

**CONTRIBUTION TO THE KNOWLEDGE
OF THE LEPIDOPTEROLOGICAL FAUNA OF CRETE (LEP.)**

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The separation of Crete from the western mainland (Cerigo, Mona) apparently took place in the Miocene, from the eastern mainland (Kasos, Karpathos, Rhodos) only in the Pliocene. Of the original mainland only the high mountain ridges remained unsubmerged, and the island is really an isolated elevation in the Mediterranean. The powerful mountain centres composed of karstic limestones reach alpine heights (Leuca Ori 2469 m.) and are in part covered with eternal snow; at lower altitudes they form extensive plateaus (Nida in the Psiloritis, 1400 m.). Narrow alluvial plains lie below them at the coast. The water courses are short and often dry up completely.

By its climate Crete belongs to the Mediterranean region of winter rains. Temperatures are high. Canea on the north coast (40 m. above sea level): January 10.8°C, April 15°C, July 25.7°C, October 20.3°C, average annual temperature 18.2°C. Atmospheric precipitations are abundant, almost completely confined to the winter months (November to January) and amount to 50 % of all the precipitations in the year (Canea 634 mm.). But there is considerable drought; already in May the vegetation is destroyed by the summer drought, and the soil is torn by deep fissures; the cause lies not only in the easy permeability of the karstic soil but also in the effect of the strong winds often blowing for days on end. At the south coast the hot African wind brings in June also fine sand from the Libyan desert.

The vegetation is Mediterranean. In the lowest levels the shrub formation *Phrygana* predominates; this is composed of thorny shrubs and subshrubs, especially *Euphorbia acanthamos*, *Poterium spinosum*, *Genista acanthoclada*, *Thymra capitata*, *Levandula Stoechas*, and among them a fairly numerous lower flora. More at higher levels grows the macchia with heathery *Arbutus unedo* and *andrachne*, *Juniperus phoenicis*, *Phyllyrea*, *Pistacia lentiscus*, *Ceratonia siliqua* and *Olea oleaster*. But compared with the West Mediterranean macchia it is not too wide-spread and is also rather pauperised. Of woodland formations occur groves of *Plata-*

nus orientalis. They are meadow groves along the water courses, with rich underground moisture and spread usually at lower levels; they have a boreal appearance, but are accompanied also by numerous oleanders, myrtles, tamarisks, and in the river deltas they pass into the swamp growths composed especially of reed-grasses. Forests are very rare; from the lower levels is recorded the growth with the shore pine *Pinus halapensis*, from higher levels oak-woods with *Quercus ilex* (HAYEK, REBEL). In the piedmont region is recorded *Quercetum cocciferae* (*Q. colliprinos* WEBB., RIKLI). The high-mountain flora lacks completely the northern, alpine species. Characteristic in it are especially *Astragalus angustifolius*, *A. creticus* etc., *Acantholimon*, *Echinus*, many *Liliaceae* as e. g. *Chionodoxa*, and numerous endemites. Olive groves (*Olea europea sativa*) and fields of carob-trees (*Ceratonia siliqua*) are very wide-spread and extensive, but we find also cultivation of vine, lemons etc. The cereal fields are relatively poor; vegetables are grown on the coast. REBEL lists from Crete some 1210 plant species (of which more than 140 were found in Europe only on Crete) and about 100 endemites (among them about 20 high-mountain species). According to RIKLI this flora of the Eastern Mediterranean region, in which Western Mediterranean elements retreat considerably, shows distinct relations to the flora of Anterior Asia, some of whose species reach their western limit on Crete. In agreement with this eastern (Pontic) species predominate to a large extent also in the composition of the origin of the Lepidopterological fauna of the island.

Since the time when this part of the mainland became a separate island with a rapidly drying mountain karst soil and exposed to the violent sea winds the flora has gradually become poor and with it also the Lepidopterological fauna. Some sporadic species apparently died out by continuous inbreeding, and also those which could not adapt themselves to the strongly changed conditions of the outer environment died out; more resistant species changed into local forms or gave rise also to new species.

The Lepidopterological exploration of Crete began more than a hundred years ago with the Natural Science Expedition arranged by IMRE FRIVALDSZKY, who in the spring of 1843 sent the collector LACH to Crete. Already in 1844—45 the nephew of the scientist, JÁNOS FRIVALDSZKY, together with ANDREAS TERREN caught butterflies here by artificial light and visited also for the first time the Psiloritis Mts. Since then a number of other scientists have been working here: ERBER (1870), MATHEW (1897), PLETSCHER (1900), HOLTZ (1903), LEONIS (1903), REBEL and STURANY (1904), DÖRFLER (1904), BIRÓ (1906), PAGANETTI-HUMMLER (1914), Q. SCHIEBEL (1925), C. F. ROEWER, SCHULZ A. (1926), E. TRONÍČEK (1936).

