

A NOTE ON THE TEMPERATURE PREFERENCE IN *MESOBUTHUS TAMULUS*
TAMULUS (FABR.) (ORDER : SCORPIONIDA. FAMILY : BUTHIDAE)

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INTRODUCTION

Mesobuthus tamulus tamulus is commonly occurring yellow scorpion in Maharashtra. Very scanty information is available on its behavioural patterns except scorpion poisoning and venom studies (Ramamurthi & Jangi, 1987, Tare 1981), while a comprehensive account on its taxonomy by Tikadar & Bastawade (1983) is worth mentioning. In January, experiments were conducted by keeping an illuminated electric bulb in the cage. Scorpions responded towards this stimulus. The present paper deals with one month's observations on *Mesobuthus tamulus tamulus* (Fabr.). Various experiments yielded similar results.

Scorpions, inhabitants of warmer part of the globe, show great adaptability as tolerance for higher temperatures. Few authors, cloudsley-Thompson (1962) ; Alexander & Ewer (1958) ; Warburg & Ben horin (1981) and Hadley (1970) have demonstrated the ability of several species of scorpions to withstand higher temperatures, e. g. *Leiurus quinquestriatus* (L.). *Hadrurus arizonensis*, *Centruroides sculpturatus*, *Opisthophthalmus latimanus*, *B. judaicus*, *Buthotus minax*.

MATERIALS AND METHODS

Five specimens of *Mesobuthus tamulus tamulus* were collected from Pashan, in the vicinity of Pune. The specimens brought to the laboratory were kept for a week to acclimatize them. They were kept in a wooden cage of 45 cms×30 cms×30 cms size having a glass top. The sides were fitted with iron mesh. The cage was supported by four, 7.5 cm. high wooden blocks, which were immersed in plastic containers filled with water to prevent the attack of ants. Sand and dry soil was spread in the cage. Few pieces of dry coconut shells and smaller stones were kept here and there for shelter. Insects were given as food, twice a week and a petridish filled with water was kept in the cage.

An illuminated electric bulb of 60 w. was arranged in the cage for a period of one hour. Initial temperature in the cage and temperature surrounding scorpions was noted. After half an hour temperature surrounding scorpions was recorded. Orientation—approach and the sitting posture of scorpions were observed.

