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The Assessment Of Therapeutic Potential Of Honeybee Venom And Scorpion Venom Against Certain Pathogens

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ABSTRACT

Apitherapy is an alternative therapy that treats a variety of human diseases by using honeybee secretions, most importantly bee venom. Different products of honeybees are available which are medicinally important to common health. Similarly, scorpion venom is medically important However, very little information is available about the antibacterial and antifungal potential of honeybee and scorpion venom against certain fungal strains. Therefore, the current research study is designed to evaluate the therapeutic potential of honeybee and scorpion venom against Candida albicans. Different concentrations of honeybee venom and scorpion venom were checked to evaluate the anti-fungal potential. The highest zones of inhibition (17 mm and 19 mm) were noticed at the highest tested dose of 100 ug/ml concentration of Bee venom and Scorpion venom respectively. Similarly, the minimum inhibition zones (07 mm and 08mm) were recorded at the minimum tested concentration of 50 ug/ml for Bee Venom and Scorpion Venom. However, the potential was enhanced in case of the combination therapy when used together. Similarly, the honeybee venom and scorpion venom were checked against C. albicans showing strong antifungal potential. As the concentration of the venom increased, the inhibition rates simultaneously showed a corresponding rise showing the test-dependent manner of the activity. Further research works are required to isolate the bioactive compounds present in Bee Venom and Scorpion Venom and test them isolated against different pathogens both in In-Vivo and In-Vitro manner. Moreover, the cytotoxic effects of the venom must be analyzed before ensuring the In-vivo attempts.

Keywords: Bee Venom, Scorpion Venom, Anti-Fungal Activity, Anti-Bacterial, Candida Albicans

INTRODUCTION

Apitherapy is an alternative therapy that treats a variety of human ailments by using honeybee products, most notably bee venom (Carpena, M. et al., 2020). Honeybee venom has recently been used by doctors and certified apitherapists to treat patients with autoimmune or chronic illnesses. The strong biotherapy properties of honeybee venom were validated by both laboratory tests and clinical studies. In the case of rheumatism and arthritis, honeybee venom prevents inflammation and connective tissue breakdown; in the case of multiple sclerosis and lupus, it restores activity and mobility by bolstering the body's natural defense (Ahmed, O et al., 2017).

The injection of honeybee venom into the human body for the treatment of a variety of diseases, including rheumatoid arthritis, is known as bee venom therapy (BVT) (Lee SM et al., 2014). A variety of bioactive substances are found in bee venom, which is secreted by female worker bees. These consist of various amino acids with a few volatile compounds, peptides such as mellittin, apamin, mast cell degranulating peptide,

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and adolapin, and enzymes such as phospholipase A2-PLA2 and hyaluronidase. Several investigations into the therapeutic potential of these components have demonstrated their usefulness in the management of disorders affecting the central nervous system, including amyotrophic lateral sclerosis (ALS), Parkinson's disease (PD), and Alzheimer's disease (AD) and several other pathological conditions, as well as human inflammatory disorders.

Living in the environment we are facing serious challenges of contamination and different infections including protozoans, helminths, viral, fungal and microbial. Fungi, Protozoan, Nature is full of viruses and microorganisms. They exist as the typical flora that inhibits various body organs. The most common opportunistic infection in humans is the dimorphic yeast Candida albicans, or C. albicans. According to (Carpena et al., 2020), candidiasis is the fourth most common cause of nosocomial infections and can cause anything from superficial and mucosal infections to potentially fatal septicaemic mycosis in patients who are incapacitated. As the number of individuals with impaired immune systems has increased over the past few decades, so too has the incidence of C. albicans-caused candidal infections (Lee SM et al., 2014).

