A REVIEW OF THE LEBANESE BUTTERFLIES OF THE FAMILY PIERIDAE (LEPIDOPTERA)

Alice Blatchford Bliss

Submitted in Partial Fulfillment of the Requirements
of the Degree of Master of Science

Department of Biology
American University of Beirut
Beirut, Lebanon
1967

Approved by:

Joseph Butros Ph.D.

Joseph Russell Ph.D.

Robert E. Lewis, M.S., Ph.D., Chairman

A REVIEW OF THE LEBANESE BUTTERFLIES OF THE FAMILY PIERIDAE (LEPIDOPTERA)

Acknowledgements

My sincere thanks are extended to Professor Robert E. Lewis whose advice and guidance made this study possible. Many of the field observations on the species of the Pieridae were contributed by him as a result of his collecting trips in Lebanon over the past years.

I would like to thank Dr. L.G. Higgins of Chobham Surrey, Mr. T.G. Hogarth of the Division of Insects, British Musuem (Natural History), London and Mr. E.P. Wiltshire of Geneva, Switzerland for their assistance in determining the nomenclatural status of the species of Lebanese pierids.

My gratitude is also extended to Professors Joseph M. Butros, Joseph H. Powell and John F. Schacher for services rendered.

TABLE OF CONTENTS

Abstract

The twenty-two species of the twelve genera of pierid butterflies known to occur in Lebanon are discussed. Literature pertinent to the fauna is reviewed. The physical characteristics of each species are described and a key to individuals of both sexes is presented. Factors affecting the distribution of the various species are considered, an attempt to analyze the various faunal components is made and a primarily European origin for the majority of the species is suggested.

Introduction

The family Pieridae (Asciidae) is composed of a number of genera which are more or less cosmopolitan in their distribution. Basically the family is of Holarctic origin and distribution with a number of intrusive genera in the American tropics and the Ethiopian and Oriental Regions.

Members of this family, with the exception of certain tropical species, are primarily white, yellow or orange in color, usually marked with black. Many species are sexually dimorphic and frequently the females of certain genera, especially Colias occur in two color forms.

Representatives of the family Pieridae possess the following combination of characteristics which distinguish them from other families in the suborder. The prothoracic legs are never reduced as in the case in the Nymphalidae and representatives of certain other families. The discal cells are closed in both the fore and hind wings. The compound eyes are entire and never covered with hairs or scales. The labial palpi, although not particularly reduced, are always considerably less than one half the length of the antennae. The bases of the major wing veins are never inflated, as is characteristic of members of the Satyridae and allied families. The radial vein has four branches and M_2 arises nearer M_1 than M_3. There are two anal veins in the hind wing. The tarsal claws are bifid.

According to Seitz (1909) there are twenty-three genera belonging to this family which are associated with the Palearctic Region. Some of these, for example, Pieris, Colias, Catopsila and Anthocharis, contain representatives which are indigenous to other faunal regions. Of the Palearctic genera, representatives of twelve occur within the political boundaries of the Republic of Lebanon. This study deals with the twenty-two species of pierid butterflies known or believed to occur in Lebanon.

Literature Review

Very little literature is available dealing specifically with the Lebanese lepidopteran fauna. The English publications mentioned below, with the exception of Seitz, are written by amateurs.

The English translation of Seitz, Macrolepidoptera of the World, is a systematic description of the Palearctic butterflies with accompanying illustrations. Although it was published in 1909 it remains the authoratative work in the field and was used in identifying the specimens considered in this investigation.

In conjunction with this volume it should be noted that Seitz, while the author of various sections, also functioned in the capacity of editor. The section dealing with the family Pieridae was actually written by J. Röber and appeared in published form on November 21 and 24, 1907 and January 1, 1908. Further, much of the information pertaining to the immature stages was gleaned from the published and unpublished studies of Aleman and Spuler.

Ellison and Wiltshire (1939) published an annotated list of species and forms of butterflies from the Mediterranean coast, the Lebanon Mountains and the Bekaa. Little was known then, as today, of the Lepidoptera inhabiting the Anti Lebanon Mountains. The list is a composite of the species in the authors' collections and those found in the records of earlier collectors, when these were considered to be accurate. Since the specimens are missing the authors mentioned that "identifications based on the available

knowledge in 1850 or even 1900 may be misleading in 1936". Also exact localities are unavailable in many of the early instances. For example "'Beirut' may mean anything from the sea coast to the highest peaks".

Some of the collectors whose publications and collections were synthesized include such early workers as Lederer (1855, Verh. zool.-bot. Wien 5:187 and 1857, Wien. ent. Monats. 1:90), Nicholl, Graves and Zerny (Iris 46-48, 1932-34). The last two dealt with more recent records. Other less important works dealing with the area under consideration included in Ellison and Wiltshire (1939) are: Calberla, who dealt mainly with desert border forms and cited few references to Lebanon; Herzog whose work is filled with "mistakes" and Miss Fontaine, who recorded two species not mentioned elsewhere. The Cremona brothers were commercial collectors some of whose records were cited. None of these earlier works were available to this author.

Wiltshire's Lepidoptera of Iraq (1957) is not pertinent to Lebanon but has significant information on the food plants of the various species. It is a list of 937 species of butterflies and moths inhabiting Iraq with comments on each species concerning their biology, distribution and economic importance.

Higgins (1964) comments on some Lebanese Lepidoptera which he considered interesting among the specimens he collected during a five-week stay in May and June 1962. He estimates that there are 131 species of butterflies in Lebanon of which the majority are Palearctic. A few are tropical and several are regular or occasional immigrants. Higgins collected at Beirut, "Cedar Mt." Bscharré,

Chtaura, Bweirj, Ain Zhalta, Faraya and on the western slopes of the Lebanon Mountains.

Unfortunately, literature pertaining to the fauna of the eastern Mediterranean tends to be widely scattered throughout various European and Asian publications and many of these publications are in foreign languages unfamiliar to the author. In addition, most of the earlier treatments are not available in the library of this University. For this reason it has been necessary to rely upon a relatively few recent publications, which have been cited above, and a number of personal communications with people in England and Switzerland.

Although there is considerable difference of opinion concerning the proper generic and specific names to be employed, the system in Seitz (1909) is followed whenever possible. Names not employed in this volume are utilized only when there seems to be appropriate nomenclatural reasons for the change.

Materials and Methods

Material upon which this study is based was collected and preserved by standard methods described in most textbooks on introductory entomology. For a more detailed account the reader is referred to chapters 26 and 32 of Borror and Delong, (1964).

In addition to the study of whole specimens, preparations for the study of wing venation were made according to the procedure described in the volume cited above. Bleached wings were mounted in standard 2 x 2 slide mounts and projected, exact tracings of the individual veins being obtained in this manner.

Unfortunately descriptions of all five larval instars are unavailable. Since it is known that color patterns of lepidopteran larvae change from instar to instar, an investigation into these changes for the Lebanese species should be most rewarding. This also applies to the pupal stages.

The description of the imagines is based upon material in the collections of the American University of Beirut, Museum of Natural History. It should be noted, however, that in a few cases one or both sexes of a species is represented in this collection by extremely old material. While an effort has been made to base descriptions upon recently collected specimens, utilization of older material in some cases was unavoidable. Descriptions of old specimens are indicated as such in the text.

Systematic Treatment

The following is an artificial key to the pierid butterflies occurring within the political boundaries of the Republic of Lebanon. An effort has been made to rely on characteristics which could be used by the amateur lepidopterist in separating closely related species. To a large extent color has been employed since color differences are the most conspicuous to the uneducated or untrained eye. It is true that the color of individuals of a species is subject to a certain amount of variation in intensity due both to age and individual genetic constitution but such variations are hardly sufficient in this case to negate the value of the character. Where such drastic differences occur as to result in dimorphism, as in females of the genus Colias, both forms key out separately.

A characteristic common to all pierids is that M_2 on the fore wing arises from the discal cell. In all but Leptidia M_2 is nearer M_1 than M_3 at the base, Radius is three to five branched and R_1 arises from the cell. In Leptidia M_2 is not nearer M_1 than M_3 at the base, Radius is five-branched and R_1 arises beside the cell. Refer to Plate I for typical venation patterns of eleven of the twelve genera discussed below.

Key to the Lebanese Butterflies of the Family Pieridae

1. Males 2

   Females 23

2. Base color of upper surface of wings yellow, orange, salmon or white with broad orange apical band, sometimes in combination with black 3

   Base color of upper surface of wings white, sometimes tinged with yellow or green usually bearing some pattern in black or brown 11

3. Length of fore wing from base to apex exceeding 25 mm..... 4

   Length of fore wing from base to apex less than 25 mm..... 7

4. Outer margin of wings ornate; apex of fore wing pointed; hind wing with pointed marginal extension at apex of Cu_1 (Fig 1) 5

   Outer margins of wings not ornate as described above; wings dark orange; fore and hind wings with broad black marginal bands; discal spot of fore wing black; discal spot of hind wing orange ..... *Colias aurorina libanotica*

5. Fore wings suffused with orange over base color of cadmium yellow; discal spots dark orange .... *Gonepteryx cleopatra taurica*

   Fore wing lacking orange cast; discal spots lighter orange .. 6

6. Fore wing darker in color than hind wing; marginal spots .... reduced; orange discal spots frequently reduced .....

..... Gonepteryx farinosa

Fore wing similar to hind wing in color; marginal spots not reduced; orange discal spots not reduced .....

..... Gonepteryx rhamni meridionalis

7. Fore and hind wings salmon, with distinct purplish sheen in fresh specimens; apex of fore wing with two scalloped bands, the most distal extending to anal angle of wing.

..... Teracolus fausta

Fore wing either bright yellow with broad black marginal band, yellow or white with conspicuous orange apical band or suffused with yellowish scales and bearing a black apex and conspicuous black discal spot 8

8. Fore wing bright yellow with a broad black marginal band and black discal spot; hind wing dusky yellow with an orange (usually double) discal spot ..... Colias croceus

Fore wing colored otherwise and lacking black marginal band; hind wing lacking discal spot 9

9. Fore wing light yellow with black apex and large black discal spot; lacking orange markings; hind wing dusky.

..... Anthocharis charlonia mesopotamica

Fore wing with conspicuous orange apex; hind wing of same base and color as fore wing 10

10. Base color of fore and hind wings white; fore wing with broad orange apical band, frequently bordered apically and proximally by scattered black scales .....

..... Anthocharis cardamines phoenissa

Base color of fore and hind wing bright yellow; fore wing

with broad orange apical band similar to the preceeding species ..... Anthocharis damone syra

11. Length of fore wing from base to apex exceeding 25 mm. 12

Length of fore wing from base to apex less than 25 mm. 14

12. Upper surface of fore and hind wings clear greenish - white, devoid of all black markings .. Catopsilia florella

Upper surface of fore and hind wings white with conspicuous black margins 13

13. Fore and hind wings with conspicuous black veins .... Aporia crataegi hyalina

Fore and hind wing veins not pigmented; fore wing with black apex; hind wing with black or dark brown spot on costal margin ..... Pieris brassicae verna

14. Under surface of hind wing with a distinct greenish pattern composed of yellow and black scales 15

Under surface of hind wing either lacking a distinct pattern or if pattern present it is not greenish 18

15. Apex of fore wing distinctly black or brownish interrupted by scattered white spots; discal spot on upper and lower surface of fore wing divided by a narrow white line or bearing a white center 16

Apex of fore wing with a pattern of scattered black or brown spots which are not contiguous; discal spot not divided by white line or with white center .... Synchloe callidice chrysidice

16. Proximal margin of apical pattern of fore wing stongly irregular; color pattern on underside of hind wing interrupted preapically by a more or less continuous band

of white ..... Pontia daplidice laenas

Proximal margin of apical pattern of fore wing partically straight; color pattern on underside of hind wing either reticulated or interrupted by more than one band of white 17

17. Color pattern of underside of hind wing basically greenish, interrupted by scattered spots of pure white of varying size and shape; not forming distinct light bands; anal margin of hind wing gently curved .....
.....Euchloe ausonia crameri

Color pattern of underside of hind wing as above but interrupted by numerous complete and incomplete bands of white; anal margin of hind wing almost straight (Fig 10)
..... Euchloe belemia palestinensis

18. Under surface of fore and hind wings with a distinct pattern; pattern of hind wing consisting of a narrow marginal band and large white spots separated by bands of brown scales which outline all of the veins .....
.....Belenois mesentina

Under surface of fore and hind wings lacking a distinct pattern or if a pattern is present it is limited to a few spots or patches of dark scales on a field of white or creamy yellow 19

19. Discal cell very small, one-third to one-fourth the length of the wing (Fig. 11) 20

Discal cell normal in size, about one-half the length of the wing (Fig. 7) 21

20. Upper surface of fore and hind wings more or less pure white; apex of fore wing bearing a conspicuous brownish or grayish apical spot; under surface of hind wing dusky gray due to a scattering of darker scales .. Leptidia sinapis deserticola

Upper surface of fore wing white with yellowish tinge basally and a dark apical spot, the posterior margin of which extends caudally along the wing margin; upper surface of hind wing strongly suffused with yellow; under surface almost completely covered with dusky scales ....Leptidia lathyri aestiva

21. Wing veins outline in dark scales, especially on the ventral surface of the fore wing; under surface of hind wing suffused with grayish and cream colored scales interrupted by radiating streams of light yellow in the cells .... Pieris napi pseudorapae

Wing veins not outlined in dark scales on either the upper or the lower surface; pattern on under surface of hind wing not as described above 22

22. Under surface of wings devoid of black markings; apex of fore wing with faint dark margin but dark spot in cell M_3 of fore wing always reduced and usually absent ..Pieris ergane

