OCCASIONAL PAPER NO. 166

RECORDS OF THE
ZOOLOGICAL SURVEY OF INDIA

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

TRIDIB RANJAN MITRA

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Tridib Ranjan Mitra
Zoological Survey of India, Calcutta

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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

Locality	*Date*	*Predator*	*Prey*
Calcutta	4.2.67	*Ischnura senegalensis*	*Agriocnemis p. pygmaea*
Calcutta	15.6.67	*Orthetrum s. sabina*	*Ceriagrion coromandelianum*
Dum Dum Park	1.8.72	*Orthetrum s. sabina*	*Ischnura senegalensis*
Naihati	12.10.74	*Ceriagrion coromandelianum*	*Agriocnemis p. pygmaea*
Hazaribagh	31.10.74	*Ischnura senegalensis*	*Agriocnemis p. pygmaea*
Dum Dum Park	19.9.81	*Orthetrum s. sabina*	*Agriocnemis p. pygmaea*

* Features observed three or more times have been considered as common.

Table - 2. Interspecies competition for territory

Locality	*Date*	*Territory of species*	*Competitor / Intruder*
Dum Dum Park	15.9.82	*Crocothemis s. servilia*	*Orthetrum s. sabina*
Dum Dum Park	16.10.82	*Crocothemis s. servilia*	*Orthetrum s. sabina*
Purulia	30.11.86	*Crocothemis s. servilia*	*Orthetrum s. sabina*
Purulia	2.12.86	*Orthetrum s. sabina*	*Crocothemis s. servilia*

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. tullia* 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 occassions; 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

Locality Dum Dum Park. Period of observations 1967-1988

Season	*Names of species*
Cool (December - February)	*Pseudagrion r. rubriceps, Pseudagrion microcephalum, Agriocnemis p. pygmaea, Ischnura senegalensis, Ceriagrion coromandelianum, Diplacodes trivialis, Brachythemis contaminata, Orthetrums s. sabina, Crocothemis s. servilia, Neurothemis t. tullia* (Density of population of each speciles than that of post monsoon).

Summer (March-May)	*Ischnura senegalensis, Agriocnemis p. pygrmaea, 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 *Pesudagrion 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

Locality	Species	Objects	Reaction
Calcutta	*Ictinogomphus rapax*	Trams & Bus	Follows and returns to the approximate point of start. distance travelled about 3 metres.

Dum Dum Park	*Pseudagrion microcephalum*	Man	Follows but does not hit the person and returns to the approximate point of start. Distance travelled about 1 meter.
Dum Dum Park	*Brachythemis contaminata & Diplacodes trivialis*	Man	Follow persons, remaining about 30 cms away from the person and returns to the approximate point of start. Distance travelled about 1-2 meters.
VIP Road	*Crocothemis s. servilia & Pantala flavescens*	Bus	Follow with aggressive attitude and sometimes hit the object; returns to the approximate point of start. Distance travelled about 1-2 meters.

(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 cobewebs 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*

Date	*Locality*	*Odonata*	*Condition of the prey*
11.5.80	VIP Road	*Crocothemis s. servilia* (Female)	Head eaten by Mynah, *Acridotheres tristis,* and released due to author's intervention.
9.6.80	VIP Road	*Tholymis tillarga* (Female)	Attacked by House Crow, *Corvus splendens,* released due to author's intervention, abdomen missing.
14.7.81	VIP Road	*Orthetrum s. sabina* (Female)	Attacked by House Sparrow, *passer domesticus* released due to attack of House Crow on the predator; head of the dragonfly missing.
8.5.82	VIP Road	*Tholymis tillarga* (Male)	Head and part of thorax seriously damaged, by Mynah; released due to author's intervention.
8.4.83	Dum Dum Park	*Trithemis pallidinervis* (Male)	Abdomen eaten by House Sparrow, released due to human intervention.
7.5.83	VIP Road	*Tholymis tillarga* (Male)	Abdomen eaten by House Sparrow, released due to attack of another House Sparrow.

(B) *LIZARDS*

15.10.81	Dum Dum Park	*Orthetrum s. sabina* (Male)	Head eaten by House gecko, *Hemidactylus brookii*
15.10.81	Dum Dum Park	*Crocothemis s. servilia* (Female)	Head and thorax eaten by House gecko
15.10.81	Dum Dum Park	*Brachythemis contaminata* (Male)	Head and thorax eaten by House gecko
26.11.86	Kotulpur	*Crocothemis s. servilia* (Female)	Completely eaten by Garden Lizard, *Calotes versicolor,* within a few minutes of capture.

(C) *SPIDERS*

15.9.71	Calcutta	*Brachythemis contaminata* (Male)	*Plexippus paykulli* killed the specimen

16.11.82	Dum Dum Park	*Agriocnemis p.* pygmaea (Male)	*Crossopriza lyoni* killed the specimen.

(3) Death due to attack of ants (Table-6)

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

(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)

Date	*Locality*	*Odonata*	*Condition of the specimen*
27 10.1980	GT Road	*Diplacodes trivialis* (Male)	Compressed on a grille of a jeep.
27 10.1980	GT Road	*Brachythemis contaminata* (Female)	Compressed on a grille of a jeep.
27 10.1980	GT Road	*Crocothemis s. servilia* (Male)	Compressed on a grille of a jeep.
28.10.1980	GT Road	*Orthetrum s. sabina* (Male)	Head inside the grille of a jeep
28.10.1980	GT Road	*Trithemis palli-dinervis* (Female)	Body pressed on a grille of a jeep.
11.7 1982	VIP Road	*Brachythemis contaminata* (Male)	Pressed by a bicycle

(6) *Death due to unknown cause* (Table-8)

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

(E) *Odonata and their prey* (Table-9)

