

Some observations on Red-vented bulbul (*Pycnonotus cafer*) preying on Plain Tiger (*Danaus chrysippus*) butterflies

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Abstract

Plain Tiger (*Danaus chrysippus*) is an unpalatable butterfly. As per theory of Batesian mimicry, female Danaid Eggfly (*Hypolimnas misippus*) and female Indian Fritillary (*Argyreus hyperbius*) mimic *D. chrysippus* for getting protection against avian predators. Birds are believed to be the main predators of butterflies and after an initial learning period these birds are expected to discriminate between the unpalatable butterflies - including mimics - and the palatable non-poisonous ones. Birds are not expected to prey on poisonous models as a matter of routine. Contrary to this, in 2007, Red-vented bulbul (*Pycnonotus cafer*) captured *D. chrysippus* continuously for about 15 days during breeding season in Noida, a satellite town of Delhi, without any apparent learning. As there are very limited direct observations of birds attacking butterflies reported in the literature, I have presented my observations in this paper for the sake of record. Circumstances under which *P. cafer* is likely to restore to predation on these unpalatable butterflies are also examined based on ten year butterfly counts (2003-2012) in the area and data collected on the nesting behaviour of bulbuls in the same area in the year 2013.

Keywords

Batesian mimicry, Red-vented bulbul, *Pycnonotus cafer*, Plain Tiger, *Danaus chrysippus*, predator, brood-parasite, Pied-crested cuckoo, *Clamator jacobinus*.

Introduction

Red-vented bulbul (*Pycnonotus cafer*) is one of the most common birds of India, much loved and quite welcome in all homes and gardens because of its sweet, short, fluid notes and cheerful presence. Plain Tiger (*Danaus chrysippus*) is one of the most common butterflies of India. Both *P. cafer* and *D. chrysippus* are quite common in Delhi area and here, just like in any other part in India, *P. cafer* is not reported to prey on *D. chrysippus* and this is probably because of two reasons: first, staple diet of the bulbul is fruits and berries (Fig 1.); and second, *D. chrysippus* (Fig 2.) is believed to be a poisonous, unpalatable butterfly to the birds. So, though bulbul happily picks up smaller moths and other insects in addition to its favourite berries, it generally stays away from *D. chrysippus*.

D. chrysippus is protected against attacks from avian and reptilian predators by virtue of the unpalatable alkaloids it ingests during its larval stage (Kunte 2000, Kehimkar 2008). In Noida, *D. chrysippus*



Fig 1. *Pycnonotus cafer* with a *Ficus religiosa* fig for young



Fig 2. *Danaus chrysippus* on sunflower

caterpillars feed on milkweed *Calotropis procera* and latex of this plant contains cardiac glycosides calotropin, uscharin, calotoxin, calactin and uscharidin. It increases the heartbeat respiration in animals leading to distress and death (*The Wealth of India*, Raw Materials, Vol. 3: Ca-Ci Revised Edition, CSIR, 1992, s.v. "Calotropis"). Feeding caterpillars of *D. chrysippus* store these poisons in their bodies and adult butterflies also retain them and thus become unpalatable to birds and reptiles. Female Danaid Eggfly (*Hypolimnas misippus*) and female Indian Fritillary (*Argyreus hyperbius*) are Batesian mimics of *D. chrysippus*.

As per *Handbook of the Birds of India and Pakistan* (Ali and Ripley 1971), food of *P. cafer* includes fruits and berries (of *Larantus*, *Lantana*, *Zizyphus*, *Ficus*, *Santalum*, *Salvadora* and others), flower nectar (of