Under surface of wings suffused with dark gray and cream-colored scales; apex of fore wing bearing a conspicuously darkened margin; dark spots present in cell M_3 of fore wing and on leading margin of hind wing on the upper surface and cell M_3 and Cu_2 of fore wing on under surface .... Pieris rapae leucosoma

23. Base color of upper surface of wings yellow, orange, or salmon, sometimes in combination with black; if white, suffused with yellow, the margins of the wing are ornate 24

Base color of upper surface of wings white, translucent tinged with pink or sometimes tinted with yellowish scales, almost always in combination with black or blackish-brown 30

24. Length of fore wing from base to apex usually exceeding 25 mm; wings never salmon colored dorsally 25

Length of fore wing from base to apex usually less than 25 mm; wings salmon colored; on dorsal surface brown spots form marginal and subapical bands on the fore wing, and brown marginal spots tip the veins on the hind wing .... Teracolus fausta

25. Outer margins of wings ornate; apex of fore wing pointed; hind wing with pointed marginal extension at apex of Cu_1 (Fig. 1) 26

Outer margins of wings not ornate as described above 28

26. Upper surface of fore and hind wings yellowish-white; hind wing deeper yellowish than fore wing; ventral surface of wings deeper yellow than upper surface .... Gonepteryx cleopatra taurica

Upper surface of wings lighter than in the above species color of fore and hind wing of equal intensity 27

27. Upper surface of fore and hind wings light yellowish white throughout; discal spot on fore wing reduced and frequently absent ..... Gonepteryx farinosa

Upper surface of fore and hind wings light yellowish white

tending toward a deeper yellow on the apex of the fore wing not conspicuously reduced .. Gonepteryx rhamni meridionalis

28. Black markings on wings restricted to conspicuous discal spot and narrow costal and apical bands on fore wing and a few scattered marginal spots on hind wing; remainder of upper wing surfaces clear chrome yellow ..... Catopsilia florella

Black markings of upper surface of fore and hind wings conspicuous forming a bold pattern unlike that described above 29

29. Discal spot on upper and lower surfaces of fore wing large; discal spot on upper and lower surfaces of hind wing double; lower surface of hind wing greenish-yellow; post marginal band of yellow on upper surface of hind wing not extending to anal margin ..... Colias croceus

Discal spot on upper and lower surface of fore wing small; discal spot on upper and lower surfaces of hind wing single; lower surface of hind wing grayish-green; post marginal band of yellow on upper surface of hind wing extending to anal margin ..... Colias aurorina libanotica

(Note: It is not known if the female of this form is dimorphic in Lebanon. No effort is made to treat a white form in this key. White females with a single discal spot on the hind wing would probably be referable to this species.)

30. Pattern of wings consisting only of heavily pigmented wing veins; wings translucent, suffused with pinkish cast .....
.....Aporia crataegi hyalina

Pattern of wings composed of scales; wing veins not pigmented; wings opaque 31

31. Fore wing in excess of 25 mm 32

Fore wing less than 25 mm 33

32. Pattern of upper surface of wings consisting of a black apical portion of the fore wing, large black spots in cells M_3 and Cu_2 and a more or less distinct blackish band along the anal margin; hind wing with a single black spot at the apex of Rs ..... Pieris brassicae verna

Pattern of upper surface of wings consisting of conspicuous brownish black apico-marginal band on fore wing interrupted by a series of oval, white spots; hind wing with a similar, interrupted marginal band; venation of under surface of hind wing outlined in brownish black scales ... Belenois mesentina

33. Wings white dorsally, under surface of hind wing with a distinct greenish pattern composed of yellow and black scales 34

Wings white dorsally under surface of hind wing either lacking a distinct pattern or if a pattern is present it is not greenish 40

34. Apex of fore wing distinctly black or brownish interrupted by scattered white spots; discal spot on upper and lower surface of fore wing divided by a narrow white line or bearing a white center 35

Apex of fore wing with a pattern of scattered black or brown marginal spots whose mesal extensions along the veins meet a narrow apical band interrupted in Cu_2. Broad discal spot ...

..... Synchloe callidice chrysidice

35. Proximal margin of apical pattern of fore wing strongly irregular; color pattern on underside of hind wing interrupted preapically by a more or less continuous band of white, upperside of hind wing with brown scales along the veins ..... Pontia daplidice laenas

Proximal margin of apical pattern of fore wing practically straight; color pattern on underside of hind wing either lacking, reticulated or interrupted by more than one band of white 36

36. Underside of hind wing patterned 37

Underside of hind wing uniformly covered with yellow and brown scales except for yellow discal spot .....
..... Anthocharis charlonia mesopotamica

37. Pattern on underside of hind wing reticulated; anal margin of hind wing gently curved 38

Pattern on underside of hind wing of white stripes; anal margin of hind wing almost straight (Fig. 10) .....
..... Euchloe belemia palestinensis

38. Upperside of discal band of fore wing extending to costal margin .....Euchloe ausonia crameri

Upperside of fore wing with discal spot 39

39. Underside of fore wing yellow apically..Anthocharis damone syra

Underside of fore wing not yellow apically or if so, only slightly ..... Anthocharis cardamines phoenissa

40. Discal cell reduced, one-third to one-fourth the length of the wing (Fig. 11) 41

Discal cell normal, about one-half the length of the wing (Fig. 2) 42

41. Upper surface of fore and hind wing more or less pure white; apex of fore wing bearing black or brown scales along veins on the apex of the wing, underside of hind wing dusky gray.. ..... Leptidia sinapis deserticola

Upper surface of fore wing with yellowish tinge basally, a dark apical spot, dusky scales scattered on underside of fore and hind wings ..... Leptidia lathyri aestiva

42. Fore wing with conspicuous brown spots in cells M_3 and Cu_2 and occasionally on hind wing at the tip of Rs; wing veins outlined in dark spots, especially on the ventral surface of the hind wing which is yellow except for the anal cells .... Pieris napi pseudorapae

Fore wing with irregular spots in cells M_3 and Cu_2, spots distinct or absent on hind wing at tip of Rs; wing veins not outlined in dark scales on either the upper or lower surfaces; yellow found on ventral surface at apex of fore wing and covering hind wing 43

43. Upperside of fore wing with black and brown scales on apex; irregular spot in cell Cu_2 often extending mesally along anal edge, reduced brown scales at base ..... Pieris ergane

Upperside of fore wing suffused with yellow, irregular spot rarely extending mesally along anal edge, brown scales extending distally from base of both fore and hind wings ... . Pieris rapae leucosoma

Aporia crataegi hyalina Röb., 1907

Röber in Seitz, Macrolepidoptera of the World, 1:40

This is one of the largest pierids found in Lebanon. Forms of it occur in Europe east to northern Asia and south to North Africa except Egypt.

Adult Male (Figs. 12, 14)

Head: The antennae are composed of yellow segments covered with dark brown scales except at the apex of the club where the scales are missing. The vertex is covered with long, stiff, black and white hairs, which are particularly dense anterior to the antennal bases and become less so posteriorly. Short white hairs rim the caudal margin of the eye. Ventrally the head and maxillary palpi are clothed with white pubescence. On the ventral surface of the palpus these hairs form a fringe which extends to the apex.

Thorax: Dorsally, the black nota are clothed with white pubescence. Ventrally the sternites and proximal leg segments are covered with white scales and hairs. The hairs extend onto the ventral surface of the femur where they form a dense fringe. On the tibia and tarsus the vestiture of short dark brown and white hairs incompletely clothes the underlying black integument.

Abdomen: The abdomen is bicolored. Dorsally, in worn speciments the black tergites show through the pearl gray pubescence. This pubescence appears most dense on tergites I to III. Caudally the hairs are short and reduced to a median fringe. A similar white fringe is found ventrally, bisecting the white-scaled sternites and abdominal apex.

Wings: (Fig. 2) The dorsal surface of the fore wing is white. Dark brown scales cover the costal margin and line the dark brown veins, except at the distal ends where they spread into the adjacent cells to form a scalloped edge. Several rows of dark brown scales form a band at the apex of the discal cell. Fine long white hairs covering the base and proximal tip of the anal cell add a shagginess to the medial area.

The hind wing is white and in some specimens tends toward pale yellow. The dark brown veins are less pronounced where white scales cover them. The pattern is similar to the fore wing except that a narrower band with less defined scallops covers the distal margin. A layer of fine, long white hairs give a haziness to the proximal portions of the cells posterior to Cu_1. In the majority of specimens in the collection distal brown and white scales are lacking.

The ventral surface of the fore wing is covered with white scales. The dark brown veins are bordered on either side by a double or triple row of brown scales. The base color of the ventral surface of the hind wing is also white with fewer but larger dark brown scales edging the veins and scattered within cells M_1, M_2, M_3, and Cu_1.

Adult Female (Fig. 13)

The characteristics of the female are similar to those described for the male. There are fine yellow-orange hairs covering the pronotum. The central area of the fore wing is transparent, mainly due to the loss of scales and the distance between those which remain. In cells 2A and 3A of the hind wing

and along the marginal areas white scales appear quite dense.

Females in the collection show the typical transparent wings ascribed to the subspecies hyalina from the Taurus Mountains of southern Asia Minor. In addition, both preserved and living material show a distinct reddish cast to the wings unlike that noted for any other form. Ellison and Wiltshire (1939) speculate that this is but another example of the tendency toward reddish coloration so typical in other heteroceran species in Lebanon. In any case the presence of red pigment in the wings of the female renders the Lebanon population quite distinct.

Egg

The egg of this species is yellow, conical and is deposited on species of Prunus, Pyrus, and Crataegus.

Larva

The larva has a black head. The body is mainly "ashy gray" with a black dorsal area and with two orange-yellow or brown-red stripes. A lateral reddish-yellow line lies just above the black thoracic and anal legs.

Pupa

The pupa is whitish covered with dots arranged in "star formations".

Remarks

Bodenheimer (1935) states that A. crataegi never dies out in Palestine, being reinforced by immigrants from the north every few years. Why such reinforcement does not occur annually is not clear and his statement is probably a lapsus so typical of this author's writings. He further states that it is unknown whether this immigration takes the form of an organized migration or is simply

an overflow from adjacent highly populated areas.

According to Wiltshire (1957) this species is common at medium altitudes in Iraq, occuring as a single generation which flies during May and June. Hibernation probably occurs on the food plant during the larval stage.

Material Examined

Ain Zhalta	1000 m	12-V-1963	2	♂
Ammik	1000 m	6-V-1963	6	♂
Bweirj	1300 m	26-V-1963	22	♂ 5 ♀
Chtaura	1000 m	3-V-1963	1	♂

Pieris brassicae verna Zell., 1847

Pieris brassicae verna Zeller, 1847, Isis, 222.

Pieris brassicae catoleuca Röber, 1896, Ent. Nachr. 22:81.

This is the largest species of the genus Pieris. Forms of it occur from the Azores and Canary Islands eastward through the Palearctic Region except high northeast Asia.

Adult Male (Fig. 15)

Head: The antennae are yellow, covered with dark brown and occasionally white scales. The club is oval consisting of yellow segments, each bearing a brown apical margin. The vertex is covered with white and black hairs and is particularly hirsute anterior to the bases of the antennae. Yellow and white hairs rim the caudal margin of the eyes. Ventrally the cephalic region and the maxillary palpi are clothed with white pubescence. The ventral surface of the palpus is shaggy, with a black apex.

Thorax: Dorsally, the black nota are clothed with pearl gray

pubescence. The ventral surface and leg bases are covered with white scales and hairs. The few remaining hairs on the distal segments of the legs are short, exposing the dark brown integument of the basal tarsal segments and the tan integument of the terminal ones.

Abdomen: The abdomen is bicolored. Dorsally, in worn specimens, the black tergites show through the pearl gray pubescence. This pubescence is extremely dense on tergites I-III. Caudally it is reduced and replaced ventrally by white scales. The sternites and the apex of the abdomen are covered with white scales and hairs which form a median fringe.

Wings: Dorsally both fore and hind wings are covered and fringed with white scales and show varying degrees of dark brown and gray extending from the proximal edge distally. On the fore wing brown scales cover the base and costal margin increasing toward the apex. They form a band with a concave scalloped proximal edge which extends from the end of Sc to the middle of cell Cu_1. The concavity of the scallops is emphasized by brown scales extending mesally along the veins from the proximal edge of the band.

The hind wing is white except for a triangular spot on the costal margin near the distal end of Sc + R_1. Dark brown scales are scattered from the mesal edge laterad into the proximal areas of the cells in all but one-fourth of the samples examined. Specimens caught in July lack these brown scales and possibly represent a later generation. In one-half of the samples a brown band of one or two rows of scales extend laterally from the distal spot to the apex.

Ventrally the fore wing is covered with white scales mesally, with light yellow scales along the costal margin increasing apically to form a narrow band which extends from the tip of Cu_1 to 2A. There are large brown spots in cell M_3 and Cu_2.

The hind wing is covered with light yellow scales centrally and deep yellow scales along the edge of the frenular lobe and costal margin. Black scales are scattered throughout the cells, while black hairs trim the costal margin. The light yellow scales and lack of black scales in cell 3A contribute to the dorsal whiteness of this cell.

Adult Female (Fig. 16)

The characteristics of the female are similar to those described for the male with the following exceptions. The scallops in the proximal edge of the apical band of the fore wing are convex, separated by identations formed by the white scales lining the veins. Two large brown distal wing spots of equal size are present in cells M_1 and Cu_2. Brown scales scattered laterad along the anal margin terminate distally in a small oval spot in cell 2A. More gray scales are found proximally.

Ventrally the hind wing of the three female specimens examined show significant reduction in the number of black scales and the basic color is cream. There is a small triangular brown spot in cell Rs.

