

Georgian Carnivore Conservation Project component:

Baseline biodiversity surveys and monitoring for Vashlovani Protected Areas



Study of Lepidoptera in Vashlovani Protected Areas

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Introduction

Lepidoptera is a large order of insects that includes moths (Heterocera) and butterflies (Rhopalocera) (called lepidopterans). Lepidoptera is the third largest order, in terms of number of species, after coleopterans and hymenopterans. They play, therefore, an important role in the natural ecosystem.

Lepidopterans have been studied in Georgia since the 19th century with The first collections belonging to Lederer (Lederer L. 1870) and Chrystoph (Chrystoph, 1876, 1885). These and other materials are summarized in the memoirs of Romanoff (Romanoff N. 1885, 1887) and the fundamental catalogs of Radde (Radde G. 1899) and Staudinger (Staudinger O. 1901). In the 20th century, the Zoological department of the State Museum of Georgia carried out a large-scale survey throughout the Caucasus, which resulted in enriching collections of the museum and creating catalogs of different groups of invertebrates.

Today many species of butterflies are widely used as indicator, key and umbrella species. Butterflies are effectively used as taxonomical surrogates. Together with birds they give a clear picture of tendencies caused by environmental changes. Butterflies offer the best characteristics for environment assessment, as they are easily caught and studied at the species level.

The first attempt to study butterflies in Vashlovani Protected Areas was made in the 1970s and so the current survey represents a new baseline for the continued monitoring biodiversity in Vashlovani.

Aim of study

The aim of our study was to study the lepidoptera of Vashlovani Protected Areas using transects to conduct a species inventory. In addition, it was necessary to create a collection of species which would be given to the PA administration for use in their visitors centre.

Study area

The study area included Vashlovani Protected Areas and surrounding territories, located in the Eastern part of Georgia. Specific natural conditions determine the existence of original flora and fauna in the arid and semi-arid zone. The diversity of natural complexes has led to the development of five main floristic types: desert & semi-desert, arid sparse forests, steppe, and elements of deciduous forests. In addition, there are three intra-zonal types: rocky xerophytes, riparian forest lines along the rivers, and foothill bushes.

Dry climate, long hot summers and comparatively short and mild winters are characteristic to arid and semi-arid ecosystems of Georgia. The most humid period is the short summer from June to August.

The region has two main rivers: The Alazani, which can be considered as the eastern border of the zone, and the Iori, which crosses the southern part of the region. On both sides of the Iori, there are dry steppes, while the climate on the right bank of Alazani is mildly humid. The region is rich in endemic and endangered species of plants. The diversity of fauna is remarkable. There are about 52 mammal species, over 90 species of birds, and approximately 30 of reptile, 18 of fish, and 6 amphibian species in the area.

Methods

Although the main focus of the study was butterflies, we tried to gather some information about moths as well and therefore, the methodology was different. Field work was carried out in June and July 2012 in Vashlovani Protected Areas.

Butterflies

The study of butterflies was carried out on previously selected transects, each of five kilometers. When we started the survey in June, the plants had already finished blossoming and the open fields were not interesting for butterflies. This fact was seen clear during the preparation stage of the survey when we checked and assessed the whole territory. Considering the diverse habitats in Vashlovani, five transects were selected and covered grasslands, scrub and woodlands. The surrounding areas of the PA were also included in study. The study covered biotopes of arid forests, riparian forests, steppes, and semi-desert. The map of the study area and transects carried out are given in Appendix 2.

While registering, two observers moved on the path with an average speed of (3 km/h) and described the butterflies in their field of view. The area for registering the butterflies was 2-5 metres on both sides of the path. The distance between the observers was 10-12 meters.

Considering the semi-arid ecosystem, the observation on butterflies started two hours after sunrise and finished four hours before sunset. Weather conditions were taken into consideration as well. Observations on the transects were made only in warm and clear weather, with the temperature at least 13-17°C (in shade), 60% in direct sunlight, or in comparatively cloudy weather with temperature over 17°C.

All of the Lepidoptera, flying or resting, were recorded. The first observer identified butterfly species with the means of field guides and atlas. The butterflies were registered using special field registering form (see Appendix 3), and the second observer caught butterflies with a butterfly net and placed them in special containers.

Having returned from the field, genera and sex of the butterflies was identified, diurnal lepidopterans were identified to genus using additional guides and atlases.

During the fieldwork, larvae and eggs were also collected, because at this time of the year some of the species are available only at this stage of the life cycle.

