

A review of the Gonypetidae Westwood, 1889 (Dictyoptera: Mantodea) with two new records from Sindh, Pakistan

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Abstract- The main aims of present study were revision of family Gonypetidae and documentation of new records, habitats, morphological characteristics, morphometry, and global distribution of praying mantids from this region, during October 2018-September 2021. The first established was family Gonypetidae by Westwood, and it has been revived as part of a major emendation of mantids taxonomy. Gonypetidae Schwarz & Roy, 2019 are a new family of praying mantids, based on the type *Gonypeta* genus. *Memantis fuliginosa* Thunberg, 1815 and *Humbertiella ceylonica* Saussure, 1869 new records from Sindh, Pakistan. The distribution records of species from various districts of Sindh Pakistan are augmented.

Index Terms- Pakistan, Sindh, Gonypetidae, new records.

I. INTRODUCTION

Family Gonypetidae was first observed by [1]. The new placement is in superfamily Gonypetoidea of group Cernomantodea, infraorder Schizomantodea (Dictyoptera: Mantodea) family Gonypetidae was established by [2]. Mantis (Dictyoptera: Mantodea), commonly known as praying mantids but bark mantis common name of the species belongs to this family. Gonypetidae consist on two subfamily, four tribes, eighteen genera and over sixty species included [3]. Mantis are predatory nature, mainly feeding variety of insects viz aphids, butterflies, grasshoppers, moths and many other small living organisms. Bark mantis highly adapted in mimicry and camouflage, they are used as natural bio-control agent against many pests [4]. Previously *Humbertiella indica* Saussure, 1869, *Humbertiella affinis* Giglio-Tos, 1917 and *Humbertiella sindhica* Soomro, Soomro and Wagan, 2001 reported from, Pakistan but, placed in family Eremaiphilidae [5], while that [6] [7] were arranged in family Liturgusidae. *Humbertiella ceylonia* Saussure, 1869 and *Humbertiella indica* Saussure, 1869 described from Nepal [8]. *Humbertiella similis* Giglio-Tos, 1917, *Humbertiella ceylonia* Saussure, 1869, *Humbertiella indica* Saussure, 1869, *Humbertiella affinis* Giglio-Tos, 1917 and *Humbertiella nigrospinosa* Sjostedt, 1930 collected from India [9] [10] [11]. Beside this *Memantis fuliginosa* Thunberg, 1815 was recorded from India, Myanmar and Nepal [12]. However, available data so far for this part of the world was insufficient with exception of [5] [6] [7] [8]. It was therefore necessary to revise this family from Sindh, Pakistan at first. Furthermore morphological characteristics, taxonomic status and illustrations are provided. However, morphometry, habitat, global distribution and remarks have also been briefly discussed. In this manuscript, we offered two species with addition of new fauna from Pakistan and it assures that this information might be helpful in filling certain gaps in Gonypetidae fauna of Pakistan and will bring knowledge up to date.

II. MATERIALS & METHODS

III. Study area

All the specimens were collected from the various agriculture crops of different localities of Sindh, Pakistan. During 2018 October- 2021 September, material were sort out in two species then gender wise identification were presented.

IV. Killing techniques

Collected material was brought to Entomology Bio-control Research Laboratory (EBCRL), Department of Zoology, University of Sindh, Jamshoro. Method for killing was adapted from [5] [7] [13] [14]. Samples were killed by using chloroform or potassium cyanide in standard entomological method. Specimens killing in bottles for 5-10 min. Specimens were not left too long because the color of the specimens might be changed.

V. Pinning and Stretching of Specimens

Collected samples were pinning quickly after killing. Insects pin was fixed on the posterior pronotum to transverse sulcus slightly to the right of median carina. Head was slightly directed to downwards on the stretching board. Left wings were set with the long axis of the body nearly at the right angle to the pin. Posterior legs were bent beneath the body to minimize the possibility of breaking and to occupy the small area. The abdomen was dropped below the wings and not obscured by the hind legs.

VI. Preservation and Identification

Fully dry insects were preserved in insect cabinet with labels which showing scientific name of specimens, collection date, habitat, locality, and collector name. Naphthalene balls (C₁₀H₈) were placed in boxes to prevent the attack of parasites, ants and other insects. Specimens were identified through bibliographies given by [3] [13] [14].

VII. Line Drawing and Photography

Photographs of the various part of species were prepared. Line drawing was made with Camera Lucida fitted on microscope and this improved with the help of software Adobe illustrator CC-2015.

