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Research Article

# Some Observations on Oriental Hornet (*Vespa orientalis)* in Jodhpur (Rajasthan), India

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**Abstract:** This paper presents observation of Oriental hornets (*Vespa orientalis*) in Jodhpur (Rajasthan) around their nest apparently made primarily by pulp/mud that had several openings. Some hornets were hovering over these openings and the brood cells. Studies on *V. orientalis* report that this fanning could be for cooling of the nest. There were some larvae/pupae lying on ground beneath the nest. It could not be confirmed however, whether these larvae/pupae fell accidentally or were purposely thrown out of the nest. Hornet sting does cause severe pain, which is more than honeybee or wasp sting. Immediate use of "Astheline" (salbutamol) inhaler spray on sting affected area and subsequent relief indicates a possible use of this spray as a first aid. However, this needs further confirmation. This paper also suggests further studies on uses and phylogeny of hornets based on perusal of published reports. Perusal of published reports on morphology and molecular data phylogenetic analysis indicate that morphological differences in hornets are possibly due to differences in environmental niche. Comparative studies on hornets from India (particularly from Rajasthan) and other regions of the world may help in confirmation of these findings.

**Keywords:** Bio-prospecting, hornet, salbutamol, solar energy, sting, venom, ventilation, xanthopterin

## INTRODUCTION

Among 23 species of hornets (Hymenoptera: Vespidae) distributed in Palaearctic and Oriental regions; 15 species are reported from India. These social insects live in large colonies constituting three polymorphic members namely workers that are sterile, males and one queen[1]. There are reports of *Vespa orientalis* Linnaeus from different parts of India[1–4], possibly the nest and some features of behaviour remain unreported from Jodhpur (Rajasthan). It is important to have annual or seasonal records of biodiversity of a region to spot even a small change that may be indicator for bigger alterations in the environment. Observations and perusal of literature on Oriental hornet (*Vespa orientalis*) indicates that annual records to understand any alterations in population dynamics or dispersal are lacking in many regions. Further, there is a need to spread public awareness about the harm and benefits of hornets. Present study is a short communication based on some observations and experience. Further, based on perusal of literature; the present paper reports importance of *V. orientalis* in possibilities of bioprospecting. Reported studies also suggest importance of understanding alterations in morphology as it may have association with adaptations reflected in molecular phylogeny.

**Experimental:** The observations were made during end of spring and beginning of the summer near University teacher's quarters in Jodhpur (Rajasthan), India (Latitude: 26.26933; Longitude: 73.02555). Characteristics described in reports[1,5] were used for identifying the hornets.
Perusal of literature helped in identifying areas of future studies on benefits and harm for agriculture, uses of hornets, their larvae and pupae, bioprospecting and phylogeny studies.

## RESULTS AND DISCUSSION

**Hornets and Nest:** Characteristics described in reports[1,5] helped in identifying the hornets under this study as *Vespa orientalis* (**Figs.1a-1c**). These hornets were near, around and inside the pulp/mud nest built on the wall. This nest was bigger than the ones that other wasps build; and was nestled behind small bushes.


**Fig. 1: 1a.** *Vespa orientalis*; **1b.** The abdomen and **1c.** The head.

Some hornets were always busy going from one opening in the nest to the other; others would just hover over the larger openings or smaller openings with eggs/larvae/pupae. The fanning of nest entrance or any other opening is for cooling[6]. However, fanning near the brood cells has not been extensively studied[6] but may be for controlling temperature of the brood.

There were some hornets hovering over the fallen larvae/pupae on ground out of the nest, as reported in other study[7], but were not being picked up. In case of yellow jacket wasps and bald-faced hornet, ejection of larvae are due to falling number of workers to feed them[8] or insufficient supply of food[9]. However, further investigation may help to gauge the reason behind rejecting/throwing or accidental falling of larvae/pupae out of hornet nest of *V. orientalis*.

When there was no activity around or near the nest for some days, the outer cover of nest was removed which revealed five storeys inside that looked like a tier cake. The largest tier was at the base and the smallest tier was the last. Small longitudinal rodlike structures separated each tier **(Fig. 2).** Further, each tier had several hexagonal cells **(Fig. 3).** There are reports of the process of nest building and the activities[5,10,11] under artificial conditions[12], communication rhythms[13] and social behaviour of *V. orientalis*[14] but not possibly from Rajasthan (India).