Date	*Locality*	*Odonata*	*Prey*
9.9.1966	Calcutta	*Brachythemis contaminata*	Housefly, *Musca domestica*
10.11.1966	Calcutta	*Crocothemis s. servilia*	Housefly, *Musca domestica*
5.3.1967	Calcutta	*Ischnura senegal ensis*	Butterfly? (Lycaenidae)
6.6.1977	Darjeeling	*Crocothemis s. servilia*	Butterfly (Unidentified)
10.7 1977	Dum Dum Park	*Diplacodes trivialis*	Ant, *Solenopsis geminata*
11.8.1977	Dum Dum Park	*Pantala flavescens*	Mosquito,? *Anopheles* sp.
12.8.1977	Dum Dum Park	*Pantala flavescens*	Mosquito,? *Anopheles* sp.
10.10.1977	Dum Dum Park	*Pantala flavescens*	Mosquito,? *Anopheles* sp.
12.8.1979	Dum Dum Park	*Pantala flavescens*	Mosquito,? *Anopheles* sp.
12.8.1979	Dum Dum Park	*Tholymis tillarga*	Mosquito,? *Anopheles* sp.
15.5.1981	Dum Dum Park	*Tholymis tillarga*	Mosquito,? *Anopheles* sp.
15.5.1981	Dum Dum Park	*Trithemis palli-dinervis*	Beetle (Unidentified)
15.5.1981	Dum Dum Park	*Tholymis tillarga*	Beetle (Unidentified)
15.6.1981	Dum Dum Park	*Pseudagrion microcephalum*	Ant, *Paratrachina longicornis*
12.11 1982	Dum Dum Park	*Pseudagrion r. rubriceps*	Aphid, *Aphis cracivora*
30.11 1982	Dum Dum Park	*Ceriagrion coromandelianum*	Ant, *Solenopsis geminata*
23.11 1986	Joypur forest	*Orthetrum s. sabina*	Spider (Lycosidae)

(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)

Locality	*List of species*
Calcutta	*Trithemis pallidinervis*
Dum Dum Park	*Pseudagrion microcephalum, Ceriagrion coromandelianum, Ceriagrion cerinorubellum, Agriocnemis pygmaea pygmaea, Onychargia atrocyana, Neurothemis tullia tullia, Zyxomma petiolatum.*

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

Locality	*List of species*
Calcutta	*Gynacantha bayadera, G. dravida, G. rammohani, Hemianax ephippiger, Pantala flavescens.*
Dum Dum Park	*Orthetrum s. sabina, Brachythemis contaminata, Crocothemis s. servilia, Tholymis tillarga, Zyxomma petiolatum.*

(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.

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

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

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

Odonata	*Relation of body with substratum*	*Position of wings*
Ceriagrion coromandelianum	Angular, sometimes nearly parallel	Folded over the thorax
Pseudagrion microcephalum	Angular, sometimes nearly parallel	Folded over the thorax

Trithemis pallidinervis	Angular, sometimes nearly parallel	Opened but not fully stretched
Crocothemis s. servilia	Angular, sometimes nearly parallel	Opened and fully stretched
Brachythemis contaminata	Angular, sometimes nearly parallel	Opened and fully stretched
Neurothemis t. tullia	Angular, sometimes nearly parallel	Opened and fully stretched
Pantala flavescens	Angular, sometimes nearly parallel	Opened and fully stretched
Diplacodes trivialis	Horizontal	Opened and fully stretched
Orthetrum s. sabina	Horizontal	Opened and fully stretched
Lathrecista a. asiatica	Horizontal	Opened and fully stretched
Bradinopyga geminata	Horizontal	Opened and fully stretched

During roosting they do not change their position

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

Odonates ususally 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

Odonata	*Position of the wing*	*Position of the abdomen*
Brachythemis contaminata	Wings cover the anterior part of the thorax and the tip is directed to the ground	Obelisk (Tip of the abdomen directed to the sun)
Neurothemis t. tullia	Wings cover the anterior part of the thorax and the tip is directed to the ground	Obelisk
Diplacodes trivialis	Wings cover the anterior part of the thorax and the tip is directed to the ground	Obelisk

Odonata	*Position of the wing*	*Position of the abdomen*
Orthetrum s. sabina	Wings cover the anterior part of the thorax and the tip is directed to the ground	Horizontal
Lathrecista a. asiatica	Wings cover the anterior part of the thorax and the tip is directed to the ground	Horizontal
Pantala flavescens	Wings fully opened	Hang under leaves
Tholymis tillarga	Wings fully opened	Hang under leaves
**Bradinopyga geminata*	Wings cover the anterior part of the thorax; tip directed to the ground.	Horizontal Three observations: On 4. 4.86; 7.5.86 & 9.6.86

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

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

*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."

(K) *Breeding seasons* (Table-16) (Pl. 3)

Breeding seasons of ten species (Based on tandem & copulating pairs)

Seasons	*Locality*	*Odonata*	*Period of the day* (hour)	*Site*
June-Nov.	Calcutta	*Pseudagrion microcephalum*	6.00-11.00	Over water
June-Nov.	Calcutta & Naihati	*P. r. rubriceps*	6.00-11.00	Over water
June-Nov.	Calcutta & Naihati	*Ceriagrion coromandelianum*	6.00-11.00	Over water
June-Nov.	Calcutta & Bankura	*Ischnura a. aurora*	6.00-11.00	Over water
June-March	Calcutta	*Ischnura senegal-ensis*	6.00-11.00	Over water
Jan.-Dec.	Calcutta	*Agriocnemis p. pygmaea*	6.00-11.00	Over water
June-Oct.	Calcutta & Hazribagh	*Brachythemis contaminata*	17.00-1800	Over water
June-Nov.	Dum Dum Park & Purulia	*Crocothemis s. servilia*	7.00-12.00	Over water
June-Oct.	Dum Dum Park	*Tholymis tillarga*	17.00-17.30	Over water
*Nov.-Jan.	Calcutta Dum Dum Park, Dinajpur, Purulia & Raimona	*Orthetrum s. sabina*	10.00-12.00	Near and away from water

*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.