One of the earliest lists of *Arthropodes* of Crete, of 1854 (LUCAS, Essai sur les animaux articules qui habitent l'île de Crète) includes 25 species of butterflies. In 1870 still only 50 species were listed from Crete (STAUDINGER, Beitrag zur Lepidopterenfauna Griechenlands). Finally REBEL (Lepidopterenfauna Kretas, 1916) worked all collections and reports; at that time he found on the island 327 species: *Macrolepidoptera* 177 (*Rhopalocera* 40, *Heterocera* 137) and 150 *Microlepidoptera*, from 63 different localities on the coast and in the mountains, especially from the

northwestern region of the island; the south coast remained little known. REBEL regarded 22 species and 10 races as endemic; from among the *Macrolepidoptera* he listed the following species: *Coenonympha thyrsis* FRÉ., *Lycanea psylorita* FRÉ., *Agrotis sturanyi* RBL., *Cucullia minogenica* RBL., *Hypenodes nesiota* RBL., *Larentia lasiothiotica* RBL., *Acidalia troglodytaria* H. S., *Cochlidion creticum* RBL., and *Sesia cretica* RBL. But SEITZ did not acknowledge REBEL's priority of description for *C. minogenica* and *H. nesiota* (WARREN), did not mention at all *A. sturanyi* RBL. (*Rhyacia lucerneae* Z.), and for others he found that they occur also outside Crete: *Dt. troglodytaria* H.-S. (Greece, Asia Minor, Syria), *C. lasiothiotica* RBL. (Granada). REBEL determined the origin of the Lepidopterological fauna of Crete as follows: endemic species and races (32), eastern, Pontic (186), Mediterranean and tropical (53), Siberian (36), and of uncertain origin (20 species).

We have to see the cause of the relatively poor Lepidopterological fauna, evident also from REBEL's comparison (the figures in brackets give the number of species established prior to 1916): Cyprus (156), Crete (327), Greece (1905), Asia Minor (2242), in the mountainous character of the island with rapidly drying karstic soil, in the short course of the often completely drying rivers, in the lack of forests, and in the on the whole not rich flora. Notwithstanding the unfavourable island environment REBEL estimated the number of possible species of Crete to be about 600, and thought that perhaps the insufficient exploration of the island was the cause why at that time (1916) only about half of them had been discovered. Since then the number of species found has increased on Cyprus by almost one half (303 species in 1939), but on Crete it has scarcely changed at all.

The mountains in the middle of the island with the groups Leuca Ori, Psiloritis, Lasithi and Asphentis running from west to east divide the island into a northern and a southern region, which are different also climatologically. On the north coast vegetation is still fresh in May, and in the mountains it is possible to catch butterflies even in June. But the south coast offers at that time a sorry sight of already desert fields, dry river beds and a parched vegetation on the dried-out soils where cactuses flourish. Lepidopterologically the southern region is characterised by the occurrence of *Danaüs chrysippus* L.

In the regions mentioned, of which I observed the northern one more in detail, we can still distinguish a lower coastal zone, also with a fairly characteristic Lepidopterological fauna, and a higher hill and piedmont zone which forms the transition to the mountains proper. Especially at lower levels, in the basins of the streams and rivers with meadow groves of plane-trees or their fragments with *Oleander* and other leafy shrubs, the island life of the *Lepidoptera* reaches its optimum. It is just in the plant formation with *Platanus orientalis* that RIKLI sees the unique Mediterranean association containing many boreal species. But also Lepidopterologically I observed in it conditions reminiscent of ours. We see here also small meadows reminiscent of our own meadows otherwise lacking here. This zone of original vegetation of fresh-water courses borders on the considerably more modest plantations of olive groves and carob-tree

fields. Just as in our fields the flight of Lepidoptera is here concentrated on the boundaries between the fields and on their borders.

In the mountain region (Psiloritis) too conditions are similar to ours in that with increasing altitude above sea level from a certain limit (which at higher levels depends directly on the state of the vegetation) the *Lepidoptera* species decrease, especially quantitatively. There are here relatively many localities in protected places of the piedmont region still moistened by streams, e. g. Anogia (750 m.). When the ground begins to rise to higher levels, and when even the poor fields stop, we find pauperised macchia inhabited by a scanty Lepidopterological fauna. The Nida plateau (1300—1400 m.), a plateau of amphitheatrical appearance formed by the erosion of the surrounding limestone rocks of the mountains proper, where flocks of sheep and goats pasture continuously, is relatively poor in flora and fauna, though characterised by endemites (*Gymnodactylus bartoni* ŠTĚPÁNEK; the life of the *Lepidoptera* is restricted to its margin, where the ground rises in the zone of thorn bushes, especially *Astragalus*, offering food to the caterpillars of the endemic *Polyommatus psylorita* FRÉ. which is here in June the leading species of the association of a sunny aspect¹⁾).

In the Psiloritis Mts. I found in the middle of June near the remnants of snow fields (around 2,200 m.) the last *Lepidoptera*: *Pieris rapae* L., *Colias crocea* FOURC., *Vanessa cardui* L., *Polyommatus psylorita* FRÉ., *Rhyacia lucerneae sturanyi* RBL. and several species of *Microlepidoptera*. The last specimen (from the group of the *Microlepidoptera*) I saw on a stony, already almost sterile locality, at an altitude of 2260 m. *R. lucerneae sturanyi* RBL. leads here two modes of life: on the Nida plateau (1350 m.) it lives hidden during the day and flies only by night regularly to the light of the lamp; at the crest of the mountains (2200 m.) it flies in the proximity of the eternal snow in full sunshine already in the morning hours. At lower protected levels it could fly by night, but this was impossible at the crests of the mountains where a gale blows at night, and the temperature in the middle of June drops to freezing point. The species is an example of how the vertical position of the locality, especially in conjunction with the climatic and orographic factors can influence the mode of life of a species so essentially that it changes the time of day of its flight.

