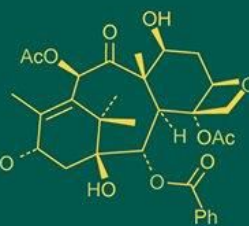
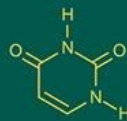
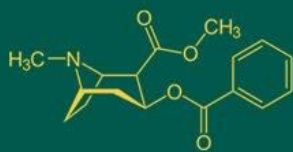


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Species composition of mantis fauna in different habitats of Jabugam in Gujarat, India

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Abstract

Praying mantids are ecologically significant predatory insects that play an important role in natural pest regulation, yet their diversity remains poorly documented in many regions of India. The present study aimed to assess the diversity and habitat association of mantids in Jabugam, Bodeli taluka of Chhotaudepur district, Gujarat. Surveys were conducted across different habitats, including paddy fields, grasslands, mango orchards and banana plantations. Specimens were preserved and identified using standard taxonomic keys. A total of seven mantid species belonging to four families Mantidae, Hymenopodidae, Empusidae and Toxoderidae were recorded, namely *Mantis religiosa religiosa*, *Creobroter apicalis*, *Gongylus gongylodes*, *Hierodula coarctata*, *Hierodula membranacea*, *Aethalochroa ashmoliana* and *Statilia maculata continentalis*.

Keywords: Dictyoptera, Mantodea, mantis, diversity, richness, Gujarat

Introduction

The Convention on Biological Diversity, initiated during the 1992 Earth Summit (UNCED), urges signatory nations to inventory their biodiversity, which is essential for long-term sustainable management and conservation (Heywood, 1995) [3]. Due to the impracticality of cataloguing all biota simultaneously, priority groups like mantids are selected. Mantids, placed under the Order Mantodea by Burmeister in 1838, are carnivorous insects and key predators in terrestrial ecosystems. They hunt various arthropods and occasionally small vertebrates, often exhibiting cryptic colouration and specialized features like raptorial forelegs and binocular vision.

Mantids, commonly known as praying mantises, are an important group of predatory insects belonging to the order Mantodea. These insects play a vital role in maintaining ecological balance by preying on various agricultural pests, making them a significant component of integrated pest management strategies (Prete *et al.*, 1999) [7]. The species composition of mantid fauna varies widely across different habitats, influenced by environmental conditions, vegetation type and prey availability (Roy & Das, 2012) [9]. Studying the diversity and distribution of mantids provides critical insights into their ecological roles and aids in the conservation of these beneficial insects.

Praying mantids are distributed globally, with around 2,300 species identified, primarily in tropical and subtropical regions (Ehrmann, 2002) [2]. The greatest species richness is found in African forests and savannahs, followed by Southeast Asian rainforests. Once classified under the order Dictyoptera, mantids have existed since the Paleocene period (Roy, 2007) [10]. Known by various names such as Gottesanbeterin, Prie-Dieu and “god-horse,” their common name refers to their prayer-like posture. These carnivorous insects exhibit unique prey capture, camouflage and reproductive behaviours (Jaccard, 1908) [4], yet their ecology remains relatively understudied.

India, being one of the world’s megadiverse countries, hosts a wide array of mantid species. Gujarat, with its varied agroclimatic zones, serves as a suitable region for exploring mantid biodiversity. Despite their ecological significance, comprehensive studies on the species composition of mantids in Gujarat are limited, with much of the research focusing on a few isolated regions (Chakraborty *et al.*, 2000) [1]. Understanding the habitat preferences and distribution patterns of mantid species can help improve their conservation and utilization in pest management programs.

The mantid fauna in India, particularly in Gujarat, remains largely undocumented, despite the significant crop losses caused by insect pests in the region. Research focused on praying mantids in Gujarat is minimal, with only four species across four genera documented so far by the Zoological Survey of India (Sureshan, 2009) [11]. Therefore, the current research was conducted in Jabugam, located in the middle Gujarat region. The findings from this study aim to provide a baseline for future explorations into mantid diversity and distribution, particularly in relation to their preferred habitats and associated host plant species.

Materials and Methods

Study area

The present study on mantid diversity was undertaken across a range of habitats in Jabugam, located in Bodeli taluka of Chhotaudepur district, Gujarat, India. This region lies at a geographic coordinate of 22°17'37.70" N latitude and 73°46'41.02" E longitude, positioned at an elevation of 92 meters above mean sea level. Jabugam experiences a semi-arid to sub-tropical climate, marked by scorching summers and relatively chilly winters. The monsoon season typically arrives by June and withdraws by late September, with July and August receiving the heaviest rainfall under the influence of the South-West monsoon. The area is traversed by the Orsang river, which contributes to a relatively shallow groundwater table, approximately 12 meters deep, with groundwater of good quality. The terrain is characterized by sandy loam soil, known for its fertility, supporting major crops such as banana, cotton and maize. While daytime temperatures commonly range between 25°C to 35°C (80°F to 90°F).

