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A Comparative Study of Structural Adaptations of Mouthparts in Mantodea From Sindh

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Abstract.- Structural adaptations of mouthparts in seven species of the praying mantids belonging to families Empusidae, Eremiaphilidae, and Mantidae are reported.

Key words: Mantodea, mouthparts, praying mantids, Sindh.

INTRODUCTION

The relationship between mouthparts structure and diet has been known for years. This connection between mouthparts morphology and specific food types is incredibly pronounced in class insecta (Snodgrass, 1935). As insects have evolved and adapted new food sources, their mouthparts have changed accordingly. This is extremely important trait for evolutionary biologists (Brues, 1929) as well as systematists (Mulkern, 1967). Mantids are very efficient and deadly predators that capture and eat a variety of insects and other small prey. They are regarded as terrific pest exterminators. They keep down the population of various insects that are threat to farming. They can be used as an efficient biocontrol agent. A master of disguise, the praying mantid can be an assistant to farmer and gardener. Several authors (Brues, 1929; Snodgrass, 1935; Leverault, 1937; Chopard, 1938, 1949; Beier, 1934, 1939, 1968, 1974; Gangwere, 1965: Imms, 1988), have studied various aspects of praying mantids but no separate literature is found on the mouthparts of these insects.

Presently, seven species of families Empusidae, Eremiaphilidae, and Mantidae from Sindh have been studied.

MATERIALS AND METHODS

The praying mantids were collected from different localities of Sindh, namely Matiari, Tando-Adam, Sanghar, Khairpur, Hyderabad, Mirpurkhas, Nawab shah, Larkana, Maini forest, Tando jam, Hala, Rani Bagh, Latifabad, Oderolal Station, Jamshoro, Kotri, Thatta by traditional insect hand net, hand picking and by using light trap on the bark of trees, shrubs, bushes and on grasses.

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The observations were carried out on live praying mantids in open fields early in the morning. After locating the species and quietly watching their feeding for about 2 to 3 hours they were caught and preserved for mouthparts study. For the study of mouthparts, 5 specimens of each sex of each species were studied. The mouthparts were carefully extracted, boiled in 20%KOH, washed with distilled water and preserved in 70% alcohol. Only young adults were used in an effort to avoid the confusion of parts due to erosion of mandibular dentes.

The figures are drawn with the help of the ocular graph.

RESULTS

Description of mouthparts of different mantids is given below:

The measurements and differences of different mouth parts are shown in Table I and II, respectively when Table III shows the adaptive natures of mouthparts of various species investigated.

Family Mantidae

Sub family Mantinae

The labrum (Figs. 1A-C) is sub triangular or triangular with broad clypeus. The mandibles (Figs. 2A-C) are long and some what broad, with

triangular base, the right mandible has two sharp incisors and two molars. Between incisors and molars, there is a sharp cutter plate which is

