

Nuptial flights of ants provide a fat and protein-rich diet for birds

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Abstract: In many ant species, nuptial flight tends to be short in time and assumed to be synchronous across a large area. Here, we report that, massive nuptial flights of Carpenter ants (*Camponotus* sp.) occur frequently throughout the summer and beginning the monsoon, and their alates form up to 90% of the diet of the birds during this period. This fat and protein-rich diet enables both sexes accumulate may serve as an energy source and feed for juvenile and nestlings for their growth. The annual nuptial flight period enable them to exploit the extremely nutritious forms of ant alates when the juvenile and nestlings' energetic demands are highest.

Keywords Ants, Birds, Diet, Nuptial flight. ant alates

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I. Introduction

Every living organism requires considerable amount of energy for its sustenance and reproduction. Constant food intake is essential on day to day basis to fulfill energy demand. Therefore, foraging strategies adopted by birds are one of the major interesting fields of research.

Ants are widespread and abundant in almost every terrestrial ecosystem (Hölldobler and Wilson 1990; Folgar-ait 1998), yet surprisingly little is known about their reproductive ecology (Dunn et al. 2007). In many ant species, mating occurs in nuptial flights, in which males and females emerge from their maternal nest in order to mate and establish new colonies. Most ant species are exogamous and invest much energy and biomass in their reproductive castes, making the precise timing of nuptial flights also of paramount importance for their predators. Synchronization among colonies could serve as an antipredator strategy by swamping the predator population. Such a reproductive strategy is known for many ant and termite species, as well as for tropical trees with mass flowering (e.g., Van Schaik et al. 1993; Kelly 1994). In temperate latitudes, nuptial flights are brief, usually synchronized with meteorological events such as first rain of the season or an extremely hot day (Hölldobler and Wilson 1990) or concentrated at the beginning of summer or early fall (Dunn et al. 2007). There are two main types of ant mating syndromes (Hölldobler and Bartz 1985; Hölldobler and Wilson 1990; Boomsma et al. 2005): (1) male aggregation, in which large swarms of male alates gather in aggregations that function as leks, at which the females arrive to select males. These gatherings tend to be short in time and are assumed to be synchronous across a large area and (2) female "calling," in which females attract males. This latter syndrome can last for very long periods or even year-round, with occasional males flying out in search of calling females. These species usually perform mass nuptial flights on spring afternoons, synchronized with a low-pressure system that brings dry air and high temperatures, and is usually followed by a burst of rain (Kugler 1989). Compared with other flying insects, ant alates are very high-quality food as their bodies contain high proportion of fat (sometimes >50% of dry mass) and protein (Redford and Dorea 1984). Thus, ant alates are common food items for many insectivores.

II. Materials and methods

Study Area

The study was conducted in the Nemi Nagar urban area of Jaipur, Rajasthan, India. The geo-coordinates lies within latitude 26° 1' 36" North and longitude 75 4' 32" East. The height above mean sea level is 390 m. East and North area of Jaipur district is surrounded by Aravali hills. Very close to Jaipur, there is a single natural lake named Sambhar lake, the water of which is salty and is the largest source of good quality salt in India.

