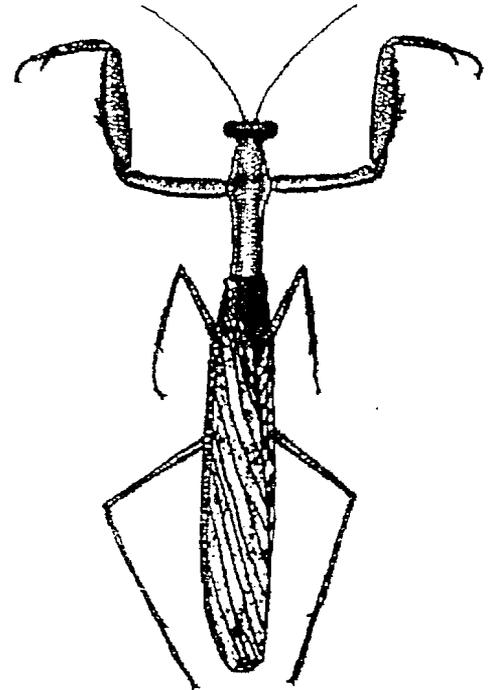


# Mantis Study Group Newsletter 5

August 1997

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## Editorial

Attendance at the MSG and Blattodea Culture Group meeting on May 17th was disappointing; there were fewer members present than attended last year! Four live species and 47 preserved species of mantids were on show at the meeting, along with 24 live and about 95 preserved species of cockroaches. Slides of mantids and cockroaches were also shown at the meeting. It seems most people opted to attend the BTS show on the following day in preference to the MSG meeting; about 15 MSG members who missed the meeting visited the group's stand at the BTS exhibition.

At several exhibitions a number of visitors have enquired about books on rearing mantids. After discussing the matter with a few people I decide the only thing to do was to write one. For a limited period I am offering the book to MSG members at a special discount price: further details are given on the order form which is enclosed with this newsletter.

Once again, I would like to ask all members to contribute something to the newsletter. This issue includes some welcome illustrations from two members, and the first of a series of three articles on hearing from David Yager. Page 12 has a wordsearch sent in by Nicole Glardon, if you want to make it really difficult - try it without looking at the list of genera!

## Back issues of Newsletters

These are available from Paul Taylor at £1.50 each. Please make cheques payable to *Mantis Study Group*. Be sure to include your address and state clearly which issues you require.

## Male *Sphodromantis lineola* wanted — Paul Taylor.

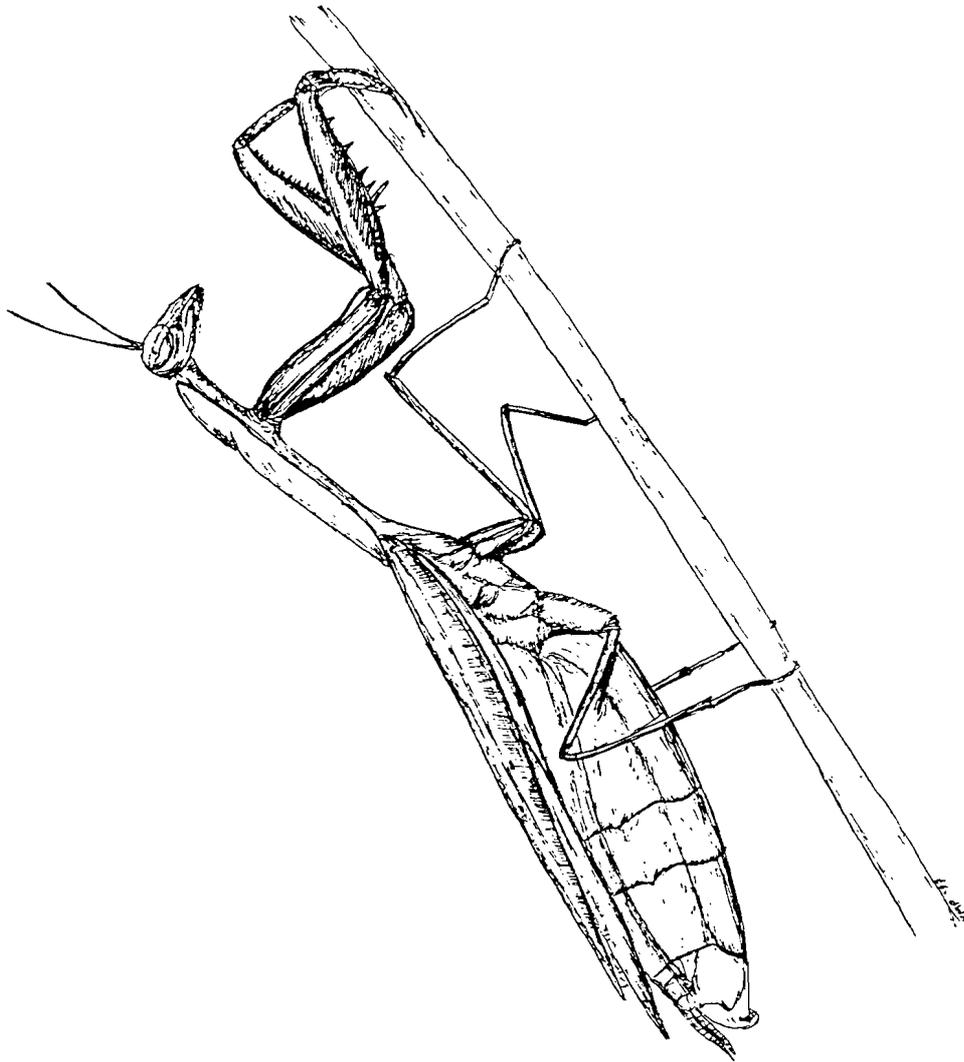
I urgently need a male *Sphodromantis lineola* to mate with several females. If anyone can help please phone: 01675-481578.

