Scientific Note: Records of *Pseudocoladenia dan fabia* and *P. fatua* (Lepidoptera: Hesperiidae: Pyrginae) from Nepal

Sajan K.C.[1]* and Bishnu Prasad Neupane[2]

1. Independent Researcher, Pokhara-06, Lakeside, Nahar Marga, Gandaki Province, Kaski -33700, Nepal; ORCID iD: https://orcid.org/0000-0002-2749-0738; 2. National Entomology Research Center, Nepal Agricultural Research Council, Khumaltar, Lalitpur - 44700, Nepal; ORCID iD: https://orcid.org/0000-0001-9245-981X; *Corresponding author: sajankc143@gmail.com

Date of issue online: 29 October 2022
Electronic copies (ISSN 2575-9256) in PDF format at: http://journals.fcla.edu/troplep; https://zenodo.org; archived by the Institutional Repository at the University of Florida (IR@UF), http://ufdc.ufl.edu/ufir; **DOI**: 10.5281/zenodo.7246227.

Abstract: Several individuals of *Pseudocoladenia dan fabia* (Evans, 1949) and *Pseudocoladenia fatua* (Evans, 1949) are reported from Sunsari and Dhankuta districts of East Nepal. Identifications were based on external characters and genital structures of examined specimens. This is the first record of *P. fatua* from Nepal, while a previous report of *P. dan fabia* from Nepal was doubtful and we here confirm for the first time its occurrence in Nepal.

Key words: Fulvous Piet Flat, new record, Ruddy Pied Flat, Sikkim Pied Flat.

INTRODUCTION

The species of *Pseudocoladenia* Shirôzu & Saigusa, 1962 were previously placed under *Coladenia* Moore, 1881. Shirôzu & Saigusa (1962) erected *Pseudocoladenia* based on differences in the male genital structures in comparison with other species of *Coladenia*. All the species in these two genera are Oriental in distribution (Evans, 1949). Only one species of *Pseudocoladenia* has so far been reported from Nepal, namely *P. fatih* (Kollar, [1844]) (Smith, 1989, 2010, 2011; Huang, 2021). While that taxon in the past has been regarded as a subspecies of *Pseudocoladenia dan* (Fabricius, 1787), recently it was elevated to species level by Huang (2021) based on its male genital morphology. The species is common across the country from as low as 640 m to 2,070 m (Smith, 1989, 2010, 2011). On the Indian subcontinent, *P. fatih* is recorded from northwest to central Himalayas, from Hazara in Pakistan to central Nepal (Evans, 1949; Gasse, 2018). In the present study, *Pseudocoladenia fatua* (Evans, 1949) is reported for the first time from Nepal, while the previous report of *Pseudocoladenia dan fabia* (Evans, 1949) from Nepal was doubtful and we thus confirm here for the first time its occurrence in Nepal.

MATERIALS AND METHODS

This paper is based on information collected during opportunistic surveys made by the first author in Sunsari and Dhankuta districts in East Nepal in the months of March, August and November, 2021. A Canon 7D Mark II camera with 100 mm f/2.8L Macro IS USM lens was used to photograph butterflies. A GPS built into the camera recorded location and the elevation details within image metadata. Butterflies were hand-collected and stored in a vial containing ethyl acetate. The specimens were taken to the National Entomology Research Center, Khumaltar, Lalitpur, for dissection. Abdomens of the collected specimens were stored in 80% ethyl alcohol with data labels for subsequent study of genitalia to help confirm identifications. The specimens were immersed in 10% KOH solution and dissected under an Olympus Stereo-microscope Model SZ2-ILST, and photographs of genital parts were taken with an iPhone 6s smartphone. Contrast of the genitalia images was enhanced using MS Word 2019.

In the field, identification was done using Evans (1949). Identifications were subsequently verified by examination of male genitalia (Fig. 2) and comparison with illustrations/photographs in Evans (1949), Huang & Xue (2004) and Huang (2021). Additional information on the species was obtained from Kehimkar (2016) and Smetacek (2016), and identifications were further confirmed through personal communication with Hao Huang (China). We follow Evans (1949) for morphological terms such as those used for wing venation and male genitalia.