Moths

Moths were collected at night from sunset at 20:30 till 02:00. A special device for attracting the nocturnal insects was used - (http://www.entosphinx.cz/files/Katalog_EU_2012.pdf) – a four wing construction with white cloth stretched on it and a special bulb in the centre of the cloth. The construction was placed in an open place from all the sides. Lepidopterans flying to the light were identified on a family level. Comparatively larger moths were collected.

Results

Arid shallow forests are represented in Vashlovani canyons where *Lycaenidae* and *Nymphalidae* are dominant.

The Bear (“Datviskhevi) and Eagle gorges held the least number of species, which is presumably due to the lack of flowering plants. The highest diversity of Lepidoptera was represented in the western part of Vashlovani ranger’s station. There were plenty of flowering plants and grass there and butterflies of every family were collected.

Surrounding areas of Vashlovani PA were distinguished by a low number of species. These areas have been used for agriculture for several years and have been periodically processed with pesticide, including insecticide. Fewer species were found in areas where there are lots of sheep. Unfortunately we did not have the possibility to start the study early in spring, when most of the plants in the region are in active flowering phase. The general picture might have been different if the study had taken place in this period.

Based on the results of our survey and existing literature list of lepidopterans widespread in Vashlovani was created. Of the 228 species existing in Georgia 102 species, from five families were found in Vashlovani: Papilionoidea (2 species), Hesperioidea (8), Pieridae (22), Lycaenidae (33) and Nymphalidae (370). The complete species list for Vashlovani is given in Appendix 1, with Latin and English names. Unfortunately, there is no Georgian equivalent for most of the species.

Only two of the species, *Polyommatus daphnis* and *Tomares romanovi*, are included in the category of Vulnerable (VU - B2cii) according to the national Red Book of Georgia. The rest of the species are not considered as rare species either at national or international level.

Collection

Butterflies collected were placed on a special board, flattened and after 7-9 days moved to special collection boxes, numbered and labeled. Labels give the latin names and where a species shows sexual dimorphism (well expressed differences between the sexes) the sex of each specimen is given by the symbols ♂ (male) and ♀ (female). For some of species additional specimens are also included to provide a view under the wings (indicated by the symbol U).

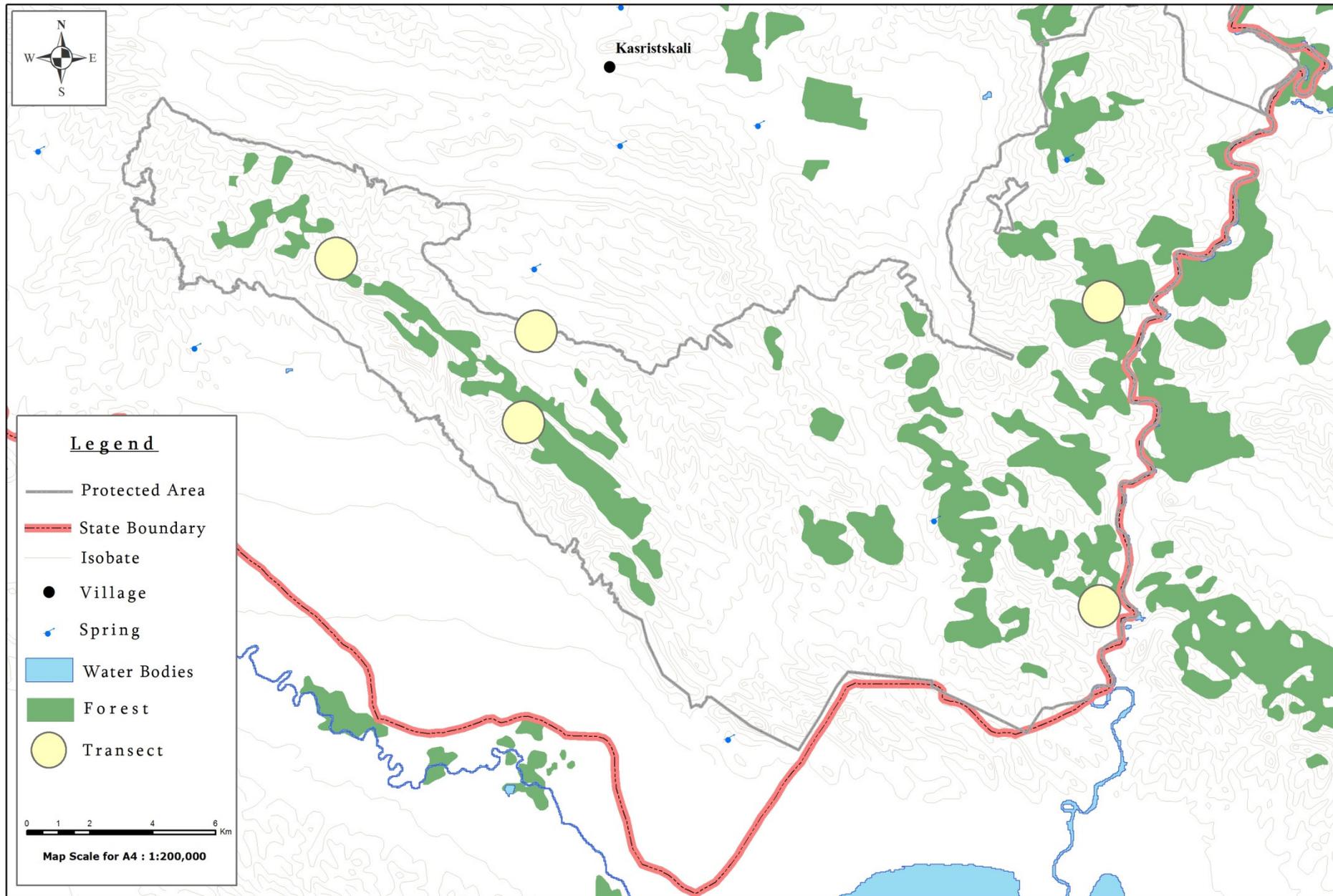
52 species of both lepidopterans - moths and butterflies are presented in the collection in four entomological boxes (50 x 45 x 10 cm). Three of them display butterflies (Ropalocera) from superfamilies: Papilionoidea and Hesperioidea, Lycaenidae, Pieridae, Nymphalidae. The fourth displays Moths (Heterocera) from the families; Noctuidae, Sphingidae, Zygenidae. Also insects of different orders (bugs and cicadae) are included. Instructions for the care of the collection are included in Appendix 5 whilst the full list and number of species included is given in Appendix 6.