## Internet mailboard

Vijay Gadad has set up a bulletin board for praying mantis enthusiasts. For further information contact Vijay: gadad@nwu.edu.

## Amateur Entomologists' Society Exhibition

This is the next exhibition at which the MSG will be exhibiting. It takes place at Kempton Park Racecourse. Sunbury on 4th October, from 1100 to 1700.



*Mantis religiosa*, drawing by Kieren Pitts.

**Book information** — Phil Bragg.

The ISBN number of *Praying mantids and Stick insects* by Schoeman which I gave in *MSG Newsletter* 1:6 was incorrect - because the number on the title page of the book is wrong! The correct number is ISBN 0-7986-1368-8. I telephoned the publishers in South Africa to try and obtain the publication date and was told "about 1990"; the lady I spoke to said it would take her some time to check so, to avoid too large a phone bill, I declined to hold. She also told me the book is out of print, she didn't think there were any copies left, and there are no plans to reprint the book.

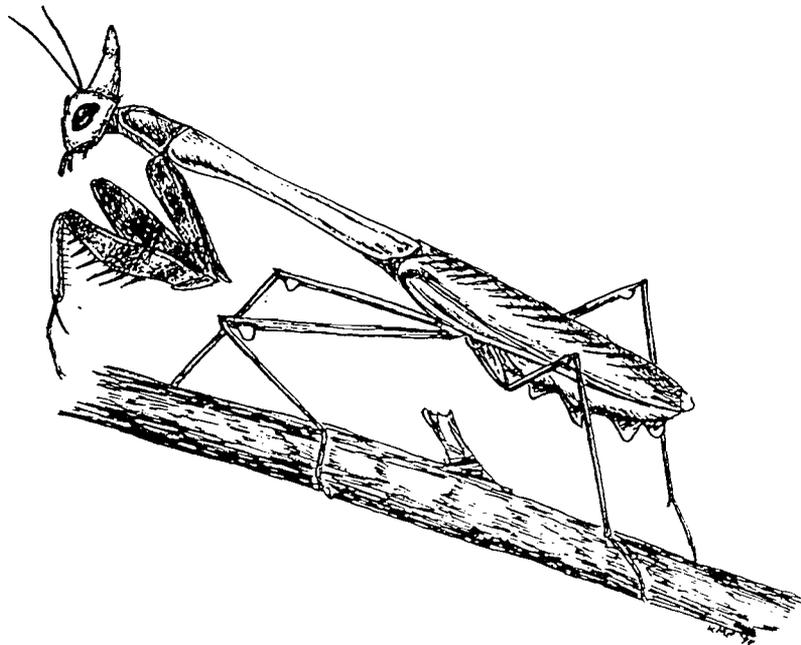
## Maggots as mantis food — Phil Bragg & John Pepper.

The following notes are compiled from a letter which I received from John Pepper, and from the results of some checking which was prompted by his letter.

There are three types of maggot available as fishing bait in the UK. These are: the standard maggot which is a species of blue-bottle (*Calliphora* sp.), "Pinkies" which are a species of green-bottle (*Lucilia* sp. - I think, but I have not reared any to confirm this), and "Squats" which are the common housefly (*Musca domestica*); it is possible that different breeders may use different species of flies. All sizes of maggots are available in a variety of colours (red, pink, yellow, blue), or in the natural uncoloured (white) form. The colours and sizes stocked vary from one angling shop to another: note that "Pinkies" come in all colours including their natural white. Prices vary greatly from one area of the country to another. The Midlands is traditionally the cheapest area, typically 50p per quarter pint for all sizes; London is an expensive area because they are not bred in London and there are therefore relatively high transport costs involved, typically they cost in the region of £1.30 per quarter pint.

