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CONTRIBUTION TO THE KNOWLEDGE OF THE BUTTERFLY FAUNA (LEPIDOPTERA: RHOPALOCERA) OF THE ŠENTVID PLATEAU, NW SLOVENIA

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Izvleček – PRISPEVEK K POZNAVANJU FAVNE DNEVNIH METULJEV (LEPIDOPTERA: RHOPALOCERA) ŠENTVIŠKE PLANOTE, SZ SLOVENIJA
Prispevek predstavlja favno dnevnih metuljev (Lepidoptera: Rhopalocera) Šentviške planote, ki je med slabše raziskanimi območji v Sloveniji in leži na nadmorski višini od 600-900 m. Na petih lokacijah popisov smo skupaj ugotovili 76 vrst dnevnih metuljev, od tega 10 ogroženih in 4 zavarovane vrste. Kljub razmeroma kratkemu obdobju opazovanj smo na tej nadmorski višini ugotovili razmeroma veliko število vrst dnevnih metuljev. Najverjetnejša razlaga velike pestrosti metuljev je v dejstvu, da je Šentviška planota razmeroma dobro ohranjena, na jug orientirana kulturna krajina, s pretežno ekstenzivnimi travniki in mešanimi gozdovi, z milim podnebjem, ugoden je tudi padavinski režim v poletnih mesecih, ki ohranja vegetacijo travnikov zeleno, ko je ta na Primorskem že presušena.

KLJUČNE BESEDE: favna, metulji, raznovrstnost metuljev, ohranjanje, Slovenija, Šentviška planota

Abstract – The paper presents butterfly fauna (Lepidoptera: Rhopalocera) of the Šentvid plateau, an insufficiently surveyed part of Slovenia located at an altitude between 600-900 m a.s.l.. Altogether 76 butterfly species were recorded on five locations. Among them 10 are threatened and four are protected species. Despite short period of observations relatively high number of butterfly species was observed for this altitude. Most probable explanation for butterfly species richness is that Šentvid plateau is reasonably well-maintained and south oriented cultural landscape, with extensive mead-

ows and mixed forests, and with a mild climate, particularly the favourable precipitation regime in summer months, maintaining vegetation of the grasslands green.

KEY WORDS: fauna, butterflies, butterfly diversity, conservation, Slovenia, Šentvid plateau

Introduction

Red list of threatened butterflies (Macrolepidoptera) of Slovenia (Carnelutti, 1992a, 1992b) and recently published Atlas of butterflies (Lepidoptera: Rhopalocera) of Slovenia (Verovnik *et al.*, 2012) show great biodiversity of butterfly species in Slovenia. But all parts of Slovenia are not equally well surveyed. One of the insufficiently surveyed parts of Slovenia is the Šentvid plateau in the foothills of the Julian Alps.

It is a karstic plateau, situated between two narrow valleys formed by the rivers Idrijca and Bača (Melik, 1960; Jarc *et al.*, 2002). Central part of the plateau is at 650-700 metres a.s.l. It belongs to the subalpine part of Slovenia and is a part of the Idrija-Cerkno hills. It is characterized by gently undulating landscape, dispersed settlements and mosaic of farmland and mostly beech woodland (Marusič, 1998). There are twelve settlements in the surveyed area (Kofol, 1996).

Plateau is almost entirely composed of carbonate rocks, mostly dolomitized limestone and dolomite. Karstification of the landscape is visible - undulating, rocky and mostly without surface water (Meze, 1988). In some parts of the plateau there are karst sinkholes. There is also a small periodic lake near the village Ponikve, called Rupa (Mavrič, 2009). On the edge of the plateau there are several karst caves. On the rocks shallow or medium deep brown soils have developed, sometimes rendzina. In karst sinkholes and other depressions there is pseudogley or acid brown soil with podzol and pseudogley (Mavrič, 2009).

Šentvid plateau has a mild climate of western and southern Slovenia. The characteristics of this climate are: submediterranean rainfall regime, the average annual rainfall is 1300 to 1800 mm and the average October temperatures are higher than in April. Temperatures in central part of the plateau are very different from those at the edges of the plateau. The average annual temperature at the edge is 8-10° C, in central part 6-8° C. Average temperature of the coldest month is -3-0° C, the warmest 15-20° C. Solar radiation in the winter is on average 280-320 hours and in the summer 700-740 hours (Mavrič, 2009; Ogrin, 1996). Rainfall in spring and summer is around the equilibrium. There are more precipitation days in spring, but with less intensity. There are less summer precipitation days, but with heavy rain (Meze, 1988). Temperature inversions are common in the winter time (Mavrič, 2009).

