Observations on the habits and habitats of adult dragonflies of Eastern India with special reference to the fauna of West Bengal

TRIDIB RANJAN MITRA

ZOOLOGICAL SURVEY OF INDIA
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INTRODUCTION

Eastern India, in the present article, covers parts of the state of Assam, Bihar Sikkim and West Bengal. Physiographically Assam, North Bihar and Lower West Bengal (South of Darjeeling) belong to the Great Plains of India. In this there is no definite physiographic barrier to divide it further, though the eastern part is more humid than the western part. Rainfall increases steadily as one moves from the West to the East, rising from about 200 cms to about 400 cms in Assam. Today this is one of the most heavily populated rural areas. South Bihar belongs to the Chota Nagpur Region of the Peninsular uplands. This is characterised by the dry deciduous forests and the peninsular hills. Darjeeling of West Bengal is the part of Eastern Himalaya. Like the physiography, localities have got different geological history. For instance. Purulia of West Bengal is the remnant of the Triassic Gondwana land. while Susunia Hills of Bankura district of West Bengal represent the Pleistocene formation. The Gangetic alluvium is considered to be of recent origin.

Material and Methods In the present article, since there is no consolidated report on the ecology of Odonata of this part of India, I have tried to put together a number of observations that I have, from time to time during the course of collection of Odonata from eastern India during the period from 1966-1988, been able to make on the habits and habitats of adult dragonflies. Common* features have not been cited with dates and localities of observations. Majority of observations could be made near my residence at Dum Dum Park.

OBSERVATIONS

(A) Interspecies relations

(a) Table-1 Predator-prey relation

<table>
<thead>
<tr>
<th>Locality</th>
<th>Date</th>
<th>Predator</th>
<th>Prey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcutta</td>
<td>4.2.67</td>
<td>Ischnura senegalensis</td>
<td>Agriocnemis p. pygmaea</td>
</tr>
<tr>
<td>Calcutta</td>
<td>15.6.67</td>
<td>Orthetrum s. sabina</td>
<td>Ceriagrion coromandelianum</td>
</tr>
<tr>
<td>Dum Dum Park</td>
<td>1.8.72</td>
<td>Orthetrum s. sabina</td>
<td>Ischnura senegalensis</td>
</tr>
<tr>
<td>Naihati</td>
<td>12.10.74</td>
<td>Ceriagrion coromandelianum</td>
<td>Agriocnemis p. pygmaea</td>
</tr>
<tr>
<td>Hazaribagh</td>
<td>31.10.74</td>
<td>Ischnura senegalensis</td>
<td>Agriocnemis p. pygmaea</td>
</tr>
<tr>
<td>Dum Dum Park</td>
<td>19.9.81</td>
<td>Orthetrum s. sabina</td>
<td>Agriocnemis p. pygmaea</td>
</tr>
</tbody>
</table>

* Features observed three or more times have been considered as common.
Table 2. Interspecies competition for territory

<table>
<thead>
<tr>
<th>Locality</th>
<th>Date</th>
<th>Territory of species</th>
<th>Competitor / Intruder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dum Dum Park</td>
<td>15.9.82</td>
<td>Crocothemis s. servilia</td>
<td>Orthetrum s. sabina</td>
</tr>
<tr>
<td>Dum Dum Park</td>
<td>16.10.82</td>
<td>Crocothemis s. servilia</td>
<td>Orthetrum s. sabina</td>
</tr>
<tr>
<td>Purulia</td>
<td>30.11.86</td>
<td>Crocothemis s. servilia</td>
<td>Orthetrum s. sabina</td>
</tr>
<tr>
<td>Purulia</td>
<td>2.12.86</td>
<td>Orthetrum s. sabina</td>
<td>Crocothemis s. servilia</td>
</tr>
</tbody>
</table>

Remark. Crocothemis s. servilia chases Orthetrum s. sabina when the latter intrudes in the territory of the former. After a few clashes Orthetrum s. sabina leaves the territory of Crocothemis s. servilia; but does not leave the area i.e. it remains near the territory of Crocothemis s. servilia. Similarly when Crocothemis s. servilia intrudes in the territory of Orthetrum s. sabina the latter chases out Crocothemis s. servilia, of the territory, which, too, leaves the territory but does not leave the area. On the other hand smaller species like Brachythemis contaminata, Neurothemis t. tulia and Diplacodes trivialis when go inside the territory of other species like Crocothemis s. servilia and Orthetrum s. sabina no clash occurs. Moreover, during the competition for territorial space, driving the competitor/intruder out of the area (c 25m radius) was not observed. No clash or aggressive behaviour was noted at the feeding and roosting ground. But when Orthetrum s. sabina intrudes in the breeding territory of Crocothemis s. servilia in its nonbreeding season clashes occur.

(c) Interspecies pair formation:

In Calcutta Pseudagrion rubriceps rubriceps (Male) and Pseudagrion microcephalum (Female) were captured in tandem on several occasions; and Mitra & Lahiri (1972) once reported. But I could not see Pseudagrion microcephalum (Male) and Pseudagrion rubriceps rubriceps (Female) pair formation; moreover, I could not see wheel formation in these species.

(d) Interspecies congregation

Table 3. Assemblage of easily available species in different seasons

<table>
<thead>
<tr>
<th>Locality</th>
<th>Names of species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool (December - February)</td>
<td>Pseudagrion r. rubriceps, Pseudagrion microcephalum, Agriocnemis p. pygmaea, Ischnura senegalensis, Ceriagrion coromandelianum, Diplacodes trivialis, Brachythemis contaminata, Orthetrum s. sabina, Crocothemis s. servilia, Neurothemis t. tulia (Density of population of each species than that of post monsoon).</td>
</tr>
</tbody>
</table>
Summer (March-May)

Ischnura senegalensis, Agriocnemis p. pygmaea, Onychargia atrocyana, Pseudagrion microcephalum, Ceriagrion coromandelianum; Brachythemis contaminata, Crocothemis s. servilia, Neurothemis t. tullia, Tholymis tillarga (Visible only in the early morning; Population of each species is low).

Moonsoon (June-August)

Pseudagrion r. rubriceps, Pseudagrion microcephalum, Ischnura senegalensis, Ceriagrion coromandelianum, Crocothemis s. servilia, Brachythemis contaminata, Diplacodes trivialis, Pantala flavescens (Due to heavy shower of rain observations were often disrupted).

Post-monsoon (September-December)

Pseudagrion r. rubriceps, Pseudagrion microcephalum, Ischnura senegalensis, Ceriagrion coromandelianum, Agriocnemis p. pygmaea, Copera marginipes, Orthetrum s. sabina, Crocothemis s. servilia, Diplacodes trivialis, Pantala flavescens, Neurothemis t. tullia, Trithemis pallidinervis, Tholymis tillarga, Urothemis signata signata, Ictinogomphus rapax.

(B) Intraspecies relation

(i) Territorial defence during breeding was observed in Crocothemis s. servila, Orthetrum s. sabina and Tholymis tillarga.

(ii) Disturbance to other breeding pairs was observed in Pseudagrion microcephalum, Pseudagrion r. rubriceps and Tholymis tillarga.

(iii) Fight for food was noticed in Ischnura senegalensis. On February 4, 1967, in Calcutta, a female specimen of Ischnura senegalensis caught one Agriocnemis p. pygmaea specimen in its mouth. A male specimen of the same species reached the spot and clashed with the female probably to snatch the prey. The female somehow got rid of the male and flew to a distance beyond reach of the male.

(C) Reaction towards moving objects

Table - 4. Reaction of six common species of Calcutta, Dum Dum Park and VIP Road

<table>
<thead>
<tr>
<th>Locality</th>
<th>Species</th>
<th>Objects</th>
<th>Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcutta</td>
<td><em>Ictinogomphus rapax</em></td>
<td>Trams &amp; Bus</td>
<td>Follows and returns to the approximate point of start. distance travelled about 3 metres.</td>
</tr>
</tbody>
</table>
(D) Death in adult dragonflies

Several dead and dying dragonflies were collected from different parts of East India. According to the condition of the specimens following classification of the specimens can be made.

(1) Natural death  Death without any external injury.

(2) Death due to attack of Predators  Either eaten or injured by the predators like birds, lizards or spiders,

(3) Death due to attack of ants  Sometimes ants attack weak specimens which ultimately die.

(4) Death due to starvation  Specimens entangled in the cobeweb could not come out of the cobweb, hence dies due to lack of food.

(5) Death due to accidents caused by the automobiles  Automobiles and other modern gadgets dash the flying specimens; sometimes the flying specimens are sucked in automobile grille and ultimately die.

(6) Death due to unknown cause  Apparent reason for death could not be ascertained.

(1) Natural deaths  On April 4, 1984, one male specimen of Onychargia atrocyana was collected. The specimen does not contain any external injury. Hence it is suspected that the specimen might have suffered from natural death.