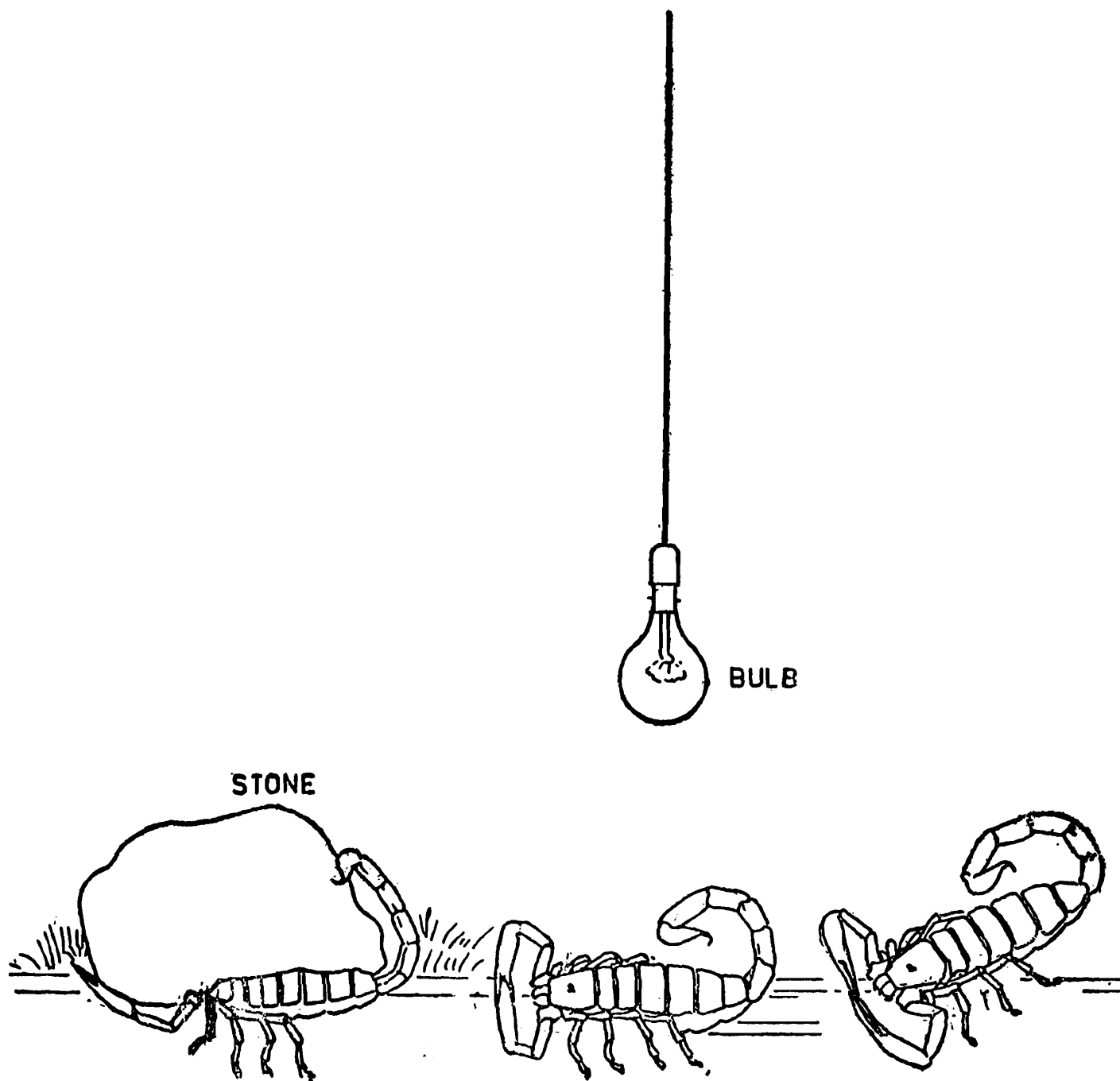


FIG.1 RESPONSE TO THE SOURCE OF HEAT

In an another set of experimnt, a beaker containing the illuminated candle was kept in the cage. Temperature was recorded. The experiment was repeated by shifting the beaker and the reaction of scorpions was noted.

OBSERVATIONS

1. *Response to electric bulb* :—

In the month of January 1981, 3 sets of experiments were conducted on 5 scorpions. All scorpions reacted positively. They oriented with projected open pincers from below the stone, within 5-10 minutes, gradually scorpions approached with the movement of pedipalps.

Real sign whether scorpions realised the sense of heat was that they opened and extended their pedipalps. In one instance, scorpion just extended its pedipalps from below the stone.

When the light was put on, scorpions gradually came out from beneath the coconut shell. After few minutes march, scorpions attained particular sitting position some distance away from the bulb. Their prosoma were facing away from the bulb and metasoma were towards the bulb. Tails were curled over back and pedipalps were held very close to chelicerae.

Few scorpions just shifted their previous sitting position and remained concealed beneath stones. Scorpions sat in this position for more than hour, when the light was made off, they did not change their place, scorpions had acquired a temperature surrounding them 33-35°C.

TABLE I : Showing the sitting position of scorpions.

Scorpion	Distance of sitting away from bulb	Position of sitting
A	4 cms away	Posterior end facing towards the bulb sting upwards
B	8 cms away	—do—
C	4 cms above on the inner side of cage	—do— Pedipalps closed near chelicere
D	8 cms away in the corner of cage	—do—
E	7 cms away	Below a stone.

TABLE II Showing the response of scorpions towards the source of heat

Date : 6.1.1981

Time of light on : 11.00 a.m.

Initial temp.

Time of light off : 12.00 noon

in the cage 25°C.

Scorpion	Time of orientation	Initial Temp. surrounding scorpions	Time required to come near bulb	Time of sitting	Distance	After $\frac{1}{2}$ hr. temp. acquired by scor.	Sitting position of scorpions
A	11.05 a.m.	24°C	2 minutes	11.07 a.m.	4 cms	30°C	Below stone, near bulb, prosoma towards bulb.
B	11.07 a.m.	24°C	3 minutes	11.10 a.m.	6 cms	30°C	Sting towards bulb, in the corner of cage
C	11.12 a.m.	25°C	8 minutes	11.20 a.m.	8 cms	29°C	Scorpion was in the gap between two stones, sting towards the bulb.
D	11.20 a.m.	25°C	Immediately	11.20 a.m.	8 cms	29°C	—do—
E	11.45 a.m.	25°C	—do—	11.45 a.m.	10 cms	30°C	On the inner side of cage. Just it reverted the position. Prosoma towards bulb.

