

# 11

## YELLOWJACKETS

(*Vespula* species)



**In the late 1990s a plague of yellowjackets in Center City made outdoor dining hazardous. They have since become scarce here.**

*Figure 11.1* Eastern yellowjacket (*Vespula maculifrons*) on porcelainberry (*Ampelopsis brevipedunculata*) just off Martin Luther King Drive in Fairmount Park, September 2012.

In 1887, Ezra Townsend Cresson of the Academy of Natural Sciences of Philadelphia completed a 350-page monograph on North American Hymenoptera, which includes bees, ants, and wasps. Cresson wrote that unlike paper wasps, which construct “nests on trees, or in corners of buildings, or under the roofs of outbuildings, yellowjackets build their nests underground, as most country boys know by painful experience.”<sup>1</sup>

## The German yellowjacket

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Ninety years later, yellowjackets started nesting in attics and walls of buildings. To investigate this phenomenon, entomologists at Cornell University in Ithaca used a newspaper notice to solicit information from local residents about any wasp nests. Readers identified twenty wasp nests—seventeen in houses, two in vegetation, and one underground. The predominant species nesting in houses was the German yellowjacket (*Vespula germanica*), an introduced species that until recently had been rare. Only one of the seventeen nests in houses was colonized by what had previously been Ithaca’s most common species of yellowjacket, the eastern yellowjacket (*Vespula maculifrons*), which is native to North America.<sup>2</sup>

The same year that the German yellowjacket was recognized as the dominant species in houses in Ithaca, it was discovered to be the principal species in houses in northern Delaware.<sup>3</sup> Five years later it was found to be more common in urban than rural areas in northern New Jersey, although still less common overall than the eastern yellowjacket, according to surveys using traps baited with fish-flavored cat food.<sup>4</sup> In the 1980s, the German yellowjacket spread to the Midwest,<sup>5</sup> and homeowners’ complaints to pest control operators about yellowjackets increased.<sup>6</sup>

## Pestiferous yellowjackets in Center City

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By the 1990s, swarms of yellowjackets attracted to food and sweet beverages made eating outside in Center City unpleasant and dangerous. Yellowjackets would typically appear at the dinner table within ten minutes of food and drink being served. I recall interrupting dining to move inside to escape them. Yellowjacket traps, then popular items in local hardware stores, killed yellowjackets but offered no relief.



Figure 11.2 Parc Restaurant, Bistro, and Cafe, at Rittenhouse Square, April 2012. The disappearance of yellowjackets has improved the quality of outdoor dining.

In addition to fruit, honey, molasses, soft drinks, and fruit juices, their culinary preferences include fine meats and fish: roast beef, roast lamb, boiled ham, cooked beefsteak, bacon rind, cooked calf's liver, wienerwursts, salmon, rabbit, and chicken.<sup>7</sup> In order to assess baits, one study systematically tested yellowjackets' preferences for processed meats: it found canned chicken and canned fish superior to freeze-dried chicken.<sup>8</sup> Yellowjackets feeding on meat attract more yellowjackets.<sup>9</sup> Yellowjackets use odors to locate food high in sugar content. When they return to their nests, they carry these odors with them; other yellowjackets leaving the nest learn these olfactory cues and use them to guide them as they forage.<sup>10</sup>

Despite what would appear to have been a threat to public health, the plague of yellowjackets in Philadelphia unfolded without any systems in place for monitoring it. Philadelphia has no quantitative record of yellowjacket populations, just as it has no objective documentation of the outbreaks of insects that defoliated the city's shade trees in the mid-nineteenth century. The technical difficulties of tracking populations of pollinators such as bees<sup>11</sup> exemplifies problems that would complicate attempts to measure populations of yellowjackets, whose abundance may vary from block to block and day to day, depending on many variables, including use of insecticides.