¹⁾ In the Nida plateau where we slept in a small stone chapel with a protective wall, in the scanty shade of a few old oaks, *Quercus ilex*, with a flood of caterpillars of *Euprocitis phaeorrhoea* Don. (*chrysorrhoea* auct. nec L.), I measured several localities by aneroid; lowest levels 1290 m., chapel 1360 m., Diova Cave (the highest point of the plateau) 1420 m., and recorded some temperatures which I give here because of the rareness of records from these parts. 10. VI.: 8 a. m. — 17.5° (rather overcast, rain), 3 p. m. 16.75°, (sun hidden by cloud strong wind), 8 p. m. 17° (clear, strong wind), 8.30 p. m. 16.5°, 10.45 p. m. 14.75° — 11. VI.: the whole day sunny, slightly overcast, moderate wind; 8 a. m. 15.75°, 1 p. m. 20.25°, 3 p. m. 20°, 8 p. m. 13° (clear, calm), 11.30 p. m. 8° — 12. VI.: 8 a. m. 15.5° (clear, sunny, calm), 3 p. m. 21° (moderately, overcast sunny, moderate northwest wind), 8 p. m. 12.5° more overcast, calm), 8.15° p. m. 12°, 10.30 p. m. 9.75° — 13. VI.: 0.30 a. m. 11.5°, 3.30 a. m. 8.5°, 8 a. m. 9.5°, 12 a. m. 19.5°, 8.45 p. m. 14.5° (clear, strong northeast wind), 9.30 p. m. 13° — 14. VI.: 0.30 a. m. 11° (clear, strong northeast wind), 8 a. m. 15° (clear, sunny, calm), 3 p. m. 22° (mostly clear, sunny, northeast wind), 8.30 p. m. 12.5°, 10 p. m. 9.5° (clear, calm). Centigrades.

Our stay (with Dr. Štěpánek of the National Museum) on Crete lasted from May 22 to June 21, 1936; the weather was favourable and mostly constantly sunny. The localities of my collection on the island were 1) on the north coast at the port of Heracleion (Candia): Knossos, the place of the famous archeological excavations — the village and river of Gazi — the Admiros delta; in the northeast near the small harbour town of Agia Nicolaos: the river beds of the Xyro-potamos and near the village of Minoa — 2) on the south coast east of the port of Herapetra: the river beds of the Livadia-potamos near the village of Gianici, around the river Graligia-potamos at the vegetable-growing village of Graligia, and the bed of the Stomio-potamos; 3) in the northern piedmont region and in the Psiloritis Mts.: the village of Anogia (750 m.), the cross-roads Triodos (1000 m.) and the Nida plateau (average 1350 m.) and places at the crest of the mountains (about 2200 m.).

The collections were made in the following order:

Knossos, 20 and 21/V, afternoon, against the current of a stream, the banks covered with trees and shrubs; fresh vegetation.

Gazi-Admiros, 22 and 23/V: with the current of the Gazi, tree and shrub growth, especially with *Platanus orientalis*, *Nerium oleander* and rushes (*Juncaceae*), to the Admiros delta on the coast. Fresh and rich vegetation.

Agia Nicolaos, 25 and 26/V, afternoon: in the dry bed of the Xyro-potamos with dried vegetation, 27/V in the rush swamps at the coast near Minoa (*Crambetum*).

Herapetra, 28/V, morning: in the dry desert bed of the Livadia potamos, with parched vegetation, in the afternoon in the bed of the Graligia-potamos, and on 29/V in the half-dry bed of the Stomio-potamos.

Anogia (Anoya) (750 m.), 2—8/VI, at the northern foot of the Psiloritis, catching also at night with artificial light; Triodos (1000 m.), 9/VI, cross-roads with springs, on the road to the Nida plateau.

Nida (Nidha, 1300—1400 m.), 9—13/VI, extensive high-level plateau in the northern part of the Psiloritis, especially with thorn bushes *Astragalus* and with a sparse low, mainly grassy flora. At night catching by light at the chapel.

Psiloritis (Ida), 15—16/VI; the records called after this locality refer to several places above the Nida plateau (around 2200 m.) on the way to the mountain ridge.

***Iphiclides podalirius* L.**

Anogia, 2/VI, faded specimen of normal size.

REBEL recorded from Crete a spring generation of *ornata* WHEEL. (20/IV—1/VI), not rare and found everywhere in the Lasithi Mts. to an altitude of about 1000 m. (13—16/VI); WARNECKE mentioned from here also only a spring generation (1 ♂ June). In the second generation it seems to occur here as *zancleus* Z.

ROSEN (SEITZ) calls the large, vividly coloured Greek specimens *creta* VRTY. — Zoogeographical affinity: ssp. *smymensis* EIMER (VERITY).

***P. machaon* L.**

Gazi, 23/V — Herapetra 29/V — Anogia 3/VI, Both specimens I caught as proof are very similar to *asiatica* MEN., and are partly reminiscent also of other forms in two features: the anal eye is cinnabar yellow (*xanthophthalma* STGR.: "Analaug rotgelb") and the blue stripe of the anal eye is reduced to a slight light gray trace (*intacta* SHELJ.: "fast keine blaue Bestäubung des Analauges").

SEITZ proposed to replace *sphyrus* HB. by the ssp. *asiatica* MEN., and thus intimated that there is no really essential difference between them. REBEL reports from Crete that the species is much more abundant than *podalirius* L. and spread as far as into the Psiloritis (Nida, above 1400 m.); in his original paper he remarked that the specimens of Crete can be placed best to *sphyrus* (1916) and in the list from Cyprus he gave *sphyrus* also for Crete and considers its replacement by the ssp. *asiatica* (SEITZ) a mistake (1939). — WARNECKE. — Zoogeographical affinity: ssp. *gigantea* STGR. (VERITY).