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

Dimensions of territories of three species

Date	*Odonata*	*Dimension* (approx)	*Aquatic body*	*Remarks*
30.6.74	*Tholymis*	10 × 3 m	Pond	No competitor
22.9.94	*tillarga*	5 × 6 m	Pond	No competitor
15.6.79		4 × 3 m	Drain	No competitor
14.7.79		5 × 2 m	Drain	No competitor
15.8.79		10 × 1 m	Drain	No competitior
15.9.82	*Crocothemis s. servilia*	4 × 2 m	Pond	Good number of competitors/ intruders in-cluding *Orthe-trum s. sabina*
16.10.82		2 × 1 m	Drain	" " "
30.11.86		3 × 1 m	Drain	
30.11.86	**Orthetrum s.*	6 × 5 m	Pond	No competitor
2.11.86	*Sabina*	3 × 2 m	Drain	Good number of competitors/ intruders in-cluding *Croco-themis s. servilia*
	2.12.86	3 × 1 m	Drain	" " "

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

Records o emergence of imago of seven species

Date	*Locality*	*Odonata*	*Time*	*Sunrise*	*Sunset*
25.3.68	Dum Dum Park	*Orthetrum s. sabina*	18.05 hr.	6.02 hr.	17.44 hr.
9.3.71	Dum Dum Park	*Orthetrum s. sabina*	18.00 hr.	5.50 hr.	17.35 hr.
23.12.73	Kachugaon	*Brachythemis* contaminata	10.20 hr.	Not recorded	Not recorded
29.10.74	Hazaribagh	*Bradinopyga geminata*	18.05 hr.	Not recorded	Not recorded
1.11.74	Hazaribagh	*Copera marginipes*	14.15 hr.	Not recorded	Not recorded

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.

5.8.80	Dum Dum Park	*Tholymis tillarga*	5.00 hr.	5.09 hr.	18.15 hr.
4.4.81	Dum Dum Park	*Orthetrum s. sabina*	18.00 hr.	5.48 hr.	17.50 hr.
26.4.81	Samsingh	*Pantala flavescens*	14.30 hr.	Not recorded	Not recorded
29.9.88	Tumin	*Neurothemis i. intermedia*	9.30-9.45 hr.	Not recorded	Not recorded

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 heterospecfic 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 competetion 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 coenagrionid 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 Hagashi'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. Montogomery'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 otherhands 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 seasons. The unususal 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 Himalyaya, countrary to my experiences in different parts of Eastern India where breding 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 can not, 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, open 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 mde on the following subjects *viz.*

(A) Interspecies relation (Predator-prey relation, competetion 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 atrocyana* Selys, *Ictinogomphus rapax* (Rambur), *Lathrecista a. asiatica* (Fabricius) *Orthetrum s. 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.

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REFERENCES

Acharya, H.G. 1961. Strange behaviour of some dragonflies. *J. Bombay nat. Hist. soc.* 58 819-820.

Bharagava, R.N. and M. Prasad 1974. *Orthetrum glaucum* (Brauer) preying upon *Palpopleura sexmaculata sexmaculata* (Fabr.) (Odonata Libellulidae) *J. Bombay nat. Hist. Soc.* 71 64.

Bick, G. H. 1949. Night collections of dragonflies (Odonata Anisoptera) *Ent. New.*60 182.

Bick, G.H. 1972. A review of territorial and reproductive behaviour in Zygoptera *Contactbr. nederlandse Libellen onderzoekers.* No. 10 (suppl) pp. 1-14

Bick, G.H. and J.C. Bick 1981 Heterospecific pairing among Odonata. *Odonatologica* 10 259-270.

Bick, G.H. and D. Sulzbach 1966. Reproductive behaviour in the damselfly *Haterina americana* (Fabricius) (Odonata Calopterygidae) *Anim. Behav.* 14 156-158.

Bick, G.H. and L.E. Hornuff 1966. Reproductive behaviour in the damselfly *Enallagma aspersum* and *Enallagma exusalns* (Hagen). *Proc. Ent. Soc. Wash.* 60 78-85.

Borror, D.J. 1934. Ecological studies of *Argia moesta* Hagen (Odonata Coenagrionidae) by means of marking. *Ohio J. Sci.* 34 97-108.

Cloudsley-Thompson, J.L. 1953. The ecological significance of diurnal rhythms in terrestrial arthropods. *Proc. 14th Int. Congr. Zoology*, Copenhagen, pp. 46-52.

Cloudsley-Thompson, J.L. 1956. Diurnal rhytms of activity in terrestrial arthropods. *Nature. Lond.* 178 215.

Cloudsley-Thompson, J.L. 1960. Adaptive functions of circadian rhythms. *Coldspring Harb. Symp. Quart. Biol.* 25 345-355

Cloudsley-Thompson, J.L. 1966. Seasonal changes in daily rhythms of animals. *Internat. J. Biometerorl.* 10 119-125.

Cloudsley-Thompson, J.L. 1975. Adaptations of arthropods to arid environments. *Ann. Rev. Entomol.* 20 261-283.

Cloudsley-Thompson, J.L. 1980. Biological Clocks. Their functions in nature. pp. ix+138. Weidenfeld and Nicoloson. London.

Corbet, P.S. 1962. A biology of dragonflies. pp. xv+247 H.F.G. Witherby, London.

Corbet, P.S. 1980. Biology of Odonata. *Ann. Rev. Entomol.* 25 189-217

Corbet, P.S. 1981 Seasonal incidence of Anisoptera in light traps in Trinidad, West Indies. *Odonatologica* 10 179-187

Corbet, P.S., C. Longfield and N.W. Moore 1960. Dragonflies. pp.xii+260. Collins, London.

Corbet, P.S. and P.L. Miller 1991 "Accompanying" behaviour as a means of prey acquisition by *Brachythemis leucostica* (Burmeister) and other Anisoptera. *Odonatologica* 20 29-36.

Fraser, F.C. 1933. Odonata. Fauna of British India, including Ceylon and Burma. Vol. 1, pp. xiii+423. Taylor & Francis Ltd., London.