Egg

The eggs of this species are yellow and conical. They are deposited in large numbers on the underside of the leaves of species of Brassica, Lepidium, Capparis, Beta and Tropaeolum. Since these plants are most frequently encountered near human settlements and

agricultural areas the adults occur more commonly there.

According to Seitz (1909) only a small percentage of the eggs develop into adults. Part of this mortality is attributable to ichneumonid and braconid parasites of the larvae and pupae. While no mention is made in the literature to the possibility of parasite dammage to the eggs, they are almost certainly host to various species of chacidoid hymenopterans.

Larva

The larva has a gray head with black spots. The body is bluish-green with yellow dorsal and lateral stripes and a gray ventral surface. All surfaces are black-spotted and the legs are paler than the ventral aspect. They are said to be repugnant and possibly poisonous to avian predators.

Pupa

The pupa is yellow-green with black spots and bears a number of small tubercles on its dorsal surface. Cephalically it bears an obtuse process.

Remarks

This species is reported to be of economic importance in certain parts of Europe and Asia. Wiltshire (1957) records that this is the case in Iraq.

Seitz (1909) states that the summer form is larger and possesses larger black spots and a lighter underside of the hind wing. The latter character is possibly due to the reduction in the number of black scales as noted in Lebanese females collected during July.

Ellison and Wiltshire (1939) state that P. brassicae is plentiful in Lebanon near cultivation and occurs from the coast to elevations of 1500 meters or more. Although they do not mention

its occurence in the Bekaa it has been noted more or less commonly there during the spring.

In Palestine Bodenheimer (1935) states that this species is common on the coastal plains during the winter and spring but disappears in July when the temperature exceeds 26°C. It reappears in late September to December as immigrants arriving from the north and can pass through as many as five generations by the following July. A similar population cycle is said to exist in the hills.

Individuals of this butterfly are known to migrate. Wiltshire (1957) mentions migrating swarms in the northern countries but states that a similar phenomenon has not been noted in Iraq. Although Bodenheimer does not mention migrations of large numbers he does state that migrating individuals come to Palestine from the north and that if the species occurs as far south as Egypt it is only in isolated cases.

In Lebanon P. brassicae has been seen on the wing throughout the winter and spring months along the coast. At higher elevations and in the Bekaa it appears to occur in the adult stage only during the spring, and perhaps, in very reduced numbers during the early summer. It is thought to overwinter in the pupal stage and to attain three to four generations only in the coastal regions.

Material Examined

American University Campus	SL	4-IV-1963	1 ♂	
Aramoun	577 m	26-VII-1964		2 ♀
Haouchab	250 m	6-V-1963	1 ♂	
Hammana	1500 m	23-V-1964	2 ♂	
17-VII-1964	2 ♂ ;	19-VII-1964		1 ♀

Nahr Ibrahim	500 m	24-VII-1964	1 ♀
Nahr el Kelb	100 m	2-V-1963	1 ♂

Pieris rapae leucosoma Sch., 1905

Schawerda, Verh. Zool. bot. Ges. Wien, LV:514

Forms of this species occur throughout the world. Individuals are abundant. In areas where they occur their larvae do considerable damage to certain crops.

Adult Male (Fig. 17)

Head: In living material the eyes are a luminous greenish gray. The antennae are composed of yellow segments covered with brown and white scales. The flagellum varies from totally brown or white to a mixture of both. In the majority of specimens the intermediate condition exists and the flagella appear checkered. The clubs are flattened, spoon-shaped and are brown with a scattering of white scales. The apices are naked as are many areas on the flagella. In these areas the brown rimmed yellow segments are exposed.

The vertex is covered in varying degrees by black and white hairs, which, in twenty-five specimens, appear tufted anterior to the antennal bases. Posterior to the origins of the antennae the hairs are reduced or absent. Through this sparse vestiture can be seen the black integument of the vertex and the white scales bordering the caudal edge of the eye. In some specimens there is a scattering of yellow scales and a pale creamy tinge to the hairs on the caudal margin of the head. Long white hairs cover the underside of the head and maxillary palpi. On the palpus they are

mixed with black hairs and form a fringe on the ventral surface leading to the apex.

Thorax: Dorsally, pearl gray pubescence covers the nota and ventrally, white scales and hairs cover the black sclerites and proximal leg segments. The long white hairs extend onto the femur forming a ventral fringe. Only a few short white hairs remain on the tibia and tarsus. In the naked areas the tan integument of these terminal segments is exposed.

Abdomen: The upperside of the abdomen is black and blends laterally into gray depending on the degree of pearl gray pubescence remaining on the tergites. Tergites I to III appear to be the last sclerites to loose their hairs. The more caudal tergites which have lost most if not all their pubescence still appear gray from a scattering of white scales. This gray blends into white on the underside where a dense layer of white scales and hairs covers the sternites. The hairs form a medial fringe.

Wings: (Fig. 7) The dorsal surfaces of both fore and hind wings are ivory white with a dusky bases. The degree of duskiness depends on the number of brown and black scales covering the alar sclerites and extending into the proximal portions of the adjacent cells. Ivory white scales form an inconspicuous fringe on both distal and anal margins.

On the upper side of the fore wing scattered dark brown scales fill the costal cell and line the costal margin. Others cover the apex of the wing in a pattern similar to that found in the males of P. ergane. A circular or irregular spot of brown and gray scales appears medially in cell M_3.

On the upper surface of the hind wing there is a yellow cast to the ivory white. Brown scales extending distally into the posterior cells are scattered on a white background. In the majority of males there is a small irregular brown spot, or the remains of one, on the apical margin immediately beyond the tip of R_5.

The underside of the fore wing is also ivory white. A few dark brown scales are scattered at the base and costal margin and extend faintly to the apex which is covered with pale yellow scales. Pale yellow hairs and scales line the anterior edge and costal cell to a varying degree.

On the underside of the hind wing the interneural areas are covered with yellow or pale yellow scales except for cells 2A and 3A. A few fuscous scales are scattered mainly in the proximal area. Scattered yellow scales cover the proximal edge of the costal margin. Eleven male specimens are conspicuously marked. Thirteen male specimens lack this yellow section. Of the six females in the collection only one shows an edge distinctly darker than the surrounding background.

In six specimens (five males and one female) the anterior inner margin of the proximal portion of the discal cell is covered with yellow scales. These individuals appear to fit Seitz's (1909) description of P. rapae leucosoma. However, additional collections are required before P. r. leucosoma can be considered to represent a third brood as suggested in Seitz (1909) in connection with ssp. leucosoma.

Adult Female (Fig. 18)

The characteristics of the female are the same as those described for the male with the following exceptions, which are mainly found on the dorsal surface of the fore wing. The brown scales extend farther into the cells, especially the discal cell. The brown apex is broader and two dark brown medium-sized spots lie in direct alignment with one another in cell M_3 and Cu_2. A few brown scales may extend from the base along the anal margin faintly connecting with the spot in cell Cu_2, but it is not as conspicuous a connection as in the female of P. ergane.

The dark brown irregular spot on the hind wing at the tip of rs. is a conspicuous third in line with the two cellular spots in the hind wing.

Egg

The egg of this species is yellow and pearshaped. It is covered by longitudinal ribs and forty-six transverse folds. The eggs are deposited singly on cabbage and Reseda.

Larva

The larva has a brownish-green head. The body is velvety, dull green, paling laterally into a yellowish green venter. A thin line is found dorsally while laterally a narrow yellow stripe in which the black stigmata are located extends the length of the body.

Pupa

The pupa is yellowish, green-gray or brownish with three yellow stripes.

Remarks

According to Ellison and Wiltshire (1939) P. rapae leucosoma

is abundant everywhere. Higgins (1964) elevated leucosoma to a full species and stated that he had collected worn specimens belonging to the first generation at Chtaura and Becharre. He further stated that a few specimens of Pieris rapae from near Beirut are in the Ellison collection but, he had not noted the species anywhere in the mountains. He seems to have since revised his opinions concerning the status of leucosoma and in a recent communication refers to it as a subspecies of P. rapae. He has apparently been unable to compare individuals from different seasonal generations and states that the seasonal variation in this species in Syria is not well defined.

Pieris rapae flies throughout the year in the coastal regions of Lebanon although it is less common during the late summer and autumn, and has been noted on the wing even during the winter months. Until such time as sufficient collections have been made to indicate the amount of seasonal and individual variation in this species in the eastern Mediterranean countries, its subspecific identity must remain a moot question.

Material Examined

Ain Zhalta	1100 m	12-V-1963	11 ♂	
Aramoun	577 m	26-VII-1964	2 ♂	1 ♀
Antelias	250 m	2-VIII-1964	1 ♂	
Barouk	1000 m	3-V-1963	1 ♂	
Beirut	SL	23-III-1963	1 ♂	
	148 m	31-VII-1964	11 ♂	
Damour	400 m	27-III-1964	2 ♂	1 ♀
		7-IV-1963	4 ♂	

Hammana	1500 m	23-V-1964	1	♂		
12-VII-1964	1	♀ ,	17-VII-1964	2	♂	1	♀
19-VII-1964	1	♂ ,	23-V-1964			1	♀
Haouchab	250 m	6-IV-1963	4	♂		
Hrajel	1300 m	5-V-1963	1	♂		
International Airport	SL	24-III-1963	1	♂		
Nahr el Kelb	100 m	2-V-1964	1	♂	1	♀
2-V-1964	150 m	1 ♂,	23-V-1964	200 m	2	♂	

Pieris ergane Hubn., 1827

Hubner, Eur. Schmett. I, t. 184, figs. 904-907.

According to Spuler in Seitz (1909) forms of this species occur from Italy to southeastern Europe and Asia Minor.

Adult Male (Fig. 19)

Head: The antennae and flattened spoon-shaped clubs are composed of yellow segments covered with dark brown and occasionally white scales. This covering lends a striped appearance to the flagellum. The club is primarily brown except for the yellow apex where the scales have been lost. A combination of black and white hairs covers the vertex, which is particularly shaggy anterior to the antennal bases and at the caudal margin. Dorsally, the pubescence is reduced or lacking, revealing the black underlying integument or the short white hairs bordering the caudal margin of the eye. Ventrally the head region is clothed with white hairs. The maxillary palpi are clothed with white and black hairs. On the ventral surface these hairs form a fringe which extends to the black apex.

Thorax: Dorsally, the black nota are clothed with blue grey pubescence. The black ventral sclerites and leg bases are covered with white scales and long white hairs. These hairs extend onto the ventral surface of the femur to form a fringe. The sparse vestiture of short white hairs on the tibia and tarsus exposes the tan-colored integument of the distal leg segments.

Abdomen: The abdomen is bicolored. Dorsally the shaggy appearance results from the fine pearl grey pubescence which is particularly long and dense on tergites I to III. Ventrally the sternites and apex of the abdomen are densely covered with white scales and hairs. The hairs on a laterally flattened dried abdomen form a medial fringe.

Wings: The upper surfaces of both the fore and hind wings are ivory white with dusty bases. The only variation lies on the fore wing where brown scales either line the costal margin, are scattered in the costal cell or cover the apex of the wing.

On the ventral surface variation from the dorsal pattern is seen on the hind wing. On the fore wing white scales spread over the entire surface. A few scattered black scales extend from the base along the main veins, while others occur at the ends of the veins anterior to M_3. The base color of the hind wing is pale yellow. Brown scales are scattered along and occasionally between the veins. However, the scales are most dense along the cubital, radial and subcostal veins.

Adult Female (Fig. 20)

The characteristics of the female are similar to those described for the male with the following exceptions. On the

dorsal surface of the fore wing two brown medium-sized spots lie in alignment in cells M_3 and Cu_2. In addition the black scales at the base of the wing extend farther into the cells than in the male. The dark brown or black apical tips are narrower extending to M_1 rather than M_3.

On the ventral side of the hind wing the yellow areas appear more distinct, in particular the costal margin. On the fore wing the scales are translucent white allowing the dorsal pattern to show through except on the yellow - tipped apex.

Egg

No information.

Larva

According to Spuler (in Seitz, 1909) the larva has a bluish - green head with pale brown mouthparts. The thoracic legs are bluish - green, as is the body, which is also dotted with numerous small white hairy warts. "The stigma-line is represented on each segment by a yellow spot in which is situated a dark brown edged light brown stigma". The crochets are light brown as are the soles of the prolegs.

Pupa

No information.

Remarks

According to Wiltshire (1957) this species has three to four generations annually in Iraq, but information is lacking concerning the number of generations in Lebanon.

This species appears to inhabit the higher altitudes in Lebanon since the majority of specimens were taken from above nine hundred meters.

Material Examined

Barouk	1000 m	3-V-1963		2 ♀
Chtaura	904 m	21-IV-1963	2 ♂	
Chtaura	1000 m	3-V-1963		1 ♀

Pieris napi pseudorapae Ver., 1908

Verity, Rhop. Pal., pp 144, 166.

Forms of this species are found in Europe and North Africa east to Asia except for the southern part.

Adult Male (Fig. 21)

Head: The antennae consist of yellow segments, covered with dark brown and occasionally white scales which causes the flagellum to appear striped. The flattened, spoon-shaped club is brown except for a yellow apex where the scales have been lost. In the majority of specimens scales are also absent from the ventral surface. A combination of black and white hairs covers the vertex. The hairs are particularly bristly anterior to the antennal bases. In the majority of specimens this pubescence is reduced or absent posterior to the origins of the antennae which exposes the black underlying integument or short white hairs bordering the caudal margin of the eye. Ventrally the head region is clothed with white hairs. The maxillary palpi are clothed with white and black hairs. On the ventral surface these hairs form a fringe which extends to the black apex.