***Allancastris cerisyi* GOD.**

cretica RBL., Triodos 9/VI — Nida 17/VI — apparently the last specimens of a belated mountain population.

REBEL found this characteristic local form very wide-spread in Crete at altitudes of 300—1400 m. (Nida), and the flight time from the end of March to the end of May. — f. *schulzi* Bryk (BRYK).

***Pieris brassicae* L.**

Anogia 6/VI. On the pair of specimens from the foothills of the Psiloritis fits also the description of *wollastoni* BTLR., of Madeira (reverse of the lower wings greenish gray). Both specimens, especially the female one, are of considerable size, their black spots are also very large, and thus they are reminiscent of *catoleuca* RÖB. of Asia Minor.

REBEL reports from Crete the species as very abundant and spread everywhere, even in the Lasithi Mts. (1500 m.); in the June specimens he recognised the summer generation of *lepidii* SEITZ.

***P. rapae* L.**

Knossos 21/VI — Gazi 25/V — Herapetra 28/V — Nida 11/VI — Psiloritis (2170 m.) 15/VI. These specimens belong probably to the second generation. The males are characterised by their considerable size; the dark spots on the wings, especially the apical ones, are always strongly and characteristically developed, black on a greenish whitish background; also the reverse of the wings is very light, white and in the posterior wings slightly yellowish. Some of these features make them reminiscent especially of *messanensis* ZELL. and *dubiosa* RÖB. from Asia Minor.

REBEL recorded from Crete the species common in three generations and distributed up to an altitude above 2000 m. He mentioned its considerable variability; especially the specimens from March to May show mostly a coarser black powdering of the reverse of the posterior wings and varying colouring from yellow to white. Two females from Crete, from Spili and Kavusi he determined as *leucotera* STEF. — Zoogeographical affinity: ssp. *atomaria* FRUHST., ssp. *tertia* VRTY. (VERITY).

***Pontia daplidice* L.**

Gazi 23/V — Herapetra 28, 29/V. The specimens are on the reverse of the wings greenish yellow coloured which compared with the darker green coloration of the nominate form is a characteristic feature of the Mediterranean forms of *raphani* Esp. (Southern Europe and Asia Minor).

REBEL found the species abundant in Crete and in the same localities as *P. brassicae* L. — Zoogeographical affinity: ssp. *expansa* VRTY. (VERITY).

***Colias crocea* FOURC.**

Knossos 20, 21/V — Gazi 22 23/V — Herapetra 29/V — Anogia 2/VI — Psiloritis (2170 m.) 15/VI — Nida 17/VI; *helice* HB.: Anogia 4/VI (1 faded ♀).

According to REBEL abundant in Crete and distributed everywhere, in the Asphendi Christos Mts. to above 1500 m.; *helice* only sporadically. — WARNECKE.

***Gonopteryx cleopatra* L.**

taurica STGR. — Knossos — Gazi — Anogia.

REBEL reported from Crete originally the nominate species, distributed on the whole island up to an altitude of about 1000 m. (Lasiathi) and mentioned only that VERITY designated the specimens of Crete as *insularis* because of their small measurements, and that the form of Crete rather resembles the Greek mainland *taurica* STGR. than the race of Asia Minor. Finally he listed in the list for Cyprus under *taurica* also Crete. — WARNECKE recorded only the species. — Zoogeographical affinity: ssp. *europaea* VRTY. (VERITY).

***Leptidea sinapis* L.**

diniensis B. — Gazi 22, 23/V — Herapetra 29/V. The specimens differ from the nominate form. In the males the apical spot on the right side of the anterior wings does not reach the margin, it is distinctly separated from the margin of the wings and connected with it only by blackish gray dusted veinlets. The female at Gazi has an unclear apical spot, but a very distinct spot in the proximal part: *andromorphica* VRTY., which had not been known before from Crete.

In Crete REBEL listed three specimens of the southern summer form *diniensis* BSD., which MATHEW caught in June 1897 in the vicinity of Canea or Suda Bay, but he did not find any proof of it; the find appears striking to him, but he did not doubt it. The species is in the Aegean Sea evidently sparsely distributed. — Zoogeographical affinity: ssp. *magna* VRTY. (VERITY).

***Danais chrysippus* L.**

Herapetra 29/V, in the morning, a very faded specimen on a blossom of *Scabiosa* at the river-bed of the Stomio-potamos.

From the mainland of Crete only FRIVALDSZKY recorded the species, for FLETSCHER ascertained it in June 1900 at Suda Bay flying above the sea around the steamer. Apparently the species flies only rarely as far as here, similarly as in Cyprus (TURNER: The Butterflies of Cyprus, Tr. Ent. Soc. London, 1920). Also in Rhodes it appears as a great rarity (TURATI: Arch. Zool. Ital. 13, Napoli, 1929).

***Hipparchia semele* L.**

cretica RBL. — Knossos 21/V — Anogia 3, 6/VI — Nida 11/VI. One female from the Nida plateau exhibits on the anterior wings between two eyes a slightly smaller round spot of right-side origin (*addenta* TUTT).