Fraser, F.C. 1936. *Ibid.* Vol. 3. pp. xi+461

Furtado, J.L. 1972. The reproductive behaviour of *Ischnura senegalensis* (Rambur) *Pseudagrion microcephalum* (Rambur) and *P. perfuscatum* Lieftinck (Odonata, Coenagrionidae). *Malayan J. Sci.* 1(A) 57 -69.

Furtado, J.L. 1974. The reproductive behaviour of *Copera marginipes* (Rambur) and *Copera vittata acutimargo* (Kruger) (Zygoptera . Platycnemididae) *Odonatologica* 3 167-177

Furtado, J.L. 1975. The reproductive behaviour of *Prodasineura collaris* (Selys) and *P. verticalis* (Selys) (Odonata Protoneuridae). *Malayan J. Sci.* 3(A) 61-67

Gambles, R.M. 1971 Dragonfly dormitories. *The Niger. field.* 36 166-170.

*Higashi, K. 1969. Territoriality and dispersal in the population of dragonfly *Crocothemis servilia servilia* (Drury). *Mem. Fac. Sci. Kyush. Univ.* ser. E. 5 95-113.

Huxley, J. 1953. Evolution in action. pp. 167 Pelican Book.

Kennedy, C.H. 1950. The relation of American dragonfly-eating birds to their prey. *Ecol. Monogr.* 20 103-142.

Kidd, L.N. 1954. *Aeshna grandis* preying upon *Apis mellifera. entomologist.* 87 148.

Kiauta, B. 1965. Dragonflies—victims of traffic and modern civilization. *Proteus, Ljubliana* 27 196-197 (Slovene).

*Kiauta, B. 1971 Predation by ants, *Formica fusca* L. and *F. rufa polyctena* Bordr. on the emerging dragonfly, *Aeshna juncea* (L.) and its teratological consequences. *Tombo* 14 2-5.

Kormondy, E.J. 1959. The systematics of *Tetragoneura* based on ecological lifehistory and morphological evidence (Odonata Corduliidae). *Misc. Publ. Mus. Zool. Univ. Mich.* No. 107 1-79.

Kumar, A. 1979. On the occurrence of multivoltine generations in some Indian dragonflies. *Sci. & Cult.* 45 126-127

Kumar, A. and Prasad, M. 1977. A note on dragonflies caught in spider webs. *Odonatologica* 6 19-20.

Larsen, T.B. 1981. Butterflies as prey for *Orthetrum austeni* (Kirby) (Anisoptera Libellulidae). *Notul. Odonatol.* 1 130-133.

Le Gross, A.E. 1953. A note on dragonflies as prey of spiders. *Lond. Nat.* 33 3-4.

*Mathavan, S. 1975. Ecophysiological studies in chosen insects. Ph.D. Thesis. Madurai Kamraj University, Madurai, India. 115 pp.

Mathur, R.N. 1960. Enemies of termites (White ants). *Proc. Symp. Termites on the humid tropics. New Delhi.* pp. 137-139.

Millard, W.S. 1905. Curious accident to a dragonfly. *J. Bombay nat. Hist.* Soc. 16 521.

Mitchell, F.J. 1910. The food of dragonflies. *J. bombay nat. Hist. Soc.* 20 533.

Mille, P.L. 1992 Dragonflies of the Campus at Madurai Kamraj University, Tamil Nadu, India *Notul. Odonatol.* 2 160-165

Mitchell, F.J. 1910. The food of dragonflies. *J. Bombay nat. Hist. Soc.* 20 533.

Mitra, T.R. 1974a. Another record of migratory flights of *Pantala flavescens* in Calcutta. *Entromologists' Rac. J. Var.* 86 53-54.

Mitra, T.R. 1974b. A note on the peculiar behaviour of dragonflies. *J. Bombay nat. Hist. Soc.* 71 160-161.

Mitra, R.R. 1974c. Notes on vertebrate enemies of dragonflies. *Ent. News.* 85 61.

Mitra, T.R. 1977 Field observations on the death in adult dragonflies. *Odonatologica* 6 27-33.

Mitra, T.R. 1987 Note on *Tholymis tillarga* (Fabr.) (Odonata Libellulidae) with special reference to breeding. *J. Bengal Nat. Hist. Soc.* 4(2) N.S. 144-146.

Mitra, T.R. and A.R. Lahiri 1972. *Pseudagrion rebriceps* Selys in tandem with *Pseudagrion microcephalum* (Rambur) (Odonata Coenagrionidae). *Entomologists' Rec. J. Var.* 84 19.

Mitra, T.R. and S.K. Mukiherjee 1967 The story of dragonflies. Part 3. *Nature Study* 13 No. 11 (No. 163) 6(108)-7(109). (In Japaneese).

Miyakawa, K. 1961. A dragonfly run over by a street car. *Tombo* 4 34.

Moore, B.P. 1954. some records of dragonflies with their prey. *Ent. Mon. Mag.* 89 94.

Moore, N.W. 1951 On the length of life of adult dragonflies (Odonata Anisoptera) in the field. *Proc. Bristol. Nat. Soc.* 28 267-272.

Moore, N.W. 1952a. Notes on the so called Territories of dragonflies (Odonata Anisoptera) *Behaviour* 4 85-100.

Moore, N.W. 1952b. Notes on oviposition behaviour of *Sympetrum striolatum* Charpentier. *Behaviour* 4 101-103.

Moore, N.W. 1953. Population density in adult dragonflies (Odonata : Anisoptera) *J.Anim. Ecol.* 22 344-349.

Moore. N.W. 1960. In Corbet, P.S., C. Longfield and N.W. Moore.

Moore, N.W. 1964. Intra and interspecific competition among dragonflies (Odonata). *J. Anim. Ecol.* 33 49-71

Monotogomery, B.E. 1944. The distribution and relative seasonal abundance of Indiana species of Agrionidae (Odonata Zygoptera). *Proc. Indiana Acad. Sci.* 53 179-185.

