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SHORT COMMUNICATION

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Balakrishnan Valappil & V.K. Chandrasekharan

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SHORT COMMUNICATION

Early stages of Nilgiri Grass Yellow *Eurema nilgiriensis* (Yata, 1990) (Lepidoptera: Pieridae), with a note on its range extension in the Kerala part of the Western Ghats, India

Balakrishnan Valappil [1] & **V.K. Chandrasekharan** [2]

[1] Nest, Santhinagar, Kizhuparamba P.O., Malappuram District, Kerala 673639, India.
[2] Kaniv (Kalathil House), Nhanampoyil, Edakkulam P.O., Kozhikode District, Kerala 673306, India.
[1] balavalappil@gmail.com (corresponding author), [2] vkchandrasekharanlic@gmail.com

Abstract: Complete documentation of the early stages of *Eurema nilgiriensis* (Yata) on the larval host plant *Ventilago bombaiensis* (Rhamnaceae) is presented in this paper. In addition to this, notes on the range extensions of this species in southern Western Ghats in Kannur, Kozhikode, Wayanad, Malappuram, and Palakkad districts in Kerala is also provided. Field records from the northern Kerala part of the Western Ghats and the complete biology are reported for the first time since its description in 1990. Photographic records from seven locations since 2011 were confirmed by comparing with the original descriptions and in consultation with the author of the species. Eggs collected from field were reared at home, and every stage observed is also reported, as well as the discovery of the host plant *Ventilago bombaiensis*. It is concluded that the species is widespread in forested areas at elevations from 70m to 1,000m.

Keywords: *Eurema andersoni*, host plant, *Ventilago bombaiensis*.

The Nilgiri Grass Yellow *Eurema nilgiriensis* (Yata, 1990), is a small yellow butterfly belonging to the 'sari' subgroup of the genus *Eurema* Hübner (1819) (Lepidoptera, Pieridae). The species was described from Nilgiri Hills by Osamu Yata in 1990 from personal collections in Japan (Yata 1990). This species is closely related to other species of grass yellows such as *E. andersoni* (Moore, 1886), *E. ormistoni* (Walkins, 1925), *E. celebensis* (Wallace, 1867), and *E. beatrix* (Toxopeus, 1939), these five taxa forming a group called the 'andersoni complex' (Yata, 1989, 1990, 1991, 1992). Of these, *E. andersoni* and *E. nilgiriensis* are seen in the southern Western Ghats including Kerala, Karnataka, and Tamil Nadu (Larsen 1987; Gaonkar 1996; Kehimkar 2016; Kunte 2018). According to Yata (1990), *E. nilgiriensis* shows very distinct morphological characteristics (wing pattern), and the very distinct male genitalia distinguishes it from *E. andersoni*.

Basic morphological identification keys that separate *E. nilgiriensis* from *E. andersoni* are given below (Yata 1990).

1. Male (upperside of the forewing): Ground colour yellow. Black distal border broad with its inner edge more or less irregularly incurved from costa to vein 4, much obtuse angled at vein 4, more deeply excavated in space 2 than in space 3; while the distal border is

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more deeply excavated in space 3 than in space 2, in *E. andersoni* (see Image 24–27).

2. Female (upperside of the forewing): Ground colour pale lemon yellow. Black distal border fairly broad with its inner edge oblique and uniform from costa to vein 4, strongly angled midway, almost right-angled at vein 4, more deeply excavated in space 2 than in space 3; while the distal border is equally excavated in both spaces 2 and 3 in *E. andersoni*.

Materials and Methods

While on a usual butterfly watching trip in the forested tracts of the Kerala part of the Western Ghats, we encountered a female Nilgiri Grass Yellow laying eggs on a climber in a private plantation near a stream at Kakkad (11.494°N & 75.962°E, 50m) near Engapuzha, Kozhikode District, Kerala, on 24 December 2017 at 11.25h. The eggs were collected and reared in closed plastic containers at room temperature (25–30°C) with fresh leaves of the larval food plant. Eggs, various larval stages, pupa and the eclosed adult were photographed using a Canon 5D Mark III DSLR with a 100mm macro lens and a Kenko 1x1.4 teleconverter.

