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## A FAILURE OF THE RED PIERROT *TALICADA NYSEUS* GUÉRIN-MÉNEVILLE, 1843 (LEPIDOPTERA: LYCAENIDAE) BUTTERFLY TO COLONIZE DELHI AREA

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### OPEN ACCESS

**Abstract:** The Red Pierrot *Talicaada nyseus* Guérin-Ménéville, 1843 is a butterfly of the semi-arid plains. Its historical distribution range includes Sri Lanka, southern India, northeastern India and Myanmar. It was recently reported from a few places in northern India far away from its known range boundaries in India. Dehradun, Kumaon Himalaya, Delhi and Kalatop are the places from where it has been reported in the recent past. *Talicaada nyseus nyseus* appeared in the Delhi area in 2008, survived and bred for more than a year and then suddenly disappeared in the summer of 2009. The appearance of *T.n. nyseus* in Dehradun has been linked to the introduction of *Kalanchoe* ornamental plants in the newly developed residential areas. This paper examines the likely reasons for its disappearance from the Delhi area.

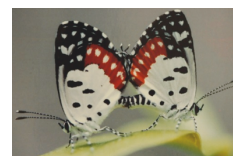
**Keywords:** Common Indian Yellow Wasp, *Kalanchoe*, *Polistes hebraeus*, Red Pierrot, *Talicaada nyseus*.

The Red Pierrot (*Talicaada nyseus* Guérin-Ménéville, 1843) is a butterfly of semi-arid plains, human habitations, urban gardens, hill stations and forests where *Kalanchoe* occurs (Kunte 2000). The nominate subspecies *Talicaada nyseus nyseus* is distributed in peninsular India south of Mumbai and Odisha. Two other subspecies are found in Assam and Burma (Myanmar) (Larsen 1987). Its historical distribution range includes Sri Lanka, southern India, northeastern India and Myanmar (see Table 1). It was recently reported from Dehradun where it is present only in the urbanized blocks with ornamental *Kalanchoe* plants in home gardens but absent from the native vegetation of the area (Singh 2005). It was also reported from Kumaon Himalaya (Haldwani, Chandadevi, Jones Estate) where it is now well established (Smetacek 2011). It was



DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENDANGERED	EXTINCT IN THE WILD	EXTINCT
DD	LC	NT	VU	EN	CR	EW	EX

*Talicaada nyseus*  
Red Pierrot



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also reported from Delhi (Smetacek 2009) and Kalatop in Himachal Pradesh (Mahendroo 2013).

To this list I add my own two records of this butterfly from northern India from outside its known historical range: one butterfly was spotted on 29 May 2008 at Kataha Ghat (27.106173N & 81.940446E), Gonda (Uttar Pradesh) and one on 31 May 2008 at Women's Polytechnic Campus, Lucknow (26.87650N & 81.000931E). I photographed the butterfly in Lucknow for the sake of a record and made an entry in my diary for the Gonda observation.

In Delhi, I first spotted this butterfly on 16 March 2008 at Lodi Colony and later on 26 March 2008 in Noida. Soon it became a regular sight in Noida and I started keeping a record of its sightings. On 07 June 2008, I collected caterpillars of *T. n. nyseus* and brought them home. The first butterfly emerged on 15 June 2008. I released it outside after taking photographs. On the very same day the monsoon reached Delhi, breaking a 108-year-old record (The Hindu, 16 June 2008) of early arrival. The scheduled normal date of arrival of the monsoon in Delhi is 29 June. On the very first day of the monsoon Safdarjang meteorological office recorded 30.3mm of rainfall between 08.30hr and 17.30hr. However *T. n. nyseus* disappeared from Delhi/Noida sometime in the middle of the summer of 2009 and has not been spotted since then.

### Study area

Sectors 33 and 24 of Noida (28.60N & 77.35E), India. Noida is a satellite town of Delhi. Sector 33 is a residential area with small home gardens and potted plants in almost all the houses. Sector 24 is an Institutional Area with numerous offices and educational institutes. A busy main road separates the two sectors. There are numerous *Kalanchoe* plants in home gardens and also in the flower beds in the office.

