Comparative Analysis of Temperature Readings of Active And Inactive Potter Wasp Nests

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Wasp

- Wasp, any member of a group of insects in the order *Hymenoptera*, suborder *Apocrita*, some of which are stinging. Wasps are distinguished from the ants and bees of *Apocrita* by various behavioural and physical characteristics, particularly their possession of a slender, smooth body and legs with relatively few hairs.
(https://www.britannica.com/animal/wasp)
- Solitary wasp also known as hunting wasps are non-stinging varieties and do not form colonies.
- Social wasp forms colony and shows division of labours.

- The subfamily *Eumeninae*, commonly called potter wasps, is the most species rich subfamily among the Vespidae.

- The subfamily *Eumeninae* or potter wasp is classified in to three, *Zethini, Eumenini* (Eumenes) and *Odynerini* (Odynerus)

- Eumenes genera is further divided in to *Coeleumenes, Delta, Phimenes*…etc.

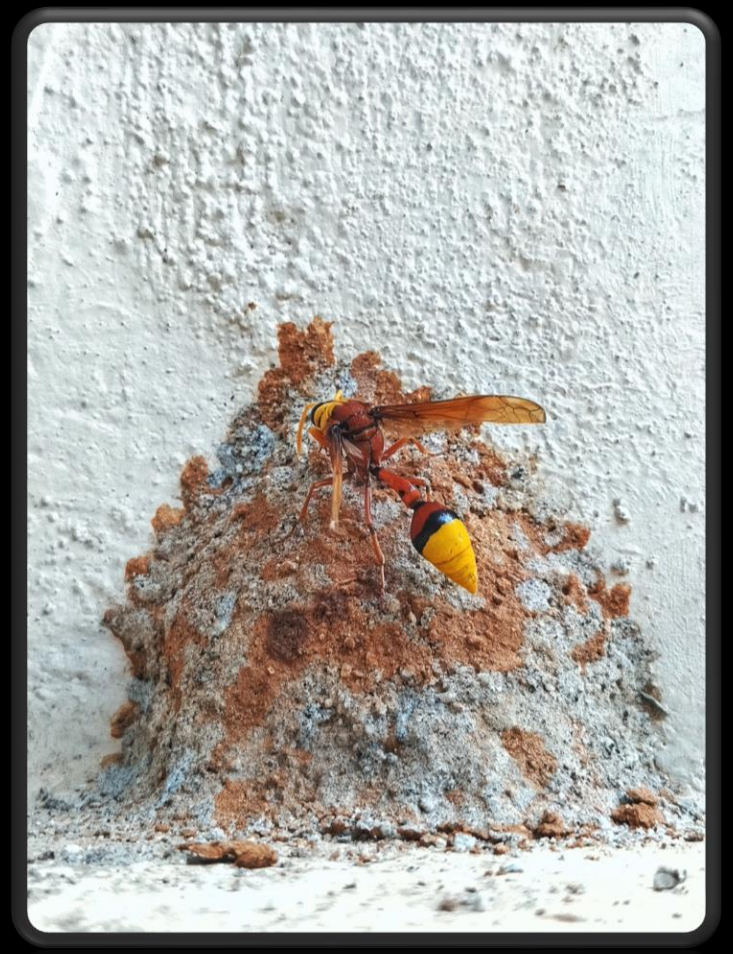
- They are usually solitary and rarely sub-social

- Potter wasp feed on flower nectar.

- **We are going to focus on *Delta* sp. And *Phimenes* sp.**

Potter Wasp

Potter Wasp



Delta sp.

Phimenes sp.

Life cycle of potter wasp

1. The parent wasp lays egg inside the nest.
2. Provision them with caterpillar or spiders.
3. Egg transforms in to larvae and then to pupae
4. Finally adult wasps emerge from the nests

… The adult females die by the end of the summer. The larvae eventually pupate and emerge the following summer. There is only one generation each year….

- *Eumeninae* shows a remarkable flexibility in their nesting habits. They are commonly known as "potter wasps" due to their construction of mud nests that resemble earthen pots

