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Școala Doctorală Biologie Integrativă

The biology and ecology of *Eriogaster catax* and *Eriogaster lanestris* (Lepidoptera: Lasiocampidae) from semi-natural habitats in Transilvania

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CONTENT

Introduction

Eriogaster catax (Lepidoptera, Lasiocampidae) is one of the locally distributed, least studied species (Drews & Wachlin, 2003) and is currently considered an endangered species in several European countries (Borges 2012), although the risk factors are not well known (Caron, 2009; Freina, 1996). In Europe, it is also one of the few protected moth species [3], through Annexes II and IV of the Council Directive 92/43/EEC, Annex II of the Bern Convention (Höttinger, 2005) and, according to the IUCN Red List, it is a Data Deficient (DD) species (Farkač et al, 2005)..

E. catax is a xero-thermophilic or, by case, a thermo-hydrophilic species, having particular requirements with regards to its habitat (Borges, 2012; Bury, 2015; Malkiewicz, 2015; Freina, 1996). It typically inhabits plain and hilly areas, reaching as far as the submontane region, according to the occurrence of the typical host plants, namely *Prunus spinosa* and *Crataegus monogyna* (Borges, 2012). It can be found in natural, semi-natural and sometimes even anthropic environments (Baillet, 2013), including bushy meadows, glades, forest edges, deciduous forests, clerarings or evenliving fences (Baillet, 2013; Bury, 2015; Hottinger, 2005). The adults of *E. catax* start flying at the end of August (Hottinger, 2005), the peak of their flight period having been recorded between the end of September and the end of October, according to weather conditions and geographic area (Baillet, 2013; Bury, 2015; Caron, 2009; Cervelló & Passola, 1994; Chrzanowski et al, 2013; Cifuentes, 1992; Forster & Wohlfahrt, 1984; Gómez de Azipura, 1988; Malkiewicz, 2015; Pérez de Gregorio et al, 1995). It is during this period that the female lays the eggs, preferentially on the branches of *Prunus spinosa* or *Crataegus monogyna*, in a tightly fixed spiral cluster, placed at around 2/3 of the plant's height (Baillet, 2013; Borges, 2012; Bury, 2015; Caron, 2009; Chrzanowski et al, 2013; Freina, 1996; Hottinger, 2005; Malkiewicz, 2015; Ruf, 1999). . Generally, the eggs are well camouflaged, but easy to identify (Caron, 2009).

The oviposition site is crucial for lepidopterans (Renwick, 1989), considering that the caterpillars of most species have a reduced mobility, therefore they require protection from predators and are highly dependant on closely available food sources (Furst & Nash, 2009).

The embryonic stage is the wintering form for *E. catax* and lasts for approximately six months, after which the larvae emerge in March or April, according to weather conditions (Bury, 2015; Chrzanowski et al, 2013; Freina, 1996).

One main charactheristic of the larvae is their social behavior; they are gregarious during the first three developmental stages (Baillet, 2013; Bury, 2015; Chrzanowski et al, 2013; Freina, 1996;). The nest serves as an activity center and plays an important role in the thermoregulation of the colony (Costa, 1997; Fitzgerald & Costa, 1999), probably also acting as shelter against predators (Costa, 1997; Ruf et al, 2003). However, it does not include food resources (Joos et al, 1988; Ruf & Fiedler, 2002b; Ruf et al, 2003) therefore the larvae leave the platform in order to feed, during the warmer period of the day (Bury, 2015; Caron, 2009; Malkiewicz, 2015). The chrysalis stage can be found at ground level (Baillet, 2013; Carron, 2009; Hottinger, 2005), under the leaves at the basis of the bush, in a silk cocoon (Malkiewicz, 2015).

Eriogaster catax is present in the warmer regions of the West Palearctic, its distribution ranging from the Iberian Peninsula (Northern Spain), to the Balkans (Baillet, 2013; Borges, 2012; Bury, 2015; Freina,1996), up to Asia Minor and the south of the Ural Mountains (Baillet, 2013; Borges, 2012; Bury, 2015; Freina, 1996; Freina & Witt, 1987; Karsholt & Razowski, 1996; Konvicka et al, 2005; Leraut, 2006; Ruf et al, 2003). The species is absent from the Mediterranean islands (Borges, 2012). In Europe, *E. catax* is currently known from 22 countries: Spain, France, The Netherlands, Belgium, Luxembourg, Switzerland, Italy, Germany, The Czech Republic, Austria, Slovenia, Croatia, Bosnia and Herzegovina, Poland, Slovakia, Hungary, Serbia and Montenegro, Macedonia, Greece, Romania, Bulgaria, Belarus, Ukraine, The Republic of Moldova and Russia (Bury, 2015; D'Antoni, 2003; Dubatolov & Zolotuhin, 1992; Jost et al, 2000; Karsholt & Razowski, 1996; Zolotuhin & Nieukerken, 2013) .