VIII. Morphometry of Samples

Measurement of various body parts of specimens was calculated in millimeters (mm) through Ocular graph, compass, divider, and the scale.

IX. Depository

Sindh Entomological Museum, Department of Zoology, University of Sindh, Jamshoro, Pakistan.

X. RESULTS & DISCUSSION

SYSTEMATIC ACCOUNT

DICTYOPTERA

MANTODEA

CERNOMANTODEA

GONYPETOIDEAGONYPETIDAEGONYPETINAEGONYPETINI

1)

MEMANTIS FULIGINOSA (THUNBERG, 1815)*Mantis fuliginosa* (Thunberg, 1815): 291-292.*Gonypeta femorata* (Saussure, 1870): 230.*Humbertiella consobrina* (Saussure, 1871b): 273-274.*Gonypeta fuliginosa* (Kirby, 1904b): 224.*Gonypeta femorata* Saussure, 1871a): 58-59.*Memantis fuliginosa* (Giglio-Tos, 1927):179.*Elaea consobrina* (Kirby, 1904b): 214.*Memantis fuliginosa* (Giglio-Tos, 1915c): 163.**2) MORPHOLOGICAL CHARACTERISTICS**

Body small and slim, colors reddish brown or chocolate brown, head wider than elongated, facial shield dark brown or blackish, antennae setaceous, two compound eyes spherical in shape, eyes projected over the lateral region of pronotum and external protuberance, pronotum robust and wider, hexagonal in shape, surface of pronotum with divided section, coxa straight, tetragonal in shape, femora much more wider, stout, triangular in shape from dorsal side, pairs of wings well developed expansion cover abdomen, costal area of tegmina crossed by horizontal lines, tegmina surface extended with dark brown or blackish brown blotch and hind wing costal margin with reddish brown or pale brown patches.

3) MORPHOMETRY FEMALE

LH. 3.16 ± 0.28 (mm), LA. 20.66 ± 1.15 (mm), LP. 5.33 ± 0.57 (mm), LAB. 10.16 ± 0.5 (mm), LT. 20.66 ± 1.15 (mm), WT. 5.3 ± 0.57 (mm), LW. 19.6 ± 0.57 (mm), WW. 11.6 ± 0.57 (mm), LF. 6.16 ± 0.28 (mm), WF. 3.33 ± 0.57 (mm), TBL 29.66 ± 0.57 (mm).

4) MATERIAL EXAMINED

SINDH, 2♀s Mirpur Mathaelo N 28.0271°, E 69.3235°, 1♀ Dokri N 27.3800°, E 68.0925°.

5) HABITAT

Memantis fuliginosa Thunberg, 1815) are broadly distributed in the fields. Agricultural fields which are affected by this species are Bamboo *Dendrocalamus strictus* and *Oryza.sativa*.

6) GLOBAL DISTRIBUTION

Myanmar, Saudi Arabia, India, Pakistan, Singapore, Nepal, and Sri Lanka [12].

7) REMARKS

M. fuliginosa is the generally recognized as small mantis. It is predatory in nature. They are broadly dispersed in India, Myanmar, Nepal, Saudi Arabia, Singapore, Sri Lanka and now during present study evident occurrence of this species from Sindh Pakistan. The presence of this species from reported from Saudi Arabia at first [15]. Although this species reported from Sri Lanka [16]. During present study, we have reported this species first time from Mirpur Mathaelo N 28.0271°, E 69.3235°, Dokri N 27.3800°, E 68.0925°, upper Sindh, Pakistan. This species nearly share their morphology with *Memantis anomala* Lombardo, 1993.

HUMBERTIELLINA**HUMBERTIELLA CEYLONICA (SAUSSURE, 1869)***Humbertiella ceylonica* (Beier, 1935): 7.*Theopompula taprobanarum* (Giglio-Tos, 1927): 67.*Humbertiella septentrionum* (Kirby, 1904b): 214.*Theopompa septentrionum* (Wood-Mason, 1891): 64-66.*Theopompa taprobanarum* (Wood-Mason, 1891): 62-64.*Humbertiella taprobanarum* (Beier, 1935): 7.*Humbertiella taprobanarum* (Ehrmann, 2002): 189.*Humbertiella taprobanarum* (Otte and Spearman, 2005): 131-132.*Theopompa assimulata* (Wood-Mason, 1891): 62-64.*Humbertiella assimulata* (Kirby, 1904b): 214.*Theopompula assimulata* (Giglio-Tos, 1917): 84-85.*Theopompula assimulata* (Giglio-Tos, 1927): 67.

