the onslaught of WYJ can be overwhelming, and can occur days/weeks after the beekeeper has left. The bees, of course, are in a state of clean-up and repair after the honey harvest. The Queen bee has decreased egg laying, and the first of the smaller winter bees are hatching. Cooler temperatures make the bees cluster up, exposing outer frames to robbing, or providing a space for WYJ to invade. From those outer frames, the WYJ can clean out honey stores for quick fuel, and pick off the outer layer of bees from the cluster with little effort. They can even work their way into brood that can be taken back to the nest. If a hundred or even a thousand or more WYJs make their way to the outer frames inside of a beehive, then the bee colony can be destroyed quite quickly (ours was in less than 3 days) from the inside.

#### Part 4 A little incite

The WYJ is an opportunistic feeder. So, if the beekeeper eliminates or reduces the opportunity, much of the problem is solved. Here are a few of my suggestions:

- 1) Reduce the entrances of beehives to under an inch early in the summer and leave them until winter. Yes, the beehives are strong and guard bees do their best, but every WYJ that sneaks in some unprotected edge of a beehive increases the WYJ colony knowledge of the food source. When their population increases that memory will lead more to the hive. We use a 1/8 inch square hardware cloth/ stainless screen cut to length and bent "hot dog fold" for a quick pressed in entrance reducer. It does not restrict airflow like the wood ones, and holds up in all weather. I really like many of the more elaborate reducers/robbing screens found on line and in some store and catalogues. As long as what you use can be reduced to a very small opening, I think it would work well.
- 2) Be a gentle beekeeper during hive inspections. Remember that high activity alerts WYJ to the hives. A calm inspection keeps fewer bees from flying and from being alarmed. Smoking or using essential oil mixed syrup sprayed toward the bees may also help keep them calmer.
- 3) Be a clean beekeeper during inspections and especially during the honey harvest. Broken brood and honey comb smells will attract WYJ to the hives, so clean up as much as you can and dispose of it away from the hives. During the honey harvest, keep frames covered as much as possible, and remove full boxes away from the hives. Also place cappings, or wet comb out to be cleaned well away from the hives.

- 4) Completely close off the entrance right after the honey harvest for a day or two or three. I will probably get some grief over this, but the heavy activity of having the hives open, all that yummy smell, broken honey and brood comb, etc. is a dinner bell that just doesn't quit ringing until the bees have time to clean up the mess in their hive. This will also eliminate robbing by other beehives on the weaker hives. Once you open it, keep it reduced to just enough space for a bee or two at a time (see 1).
- 5) Keep other food sources of the WYJ cleaned up or away from the apiary. Those foods are, but not limited to: Soft skinned and rotting fruit, dog food and stool (contains proteins), cat food and stool, dead animal carcasses, open mulching piles/bins, uncleaned bar-b-Qs, open soda/beer, uncovered garbage.

#### Part 5 When it is war!

*A little caveat' here: The WYJ is a beneficial insect and has a place in the environment. It is a carnivorous larva/caterpillar/aphid eater that feeds on crop destroying insects. I am not suggesting that all WYJ should be eradicated from the environment. I am only interested in removing them from the immediate vicinity of my apiaries, especially when my beehives are at their most vulnerable.*

We have all seen the varied Yellow Jacket/Wasp traps available on the market or do-it-yourself. I would imagine that you have had about the same success with them as I have. Sometimes I catch so many WYJs that I can't see the original bait or liquid in the container. Other times, I'm lucky to catch one – yet dozens fly by a minute straight to my dogs watering bowl. I've used just about everything that could be liquefied or chopped small enough to fit in a trap. Meats, fish, sodas, beer, fruit, pheromones that cost an arm and a leg and don't last all that long. I've hung the traps high in the eaves of a building, sat others on the ground, and many in between. Like I said, sometimes they work and sometimes not. But no matter where and if I trapped WYJs, I was mostly just trapping the foragers (maybe a young queen once in a while early in the spring). This was doing nothing for the source of the problem, which is the colony.

When my online research took a turn towards looking for WYJ colony eradication, I stumbled on two multi-year studies. Both studies were very well done, and each reaches the same conclusion. With continued search online, I found several other organizations/countries around the world that used these two studies as jump off points for their own Yellow Jacket control programs.

In essence, the first study done out of the University of Southern California, in Riverside, was looking for a way to rid public locations of WYJ colonies. They set up different kinds of Yellow Jacket traps, in several locations (where people, food, and Yellow Jackets came in contact- pick-nicking sites, campgrounds, etc). They counted the Yellow Jackets that were trapped, and when a threshold was met that they considered denoted a high Yellow Jacket colony population nearby, they then set poisoned bait traps. They used these counts as a control for determining if bait/poison trials were successful. Trials were held to see what bait attracted the most visits by Yellow Jackets. Several poisons were tried to determine which would be carried back by foraging Yellow Jackets to the colony, without killing the forager along the way, and then killed the colony. Their conclusions also determined where and how far apart to place traps and poisoned bait for optimal Yellow Jacket colony eradication.

Likewise, a multi-year study was conducted in Hawai'i Volcanoes National park, Hawaii using the same poison and bait that the University of California determined to work best. The WYJ was introduced in the 1970's via overwintering queens transported to the islands in Christmas trees from Washington and Oregon states. The WYJ had become a problem in Hawai'i's natural areas attacking people, especially at picnic grounds and camping areas, and caused ecological damage through predation of arthropods and pollinators of indigenous flora (Hanna, King, Spurr).

Both of these studies found that minced canned chicken meat, laced with a small quantity of fipronil eradicated WYJ colonies, often in less than a week. The USCR study also noted, that with the cost of the minced canned chicken meat being pretty expensive, the use of Purina Frisky's brand canned cat food in Ocean Whitefish flavor came in a close second place. For the cost it was considered the best value. The fipronil in both studies was used in small amounts, ranging from 0.025 – 0.1% . The small volume of poison is carried via the bait back to the colony by the foraging WYJ where it is fed to the larva. The larva then feed the adults their excreted carbohydrate and poison. In this way the entire colony is eventually killed. Replacing the bait after just a few days (depending on weather conditions), keeping it soft and malleable was important for WYJ consumption.



For beekeepers, this combination of bait and poison is perfect for use around apiaries. Bees are not carnivores and are not attracted to the fipronil laced chicken or whitefish baits. The USCR study recommended hanging bait traps from 100-150 feet apart in a perimeter around the site to be protected. ½ inch wire mesh cages were made to secure the bait/poison. They were hung approximately five feet off the ground, and prevented most small animal and bird accidental poisoning. I built myself several of these small cages, stapling the ½ wire mesh to a small square sheets of plywood on the top and bottom, and cutting a small “door” in the wire.



Early this spring, once we saw Yellow Jackets flying, we baited our wire cages with a can of the Whitefish cat food and laced them with 5 drops of poison well mixed together. I collected the “used cans” after each week and replaced them with a fresh bait/poison combo. I did this for three consecutive weeks, at the cost of 50 cents a can for the cat food, and a few cents in poison. Each time we inspect our hives (about every 10 days) we stand and wait to see any WYJs flying or landing near our hives. We have yet to see any. For us, that is clearly a huge success over the past several years when

we would see by this time of year, several per hive per minute. I am planning on rebaiting the cages starting just before honey harvest time, and continue it through at least October. I am hopeful that for the small cost and effort I can protect my beehives from the WYJ onslaughts of previous years.

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