RESULTS

Hesperiidae Latreille, 1809
Pyrginae Burmeister, 1878
Celaenorrhini Swinhoe, 1912
Pseudocoladenia Shirôzu & Saigusa, 1962

Pseudocoladenia dan fabia (Evans, 1949)

Material examined: 4♂♂; Itahari, Sunsari District, Province No. 1, 26°43’08”N, 87°17’09”E, 120-150 m; 14-21.VIII.2021 and 9-11.XI.2021; Coll. Sajan K.C.

Diagnosis: According to Huang & Xue (2004) and Huang (2021), *P. dan fabia* has the forewing spots smaller and more

Figure 1. *Pseudocoladenia* in Nepal. **A**: *Pseudocoladenia dan fabia* (male from Sunsari, 130 m). **B**: *P. dan fabia* (female from Sunsari, 130 m). **C**: *P. dan fabia* (male from Sunsari, 623 m). **D**: *P. fatua* (male from Dhankuta, 723 m). **E**: *P. fatua* (male from Dhankuta, 650 m). **F**. *P. fatua* (male from Dhankuta, 1,416 m). **G**: *P. fatua* (male from Dhankuta, 1,566 m). **H**: *P. fatua* (male from Dhankuta, 1,356 m). **I**: *P. fatua* (male from Dhankuta, 1,487 m). **J**: *P. fatua* (female from Dhankuta, 1,358 m). **K**: *P. fatih fatih* (male from Kaski, central Nepal, around 850 m). **L**: *P. fatih fatih* (female from Kaski, central Nepal, around 850 m).

separated (spot 2 not extending beyond v3 origin), with the cell spot more excavated inward and its lower half longer than the upper half, while *P. fatua* and *P. fatih* both have their forewing spots more compact with the cell spot less excavated. The male genitalia of *P. dan fabia* are distinguished by the short apical process of the valva (Figs. 2A, 2C).

Taxonomic notes: *Pseudocoladenia dan* (Fabricius, 1787), commonly called the Fulvous Pied Flat, has two subspecies on the Indian subcontinent, with *P. dan dan* recorded from SE Gujarat to Kerala in the Western Ghats, and SE Andhra Pradesh in the Eastern Ghats (Gasse, 2018; Varshney & Smetacek, 2015) and *P. dan fabia* (Evans, 1949) from Sikkim to NE India, including Bhutan, and NE Bangladesh (Gasse, 2018; Singh & Chib, 2015). Although Smith's (1989) illustrated list of butterflies of Nepal included a picture of *P. dan fabia* in its natural habitat, from Jhapa District at around 365 m in June, he listed this image under *P. fatih*. Kehimkar (2016) included Nepal as part of the distribution of *P. dan fabia*.

We observed several individuals of *P. dan fabia* flying inside a forest and sitting on or under leaves, between 14 to 21 August, 2021 in Itahari, Sunsari District at 120-150