Results and Observations

Early stages

Female laid eggs on the tender shoots of the host plant. The eggs were white and spindle-shaped, having a narrow base as in other *Eurema* species. We collected two eggs. The eggs along with the hostplant leaves were kept in closed containers, wiping the condensed moisture at least twice daily. The same method of keeping the caterpillars and the host plant in closed containers were followed throughout the rearing process to keep the leaves fresh. The containers were cleaned of used up leaves, caterpillar droppings and the moisture condensed inside the jar. The transparent container was kept on window sill to expose the caterpillars to sunlight. The eggs hatched after four days. The small, slender caterpillar (Image 2a, 2b) was creamy white in colour. Later the colour turned yellow, with the caterpillar resting

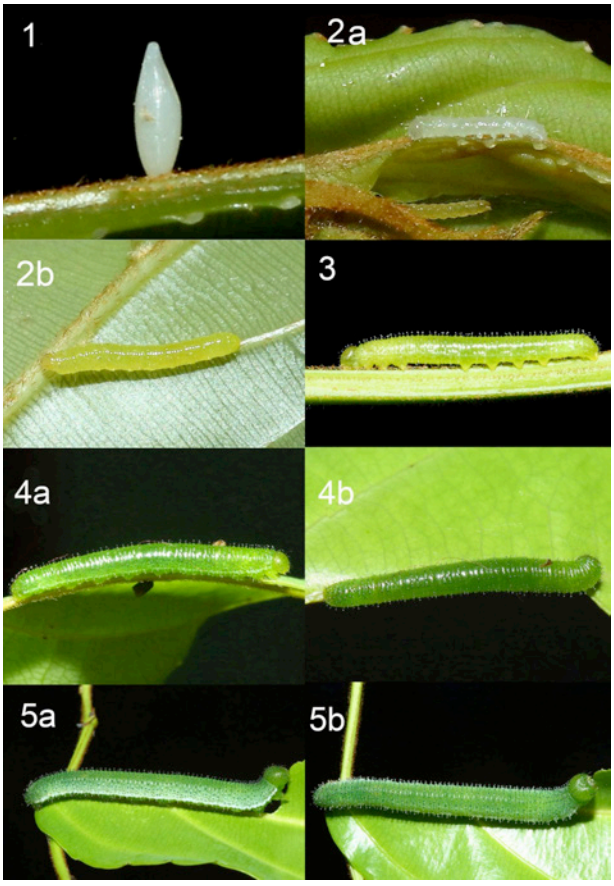

Image 1–5. Early stages of *Eurema nilgiriensis*: 1—Egg | 2(a–b)—First instar larva | 3—Second instar larva | 4(a,b)—Third instar larva | 5(a,b)—Fourth instar larva. © Chandrasekharan V.K.