### METHODS

I kept daily records of butterfly sightings, including *T. n. nyseus* around my home in Sector 33 Noida for the period (2003–2012). Never in large numbers, this butterfly was seen only around the potted *Kalanchoe* plants in the home gardens in front of the houses. Fig. 1 shows the maximum number of the butterfly observed any month from January 2008 to December 2009.

After reading the initial reports of its survival in Dehradun, I believed it would easily establish itself in the Delhi area also but when it went missing for four consecutive years after its last sighting in May 2009, I thought it fit to carefully examine the reasons for

its disappearance from the Delhi area. I followed the following basic model to get an insight into the ecological requirements of this butterfly:

- (i) List all the known larval host plants of *T. n. nyseus* reported till date
- (ii) Plot a global distribution of these host plants
- (iii) Tabulate distribution of larval food plants in India
- (iv) Check availability of these host plants in the Delhi area
- (v) Plot current global distribution of *T. n. nyseus*.
- (vi) Analyze the patterns emerging from the above superimposed maps.
- (vii) Propose likely reasons for the disappearance of this butterfly from the Delhi area.

### Larval host plants

The presence of larval food plants is a fundamental requirement for the survival of any butterfly species in any particular geographical area. Though the mere presence of larval food plants of any specific butterfly species in an area does not guarantee the presence of that butterfly in the area, an absence of such food plants positively rules out their presence from the area. All the known larval food plants for *T. n. nyseus* are presented in Table 1. It becomes very clear that the *T. n. nyseus* larva feeds exclusively on *Kalanchoe* species.

*Kalanchoe* (Crassulaceae) comprises about 125 species of succulent flowering plants. With one species in America, 56 in southern and eastern Africa, and 60 in Madagascar, the genus extends to south-eastern Asia and as far as China. Madagascar contains the largest number of species, suggesting that it is an ancient centre of speciation, and perhaps the centre of origin for the genus (Allorge-Boiteau 1996). As per The Wealth of India - Raw Materials Vol. V, about 11 species are recorded from India though it (The Wealth of India) includes only three: *Kalanchoe integra*, *K. laciniata*, and *K. pinnata*, and further says that many *Kalanchoe* species are grown in India for their ornamental foliage and flowers. They prefer dry, rocky and sandy localities and are useful in gardens as border and pot plants and in rockeries. Table 2 lists 10 *Kalanchoe* species found in India in the wild. Until about 180 million years ago (Mya) the Indian plate was still joined with the Madagascar and Madagascar in turn was connected to Africa, so the presence of about 10 *Kalanchoe* species in peninsular India is no surprise.

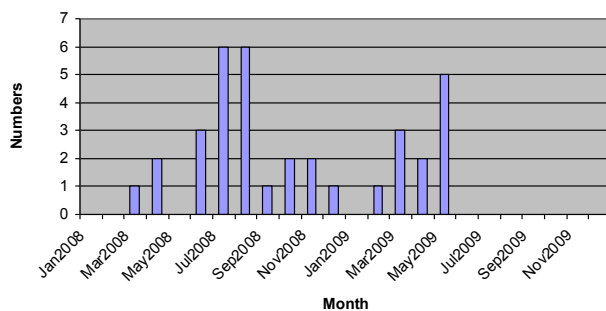
### Likely origin of *Talicauda nyseus nyseus*

Although it is tempting to assume that *T. n. nyseus* in peninsular India is a part of the remnant original fauna of the Madagascar and that the butterfly rode the Indian