## Medical documentation of yellowjackets in Philadelphia

To uncover evidence of this plague, I searched the medical literature for all reports of victims of insect stings in Philadelphia at any time in the past. I found four publications—all dated from 1996 to 1999. Thomas Jefferson University Medical Center recorded 449 visits to the emergency room for stings from 1991 to 1996, peaking during September and October, a period the author dubbed “yellow jacket delirium.”<sup>12</sup> At the Hospital of the University of Pennsylvania, gastroenterologists' endoscopic examination of a woman with painful esophageal obstruction revealed she had ingested a yellowjacket.<sup>13</sup> Over a period of five years, eight children were treated

at Children's Hospital for anaphylaxis (a life-threatening allergic reaction) due to insect stings.<sup>14</sup> At the Hospital of the Veterinary School of the University of Pennsylvania, two dogs were treated for massive envenomation due to yellowjacket stings; one survived.<sup>15</sup>

## Causes of yellowjacket outbreaks

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When the urban yellowjacket problem surfaced in the 1970s, Harry G. Davis of the U.S. Department of Agriculture concluded that urban sprawl had displaced yellowjackets from their traditional nesting sites underground, while at the same time providing new sources of food for species like German and eastern yellowjackets, members of a group of *Vespula* (yellowjacket) species that are scavengers. He reviewed the global dissemination of pestiferous species of yellowjackets, especially the German yellowjacket in New Zealand, Tasmania, South Africa, Chile, Europe, and North America. Facilitating the spread of the German yellowjacket may have been the evolution of new genotypes that produced large colonies nesting in buildings.<sup>16</sup>

## Danger from yellowjackets

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Urban yellowjackets are more dangerous than mud daubers. Mud daubers spend most of their time hunting spiders, visiting flowers, collecting mud, and constructing nests. The male organ pipe mud dauber may guard its nest, but it does not sting. Mud daubers are not attracted to human food. The wasp nests themselves house only eggs and larvae—no adult wasps until the moment they hatch. The wasps that build these nests live alone, not in groups, and they are not aggressive.

Yellowjackets, in contrast, live in colonies. When a hive is disturbed, its members sting in swarms, like those of Africanized (“killer”) bees.<sup>17</sup> Members produce alarm pheromones that attract other members and induce them to attack.<sup>18</sup> Roger Simon and Allen Benton at Pennsylvania State University studied a nest of the eastern yellowjacket in a barn. They determined that it contained over 5,000 adult yellowjackets and over 10,000 cells. The wasps remained active into December.<sup>19</sup> Yellowjackets become more aggressive and are more likely to sting in the fall, when their natural sources of food disappear.<sup>20</sup> Nationwide, deaths due to attacks by animals are reported to the U.S. Department of Health and Human Services. From 1979 through 1990, the average number of deaths each year due to attacks was forty-four by bees, wasps, and hornets; sixteen by dogs; six by snakes, and four by spiders.<sup>21</sup> Yellowjackets are classified as wasps.

Yellowjacket stingers are barbed and may get stuck in victims, particularly the stingers of eastern yellowjackets. When a victim brushes off a yellowjacket, the stinger apparatus may separate from the wasp and stay lodged, where its venom contains pheromones that guide other yellowjackets to the victim even while he or she is attempting to flee.<sup>22</sup> The loss of the stinging apparatus in the body of the victim results in the insect's death, which has been cited as an example of ultimate self-sacrifice, or altruism—from the perspective of the hive. The selective forces that favor such altruism, however, are selfish from the perspective of the genes of the stinging insect, whose defense of the hive serves to propagate its own genes through those of its close relatives.<sup>23</sup>

## Decline in numbers of yellowjackets

Although yellowjackets in urban settings are pestiferous, elsewhere they provide important ecological services, particularly as predators of other insects, including agricultural pests. Declines in populations of yellowjackets could harm agriculture. Recent reports have suggested that such a decline may be taking place. Analysis of stings reported per year to the Illinois Poison Center found a reduction of 50 percent after 2005. Almost all of the stings took place around victims' homes in urban areas. The authors suggest that declines in reported stings are symptomatic of declines in populations of Hymenoptera generally—including not only yellowjackets, but also pollinators such as honeybees.<sup>24</sup>

In Center City, yellowjackets have disappeared. Over the last three years (2011 to 2013), I found none, even after attempting to lure them with bait such as soda, juice, fruit, and meat in September and October. Bees, on the other hand, remain conspicuous in community gardens and on flowering shrubs and trees. Bees easiest to observe include bumblebees, honey bees, carpenter bees, and sweat bees.

