



REVIEW ARTICLE

A REVIEW ON CLINICAL MANAGEMENT AND RURAL RISK FACTORS OF HONEY BEE STING

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ABSTRACT

Honey bees are typically non-aggressive, but when threatened, they act as a highly coordinated defence force. The biological basis of bee aggression, evaluation of the vulnerability of small ruminants to such attacks and practical measures to prevent similar episodes are necessary to discuss. Bees play a crucial role in maintaining ecological balance through pollination, their defensive behaviour can pose serious risks when provoked. Aggressive behaviour of honey bee is more pronounced during warm weather and blooming seasons, when hive activity is at its highest. Surprising and alarming incident occurred near Amreli, Gujarat, India where a swarm of honey bees attacked a flock of grazing sheep and goats. The incident has brought renewed attention to the need for coexistence between wildlife and livestock in rural India. Various species of honey bees can be seen in India such as *Apis mellifera ligustica*, *Apis cerana* and *Apis dorsata* etc. Hypersensitivity reactions, visible stingers, haematological and biochemical parameters are used for diagnosis following honey bee sting. Various types of treatments such as epinephrine injection, NSAIDs etc. can be used for honey bee stings. Prevention and care for honey bee sting by avoiding bee habitats, wear protective clothing etc. are necessary. USDA gave the guidelines on coexisting with bees. In conclusion, Human should aim to understand and respect presence of honey bees and improve coexistence. There should be more research work to understand honey bee behaviour and sting effects on animal as well as human body.

INTRODUCTION

Honey bees are typically non-aggressive, but when threatened, they act as a highly coordinated defence force. Experts believe this swarm's aggression was a protective reaction to perceived danger near their hive. Honey bees (*Apis mellifera*) are known for their complex social structure and defensive behaviour. Bees are generally non-aggressive, but they can become fiercely protective if their hive is disturbed. Guard bees emit alarm pheromones that quickly amplify defensive actions, often resulting in coordinated stinging attacks (Winston, 1987). Their aggressive behaviour is more pronounced during warm weather and blooming seasons, when hive activity is at its highest. In India, swarming activity typically reaches its peak from March to May, aligning with the grazing periods of small ruminants (Rinderer et al., 1993). The incidences of honey bee attack on domestic animals are very rare in India. However, field observation suggest that attack of honey bee can affect grazing domestic animals in open village landscape. In 2024, the authors recorded an incident of honey bee attack in Amreli, Gujarat. Around 19 goats were attacked by Honey bee swarm during grazing in field area. Some goats exhibited difficulty in breathing. All goats were found in lateral recumbency with swelling at facial region and severe allergic reaction on body. Rural India is often a landscape of peaceful coexistence

between humans, domesticated animals and elements of the wild (Oommen, 2021). However, this balance can be disrupted, as seen in a recent event in Amreli, where a swarm of honey bees attacked a flock of goats. The incident not only caused panic but also raised significant concerns regarding livestock safety, rural preparedness, and the behavioural ecology of bees.

CLASSIFICATION OF HONEY BEES IN INDIA BASED ON AGGRESSIVENESS: In India, honey bee species exhibit a range of aggressiveness, from non-aggressive types like the Italian and Carniolan honey bees to highly aggressive types such as the Africanized honey bees. The choice of honey bee species is essential for successful apiculture, especially considering the level of aggression and management requirements (Neumann and Carreck 2020). *Apis cerana* remains the most commonly kept species due to its resistance to pests and adaptability to local conditions, while *Apis dorsata* and *Apis mellifera scutellata* (Africanized honey bees) can present significant challenges for beekeepers in terms of handling and safety.

Non-Aggressive Honey Bees in India

- ***Apis mellifera ligustica* (Italian Honey Bee):** *Apis mellifera ligustica* is recognized for its docile temperament and high honey

yield. This subspecies is commonly utilized in commercial apiculture throughout India, particularly in areas where *Apis cerana* demonstrates lower productivity (Rinderer and Harbo, 1993).