John was particularly concerned that the dyes used for colouring maggots may be harmful to mantids. I contacted a firm which breeds maggots for the angling trade. Most maggots are coloured with dyes which are added to their food; this is almost certainly harmless since it has no adverse effect on the maggots. Sometimes maggots are coloured by adding a dye to the outside of the maggot: I have been unable to obtain any information about the nature of the dyes used. Although the coloured maggots are unlikely to harm mantids, it is probably best to stick to the uncoloured (white) maggots. I have always used white maggots, as has everyone else I have asked. Has anyone used coloured maggots as mantis food? - if so please write a note for the newsletter.

"Squats" are kept in sand, "Pinkies" and standard maggots are kept in sawdust. When keeping them in the fridge, a large container reduces the unpleasant ammonia smell; adding extra sand or sawdust also helps (bran can be used in place of sawdust). If the container becomes damp the maggots will be able to climb and perhaps escape. In some areas maggots are available throughout the year.



*Empusa pennata*, drawing by Kieren Pitts.

## "Indian Green" Mantids

Nymphs of this species have been distributed to a number of people in the UK by Paul Taylor. The species has not yet been identified: the first nymphs are only just becoming adult. They were distributed with the name "Indian Green" to distinguish them from different nymphs from other oothecae which Paul received from India. All those checked so far have been females. If anyone has males (adult or nymphs) of this species would they please contact either Phil Bragg or Paul Taylor.

## Maggots infesting mantids — Thøger Johansen.

In relation to the question about maggots posed by Michael Mann in *MSG Newsletter* 4:3 I have just had a similar experience with two of my mantids (*Deroplatys desiccata* and *Popa undata*).

My *Popa* female became quite corpulent as expected but failed to produce any oothecae after mating. I put it down to environmental factors and raised the temperature and humidity in her container. But after 2 months her labour throes gave way to something other than egg cases, namely small white maggots (just as Michael described). I have seen mantis nymphs in foetal stages and these clearly do not fall into that category. They apparently evolve to a free-flying stage and look like meat-flies about fruitfly size.

They also appeared in my unmated *Deroplatys desiccata* female which, excluding the possibility of parthenogenesis, should definitely rule out the possibility of mantis offspring of any kind.

