International Invertebrates in Captivity Conference - August 2004 Rio Rico, Arizona

COURTSHIP, MATING, CRYPTIC AND THREATENING BEHAVIOR IN TANZANIAN MARBLED MANTIS (*Polyspilota aeruginosa* Goeze)

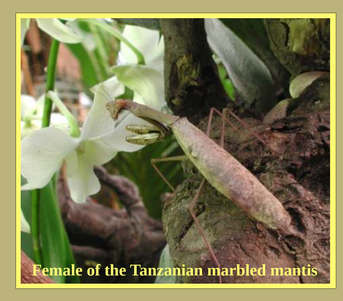
Authors: Silvia Scarian (!), Margherita Turchetto (+), Enzo Moretto (*)

(!) Student Dep. of Biol. Univ. of Padova, (+) Prof. Zool. Dep.of Biol. Univ. Padova , (*) Butterfly Arc Montegrotto T. Invert. Living Museum www.butterflyarc.it

Silvia Scarian Manseque handling a female of the Tanzanian marbled mantis

INTRODUCTION

It is estimated that there are 1800 species of mantis in the world. Their aspect and behavior are unique and particularly interesting. In the common perception, they represent the contrast of sacred yet ferocious predators. They have an extraordinary capacity to remain completely stationary and then suddenly, with incredible speed, to pounce on their prey, hunting any animal of their own size and even small birds! (Feldman, D. 1999). Some species, if disturbed, show colours and patterns aimed at frightening intruders and also at appearing to be larger than they are in fact (Portman, A., 1959).



Female of the Tanzanian marbled mantis

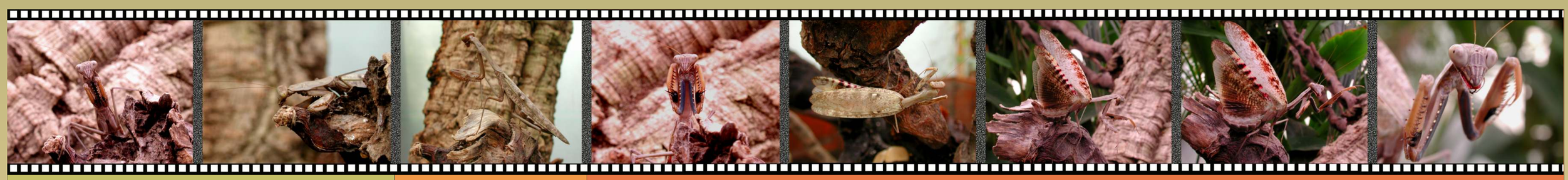
MATERIALS AND METHODS

In the Living Invertebrates Museum at the Butterfly Arc, studies are carried out on the biology and behavior in captivity of the Tanzanian marbled mantis. In 2003, 20 specimens, hatched from two oothecae from Tanzania (East Africa), were studied and their whole life-cycle was monitored, including adult mimicry, courtship and mating behavior. The most significant attitudes were recorded by video and digital cameras. Results were presented in photographic sequences showing adults' mimic postures, courtship and mating behavior, together with a close-up sequence of the movement of the tip of the abdomen during mating.

RESULTS

FROM CRYPTIC MIMICRY TO AGRESSIVE MIMICRY AND THREATENING POSITIONS

Mantises present two essential aspects of mimicry: cryptic mimicry, and the threatening attitude, of great importance both during hunting and as defense against other predators (Prete, F.R. et al., eds.1999). We observed both these aspects in adult females of *Polyspilota aeruginosa* Goeze. In particular, defensive attitudes, in response to the degree of disturbance, follow a special sequence. From the inconspicuous form, in which the insect does not wish to be seen and assumes a position of repose, it gradually assumes a terrifying attitude which accentuates maximum visibility (see sequence below). These threatening positions have been classified from 1 to 4, 1 being the warning level and 4 the highest.



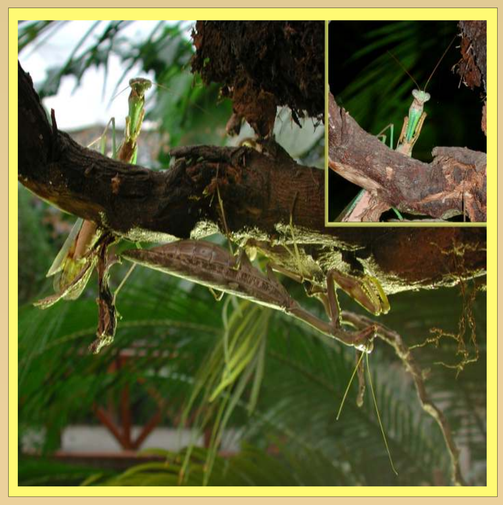
Cryptic position, stationary repose	**Cryptic position**, accentuated by flattening against substrate (Squatting)	**Aggressive mimicry**, with raptorial legs extended and head moving	**Level 1: threatening position.** Assumption of an attitude which highlights eye-spots	**Level 2: threatening position.** Front legs are extended and wings horizontal	**Level 3: threatening position.** Front legs are extended and wings raised	**Level 4: threatening position.** Like level 3, but with palps retracted to show red mouth	**Level 4: threatening position.** Message of head, with palps retracted to show red mouth