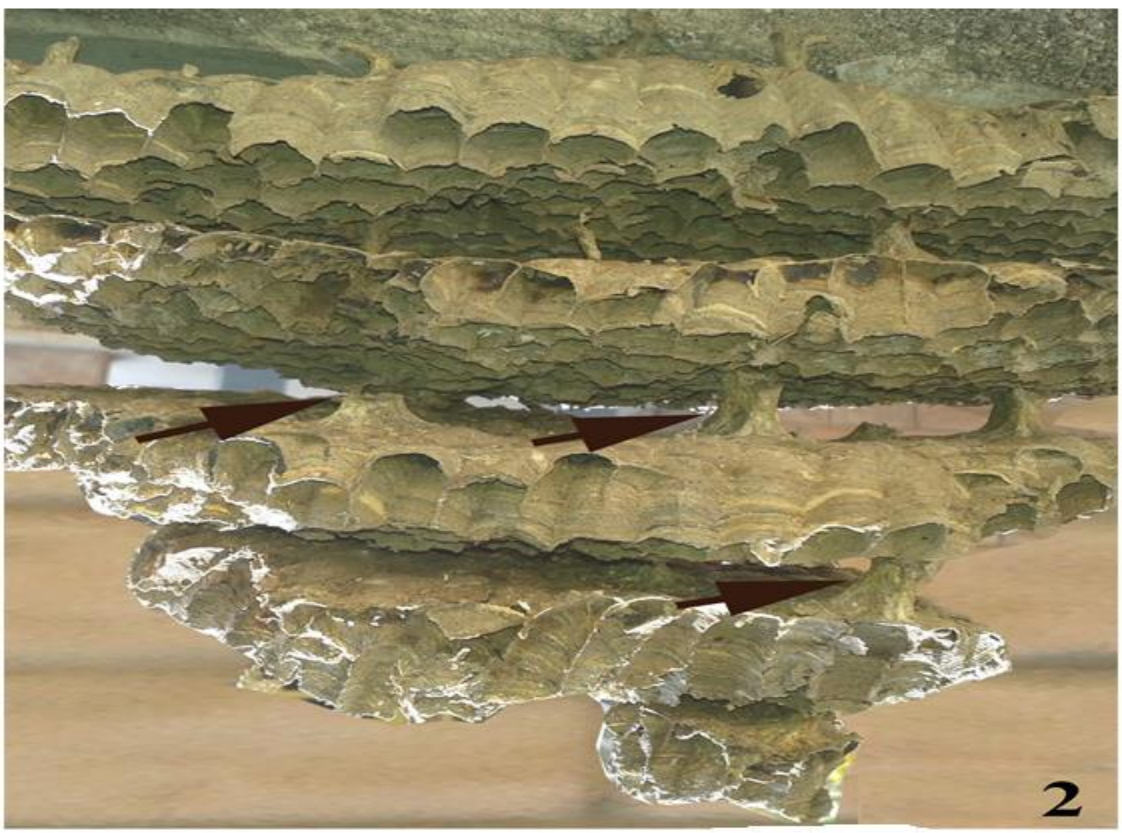


**Fig. 2:** *Vespa orientalis* nest without the outer cover. Different tiers of the nest are separated by short rodlike structures (arrow). (Note: This is picture is of the reassembled nest broken during removal from wall).

**Fig. 3:** The hexagonal cells in *V. orientalis* nest.

**Predation:** Possibly, *V. orientalis* seen in Jodhpur predate grasshoppers as the hornets were also spotted hovering over and making attempts at picking up a dead grasshopper. Foraging of grasshoppers by hornets[15] including *V. orientalis*[16] has been reported from other parts of the world. These observations get support from other studies that report predation by hornet wasps on pest that are harmful for agriculture or other vegetation[17,18] and thus can serve as good source of biological pest management. Hornets like *V. orientalis* may act as pollinators of plants including crop plants of commercial importance[19]. On the other hand, they also predate on honeybees[16,20] and thus can cause damage directly or indirectly to economic ventures of humans like honey harvesting and affect crop yield due to effect on pollination of flowers[1].

**Uses:** Studies also report uses of hornets and or wasps for humans. For example, larvae and pupae of hornets are eaten by some people[1,21] and used to relieve inflammation, pain, medicine for skin infections and leucoderma[22] etc. Boiled or steamed insects and steam from this water is used for treating mastitis in cattle[23,24] in addition to use of paste of soil from the nest[24]. Though the paper[24] identifies the insect as *V. orientalis*, the colloquial word "Tantia" is used. Thus, not sure whether the authors are referring to common wasp, colloquially called "Tantia" or the *V. orientalis*. Nonetheless, these studies indicate importance of wasps and hornets including *V. orientalis* for human benefits.

