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Article

Assessment of the status of *Euchloe tomiris* Christoph, 1884 (Lepidoptera, Pieridae) and measures for the conservation of its population in Tajikistan

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Abstract. The research is devoted to the locally distributed butterfly *Euchloe tomiris* Christoph, 1884, which has a low abundance and fragmented distribution in the southwestern areas of Tajikistan. The research was mainly focused on the ecology and state of the habitat of the species, as information in these areas is very scarce. During 2023–2024, butterfly numbers were low throughout their range in Tajikistan. This is mainly due to continuous human activity, such as grazing in the butterfly's habitats, the use of land for agricultural purposes, as well as the biology of this species. In addition, this species is tied to the places where the forage plant grows.

Keywords: butterfly, rare species, endemic, ecology, monitoring, threats, conservation measures

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Научная статья

Оценка состояния *Euchloe tomiris* Christoph, 1884 (Lepidoptera, Pieridae) и меры по сохранению ее популяции в Таджикистане

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Аннотация. Исследование посвящено локально распространенному виду бабочек *Euchloe tomiris* Christoph, 1884, имеющему низкую численность и фрагментарное распространение в юго-западных районах Таджикистана. Исследование было в основном сосредоточено на экологии и состоянии среды обитания вида, поскольку информация по этим направлениям очень скудна. Установлено, что в 2023–2024 гг. в Таджикистане численность бабочек в пределах ее ареала была невысока. В основном это связано с постоянной деятельностью человека, такой как выпас скота в местах обитания бабочек, использование земель в сельскохозяйственных целях, а также биологией этого вида. Кроме того, данный вид привязан к местам произрастания кормового растения.

Ключевые слова: бабочка, редкий вид, эндемик, экология, мониторинг, угрозы, природоохранные мероприятия

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Introduction

Butterflies are an essential component of various natural ecosystems and act as a key indicator in conducting environmental monitoring of national and regional fauna (Antipova, 2013; Sevilleja et al., 2019). In addition, butterflies are pollinators to over 20,000 species of wild and domesticated plants, second only to bees and wasps (Corlett, 2004; Munyuli, 2011). Recently, due to the active development of land by humans for economic activities, the habitat of many insect species has decreased, endangering populations of rare and endemic species. The most at risk are those species that have a small population size, and a local distribution. One of these species in Tajikistan is *Euchloe tomiris* Christoph, 1884 (family Pieridae). The genus *Euchloe* Hübner, 1823 has a Southern Palearctic origin and has a small number of species (Kreuzberg and Legezin, 1997). *E. tomiris* is endemic to Central Asia, known from Tajikistan, Uzbekistan and Turkmenistan. Due to the disparity of populations and low numbers of this butterfly, it was included in the Red Books of the Tajik SSR (Stshetkin et al., 1988), the Red Book of the Republic of Tajikistan (Davlatov, 2015) and the Republic of Uzbekistan (Legezin, 2009). Over the past few years there has been no reliable information on the state of the population of this butterfly within its range, including Tajikistan. Given the lack of data, monitoring studies are needed to clarify the current state of the *E. tomiris* populations and other rare butterfly species in Tajikistan. The monitoring results are necessary for further development of measures to protect this species, and can also be used to prepare the third edition of the Red Book of the Republic of Tajikistan.

E. tomiris is a small butterfly with a forewing length of 19–20 mm in males and 20–21 mm in females. The wingspan is 29–30 and 33–34 mm for males and females, respectively. The butterflies have a whitish coloration with a greenish tinge at the base of the wings. The discal spots are wider in females than in males. The apical spot is black, in the female it reaches to the vein M2. On the underside of the wings, the same markings are found as on the upperside, but the background of the forewings is slightly lighter; the hindwings are gray. Dark scales are clearly visible at the base of the wings, but in the hindwings, these are more extensive and reach the discal area (Fig. 1).

Materials and methods

Methods of material collection

The material for this article was collected during the flight of *E. tomiris* from early March to early April 2023–2024 in Tajikistan. The butterflies were counted using the transects method (Pollard, 1977; Sevilleja et al., 2019), which allows for the estimation of population size in different regions. According to this method, the length of the transects is ideally 1 km, and butterflies counted to a width of 5 m on both sides. If there are several types of habitats on the selected transects, the transects is divided into 5–6 sections. In our case, the selected areas covered the same type of habitat, so the transect was considered as a single unit. In total, we examined 25 transects. To study the phenology of the species, the count was carried out twice a day (from 10 a.m. to 12 p.m. and from 2 p.m. to 4 p.m.) every 5 days. The condition of the habitat of the species was assessed visually; any factors negatively affecting the habitat were recorded.

