

ANTITYPE SUDA (GEYER, 1832)
(LEPIDOPTERA: NOCTUIDAE), NEW SPECIES
OF NOCTUID FAUNA OF CROATIA, FOUND IN
THE BOKOVO NATURE PARK

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The paper gives the first record of *Antitype suda* (Geyer, 1832) a species from the Noctuidae family, newly recorded for the fauna of Croatia, with data and localities, species distribution data and biological features.

Key words: *Antitype*, fauna, Mt Biokovo, Republic of Croatia

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Rad donosi prvi nalaz vrste *Antitype suda* (Geyer, 1832) iz porodice sovice (Noctuidae) za faunu Hrvatske, s datumima i lokalitetima na kojima je sakupljena. Navode se i podaci o distribuciji vrste i njene biološke značajke.

Ključne riječi: *Antitype*, fauna, Biokovo, Republika Hrvatska

INTRODUCTION

The family Noctuidae was once considered the largest Lepidoptera family with around 35 000 described species (FIBIGER *et al.*, 2011). The Noctuidae family is part of the superfamily Noctuoidea that is the largest superfamily in the Order Lepidoptera counting 42 000 described species according to HEPPNER (1991), 45 890 according to POOLE (1989) and 70 000 according to KITCHING & RAWLINS (1998). According to ZAHIRI *et al.* (2012) it is unclear whether POOLE included into the overall count the families Oenosandridae, Notodontidae and Erebidae but according to some other opinions all the “erebids” were included in the Noctuoidea count.

According to the traditional systematic review, the family Noctuidae is the largest Lepidopteran family with more than 1 250 species determined in the European fauna (KARSHOLT & RAZOWSKI, 1996).

New systematic research based on molecular methods has led to considerable changes in the systematics of the family Noctuidae (ZAHIRI *et al.*, 2011, 2012). The former subfamilies of Noctuidae (Scoliopteryginae, Rivulinae, Hypeninae, Calpinae, Herminiinae, Hypenodinae, Toxocampinae, Boletobiinae and Erebiniae) and the former Arctiidae, Lymantriidae, Micronoctuidae, Herminiidae and Aganaidae families are now a part of the newly distinguished family Erebidae (ZAHIRI *et al.*, 2012). The family Erebidae counts 341 species in Europe (FIBIGER *et al.*, 2011). In Europe, the family Noctuidae comprises 20 subfamilies and now counts 1 237 species (FIBIGER *et al.*, 2011).

In Croatia, systematic research into the fauna of Noctuidae began in the 19th century (MANN, 1869; ABAFI-AIGNER, 1898) and continued during the 20th and 21st century with greater or lesser intensity (GALVAGNI, 1909; BURGERMEISTER, 1964; CARNELUTTI, 1994; HAFNER, 1994; KRANJČEV, 1985; KUČINIĆ, 1992, 1998; KUČINIĆ & BREGOVIĆ, 1996; KUČINIĆ & LORKOVIĆ, 1998; KUČINIĆ *et al.*, 1998; HABELER, 2005).

This research has recorded great number of noctuids in the Croatian fauna (CARNELUTTI, 1994; KUČINIĆ, 1997; KUČINIĆ *et al.*, 1998; HABELER, 2005). In his master's thesis, KUČINIĆ identified 587 species from the family Noctuidae for the fauna of Croatia, but that number of species should not be considered as final because HABELER recorded several species as new for the fauna of Croatia from the island of Krk (HABELER, 2005).

Based on a multiyear research programme, data relating to the first discovery of a new noctuid species for Croatian fauna are given in this paper. Data and localities of collected *Antitype suda* (Geyer, 1832) specimens along with its distributional data and corresponding biological features are given in detail.

MATERIAL AND METHODS

Research area

Mt Biokovo is one of the most imposing massifs in the Mediterranean part of the Dinaric Karst with strongly expressed geomorphological features. It stretches in parallel to the Adriatic coastline, with a plateau in the mid altitudes (above 900 meters), 5 to 6 kilometres wide. There is a great difference both in the climate and phytocoenological features between the northern and southern slopes of Mt Biokovo (KUŠAN, 1969). Most research into the Lepidoptera, except the collection of the Heteroceran moth inventory in Rastovac during research into Mt Biokovo in 2007 and 2008, was conducted on the southern slopes (MLADINOV & KUČINIĆ, 1993; KUČINIĆ *et al.*, 1998, 2002; MIHOČI, 2012). Mount Biokovo is a rather high mountain for the western Balkans with its highest peak, Sv. Jure, at 1762 m a.s.l.