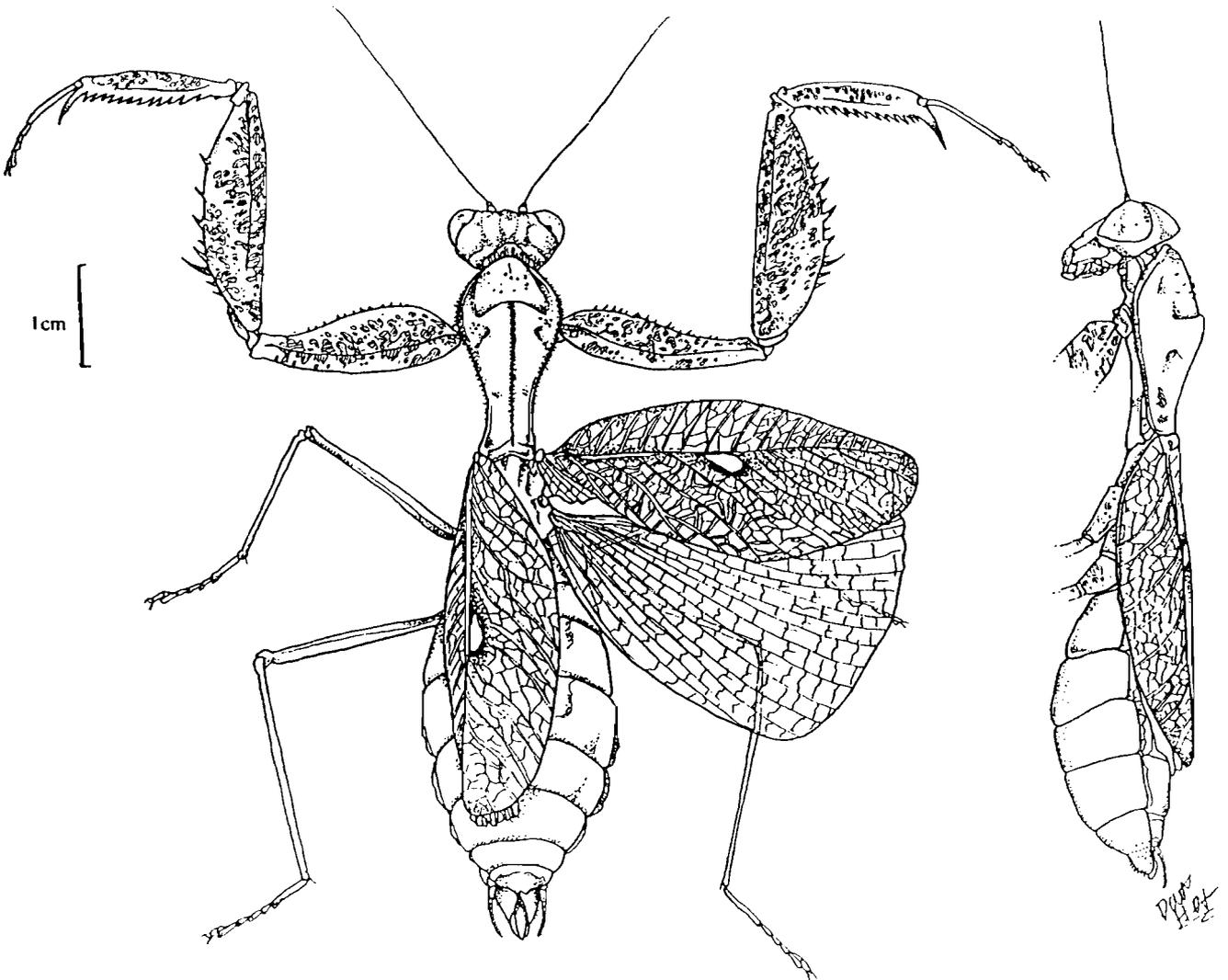
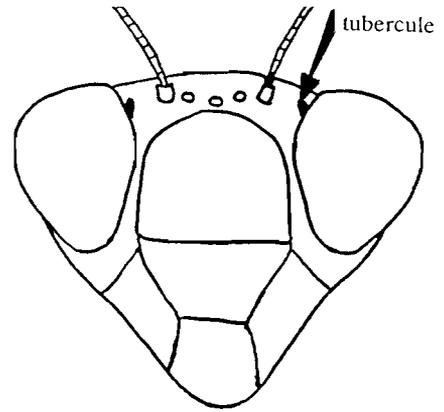
Both mantids have been fed grasshoppers but whether this has any bearing on the nematode question (can mantids receive worm infections with locusts as intermediaries like eg. tarantulas) or not is as yet undecided. I have sent the larvae and their victims to Phil Bragg and hope someone out there will be able to unravel the mystery. Finally, the question of further contamination is also pertinent as not all of my containers are fruitfly-proof and are therefore open for parasitic visitors.

## Comments on the above — Phil Bragg.

The specimens sent by Thøger were indeed clearly insect larvae. There were at least 103 removed from the body of the *D. desiccata*; since the specimen was damaged in the post, I was unable to determine in which parts of the body the larvae had been. Having decided that the larvae were probably some sort of Diptera, I sent some to the Natural History Museum to have this confirmed. I would like to thank Nigel Wyatt who kindly identified them as puparia of scuttle flies and sent me the following comments: "They are the puparia of scuttle flies (family Phoridae). Phoridae is a large family of flies which mainly have saprophagous larvae but some are parasitoids or predators. There have been several instances of their infesting populations of captive insects, such as laboratory cultures, for example of cockroaches and stick insects. It appears that their larvae mainly attack dead or moribund insects, and are not being truly parasitic in these cases, but there is still some uncertainty about this."

**Distinguishing *Sphodromantis* and *Hierodula*** — Phil Bragg.

David Olivera's key (see last four *Newsletters*) treats *Sphodromantis* and *Hierodula* as one genus. Opinions seem to differ between treating them as distinct genera or as subgenera of *Hierodula*. Since the two are similar, and some of both are (or were recently) in culture, it may be helpful to know how to distinguish the two taxa. *Sphodromantis* have a tubercule between the base of the antennae and the eye (marked with an arrow - see figure); this is absent in *Hierodula* and other (sub)genera in the *Hierodula*-group.



Female *Sphodromantis lineola*, drawings by Daniel Hallet.

## **Spatial vision in praying mantids — Karl Kral.**

Praying mantids, especially the larger species such as *Mantis*, *Tenodera*, or *Sphodromantis*, are ideal insects for the study of visually controlled behaviour. For one thing, they are less inclined than many other insects to frenetic movement; as predatory and opportunistic loners they typically tend to be minimalists as far as movement is concerned. If a praying mantis moves, then its movements are always related to near surrounding objects.