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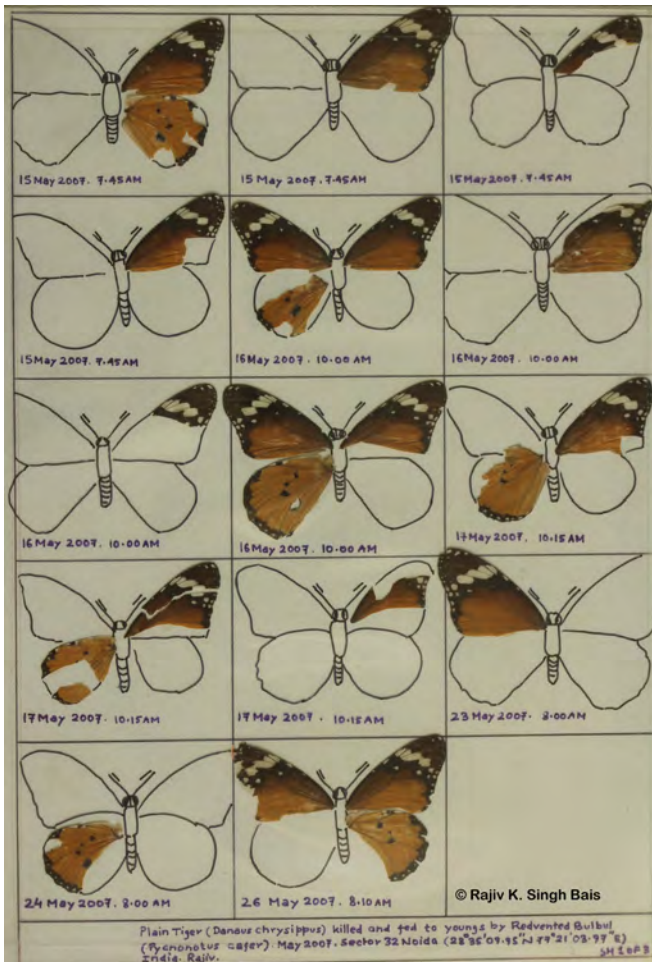


Fig 3. Re-constructed *Danaus chrysippus*. (Sh 1 of 3)

Erythrina, *Cappris*, *Salmalia*, *Woodfordia*, *Lavanthus*, etc). It also feeds on insects (caterpillars, moths, ants, termites etc.). *Handbook* also mentions of a young lizard, 9cm long, brought to the nestlings resulting in the death of a 5-6 day old chick attempting to swallow it. In one study (Bhatt and Kumar 2001), conducted from April 1995 to April 1997 in Haridwar in north India, about foraging behaviour of *P. cafer*, butterflies are not reported to be a part of bulbul's food. But in May 2007 bulbuls were seen preying on *D. chrysippus* butterflies continuously for 15 days in Noida, a satellite town of Delhi.

Main Predators of Butterflies

Writing about mimicry in butterflies, Punnett (1915) writes that the data at present available with regard to the attacks of bird upon butterflies under natural conditions are too meagre. He also writes about experiments involving feeding of birds in captivity and cautions that the food accepted or rejected by captive animals is very little guide to its preference under natural conditions. Shapiro (1974), while proposing beak-mark scoring for estimating the frequency of predator-prey contacts in butterfly population, quotes from many different sources and concludes that direct observations of bird attacks on

butterflies are rare. He further says "... beakmark scoring is the only method (other than direct observations) currently available for estimating the frequency of predator-prey contacts in butterfly population...". Clearly, data related to direct observations of bird attacks on butterflies in their natural habitat are very important for modifying and correcting our understanding of the concept of mimicry in butterflies. In view of such paucity of data on direct observations of bird attacks on butterflies-more so when chemically protected models are involved. It is important that all such observations are carefully recorded in proper context. This paper is presented with records of bulbul's attack on *D. chrysippus* and *Danaus genutia* in the year 2007 and related data collected over a period of 10 years from 2003 to 2012 and possible explanations of this not-so-common behaviour of Red-vented bulbul.

Study Area I (Foraging ground of bulbul)

A government nursery in the partly developed sector 33A of Noida (28.586N, 77.352E), India, (Fig 7). This nursery is surrounded by barren land and yet-to-be-developed parks. This nursery is a part of the transect I walked for ten years from 2003 to 2012 for counting butterflies. Beyond these empty plots of land are some of the most densely populated areas of

