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TEMPERATURE ADAPTIVE BEHAVIOUR IN THE SCORPION, *OPISTHOPHTHALMUS LATIMANUS* KOCH

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In discussing the possible functions of the pectines of the scorpion, von Ubisch (1922) suggests that they serve 'um den Stigmen frische Luft zuzufuhren' by their fanning movements or, alternatively, they prop up the mesosoma so that fresh air can reach the stigmata. Both of these suggestions imply that under conditions of respiratory stress a scorpion will lift its mesosoma clear of the ground so that the book-lungs have free access to air. Although von Ubisch did not apparently observe such behaviour, the recent report of 'abdominal elevation' in the Australian scorpion, *Urodacus abruptus* Poc. (Southcott, 1955) lends colour to such an hypothesis, although work on the functions of the pectines makes it seem very improbable that they actually serve as 'respiratory fans'. Southcott gives an illustration of a female of *U. abruptus* in the attitude typical of 'abdominal elevating behaviour', and from a comparison of this with some of the stances observed in various South African scorpions it becomes clear that such behaviour occurs also in the latter. *Opisthophthalmus latimanus* Koch, *O. nitidiceps* Poc., *O. austerus* Karsch., *Parabuthus planicauda* Poc. and *Uroplectes triangulifer* Thor. all show the pattern to varying extents, and it was felt that with so many species available for study, it would be profitable to follow up Southcott's observations. Preliminary tests indicated that the biological significance of this phenomenon appeared to be the same in all these species, and the results described below refer particularly to *Opisthophthalmus latimanus* which has been most intensively studied.

In this animal the pattern generally does not consist of a simple elevation of the abdomen, but more usually of a raising up of the entire body of the scorpion by a straightening of all the legs. Fig. 1 illustrates semidiagramatically the differences between (*a*) the normal resting stance of *O. latimanus*, (*b*) the stance in which the whole body is lifted clear of the ground, and (*c*) the more extreme 'abdominal elevation'. There is indeed no sharp distinction between these last two, and other rather rarer variations occur, e.g. that in which the abdomen, lifted clear of the ground, is supported by the tail (Fig. 1*d*). All of these different stances have in common a straightening of the legs; they will collectively be referred to here as 'stilted poses' and the behaviour itself as 'stilting'. In none of the species studied here, nor in *Androctonus australis* (L.) (Cloudsley-Thompson, 1955), is there any indication that the pectines might be used to prop up the abdomen, as von Ubisch

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away from an unpleasant stimulus or a displacement activity arising from a conflict between opposing photopositive and photonegative drives.

Interpreted in terms of its normal life, these observations imply that as temperatures rise and general activity of the animal increases, the light reaction will not direct the animal in such a way as to cause it to leave the safety of its burrow, but rather its reversal of sign will result in the scorpion retreating into the deeper parts which, as rough measurements in the field have shown, may be more than 20° C. below the soil temperature outside. It would seem that this reversal of light behaviour is the basis of an escape from a potentially lethal position.

It is interesting to note that the protective behaviour pattern of this scorpion in relation to high temperature has two facets—a static postural behaviour pattern which permits a certain degree of regulation, followed by a dynamic locomotory pattern which allows the animal to evade the difficulty by leaving the potentially lethal environment.

During the course of this investigation one of us (A. J. A.) held a bursary granted by the South African Council for Scientific and Industrial Research, to whom our thanks are due.

SUMMARY

1. Behaviour termed 'stilting' is described for the scorpion, *Opisthophthalmus latimanus*. In this pattern the legs are straightened, lifting the body clear of the substratum.

2. Evidence is submitted that it is not concerned with allowing greater respiratory exchange.

3. Stilting is generally elicited in response to a rise in environmental temperature above 18° C. and is invariably found at temperatures above 28° C.

4. A comparison using scorpions held in the stilted and normal resting stance, shows that, when the environmental temperature rises sharply, the body temperature of the resting animal rises rapidly, while that of the stilting animal is almost unchanged. The mechanism of this effect is shown to be due largely to the increased circulation of air around the animal which is permitted by the stilting.

5. From observations of behaviour in both the laboratory and the field, it appears probable that the stilting pattern is shown by *O. latimanus* during the hot hours of the day when the scorpion waits in the entrance of its burrow to catch prey.

6. Laboratory observations indicate that when the temperature becomes so high that stilting has no longer any protective value, a photopositive reaction, which would keep the scorpion at the entrance of its burrow, changes to a photonegative one and the animal can retreat into the cool depths of its burrow.

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