O' Farrell, A.F. 1971. Roosting and relative activities in some Australian Zygoptera. *Journal of Entomology.* (A) 46 79-87

Paulson, D.R. 1973. Temporal isolation in two species of dragonflies *Epitheca sepia* (Gloyd, 1933) and *E. stella* (Williamson, 1911) (Anisoptera Corduliidae). *Odonatologica* 2 115-119.

Paulson, D.R. 1974. Reproductive isolation in damselflies. *Syst. Zool.* 23 40-49.

Pinhey, E.C.G. 1979. Examples of Anisoptera swarms (Odonata). *Arnoldia* 8 1-2.

Prasad, M. and Biswas M.K. 1980. A note on dragonflies (Odonata Insecta), *J. Bombay nat. Hist. Soc.* 77 353.

Ram, R, and Prasad M. 1978. Some field observations on Odonata predation by spiders. *Notul. Odonatol.* 1 25-26.

Reicholf, J. 1973. A migration of *Pantala flavescens* (Fabricius 1998) along the shore of Santa Catarina, Brazil (anisoptera : Libellulidae) *Odonatologica* 2 121-124.

Rowe, R.J. 1978. *Ischnura aurora* (Brauer), a dragonfly with unusual mating behaviour (Zygoptera Coenagrionidae). *Odonatologica* 7 375-383.

Southern, H.N. 1974. Evolutionary ecology. pp. xxxii-xxxix. In *Introduction of "Evolution the Modern synthesis"* by J. Huxley. Third Revised Edition George Allen & Unwin.

Srivastava, B.K. and S. Babu 1984a. Reproductive behaviour of *Ceriagrion coromandelianum* (Rambur) (Zygoptera Coenagrionidae). *Ist. Indian Symp. Odonatology*, Madurai, Abst. p.11.

Srivastava, B.K. and S. Babu 1984b. Some observations on *Ischnura aurora* (Brauer) in Indian biotopes (Zygoptera Coenagrionidae). *Fraseria* 6 24.

Subramanyam, T.V. 1936. A dragonfly preying upon a spider. *J. Bombay nat. Hist. Soc.* 39 190.

*Tümpel, R. 1901 Die Geradflugler Mitteleuropas. Gotha

Tyagi, B.K. 1981. Dragonflies feeding upon Housefly. *J. bombay nat. Hist. Soc.* 77 531

Utzeri, C. 1980. Considerations on cannibalism in Zygoptera. *Notul. Odonatol.* 1 100-102.

Utzeri, C. and G. Gianandrea 1988. Aspects of territoriality in *Crocothemis erythrea* (Brulle) (Libellulidae). *Proc. IXth Internatnl. Symp. Odontol.* Madurai, Abst. pp. 45-46.

Worth, C.B. 1962. Dragonflies and bicycles. *J. bombay nat. Hist. Soc.* 59 676-677

Wright, M. 1946. Economic importance of dragonflies (Odonata). *J. Tenn. Acad. Sci.* 21 60-71

*Original not consulted.

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.

ORDER ODONATA

SUB ORDER ZYGOPTERA

FAMILY CALOPTERYGIDAE

GENUS ***Neurobasis*** Selys

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

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* 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 lieftincki 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 quadrimaculata 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 SYNLESTIDAE

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

Protosticta himalaica Laidlaw

Genus ***Drepanosticta*** Laidlaw

Drepanosticta carmaichaeli (Laidlaw)

Drepanosticta polychromatica Fraser

FAMILY PROTONEURIDAE

Genus ***Disparonuera*** Selys

Disparoneura quadrimaculata Selys (D)

Genus ***Caconeura*** Kirby

Caconeura gomphoides (Rambur) (D)

Genus ***Elattoneura*** Cowley

Elattoneura campioni campioni (Fraser)

Elattoneura campioni cacharensis (Fraser)

Elattoneura atkinsoni (Selys)

Genus ***Prodasineura*** Cowley

Prodasineura odoneli (Fraser)

Prodasineura autumnalis (Fraser)

FAMILY PLATYCNEMIDIDAE

Genus ***Calicnemia*** Strand

Calicnemia exmia (Selys)

Calicnemia miles (Laidlaw) (H N)

Calicnemia miniata (Selys)

Calicnemia mortoni (Laidlaw)

Calicnemia imitans Lieftinck

Calicnemia pulverulans (Selys)

Calicnemia mukherjeei Lahiri

Calicnemia sudhaae sp.n. (Fig. 2)

(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.)*

Genus ***Coeliccia*** Kirby

Coeliccia bimaculata Laidlaw

Coeliccia prakritiae Lahiri**

Coeliccia renifera (Selys)

Coeliccia fraseri Laidlaw (in Fraser 1932)

Coeliccia didyma didyma (Selys)

Holotype & Allotype : 1♂1♀, Mizoram, Terei, 24.x. 1991; *Paratypes* : 2♂3♀, India, Mizoram, Teei (24.x1991.) & Bung (26.x.1991). Deposited in Zoological Survey of India, Calcutta.