In the laboratory a relatively simple trick can be used to show in a rather elementary way that in insects as well as in vertebrates and humans, disparate retinal images can contribute to depth perception (S. Rossel, 1983, *Nature*, **302**: 821-822). (Retinal disparity is the angular difference in the visual rays from both eyes to the object point). If optical prisms are placed before the large compound eyes of a *Mantis religiosa* or *Tenodera australasiae* so that the horizontal deviation of the left retinal image is artificially enlarged as compared to the right retinal image (where the image is an object of prey within the binocular visual field), the mantis' strikes will fall short, i.e. the distance will be underestimated. This error confirms the influence of disparity.

Another experiment with the praying mantis shows that in insects, not only stereopsis but also motion parallax can be an important source of information for spatial vision (Poteser & Kral, 1995, *J. Exp. Biol.*, **198**: 2127-2137). Here advantage is taken of the fact that when the animal moves, nearer objects shift through a greater angle than more distant ones. If a young *Polyspilota* sp. or *Tenodera sinensis* is placed on an island in the middle of an arena and offered a black rectangular object as a jump-target, the animal will immediately begin to make side-to-side peering head movements directed towards the vertical edge of the object, this is usually followed by an aimed jump and safe landing on the edge. If the object is moved synchronously but counter to the peering movement of the head, the jump will be too short. If the object is moved in the same direction as the head movement, but at a slightly slower speed, the jump will be too long. The explanation for this error is that when the object is moved counter to the head movement, the retinal image movement is increased and the object appears to be nearer than it actually is. If the object is moved in the same direction as the head movement, the retinal image shift is decreased, making the object appear to be more distant than it really is.

These two experiments on praying mantids thus demonstrate that binocular disparity can provide precise and reliable information on the distance to a potential object of prey, while motion parallax plays an important role in distance measurement to stationary objects. Both factors can apparently provide information on both relative and absolute distances, whereby stereopsis is limited to the near local environment and motion parallax is used for a relatively large distance range. There is no information on the extent to which these two factors work together in spatial vision.

## **Identity of the Belize mantis — Phil Bragg.**

I have recently identified the mantids from Belize which were being sold at the AES exhibition in 1996. They are *Phasmomantis sumichrasti* (Saussure, 1861). I know of two people other than myself who bought small nymphs of this species, all three of us have ended up with males only! Hopefully somebody has it in culture. I have also recently been told that there is a second species in culture from Belize, but I have no details about it.

## **Mantids without ears: the puzzle of the deaf females** — David Yager.

The excitement of discovering hearing in mantids and the window that information gave us onto their 'Dark Side' - their nocturnal life - led us into a blunder: we started saying "Mantids can hear." It didn't take long, however, for the error of that generalization to become all too evident. Yes, some mantids have sensitive ultrasonic hearing, but the situation across the suborder is much more complicated. Many mantids do not have functional ears: and therein lie some interesting stories.

### **Nymphal deafness**

Consider a newly hatched mantis nymph. Even for a large species like *Hierodula membranacea*, nymphs average only 9.5mm in length and 95mg in mass, a far cry from an adult female at 90cm and 8g. While they are visual predators like the adults, their size makes them much more vulnerable to predation themselves. Nymphs' behavioral repertoire differs from adults since they don't have to worry about finding mates. Thus, we might expect that nymphs and adults would have very different ecologies and sensory worlds.

At least in the two species whose development we have studied intensively (*H. membranacea* and *Taumantis ehrmannii*), young nymphs are deaf. Older nymphs of the two species differ, however. In *H. membranacea*, they gradually acquire hearing over the last half of development so that late instar nymphs can hear moderately well; their most sensitive frequencies are very similar to adults'. No *T. ehrmannii* nymphs are able to hear at all. My suspicion is that the latter case is more typical of mantids in general, and that the former pattern is more characteristic of large species with prolonged development.

What is the critical anatomical change that confers hearing upon a mantis during its growth? To our surprise it turned out to be neither the appearance of the auditory nerve cells nor the size of the tympanum. Rather, it is the size and position of the tracheal air sac (in effect, their 'middle ear') that seems to be most important in determining when a mantis starts to hear.

### **Primitive deafness**

Anatomical evidence gleaned from work in several museums suggests that mantids in the families Chaeteesidae and Mantoididae (and possibly Metallyticidae) are deaf. At the site where other mantids have their ear, these animals have no slit, no cuticular knobs, nothing that suggests an auditory organ. What they do have, however, bears a striking resemblance to the corresponding site on a) newly hatched nymphs and b) cockroaches (though very closely related to mantids, cockroaches do not have high-frequency hearing). This makes us think that these families arose before the innovation of an ear in the mantis lineage. If true, the 'ear' anatomy of these two families provides us with a glimpse of the primitive, earless condition.

