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World- Wide Distribution of Pestiferous Social Wasps(Vespidae)

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Introduction

The purpose of this report is to review the literature regarding the distribution of certain social wasps in the family Vespidae in order to identify those species that should be tested for their behavioral response to the presence of a nest mimic, The Original Waspinator, within their search field. The intent of this review is to identify widely distributed pestiferous species, especially those that occur in North America, South America, Hawaii, Japan, Australia, New Zealand, western Europe and the United Kingdom.

“Pestiferous” species are those social wasps that have adopted a scavenger habit as opposed to the strictly predatory habit of most social wasps. The scavenger habit brings these species into contact with human activity more often because the workers are attracted to exposed food and drink. Scavenger species also tend to make larger nests that contain more workers.

Social Wasps

Wasps (Order Hymenoptera - wasps, bees, ants) in the family Vespidae, subfamily Vespinae, have adopted a eusocial, colonial habit in which colony labor is divided between a queen and workers. Workers build, defend and provision the nest with food while the queen lays eggs. Workers are the female offspring of the queen. Males are produced only during a relatively short period and only serve to mate with new queens. In the United States (US) social wasps in the genus *Vespula* are called yellowjackets.

Social wasp nests can grow to thousands of workers by the end of summer. At this time the large number of workers can become bothersome and even dangerous when human activity comes into contact with nests or foraging worker wasps. While most social wasp species are strictly predatory by nature, and have no interest in non- living prey, a few have adopted a scavenger habit that brings them into direct contact with people. These are referred to as the “scavenger” or “pestiferous” species. Scavenger species also tend to build larger nests that can survive longer into the fall than non- scavenger species. Some researchers have suggested that species that have adopted a scavenger habit have an ecological advantage over strictly predatory species.

World-wide the most abundant and bothersome scavenger species belong to a single species group - the *Vespula vulgaris* species group. A species group is a collection of closely related species as inferred from similarities in morphological structure and behavior. There are three species in the

V. vulgaris species group that cause most of the problems - *V. **espula vulgaris*** (common wasp [yellowjacket]), *V. **germanica*** (German wasp [yellowjacket]), *V. **pensylvanica*** (western wasp [yellowjacket]). A fourth species, *V. **maculifrons*** (eastern wasp [yellowjacket]), is important in the eastern and southern US as well.

Social Wasp Nests

Social vespids construct a nest from chewed wood fiber. The nest combs are enclosed by a papery envelope. The wood fiber from which the nest paper is made is collected locally and the paper takes on the color of the available fibers. The nests are typically grey or brown and somewhat mottled. The nests are tiered internally with several to many comb layers. Some nests are built above ground, called *aerial nests*, suspended from a support while most nests are built in cavities below ground, called *subterranean nests*. Nest construction begins in the spring and nests continue to grow throughout the summer reaching maximum size by late summer or early fall. The Original Waspinator nest mimic closely resembles a typical aerial social wasp nest.

Pest Species Distribution and Identification

The tables below illustrate the coloration and color pattern differences between the four most common pest species. Species in the *V. vulgaris* species group are distinguished by the coloration of the abdomen (Table 1), and/or color patterns around the compound eyes (Table 2 & 3). Two species, *V. vulgaris* and *V. germanica*, occur world-wide. Both are capable of making large and threatening ground nests. Where they have recently invaded new regions, such as Australia, New Zealand and Tasmania, these species tend to displace native wasp species and have significant impact on other native fauna and flora. *Vespula pensylvanica* is primarily a pest in western North America and Hawaii but has potential to spread elsewhere. *Vespula maculifrons* occurs in pestiferous numbers in the eastern and southern US.

Table 1. Main pest (scavenger) species world- wide

Vespula pensylvanica(western yellowjacket)

The western yellowjacket wasp occurs in the western US, western Canada and Hawaii. *V. pensylvanica* is considered to be the most important invader species in Hawaii and is targeted for management. Identification: continuous yellow ring, dorsally, around compound eyes (Table 3); upper surface of abdomen (gaster) similar to drawing at left; black mark on first segment diamond- shaped. Modified from Akre et al. 1981.