Thorax: Dorsally the black nota are clothed with blue-gray pubescence. The black ventral surface and leg bases are covered with white scales and long white hairs. These, with a few black hairs, extend onto the ventral surface of the femur and form a

fringe. The tan-colored integument of these distal leg segments may be seen through the sparse vestiture of short white hairs on the tibia and tarsus.

Abdomen: The abdomen appears bicolored. Dorsally the tergites appear shaggy from the covering of fine pearl-grey pubescence which is particularly long and dense on tergites I to III. Ventrally the sternites and apex are densely covered with white scales and hairs. Occasionally, the hairs on the abdomen form a medial fringe. In the majority of specimens the presence of an abundance of pubescence on the dorsal surface suggests that the specimens might have been caught soon after emergence. In one-third to one-half of the individuals the gray appearance of the abdominal segments or apex is due to the reduced number of white scales.

Wings: Superficially this species differs from P. ergane in the pattern on the upper surface of the fore wing. The apical band appears darker in these specimens than in P. ergane and broader due to the fact that the brown scales which cover the veins extend mesally from the band for a short distance. The base color is translucent white which allows the dark brown scales lining the veins on the ventral side to show through. Similarly, black scales cover the wing bases and extend along the costal margin. In one or two specimens there is a faint suggestion of a dark brown spot showing through in cell Cu_2.

On the upper surface of the hind wing the veins appear more prominent and have a grey cast to them. This is a result of the brown scales which line the veins on the ventral surface showing through. The joint cubitus and medial vein which borders the

posterior edge of the discal cell appears more distinct, due to the veins branching laterally and posteriorly from it. The veins appear to taper distally being more heavily scaled at their proximal ends. Although black scales cover the wing bases to about the same degree to which they are covered in P. ergane, the area appears greater because the black scales extend further distad along the veins. The base color and veins in all male specimens except two is pale yellow. In only four specimens were the two brown spots present in cells M_3 and Cu_2 of the fore wing. Eight individuals were lacking all the spots and the remaining specimens bear either one or two spots. It appears that the last dark brown scales to be lost are those along the margins of the yellow veins on the hind wings. The majority of specimens collected in Chtaura in March show this hind wing pattern.

On the upperside of approximately half of the specimens scattered brown scales line the distal ends of the veins.

Adult Female (Fig. 20)

The characteristics described for the male are similar to those of the female with the following exceptions. Dorsally on the fore wing there are more dark brown and grey scales extending from the base into the proximal portions of the cells. In fresh specimens the dark apex appears more prominent. Two medium-sized dark brown spots lie distally in cells M_3 and Cu_2. The second is more irregular and oval-shaped, appearing connected to the base by a loose row of brown and grey scales which extend to the base along the anal margin.

On the hind wing a dark brown spot in rs lies in line with

the spots on the fore wing. Two specimens have a pale yellow cast to their wings produced by a deeper yellow base color on the ventral surface. Ventrally, it appears that black scales are absent in the anal cells. The base color and brown spots appear fainter than in the males.

Egg

The egg is greenish and pear-shaped. They are deposited singly.

Larva

The larva appears "dirty green" and is densely covered with short hairs. A yellow stripe is found above the legs. It also has small white tubercles, black dots and black stigmata with yellow edges. The larvae feed on cabbage, Reseda and various Cruciferae.

Pupa

The pupa is greenish yellow with black spots and dots.

Remarks

There appears to be some indecision concerning the status of this form. It is variously considered to be either a subspecies of P. napi or a full species. P. pseudorapae does not appear in Seitz (1909) as a species or subspecies of Pieris.

Wiltshire (1957) mentions that it is an inhabitant of the mountains and appears in Iraq in three or four successive generations.

According to Higgins (1964) he mentions in his "comments upon the more interesting species collected, Pieris pseudorapae Verity as being a common insect in the fruit orchards near Chtaura, and

[that] we took specimens commonly in the mountains. [He further adds that] it is unlikely that P. napi Linne will be found in the Lebanon". He also comments (pers. comm. 1967) that "Artogeia [Pieris] napi Linnaeus, 1758 [is] common in orchards etc. in the form pseudorapae Verity, [should] best [be] regarded as a subspecies, [differing from] Warren [who] would place it as a separate species. The illustration of P. pseudorapae Verity male Higgins (1964) has lost the majority of dark brown scales on the dorsal surface. The only slightly grayish areas are along the proximal costal margin and in cell M_3. A yellowish cast appears to suffuse the hind wing except for the anal cells.

Although there is more material for this species than for others, additional material is needed to suggest seasonal variation. The species occurs on both sides of the Lebanon Mountains from March through May at sea level and 1000 m, and at 1600 m in June.

Material Examined

Antelias	50 m	31-III-1963	1 ♂	
Chtaura	904 m	31-III-1963	1 ♂	
		21-IV-1963	6 ♂	
22-III-1964	1000 m	15 ♂ 2 ♀; 3-V-1963	8 ♂	
Damour	400 m	27-III-1964	2 ♂	1 ♀
		7-IV-1963	1 ♂	
International Airport	SL	24-III-1963		1 ♀
Nahr el Kelb	100 m	2-V-1963		1 ♀
Natural Bridge	1600 m	2-VI-1963		1 ♀
"Unmarked Chtaura"		V-1962		1 ♀

Pontia daplidice laenas Forsk., 1908

Forskal., Ent. Zeit., 22:12, p.51.

According to Seitz (1909) this species was originally placed in the Genus Leucochloe by Rober. Forms of it occur throughout the Palearctic region except the "high north".

Adult Male (Fig. 24)

Head: The antennae consist of yellow segments covered with dark brown and white scales, with the exception of the apices which are naked and yellow. The vertex is covered with white hairs and a scattering of black stiff hairs. In these specimens most of the pubescence has been lost from the area posterior to the antennal bases and before the caudal margin. Ventrally the cephallic region and maxillary palpi are clothed with white pubescence. On the ventral surface of the palpus black hairs are scattered among white ones lending a gray cast to the marginal fringe which extends to the black apex.

Thorax: Dorsally the nota are clothed with a pearl gray pubescence except in worn specimens where the black integument is exposed. The ventral sclerites and leg bases are black covered with white scales and hairs. In less worn specimens the few remaining white hairs on the ventral surface suggest the presence of a fringe. The vestiture of white hairs on the tibia and tarsus exposes the brown integument of the distal segments.

Abdomen: The abdomen is bicolored. Dorsally the black tergites show through the pearl gray pubescence which appears most dense on tergites I to III, and is reduced or absent on the more caudal segments. Ventrally the sternites are covered with

white scales and a few scattered white hairs.

Wings: (Fig. 5) The base color of the dorsal surfaces of both the fore and hind wings is ivory white. Both have proximal dusky bases and a fringe of white scales along the distal and anal margins. There is a brown pattern on the fore wing. A scattering of dark brown scales along the costal margin and in the discal cell extends distally to form a double-banded discal spot. A dividing line of white scales covers the base of M_{2+3}. The apex is covered by a narrow irregular preapical band which extends caudad from the costal margin narrowing in cell M_2 and expanding in M_3. Other scales form circular brown spots at all the vein tips from R_{2+3} posterior to and including Cu_1. These marginal spots are joined to the preapical band by brown colored vein segments intersecting both bands.

The white scales on the hind wing are translucent allowing the ventral pattern to show through. Only a few scattered brown scales remain on the distal tips of veins M_1, M_2, M_3, and the inteneural areas.

Ventrally the base color of the fore wing is white. A combination of yellow and brown scales form the pattern on the ventral surface. A small faint spot of scattered brown scales forms a distal spot in Cu_2.

The ventral surface of the hind wing is covered by an olive green pattern with the exception of the anal cell. This is produced by a combination of yellow and brown scales. Interspersed white areas define the design. Scattered yellow scales trim the frenular lobe and cover the veins. The brown and yellow scales

extend from the base of the wing along the main veins and cover the bases of M_{2+3} which define the apex of the discal cell. Another group of scales form an undulating band from which knob-like spots extend forming distal points which cover the apices of the veins.

Adult Female

None available.

Egg

No information.

Larva

The larva has a yellow head. The body is bluish gray with a blue-gray venter and a pair of longitudinal stripes on each side. It feeds on seeds of species of Reseda, Turritus, Sisymbrium Sinapis, and Alyssum.

Pupa

The pupa is either green, brownish or gray with lateral yellowish - white abdominal stripes.

Remarks

This species is known to occur from May through August on the coastal plain and at various altitudes up to 2500 meters in July.

Additional information is needed to discover if this is a resident of the coastal plain, as is true of the populations inhabiting the oases in Iraq. In Iraq individuals are seen from spring to early summer on the desert and from spring to autumn in the mountains (Wiltshire 1957).

From the specimens in the collection it appears that in

Lebanon this species occurs at varying altitudes from sea level to 2500 meters and has been taken from May through August.

Material Examined

Antelias	50 m	13-V-1964	1 ♂
Aramoun	577 m	26-VII-1964	1 ♂
Ghebaleh	1100 m	7-VIII-1964	1 ♂
Becharré Cedars	2000-2500 m	15-VII-1963	1 ♂
Nahr Ibrahim	500 m	24-VII-1964	1 ♂

Belenois mesentia Cr., 1777

Cramer, Pap. Exot. III, p.140.

According to Seitz (1909) forms of this species are found in Africa, eastward through Syria, Arabia, Persia, India and presumably in Kashmir and Tibet. It is not a common species in Lebanon and no recently collected material is available.

Adult Male

Head: The antennae consist of yellow segments covered with reddish brown scales and a scattering of white ones. The vertex is primarily covered with long white hairs interspersed with brown ones which are in four tufts arranged at right angles to each other anterior to the bases of the antennae. White pubescence covers the ventral surface of the head and maxillary palpi where it forms a shaggy ventral margin. In the three dark-veined specimens the dorsal surfaces and apices of the palpi are covered with dark brown scales.

Thorax: Dorsally, the black nota are covered with white pubescence but in worn specimens they are quite conspicuous. The ventral sclerites and leg bases are clothed with white scales and

hairs. The hairs extending onto the ventral surface of the femur form a short fringe. The tan-colored integument of the tibia and tarsus shows through the remaining vestiture of short white hairs.

Abdomen: In two of the specimens the abdomen is covered with white scales. The remaining specimens are black dorsally devoid of scales. Ventrally the abdomen is white. White pubescence is found on tergites I and II. The sternites are clothed with white scales which are missing in well-worn specimens.

Wings: (Fig. 3) Dorsally both wing surfaces have a white background with a marginal brown pattern. On the fore wing brown scales line the costal margin and form a distal apical band which widens caudally. The apical pattern consists of a diagonal band extending from the costal margin to Cu_1. Brown scales extend from the distal margin of the band along the veins to a fine line of brown scales edging the wing. White spots in the cells between the veins vary in size and shape depending on the shape of the cell. Brown and white scales fringe the distal margin while only white scales edge the anal margin.

The white scales on the dorsal surface of the hind wing allow the ventral pattern to show through. The marginal pattern on the hind wing consists of a brown band interspersed with white spots situated between the veins. The pattern of the hind wing is more symmetrical than that of the fore wing.

Ventrally the fore wing is white covered with a brown pattern similar to that found on the dorsal surface. Additional brown scales fill the narrow costal and Sc + R cells.

The pattern on the hind wing covers the entire surface. It

begins with gray scales at the wing base and shadesinto brown scales along the veins, ultimately forming the marginal lace-like pattern. Narrow bands of brown scales form connections between the veins at a distance from the apex of the discal cell.

Adult Female

No females are present in the collection. According to Seitz (1909) the characteristics are essentially the same as those described for the male with the following exceptions. The apical markings of the fore wing are wider and the marginal markings of the hind wing are larger with small central black spots. The ventral side is yellowish-white with markings similar but fainter than the dorsal surface. The hind wing bears a dark discal band.

Egg

The egg of this species is yellow and semiconical. They are deposited close together, but not touching, on the upperside of the leaves of Capparis species.

Larva

The full grown larva is about 3 cm long, clyndrical, becoming incrassate toward its brownish head. The green body is covered with fine hairs and has a pair of broad lateral chocolate-colored stripes, with white dots and a narrower yellow stripe above the legs.

Pupa

The pupa is gray with pale spots.

Remarks

Very little is known about this species in Lebanon and the literature is confusing. In more recent literature the species has

been assigned to two different genera. According to Wiltshire (pers. comm. and 1957) Belenois mesentia Cramer, 1780 (nec. mesentia Cramer, 1777) is equal to Glycestha aurota Fabricius, 1793. However, there is no illustration of G. aurota in Wiltshire (1957). In spite of the lack of an illustration it appears highly unlikely that it is distinct from B. mesentia and the latter name has thirteen years priority over the former.

In spite of specimens to document its seasonal abundance in the country, it seems probable that B. mesentina, like T. fausta is a species which cannot withstand the cold winters of Lebanon. It is likely that it reaches this far north only after the summer is well advanced and perhaps produces one generation before inclement winter weather forces it to retreat southward.

Additional material is needed to see if it occurs at high elevations as in Iraq where Wiltshire (1957) comments that it is an erratic migrant everywhere in Iraq except the highest mountains. It is seen in the foothills and middle heights in spring and autumn.

Material Examined

Beirut	SL	18-XI-1909	1 ♂
		30-XI-1909	1 ♂
Khartoum		1950	1 ♂
Unlabelled			2 ♂

Synchloe callidice chrysidice H-Sch., 1844

Herrich-Schafer, Eur. Schmett. I, pl. 97, figs. 200-203.

Forms of this species occur from southern Europe eastward through Asia Minor and Persia to southwest China, Tibet and Kashmir.