Sample collection, preservation and identification

Adult mantids were systematically collected from diverse ecological zones, including grasslands, paddy fields, mango orchards and banana plantations, employing a standardized sweep net method. The net, crafted from fine nylon mesh, was attached to a handle with a hoop and a net designed to ensure minimal harm during capture. Specimens were immediately preserved in 70% ethyl alcohol, each with detailed labels noting the collection site, date and collector's name for accurate archival. Observations were primarily conducted on-site, followed by targeted collection and photographic documentation to aid identification. Mantids were then euthanised using a killing jar, meticulously spread and pinned for further taxonomic analysis. Preliminary identification relied on taxonomic keys from the *State Fauna Series* of the Zoological Survey of India, Kolkata and by taxonomic keys available online.

Results and Discussion

An investigation was undertaken to know the biodiversity of mantids at the College of Agriculture, Jabugam campus and the findings are presented as under. After an intensive survey was made in different habitats and different localities of Jabugam. Overall, four families, viz., Mantidae, Hymenopodidae, Empusidae and Toxoderidae have been recorded. Details of all the species of mantids recorded during the present study are given below:

Mantis religiosa religiosa (Linne, 1758)

Diagnostic characters: This mantid species, found worldwide, is recognized by its yellowish-green to brown

coloration and triangular head with a yellowish patch across the eyes. It has slender, non-lobed middle and hind legs and forelegs with granules and marbled spots. Its transparent wings feature distinct venation, with bifurcating veins at key points. It is one of the most common and widely distributed mantids globally.

Morphometric characters (length in mm)

The body length of *M. religiosa* ranging between 71.98 to 72.36 mm. The length of pronotum were ranging between 17.20 to 19.30 mm, whereas the pronotum width ranging between 6.2 to 8.1 mm. Further, the mean length and width of abdomen were 46.03 and 12.13 mm, respectively Patel and Shukla (2018) [6].

Habitat: Paddy, Mango, Pond, Grassland and Banana ecosystem.

Creobroter apicalis (Audinet-Serville, 1839)

Diagnostic characters

Body green, forewing with a yellow median spot bordered by black eye-like markings. Head trapezoidal, vertex rough with middorsal spine; eyes black, conical, projecting upward; ocelli orange, prominent; antennae fuscous, filiform. Mesosoma saddle-shaped, supracoxal dilation well developed; female pronotum dentate, male margins smooth. Forefemur with three green annulations, spines black-tipped. Forewing semi-opaque, costal and anal areas transparent; hindwing proximally pink, medially black, distally transparent with characteristic vein bifurcations.

Morphometric characters (length in mm)

The length and width of body ranging between 42.28 to 42.99 mm and 8.82 to 9.18 mm, respectively. The mean length and width of pronotum was 10.04 mm and 4.09 mm, respectively. The mean length and width of abdomen were 28.55 and 12.13 mm respectively Sureshan *et al.* (2009) [11].

Habitat: Paddy and Grassland ecosystem

Gongylus gongylodes (Linnaeus, 1758)

Diagnostic characters

Body greenish brown. Head conical and compressed, with anteriorly prolonged foliaceous lobes; vertex testaceous with yellowish-green tinge; eyes oval, fuscous to black. Frontal sclerite spiniform with rhomboidal carinated disc; clypeus and labrum medianly carinated; antennae short, filiform, non-ciliated. Mesosoma slender, prozona spatulate, metazona laterally denticulated, with anterior rhomboidal dilation. Forelegs yellowish brown, coxa carinated with conical backwardly directed lobes; femur foliaceous with brown bands and ventral groove. Forewings broad, extending beyond abdomen, costal area basally widened and brown opaque; discoidal area yellowish green; hindwings hyaline. Metasoma brown, broad, laterally laminated, longer than wings; mid-abdominal segments foliaceous laterally; cerci short, pubescent Vyjayandi (2007) [13].

Morphometric characters (length in mm)

The length of body was ranging between 93.92 to 94.16 mm. The mean length and width of pronotum were 42.74 and 6.03 mm, respectively. The mean length and width of abdomen were 36.64 and 22.02 mm, respectively.

Habitat: Paddy and Grassland ecosystem.

***Hierodula coarctata* (Saussure, 1869)**

Diagnostic characters

Body pale green to yellowish with grey and black markings. Head thick, triangular, vertex smooth; ocelli prominent; eyes round laterally, ventrally subconical; antennae with scanty bristles; frontal sclerite wider than high with two blunt vertical carinae forming a median groove. Mesosoma elongate with prominent oval supracoxal dilation; prosternum and mesosternum with reddish-magenta patches and central black tubercles. Fore femur with 4 external and 4 discoidal spines; coxa bearing obtuse thick spines. Wings longer than abdomen; forewing partly opaque bright green with lemon-yellow stigma bordered by reddish patches; hindwing transparent. Abdomen pale yellow with bright green transverse ventral bands.

Morphometric characters (length in mm)

The body length of the *H. coarctata*, were ranging between 57.92 to 58.97 mm. The mean length and width of pronotum were 24.13 and 12.55 mm, respectively.

