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MORPHOLOGICAL STUDY OF SPERMATOPHORE OF A COMMON INDIAN SCORPION *MESOBUTHUS TAMULUS TAMULUS* (FABR.)

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INTRODUCTION

The morphological and taxonomical studies of Indian scorpions have been updated recently by Tikader and Bastawade (1983). The biological observations of Indian scorpions have so far been neglected. Though the naturalists like Maccary (1810), Fabre (1925) and Pavlovsky (1924) reported about sexual behaviour in scorpions, nothing was exactly known, until Alexander (1956-57) described the procedure through which the spermatids are transferred from male genital apparatus to female genital apparatus. Later on many scorpiologists like Angermann (1955), Bucherl (1956), Maury (1973-75) and De Zolessi (1956) made considerable contributions to our understanding of the mating behaviour in scorpions from different countries. Mathew (1956) studied mating behaviour in *Heterometrus scaber* Pocock, a common species in Southern India. He also reported about the spermatophore in the postinsemination state in this species. Some more observations on these aspects have been put forth recently by Shulov and Amitai (1959-60), Williams (1971) and Francke 1979-84. The phylogenetic relationship of some chactoids have been discussed by Francke and Soleglad (1981) on the basis of hemispermatophores alongwith other characters.

Almost nothing has been reported, except Mathew (1956), about the morphology of either the pre or postinsemination state of the spermatophores in Indian scorpions. The present report deals with the morphological study of the spermatophore in the postinsemination state in *Mesobuthus tamulus tamulus* (Fabr.), a very common species around Pune, Maharashtra, India.

MATERIAL AND METHODS

Mature males and females of *Mesobuthus tamulus tamulus* (Fabr.) were collected live from under stones around Pune, Maharashtra. Each specimen was kept separately in a 500 ml plastic stopper glass jar, with a thick layer of sterilysed soil and a small piece of flat stone at the bottom. The jars were also provided with a wet cotton plug to maintain the humidity. Small cockroaches and house crickets were offered regularly to these specimens as their food. The cotton plug was changed every two days. The jars were cleaned after every 5 days to avoid fungal infection and mite and ant attacks. Each jar was covered with black paper to maintain darkness.

Two pairs of one male and one female were kept in two separate jars for daily observations on mating behaviour. These pairs didn't show any sort of affinity during the first two days, and were passive towards each other. On the third day one pair mated during night, leaving a postinsemination spermatophore on a flat stone kept inside the jar. Subsequently, on the fifth day the other pair also mated successfully during night and left a postinsemination spermatophore on a piece of stone. The actual mating behaviour in both cases could not be observed in detail.

THE SPERMATOPHORE

The spermatophore in scorpions is a transparent, pinkish brown, chitinous plus proteinous structure that is extruded and deposited by the male on a suitable substratum to transfer the spermatids into the female genital apparatus. This structure is different in size and shape in different families, genera and even sometimes in species of scorpions. It is thin, elongated and flagelliform in *Mesobuthus tamulus tamulus* (Fabr.) and measures about 15 to 18 mm in total length.

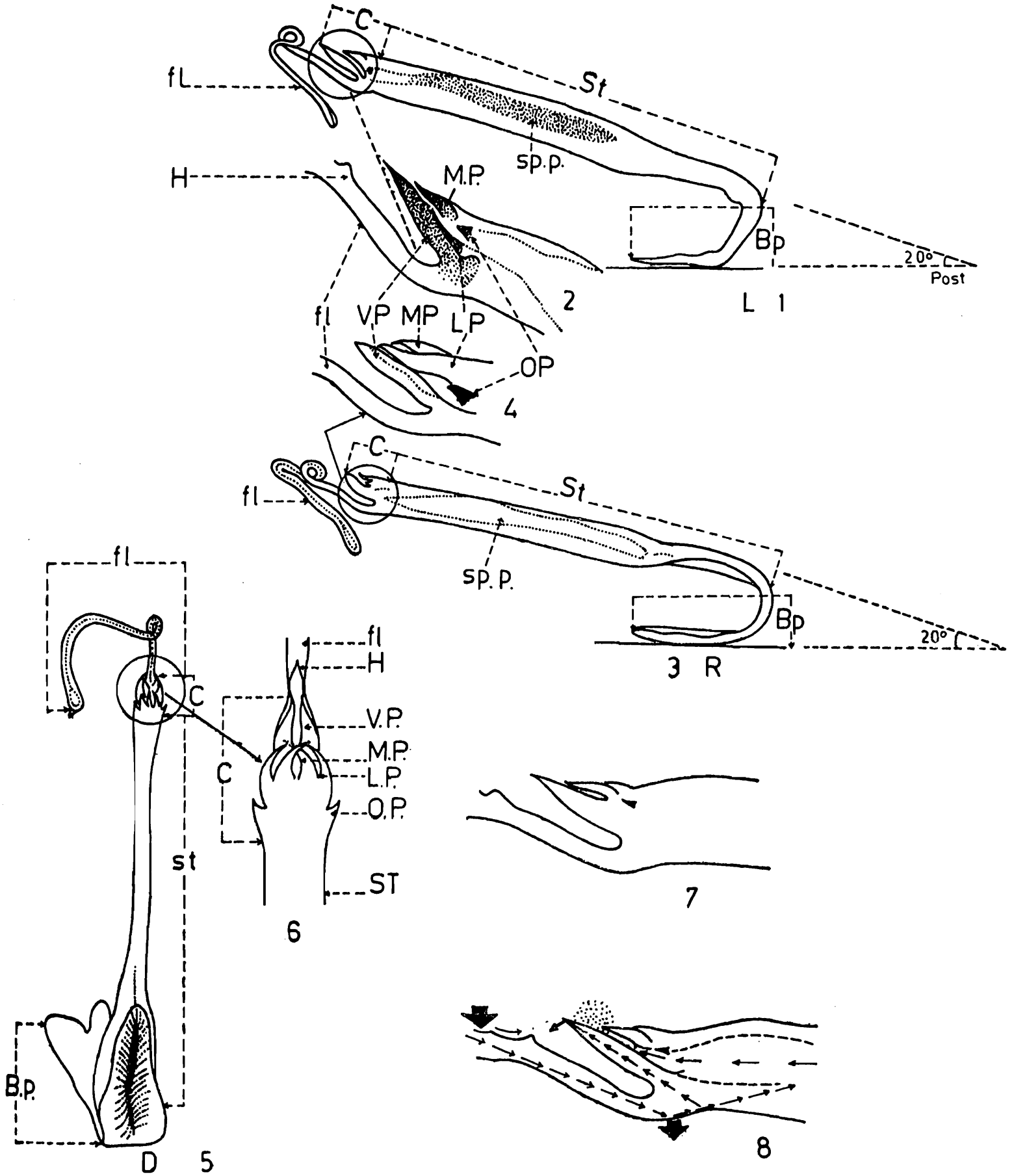
The spermatophore in postinsemination state in *M. tamulus tamulus* (Fabr.) is pinkish-brown, much darker on the capsular region, which is chitinous and pale, transparent on the stem and almost whitish on the flagellum (pl. 1 ; figs. 1, 3 & 5). Its four main parts are 1. Basal plate (Bp), 2. Stem (st.), 3. Capsule (C.) and 4. Flagellum (Fl.).