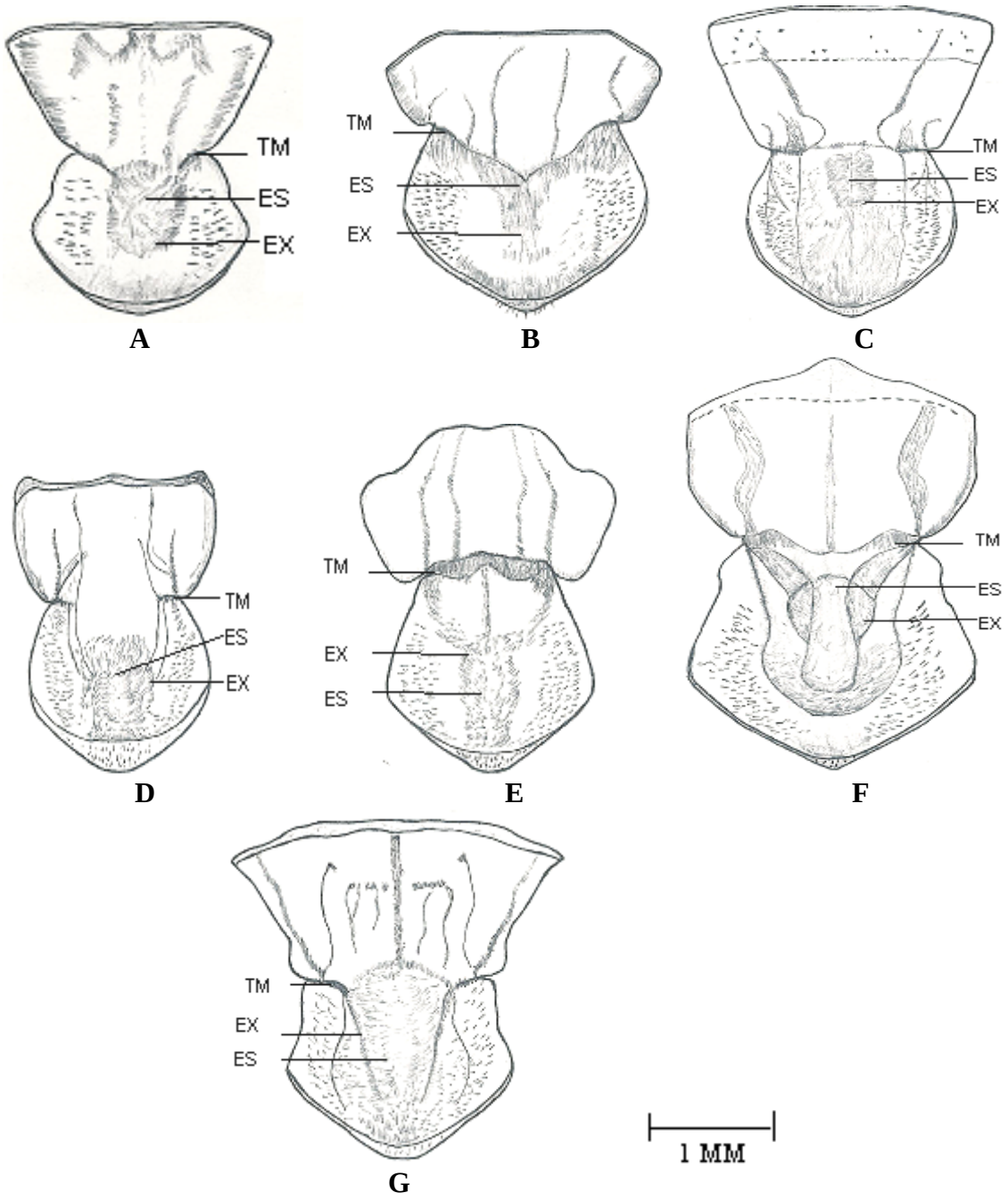

Fig. 1. Ventral view of labrums of *Sphodromantis transcaucasica* (A), *Tendera attenuata (*B), *Mantis religiosa akbari (*C), *Aethalochroa affinis* (Mantidae) (D), *Empusa unicornis (*E), *Blepharopsis mendica* (Empusidae) (F) and *Humbertiella indica* (Eremiaphilidae) (G).

connected with right incisor and left molar. It is well developed in this group. The left mandible is broad overlap the right mandible and has four different incisors; its molar lobe bears two large and one

small teeth, a sharp cutter plate connects left incisor tooth with right molar tooth. In both mandibles there is a cavity formed by incisors cutter plate or ridge.

