Ocular Lesions Other Than Stings Following Yellow-Legged Hornet (Vespa velutina nigrithorax) Projections, as Reported to French Poison Control Centers

Hervé Laborde-Castérot, Éric Darrouzet, Gaël Le Roux, Magali Labadie, Nicolas Delcourt, Luc de Haro, Dominique Vodovar, Jérôme Langrand

Ocular Lesions Following Yellow-Legged Hornet (*Vespa velutina nigrithorax*) Projections

Hervé Laborde-Castérot, MD, PhD[1]; Eric Darrouzet, PhD[2]; Gaël Le Roux, PharmD[3]; Magali Labadie, MD[4]; Nicolas Delcourt, PharmD, PhD[5]; Luc de Haro, MD, PhD[6]; Dominique Vodovar, MD, PhD[1,7]; Jérôme Langrand, MD[1,7]

1 Centre antipoison de Paris, Hôpital Fernand Widal, APHP Nord–Université de Paris, 75010 Paris, France.

2 IRBI, UMR CNRS 7261, University of Tours, Parc de Grandmont, 37200 Tours, France

3 Centre antipoison et Toxicovigilance Grand Ouest, Centre hospitalier universitaire, 49933 Angers Cedex 9, France

4 Centre antipoison de Bordeaux, Hôpital Pellegrin, Centre hospitalier universitaire, 33076 Bordeaux, France

5 Centre antipoison et de toxicovigilance et INSERM UMR1214, CHU Purpan, 31059 Toulouse, France

6 Centre antipoison de Marseille, Hôpital Sainte Marguerite, APHM, 13009 Marseille, France

7 INSERM UMR-S 1144, 75006 Paris, France

Corresponding author: Hervé Laborde-Castérot, Centre antipoison de Paris, Hôpital Fernand Widal, APHP Nord, Université de Paris, 200 rue du Faubourg Saint-Denis, 75010 Paris, France; herve.laborde-casterot@aphp.fr; Phone (+33)140054328

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Key points

Question: Can the yellow-legged hornet cause eye damage without stinging?

Findings: A retrospective series of 29 cases of yellow-legged hornet ocular exposure, excluding stings in the eye, from French poison control centers found exposure was likely related to the projection of a liquid by the hornet. Most patients had a favorable outcome, but two patients developed keratitis and two others presented with neuropathic pain.

Meaning: Projections from the yellow-legged hornet can cause eye damage and should be prevented.

Abstract

Importance: Since the accidental introduction of the yellow-legged hornet (*Vespa velutina nigrithorax*) in France in 2004, there have been reports of unexpected liquid projections toward the face by this insect, but the associated ocular morbidity remains unknown.

Objective: To describe the first case series of ocular lesions after exposure to a projection emitted by a hornet.

Design, Setting, and Participants: This was a retrospective analysis of all cases of ocular exposure to a projection by a yellow-legged hornet (excluding stings in the eye) collected by French poison control centers between January 1, 2004, and December 31, 2019.

Main Outcomes and Measure: Symptoms were evaluated and a fluorescein eye stain test was used.

Results: Twenty-nine cases were recorded; the first occurred in 2009. Most cases (80%) were occupational exposure among professionals dealing with hornet nests (firefighters, wasp exterminators). Symptoms consistent with conjunctivitis often resolved quickly after ocular decontamination, but five patients developed a periorbital edema, two experienced radiating neuropathic pain and two suffered from keratitis.

Conclusions and Relevance: The projection of a liquid into the eyes by the yellow-legged hornet presents a new risk to human health, but its precise nature remains to be determined. Ocular lesions had a favorable outcome. For professionals who deal with these insects, adaptation of the usual protections designed for native hymenopterans is required.

Introduction

Ocular injuries related to hymenopterans (bees, wasps, ants, and sawflies) are usually related to corneal stings. Complications threaten sight via different mechanisms (e.g., venom toxicity, foreign-body reaction, infection, immunological reaction).[1] To date, liquid projection from any hymenopterous insect is not a known cause of ocular injury.

Commonly referred to as the "Asian hornet," the yellow-legged hornet *Vespa velutina nigrithorax* was introduced from China to southwestern France around 2004.[2] It is not very aggressive toward humans and attacks only when it feels threatened.[3] Similar to the European hornet (*Vespa crabro*), it may be responsible for severe medical complications, but typically only in cases of multiple stings or anaphylaxis.[4,5]

Over the past decade, French poison control centers (PCCs) have received several unusual calls about patients experiencing ocular symptoms related to the yellow-legged hornet, without having been stung. That particular behavior from *V velutina* and its clinical consequences have not yet been reported. This study aimed to describe the characteristics and outcomes of yellow-legged hornet ocular projections recorded by French PCCs.

Methods

All cases of exposure to xenobiotics collected by France's eight PCCs are registered anonymously in the French National Database of Poisonings (FNDP; French Ministry of Health). The FNDP's use in this study was authorized by the French data protection authorities, and informed consent was waived.

We carried out a retrospective study to analyze all ocular exposure cases caused by the yellow-legged hornet (excluding stings in the eyes) collected in the FNDP between January 1, 2004 (the estimated year the yellow-legged hornet appeared in France), and December 31, 2019. *V velutina* was identified based on the victim's description during a phone call to the PCC.[3] A clinical toxicologist reviewed all cases and

collected the following data: sex and age of the victim, geographical location (eFigure 1), date and circumstances of exposure (occupational or not), symptoms, and outcome.