Characteristics of the research region

The locations where we found *E. tomiris* cover small areas of the Tabakchi and the Panj Karatau Ridges (Fig. 2). The Tabakchi is a medium-mountain ridge, located on the left bank of the Vakhsh River in Southwestern Tajikistan and is part of two districts of the Khatlon region: Levakand and Dangara at an altitude range of 350–1300 m above sea level. It stretches from northeast to southwest for 10 km. The average January temperature according to long-term data is +2 °C, but the absolute minimum for the entire region does not fall below +22 °C, and the temperature of the hottest month (July) reaches +31 °C on average, the maximum is above +40...+46 °C (Musoev, 2018). The research area is a hilly foothill with pits and ravines of various shapes, covered with sparse xerophytic vegetation (Fig. 3A). *Cymatocarpus popovi* Botsch. et Vved is an annual is found here, which is the food plant for the caterpillars of *E. tomiris*. This area is place is mainly used as a pasture for livestock.

The Panj Karatau Ridge is located in southern Tajikistan, in the territory of the Panj and Farkhor districts of Khatlon region. The ridge from the north, from the confluence of the Tairsu and Kyzylsu Rivers, stretches to south for more than 100 km to the Panj River. The average height of the ridge reaches 1300 m above sea level, and the highest point rises to 1700 m above sea level. During the year, the average air temperature in the Panj district is +17.3 °C. and the coldest month is January with an



Fig. 1. Appearance of a butterfly *Euchloe tomiris*.



Fig. 2. Distribution of *Euchloe tomiris* in Tajikistan. 1 – Tabakchi Ridge; 2 – Panj Karatau Ridge; 3 – Aktau Ridge; 4 – Aрукtau Ridge; 5 – Babatag Ridge.

average temperature of +5.1 °C. July is the hottest month, when the average temperature here rises to +38.7 °C. The Panj Karatau Ridge is located within the South Tajik type of belt (Goncharov, 1937). The foothills of the ridge where the research was conducted belong to the upper band of low-grass semi-savannas, characterized by longer-lived shrubs ephemeroïds (mainly *Phlomis bucharica* Regel). Above to the watershed, it is replaced by a belt of shyblyak and semi-savannah.

Results and discussion

Ecology

Previously, *E. tomiris* in Tajikistan was known from the Tabakchi Ridge (Shchetkin et al., 1988). *E. tomiris* finds are mentioned in the literature for the Aрукtau (Kreuzberg and Legezin, 1997), Babatag, and Aktau ridges (Tshikolovets, 2003). However, these data require additional verification, as the relevant studies lack information on specific samples collected in these areas (Fig. 2, marked with a question mark). Our study discovered a new region for this butterfly in southern Tajikistan – the Panj Karatau Ridge (Fig. 3B). *E. tomiris* prefers foothills with sparse xerophytic vegetation, as well as clay places at an altitude of 450–580 m above sea levels. This species is strictly tied to the places of growth its food plant (*Cymatocarpus popovi*).

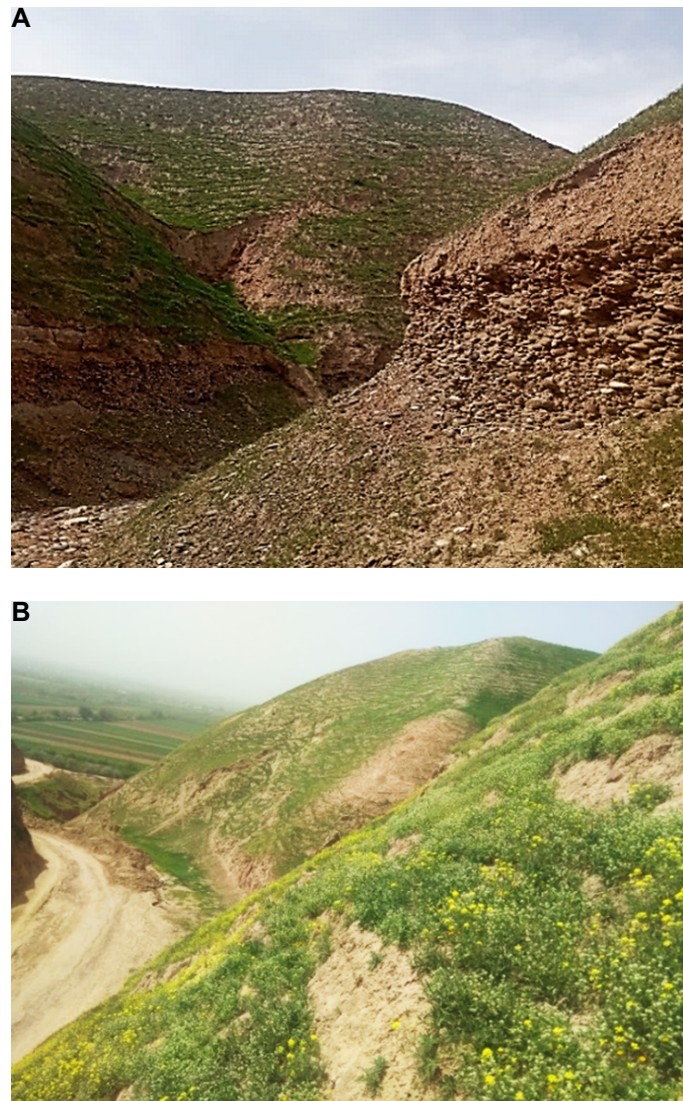


Fig. 3. Locations of *E. tomiris*. **A** – Tabakchi Ridge; **B** – Panj Karatau Ridge.