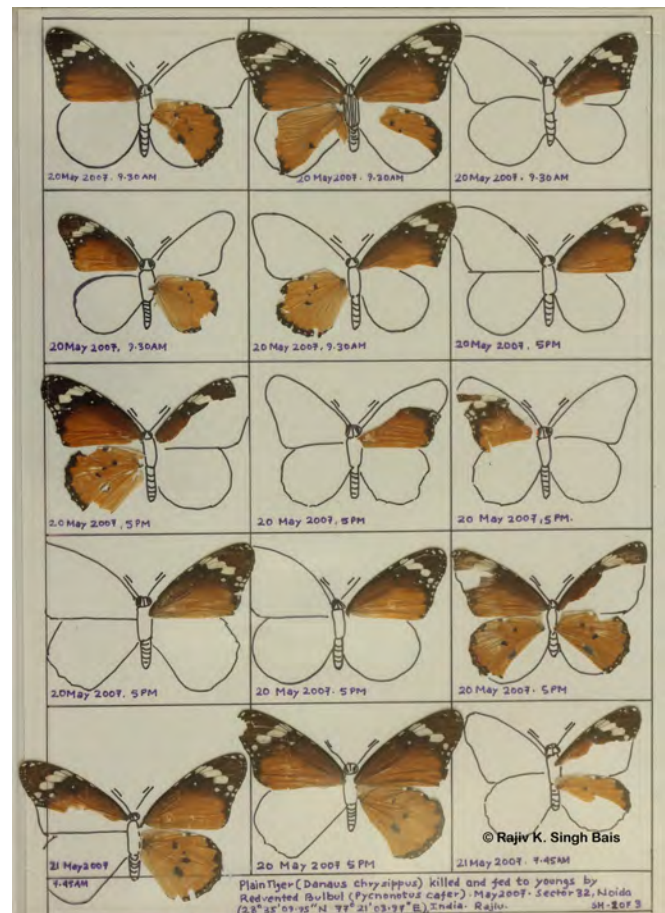


Fig 4. Re-constructed *Danaus chrysippus*. (Sh 2 of 3)

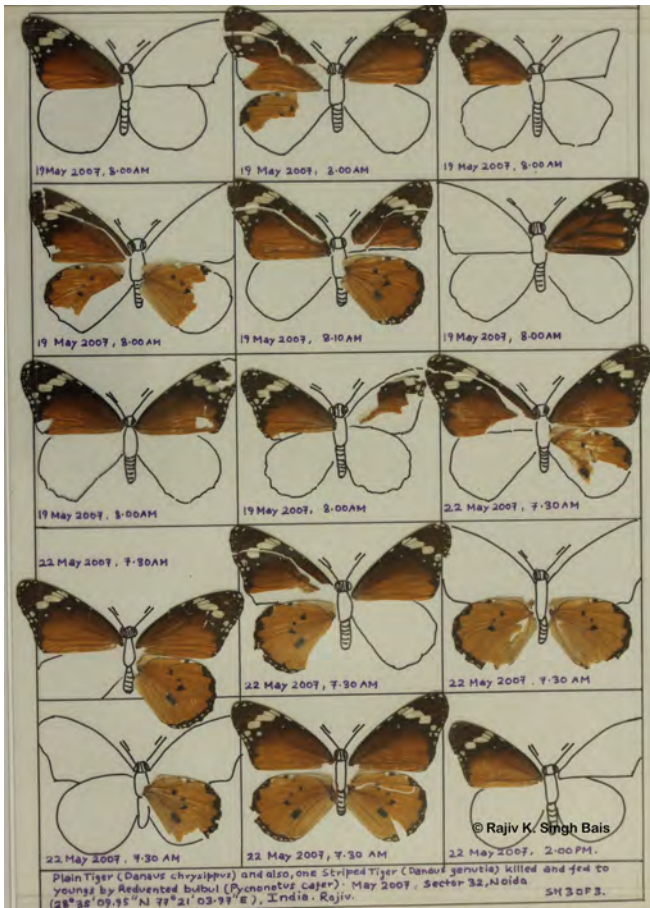


Fig 5. Re-constructed *Danaus chrysippus* and *Danaus genutia*. (Sh 3 of 3)



Fig 6. *Pycnonotus cafer* killing a *Danaus chrysippus* for young. Photo: Rajiv K. Singh Bais

the town. Every year during the monsoon empty plots around the nursery get overgrown with variety of flowering wild plants including milkweed (*Calotropis procera*), Dandelion (*Taraxacum officinale*), *Lantana camara*, *Sida rhombifolia*, Indian Mallow (*Abutilon indicum*), *Cassia sophera*, *Cassia mimosoides*, Mexican Poppy (*Argemone mexicana*), Congress grass (*Parthenium hysterophorus*) and Wild Field Thistle (*Cirsium arvense*). *C. procera* is

the larval food plant of *D. chrysippus* in the study area. There are also sparsely located trees of *Millettia pinnata*, *Neolamarckia cadamba* and *Vachellia nilotica*. Inside the nursery *D. chrysippus* is attracted to the flowers of *Jatropha (Jatropha integerrima)*, Marigold (*Tagetes* spp.), *Cirsium arvense* and *lantana camara*.

Methodology

As mentioned before, a 1.0 km transect was walked at least once every week for counting butterflies generally in line with *Monitoring Butterflies for Ecology and Conservation* (Pollard and Yates 1995). Records were kept for butterflies, day-flying moths and any other interesting observations related to butterflies. This methodology evolved over time as the recording progressed and newer observations (e.g. birds attacking butterflies) made.

