

# A Faunistic Comparative Study of Families HesperIIDae and Nymphalidae (Lepidoptera: Rhopalocera) of Syrian Arab Republic and Republic of Armenia

N. Zarikian

**Abstract**—Comparative analysis of the fauna of two families of butterflies (Lepidoptera: Rhopalocera) – HesperIIDae and Nymphalidae were carried out. In general, 122 species of the families are recorded. among these 33 species belong to HesperIIDae and 89 to Nymphalidae. The numbers by countries are as follows: 72 species are found in Syria (including 24 HesperIIDae and 48 Nymphalidae) and 97 in Armenia (26 and 71 species, respectively). Two species of HesperIIDae are reported for Syrian fauna for the first time and one species is newly recorded for Armenia. From the species above mentioned 38 are common both for Syria and Armenia. For estimation of the similarity of faunas studied were used the Jaccard index. By families the index is rather different, consisting for HesperIIDae 0.5151 and for Nymphalidae 0.337.

**Keywords**—Armenia, fauna, HesperIIDae, Nymphalidae, Rhopalocera: Lepidoptera, Syria.

## I. INTRODUCTION

**B**UTTERFLIES (Lepidoptera: Rhopalocera) are one of the brightest and most conspicuous groups of insects. Being rather available in the field surveys and popular among entomologists, they can be considered as suitable object for different kinds of biological researches, in particular, biogeographical ones. Despite of several surveys dedicated to the butterflies of both countries and those which respect to the larger regions [1]-[7] and Caucasus and Transcaucasia regions [8], [9]; but the researches and published data for the fauna of both countries Armenia [10]-[16], Syria [17]-[21] and neighbor countries such as Turkey and Israel [22], [23] are not enough for comprehensive knowledge of the fauna of both countries. Belonging to the Eastern Mediterranean sub-province of the Palearctic biogeographical region, Syria and Armenia are characterized by rather different natural conditions.

The Syrian Arab republic area includes 185.180 km<sup>2</sup>. The altitude interval of the country is -200-2,814 m a.s.l. Territory can be divided into four physiographic regions: 1) Coastal plain; 2) Mountains and highlands; 3) Eastern plateau; 4) Desert plains [24], [25]. Republic of Armenia is a land locked country with a total area of 29.740 km<sup>2</sup>.

N. Zarikian is PhD student in the Laboratory of Entomology and Soil Zoology, Institute of Zoology, Center of Zoology and Hydroecology, NAS RA, Yerevan, Armenia (e-mail: noushigz@hotmail.com).

Armenia is generally mountainous country with altitude interval 380-4095 m a.s.l. Seven physiographic divisions are proposed for Armenia [26], as follows: 1) Gugark-Mrovdag; 2) Urhts-Vayk; 3) Zangezour; 4) Javakhet-Ashotsk volcanic plateau; 5) Aragats-Syunik volcanic plateau; 6) Ararat. Thus, comparison of the faunas of both countries can be considered as important and valuable input into biogeography of the region as a whole.

## II. MATERIALS AND METHODS

The study is based mainly on the analysis of our own materials, collected in all above mentioned physiographic divisions of Syria and Armenia. Material was collected during expeditions, conducted in Syria in 2009-2012 and in Armenia in 2013-2014. Specimens were collected using a sweep net and killed in killing jars with ethyl acetate. Each specimen was put into a labeled envelope and brought to the laboratory to be spread and dried. Identification were carried out using the guides of Hesselbarth *et al.* (1995) [27], Tuzov *et al.* (1997) [28], [29], Bozano (1999-2011) [30], etc., and by comparison with author's reference collections [31], [32]. Besides, all available literature and collection data were taken into account.

## III. RESULTS AND DISCUSSIONS

Generalizing of data obtained has shown, that 122 species of two families of Lepidoptera are known from both countries (Table I); among these, 33 species belong to HesperIIDae and 89 – to Nymphalidae. The numbers by countries are as follows: 72 species are found in Syria (including 24 HesperIIDae and 48 Nymphalidae) and 97 in Armenia (26 and 71 species, respectively) (Table I).