(2) Death due to attack of predators (Table-5)
### (A) BIRDS

<table>
<thead>
<tr>
<th>Date</th>
<th>Locality</th>
<th>Odonata</th>
<th>Condition of the prey</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.5.80</td>
<td>VIP Road</td>
<td><em>Crocothemis s. servilis</em> (Female)</td>
<td>Head eaten by Mynah, <em>Acriodontherses tristis</em>, and released due to author’s intervention.</td>
</tr>
<tr>
<td>9.6.80</td>
<td>VIP Road</td>
<td><em>Tholymis tillarga</em> (Female)</td>
<td>Attacked by House Crow, <em>Corvus splendens</em>, released due to author’s intervention, abdomen missing.</td>
</tr>
<tr>
<td>14.7.81</td>
<td>VIP Road</td>
<td><em>Orthetrum s. sabina</em> (Female)</td>
<td>Attacked by House Sparrow, <em>passer domesticus</em> released due to attack of House Crow on the predator; head of the dragonfly missing.</td>
</tr>
<tr>
<td>8.5.82</td>
<td>VIP Road</td>
<td><em>Tholymis tillarga</em> (Male)</td>
<td>Head and part of thorax seriously damaged, by Mynah; released due to author’s intervention.</td>
</tr>
<tr>
<td>8.4.83</td>
<td>Dum Dum Park</td>
<td><em>Trithemis pallidinervis</em> (Male)</td>
<td>Abdomen eaten by House Sparrow, released due to human intervention.</td>
</tr>
<tr>
<td>7.5.83</td>
<td>VIP Road</td>
<td><em>Tholymis tillarga</em> (Male)</td>
<td>Abdomen eaten by House Sparrow, released due to attack of another House Sparrow.</td>
</tr>
</tbody>
</table>

### (B) LIZARDS

<table>
<thead>
<tr>
<th>Date</th>
<th>Locality</th>
<th>Odonata</th>
<th>Condition of the prey</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.10.81</td>
<td>Dum Dum Park</td>
<td><em>Orthetrum s. sabina</em> (Male)</td>
<td>Head eaten by House gecko, <em>Hemidactylus brookii</em></td>
</tr>
<tr>
<td>15.10.81</td>
<td>Dum Dum Park</td>
<td><em>Crocothemis s. servilis</em> (Female)</td>
<td>Head and thorax eaten by House gecko</td>
</tr>
<tr>
<td>15.10.81</td>
<td>Dum Dum Park</td>
<td><em>Brachythemis contaminata</em> (Male)</td>
<td>Head and thorax eaten by House gecko</td>
</tr>
<tr>
<td>26.11.86</td>
<td>Kotulpur</td>
<td><em>Crocothemis s. servilis</em> (Female)</td>
<td>Completely eaten by Garden Lizard, <em>Calotes versicolor</em>, within a few minutes of capture.</td>
</tr>
</tbody>
</table>

### (C) SPIDERS

<table>
<thead>
<tr>
<th>Date</th>
<th>Locality</th>
<th>Odonata</th>
<th>Condition of the prey</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.9.71</td>
<td>Calcutta</td>
<td><em>Brachythemis contaminata</em> (Male)</td>
<td><em>Plexippus paykulli</em> killed the specimen</td>
</tr>
</tbody>
</table>
(3) Death due to attack of ants (Table-6)

<table>
<thead>
<tr>
<th>Date</th>
<th>Locality</th>
<th>Odonata</th>
<th>Condition of the specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.6.1981</td>
<td>VIP Road</td>
<td><em>Neurothemis t. tullia</em> (Male)</td>
<td>Head loose, unable to fly; attacked by <em>Camponotus compressus</em>; died after five minutes from the time of observation.</td>
</tr>
<tr>
<td>11.5.1982</td>
<td>VIP Road</td>
<td><em>Tholymis tillarga</em> (Male)</td>
<td>No external injury visible; unable to fly, severely attacked by <em>Solenopsis geminata</em>; died after ten minutes from the time of observation.</td>
</tr>
<tr>
<td>15.5.1982</td>
<td>VIP Road</td>
<td><em>Tholymis tillarga</em> (Female)</td>
<td>Legs broken, wings damaged, attacked by <em>Solenopsis geminata</em> died after ten minutes from the time of observation.</td>
</tr>
</tbody>
</table>

(4) Death due to starvation

On 14.4.1985 a male dead specimen of *Crocothemis servilia servilia* was collected from a cobweb and on 15.6.1986 a female dead specimen of *Hemianax ephippiger* was collected from another cobweb. These cases are suspected as the death due to starvation since the cobwebs were not made by the spiders or any other animals.

(5) Death due to accidents caused by automobiles and bicycles (Table-7)

<table>
<thead>
<tr>
<th>Date</th>
<th>Locality</th>
<th>Odonata</th>
<th>Condition of the specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 10.1980</td>
<td>GT Road</td>
<td><em>Diplacodes trivialis</em> (Male)</td>
<td>Compressed on a grille of a jeep.</td>
</tr>
<tr>
<td>27 10.1980</td>
<td>GT Road</td>
<td><em>Brachythemis contaminata</em> (Female)</td>
<td>Compressed on a grille of a jeep.</td>
</tr>
<tr>
<td>27 10.1980</td>
<td>GT Road</td>
<td><em>Crocothemis s. servilia</em> (Male)</td>
<td>Compressed on a grille of a jeep.</td>
</tr>
<tr>
<td>28.10.1980</td>
<td>GT Road</td>
<td><em>Orthetrum s. sabina</em> (Male)</td>
<td>Head inside the grille of a jeep</td>
</tr>
<tr>
<td>28.10.1980</td>
<td>GT Road</td>
<td><em>Trithemis palli-dinervis</em> (Female)</td>
<td>Body pressed on a grille of a jeep.</td>
</tr>
<tr>
<td>11.7 1982</td>
<td>VIP Road</td>
<td><em>Brachythemis contaminata</em> (Male)</td>
<td>Pressed by a bicycle</td>
</tr>
</tbody>
</table>
(6) **Death due to unknown cause** (Table-8)

<table>
<thead>
<tr>
<th>Date</th>
<th>Locality</th>
<th>Odonata</th>
<th>Conditions of the specimen</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.5.1980</td>
<td>VIP Road</td>
<td><em>Rhyothemis v. variegata</em> (Male)</td>
<td>Head and body damaged</td>
</tr>
<tr>
<td>16.5.1980</td>
<td>VIP Road</td>
<td><em>Ischnura senegalensis</em> (Female)</td>
<td>Legs missing, infested with ants, <em>Solenopsis geminata</em>.</td>
</tr>
<tr>
<td>16.6.1980</td>
<td>VIP Road</td>
<td><em>Brachythemis contaminata</em> (Male)</td>
<td>Head missing, body pressed on the road.</td>
</tr>
<tr>
<td>17.6.1980</td>
<td>VIP Road</td>
<td><em>Thorymis tillarga</em> (Male)</td>
<td>Abdomen pressed on the road, infested with <em>Solenopsis geminata</em>.</td>
</tr>
<tr>
<td>28.6.1980</td>
<td>VIP road</td>
<td><em>Thorymis tillarga</em> (Male)</td>
<td>Thorax and abdomen pressed on the road.</td>
</tr>
<tr>
<td>30.6.1980</td>
<td>VIP Road</td>
<td><em>Onychargia atrocyana</em> (Male)</td>
<td>Thorax broken</td>
</tr>
<tr>
<td>2.7 1980</td>
<td>VIP Road</td>
<td><em>Trithemis pallidinervis</em> (Male)</td>
<td>Abdomen pressed on the road.</td>
</tr>
<tr>
<td>3.9.1980</td>
<td>VIP Road</td>
<td><em>Ictinogomphus rapax</em> (Female)</td>
<td>Thorax pressed on the road, attacked by <em>Solenopsis geminata</em>.</td>
</tr>
<tr>
<td>2.5.1981</td>
<td>VIP Road</td>
<td><em>Pantala flavescens</em> (Male)</td>
<td>Eyes damaged; wings broken; thorax and abdomen injured.</td>
</tr>
<tr>
<td>4.5.1981</td>
<td>VIP Road</td>
<td><em>Orthetrum s. sabina</em> (Male)</td>
<td>Head missing; thorax damaged.</td>
</tr>
<tr>
<td>5.7 1981</td>
<td>VIP Road</td>
<td><em>Thorymis tillarga</em> (Female)</td>
<td>Head, thorax and abdomen damaged</td>
</tr>
<tr>
<td>5.7 1981</td>
<td>VIP Road</td>
<td><em>Crocothemis s. servilia</em> (Male)</td>
<td>Head and thorax broken.</td>
</tr>
<tr>
<td>16.7 1981</td>
<td>VIP Road</td>
<td><em>Ceriagrion? coromandelianum</em> (Female)</td>
<td>Thorax broken</td>
</tr>
<tr>
<td>19.9.1981</td>
<td>VIP Road</td>
<td><em>Pseudagrion microcephalum</em> (Female)</td>
<td>Thorax broken</td>
</tr>
<tr>
<td>5.5.1982</td>
<td>VIP Road</td>
<td><em>Thorymis tillarga</em> (Male)</td>
<td>Head missing.</td>
</tr>
<tr>
<td>6.5.1982</td>
<td>VIP Road</td>
<td><em>Thorymis tillarga</em> (Female)</td>
<td>Body pressed</td>
</tr>
<tr>
<td>7.7 1982</td>
<td>VIP Road</td>
<td><em>Thorymis tillarga</em> (Male)</td>
<td>Thorax and abdomen broken.</td>
</tr>
</tbody>
</table>
(E) *Odonata and their prey* (Table-9)