**Table 1. Documented range and larval food plants of Red Pierrot Butterfly *Talicaada nyseus***

	Range	Food Plant	Source
1.	Assam, Upper Burma, Sind, Orissa, South India, Ceylon. Not found in Bombay. Poona during dry months (September to June). Belgaum – September and October. Hyderabad, Sind, Ganjam, Bangalore, the Pulni Hills, Calicut, Wynad, Rutnagherry, Canara, Travancore and doubtless throughout South India in suitable localities in addition to Assam and Upper Burma.	Crassulaceae family of plants such as <i>Bryophyllum calycinum</i> and <i>Kalanchoe laciniata</i> . These plants grow wild all over India	Niceville (1890)
2.	Central, western and southern India; Ceylon; Assam; Upper Burma.	<i>Bryophyllum calycinum</i>	Bingham (1907)
3.	<i>Talicaada nyseus nyseus</i> Guer. Ceylon; S. India. Not Rare. <i>Talicaada nyseus khasiana</i> , Swin. Assam, N. Burma. Not Rare. <i>Talicaada nyseus</i> Evans. Shan States. Rare		Evans (1927)
4.	Ceylon, southern India, Khasi and Naga Hills. N. Burma. Butterfly is extremely local but often abundant round its food plant. Widely distributed in peninsular India and has been recorded from many localities south of Bombay, Mysore and Orissa	<i>Bryophyllum</i> , <i>Kalanchoe</i> . Probably other species of Crassulaceae (Stonecrop family)	Wynter-Blyth (1957)
5.	The nominate subspecies is in peninsular India south of Bombay and Orissa. The two other subspecies are found in Assam and Burma. Seen on the streets of Colaba in Bombay	Crassulaceous plants such as <i>Kalanchoe</i> and <i>Bryophyllum</i> .	Larsen (1987)
6.	Not a common butterfly but abundant around its larval host plant – <i>Kalanchoe</i> . Distribution ranges over low elevations throughout the Indian sub continent.	<i>Kalanchoe laciniata</i> , <i>K. pinnata</i> . Later more commonly used because it is abundant and also grows in gardens.	Kunte (2000)
7.	Peninsular India (Mumbai southwards), Orissa, North East; Myanmar, Sri Lanka. Moist deciduous to evergreen forests from sea level to certain elevation.	<i>Kalanchoe laciniata</i> <i>K. pinnata</i> .	Kehimkar (2008)

Note: Names of many range locations mentioned in the original source as they appear in Table 1 have undergone changes. Significant changes are: Burma = Myanmar, Orissa = Odisha, Ceylon = Sri Lanka, Bombay = Mumbai, Poona = Pune, Bangalore = Bengaluru, Pulni Hills = Palani Hills, Wynad = Wayanad. No exact equivalents exist for Canara and Travancore. Erstwhile Travancore state covered central and southern Kerala including southern most part of Tamil Nadu. Canara roughly refers to coastal areas of Karnataka.



**Figure 1. Maximum number of Red Pierrot Butterfly *Talicaada nyseus* observed during any observation in a month from January 2008 to December 2009**

plate on its journey north, one study (Kunte 2011) of the biogeographic origins of the butterflies of the Western Ghats shows that the butterfly fauna of Western Ghats was established fairly recently in comparison to the tectonic history of the Indian peninsula. It further quotes (Larsen 1984) that dry habitat genera which includes *Tarucus* are most likely of Eremic (Saharan and central Arabian) origin which spread to India relatively recently, certainly long after the initial collision of the Indian plate with the Eurasian plate. The Indian plate collided with the Eurasian plate about 45 Mya.

In either case the presence of contiguous habitats throughout the path of its terrestrial dispersal is

necessary because its very weak flight close to the ground suggests that it is unlikely to fly long distances across large oceans.

## DISCUSSION

Larsen (1987) says that *T. n. nyseus* is locally abundant in the Nilgiri mountains of southern India from the foot of the ghats to the highest peaks; also present on the streets of Colaba in Bombay and its only ecological requirement seems to be the presence of Crassulaceous plants such as *Kalanchoe* and *Bryophyllum*. Its recent discovery in Dehradun (Singh 2005) was also linked to the introduction of *Kalanchoe* in home gardens in Dehradun which reinforced the observations made by Larsen. Fig. 2 shows the global distribution of *Kalanchoe* and also of *T. n. nyseus*. Keeping aside all other ecological factors limiting the spread and survival, the theoretical geographical range of *T. n. nyseus* can be as large as the entire tropical regions of the world wherever *Kalanchoe* is present. The present distribution of *T. n. nyseus* is much smaller. Even if we assume that most species of *Kalanchoe* can not be eaten by the *T. n. nyseus* larvae but only *Kalanchoe pinnata* and *K. laciniata*, as recorded from India, then also the butterfly should have expanded its range to the areas where *Kalanchoe pinnata* and *K. laciniata* occur, but it failed. Factors other than food plant availability restrict the range of *T. n. nyseus* to a