Research into the Lepidoptera fauna of Dalmatia was started at the beginning of the 19th century by GERMAR (1817) and became more vigorous in the last decades with the studies of MANN (1869) and REBEL (1891, 1895, 1919, 1924/25). The exploration was continued in the 20th century by STAUDER (1919/20, 1920/21, 1922, 1923, 1925, 1926, 1927, 1932–33), BURGERMEISTER (1964), HABELER (1976) and MLADINOV (1965, 1974). In the last 25 years, moths were collected on Mt. Biokovo (SVENDSEN, 1991; MLADINOV & KUČINIĆ, 1993; KUČINIĆ *et al.*, 1998; KUČINIĆ *et al.*, 2000; MIHOČI *et al.*, 2011). The most intensive research into the Lepidoptera was performed between 1989 and 1993 and in the years 2007 and 2008. In 2007, 2008 research was done into the vertical distribution of moth diversity from tsea level to the top of Mt Biokovo at 14 localities with a vertical difference between each locality of 135 meters (MIHOČI, 2012). Research between 1989 and 1993

was done at 14 localities but only three coincided with the systematic research done in 2007, 2008 and 2013. Altogether, moths were sampled at 25 localities on Mt Biokovo. Out of these, only one was on the northern slopes, and 24 were positioned on the southern slopes.

Collecting of the material and laboratory work

Specimens of Lepidoptera were collected using a UV lamp connected to a transportable generator of 1 000 W. After 2006, it was replaced by portable 15 W battery. Voucher specimens are deposited in the Croatian Natural History Museum as part of the following collections: the Mihoci Collection, Kučinić Collection and Vajdić Collection. Two specimens of *Antitype suda* are placed in the Central Collection of Hesperioidea and Macroheterocera in the Croatian Natural History Museum.



Fig. 1. Geographical distribution of *Antitype suda* according to RONKAY *et al.* (2001).

For precise taxonomical identification, the genital features were studied. Genital slides were prepared following the standard methods. Abdomen of the moth was cut in length of 4–6 mm and macerated in 10% KOH for 24 hours to remove the soft tissues. Chitinised part was purified in distilled water and dehydrated in alcohol series (25 – 96%) and briefly immersed in xylene (10–20 seconds). Genitalia were mounted in Canada balsam.

Identification was based mainly on the description of genital features by RONKAY *et al.* (2001), BERIO (1985), RÁKOSY (1996) and HACKER (1989). The main biological features and the distribution map are given according to RONKAY *et al.* (2001) (Fig. 1). Systematic presentation follows FIBIGER *et al.* (2011).



Fig. 2. Schematic representation of Mt. Biokovo profile marked with the area where *Antitype suda* was recorded.

RESULTS AND DISCUSSION

Analysis of noctuids collected on Mt Biokovo proved that in the area an interesting species from the genus *Antitype* is present. Altogether, 13 specimens of this species were collected, all of them males. In Europe there are four species from the genus *Antitype*. Only one of them, *Antitype chi* (Linnaeus, 1758), was so far recorded in Croatia. *Antitype chi* is widely distributed, which corresponds well with the three specimens present in the Central Collection of Hesperioidea and Macroheterocera that were collected in Senjska Draga and Križpolje.

Until recently there were 69 recorded noctuid species on Mt Biokovo, (MLADINOV & KUČINIĆ, 1993; KUČINIĆ *et al.*, 2000) but there was not a single record of *Antitype chi*. The specimens from Mt Biokovo do not belong to this species. Known biogeographical and distributional data for the species of the genus *Antitype*, *Antitype suda* or *Antitype jonis* (LEDERER, 1865) lead to the hypothesis that these two species might be present on Mt Biokovo. These two species have similar external morphologies and their satisfactory separation requires the study of the genitalia in both sexes. In addition, these two species can be found in sympatry, e.g. in Albania and Macedonia (RONKAY *et al.*, 2001). Even morphological analysis of genitalia, comparing different publications and different authors, indicates difficulty in separating these two species. Typical forms can be easily

distinguished (RONKAY *et al.*, 2001), but there are cases of atypical genital morphology as well. A genital preparation of one male (Figs 3, 4) was compared to the genitalia features of *A. suda* and *A. jonis* according to RONKAY *et al.* (2001). Based on this comparison we identified our specimen as *Antitype suda* as follows: 1. Fultura inferior is broader and



Fig. 3. Adult moth (specimen from Mt. Biokovo, locality L11 1485 meters a.s.l., 12. 09. 2007., leg. I. Mihoci & M. Vajdić).

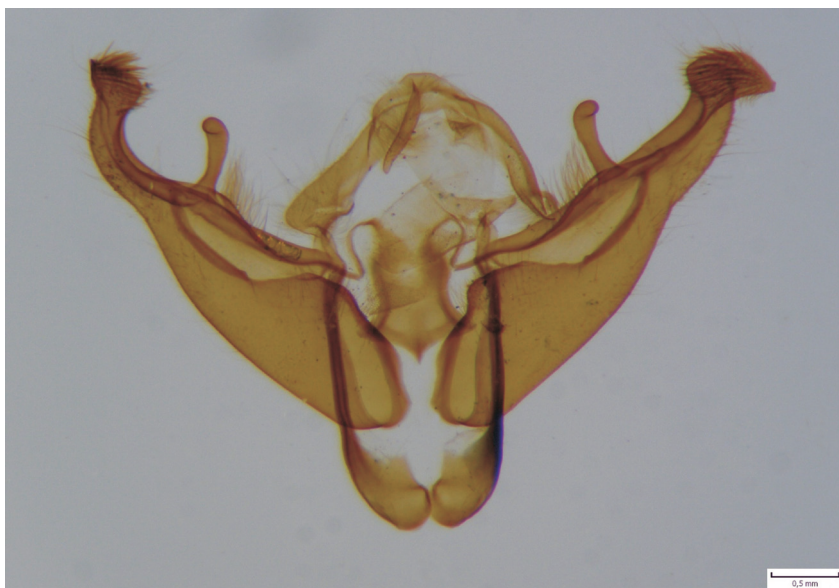


Fig. 4. Genitalia preparation (male specimen from Mt Biokovo, locality L11 1485 meters a.s.l., 12.09.2007., leg. I. Mihoci & M. Vajdić).