<table>
<thead>
<tr>
<th>Date</th>
<th>Locality</th>
<th>Odonata</th>
<th>Prey</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.9.1966</td>
<td>Calcutta</td>
<td><em>Brachythemis contaminata</em></td>
<td>Housefly, <em>Musca domestica</em></td>
</tr>
<tr>
<td>10.11.1966</td>
<td>Calcutta</td>
<td><em>Crocothemis s. servilia</em></td>
<td>Housefly, <em>Musca domestica</em></td>
</tr>
<tr>
<td>5.3.1967</td>
<td>Calcutta</td>
<td><em>Ischnura senegalensis</em></td>
<td>Butterfly? (Lycaenidae)</td>
</tr>
<tr>
<td>6.6.1977</td>
<td>Darjeeling</td>
<td><em>Crocothemis s. servilia</em></td>
<td>Butterfly (Unidentified)</td>
</tr>
<tr>
<td>10.7 1977</td>
<td>Dum Dum Park</td>
<td><em>Diplacodes trivialis</em></td>
<td>Ant, <em>Solenopsis geminata</em></td>
</tr>
<tr>
<td>11.8.1977</td>
<td>Dum Dum Park</td>
<td><em>Pantala flavescens</em></td>
<td>Mosquito,? <em>Anopheles</em> sp.</td>
</tr>
<tr>
<td>12.8.1977</td>
<td>Dum Dum Park</td>
<td><em>Pantala flavescens</em></td>
<td>Mosquito,? <em>Anopheles</em> sp.</td>
</tr>
<tr>
<td>10.10.1977</td>
<td>Dum Dum Park</td>
<td><em>Pantala flavescens</em></td>
<td>Mosquito,? <em>Anopheles</em> sp.</td>
</tr>
<tr>
<td>12.8.1979</td>
<td>Dum Dum Park</td>
<td><em>Pantala flavescens</em></td>
<td>Mosquito,? <em>Anopheles</em> sp.</td>
</tr>
<tr>
<td>12.8.1979</td>
<td>Dum Dum Park</td>
<td><em>Tholymis tillarga</em></td>
<td>Mosquito,? <em>Anopheles</em> sp.</td>
</tr>
<tr>
<td>15.5.1981</td>
<td>Dum Dum Park</td>
<td><em>Tholymis tillarga</em></td>
<td>Mosquito,? <em>Anopheles</em> sp.</td>
</tr>
<tr>
<td>15.5.1981</td>
<td>Dum Dum Park</td>
<td><em>Trithemis pallidinervis</em></td>
<td>Beetle (Unidentified)</td>
</tr>
<tr>
<td>15.5.1981</td>
<td>Dum Dum Park</td>
<td><em>Tholymis tillarga</em></td>
<td>Beetle (Unidentified)</td>
</tr>
<tr>
<td>15.6.1981</td>
<td>Dum Dum Park</td>
<td><em>Pseudagrion microcephalum</em></td>
<td>Ant, <em>Paratrichina longicornis</em></td>
</tr>
<tr>
<td>12.11 1982</td>
<td>Dum Dum Park</td>
<td><em>Pseudagrion r. rubriceps</em></td>
<td>Aphid, <em>Aphis cracivora</em></td>
</tr>
<tr>
<td>30.11 1982</td>
<td>Dum Dum Park</td>
<td><em>Ceriagrion coromandelianum</em></td>
<td>Ant, <em>Solenopsis geminata</em></td>
</tr>
<tr>
<td>23.11 1986</td>
<td>Joypur forest</td>
<td><em>Orthetrum s. sabina</em></td>
<td>Spider (Lycosidae)</td>
</tr>
</tbody>
</table>

(F) *Odonata recorded inside the houses of Calcutta and its suburbs*

Specimens of certain species of Odonata sometimes enter in the houses of Calcutta and its suburbs and they have been collected. It is noteworthy that there is no record of entry of any swarm in the houses. Following is the list of
species of Odonata collected inside the houses of Calcutta and Dum Dum Park.

(1) **Collection during the daytime** (Table-10)

<table>
<thead>
<tr>
<th>Locality</th>
<th>List of species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcutta</td>
<td>Trithemis pallidinervis</td>
</tr>
<tr>
<td>Dum Dum Park</td>
<td>Pseudagrion microcephalum, Ceriagrion coromandelianum, Ceriagrion cerinorubellum, Agriocnemis pygmaea pygmaea, Onychargia atrocyana, Neurothemis tullia tullia, Zyxomma petiolatum.</td>
</tr>
</tbody>
</table>

(2) **Collection during the night** (Table-11)

<table>
<thead>
<tr>
<th>Locality</th>
<th>List of species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcutta</td>
<td>Gynacantha bayadera, G. dravida, G. rammohani, Hemianax ephippiger, Pantala flavescens.</td>
</tr>
<tr>
<td>Dum Dum Park</td>
<td>Orthetrum s. sabina, Brachythemis contaminata, Crocothemis s. servilia, Tholymis tillarga, Zyxomma petiolatum.</td>
</tr>
</tbody>
</table>

(G) **Migratory flights** (Table-12)

Migratory flights could be seen only in *Pantala flavescens*. Following table reveals the direction of flights and approximate thickness of the swarm in Calcutta, its suburbs and Sikkim.

<table>
<thead>
<tr>
<th>Date</th>
<th>Locality</th>
<th>Duration</th>
<th>Direction</th>
<th>Thickness of swarm (Horizontal X vertical approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.9.80</td>
<td>VIP Road</td>
<td>9.40-9.55 hrs.</td>
<td>West to East</td>
<td>20 X 15 individuals</td>
</tr>
<tr>
<td>22.9.80</td>
<td>VIP Road</td>
<td>10.5-10.15</td>
<td>Northwest to Southeast</td>
<td>10 X 6 individuals</td>
</tr>
<tr>
<td>3.10.81</td>
<td>VIP Road</td>
<td>9.15-9.30</td>
<td>West to East</td>
<td>15 X 6 individuals</td>
</tr>
<tr>
<td>12.9.83</td>
<td>VIP Road</td>
<td>9.5-9.15</td>
<td>West to East</td>
<td>6 X 5 individuals</td>
</tr>
<tr>
<td>22.9.88</td>
<td>Tumin</td>
<td>10.0-11.00</td>
<td>—</td>
<td>A huge swarm</td>
</tr>
</tbody>
</table>

(H) **Posture of rest/perch** (Table-13) (Pl. 1 & 2)

(1) **Diurnal observations on the posture of rest/perch at Dum Dum Park**

<table>
<thead>
<tr>
<th>Odonata</th>
<th>Relation of body with substratum</th>
<th>Position of wings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceriagrion coromandelianum</td>
<td>Angular, sometimes nearly parallel</td>
<td>Folded over the thorax</td>
</tr>
<tr>
<td>Pseudagrion microcephalum</td>
<td>Angular, sometimes nearly parallel</td>
<td>Folded over the thorax</td>
</tr>
<tr>
<td>Odonata</td>
<td>Position of the wing</td>
<td>Position of the abdomen</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td><em>Trithemis pallidinervis</em></td>
<td>Angular, sometimes nearly parallel</td>
<td>Opened but not fully stretched</td>
</tr>
<tr>
<td><em>Crocòthermis s. servilia</em></td>
<td>Angular, sometimes nearly parallel</td>
<td>Opened and fully stretched</td>
</tr>
<tr>
<td><em>Brachythemis contaminata</em></td>
<td>Angular, sometimes nearly parallel</td>
<td>Opened and fully stretched</td>
</tr>
<tr>
<td><em>Neurothemis t. tullia</em></td>
<td>Angular, sometimes nearly parallel</td>
<td>Opened and fully stretched</td>
</tr>
<tr>
<td><em>Pantala flavescens</em></td>
<td>Angular, sometimes nearly parallel</td>
<td>Opened and fully stretched</td>
</tr>
<tr>
<td><em>Diplacodes trivialis</em></td>
<td>Horizontal</td>
<td>Opened and fully stretched</td>
</tr>
<tr>
<td><em>Orthetrum s. sabina</em></td>
<td>Horizontal</td>
<td>Opened and fully stretched</td>
</tr>
<tr>
<td><em>Lathrecista a. asiatica</em></td>
<td>Horizontal</td>
<td>Opened and fully stretched</td>
</tr>
<tr>
<td><em>Bradinopyga geminata</em></td>
<td>Horizontal</td>
<td>Opened and fully stretched</td>
</tr>
</tbody>
</table>

During roosting they do not change their position

(I) **Thermo-regulation** (Table-14) (Pl. 2 & 3)

Odonates usually take shelter under shade or expose minimum part of their body to avoid the heat of the sun. Following is the summary of the posture of rest under the sun at Dum Dum Park
MITRA  *Habits and habitats of adult dragonflies*