The species has a heterogenous distribution, with isolated populations, so that its actual distribution area is in fact discontinuous (Alcántara de la Fuente, 2009; Baillet, 2013). With regards to the European distribution, two important centers can be noted: one including south-western France and the Apennines region in Italy and one including countries from Central and Eastern Europe (Slovakia, Czech Republic, Hungary), which is very likely the main one (Baillet, 2013; Burry, 2015; Freina, 1996,).

However, during the last century, *E. catax* populations have become extinct in many known locations from Central Europe, including Bohemia region (northern Germany) and most of Poland, while their numbers have dramatically decreased in Switzerland and other parts of Europe (Aistleitner, 1999 Konvicka, 2006; Novák & Liška, 1997; Laštuvka, 1998). In Romania, *E. catax* occurs in all hystorical provinces of the country (Rakosy, 2003), but is rarely signaled

(Rakosy, 2008), and so far hasn’t been fully charted at a national level. The largest known population, which was monitored during the present study, is located in Cluj County in the Eastern Hills of Cluj, ROSCI0295, a Natura 2000 site.

Due to the fact that *E. catax* has become extinct in many regions, as a result of habitat distruction for agricultural expansion and the large-scale use of pesticides, the species has been introduced in the Annexes of Habitats Directive of the European Union (Malkiewicz, 2015). However, the conservation status of the species remains difficult to determine (Alcántara de la Fuente, 2009; Baillet, 2013; Hottinger, 2005). The isolation and numerical decline of populations from western and central Europe, as well as the existence of populations comprising a small number of individuals represent impediments in acquiring relevant data regarding the biology and ecology of the species (Baillet, 2013; Caron, 2009; Hottinger, 2005).

Considering that data concerning the specific preferences with regards to the shape and structure of host plants, the trophic substrate for the larvae, as well as the way in which the eggs are layed may be essential for implementing management and conservation measures, the aim of the present study was to provide new insights into the oviposition strategy of *E. catax*.

Objectives

Based on literature review and our considerations regarding the research until present on *Eriogaster catax*, we have considered the following objectives for this PhD thesis:

The morphological analysis of the species *E. catax* and *E. lanestris*, ultrastructurally by means of electron microscopy.

Establishing the oviposition preferences of *E. catax* in the Nature 2000 Eastern Cluj Hills Site by measuring some parameters as following: the clutch height on the host plant, clutch size, embryonic fertility evaluation, the preffered host plant for oviposition, shape and structure of the shrub, the slope cardinal orientation, conservation statu and the populations density.

Determining the oviposition preferences and niche comparison for the syntopic species *E. catax* and *E. lanestris* in the Turda Gorge Nature Reserve.

Estimating the rerlation between the anthropic activity and *E. catax* population in the Nature 2000 Eastern Cluj Hills Site and proposing some long term management measures leading to the species conservation and its habitat.

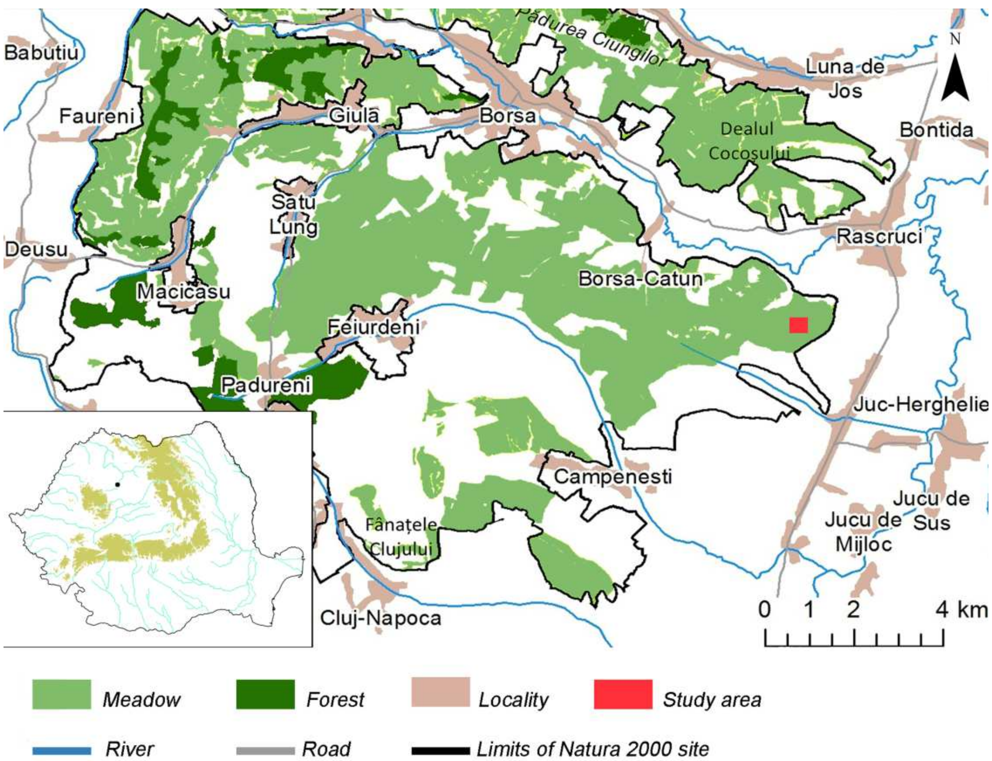
Key words: *E. catax, E. lanestris,* oviposition preferences, ecology, biology, consevation