Appendix 1: List of butterflies found in Vashlovani Protected Areas (Lepidoptera: Rhopalocera).

№	Latin Name	English Name
	Hesperiidae	Skippers
1.	<i>Erynnis tages</i>	Dingy Skipper
2.	<i>Erynnis marloyi</i>	Inky Skipper
3.	<i>Carcharodus flocciferus</i>	Tufted Skipper
4.	<i>Pyrgus melotis</i>	
5.	<i>Pyrgus alveus</i>	Large Grizzled Skipper
6.	<i>Pyrgus orbifer</i>	
7.	<i>Ochlodes sylvanus</i>	Large Skipper
8.	<i>Thymelicus hyrax</i>	
	Papilionidae	Swallowtails
9.	<i>Iphiclides podalirius</i>	Scarce Swallowtail
10.	<i>Papilio machaon</i>	Old World Swallowtail
	Pieridae	
11.	<i>Aporia crataegi</i>	Black-veined White
12.	<i>Leptidea sinapis</i>	Wood White
13.	<i>Leptidea duponcheli</i>	
14.	<i>Anthocharis cardamines</i>	Orange Tip
15.	<i>Euchloe ausonia</i>	Eastern Dappled White
16.	<i>Euchloe belia</i>	
17.	<i>Zegris eupheme</i>	Sooty Orange Tip
18.	<i>Zegris menestho</i>	
19.	<i>Aporia crataegi</i>	Black-veined White
20.	<i>Pontia daplidice</i>	Bath White
21.	<i>Pontia bellidicae</i>	
22.	<i>Pieris rapae</i>	Small White
23.	<i>Pieris ergane</i>	Mountain Small White
24.	<i>Pieris napi</i>	Green-veined White
25.	<i>Pieris manni</i>	
26.	<i>Pieris brassicae</i>	Large White
27.	<i>Pontia edusa</i>	Eastern Bath White
28.	<i>Colias hyale</i>	Pale Clouded Yellow
29.	<i>Colias croceus</i>	Dark Clouded Yellow
30.	<i>Colias chrysotheme</i>	Lesser Clouded Yellow
31.	<i>Colias aurorina</i>	
32.	<i>Gonepteryx rhamni</i>	Common Brimstone
	Nymphalidae	
33.	<i>Pararge aegeria</i>	Speckled Wood
34.	<i>Lasiommata megera</i>	Wall Brown
35.	<i>Melanargia galathea</i>	Marbled White
36.	<i>Coenonympha saadi</i>	
37.	<i>Coenonympha pamphilus</i>	Small Heath
38.	<i>Callerebia phegea</i>	
39.	<i>Hyponephele lycaon</i>	Dusky Meadow Brown
40.	<i>Hyponephele lupina</i>	Oriental Meadow Brown
41.	<i>Maniola jurtina</i>	
42.	<i>Brenthis hecata</i>	Twin-spot Fritillary
43.	<i>Brenthis daphne</i>	Marbled Fritillary
44.	<i>Hipparchia syriaca</i>	
45.	<i>Hipparchia semele</i>	
46.	<i>Hipparchia pellucida</i>	
47.	<i>Brintesia circe</i>	Great Banded Grayling