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

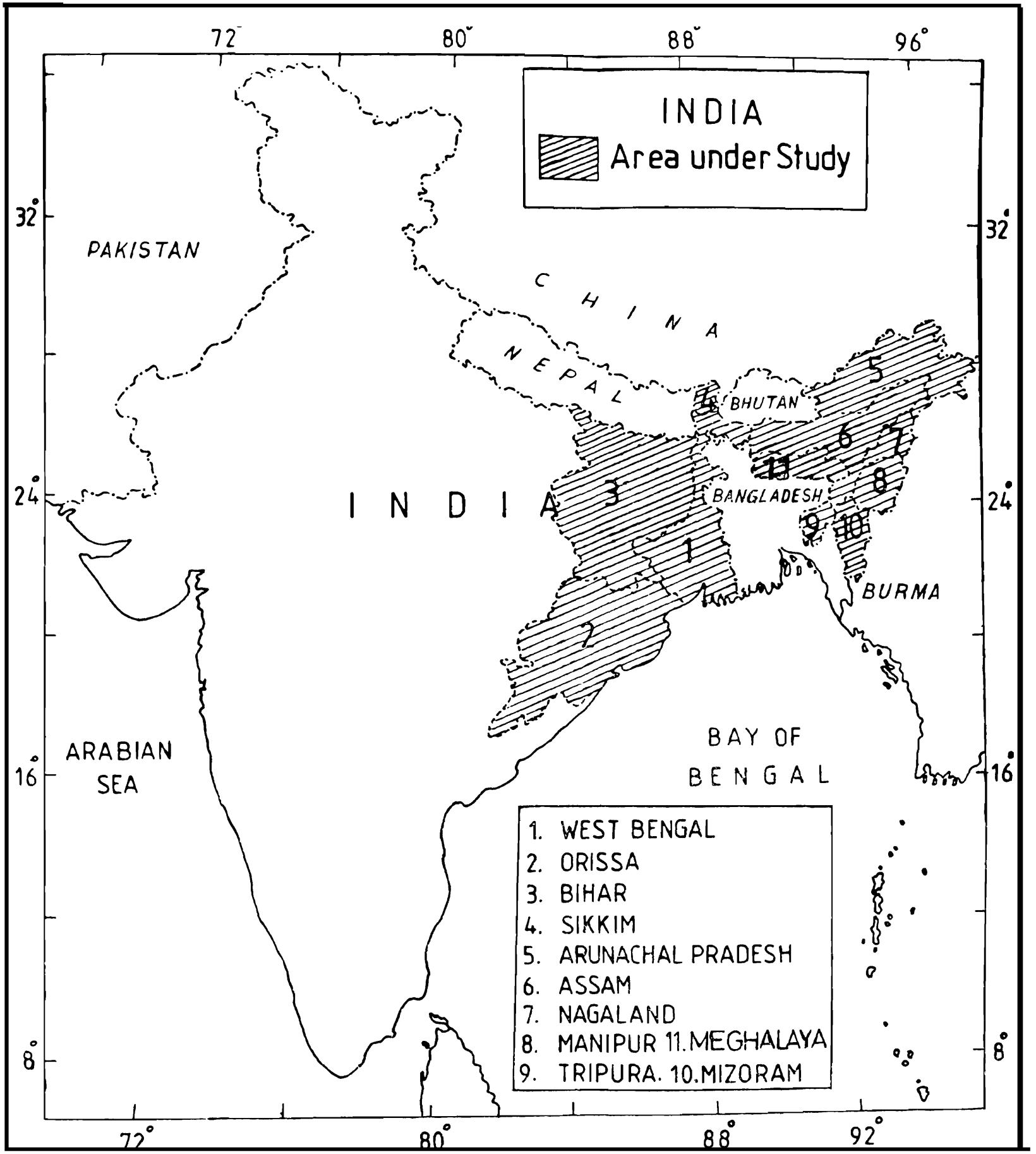

Fig. 1. Map showing the states under consideration.

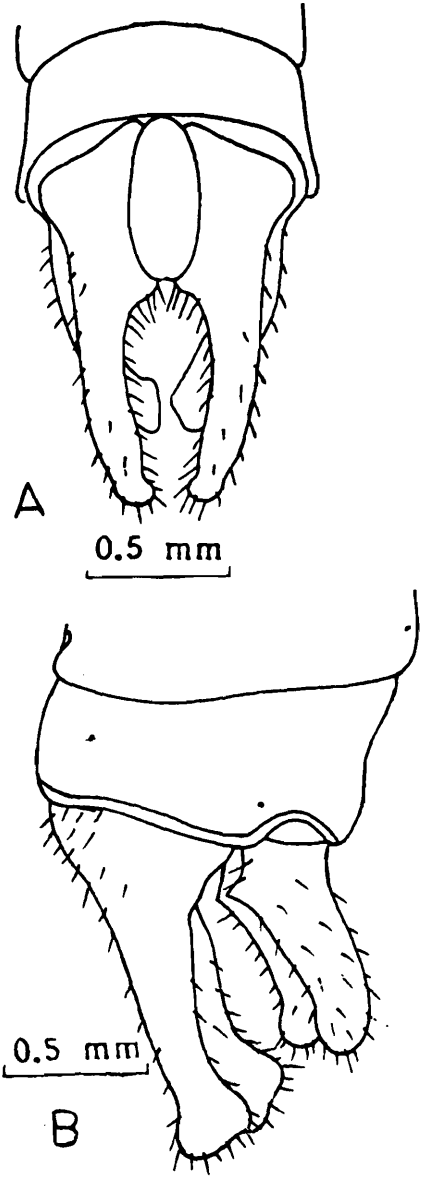

Fig 2. Anal appendages of *Calicnemia sudhaae* Sp.n.
A. Dorsal view. B. Lateral view.
(The species has been named in honour of my mother Late Sudha Rani Mitra. The full description of the species will be published shortly).