Materials and methods

Study area

1. The Natura 2000 Site, Eastern Hills of Cluj, ROSCI0295.

The location was chosen based on previous monitoring studies focused on lepidopterans, which revealed a large number of *E. catax* nests. Dealurile Clujului Est Site comprises 5531 hectares of meadows and 405 hectares covered with arbustive vegetation. Furthermore, on most meadows *P. spinosa* and *C. monogyna* bushes can be found in various proportions (Baur et al, 2006; Rakosy, 2011).

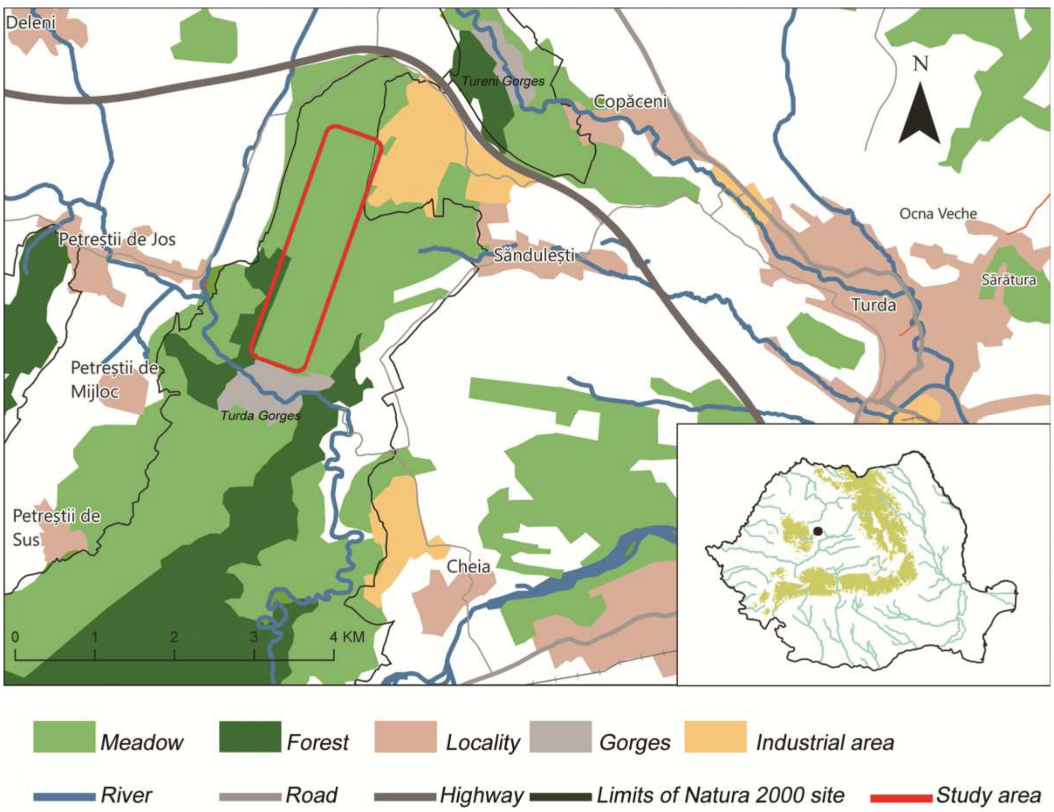


Study area in the Eastern Hills of Cluj.