Fig. 5. Aedeagus of analysed specimen (Mt Biokovo, locality L11 1485 meters a.s.l., 12.09.2007., leg. I. Mihoci & M. Vajdić).



Fig. 6. Typical habitat at which *Antitype suda* was collected on Mt Biokovo, locality L11 1485 meters a.s.l. (Photo by A. Mrnjavčić Vojvoda)

comparable to *A. suda astfaelleri* (SCHAWERDA, 1925); 2. The distal third of the valve is broader; 3. Cucullus is larger than in *A. jonis*; 4. Ampula is closer to the base of the cucullus. The aedeagus of the analysed specimen (Fig. 5) has very expressed cornuti that are not found in features of either *A. suda* or *A. jonis* in RONKAY *et al.* (2001), but the shape of the aedeagus is similar to that of *A. suda* (RONKAY *et al.*, 2001). According to the recent research into moth genitalia it is evident that there exists a great variability among genitalia at both intra- and inter-species levels (MUTANEN, 2005; MUTANEN & KAITALA, 2006; MUTANEN *et al.*, 2006), which leads to the necessity for the use of molecular methods in species level identification. The scale of the intraspecific variation in most cases is the same for the molecular (e.g. barcode) characters. The "great intra- and interspecific variation in the genitalia" is a rare though existing case in the noctuid groups. In groups where the specific differences are small, as in the genus *Euxoa* (MUTANEN, 2005; MUTANEN *et al.*, 2006), this variability may cause a considerable overlap between closely related species, therefore a supporting molecular study may help in the identification. In the majority of the trifine noctuids, the regular scale variability does not produce such difficulties but, of course, in extreme cases, teratological developments may occur in any species.

Antitype suda is a mountainous species. These biological features are conditioned by the allopatric distribution typical of all mountain species as in some other insect groups i.e. Trichoptera, genus *Drusus* (PAULS *et al.*, 2006, 2008; PREVIŠIĆ *et al.*, 2009; KUČINIĆ *et al.*, 2011). Different species of insects, which have allopatric distributions in mountainous parts, are interesting for research into taxonomy, phylogeny and phylogeography. Isolation of mountain populations leads to processes of speciation as in genus *Erebia*, genus *Drusus* (Trichoptera), so those are good models for speciation research (VILA *et al.*, 2005; PAULUS *et al.*, 2006; PREVIŠIĆ *et al.* 2009, 2014).

Antitype suda inhabits xerothermic, often rocky slopes. The caterpillar lives polyphagously on *Galium* and *Silene* on rocks at 1600 m a.s.l. The moths fly in the autumn, from

Tab. 1. List of dates and altitudes where *Antitype suda* was collected (all males).

	Date of collection	Altitude (meters a.s.l.)
1.	29. 08. 1990.	1080
2.	29. 08. 1990.	1080
3.	27. 09. 1995.	1270
4.	27. 09. 1995.	1270
5.	27. 09. 1995.	1270
6.	27. 09. 1995.	1270
7.	14. 09. 1990.	1450
8.	12. 09. 2007.	1485
9.	12. 09. 2007.	1485
10.	13. 09. 2007.	1215
11.	01. 10. 2007.	1215
12.	01. 10. 2007.	1350
13.	01. 10. 2007.	1350

late August to late October/early November. A detailed list of collected specimens, data and altitude of collection is given in Tab. 1. Distribution area of collected specimens on Mt Biokovo varies between 1080 and 1500 meters a.s.l. in a beech forest (Figs. 2, 6). According to BERIO (1985), *A. suda* is found in the Abruzzi mountains at altitudes between 1000 and 1800 meters but, according to HACKER (1989), this species can also be found at lower (700 meters) and higher (2000 meters) altitudes. The Balkan subspecies, *Antitype suda schimae* (SCHAWERDA, 1911) inhabits altitudes at about 1000 meters (RONKAY et al., 2001).

Only after detailed morphological and molecular comparison of populations of *Antitype suda* found on Mt. Biokovo with those from Bosnia and Herzegovina, Macedonia and Greece, will the exact taxonomic status of population from Mt. Biokovo be defined. A great similarity to or even identity with the nearest populations in Bosnia and Herzegovina that belong to the subspecies *Antitype suda schimae* can be predicted. Based on this, the population found on Mt Biokovo was not assigned to the subspecies level.

In the future it would be necessary to analyse different populations of species and *A. suda* – *A. jonis* species – pair using morphological and molecular methods and to define the exact taxonomic status of population from Mt. Biokovo. We can expect similar results in this investigation to that for the genus *Drusus*.

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