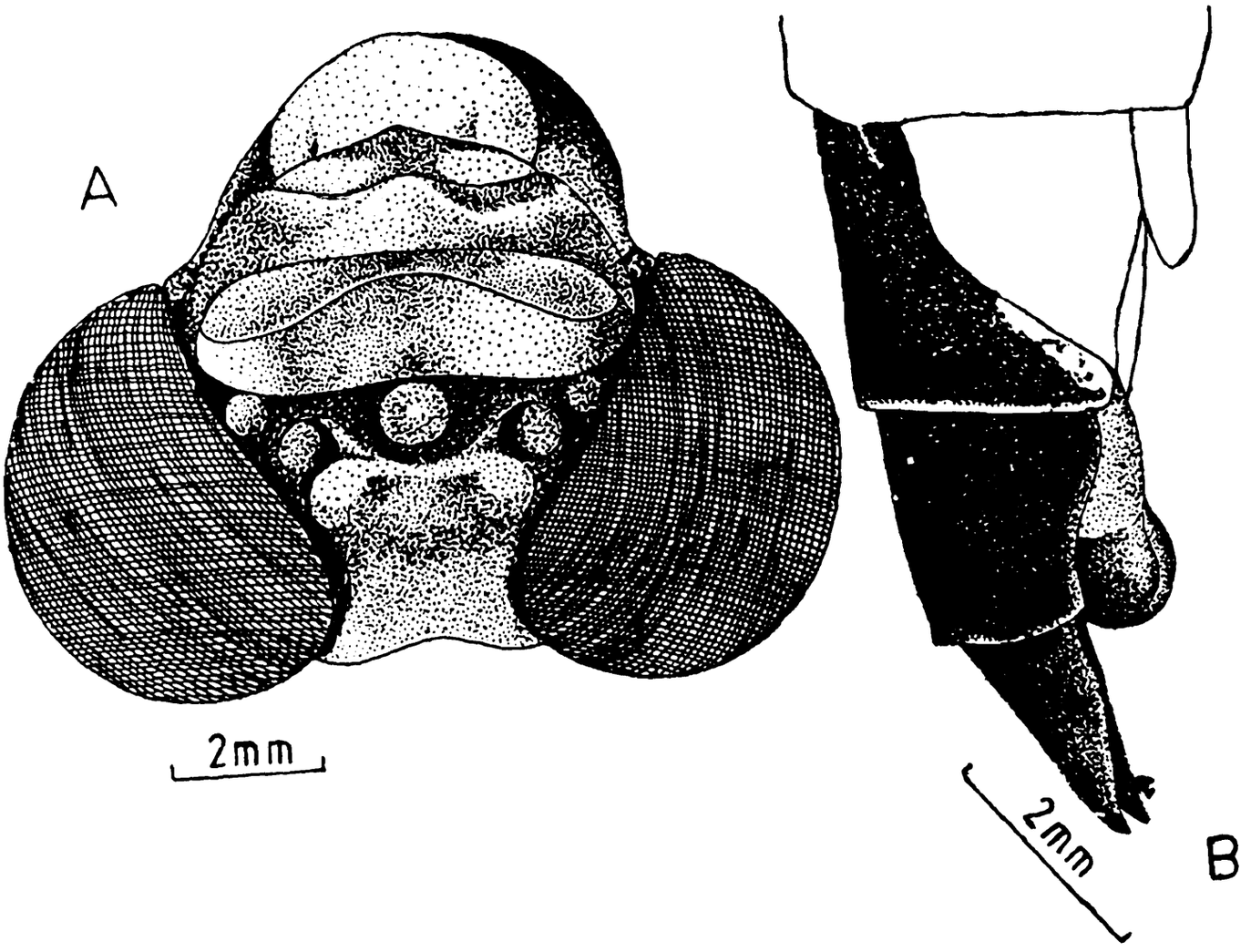

Fig 3. Head and last part of the abdomen of *Gomphidia leonorae* sp. n.
A. Head of the species. B. Last part of the abdomen.
(The species has been named in honour of senior odonatologist Mrs. Dr. Leonora K. Gloyd. Full description of the species will be published shortly).

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
Argiocmemis rubescens rubeola Selys
Genus ***Agriocnemis*** Selys
Agriocnemis lacteola Selys
Agriocnemis pieris Laidlaw
Agriocnemis clauseni Fraser
Agriocnemis nana (Laidlaw) (B)
Agriocnemis splendidissima Laidlaw (F M)
Agriocnemis pygmaea pygmaea (Rambur)
Agriocnemis femina femina (Brauer)
Agriocnemis dabreui Fraser

Genus ***Mortonagrion*** Fraser
Mortonagrion aborense (Laidlaw)
Genus ***Himalagrion*** Fraser
Himalagrion exclamatione Fraser
Genus ***Onychargia*** Selys
Onychargia atrocyana Selys (H)

SUBORDER ANISOZYGOPTERA

FAMILY EPIOPHLEBIIDAE

Genus ***Epiophlebia*** Calvert

Epiophlebia laidlawi Tillyard

SUBORDER ANISOPTERA

FAMILY GOMPHIDAE

Genus ***Nihonogomphus*** Oguma

Nihonogomphus pulcherrimus (Fraser) (B)

Nihonogomphus indicus Lahiri

Genus ***Onychogomphus*** Selys

Onychogomphus striatus Fraser (C)

Onychogomphus biforceps Selys (E)

Onychogomphus grammicus (Rambur)

Onychogomphus meghalayanus Lahiri

Onychogomphus saundersi Selys

Onychogomphus risi (Fraser)

Onychogomphus duaricus Fraser

Onychogomphus cacharicus (Fraser)

Genus ***Nepogomphus*** Fraser

Nepogomphus modestus (Selys)

Genus ***Phaenandrogomphus*** Lieftinck

Phaenandrogomphus aureus (Laidlaw) (E)

Genus ***Stylogomphus*** Fraser

Stylogomphus inglisi Fraser

Genus ***Paragomphus*** Cowley

Paragomphus lineatus (Selys) (K M)

Paragomphus lindgreni (Fraser)

Paragomphus echinoccipitalis (Fraser)

Genus ***Merogomphus*** Martin

Merogomphus martini (Fraser)

Genus ***Macrogomphus*** Selys

Macrogomphus montanus Selys

Macrogomphus seductus Fraser

Genus ***Ictinogomphus*** Cowley

Ictinogomphus rapax (Rambur)

Ictinogomphus pertinax Selys (E G)

Ictinogomphus angulosus (Selys)

Ictinogomphus atrox (Selys)

Ictinogomphus distinctus Ram

Genus ***Gomphidia*** Selys

Gomphidia williamsoni Fraser

Gomphidia t-nigram 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

Burmagomphus pyramidalis pyramidalis Laidlaw

Burmagomphus hasimaricus Fraser

Burmagomphus sivalikensis Laidlaw

Genus ***Platygomphus*** Selys

Platygomphus dolabratus Selys

Genus ***Megalogomphus*** Campion

Megalogomphus bicornutus (Fraser)

Megalogomphus flavicolor (Fraser)

Genus ***Perissogomphus*** Laidlaw

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* *Holotype & Paratype :* 1♂1♀, West Bengal, Bankura, Susunia Hill, 2. vill. 1974, Deposited in Zoological Survey of India, Calcutta.