2. Nature 2000 Site Cheile Turzii - ROSCI0035

The study was performed in an area situated in central Transylvania, in the upper part of the right slope of the Turda Gorges, Cluj County Romania, which is a natural reservation and part of the Nature 2000 Site Cheile Turzii - ROSCI0035

As natural reservation, Turda Gorges is a renowned hot-spot of biodiversity, as a consequence of the interecosystemic effect (Rákosy, 1995, Rákosy & Varga 2006), comprising over 900 known species of vascular plants (Nyarády, 1939; Rákosy, 2001) and over 1350 species of lepidopterans (Rákosy, 2001). The plateau area of the Gorges consists in a meadow including numerous shrubs of *Prunus spinosa*, *Crataegus sp.* and *Rosa sp.*, which ensure a suitable habitat for both *E. catax* and *E. lanestris* and also for other endangered species of butterflies, such as *Colias myrmidone* (Rákosy, 2001).



Map of the studied area and its surroundings

The establishment of the study perimeters

The susceptible areas for *E. catax* were identified. Poligons were generated for the areas having at least 10% bush coverage, using the ArcGIS 10.2 (Esri) software, based on the following layers: orthophotographic plan, topographic map and land usage map. Secondly, the established habitats were analysed in the field, using standard transects. The study perimeters were identified using a Garmin 60 CSx GPS, considering the occurrence of nests, host plants and land conformation. The areas from which *P. spinosa* and *C. monogyna* were removed by human activity were excluded.

Fieldwork and data collection

The observations and measurements were carried out between 2011 and 2017, during systematic field trips taking place between March and June in each study year. Most nests were inventoried during April, when the larvae were in L2 or L3 stage, when the nests were already large enough to be easily spotted.

All bushes from the perimeter were carefully cheched. The exact position of nests was determined using a GARMIN GPS*map 62s* GPS. In order to avoid counting the same nest several times, and to highlight the smaller nests, they were marked with a coloured plastic ribbon, tied on the tip of the branch. The oviposition height was measured from ground level to the median part of the nest, using a 5 m tape measure. The height of the host plant was also measured and recorded.

For each nest, the species of host plant was recorded. According to shape and size, the bushes were divided in two categories: isolated bushes (having a surface of up to 3-4 m²) and grouped bushes (having a surface of more than 4 m²).

The cardinal orientation of each location was determined using cardinal degrees, as follows: N: 0-22.5 and 337.5-360; NE: 22.5-67.5; E: 67.5-112.5; SE: 112.5-157.5; S: 157.5-202.5; SW: 202.5-247.5; W: 247.5-292.5; NW: 292.5-337.5. The slope exposition was calculated for each location.

In order to determine the number of eggs layed by the female *E. catax*, the nests were collected after being abandoned by the larvae and their passage to solitary life. As the nest is built around the eggs, by removing the silk span by the caterpillars, the eggs exuviae were isolated. The eggs were cleaned from protective hairs using fine tweezers and a brush and counted under a dissection microscope (Olympus, Japan). In order to avoid errors, the counted eggs were marked. The total number of eggs, number of hatched eggs and unhatched ones were recorded. From the years 2011, 2012 and 2013, a total of 50 nests/year were examined. For the next years, all nests were taken into consideration, namely 33 for 2014, 12 for 2015 and 22 for 2016.

Statistical analyses

The statistical analysis of data was performed using EpiInfo 7™software (CDC, USA) and EpiTools website . For the oviposition height, 20 cm intervals were taken into account, starting froum the ground level, to the highest point where a nest was recorded. Thus 14 intervals were obtained (0-20 cm, 21-40 cm, …261-280 cm). For each interval the frequency and 95% confidence intervals (CI) were established and the differences were assessed by means of chi square testing and considered signivicant at a p value lower than 0.05. For the total height of the host plant, 50 cm intervals were used (total 7 intervals), as described above. The possible correlation between the host plant height and the oviposition height was assessed using Spearman's rank correlation test (Spearman's rho). For the species and grouping of host plants, and for the cardinal orientation, the frequency and 95% confidence intervals (95% CI) were established.