Theopompula taprobanarum (Giglio-Tos, 1917): 84-85.

1) MORPHOLOGICAL CHARACTERISTICS

Body shorter than longer, more or less wider than narrow, dorso-ventral, colors blotched with grey, green, compound eyes stout exophthalmic, antennae longer body surpassing in length, pronotum robust, strong and broader, with tuberculate, narrow lateral trapezoidal or isosceles upper -lateral region with very sharp or an acute lobes, femora longer than pronotum and pronotum much wider than coxae and femur, cyclopean ear located on meta-thorax region, fore-femora with 4-5 discoidal and 3-4 posterior – ventral with irregular in shape, wings extended beyond abdomen more often in male than female, stigma narrow and oblique, female genitalia faintly longer with tuberculate and cerci furry or hairy and long, tegmina blotched or mottled, hind wing much transparent.

2) MORPHOMETRY

Female: LH. 5 (mm), LA.25 (mm), LP. 7 (mm), LAB.19 (mm), LT. 26 (mm), WT. 9 (mm), LW. 22 (mm), WW.15 (mm), LF.8 (mm), WF.4.5 (mm), TBL.31 (mm).

3) MATERIAL EXAMINED

SINDH 1♀ Miro Chandio N 27.7667°, E 68.1000°.

4) HABITAT

Humbertiella ceylonica Saussure, 1869 is widely distributed in many countries, but from this region first time reported this species. This species mostly found from known as bark of trees or rocky area.

5) GLOBAL DISTRIBUTION

Bangladesh, Myanmar, India, Sri Lanka, Pakistan and Thailand [17].

6) REMARKS

Humbertiella ceylonica Saussure, 1869 is the generally recognized as bark mantis. This species widely dispersed in various status of India such as Assam, Bihar, Karnataka, Madhya Pradesh,

Maharashtra, Tamil Nadu, Uttar Pradesh and West Bengal. This species originated first time from Sir Lanka [16]. During present study we have been observed and compared morphological features this species with another species of same genus. According this finding and consequence *H. ceylonica* very closely related general morphology with *Humbertiella indica* Saussure, 1869 except no evidence flat dark stain on femora of *H. indica*.

I. CONCLUSION

Present finding showed the revision of family Gonyptetidae from Sindh, Pakistan. We concluded and confirmed in our study that presences of *Memantis fuligionsa* (Thunberg, 1815) and *Humbertiella ceylonica* (Saussure, 1869) from Sindh, Pakistan. We need more intensive surveys from different localities of Sindh, Pakistan, for addition new fauna of this family.

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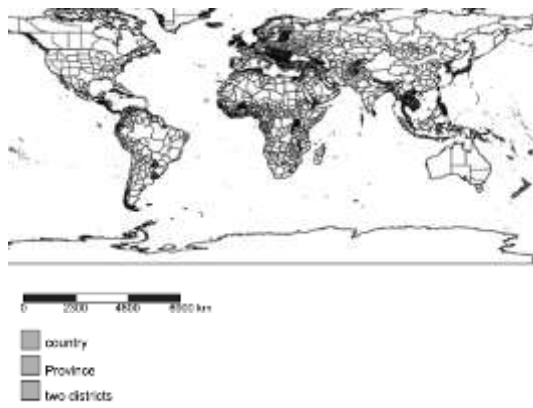


Table 1. Updated fauna of Gonypetidae in Sindh, Pakistan

FAMILY	SUBFAMILY	TRIBE	NAME OF GENERA	SPECIES NAME
Gonypetidae	Gonypetinae	Gonypetini	<i>Memantis</i>	<i>Memantis fuliginosa</i> (Thunberg, 1815)
			<i>Humbertiella</i>	<i>Humbertiella indica</i> (Saussure, 1869)
				<i>Humbertiella affinis</i> (Giglio-Tos, 1917)
				<i>Humbertiella sindhica</i> (Soomro, Soomro and Wagan, 2001)
				<i>Humbertiella ceylonica</i> (Saussure, 1869)

Figure 1 Map of Pakistan, Sindh



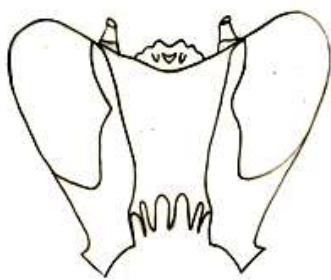
(A)



