Biodiversity of praying mantids (Insecta: Mantodea) in Gujarat, India

Patel Hiral, Abhishek Shukla and Surani Pratik

Abstract

The present study was conducted during August 2016 to July 2017 with the objective to explore the fauna of mantids from different agri-horticultural crops, ornamentals, weeds, wild vegetation and leaf litter at Navsari, South Gujarat, India. Overall 374 specimens of mantids were collected from different agro-ecosystems. From these specimens, 21 known species belonging to 15 genera and 5 families were identified. Out of all 21 species proportion of Mantis religiosa (Burmeister, 1838) was found the most abundant in the study area i.e. 67.91 followed by Hierodula viridis (Burmeister, 1838) (6.95) and Humbertiella ceylonica (Saussure, 1869) (5.34%), which were also recorded as very common species. Among different agro-ecosystems, grassland ecosystem ranked first position with 21 species (100%). The paddy ecosystem constituted 14 species (66.67%), followed by mango ecosystem which constituted 10 species (47.61%), while in banana and pond ecosystem 7 species (33.33%) were presented. The variation in species of mantids might be due to diverse kind of habitat, vegetation, food availability and agricultural practices. Maximum numbers of species were recorded during September and October months during the survey period. The value of Shannon index of diversity for mantids at Navsari Agricultural University campus was 1.49, evenness was 0.49 while species richness is 21.

Keywords: Praying mantids, biodiversity, south Gujarat

1. Introduction

Mantids (Insecta: Mantodea), usually known as Praying Mantis, hold significant place in the ecosystem as predators, mainly feed on grasshoppers, moths, butterflies, flies, beetles and they are well adapted in camouflage and mimicry [1]. Mantids have attained their common popular name from the way they raise their two fore legs in a posture of prayer. They are often found waiting still for hours together for their prey with their heads rotating 180° [2]. They are diurnal and are attracted to lights at night [3]. They are weak flies and are generally seen sitting on herbs, shrubs and trees [4]. There are around 2300 species of mantids under 434 genera all over the world [5]. From India 162 species of mantids under 68 genera belonging to six families were reported [6]. Research on mantids in India was further propelled by several researchers in India [7-12]. So far 4 species and 4 genera of mantids have been recorded from all over Gujarat [6]. We are representing here mantids diversity of NAU campus. Considering the importance of this group in biological control, the present study was carried out to understand the diversity of these important mantids under the South Gujarat agro-climatic conditions.

2. Materials and Methods

Study site

A study on biodiversity of mantids were carried out at Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) during August 2016 to July 2017. Navsari is situated at coastal region of western India. Geographically, it is situated at 20°57' N latitude and 72°54' E longitude with an altitude of 11.98 meters above the mean sea level.

Collection, Preservation and Identification of mantids

Adult, free flying mantids was collected from the different ecosystems i.e. grassland ecosystem followed by paddy, mango, banana and pond by using standard insect collecting swap net attached to a ring with a handle of 1.00 m length, 0.3m hoop ring diameter. The soft nylon net with 1.00 m depth sewed on the hoop ring. All the collected specimens were preserved in 70 per cent ethyl alcohol with proper labeling, indicating locality, date and name.
of collector. Mostly, spot observation were followed by collection and photography from the different areas for their identification. For identification mantid specimens were killed in killing jar and spread and pinned properly. The initial identification, of the praying mantids was done with the help of the keys of state fauna services of Zoological Survey of India, Kolkata. The final confirmation had been be done with the help of expert by sending specimens and personal visit.

Biodiversity analysis
For making biodiversity analysis, the data regarding collected specimens of mantids were arranged according to the source. The biodiversity count was made by using Shannon diversity index [13] to estimate species richness, evenness and species diversity. The per cent proportion of different mantid species were determined and percentage of each species was calculated. This analysis were made to determine the most abundant and prevalent mantid species in the surveyed area during course of study.

3. Results and Discussion
An investigation was undertaken to know the biodiversity of mantids at Navsari Agricultural University campus and the findings are presented as under:

Biodiversity of mantids
During the present study, total 21 species of mantids were recorded from different locations, which belong to five families. Among them 57.14 per cent species belongs to family Mantidae, 14.28 per cent from Empusidae, 14.28 per cent species belongs to family Toxoderidae, 9.52 per cent species represents Hymenopodidae, and remaining 4.76 per cent species from family Liturgusidae (Table 1 and Figure 1).

Dwari and Mondal [14] in a study also reported a total 10 species of mantids belonging to 9 genera under 3 families viz. Mantidae, Hymenopodidae and Liturgusidae. The Mantidae was the most dominant family. Under the present study Mantidae was the most dominant family comprises of 8 genera and 12 species with 57.14 per cent species distribution. This may be more or less in accordance with the earlier work. Chaturvedi and Hegde [15] who also reported mantidae as most common family in various parts of Bandhavgarh and Sanjay Gandhi National Park, Mumbai.