### **Secondary deafness**

Several groups of mantids scattered around the taxonomic landscape of Beier have highly aberrant 'ear' anatomy that looks very different from what we believe is the primitive form. These animals have proven deaf in our physiological tests. Some examples are the Photinae, Eremiaphilidae, Oligonychinae, and the Epaphroditini. In almost every case, there are closely related mantids that can hear, so we feel confident that these lineages once had hearing, but have more recently lost it. (The argument for the Eremiaphilidae is based primarily on biogeography. I wish someone would figure out who their closest relatives are

...). Why would an animal give up an entire sensory system? Read on for a related, but even stranger situation and a few clues (but no answers).

### Hearing males/deaf females

Many of the mantids we most often encounter are strongly sexually dimorphic. Think of *Stagmomantis* or *Litaneutria* or *Iris* or *Ameles*, for example. Females are markedly larger than males; they have shorter wings, shorter antennae, and smaller ocelli. Their life histories are different, with females requiring more time and more instars to mature to adulthood and then living much longer than the males. Their behaviours are also quite different: females are more sedentary, more voracious, more apt to attack or display when threatened. Data from my museum work indicates that 32-34% of the roughly 400 mantis genera have strong anatomical dimorphism.

In mildly and non-dimorphic species, males and females have the same auditory capabilities: the same maximum sensitivity in the same frequency range. Not true for strongly dimorphic species. In every case, the males can hear and the females cannot. The anatomical alterations in the ear that accompany such a major physiological change are deceptively small. The slit is shallower, more a V-shaped groove than a slit, because the walls are further apart and rotated outward; the knobs are reduced or absent. We looked quite carefully at the internal ear anatomy of *Stagmomantis* females and came away mystified by the lack of obvious explanation for their miserable hearing.

We can certainly say that these females were once able to hear (speaking in an evolutionary sense now ...) and have secondarily become earless. After all, the species has an ear and good hearing (although you could quite reasonably argue that males and females in these cases are functionally different species). So we are back to the question of why an animal would give up an entire sensory system.

The frequent debates among the (human) inhabitants of my lab have completely turned around our thinking on this issue over the last couple of years. It looks like we were groping in the dark simply because we were asking the wrong question.

The best predictor of how well a particular mantis hears is its wing length. With only a very few exceptions (primarily the primitively and secondarily deaf groups mentioned above), if you encounter a mantis with long wings, you can be confident that it has sensitive ultrasonic hearing. On the other hand, if your catch has reduced wings, I guarantee that its hearing is poor-to-nonexistent. This is not only true in sexual dimorphism, but throughout the mantis world. In those rare cases where males have reduced wings (*Geomantis*, *Apteromantis*, *Bolivaria*, some *Yersinia*, and a few others), they, too, are deaf. On the other hand, some genera like *Hymenopus* show extreme sexual dimorphism in body size, but both sexes are fully winged: and both sexes hear just fine. [A practical note: evaluating wing length in long, stick-like mantids can be tricky. The key issue is whether or not they can fly.]

We now think that the ear is only one of a several of structures that are part of the flight system. The flying mantis needs an ear in the same sense that an airliner or a fighter jet needs 'sensory' equipment like radar. Earthbound mantids don't need an ear: so they lose it. [I discuss the issue of how flying mantids use their ear in the fourth article of this series.] So, the question we really need to answer is why so many female mantids have given up flight. Data from other insect groups helps here. In general, female insects that don't fly produce more eggs more often compared to relatives that do fly. The resources (muscle, fat stores, etc.) required for flight can be reallocated to egg production. In other words, we suspect that many mantis females have traded flight for fecundity, and given up hearing in

the bargain.

Next time: One mantis subfamily has evolved a second, independent auditory system: it's an auditory bicyclops!

### Mantis Hearing Bibliography

For those who cannot wait until the next issue of the *MSG Newsletter*, David Yager has provided the following bibliography of articles dealing with hearing in mantids.