Table 2. Distribution of *Kalanchoe* spp. in India

	Species	Distribution	Synonym in FBI	Source
1	<i>Kalanchoe integra</i> (Medic.) Kuntze	Tropical Himalaya, from Bhutan to Kashmir, alt. 1000-3000 ft.; common. Burma. Tropical Himalayas from Kashmir to Bhutan up to a height of 6000 ft., on Lushai hills and in the Deccan.	<i>K. spathulata</i> DC	FBI WOI
2	<i>K. laciniata</i> (Linn.) DC.	Tropical regions of the Deccan Peninsula; In Bengal at Patna, Dacca. Burma. Mts. of Deccan Peninsula; Tovequary Hill in Belgaum and North Deccan Hills. Deccan and hilly areas of S. India up to an elevation of 3000 ft. Eastern Ghats, Andhra Pradesh, Tami Nadu.	<i>K. brasiliensis</i> (Camb.)	FBI FBI WOI FEG
3	<i>K. pinnata</i> (Lam.)	Tropical plains of India, from the base of Himalaya to Ceylon and Malacca; Universal in lower Bengal. Throughout the tropics of the world; presumed a native of Africa and an introduced plant in Bengal. Eastern Ghats	<i>Bryophyllum calycinum</i> (Salisb)	FBI FEG
4	<i>K. lanceolata</i> (Forssk.) Pers	Mts. of Deccan Peninsula, alt. 2000-7000 ft. ; common. Deccan Peninsula, Bihar. Peninsular India (endemic). Kerala – Kozhikkode, Palakkad; Tamil Nadu – Coimbatore, Dharmapuri, Madurai, Nilgiri, Salem. Abundant in the wastelands of Palghat.	<i>K. floribunda</i> (Wight & Arn)	FBI FEG IBO WGB
5	<i>K. lanceolata</i> var. <i>glandulosa</i>	Mts of the Deccan Peninsula. Western Ghats. Kerala – Palakkad, Maharashtra – Pune, Satara. Tamil Nadu - Coimbatore.	<i>K. grandulosa</i> (Hochst. in A. Rich.)	FBI IBO
6	<i>K. grandiflora</i> (Wright & Arn)	Nilghiri and Pulney Mts. alt 7000-8000 ft. Endemic to Southern Western Ghats. Kerala – Idukki, Wayanad; Tamil Nadu – Nilgiri, Dindigul, Theni.		FBI IBO
7	<i>K. olivacea</i> (Dalzell & Gibson)	High altitudes of Sirumalai Hills in the Eastern Ghats. Western Ghats. Kerala – Idukki, Palakkad; Maharashtra – Kolhapur, Pune, Satara.		FEG IBO
8	<i>K. tubiflora</i>	Native of Madagascar. Cultivated in gardens in India.		FEG
9	<i>K. bhidei</i> (T. Cooke)	Western Ghats. Kerala – Idukki; Maharashtra – Kolhapur, Satara.		IBO
10	<i>K. cherukondensis</i>	Eastern Ghats. Andhra Pradesh (endemic).		FEG