Due to the characterized type of settlements, interesting location and mosaic distribution of agricultural land is classified as a valuable cultural landscape (Marušič, 1998). Šentvid plateau has preserved rural character despite the economic and social changes (Kavčič, 2010).

The aim of this paper is to contribute to the knowledge of the butterfly fauna (Lepidoptera: Rhopalocera) of the Šentvid plateau, which has been so far insufficiently surveyed.

Materials and Methods

The records were obtained through field observations from 2009 onwards. The five observation localities are spread across the Šentvid plateau (Fig. 1), the highest point is at 923 m and the lowest at 608 m a.s.l. Butterfly species were identified in the field using Tolman & Lewington (2008) and Polak (2009) and immediately released. Only unknown or interesting specimens were kept, photographed and released afterwards. They were identified later on, based on collection material. The taxonomy and nomenclature follows Verovnik *et al.* (2012).

The alphabetical list of locations contains a short description of the habitat, coordinates (WGS84), altitude and dates of the observations. Dates follow the format: day.month.year.

A. South-eastern slope of the hill Črvov grič – pastures with some rocky spots and deciduous forests, coordinates - X: 46.14229718 N, Y: 13.86689392 E, 923 m, field trips: 1.8.2010, 8.7.2012, 18.8.2012, 8.9.2012.

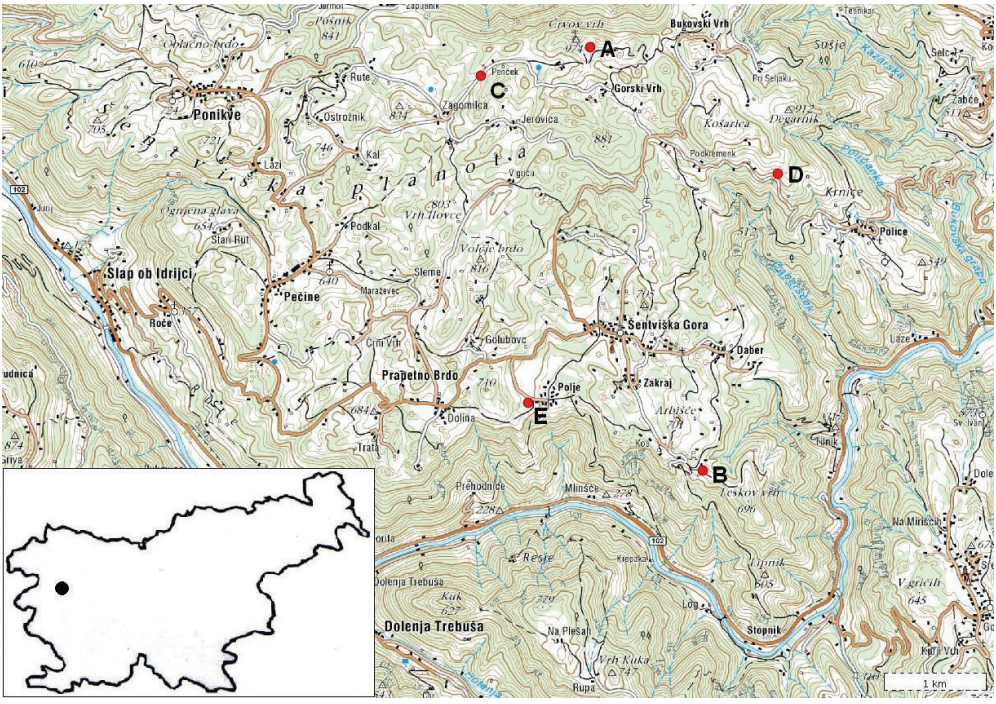

Fig. 1: Map of five research locations on the Šentvid plateau (Geopedia, 2012).

B. Leskov vrh and Arbišče – dry meadows and forest edge (Fig. 3), coordinates – X: 46.10506966 N, Y: 13.8819115 E, 625 m, field trips: 26.3.2011, 9.4.2011, 17.4.2011, 30.5.2011, 12.6.2011, 21.7.2011, 14.8.2011, 8.9.2012.

