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FIELD OBSERVATIONS ON DEATH IN ADULT DRAGONFLIES

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164 dead and dying specimens referable to 11 species, viz. *Tholymis tillarga* (Fabr.), *Brachythemis contaminata* (Fabr.), *Pantala flavescens* (Fabr.) *Ictinogomphus rapax* (Ramb.), *Acanthagyna dravida* (Lieft.), *Crocothemis servilia servilia* (Drury), *Rhyothemis variegata variegata* (L.), *Urothemis signata signata* (Ramb.), *Sympetrum hypomelas* (Sel.), *Ceriagrion coromandelianum* (Ramb.), *Pseudagrion microcephalum* (Ramb.) were noted in the outskirts of Calcutta during Aug. 1975 - Oct. 1976. Most (121) of them were *T. tillarga*, followed by *B. contaminata* (28), *P. flavescens* (3), *C. s. servilia, I. rapax, A. dravida, C. coromandelianum* (2 each), *P. microcephalum, S. hypomelas, U. s. signata* and *R. v. variegata* (1 each). Among all species 127 were males, only 37 were females. The majority of the individuals had head- or head-thoracic injuries, some had legs, wings and abdomen missing or damaged. 9 injured and 4 uninjured individuals, picked up alive, died later. 3 dead specimens showed no sign of external injury. Bird predation has been suspected as an important cause of injury/injuries in the specimens, while the intact individuals probably suffered natural deaths.

INTRODUCTION AND OBSERVATIONS

On October 23, 1971, at about 1130 hrs, I encountered a dead adult of *Tramea basilaris burmeisteri* (Kirby) lying on a thoroughfare far from water at Bhandara in the state of Maharashtra, India. Later at Calcutta I saw several dead specimens of common species under similar conditions, but did not examine their physical conditions or attempt to determine the causes of death. In 1975-1976, during observations of odonates in the outskirts of Calcutta, I observed dead or dying dragonflies more carefully. Eleven species were noted between 0600 and 0800 hrs on the road leading to Dum Dum Airport along a 300 m stretch, not more than 4 m from the water edge.

Between August, 1975 and October, 1976 about 20 dragonfly species were noted in the area under observation, but only 11 species, viz. *Tholymis tillarga* (Fabr.), *Brachythemis contaminata* (Fabr.), *Pantala flavescens* (Fabr.), *Ictinogomphus rapax* (Ramb.), *Acanthagyna dravida* (Lieft.), *Crocothemis servilia servilia* (Drury), *Ceriagrion coromandelianum* (Ramb.), *Urothemis signata signata* (Ramb.), *Sympetrum hypomelas* (Sel.), *Rhyothemis variegata variegata* (L.), *Pseudagrion microcephalum* (Ramb.) were included among the 164 individuals noted as dead or dying. Most (121) of these were *T. tillarga,* followed by *B. contaminata* (28), *P. flavescens* (3), *I. rapax, A. dravida, C. servilia, C. coromandelianum* (2 each), *U. signata, S. hypomelas, R. variegata* and *P. microcephalum* (1 each). Among all species, 127 were males and only 37 females. Most specimens had head or head thoracic injuries, some had legs, wings and abdomen missing or damaged. 9 injured and 4 uninjured individuals picked up alive slowly died later, 3 dead specimens showed no signs of external injury.

A detailed account of observations is given in Table I.

Table I
Record of observations

Date	Material	Condition of specimens *(all dead, unless otherwise specified)*
6-VIII-75	*Brachythemis contaminata*, 1 ♂	Body pressed on the road
8-VIII-75	*Crocothemis servilia*, 1 ♂	Body very badly damaged
12-VIII-75	*Ictinogomphus rapax*, 1 ♀	Last 3 abdominal segments missing
2-IX-75	*Tholymis tillarga*, 1 ♂	Last 2 abdominal segments missing
4-IX-75	*T. tillarga*, 2 ♂	Bodies pressed on the road
5-IX-75	*T. tillarga*, 1 ♂	Head and abdomen eaten by ants
6-IX-75	*T. tillarga*, 1 ♂	Body heavily infested with ants
7-IX-75	*T. tillarga*, 2 ♂	Bodies seriously damaged
8-IX-75	*Brachythemis contaminata*, 1 ♂	Head and thorax seriously damaged
9-IX-75	*B. contaminata*, 1 ♂	Head missing
10-IX-75	*Tholymis tillarga*, 2 ♂	Body of one specimen pressed on the road, in other head missing
15-IX-75	*Brachythemis contaminata*, 2 ♂	In one, head and last 2 abdominal segments missing; in other, last 3 abdominal segments missing
24-IX-75	*Tholymis tillarga*, 1 ♂	Body covered with ants
24-IX-75	*Brachythemis contaminata*, 1 ♀	Alive, unable to fly, died within a few hours
27-IX-75	*Tholymis tillarga*, 1 ♂	Abdomen slightly, thorax and head seriously damaged
30-IX-75	*T. tillarga*, 2 ♂	One dead and covered with ants; the other alive, unable to fly, died within a short time
2-X-75	*T. tillarga*, 2 ♂	One undamaged, the other covered with ants

