

**STUDY OF THE CONSTRUCTION NESTS OF DIFFERENT WASP SPECIES AND ITS ANTIMICROBIAL ACTIVITIES****Dr. Vidya V. Bhoyar<sup>1\*</sup>, Afreen Fatema R. K.<sup>2</sup>, Sayema Khamar<sup>3</sup>, Saniya Khanam S. K.<sup>4</sup>**

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**ABSTRACT**

The recent increase in antibiotics resistance demands the discovery of novel antibiotics. Hence, this project was designed to explore novel antibiotic producing substance from nest of wasps. Hence in this project we have done the observation and construction plan of different wasp nest and 3 nest sample were collected from residential area and 1 from college campus. These nests are dried at room temperature. 32°C and grind. Powdered form uses to prepare extract with 0.1M NaOH solution. These crude extract were tested for antibacterial activity by agar streak method. Antibacterial susceptibility by test was carried out using agar disc diffusion method – The extract showed antimicrobial activity against the tested strains. Highest activity was seen against *Bacillus cereus* and *E. coli* whereas lowest activity, seen against *Staph aureus*. This present study showed the effectiveness of the crude nest extract against the tested bacterial strains and indicates the potential

use of the extracts as antimicrobial agents for the control of infectious diseases.

**KEYWORD:** Wasp, Wasp nest, antimicrobial activity, bacterial strain, mud nest, Paper nest.

**INTRODUCTION**

As we are a part of an ecosystem it contains lot of organisms around us, who has their own special place in an ecosystem. In this study we have come across the members of the largest Class: Insecta of the largest Phylum: Arthropoda of Kingdom: Animalia. The Wasps belongs to the Order: Hymenoptera. The wasp belongs to Family. Vespidae, having two type of social

life Primitive and advanced.

The Primitive social wasp (*polystes*) is having simple nest consisting of an open layer of brood cells and suspended by a single pedicle. The colony survive only for some months in summer and disorganized during every autumn in temperate region.

The advanced social wasp (*vespula* and *vespa*) is having a complex structured consisting large no. of parallel combs connected by inter-comb suspensory pillars and attached to a roof by large no. of roots or attachments. Most social wasps of the family Vespidae make nests from paper, but some *stenogastrine species*, such as *Liostenogaster flavolineata*, use mud.

### MUD NEST

Nests of Mud are built under rocks or bridges with water nearby. They are made completely out of mud. Nests are made to house many more wasps than they actually do. Each nest is very underpopulated but it is not fully understood why this is the case. Currently it is believed that female helpers would rather become floaters than be a low ranked helper so most of them will leave the nest. There is also a small chance that a floater will be successful in usurping the position of a wasp in another nest.

A new colony is formed by a single fertilized female who builds a small nest, in which she will lay a small number of eggs (typically only 9 to 10). As the nest continues to grow, the number of females in the colony will remain fairly constant. Individual nests do not have more than about ten individuals but these wasps sometimes build nests very close to each other (called nest aggregations). While there may be only a few individuals in each nest, there can potentially be hundreds of individuals in an aggregation.

### PAPER NEST

Paper wasps are vespidae wasps that gather fibers from dead wood and plant stems, which they mix with saliva, and use to construct nests made of gray or brown papery material. Some types of paper wasps are also sometimes called umbrella wasps, due to the distinctive design of their nests.

Nests can be found in sheltered areas, such as the leaves of a house, the branches of a tree, on the end of an open pipe, or on an old clothesline. Some species, such as *Ropalidia romandi*, will vary their nest architecture depending on where they build their nest.

Three species of *Polistes* are obligate social parasites, and have lost the ability to build their

own nests, and are sometimes referred to as "cuckoo paper wasps". They rely on the nests of their hosts to raise their brood. A few hornets and yellow jackets are also brood parasites (e.g., *Vespula austriaca*).

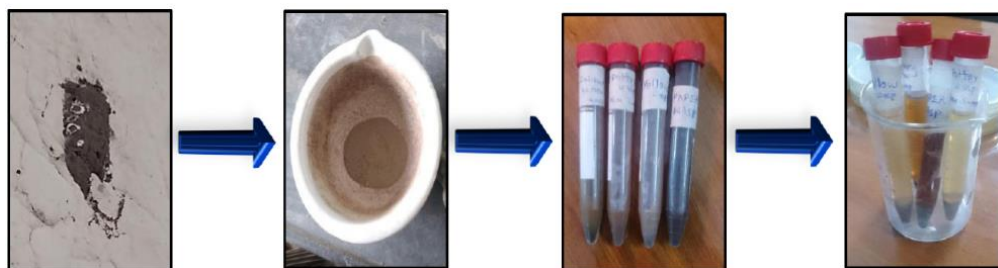
## METHODOLOGY

### A. SAMPLE COLLECTION

Samples were collected from mud wasp nests and paper nests from Sameera Bagh, Nanded, Maharashtra, India and N.E.S. Science College Campus Nanded, Maharashtra, India. Nest taken to the laboratory and washed thoroughly using distilled water to remove dust. The washed sample were placed in sterile polyethylene bags, closed tightly and stored in the refrigerator at 4 °C until further use.