FBI - Flora of British India: Vol. II, (1879), Government of India; WOI - The Wealth of India: Vol. V. (1959), Council of Scientific and Industrial Research, New Delhi; FEG - Flora of Eastern Ghats: Vol. 3 (2007) T. Pullaiah, K. Sri Ramamurthy, S. Karuppusamy. Regency Publications, New Delhi ; IBO - Indiabiodiversity.org (Accessed on 05 Sep 2013); WGB - Western Ghats Biodiversity Information System <[http://www.ces.iisc.ernet.in/biodiversity/sahyadri\\_database](http://www.ces.iisc.ernet.in/biodiversity/sahyadri_database)> (Accessed on 05 September 2013)

much smaller geographical area which describes a very specific niche required for the survival of this butterfly. It implies that we can not simply bring in caterpillars of this butterfly to Delhi embedded in the fleshy *Kalanchoe* and expect them to survive unless other ecological factors are also equally favourable, including interactions with predators and parasites.

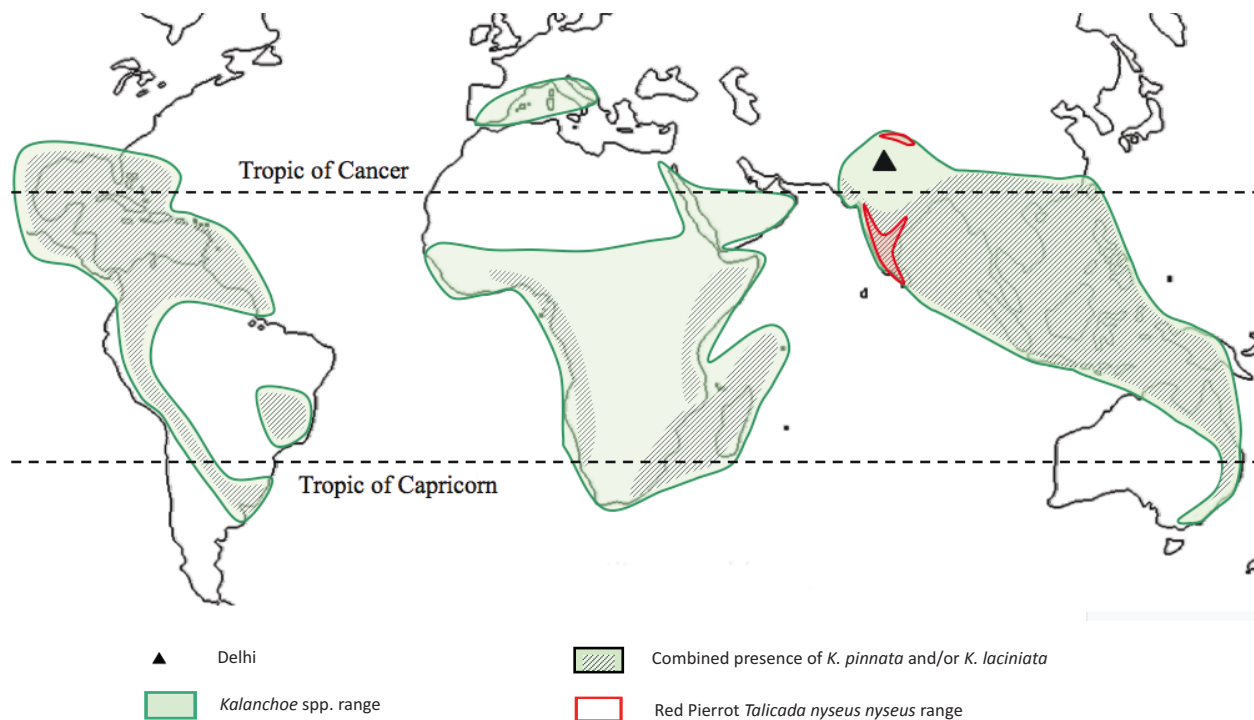
At least one *Kalanchoe* species, namely *Kalanchoe integra* (Medic.) Kuntze (*K. spathulata* DC) occurs naturally in the Himalaya from Kashmir to Bhutan which may explain the sustenance of recently introduced (or discovered) *T. n. nyseus* around human habitations in Dehradun, Kumaon and Kalatop. But the case with Delhi is different.