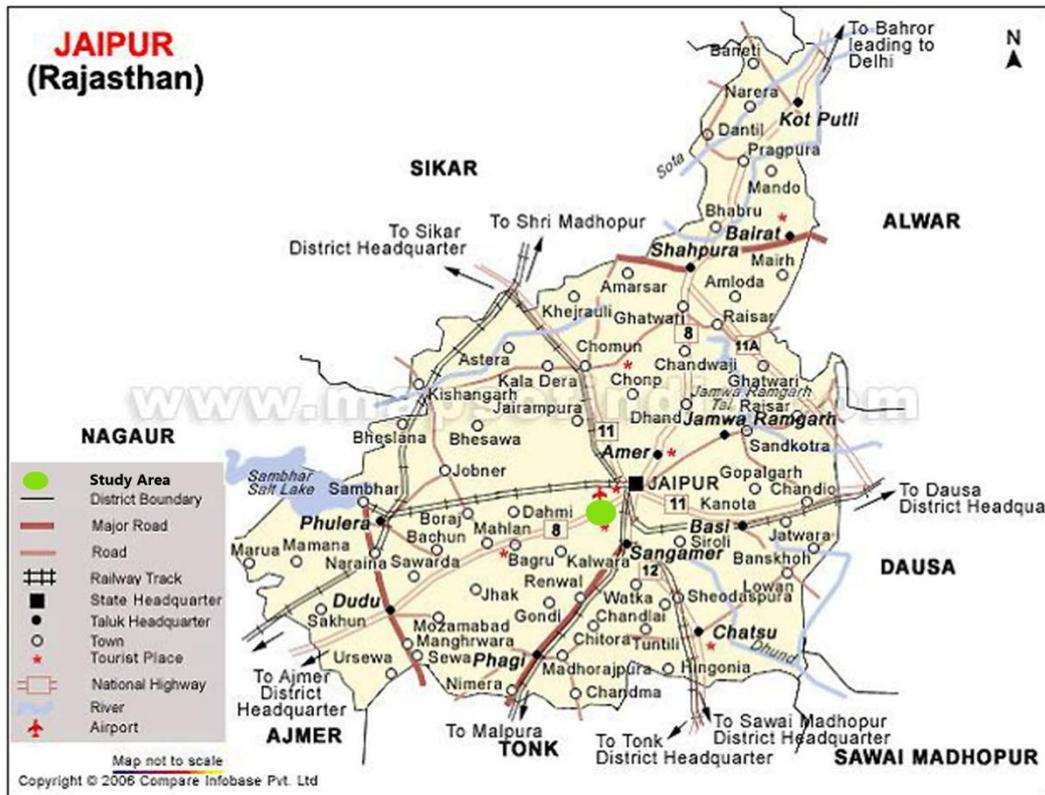


Fig. 1 . Study Area

Jaipur - the capital of Rajasthan is situated on the eastern boundary of Thar desert- a semi arid land. A distant place from Arabian Sea as well as Bay of Bengal gives rise of continental climate. During monsoon period from July to September and occasionally during rest period of the year in the wake of western disturbances humidity, cloudiness and rainfall activities increase. The year is broadly divided into four seasons namely - the winter season starts from mid December to mid February, summer or hot weather season from March to May, monsoon season spread from end of June to mid September, and October and November are known as transit period or post monsoon period. The summers in Jaipur are very hot while winters are extremely cold. The maximum temperatures hover at 40 °C to 47 °C in May. Heat wave prevails for a few days in the season, when day temperature rises to 4 – 6 °C above normal. The winter minimum temperatures remain about 4 – 9 °C and fall below zero deg. Or so when chilly wind (northerly) blow from Himalayan region. Mist and fog occur in the morning hours after passage of western disturbances. The minimum temperature as low as -2.2 °C was recorded on 16 th January, 1964 and 31 st January, 1905.

The Maximum temperature's upward surge starts from April and reaches at peak in the month of May. The down ward trend in minimum temperatures commences in September and continues up to January. January is the coldest month. Rainfall increases from the month of June when thundery activities start and July and August are the rainiest months. Monsoon withdraws in the middle of September. Rainfall decreases sharply in October and November. These are the transit months.

Due to its particular topography and climate, this area hosts a very rich and diverse flora and fauna and constitutes a very important habitat for many birds and flying insects. For diet analysis of birds a number of methods have been employed for field studies by ornithologists (Duffy and Jackson 1986). Studies that require sacrificing of birds is not justified and most species of birds are protected under law. Further, analysis often may become biased against small and soft-bodied preys that are rapidly digested in stomach (Lifjeld 1983). Nestling of many bird species regurgitates food when approached. Such regurgitate pellets from nestlings are useful for diet analysis (Johnson et al. 1980). Emetic substances (Prys-Jones et al. 1974) and artificial nestling (Betts 1956) can also be used. Moreover, these methods give little information about food content of adults if prey taken by adult differs in type and size than that fed to nestlings.

Direct field observation of foraging individual is a popular method to determine food of the bird. It is easy to approach and ideal for birds that eat large and conspicuous food items. Further, it does not require capturing or killing of birds and it is unaffected by different digestion rate of various prey species; so direct

observation was easier. Another important thing was that the close observation was possible within a distance 5 to 30 m observation with 7x 50 binoculars or by camera. We used a photographed

Field observation

The period of observations was from 06:04 to 17:34 h on 29 May 2006; from 07:09 to 07:30 h on 28 May 2007 and from 14:06 to 14:37 h on 28 January 2017. We had been observing avian activity daily in the morning, but those days we noted relatively little more avian activity. We then encountered a different birds were feeding on swarming insects and some were feeding to their chicks to same insects. Birds were observed and taken their photographs during the entire observation period. Observations by photographs of the species of birds that were actively feeding at the swarm of alate carpenter ants are presented below:

S.No	Date	time	Name of Species	Local Name	observation
1	29 May 2006	06.04	<i>Pycnonotus cafer</i>	Red-vented Bulbul	Feeding
2	29 May 2006	06.15	<i>Saxicoloides fulicata</i>	Indian Robin	Feeding
3	29 May 2006	06.21	<i>Sturnus pagodarum</i>	Brahminy Starling	Feeding to juvenile
4	29 May 2006	17.17	<i>Pycnonotus cafer</i>	Red-vented Bulbul	Feeding
5	29 May 2006	17.17	<i>Saxicoloides fulicata</i>	Indian Robin	Feeding
6	29 May 2006	17.20	<i>Saxicoloides fulicata</i>	Indian Robin	Feeding to juvenile
7	29 May 2006	17.33	<i>Turdoides striatus</i>	Jungle Babbler	Feeding
8	28 May,2007	07.09	<i>Pycnonotus cafer</i>	Red-vented Bulbul	Feeding
9	28 Jan,2017	14.05	<i>Prinia socialis</i>	Ashy Prinia	Feeding
10	28 May,2007	07.12	<i>Saxicoloides fulicata</i>	Indian Robin	Feeding
11	28 Jan,2017	14.20	<i>Turdoides caudatus</i>	Common Babbler	Feeding
12	28 Jan,2017	14.26	<i>Acridotheres tristis</i>	Common Myna	Feeding
13	28 Jan,2017	14.29	<i>Passer domesticus</i>	House Sparrow	Feeding