C. Penček – dry and wet meadows, deciduous forest edge, coordinates - X: 46.13962219 N, Y: 13.85308659 E, 838 m, field trips: 2.8.2010, 14.8.2011, 18.8.2012, 8.9.2012.

D. Near Podkremenk – wet and dry meadows in gradual succession, single bushes and trees, coordinates - X: 46.13135788 N, Y: 13.89090439 E, 800 m, field trips: 17.6.2012, 10.7.2012, 18.8.2012, 8.9.2012.

E. Polje, village – agriculture fields, pastures, deciduous forest edge and sporadically dry and wet meadows, coordinates - X: 46.11082402 N, Y: 13.85964787 E, 608 m, field trips: 9.5.2009, 22.6.2009, 1.8.2009, 28.3.2010, 9.4.2010, 16.5.2010, 26.6.2010, 18.7.2010, 22.7.2010, 31.7.2010, 5.9.2010, 11.4.2011, 17.4.2011, 1.5.2011, 30.5.2011, 3.7.2011, 17.7.2011, 29.7.2011, 14.8.2011, 26.12.2011, 3.3.2012, 17.6.2012, 18.8.2012, 8.9.2012.

Results and discussion

Altogether 76 butterfly species were recorded in five locations. Tab. 1 presents a list of observed species, their locations and number of separate recording events at each location. Fig. 2 shows that the largest number of species recorded was in July.

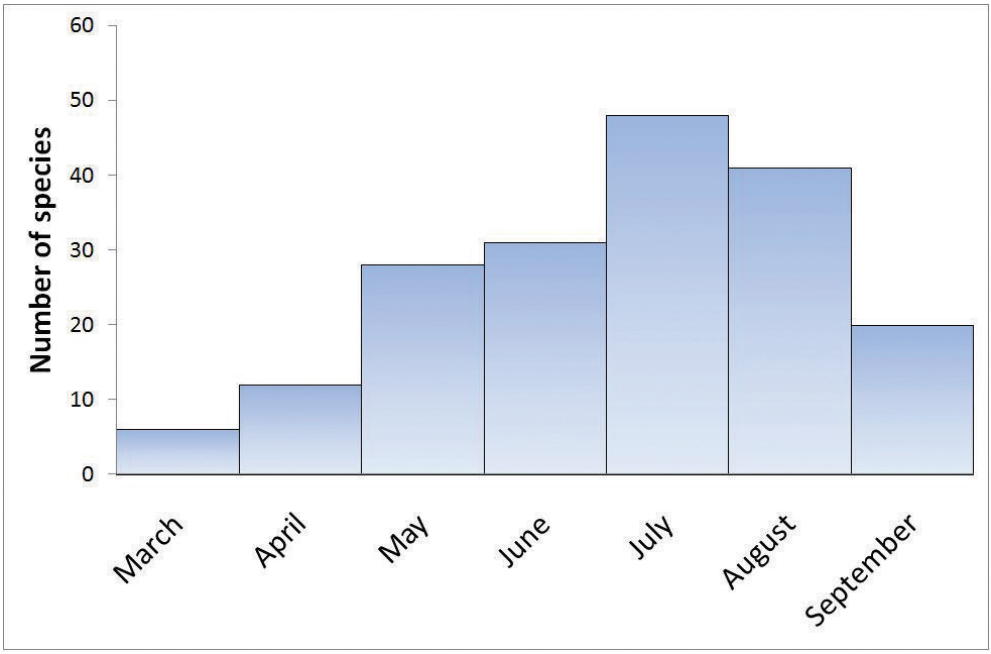

Fig. 2: Cumulative butterfly species richness between March and September at all sites pooled together.

Tab. 1: The list of butterfly species and localities with the number of observation records.