Table I – continued

3-X-75	*Brachythemis contaminata*, 1 ♀	Alive, two-thirds of right forewing missing
3-X-75	*Tholymis tillarga*, 1 ♂	Head and thorax damaged
4-X-75	*T. tillarga*, 1 ♂	Head, thorax and wings seriously damaged
9-X-75	*T. tillarga*, 1 ♂	Body pressed on the road
12-X-75	*T. tillarga*, 4 ♂	Major portion of body eaten by ants
17-X-75	*T. tillarga*, 3 ♂	In one, head and thorax seriously damaged; in the second one, thorax damaged; in the third, left side of thorax slightly damaged
20-X-75	*Brachythemis contaminata*, 1 ♂	Wings fluttering, unable to fly, left thoracic venter damaged, died within 1 hr
21-X-75	*Tholymis tillarga*, 1 ♂, 2 ♀	In ♂, head damaged; in one ♀, head missing; in the other, head and thorax seriously damaged
22-X-75	*T. tillarga*, 2 ♂, 1 ♀	Body of one ♂ pressed on the road; in the other 4 legs missing, right thoracic venter damaged; head and thorax of ♀ damaged
23-X-75	*T. tillarga*, 1 ♂	No mark of external injury
24-X-75	*T. tillarga*, 1 ♂	Head and thorax injured, infested with ants
25-X-75	*T. tillarga*, 2 ♂	In one, head missing; in the other thorax slightly injured
26-X-75	*Brachythemis contaminata*, 1 ♂	Part of thorax and abdomen eaten by ants
27-X-75	*Tholymis tillarga*, 4 ♂	One alive, its thorax injured, right hind wing missing; others dead; in one, dorsum of thorax damaged; others' bodies pressed on the road, heads missing
28-X-75	*T. tillarga*, 1 ♂, 3 ♀1	1 ♂, 2 ♀ dead; body of ♂ pressed on the road; 1 ♀ venter injured, head loosely attached; 1 ♀ with thoracic venter of 2nd abdominal segment injured; the third ♀ alive, unable to fly, died after 2½ hrs. of capture
29-X-75	*T. tillarga*, 2 ♂, 1 ♀	♂♂ bodies badly damaged; ♀ alive, its eyes slightly pressed, tarsus of one leg missing, died after 1 hr of capture
31-X-75	*T. tillarga*, 1 ♀	Lower part of abdomen damaged, one eye pressed
3-XI-75	*T. tillarga*, 1 ♂, 1 ♀	♂ thorax damaged; ♀ thorax and wings left on the road
7-XI-75	*T. tillarga*, 1 ♂, 1 ♀	♂ body badly damaged; ♀ alive, unable to fly, left side of thorax pressed, died after 3 hrs of capture
10-XI-75	*T. tillarga*, 1 ♂, 1 ♀	♂ abdomen missing; ♀ thorax seriously damaged, soft parts came out
8-V-76	*Brachythemis contaminata*, 1 ♂	Thorax-abdomen junction separated, thorax pressed, head damaged, one hind leg missing, one foreleg damaged, wing twisted