COMBAT BETWEEN MALES IN THE PRESENCE OF THE FEMALE

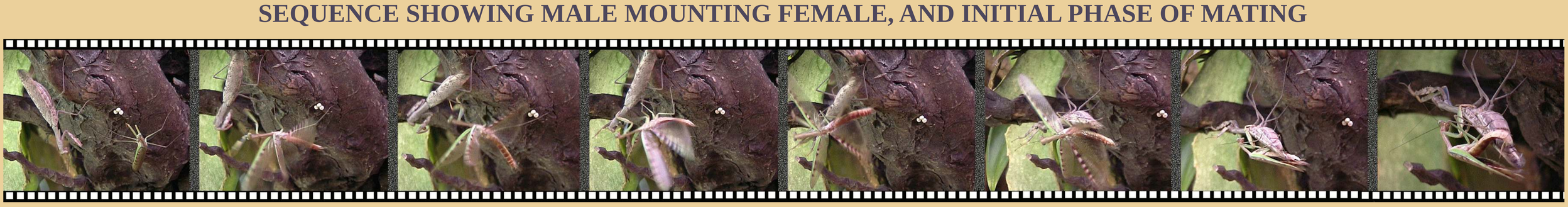
In the presence of the female, adult males may initiate aggressive behavior, which ceases after short fights, apparently without injury, during which one male establishes dominance over the other. This is expressed by the dominant male mounting the non-dominant one. In observed cases, the dominant male then mated properly, with the exception of one episode in which the non-dominant male, once it began to mate, was almost immediately driven away by the dominant one, which in turn mated with the female without being disturbed by the other male. Fights between males only last a few seconds: the main phases are shown in the sequence below. In the photo (right), note the final positions of the males after the fight, with the dominant male lying across the body of the non-dominant one. The outcome of these short fights never revealed visible damage, in spite of the well-known offensive capacity of the raptorial legs and sharp mandibles.

COURTING AND MATING

The males of predatory species have several methods for communicating their intention to mate with the female, all aiming at not being mistaken for prey and devoured (Elgar, M.A. 1992). The females are generally larger and stronger than the males and, in many species, descriptions of how they eat the male, even during mating itself, have been made (Lawrence, S.E. 1992; Hurd et al. 1994. Maxwell, M.R. 1998). We did not observe this in the specimens we studied, although cannibalism among neanids was noted. One explanation for this attitude on the part of our females may have been that they were always supplied with sufficient food. In any case, no particular behavior by males, which could be defined as ritualized courtship was noted, although they did approach the female in a circumspect fashion, with the abdomen often extended sideways, in order to simulate the act of copulation, as already described for Sphodromantis lineola (Kynaston S.E. et al. 1994). Perception of the female by the male involves considerable visual acuity. This is easily appreciated, as the male's head turns very obviously toward the object of his attention (Kral K. & Denentak D., 1999). He sees the female at a distance of at least 50-70 cm, and moves his antennae actively here and there, searching for special olfactory messages. Then, while the female simply perceives the arrival of the male, sooner or later, with evident “glances” at him, the male makes a sudden jump, often accompanied by a short flight, in order to approach her. At this point, the male's antennae, normally upright, are lowered toward the female. This is clear in the photo (right) in which (inset) the antennae are first raised, and then lowered toward the female. This often happens with a single antenna, that on the side nearer the female, which indicates a sense of direction in perception.



SEQUENCE SHOWING MALE MOUNTING FEMALE, AND INITIAL PHASE OF MATING



MATING SEQUENCE

References

Elgar, M.A. (1992) Sexual cannibalism in spiders and other invertebrates. Cannibalism:Ecology and evolution among diverse taxa. Oxford Univ. Press pp.128-155.
Feldman, D. (1999) The Praying Mantis. Insect Behavior - Colorado State University
Hurd et al. (1994) Cannibalism reversed male-biased sex ratio in adult mantidss: female strategy against food limitation?. Oikos, 69,193-198.
Kral, K. & Denentak, D. (1999) The visual orientationstrategies of manthis religiosa and Empusa fasciata reflect differencies in the structure of their visual surroundings. J. Insect behavior, Vol. 12, No.6:737-752
Kynaston, S.E., McErlain-Ward, P. & Mill, P.J. (1994) Courtship, Mating Beahaviour and sexual cannibalism in the prayng mantis, Sphodromantis lineola. Anim. Behav, 47:739-741
Lawrence, S.E. (1992) Sexual cannibalism and male mating behaviour in sexuality cannibalistic prayng mantids. Animal Behaviour, 55, 1011-1028.
Maxwell, M.R. (1998) Lifetime mating opportunities and male mating behaviour in sexually cannibalistic prayng mantids. Animal Behaviour, 55, 1011-1028.
Portman, A. (1959) Animal camouflage. Ann Harbor. The University of Michigan press, 60-64 pp.
Prete, F. R. et al. Ed. *(1999) The Praying Mantids. Baltimore: Johns Hopkins University Press*

Acknowledgments: we thank Dr. Gabriella Tamino and all Butterfly Arc collaborators for the valuable assitance. A special thank to Gabriel Walton for the English traslation.