Habitat: Paddy and fruit orchard ecosystem

***Hierodula membranacea* (Burmeister, 1838)**

Diagnostic characters

Colour: light green. This is a comparatively large species capable of inflicting a painful bite that may occasionally break the skin. Head triangular; antennae slender and filiform; ocelli conspicuous. Forelegs with inner margin of coxa distinctly tuberculated. Middle and hind legs slender, coxa short; hind femur longer than coxa but slightly shorter than tibia; metatarsus equal in length to all remaining tarsal segments combined. Wings extending beyond metasoma; forewings with opaque costal area and posterior radial vein bifurcating proximally; hind wings hyaline with radial veins bifurcating Rao *et al.* (2005) [8].

Morphometric characters (length in mm)

The forewing length measured approximately 45.10 mm, while the hind wing was slightly shorter with a mean length of 42.05 mm. The abdomen was comparatively longer, recording an average length of 45.60 mm. These measurements indicate that the abdominal length marginally exceeded the wing dimensions, reflecting proportional body growth and structural balance Mukherjee and Ghate (2010).

Habitat: Paddy ecosystem

***Aethalochroa ashmoliana* (Westwood, 1841)**

Diagnostic characters

Colour brown; body bizarre in appearance. Head small, wider than high; antennae filiform. Pronotum spiny or tuberculated, prozona spatulate with well-developed supracoxal dilation; metazona distinctly carinated and approximately equal in length to the fore coxa. Fore coxa bearing an inner distal serrated lobe. Middle and hind legs short and stout; coxa short; femur slightly foliaceous with distinct internal and external distal lobes. Forewings semihyaline with a comparatively more opaque costal area; hind wings longer than forewings, though both wings are

relatively short, extending up to about three-fourths of the metasoma.

Morphometric characters (length in mm)

The mean length of the forewing was recorded at approximately 49.85 mm, whereas the hind wing measured slightly longer with an average length of 50.30 mm. The abdomen was the longest body part, with a mean length of 51.42 mm, indicating a marginal predominance of abdominal length over the wings.

Habitat: Grassland ecosystem

***Statilia maculata continentalis* Werner, 1935**

Diagnostic characters

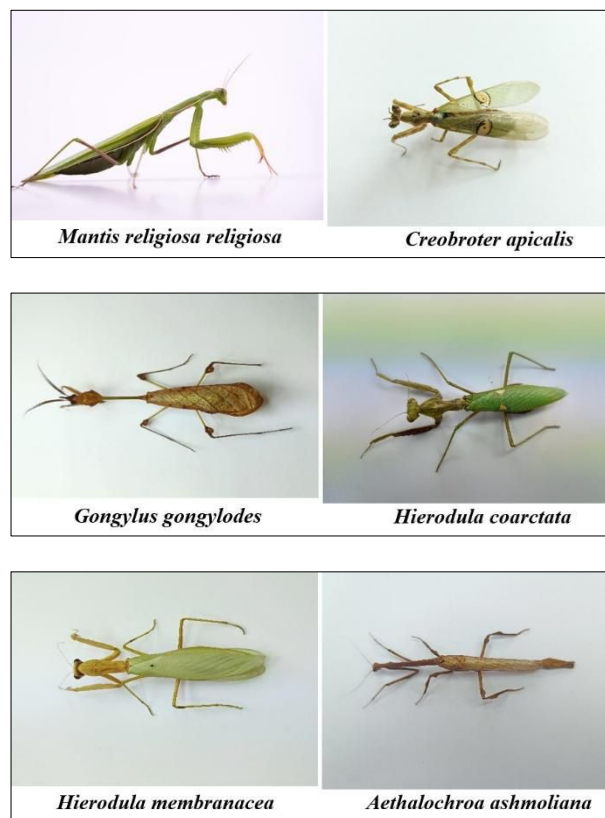
Colour: Green, fummy brown; Head: triangular; Antenna: slender, filiform; ocelli conspicuous; Forelegs: slender, coxa not flat with middorsal tuberculated ridge, ventrally submarginal area with 6 to 7 large well pronounced tubercles, internal apical lobes contiguous. Middle and Hind legs: coxa short; femur longer than coxa; Wings: both wings non-truncate with conical endings; costal area opaque, hindwings semi hyaline, anterior radial vein bifurcates.

Morphometric characters (length in mm)

The length and width of body ranging between 57.06 to 57.87mm and 7.64 to 8.26mm, respectively. The female was larger than male. The mean length and width of pronotum were 14.24 mm and 8.19mm respectively Sureshan *et al.* (2009) [11].

Habitat: Paddy and Grassland ecosystem.

Photographic catalogue





Conclusion

The diagnostic features and morphometric parameters recorded for the mantid species in this study provide a reliable basis for precise field-level identification. These characters facilitate clear differentiation among closely related mantid species. In addition, information on habitat utilization and host plant associations enhances understanding of the ecological significance of mantids, particularly their role as natural predators of agricultural pests. Such insights are valuable for recognizing mantids as beneficial components of agro-ecosystems, emphasizing their conservation and promoting their effective incorporation into integrated pest management programs.

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