The subspecies chrysidice is known from the mountains of Asia Minor and Persia.

Adult Male

Head: The antennae are composed of yellow segments with brown margins which are covered with dark brown and white scales. In two of the three specimens examined these scales produce a checkered effect on the dorsal surface. In all three specimens scales are lacking on the ventral surface and apex of the flattened spoon-shaped club thereby exposing the yellow underlying integument. The vertex is covered with stiff hairs which are white with a scattering of black, brown and yellow. They are particularly long anterior to the antennal bases. Posterior to the bases the remaining short ones expose the underlying black integument and the yellow scales which rim the caudal margin of the eyes. Ventrally the cephalic region and maxillary palpi are clothed with long white and yellow pubescence. Brown hairs intermingle with the white ones to form the fringe on the ventral surface of the palpus while the dorsal surface is densely covered with white scales.

Thorax: Dorsally, the black nota show through a thin pubescence of pearl-gray and golden-colored hairs. The ventral sclerites and proximal leg segments are covered with white and golden-colored scales and hairs. Some of these hairs which extend onto the ventral surface of the femur form a long fringe. The sparse vestiture of short white or golden-colored hairs on the tibia and tarsus expose the tan integument of these distal leg segments.

Abdomen: The abdomen is missing from one of the female specimens. In our material it appears bicolored. Only a few

scattered white and golden-colored hairs and scales remain on the black tergites. The scales form a dense covering on the sternites and apex of the abdomen.

Wings: (Fig. 6) The dorsal surfaces of both fore and hind wings are covered with translucent cream-white scales some of which form a conspicuous fringe along the distal and anal margins. On the fore wing black scales cover the base while brown scales form an asymmetrical band which is broader posteriorly than anteriorly. A line of brown spots in cells R_{2+3}, M_1 and Cu_1, (absent in M_2) form a narrow preapical band. Brown scales along the distal ends of the veins extend into the adjacent cells. These lateral extensions join at the margin and produce a scalloped effect on the proximal edge of the band,

The entire dorsal surface of the hind wing, excluding the proximal dusky basal area, is translucent ivory white through which may be seen the gray outline of the pattern on the ventral surface. Fine white pubescence extends from Cu to 3A.

The basic color of the ventral surface of the fore wing is ivory white. The apical pattern is similar to its dorsal counterpart, but is composed of a combination of brown and golden-colored scales. The discal band of the upper surface shows through the translucent scales of the ventral surface.

Ventrally on the hind wing the olive and yellow background is produced by a combination of black, brown and yellow scales. Areas of white scales produce a lace-like pattern. An oval white spot lies centrally in the discal cell. Four white spots in the shape of arrowheads with their apices directed mesally lie distally in

cells M_1, M_2, M_3, and Cu_1. These are followed by marginal white circular spots in each cell separated by colored scales lining the veins.

Adult Female

The female body characteristics are basically the same as described for the male with the following exceptions. The dorsal pattern on the fore wing is bolder, the discal band is broader, as are those on the apex and the apical bands are joined by mesally directed extensions along the veins from the marginal band. In the two female specimens, the bands appear to end the cell M_3, but scattered scales in cells Cu_1 and Cu_2 suggest that in fresh specimens the bands have a greater posterior extent.

Egg, Larva, Pupa

Information on the developmental stages of this species as well as the other species of this genus is lacking in Seitz (1909).

Remarks

This is an alpine species appearing at 2000-2500 meters in August. Additional material is needed to establish whether a single generation occurs between July and August as is stated to occur in Iraq by Wiltshire (1957).

There is a dusty golden-colored cast which suffuses the surfaces of all three specimens. This is probably attributable to aging, since the single male and the only labelled female were collected on "Cedar Mt." on August 17, 1897. Additional material is required from this locality to establish the presence of this species in Lebanon today.

Although the specimens examined resemble the description

given in Seitz (1909), Higgins (pers. comm.) doubts that the species does occur in Lebanon. He states that while specimens from high levels on "Cedar Mtn." are usually recorded under this name, they do not correspond with the figure published by Herrich-Schaeffer in 1844.

Material Examined

"Cedar Mt."	17-VIII-1897	1 ♂	1 ♀
"Unlabelled"			1 ♀

Euchloe belemia palestinensis Röb., 1907

Röber, in Seitz Macrolepidoptera of World I:51

Forms of this species occur from southern Spain and North Africa eastward to Asia Minor and Syria.

Adult Male (Fig. 23)

Head: The antennae are composed of yellow segments, covered with dark brown and white scales. The clubs are flattened and spoon-shaped. In two specimens the apex and ventral surfaces are naked, exposing the yellow segments. Pearl gray pubescence covers the vertex which is particularly shaggy anterior to the antennal bases. In two of the three specimens the pubescence occurs over the entire cephalic region. Yellow scales rim the caudal margin of the eye. Ventrally the cephalic region of the head capsule and the maxillary palpi are clothed with pearl gray pubescence. Long black and white hairs fringe the ventral margin palpus.

Thorax: Dorsally, fine pearl gray hairs cover the nota. The black sternites and basal leg segments are covered with white scales and hairs which extend onto the ventral surface of the femur, and

form a long white fringe. The light tan-colored integument of the tibia and tarsus shows through the sparse vestiture of short white hairs.

Abdomen: The abdomen is tricolored: black dorsally blending into gray laterally and white ventrally. Tergites I to IV are clothed with pearl gray pubescence while the more posterior ones have a scattering of white scales. The sternites and apex of abdomen are covered with white scales.

Wings: (Fig. 10) The base color of the dorsal surfaces of both wings is ivory white. Conspicuous long white fringes line the distal and anal margins of both wings. On the fore wing, black and gray scales cover the base extending into the costal cell. The costal margin is covered with yellow scales. Brown scales form a double apical band. Dark brown scales form a narrow apical band and cover the wing tips. These two bands are joined by the veins which are covered with brown scales. The white inteneural areas appear as three irregularly shaped spots, the most anterior being the largest, followed by two smaller spots of approximately equal size. The transparent white of the hind wing allows the ventral pattern of the transverse stripes to show through on the dorsal surface. Black scales cover the wing base and extend into the proximal portions of the cells.

The base color of the ventral surface of the fore wing is opalescent white, yellow scales edge the proximal costal margin interrupted occasionally by brown scales. Brown scales form a double banded discal spot. The dividing line of white scales covers the base of M_{2+3}. The apex is divided into four distinct

vertical stripes of olive-gray separated by three narrower stripes of light gray. The colors are produced by combinations of brown and yellow scales.

On the hind wing only a few white areas are exposed. The remainder of the wing surface is covered by combinations of yellow and brown scales forming the olive-gray pattern. Of the six irregular crossbands, three begin at the costal margin and three arise on the apical margin to form a zebra-like striped pattern. The fourth is broken medially at the apex of the discal cell. Along the straight anal margin the bases of the three proximal stripes and the basal half of the fourth are joined on the anal margin. Light yellow pubescence occurs posterior to Cu and extends to the anal margin.

Adult Female

None available. Apparently no appreciable difference exists between the male and female, for no information concerning the female is found in Seitz (1909).

Egg, Larva, Pupa

Although there is little mention of developmental stages in the literature they are probably similar to those of E. ausonia. According to Wiltshire (1957) the larvae feed on Hirschfedia adpressa, Sinapis alba and probably other wild Cruiciferae.

Remarks

There is an additional specimen in the collection which closely resembles the material described above. It is a female and fits the description of the summer form of E. belemia which Hubner named glauce. Higgins (pers. comm.) suggests the possibility

that this form occurs in Lebanon but the proof of this thesis must await the collection of additional specimens. The specimen in question was taken at Haouchab in northern Lebanon on April 6, 1963. It is highly improbable that the summer generation would be in flight so early in the year.

Information is lacking and there is insufficient collected material to say anything about the number of broods occuring in Lebanon. Wiltshire (1957) remarks that two spring generations occur in Iraq, (January to March), (March to April).

Material Examined

Chtaura	904 m	21-IV-1963	1 ♂	
Chtaura	1000 m	3-V-1963	1 ♂	
		22-III-1964		1 ♀
International Airport	SL	24-III-1963	1 ♂	

Euchloe ausonia crameri Butler, 1867

Forms of this species occur in southern Europe, North Africa eastward to Asia Minor.

The following description is based on a single male taken at Chtaura (1000 m) in late March, 1964. The main basis for separating it from the E. belemia palaestinensis Rober, 1907 is the difference in the pattern on under surface of the hind wing.

Adult Male (Fig. 26)

Head: The antennae consist of yellow segments covered with white and occassionally brown scales. A loss of scales on the ventral side of the flagellum and lateral margins of the flattened spoon - shaped club reveals the light brown margins of the segments.

Pearl gray pubescence covers the vertex. Anterior to the antennal bases long white and black hairs intermingle with grey ones making the area particularly bristly. Posterior to the antennal bases the pubescence is reduced revealing short yellow hairs covering the dorso-lateral surfaces of the head capsule caudad of the eyes. The ventral region of the head is clothed with white and yellow pubescence. The maxillary palpi are covered with white and black hairs which are particularly long on the ventral surface, where they form a fringe. The black hairs are lateral and the white hairs are mesal.

Thorax: Dorsally pearl gray pubescence is present on all nota. The black sternites are covered with long yellow scales and hairs while white scales and hairs cover the proximal leg segments. White hairs extend onto the ventral surface of the femur forming a long bushy white fringe. The tan integument of the tibial and tarsal segments shows through the sparse vestiture of short white hairs.

Abdomen: The abdomen is shaggy gray except for a narrow line of white scales covering the sternites and apex of the abdomen.

Wings: On the upperside of both wings the base color is chalky white. On both wings a conspicuous brown and white fringe occurs on the apex and distal margins while a white fringe edges the anal margin. A few yellow scales line the proximal edge of the costal margin. Black scales covering the base of the wing extend distally into the cells and cover one-third of the anal margin. The lateral black areas covered with fine white pubescence appear as grey extensions to the pubescence of the body. Scattered dark

brown scales on the costal margin form a series of single-scaled, horizontal stripes extending to the wide irregular discal band which is broadest at the anterior end. Other dark brown scales form a narrow apical band and cover the distal ends of the veins which extend beyond the band (from R_{2+3} through Cu_1). The common base of R_4 and R_5 lacks brown scales. The white interneural areas distal to the band appear as six irregular spots, of which two are at the extreme apical tip. The remaining four all extend to the apical band. The most anterior spot is largest and is followed by two smaller spots of equal size. The last spot is the smallest and blends with the band, which, at that point, consists of a few individual scales.

The transparent white of the hind wing permits the ventral pattern of irregular bands and spots to show through on the dorsal surface. Black scales cover the wing base and extend into the proximal areas of the cell. Long fine white hairs cover the posterior half of the discal cell and cells Cu_1, Cu_2, 2A and 3A to the anal margin.

On the ventral surface of the fore wing the base color is white. The yellow scales on the costal margin extend its entire length and from them the brown horizontal stripes appear distinct. The dark brown discal band appears double, being divided by tan scales covering the base of M_3. The pattern on the apex is similar to that on the dorsal surface but appears slightly different due to the combination of yellow and brown scales covering the distal band and its extensions.

On the hind wing only a few white areas are exposed. The

remainder of the wing surface is covered with combinations of yellow and brown scales forming a yellowish brown, reticulated pattern. Yellow scales cover the veins and scattered fine yellow hairs occur in the proximal and anal areas. The white areas describe a lace-like pattern. Extending mesally along all the margins are white areas. Small spots anastomose along the distal and anal margins while long rectangular spots extend to the costal margin. The most proximal spot crosses the branch of rs and M_1, the second extends to M_1 and the most distal is J-shaped, extending to the base of Cu_2 in the discal cell. Scattered smaller spots and dots are found throughout the black and yellow area.

Adult Female

None available.

Eggs

The egg of this species is "brown-yellow" and "elongate tapering above, "finally" leaden-gray with ribbed sides".

Larva

The larva is similar to that of A. cardamines, having a "greenish body with three stripes and white stigmata". It feeds on "Cruciferae sp. Sisymbrium erucastrum and Barbarea vulgaris.

Pupa

The pupa is brown covered by small black dots "stongly tapering at both ends". They sometimes require two years for development.

Remarks

Previous records of the species are known from Lebanon. According to Ellison and Wiltshire (1939) individuals were found

"at Aleih, Deir el Qamar [and] not uncommon at middle heights, [on] April 12th, [found] on open ground. One brood [was] taken."

Although no mention of this species appears in Higgins (1964) he mentions collecting three worn E. ausonia Huebner, 1804, specimens from Chtaura. He further adds that "the race is large and well marked, best referred to subspecies crameri Butler, 1867. This is a difficult species, the nomenclature is complicated, and it is difficult to get series showing seasonal variation (two broods). [Apparently] there is an alpine subspecies in Europe".

Additional material is needed before it can be established that two broods occur in Lebanon. Specimens have only been recorded from Lebanon in March and April.

Material Examined

Chtaura	1000 m	22-III-1964	1 ♂

Anthocharis charlonia mesopotamica Stgr., 1891

Staudinger, Iris, IV, p. 228

Forms of this species have been found from North Africa eastward through northern Asia Minor, Kurdistan to northern Persia. The following description is based on a single female.

Adult Female (Fig. 25)

Head: The antennae are composed of yellow segments covered with dark brown and occassionally white scales. The club is covered dorsally by brown scales. The ventral surface is flattened and denuded, exposing its yellow segments. The vertex anterior to the origin of the antennae is covered by white and black stiff hairs. Posterior to the antennal bases the hairs have been lost except for

a few scattered scales and a few white and yellow rimming the caudal margin of the eyes. Posterior to this, tufts of pink hairs lie at the junction of the head and thorax. Ventrally the cephalic region and maxillary palpi are clothed with white and yellow pubescence. The ventral surface of the palpus is very shaggy from its covering of yellow hairs and a few scattered black ones.