(1) After one hour temperature surrounding scorpions was in the range of 33-35°C.

(2) At 1.20 p. m. all the scorpions changed their sitting places.

(II) *Response of Scorpions towards illuminated candle :*

Fifteen minutes after keeping the beaker containing illuminated candle in the cage, 3 out of 5 scorpions displayed similar orientation—approach response to those observed by keeping illuminated bulb. Scorpions came closer to beaker and sat with their pedipalps closed near chelicerae.

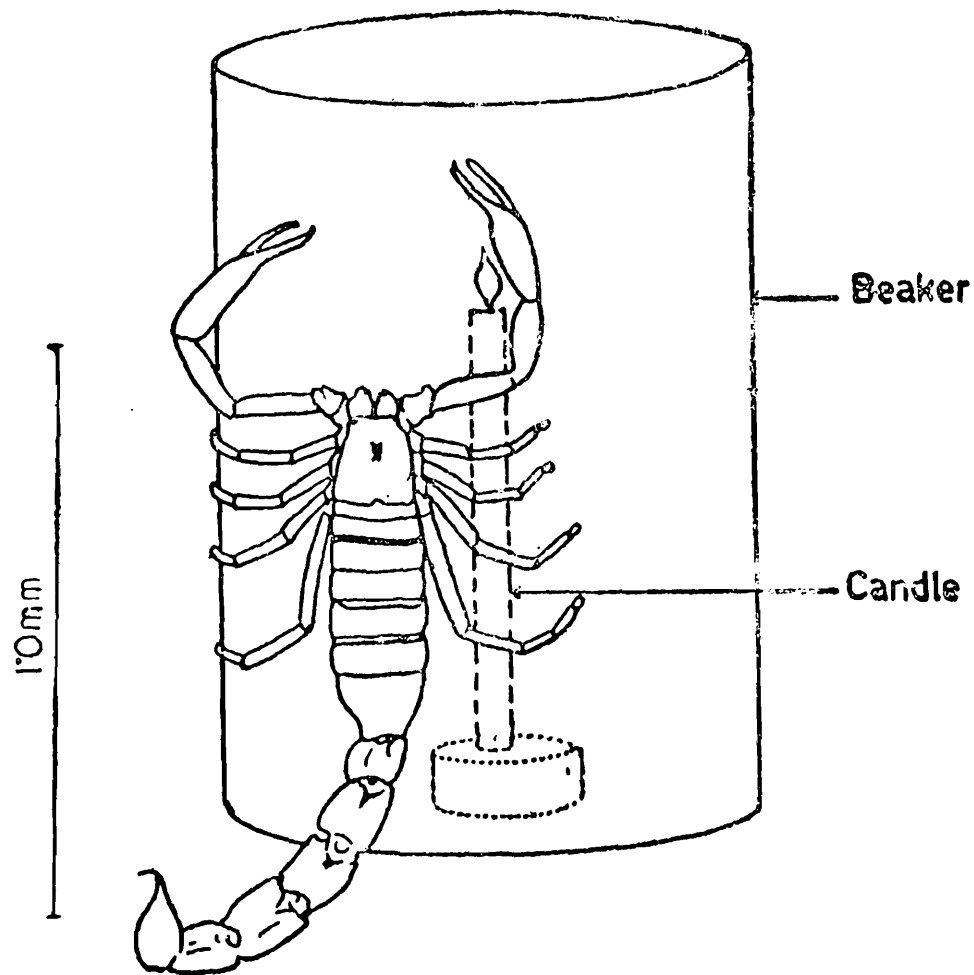


Fig 1 RESPONSE TO ILLUMINATED CANDLE

Three females came in close contact with beaker and sat in the gap between inner side of cage and the beaker. One gravid female twice attempted to climb on the beaker. Her pedipalps were touching the upper edge of beaker and she stood in erect position.