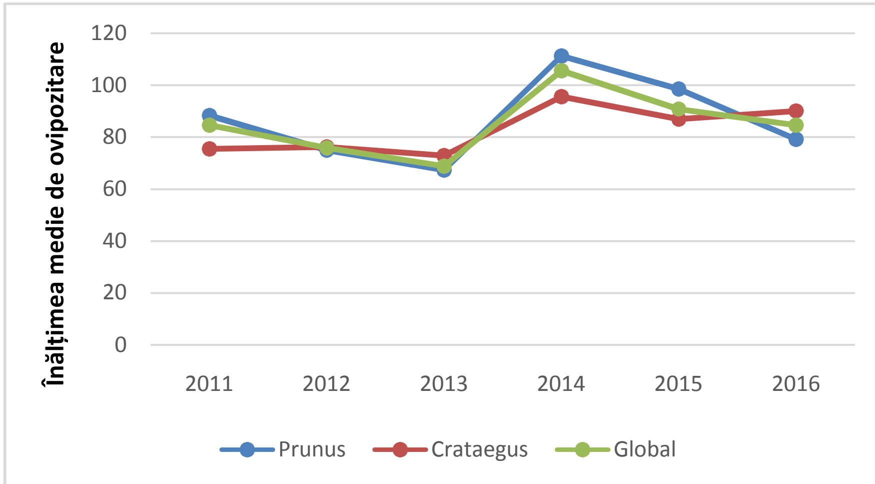
Results

I. Multiannual study of oviposition preference in *Eriogaster catax* (Lepidoptera: Lasiocampide)

During the six years of study, a total of 591 nests were inventoried: 212 in 2011, 224 in 2012, 88 in 2013, 33 in 2014, 12 in 2015, and 23 in 2016. The attained data were analysed both annually and globally.

Oviposition height

Overall, the average oviposition height was of 82.2 ± 36.6 cm. According to host plant, the average oviposition height was 85.8 ± 39.15 cm on *P. spinosa* and 78.3 ± 30.76 cm for *C. monogyna.*

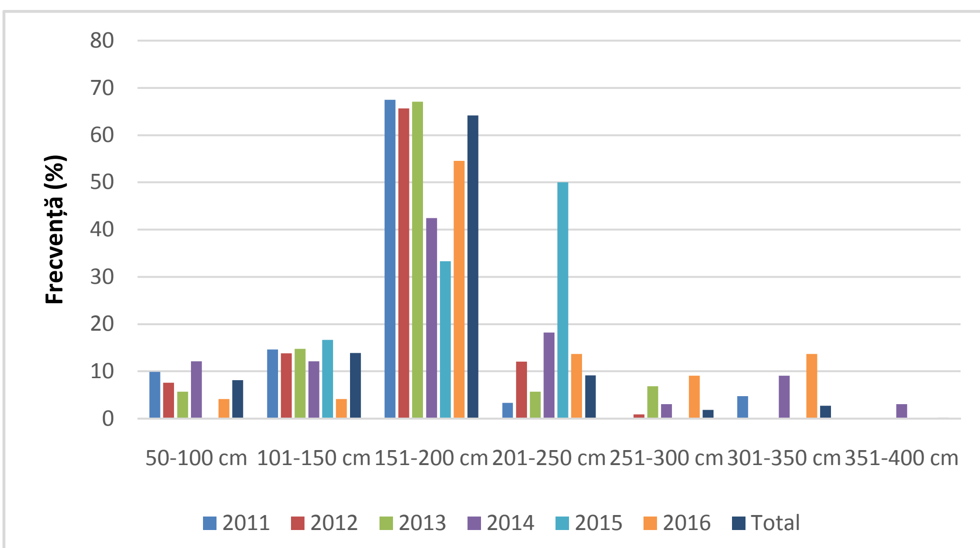


Oviposition height of *Eriogaster catax* between 2011 and 2016.

Host plant height

Overall, the average height of the host plant was of 170.55 ± 48.66 cm (Fig 4). The average height of *P. spinosa* was 176.49 ± 54.58 cm and that of *C. monogyna* was 163.33 ± 39.22 cm.

Analysing the distribution of host plants on 50 cm intervals, the most frequent interval was 151-200 cm, followed by 101-150 cm, with statistically significant differences (p<0.0001; χ^2= 1465.25; df= 6).



Host plants distribution on 50 cm intervals for the entire study period

Preference for the host plant

Overall, the frequency of *P. spinosa* was 54,15% (n=324), while that of *C. monogyna* was 45.85% (n=268) (Fig 2). The difference was statistically significant (p= 0.0043; χ^2= 8.12; df= 1).

