# A new subspecies of *Neolysandra corona* (VERITY, 1936) (Lepidoptera: Lycaenidae: Polyommatinae) from Northwestern Iran

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Abstract: In July 2020 a new population belonging to the genus *Neolysandra* Koçak, 1977 was discovered by the third author, Adel RAMEZANI, in the high mountains north of Miyaneh, East Azarbaijan Province, Iran. Based on similarities with the allopatric *Neolysandra corona* (VERITY, 1936), we describe this new taxon here as a subspecies of latter species, *Neolysandra corona lucida* ssp. n.

## Eine neue Unterart von *Neolysandra corona* (VERITY, 1936) (Lepidoptera: Lycaenidae: Polyommatinae) aus dem Northwestiran

Zusammenfassung: Im Juli 2020 entdeckte der Drittautor Adel RAMEZANI nördlich von Miyaneh (Iran, Provinz Ostazarbaijan) eine neue Population aus der Gattung *Neolysandra* Koçak, 1977. Die Tiere ähneln der allopatrischen *Neolysandra corona* (VERITY, 1936) und werden hier als *lucida* ssp. n. beschrieben.

#### زیر گونه جدیدی از (Neolysandra corona (Verity, 1936) (Lepidoptera: Lycaenidae: Polyommatinae)از شمال غرب ایران

در تیرماه 1399 نویسنده سوم مقاله ،عادل رمضانی که یک گیاه شناس است جمعیتی از پروانه ای از جنس Neolysandra KoçAK, 1977 را در دامنه های کوه بزقوش در شمال میانه کشف و عکاسی کرد.نویسنده اول با سفر به منطقه و با همراهی نویسنده سوم افرادی از نر و ماده از تاکسون جدید را پیدا و بیولوژی و اکولوژی ابتدایی آن را مطالعه و مشخص کردند. با توجه به پراکنش سایر گونه های مشابه و بر اساس شباهتها و غیر هم بوم بودن با تاکسون Neolysandra corona (VERITY, 1936) تصمیم گرفتیم که آن را به عنوان زیرگونه جدیدی از این گونه توصیف و معرفی کنیم.

### Introduction

The genus Neolysandra Koçak, 1977 has a limited geographical range in the Anatolian-Iranian plateau and the Levant. Five species are known to occur in Iran: N. coelestina (Eversmann, 1843), N. diana (MILLER, 1913), N. fatima (Eckweiler & Schurian, 1980), N. corona (Verity, 1936) and N. fereiduna Skala, 2002 (see Nazari 2003, Tshiko-LOVETS et al. 2014, NADERI 2020). Additional species also occur in Turkey (N. nazugum Коçак, 2013) and Lebanon (N. ellisoni (PFEIFFER, 1931)). Neolysandra was originally described as a subgenus of *Polyommatus* to accommodate Lycaena diana MILLER, 1913. Since then, molecular studies have conformed its status as a separate genus distinct from Polyommatus and Lysandra (TALAVERA et al. 2013) Neolysandra differs from other genera by the markedly wide and elliptical uncus, short and scarce hairs covering the eyes, and reduced marginal and submarginal pattern on the wing underside (Coutsis 2001).

As part of continued research on high-mountain butterfly species in Iran, in July 2020 the third author (Adel RAMEZANI) took a photo of an apparently new population of *Neolysandra* in the high altitudes of Bozghoosh Mountains, north of Miyaneh, East Azarbaijan Province, NW Iran. To investigate further, the first (Alireza NADERI) and third (Adel RAMEZANI) authors visited the locality again in July 2020. During this difficult excursion, we found a small population of this taxon comprised of only male individuals. Upon further searches for probable food plants in that locality, we also found a small patch of *Vicia ciceroidea* BOISS., 1846 with a number of males and females of the new taxon flying around it. The females were attempting to lay eggs on the small fresh leaves or flowers of the plant. While somewhat similar to *Neolysandra corona*, the new taxon showed considerable differences in size, morphology and distribution, therefore we describe it here as a new subspecies of the latter.