Family	Species	Locality				
		A	B	C	D	E
Hesperiidae	*Hesperia comma* (Linnaeus, 1758)		1	2		7
	Heteropterus morpheus (Pallas, 1771)			1	1	2
	Ochlodes sylvanus (Esper, 1777)	1	2	1	1	5
	Spialia sertorius (Hoffmannsegg, 1804)		1			
	Thymelicus sylvestris (Poda, 1761)		1		2	
Papilionidae	*Iphiclides podalirius* (Linnaeus, 1758)					4
	Papilio machaon (Linnaeus, 1758)	2	2	1		6
	Parnassius mnemosyne (Linnaeus, 1758)					2
	Zerynthia polyxena (Denis & Schiffermüller, 1775)		3			5
Pieridae	*Anthocharis cardamines* (Linnaeus, 1758)		3			5
	Aporia crataegi (Linnaeus, 1758)		1			
	Colias croceus (Fourcroy, 1785)	3	2	3		8
	Gonepteryx rhamni (Linnaeus, 1758)	2	3	2		10
	Leptidea cf. sinapis (Linnaeus, 1758)	2	8	2		16
	Pieris brassicae (Linnaeus, 1758)					2
	Pieris napi (Linnaeus, 1758)	1	3	1	1	10
	Pieris rapae (Linnaeus, 1758)	1	1		1	2
	Pontia edusa (Fabricius, 1777)		1			1
Lycaenidae	*Aricia aegestis* (Denis & Schiffermüller, 1775)		2			2
	Aricia artuxerxes (Fabricius, 1793)				1	
	Callophrys rubi (Linnaeus, 1758)		1			2
	Celastrina argiolus (Linnaeus, 1758)					2
	Cupido argiades (Pallas, 1771)		1			1
	Cupido minimus (Fuessly, 1775)				1	2
	Hamearis lucina (Linnaeus, 1758)					1
	Lycaena alciphron (Rottemburg, 1775)		1			
	Lycaena hippothoe (Linnaeus, 1761)			1		
	Lycaena tityrus (Poda, 1761)	3	1			2
	Phengaris arion (Linnaeus, 1758)	1				1
	Plebejus argus (Linnaeus, 1758)		3			1
	Polyommatus bellargus (Rottemburg, 1775)		3	1	1	9
	Polyommatus coridon (Poda, 1761)		1			2
	Polyommatus dorylas (Denis & Schiffermüller, 1775)		1			
	Polyommatus icarus (Rottemburg, 1775)	2	4	3	2	8
	Cyaniris semiargus (Rottemburg, 1775)		2			
	Satyrium ilicis (Esper, 1779)					1
	Satyrium spini (Denis & Schiffermüller, 1775)				1	1
	Scolitantides orion (Pallas, 1771)	2		1		1
Nymphalidae	*Aglais urticae* (Linnaeus, 1758)		3		1	3
	Apatura iris (Linnaeus, 1758)			2	1	1
	Argynnis adippe (Denis & Schiffermüller, 1775)				1	1
	Argynnis aglaja (Linnaeus, 1758)		1	1		2

Family	Species	Locality				
		A	B	C	D	E
Nymphalidae	*Argynnis paphia* (Linnaeus, 1758)	1	1	3	1	2
	Boloria dia (Linnaeus, 1767)		2			
	Brenthis daphne (Bergsträsser, 1780)		2			
	Brenthis hecate (Denis & Schiffermüller, 1775)		2			
	Brenthis ino (Rottemburg, 1775)				1	
	Brintesia circe (Fabricius, 1775)		1			1
	Coenonympha arcania (Linnaeus, 1761)	1	2		2	3
	Coenonympha pamphilus (Linnaeus, 1758)	2	5	3	2	17
	Erebia aethiops (Esper, 1777)		1	1	1	5
	Erebia ligea (Linnaeus, 1758)	1				
	Erebia pronoe (Esper, 1780)				2	
	Hipparchia fagi (Scopoli, 1763)				1	1
	Aglais io (Linnaeus, 1758)		1			3
	Issoria lathonia (Linnaeus, 1758)			1		
	Lasiommata maera (Linnaeus, 1758)	1			4	
	Lasiommata megera (Linnaeus, 1767)				1	
	Libythea celtis (Laicharting, 1782)					1
	Lopinga achine (Scopoli, 1763)		2		2	3
	Maniola jurtina (Linnaeus, 1758)	2	3	3	2	13
	Melanargia galathea (Linnaeus, 1758)	2	4	1	1	8
	Melitaea athalia (Rottemburg, 1775)	1	2	1		3
	Melitaea aurelia (Nickerl, 1850)		3	1		2
	Melitaea britomartis (Assmann, 1847)		2	1	1	1
	Melitaea cinxia (Linnaeus, 1758)		2			1
	Melitaea didyma (Esper, 1778)	1	1	1		4
	Melitaea phoebe (Denis & Schiffermüller, 1775)				1	
	Minois dryas (Scopoli, 1768)				2	
	Neptis rivularis (Scopoli, 1763)					1
	Pararge aegeria (Linnaeus, 1758)		1			2
	Polygonia c-album (Linnaeus, 1758)	2				2
	Pyronia tithonus (Linnaeus, 1767)					1
	Satyrus ferula (Fabricius, 1793)				1	2
	Vanessa atalanta (Linnaeus, 1758)	3		2		3
	Vanessa cardui (Linnaeus, 1758)	1				5
Number of field trips		**4**	**8**	**4**	**4**	**24**
Number of species on locality		**23**	**45**	**25**	**29**	**57**