**Odonata**

<table>
<thead>
<tr>
<th><strong>Position of the wing</strong></th>
<th><strong>Position of the abdomen</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthetrum s. sabina</td>
<td>Wings cover the anterior part of the thorax and the tip is directed to the ground</td>
</tr>
<tr>
<td>Lathrecista a. asiatica</td>
<td>Wings cover the anterior part of the thorax and the tip is directed to the ground</td>
</tr>
<tr>
<td>Pantala flavescens</td>
<td>Wings fully opened</td>
</tr>
<tr>
<td>Tholymis tillarga</td>
<td>Wings fully opened</td>
</tr>
<tr>
<td><em>B. geminata</em></td>
<td>Wings cover the anterior part of the thorax; tip directed to the ground.</td>
</tr>
</tbody>
</table>

*(J) Vertical range of flight  Height up to which dragonflies usually fly (Table-15)*

<table>
<thead>
<tr>
<th><strong>Odonata</strong></th>
<th><strong>Approximate range (in cms)</strong></th>
<th><strong>Remarks</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudagrion microcephalum</td>
<td>30-50</td>
<td>Sometimes goes higher</td>
</tr>
<tr>
<td>Pseudagrion r. rubriceps</td>
<td>30-50</td>
<td>Sometimes goes higher</td>
</tr>
<tr>
<td>Ceriagrion coromandelianum</td>
<td>30-50</td>
<td>Sometimes goes higher</td>
</tr>
<tr>
<td>Ischnura senegalensis</td>
<td>30-50</td>
<td>Sometimes goes higher</td>
</tr>
<tr>
<td>Agriocnemis p. pygmaea</td>
<td>30-50</td>
<td>Rarely goes higher</td>
</tr>
<tr>
<td>Orthetrum s. sabina</td>
<td>100-150</td>
<td>Rarely goes higher</td>
</tr>
<tr>
<td>Diplacodes trivialis</td>
<td>100-150</td>
<td>Rarely goes higher</td>
</tr>
<tr>
<td>Crocothemis s. servilia</td>
<td>100-150</td>
<td>Rarely goes higher</td>
</tr>
<tr>
<td>Brachythemis contaminata</td>
<td>50-100</td>
<td>Rarely goes higher</td>
</tr>
<tr>
<td>Rhyothemis v. variegata</td>
<td>200-300</td>
<td>Sometimes goes higher</td>
</tr>
<tr>
<td>Pantala flavescens</td>
<td>200-300</td>
<td>Sometimes goes higher*</td>
</tr>
</tbody>
</table>

*In Jodhpur, Thar desert of Rajasthan, it was observed in March-April of 1980 that the species remain in the shade during daytime. This type of behaviour is also observed in Calcutta and Dum Dum Park.*

*Miller (1992) reported "aerial copulations were occasionally observed at up to 10m. above the ground among feeding swarms."*
Breeding seasons of ten species (Based on tandem & copulating pairs)

<table>
<thead>
<tr>
<th>Seasons</th>
<th>Locality</th>
<th>Odonata</th>
<th>Period of the day</th>
<th>Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>June-Nov.</td>
<td>Calcutta</td>
<td>Pseudagrion microcephalum</td>
<td>6.00-11.00</td>
<td>Over water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June-Nov.</td>
<td>Calcutta &amp; Naihati</td>
<td>P. r. rubriceps</td>
<td>6.00-11.00</td>
<td>Over water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June-Nov.</td>
<td>Calcutta &amp; Naihati</td>
<td>Ceriagrion coromandelianum</td>
<td>6.00-11.00</td>
<td>Over water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June-Nov.</td>
<td>Calcutta &amp; Bankura</td>
<td>Ischnura a. aurora</td>
<td>6.00-11.00</td>
<td>Over water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June-March</td>
<td>Calcutta</td>
<td>Ischnura senegalensis</td>
<td>6.00-11.00</td>
<td>Over water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan.-Dec.</td>
<td>Calcutta</td>
<td>Agriocnemis p. pygmaea</td>
<td>6.00-11.00</td>
<td>Over water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June-Oct.</td>
<td>Calcutta &amp; Hazribagh</td>
<td>Brachythemis contaminata</td>
<td>17.00-1800</td>
<td>Over water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June-Nov.</td>
<td>Dum Dum Park &amp; Purulia</td>
<td>Crocothemis s. servilia</td>
<td>7.00-12.00</td>
<td>Over water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June-Oct.</td>
<td>Dum Dum Park</td>
<td>Tholymis tillarga</td>
<td>17.00-17.30</td>
<td>Over water</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Nov.-Jan.</td>
<td>Calcutta Dum Dum Park, Dinajpur, Purulia &amp; Raimona</td>
<td>Orthetrum s. sabina</td>
<td>10.00-12.00</td>
<td>Near and away from water</td>
</tr>
</tbody>
</table>

*On 15.9.82, 19.9.82 and 15.8.83 one pair of Orthetrum sabina sabina, in each day at Dum dum Park, was found to move in wheel position over water, even when disturbed by the author. This behaviour is not in conformity with the behaviour observed during November to January. In that period the copulating pair moves away from the aquatic body for sometime to avoid disturbances.
**Mitra**

**Habits and habitats of adult dragonflies**

(L) **Horizontal dimensions of territories** (Table-17)

### Dimensions of territories of three species

<table>
<thead>
<tr>
<th>Date</th>
<th>Odonata</th>
<th>Dimension (approx)</th>
<th>Aquatic body</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.6.74</td>
<td><em>Tholymis</em></td>
<td>10 x 3 m</td>
<td>Pond</td>
<td>No competitor</td>
</tr>
<tr>
<td>22.9.94</td>
<td><em>tillarga</em></td>
<td>5 x 6 m</td>
<td>Pond</td>
<td>No competitor</td>
</tr>
<tr>
<td>15.6.79</td>
<td></td>
<td>4 x 3 m</td>
<td>Drain</td>
<td>No competitor</td>
</tr>
<tr>
<td>14.7.79</td>
<td></td>
<td>5 x 2 m</td>
<td>Drain</td>
<td>No competitor</td>
</tr>
<tr>
<td>15.8.79</td>
<td></td>
<td>10 x 1 m</td>
<td>Drain</td>
<td>No competitor</td>
</tr>
<tr>
<td>15.9.82</td>
<td><em>Crocothemis s.</em></td>
<td>4 x 2 m</td>
<td>Pond</td>
<td>Good number of competitors/intruders including <em>Orthetrum s. sabina</em></td>
</tr>
<tr>
<td>16.10.82</td>
<td></td>
<td>2 x 1 m</td>
<td>Drain</td>
<td>&quot; &quot; &quot;</td>
</tr>
<tr>
<td>30.11.86</td>
<td></td>
<td>3 x 1 m</td>
<td>Drain</td>
<td>No competitor</td>
</tr>
<tr>
<td>30.11.86</td>
<td><em>Orthetrum s.</em></td>
<td>6 x 5 m</td>
<td>Pond</td>
<td>Good number of competitors/intruders including <em>Crocothemis s. servilia</em></td>
</tr>
<tr>
<td>2.11.86</td>
<td><em>Sabina</em></td>
<td>3 x 2 m</td>
<td>Drain</td>
<td>&quot; &quot; &quot;</td>
</tr>
<tr>
<td>2.12.86</td>
<td></td>
<td>3 x 1 m</td>
<td>Drain</td>
<td>&quot; &quot; &quot;</td>
</tr>
</tbody>
</table>

(M) **Emergence of Imago** (Table-18)

### Records of emergence of imago of seven species

<table>
<thead>
<tr>
<th>Date</th>
<th>Locality</th>
<th>Odonata</th>
<th>Time</th>
<th>Sunrise</th>
<th>Sunset</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.3.68</td>
<td>Dum Dum Park</td>
<td><em>Orthetrum s. sabina</em></td>
<td>18.05 hr.</td>
<td>6.02 hr.</td>
<td>17.44 hr.</td>
</tr>
<tr>
<td>9.3.71</td>
<td>Dum Dum Park</td>
<td><em>Orthetrum s. sabina</em></td>
<td>18.00 hr.</td>
<td>5.50 hr.</td>
<td>17.35 hr.</td>
</tr>
<tr>
<td>23.12.73</td>
<td>Kachugaon</td>
<td><em>Brachythemis contaminata</em></td>
<td>10.20 hr.</td>
<td>Not recorded</td>
<td>Not recorded</td>
</tr>
<tr>
<td>29.10.74</td>
<td>Hazaribagh</td>
<td><em>Bradinopyga geminata</em></td>
<td>18.05 hr.</td>
<td>Not recorded</td>
<td>Not recorded</td>
</tr>
<tr>
<td>1.11.74</td>
<td>Hazaribagh</td>
<td><em>Copaera marginipes</em></td>
<td>14.15 hr.</td>
<td>Not recorded</td>
<td>Not recorded</td>
</tr>
</tbody>
</table>