Table . The frequency and 95% CI of host plant species

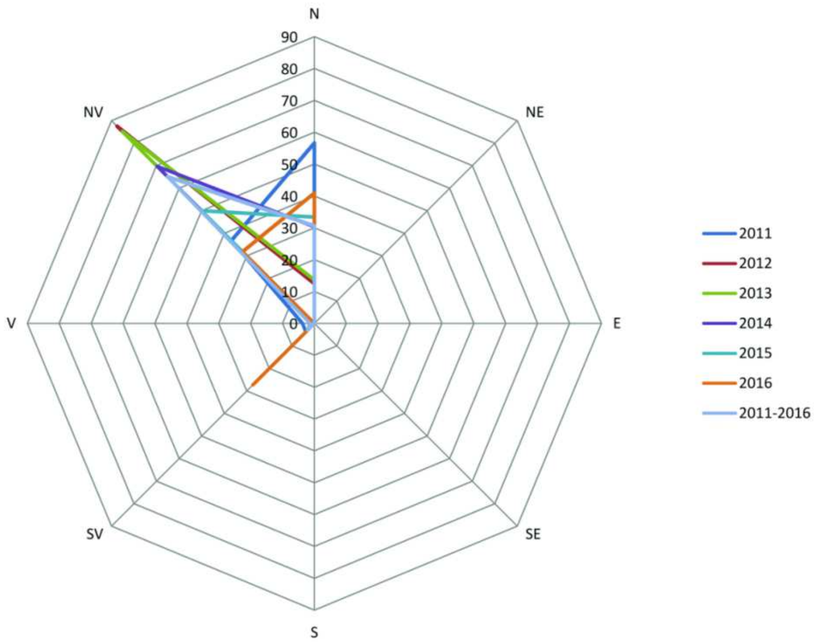
	Prunus spinosa		***Crataegus monogyna***		χ^2 (df=1)	**p**
	Frequency (%)	**95% CI**	**Frequency (%)**	**95% CI**		
2011	70.75	64.13-76.78	29.25	23.22-35.87	73.05	< 0.0001
2012	28.13	22.34-34.50	71.88	65.50-77.66	85.75	< 0.0001
2013	73.86	63.41-82.66	26.14	17.34-35.59	40.09	< 0.0001
2014	63.64	45.12-79.60	36.36	20.40-54.88	4.90	0.02
2015	33.33	9.92-65.11	66.67	34.89-90.08	2.66	0.1
2016	77.27	54.62-92.18	22.73	7.82-45.37	13.09	0.0003
Total	54.15	50.11-58.12	45.85	41.88-49.89	8.12	0.0043

Egg counts

The average number of layed eggs was of 186 ± 22 eggs/nest. The maximum number of eggs/nest was of 265, while the minimum one was 132. Overall, 95% of eggs hatched. The maximum number of unhatched eggs in a single nest was 45, while in three nests, all of the eggs were fertilie, toalising 215, 218 and 224 respectively.

Preference for the cardinal orientation

A significant majority of nests (65.14%; n= 386) were positioned on the north-western exposition ($p<0.0001$; χ^2= 884.45; df= 3), followed by the northern one



Distribution of nests by cardinal intervals for period between 2011 and 2016.

II. Ecological niche comparison of the two syntopic species – *Eriogaster catax* and *Eriogaster lanestris* in Turda Gorge Nature Resrve

Results

During our study, 48 nests of *E. catax* between 481-739 m altitude and 111 nests of *E. lanestris* between 550-752 m altitude were inventoried and measured. The mean altitude of the recorded *E. catax* nests was 673, 927 ±76.53 m and that of *E lanestris* was 704,79 ±57.74 m.

Oviposition height

The mean height of oviposition on the host plants was 57.89 ± 25.34 cm for *E. catax* and 45.12 ± 23.87 cm for *E. lanestris.* The global difference between the two species was significant (H=13.6; d.f.=1; p=0.0002). On *P. spinosa*, the mean oviposition height was 53.23 ±22.84 cm for *E. catax* and 43.84 ±20.15 cm for *E. lanestris*. The difference was statistically significant (H=5.27; d.f.=1; p=0.0217). On *Crataegus sp.,* the mean oviposition height was 65.66 ±27.97 cm for *E. catax* and 53.33 ±40.5 cm for *E. lanestris*. The difference was statistically significant (H=4.26; d.f.=1; p=0.0390).

Host plant height

The mean height of the host plants reflecting the affinities of *E. catax* was of 128.729 ±140.659 cm, while for the other species, *E. lanestris*, it was of 52.88 ± 31.57 cm. According to data from *P. spinosa* shrubs, the mean height preference of *E. catax* was 81.6 ±67.43 cm, while that of *E. lanestris* was of 50.66 ± 24.87 cm. For the second host plant, *C. monogyna*, the mean height for *E. catax* clutches was of 207.27 ±191.02 cm, while *E. lanestris* displayed a lower threshold, of 67.06 ± 58.18 cm. The global height difference between the host plants in relation to species oviposition preferences was significant (H=14,26; df=1; p=0,0002). Significant differences in height preferences of the two species were recorded for both *P. spinosa* (H=5.66; df=1; p=0.0173) and *C. monogyna* (H=5,72; df=1; p=0.0167).