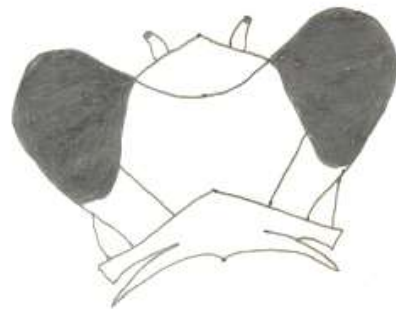
(B)



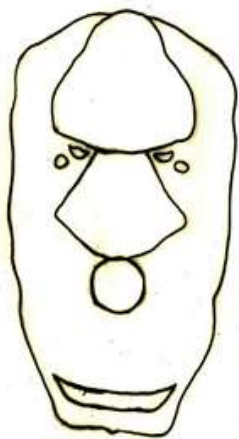
Figure 2. (A) Dorsal view, (B) Dorsal view of Abdomen *Memantis fuliginosa* ♀, (C) Dorsal view and (D) Lateral view of *Humbertiella ceylonica* ♀



(A)



(B)



(C)



(D)

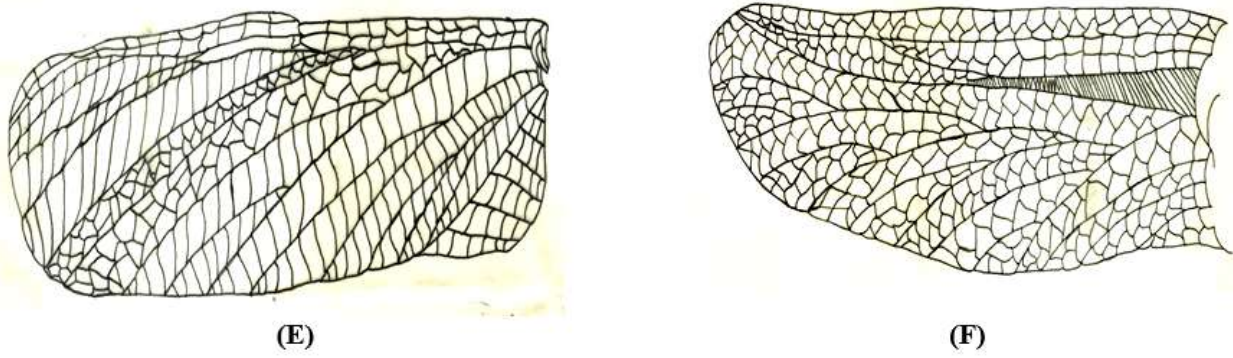


Figure 3. (a) Head, (c) Pronotum (e) Tegmina *Memantis fuliginosa*, (b) Head, (d) Pronotum (f) Tegmina *Humbertiella ceylonica* (Barline 2mm)