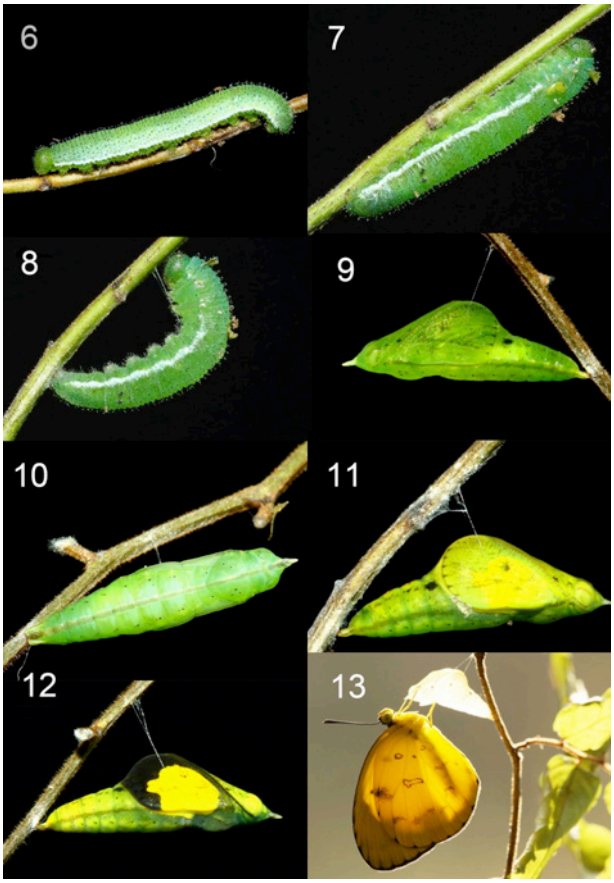

Image 6–7. Early stages of *Eurema nilgiriensis*: 6—Fifth instar larva | 7,8—Prepupation larva | 9,10—Pupa | 11—Pupa a day before eclosion | 12—Pupa before eclosion | 13—eclosed butterfly. 6–12 © Chandrasekharan VK, 13 © Balakrishnan Valappil.

Image 14–15. Imago *Eurema nilgiriensis*: 14—Upperside | 15—Underside. 14 © Balakrishnan Valappil, 15 © Chandrasekharan V.K.

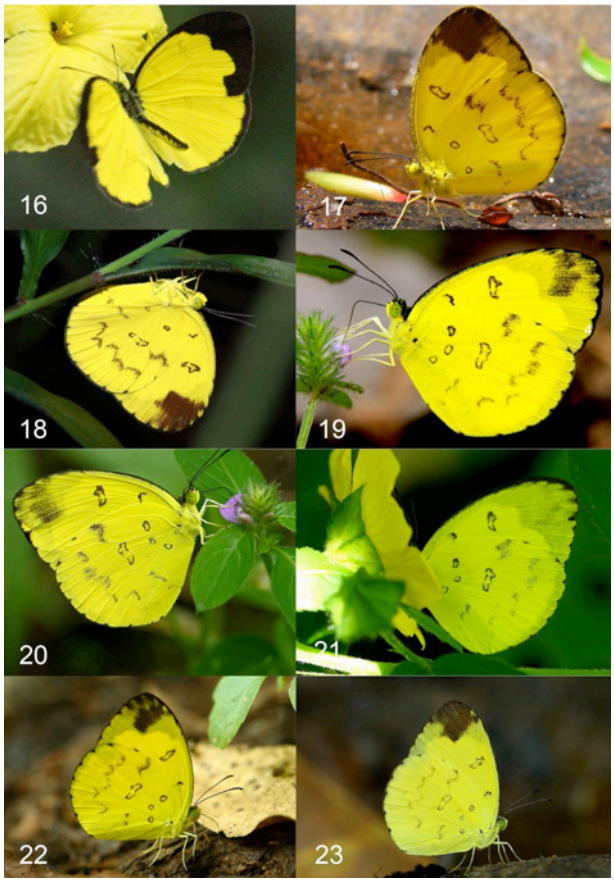

Image 16–21. Earliest field records of *Eurema nilgiriensis*: 16—Parambikulam TR | 17—Malabar WS |18—Aaralam WS | 19—Wayanad | 20—Wayanad | 21—Nelliyampathy Hills | 22—Malabar WS | 23—Karimpuzha WS. 16 © Balakrishnan Valappil, 17 © Sasi Gayathri, 18–23 © Chandrasekharan V.K.

near the yellowish veins of the tender leaves in perfect camouflage. In the second instar, the caterpillar became greenish-yellow and had a thin lateral longitudinal line near the legs. In the third instar, the caterpillar turned more greenish and the lateral line became distinct. In the fourth instar, the caterpillar started eating semi-mature leaves and rested on the upper side of the leaf along the midrib facing the tip. The final-instar caterpillar was leaf green and the white longitudinal line near the legs had a continuous suffused white patch above, which faded towards the dorsum. The head was pale green having thin dark hairs. There were conical tubercles all over its body with each tubercle bearing a long hair. The longer hairs had drops of a transparent liquid at their tips. The final-instar caterpillar measured 21mm in length.