Oviposition choice in relation to the shape and structure of the shrub

E. catax was more confined to grouped shrubs, with a frequency of 62.5% (95% CI 47.35-76.05%), as opposed to solitary ones, with 37.5% frequency (95% CI 23.95-52.65%), with a statistical significance (χ^2=5.04; d.f.=1; p=0.0242).

E. lanestris displayed a higher frequency 90.09% (95% CI 82.96-94.95%) of oviposition on grouped shrubs, while solitary shrubs presented a low percentage, of 9.91% (95% CI 5.05-17.04%). The differences were statistically significant (χ^2=139.53; d.f.=1; p=0).

E. lanestris exhibited significantly increased confinement to grouped shrubs as opposed to *E. catax* (χ^2=15.3; d.f.=1; p<0,0001).

The choice of host plant used as larval food source

The larvae of *E. catax* were found with a higher frequency on *Prunus spinosa*, 62.5% (95% CI 47.35-76.05%) and in reduced numbers on *Crataegus sp.* 37.5% (95% CI 23.95-52.65%). The preference for *P. spinosa* was statistically significant (χ^2=5.04; d.f.=1; p=0.0242).

The larvae of *E. lanestris* also displayed a higher frequency on *P. spinosa,* 86.49% (95% CI - 78.69-92.23) and a low presence on *Crataegus sp.* 13.51% (95% CI 7.77-21.31%), having a significant preference for *P. spinosa* (χ^2=115.31; d.f.=1; p=0).

Both species showed significant affinities towards the same host plant, but more markedly *E. lanestris* (χ^2=10.3; d.f.=1; p=0.0011).

The cardinal orientation of the slope for sampling locations

A higher frequency in *E. catax* distribution was attributed to the SE slope 37.5% (95% CI 23.95-52.65%), with a lower frequency, of 27.08% (95% CI 15.28-41.85%) on E and NW slopes

. The distribution of the nests according to cardinal points was significant (χ^2=11.33; d.f.=5; p=0.0101).

E. lanestris was more abundant on SE slopes, with a frequency of 54.05% (95% CI44.33-63.55%), with a low threshold on NW slopes, 24.32% (95% CI 16.68-33.38%).

E. lanestris was more confined to the cardinal direction when compared to *E. catax,* but with no statistical significance (χ^2=3.04; d.f.=1; p=0.0811).

III. The relation between anthropic impact and *E. catax* population from the Nature 2000 Eastern Hills Cluj Site

The problem of shrubs removal by burning them in the Nature 2000 Site Eastern Cluj Hills does not represent a local problem or an isolate case. This kind of practice is employed at national level. Arson is a cheap approach in cleaning the field and those employing, either unknowingly or by ignorance, do not care about the impact upon biodiversity.

Not all the times the arson is employed for shrub removal. These shrubs are removed mostly by agricultural machinery, sometimes leading to total removal, including bushes between two land parcels. This is happening both for meadows and arable land.

The problem of intensified agriculture in Romania has as a motive among others, the UE subsidy that encourages the farmer's use of abandoned land, set aside from agricultural circuit. These lands are not exploited by the locals but more often us as concession areas by the investors who's interest reside in cost diminishing by leveling the land/crop on greater surfaces.

The grazing subsidy lead to an increase in Romanian sheep number, and the lands used as grasslands are being currently grazed. Intensive grazing does not have a direct effect on both species from my study. Indirectly, by increasing the soils nitrogen concentration encourages the natural succession of shrub growth on abandoned fields. In this first phase my look positive because a great number of shrubs are used as larval trophic basis for *E. catax* and *E. lanestris.* The natural succession will tend towards the total coverage of the area leading to a higher density of the shrubs resulting in an inadequate type of habitat.

Management measures needed for the conservation of *E. catax* and its habitat

1. Maintaining a percent of shrub field cover of about 20-30%, where there is certain presence of the species, or the presence of suitable habitat.

2. Forbidding the cleaning of the field and any other workings involving the shrubs from September to April, when larvae nests are visible, avoiding damages.

3. For metapopulations conservation, the maintenance or development of ecological corridors is needed by maintaining the shrubs between two land parcels, alongside roads or near the railways. Maintaining a vegetation mosaic on the field assures the functionality of a metapopulation.