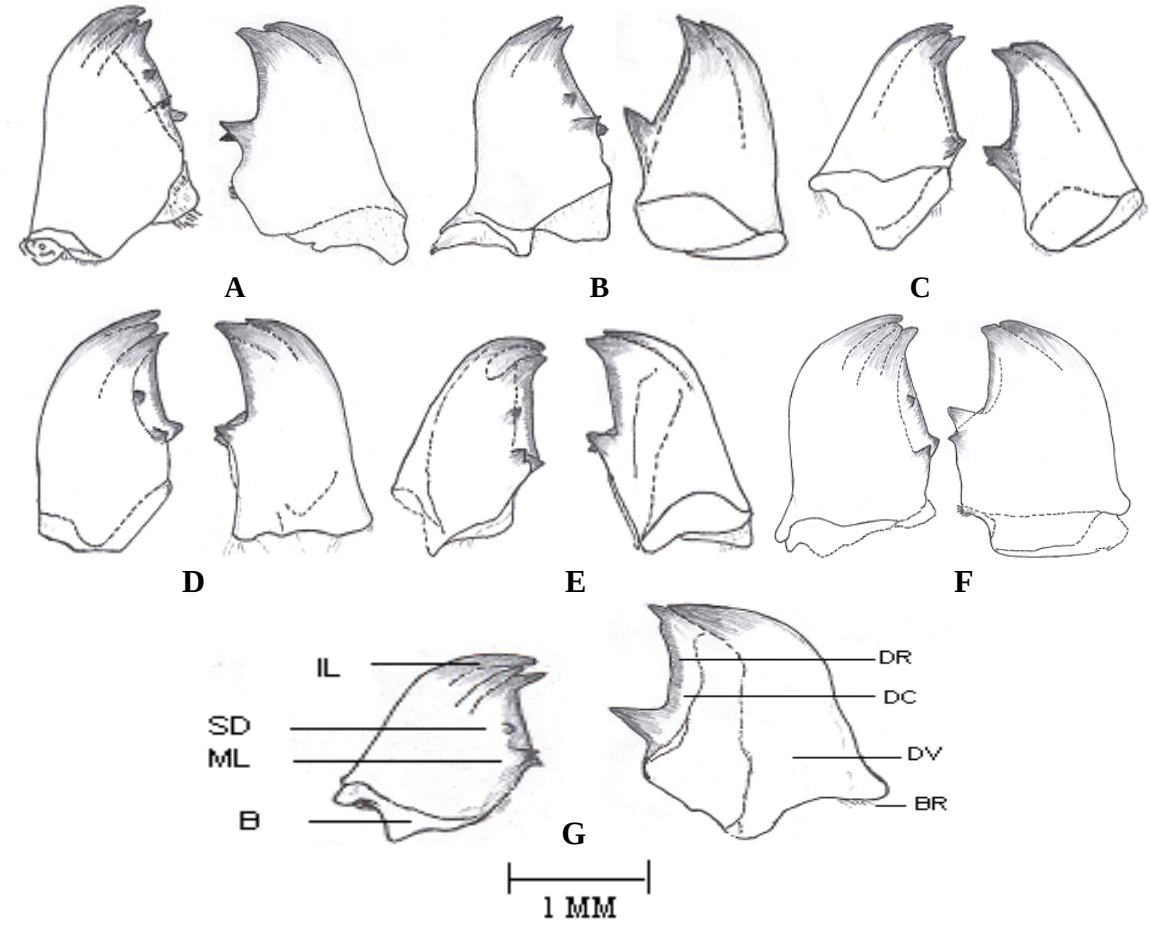

Fig: 2. Dorsal view of left and right mandibles of *Sphodromantis transcaucasica (*A), *Tendera attenuata (*B), *Mantis religiosa akbari (*C), *Aethalochroa affinis* (Mantidae) (D), *Empusa unicornis (*E), *Blepharopsis mendica* (Empusidae) (F) and *Humbertiella indica* (Eremiaphilidae) (G).

broad stipes. The lacinia of maxilla is broad at the base and pointed along with two sharp maxadentes. The labium (Figs. 3H-J) is broader at the Submentum and mentum is narrow. Paraglossae broad and somewhat larger than glossae and fused to form ligula. The Fissure mesarima separating corresponding sides of ligula.