REBEL described from Crete the endemic subspecies *cretica*, abundant and distributed in the whole island. According to DÖRFLER it is rarer in the Psiloritis and lacks in the non-rocky Messara lowland. Also GALVAGNI lists it from Crete (Megaspaläon) and WARNECKE mentions it from here as the most abundant butterfly of ROEWER's expedition; its whitish median stripe on the posterior wings is considered remarkable by WARNECKE, more marked than in *blanchieri* FRUHST. (Aspromonte, southern Italy) and *aristaeus* BONN. (Corsica), but he found by chance such a marked stripe in the otherwise very dark form *polydorus* STAUDER (Innsbruck).

***Pseudochazara anthelea* HB.**

amalthea FRIV. — Anogia 3/VI.

FRIVALDSZKY discovered this mountain race in June 1844 in the Psiloritis. REBEL records the localities in Crete at altitudes of 800—1000 m., and my own locality (750 m.) seems to give the lower vertical limit. WARNECKE: Lakkos 1 ♂ VI.

The nominate species is distributed in Asia Minor, *amalthea* in the Balkans; in this case the fauna of Crete shows to be related to that of the European mainland, which would prove a later separation of the island from Europe than from Asia.

***Pararge aegeria* L.**

Knossos 20/V — Gazi 23/V — Herapetra 29/V — Nida 11/VI. The pair of specimens from both localities at Heracleion is reminiscent of *intermedia* WEISM. Nida plateau (1400 m.) is still the highest situated locality of this species in Crete.

REBEL found this species in Crete locally distributed and abundant; he remarked that the males are on the right side of the wings somewhat darker than the South European ones.

***P. megera* L.**

lyssa HB.-GEYER (nec BSD.). — Knossos 21/V — Herapetra 28, 29/V — Anogia 3/VI — Nida 17/VI.

REBEL placed the specimens from Crete to *maegerina* H. S. (Armenia), distributed everywhere in the island up to an altitude of 1800 m., and abundant. This form is a transition to *lyssa* (1916). In the list from Cyprus he included however under *lyssa* also Crete (1939).

***Maniola hispulla* HB.**

Knossos 20, 21/V — Gazi 22, 23/V — Herapetra 29/V — Anogia 3, 8/VI.

REBEL determined the specimens from Crete as *jurtina-hispulla* HB., distributed everywhere in the island up to an altitude of 1400 m. (Nida), and very abundant. — Zoogeographical affinity: ssp. *illuminata* KRUL., ssp. *telmessiae formis* VRTY. (VERITY).

***Coenonympha thyrsis* FRR.**

(*cretica* STGR. sen.) — Knossos 20, 21/V — Agia Nicolaos 25-27/V — Herapetra 28, 29/V — Anogia 2/VI — Nida 11, 13, 17/VI. Every-

where abundant, also on sterile soils. Endemic species here replacing *pamphilus* L. In the interior of the island it shows a tendency to a reduction of the dark colours on the right side of the wings. Thus especially the apical eyes are in the mountain specimens, especially from the Nida plateau, considerably smaller than in the specimens from the coast. Also the total size of the mountain specimens living here on poor soils is smaller.

In my own collections of 10 ♂ and 14 ♀ I found two very different specimens which I name here in honour of my fellow-traveller in Crete, Docent Otakar Štěpánek, of the National Museum, Prague, as:

f. štěpáneki: the dark margin on the right side of the wings reaches to their fringes so that the yellow stripe separating the dark arcuate stripe from the fringes and typical for the nominate species is almost completely imperceptible. Description according to ♂ Knossos 20. V. 1936 and to ♀ Agia Nicolaos 26. V. 1936. Among the species on the coast of Crete. Transitions are more numerous. — That we have here a widespread and striking feature follows partly already from REBEL's remark on the variability of the species in surveying his considerable material: "Der schwarze Saum der Vorderflügel tritt beim ♂ zuweilen bis an die Fransenbasis, lässt aber zumeist, namentlich häufig auf den Hinterflügeln, eine gelbe Saumlinie frei" (1916).

REBEL mentions it from Crete as an independent species, occurring everywhere in the island up to an altitude of 1400 m. and here and there very abundant; apparently in two generations, but so far ascertained only from the beginning of April to the middle of July. GAEDE (SEITZ) placed the specimens of Crete as the only form of the special group "thyrsis Gruppe" within *pamphilus* L. VERITY designated it by his separate taxonomic unit between the species and subspecies as *C. pamphilus* exerge *thyrsis* FRR. with a distribution only in Crete.

***Vanessa atalanta* L.**

Knossos 21/V — Anogia caterpillar 3/VI (larva 5/VI. imago e. l. 19/VI). Another specimen from a caterpillar was found in June also at Anogia. In both specimens the vermilion stripe of the anterior wings is narrowed and interrupted as in *fracta* TUTT. or *italica* STICH.

The form *fracta* occurs among the species especially in southern regions and more rarely in northern regions, probably only in hot summers or at an accidentally warm locality of the larva. *Italica* was also cultivated artificially at an increased temperature. The interruption of the vermilion stripe on the anterior wings appears as a characteristic feature of the forms living in warm southern regions and apparently as a feature of an outstanding, large regional subspecies, though STICHEL (SEITZ) thinks that the formation of subspecies is almost completely lacking in this holarctic species.

The nominate form has black spots in the vermilion stripe of the posterior wings; these spots are of an irregular shape, yet essentially rounded to wedge-like. My specimens from Crete have the same spots, but of an elongated, rectangular shape; in a schematic representation these spots appear as lines. The interruption of the vermilion stripe on the anterior wings is another characteristic feature. I designated this

form from the foot of the Psiloritis, Anogia, June 1936, which apparently predominates in the island among the species, as f. *Weingärtneriae*. It is dedicated to Miss Marie Weingärtnerová, Havlíčkův Brod.