#### Neolysandra corona lucida ssp. n.

Holotype *d*: East Azarbaijan: N. Miyanhe, Bozghoosh Mts., 2800-2900 m, 3 July 2020, leg. A. R. NADERI, Coll. NHM of Iran (National Natural History Museum and Genetic Resources of Iran, Department of Environment).

Paratypes: all the same data (total 21 ♂♂, 10 ♀♀): 2 ♂♂, 1 ♀ Coll. Wolfgang Eckweiler, 1 ♂, 1 ♀ Coll. Payam Zehzad, 2 ♂♂, 1 ♀ Coll. Georges Betti, 1 ♂ Coll. Wolfgang Ten Hagen, 1 ♂ Coll. Frederic Carbonell, 1 ♂, 1 ♀ Coll. Amir-Hossein Harandi, 1 ♀ Coll. NHM of Iran (National Natural History Museum and Genetic Resources of Iran, Department of Environment). 13 ♂♂, 5 ♀♀ Coll. A. R. NADERI.

Etymology. The new taxon is named *lucida* after the iridescent colour of the male upperside.

#### Description

**đ** (Fig. 1 and 3): Forewing length 15–16 mm, Holotype 16 mm. Upperside: Wings wide and broad, fringes basally black but distally white. Ground colour shiny silvery blue with relatively wide black submarginal suffusion in forewings not reaching to costal area. No dark suffusion on the basal half of wings. Hindwings with the same colour but with a narrow black submarginal suffusion from S8 extending to S4 which turns into round spots in S4 and is absent from S3 to S1. Black veins always present on both fore- and hindwings, extending to postdiscal area.

Underside: Ground colour creamy brown, submarginal spots round, black and prominent, ordered in a curve, with a narrow, distinct and large discal spot in forewing S2, but vestigial in hindwing. Iridescent green suffusion limited to the base of the forewings, but extended on the hindwings to more than half of the wings up to S4 and half of S5 to S8, often even reaching to submarginal area. The submarginal rounded spots with clear white surrounding, similarly curved in S3 and vestigial in S2. Black spot in S2 doubled, but the upper one is weak and vestigial.

**Q** (Fig. 2): Forewing length 15 mm. Upperside: Ground colour uniformly deep brown with relatively clear discal spots in both wings, sometimes rimmed by blue scales especially in forewing. Fringes basally black and distally creamy white.

Underside: Ground colour light chocolate brown; submarginal irregular spots bold and distinct with white border. Forewing discal spot distinct but vestigial on hindwings. A row of darker brown spots in the marginal area of both wings. The greenish-golden suffusion covers nearly all the hindwing surface except for the marginal area. Submarginal row of spots vestigial and washed up inside the suffusion.

#### **Differential diagnosis**

*N. corona lucida* ssp. n. is different in pattern and colour from *N. coelestinus*, *N. diana* and *N. fatima*, but closer to *N. corona* and *N. fereiduna*, and can be easily differentiated from all of them by the following characteristics:

The upperside ground colour of ssp. *lucida*  $\partial \partial$  is always iridescent silvery blue, while in nominotypical populations of *N. corona* it tends towards light blue (Pantone: 12-4608: SKALA 2002). Ground colour in *N. fatima* is deep blue (Pantone 1639-30: SKALA 2002) with narrow black marginal band in forewing restricted to S7 in hindwings (ECKWEILER & SCHURIAN 1980). In *N. fereiduna*, ground colour is silver lake blue (Pantone 17-4030: SKALA 2002) with short black lines reaching the submarginal area.