**Sting:** Hornet sting is harmful as the sting venom may cause severe pain or at times life threatening conditions in humans and animals[1]. Personal experience of *V. orientalis* stings on two occasions confirms that severity of pain of *V. orientalis* stings is more intense than sting of honeybee or common wasp. Possibly the severity of pain is more due to the chemical composition of hornet venom. Studies have shown that Hymenopterans venoms are mixture of proteins, polycationic peptides and toxins[25] amongst which Vespa venom sac contains omega amino acids[26]. Some of these amino acids act as neurotransmitters like glutamic acid, gama-amino-n-butyric acid, taurine, beta-alanine and glycine etc. Other amino acids that are present in the venom are leucine (insect autotoxin), arginine, glutamine, tryptophan (serotonin precursor) and histidine (histamine precursor)[26]. *V. orientalis* venom contains phospholipase A1/A2[27]and *Vespa carbo* venom contains 5-hydroxytryptamine (5-HT), histamine, acetylcholine and kinin amongst other chemicals that add to toxicity of venom. Hornet kinin is considered different from wasps' kinin, as it cannot be inactivated by trypsin unlike wasp's kinin[25]. Wasp venom cause hypoasthesis and anaesthesia proceeded by shock and followed by oedema, redness and haemorrhages at the site of the wasp bite[28]. Hornet venom allergy may lead to muscle damage, death due to anaphylaxis, haemolysis and nephrotoxicity in cases of multiple stings[29].

Personal experience of hornet sting also confirmed that no over the counter painkiller like combiflam (combination of Ibuprofen and Paracetamol) gives significant pain relief but the inflammation can be contained due to antihistamine tablet like cetirizine in case of multiple stings from adult hornet. However, inhaler sprays like "Asthalin" (Cipla inhaler 100mcg salbutamol) give immediate pain relief and contain swelling at least in case of single sting from young hornet. This relief could be due to salbutamol or the cold fomentation of the spray or combination of both. On the other hand, it is also possible that the venom of the young hornets is not as potent as that of the adult as reported in study on *V. orientalis* venom[30]. Careful survey of literature did not show recommendation of salbutamol by doctors for relief from hornet sting pain. Nonetheless, some skin disorders are treatable by using r-salbutamol cream[31]. It would be interesting to investigate application of salbutamol either as an ointment or in form of spray where it could also act as a cold fomentation in case of hornet sting(s).

**Possible future studies:** The following sections discuss possibility for future studies on *V. orientalis* based on perusal of literature:

**Phylogeny:** Studies based on morphological characteristics indicate that the relatedness of *V. orientalis* is not definitive[32]. However, combined analysis based on morphology and molecular analysis shows that genus *Vespa* has monophyletic origin. Despite marked morphological differences, molecular phylogeny analysis of 12S gene shows close relationship of *V. orientalis*, *V. affinis* and *V. mocsaryana*. The morphological differences are due to adaptations to arid climate but suggest confirmation of relationship on further molecular data analysis[33]. Phylogenetic analysis of hornets from India could aid in further confirmation of these studies and possibly throw some light on adaptive changes due to arid or semi-arid conditions like those found in state of Rajasthan (India).

**Bioprospecting:** Investigators have found that the yellow strips (xanthopterin in yellow pigment granules) and the cuticle on *V. orientalis* are capable of trapping and using solar energy to become more active during the daytime. The brown pigment (melanin) of the cuticle is arranged such that sunlight can be split. A dye-sensitized solar cell (DSSC) for light harvesting properties of Xanthopterin has been tested[34]. Thus, possible use of hornets for harvesting solar energy could be investigated further.

## CONCLUSION

There is paucity in annual or seasonal records of biodiversity of a region to spot even small changes that may be indicators for bigger alterations in the environment. This is true for the Oriental hornet (*Vespa orientalis*) where annual records to understand any alterations in population dynamics or dispersal are lacking in many regions especially in Rajasthan (India). Further, there is a need to spread public awareness about the harm and benefits of hornets. Moreover, possibilities of use of any spray containing salbutamol as first aid for the sting need further affirmation.

Comparison of *V. orientalis* from different regions of India and the rest of the world based on phylogenetic studies (both morphological and molecular data) would help in understanding relatedness and adaptive changes in hornets from different ecological niches. Studies on xanthopterin acting as source for converting solar energy merit further strengthening of the findings and potential applications to enable bioprospecting of xanthopterin from dead *V. orientalis*.

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