

Ecology and Ethology of Crane fly *Tipula paludosa* Meigen (Tipulidae: Diptera) from Kolhapur region, India

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ABSTRACT

The crane fly *Tipula paludosa* Meigen (Tipulidae : Diptera) is an important food for various insects, fishes and birds. However, it is destructive to lawns. Therefore, its seasonal abundance, natural enemies, mating and oviposition behaviours have been studied. Kolhapur is bounded to Western Ghats and receives on an average of 1100 mm rainfall. The occurrence of adult crane fly was noted from October to April and reached to peak in February. Mating occurred very immediately after adult emergence from pupae and displayed chain a behaviours, viz., attraction, recognition, orientation, wing fanning, mounting, copulation, tail to tail end position and post copulatory grooming. Oviposition behaviours comprised recognition and examination of oviposition site and surface respectively, insertion of abdomen in soil and actual oviposition. The adult crane flies were predated by dragon flies *Bradinopyga* sp. and *Crocothemis* sp., the larvae were predated by carabid beetles and parasitized by nematode *Agamermis* sp.

Key words : Crane fly, Ecology, Ethology, Kolhapur region, India.

INTRODUCTION

In the natural population process mating plays a very crucial role for control of pest insects. In certain insects mating and fertilization is required for production of a viable offsprings to produce daughters. Few detailed studies on courtship and mating behaviour are exist (Sathe & Margaj, 2001; Sathe et al., 2014). The review of literature indicates that little is known about mating behaviour in the crane flies. Crane flies are commonly known as "mosquito hawks" or "daddy long legs" which belong to Tipulidae family of order Diptera. These crane flies are small (2 mm) to large (40 mm) sized which serve as source of food for fishes, amphibians, birds, mammals and arthropods including wasps (Tuft and Beggs, 1995). About 17645 species of Tipuloidea are known from the world, out of which about 1500 species and subspecies are reported from India (Bhagat, 2014). Crane flies

are mistaken as large mosquitoes but their nuisance value to man is almost negligible. However, some species acts as pests. Being the food for pisces, amphibians and birds, their population should be maintained coinciding their above preys. Therefore, for obtaining more and more females mating is essential. In past, crane flies have been studied by Reunine (1917), Cuthbertson, (1929), Thomas (1946), Alexander (1950, 1953, 1964), White (1951), Laughlin (1967), Hadley (1969), Campbell et al. (1974), Alder & Alder (1991), Naskar et al. (2013), Bhagat (2014) etc. attempted the studies related to biodiversity, ecology and ethology of crane flies.

MATERIALS AND METHODS

Kolhapur district of India is situated between 15° to 17° North latitude and 23° to 74° East longitude with an average rain fall 1100 mm

mostly covered by monsoon and bounded by Western Ghats, India and therefore, with different water bodies and a very rich biodiversity. Occurrence, natural enemies, life cycle, mating and oviposition were studied by field spot observations. Mating behaviour was also studied under laboratory by caging newly emerged pair (1 male & 1 female) in glass cage 25 x 25 x 25 cm and also Crane fly food preference to preys was studied by offering larvae and adults to the preys using the same cage under laboratory conditions (27±1°C, 75-80% R.H. and 12 hr photoperiod) in addition to regular spot observations in the field at one week interval. The crane flies were collected with the help of insect net by one man one hour search method after study they were released in the natural environment.

RESULTS

Results recorded in figures 1 & 2 and table 1 indicated that the population of crane flies was low in the months of October and April, it was moderate in the months November and January and recorded high in the months December, February and March (table-1). Only one generation was possible during the year. The fly spend most of the time of the year in immature stages. Cool summer and mild winter was suitable for the present species. The larvae developed in mineral, black, marshy and sandy soils. Kolhapur is bounded to the Western Ghats and dry plain regions. Hence, the climate of Kolhapur was very conducive for crane fly. The adult crane flies were predated by Dragon flies like *Bradinopyga* sp. and *Crocothemis* sp. and larvae by carabid beetles. A nematode *Agamermis* sp. was also found parasiting the larvae of crane flies from Kolhapur region.

T. paludosa was crane flies were sexually matured at the time of emergence and mated immediately. Several males were attracted to

females at the time of emergence from pupae in the field. Males were active and searched for females intensively. Recognition of female was one of the important steps in mating behaviour. Males found activated by diving with wings buzzing if females was sighted. Attraction of sex probably was due to sexual dimorphism. Close range mating stimulant might be involved and played important role in mating due to which male landed on female body and holded, performed double gripping and firm gripping. Then tail to tail mating position was formed due to male's go away behaviour, genitalia rotation was by 180°, twisting motion of male abdomen was noticed.

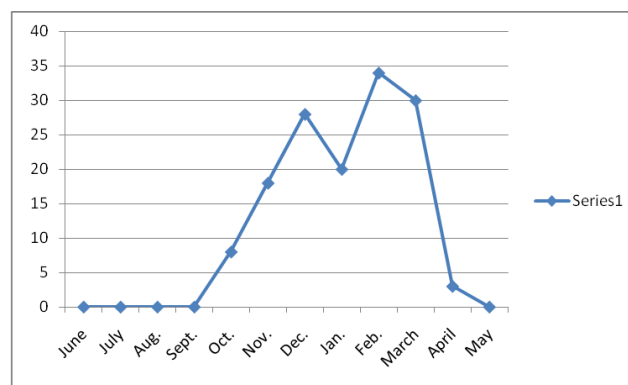


Figure 1. Occurrence of *T. paludosa* in Kolhapur region.