4. Avoidance of forbidden practices like stubble arson, agricultural lands arson, and sanctioning leading to avoidance of such practices.

5. Modifying the phytosanitary treatment period applied against insects and other pests where there is certain presence of the species *E. catax*. During 1th of April -15th of June (larval development period) avoidance of insecticides is necessary.

6. In case of national infrastructure works where the impact on the habitat cannot be avoided, the translocation of the larvae nests is needed after identification of suitable habitats.

7. Controlling the grazing by implying a maximum number of grazing animals/unit of area.

8. Creating an agro-environmental subsidy package as in the case of *Maculinea sp.*- Package 6 meadows important for butterflies (http://www.apia.org.ro) butterflies to encourage farmers in maintaining the *Prunus sp.* and *Crataegus* shrubs in the field.

9. Activities for promoting and disseminating information among the general public and especially among the youth. This may lead to an increase in tolerance degree for the hairy larvae of *E. catax*, a less charismatic species.

An important role in applying such measures and in creating farmer subsidies, beside governmental organizations, is played by the ONG's.

The best example is The Romanian Lepidopterological Society, which through sustained efforts managed to employ the above mentioned agro-environmental subsidy. Also it founded the Nature 2000 Site Eastern Cluj Hills named by the Order MMP nr. 2387/2011.

In the pre-trial stage of Nature 2000 Site Eastern Cluj Hills ROSCI0295 designation, and in the management plan elaboration, the introduction of *E. catax* in the site's updated Standard Form (in the year 2016) was a success.

Conclusions

Considering the literature rview for *E. catax*, we can observe that the majority of informations consists of species records from faunistic inventories. The knowledge about the biology and ecology of the species are scarce and they most often come from direct observations, not from elaborate studies with statistically significant results.

By employing SEM technique in analyzing the morphology of some species, questions can be answered regarding their biology and ecology. In our case, the primitive character of the wings suggest the reduced disperal capacity of the adults. The different flight period of the adults and implicitly the oviposition time, is reflected ultrastructurally in the shape, clustering type and difference in egg size between both species. Ultrastructural differences in silk thread suggests *E. catax* and *E. lanestris* use nests in a characteristic way.

Most of the clutches (65, 14%) were laid on the sunny side of the shrubs with north-west exposure. In my study, I have determined the mean oviposition height (82, 29 cm ± 35.60) and height intervals preferred by *E. catax* females (61-80 cm - 36,46% and 41-46 cm -24,37%), intervals with significant accuracy.

Concerning the preferences for the host plant, the study showed a higher fidelity in the case of *E. catax* for *P. spinosa* (54,15%), although in some circumstances *C. monogyna* is the preferred host plant. A comparison of our results with literature studies concludes that there is variation in host plant preference, from one population to another.

The statistically significant results showed the high fidelity of females towards grouped shrubs (69.88%) when compared to isolated shrubs. Concerning the egg/clutch number or larvae/nest, the literature results exhibit indicative numbers, while my study shows a mean number of laid eggs (186 ± 22), considering the great number of investigated clutches. The 95% fertility relates to population's fitness.

In the current study conducted in the Turda Gorge Nature Reserve, we obtained similar results concerning the trophic larval basis, shrubs shape and structure and number of laid eggs for *E. catax*. Significant differences were observed in mean oviposition height (57,89 ± 25,34 cm). Differences were exhibited in the cardinal orientation also, most nests having a SE exposure (37.5%).

My results are different from other authors' reports. The differences between the results of my study as well as the differences in relation to other published studies, suggests a great variation in ecological necessities from one population to another. Species conservation needs future such studies conducted on a larger set of populations.

Observed similarities between *E. catax* and *E. lanestris*, in habitat preference and ecological requirements for oviposition site may indicate *E. lanestris* as of more importance due to his presence as an indicator species for a potential presence of *E. catax*, and the existence of a proper habitat for both species.

The results of the two studies have a major contribution for establishing an adequate management plan for *E. catax.*

Analyzing the anthropic impact on the habitat of *E. catax* in Nature 2000 Site Eastern Cluj Hills, my study emphasizes the negative effect of some agricultural practices, quantified by the populations decline due to habitat loss as well as the reduced mobility of females.

For the conservation of *E. catax* and its habitat, urgent management measures are needed. Direct measures, like forbidding or constraining activities in the habitat of the species may lead to future declines like the one emphasized in my study. Indirect measures, such as information for the general public and those factors involved in raising awareness may constitute a lobby for the stakeholders leading to the formation of compensatory mechanisms for the farmers constrained to apply the accepted management measures.

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