

Journal Pre-proof

Exposure to species of Vespidae in the urbanized areas of New Orleans, Louisiana

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PII: S1081-1206(21)00361-6
DOI: <https://doi.org/10.1016/j.anai.2021.05.014>
Reference: ANAI 3607



To appear in: *Annals of Allergy, Asthma Immunology*

Received date: 10 March 2021
Revised date: 26 April 2021
Accepted date: 13 May 2021

Please cite this article as: John C Carlson , Mark S Fox , Exposure to species of Vespidae in the urbanized areas of New Orleans, Louisiana, *Annals of Allergy, Asthma Immunology* (2021), doi: <https://doi.org/10.1016/j.anai.2021.05.014>

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Title Page Title: Exposure to species of Vespidae in the urbanized areas of New Orleans, Louisiana

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Keywords: Vespidae; Hymenoptera; venom; anaphylaxis; urban

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Abbreviations/Acronyms: none

Funding Source: none

Trial Registration: not applicable

Conflicts of interest: none

The venom of social Hymenoptera is an important trigger for anaphylactic events. Currently available extracts for testing venom-allergic patients were standardized prior to recent changes in urbanization and introduction of invasive species. Failure to test for all relevant species may be one reason that these tests are unable to identify the cause of wasp venom allergies in some

patients.¹ In addition, cross-reactivity between species in the Vespidae (genera *Vespa*, *Vespula*, *Dolichovespula*, *Polistes*, *Mischocyttarus*) may cause positive tests in patients for whom the primary sensitization was not one of the species tested.²

In our allergy clinics located in greater New Orleans, patient histories consistently implicate *Polistes* in triggering anaphylactic events. Previous research suggested that histories are not reliable for identification of culprit insects, but focused on identification of the insects themselves rather than their distinctive nests.³ For our patients coming into contact with nests, only *Polistes* nests were implicated as the source of stinging insects. We conducted a survey of social Vespidae in the greater New Orleans area to estimate exposure risks for our patients in this urban landscape.

Ten locations in Orleans and Jefferson Parishes, Louisiana with greenspace were identified. Greenspace consisted of large parks, protected levee systems, and areas adjacent to highways. Sites were between Lake Pontchartrain to the north and the Mississippi River to the south. Twenty-minute walking transects were conducted within each greenspace, and additional 20 minute transects were conducted in an adjacent neighborhood, for a total of 20 collections (10 transects in greenspace; 10 transects in neighborhoods). Collections were performed during September 2017, a time of year when colony sizes peak. Collections were completed on sunny days between 10am and 4pm to maximize the probability of encountering foraging insects. Where possible, Vespidae were collected using an aerial sweep net to keep as vouchers for definitive identification.⁴ When specimens were not captured, morphology and coloration of the insect was compared with voucher specimens.

86 specimens were collected, and an additional 37 observed but not collected during the transects. (Table 1) Of these, 68% were from greenspaces. Six social species of Vespidae were collected: *Polistes carolina*, *P. fuscatus*, *P. exclamans*, *P. metricus* and *Mischocyttarus mexicanus*. No *Vespula*, *Vespa*, or *Dolichovespula* were collected. All of the observed (but not collected) specimens were consistent with the morphology and coloration of the *Polistes* species that were collected. Twenty-eight solitary wasps with similar coloration were incidentally collected (primarily in greenspace), reducing the probability that these aposematically colored species were present but not seen. The biodiversity of social wasps was higher in the greenspace areas (5 species) than in the adjacent residential areas (3 species), and there were twice as many total *Polistes* in greenspaces compared to residential areas. New Orleans entomologists (Claudia Riegel and Eric Guidry, New Orleans Mosquito, Termite and Rodent Control Board; Zack Lemann, Audubon Insectarium) communicated that they have not collected *Vespula*, *Dolichovespula*, and *Vespa* within the target area. Review of records uploaded to inaturalist.org demonstrate only paper wasp species in the study area.

The absence of *Vespula* and *Dolichovespula* from the greater New Orleans area is surprising given the extensive greenspace in the city. One possible explanation is that the frequency of flooding destroys subterranean *Vespula* colonies. It is more difficult to explain the absence of aerial-nesting *Dolichovespula*. In areas of dense urbanization, these conspicuous colonies may be more promptly eliminated by concerned residents. Because the city is bounded by water, colonization events in the city may be rare compared with the rate of efforts to remove them. Trophic interactions may also be involved; additional study is warranted. The presence of *Mischocyttarus* in New Orleans was not previously reported in the literature. While there are no recorded cases of anaphylaxis associated with this species, it is possible that patients

experiencing anaphylaxis believe that they have been stung by *Polistes* species with similar morphology and coloration. The venom components of these genera have not been compared, and it is unclear whether testing with *Polistes* extracts would identify patients reactive to *Mischocyttarus* venom. There are three species of *Mischocyttarus* within the US, two widely distributed. The extent of species movement is poorly understood.

There is no consensus on whether to desensitize patients with sensitizations to multiple Vespidae genera using a single venom extract or all available extracts.⁵ While venom component testing may become more useful, this is not currently in routine use in the US.⁶ Instead, we now describe the probability of *Polistes* being the trigger when the sting occurred in the greater New Orleans area, in helping families to determine which extracts to use in desensitization.

The distributions of Hymenoptera species have changed significantly in recent years, with documented public health impacts such as an increase in venom-induced anaphylaxis cases in Alaska.⁵ As with the expansion of *Vespa crabro* (European hornet) and *Polistes dominula* (European paper wasp) across the United States and recent introduction of *Vespa mandarinia* (Asian giant hornet, popularized as the “murder hornet,”) allergists should be aware that their community’s exposures may continue to change. It is important to note that *P. dominula* contains an allergen that is not cross-reactive with species of *Polistes* contained in venom extracts available in the US.⁷

In contrast with the changing exposures, the species contained in commercially available extracts are unlikely to change in the near future. All US venom extracts are currently prepared by a single vendor with set species composition. While ImmunoCAP testing has expanded the range

of venom types for which sensitization can be tested, desensitization requires commercially-available, FDA approved extracts.

Allergists rely on pollen and mold counters to determine the shifting exposures of airborne allergens. Similarly, partnerships with entomologists will be useful in predicting venom exposures, and direct venom choice for immunotherapy. Extension entomologists at universities are broadly familiar with insect species and have made important contributions to understanding the entomological factors in patients with venom allergy.⁸ Expanding these collaborations will clarify exposure risks as species ranges change, and better inform the need for diagnostic and therapeutic tools available to Allergists.

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Table 1. Vespidae collected in transects of greenspace and adjacent residential areas in urban New Orleans, Louisiana.

	# collected in greenspace	# collected in residential areas
<i>Mischocyttarus mexicanus</i>	2	0
<i>Polistes carolina</i>	1	0
<i>Polistes fuscatus</i>	10	8
<i>Polistes exclamans</i>	3	2
<i>Polistes metricus</i>	66	29
Total	83	39