Results

The FNDP presented 29 ocular exposure cases caused by a yellow-legged hornet, excluding stings in the eye (Table 1). These cases represent about 6% of all accidental exposure to the yellow-legged hornet cases recorded in the FNDP during the same period (516 cases). There was one case per year in 2009, 2010, 2012, and 2013, three or four cases between 2014 and 2017, eight in 2018, and two in 2019. Except for two cases, all occurred between July and November. Exposures were initially predominant in the southwest area.

Circumstances of Exposure

About two-thirds of cases involved professionals dealing with nests, mostly firefighters and wasp exterminators, who were wearing the usual protective clothing, including a woven mesh in front of the face. The remaining patients were individuals exposed while they were trying to, and/or succeeding in, squashing a yellow-legged hornet, while they were resting outdoors, or while gardening. Two patients wore vision glasses that had slipped because of head movements (cases 9, 20).

Symptoms

All patients experienced unilateral eye redness and pain. In addition, five patients developed a periorbital edema, three reported blurred vision, and one suffered from rhinitis. Two patients experienced persistent radiating pains from the affected eye to the ipsilateral hemicranium although other ocular symptoms had resolved. Two patients had a history of anaphylaxis to the European hornet but developed no allergic manifestation during their call to the PCC (i.e., after 60 minutes for case 5 and 90 minutes for case 20).

Outcome

Eight patients were lost to follow-up. Nineteen patients visited a physician. Among 13 fluorescein eye stain tests performed, two revealed corneal lesions. Ocular symptoms resolved quickly, usually within a few hours of decontamination, with water or saline solution or sometimes after a few days of symptomatic treatment. One patient reported a persistent periorbital edema on day 6, and one presented with hemicranial neuropathic pain for 20 days.

Discussion

French PCCs recorded a series of 29 cases of ocular symptoms after a projection from a yellow-legged hornet, which were associated with minor injuries and favorable outcomes. After immediate ocular irritation, characterized by eye redness and pain, symptoms normally resolved quickly. However, two patients suffered from keratitis and two others experienced neuropathic pain. No allergic reaction was observed in this series.

The yellow-legged hornet has a surprising ability to project liquid,[6] which was commonly thought to be venom; however, there are no scientific data on its nature or anatomic origin. Indeed, like all *Vespidae* species, the yellow-legged hornet attempts to sting or exude venom from its stinger if it feels threatened. Moreover, individuals can use sting venom volatiles as an alarm pheromone to attract multiple hornets for an attack.[7] The venom's composition could explain the symptoms observed in these cases. Nearly 300 putative toxins have been identified in *V velutina* venom, some of which could be involved as metalloproteases in corneal damage.[8] Others are neurotoxins that could explain the prolonged neuropathic pain observed in two patients.[4] However, because the venom gland's volume is largely inferior to the volume of liquid projected (i.e., the venom reservoir is about 1 mm in length),[9] this liquid might originate from the intestinal tract, with or without venom.

Moreover, the projection mechanism is also unexplained; it may be voluntary or a reflex during flight. This phenomenon has also been observed in other hymenoptera species, such as ants,[10] or coleoptera species,

such as carabid beetles,[11] which project a liquid containing formic acid. This projection occurs when the insect feels threatened. However, to our knowledge, this behavior has not been observed in *Vespidae* species. One hypothesis is that insects with a sting present venom without formic acid and use different behavior for defense (sting vs. liquid projection). Our findings in *V velutina* could indicate defense behaviors, stinging, and liquid projection. In addition, in the domestic setting, exposures occurred mainly when killing the insect; in these cases, the projection could be a result of being threatened or a mechanical effect of abdomen compression from crushing the insect.

When dealing with a yellow-legged hornet nest, professionals are at risk of being sprayed in the face; wearing a mesh over the face is insufficient protection. In fact, this risk could be increased by the mesh if hornets indeed release their venom when stinging the mesh. Wearing safety glasses is highly recommended. Our case series shows that wearing vision glasses is ineffective protection. Therefore, prompt ocular decontamination with water or saline solution is strongly suggested in cases of ocular exposure.

Limitations

The identification of a yellow-legged hornet based on the information provided by callers to PCCs was compatible with its temporal and geographical evolution. The first case was reported in 2009, and the number of annual cases increased gradually, spreading from southwestern France to the rest of the country. Cases increased each year until 2018, but fewer cases were recorded in 2019, consistent with field observations that found fewer nests that year, probably due to preventive measures and/or weather conditions. Moreover, no case of ocular exposure to a projection from a hornet was found in the FNDP from 2000 to 2003, before the yellow-legged hornet appeared in France. Furthermore, our data are limited by the retrospective design of the study and should be confirmed by further research.

Conclusions

This original case series shows that the yellow-legged hornet *V velutina* can extrude and project an unidentified liquid in the eyes, causing ocular lesions. Periorbital edema, neuropathic pain, and keratitis were reported, which had favorable outcomes. This study highlights a new occupational risk for professionals dealing with yellow-legged hornet nests that requires the usual preventive measures.

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Author Contributions: Drs Laborde-Castérot and Langrand had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: Laborde-Castérot, Langrand.

Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Laborde-Castérot, Darrouzet, Vodovar.

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