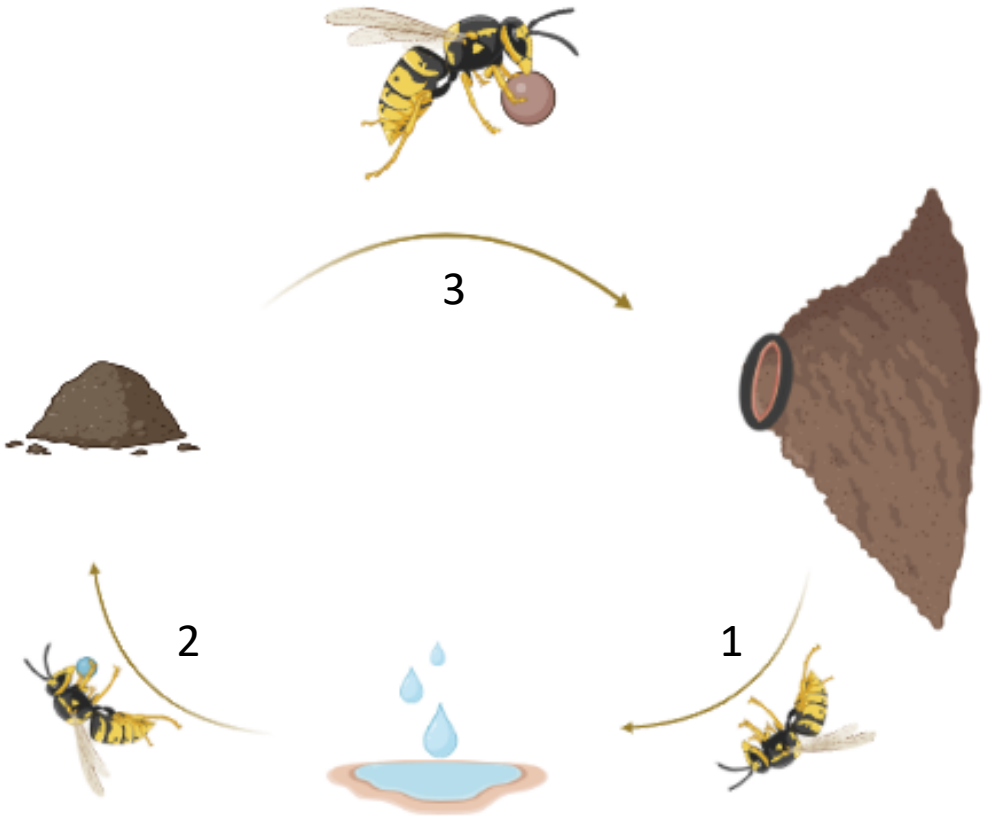
- These mud nests can be either single-cell or multi-cell in design

- nesting sites are borings in decaying wood, certain species also utilize other structures like hollow plant twigs, stems, artificial cavities on man-made objects, ceilings, and even old mud nests.

- Potter wasp usually provision their broods with mainly larvae of *Lepidoptera*, *Curculionidae* and *Chrysomelidae*.

Nesting and nest construction





Pictorial Representation of Nest Construction by *Phimenes*

The initial phase of my internship involved making these observations and spotting the Potter wasps and its nests…..

but there's still a second half to come.

Comparison of temperature variation between active and inactive nests

Aim;

- To take interior and exterior temperature readings for several active and inactive nests around the campus.

- To Plot graph and to analyse graphs

- To comment on the thermoregulations inside active nests.

Main instruments used;

- Thermocouple thermometer
- FLIR IR Thermometer
- Kestrel 3500 pocket weather Meter

My work;

- Spotted and identified 10 active and 9 inactive nests around the campus. There were more nests but at a certain height….!

- Started to monitor these nests daily (3 times per day) and record the interior, ambient and exterior temperature.

Nest	Date	Time	Ambient	Surface	Exterior	Interior Hole 1	Interior Hole 2
N A-BHL							
$ Category A nest	03-06-2023	11:36	28.9	26.8	27.2	25.6	26
$ Behind hydraulics Lab	06-06-2023	10:55	29.4	26.8	27.1	26	25.9
$ On a wall		13:56	30.6	27.8	28.2	26.1	26.1
		17:27	28.7	27.3	27.5	25.9	25.9
	08-06-2023	10:45	30.1	26.4	26.8	26.4	26.5
		13:53	28.3	27.4	27.7	25.6	25.8
		17:00	28.9	27.6	28	25.9	26.2
	12-06-2023	11:00	27.9	25.5	25.8	25.9	25.7
		14:00	29	26.2	26.4	26.1	25.4
		16:30	29.4	26.6	27	27.3	27
	14-06-2023	11:00	28.6	25.8	26	25.4	25.7
		14:00	29.6	26.8	27.8	26	25.5
		17:30	28.7	26.7	27	25.9	25.8
	16-06-2023	11:00	27.4	25.9	26.2	26	25.9
		13:00	30.5	26.7	27.2	27.4	27.2
		17:00	29.1	27	27.3	26.2	25.8