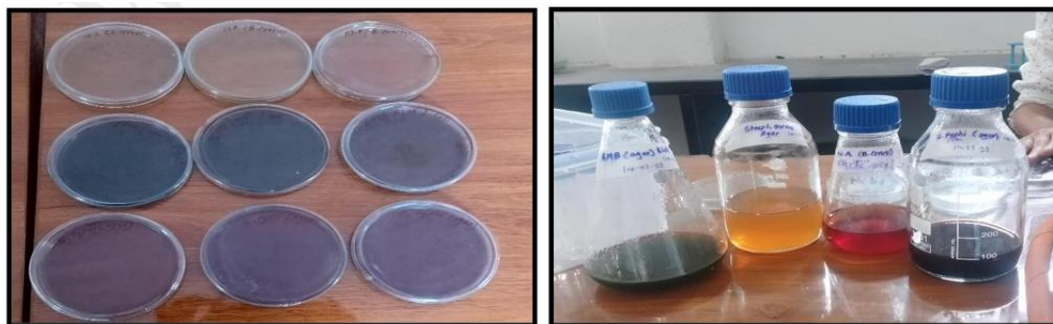
### B. NEST EXTRACT PREPRATION

About 0.1g of the nest was weighted and hydrolyzed with 10ml of NaOH (Sodium Hydroxide) at 90 °C for 1 hrs. The hydrolyzed nest was allows to cool and centrifuged at 4000rpm for 30 minutes.



### C. BACTERIAL STRAINS

Five strains of pathogenic bacteria for the antibacterial activity assay were used in this study. The bacterial strains were maintained by the Science College Nanded (Maharashtra, India). The antibacterial activity against two Gram-positive strains was examined; *Staphylococcus aureus*, and *Bacillus cereus*. The antibacterial activity against three Gram-negative strains was examined; *Salmonella typhimurium*, *Escherichia coli* and *Proteus bacteria*. All bacterial strains were maintained as stock strains and kept at cold temperature until use.



#### D. ANTIMICROBIAL ACTIVITY

The disc diffusion method to evaluate antimicrobial susceptibility was performed. For each bacterial strain, using sterile cotton swab stick into the broth and inoculated into the plates into respected agar plates. After the surface was dried, sterile paper discs were placed on the surface of the agar plate after dipping into wasp extract solution. All agar plates with the bacterial strains and paper discs soaked by the solutions were incubated for 24 h at 37 °C. The agar plated were the observed to evaluate antimicrobial activity.

#### OBSERVATION AND RESULTS

##### Construction of Nest

The Nest construction styles observed in this study were of two types i.e., Paper Nest and Mud nest. The differences of these nests are enlisted below according to the species.

Sr. No	Wasp Name	Material of Nest	Location of Nest	Chambers of Nest	Nest Season	PH of Nest
1.	Solitary Potter Wasp 1	Mud, Saliva, Venom	Corners of doors, windows, roofs	1 large cylindrical chamber	Winter	7
2.	Solitary Potter Wasp 2	Mud, Saliva, Venom	Corners of doors, windows, roofs	Seven large pots/ chamber	Winter	7.5
3.	Paper Wasp	Plant Fiber, Saliva, Venom	Corners of doors, windows, roofs, on plants	Multiple hambers	Late spring early summer	8
4.	Yellow Jacket Wasp	Mud, Saliva, Venom	Corners of doors, windows, roofs	Single chamber encloses multiple chamber	Early summer	7.3

##### Available of Nest

4 types of nests collected from different location of Nanded Maharashtra. (S1) a new mud nest sample of potter wasp. (S2) is an old mud nest sample of yellow jacket wasp. (S3) paper nest sample of paper wasp. (S4) yellow jacket mud wasp nest.