The female taken initiative and dragged the male up a stem and hanged there nearly motionless. Many times the male was suspended head downward during the mating behaviour. Two pairs of hair tufts found on male's 9th sternum were moved alternately along the base of female cerci and brushed the sides of male hypopygium. Periodic quivering of antennae, wings and halteres have been noted. Pre-mating, mating and post mating periods were 0.0 min., 3 hr. and 15 days respectively. Likely, preoviposition, and post oviposition periods were 3 hr, 3-5 min. and 14.5 days respectively. Eggs were deposited in the soil or in decaying organic matter. With the

June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March
-	-	-	-	+	++	+++	++	+++	+++
(0)	(0)	(0)	(0)	(8)	(18)	(28)	(20)	(34)	(30)

Table 1. Seasonal abundance of adult crane fly *T. paludosa* from Kolhapur. Low = 1 to 10; Moderate = 10-20; High = 20-30 and above.

help of cerci eggs were pressed into the soil. The mated female showed following chain of oviposition behaviours, recognition of oviposition site, antennal examination of oviposition surface, insertion of abdomen in soil and actual oviposition. In general, the crane fly showed following chain of mating behavior: attraction, recognition, orientation, wing fanning or vibration, mounting, copulation, tail to tail position and post copulatory grooming.



Figure 2. Mating in *T. paludosa*.

DISCUSSION

The European crane fly *T. paludoso* scattered from southern Finland and lower Scandinario to northern Italy and from Great Britain to the USSR (Alexander, 1950; Fox 1957). Introduction of this species into North America took place in eastern Canada. In 1952 the fly was first reported from New founded land and 2 years later on Cape Breton Island, Nova Scotia. Its larvae were destructive to became problem on turf, vegetable gardens and perennial flower gardens. Soil ballasts dumped on shore from ships at Cape Breton Island were believed to be the source of infestation (Fox, 1957).

On the West Coast, *T. paludosa* larvae were first discovered in British Columbia causing severe damage to lawns on the outskirts of Vancouver in 1965, and by the spring of 1974 it was spread over the entire lower Fraser River farming district. In India, still it is not troublesome pest and occur in small numbers in Kolhapur region mostly from November to May.

The larvae of crane flies were caterpillar like in appearance and habit and considered to be among the most old-fashioned and conservative of Diptera. The larvae live in damp surroundings, in wet earth, under bark, or in putrid water and some pussess long tubes from the tail-end for breathing. The larvae feed on decaying vegetable stuff and found in the mess which accumulated in hollow tress. Pupae were long and with straight legs and associated with mud, sand, earth or decaying leaf mould.

In India, the crane flies were recorded in dry conditions of the plains and occurred in sufficient number and caused damage to lawns kept well watered throughout the year. They were not very common in the dry plains and the hills (Lefroy & Howleff, 1909). According to Lefroy & Howleff (1909) only 26 species have been recorded from India. Recent account indicated that there are a total of more than 1475 valid species and sub species known from India (Naskar et al., 2013). Bhagat (2014) reported 60 species of crane flies of 22 genera from Jammu & Kashmir, India. According to him the genus *Tipula* was dominant over other genera in the Jammu & Kashmir. However, there is no account on crane flies from Maharashtra.

Crane flies were common in the diet of native insectivores and *Vespa* wasps (Toft and Beggs, 1995). The seasonability of adult crane fly species was determined by Toft and Beggs (1995) with the help of Malaise trap. They reported that 11 species shared at least 40% of their flight period with high wasp numbers, with 3 of these restricted almost entirely to the period of high wasp abundance. These species were most vulnerable to the predators including Wasps.

Adler and Adler (1991) studied mating behaviour and the evolutionary significance of mate guarding in three species of crane flies namely *Dactylolabis montana*, *Limonia simulans* and *Antocha saxicola*. All these species were polygamous and sex ratio was male-biased. After a short mating bout, males guarded by females by standing over them during oviposition. Sperm competition appeared to be intense and followed last-male advantage, based on the packing of sperm within the two elongate spermathecae. Males of *A. saxicola* successfully defended its rivals over 85% of the time. In contrast, males of *D. montana* and *L. simulans* lost the female over 65% of the time during interactions with rivals. A guarding male does not have to retain the female for guarding to be adaptive. Legs and claws of all species were sexually dimorphic and played an important role in guarding and defending.

In an Ichneumonid fly *Eriborus artengeopilus* (Cameron), a parasitoid and biocontrol agent of gram pod borer *Helicoverpa armigera* (Hubner) (Lepidoptera) the pre-mating, mating and post mating periods averaged 8, 4.5' and 12 days respectively (Sathe & Margaj, 1996). In the present crane fly pre-mating period was nil, mating period was 3 hr and post mating period was 15 days. The crane fly also displayed the following chain of mating behavior: attraction, recognition, orientation, wing fanning, mounting, copulation, tail to tail end position and post copulatory grooming. Similarly, oviposition was also accomplished by a chain of behaviours viz., recognition of site, antennal examination of oviposition surface, insertion of abdomen in soil and actual oviposition. The present work will be helpful as a baseline data for understanding economical aspects of crane flies and their role in ecocycles.

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