During the period, November 25-30, 1987, in the area of the river Kulik of North Bengal, it was noted that in the overcrowded localities territorial fights were not distinct. Moreover, some specimens were found to wait on land for partners; the copulating pairs were not leaving the area if the wheel appeared weak, which after sometimes got detached, and the pair immediately formed the wheel again.
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<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Species</th>
<th>5.00 hr</th>
<th>5.09 hr</th>
<th>18.15 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.8.80</td>
<td>Dum Dum</td>
<td><em>Tholymis tillarga</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Park</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4.81</td>
<td>Dum Dum</td>
<td><em>Orthetrum s.</em></td>
<td>18.00 hr</td>
<td>5.48 hr</td>
<td>17.50 hr</td>
</tr>
<tr>
<td></td>
<td>Park</td>
<td><em>sabina</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.4.81</td>
<td>Samsingh</td>
<td><em>Pantala flavescens</em></td>
<td>14.30 hr</td>
<td>Not recorded</td>
<td>Not recorded</td>
</tr>
<tr>
<td>29.9.88</td>
<td>Tumin</td>
<td><em>Neurothemis i. intermedia</em></td>
<td>9.30-9.45 hr</td>
<td>Not recorded</td>
<td>Not recorded</td>
</tr>
</tbody>
</table>

**BRIEF PARTICULARS OF THE LOCALITIES OF OBSERVATIONS**

- Bankura: A town in the district of Bankura, West Bengal.
- Calcutta: Three hundred years old city, with parks and tanks.
- Darjeeling: A town in the eastern Himalaya of West Bengal on an altitude of c.2000 m.
- Dum Dum (= DD Park): 10.7 kms north of Calcutta, in the district of 24 Parganas. It is a 35 ha semi-urbanised residential area; with ponds, gardens and sweage canals.
- GT Road: A national highway from Calcutta to Delhi.
- Hazaribagh: A district in Bihar. Observations were made in a dry deciduous forest, The Hazaribagh National Park.
- Joypur forest: A small forest with Sal (*Shorea robusts*) plantations, in Bankura.
- Kachugaon: A tropical semi-evergreen forest in Goalpara district of Assam.
- Kulik: A tributari of the river Mahanadi in the district West Dinajpur of West Bengal.
- Purulia: A town in the district of Purulia, a dry zone of West Bengal.
- Raimona: A tropical semi-evergreen forest in the district of Goalpara of Assam.
- Samsingh: A part of the eastern Himalaya (c. 1000 m) in the district of Darjeeling.
- Tumin: A village at an elevation from c. 1400-1800 m. in Sikkim, East District, eastern Himalaya. It is rich with hill streams, paddy cultivation and vegetables gardens.
- VIP Road: A high way from Dum Dum Air Port to Calcutta, fringed with trees, broad sweage canals, and villages.

**DISCUSSION**

Cannibalism or intraspecific predator-prey relationship in Odonata is well known (Utzeri 1980). Interspecific predator-prey relationship have been reported by Fraser (1933), Bhargava and Prasad (1974), Prasad and Biswas (1980). From the present records (Table-1) it appears that dragonflies prey upon species smaller than themselves. Similar observations have also been made in the cases of other insect prey. Hence it can be presumed that the selection of prey by Odonata is purely visual; and that the size of the prey plays an important role in its selection.
Heterospecific pair formation (A-c) is also known in Odonata; but copulation is rare. Bick (1972, pers. comm.), Bick & Bick (1981) reported only two cases of oviposition by heterospecific pairs. Mitra and Lahiri (1972) recorded the tandem flights of *Pseudagrion r. rubriceps* and *Pseudagrion microcephalum*. It was noticed that both sexes of each species seek partners during breeding seasons, and that both sexes participate in selecting partners. It would not be unjustified, therefore, to conclude that visual recognition of sexes has not been achieved in these cases, but mechanical isolation prevents oviposition (Paulson 1974).

Territory formation and its defence by Odonata have been described by several workers (Corbet 1962, 1980; Kormondy 1959) although Moore (1952) concluded that "dragonflies do not possess territories in the accepted sense of the term". According to Corbet (1980), Mathavan (1975) the dimension of the territories decreases as the density of male population increases; according to Mitra (1987) the dimension of the territories depend on two factors: area of the aquatic body and some intrinsic factors. Observations on *Tholymis tillarga*, *Crocothemis s. servilia* and *Orthetrum s. sabina* reveal that the dimensions of territories depend on the density of male population, area of the aquatic body and some intrinsic factors. Territorial defence was not confined only in horizontal direction but also in the vertical direction. In case of overcrowded breeding area Utzeri and Gianandrea (1988) reported that males could not get opportunity to form a territory wander about the area for the day. In the case of *Orthetrum s. sabina* of North Bengal it was noted that those who could not get comfortable area for breeding wait outside the aquatic body. Absence of distinct territory in those *Orthetrum s. sabina* due to overcrowdedness agrees with the observations of Bick (1972) on *Calopteryx virgo* (footnote to Table-17). Interspecific competition for territory is also known (Moore 1964). Sometimes the territories of two species viz. *Crocothemis s. servilia* and *Orthetrum s. sabina* either overlap or one intrude in the territory of the other. In these cases of competition/intrusion, competitor/intruder is removed by the other from the territory but none can remove the opponent from the area (Tables 2 & 17). It is, therefore, contended that Moore's (1964) observation does not hold good for these species. Reaction against the intruders in the territories is also probably restricted by the size limits; smaller species like *Neurothemis t. tullia*, *Diplacodes trivialis*, *Brachythemis contaminata* and several coenagronid damselflies are tolerated by *Tholymis tillarga*, *Crocothemis s. servilia* and *Orthetrum s. sabina*. Similar observations were also made by Kormondy (1959) in some species of *Tetragoneura*. Higashi (1969) reported that the territory of *Crocothemis s. servilia* is not permanent. Present observations on above species agree with Higashi's observations. According to Huxley (1953) dragonflies have the highest development of compound eyes; and sight is their most highly developed sense (Corbet 1962). From the above observations it is contended that Corbet (op. cit.) is right to consider that habitat selection of the adult dragonflies is primarily visual.
Gambles (1971) described nocturnal aggregations of some species including *Bradinopyga geminata* of India. In Calcutta *Lathrecista a. asiatica* regularly remain in huge swarm on the overhead wires in the afternoon of summer days. In 1973 December, I found large numbers of *Ceriagrion olivaceum* and *Aciagrion pallidum* to roost on the bank of the river Sankosh, Assam. Observations on the aggregation of different species in different seasons at Dum Dum Park indicate that post-monsoon is the best period for collecting Odonata in the area. Since mass emergence of any species was not observed, classification of the fauna in the area on the basis of seasonal distribution could not be made. Nevertheless, with the records of emergence (Table-18), available data on flight period and activity pattern of those species, it can be said that the emergence rhythm is 'composite" (sensu Cloudsley-Thompson 1956, 1980). Moreover, this conclusion agrees with Moore (1953). Most of the species emerging between November-April, occur almost throughout the year; while those like, *Tholymis tillarga, Bradinopyga geminata* emerge in August-October and remain on the wing only for a part of the year. Montgomery's (1944) observations on *Argia* in the United States does not apply to those Calcutta species.

Reaction towards moving objects e.g. vehicles and men have been reported by Acharya (1961), Corbet (1962), Mitra (1974 b) and Worth (1962) but no one could suggest a possible reason for the behaviour. During the observations it appeared that the reaction may be due to two factors—visual recognition of large object in the environment, and temporary displacement of the dragonflies from the area of operation, since sometimes the whole swarm of dragonflies e.g. *Pantala flavescens* follows the vehicle. Corbet & Miller (1991) could observe this behaviour in *B. contaminata* but failed to pursued *D. trivialis*.

Death caused by automobiles, accidents, starvations and for other reasons had been described by Kiauta (1965, '71), Millard (1905), Mitra and Mukherjee (1967), Miyakawa (1961) and Moore (1951) and natural deaths by Mitra (1977). Borror (1934), Corbet (1962, 1980), Gambles (1960), Kormondy (1959) and Moore (1951) discussed the longevity of dragonflies.

Specimens, suspected as examples of natural deaths, were not always old, some of them were subadult also. Therefore, it can be said that senility is not the only reason for natural deaths. Attack on living dragonflies by ants were possible only in the cases of weak dragonflies. Deaths due to suction into automobiles grilles take place when dragonflies cross roads and charged by the vehicles from the sides. On the other hands when the vehicles meet the dragonflies head on they fly up and avoid the impact.

Nonodonate prey species of dragonflies have been recorded by Foulton (1911), Fraser (1933), Kidd (1954), Larsen (1981), Mathur (1960), Mitchel (1910), Moore (1954), Subramanyam (1936), Tümpel (1901), Tyagi (1981) and Wright (1946). The present list (Table-9) of prey of Indian dragonflies is the first
of its kind. *Solenopsis geminata, Paratrachina longicornis* and *Aphis cracivora* are new records as prey of dragonflies. Predators had been reported by Corbet (1962), Fraser (1933), Kennedy (1950), Kumar and Prasad (1977), Le Gross (1953), Mitra (1974c) and Ram and Prasad (1978) and Wright (1946). *Corvus splendens* is the new record among bird predators of Indian dragonflies, and two species of spiders are also new additions to this list.