Graphical Analysis

Active nests

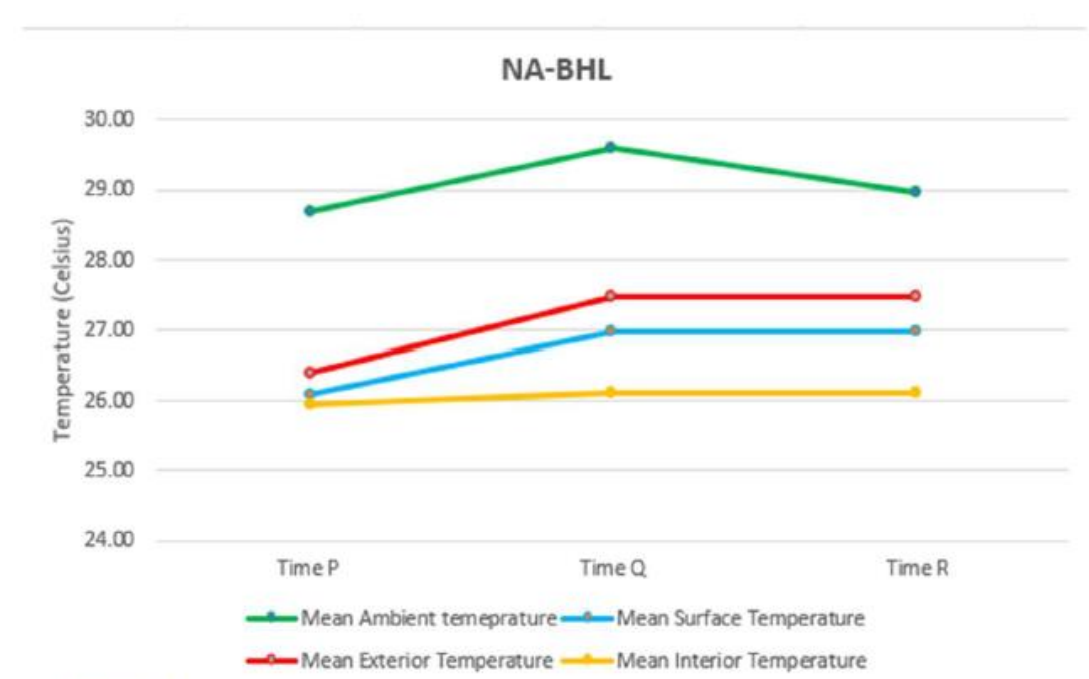
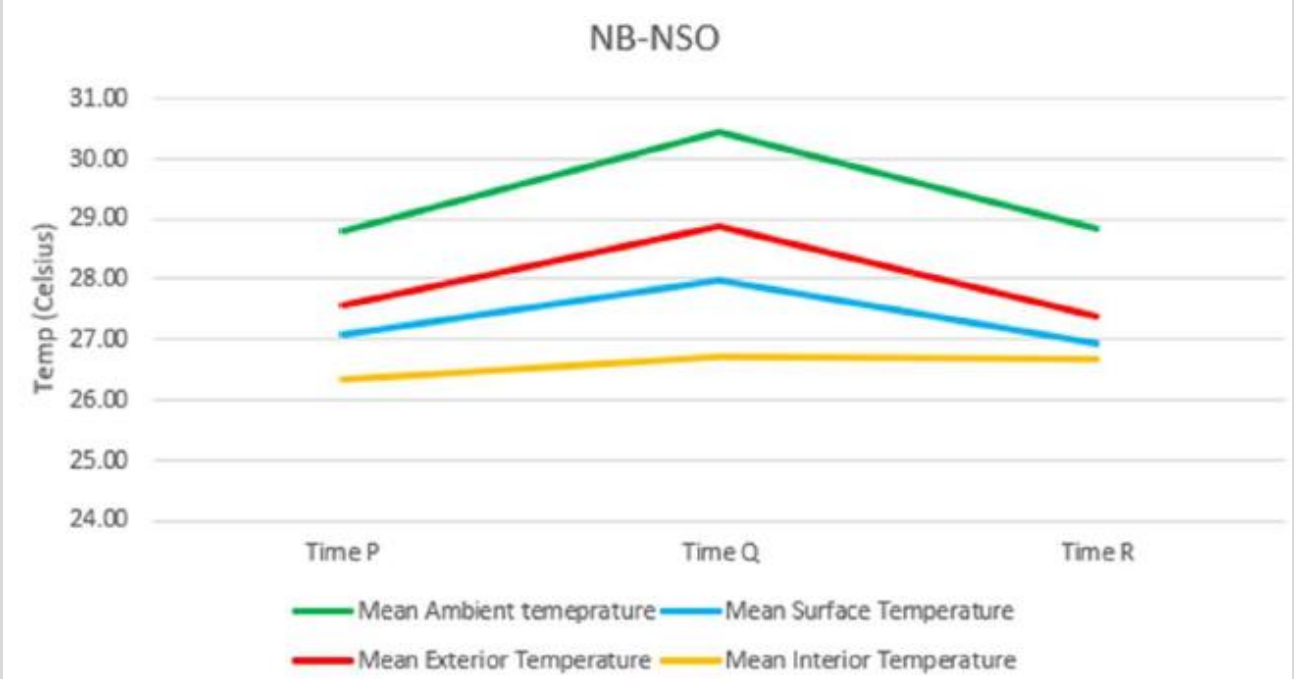