Nymphalidae are obviously prevail both in Armenia and Syria (Fig. 1), but has not the same sub-families component. For example, Danainae presents as 4% in Syria, but 0% in Armenia, also Apaturinae and Libytheinae 0% in Syria and 1% in Armenia, which means that these sub families are prone to ecologically different area specialized for each country.

TABLE I  
SPECIES COMPOSITION OF HESPERIIDAE AND NYMPHALIDAE OF ARMENIA  
AND SYRIA

| No.                       | Taxa   | Country | ARM. | SYR. |
|---------------------------|--|---------|------|------|
| <b>FAMILY HESPERIIDAE</b> |  |         |      |      |
| 1.                        | <i>Carcharodus lavatherae</i> (Esper, [1783])          |         | +    | -    |
| 2.                        | <i>Carcharodus alceae</i> (Esper, [1780])              |         | +    | +    |
| 3.                        | <i>Carcharodus flocciferus</i> (Zeller, 1847)          |         | +    | -    |
| 4.                        | <i>Carcharodus stauderi</i> (Reverdin, 1913)           |         | +    | +    |
| 5.                        | <i>Carcharodus orientalis</i> (Reverdin, 1913)         |         | +    | +    |
| 6.                        | <i>Erynnis marloyi</i> (Boisduval, [1834])             |         | +    | +    |
| 7.                        | <i>Erynnis tages</i> (Linnaeus, 1758)                  |         | +    | -    |
| 8.                        | <i>Muschampia proteides</i> (Wagner, 1929)             |         | +    | +    |
| 9.                        | <i>Muschampia proto</i> (Ochsenheimer, 1808)           |         | -    | +    |
| 10.                       | <i>Muschampia poggei</i> (Lederer, 1858)               |         | +    | +    |
| 11.                       | <i>Muschampia tessellum</i> (Hubner, [1803])           |         | +    | -    |
| 12.                       | <i>Muschampia nomas</i> (Lederer, 1855)                |         | +    | +    |
| 13.                       | <i>Pyrgus melotis</i> (Duponchel, [1834])              |         | +    | +    |
| 14.                       | <i>Pyrgus serratulae</i> (Rambur, [1839])              |         | +    | +    |
| 15.                       | <i>Pyrgus armoricanus</i> (Oberthur, 1910)             |         | +    | +    |
| 16.                       | <i>Pyrgus jupei</i> (Alberti, 1967)                    |         | +    | -    |
| 17.                       | <i>Pyrgus alveus</i> (Hubner, [1803])                  |         | +    | -    |
| 18.                       | <i>Pyrgus cinarae</i> (Rambur, [1839])                 |         | +    | -    |
| 19.                       | <i>Pyrgus sidae</i> (Esper, [1784])                    |         | +    | -    |
| 20.                       | <i>Spialia orbifer</i> (Hubner, [1823])                |         | +    | +    |
| 21.                       | <i>Spialia osthelderi</i> (Pfeiffer, 1932)             |         | -    | +    |
| 22.                       | <i>Spialia phlomidis</i> (Herrich-Schaffer, [1845])    |         | +    | +    |
| 23.                       | <i>Eogenes alcides</i> (Herrich-Schaffer, [1852])      |         | +    | -    |
| 24.                       | <i>Thymelicus acteon</i> (Rottemburg, 1775)            |         | -    | +    |
| 25.                       | <i>Thymelicus hyrax</i> (Lederer, 1861)                |         | +    | +    |
| 26.                       | <i>Thymelicus lineola</i> (Ochsenheimer, 1808)         |         | +    | +    |
| 27.                       | <i>Thymelicus sylvestris</i> (Poda, 1761)              |         | +    | +    |
| 28.                       | <i>Hesperia comma</i> (Linnaeus, 1758)                 |         | +    | +    |