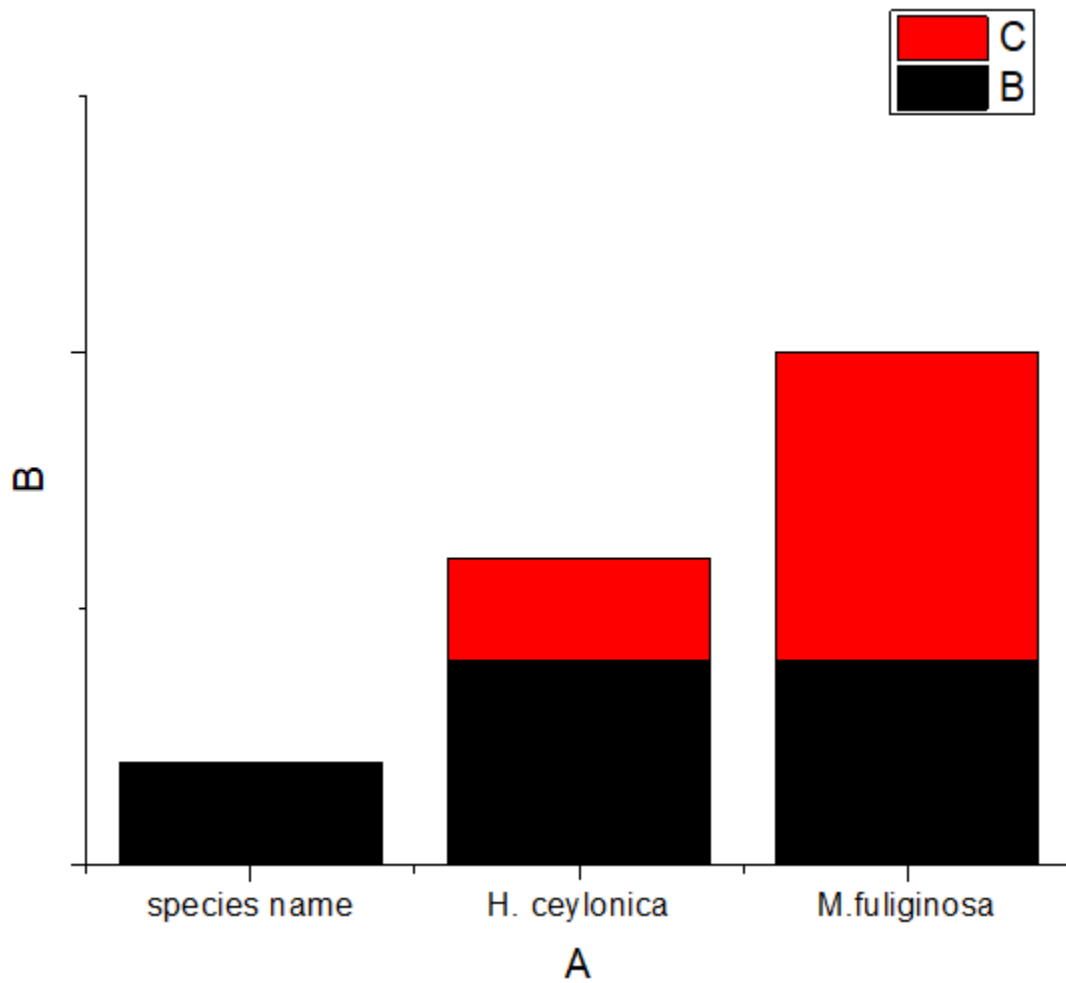


Figure 4. Total male and female numbers of collected species

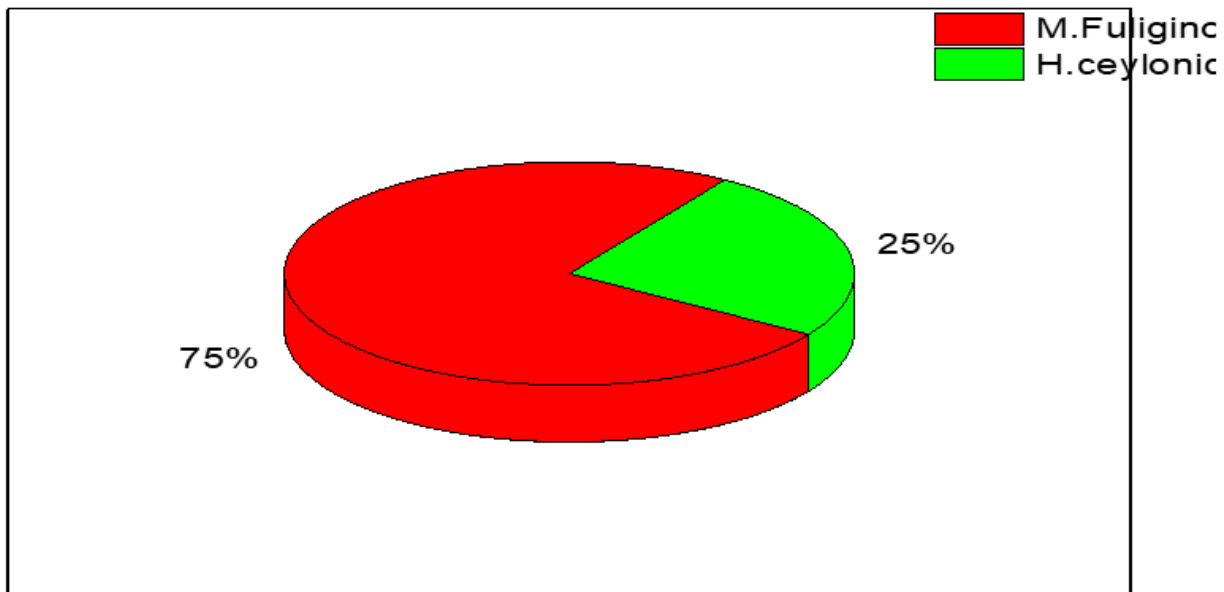


Figure 5. Species wise percentage of collected specimens