Observations

In May 2007, in addition to recording butterflies, I was also documenting nesting activities of a pair of Small Green Bee-eater (*Merops orientalis*). 06 May 2007 was a day of *D. chrysippus* butterflies when I recorded 56 of them on flowering *Jatropha* and *Cirsium arvense*. This was a sudden increase in their numbers in the study area. Other butterflies present in the area were: *Junonia almana* (1), *Catopsilia pomona* (1), *Belenois aurota* (4) and *Lampides boeticus* (1). I was aware of a pair of Red-vented bulbul nesting somewhere nearby, though I was not recording its day to day progress. On this date bulbul was seen capturing and carrying small moths for the nestlings.

On 14 May 2007, bulbul chased and captured two flying *D. chrysippus* butterflies between 0750 and 0820 hrs. However on both the occasions butterflies escaped while being battered on the ground. I do not think these butterflies saved their lives by virtue of their unpalatability, but rather on the strength of their strong wings and muscle power. Even when the butterflies were getting away from the bird they were once again given a good chase by the bulbul. All along I believed *D. chrysippus* to be an unpalatable butterfly for the birds; though it was sometimes seen being captured by the preying mantids, I had never seen it being chased or captured by *Merops orientalis*, *Dicrurus adsimilis* or any other bird present in the area.

I soon discovered that both the parent bulbuls were hunting butterflies for feeding to their young – three of them – who were found perched at a height of 1.5 metre, partially hidden inside a loose cluster of bougainvillea. This day (14 May 2007), I counted following butterflies in the hunting ground of the bulbuls: *D. chrysippus* (31), *Tirumala limniace* (2). Main flowering plant: *Jatropha*.

Table 1. Number of butterflies reconstructed from broken wings collected during the observation period

SN	Date	Time hrs.	<i>Danaus chrysippus</i>	<i>Danaus genutia</i>
1	15-May-07	745	4	0
2	16-May-07	1000	4	0
3	17-May-07	1010	3	0
4	18-May-07	1020	0	0
5	19-May-07	750	7	1
6	20-May-07	945	5	0
7	20-May-07	1700	8	0
8	21-May-07	745	2	0
9	22-May-07	730	6	0
10	22-May-07	1400	1	0
11	23-May-07	800	1	0
12	24-May-07	800	1	0
13	25-May-07	750	0	0
14	26-May-07	810	1	0
Total			43	1

On 15 May 2007, I again returned to this area at 0745 hrs and counted *D. chrysippus* (28), *Tirumala limniace* (4), *Danaus genutia* (1), *Belenois aurota* (1) and *Lampides boeticus* (3). Bulbul again captured a flying *D. chrysippus*, battered it on the ground and took it to some distant location, wings still attached. While being battered on the ground the butterfly fell twice on the ground but could not escape. I collected one long piece of the forewing from the battering site. Bird took the butterfly high up on the electric line above the boundary wall of the nursery and then flew outwards. I also collected three more broken wings of *D. chrysippus* from the spot where yesterday bulbul was seen feeding the young and preserved them for re-construction. Bee-eaters (*Merops orientalis*) were also seen carrying insects inside the nest-hole but I never saw them chasing or capturing *D. chrysippus*.

16 May 2007 was a bright, warm sunny day with no wind. I counted following butterflies in bulbul's hunting ground: *D. chrysippus* (18), *Tirumala limniace* (3), *Belenois aurota* (1), *Pieris brassicae* (1), *Catopsilia pomona* (1), *Lampides boeticus* (1) and *Zizeeria karsandra* (4). I reached there at 0730 hrs and stayed up to 0830hrs. Today again the young were perched inside the same cluster of bougainvillea where I discovered them on 14 May 2007. Today I wanted to actually see bulbul capturing, battering and feeding a so called poisonous, unpalatable species of butterfly to the young. Soon at 0745 hrs, I was rewarded with the sight! One *D. chrysippus* was captured on the wings, battered on the ground and then taken to the young. Of the three young one looked slightly bigger than the other two. Butterfly,

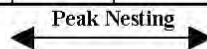
with orange wings still attached, was first offered to the smaller ones but they could not either handle the butterfly or showed reluctance to accept it. The butterfly was immediately offered to the third one. I am not sure if wings were also swallowed as I did not come any closer for fear of disturbing them while parent bird partly obstructed my view. I think the parent bird held the butterfly in the beak while the third juvenile pecked at it. I searched for the broken wings of the butterfly once the birds moved to another location but could not locate any. I re-visited the site at 1000hrs and collected wings belonging to four *D. chrysippus* killed between 0830 and 1000hrs.

