Toxicon 145 (2018) 1–5

Contents lists available at ScienceDirect

Toxicon

journal homepage: www.elsevier.com/locate/toxicon

Food poisoning associated with ingestion of wild wasp broods in the upstream region of the Lancang river valley, Yunnan province, China

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ARTICLE INFO

Article history:
Received 16 October 2017
Received in revised form
21 February 2018
Accepted 23 February 2018
Available online 2 March 2018

Keywords:
Food poisoning
Wild wasp brood
Epidemiological and clinical features
Lancang river valley
Yunnan province
China

ABSTRACT

Introduction: Food poisoning due to wild wasp broods ingestion has long been noted in the upstream region of the Lancang river valley, Yunnan province, China. This study describes the epidemiological and clinical features of the poisoning and possible causes.
Methods: Surveillance data collected between 2008 and 2016 were analyzed to produce demographic data on patients, information on clinical presentations, wasp species identification, and estimations of possible risk factors for symptomatic cases.
Results: Eleven poisoning events were associated with the ingestion of wild wasp broods, including 46 exposed persons with 31 symptomatic living cases and 8 deceased cases that were reported in the Yunnan province between 2008 and 2016. Poisoning cases were only detected in the upstream region of the Lancang river valley in the autumn. The severity of the symptoms was correlated with an evident dose-effect relationship regarding the quantity ingested. The mean latent period from wild wasp broods ingestion to the onset of the symptoms was 10 h for symptomatic living cases and 7 h for deceased cases, respectively. Both gastrointestinal and neurological symptoms were commonly observed in the poisoning cases.
Conclusion: The toxin source may be indirectly caused by the wasp broods due to the prevalence of local poisonous plants, such as *Tripterygium wilfordii* Hook F, *Tripterygium hypoglaucum* Hutch and *Vaccinium bracteatum* Thunb. Educational programs at the start of wasp harvest season in September in the high-risk area should be carried out to reduce the incidence of poisonings.

1. Introduction

Wasps belong to the order *Hymenopterans* which include members of bees, wasps and ants. The wasp family can be further divided into social wasps and solitary wasps. Social wasps live in colonies that may contain 3-6000 individuals (Wasp Removal UK blog, 2011). The position of colonies from the underground nest of the yellow jacket to the nest of the paper hornet that hangs from shrubbery, trees, or can adhere to the side of a shed or house (Hahn et al., 2017). These insects collect water, plant fibers, carbohydrates, and hunt arthropod prey or scavenge animal protein, then returning to the nest to support their offspring (Richter, 2000).

One of the most widely seen life-threatening interactions between man and wasps are allergic reactions to their stings (Casale and Burks, 2014). In the United States, allergic reaction caused by the venom from wasp stings have accounted for over 79 deaths per year (Forrester et al., 2012). Wasp venom contains many different poisonous components that causes erythema, edema and local pain, while the poisoning effects can be systemic and can eventually cause death (Mealie, 2016).

The broods of social wasps (i.e., the larvae and pupae) are currently eaten as a delicacy in many countries, including Brazil, Paraguay, Venezuela, Congo (Kinshasa), Indonesia, Myanmar, Vietnam, and Japan (Foliart, 2002). Food poisoning associated with the ingestion of these wasp broods has never been reported in many of these countries. Wild wasp broods collection and consumption is common in many provinces in China, including Yunnan. The edible wasp broods are generally collected from 12 species including the following: *Vespa velutna auraria* Smith, *V. tropica ducalis* Smith, *V. analis* Buysson, *V. variblis* Buysson, *V. sorror* Buysson, *V. basalis* Smith, *V. ducalis* Smith, *V. mandarinia mandarinia* Smith, *V. bicolor bicolor* Fabricius, *Provespabarthelemyi* Buysson, *Polistessagittarius* Saussure,

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https://doi.org/10.1016/j.toxicon.2018.02.045
0041-0101/

P. sulcatus Smith (Feng et al., 2001). Unlike the aforementioned countries, human poisoning due to the ingestion of wild wasp broods has long been noted in the northwestern Yunnan (Duan, 2008; Gao, 2014; Gao and Wang, 2012; Ma, 2016; Yang, 2000). However, little is known about the epidemiological information on the poisonings. Therefore, we summarized available surveillance data from an emergency response system in the Yunnan province to describe the epidemiological and clinical features of poisoning clusters associated with the ingestion of wild wasp broods and discussed the possible reasons causing the poisonings.