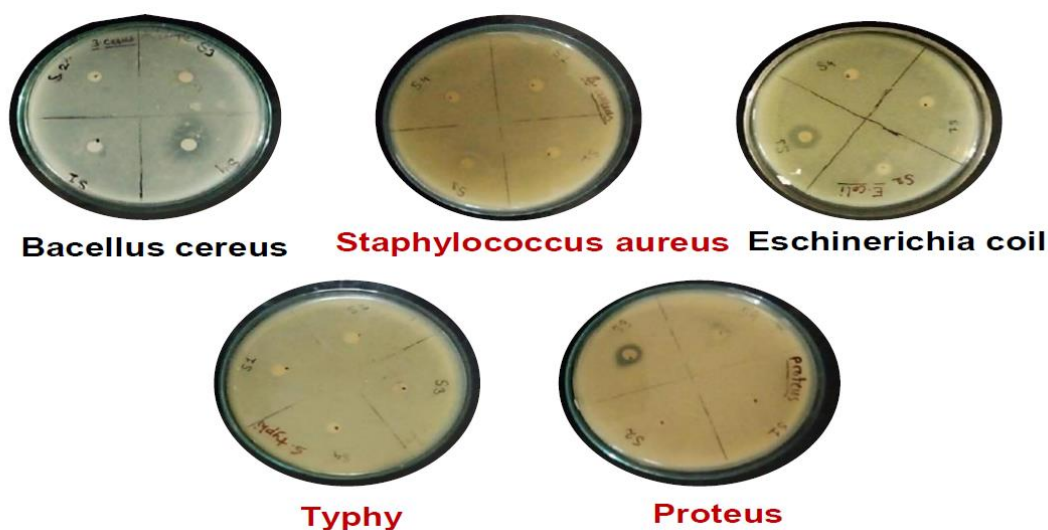
### Antimicrobial Efficiency of Extract Wasp Nest

The disc diffusion method was used to test the antimicrobial efficacy of nest extract against *E.coli*, *Bacillus cereus*, *Staphylococcus aureus*, *S. typhi* and *Proteus* bacteria. The result of this experiment revealed that extract of nest new solitary potter wasp was able to yield a moderate zone of inhibition around the disc indicating that extract contained antimicrobial agent to inhibit the growth of all microorganisms.

Antimicrobial activities of extract form against 5 pathogenic bacterial strains were evaluated by determining the presence of inhibition zone.

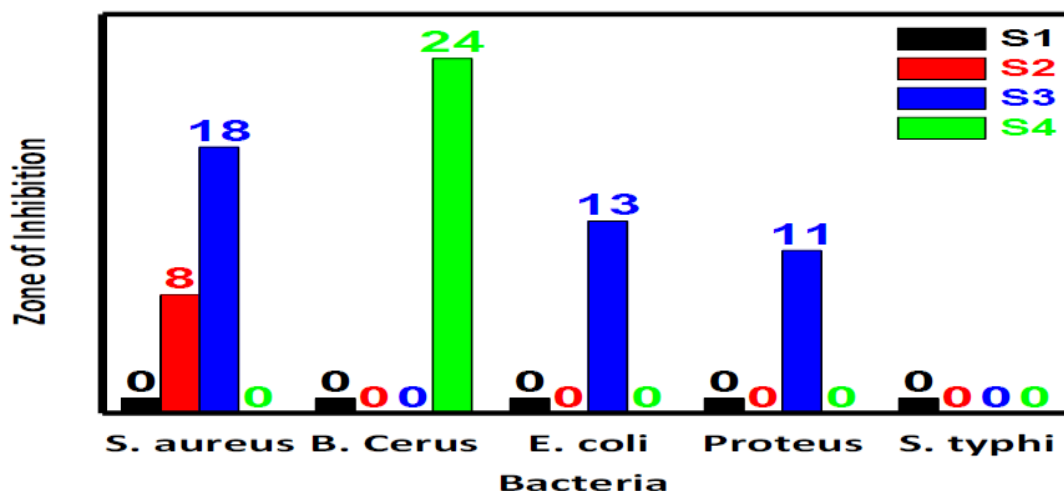
### RESULTS

The gram-negative bacterium *Bacillus cereus* most susceptible to wasp nest extract the yellow jacket wasp nest exhibited very low antimicrobial activity against pathogenic bacterial strains. The potter wasp nest extract shows very high antimicrobial activity against *B. Cereus*. While paper wasp shows very high antimicrobial activity against *Proteus*, *S. Typhi*, *E.coli*.



**Figure:** Antimicrobial activity of Wasp nest extract against *Bacillus cereus*, *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhimurium*, and *Proteus sp.*

Sr. No.	Bacterial Strain	New Potter Wasp (S1)	Yellow Jacket Wasp (S2)	Paper Wasp (S3)	Potter Wasp (S4)
1	<i>Salmonella typhimurium</i>	-	-	-	-
2	<i>Escherichia coli</i>	-	-	+	-
3	<i>Proteus sp.</i>	-	-	+	-
4	<i>Bacillus cereus</i>	-	-	-	+
5	<i>Staphylococcus aureus</i>	-	+	+	-



## CONCLUSION

This study concludes that the colonial having more chambers constructed than that of the solitary ones as well as the constructively or architecture of colonial wasps is evolved and well managed than that of solitary ones.

The solitary wasps is showing less antimicrobial activity as the nest is constructed by the venom on secretion of single wasp whereas the colonial wasps shows antimicrobial activity against almost all pathogenic microbes except *S. typhi* as nest is constructed by workers.

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