Sub family Vatinae

The labrum (Fig. 1D) is triangular and usually small and thin. The mandibles (Fig. 2D) are small with 2 sharp incisors and 2 molars in the right mandible and 4 incisors and 2 molars in the left mandible. The molars are much small in this family. The maxillae (Fig. 3D) are elongated and armed with lacinia and long maxillary palps. The lacinia of maxilla is broad at the base and pointed along with two sharp maxadentes, one on the ventral edge is always shorter than the dorsal maxadent. The lacinia in this group is little bit straight and bears long and short dense lacinarastra. The galea of maxilla is moderate to flap-like. It has few finest hairs on the dorsal side. The stipes is moderate in this group. The cardo is small. The labium (Fig. 3K) is broad with broad submentum while mentum is very small. Paraglossae and glossae are nearly equal. The

fissure mesarima is prominent.

The labrum (Fig. 1E) is triangular and hairy on the dorsal side while clypeus has median line of

Family Empusidae

Sub family Empusinae

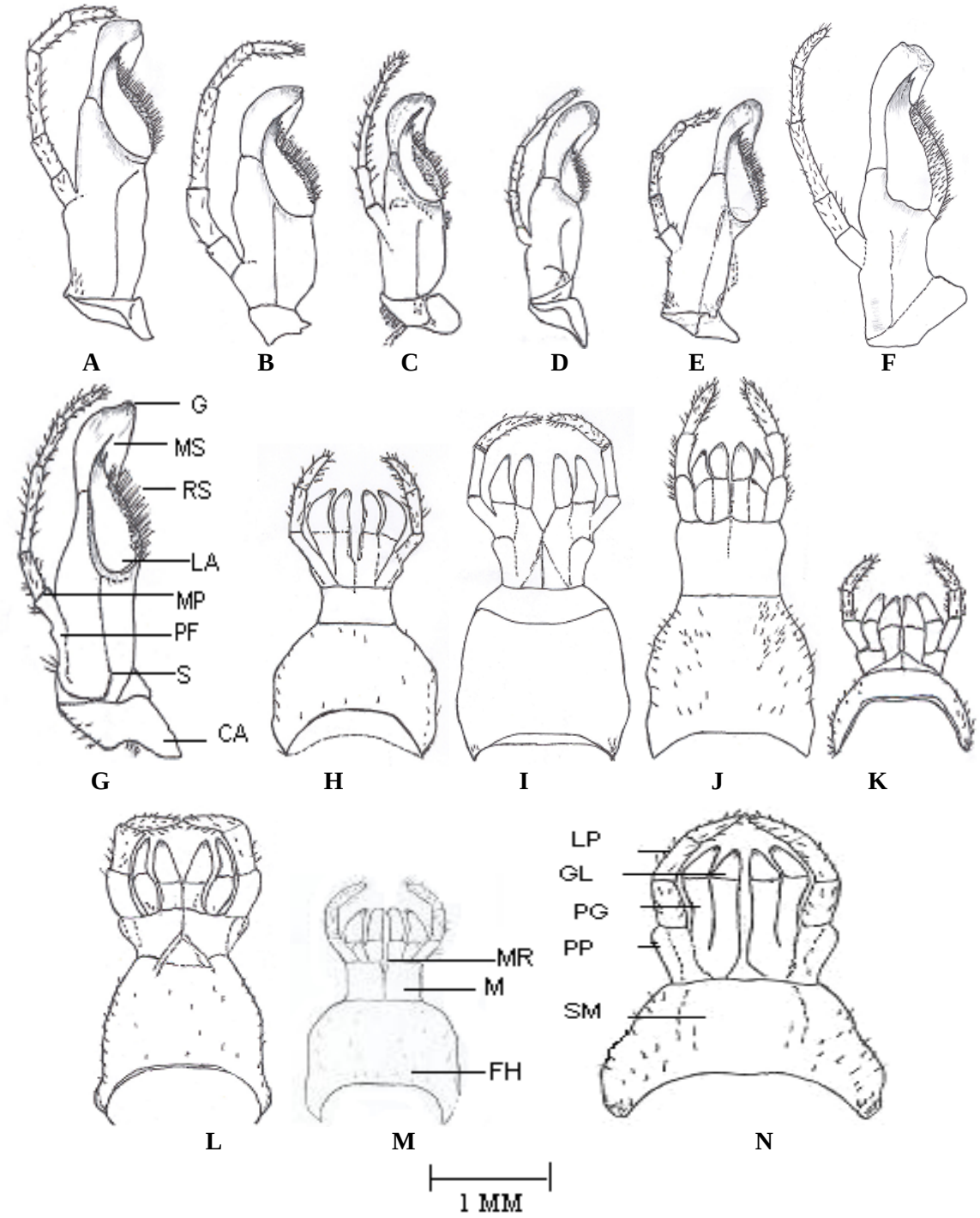

Fig: 3. Ventral view of right maxilla and labium of *Sphodromantis transcaucasica* (A, H), *Tendera attenuata (*B, I), *Mantis religiosa akbari (*C, J), *Aethalochroa affinis* (Mantidae) (D, K), *Empusa unicornis (*E, L), *Blepharopsis*

mendica (Empusidae) (F, M) and *Humbertiella indica* (Eremiaphilidae) (G, N).
BA, base; BR, brustia; CA, cardo; DC, dental cavity, DP, dental plate, DR, dental ridge or cutter plate; DV, dorsal view; ES, epipharyngeal suture; EX, epipharynx; FH, fine hair; G, galea; GL, glossa; IL, incisor lobe; LA, lacinia; LP, labial palps; ML, molar lobe; MP, maxillary palpus; MR, mesarima; MS, maxadentes; MU, muscles, PF, palpifer; PG, paraglossa; PP, palpiger; RS, lacinarastra; S, stipes; SD, small dente; SM, submentum; TM, torma,

Table I.- Measurements in (mm) of labrum, mandibles, maxillae and labium.