1. *Basal plate* (Bp) : It is a flat, thin and wing like structure (Figs. 1, 3 & 5) which is extruded first by male. When it comes out of the male genital apparatus it is cream white in colour and remains semisolid in nature, sticking to the ground firmly as it dries up (Alexander 1959)). After drying, it turns brownish and hard, helping to pull out the remaining part of the spermatophore and holding the spermatophore in a particular direction during mating.

2. *Stem* (St.) : This portion is a continuation of the Basal plate (Fig. 5) into a tubular, transparent, hollow structure. The basal plate rolles upward (Fig. 5), and the stem encloses a pair of spermatid packets (Fig. 1). This tubular stem measures about 8-10 mm in length, $2-2\frac{1}{2}$ mm in width and 4-5 mm in depth. The sperm packets lead distally into the capsular region by a narrow channel.

3. *Capsule* (C.) : This region consists of a complex structure with four pairs of different processes, termed as 1. Oblique process (Op), 2. Median process (Mp), 3. Lateral process (Lp) and 4. Ventral process (Vp). Alexander (1959) reported three pairs in *Parabuthus planicauda* Pocock. These processes protect the opening of the sperm packet, and help in transfering the spermatids into the female genital apparatus. The lateral view of the capsule (Figs. 2 & 4) reveal a duct between the median and ventral processes, through which spermatids exit from the spermpackets.

4. *Flagellum* (Fl) : The flagellum is the tubular extension of the ventro-distal portion of stem (Figs. 2 & 4). The halfs are stuck together on the median line jointly to



1. Lateral view (left side) of postinsemination spermatophore of *Mesobuthus tamulus tamulus* (Fabr.) 2. Lateral view of capsular region (Left). 3. Lateral view (Right side) of postinsemination spermatophore. 4. Lateral view of capsular region (Right). 5. Dorsal view of post insemination spermatophore. 6. Dorsal view of capsular region. 7. Lateral view of capsular region preinsemination condition. 8. Lateral view of capsular region arrows indicating site of pressures and release of spermatids.

form a single flagellum. This extension starts from the ventral side of the capsular region. There is a slightly raised portion on the dorsal side of the flagellum just below the distal end of the ventral process, and is termed the hook (H) (Figs. 2, 7 & 8). The flagellum is totally transparent and remains coiled or looped at one or two places (Figs. 1, 3 & 5). This part may be suggested as useful as an additional support for the female to click open the capsule and to obtain the spermatids (Figs. 7 & 8).

DISCUSSIONS

Scorpions, during their phylogeny have evolved a mating procedure that avoids the drying up of the spermatids at the time of their transfer from male to female. Such type has generally been paralleled in other groups of animals. The mating is initiated by laying the spermatophore by male and the spermatids were sucked in by female during mating. The buthoids differ from chactoids in having a flagelliform spermatophore so as to the *Mesobuthus tamulus tamulus* (Fabr.), a typical Indian buthoid form. An additional pair of ventral process is described for the first time in this species. The spermatophore is fixed on the substratum by the male in such a direction that no leakage of the spermatids is allowed ; where as the female, during their mating, presses the spermatophore untill the spermatids bust out through an apperature, formed on a capsular region (Figs. 7 and 8). *In Mesobuthus tamulus tamulus* (Fabr.) the spermatophore is pressed against the substratum upto the angle of 20° where it helps the female to take the spermatids.

SUMMARY

A detailed morphological study of the spermatophore, in the postinsemination state is given. The study is based on two such spermatophores extruded by two different males kept in the laboratory.

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