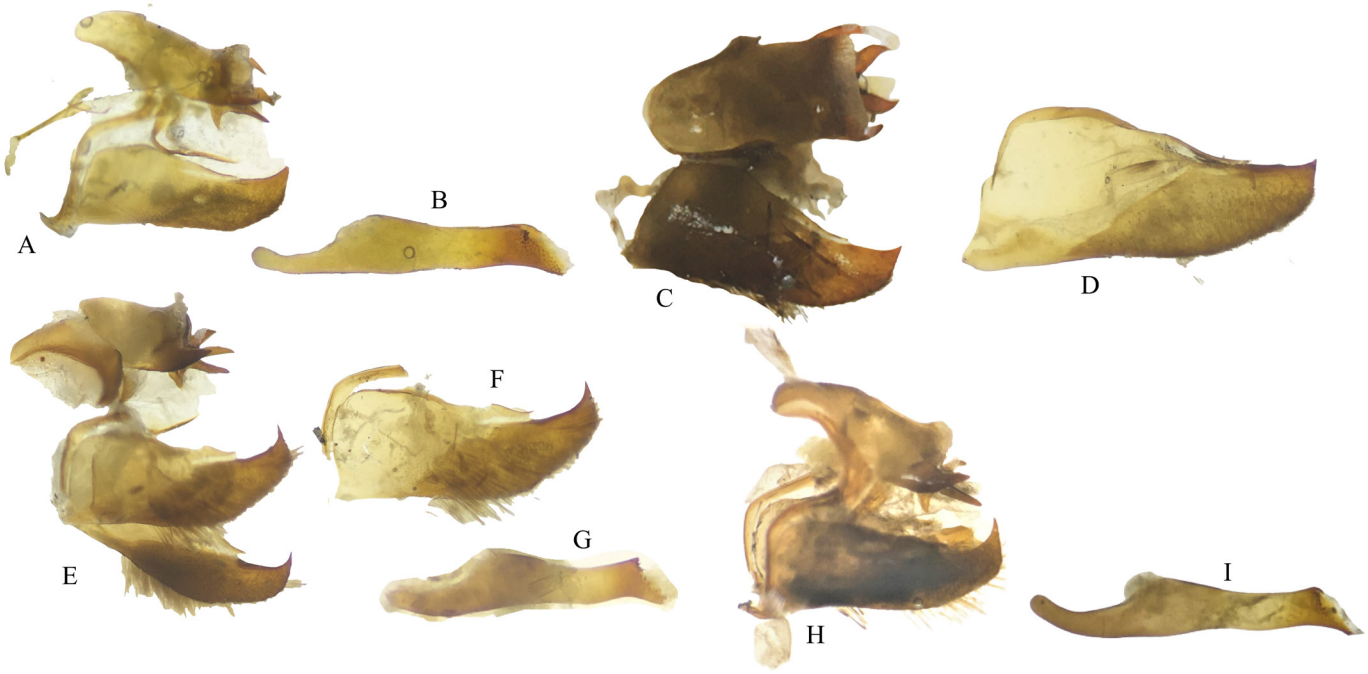

Figure 2. **A**: *Pseudocoladenia dan fabia* male genitalia (Fig. 1A specimen). **B**: Ditto, aedeagus **C**: *Pseudocoladenia dan fabia* male genitalia. **D**: Ditto, valva. **E**: *P. fatua* male genitalia (Fig. 1F specimen). **F**: Ditto, valva. **G**: Ditto, aedeagus. **H**: *P. fatua* male genitalia (Fig. 1H specimen). **I**: Ditto, aedeagus.

m (Fig. 1A,1B). The species was equally abundant during the first author's next visit in early/mid-November. A few individuals were also found in Dharan, Sunsari District at 620 m (Fig. 1C). Prominent vegetation included *Shorea robusta* (Dipterocarpaceae), *Tectona grandis* (Lamiaceae), *Lantana camara* (Verbenaceae), and *Mikania micrantha* (Asteraceae) in Itahari, and *Shorea robusta* in Dharan.

Pseudocoladenia fatua (Evans, 1949)

Materials examined: 1♂; Pakhribas, Dhankuta District, Province No. 1, 27°02'42"N 87°17'32"E, 1,566 m; 23.VIII.2021; Coll. Sajan K.C. 1♂ Paripatle, Dhankuta District, Province No. 1, 27°0'27"N 87°18'43"E, 1,416 m; 29.VIII.2021; Coll. Sajan K.C.

Diagnosis: Males of *P. fatua* lack any spot in forewing space 1b and have yellow forewing spots, while the female has white spots with the spots in space 1b sometimes present. The closely related *P. fatih* has a single or twin spot in forewing space 1b and has white hyaline forewing spots in both sexes. Both taxa have more compact forewing spots than those in *P. dan fabia* (Huang & Xue, 2004; Huang, 2021). The male genitalia of *P. fatua* are distinguished by the much longer and curved apical process of the valva than in *P. dan fabia* (Fig. 2F, 2H).