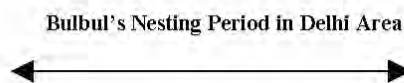
Subsequent to these encounters, I paid daily visits to the site during the period 15-26 May 2007 and collected the broken wings of the *D. chrysippus* (and also *Danaus genutia* on one occasion). Broken wings collected during each visit were placed in a separate paper envelope with date and later butterflies were re-constructed to arrive at the number of butterflies killed on each date. Size, age, colour, time of collection and relative location of the collection points were taken in to account while re-constructing the butterflies from the broken wings placed in any particular envelope. Re-constructed butterflies were pasted on A4 size transparent plastic sheets (Fig 3, 4 & 5). Details are summarized in Table 1. Peak numbers of *D. chrysippus* butterflies observed for the period 2003-2012 are given in Table 2.

During this first part of the study (Study Area I), I actually saw bulbul chase / capture the *D. chrysippus* on 14,15,16,17 and 22 May 2007. After this period, on 09 June 2007 at around 0830hrs in the same area, I again observed a bulbul offering a *D. chrysippus* to a juvenile perched on a low branch which the young could not handle and subsequently parent bird ate it completely with all the wings attached. I do not know if this was the same family which I watched in the month of May 2007 or a different one. Next day on 10 June 2007, I reached the same spot with a camera fitted with a 100-400mm lens to shoot bulbul catching *D. chrysippus* but bulbul did not oblige. On 01 July 2007 at 1715 hrs in the evening, I was roaming around the same spot in the nursery with camera when a bulbul brought one *D. chrysippus* for feeding to the young. Unfortunately before I could fire the shutter the bird got disturbed and quickly moved to another spot and in the process the butterfly fell off the beak. I could not locate the dead butterfly inside the dense *Lantana cluster*. There was only one more *D. chrysippus* at this late evening hour of the day. It appears that in 2007 breeding season this patch was a part of the foraging circuit of at least two pairs of bulbuls who nested nearby. In subsequent years (2008-2013) also ground under the flowering plants was checked for the presence of any broken butterfly wings but no *D. chrysippus* wings were found.

Table 2. Peak Numbers of *Danaus chrysippus* Butterflies in the Study Area I (Foraging ground of bulbul)

	Pre-monsoon				Delhi Monsoon			Post-monsoon				
2003				15 30 Apr					20 18 Sep			
2004						24 15 Jun					17 15 Nov	
2005					26 19 May							31 08 Dec
2006						13 24 Jun					20 05 Nov	
2007					56 15 May				06 08 Sep			
2008						10 28 Jun				04 19 Oct		
2009						12 06 Jun		70 29 Aug				
2010								49 03 Aug	40 03 Sep			
2011								24 07 Aug				
2012								08 15 Aug		09 02 Oct		
Year/ Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Peak Nesting


Bulbul's Nesting Period in Delhi Area


Observations by others

Usha Ganguli in article "Some notes on the nest behaviour of a pair of Red-vented bulbuls" (Ganguli 1963) has written about a pair of Red-vented bulbul nesting in Delhi in the month of April 1963. She writes: "... Both parents took turns to feed the young ones. To begin with they brought tiny insects, later I saw butterflies (which looked like Plain Tigers but are very likely to be female Danaid Eggflies which are excellent mimics of the Plain Tiger), green grasshoppers and grubs etc. shoved down the throats of the chicks. The butterflies were given whole – wings and all! ..."

Another paper (Stimson and Berman 1990) reports that on the island of Hawaii, the Monarch butterfly *Danaus plexippus* has two distinct and genetically

determined wing-colour morphs, white and orange. The white morph has increased in frequency in the last 20 years perhaps because of the predation on the orange form by introduced bird *Pycnonotus jocosus* and *P. cafer* bulbuls. During the study the ground and the grass under and near milkweed bushes (*Calotropis gigantea*) were searched for the wings of the Monarch, presumably broken off by the predator. Most of these wings were found to be orange. These two bulbuls *P. cafer* and *P. jocosus* were introduced in Oahu in 1965 and are now most common insectivorous birds preying on insects as big as Monarch.