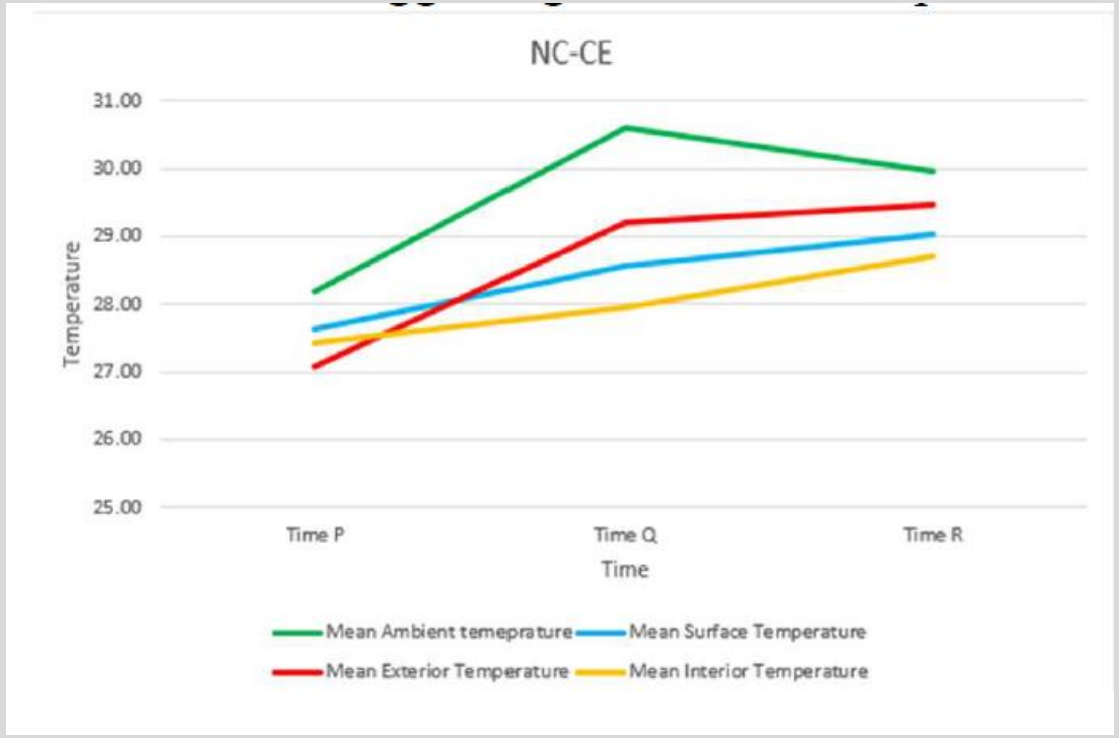
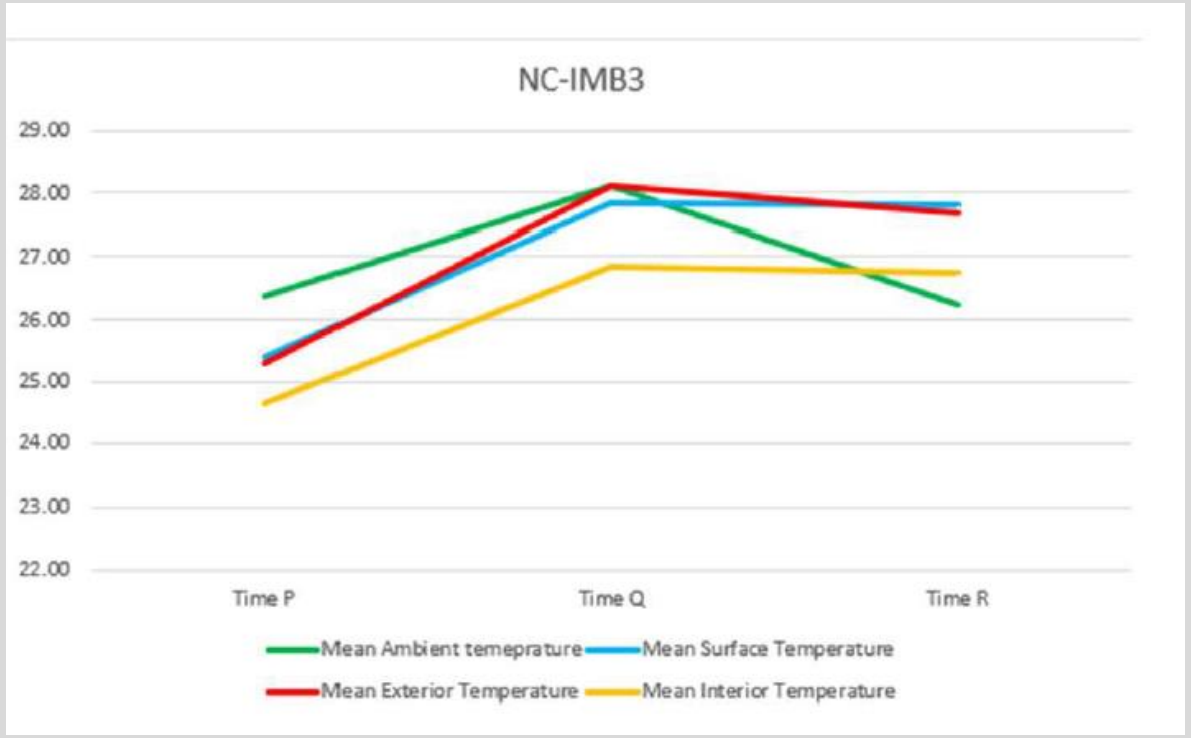