Wasps other than yellowjackets are also common, including paper wasps, which, like yellowjackets, live socially. The European paper wasp (*Polistes dominula*, also referred to as *Polistes dominulus*) is yellow and black and easily mistaken for a yellowjacket. Common in Philadelphia, it is an introduced species whose range in North America has been expanding rapidly.<sup>25</sup> Populations of some local bees and wasps may have declined, but the disappearance of yellowjackets is so distinctive that it likely represents a separate phenomenon.

In the summer of 2012 I found a yellowjackets' nest in the ground at Bartram's Garden. The species was the native eastern yellowjacket (*Vespula maculifrons*), the most common pestiferous yellowjacket in the eastern half of the country prior to the introduction of the German yellowjacket.<sup>26</sup>



Figure 11.3 Bumblebee (*Bombus impatiens*) on chicory (*Cichorium intybus*). Unlike yellowjackets, bumblebees are still common in Center City. They do not bother people eating outside.



Figure 11.4 Male eastern carpenter bee (*Xylocopa virginica*) waiting in midair for female to emerge from the wood of this bench behind the Philadelphia Museum of Art. It resembles a bumblebee, except its abdomen is smooth rather than hairy. It is uninterested in the bottle. Like bumblebees, it continues to be common in Center City.



Figure 11.5 European paper wasp (*Polistes dominula*) on porcelainberry. Its orange antennae distinguish it from yellowjackets, whose antennae are black. It has recently become common in Center City. Unlike yellowjackets, it does not pester people dining outdoors.



Figure 11.6 Nest of European paper wasp. It is suspended under an eave at the Fairmount Water Works.



Figure 11.7 Bald-faced hornet (*Dolichovespula maculata*) at 23rd and Panama Streets in Center City. In Center City it does not harass people dining outdoors.



*Figure 11.8* Bald-faced hornet's nest on Kater Street.

## Causes of the decline

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What might account for the disappearance of yellowjackets in Center City? Just as no quantitative measure documented the population explosion of yellowjackets here in the 1990s, no systematic measure has documented the population crash. Declines in populations of bees galvanize popular interest because bees are agriculturally important pollinators, but yellowjackets attract interest only when they are pestiferous. Records of the collapse of Center City's populations of yellowjackets reside exclusively in people's memories, which can recall yellowjackets at dinner tables better than they can specify the years and extent of yellowjacket abundance. The decline in abundance has yet to be delineated geographically, although I have noted such a decline in Narberth, a suburb of Philadelphia. I remember infestations of yellowjackets around garbage cans a decade ago in Fairmount Park. Searching for them in Fairmount Park during the past three years in late summer and fall, I found no yellowjackets around trash cans. However, in 2012 I identified German yellowjackets infesting an attic in a home in rural Churchtown, Lancaster County.



Populations of yellowjackets may have gone through cycles of boom and bust like those of bagworms and ailanthus moths. Populations of German yellowjackets, in particular, may have proliferated soon after their establishment, only to crash as parasites or pathogens caught up with them.

Many conditions could theoretically have contributed to the decline in numbers of yellowjackets. Tighter construction in buildings discourages yellowjackets from nesting in exterior walls and attics. Neonicotinoid insecticides, whose use by homeowners is unregulated and unmonitored, are toxic to insects even in low doses.<sup>27</sup> The increase in crowds of people in Center City aggravates soil compaction, reducing ground suitable for subterranean nests of yellowjackets. Improved collection of garbage in Center City deprives yellowjackets of food.

### European paper wasp

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One hypothetical cause for the decline of yellowjackets in Philadelphia is the establishment of the European paper wasp, which was first reported in Pennsylvania in 1990.<sup>28</sup> It is now the most common wasp in Center City. Its black and yellow stripes make it easy to confuse with yellowjackets, but its antennae are orange, in contrast to yellowjackets' antennae, which are black. The European paper wasp does not congregate around soda cans and human food as do yellowjackets, but it may compete with yellowjackets for prey. It has been blamed for declines in populations of native paper wasps, such as *Polistes fuscatus*,<sup>29</sup> still present in Philadelphia.

### Wasp years

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Yellowjackets in England and in the Pacific Northwest have shown mysterious cyclical population spikes, called “wasp years.” The spikes recur at irregular intervals, sometimes decades apart, and simultaneously encompass more than one species of yellowjacket.<sup>30</sup> Many hypotheses have attempted to explain these jumps in abundance, but none is convincing.<sup>31</sup> If past plagues of yellowjackets in Center City reflect such population cycles, they may recur.