Figure 1. Flock of goats attacked by honey bees found in lateral recumbency

Moderately Aggressive Honey Bees in India

- ***Apis cerana* (Asian Honey Bee):** *Apis cerana*, also known as the Asian honey bee, is the predominant species maintained by beekeepers in India. Although it exhibits a somewhat higher level of aggression compared to *Apis mellifera*, it remains manageable for experienced apiculturists (Seeley, 1989).

Highly Aggressive Honey Bees in India

These species are known for their defensive nature and can be dangerous when their colonies are disturbed.

- ***Apis dorsata* (Giant Honey Bee/ Rock Bee):** *Apis dorsata*, commonly referred to as the giant honey bee, is a wild species that constructs large, open nests on tree branches. Although less aggressive than Africanized bees, they can display intense defensive behaviour when their colonies are disturbed (Oldroyd and Wongsiri, 2006).
- ***Apis mellifera scutellata* (African Honey Bee):** The African honey bee, introduced to certain parts of India, is highly aggressive and reacts swiftly to any perceived threats. This hybrid, widely known as the Africanized honey bee, has been linked to numerous incidents involving attacks on both humans and animals (Rinderer and Harbo, 1999).

Hybrid Honey Bees in India:

- **Africanized Honey Bees (Hybrid of *Apis mellifera* and *Apis mellifera scutellata*):** These bees exhibit strong defensive instincts and will launch aggressive attacks against perceived intruders. A defining characteristic of their behaviour is their tendency to chase threats over long distances (Rinderer and Harbo, 1999).

THE EFFECTS OF HONEY BEE STINGS

Honey bee stings are common in various parts of the world, but they can lead to a range of reactions, from mild irritation to life-threatening allergic reactions. While most people only experience temporary discomfort, it's essential to understand the biological effects and risks associated with bee stings (Golden and Golden (2021; Neumann and Carreck 2020). This article explores the types of reactions caused by honey bee stings, from mild to severe, and outlines necessary precautions and treatments. A honey bee sting functions as a defensive response when the bee senses danger. Due to its barbed structure, the stinger lodges in the skin and continues to deliver venom even after detachment, ultimately leading to the bee's death. This sacrificial act helps defend the colony from potential threats (Rangel *et al.*, 2010). The venom is composed of various active substances such as melittin, phospholipase A2, and histamine that are responsible for the pain and swelling commonly experienced after a sting (Berenbaum, 1995).

Why Sheep and Goats Are at Risk?: Domesticated small ruminants are especially vulnerable to bee attacks due to various behavioural and anatomical factors. Their wool or dense fur can trap bees, preventing escape. Panic behaviours, such as running or clustering together, can worsen the situation by provoking more aggression from the bees (Dwyer, 2009). Moreover, animals caught in confined pastures have limited options for escape or shelter. Unlike wild animals, sheep and goats are relatively defenceless against such aerial assaults. Their wool can trap stinging bees, and their instinct to huddle or stampede only worsens the situation. Without quick human intervention, the animals can suffer severe pain, stress, or even death (Veado *et al.*, 2020).

What Happens When a Bee Stings?

The sting of a honey bee involves the injection of venom, which causes a localized reaction in most cases. The venom contains:

Melittin: The main substance that causes pain and inflammation (Rangel *et al.*, 2010).

Phospholipase A2: This enzyme leads to tissue destruction by damaging the cell membranes (Berenbaum, 1995).

Histamine: A compound that plays a role in causing allergic responses (Berenbaum, 1995).

When a bee stings, the venom enters the skin through its barbed stinger, and the bee's death ensures that the venom continues to spread, intensifying the response in the human or animal.

Types of Reactions to Honey Bee Stings

Localized reactions

Localized reactions are the most common and usually result in minor symptoms.

These include:

- **Pain:** Initially, a sharp pain occurs at the sting site, progressing to a burning sensation (Rangel *et al.*, 2010).
- **Redness and swelling:** Redness and swelling commonly develop at the sting location (Berenbaum, 1995).
- **Itching:** The area can become itchy as the body responds to the venom.

These symptoms usually resolve within several hours to a few days (Berenbaum, 1995).