Next, some more interesting observations of butterfly species of the Šentvid plateau are presented:

Pyronia tithonus

The species was observed on 17th of July 2011 on the southern slope at Polje village on the pastures with some rocky spots, shrubs and deciduous forest (Loc. E). According to Verovnik *et al.* (2012) this is one of the most northern observations in Slove-

nia. The species is univoltine and can be found especially on warm localities. Adults are flying from mid June until September. Larvae feed on grasses.

Erebia pronoe

This is a mountain, Alpine species, usually occurring above the tree line, except the valleys in the Alps (Verovnik *et al.*, 2012). The finding of *E. pronoe* on one of the higher localities (Loc. D) of the Šentvid plateau at 800 m a.s.l. in August was a bit surprising as this is one of the southernmost findings in Slovenia, on the south slopes of the Alps. Usually, it is occurring in August, but it can be found from the end of June to October, depending on year and altitude (Verovnik *et al.*, 2012). Larvae feed on different *Festuca* species, especially *Festuca ovina* (Schweizerischer Bund für Naturschutz, 1991).

Lopinga achine

This protected species is widespread in the region. It was observed on different localities from the end of May until the end of July. Specimens were observed along the deciduous forest edges. Findings are inside the main distribution area of the species in Slovenia (Verovnik *et al.*, 2012). Species is univoltine. Adults can be seen from mid May until mid August. Larvae feed on different grasses and bent-grasses.

Lycaena alciphron

One specimen of this local and threatened species was observed on 14th of August 2011 on extensive dry grassland (Loc. B). Species is most common at middle altitudes,

Fig. 3: Locality of Leskov vrh, Šentvid plateau (Locality B) (May, 2011). (Foto: G. Torkar)

but can be found up to 1650 m (Verovnik *et al.*, 2012). It is univoltine and adults can be found from mid May until the end of August. Larvae feed on *Rumex acetosa* and *Rumex acetosella*.

Melitaea britomartis

This local and threatened species was observed on dry meadows (Loc. B, C, D, E) from the end of May until mid August, probably because of the high altitude. Due to land abandonment the species is threatened in Slovenia and some local populations are disappearing. This is particularly the case in the Dinarides (Verovnik *et al.*, 2012). Species is univoltine and adults fly from mid May until the beginning of August. Larvae feed on *Plantago* spp., *Veronica* spp. and *Rhinanthus minor* (Verovnik *et al.*, 2012).

Parnassius mnemosyne

This protected species was observed from the end of April to mid May at Polje village (Loc. E) in high numbers. Adults were observed in different habitats from forest edges to different types of meadows and pastures. It is probably present also in other parts of Šentvid plateau, because the larval food plants (*Corydalis* spp.) are quite common. Species is univoltine and adults can be found from the end of April to mid June, or until beginning of August at higher altitudes. Species is declining especially in central and eastern part of Slovenia (Verovnik *et al.*, 2012).

Phengaris arion

Only two specimens were observed, on pastures and on wet meadows in the lowest and the highest surveyed localities (Loc. A, E). Specimens were seen on 22nd of July and 1st of August 2010. Also in other parts of Slovenia this species is very local with scattered distribution, mainly on warm south exposed extensive meadows (Verovnik *et al.*, 2012). Species is univoltine, adults fly from the end of June until mid August. Larvae are social parasites of ants, but first feed on *Thymus* spp. and *Origanum vulgare*. It is surprising that it was observed only in the summer 2010 despite many surveys in the same period in this and other years, in sites with suitable larval habitat.