| 29.                       | <i>Ochlodes sylvanus</i> (Esper, [1779])               |         | +    | +    |
| 30.                       | <i>Gegenes nostradamus</i> (Fabricius, 1793)           |         | -    | +    |
| 31.                       | <i>Gegenes pumilio</i> (Hoffmannsegg, 1804)            |         | -    | +    |
| 32.                       | <i>Pelopidas thrax</i> (Hubner, [1821])                |         | -    | +    |
| 33.                       | <i>Borbo borbonica</i> (Boisduval, 1833)               |         | -    | +    |
| <b>FAMILY NYMPHALIDAE</b> |  |         |      |      |
| <b>Libytheinae</b>        |  |         |      |      |
| 34.                       | <i>Libythea celtis</i> (Laichating, 1782)              |         | +    | -    |
| <b>Danainae</b>           |  |         |      |      |
| 35.                       | <i>Danaus chrysippus</i> (Linnaeus, 1758)              |         | -    | +    |
| 36.                       | <i>Charaxes jasius</i> (Linnaeus, 1767)                |         | -    | +    |
| <b>Satyrinae</b>          |  |         |      |      |
| 37.                       | <i>Kirina roxelana</i> (Cramer, [1777])                |         | -    | +    |
| 38.                       | <i>Kirinia climene</i> (Esper, [1783])                 |         | +    | -    |
| 39.                       | <i>Pararge aegeria</i> (Linnaeus, 1758)                |         | +    | +    |
| 40.                       | <i>Lasiommata maera</i> (Linnaeus, 1758)               |         | +    | +    |
| 41.                       | <i>Lasiommata megera</i> (Linnaeus, 1767)              |         | +    | +    |
| 42.                       | <i>Coenonympha arcania</i> (Linnaeus, 1767)            |         | +    | -    |
| 43.                       | <i>Coenonympha leander</i> (Esper, [1783])             |         | +    | -    |
| 44.                       | <i>Coenonympha glycerion</i> (Borkhausen, 1788)        |         | +    | -    |
| 45.                       | <i>Coenonympha saadi</i> (Kollar, [1849])              |         | +    | -    |
| 46.                       | <i>Coenonympha pamphilus</i> (Linnaeus, 1758)          |         | +    | -    |
| 47.                       | <i>Maniola jurtina</i> (Linnaeus, 1758)                |         | +    | +    |
| 48.                       | <i>Maniola telmessia</i> (Zeller, 1847)                |         | -    | +    |
| 49.                       | <i>Hyponephele lycaon</i> (Rottemburg, 1775)           |         | +    | +    |
| 50.                       | <i>Hyponephele lupine</i> (Costa, [1836])              |         | +    | +    |
| 51.                       | <i>Hyponephele naricina</i> (Staudinger, 1870)         |         | +    | +    |
| 52.                       | <i>Hyponephele wagneri</i> (Herrich-Schaffer, [1846])  |         | -    | +    |
| 53.                       | <i>Proterebia afra</i> (Fabricius, 1787)               |         | +    | +    |
| 54.                       | <i>Erebia medusa</i> ([Schiffmuller], 1775)            |         | +    | -    |
| 55.                       | <i>Erebia aethiops</i> (Esper, [1777])                 |         | +    | -    |
| 56.                       | <i>Erebia graucasica</i> (Jachontov, 1909)             |         | +    | -    |
| 57.                       | <i>Chazara bischoffii</i> , (Herrich-Schaffer, [1846]) |         | +    | -    |
| 58.                       | <i>Chazara briseis</i> , (Linnaeus, 1764)              |         | +    | -    |
| 59.                       | <i>Chazara Persephone</i> , (Hunber, [1805])           |         | +    | +    |