48.	<i>Chazara briseis</i>	Hermit
49.	<i>Chazara anthe</i>	
50.	<i>Neptis rivularis</i>	
51.	<i>Limenitis reducta</i>	Southern White Admiral
52.	<i>Polygonia c-album</i>	Comma
53.	<i>Nymphalis polychloros</i>	Blackleg Tortoiseshell
54.	<i>Inachis io</i>	European Peacock
55.	<i>Vanessa cardui</i>	Painted Lady
56.	<i>Vanessa atalanta</i>	Red Admiral
57.	<i>Melitaea interrupta</i>	
58.	<i>Melitaea didyma</i>	Spotted Fritillary
59.	<i>Melitaea persea</i>	
60.	<i>Melitaea transcaucasica</i>	
61.	<i>Melitaea trivia</i>	Lesser Spotted
62.	<i>Melitaea cinxia</i>	
63.	<i>Melitaea phoebe</i>	Knapweed Fritillary
64.	<i>Argynnis lathonia</i>	Queen of Spain Fritillary
65.	<i>Argynnis pandora</i>	Cardinal
66.	<i>Argynnis paphia</i>	Silver-washed Fritillary
67.	<i>Libythea celtis</i>	European Beak
68.	<i>Polygonia c-album</i>	Comma
69.	<i>minois dryas</i>	Dryad
	<i>Lycaenidae</i>	
70.	<i>Satyrium ilicis</i>	Ilex Hairstreak
71.	<i>Strymon spini</i>	
72.	<i>Pseudothecla lunulata</i>	
73.	<i>Pseudothecla turanica</i>	
74.	<i>Pseudothecla ledereri</i>	
75.	<i>Callophrys chalybeitincta</i>	
76.	<i>Callophrys rubi</i>	
77.	<i>Lycaena phlaeas</i>	Small Copper
78.	<i>Lycaena thersamon</i>	Lesser Fiery Copper
79.	<i>Lycaena dispar</i>	Large Copper
80.	<i>Tomares romanovi</i>	
81.	<i>Tomares Callimachus</i>	
82.	<i>Chilades phiala</i>	
83.	<i>Tarucus balkanicus</i>	Balkan Pierrot
84.	<i>Cupido minimus</i>	Small Blue
85.	<i>Cupido Osiris</i>	Osiris Blue
86.	<i>Pseudophilotes vicrama</i>	Eastern Baton Blue
87.	<i>Pseudophilotes baton</i>	Baton Blue
88.	<i>Plebeius argyrognomon</i>	Reverdin's Blue
89.	<i>Plebeius pylaon</i>	
90.	<i>Plebeius argus</i>	Silver-studded Blue
91.	<i>Plebeius eurypilus</i>	
92.	<i>Plebeius zephyrinus</i>	
93.	<i>Polyommatus bellargus</i>	Adonis Blue
94.	<i>Polyommatus icarus</i>	Common Blue
95.	<i>Polyommatus persica</i>	
96.	<i>Polyommatus thersites</i>	Chapman's Blue
97.	<i>Polyommatus amandus</i>	Amanda's Blue
98.	<i>Polyommatus coelestinus</i>	
99.	<i>Polyommatus semiargus</i>	Mazarine Blue
100.	<i>Polyommatus agestis</i>	Brown Argus
101.	<i>Polyommatus daphnis</i>	
102.	<i>Glaucopsyche alexis</i>	

Appendix 2: Map of Study area



Unidentified Species:

Latin Name of the Species	Quantity

Collected Species:

Latin Name of the Species	Quantity

Comments:

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Appendix 4: Fieldwork photos



Appendix 5: Collection Maintenance rules

In order to maintain the collection in good condition it is necessary to protect it from different damaging factors and meet the maintenance requirements.