Table 1: Species distribution of mantids in different families:

<table>
<thead>
<tr>
<th>Order Mantodea</th>
<th>Family</th>
<th>Genera</th>
<th>No. of species</th>
<th>% Species</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mantidae</td>
<td>8</td>
<td>12</td>
<td>57.14</td>
</tr>
<tr>
<td></td>
<td>Hymenopodidae</td>
<td>2</td>
<td>2</td>
<td>9.52</td>
</tr>
<tr>
<td></td>
<td>Liturgusidae</td>
<td>1</td>
<td>1</td>
<td>4.76</td>
</tr>
<tr>
<td></td>
<td>Empusidae</td>
<td>2</td>
<td>3</td>
<td>14.28</td>
</tr>
<tr>
<td></td>
<td>Toxoderidae</td>
<td>2</td>
<td>3</td>
<td>14.28</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>5</td>
<td>15</td>
<td>100</td>
</tr>
</tbody>
</table>

Fig 1: Distribution of Mantodea in different families

Looking to the habitat wise distribution of mantids, grassland ecosystem ranked first position with 21 species (100%). The paddy ecosystem constituted 14 species (66.67%), followed by mango ecosystem constituted 10 species (47.61%), banana and pond ecosystem presented 7 species (33.33%) (Table 2, Fig 2). The variation in species of mantids might be due to diverse kind of habitat, vegetation, food availability and agricultural practices. Chaturvedi and Hedge [15] also collected maximum number of mantid species from grassland found in Sanjay Gandhi National Park, Mumbai.

Table 2: Species richness of Mantids from five major agro-ecosystems of NAU campus

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Habitats</th>
<th>Number of observed species</th>
<th>Per cent distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Paddy ecosystem</td>
<td>14</td>
<td>66.67</td>
</tr>
<tr>
<td>2</td>
<td>Mango ecosystem</td>
<td>10</td>
<td>47.61</td>
</tr>
<tr>
<td>3</td>
<td>Pond ecosystem</td>
<td>7</td>
<td>33.33</td>
</tr>
<tr>
<td>4</td>
<td>Grassland ecosystem</td>
<td>21</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>Banana ecosystem</td>
<td>7</td>
<td>33.33</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
The results showed that *Mantis religiosa* (67.91%) was found the most abundant in the study area followed by *Hierodula viridis* (6.95%) and *Humbertiella ceylonica* (5.34%) which were also recorded as very common species. Whereas, *Archimantis latistyla* (2.40%), *Hierodula venosa* (2.13%), *Aethalochroa ashmoliana* (1.87%), *Statilia maculata* (1.60%) were evidenced as common in occurrence. Similarly, 15 species viz. *Schizocephala bicornis* (1.60%), *Hierodula membranacea* (1.60%), *Tenodora sinensis* (1.06%), *Hierodula keralensis* (1.06%), *Creobroter apicalis* (0.80%), *Hierodula coarctata* (0.80%), *Empusa guttula* (0.80%), *Hierodula grandis* (0.80%), *Aethalochroa insignis* (0.80%), *Ameles fasciipennis* (0.53%), *Gongylus gongylodes* (0.53%), *Gongylus trachelophyllus* (0.26%) were found as rarely occurred mantids under the present study area. Sureshan [9] from Orissa while studying the diversity of mantids, found *M. religiosa* as a most dominant species among overall collected species. Further, Vyjayandi [12] also reported *M. religiosa*, *H. viridis* and *H. keralensis* as the most dominant species in Kerala, thus more or less in accordance with the present findings.