For many years, people have used bee venom from honeybees (Apis mellifera L.) as an anti-inflammatory, anti-coagulant, and pain reliever to treat chronic illnesses such multiple sclerosis, fibrosis, arthritis, rheumatism, tendonitis, and bursitis (Kwon YB et al., 2202). Similarly, In Asia, scorpions and their venoms have been used as medicine for thousands of years. A highly complex combination of salts, nucleotides, biogenic amines, enzymes, mucoproteins, peptides, and proteins (such as neurotoxins) makes up scorpion venom. Peptides found in scorpion venoms alter or impede ion-channel activity and have potential uses in controlling cell excitability. Numerous studies shown their strong antimicrobial properties and their capacity to alter a range of biological processes implicated in neoplastic, neurological, cardiovascular, and immunological disorders. It is predicted that peptides obtained from scorpions may be used to create new, targeted medications due to their essential structural and intentional diversity (Attarde, S. S., & Pandit, S. V, 2016).

Different medicines are used in excess amount that have increased the drug resistance in different pathogens. The rise in multi-drug resistance is a serious global issue of the present times. Therefore, some new treatment strategies are required to treat diseases based on Peptide derived from natural sources like venom. Somehow very limited information is available about the therapeutic potential of honeybee venom and scorpion venom against different pathogens. Therefore, the current research work is designed to address the antipathogenic potential of venom against fungal and bacterial strains.

Materials and Methods

Bee Venom sample Collection

The BV used in this study were produced at the bee farms of Kohat University of Science and Technology, KUST. Similarly, the scorpion was collected following the protocol as discussed in (Liu et al., 2018). The collected venom was transported to

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Molecular Laboratory department of Zoology University of Science and Technology Bannu and stored at 4 ^{0}C till further processing.

Concentration preparation

Lyophilized Bee and Scorpion venom was dissolved in distilled water and different concentrations were prepared for further process.

Antibacterial use

To examine the antibacterial activities of Bee Venom and Scorpion Venom on *Staphylococcus aureus*, different concentrations of the venom were prepared. The strain of *Staphylococcus aureus* was cultured in Nutrient Agar plates. Disk diffusion method was followed in ordered comparison with control Ciprofloxacin. All the activities were repeated in triplicate fashion.

Antifungal use

C. albicans was selected to examine the antifungal activities of honeybee venom and Scorpion venom.

Results

The antibacterial potentials of Bee venom and Scorpion venom against *S. aureus* and *C. albicans* are shown in Table 01 and Table 02 respectively. Similarly, the antifungal results of Bee venom and Scorpion venom are given Table 03 and Table 04. Similarly, the combined antimicrobial and antifungal results of Bee venom and Scorpion venom are given Table 05 and Table 06 respectively. The Antibacterial activity of the Honeybee venom Scorpion venom has been given in Figure 01 (A & B) respectively. The Anti-fungal activity of the honeybee venom Scorpion venom has been given in Figure 02.

Table 01. Represents the anti-microbial activities of Bee Venom against *S. aureus*

Concentrations	**Diameters of Zone of Inhibition of *S. aureus* (mm)**	
	Ceftriaxone	Bee Venom
50 ug/ml	13	07
70 ug/ml	25	15
100 ug/ml	30	17

Table 01. The highest zone of inhibition of Bee Venom (17 mm) against *S. aureus* was noted at the highest tested dose of 100 ug/ml concentration. while the lowest zone of inhibition (07 mm) was measured at the minimum tested dose of 50 ug/ml.

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Table 02. Represents the anti-microbial potential of Scorpion Venom against S. aureus

Concentrations	**Diameters of Zone of Inhibition of *S. aureus* (mm)**	
	Ceftriaxone	Scorpion Venom
50 ug	13	08
70 ug	21	13
100 ug	30	19

Table 02: The highest zone of inhibition of Scorpion Venom (19 mm) against *S. aureus* was noted at the highest tested dose of 100 ug/ml concentration. while the lowest zone of inhibition (08 mm) was measured at the minimum tested dose of 50 ug/ml.