Specimens of some species of dragonflies often enter houses both during the day and night. Fraser (1933, 1936) and Corbet (1962) noted that forest dwelling and crepuscular species enter houses. Out of thirteen species recorded inside the houses of Calcutta and Dum Dum Park (Tables 10 & 11) *Gynacantha dravida, Gynacantha rammohani, Tholymis tillarga, Bradinopyga geminata* and *Zyxomma petiolatum* show crepuscular habit. My experiences in the forests of Assam valley, the Eastern Himalaya, the Chota Nagpur Plateau, and the Orissa Highlands do not agree with observations of Fraser and Corbet, since I neither observed nor received any specimen collected from the forest rest houses. Possibly dragonflies enter houses in Calcutta and its environs as a response to shrinkage of their natural habitats.

The means of thermo-regulation in Odonata is variable (Table 14). Besides different types of postures of different dragonflies, certain species viz. *Bradinopyga geminata* has crepuscular habit which help in thermo-regulation (Sensu Cloudsley-Thompson 1953, 1966 & 1975) and protection from the predators. It is, therefore, conjectured that its crepuscular habit is an evolutionary adaptation (Sensu Southern 1974). The habit of *Brachythemis contaminata, Diplacodes trivialis* and *Neurothemis t. tullia* to remain in 'obelisk' position in the hot sun agrees with the habit of *Trithemis festiva* of Java (Corbet 1962). *Crocothemis s. servilia* and *Ischnura a. aurora* have been observed to rest in the bush in the midsummer at Hazaribagh.

Nocturnal aggregation of species agree with the observations of Bick (1949). The perching mechanism, in general agree with the observations of O' Farrell (1971).

No list of the breeding season and emergence of Odonata in eastern India is available, hence no data for comparison is available. The present list indicate that breeding season differ from species to species though post-monsoon season appears to be favourable for most of the species. The general method of breeding agrees with the method described by Bick and Hornuff (1966), Bick and Sulzbach (1966), Corbet (1962), Furtado (1972, 1974 & 1975) and Moore (1952 & 1960). The unusual mating behaviour of *Ischnura aurora* noted by Rowe (1978) was not observed by me in any species. Egg laying of female *Ceriagrion coromandelianum* and *Ischnura aurora aurora* unaccompanied by male as reported by Srivastava and Babu (1984 a, b) were also not recorded by me. Gambles (1960) observed that smaller species in Nigeria, apparently breed all
the year round, while the larger species breed in a definite time of the year. From the present list it can be said that smaller species such as *Agriocnemis p. pygmaea* and *Ischnura senegalensis* breed most part of the year, while breeding periods of others are confined to a particular season. The unusual breeding behaviour of *Orthetrum s. sabina*, observed in September 1982 and August 1983 at Dum Dum Park is probably due to seasonal isolation as reported by Paulson (1974) and not temporal isolation (Paulson 1973), as the two seasons vary. Though Kumar (1979) reported that *Orthetrum s. sabina* breeds almost round the year in Dehra Dun (alt. 650 m; 29°57'-31°2' N., 77°35'-78°20'E) in the Western Himalaya, contrary to my experiences in different parts of Eastern India where breeding of the species was observed only in cool season (Nov.-Jan.). According to Watson (1984) *Orthetrum sabina* is a complex. Hence it may be conjectured that in this case probably ethological difference has evolved, and morphological difference has not yet achieved, which may develop in due course.

Different species fly at different heights (Table 15), but none regularly fly above 4 m. Flight is probably determined by the distribution of food species (Corbet 1981); however, other factors in the past may have determined the height of the flight of the dragonflies to which the food species of dragonflies have become adapted. The evolutionary priority of cause and effect cannot, therefore, be determined (sensu Cloudsley—Thompson 1960, 1980). Continuous hovering over open land by a swarm of *Crocothemis s. servilia* at mid-day in the hot summer, and hovering by *Pantala flavescens* over open space before and after rains during the post monsoon period in Calcutta, opens interesting fields of research. Migratory swarms of *Pantala flavescens* could be observed in Calcutta since 1966 (Mitra 1974a). Though Mitra (1974a) and Reicholff (1973) recorded swarms of individual species (only *P. flavescens*), Pinhey (1979) reported mixed swarm of *Pantala flavescens* and *Hemianax ephippiger* near Zambezi river. Hence it can be contended that migratory swarms of Odonata may be composed of either one species or more than one species.

**SUMMARY**

Data on field observations on the habits and habitats of adult Odonata of eastern India—Eastern Himalaya (Darjiling and Sikkim), Assam Valley, Chhotanagpur plateau (Hazaribagh of Bihar and Purulia of West Bengal) and Ganga Plain have been collected since 1966.

Observations could be made on the following subjects *viz.*

(A) Interspecies relation (Predator-prey relation, competition for breeding territory, interspecies pair formation); (B) Intraspecies relation (Defence of breeding territories, disturbances to other breeding pairs, fight for food); (C) Reaction towards moving objects; (D) Death in adult dragonflies (Natural
death, death due to attack of predators—lizards, birds, spiders and ants; due to starvations; accidents caused by automobiles and due to unknown cause); (E) Non-Odonata prey; (F) Records of Odonata entering houses of Calcutta and suburbs; (G) Migratory flights; (H) Posture of rest/perch; (I) Thermoregulation; (J) Vertical ranges of flight; (K) Breeding seasons; (L) Dimensions of breeding territories; (M) Emergence of imago.

Observations were made on following species; *Copera marginipes* Rambur, *Pseudagrion r. rubriceps* Selys, *Pseudagrion microcephalum* (Rambur), *Ceriagrion coromandelianum* (Fabricius), *Ceriagrion cerinorubellum* (Brauer), *Ceriagrion olivaceum* Laidlaw, *Aciagrion pallidum* Selys, *Ischnura a. aurora* Brauer, *Ischnura senegalensis* (Rambur), *Agriocnemis p. pygmaea* (Rambur), *Onychargia atrophyana* Selys, *Ictinogomphus rapax* (Rambur), *Lathrecista a. asiatica* (Fabricius) *Orthetrum sabina* (Drury), *Bradinopyga geminata* (Rambur), *Zyxomma petiolatum* Rambur, *Crocothemis s. servilia* (Drury), *Diplacodes trivialis* (Rambur), *Brachythemis contaminata* (Fabricius), *Trithemis pallidinervis* (Kirby), *Neurothemis t. tullia* (Drury), *Neurothemis i. intermedia* (Rambur), *Pantala flavescens* (Fabricius), *Tholymis tillarga* (Fabricius), *Rhyothemis v. variegata* (Linnaeus). References on the habits and habitats of adult Odonata observed by the author and others, in other parts of India have been mentioned in the discussions.

ACKNOWLEDGEMENTS

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APPENDIX

ODONATA OF EASTERN INDIA

(Arunachal Pradesh, Assam, Bihar Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Sikkim, Tripura, West Bengal).*

(Fig. 1) Map showing the states under consideration.

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<tr>
<th>ORDER</th>
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<td>CALOPTERYGIDAE</td>
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<tr>
<td>GENUS</td>
<td><em>Neurobasis</em> Selys</td>
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*Neurobasis chinesis chinensis* (Linnaeus)

Genus *Vestalis* Selys

*Vestalis gracilis gracilis* (Rambur) (H M)

*Vestalis apicalis apicalis* Selys

*Vestalis smaragdina smaragdina* Selys (M)

Genus *Echo* Selys

*Echo margarita margarita* Selys (E H)

*Echo margarita tripartita* Selys

Genus *Matrona* Selys

*Matrona basilaris basilaris* Selys (E)

*Matrona basilaris nigripectus* Selys (E I)

GENUS *Caliphaea* Selys

*Caliphaea confusa* Hagen (in selys 1859)

FAMILY EUPHAEIDAE

Genus *Bayadera* Selys

*Bayadera hyalina* Selys

*Bayadera indica* (Selys)

*Bayadera kali* Cowley

*Bayadera longicauda* Fraser

Genus *Anisopleura* Selys

*Anisopleura comes* Hagen

*Anisopleura lestoides* Selys

* Based on recent studies made by the author.