Family	Sub family	Species	L	Ml	Mr	Ml	Mr	LB
Mantitidae	Mantinae	*Sphodromantis transcaucasica*	0.25	0.24	0.25	0.36	0.36	0.50
		Tenodera attenuate	0.18	0.19	0.19	0.33	0.33	0.33
		Mantis religiosa akbari	0.20	0.18	0.17	0.27	0.27	0.31
	Vatinae	*Aethalochroa affinis*	0.18	0.14	0.15	0.20	0.20	0.27
Empusidae	Blepharodinae	*Blepharopsis mendica*	0.35	0.30	0.30	0.38	0.38	0.43
	Empusinae	*Empusa unicornis*	0.21	0.21	0.22	0.27	0.27	0.30
Eremiaphilidae		*Humbertiella indica*	0.24	0.23	0.24	0.30	0.30	0.31

Labrum (L), Mandible left (Ml), Mandible right (Mr), Maxilla left (Ml), Maxilla right (Mr), Labium (LB).

Table II.- Differences in the outline of labrum, mandibles and labium

Name of the species	Outline of labrum	Outline of mandibles	Outline of labium
Sphodromantis transcaucasica	Sub triangular mentum narrow	long and some what broad	sub mentum broad
Tenodera attenuata	Sub triangular pointed at tip	small and broad	sub mentum elongated mentum small
Mantis religiosa akbari	Narrow and triangular	Small and broad	Sub mentum and mentum moderate
Aethalochroa affinis	small and triangular	very small and narrow	very small
Blepharopsis mendica	Triangular	long and some what broad	submentum is much broad
Empusa unicornis	Broad and triangular	small and some what narrow	sub mentum pointed at tip
Humbertiella indica	Triangular	long and broad	submentum and mentum are small

projection. The mandibles (Fig. 2E) are some what rectangular longer than broad. The incisors are much sharp in this family. The maxillae (Fig. 3E) are much elongated. The galea of maxilla is moderate to flap-like. The stipes is moderate and cardo is small. The labium (Fig. 3L) is also moderate. The paraglossae are little bit long while glossae are little small and thin. The labial palps of maxillae are long and slightly over lapped the paraglossae. The labial palps are three segmented. The fissure mesarima is much separating the corresponding sides of the ligula.