Moderate allergic reactions

Some individuals experience moderate allergic reactions, which are more pronounced but not life-threatening. Symptoms of a moderate reaction include:

- **Increased swelling:** The swelling near the sting site can spread to surrounding areas (Berenbaum, 1995).
- **Hives:** Elevated, red, and itchy welts can appear around the sting site or in other parts of the body (Simons *et al.*, 2010).
- **Dizziness or headache:** Certain individuals might feel dizzy or develop a headache (Simons *et al.*, 2010).

These reactions can generally be managed with antihistamines and cold compresses.

Severe allergic reactions (Anaphylaxis)

In rare cases, a honey bee sting can trigger anaphylaxis, a severe allergic reaction that is potentially fatal. Symptoms of anaphylaxis include:

- **Difficulty breathing:** Swelling in the throat or airway can obstruct breathing (Simons *et al.*, 2010).
- **Rapid pulse and weakness:** A faster heart rate, along with weakness and dizziness, may take place (Rangel *et al.*, 2010).
- **Nausea or vomiting:** Digestive issues such as nausea, vomiting, or diarrhoea might occur (Berenbaum, 1995).
- **Loss of consciousness:** In severe instances, the individual could faint due to a rapid decrease in blood pressure (Simons *et al.*, 2010).

Epinephrine (adrenaline) is the first-line treatment for anaphylaxis, and it should be administered immediately to counteract the effects (Simons *et al.*, 2010).

Factors That Influence the Severity of a Bee Sting Reaction

Several factors can influence how severely someone reacts to a honey bee sting:

Individual sensitivity: Individuals with a history of allergic reactions to bee venom may experience more intense reactions (Rangel *et al.*, 2010).

Sting location: The location of the sting on the body can influence the severity of the reaction, with areas such as the face and throat being especially vulnerable (Berenbaum, 1995).

Number of stings: Being stung multiple times by a bee swarm can result in more venom being injected, leading to a stronger reaction. (Rangel *et al.*, 2010).

Age and health: Severe reactions are more common in children, the elderly, and those with weakened immune systems (Simons *et al.*, 2010).

DIAGNOSIS: Diagnosis can be based on clinical signs and visible stingers with supportive tests such as haematological parameters, biochemical parameters, renal markers and urine analysis (Schumacher *et al.*, 1990). Habermann (1972) stated that elevated IgE levels support hypersensitivity reaction following honey bee sting. Vetter and Visscher (1998) stated that embedded stringers with attached venom sacs and clustering on face, nostrils, ear, eyelids and neck can be seen during diagnosis. Renal injury indicators such as increased Blood urea nitrogen and increased serum creatine level can be observed during diagnosis (Peterson, 2016). Sharma and Singh (2021) stated oedema of lips, eyelids and muzzle can be observed following honey bee sting. Systemic reactions like open mouth breathing, hypersalivation, myoglobinuria, tachypnoea and dyspnoea can be seen following honey bee sting (Kumar *et al.*, 2023).

TREATMENT

Immediate first aid for mild reactions

For most animal or human who experience mild reactions, the following first aid measures can help alleviate symptoms:

- **Remove the stinger:** Use a flat item, such as a credit card, to gently scrape the stinger from the skin (Simons *et al.*, 2010).
- **Clean the area:** Clean the sting area with soap and water to minimize the chance of infection (Berenbaum, 1995).
- **Cold compress:** Place a cold compress on the area to alleviate swelling and discomfort (Rangel *et al.*, 2010).
- **Antihistamines:** Over-the-counter antihistamines help to reduce swelling and itching (Simons *et al.*, 2010).
- **Pain relief:** Non-steroidal anti-inflammatory drugs (NSAIDs) like ibuprofen can help to reduce inflammation and pain (Simons *et al.*, 2010).

Treatment for severe reactions

If an individual shows signs of anaphylaxis, immediate medical attention is required. The following steps are crucial:

- **Epinephrine:** If available, administer an epinephrine injection (EpiPen) to help reverse the symptoms of anaphylaxis by constricting blood vessels and opening the airways (Simons *et al.*, 2010).
- **Emergency care:** Call emergency services immediately if signs of anaphylaxis are present.