#### Status of *Kalanchoe* in Delhi area

Table 2 shows that there is no natural or naturalized *Kalanchoe* species in Delhi area, though ornamental

plants of *Kalanchoe* species are present in public parks and home gardens. This was also confirmed by Dr. Gurcharan Singh (pers. comm. 2013) of Delhi University. According to Gurcharan Singh in Delhi only cultivated species of *Kalanchoe* are found which he had personally identified and photographed and these included: *Kalanchoe beauverdii*, *K. beharensis*, *K. blossfeldiana*, *K. daigremontiana*, *K. pinnata*, *K. thyrsiflora* and *K. tomentosa*. Gurcharan Singh wrote in the same communication that J.K. Maheshwari's *Flora of Delhi* does not include *Kalanchoe*; not even the family Crassulaceae.

The quality of the habitat is the highest in the centres of species' ranges and becomes more unsuitable as the edge of the range is approached and the highest population densities are observed in the range core, but the species become increasingly rare towards its range margin. Without frequent immigration from core



**Figure 2. Global Distribution of food plant *Kalanchoe* and *Talicada nyseus nyseus***

This map is based on data obtained from following internet resources: <<http://www.discoverlife.org/mp/20m?kind=Kalanchoe+laciniata>> accessed on 13 September 2013; <<http://www.discoverlife.org/mp/20m?kind=Kalanchoe+pinnata>> Accessed on 13 September 2013; <<http://www.discoverlife.org/mp/20m?search=Kalanchoe>> accessed on 13 September 2013

populations to replenish individuals lost in peripheral populations, the latter may exhibit an increased incidence of local extinction (Mott 2010). It needs to be kept in view that *T. n. nyseus* is a weak flier and is generally seen fluttering around the food plant close to the ground. So, if it is purposely or accidentally introduced in the Delhi area then its survival will depend on the presence of a *Kalanchoe*-rich corridor up to the nearest wild population of *Kalanchoe* species in the forests of Himalaya or Deccan so that heavily preyed upon butterflies can be quickly replaced by fresh arrivals from the original source until the local population stabilizes. Without this it is unlikely that *T. n. nyseus* will ever survive in the Delhi area.

*Talicada nyseus nyseus* survived in the Delhi area for one full season, bred and produced a new generation shows that there are numerous favourable factors; biotic, abiotic or other, helping this butterfly to get a strong foothold in a new territory. However its sudden disappearance in May 2009 points to certain very unfavourable factors not allowing it to get fully established in the Delhi area.

#### Predation by Indian Yellow Wasp

Predation by the Indian Yellow Wasp (*Polistes*

*hebraeus* Fabr.) appears to be one such factor. On 17 May 2009 a mating pair of *T. n. nyseus* was caught by a *P. hebraeus* in Sector 24 (Images 1–3). As the wasp devoured one of the butterflies of the coupled pair the other one still remained joined until the piercing mandibles of the predator reached the junction point and then, with some struggle, the second butterfly succeeded in de-coupling itself and flew away. The wasp continued chewing the abdomen of the killed butterfly after discarding the curled up wings. When only a small ball of flesh remained, then the wasp carried it away to some unknown destination; most likely to its nest as food for the young. This was my last observation of this butterfly before it completely disappeared from the area.

In India *P. hebraeus* often occurs in and around dwellings. This wasp constructs papery nests in verandahs, eaves, ceilings or rafters or any convenient spots (The Wealth of India, Vol. V). In Noida, nests of Yellow Wasp are seen located 3–5 m from the ground, on small trees. The leafy canopy of the tree provides necessary protection against the sun and rain. Inside the houses these nests are found inside the window mounted room water coolers, under flights of stairs or even inside the silencer of a parked motorcycle if it is





Image 1. Red Pierrot *Talicada nyseus nyseus* mating pair in Noida



Image 2. Indian Yellow Wasp killing a Red Pierrot butterfly *Talicada nyseus nyseus* in Noida



Image 3. Indian Yellow Wasp *Polistes hebraeus*

not used for long. During spring time there are normally 3–4 smaller circular nests of *P. hebraeus* in our home measuring just 5cm across. Nest building begins around Holi festival in the month of March and the entire

process of nesting and breeding slowly comes to an end after the monsoon hits Delhi. In 2010 a big rectangular nest was constructed inside our house measuring 23x12 cm with around 800 cells. It hung from the lintel of the corner window of the bathroom on the outside.