Table I – continued

9-V-76	*Pantala flavescens*, 1 ♀	Thorax damaged, dorsum of 2nd abdominal segment pressed
12-V-76	*Brachythemis contaminata*, 1 ♂	Body pressed on the road
16-V-76	*B. contaminata*, 1 ♂	Head missing, lower part of abdomen loosely attached, left wing partly missing
20-V-76	*B. contaminata*, 1 ♂	Thorax and head damaged
22-V-76	*B. contaminata*, 1 ♂	Body infested with ants
27-V-76	*Tholymis tillarga*, 1 ♂, 1 ♀	♂ body infested with ants; ♀ body pressed on the road
2-VI-76	*Pantala flavescens*, 1 ♂	Thorax broken
2-VI-76	*Ceriagrion coromandelianum*, 1 ♂	Head and thorax damaged
4-VI-76	*Tholymis tillarga*, 1 ♂, 1 ♀	♂ infested with ants; ♀ right side of thorax broken
4-VI-76	*Brachythemis contaminata*, 1 ♂	No mark of injury
12-VI-76	*Rhyothemis variegata*, 1 ♂	Wings fluttering, unable to fly, no mark of injury, died after 1½ hr
16-VI-76	*Tholymis tillarga*, 1 ♂	Head lost
17-VI-76	*Crocothemis servilia*, 1 ♂	Head and abdomen missing, thorax damaged
17-VI-76	*Tholymis tillarga*, 2 ♂	One's body pressed on the road, other's thorax damaged
17-VI-76	*Acanthagyna dravida*, 1 ♂	Head missing, thorax damaged
18-VI-76	*Tholymis tillarga*, 2 ♂	One's body pressed on the road, other's thorax damaged, legs and wings moving, unable to fly, died in the laboratory
19-VI-76	*T. tillarga*, 1 ♂	Body pressed on the road
23-VI-76	*Brachythemis contaminata*, 1 ♀	Body twisted
23-VI-76	*Ictinogomphus rapax*, 1 ♀	Whole body damaged
26-VI-76	*Acanthagyna dravida*, 1 ♂	Head missing, thorax damaged
28-VI-76	*Tholymis tillarga*, 1 ♀	Eyes damaged, head loose, thorax broken, some ants on the body
1-VII-76	*T. tillarga*, 2 ♂	One's body pressed on the road, other's head and abdomen lost
1-VII-76	*Brachythemis contaminata*, 1 ♂	Body pressed on the road
2-VII-76	*Tholymis tillarga*, 1 ♀	Body damaged
8-VII-76	*Brachythemis contaminata*, 1 ♂	Head lost, thorax damaged
12-VII-76	*Pantala flavescens*, 1 ♂	Dorsum of 2nd abdominal segment pressed, right lateral side of thorax broken, part of left hind wing missing
3-VIII-76	*Tholymis tillarga*, 2 ♂	Thorax seriously damaged
6-VIII-76	*Brachythemis contaminata*, 1 ♂	Thorax damaged, last few abdominal segments lost
7-VIII-76	*B. contaminata*, 1 ♀	Thorax damaged
8-VIII-76	*B. contaminata*, 1 ♂	Infested with ants
8-VIII-76	*Tholymis tillarga*, 1 ♂	Infested with ants
9-VIII-76	*T. tillarga*, 1 ♂	Left side of thorax, head and last few abdominal segments broken