*New records*: Marked : = A Oriental region; B = India; C = North India; D = Eastern India; E = Arunachal Pradesh; F = Assam; G = Bihar; H = Manipur; I = Mizoram; J = Nagaland; K = Orissa, L = Sikkim; M = Tripura; N = West Bengal.
Anisopleura subplatystyla Fraser (L)
Anisopleura vallei St. Quentin
Anisopleura lief tincki Prasad & Ghosh

Genus Euphaea Selys
Euphaea ochracea ochracea Selys (E H N)
Euphaea ochracea brunnea Selys
Euphaea cardinalis (Fraser)
Euphaea guerini masoni Selys

Genus Schmidtiphaea Asahina
Schmidtiphaea schmidi Asahina

FAMILY AMPHIPTERYGIDAE
Genus Philoganga Kirby
Philoganga montana (Selys)

FAMILY CHLOROCYPHIDAE
Genus Libellago Selys
Libellago lineata lineata (Burmeister) (M)

Genus Rhinocypha Rambur
Rhinocypha cuneata Selys
Rhinocypha fenestrella (Rambur) (E F)
Rhinocypha ignipennis Selys
Rhinocypha spuria Selys (F I)
Rhinocypha quadriramulata Selys (H K)
Rhinocypha bifenestrata Fraser
Rhinocypha unimaculata Selys
Rhinocypha bifasciata Selys
Rhinocypha trifasciata Selys
Rhinocypha immaculata Selys (H)
Rhinocypha bisignata Selys (D)
Rhinocypha trimaculata Selys
Rhinocypha perforata beatifica Fraser
Rhinocypha perforata limbata Selys
Rhinocypha biforata biforata Selys
Rhinocypha biforata delimbata Selys
Rhinocypha vitrinella Fraser
FAMILY LESTIDAE
Genus *Lestes* Leach

*Lestes dorothea* Fraser
*Lestes elatus* Hagen (in Selys, 1862)
*Lestes viridulus* Rambur (K)
*Lestes nodalis* Selys (K)
*Lestes gaorensis* Lahiri
*Lestes umbrinus* Selys (G K)
*Lestes platystylus* Rambur
*Lestes praemorsus decipiens* (Kirby)
*Lestes praemorsus sikkima* Fraser
*Lestes nigriceps* Fraser
*Lestes thoracicus* Laidlaw
*Lestes concinnus* Hagen (in Selys 1862)

Genus *Indolestes* Fraser

*Indolestes cyaneus* (Selys)
*Indolestes indicus* Fraser

Genus *Orolestes* McLachlan

Orolestes durga Lahiri

FAMILY SYNLVESTIDAE
Genus *Megalestes* Selys

*Megalestes major* Selys (I)
*Megalestes irma* Fraser
*Megalestes lieftincki* Lahiri
*Megalestes raychandhurii* Lahiri

FAMILY MEGAPODAGRIONIDAE
Genus *Burmargiolestes* Kennedy

*Burmargiolestes laidlawi* Lieftinck

FAMILY PLATYSTICTIDAE
Genus *Protisticta* Selys

*Protisticta himalaica* Laidlaw

Genus *Drepanosticta* Laidlaw

*Drepanosticta carmaichaeli* (Laidlaw)
*Drepanosticta polychromatica* Fraser
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<td>Calicnemia sudhaee sp.n. (Fig. 2)</td>
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(Abdomen; 28-30mm; Hind wing 20-22mm; Male post nodals in fore wing 16-18; hind wing 13-17; Female post nodals in fore wing 16; in hind wing 15. Differs from Calicnemia pulverulans in length of hind wing and colour pattern.)*

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* Lahiri (1985 : Rec. zool. Surv. India 82 : 62-65) described the species in the name of his mother. Here the spelling has been corrected.

Fig. 1. Map showing the states under consideration.
Fig 2. Anal appendages of *Calicnemia sudhaae* Sp.n.
A. Dorsal view. B. Lateral view.
(The species has been named in honour of my mother Late Sudha Rani Mitra. The full description of the species will be published shortly).
Fig 3. Head and last part of the abdomen of *Gomphidia leonora* sp. n.
A. Head of the species. B. Last part of the abdomen.
(The species has been named in honour of senior odonatologist Mrs. Dr. Leonora K. Gloyd. Full description of the species will be published shortly).
Coeliccia vacca Laidlaw
Coeliccia schmidti Asahina
Coeliccia sarbottama Lahiri
Coeliccia rotundata Asahina
Coeliccia rossi Asahina

Genus : Indocnemis Laidlaw
Indocnemis kempi Laidlaw

Genus Copera Kirby
Copera marginipes (Rambur) (H)
Copera vittata serapica (Selys) (E)
Copera vittata assamensis Laidlaw
Copera ciliata (Selys)
Copera superplatypes Fraser

FAMILY COENAGRIONIDAE

Genus Pseudagrion Selys
Pseudagrion microcephalum (Rambur)
Pseudagrion australasiae Selys
Pseudagrion malabaricum Fraser
Pseudagrion decorum (Rambur)
Pseudagrion hypermelas Selys
Pseudagrion rubriceps rubriceps Selys (K M)
Pseudagrion spencei Fraser

Genus Ceriagrion Selys
Ceriagrion coromandelianum (Fabricius)
Ceriagrion fallax cerinomelas Lieftinck (I)
Ceriagrion olivaceum Laidlaw
Ceriagrion cerinorubellum (Brauer) (K)
Ceriagrion azureum (Selys) (I)
Ceriagrion coeruleum Laidlaw

Genus Cercion Navas
Cercion malayanum Selys
Cercion calamorum dyeri (Fraser) (K)

Genus Aciagrion Selys
Aciagrion occidentale Laidlaw
Aciagrion hisopa hisopa (Selys)
Aciagrion tillyardi Laidlaw
Aciagrion approximans (Selys) (L)
Aciagrion pallidum Selys (K M)
Aciagrion azureum Fraser (E)
Aciagrion olympicum Laidlaw

Genus: Ischnura Charpentier
Ischnura senegalensis (Rambur)
Ischnura elegans elegans (Vander Linden)
Ischnura forcipata Morton
Ischnura aurora aurora Brauer (I)
Ischnura rufostigma rufostigma Selys
Ischnura rufostigma annandalei Fraser (K)
Ischnura rufostigma mildredae Fraser (B)

Genus: Rhodischnura Laidlaw
Rhodischnura nursei (Morton)

Genus: Enallagma Charpentier
Enallagma parvum Selys

Genus: Argiocnemis Selys
Argiocnemis rubescens rubeola Selys

Genus: Argiocnemis Selys
Argiocnemis lacteola Selys
Argiocnemis pieris Laidlaw
Argiocnemis clauseni Fraser
Argiocnemis nana (Laidlaw) (B)
Argiocnemis splendidissima Laidlaw (F M)
Argiocnemis pygmaea pygmaea (Rambur)
Argiocnemis femina femina (Brauer)
Argiocnemis dabreui Fraser

Genus: Mortonagrion Fraser
Mortonagrion aborense (Laidlaw)

Genus: Himalagrion Fraser
Himalagrion exclamatione Fraser

Genus: Onychargia Selys
Onychargia atrocyana Selys (H)

SUBORDER ANISOZYGOPTERA
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<th>FAMILY</th>
<th>Genus</th>
<th>EPIOPHLEBIIIDAE</th>
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<td>Tillyard</td>
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<td><strong>Nihonogomphus</strong></td>
<td><strong>Pulcherrimus</strong></td>
<td>(Fraser) (B)</td>
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<td>Lahiri</td>
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<td><strong>Striatus</strong></td>
<td>Fraser (C)</td>
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<td><strong>Biforceps</strong></td>
<td>Selys (E)</td>
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<td>(Rambur)</td>
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<td><strong>Meghalayanus</strong></td>
<td>Lahiri</td>
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<td><strong>Aureus</strong></td>
<td>(Laidlaw) (E)</td>
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<td><strong>Inglisi</strong></td>
<td>Fraser</td>
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<td><strong>Lineatus</strong></td>
<td>(Selys) (K M)</td>
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<td><strong>Peritans</strong></td>
<td>Selys (E G)</td>
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<td><strong>Ictinogomphus</strong></td>
<td><strong>Angulosus</strong></td>
<td>Selys</td>
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Ictinogomphus atrox (Selys)
Ictinogomphus distinctus Ram

Genus Gomphidia Selys
Gomphidia williamsoni Fraser
Gomphidia t-nigrum Selys
Gomphidia leonorae Sp.n. (Fig. 3)

(Abdomen + Anal appendages 57.00mm; Hind wing 47.00mm; the measurements agree with the measurements of G.krugeri Martin but differs from G.krugeri in color pattern in head and thorax.)*

Genus Anormogomphus Selys
Anormogomphus heteropterus Selys

Genus Davidius Selys
Davidius aberrans senchallensis Fraser
Davidius malloryi Fraser
Davidius davidi assamensis Laidlaw.