Pupation took place on the host plant twig kept in a

Table 1. Earliest photographic records of *Eurema nilgiriensis* in northern Kerala.

	Date of record	Location	Elevation (in m)	Area	Recorded by	Figure
1	05.xi.2011	Peruvannamuzhi	70	Malabar Wildlife Sanctuary, Kozhikode District	Sasi Gayathri	17
2	26.xi.2011	Meenmutty falls	150	Aralam Wildlife Sanctuary, Kannur District	VKC	18
3	12.x.2013	Kunhome.	741	Wayanad District	VKC	19, 20
4	10.x.2016	Kariyanshola	650	Parambikulam Tiger Reserve, Palakkad District	BV	16
5	30.ix.2017	Kakkayam	755	Malabar Wildlife Sanctuary, Kozhikode District	VKC	22
6	13.x.2017	Nelliyampathy	1000	Nelliyampathy Hills, Palakkad District	VKC	21
7	08.xii.2018	Panappuzha	70	Karimbuzha Wildlife Sanctuary, Nilambur, Malappuram District	VKC	23

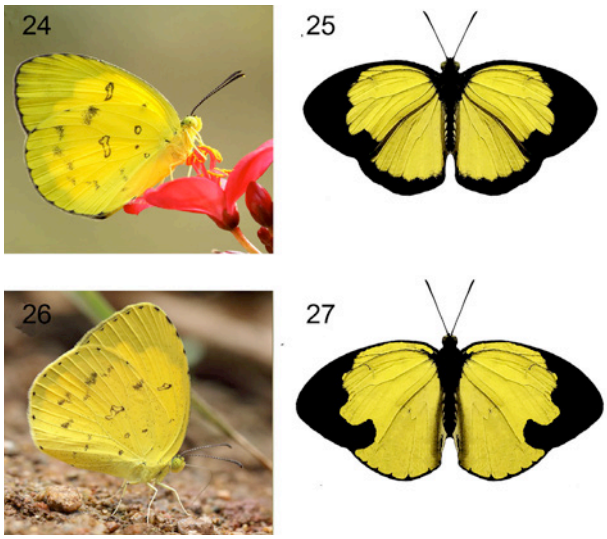

Image 24–27. Comparison of *Eurema nilgiriensis* and *Eurema andersoni*, 24–25. *Eurema nilgiriensis*: 24—Underside, phtograph | 25—Upperside, graphic representation | 26–27—*Eurema andersoni*: 26—Underside, photograph | 27— Upperside, graphic representation. © Balakrishnan Valappil.

jar. Before pupation, the caterpillar shrank and turned translucent green, with the white patch being reduced to a longitudinal line that discontinued at the 4th segment (Image 7,8). The freshly formed pupa was shiny green and translucent (Image 9,10); it later turned opaque and solid. It had pale black spots on both sides of the mid-dorsum and pale black blotches on the wing case. The pupal head had a conical pointed projection, of which the upper half was white in colour. The pupa measured 16 mm in length. The egg-to-pupa duration was 28 days. The adult butterfly emerged eight days after pupation. The total period from egg to adult butterfly was 36 days.

Larval food plant

Ventilago bombaiensis, Synonym *Smythea bombaiensis*, Family Rhamnaceae; Common name: Bombay smythea, Malayalam name: Vembada Valli, Image 28,29.

Range extension

Since the description of this species, no images of the live butterfly were published until November 2016. This was not due to the rarity of the species, but rather all images of the species taken from the Western Ghats were erroneously identified as One-spot Grass Yellow (*E. andersoni*), without detailed scrutiny. During an annual butterfly survey conducted at Parambikulam Tiger Reserve, Palakkad District, Kerala, in October 2016, BV photographed the upperside and underside of a *Eurema* species from Kariyanshola. With reference to the original

Image 28–29. Larval food plant of *Eurema nilgiriensis*: Ventilago bombaiensis, Family Rhamnaceae. © Chandrasekharan V.K.

description, it was found that the morphological features of the specimen photographed matched with those of *E. nilgiriensis* (Yata 1990). Subsequently, after a detailed review, some previous images that were considered to be *E. andersoni* from Western Ghats, Kerala, were found to be *E. nilgiriensis*, while some recent records are also confirmed as being *Eurema nilgiriensis*. We attach a table for ready reference summarising the confirmed records based on the external morphology (Table 1).