REBEL reported from Crete that the species occurs up to an altitude of 1400 m. (Nida), but is not abundant. Originally he believed that the specimens from Crete represent probably only a small race ("kleine Rasse"); he thought so because of the smaller size of the specimens (28—29 mm.) and stated that it forms the transition to the dwarf form *nana* SCHULTZ (1916). But this is a mistake, for in the atlas which he revised (Berges Schmetterlingsbuch, IX. Auflage, Stuttgart 1910) he gives the size of the nominate form as 27—30 mm. and that of *nana* as 22—25 mm. According to this, his specimens from Crete are of normal measurements. In the list for Cyprus he listed also for Crete the nominate form (1939). — Zoogeographical affinity: ssp. *minutior* VRTY. (VERITY).

V. cardui L.

Heraptera 29/V — Anogia 3/VI — Psiloritis (2160 m.) 15/VI — Nida 17/VI — Fairly abundant.

STICHEL (SEITZ) stated that the South Russian *inornata* BRAMS. and the Balkan specimens trend towards a certain reduction: to a narrowing of the black stripe across the middle of the anterior wings. Both specimens from Crete, which remained to me, show this feature, and especially the specimen from Anogia is reminiscent of *japonica* STICH by the striking reduction of the submarginal spots on the right side of the posterior wings, in which the anterior spots are lacking or are entirely isolated. Presumably these are features of a variety.

REBEL saw the species in Crete at a high altitude (Asphendi Christos 2155 m.) and abundant. — WARNECKE. — Zoogeographical affinity: ssp. *universa* VRTY. (VERITY).

Polygonia egea CR.

Heracleion 25/V, tiny caterpillar in a street of the town on a garden wall, 19/V (imago e. l. 21/VI) — Anogia 6, 7/VI.

REBEL reported from Crete the species as occurring in the whole island, and in the Psiloritis up to the Nida plateau (1400 m.). WARNECKE recorded from Omelos a light form indistinguishable from the population of Dalmatia.

Lycaena phlaeas L.

Knossos 20/V — Anogia 2, 3, 8/VI. Of seven specimens caught five belong to *coeruleopunctata* STGR.; this form has not been known till now from Crete. All the specimens show a transition to gen. aest. *eleus* F.; though they are of larger measurements, with a typical spur, and though also the colour of the reverse of the wings is grayish red, yet the darkening of the right side of the wings is so slight that the orange parts are all well developed as in the nominate form of the spring generation. The blackish spots on the right side of the wings are big, and the small spots on the reverse of the posterior wings are little marked.

REBEL found in Crete the species occurring in several generations, and already from the end of May in the summer form *eleus* F. As the highest locality is given Kristallenia, a monastery in the Lasithi Mts.

(870 m.). — Zoogeographical affinity: ssp. *nigrioreleus* VRTY., ssp. *aestivus* ZELL. (VERITY).

***Syntarucus pirithous* L. (*telicanus* LANG).**

Gazi 22/V — Two faded females.

REBEL listed from Crete one locality: Canea, early April (1914), PAGANETTI-HUMMLER.

***Lampides boeticus* L.**

Gazi 23/V (faded ♂) — Nida 13/VI (fresh ♀). The blackish brownish gray and only slightly dusted blue specimens with two distinctly developed, transverse stripes of whitish spots in front of the margin of the right side of the posterior wings are reminiscent of *arminiensis* GERHARD (SEITZ). Nida in the Psiloritis is still the highest locality of the species in Crete (1400 m.).

REBEL saw in Crete only the June population from 4 localities on the shore and in the Lasithi Mts. (Kristallenia, 870 m.).

***Philotes vicrama* MOORE.**

schiffermülleri HEMMING — Anogia (750 m.) 8, 9/VI (1 faded ♂ and ♀). The female is on the whole typically coloured and of normal measurements; on the right side of both wings dark spots shine through from the reverse side. On the posterior wings is no dark central spot, on the anterior wings it is only slightly developed.

REBEL mentioned in his original paper on Crete L. *baton* BSTGR., occurring here sporadically (1916). In consequence of the revision carried out by HEMMING (Revision of the *baton* group etc., The Entomologist, 62, London, 1929), in which he distinguished between *P. baton* BSTGR. and *P. vicrama* MOORE and placed the specimens from the island of Nikaria (Sporades) to *vicrama schiffermülleri* HEMMING, REBEL later included this form in his contributions to the fauna of the islands of the Eastern Mediterranean, and in his list for Cyprus he records it also from Crete, but everywhere on principle as *P. baton schiffermülleri* HEMMING.

***Celastrina argiolus* L.**

Gazi — Herapetra 29/V. The specimens from Herapetra at the mouth of the river Stomio are new for southern Crete.

REBEL recorded the species in Crete as occurring sporadically in the northern region of the island and placed the population of Crete to *parviflora* FUCHS. The locality of Omalos (1087 m., pass in the Leuca Ori Mts.) mentioned by WARNECKE is the highest one of that species in the island; the specimens have the reverse of the wings rather slightly punctuate, but otherwise they do not differ from the central European form. — Zoogeographical affinity: ssp. *calidogenita* VRTY. (VERITY).