Genus Dubitogomphus Fraser
Dubitogomphus bidentatus (Fraser)

Genus Cyclogomphus Selys
Cyclogomphus heterostylus Selys

Genus Anisogomphus Selys
Anisogomphus occipitalis Selys
Anisogomphus caudalis Fraser
Anisogomphus bivittatus (Selys)
Anisogomphus orites Laidlaw

Genus Burmagomphus Williamson
Burgamomphus pyramidalis pyramidalis Laidlaw
Burgamomphus hasimaricus Fraser
Burgamomphus sivalikensis Laidlaw

Genus Platygomphus Selys
Platygomphus dolabratus Selys

Genus Megalogomphus Campion
Megalomomphus bicornutus (Fraser)
Megalomomphus flavicolor (Fraser)

Genus Perissogomphus Laidlaw

Perissogomphus stevensi Laidlaw

Genus **Heliogomphus** Laidlaw

Heliogomphus selysi (Fraser)
Heliogomphus spirillus (Fraser)

Genus **Asiagomphus** Asahina

Asiagomphus odoneli (Fraser)
Asiagomphus personatus (Selys)

FAMILY AESHNIDAE

Genus **Gynacantha** Rambur

Gynacantha dravida Lieftinck
Gynacantha bayadera Selys
Gynacantha khasiaca Mc Lachlan
Gynacantha subinterrupta Rambur (I)
Gynacantha bainbriggei Fraser
Gynacantha odoneli Fraser
Gynacantha albistyla Fraser
Gynacantha basiguttata Selys
Gynacantha biharica Fraser
Gynacantha arnaudi Asahina
Gynacantha rammohani Mitra & Lahiri

Genus **Anax** Leach

Anax imperator imperator Leach
Anax guttatus Burmeister (E)
Anax parthenope parthenope Selys'
Anax nigrofasciatus nigrolineatus Fraser

Genus **Anaciaeschna** Selys

Anaciaeschna jaspedia (Burmeister)

Genus **Hemianax** Selys

Hemianax ephippiger (Burmeister) (F K)

Genus **Oligoaeschna** Selys

Oligoaeschna martini (Laidlaw)
Oligoaeschna decorata Lieftinck
Oligoaeschna khasiana Lieftinck

Genus **Periaeschna** Martin
Periaeschna unifasciata Fraser
Periaeschna magdalena Martin
Periaeschna flinti assamensis Asahina
Periaeschna nocturnalis Fraser

Genus L Tetracanthagyna Selys
Tetracanthagyna waterhousei MacLachlan

Genus L Cephalaeschna Selys
Cephalaeschna viridifrons (Fraser)
Cephalaeschna masoni (Martin)
Cephalaeschna acutifrons (Martin)
Cephalaeschna orbifrons Selys

Genus L Petaliaeschna Fraser
Petaliaeschna fletcheri Fraser

Genus L Gynacanthaeschna Fraser
Gynacanthaeschna sikkima (Karsch)

Genus L Polycanthagyna Fraser
Polycanthagyna ornithocephala MacLachlan

Genus L Aeshna Fabricius
Aeshna petalura petalura Martin

Genus L Planaeschna McLachlan
Planaeschna intersedens (Martin)

FAMILY L CORDULEGASTERIDAE
Genus L Anotogaster Selys
Anotogaster nipalensis Selys
Anotogaster gregoryi Fraser
Anotogaster basalis palampurensis Fraser

Genus L Chlorogomphus Selys
Chlorogomphus preciosus preciosus (Fraser)
Chlorogomphus atkinsoni (Selys)
Chlorogomphus campioni (Fraser)
Chlorogomphus fraseri St. Quentin
Chlorogomphus selysi Fraser
Chlorogomphus mortoni Fraser

Genus L Cordulegaster Leach
Cordulegaster brevistigma brevistigma (Selys)
   Genus   **Neallogaster** Cowley

**Neallogaster hermioni** (Fraser)
   FAMILY   CORDULIIDAE
   Genus   **Idionyx** Hagen

Idionyx optata Selys
Idionyx imbricata Fraser
Idionyx intricata Fraser
   Genus   **Macromia** Rambur

Macromia moorei moorei Selys (F)
Macromia pallida Fraser
Macromia flavovittata Fraser
Macromia flavicolorata Fraser
Macromia flavicincta Selys
Macromia cingulata Selys
   Genus   **Epophthalmia** Burmeister

Epophthalmia vittata vittata Burmeister (G)
Epophthalmia vittigera bellicosa Leiftinck (N)
Epophthalmis frontalis frontalis Selys
   Genus   **Hemicordulia** Selys

Hemicordulia asiatica Selys
   Genus   **Somatochlora** Selys

Somatochlora daviesi Lieftinck
   FAMILY   LIBELLULIDAE
   Genus   **Urothemis** Brauer

Urothemis signata signata (Rambur)
   Genus   **Macrodiplax** Brauer

Macrodiplax cora (Brauer)
   Genus   **Aethriamanta** Kirby

Aethriamanta brevipennis (Rambur) (E)
   Genus   **Tetrathemis** Brauer

Tetrathemis platyptera Selys
   Genus   **Hylaeothemis** Ris

Hylaeothemis fruhstorferi apicalis Fraser (K)
   Genus   **Lyriothemis** Brauer
Lyriothemis acigastra (Selys)
Lyriothemis bivittata (Rambur)
Lyriothemis cleis (Brauer) (B)

Genus Agrionoptera Brauer

Agrionoptera insignis insignis (Rambur)

Genus Amphithemis Selys

Amphithemis curvistyla Selys (I)
Amphithemis vacillans (Selys)

Genus Nannophya Rambur

Nannophya pygmaea (Rambur)

Genus Lathrecista Kirby

Lathrecista asiatica asiatica Fabricius (E G H K)

Genus Cratilla Kirby

Cratilla lineata lineata (Brauer) (K)

Genus Potamarcha Karsch

Potamarcha congener (Rambur) (F K)

Genus Orthetrum Newmann

Orthetrum anceps (Schneider) (A I)
Orthetrum brunneum brunneum (Fonscolombe) (E)
Orthetrum cancellatum cancellatum (Linnaeus) (D)
Orthetrum chrysis (Selys)
Orthetrum glaucum (Brauer) (K)
Orthetrum japonicum internum McLachlan (F)
Orthetrum luzonicum (Brauer) (K)
Orthetrum pruinosum neglectum (Rambur) (E G)
Orthetrum sabina sabina (Drury) (I J)
Orthetrum taeniolatum (Schneider)
Orthetrum testaceum testaceum (Burmeister) (F K)

*Orthetrum triangulare triangulare (Selys) (H)

Genus Palpopleura Rambur

Palpopleura sexmaculata sexmaculata (Fabricius) (E J)

Genus Brachydiplax Brauer

* Orthetrum chandrabali Mehrotra and O. ganeshi Mehrotra have been considered synonyms of O.t. triangulare (Selys).
Brachydiplax sobrina (Rambur)
Brachydiplax farinosa Kruger
Brachydiplax chalybea chalybea Brauer
Genus Acisoma Rambur
Acisoma panorpoides panorpoides Rambur (I)
Genus Diplacodes Kirby
Diplacodes nebulosa (Fabricius) (K)
Diplacodes trivialis (Rambur)
Genus Indothemis Ris
Indothemis carnatica (Fabricius)
Indothemis linbata limbata (Selys) (D I)
Genus Crocothemis Brauer
Crocothemis servilia servilia (Drury)
Crocothemis erythraea erythraea (Brulle)
Genus Bradinopyga Kirby
Bradinopyga geminata (Rambur) (K M)
Genus Brachythemis Brauer
Brachythemis contaminata (Fabricius)
Genus Neurothemis Brauer
Neurothemis fulvia (Drury) (I)
Neurothemis fluctuans (Fabricius) (F I)
Neurothemis intermedia intermedia (Rambur) (H K M N)
Neurothemis intermedia atalanta Ris (K)
Neurothemis tullia tullia (Drury)
Genus Rhodothemis Ris
Rhodothemis rufa (Rambur) (D)
Genus Sympetrum Newman
Sympetrum hypomelas (Selys) (G H I)
Sympetrum orientale (Selys)
Genus Trithemis Brauer
Trithemis festiva (Rambur) (G K N)
Trithemis aurora (Burmeister) (I)
Trithemis pallidinervis (Kirby) (G M)
Genus Zygonyx Hagen
Zygonyx iris iris Selys (H)
Zygonvx iris davina Fraser
Zygonvx iris intermedia Lahiri

**Genus** 
*Rhyothemis* Hagen

*Rhyothemis variegata variegata* (Linnaeus & Johansson) (H)
*Rhyothemis plutonia* Selys
*Rhyothemis obsolescens* Kirby
*Rhyothemis triangularis* Kirby

**Genus** 
*Onychothemis* Brauer

*Onychothemis testacea ceylanica* Ris

**Genus** 
*Zyxomma* Rambur

*Zyxomma patiolatum* Rambur (N)

**Genus** 
*Tholymis* Hagen

*Tholymis tillarga* (Fabricius) (I)

**Genus** 
*Pantala* Hagen

*Pantala flavescens* (Fabricius) (I)

**Genus** 
*Pseudotramea* Fraser

*Pseudotramea prateri* Fraser

**Genus** 
*Tramea* Hagen

*Tramea basilaris burmeisteri* Kirby (N)
*Tramea virginia* (Rambur) (I N)
*Tramea limbata limbata* (Desj.) (D)

**Genus** 
*Camacinia* Kirby

*Camacinia gigantea* (Brauer)

**Genus** 
*Hydrobasilieus* Kirby

*Hydrobasilieus croceus* (Brauer)
PLATES
Fig. (a) Posture of rest of *Trithemis pallidinervis* (Kirby). (Top)
(b) Posture of rest of *Crocothemis s. servilia* (Drury) (Middle)
(c) Posture of rest of *Lathrecista a. asiatica* (Fabricius) (Bottom)
Fig. (a) Posture of rest of *Lathrecista a. asiatica* (Fabricius) (Top)
(b) Posture of rest of *Neurothemis i. intermedia* (Rambur) (Middle)
(c) Thermoregulation of *Neurothemis i. intermedia* (Rambur) in the bush. (Bottom)
Fig. (a) Thermoregulation of *Ischnura a. aurora* (Brauer) in the bush. (Top)
(b) Breeding of *Crocothemis s. servilia* (Drury). (Bottom)