|                      |   |  |   |   |
|----------------------|---|--|---|---|
| 60.                  | <i>Brintesia circe</i> (Fabricius, 1775)                |  | + | - |
| 61.                  | <i>Pseudochazara thelephassa</i> , (Geyer, [1827])      |  | + | + |
| 62.                  | <i>Pseudochazara beroe</i> , (Freyer, 1843)             |  | + | - |
| 63.                  | <i>Pseudochazara pelopea</i> , (Klug, 1832)             |  | + | + |
| 64.                  | <i>Pseudochazara mamurra</i> (Herrich-Schaffer, [1846]) |  | + | + |
| 65.                  | <i>Pseudochazara geyeri</i> (Herrich-Schaffer, [1846])  |  | + | - |
| 66.                  | <i>Hipparchia pellucida</i> (Staudinger, 1923)          |  | + | + |
| 67.                  | <i>Hipparchia syriaca</i> (Staudinger, 1871)            |  | + | + |
| 68.                  | <i>Hipparchia semele</i> (Linnaeus, 1758)               |  | + | - |
| 69.                  | <i>Hipparchia fatua</i> , (Freyer, [1844])              |  | + | + |
| 70.                  | <i>Hipparchia parisatis</i> , (Kollar, 1849)            |  | + | - |
| 71.                  | <i>Hipparchia statilinus</i> , (Hufnagel, 1766)         |  | + | - |
| 72.                  | <i>Hipparchia hermione</i> (Linnaeus, 1764)             |  | - | + |
| 73.                  | <i>Hipparchia pisidice</i> (Klug, 1832)                 |  | - | + |
| 74.                  | <i>Aretusana aretusa</i> (Schiffmuller, 1775)           |  | + | - |
| 75.                  | <i>Satyrus amasinus</i> (Staudinger, 1861)              |  | + | + |
| 76.                  | <i>Satyrus actaea</i> (Esper, 1781)                     |  | - | + |
| 77.                  | <i>Minois dryas</i> (Scopoli, 1763)                     |  | + | - |
| 78.                  | <i>Melanargia russiae</i> (Esper, [1783])               |  | + | - |
| 79.                  | <i>Melanargia galathea</i> (Linnaeus, 1758)             |  | + | - |
| 80.                  | <i>Melanargia larissa</i> (Geyer, [1828])               |  | + | - |
| 81.                  | <i>Melanargia grumi</i> (Standfuss, 1892)               |  | + | - |
| 82.                  | <i>Melanargia syriaca</i> (Oberthur, 1894)              |  | - | + |
| 83.                  | <i>Melanargia titea</i> (Klug, 1832)                    |  | - | + |
| 84.                  | <i>Ypthima Asterope</i> (Klug, 1832)                    |  | - | + |
| <b>Apaturinae</b>    |   |  |   |   |
| 85.                  | <i>Thaleropsis ionia</i> (Eversmann, 1851)              |  | + | - |
| <b>Limenitidinae</b> |   |  |   |   |
| 86.                  | <i>Limenitis reducta</i> (Staudinger, 1901)             |  | + | + |
| 87.                  | <i>Neptis rivularis</i> (Scopoli, 1763)                 |  | + | - |
| <b>Nymphalinae</b>   |   |  |   |   |
| 88.                  | <i>Hypolimnas misippus</i> (Linnaeus, 1764)             |  | - | + |
| 89.                  | <i>Junonia hierta</i> (Fabricius, 1798)                 |  | - | + |
| 90.                  | <i>Vanessa atalanta</i> (Linnaeus, 1758)                |  | + | + |