***Polyommatus psylorita* FRÉ.**

Triodos 9/VI — Nida 9—18/VI — Psiloritis 15/VI. Mountain species. At the cross-roads with springs, Triodos (1000 m.) they settled singly on the wet places, and on the crest of the Psiloritis (2160 m.) they occurred still more rarely. This species reached its optimum according to number on the protected Nida plateau (1300—1400 m.), where it occurred in June as the leading species of an association of the following composition:

***Polyommatus psylorita* TRONÍČEK (1936)**

<i>Zerynthia cerisyi cretica</i> RBL.	+
<i>Colias crocea</i> FOURC.	+
<i>Pararge megera lyssa</i> BSD.	+
<i>Coenonympha thyrsis</i> FRR.	1
<i>Vanessa cardui</i> L.	+
<i>Polyommatus psylorita</i> FRR.	4
<i>P. icarus</i> ROTT.	+

Imago association of a sunny aspect. — Habitat: *Astragaletum*, moist soil — Observation area: about 25 sq. m. — Time of observation: 17.VI.1936, 11.30—11.40 a. m., clear, sunny, calm. weather. — Locality: Nida Plateau. 1300 m., Psiloritis, Crete.

Legend: scale of abundance: + sporadic, singly, 1 — rare, not abundant, 2 — fairly abundant (medium numbers), 3 — abundant, 4 — very abundant (as a rule the dominant species of the association). Numbers of *P. psylorita* (about 100 specimens) determined by evaluation. — Within the wider sphere of the association on the Nida Plateau in June in a sunny aspect still: *P. rapae* L., *P. aegeria* L., *L. boeticus* L. (11. to 13/VI).

REBEL recorded the species, discovered by JÁNOS FRIVALDSZKY (1844—45) in June in the Psiloritis on the rim of snowfields, as the most characteristic endemic species of Crete and as the only species of *Rhopalocera* which did not develop from a local form, but is a relict. He mentioned the deviation on the reverse of the anterior wings of *caeca* COURV. and remarked that it is frequent in the males in transitions. The occurrence of the species is restricted to the Psiloritis (1916) and the Nida plateau appears as its centre of distribution in these mountains.

This proteandric species apparently begins to hatch at the beginning of June. In my collection (9—18/VI) of about 60 males occurred only one female. HOLTZ stated that he caught the species on 13—16/VI (1903) in the Psiloritis (1600—2000 m.) in great number in both sexes, and the rarer females were often seen creeping under thorn-bushes (REBEL, 1916). The eggs are laid singly on the right side of the pink-blossoming thorn-bushes of *Astragalus*, and I observed them on 18/VI in the noon-sun. The egg stage lasted 9 days.

The form *obenbergeri* TRK. (1938) appears among the species. The description of this form with photographs of the types and co-types and a contribution to the knowledge of the species *P. psylorita* FRR. I published in the journal of the Czechoslovak Entomological Society, Prague, 1938 (lit. cit.).

***P. astrarche* BRGSTR. (*medon* HFN.).**

Knossos — Gazi — Anogia 3/VI, apparently the highest locality of the species in Crete (750 m.).

REBEL mentioned this species in Crete as abundant and occurring especially on the north coast in May also as gen. aest. *calida* BELL., up to an altitude of about 400 m. (the vertical position of the locality of Malaes, a monastery southeast of the Lasithi Mts., is however not known to me). — Zoogeographical affinity: ssp. *aestiva* STGR. (VERITY).

***P. icarus* L.**

Knossos — Gazi — Agia Nicolaos — Herapetra — Anogia — Nida. Several intensively coloured specimens from the Psiloritis, on the Nida plateau, which is the highest locality of this species in Crete. *Caerulea* FUCHS: Anogia 7/VI.

REBEL recognised this species in Crete as the most abundant, occurring everywhere, up to an altitude of 1100 m.; he mentioned also the singly occurring *icarinus* SCRIBA and *coerulea* FUCHS, only specimen 24. VI. 1914, Candia, Demelius. — Warnecke. — Zoogeographical affinity: ssp. *zelleri* VRTY., g. aest. *aestivalis* TUTT, g. aest. *transfereus* VRTY. (VERITY).

***Carcharodus alceae* ESP.**

alceae ESP. (*australis* Z.) — Knossos — Herapetra; the specimens of 29/V at the mouth of the river Stomio (near Herapetra) are new for the southern coast of the island.

REBEL in his original paper listed the specimens from Crete as *australis* Z., which represents a southern, darker, summer form of the species (1916). In the list for Cyprus he gives under the nominate form also Crete (1939).

EVANS (1949) gives *australis* Z. (1847, Sicilia) as synonym of the subsp. *alceae* ESP.

***Pyrgus armoricanus* OBERTHÜR (1910).**

Anogia in the northern foothills of the Psiloritis, 750 m., 7/VI, 1 pure ♂ (det. REISSER, Vienna). New for Crete.

REISSER recorded this species in the Greek island of Kythera (1 ♂ 23/VIII/1925), and mentioned its resemblance to ♂ from Crete (Leuca Ori, Lakki, 10/VI/1942, leg. Zimmermann), determined by ZERNY as *armoricanus* OBTH.; but for the specimen from Crete he left open also the possibility of *persica* REV. — Zoogeographical affinity: ssp. *fulvoinspersa* VRTY.

***Thymelicus acteon* ROTT.**

Knossos — Gazi — Herapetra — Anogia. Specimens caught at the mouths of the rivers Livadia and Stomio (near Herapetra), 28 and 29/V, new for the south coast of the island.