### Table 3: Population and abundance of mantids in South Gujarat.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Mantid Species</th>
<th>Population (No)</th>
<th>Abundane (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><em>Ameles fasciipennis</em> (Kaltenbach, 1963)</td>
<td>2</td>
<td>0.53</td>
</tr>
<tr>
<td>2.</td>
<td><em>Humbertiella ceylonica</em> (Saussure, 1869)</td>
<td>20</td>
<td>5.34</td>
</tr>
<tr>
<td>3.</td>
<td><em>Gongylus gongylodes</em> (Linnaeus,1758)</td>
<td>2</td>
<td>0.53</td>
</tr>
<tr>
<td>4.</td>
<td><em>Tenodora sinensis</em> (Nurseryman, 1962)</td>
<td>4</td>
<td>1.06</td>
</tr>
<tr>
<td>5.</td>
<td><em>Mantis religiosa</em> (Burmeister, 1838)</td>
<td>252</td>
<td>67.91</td>
</tr>
<tr>
<td>6.</td>
<td><em>Hierodula viridis</em> (Burmeister, 1838)</td>
<td>26</td>
<td>6.95</td>
</tr>
<tr>
<td>7.</td>
<td><em>Creobroter apicalis</em> (Westwood, 1889)</td>
<td>3</td>
<td>0.80</td>
</tr>
<tr>
<td>8.</td>
<td><em>Hierodula keralensis</em> (Vyjayandi, 1995)</td>
<td>4</td>
<td>1.06</td>
</tr>
<tr>
<td>9.</td>
<td><em>Aethalochroa ashmoliana</em> (Westwood, 1841)</td>
<td>7</td>
<td>1.87</td>
</tr>
<tr>
<td>11.</td>
<td><em>Hierodula coarctata</em> (Saussure, 1869)</td>
<td>3</td>
<td>0.80</td>
</tr>
<tr>
<td>12.</td>
<td><em>Empusa guttula</em> (Thunberg, 1815)</td>
<td>3</td>
<td>0.80</td>
</tr>
<tr>
<td>13.</td>
<td><em>Gongylus trachelophyllus</em> (Burmeister, 1838)</td>
<td>2</td>
<td>0.53</td>
</tr>
<tr>
<td>14.</td>
<td><em>Archimantis latistyla</em> (Serville, 1838)</td>
<td>9</td>
<td>2.40</td>
</tr>
<tr>
<td>15.</td>
<td><em>Hierodula grandis</em> (Saussure, 1869)</td>
<td>3</td>
<td>0.80</td>
</tr>
<tr>
<td>16.</td>
<td><em>Tropiodo gattatipennis</em> (Stal, 1877)</td>
<td>2</td>
<td>0.53</td>
</tr>
<tr>
<td>17.</td>
<td><em>Hierodula membranacea</em> (Burmeister, 1838)</td>
<td>6</td>
<td>1.60</td>
</tr>
<tr>
<td>18.</td>
<td><em>Schizocephala bicornis</em> (Linnaeus, 1758)</td>
<td>6</td>
<td>1.60</td>
</tr>
<tr>
<td>19.</td>
<td><em>Aethalochroa insignis</em> (Wood-Mason, 1878)</td>
<td>3</td>
<td>0.80</td>
</tr>
<tr>
<td>20.</td>
<td><em>Hierodula venosa</em> (Olivier, 1792)</td>
<td>8</td>
<td>2.13</td>
</tr>
<tr>
<td>21.</td>
<td><em>Toxoderospinera</em> (Wood-Mason, 1889)</td>
<td>3</td>
<td>0.80</td>
</tr>
</tbody>
</table>

| Total  | 374 | 100 |

Further, the monthly activities of mantids were presented in the Table 4 showed that most of the collection were made during October, 2016 (80 mantids) and was followed by September 2016 (59 mantids). However, the lowest collection of mantids were made during May 2017. Where only 9 mantids were collected. Thus, activities of mantids were highest during the month of October, which were reflected in term of number of specimens collected, while lowest activity of mantids were noticed in May with lowest collection. The present findings on mantids activities were closely supported by Dwari and Mondal [14] from various collection sites of Howrah district of west Bengal. They collected maximum number of mantids from September to November and least mantid were collected from April to July, therefore closely support the present findings. This may be due to the availability of more numbers of prays during the months of September and November as compared to the hotter months.
Table 4: Month Wise Mantids Collection

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Month</th>
<th>Year</th>
<th>No of mantids</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>August</td>
<td>2016</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>September</td>
<td>2016</td>
<td>59</td>
</tr>
<tr>
<td>3.</td>
<td>October</td>
<td>2016</td>
<td>80</td>
</tr>
<tr>
<td>4.</td>
<td>November</td>
<td>2016</td>
<td>45</td>
</tr>
<tr>
<td>5.</td>
<td>December</td>
<td>2016</td>
<td>39</td>
</tr>
<tr>
<td>6.</td>
<td>January</td>
<td>2017</td>
<td>31</td>
</tr>
<tr>
<td>7.</td>
<td>February</td>
<td>2017</td>
<td>34</td>
</tr>
<tr>
<td>8.</td>
<td>March</td>
<td>2017</td>
<td>14</td>
</tr>
<tr>
<td>9.</td>
<td>April</td>
<td>2017</td>
<td>18</td>
</tr>
<tr>
<td>10.</td>
<td>May</td>
<td>2017</td>
<td>09</td>
</tr>
<tr>
<td>11.</td>
<td>June</td>
<td>2017</td>
<td>13</td>
</tr>
<tr>
<td>12.</td>
<td>July</td>
<td>2017</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 5: Biodiversity indices of mantids