Table I – continued

11-VIII-76	*T. tillarga*, 1 ♂	Right side of thorax damaged, middle of abdomen slightly damaged
14-VIII-76	*T. tillarga*, 2 ♂	In one, head pressed; in other, lower parts of abdomen missing
15-VIII-76	*T. tillarga*, 1 ♂	Thorax and eyes damaged
18-VIII-76	*Brachythemis contaminata*, 1 ♂	No injury, wings fluttering, unable to fly, died after 3 hrs
19-VIII-76	*Tholymis tillarga*, 1 ♂	Alive, unable to fly, tibiae of two legs lost, died after 2 hrs
20-VIII-76	*Brachythemis contaminata*, 1 ♂	Infested with ants
20-VIII-76	*T. tillarga*, 1 ♂	Middle of abdomen broken, infested with ants
20-VIII-76	*Sympetrum hypomelas*, 1 ♂	Abdomen pressed, fluttering wings, could not fly, died after 2 hrs
25-VIII-76	*Brachythemis contaminata*, 2 ♂	In one, left side of thorax pressed, right hind wing missing partly; in other, body infested with ants
5-VIII-76	*Tholymis tillarga*, 1 ♂	Ventral side of thorax slightly broken
6-IX-76	*T. tillarga*, 1 ♂	Ventral surface of left side of thorax broken, legs damaged
24-IX-76	*T. tillarga*, 1 ♂, 2 ♀	♂ thorax broken on left side; one ♀'s head and thorax damaged, other's abdomen pressed, left side of thorax slightly injured
26-IX-76	*T. tillarga*, 2 ♂	Body pressed on the road
27-IX-76	*T. tillarga*, 1 ♂	Body damaged, infested with ants
4-X-76	*Urothemis signata*, 1 ♂	Right side of thorax damaged, moving anal appendages; died after 1½ hr
5-X-76	*Tholymis tillarga*, 1 ♀	Head loose, right fore wing fluttering, unable to fly, died after 1 hr
9-X-76	*Brachythemis contaminata*, 1 ♀	Dorsum of thorax broken
10-X-76	*Tholymis tillarga*, 2 ♂	In one, head, thorax and abdomen slightly pressed; in the other, head, edges of wings, left forewing and thorax damaged
11-X-76	*T. tillarga*, 6 ♂	In one, thorax damaged, abdomen lost, legs moving. In others, bodies pressed on the road
11-X-76	*Brachythemis contaminata*, 1 ♂	Head and thorax damaged
12-X-76	*Tholymis tillarga*, 2 ♀	In one, head and thorax damaged; in the other, head slightly damaged, abdomen broken in the middle
13-X-76	*T. tillarga*, 2 ♂	In one, right fore and hind wing damaged; in the other, thorax slightly damaged, left hind wing immovable
14-X-76	*T. tillarga*, 3 ♂, 1 ♀	2 ♂ seriously infested with ants; 1 ♂ and the ♀ had no sign of external injury; the ♀ was moving leg and died after 1½ hr
15-X-76	*T. tillarga*, 3 ♂	Thorax slightly broken in one; in others, thorax seriously damaged

Table I – continued

16-X-76	*T. tillarga*, 3 ♂	In one, thorax and right forewing damaged, the other infested with ants and thorax slightly damaged, third specimen seriously damaged
16-X-76	*Pseudagrion microcephalum*, 1 ♂	Head and 5 legs lost
17-X-76	*Tholymis tillarga*, 1 ♂	Left side of thorax slightly broken
17-X-76	*Ceriagrion coromandelianum*, 1 ♂	Right side of thorax broken, one wing damaged
20-X-76	*Tholymis tillarga*, 2 ♂, 1 ♀	1 ♂ without injury, the other with damaged thorax; in ♀ head and thorax damaged
23-X-76	*T. tillarga*, 1 ♂, 3 ♀	♂ thorax damaged; one ♀ 2nd abdominal segment pressed slightly, second ♀ abdomen detached from the thorax, body of third pressed on the road
24-X-76	*T. tillarga*, 4 ♀	One without any external injury, two with damaged thorax and the last heavily infested with ants

DISCUSSION

Natural death of animals in the wild is not generally seen except during epidemics. There are few references on dragonfly mortality and only MOORE (1952) briefly discusses causes of death of adults, considering predation and starvation as major factors. He opines that although tenerals were eaten by birds on several occasions, there are not many records of British birds preying on dragonflies. However, FRASER (1933), KENNEDY (1950), CORBET (1962) and MITRA (1974) have reported a number of bird species as predators. However, in predation the victim is likely to be devoured completely rather than to be left in an injured condition as in the present cases. MOORE (1952) suggests that during the mating season there are violent clashes between males and it is not uncommon to see males with legs or wings partly of wholly missing. The leg or wing injury impairs feeding efficiency, causing starvation. A prolonged spell of bad weather has the same effect.

MIYAKAWA (1961), KIAUTA (1965) and HUTCHINSON (1976) reported cases of dragonflies – victims of traffic and other forms of modern technology, but Moore's hypothesis seems to adequately explain the deaths I observed. Dead or dying individuals were seen only during the breeding seasons and on the human tracks instead of the traffic tracks and the majority of the victims (77.4%) were males. Only 7 intact individuals were noted and these were probably natural deaths.

Nevertheless, the possibility of predation cannot be completely ruled out. The observed deaths coincided with the arrival of the first bird migrants, especially swallows which are well known predators. The injured odonates were mostly *T. tillarga* and *B. contaminata*, both superficially resembling hymenopterans, a possible protective adaptation because hymenopterans are avoided by many birds. The possibility that these dragonflies were attacked but released in an injured condition because of their wing colour cannot be eliminated.

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