REBEL reported the species in Crete as not rare and as widespread, in the Lasithi Mts. up to an altitude of 870 m. (Panagia Kristallenia). — Zoogeographical affinity: ssp. *ragusai* VRTY. (VERITY).

***Gegenes nostrodamus* F.**

Herapetra, at the Livadia-potamos, 28/V, 2 ♂. New for southern Crete.

REBEL reported from Crete two finds on the north coast: Canea (or Suda Bay), VI.1897 (MATHEW) and his own find at Agia Nicolaos, 18. V. 1904. REVERDIN thought from the investigation of the genitals that *P. nostrodamus* F. (recte *pumilio* HESG. 1804) and *P. lefebvrei* RBR. are two different species (Soc. Ent. 26, 1911); REBEL remarks that on the basis of only one specimen from Crete he cannot give any opinion on this (1938).

In order to supplement the picture of the fauna of butterflies in the island of Crete I give on the basis of REBEL's work (1916) and

WARNECKE's article (1928) the following survey of the species of *Rhopalocera* on Crete: *P. podalirius* L., *P. machaon* L., *Z. cerisyi cretica* RBL., *P. brassicae* L., *P. rapae* L., *P. ergane* H. G., *P. daphidice* L., *E. belia* CR., *C. crocea* FOURC., *G. cleopatra taurica* STGR., *L. sinapis* L., *M. larissa* H.-S. (WARNECKE), *K. circe* F. (WARNECKE), *Ch. briseis* L. (WARNECKE), *H. semele cretica* RBL., *P. anthelea amalthaea* FRIV., *P. aegeria* L., *P. megera lyssa* BSD., *M. jurtina hispulla* HB., *M. lycaon* ROTT., *C. thyrsis* FRR., *V. atalanta* L., *V. cardui* L., *N. polychloros* L., *P. egea* CR., *A. maja* CR., (*pandora* SCHIFF.), *D. chrysippus* L., *S. acaciae abdominalis* GERH. (WARNECKE), *T. quercus* L., *L. phlaeas* L., *L. boeticus* L., *S. telicanus* LANG., *Ch. trochilus* FRR., *C. minimus* FSL. (WARNECKE), *Ph. vicrama schiffermülleri* HEM., *C. argiolus* L., *P. psylorita* FRR., *P. astrarche* BRGSTR., *P. icarus* ROTT., *C. alceae* ESP., *P. malvae* L.,²⁾ *P. alveus* HB., (*H. fritillum* HB.), *P. armoricanus* OBTH. (TRONÍČEK), *T. acteon* ROTT., *G. nostrodamus* F., *B. borbonica zelleri* LED.³⁾ Originally 40 species of *Rhopalocera* (REBEL, 1916) had been ascertained in Crete, later their number increased by the reports made by WARNECKE to 46 species (1928), and by those of REISSER and TRONÍČEK to 47 or 48 species (1947, 1949). REBEL considers the occurrence of *M. larissa* H. G., *K. circe* F. and *C. minimus* FSL. in Crete as excluded and gives reasons for this; the finds of *Ch. briseis* L. and *S. acaciae abdominalis* GERH. need according to him verification (1938).

I handed over my collection of *Lepidoptera* from Crete partly to the National Museum, Prague (especially the types and co-types of *P. psylorita obenbergeri* TRK. and the type of *Cochlidion creticum ochracea* TRK.), and entrusted the rest during the past war to A. SILBERNAGEL, Prague, who sent part of it for determination to Mr. HANS REISSER in Vienna, and the latter informed me in 1947 that 60 specimens of my collection from Crete (1 *Rhopalocera* and 35 species of *Heterocera*) which had been sent to him are with him in a rather damaged state. H. REISSER sent me for examination part of his manuscript with the description of *Autophila dilucida troničeki* BOURSIN, subsp. nova, which I caught in Crete at Anogia, 3 and 4/VI in artificial light (3 ♂ and 1 ♀) and on the Nida plateau in the Psiloritis on 19/VI, 1936. After the death of A. SILBERNAGEL I found part of the material in his collection, which is now in the National Museum, Prague, and the rest came by mistake from the estate into unknown hands.

Souhrn.

V anglickém textu jsou uvedeny stručné poznámky o geologických, klimatických a botanických poměrech ostrova Kréty a o průzkumu jeho motýlí zvířeny. V další části článek navazuje na lepidopterologické po-

²⁾ REBEL listed *H. malvae* L. (MATHEW C. F.: Notes of Lepidoptera from the Mediterranean, The Entomologist, 31, 1898), 1 specimen at Canea (or Suda Bay) VI in his list for Crete with a question mark, but hopes that it is not a confusion with *H. fritillum* HB. (1916). Now the material from Crete of *P. alveus* L. (*H. fritillum* HB., REBEL 1916) and *P. armoricanus* OBTH. will have to be compared.

³⁾ *L. rivularis* SC. (*camilla* SCHIFF.) — REISSER mentions this species according to the find of SCHULZ, probably from Crete (1947).

znání ostrova (REBEL 1916) a přináší výsledky mého sběru denních motýlů na severním a jižním pobřeží Kréty a v centrálním pohorí Psiloritis, v době od 20. května do 21. června 1936; uvádím též snímek společenstva *Polyommatus psylorita* TRONÍČEK z Nida planiny (Psiloritis, 1.400 m) a popisy dvou nových forem *Coenonympha thyrsis štěpáněki* TRK. a *Vanessa atalanta weingärtneriae* TRK. — Za údaje (VERITY a BRYK) děkuji kol. Vl. Poláčkovi.

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