Thorax: Dorsally, the black nota are clothed with pearl grey pubescence. Ventrally the sternites and leg bases are covered with light yellow hairs and scales. The ventral surface of the femur is particularly hairy. The few hairs remaining on the tibia and tarsus are short, exposing the light tan integument of these distal segments.

Abdomen: The abdomen is bicolored. Dorsally the black tergites are exposed except for grey pubescence remaining on tergites I to III. The posterior tergites have a scattering of yellow scales. The sternites and apex of the abdomen are covered with yellow scales and hairs which form a medial fringe.

Wings: The dorsal surface of the fore wing is tricolored. The base color is white and black scales cover the base of the wing. Black and brown scales are scattered throughout the costal cell. At the apex of the discal cell they form a broad band and further distad form an apical band which extends from the marginal tip of R_1 diagonally to the marginal tip of M_2. Short marginal interneural areas covered with white scales give a fine scalloped appearance to the apical distal edge. A few scattered scales are found extending to Cu_1. Light yellow scales fill the discal cell and proximal portions of Cell Cu_2 and 2A, while pink scales trim

the proximal end of the costal margin. A conspicuous pink and brown fringe lines the distal margin while long white hairs fringe the anal margin.

The dorsal surface of the hind wing is pale yellow-green except for dark brown scales which extend from the base of the wing into the proximal portions of the discal cell, cell Cu_2 and the anal cell.

Ventrally the fore wing is covered with yellow and brown scales. Dark yellow scales fill the discal cell and extend into the immediate proximal regions of cells Sc, R, M_3, Cu_1 and Cu_2. Distally these blend into light yellow and white scales. A mixture of yellow and brown scales cover the apex. Pink scales line the costal and distal margins to the tip of Cu_2.

The hind wing is densely clothed by yellow, black or dark brown scales. A few white spots on the costal margin and one located centrally might be due to wearing.

According to Seitz (1909) the female differs from the male by the presence of a more rounded tip and broader apical band.

Egg, Larva, Pupa

Although information on the developmental stages is lacking, they must be similar to those of A. cardamines. According to Seitz (1909) he observed a single female of this species depositing her eggs on radish leaves in Algiers.

Remarks

This species is found at higher altitudes in Lebanon (1700m) than in Iraq (less than 1000 feet), Wiltshire (1957).

Additional material is required before it is known whether

one or two broods occur per year. Ellison and Wiltshire (1939) doubt that there is a winter brood in Lebanon as in North Africa because of the snow covering the ground during the early part of the year.

Material Examined

Falougha, 5 km S.E.	1700 m	21-IV-1963	1 ♀

Anthocharis cardamines phoenissa Kalchb., 1894

Kalchberg, Jahrb. Wein. Ent. Ver., 5:27

Forms of this species occur throughout Europe and Asia Minor eastward to northern Asia and China.

Adult Male (Fig. 27)

Head: The antennae are composed of yellow segments covered with dark brown and white scales ventrally and apically. Dorsally pearl-gray pubescence occurs on the vertex and between the head and thorax. It is reduced or absent in the area immediately posterior to the antennal bases and anterior to the caudal margin of the head exposing the black integument and yellow scales bordering the caudal margin of the eye.

Thorax: On the dorsal surface covering the nota are the remains of a fine pearl-grey pubescence which, as it extends ventrally, becomes light grey and interspersed with yellow scales. The white scales and hairs clothethe black basal leg segments. Some hairs extend onto the femur to form a dense white fringe, while the light brown segments of the terminal leg segments are exposed through the sparse vestiture.

Abdomen: The abdomen is bicolored. The dorsal surface is

dark gray, shading into white ventrally. Pearl-gray pubescence is heavy on tergites I to III but reduced on the caudal segments where the black integument is exposed. The sternites and the apex of the abdomen are clothed with white scales and hairs.

Wings: (Fig. 4) The basic white color of the fore wing is interrupted at the apex by a preapical orange band. In some specimens the proximal edge of this band is more or less distinctly set off from the white portion of the wing by a widely scattered series of black scales. However, individuals lacking these scales appear to dominate our sample. The grayish brown apex results from a mixture of orange and black scales. A black discal spot is present. The base of the fore wing shades from black at its point of attachment to gray and finally white distally. The extent of the dusky area varies individually but in none of the material examined does it extend far into the discal cell.

Except for the proximal area which is dusky the dorsal surface of the hind wing is translucent white, through which may be seen the outline of the pattern on the ventral surface. In many specimens there is a tendency toward the development of small clumps of black hairs and scales where the veins meet the margin of the wing, but this is not constant.

The ventral surface of the fore wing is basically white crossed apically by an orange band which does not extend completely to the wing margin. The apex is white intersected distally by relatively broad bands of orange and black scales. These extend to the wing margin along veins M_2, M_3, and Cu_1 and frequently Cu_2. There is no conspicuous discoloration of basal portion of wing.

The hind wing bears a strongly reticulated greenish pattern caused by the superposition of yellow and black scales on the basic field of white. Although there is considerable variation in this pattern it is usually divided into proximal, medial and distal bands which are more or less connected along the veins. The extent of yellow scalation considerably exceeds the area bearing black scales, causing many of the cells to be predominantly yellow. The costal margin bears three well defined blackish bands. The most distal one occurs in the area of the intersection of Sc + R_1 with the wing margin. The discal band is more heavily suffused with yellow and is interrupted between R_5 and M_1, M_1 and M_2 and Cu_1 and Cu_2. A small tuft of black hairs is usually present where the wing veins intersect the margin creating more or less conspicuous dark marginal spots on the upperside.

Adult Female (Fig. 28)

The characteristics of the female are the same as those described for the male with the following exceptions, The abdomen is less distinctly bicolored and is more strongly suffused with white laterally. On the dorsal surface the bright preapical orange band on the fore wing is absent, and the dark apical portion is more developed. It is subdivided essentially into a series of fused brownish-gray spots which extend to the wing margin only along the veins creating a scalloped apical pattern of white and black. On the underside of the fore wing there is a tendency for the costal margin to appear yellowish-white. Many of the veins are yellowish, along at least their distal extremes, but black at the intersections of M_2, M_3, Cu_1 and the wing margin where black

scales have accumulated.

Egg

The egg of this species is whitish-green and deposited singly on the leaves of Turritis glabra and species of Sisymbrium and Cardamine.

Larva

The larva has a dark green head with black spots. The body is blue-green with minute black dots. A whitish dorsal line is found on segments I and V while a white lateral stripe runs the length of the body.

Pupa

The pupa is green to brownish with white lateral stripes and thin reddish streaks. It is smooth, strongly inflected dorsad and is terminated cephalically by an obtuse process.

Remarks

This is one of the most common pierid butterflies in Lebanon. It occurs more commonly at lower elevations along the coastal river valleys and in the Bekaa from March to May. At higher altitudes it is restricted to heavily vegetated areas. According to Ellison and Wiltshire (1939) the male abberation umbrosa Culot, with a black shade inside the orange patch, occasionally occurs.

There is no evidence that there is more than a single brood, and overwintering probably occurs in the pupal stage.

Material Examined

Barouk	1000 m	3-V-1963	3 ♂, 2 ♀
Beirut River	241 m	21-III-1965	1 ♂
Chtaura	904 m	21-IV-1963	5 ♂, 1 ♀

Chtaura	904 m	3-V-1963		1 ♀
Damour	400 m	27-III-1964	1 ♂	
		7-IV-1963	8 ♂	
Nahr Ibrahim	500 m	11-IV-1965	1 ♂	

Anthocharis damone syra Ver., 1911

Verity, Rhop. Pal., p. 342.

The males of this species are probably the most brillantly colored pierid butterflies occurring in Lebanon. Forms of the species occur from southern Italy eastward through the Balkans, Asia Minor, Syria and Iraq.

Adult Male (Fig. 40)

Head: The antennae and spoon-shaped club are composed of yellow segments. The dorsal surface of the flagellum is covered with brown and white scales producing a striped effect. White scales clothethe club. The ventral surface is covered with white scales except on the club where they are absent. Long yellow hairs mixed with a few black hairs cover the vertex anterior to the antennal bases and lie at the junction of the head with the thorax. Between these two areas the black integument is exposed. Ventrally the head region is clothed with yellow pubescence. The maxillary palpus is covered dorsally by short yellow hairs and ventrally by a combination of long yellow and black hairs which form a stiff fringe.

Thorax: Dorsally, the black nota are clothed with fine grey hairs while those at the junction of the head with the thorax are yellow or yellow-tipped. Ventrally the black sclerites leg bases

are covered with yellow scales and long yellow hairs. These hairs extend onto the femur where they form a dense fringe. The tan-colored integument of the tibia and tarsus shows through the sparse vertiture of short white hairs.

Abdomen: The abdomen is bicolored. Dorsally the black tergites in worn specimens show through. The pearl grey pubescence appears most dense on tergites I to III. The sternites and apex of the abdomen are covered with yellow scales and hairs.

Wings: The dorsal surfaces of both fore and hind wings are basically dark yellow. On the fore wing black scales cover the wing base. The apical one-half is dominated by a preapical band of brillant orange. In both specimens the proximal edge of this band is more or less distinctly set off from the yellow portion of the wing by a widely scattered series of black scales, some of which form a discal spot. The grey brown cast to the apex of the fore wing and tips of veins Sc to Cu_2 results from the presence of brown and orange scales. Light orange and brown scales fringe the apical and distal margins of the fore wing, while yellow hairs line the anal margin.

The dorsal surface of the hind wing is yellow, except for black scales covering the base and thw white ones covering the frenular lobe. The apparent pattern results from the pattern on the ventral side showing through. Fine yellow hairs fringe the distal and anal margins except at the vein tips where they are replaced by black hairs.

Ventrally the fore wing is tricolored. The orange and yellow preapical band is separated faintly by a few scattered black scales.

Black scales also form a small discal spot. Yellow scales line the costal margin and remaining area of the wing being darkest in the discal cell.

The hind wing of this species bears a strongly reticulated blackish pattern on a basic field of yellow. Although pattern variation exists between the two specimens, the black design consists mainly of three horizontal scalloped bands which are more or less connected along the veins, their ends are distinctly seen on the costal margin. Black scales extend from the most distal band to the margin along all veins except 2A. Ventral pubescence is found covering the anal angle.

Adult Female

The characteristics of the female are similar to those described for the male with the following exceptions. The base color of the wings is white. A narrow preapical band of brown scales extends from the marginal tip of R_1 disgonally to that of Cu_1. Brown scales extend from this band covering the distal ends of the veins.

The ventral surface of the fore wing is white with golden yellow covering the apex. The brown discal spot is larger than in the male and four to five short horizontal lines interrupt the proximal portion of the costal margin.

On the underside of the hind wing the basic field is a more golden-colored than the dark yellow of the male. The yellow cast to both the dorsal and ventral areas of the wings in our specimens is certainly due to aging.

Egg, Larva, Pupa

Although there is no mention of the developmental stages in

Seitz (1909), they are probably similar to those of A. cardamines and A. charlonia.

Remarks

The description of the females was based on specimens over fifty years old collected by the Cremona brothers in Beirut.

Over the years there has been a difference of opinion concerning to which genus this species should be assigned. In Ellison and Wiltshire (1939) damone is listed as a species of Euchloe rather than Anthocharis. In recent communications from both Wiltshire and Higgins the species is included in Anthocharis. According to Ellison and Wiltshire (1939) in Lebanon "it is locally common at middle heights in April. Sometimes found (eg. near Aleih) with E. cardamines. I saw it once near sea level at Nahr Damour, but believe the specimen had been blown down from the neighboring hills."

Additional material is needed to establish the range of this species in Lebanon. The few recent observations of it in the country indicate that it is a relatively uncommon butterfly and probably has but one generation per year.

Material Examined

Barouk	1800 m	3-V-1963	1 ♂	
Beirut	SL			3 ♀
5 km S.E. Falougha	1700 m	21-IV-1963	1 ♂	

Teracolus fausta Oliv., 1801

Oliver, Voy. L'Emp. Oth. Atl., t. 33, figs. 4a&b (1801)

Forms of this species occur eastward from Lebanon to Saudi

Arabia, Persia, Afghanistan, south to northwest India. Representatives of this genus are typically members of the Ethiopian Subregion. According to Seitz (1909), Neuburger described very light-colored individuals from Beirut, which he called ab. louisa. In this form the males are whitish with orange veins and the females are light yellow tinted with yellow-orange.

Adult Male (Fig. 29)

Head: The antennae are composed of yellow specimens covered ventrally by white scales and dorsally by white and brown ones in alternating horizontal bands. The club is composed of yellow segments covered dorsally with dark brown scales. The vertex anterior to the antennal bases is covered with black and white hairs, posterior to the origin of the antennae the hairs have been lost except for orange tipped hairs lying at the junction of the head with the thorax. Ventrally the cephallic region and maxillary palpi are clothed with white pubescence, making the ventral surface of the palpus appear shaggy.

Thorax: Dorsally, the gray pubescence covering the nota is scant revealing the black integument. Ventrally the sternites and leg bases are covered with white scales and hairs. The femur has a white fringe on its ventral surface, while the few short hairs remaining on the tibia and tarsal segments, expose the golden-yellow integument.

Abdomen: The abdomen is tricolored. Dorsally the exposed tergites are black, the only remains of the grey pubescence being on tergites I and II. Orange scales are scattered dorsally and laterally, blending into white ones ventrally.