- Yager, D.D. and Hoy R.R. (1986). The cyclopean ear: A new sense for the praying mantis. *Science* **213**: 727-729.
- Yager, D.D. and Hoy R.R. (1987) The midline metathoracic ear of the praying mantis, *Mantis religiosa*. *Cell Tissue Res.* **250**: 531-541.
- Yager, D.D. and Hoy, R.R. (1989) Audition in the praying mantis, *Mantis religiosa* L.: Identification of an interneuron mediating ultrasonic hearing. *J. Comp. Physiol. A* **165**: 471-493.
- Yager D.D. (1990) Sexual dimorphism of auditory function and structure in praying mantises (Mantodea; Dictyoptera). *J. Zool., Lond.* **221**: 517-537.
- Yager, D.D. and May, M.L. (1990). Ultrasound-triggered, flight-gated evasive maneuvers in the praying mantis, *Parasphendale agrionina* (Gerst.). II. Tethered flight. *J. Exp. Biol.* **152**: 41-58.
- Yager, D.D., May, M.L. and Fenton, M.B. (1990). Ultrasound-triggered, flight-gated evasive maneuvers in the praying mantis, *Parasphendale agrionina* (Gerst.). I. Free flight. *J. Exp. Biol.* **152**: 17-39.
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- Yager, D.D. and Scaffidi, D.J. (1993) Cockroach homolog of the mantis tympanal nerve. *Soc. Neurosci. Abstr.* **19**: 340.
- Yager, D.D. and Tola, K.C. (1994) Transection of the mantis tympanal nerve homolog in the cockroach alters resting posture, escape turning, and responses to substrate vibration. *Amer. Zool.* **34**: 469.
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- Yager, D.D. (1996) Nymphal development of the auditory system of the praying mantis *Hierodula membranacea* Burmeister (Dictyoptera; Mantidae). *J. Comp. Neurol.* **364**: 199-210.
- Yager, D.D. (1996) Serially homologous ears perform frequency range fractionation in the praying mantis, *Creobroter* (Mantodea, Hymenopodidae). *J. Comp. Physiol. A* **178**: 463-475.
- Harron, A.L. and Yager, D.D. (1996) Juvenile hormone reduces auditory sensitivity in the praying mantis, *Taumantis ehrmannii*. *Soc. Neurosci. Abstr.* **22**: 1144.
- Yager, D. D. (1997) Sensory processes: Hearing. In: *The Praying Mantids: Research Perspectives*. (Prete, F.R., Wells, H. & Wells, P.H., eds.) Baltimore: Johns Hopkins Univ. Press.

## Mantis abstracts

The following are abstracts of books or papers published recently, or ones which were overlooked in previous MSG newsletters. The papers are in English unless otherwise indicated. The editor would be grateful for copies of any recently published papers so that abstracts may be included in this section of the newsletters.

**Bragg, P.E.** (1997) *An introduction to rearing praying mantids*. Published by P.E. Bragg. ISBN 0-9531195-0-5. Price £2.50.

This 16 page booklet describes methods of rearing and breeding praying mantids. The headings include: An introduction to praying mantids, Types of mantids, Structure of mantids, Mantids in captivity, Cages, Feeding, Breeding, Sexing, Mating, Egg laying, Identification, Preserving mantids, Obtaining mantids, Distributing mantids, and Sources of further information.

The book is illustrated with 10 black and white drawings, plus one on the front cover. The drawings illustrate six different species of mantids, how to distinguish the sexes, details of the fore leg, and an internal view of an egg case.

**Brechtel, F., Ehrmann, R., & Detzel, P.** (1996) On the distribution of *Mantis religiosa* (Linné, 1758) (Mantidae) in Germany. *Carolinea*, 54: 73-90. [In German]

All known records, completed by some new ones, of *Mantis religiosa* (Linné, 1758) from Germany and some neighbouring districts are presented. Existence, endangering factors and protection measures are discussed with special remarks to the variability of the distribution area.

**Germ, M.** (1997) Dopamine, N-acetyldopamine and serotonin concentrations in the visual system of praying mantis during postembryonic development. *Comparative Biochemistry and Physiology A*, 116(4): 379-386.

High-performance liquid chromatography with electrochemical detection was used to quantify the two biogenic amines dopamine (DA) and 5-hydroxytryptamine (5-HT, serotonin) as well as a metabolite of DA, N-acetyldopamine (NADA), in the compound eyes and optic lobes of praying mantis (*Polyspilota* sp. and *Tenodera sinensis*) during postembryonic development. After hatching, DA and 5-HT concentrations (pmol/mg ww) were relatively high (DA,  $5.43 \pm 1.13$ ; 5-HT,  $5.65 \pm 1.0$  for *Polyspilota*), but the NADA concentration was more than 25 times higher than those of DA and 5-HT ( $143.7 \pm 16.71$  for *Polyspilota*). Subsequently, the concentrations decreased constantly into the middle larval instar and then rose to reach their highest peak in the last larval instar (DA) or a very high concentration in the seventh instar (5-HT and NADA). In adults, DA, 5-HT and NADA concentrations decreased again. The concentration profile for NADA was similar to that of 5-HT. The values per structure (compound eye and optic lobe complex) and per ommatidial column channel were also calculated. It is significant that changes in the amine levels during postembryonic development went hand in hand with development changes in the activity and behaviour of the mantids.

