

OBSERVATIONS ON THE REPRODUCTIVE BEHAVIOUR OF THE MANTIS, *ACONTIOTHESPIS MULTICOLOR*

V. C. QUESNEL

INTRODUCTION

My observations on the reproductive behaviour of this mantis began partly by accident (the chance discovery of a mating pair) and partly out of the wish to see whether or not the female habitually devours the male after mating as is apparently the case with the European mantis. (1) For some years this species was common in my garden and all the observations were made there during three periods: September--October 1958, February--March 1960, April 1962--March 1963. No apparatus of any kind was used; one individual was simply placed near to another and the ensuing events observed. Usually the male was transferred to the presence of the female. This was accomplished by nudging the mantis on to a leafy twig on which it was transferred and from which it was again gently nudged on the completion of the journey.

I have seen no account of the reproductive behaviour of any Trinidad mantis but three papers on Trinidad mantids are of interest (2), (3) (4). I use the name *Acontiothespis multicolor* as favoured by Beebe et al. (2) and Crane (3) since it is clear from the descriptions and photographs in their publications that I am dealing with the same mantis they have so named. Kevan (4) lists *Acontiothespis minima* from Trinidad and refers to one specimen only of *Acontiothespis multicolor* which he says he has not seen. He also seems to believe that the two names apply to the same species. If there is only one species the name *Acontiothespis multicolor* should have precedence as being the earlier.

This account is based on a study of seven courting pairs in which continuous observation was possible and on numerous other more isolated observations.

COURTSHIP

Courtship may be very prolonged or very short and the conditions that determine its duration are not at all clear. Very long courtships have been observed twice. They proceed as follows. The male moves in a stalking fashion to a position three or four inches in front of the female, facing her. This approach may be long-drawn-out and interrupted by displays of the type now to be described. The male bends his abdomen to the side and twists it so that the bright red dorsum is displayed more or less forwards and towards the female. He holds the pose for about a second and then returns to his normal stance. This movement of the abdomen is accompanied by a "stamping" movement of the third leg on the side to which the abdomen bends, the rate increasing until the abdominal movement reaches its climax and decreasing thereafter. This complex of movements is repeated several times, sometimes to the right, sometimes to the left, in no regular sequence. The highest number of repetitions seen is nineteen.

A new phase then begins. The abdominal movement becomes a bending up and over the thorax. At the same time the tegmina are raised and spread apart slightly and the wings are expanded. A side-to-side swaying motion may be added at the height of the display. The stamping motion of the third leg has not been observed to accompany this display. The forelegs are held slightly extended forward but not spread apart. Fig. 16 of Crane's paper (3) gives a good idea of the display although the mantis shown there is a female. This phase does not last long. After a few displays (up to six have been observed) the male quickly flies on to the female's back from his position about three inches in front of her. The whole sequence of events from the start of courtship might take from one to two hours.

In short courtships various parts of the whole sequence may be omitted or the number of repetitions reduced. Usually, the "wings-up" display is omitted but on one occasion the entire display was omitted the male flying on to the female without previous movement. Apart from this occasion the "abdomen—bending" display has always occurred, the lowest number of repetitions being three.

On one occasion the male prefaced his courtship with another type of movement which occurs in contexts other than courtship and seems not to be a part of courtship properly speaking. This movement has been referred to by Crane (3) as reminiscent of a boxer's "wind-up." It is true that there is a curious illusion of rotation but in fact all that happens is that each foreleg is moved slowly backward and forward from the coxo-pleural articulation while at the same time the femur is moved more rapidly back and forth from the coxo-trochanteral articulation. As one foreleg moves forward the other moves backward.

I have seen this movement in the female too. She is usually inactive during courtship but on one occasion she seemed greatly agitated by the male's sudden appearance. He had flown to a spot within two inches of her without seeming to notice her. She gave the "boxer" movement, which immediately attracted the male's attention, and then dropped off the leaf, apparently deliberately. I moved her back to a position six inches from the male and she displayed twice with raised tegmina and expanded wings in what has been described by Crane (3) as a defensive posture. This did not deter the male who flew on to her back without displaying.

MATING

The male alights on the female in a head-to-tail position but quickly turns around to face the same way as the female. Copulation usually follows immediately but sometimes a period of several hours may elapse between the coming together of the pair and the beginning of copulation. A possible reason for this will be mentioned later.