Females of ssp. lucida are darker and deeper brown with few individual blue scales, and without any postdiscal spots or light colour on the border of hindwings. Ventrally, the monotonous gray background colour of underside with well-defined markings and with shiny greenish suffusion covering nearly half of the wings surface in most of specimens of ssp. lucida are unique characteristics of the new taxon. The green suffusion in ssp. corona covers only 1/3 of the surface of hindwings, while it is variable in N. fereiduna from 1/3 to most of the hindwing surface (SKALA 2002). In N. fatima, the background is grayish brown with a green suffusion always covering nearly all the hindwings, but the markings are not as well-defined and many of submarginal spots are vestigial and unclear (Eckweiler & Schurian 1980). A key difference between ssp. corona and ssp. lucida QQ is that while in corona a visible postdiscal spot on the forewings is sometimes present (VERITY 1936), this spot is always absent in lucida. Females of N. fereiduna are smaller and have some blue submarginal lunules (SKALA 2002). Blue suffusion also appears in N. fatima in basal areas of both wings, more than N. corona ssp. lucida. Ventrally, females of lucida have a somewhat dark brown background with very well-defined markings on forewings, and an iridescent green suffusion that covers all of the hindwing surface with weak markings inside. Undersides in ssp. *corona* are similar except that the iridescent green suffusion never covers all the hindwing. in *N. fereiduna*, the background is grayish with well-defined markings with widespread pale iridescent green suffusion, which does not cover the entire surface of the hindwings. In *N. fatima*, the background is pale brown with clear markings and widespread iridescent green suffusion which usually covers the entire surface of the hindwings (compare Table 1).

### Discussion

We considered all of the differences and similarities between Neolysandra species and decided to describe the new entity as a subspecies of *corona*, although we cannot exclude that further DNA and phylogenetic investigations may reveal a different arrangement for the taxa in this group. All known populations within Neolysandra are allopatric, and differences in morphology and genitalia support differentiation between these populations at species level (SKALA 2002). N. corona is distributed in eastern to central Alborz Mountains between 3000-3500 m altitudes; its hostplant is Vicia sp. which is common in its habitat. Interestingly, while Vicia cracca is the hostplant for three of the five Neolysandra taxa in Iran (N. coelestinus, N. diana and N. fatima), the host for the other two (N. corona and N. fereiduna) is an unknown species of Vicia. The hostplant of the new subspecies is Vicia ciceroidea Boiss., 1846, distributed in northwestern Iran. Patches of this plant are restricted to the southern slopes of Bozghoosh Mountain (AR and AN, personal observation).

It has been suggested that species with limited range in high-altitude mountain tops in Iran and other countries in the region are remnants from the last Ice age (RAJAEI et al. 2013). During this period, northern hemisphere species adapted to cold climatic conditions shifted their range from ice-covered Eurasia to ice-free but cold southern latitudes. Once the ice-sheets retreated in the North and the climate became warmer in the South, the ancestral stock of these species either also retreated, became extinct, or fled locally to higher altitudes where the climate remained favorable (BARTONOVA et al. 2018). Subsequent geographic and reproductive isolation in many of these populations resulted in independent evolution and speciation (YouseFI et al. 2015).

Populations of nominotypical *N. corona corona* are known to occur from central to eastern Alburz Mountains (Shahkuh), although yet undiscovered populations may also occur in the western Alburz Mountains. Several high mountain peaks exist between the Alburz and Zagros ranges, but these are likely not high enough to support populations of *N. corona* ssp. *lucida* or its hostplant. It thus appears that these divided populations of *N. corona* have evolved in isolation into distinct species that we here treat as separate subspecies.