| 91.                  | <i>Vanessa cardui</i> (Linnaeus, 1758)                  |  | + | + |
| 92.                  | <i>Polygonia c-album</i> (Linnaeus, 1758)               |  | + | + |
| 93.                  | <i>Polygonia egea</i> (Cramer, [1775])                  |  | + | + |
| 94.                  | <i>Inachis io</i> (Linnaeus, 1758)                      |  | + | - |
| 95.                  | <i>Aglais urticae</i> (Linnaeus, 1758)                  |  | + | + |
| 96.                  | <i>Nymphalis xanthomeles</i> (Esper, [1781])            |  | + | - |
| 97.                  | <i>Nymphalis polychloros</i> (Linnaeus, 1758)           |  | + | + |
| 98.                  | <i>Nymphalis antiopa</i> (Linnaeus, 1758)               |  | + | - |
| <b>Argynninae</b>    |   |  |   |   |
| 99.                  | <i>Argynnis niobe</i> (Linnaeus, 1758)                  |  | + | + |
| 100.                 | <i>Argynnis adippe</i> ([Schiffmauler], 1775)           |  | + | - |
| 101.                 | <i>Argynnis paphia</i> (Linnaeus, 1758)                 |  | + | - |
| 102.                 | <i>Argynnis pandora</i> ([Schiffmauler], 1775)          |  | + | + |
| 103.                 | <i>Argynnis aglaja</i> (Linnaeus, 1758)                 |  | + | - |
| 104.                 | <i>Brenthis ino</i> (Rottemburg, 1775)                  |  | + | - |
| 105.                 | <i>Brenthis hecate</i> ([Schiffmauler], 1775)           |  | + | - |
| 106.                 | <i>Brenthis daphne</i> ([Schiffmauler], 1775)           |  | + | - |
| 107.                 | <i>Issoria lathonia</i> (Linnaeus, 1758)                |  | + | + |
| 108.                 | <i>Boloria caucasica</i> (Lederer, 1852)                |  | + | - |
| <b>Melitaeinae</b>   |   |  |   |   |
| 109.                 | <i>Melitaea ornate</i> (Christoph, 1893)                |  | + | + |
| 110.                 | <i>Melitaea phoebe</i> ([Schiffmauler], 1775)           |  | + | - |
| 111.                 | <i>Melitaea didyma</i> (Esper, [1778])                  |  | + | + |
| 112.                 | <i>Melitaea arduinna</i> (Esper, [1783])                |  | + | + |
| 113.                 | <i>Melitaea perseae</i> (Kollar, 1849)                  |  | + | + |
| 114.                 | <i>Melitaea athalia</i> (Rottemburg, 1775)              |  | + | - |
| 115.                 | <i>Melitaea deserticola</i> (Oberthur, 1876)            |  | - | + |
| 116.                 | <i>Melitaea collina</i> (Lederer, 1861)                 |  | - | + |
| 117.                 | <i>Melitaea trivialis</i> ([Schiffmuller], 1775)        |  | - | + |
| 118.                 | <i>Melitaea cinxia</i> (Linnaeus, 1758)                 |  | + | + |
| 119.                 | <i>Melitaea turkmanica</i> (Higgins, 1940)              |  | + | - |
| 120.                 | <i>Melitaea caucasogenita</i> , (Verity, 1930)          |  | + | - |
| 121.                 | <i>Melitaea punica</i> (Oberthur, 1876)                 |  | - | + |
| 122.                 | <i>Euphydryas aurinia</i> (Rottemburg, 1775)            |  | + | - |