Vespula maculifrons(eastern yellowjacket)

The eastern yellowjacket wasp occurs in the mid-west, south and eastern US. Where it co-occurs with *V. vulgaris* hybridization may occur. *Vespula maculifrons* is probably the most pestiferous social wasp species in the southeastern US. Identification: without a continuous yellow ring, dorsally, around compound eyes (Table 3); upper surface of abdomen (gaster) similar to drawing at left; black mark on first segment anchor- shaped. Modified from Akre et al. 1981.

Vespula germanica(German yellowjacket)

The German yellowjacket wasp occurs world-wide. Unlike other vespids *V. germanica* nests are often associated with human- made structures. For this reason they may be more common in urban settings perhaps even displacing other species. *V. germanica* has recently established in Australia, New Zealand and Tasmania. Identification: without a continuous yellow ring, dorsally, around compound eyes (Table 3); upper surface of abdomen (gaster) similar to drawing at left; second segment usually with free black spots; black mark on first segment diamond- shaped. Modified from Akre et al. 1981.

Vespula vulgaris(common yellowjacket)

The common yellowjacket wasp occurs world-wide and has recently been established in Australia, New Zealand, and Tasmania. Identification: without a continuous yellow ring, dorsally, around compound eyes (Table 3); upper surface of abdomen (gaster) similar to drawing at left; second segment usually with free black spots; black mark on first segment diamond- shaped. Modified from Akre et al. 1981.

Table 2. Gena band behind compound eyes

	Side views of yellowjacket head showing compound eye (C), gena area behind compound eye, mandible (m), and antenna. The gena band is completely yellow in <i>V. germanica</i> and <i>V. maculifrons</i> (left) whereas it is interrupted with black in <i>V. vulgaris</i> (far left). Modified from Akre et al. 1981.
Table 3. Dorsal head coloration	
	Top (dorsal) view of yellowjacket head showing simple eyes (e), compound eyes (C) and antennae (a). There is a continuous yellow ring around the compound eyes in <i>V. pensylvanica</i> (top left) whereas it is interrupted with black in the other species (bottom left). Modified from Akre et al. 1981.

Summary

Three or four species of social vespid wasps (yellowjackets) account for most of the problem encounters, world-wide, between humans and these otherwise beneficial insects. Dangerous encounters occur when people disturb wasp nests or when forager wasps are attracted to human activity by exposed food and drink. *Vespula vulgaris* and *V. germanica* occur world-wide and probably account for the greatest percentage of problems between social wasps and humans. In the western US, western Canada and Hawaii, *V. pensylvanica* is commonly encountered in many areas and is extremely abundant in some areas. *V. maculifrons* is the dominant species in the mid-west, south and eastern US (Table 4).

Foraging wasps depend on vision to locate carrion and live prey. Vespid wasps are highly “visually oriented” as are other predatory insects. Objects within their field of sight and smell influence wasp behavior in both positive and negative ways. Wasps respond positively to the movement of live prey but at the same time must avoid competitive interactions that might interfere with foraging activity. Scavenger species also positively respond to the odors of protein (raw or cooked meat) and fermenting carbohydrate such as sugary soda or fruit juice. Wasps are drawn into an area by these odors. On the other hand, the presence of inter- and intraspecific competitor nests, or individual rival workers, are likely to be inhibitory and keep foragers away in order to avoid conflict.

The idea behind The Original Waspinator nest mimic is that the artificial nest is a visual deterrent to foraging wasps, warning of the presence of potentially aggressive competitors.

Because all of the pestiferous scavenger species belong to the same “species group” we can infer that the behavioral response to The Original Waspinator will be similar between these species. All nests in the *V. vulgaris* species group are similar varying only in terms of size and slight color variation depending on wood fiber source.

Table 4. Regional distribution of pestiferous (scavenger) social wasps

Region	<i>Vespula</i> species			<i>maculifrons</i>
	<i>vulgaris</i>	<i>germanica</i>	<i>pensylvanica</i>	
world- wide	* * * *	* * * *		
western US, western CA, Hawaii	****	****	****	
south & eastern US, central (mid- western) US	****	****		****

Useful Literature

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