PREVENTION

While it's not always possible to prevent bee stings, certain precautions can reduce the likelihood of encountering bees:

Avoid bee habitats: Avoid locations where bees are commonly found, such as around flowers or beehives (Rangel *et al.*, 2010).

Wear protective clothing: When working near bees, wear long sleeves, pants, and a protective hat (Berenbaum, 1995).

Avoid strong fragrances: Bees are drawn to floral or fruity fragrances, so it's advisable to avoid wearing perfumes or scented lotions (Rangel *et al.*, 2010).

Remain calm: If you come across a bee, remain calm and avoid swatting at it, as quick movements may agitate the bee (Simons *et al.*, 2010).

Prevention and Preparedness: Guidelines provided by apicultural and agricultural organizations emphasize the vital role of community education in promoting safe coexistence with bee populations (United States Department of Agriculture, 2019).

The USDA 2019 Guidelines on Coexisting with Bees

- **Emphasizing the Role of Bees:** Bees are vital to agriculture and ecosystems due to their role in pollination. The guidelines begin by highlighting the ecological and economic value of pollinators, especially honey bees, in supporting food production and biodiversity.
- **Promoting Community Awareness:** The USDA and related agencies stress that educating the public is essential to ensuring both human safety and bee conservation. Community education helps people understand how to behave around bees and how their own activities can support or harm bee health.
- **Supporting Educational Initiatives:** Agencies collaborate with universities, local governments, and non-profits to develop and deliver educational materials. These include school programs, workshops, online resources, and public awareness campaigns to spread knowledge about pollinator health and safe interactions.
- **Encouraging Safe Practices Around Bees:** The guidelines encourage people, especially in rural and farming communities, to learn how to avoid disturbing bee habitats. Simple precautions-like keeping a respectful distance from hives and not using harmful pesticides can prevent negative encounters.

- Promoting Pollinator-Friendly Land Use: Programs such as the Conservation Reserve Program (CRP) are promoted to encourage the planting of native flowers and the creation of bee-friendly spaces. These not only help bee populations thrive but also reduce human-bee conflicts by providing bees with sufficient natural forage away from human activity.
- Research and Data Sharing: The USDA supports ongoing research into bee health, including the impacts of pesticides, climate change, and disease. Findings are shared with communities to inform local practices and policy decisions related to agriculture and land management.
- Inclusive and Accessible Education: The guidelines also stress the importance of reaching underserved communities, including providing materials in multiple languages and formats to ensure that commercial and small-scale beekeepers alike can access critical information.

In summary, the USDA advocates for a proactive, educational approach to living alongside bee populations. Through awareness, land stewardship, and science-based practices, communities can ensure both human safety and pollinator survival.

Consequences for Livestock and Herders: The physiological impact of multiple bee stings on livestock includes localized swelling, respiratory difficulty, and, in severe cases, anaphylaxis. Stress can also result in secondary effects such as reduced milk yield, abortion, or feeding disturbances. For herders, such attacks mean not just medical concerns but significant economic losses, especially in the case of pregnant or lactating animals (Veado *et al.*, 2020). The incident has raised concerns among livestock owners, especially during flowering and harvesting seasons, when bee activity peaks. Many are now discussing relocating grazing zones away from known hives and improving emergency preparedness.

CONCLUSION

The Amreli incident underscores the fragility of rural ecosystems and the unintended consequences of human-wildlife overlap. While bees play a crucial role in maintaining ecological balance through pollination, their defensive behaviour can pose serious risks when provoked. By fostering awareness, implementing local safety measures, and promoting respectful coexistence, such events can be prevented or managed with minimal harm. For rural communities living close to wildlife, coexistence requires caution, respect and preparedness. Although bees can pose a threat in certain circumstances, they play a crucial role as pollinators vital to agriculture. Rather than fearing them, we should aim to understand and respect their presence. By staying aware, most encounters can be safely avoided.

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