\*Recorded for the first time.

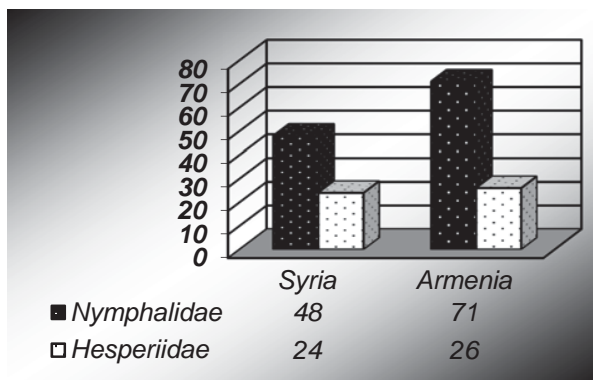


Fig. 1 Number of species of HesperIIDae and NymphalIDae recorded in Syria and Armenia

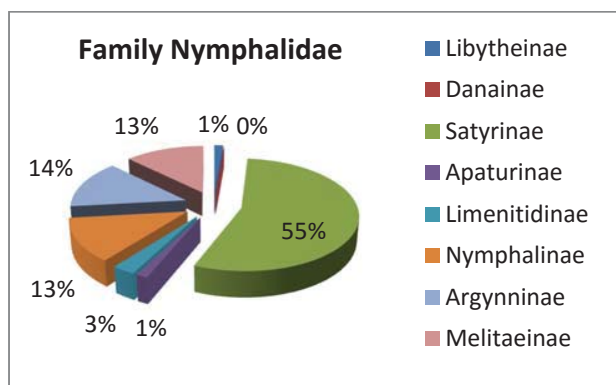


Fig. 2 The composition of Family NymphalIDae in Armenia

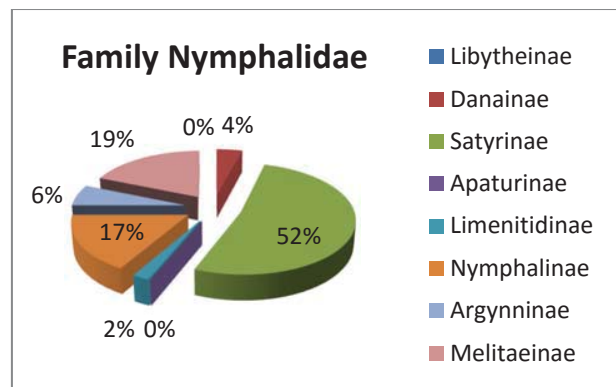


Fig. 3 The composition of Family NymphalIDae in Syria

From the species above mentioned 47 are common both for Syria and Armenia. For estimation of the similarity of faunas studied were used the Jaccard index [33] (1):

$$K_j = \frac{c}{a+b-c} \quad (1)$$

where  $a$  and  $b$  are number of species on each territory, and  $c$  – number of species common for both territories.

According to our calculation, the general index for both families is 0.3852 which allows estimating the similarity of faunas as moderate. But the family HesperIIDae 0.5151 and for NymphalIDae 0.337. Thus, faunas of HesperIIDae are much

more similar than of NymphalIDae. This can be explained by the narrower ecological specialization of NymphalIDae species than of HesperIIDae.

The differentiation of two countries Rhopalocera fauna is due mainly to the occurrence of food plants and the vegetation, in addition the altitude is an impressive factor, especially for the Armenian highland species distribution and existence [34].

#### First Time Recorded Species Description

##### *Muschampia proteides* (Wagner, 1929) (Fig. 4)

- **Synonyms:** *Hesperia proto proteides* Wagner, 1929; *Muschampia lycaonius* Wagner, 1929.
- **Biology:** Flight from June to September.
- **Host Plants:** *Marrubium*, *Stachys*, *Ballota nigra*
- **Habitat:** Dry rocky slopes, openings in pine forests from 900 up to 2500 m.
- **Distribution:** West-central Anatolia eastwards. Typical species of Taurus mountains. Collected from Kesab region in Syria.
- **Wingspan:** Male: 27-38mm; female: 26-36 mm. Both wings have a sub-marginal band of pale spots and broad gray fringes, it has also bluish abdomen.
- **Comments:** Some authors [35] treat the taxon as subspecies *Muschampia proto proteides* Wagner, 1929.

##### *Spialia osthelderi* (Pfeiffer, 1932) (Fig. 5)

- **Synonyms:** *Hesperia (Ateleomorpha) osthelderi* Pfeiffer, 1932, *Spialia osthelder struveoides* Brandt, 1939
- **Biology:** Flight from April to July.
- **Host Plants:** *Convolvulaceae*
- **Habitat:** Dry stream-beds and arid stony slopes in mountainous areas and sometimes light woodland clearings up to altitudes of 2,600 meters.
- **Distribution:** Asia Minor, the Middle East to Lebanon and through Iraq and Iran to Afghanistan. Collected from Kesab region in Syria.
- **Wingspan:** Male: 24-28 mm; female: 24-28 mm. The hindwings discal spots not united in a band as it is in the similar species *S. phlomidis*.
- **Comments:** This species recorded as endangered in the neighbor countries [35], [36].