Figure 01: Shows the antibacterial activity of the venom

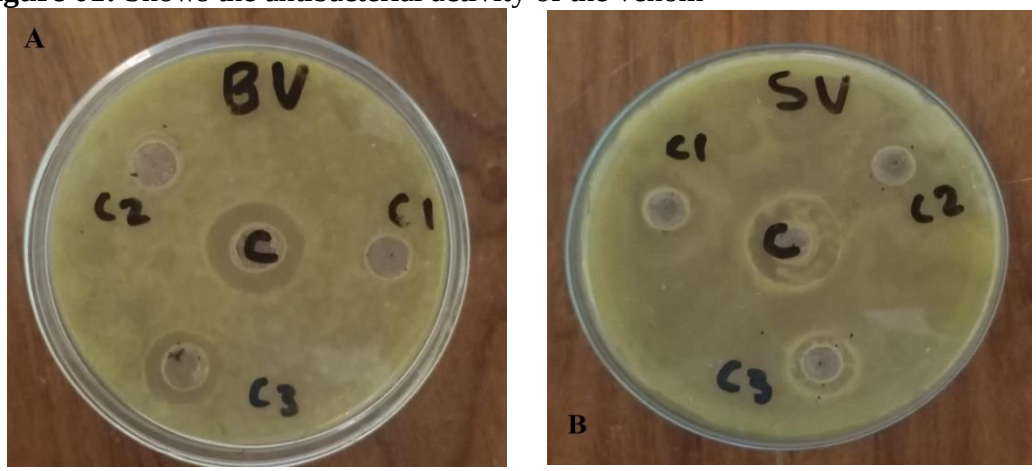


Figure 01: (A) Shows the antibacterial activity of the Honeybee venom while **(B)** Shows the antibacterial activity of the Scorpion venom.

Table 03. Anti-fungal activities of Bee Venom against *C. albicans*.

Concentrations	**Inhibition of growth of *C. albicans* (%)**	
	Fluconazole	Bee Venom
C1= 20 ug	19	11
C2= 60 ug	41	27
C3= 80 ug	57	39
C4= 100 ug	76	51

Table 03: The highest percentage of inhibition of Bee Venom (51%) against *C. albicans* was noted at the highest tested dose of 100 ug/ml concentration. while the percentage of inhibition was (11%) measured at the minimum tested dose of 20 ug/ml.

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Table 04. Shows the Anti-fungal activities of Scorpion Venom against *C. albicans*.

Concentrations	**Inhibition of growth of *C. albicans* (%)**	
	Fluconazole	Scorpion Venom
C1=20 ug	19	13
C2=60 ug	41	27
C3=80 ug	57	39
C4=100 ug	76	53

Table 04: The highest percentage of inhibition shown by Scorpion Venom (53%) against *C. albicans* was noted at the highest tested dose of 100 ug/ml concentration. while the percentage of inhibition was (13%) measured at the minimum tested dose of 20 ug/ml.

Fig02: Represents the Antifungal activity of bee venom.

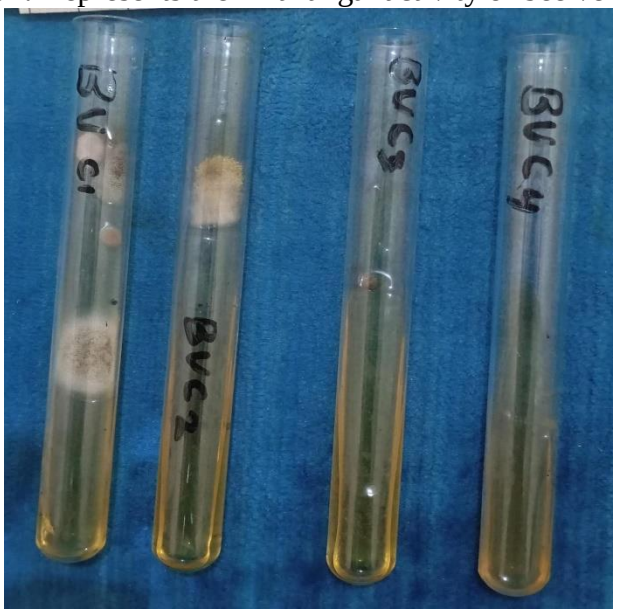


Fig02: Represents the Antifungal activity of bee venom where BV= Bee venom and C= Concentration.