**Jones, T.H., Moran, M.D., & Hurd, L.E. (1997)** Cuticular extracts of five common mantids (Mantodea: Mantidae) of the Eastern United States. *Comparative Biochemistry and Physiology B*, **116**(4): 419-422.

We undertook a preliminary investigation of the cuticular extracts of five common mantis species in the eastern United States: *Tenodera sinensis* (Saussure), *T. angustipennis* (Saussure) and *Mantis religiosa* (Linnaeus) introduced from the Old World and *Stagmomantis carolina* (Johannson) and *Brunneria borealis* (Scudder), which are New World species. The major components of these mixtures were normal alkanes, predominately hentriacontane, or in the case of the parthenogenetic species *B. borealis*, tritriacontane. Tricontanal was detected in the extracts of all five species, and smaller amounts of other aldehydes and n-tricontanol were detected in some species. Complex mixtures of methyl and dimethylalkanes also were present in these extracts. The composition of the cuticular hydrocarbons of these mantids may be an adaptation for reduction of evaporative water loss in these insects that inhabit open fields.

**Kral, K. & Poteser, M. (1997)** Motion parallax as a source of distance information in locusts and mantids. *Journal of Insect Behaviour*, **10**(1): 145-163.

This review article is devoted to results on distance measurement in locusts and mantids. Before locusts or mantids jump toward a stationary object, they perform characteristic pendulum movements with the head or body, called peering movements, in the direction of the object. The fact that the animals over- or underestimate the distance to the object when the object is moved with or against the peering movement, and so perform jumps that are too long or short, would seem to indicate that motion parallax is used in this distance measurement. The behaviour of the peering parameters with different object distances also indicates that not only retinal image motion but also the animal's own movement is used in calculating the distance.

**Moran, M.D. & Hurd, L.E. (1997)** Relieving food limitation reduces survivorship of a generalist predator. *Ecology*, **78**(4): 1266-1270.

We tested the hypothesis that food supplementation for the generalist arthropod predator *Tenodera sinensis* would alleviate starvation and reduce intraguild predation. Two field experiments showed that mantids had higher growth rates and lower dispersal in the presence of supplemental prey. However, estimated mortality was greater in food-addition plots, so that numbers of mantis nymphs remaining at the end of the experiments were not significantly different from those in control plots. When groups of mantids were raised in the laboratory, mortality declined with increased food, owing to decreased starvation. Cannibalism in these cohorts did not differ between food levels. Therefore, greater mortality at higher food levels probably was not caused by intraspecific interactions. Emigration of cursorial spiders large enough to prey on mantids decreased in the food-addition plots and may have increased intraguild predation on mantids. In any case, elevating prey level apparently does not predictably benefit food-limited generalist predators.

**Wordsearch** — Nicole Glardon.

See how quickly you can find the 21 mantis genera hidden in the square. The hidden genera are listed at the bottom of the page.

## Mantis Genera

KNOW YOUR PRAYING MANTIS!

P O O O O O O S I T N A M O R D O H P S  
S O T A U M A N T I S O O O O O D I O O  
E O O O O C O P T O P T E R Y X A E O O  
U O O O O O G O N G Y L U S O O N R O O  
D O O O B R A N C S I K I A O O U O O O  
O O O O A I N A R C O L L Y H P R D O O  
H O O O O O S Y T A L P O R E D I U O S  
A A R T O B O E R C O D U E S P E L O T  
R O O O O O O O O O O O O I O O L A O A  
P O O S I T N A M O O O T O O O L O O G  
A O O O O O A O O O O N O O O O A O O M  
X O O O O O O G O O A O O O O O O O O A  
O S I B Y L L A N M O C T O O O O O O T  
O O O O O O O O O O A O O O E O O O O O O  
O O O O O O O G O O J O O N N O O O O P  
O E M P U S A O O O O A O O T O O O O T  
O O A P O P O O O O O O M O O I D O O E  
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O O O A O O O O O O O O O O O O T R A  
O O H E T E R O C H A E T A O O O O A A

Acontista  
Brancsikia  
Coptopteryx  
Danuriella  
Deroplatys  
Empusa  
Gongylus

Harpagomantis  
Heterochaeta  
Hierodula  
Majanga  
Mantis  
Phyllocrania  
Popa

Pseudocreobotra  
Pseudoharpax  
Sibylla  
Sphodromantis  
Stagmatoptera  
Taumantis  
Tenodera