Sub family Blepharodinae

Labrum (Fig. 1F) is triangular and clypeus is also triangular. The mandibles (Fig.2F) are somewhat rectangular longer than broad with triangular base, and their teeth are blunt and little bit reduced in comparison to other families. Right mandible has two large blunt teeth while left mandible is broad has 3 molars, out of which two are much developed and strong but one is very small at the back of left molar. The maxillae (Fig. 3F) are much elongated. The lacinia in this group broad and some what elongated. The cardo is small. The sub mentum of labium (Fig. 3M) is pointed while mentum is small and narrow. The fissure mesarima is clear and separate the glossae.

Family Eremiapilidae

Labrum (Fig. 1G) is triangular and clypeus is broad. The mandibles (Fig.2G) broad, with triangular base, and their teeth are moderate. The

left mandible is broad overlap the right mandible and has 2 molars; both are much developed and strong. The maxillae (Fig. 3G) are much elongated. The lacinia in this group broad. The cardo is small. The sub mentum of labium (Fig.3N) is pointed while mentum is small and narrow. The fissure mesarima is clear and separating the each sides of the ligula.

Table III.- Number of mandibular dentes and there mouthparts adaptations.

Group and species	Number of mandibular teeth				Adaptive nature of mouthparts for feeding
	Incisors		Molars		
	Left	Right	Left	Right	
Mantidae: Mantidae					
Sphodromantis transcaucasica	4	2	3	2	Large insects and small reptiles, tree frogs small birds
Tenodera attenuate	4	2	2	2	-
Mantis religiosa akbari	4	2	2	2	-
Mantidae: Vatinae					
Aethalochroa affinis	4	2	2	2	Prefer small prey
Empusidae: Blepharodinae					
Blepharopsis mendica	4	2	3	2	small, large insects and small reptiles
Empusinae					
Empusa unicornis	4	2	2	2	-
Eremiaphilidae					
Humbertiella indica	4	2	2	2	they prefer small creeping prey

DISCUSSION

Although all Mantodean are carnivorous insects but their adaptive foraging nature is different. The present findings suggests that the member of the sub-family Mantinae (*e.g.*, *Sphodromantis transcaucasica*, *Tenodera attenuata,* and *Mantis religiosa akbari*) have much stronger and larger mouthparts and their adaptive foraging nature is to feed on the large insects and rare on small reptiles, tree frogs and nestling of humming birds. The members of the sub-family *Vatinae* (*e.g., Aethalochroa affinis)* have small comparatively less developed mouthparts and their foraging adaptation is for preying mostly on nymphs, larvae and new hatchings of animals. Members of the family *Eremiaphilidae* (*e.g., Humbertiella indica)* have strong mouthparts and their foraging adaptation is for preying on small creeping animals and large insects. On the other hand members of the family Empusidae (*e.g., Empusa unicornis*) attain the intermediate structural adaptations of the mouthparts and they feed on insects and small animals. The major difference was found in the labrum and labium while minor variations of maxillae and mandibles were also noted. The maxillae are the least specialized mouthparts in terms of external morphology and do not show any specific adaptation except in the size and position of cardo, stipes, lacinia, which show a little difference. While the mandibles have difference in the sharpness of the teeth, number of teeth and in size.

Thus the study is based on the structure of mouthparts and the prey on which mantids feed. Their different behaviors have only been seen in the young adults. Nymphs feed on mixed prey, prefer larvae, nymphs and rare on young ones of mice.

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