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Table 05 Shows the combined Anti-bacterial activities of Bee Venom and Scorpion Venom

Concentrations	**Diameters of Zone of Inhibition of *S. aureus* (mm)**	
	Ceftriaxone	Bee Venom + Scorpion Venom
50 ug	13	09
70 ug	25	15
100 ug	30	21

Table 05: The maximum zone of inhibition shown by Bee venom and Scorpion Venom (21 mm) against *S. aureus* was noted at the highest tested dose of 100 ug/ml concentration. While the lowest zone of inhibition (09 mm) was measured at the minimum tested dose of 50 ug/ml.

Table 06 Shows the combined Anti-fungal activities of Bee Venom and Scorpion Venom

Concentrations	**Inhibition of growth of *C. albicans* (%)**	
	Fluconazole	Bee Venom + Scorpion Venom
20 ug	19	15
60 ug	41	27
80 ug	57	40
100 ug	76	60

Table 06: The maximum percentage of inhibition shown by Bee venom and Scorpion Venom (60%) against *C. albicans* was noted at the highest tested dose of 100 ug/ml concentration. While the lowest percentage of inhibition (15%) was measured at the minimum tested dose of 20 ug/ml

DISCUSSIONS

The present study investigated the pharmacological properties of honeybee venom and Scorpion venom with a particular focus on their anti-bacterial and anti-fungal potential. The findings contribute to the emerging evidence that Venom is a complex mixture of bioactive peptides, enzymes, and low molecular weight compounds, which may represent a promising natural source of therapeutic agents. One of the most significant

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components of HBV is melittin, a peptide known for its strong membrane-disruptive and anti-inflammatory activities. Previous studies have demonstrated melittin's ability to interfere with the membranes of pathogens, leading to cell lysis and growth inhibition. A variety of proteins, including Melittin (the primary component at 52%), Apamin, Adolapin, Phospholipase A2, Hyaluronidase, Histamine, Dopamine, and protease inhibitor, are found in bee venom, also known as Apitoxin (Lee SM et al., 2014). Many pathogens can develop resistance to numerous medications due to the regular use of antimicrobial and antifungal treatments, such as antibiotics and antifungals.

Several peptides found in scorpion venom have been found to possess a variety of antibacterial properties and antifungal activities including hadrurin, scorpine, pandinins, opistoporins, parabutoporin mucroporin, imucoporin, and stigmurin (Liu et al., 2018). There has been a lot of interest in the development of multidrug resistance in various diseases and the possible health hazards they pose to people (Khan F U et al., 2023). Therefore, for dermatophyte infections to be successfully treated, new antibacterial or antifungal medicines with fewer side effects must be developed.

In the current research project Honeybee venom was checked against S. aureus by using the proper protocol, which demonstrated that Honeybee venom has strong anti-bacterial agents. The findings of the current research work are in line with previous data published by (El-Bilawy et al., 2025). Similarly, the Scorpion venom was tested against S. aureus and noted that the venom has strong anti-bacterial potential. The results of the current research work are supported by the previous data published by (Snyder et al., 2021).

Honeybee venom was checked against C. albicans by using the proper protocol, which demonstrated that the compounds have strong anti-fungal agents. The findings of the current research work are in line with previous data published by However, (Yu et al., 2012). Similarly, the Scorpion venom was tested against C. albicans and noted that the venom has strong anti-fungal potential. The results of the current research work are supported by the previous data published by (Xia et al., 2024)

The current research study showed that honeybee venom and scorpion venom have efficient antibacterial and antifungal potential however more research experiments are suggested for evaluating the in vivo potential of honeybee venom and scorpion venom for clinical trials. Furthermore, the cytotoxic effects of the venom must be checked before in vivo approach.

Conclusions and recommendations

From the current research work, it has been concluded that honeybee venom and scorpion venom have strong antibacterial and antifungal potential against the selected strains. Moreover, the potential was enhanced with the rise in the concentrations of venom. Further research studies are required to isolate the bioactive compounds of venom and test them separately. Similarly, the cytotoxic effects of the venom must be studied before proceeding toward the in vivo attempts.

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