##### *Melanargia grumi* (Standfuss, 1892) (Fig. 6)

- **Synonyms:** *Melanargia larissa grumi* Standfuss, 1892
- **Biology:** Flight from May to July.
- **Host Plants:** *Aegilops cylindrical*, *Bromus squarrosus*, *Poa bulbosa*.
- **Habitat:** Grassy hills, rived beds and gorges with xerophytes vegetations from 500 up to 2500 m
- **Distribution:** South-eastern Turkey. Collected from Tsaghkazor region in Armenia.
- **Wingspan:** Male: 45-53 mm; female: 45-53 mm. The upper side has darker pattern, on the hind wings there is large white post-discal band and by its quite immaculate underside.
- **Comments:** The status require further study.



Fig. 4 *Muschampia proteides* (Wagner, 1929)



Fig. 5 *Spialia osthelderi* (Pfeiffer, 1932)



Fig. 6 *Melanargia grumi* (Standfuss, 1892)

#### ACKNOWLEDGMENT

The author thanks to M. Y. Kalashian for much-appreciated assistant in reviewing and writing this paper.

#### REFERENCES

[1] T. B. Larsen "Biogeographical aspects of Middle Eastern and Arabian butterflies", 1985, Proceedings of the Symposium on the Fauna and Zoogeography of the Middle East, 179-199.  
[2] O. Kudrna, "The distribution atlas of European Butterflies", 2002, Oedipus, Schweinfurt.  
[3] V. V. Tshikolovets, Y. Nekrutenko "Butterflies of Palearctic Asia IX: The Butterflies of Caucasus and Transcaucasia (Armenia, Azerbaijan, Georgia and Russian Federation)", 2013, Czech Republic.  
[4] V. V. Tshikolovets "Butterflies of Eastern Europe, Urals and Caucasus", 2003, Kyiv-Brno, Publ. by the author, pp. 1-176, pl. 1-47, maps.  
[5] V. V. Tshikolovets "Butterflies of Europe & the Mediterranean areas", 2011, Czech Republic.  
[6] Y. P. Nekrutenko "Butterflies of the Caucasus: keys to their identification (Hesperiidae, Nymphalidae, Satyridae, Danaidae)", 1990.  
[7] V. A. Lukhtanov, A. G. Lukhtanov "The Butterflies of North-West Asia", 1994, Herbiopoliana. 1994. 440 pp., 56 color plates.  
[8] N. M. Romanoff "Les Lepidopteres De La Transcaucasie, Deuxieme partie- Memoires sur les Lepidoptere", 1885.