Figure 58



Inactive nests





Clubbing all the data from individual nests (Both active and inactive)

Active Nests

Nest code	Time	Ambient temeprature	Surface	Exterior Temperature	Mean Interior Temperature
NA-BHL	Time P	29.4	26.8	27.1	25.95
		30.1	26.4	26.8	26.45
		27.9	25.5	25.8	25.8
		28.6	25.8	26	25.55
		27.4	25.9	26.2	25.95
	Time Q	30.6	27.8	28.2	26.1
		28.3	27.4	27.7	25.7
		29	26.2	26.4	25.75
		29.6	26.8	27.6	25.75
		30.5	26.7	27.2	27.3
	Time R	28.7	27.3	27.5	25.9
		28.9	27.6	28	26.05
		29.4	26.6	27	27.15
		28.7	26.7	27	25.85
		29.1	27	27.3	26
NB-NSO	Time P	28.2	26.8	27.3	26
		28.6	26.7	27.3	26.47
		29.6	27.7	28.1	26.5
	Time Q	29.5	27.6	28.5	25.6
		32	28	29	27.47
		29.8	28.3	29.1	27.07
	Time R	30.3	27.8	28.5	27.5
		30	27.7	28.4	27.4
		30.5	28.5	29	27.7
		24.8	23.7	23.6	24.07
NB-CSA	Time P	29.9	30.3	32.4	28.9
		30.3	30.7	32.4	29.2
		30.2	29.9	32	29.9
	Time Q	31.8	32.9	34.9	32.45
		30.8	32.1	34.5	30.95
	Time R	29	31.2	31.6	30.35
		30.7	32.5	33.3	31.95
NA-IMB	Time P	25.5	24.6	24.8	23.03
		26.1	25.1	25.2	23.87
		24.5	23.3	23.6	22.77
		26.5	26.3	26.7	24.67
		25.7	26.3	26	25.7
	Time Q	26.8	27.6	27.7	25.9
		27.2	28.5	28.6	28.27
		28.8	27.6	27.4	26.17
		29.8	30.1	30.3	31.63
		28.6	29.4	29.6	26.57
	Time R	24.1	25.5	25.3	25.53
		28.5	29.3	29.4	28.93
		25	28.5	27.9	27.43
		29.2	29.4	29.5	28.8
NB-BHL	Time P	28.9	26.6	26.7	26.95
		29.4	26.3	26.8	26.2
		30.1	26	26.2	26.5
		27.9	25.2	25.3	25.55
		28.5	25.5	25.8	26.15
		27.4	25.6	26	26.05
	Time Q	30.6	27.3	27.6	27.1
		28.3	26.9	27.2	26.05
		29	25.8	26.1	26.5
		29.6	26.4	26.9	26.75
		30.5	26.7	27	26.2
	Time R	28.7	26.9	27.2	26.4
		28.9	27.2	27.6	27.75
		29.4	26.3	26.6	26.15
		28.6	26.7	26.9	26.35
		29.1	26.8	27	26.25
NB-ICDS	Time P	28	27.4		26.4
		28.5	28.2		26.9
		28	28.5		27.2
	Time Q	29.5	31.4		31
		30.1	31.5		29.8
		30.1	31.3		30.7
	Time R	31.2	32.9		30.9
		29.2	31		29.9
		30.5	33.4		30.6

Inactive Nests

Nest code	Time	Ambient temeprature	Surface	Exterior Temperature	Mean Interior Temperature
NC-BHL	Time P	28.9		27.8	27.5
		29.4		27.5	27.35
		30.1		27.2	27.15
		27.9		26	25.95
		28.5		26.3	26.55
		27.4		26.6	26.6
	Time Q	30.6		29.2	29.35
		28.3		28.4	27
		29		27	27.05
		29.6		27.8	27.7
		30.5		27.7	27.8
	Time R	28.7		27.9	27.05
		28.9		28.7	28.9
		29.4		27.8	28
		28.7		27.5	27.2
		29.1		28.1	27.35
NC-CE	Time P	28	27.6	28.1	27.5
		28.4	27.7	25	27.25
		28.2	27.6	28.1	27.55
	Time Q	29.9	28.2	28.8	27.85
		31.1	28.8	29.5	28.95
		30.8	28.7	29.3	27.1
	Time R	30.4	29.1	29.6	28.75
		29.7	28.9	29.2	28.4
		29.8	29.1	29.6	28.95
NC-ICSA	Time P	29.1	28.1	26.9	26.95
		28.2	27.4	26	25.55
	Time Q	32	28.7	28.2	27.05
		29.4	29	27.7	26.6
		28.9	28.1	26.6	26.55
	Time R	28.6	27.2	26.6	26.7
		29.5	28.7	28	27.75
		29.6	29	28.6	27.7
NC-IMB3	Time P	25.5	24.1	24.3	24.25
		26.1	26.2	26.4	24.5
		24.5	23.6	23.3	23.05
		27.5	26.8	26.5	26.15
		28.3	26.4	26.1	25.4
	Time Q	26.3	27.2	27.4	26.2
		27.2	28.2	28.7	28.05
		25.6	26.2	25.9	24.45
		32.3	29.5	30.2	27.3
		29.2	28.1	28.3	28.25
	Time R	24.1	25.5	25.2	25
		26.8	28.4	27.8	26.65
		24.8	28.5	28.5	27.3
		29.2	28.9	29.2	28
NC-JNC	Time P	28	25.4	25	26.3
	Time Q	31.2	29.8	33.6	31.65
	Time R	30.3	29.2	29.6	28.8
NC-MBP	Time P	28.5	27.1	26.6	26.3
		27.9	27.5	27.4	27.9
		28.3	27.7	27.6	27.75
	Time Q	30.1	30.5	30.2	29.05
		30	30.4	30.3	28.75
		30.1	30.5	30.4	29.45
	Time R	31	30.7	30.8	29.75
		28.9	30.5	30.4	28.5
		30.1	30.9	31	28.35