Taxonomic notes: *Pseudocoladenia fatua* (Evans, 1949), commonly called the Sikkim Pied Flat or (sometimes) Ruddy Pied Flat, was originally considered to be a subspecies of *P. dan*, until Huang & Xue (2004) raised it to species level. On the Indian subcontinent, the taxon has been reported from Sikkim to NE India, including Bhutan (Gasse, 2018; Kehimkar, 2016; Singh & Chib, 2015). Another similar taxon found in Sikkim, which may fly in Nepal, is *P. fatih festa* (Evans, 1949); that taxon can be identified from the sympatric *P. fatua* based on the following characters: 1. Forewing spots very compact, more so than in *P. fatua* (completely conjoined). 2. White spot(s) in forewing space 1b present, as in *P. fatih fatih*. 3. Both sexes have forewing spots yellowish, unlike in *P. fatua* where only the males have yellowish spots (Huang, 2021).

Individuals of *Pseudocoladenia fatua* were found in Bhedetar, Dhankuta District at around 700 m in March (Fig. 1E), August (Fig. 1D) and November; in Paripatle, Dhankuta District they were found at around 1400 m (Figs. 1F, 1G) in August, and in Pakhribas, Dhankuta District they were found at around 1500 m, also in August (Figs. 1H, 1I, 1J). Worn individuals were dull (Figs. 1F, 1G) while fresh ones were bright with sharp upper-hindwing spots (Figs. 1H, 1I, 1J). While specimens with traits typical of *P. fatua* as given in Huang (2021) were observed (Fig. 1D, 1E, 1G), especially at around 700 m, both examined specimens of male *P. fatua* had white spots in forewing space 1b (Figs. 1F, 1H), which seems to represent variation, and the most reliable characters are in male genitalia (Huang, 2021, personal communication). The prominent vegetation in both localities included pine trees (Pinaceae), *Castanopsis indica* (Fagaceae), citrus species (Rutaceae), *Pyrus* species (Rosaceae), and herbs such as *Lantana camara* and *Ageratina adenophora* (Asteraceae).

DISCUSSION

Intraspecific variation in wing pattern is often present in the species of *Pseudocoladenia*. As a result, species are most reliably identified by examination of their male genitalia,

Figure 3. Study area in Nepal.

especially the shape of the valva. In the absence of a specimen, however, identification can be made using a combination of external morphological traits and distribution, but such identifications may not always be correct.

Pseudocoladenia fatih is abundant from west to central Nepal (Figs. 1K, 1L). Its easternmost range limit, however, is not clearly known and requires more research. The transitional zone of this west Himalayan species and other east Himalayan species of *Pseudocoladenia* probably lies somewhere in Bagmati Province or west of Province Number 1 in Nepal.

Eastward, in the Terai region at lower altitudes (below around 650 m), *P. dan fabia* is abundant and adults are likely present in all seasons. *Pseudocoladenia fatua* likewise occurs from around 700 m to at least 1,600 m. Adults may or may not have a richer red wing color depending on how recently they emerged, not all are small in size as mentioned by Evans (1949), and sometimes males may also have spots in forewing space 1b.

At present, all three *Pseudocoladenia* species recorded from Nepal, namely *P. fatih fatih*, *P. dan fabia* and *P. fatua*, appear to be quite common within their Nepalese distribution. Both *P. dan fabia* and *P. fatua* have also been reported from Sikkim, and thus were indeed expected to be present in eastern Nepal.

ACKNOWLEDGMENTS

We thank the National Entomology Research Center for facilitating this research, Mr. Piet van der Poel (Netherlands) for helping to improve the initial draft and sharing his information, Mr. Hao Huang (China) for providing necessary references for this article and reviewing the photographs of the materials and confirming the identification, Dr. Darren Pollock (Eastern New Mexico University, Portales, USA) for proofreading the manuscript, and reviewers for their comments on the manuscript.

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