These sight records show that the species is very active during post-monsoon months, throughout the forested tracts of surveyed localities in Kannur, Kozhikode, Wayanad, Malappuram, and Palakkad districts of Kerala from elevations 60–1000 m in the Western Ghats. These records add to the recently published range extensions of this species from Kodagu District, Karnataka and Agasthyamalais, Kerala (Sujitha et al. 2019). From the above field records and the records already published (Sujitha et al. 2019), we presume that this species is active from September to May in the Western Ghats, October–November being the primary season. Males are often found engaged in mud-puddling along banks of streams and damp soil in well-wooded forests. Both

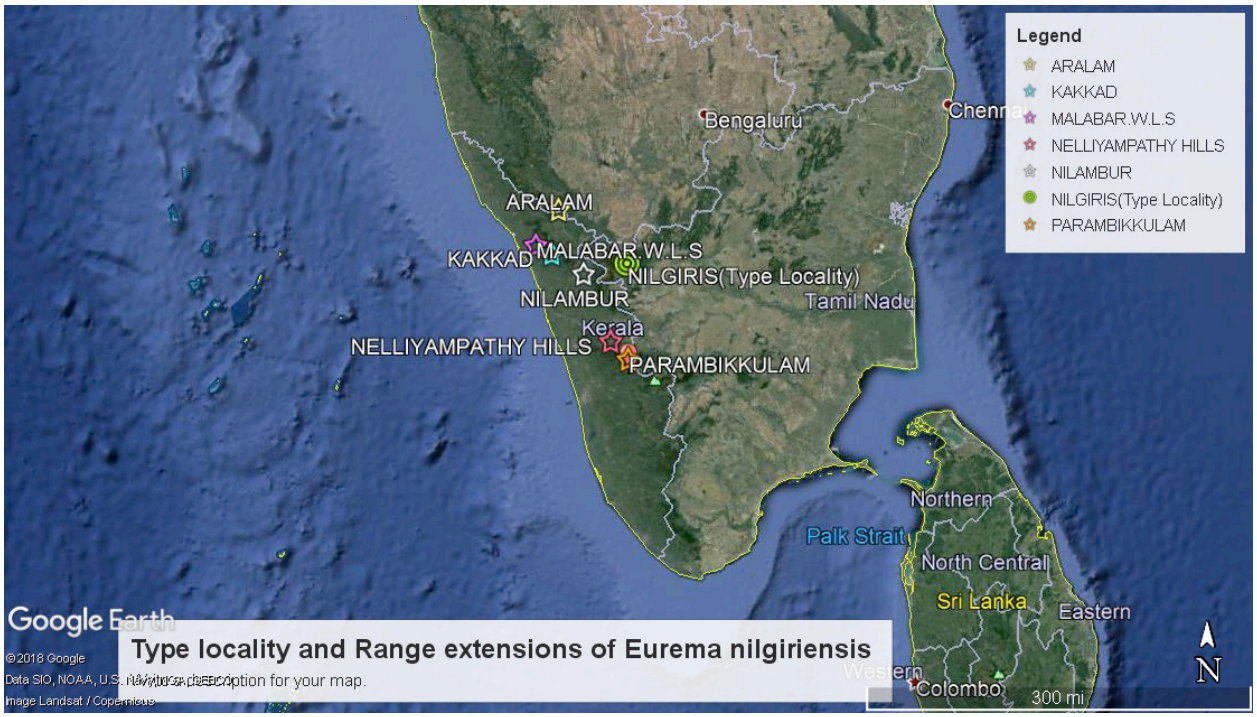

Image 30. Field records of *Eurema nilgiriensis* along with the type locality.

sexes can be found feeding on small flowers and flying along sunlit forest paths and along banks of streams, with females searching for the larval host plants, which are likely to be found on the edges of forest streams.

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