E. tomiris has a single generation per year at all points of its range. The flight period depends on the climatic conditions of the year and lasts from late – February or early March to early April. *E. tomiris* overwinters in the pupal stage in the basal part of the food plant, in the soil or plant residues (Kreuzberg and Legezin, 1997).

The state of the population

The abundance of *E. tomiris* was estimated on transects during the flight period. On the Tabakchi Ridge, the number counted varied considerably and it was sometimes absent. In the 1st and 2nd weeks of flight, the butterflies were more abundant, and between 3 to 5 specimens were counted per 1 km (in one case, up to 8 specimens). In the remaining weeks, numbers declined and only 1–2 specimens were counted per 1 km. By the end of the first week in April, the flight period was over and the larval foodplant was dies (Davlatov, 2023). Within its habitat, *E. tomiris* flies together with other species of Pieridae – *Zegris fausti* (Christoph, 1877), the number of which is several times higher. A survey of the surrounding habitat of *E. tomiris* in order to find butterflies did not yield results.

Despite surveys over many years *E. tomiris* has not been found in other areas of Tajikistan. During our research, we found of small populations of the species on the Panj Karatau Ridge. We conducted four surveys here through the season and *E. tomiris* was recorded was only once, which indicates a small population. It should be noted that, unlike the regions of the Tabakchi ridge, where at the same time the desiccation of *C. popovi* was observed, plants of this species continued to grow in the Panj Karatau ridge.

The results of the monitoring demonstrate that the number of *E. tomiris* in Tajikistan is extremely low. Other species of butterfly, previously included in the Red Book of the Tajik SSR (Stshetkin et al., 1988) and the Red Book of Republic of Tajikistan (Davlatov, 2015) as rare species *Papilio machaon* Linnaeus, 1758 and *Driopa mnemosyne* (Linnaeus, 1758), are now more widespread and have larger populations than *E. tomiris*. These species prefer different habitats and have greater recovery potential than *E. tomiris*, which inhabiting in extremely limited habitats. Thus, *E. tomiris* requires further attention and research in Tajikistan.

Factors negatively affecting the number of butterflies

According to our data, the habitat of *E. tomiris* in Tajikistan covers a small area (about 30 km²) located in Southwestern Tajikistan. If the locals use these areas as pastures in March, they serve as a road for moving to other places in other months. In addition, spring rains sometimes cause small landslides in the ravines and on the rocks preferred by the butterfly, which disrupts the species' habitat. Thus, *E. tomiris* is presumably endangered, as its population occupies a very small area and is subjected to high anthropogenic pressure. A univoltine life-cycle means that its populations have a reduced ability to recover from adverse effects.

Status

In the second edition of the Red Book of the Republic of Tajikistan (Davlatov, 2015), *E. tomiris* has the status of an endangered (EN). At the third edition of the Red Book of Tajikistan (2024), which will be released at the end of this year, we proposed to include this species in the same status: endangered (EN) – C: 2a (ii). Currently, *E. tomiris* is not listed in the IUCN Red List, but we plan to prepare information for its inclusion in the future.

Conservation measures for the population and habitat of *E. tomiris*

The following measures are proposed:

- Regulation of grazing in the main habitats of the species.
- Search for other places where food plants of the species grow and conducting experimental breeding of caterpillars to create a new population.
- Annual monitoring to assess the condition of population.
- Conducting an explanatory work with local residents about the importance of biodiversity conservation and the appropriate grazing management.

Conclusion

The study confirmed that the population levels of *E. tomiris* are extremely low and the species is very local in Tajikistan. This makes its populations extremely vulnerable. Judging by our research, a more stable population of *E. tomiris* persists in Tabakchi Ridge. *E. tomiris* keeps within the range of its forage plant; in Tajikistan, the estimated distribution area of this species is about 30 km². However, the breeding areas may be far smaller than this. Despite the fact that the habitat area and abundance of *E. tomiris* in Tajikistan is small, its habitat and population is under severe anthropogenic pressure. Thus, in order to preserve *E. tomiris*, it is necessary to take active conservation measures to ensure its survival.

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