[9] G. Radde "Lepidoptera Caucasia. Museum Caucasicus", 1899. (In Russian).  
[10] G. G. Khanamiryani, K. A. Aghababyan "Quantitative Analysis of Fauna of Butterflies (Rhopalocera, Lepidoptera) of Meghri region of Armenia", 2012, National Academy of Sciences of RA Electronic Journal of Natural sciences.  
[11] G. G. Khanamiryani, K. A. Aghababyan "Materials on the butterflies (Lepidoptera: Rhopalocera) of Meghri region of Armenia", 2011, Caucasian Entomological Bulletin 7(1): 69-77. (in Russian).  
[12] A. Aghasyan, M. Kalashyan (eds.) "The Red Book of Animals of the Republic of Armenia". - Yerevan: Pub. House "Zangak", 2010.  
[13] M. Santera "Contribution to the knowledge of the butterfly fauna of Syria (Insecta, Lepidoptera, Rhopalocera)", 1998, Senckenbergianabiologica 78 (imDruck), Frankfurt am Main.  
[14] S. A. Vardikyan "Butterflies of Armenia", 1959, Yerevan: Haypetusmankhrat, 43 pp. (in Armenian).  
[15] S. A. Vardikyan "Rare and beautiful butterflies of Armenia, which need to be protected", 1976, Abstracts and presentations of the III meeting of Ministry of Agriculture of the Republic of Armenia SSR "On the protection of insects". - Yerevan: 39-43. (In Russian).  
[16] T. C. Emmel, A. Sourakov, A. V. Dantchenko "A Butterfly Expedition to Armenia //Holarctic Lepidoptera", 1996, Vol. 3, N 2 P. 37-41.  
[17] P. P. Graves, "A Contribution to the fauna of Syria", 1910-1911, Entomologist's Rec. J. Var. 22: 271-273, ibid. 23: 31-36.  
[18] P. P. Graves "Constantinople and Syrian Butterflies. Corrections and additions, 1913, Entomologist's Rec. J. Var. 25: 139-140.  
[19] E. P. Wiltshire "Some Notes on Migrant Lepidoptera in Syria, Iraq and Iran", 1940, Entomologist.  
[20] P. B. Hardy "Butterflies of Jordan, Syria and Lebanon", 1995, Entomologist's Rec.  
[21] A. Riemis "A short visit to Syria in May 1992 (Lepidoptera)", 1992.  
[22] D. Benyamini "The Zoogeography of the butterflies (Lepidoptera, Rhopalocera) of Israel and nearby areas. Monographiae Biologicae", 1988, 62: 309-324.  
[23] D. Benyamini "A Field Guide to the Butterflies of Israel Including Butterflies of Mt. Hermon and Sinai", 1990, Keter Publishing House, Israel. 234 pp.  
[24] A. Masri "Rangeland Ecology/Cartography and Feed Reserve, (FAO/GCP/SYR/001/ITA)", 1994  
[25] A. Masri "Range Rehabilitation, Consultancy report. (FAO/GCP/SYR/003/ITA)", 1991.  
[26] H. K. Gabrielyan (ed.), "Physical geography of Transcaucasia", 1986, Yerevan: Yerevan Univ. publ., 312 pp. (in Russian).  
[27] G. Hesselbarth, H. Van Oorschot, S. Wagner "Die Tagfalter der Turkeiunterberucksichtigung der angrenzendenlander", 1995, Bocholt (Selbstverlag), 3 Bände.  
[28] V. K. Tuzov "The synonymic List of Butterflies from the ex- USSR", 1993, Moscow; Rosagroservice. 74 pp.  
[29] V. K. Tuzov (ed.) "Guide to the Butterflies of Russia and adjacent territories (Rhopalocera: Lepidoptera). Vol 1. (Hesperiidae, Hesperidae, Nymphalidae, Satyridae)", 1997, Sofia- Moscow. Pensoft.  
[30] G. C. Bozano, (Ed.) "Guide to the Butterflies of Palearctic Region". Papilionidae (Parts I-II), Pieridae (Part I), Lycaenidae (Parts I-III), Nymphalidae (Parts I-III), Satyrinae (Parts I-IV), 1999-2011, Omnes Artes, Milano.  
[31] N. Zarikyan "A Taxonomic and ecologic study of some genera of sub-family Pierinae (Nymphalidae: Lepidoptera) in Aleppo" 2014, University of Aleppo.  
[32] F. H. Kaadeh, N. Zarikyan "A Taxonomic study of Genus Pierissp. Schrank (1801) (Nymphalidae: Lepidoptera) in Aleppo", 2014, Res.J. of Aleppo University, No. 96.  
[33] P. Jaccard "Distribution de la flore alpine dans le Bassin des Dranses et dans quelques regions voisines", 1901, Bull. Soc. Vaudoise sci. Natur, V. 37. Bd. 140. S. 241-272.  
[34] A. S. Kostrowicki, M. Kaniowa, "Geography of the Palearctic Papilionoidea (Lepidoptera)", 1969, Panstwowe Wydawnictwo Naukowe, Polish Scientific Publishers (1969).  
[35] E. Karacetin, H.J. Welch, "Red Book of Butterflies in Turkey", 2011, Ankara, Turkey.  
[36] A. O. Kocak, M. Kemal "Revised and annotated checklist of the Lepidoptera of Turkey", 2007, Cent. ENT. Stud. Ankara, 8: 1-150.