Collection must be kept in a dry, cool place. Humidity can cause fungi and decay of the specimen. If mold appears on the specimen, it cannot be restored. If only several filaments of mold fungi appear on the specimen, it can be removed with pincers or soft brush. Afterwards, the specimen has to be dried in a warm oven.

The collection must be kept away from light (direct rays of sun), as it gradually fades the colors of the the specimen.

The collection must be protected against mechanical damage (shaking), as in this case the antennae and the wings of the insects are broken.

The cover of the box has to be removed as rarely as possible, only if it is necessary and in a very careful manner. In case of removing the specimen from the box, it has to be returned so that the cover glass of the box does not touch upon the head of the pin.

The collection can be damaged by pests. The most harmful of them is museum beetle, however, the collection can be damaged by other resident insects, like cockroaches and ants, therefore special measures have to be taken.

The collection is placed in new, tightly covered entomological boxes, which provide maximum protection from pests. Notwithstanding this, in order to avoid pests it is necessary to fumigate the boxes and process them with toxic chemicals. Solid fumigator, like naphthalene (camphor balls) is the most widely used. 5-6 camphor balls in a paper or butter cloth bag is placed in the corner of the collection box. Camphor balls have to be renewed twice a year.

Camphor balls can prevent pests, but in order to kill existing pests that destroy the collection, liquid fumigators have to be used. Dark powdery dust appearing under the specimen indicates the existence of pests.

Chloroform or ethyl acetate is used as liquid fumigators. The latter is a better option due to less toxicity. Cotton ball saturated with liquid fumigator is placed in the entomological box, which in its turn is placed in a plastic bag. 1 to 2 days in such state is sufficient to destroy the pests.

One of the best ways to fight the pests is freezing the collection. The boxes are placed in plastic bags and in the freezer (dry freezing) for 2-5 days with the temperature of -20°C to -25°C .

Keeping houseplants next to the collection is not recommended, because they serve as shelters for potential pests.

Appendix 6: List of the Collection Species

There are represented 52 species of day and night lepidopterans in the collection with four entomological boxes (50X45X10cm). In three of those boxes, there are day butterflies: (Lepidoptera: Ropalocera), (Papilionoidea) and (Hesperioidea); (Lycaenidae), (Pieridae), (Nymphalidae) and in one box, night butterflies: (Lepidoptera: Heterocera) from different families (Noctuidae, Sphingidae, Zygaenidae etc), as well as some beetles and melampsalta (Cisadetta) musivas.

Etymological box #1

#	Latin names of the species	Number
1	Papilio machaon	2
2	Iphiclides podalirius	3
3	Pieris brassicae	6
4	Aporia crataegi	2
5	Pieris rapae	6
6	Pontia edusa	7
7	Gonepteryx rhamni	4
8	Colias sp.	5
9	Leptidea sinapis	3

Etymological box #2

#	Latin names of the species	Number
1	Argynnis paphia	6
2	Brenthis hecate	3
3	Brenthis daphne	1
4	Melitaea interrupta	2
5	Vanessa cardui	1
6	Vanessa atalanta	1
7	Inachis io	2
8	Polygonia c-album	2
9	Hipparchia pellucida	7
10	Hipparchia syriaca	2
11	Brintesia circe	4
12	Lasiommata megera	1

Etymological box #3

#	Latin names of the species	Number
1	Maniola jurtina	4
2	Hyponphele lupina	4
3	Lycaena dispar	2
4	Polyommatus daphnis	2
5	Limenitis reducta	1
6	Melanargia galathea	4
7	Minois dryas	4
8	Tarucus balkanicus	2
9	Erynnis tages	2
10	Ochlodes Sylvanus	2
11	Thymelicus hyrax	2
12	Zygaenidae	6
13	Cicadidae	5
14	Scarabaeus sacer	1
15	Lucanus sp.	2
16	Oryctes nasicornis	1

Etymological box #4

#	Latin names of the species	Number
1	Saturnia pyri	1
2	Hyles livornica	4
3	Deilephila porcellus	4
4	Cossus cossus	1
5	Macroglossum stellatarum	4
6	Arctia sp.	1
7	Amphipyra pyramidea	1
8	Geometridae	1
9	Habrosyne pyritoides	1
10	Noctuidae	16
11	Limantria spp.	1
12	Amata phegea	3