III. Results

Based on direct observations of the birds during above dates, we estimate the different bird species were actively feeding at the swarm of alate carpenter ants. Our observations indicate that the nuptial flights are mainly in month of May in brief, usually synchronized with meteorological events such as first rain of the season or an extremely hot day or concentrated at the beginning of summer or early fall. (Dunn et al. 2007). This suggests that ants constitute the major food source consumed every summer by different bird species. The proportion of *Camponotus alates* in the diet of the birds increased during the summer.

IV. Discussion

Our finding of alates of (mainly female) *Camponotus* consume by the birds continuously for the two years in the May months is novel. Furthermore, in the month of January, 2017 unlike the flights of the alates found in mid day and consumed by more kind of birds like House sparrow and Ashy Prinia . We found that during month of May these birds feed almost in morning on *Camponotus alates*. The bird feeding to juvenile also coinciding with this period. In addition to the high energetic value of ant alates, fat intake (alates may contain up to 50% fat; Redford and Dorea 1984) can function as an important source of metabolic water (1.04 g H₂O per gram of metabolized fat) for the bird and their juveniles.

There are two contrasting views regarding feeding strategies of insectivorous birds: they may be opportunistic feeders and exploit patchy insect aggregations (Gould 1978; Fenton and Morris 1976) or may be non-opportunistic and select from among available insects (Whitaker 2004; Brigham 1990). The birds seems to belong more likely to the first group. Although ants reported in the diet of Indian Robin but ant alates not comprise the majority of its diet.



Red-vented Bulbul Feeding



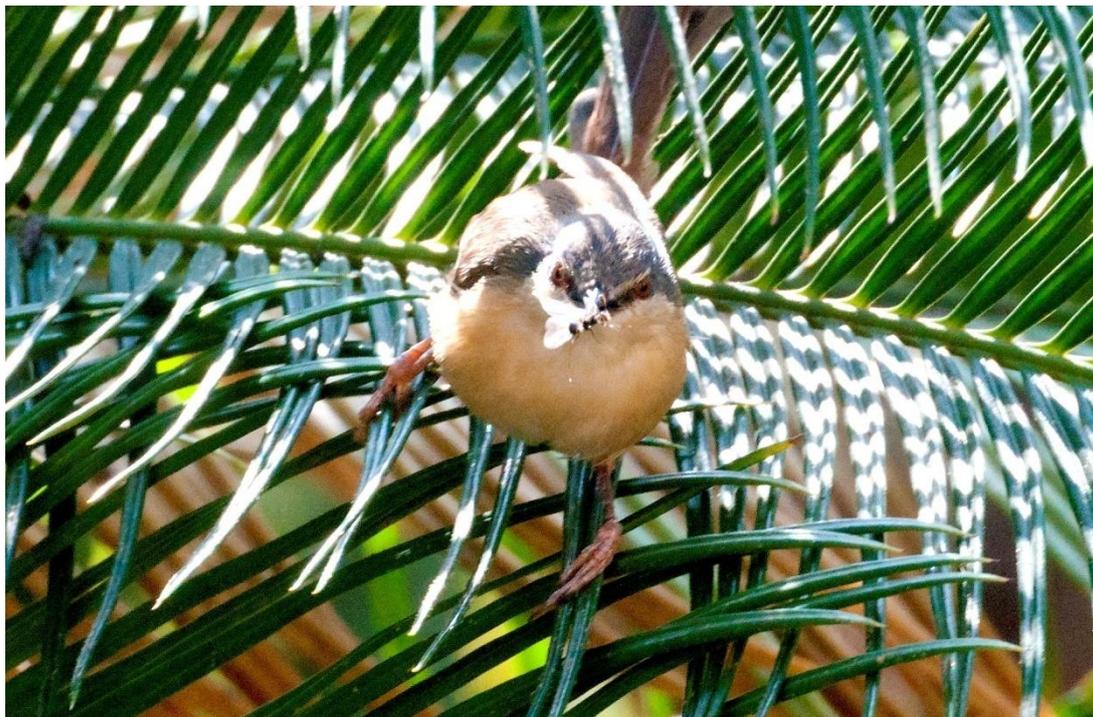
Indian Robin Feeding



Indian Robin Feeding



Common Myna Feeding



Ashy Prinia Feeding



House Sparrow (Female) Feeding



House Sparrow (Male) Feeding



Common Babbler Feeding

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