Wings: (Fig. 8) The dorsal surfaces of both fore and hind wings are covered and fringed with salmon-colored scales. Scattered brown scales extend from the mesal edge along the proximal end of the veins and costal margin. Brown scales lying on either side of the medial crossvein at the apex of the discal cell form a double band. Two narrow brown apical bands appear scalloped. The distal one extends from the costal margin to the tip of 2A; the subapical band is thicker, less scalloped and extends from the tip of Sc on the costal margin to the tip of M_3. A few scattered brown scales lie between M_3 - Cu_1. A mixture of brown and white scales line the costal margin and form a fringe from the distal tip of R_5 to that of Cu_2. An oval audroconium of deeper orange lies anterior to the mesal curve of 2A.

The hind wing, also light salmon, has black scales extending distally from the mesal edge. Cells 2A and 3A are white mesally becoming light yellow distally. Brown scales lying at the tips of veins R_5 through 2A increase in width and form an interrupted marginal band bordered by a more or less distinct fringe of white scales. The anal area is conspicuously lighter than the remainder of the dorsal surface.

Ventrally the fore wing is cream-colored allowing the dorsal pattern to show through faintly.

The hind wing is slightly darker than the fore wing. Black scales are scattered mesally. Cell 3A is covered with white scales while yellow ones are found in cell 2A.

Adult Female (Fig. 30)

The characteristics of the female are similar to those

described for the male with the following exceptions. The base color is lighter. The apical pattern of the fore and hind wings is more pronounced and the discocellular spot is larger. The ventral surface of the fore wing is basally light salmon with brown distal spots in cells Cu_1 and Cu_2. On the hind wing faint oval spots of brown and gray scales are found in cells R_1, Rs, M_1, M_2, M_3 and Cu_1. Together these form an arc which appears dorsally as a hazy medial line.

Egg, Larva, Pupa

No information.

Remarks

According to Ellison and Wiltshire (1939) this species is abundant on the coast from August onward. Earlier in the summer occasional specimens can be seen up to 1230 meters. Wiltshire (1957) associates this species with arid climates believing it to be tropical from Asia westward to the Nile. The species appears to migrate and was commonly found throughout Iraq in the last seven years at levels below 1846 meters, except during the autumn when it was at 1846 meters. He found its food plant to be Capparis spinosa, an immigrant from south Persia.

Bodenheimer (1935) refers to this species as Colotis fausta. He notes that in Jerusalem the typical behavior of a summer immigrant is that it disappears before winter. This species appears on the coastal plain from the end of May onward, becoming abundant in the hills only from August to October, where it might have produced two to three generations. In the Jordan valley it occurs from November to February or March. Bodenheimer also states

that the species disappears from the mountains and possibly from the Jordan valley.

In Lebanon the species annually reestablishs itself in June or July through migration from the south and probably passes through at least one generation before the onset of winter. Adults have been seen on the wing along the coast near Beirut as late as late as November.

Material Examined

American University Campus	SL	29-VI-1964	1	♂		
		24-VII-1964			1	♀
		29-VII-1964			1	♀
		10-VIII-1964	1	♂		
		17-VIII-1964	3	♂		
Aramoun	577 m	26-VII-1964			1	♀
Nahr El Kelb	50 m	13-VIII-1964	5	♂	1	♀

Catopsilia florella Fabr., 1787

Fabricius, Syst. Ent., p 479.

This is a species of butterfly reported from the Republic of Lebanon but not represented in the collection of the American University of Beirut, Museum of Natural History. Ellison and Wiltshire (1939) include the taxon in their list but apparently did not have specimens from the country and depended instead on an earlier record by Lederer.

In Lebanon it is considered to be a rare immigrant from the south and even in Palestine it is considered uncommon by Bodenheimer (1935). This author believed that some individuals

over-wintered in the Jordan Valley and spread from there as adults into the different areas of Palestine during the winter months.

This species has also been reported from Iraq where Wiltshire (1957) states it has been collected in the desert foot hills during March and April. He further states that their food plant, Cassia, is not known from this country. From this reference one is forced to conclude that either the larvae feed on plants other than Cassia or adult individuals migrate to Iraq from adjacent areas where the proper food occurs. While both hypotheses are probably valid, the propensity of individuals of this species to fly great distance lends considerable strength to the latter.

The species is also known to occur in Syria, Saudi Arabia and Africa, both north and south of the Sahara.

Gonepteryx farinosa Zell., 1837

Zeller, Isis, p. 5

Forms of this species are known from west Africa and the mountains of Iraq, according to Seitz (1909) it is distinct from G. rhamni and G. cleopatra, for in southern Asia Minor the three occur together. It is conspicuously larger than G. rhamni from central Europe and southern France. The specimens described here are from Turkey since specimens from Lebanon were lacking. They have since come to hand and agree with the description of Turkish material.

Adult Male (Figs. 33 & 35)

Head: The antennae are composed of reddish segments covered with dark brown and occasionally pink scales. The red segments of

the club are laterally flattened. Brown scales cover the apical fourth of the club, while the proximal three-fourths is clothed with pink scales. The vertex is covered with pink and black hairs and is particularly shaggy anterior to the antennal bases. Pink scales rim the caudal margin of the eyes.

Ventrally the cephalic region is clothed with yellow hairs and the maxillary palpi with yellow scales. The dorsal surface of the palpus is covered with pink and brown scales.

Thorax: Dorsally the black nota are clothed with pearl grey pubescence. Ventrally the sternites and leg bases are covered with yellow hairs. Pink hairs are found at the base of the first pair of legs and extend to the anterior margin of the prothorax. Shorter yellow hairs cover the tibia and tarsal segments. Only two male specimens in the sample show any loss of scales on the tarsal segments, indicating that the rest were probably caught soon after emergence.

Abdomen: The abdomen is yellow. The tergites are black covered with light yellow pubescence which is especially long on tergites I to III. The sternites are densely covered with yellow scales; the mesal ones hairlike and forming a fringe. The apex of the abdomen is covered with light yellow and white scales.

Wings: The dorsal surfaces of both fore and hind wings are yellow with the distal and anal margins being trimmed with white hairs. The scales on the fore wing are a darker yellow. A simple small discal spot is present. Tiny reddish brown dots mark the tips of veins Sc + R_1, R_{2+3}, R_4, R_5, M_1, M_2, M_3 and Cu_1.

The hind wing is covered with lighter yellow scales than the

fore wing. A slightly larger orange discal spot is present marking the apex of the discal cell and proximal area of cell Cu_2. Tiny reddish-brown dots mark the tips of veins M_3, Cu_1, Cu_2 and 2A.

Ventrally the fore wing is covered with light yellow scales. The brown spots which make the marginal pattern are also present ventrally, except that the discal spot is composed of brown and light yellow scales.

On the ventral surface of the hind wing the base color and discal spot are similar to that of the fore wing. In addition, the fremular lobe is folded close to the thorax and its margin is marked by a tricolored edge. Brown and white scales form a distal band which is edged by a pink and white fringe.

Adult Female (Fig. 34)

The characteristics of the female are similar to those described for the male with the following exceptions. The dorsal color of the wings is light ivory with yellowish margins. In one of the specimens the discal spot in the fore wing is absent dorsally and faint in two other specimens. However, ventral discal spots are present in all material examined.

Egg, Larva, Pupa

Although there is little mention of developmental stages, they are certainly similar to those of G. rhamni and G. cleopatra. According to Wiltshire (1957) the food plant is Rhamnus.

Remarks

The only record of this species in Lebanon is by Ellison and Wiltshire (1939) from Bwerji, 2 ♂, southern flank of Kanisa,

1 ♀ in May and June. They suggest this species might be found on the eastern mountain slopes in northern Lebanon.

In early spring individuals were collected from sea-level to one thousand meters on the western slopes and eastern side of the Lebanon mountains in central Lebanon. Additional material is needed to see if two to three generations occur in Lebanon as do in Iraq. Wiltshire (1957) suggests that the last generation is the one in which the species hibernates.

Material Examined

Amasya, Turkey	18-VI-1963	14 ♂	2 ♀

Gonepteryx rhamni meridionalis Röber., 1907

Röber in Seitz, Macrolepidoptera of the World I (1): 67.

This is another species of butterfly recorded from the Republic of Lebanon, but it is not represented in the collections. It is mentioned in Ellison and Wiltshire (1939) and Higgins (1967) and specimens have been taken from Ehden and Bscharré. According to Seitz (1909) forms of the species are known to occur throughout the Palearctic Region south to northern India.

Gonepteryx cleopatra taurica Stgr., 1881

Staudinger, Hor. Soc. Ent. Ross. 16:65.

Forms of this species occur from southern Europe and North Africa eastward through Asia Minor and Jordan to eastern Asia. The following description is based upon specimens collected in

Lebanon.

Adult Male (Fig. 35)

Head: The antennal segments are yellow and covered with reddish brown scales with a scattering of pink and white ones. The club segments are dark yellow each with a reddish center which are seen on the ventral surface where the segments are flattened and naked. Dorsally the proximal segments are clothed with white scales and the apical ones with pink scales. The vertex is covered with grey pubescence. In three less worn specimens the grey hairs are pink tipped and the head is extremely pilose anterior to the antennal bases. Ventrally the cephalic region is covered with yellow hairs. Yellow scales cover the ventral surface of the maxillary palpi while the dorsal surface is covered with brown and pink short hairs.

Thorax: Dorsally, the black nota are clothed with white and light yellow hairs. Ventrally the sclerites and leg bases are covered with yellow ones which on the femur form a ventral fringe. The few remaining hairs on the tibial and tarsal segments expose the light tan integument.

Abdomen: The abdomen is yellow with the exception of a few brown dorsal scales on tergites I to IV. Gray pubescence covers tergites I and II. The sternites and apex of the abdomen are covered with yellow scales and hairs which form a median fringe.

Wings: (Fig. I) The upper surface of the fore wing is orange centrally surrounded by a wide yellow border. Although the scales of the orange blend into the yellow the anterior margin of the central portion lies on subcostal vein and the posterior margin

on 3A. Black scales cover the base of the wing. A small orange discal spot lies distally, and marginally brown scales cover the tips of veins: Sc + R, R_{2+3}, R_4, R_5, M_1, M_2 and Cu_1.

The hind wing is yellow and contains a larger discal spot than the fore wing. The edge of the yellow wing is interrupted by reddish brown scales which lie at the tips of all the veins. Fine light yellow hairs cover the scales in the caudal half of the discal cell and extend posterior to vein 2A.

The underside of the fore wing is yellow with a pattern similar to that found on the dorsal surface. Brown scales form a discal spot and cover the tips of the veins.

The hind wing is primarily covered with yellow scales and has pink scales edging the frenular lobe. Brown scales form the discal spot and tiny dots in cells Rs, M_1, M_2, M_3, Cu_1, and Cu_2. Brown scales rimmed by pink ones tip the veins marginally. Fine light yellow pubescence lines the main veins, R, Cu and 3A.

Adult Female

None available. According to Seitz (1909) the female of this species is lighter in color, but still yellower ventrally than G. rhamni.

Egg

Although there is no information on the egg, it is certainly similar to that of G. rhamni and G. cleopatra.

Larva

According to Seitz (1909) the larva is bluer with a more distinct lateral white strip than the dull green larva of G. rhamni, and is found on Rhamnus alpina, R. cathartica, and R.

alaternus.

Pupa

The pupa is dirty green with lateral yellow stripes edged by red dots.

Remarks

According to Ellison and Wiltshire (1939) in Lebanon this species occurs in two broods at all heights. The specimens in our collection were taken from central regions north and south of Beirut, during March through July, from sea level to 1500 m.

Material Examined

Antelias	50 m	31-III-1963	1 ♂
Hammanah	1500 m	19-VII-1964	2 ♂
International Airport	SL	17-III-1965	1 ♂
Jouret Arsoun	1084 m	21-III-1963	1 ♂
Nahr Ibrahim	500 m	11-IV-1965	1 ♂
"Unlabelled"			1 ♂

Colias croceus Fourcr., 1785

Fourcroy, Ent. Paris II, p.250.

The brilliant yellow ground color of the males distinguishes this species from its relative C. aurorina. Forms of the species occur throughout the central and southern parts of Europe and North Africa eastward to western Asia and Persia.

Adult Male (Fig. 36)

Head: The antennae are composed of yellow segments with brown rims covered with pink and brown scales. Pink scales predominate on the flagellum and brown scales occur on the club

except for the apex where the scales are missing. In the majority of specimens the clubs retain their original cylindrical condition. In some the ventral surfaces are denuded of scales exposing the yellow segments with or without brown medial spots.

The vertex is covered with yellow hairs, some pink-tipped, interspersed with a scattering of brown hairs. The hairs are particularly dense anterior to the antennal bases and at the caudal margin of the head. Posterior to the antennal bases the pubescence is reduced or lacking thereby exposing the black underlying integument and the yellow scales bordering the caudal edge of the eye. Ventrally the head region is clothed with white hairs. The maxillary palpi are clothed with yellow scales except on their ventral surfaces where long pink, yellow and brown hairs form a fringe which extends to the pink apex.

Thorax: Dorsally, the black nota are clothed with pearl gray pubescence which is pink-tipped on the prothorax. Ventrally, the sternites and proximal leg segments are covered with white scales and yellow hairs. These hairs extend onto the ventral surface of the femur to form a fringe. Pink and occasionally white scales cover the golden-colored integument of the distal leg segments.