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Mantid Species</th>
<th>Population (No)</th>
<th>Pi</th>
<th>ln (Pi)</th>
<th>(Pi) × ln(Pi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ameles fasciipennis</td>
<td>2</td>
<td>0.005</td>
<td>-5.23110862</td>
<td>-0.027973843</td>
</tr>
<tr>
<td>2.</td>
<td>Humbertiella ceylonica</td>
<td>20</td>
<td>0.053</td>
<td>-2.92852352</td>
<td>-0.156605536</td>
</tr>
<tr>
<td>3.</td>
<td>Gongylus gongylodes</td>
<td>2</td>
<td>0.005</td>
<td>-5.23110862</td>
<td>-0.027973843</td>
</tr>
<tr>
<td>4.</td>
<td>Tenodora sinensis</td>
<td>4</td>
<td>0.011</td>
<td>-4.53796144</td>
<td>-0.048534347</td>
</tr>
<tr>
<td>5.</td>
<td>Mantis religiosa</td>
<td>252</td>
<td>0.674</td>
<td>-0.39482671</td>
<td>-0.26603297</td>
</tr>
<tr>
<td>6.</td>
<td>Hierodula viridis</td>
<td>26</td>
<td>0.070</td>
<td>-2.66615926</td>
<td>-0.18534797</td>
</tr>
<tr>
<td>7.</td>
<td>Creobroter apiacilis</td>
<td>3</td>
<td>0.008</td>
<td>-4.82564351</td>
<td>-0.03870837</td>
</tr>
<tr>
<td>8.</td>
<td>Hierodula keraleness</td>
<td>4</td>
<td>0.011</td>
<td>-4.53796144</td>
<td>-0.048534347</td>
</tr>
<tr>
<td>9.</td>
<td>Aethalochroa ashmoliana</td>
<td>7</td>
<td>0.019</td>
<td>-3.97834565</td>
<td>-0.074461015</td>
</tr>
<tr>
<td>10.</td>
<td>Statilia Maculata</td>
<td>6</td>
<td>0.016</td>
<td>-4.13249633</td>
<td>-0.066296733</td>
</tr>
<tr>
<td>11.</td>
<td>Hierodula coarctata</td>
<td>3</td>
<td>0.008</td>
<td>-4.82564351</td>
<td>-0.03870837</td>
</tr>
<tr>
<td>12.</td>
<td>Empusa gattula</td>
<td>3</td>
<td>0.008</td>
<td>-4.82564351</td>
<td>-0.03870837</td>
</tr>
<tr>
<td>13.</td>
<td>Gongylus trachelophyllus</td>
<td>2</td>
<td>0.005</td>
<td>-5.23110862</td>
<td>-0.027973843</td>
</tr>
<tr>
<td>14.</td>
<td>Archimantis latastyla</td>
<td>9</td>
<td>0.024</td>
<td>-3.72703122</td>
<td>-0.089687917</td>
</tr>
<tr>
<td>15.</td>
<td>Hierodula grandis</td>
<td>3</td>
<td>0.008</td>
<td>-4.82564351</td>
<td>-0.03870837</td>
</tr>
<tr>
<td>16.</td>
<td>Tropiodo gutatipennis</td>
<td>2</td>
<td>0.005</td>
<td>-5.23110862</td>
<td>-0.027973843</td>
</tr>
<tr>
<td>17.</td>
<td>Hierodula membranacea</td>
<td>6</td>
<td>0.016</td>
<td>-4.13249633</td>
<td>-0.066296733</td>
</tr>
<tr>
<td>18.</td>
<td>Schizophrana bicornis</td>
<td>6</td>
<td>0.016</td>
<td>-4.13249633</td>
<td>-0.066296733</td>
</tr>
<tr>
<td>19.</td>
<td>Aethalochroa insignis</td>
<td>3</td>
<td>0.008</td>
<td>-4.82564351</td>
<td>-0.03870837</td>
</tr>
<tr>
<td>20.</td>
<td>Hierodula venosa</td>
<td>8</td>
<td>0.021</td>
<td>-3.84841426</td>
<td>-0.082242016</td>
</tr>
<tr>
<td>21.</td>
<td>Toxodropus spinigera</td>
<td>3</td>
<td>0.008</td>
<td>-4.82564351</td>
<td>-0.03870837</td>
</tr>
<tr>
<td>Total</td>
<td>374</td>
<td>1</td>
<td>88.891408</td>
<td>-1.4948191</td>
<td></td>
</tr>
</tbody>
</table>

5. Acknowledgement
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6. References
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