Maximum and Minimum temperatures;

From the ambient, surface, exterior and mean interior temperature measurements, the maximum and minimum value of it is taken. These values are incorporated in a table and shown below;

Active Nests

Nest code @Time P	Maximum Ambient Temperature	Minimum ambient temperature	Maximum Interior Temperature	Minimum Interior Temperature
NA-BHL	30.1	27.4	26.45	25.55
NB-NSO	29.6	28.2	26.5	26
NB-CSA	30.3	29.9	29.9	28.9
NA-IMB	26.5	23.3	25.7	22.77
NB-BHL	30.1	27.4	26.95	25.55
NB-ICDS	28.5	28	27.2	26.4
NB-IMB	26.5	24.5	24.1	22.7
NB-IMB2	28.3	24.5	25.4	23
NB-MBP	28.5	27.9	27.65	26.1
NB-SP	28.3	25.3	25.67	25.27

Nest code @Time Q	Maximum Ambient Temperature	Minimum ambient temperature	Maximum Interior Temperature	Minimum Interior Temperature
NA-BHL	30.6	28.3	27.3	25.7
NB-NSO	32	29.5	27.47	25.6
NB-CSA	31.8	30.8	32.45	30.95
NA-IMB	29.8	27.6	31.63	25.9
NB-BHL	30.6	28.3	27.1	26.05
NB-ICDS	30.1	29.5	31	29.8
NB-IMB	30	26.3	30.1	25.4
NB-IMB2	32.3	25.6	27.8	24.9
NB-MBP	30.1	28.9	29.55	28.05
NB-SP	28.2	28.2	28.27	28.27

Nest code @Time R	Maximum Ambient Temperature	Minimum ambient temperature	Maximum Interior Temperature	Minimum Interior Temperature
NA-BHL	29.4	28.7	27.15	25.85
NB-NSO	30.5	24.6	27.7	24.07
NB-CSA	30.7	29	31.95	30.35
NA-IMB	29.2	25.5	28.93	25.53
NB-BHL	29.4	28.6	27.75	26.15
NB-ICDS	31.2	29.2	30.9	29.9
NB-IMB	28.9	24.1	26.6	24.2
NB-IMB2	29.2	24.1	28.1	24.7
NB-MBP	31	28.9	30.3	28.3
NB-SP	26.8	25.2	26.5	24.27

Inactive Nests

Nest code @Time P	Maximum Ambient Temperature	Minimum ambient temperature	Maximum Interior Temperature	Minimum Interior Temperature
NC-BHL	30.1	27.4	27.5	25.95
NC-CE	28.4	28	27.55	27.25
NC-ICSA	29.1	28.2	26.95	25.55
NC-IAP	28.5	28.3	25.65	24.95
NC-IMB	26.5	24.5	25	23.1
NC-IMB2	28	24.5	26.2	23.3
NC-IMB3	28.3	24.5	26.15	23.05
NC-MBP	28.5	27.9	27.9	26.3
NC-INC	28	28	26.3	26.3

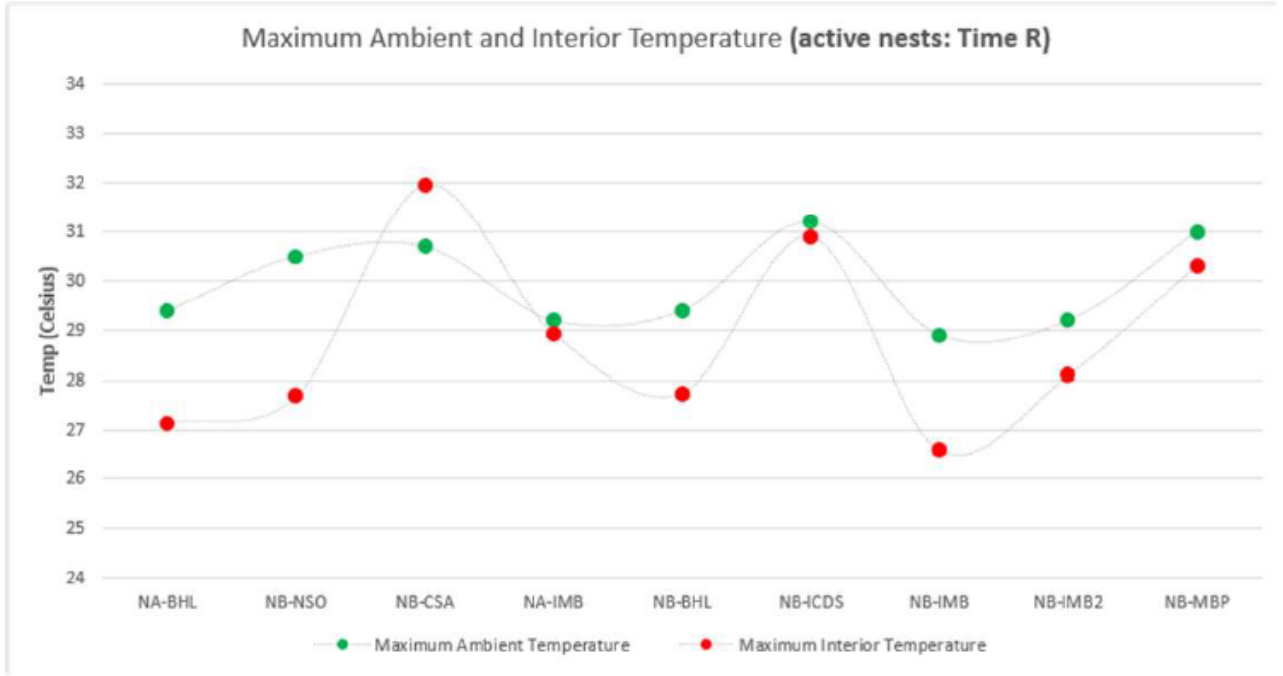
Nest code @Time Q	Maximum Ambient Temperature	Minimum ambient temperature	Maximum Interior Temperature	Minimum Interior Temperature
NC-BHL	30.6	28.3	29.35	27
NC-CE	31.1	29.9	28.95	27.1
NC-ICSA	32	28.9	27.05	26.55
NC-IAP	30.8	30.1	28.05	26.4
NC-IMB	29.2	26.3	30.8	25.1
NC-IMB2	27.9	25	29.3	24.55
NC-IMB3	32.3	25.6	28.25	24.45
NC-MBP	30.5	30.4	29.45	28.75
NC-INC	31.2	31.2	31.65	31.65