The male grips the female's thorax with his first two pairs of legs near her second and third pairs and her abdomen with his third pair. Occasionally he may jerk the female rapidly several times with an action reminiscent of a jockey urging on a galloping horse. He then curves his abdomen beneath the female's and with his claspers exposed moves it backward until the claspers can pinch the female's sub-genital plate. The female responds by opening her genital chamber whereupon the male inserts his claspers and effects copulation.

Events do not always run as smoothly as this, for several attempts may sometimes be needed to induce the female to open her genital chamber and even when this happens the male may not effect copulation at the first try. He always approaches from the female's right, an instinctive movement that has presumably evolved together with the asymmetry of the male's copulatory apparatus.

The duration of copulation was timed on one occasion and found to be 23½ hours. Other observations suggest that a period of between two and three hours is normal. After copulation the male remains on the female a few seconds and then flies off a short distance. On two occasions after alighting he has displayed at the female with raised tegmina and wings. In no instance has any male been eaten and this is more remarkable in view of the fact that on one occasion I came across a mating pair with two additional males in attendance attempting to mate as well.

The male deposits in the female a spermatophore which remains in position a considerable time — 1½ hours on one occasion when it was timed. When the spermatophore is extruded it may be eaten by the female. Since females may mate more than once and may do so in quick succession if males are abundant, it is possibly the presence of the spermatophore that prevents early copulation in those instances in which there is a delay.

EGG LAYING

The eggs are deposited on twigs and leaves in oothecae whose appearance is well illustrated by Beebe et al. (2). The process of laying takes about thirty minutes. It has been seen three times, all between 7.45 and 8.30 a.m. An incompletely hardened ootheca has been found at 1.30 p.m. but no layings have been seen in the afternoon. Since most of the observations were made in the afternoon there is definite evidence, therefore, that laying habitually occurs in the morning.

The incubation period of three egg masses is known: nineteen days for one laid in September and twenty four days for two laid in February. The longer period for the latter is undoubtedly a result of the lower ambient temperature during February as compared with September. The appearance of the young on hatching and during the subsequent instars has been well described by Beebe et al. (2).

DISCUSSION

The impression conveyed by these observations, incomplete though they may be, is that courtship is well developed and highly complex in this species. Although I have studied briefly two other Trinidad mantids, *Stagmomantis carolina* and *Tithrone roselpennis*, I have seen nothing that could be called courtship in the former and only one brief "abdomen-bending" display in the latter.

Two points call for comment. Crane (3) makes the following remarks after stating that non-mantine display is usually connected with the sexual cycle: "When mantids display, however, it appears to be altogether non-sexual in function, even though it is at its optimum only in vigorous adults. It never occurs between similar-sized males, although

one of these may kill and eat the other at the first opportunity. Similarly, it is not a part of courtship." My observations show that behaviour which is to all intents and purposes identical with that described as defensive behaviour (3) occurs at least sometimes during courtship and therefore in a sexual context. This raises the question, Has this display evolved first as defensive behaviour which has been subsequently incorporated into courtship or the other way around? This question in turn prompts another: Is the first question meaningless seeing that the species is carnivorous and probably cannibalistic and that courtship in these circumstances must involve an element of defence? Further observation and experiment may help to answer these questions but for the moment it is worth noting that the twisting and bending of the male's abdomen that occurs during courtship is fundamentally the same action that is used in copulation and its role in courtship may have evolved from its primary role in copulation.

The second point requiring comment is this. Crane (3) writes of the "boxer" movements: "In the fifth instar appears a special motion which is maintained, though less frequently, in the sixth, but is absent in the adult. It is apparently exploratory in character and consists in moving the forelegs alternately and almost constantly when in a strange place". The observations recorded above show clearly that the behaviour occurs in both the male and female adult in a sexual context. Other observations show that it occurs in non-sexual contexts as well and I consider it to be a response to conditions of stress rather than exploratory behaviour.

SUMMARY

Courtship and mating in *Acontiothespis multicolor* are described. The courtship display which involves movements of legs, abdomen and wings is well developed and complex. Defensive behaviour patterns occur also as part of courtship.

REFERENCES

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U. W. I., St. Augustine.