*Polistes* spp. are generalist predators. Adult wasps forage for two classes of food: arthropods and nectar (Gadagkar 1991). Caterpillars are the chief source of food for the young of these wasps. In one study (Clapperton 1999) conducted in New Zealand on recently established Asian Paper Wasp (*Polistes chinensis*) lepidopteran larvae were found to be the most common prey accounting for 90% of the arthropods identified in the collected pellets. Other arthropod groups represented were Diptera, Coleoptera, Formicidae, Cicadellidae and Pholcidae. For searching caterpillars, workers descend on the grass, herbs and shrubs and meticulously search each and every blade of grass by first landing on the blade and then slowly walking the entire length, first on the top and then on the underside, stopping now and then on sensing the presence of any caterpillar and then finally lifting the caterpillar and flying back to the nest. Bigger caterpillars are killed on the spot and only smaller flesh balls are transported. *T. n. nyseus* caterpillar is protected against such attacks from wasps and other predators as it bores a hole in the fleshy leaf of the *Kalanchoe* as soon as it emerges from the egg shell and enters inside of the leaf to spend the rest of its life in complete safety between the two epidermal layers of the leaf. However the adult butterfly has no such protection.

In Delhi, *T. n. nyseus* thrived only around potted *Kalanchoe* plants in the home gardens and could never get a foothold in the wild for want of larval food plants. However these very home gardens were also natural homes to the abundantly available ubiquitous *P. hebraeus* which easily captured these slow flying butterflies for feeding to their young during the breeding season. So, it appears that probably the *T. n. nyseus* population may stabilize in Delhi area away from man-made buildings and structures where predation pressure from *P. hebraeus* is much less or altogether absent. One location that immediately comes to mind is the rocky area of the Delhi Ridge around Indira Gandhi National Open University (IGNOU) in Maidan Garhi with very few tall trees and only shrubs and rocks strewn all over the place. If *Kalanchoe* is planted around these rocks in large areas then probably the butterfly will survive.

But how did it survive predation pressure in 2008? One study (Dejean 2011) shows a very strong decline in wasp populations due to particularly heavy rainfall

during the main rainy season in neotropical social wasps and also an increase in their populations as a result of low rainfall during the main rainy season. Early and excessive rainfall of 2008 from May to September in Delhi seems to have suppressed nesting and foraging activities of the *P. hebraeus* whereas *T. n. nyseus* flourished after its initial arrival in March 2008. In 2008, the monsoon advanced over Delhi on 15 June, about two weeks earlier than the normal date (29 June). During June, the northern parts of the country received excess rainfall. Punjab, West Uttar Pradesh and Haryana, Chandigarh and Delhi taken together received more than three times their normal rainfall (Monsoon Report 2008). Moreover, even before the monsoon reached Delhi the month of May recorded 146.2mm of rain, more than the total rainfall received in June (Indian Meteorological Department, District Rainfall Data for Delhi). This kind of excess rainfall must have suppressed the wasp population. But just the opposite happened in 2009. Year 2009 was the third highest rainfall deficient monsoon season (June to September) in the last 109 years for India (1901–2009). For entire India it was 22% deficient but for Haryana, Chandigarh and Delhi sub-division it was 35% deficient (Monsoon Report 2009). With little rains in May and practically rainless, hot and bright June, nesting and foraging activities of *P. hebraeus* in the summer of 2009 must have increased considerably resulting in heavy predation pressure on the lepidopteran caterpillars and adult butterflies. This predation, coupled with the fact that there are no wild populations of *T. n. nyseus* around Delhi to replenish the lost population, appears to be one of the major factors for the disappearance of this butterfly from the Delhi area.

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