Nest code @Time R	Maximum Ambient Temperature	Minimum ambient temperature	Maximum Interior Temperature	Minimum Interior Temperature
NC-BHL	29.4	28.7	28.9	27.05
NC-CE	30.4	29.7	28.95	28.4
NC-ICSA	29.6	28.6	27.75	26.7
NC-IAP	30.3	29.9	28.95	27.25
NC-IMB	29.2	24.1	27.1	24.3
NC-IMB2	27.7	24.1	26.85	24.6
NC-IMB3	29.2	24.1	28	25
NC-MBP	30.9	30.5	29.75	28.35
NC-INC	30.3	30.3	28.8	28.8

Scatter plot

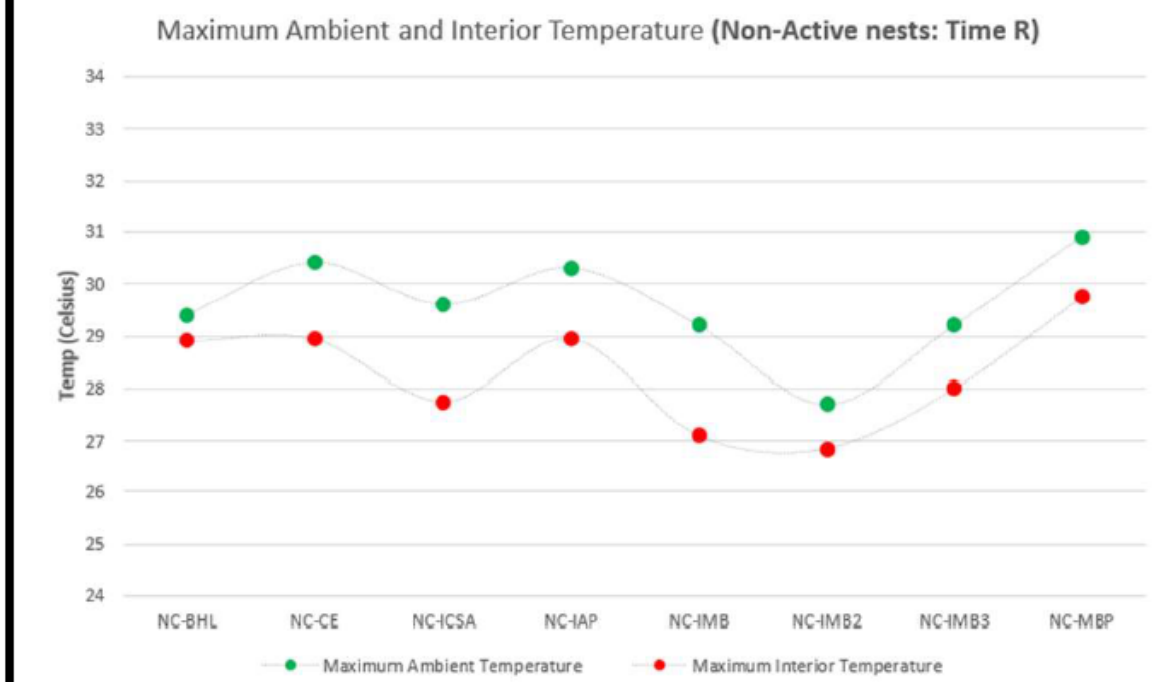
Time R

Active nests



Time R

Inactive nests



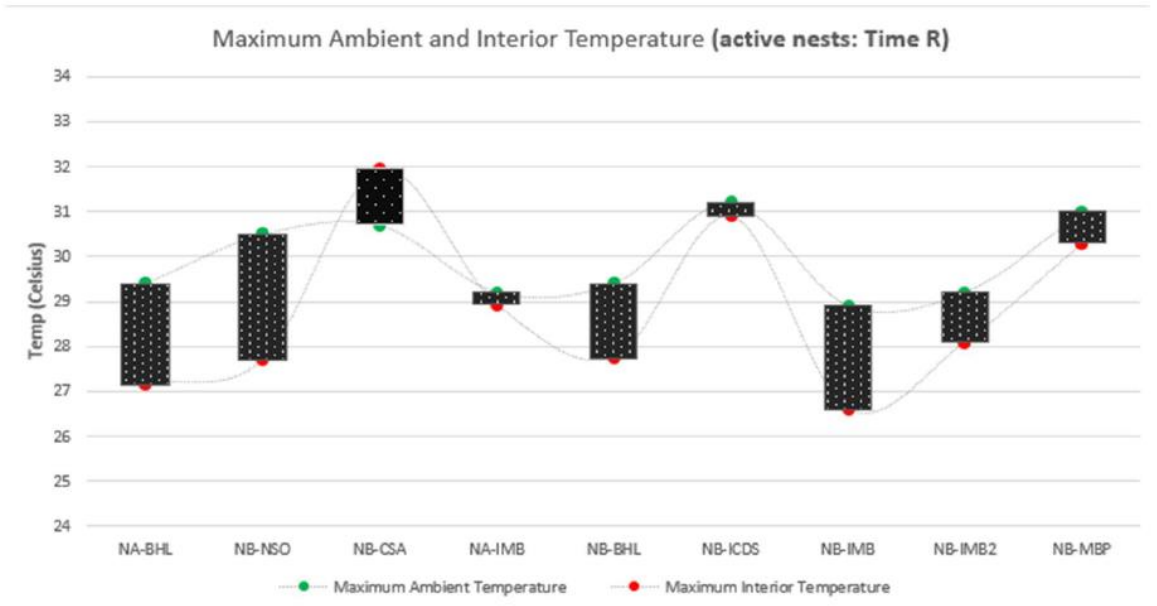


Figure 55

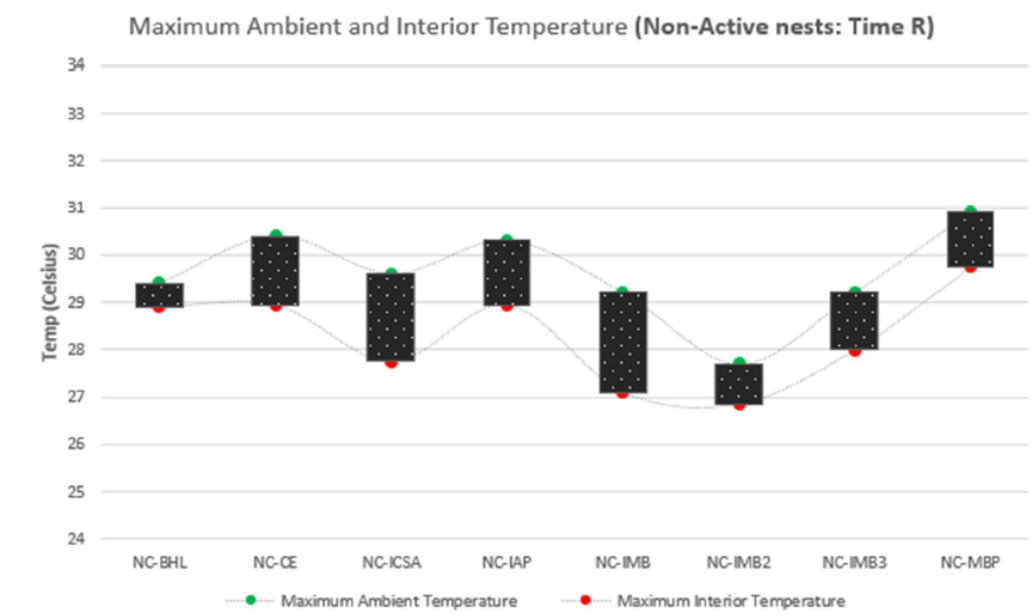


Figure 56

Results;

- The regular smooth patterned curve in inactive nests may indicate that inactive nests respond to ambient temperature as similar to a mud vessel kept out in sunlight.

- The irregular curve in active nests indicate that some level of temperature regulation exists inside it.

- By comparing the responses of active and inactive nests to a temperature source, it becomes evident that they exhibit variation, suggesting the presence of thermoregulation mechanisms within active nests.

Strange Behavior observed;

- A wasp species (*Eumenes* sp.) was spotted sitting inside an unused old nests without engaging in any activities. (There were 2 cases)

- This kind of instances (wasp returning to a nest without engaging in any activities) were not recorded or mentioned by previous workers on potter wasp.

Challenges and problems faced;

- Numerous active nests were located at a specific elevation, making it challenging for me to gather the data
- Less data
- Unable to monitor a nest from its beginning of construction till the end.

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Thankyou