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 assamensies Asahina

Periaeschna nocturnalis Fraser

Genus ***Tetracanthagyna*** Selys

Tetracanthagyna waterhousei MacLachlan

Genus ***Cephalaeschna*** Selys

Cephalaeschna viridifrons (Fraser)

Cephalaeschna masoni (Martin)

Cephalaeschna acutifrons (Martin)

Cephalaeschna orbifrons Selys

Genus ***Petaliaeschna*** Fraser

Petaliaeschna fletcheri Fraser

Genus ***Gynacanthaeschna*** Fraser

Gynacanthaeschna sikkima (Karsch)

Genus ***Polycanthagyna***, Fraser

Polycanthagyna ornithocephala MacLachlan

Genus ***Aeshna*** Fabricius

Aeshna petalura petalura Martin

Genus ***Planaeschna*** McLachlan

Planaeschna intersedens (Martin)

FAMILY CORDULEGASTERIDAE

Genus ***Anotogaster*** Selys

Anotogaster nipalensis Selys

Anotogaster gregoryi Fraser

Anotogaster basalis palampurensis Fraser

Genus ***Chlorogomphus*** Selys

Chlorogomphus preciosus preciosus (Fraser)

Chlorogomphus atkinsoni (Selys)

Chlorogomphus campioni (Fraser)

Chlorogomphus fraseri St. Quentin

Chlorogomphus selysi Fraser

Chlorogomphus mortoni Fraser

Genus ***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 flavocolorata 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)
Orthtetrum 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

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* *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 erytraea 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 petiolatum 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)

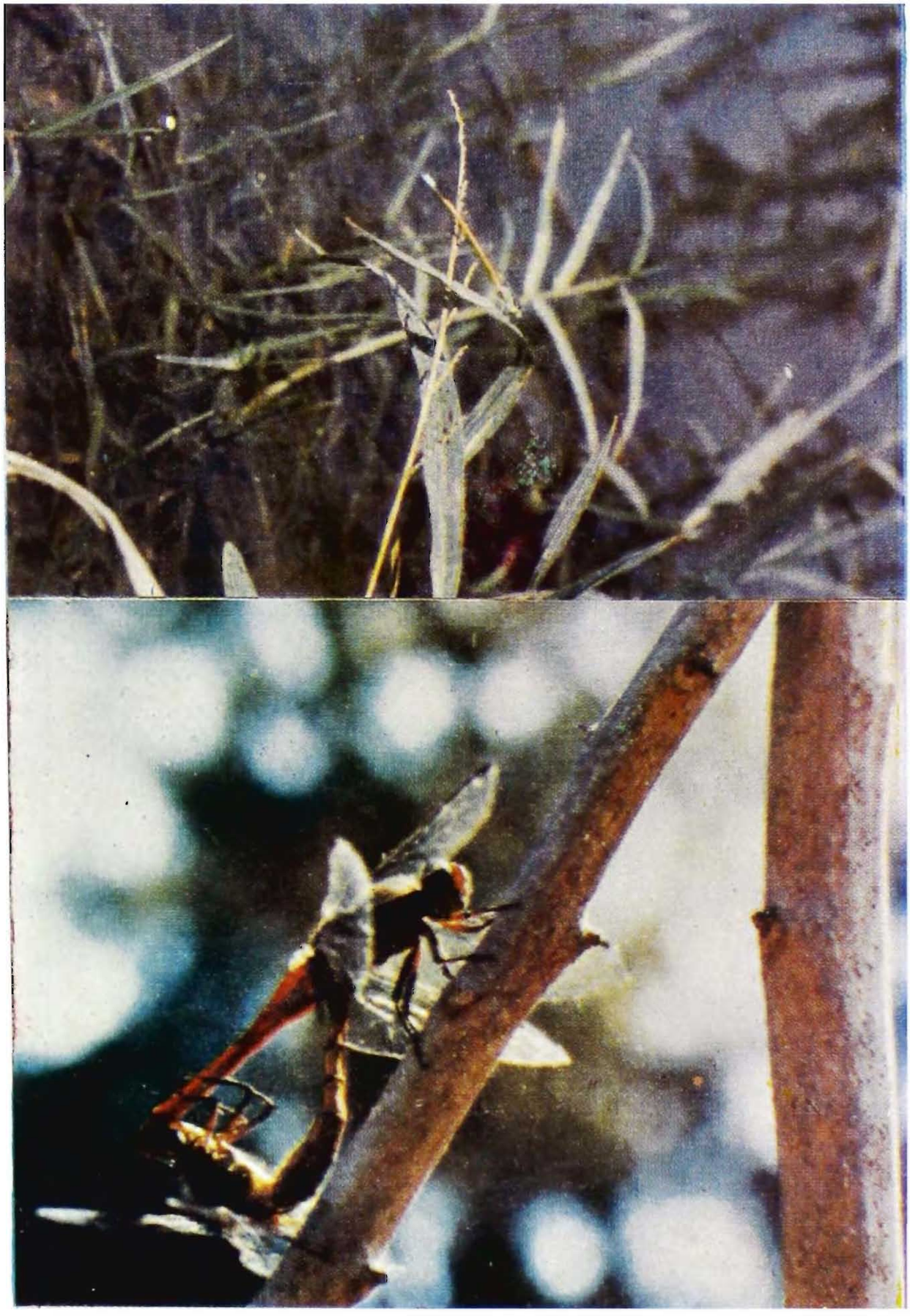

Fig. (a) Thermoregulation of *Ischnura a. aurora* (Brauer) in the bush. (Top)
(b) Breeding of *Crocothemis s. servilia* (Drury). (Bottom)