Study Area II (Nesting site of bulbul)

After observing the predation of *D. chrysippus* by bulbul in the foraging ground (first part of this study

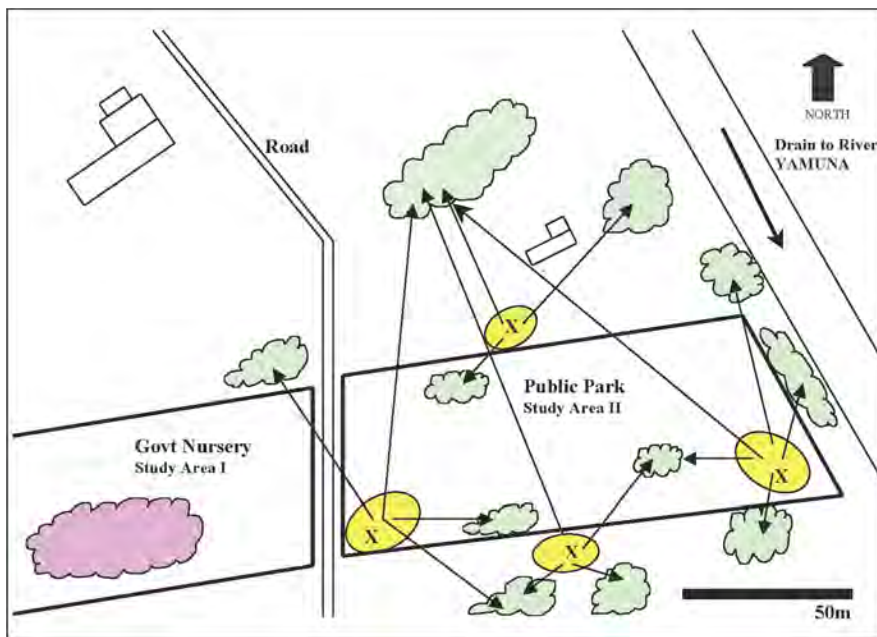


Fig 7. Location Map – Study Area I and II (28.586°N & 77.352°E)

Legends:

- X Bulbul's nest
- Yellow oval Bulbul's defended area around nest
- Cloud Foraging Patches
- Arrow Flight path to Foraging Patches
- Pink cloud Flower beds. Magnet for *Danaus chrysippus* butterflies

- Study Area I), bulbul's nesting area was discovered and chosen as Study Area II to observe bird's feeding behaviour at nest site. Study Area II was a recently developed public park (150m x 50m), adjacent to the Study Area I (Fig 7). In this park there were about 100 saplings of *Ficus benjamina*, 2-3 m high. Highly forked stems of this plant with dense umbrella like canopy on the top provided excellent nesting sites to the bulbuls of the area. Other trees included Arjuna (*Terminalia arjuna*) and guava. There were many nesting pairs of bulbuls in Study Area II but very few flowering plants or butterflies. Farthest foraging patch outside the park supported few fruiting *Ficus religiosa* trees. Nesting behaviour of *P. cafer* was observed in this park for four months, from March to June 2013.

Methodology

Bulbul nests were located by closely watching the activities of

the bulbuls. Red-vented bulbuls carrying nesting material or food in the beak were followed. Distress calls and injury feigning behaviour were also monitored to locate the nests. Identified nests were marked on a map. The study area was visited every alternate day for one hour from 0700 hrs to 0800 hrs and activities of the parent birds were observed. Returning parents were closely observed for the food they brought for the young. Activities of predators and brood parasites were also observed and recorded. On many visits, especially on Sundays when more time was spent in the field, camera with a telephoto lens was also used for photographing the birds. Flower beds of nearby Study Area I were also visited to check any increase in the number of *D. chrysippus* butterflies. Ground was also searched under flowering plants for butterfly wings.

Observations

Unlike bulbul's bold and determined behaviour in the Study Area I (foraging ground), Study Area II (nest site) revealed a different situation. Presence of numerous predators and brood parasites in the nesting area did not allow bulbuls to leave the nest unguarded for longer periods during their foraging trips. Many times they returned empty-billed for the safety of the brood and looked nervous and helpless. Fear of nestling starvation under the situation forced them to look for any, even if less-than-optimal food for the young in the immediate vicinity of the nest. This food included *D. chrysippus* or Yellow Paper Wasp (*Polistes hebraeus*) or any other insect flying close to the nest. Predation pressure in Study Area II is described in the following paragraphs.