2. Methods and material

2.1. Study setting

The upper Mekong River is known in the Tibetan autonomous region as Zaqu, and in the Yunnan province as Lancang. After leaving China and entering the Indochinese Peninsula, it is called the Mekong River. For this reason, it will be referred to as the Lancang river throughout this study. The Lancang river is approximately 1170 km long and is divided into 3 parts based on the location of water reservoirs: the upstream, midstream, and downstream catchments. The upstream of the river flows from the Diqing prefecture to the Nujiang prefecture and is confined by narrow and deep gorges (Figs. 1 and 2 A). The region is covered by large forests with abundant unchecked natural resources (Manfred, 2012). Wild wasp broods were the most common type of insect consumed by man in this area (Fig. 2 B, C and D).

2.2. Surveillance

Since 2004, a web-based emergent response system for health threats has been implemented in China. According to this system, a health threat should be identified and reported as food poisoning if it affects 30 or more people or causes a fatality. Therefore, cases of poisoning associated with the ingestion of wild wasp broods have also been reported via this system. The system' s network extends to all 837 hospitals and 1328 village health care centers of the province, where data on cases is collected by hospital or health care center epidemiologists. The data is sent immediately to the national database, where officers at different levels of the China Center for Disease Control and Prevention can instantly access the information from their respective jurisdictions.

2.3. Statistics

Wild wasp broods poisoning events that were recorded in the database of the health threats emergent response system from 2004 through 2016 were retrospectively reviewed. The information on exposed individuals during each event includes demographic details, a clinical presentation, and available wasp species identification. These data was collected and transferred into the R program (version 3.2.1) for data exploration and analysis.

Reported cases of wild wasp broods poisoning were counted per month to analyze seasonal patterns. The case locations were marked by township to explore the geographic distribution in MapInfo (version 15, serial number: MINWCA 1500000240). Descriptive analyses were performed and presented in percentage, mean, and median to describe the demographic characteristics and symptoms of cases. The difference significance was initially assessed with Fisher's exact test, the ANOVA test, the Kruskal-Wallis test, and the unequal variances *t*-test.

Ethical approval for the study was granted by the Ethics Committee of the Yunnan Provincial Center for Disease Control and

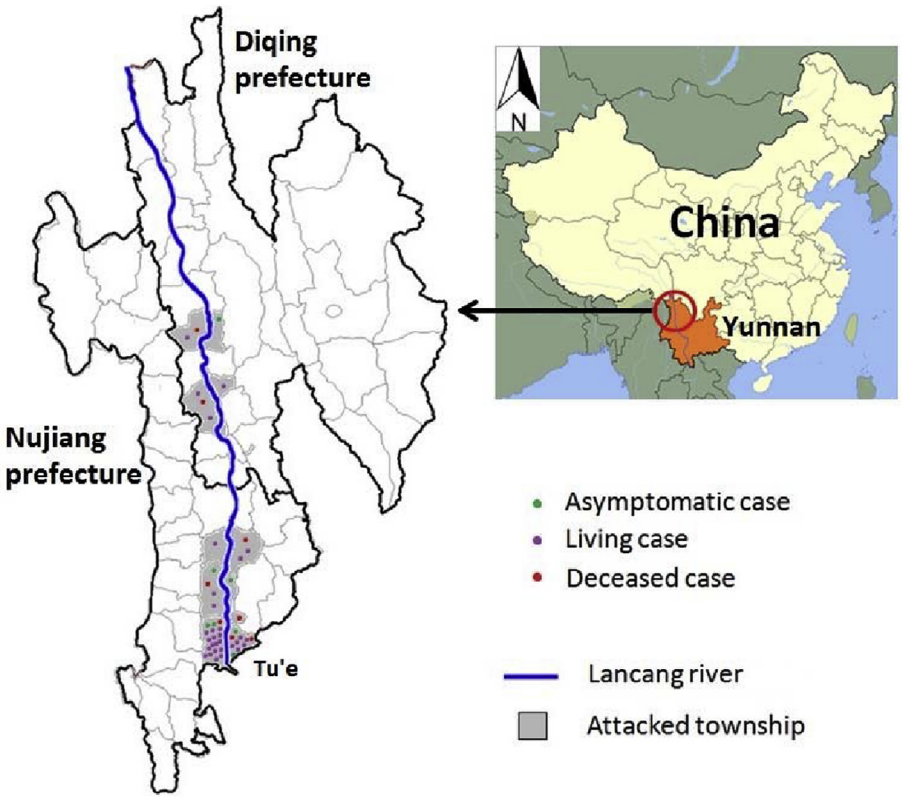

Fig. 1. The location of the upstream region of the Lancang river and geographic distribution of exposed cases associated with the ingestion of wild wasp broods by townships in the upstream region of the Lancang river valley, 2008–2016.