Zerynthia polyxena

This protected species was common at the lower altitude localities (B, E). Specimens were observed on dry meadows and forest edge where larval food plants (*Aristolochia* spp.) were present. This is also one of the most northern records of the species at the edge of the Alps in Slovenia. Species is univoltine and adults can be found from the beginning of March until the end of May. On Šentvid plateau specimens were observed from the beginning until the end of April. In some parts, particularly in central and eastern Slovenia, the species is declining (Verovnik *et al.*, 2012).

Libythea celtis

In addition to already mentioned butterfly species we would like to highlight the finding of *L. celtis* (Fig. 4) at the edge of deciduous forest east of the village Polje on 25th of December 2011 at 12:00 (Loc. E). This locality is warm and south exposed with

Fig. 4: *Libythea celtis* found on 25th of December 2011 near village Polje. (Foto: G.Torkar).

Mediterranean plants present, such as *Cotinus coggygria* and *Fraxinus minor*. This extraordinary finding in the middle of winter confirms a mild climate and the presence of temperature inversions on the Šentvid plateau (Mavrič, 2009; Ogrin, 1996). This is also one of the most northern findings of this species in Slovenia.

Satyrus ferula

The species was observed at Polje village on the pastures with some rocky spots, shrubs and deciduous forest (Loc. E) and on dry meadows in gradual succession (Loc. D). Both localities are south exposed. This is one of the most northern records of the species at the edge of the Alps in Slovenia. Species is univoltine and adults can be found from the beginning of June until early September. On Šentvid plateau specimens were observed in July and August. Larvae feed on *Festuca ovina*, *Stipa* spp. and *De-*

schampsia caespitosa (Tolman & Lewington, 2008; Verovnik *et al.*, 2012). Due to its limited range in Slovenia, the species is considered 'vulnerable' (VU) in Slovenia (Verovnik *et al.*, 2012).

The recorded number of butterfly species on small area of the Šentvid plateau shows richness and importance of this karstic plateau for conservation of butterflies. Most probable explanations for butterfly species richness is that Šentvid plateau is more or less extensively well-maintained cultural landscape, despite its altitude and remoteness from big urban centres. Also, it should not be neglected that the area has a mild climate, particularly the precipitation regime is favourable in summer months (Meze, 1988), maintaining vegetation available for butterflies. This is also confirmed with the highest species richness in summer months (Fig. 2). In Primorska region grasslands start to dry out at the beginning of summer, which leads to decrease in butterfly species richness (for example see Koren *et al.*, 2011). Most probably many butterflies migrate from these dry grasslands to areas like Šentvid plateau which makes it even more important for the conservation of butterflies.

A total of 10 threatened and four protected butterfly species were recorded. Tab. 2 presents the species from the Red list of Slovenia (Official Gazette RS 82/2002, 42/2010) and Europe (Van Swaay *et al.*, 2010), protected by Decree on protected wild animals - DPWA (Official Gazette RS 46/2004, 109/2004, 84/2005, 115/2007, 96/2008, 36/2009, 102/2011), their status in Habitat Directive Annexes - HDA (Council Directive 92/43/EEC) and the Bern Convention Annexes – BCA (Official Gazette 17/1999).

Tab. 2: The threat and protection status of found butterfly species.

Species	**Threat status**		**DPWA**	**HDA**	**BCA**
	Slovenia	Europe			
Lopinga achine (Scopoli, 1763)		VU	1A	IV	II
Lycaena alciphron (Rottemburg, 1775)	V	LC			
Lycaena hippothoe (Linnaeus, 1761)	V	LC			
Melitaea aurelia (Nickerl, 1850)	V	NT			
Melitaea britomartis (Assmann, 1847)	V	NT			
Parnassius mnemosyne (Linnaeus, 1758)	V	NT	1A, 2A	IV	II
Phengaris arion (Linnaeus, 1758)	V	EN	1A, 2A	IV	II
Satyrus ferula (Fabricius, 1793)	V	LC			
Scolitantides orion (Pallas, 1771)	V	LC			
Zerynthia polyxena (Denis & Schiffermüller, 1775)	V	LC	1A, 2A	IV	II

Threat status: V – vulnerable species, VU – vulnerable species, NT – near threatened species, LC – least concern species; DPWA: 1A – Annex I, 2A – Annex II; HDA: IV – Annex; BCA: II – Annex.

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