Predators

In the nesting site (Study Area II) main bird predators were Crow-Pheasant (*Centropus sinensis*) and Shikra (*Accipiter badius*). *Centropus sinensis* was routinely seen being chased by the bulbuls, though no direct predation was observed. Shikra was found to be much more secretive and worked by stealth. It used to wait for a long time hiding in the foliage of a medium sized tree and then would launch a swift, straight plunge towards its target. Shikra was often seen being chased away by House Crow (*Corvus splendens*), Indian Myna (*Acridotheres tristis*) and Bank Myna (*Acridotheres ginginianus*) nesting in the same area. Near continuous alarm calls were raised by bulbuls, robins (*Saxicoloides fulicatus*) and ash wren-warblers (*Prinia socialis*) during the chase. From one of the bulbul's nest all the three nestlings were taken away by one of the predators. Built on the periphery, unlike the other nests which were well hidden in the middle, this particular nest was partly exposed and visible.

A family of Small Asian mongoose (*Herpestes javanicus*) was a permanent resident in the area but I never saw it near bulbul's nest during the study period. Rat snake (*Ptyas mucosa*) was occasionally spotted but again, I never saw it trying to reach bulbul's nest. Red-wattled lapwing (*Vanellus indicus*) closely followed the movement of the snake and physically attacked it. Study of breeding biology of Red-vented bulbul in Point Calimere Wildlife Sanctuary (Vijayan 1980) reports Indian grey mongoose (*Herpestes edwardsi*) to be the greatest single cause of nesting loss in the study area. The important bird predators were reported to be Crow-Pheasant (*Centropus sinensis*) and Rufous treepie (*Dendrocitta vagabunda*).

Brood parasites

In Delhi and Noida monsoon arrived on 16 June 2013, and the same day one Pied Crested Cuckoo (*Clamator jacobinus*) was spotted in the Study Area II at 0900 hrs. In fact I first spotted six bulbuls (probably three nesting pairs) swiftly chasing each other in a close loop near the hedge along the boundary wall of the park. Soon they all settled on different branches of the hedge in a compact, circular formation, and at the centre of this circle was the Pied Crested Cuckoo seriously working out a way to get out of this fix. It suddenly took to wings while all the six bulbuls chased it away and returned. *Clamator jacobinus* is a brood parasite of *P. cafer* (Tooth 1901, Osmaston 1916). It is a migratory bird, presumably from Africa, that reaches North India just before monsoon.

Behaviour of *P. cafer* in Study Area II

During breeding season, especially after the young hatched out, parents defended a very small area around the nest where they frequently returned and chased away the intruders. Visits were made to different foraging patches and fruits, insects or spiders were brought for the young. These foraging patches were in different directions and were generally within 250m from the nest (Fig 7.). Both parents generally moved together, leaving the nest unattended and returned roughly every 5-10 minutes in quick succession with food. Food was brought either by one or both the parents. On few occasions both the parents returned without any food and then anxiously searched for food around the nest site. On 27 May 2013 at 0730 hrs, under similar circumstances when they returned empty-billed, a Yellow Paper Wasp (*Polistes hebraeus*) was killed near the nest and taken to the nestlings. Similarly on 31 May 2013 at 0705 hrs a *D. chrysippus* butterfly was captured near the nest, battered on the ground, all four wings removed, and body taken to the nest. Luckily this time I could get few photographs of the bird killing *D. chrysippus* (Fig 6.).

Discussion

What caused the explosion of *D. chrysippus* butterflies in May 2007 is one question that needs to be studied further. Butterfly population is known to follow a cyclic trend from year to year linked to many factors including availability of the food plant. Plain Tiger population generally peaks in the pre-monsoon months in Delhi area. Milkweed *Calotropis procera* shrubs die off completely by December end and re-appear by next March. In 2007 Delhi received more than normal share of rainfall in the months of January and February and probably this early moisture provided favourable conditions to the early growth of milkweed in the area resulting in an early appearance of *D. chrysippus* which coincided with the peak breeding season of *P. cafer* (May-June). Table 2 indicates yearly peaks of *D. chrysippus* butterfly population for the period (2003-2012) in the study area.