Abb. 1–3: *Neolysandra corona lucida* ssp. n. Abb. 1: Holotype 3: East Azarbaijan: N. Miyanhe, Bozghoosh Mt., 2800–2900 m, 3. VII. 2020, leg. A. NADERI, coll. NHM. Abb. 2: Paratype 9: same data as holotype coll. NADERI. Abb. 3: Paratype 3: same data as holotype, coll. NADERI. – Abb. 4–6: *Neolysandra corona corona*. Abb. 4: 3, Nordiran, Elburgsgebirge, Dizin, östl. Gatchsar, 2400–2600 m, 28.VI.–11. VII. 1975, leg. Rose, Staatliches Museum für Naturkunde Karlsruhe (ZMNK), via coll. ECKWEILER. Abb. 5: 3, Iran, Tehran, Elburs-Gebirge, Gatchsar, Dizin, 2700–3000 m, 30. VII.–31. VII. 1979, leg. ECKWEILER #32, ZMNK via coll. ECKWEILER. Abb. 6: 9: same data as Abb. 5. – Abb. 7–9: *Neolysandra fatima*. Abb. 7: 3, Türkei, Hakkari, Bercelan yaylasi, 2700–2800 m, 14. VII. 2009, leg. ECKWEILER #1025, ZMNK via coll. ECKWEILER. Abb. 8: Paratypus 3, Türkei, Hakkari, Bercelem yaylasi, 2500–2800 m, 30. VII.–5. VIII. 1978, leg. ECKWEILER, ZMNK via coll. ECKWEILER. Abb. 9: Paratypus 9: same data as Abb. 8. – Abb. 10-12: *Neolysandra fereiduna*. Abb. 10: 3, Iran, Isfahan, Zagros Mts., Kameran (Paß), S Fereydun Shar, 3300–3700 m, 24. VII. 2002, leg. ECKWEILER #851, ZMNK via coll. ECKWEILER. Abb. 11: Paratypus 3, Iran, Isfahan, Fereidun Shar, 3000–3500 m, 30. VII. 2001, leg. S. NYKL, ZMNK, via coll. ECKWEILER. Abb. 12: Paratypus 9: same data as Abb. 11.



Abb. 13–16: Field photos by Adel RAMEZANI. Abb. 13: Type locality of *Neolysandra corona lucida* ssp. n., Iran, East Azarbaijan, N. Miyanhe, Bozghoosh Mts., 2800–2900 m. Abb. 14: *Vicia ciceroidea*, the probable foodplant of *Neolysandra corona lucida* ssp. n. Abb. 15: *Neolysandra corona lucida* ssp. n.  $\mathcal{J}$  water sucking, in the background  $\mathcal{J}$  of *Turanana cytis*. Abb. 16: *Neolysandra corona lucida* ssp. n.  $\mathcal{Q}$  on *Vicia ciceroidea*. — Abb. 17: Distribution map of the *Neolysandra corona* group in Iran. (Basic map by MapCreator 2 [Primap.com], modified and localities added.)

Taxon	Hostplant	Male upperside	Female upperside	Male underside	Female underside
N. c. lucida	Vicia ciceroidea	Iridescent silvery blue with wide black submarginal band in forewing	Dark brown with some scattered blue scales	Grayish with iridescent green suffusion covering about half of the hindwing	Pale brown with iridescent greenish-golden suffusion covering all the hindwing
N. c. corona	Vicia sp.	Silvery blue with wide black submarginal bands in both wings	Dark brown, sometimes with sometimes obvious post discal spots on forewing	Grayish with iridescent green suffusion covering about one third of the hindwing	Pale brown with iridescent greenish-golden suffusion covering half of the hindwing
N. fereiduna	Vicia sp.	Silver lake blue with wide black submarginal band in forewing	Dark brown with scattered iridescent blue scales	Grayish with iridescent green suffusion covering about half of the hindwing	Pale brown with iridescent greenish-golden suffusion covering nearly all the hindwing
N. fatima	Vicia cracca	Deep blue with narrow black submarginal band	Brown with some scattered blue scales	Grayish with iridescent green suffusion covering about all of the hindwing	Pale brown with iridescent greenish-golden suffusion covering all the hindwing

 Table 1: Diagnostic differences between Neolysandra corona, N. fereiduna and N. fatima.

### Ecology

The habitat of the new subspecies N. corona lucida consists of xerophytic mountain steppes between 2800 and 2900 m. The males tend to aggregate around the mountain brooks for mud-puddling, and at nighttime they rest on the stalks of grassy plants. Females are only found around their main hostplant, Vicia ciceroidea, where they also nectar on its flower. Males can also be commonly observed around these plants looking for females to mate. Patches of the hostplant grow mainly on the southern slopes of Bozghoosh Mountain at 2800 m in steep gravel stone slopes, amongst other plants such as Onobrychis cornuta, Astragalus spp. and Thymus spp. The main accompanying butterfly species are Pseudochazara beroe (HERRICH-SCHÄFFER, [1844]), Turanana cytis (CHRISTOPH, 1877) and Polyommatus (Agrodiaetus) rovshani DANTCHenko & Lukhtanov, 1994.

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