After shifting a beaker at other place again she approached and tried to climb over beaker. Two females sat in a position such that they were in close contact with beaker. Two males did not show response towards this stimulus. Temperature surrounding scorpions was 29-30°C.

When the candle was made off, scorpions did not change their sitting position.

DISCUSSION

In January, *Mesobuthus tamulus tamulus* showed affinity towards the source of heat (Illuminated bulb and candle) and preferred a temperature surrounding their body 30-35°C with particularly sitting away from the bulb at the distance (4 to 10 cms) and their stings were facing towards the bulb. However in case of candle experiment, scorpions sat in close contact with beaker regardless of their strictly nocturnal habit.

Results of the present study are in agreement with the investigations made by earlier authors (Cioudsley-Thompson, 1962); Abushama (1984) and Alexander and Ewer (1958) stating that the upper lethal limit of temperature for the scorpion *Leiurus quinquesriatus* (H & E) to be 47°C and *Buthotus minax* was 45°C, after 24 hours exposure. *Opishophthalmus latimanus* preferred a temperature range 32-38°C. More over Warburg & Benhorin (1981) reported that two *Buthids*; *Buthotus judaicus* and *Leiurus quinquestriatus* remained in the warmer zones of the gradient (25-27°C) for longer period.

As the experiments on *Mesobuthus tamulus tamulus* were conducted in January; cold climate of this month may be a factor inducing this behaviour in *Mesobuthus tamulus tamulus*. Recent studies indicate scorpions are also able to behaviourally regulate their temperature through vertical movements within the burrow (Hadley 1970).

As soon as keeping the illuminated bulb in the cage, *Mesobuthus tamulus tamulus* opened fingers of their padipalps—This observation suggests that the pedipalp receptors may possess some cues informing about physical conditions of the environment.

Further scorpions sat in a particular position—avoiding the direct light and stings facing towards the bulb—this observation supports the views of Abushama (1964) that receptors perceiving the heat are located on hairs of poison bulb of scorpions.

Field observations indicate that *Mesobuthus tamulus tamulus* occupied a range of temperature 25-35°C in natural habitats.

SUMMARY

Although *Mesobuthus tamulus tamulus* is a nocturnal species, in captivity it displayed affinity towards the source of heat (Electric bulb and illuminated candle) in cooler month (January), scorpions reacted by sitting in a particular position. Their prosoma was facing away from the direct light for longer period. Temperature surrounding scorpions was recorded in the range of 30—35°C.

Response of scorpions towards the electric bulb was within a period of 5—10 minutes. While in case of illuminated candle the response was not so fast. The sitting distance of scorpions from the source of heat was directly related to the intensity of heat.

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REFERENCES

- Abushama, F. T. 1964. On the behaviour and sensory physiology of the scorpion *Leiurus quinquestriatus* (H & E). *Anim. Behav.* **12**, 140-153.
- Alexander, A. J. and Ewer, D. W. 1958. Temperature adaptive behaviour in the scorpion *Opisthophthalmus latimanus* Koch. *J. exp. biol.* **35**, 349-359.
- Cloudsley-Thomson, J. L. 1962. Lethal temperatures of some desert arthropods and mechanism of heat death. *Ent. exp. appl.* **5**, 270-280.
- Cloudsley-Thompson, J. L. 1962. Some aspects of the physiology of *Buthotus minax* (Scorpiones : Buthidae) with remarks on other African scorpions. *Ento. Month Mag.* **98** : 243-246.
- Hadley, N. F. 1970. Micrometrology and energy exchange in two desert arthropods. *Ecology*, **51** : 434-444.

- Ramamurthi, R. and Jangi, B. S. 1987. Scorpion poisoning, *Science Reporter*, 24 (3) : 135-142.
- Tare, 1981. Studies on Scorpions : Ecological, biometrical and output of venom studies M. Sc. Diss. Bombay University, pp. 162.
- Tikader, B. K, and Bastawade, D. B. 1983. Fauna of India Arachnida : Scorpions, Vol. III, pp, 671.
- Warburg, M. R. and Ben-Horin, A. 1981. The response to temperature gradients of scorpions from Mesic and Xeric habitats. *Comp. Biochem. psysiol.* vol. 68 A, 277-279.