Bulbul's choice of foraging patches

While selecting the nest site, birds choose a site that provides protection against potential predators, sun, wind, rain and proximity to the foraging area. As availability of food is generally quite patchy birds also decide about which food patches to visit. Fig. 7 shows the food patches chosen by bulbuls in the Study Area II in the year 2013. During the breeding season, if a particular patch of flowering plants attracted large number of *D. chrysippus* butterflies and their numbers crossed a certain threshold then that particular flowering patch became a part of the foraging circuit of the nesting bulbuls of the area. And if butterfly numbers were too large, then probably breeding bulbuls of relatively farther area also found it profitable (least effort per catch) to visit this patch. Bulbuls would capture the butterfly; remove one, two, three or all four wings from the body and then transport the bare body to feed to the hungry chicks. Subsequently juveniles would follow the parents to the foraging patches where parents would feed them with ease. This threshold value when a particular butterfly rich area becomes a foraging patch appears to be a function of many variables influencing the cost-benefit analysis made by *P. cafer* while deciding about the number of foraging patches to visit. These variables include types of prey and their nutritional value in each patch, travel time, search time, handling time etc. Based on the data presented in Table 2 for the Study Area I, this threshold seems to be a value between 26 to 56 *D. chrysippus* butterflies in an area measuring 25m x 75m. Once bulbuls start preying on *D. chrysippus* from this patch they would continue to visit it in a planned sequence for several days in a row till *D. chrysippus* butterflies are almost completely eliminated. This is one situation when bulbuls come to *D. chrysippus* with a purpose. However this appears to be true only during the

breeding season of bulbul and in non-breeding season bulbul will not prey on *D. chrysippus* even if this threshold is crossed. Towards the end of August 2009, *D. chrysippus* concentration was higher than May 2007 levels, still no butterfly was captured by the bulbuls probably because there were no breeding pairs around and no hungry chicks to be fed in late August.

There appears to be another situation during breeding season when bulbuls do not visit butterfly patch (butterfly numbers still below the threshold level) but still capture few *D. chrysippus* butterflies near the nest. As observed in Study Area II, on few occasions both the parent birds returned from the foraging patch without any food. This implies that they failed to secure the food within stipulated 5-10 minutes of absence from the nest site and for the safety of their chicks they were forced to return and defend the nest from the potential predators. Now at this juncture, both the parents looked anxious and desperately searched for food in the immediate vicinity of the nest (say within a radius of 10m from the nest) - any food - not necessarily the preferred source of nutrition. Now if a *Polistes hebraeus* or a *D. chrysippus* was spotted, the same was captured, killed and offered to the young as food before resuming their next normal trip to a distant foraging patch. As mentioned before, one *Polistes hebraeus* was killed on 27 May 2013 and a *D. chrysippus* on 31 May 2013 near the nest under similar circumstances.

This is the situation when *D. chrysippus* butterfly inadvertently enters the nesting area and gets killed. In this case killing of *D. chrysippus* is not linked to the abundance of butterflies but on bulbul's level of desperation and fear of starvation deaths of the ever-hungry nestlings. Even if there is just one *D. chrysippus*, it would be killed and offered to the young. When the chicks were not yet born (i.e. bird still incubating), *D. chrysippus* butterflies were regularly seen freely flying and sipping nectar on the flowers of the *Terminalia arjuna* within striking distance of the bulbul perched on the topmost branch of the same tree, close to the nest site but bulbul never showed any interest in chasing or capturing these butterflies till the young hatched out. So predation on *D. chrysippus* by *P. cafer* in the study area may now be summarized as follows:

1. *P. cafer* does not prey on *D. chrysippus* in non-breeding season.
2. During nesting season *P. cafer* may prey on *D. chrysippus* and there may be two situations:
 - i. During the nesting season, if *D. chrysippus* becomes abundant at some location in the foraging area then *P. cafer* will regularly visit this location to capture *D. chrysippus* as a food for the nestlings.
 - ii. During the nesting season if *P. cafer* is forced to stay put and guard the nest because of perceived threat from the predators and as a result prevented from bringing food for the nestlings from the foraging patch then if a *D. chrysippus* comes close to the nest the same shall be captured by the bulbul and offered to the nestlings as food.

ii. During the nesting season if *P. cafer* is forced to stay put and guard the nest because of perceived threat from the predators and as a result prevented from bringing food for the nestlings from the foraging patch then if a *D. chrysippus* comes close to the nest the same shall be captured by the bulbul and offered to the nestlings as food.

Suggestions

As butterfly counts in the study area are dwindling fast, I may not get any opportunity in the future to have *D. chrysippus* population at 2007 level coinciding with the peak breeding season of *P. cafer* in the area. Bird and butterfly watchers elsewhere may closely watch this interaction to check the validity of the proposed hypothesis. Toxicity levels of the milkweed in Delhi area may also be examined and compared with the toxicity records from other parts of the country where bulbuls do not prey on *D. chrysippus*.

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