Abdomen: The abdomen is bicolored. On the upperside the tergites present a shaggy appearance due to a covering of fine pearl gray pubescence which is particularly long and dense on tergites I to III. Varying degrees of pubescence exist in all but two specimens. The more pubescent individuals were apparently caught soon after emergence. On the underside the sternites and apex of the abdomen are densely covered with pale green scales. Those which

extend laterally produce varying degrees of yellow and yellow green. A scattering of yellow hairs on the sternites produces a ventral fringe on the abdomen.

Wings: (Fig. 9) The pattern on both the fore and hind wings of this species is bolder than that found on its relative, C. aurorina libanotica. The fore wing is essentially bicolored on the dorsal surface. Bright orange-yellow extends over the proximal two-thirds from the dusky base to a dark brown marginal band which covers the remaining third of the wing, the apex and the distal margin. Yellow horizontal stripes interrupt the vertical band due to the yellow scales covering the distal ends of the veins. The wing base is accentuated by scattered black scales which extend throughout the costal and anal cells and along the anal margin. Dark brown scales form a discal spot. Pink scales line the costal margin, and, with yellow scales fringe the distal margin. Yellow scales along the anal edge complete the border. The dorsal surface of the hind wing is essentially tricolored. The proximal three-fourths covered by yellow-orange and brown scales from M_1 to Cu_2 produces a dusky gold surface, which, on either side, blends into a dusky yellow green area. The remaining fourth is covered by a dark brownish-yellow stripe which is narrower than the one found on the fore wing. Black scales covering the base extend into the lateral yellow-green areas along Sc + R_1 and into cell Cu_2. A few scattered scales are in 2A, leaving the major part of the cells 2A, and 3A and the anal margin pale yellow-green. The black area is hairy, for fine pearl gray pubescence covers cell 2A. In the anterior green region a cream-colored oval spot lies distad of the

origin of Sc + R_1 in the base of its cell. In a third of the preserved specimens the spots have rose-pink centers. Bright yellow-orange scales form an irregular discal spot which blends into the background.

The colors on the ventral surface are paler than those found on the dorsal surface. The proximal two-thirds of the fore wing is golden-yellow shading to light yellow posterior to Cu_2. This area is bordered by the costal cell and a distal marginal band both of which are covered with a combination of yellow and yellow-green scales. Within the border scattered dark brown scales form two tiny marginal spots in cells R_1 and R_{2+3} and three irregular medial spots in cells M_3, Cu_1 and Cu_2 which appear along the proximal edge of the green margin. In one third of the male specimens small brown dots were found in cells R_1, R_4, M_1 and M_2. Pink scales clothe the costal margin and fringe the distal margin to Cu_2. White scales continue distally around the anal angle and onto the anal margin.

On the hind wing, the ventral pattern is less distinct than that found on the fore wing and consists of an interplay of different intensities of yellow-green. The proximal three-fourths is yellower than the marginal band with a proximal scalloped edge. Dark brown scales are widely scattered in this proximal portion or form hazy irregular medial dots in all except the costal and anal cells. These combined dots form an arc. The irregular white discal spot is surrounded by three alternating narrow bands of brown, pink and brown. Conspicuous pink scales line the proximal edge of the wing where it joins the body, edge the costal margin

and form a distal and anal fringe.

Adult Female (Figs. 37, 31, 32)

The characteristics of the female are similar to those for the male with the following exceptions. Two medium-sized yellow dots in the brown marginal band lie in cells Cu_2 and partly in M_1 and M_2 with vein M_2 bisecting them. The basal brown scales of the fore wing extend farther into the proximal areas of the cells than seen in the male. On the upper surface many brown scales combine with orange yellow ones cover the base and proximal area blending into the brown marginal band. The anal cells are covered with greenish-white and a scattering of dark brown scales. The underside of the wings is similar except that the proximal golden-yellow area is of uniform intensity.

Sexual dimorphism occurs in this species and the females also show a dimorphic white form. Two females caught at Hrajel and Laklouk with slightly different color tones, both appear to fit the description in Seitz (1909) of the ab. helice (Hbn.). Ellison and Wiltshire (1939) mentioned that both "C. croceus and ♀ ab. helice Hubn. [were] abundant everywhere at all heights."

The characteristics of the dimorphic females are similar to those for the normal females with the following exceptions. Dorsally the base color of the fore wing is white with a brownish cast (Hrajel) and with a yellow-greenish cast (Laklouk). The two spots on the fore wing are joined by three additional spots in cells R_1, R_{2+3} and R_5 on upperside of the hind wing. The spots along the proximal edge of the faint brown margin blend together into a streak and separate it from the proximal section which is

brown (Hrajel) or brownish-gray (Laklouk). The pattern and coloration of the underside are similar to the regular female with the following exceptions. The yellow found at the apex and anterior edge of the discal cell of the specimen from Laklouk was not present in the specimen from Hrajel. The underside of the wings of the specimen from Hrajel appeared greatly faded with only a suggestion of yellow. In addition, the pink fringe was absent.

Information on the developmental stages is according to Spuler in Seitz (1909).

Egg

Although there is no information concerning the eggs of this species it probably resembles that of C. aurorina.

Larva

The larva has a blue-green head. The body is dark green with a white or reddish-yellow spotted stripe above the legs. The spiracles are golden yellow.

It feeds until June or July on Cytisus capitatus, Onobrychis spp. and various species of Trifolium. Hibernation occurs in the larval stage.

Remarks

In the middle East adults of this species may be seen on the wing from early spring until late autumn and are certainly double if not triple-brooded.

Bodenheimer (1935) believes the species to be a permanent resident in Palestine and suggests that there are three generations annually, the largest occuring in the spring. Wiltshire (1957) on the other hand, while agreeing on the multivoltine nature of the Iraq population claims that it is migratory. He records it from

the mountains from spring until late autumn but states that it is rarely seen on the plain during the summer months.

In Lebanon the species occurs in the coastal area from March to May and at higher elevations from April or May through August. There is insufficient material in the collection to establish, with certainty, the number of generations but it is highly probable that two to three occur in areas along the coast and in the Bekka where lucerne and other legumes are cultivated which provide the larvae with an ample supply of food.

Material Examined

Ain Zhalta	1100 m	12-V-1963			1	♀
Antelias	50 m	31-III-1963	1	♂	1	♀
		13-V-1964	2	♂		
Nahr Damour	400 m	27-III-1964	1	♂		
		7-IV-1963	3	♂		
Falougha 5 km S.E.	1700 m		1	♂	1	♀
Faraya	400 m	9-VIII-1964	2	♂		
Ghebaleh	1100 m	7-VIII-1964	1	♂		
Hammana	1500 m	12-VII-1964			1	♀
Haouchab	250 m	6-IV-1963	1	♂	1	♀
Hrajel	1300 m	5-V-1963			1	♀
		5-V-1964	1	♂		
International Airport	SL	24-III-1965	1	♂	2	♀
Laklouk	1750 m	17-V-1963			1	♀
Becharré Cedars	2000 m	15-VI-1963			2	♀
	-2500 m					
Nahr el Kelb	100 m	2-V-1963	2	♂	1	♀

Colias aurorina libanotica Led., 1858

Lederer, Wien, Ent. Mon., II:140

Forms of this species occur from Central Asia and south-eastern Siberia west and south to Lebanon.

Adult Male (Fig. 38)

Head: The segments of the antennae are yellow, covered with fine pink scales and separated by brown scales covering the intersegmental areas. The club is tricolored; dorsally brown and pink scales remain, ventrally and at the apex the scales have been lost exposing yellow segments, which in some cases have medial brown dots. The vertex and ventral area of the head are covered with pink-tipped gray pubescence which becomes yellow along the caudal rim of eyes. The ventral surfaces of the maxillary palpi are covered with long white scales interspersed with black hairs. On the palpus fine yellow hairs cover the dorsal surface and pink ones clothe the apex.

Thorax: Dorsally, the black nota are clothed with pearl gray pubescence. Ventrally the black sternites and leg bases are covered with yellow-green scales and hairs. A few pink ones are found on the femur. The few remaining short white hairs on the tibia and tarsal segments expose the light green colored integument of the terminal leg segments. Both the hairs and the integument are suffused with pink.

Abdomen: The abdomen is bicolored. The black tergites show through the pearl gray pubescence, which is extremely well developed on tergites I to III. The pubescence is reduced caudally, where it mixes with pale yellow-green scales along the tergites'

caudal margins. The sternites and apex of the abdomen are covered with yellow and pale green scales and hairs.

Wings: Two colors predominate on the dorsal surface of the fore wing. Orange scales cover the proximal two-thirds of the wing with the exception of scattered black and grey scales at the base and along proximal fourth of the anal margin. In the most distal third of the cell brown scales covering the cellular areas and yellow scales covering the veins form a wide apical and distal band. The proximal edge is scalloped while its distal margin is fringed with pink and yellow scales. Pink scales edge the costal margin and yellow hairs the anal edge.

The basic colors of the dorsal surface of the hind wing are similar to those of the fore wing, the proximal three-fourths covered with orange scales and the distal fourth covered with dark brown ones. The medial portions of the humeral and anal cells are covered with pale green scales shading into yellow along 2A. Dark brown and pale green scales occur distad of 2A in cell Cu_2. Bright orange scales form an irregularly shaped discal spot. Anteriorly pale green scales cover the distal end of the frenular lobe and the humeral vein. Immediately distad, in the proximal half of the costal cell, there is a blending of red scales into pink, into yellow and finally into a combination of yellow-green and brown scales which occupy the distal half of the costal cell. There is a short fringe of white scales along the margin of the wing. Both wings are pubescent proximally. On the fore wing fine yellow hairs extend into the proximal portions of cells Cu_2 and 2A and on the hind wing they extend into the proximal portions

of the discal cell and cell 3A and completely cover cells Cu_2 and 2A.

Ventrally the fore wing pattern is similar to, but less distinct than that found on the dorsal surface. Also the brown discal spot is smaller and the golden colored proximal two-thirds of the wing is lighter since brown and pale yellow green scales are intermixed with the orange and yellow ones. This region gradually blends into the yellow-green scales forming bands of different widths on the costal, distal and anal margins. Pink scales cover the costal edge and form a fringe on the distal margin while white hairs fringe the anal margin.

Ventrally the hind wing is covered with yellowish-green, yellow and black scales. The entire area appears yellow-green blending into black along the anal veins and wing base, ending in pink scales covering the alar sclerites. The discal spot is irregular in shape and bears a white center surrounded by a double band: the inner being pink, the outer, yellow. There is a faint pink fringe around the hind wing. Yellow-green pubescence is found covering the anal angle and in Cu_2 cell.

Adult Female (Fig. 39)

Characteristics of the female are essentially the same as those of the male with the following exceptions. This description is based on a single female caught at the same time as the male, at Becharre. The base color of the dorsal surface of the fore wing is less dusky and more orange yellow, than in the male. The brown margin is interrupted with yellow spots in M_1, M_2, Cu_1, Cu_2 and a faint spot in M_3. The brown discal spot is circular.

On the upperside of the hind wing, light blue scales cover cells C and Sc. The yellow spots in the narrow brown margin have fused, and formed a band. The discal spot is single and larger than that found in the male.

The underside of the fore wing is yellow-orange centrally with a light green band on the distal margin and apex through which can be seen the dorsal yellow marginal spots. A pink fringe edges the costal and distal margins. The ventral surface of the hind wing lacks the dusky covering of brown scales, the more central area is grayer green than the marginal light green band. Pink scales fringe all three sides.

Egg, Larva, Pupa

No information is available on the developmental stages. They are probably similar to those of C. croceus.

Remarks

According to Wiltshire (1957) this species was collected in Amadia, Iraq, but should be found at higher altitudes in Iraq.

According to Higgins (1964) three specimens (1 ♂ and 2♀) were caught at the Becharré Cedars in mid-June and were similar to C. aurorina transcaspica. This is an alpine species in Lebanon.

Material Examined

Becharré Cedars 2000 m - 2500 m 15-VII-1963 1 ♂ 1 ♀

Leptidia sinapis deserticola Ver., 1908

Verity, Rhop. Pal., p. 202.

Forms of this species occur from southern Europe through Asia Minor to China.

Adult Male (Fig. 42)

Head: The antennae and clubs are composed of yellow segments covered with dark brown scales dorsally and white ones ventrally. In the majority of specimens the apex of the club is yellow where the scales have been lost. The vertex anterior to the antennal bases is covered with black and white hairs. Posterior to the origin of the antennae the hairs have been lost except for the white rimming the caudal margin of the eye. Ventrally the cephallic region and maxillary palpi are clothed with white pubescence. The ventral surface of the palpus is strongly hirsute and ends in a black apex.

Thorax: Dorsally, the black nota are clothed with pearl grey pubescence, ventrally the sclerites and leg bases are covered with white scales and hairs. The extremely long hairs on the ventral surface of the femur form a fringe. The sparse vestiture of short white hairs on the tibia and tarsus allows the dark brown integument of these terminal leg segments to show through.

Abdomen: The abdomen is bicolored. Dorsally the black tergites are exposed, except for some gray pubescence remaining on tergite I and a few white scales on the posterior tergites. Ventrally the black sternites are white and totally covered by scales.

Wings: (Fig. 11) The base color of the upperside of both fore and hind wings is white. On the fore wing dark brown scales extend from the base in three directions: along Sc, R_1 and the costal margin decreasing where the tips of R_1 and R_{2+3} intersect the costal margin, into the proximal half of the discal cell and along

the proximal fifth of 2A. In six specimens brown scales cover the apex from R_4 to the tip of M_2 or M_3. In four other specimens this region is covered by a mixture of grey and brown scales.

The hind wing is white except for a group of dark brown scales at the base of the wing. The grey pattern seen on the dorsal surface is actually the design on the ventral side showing through.

The ventral surface of the hind wing is covered with a mixture of white and pale yellow scales. The pattern is made of brown scales scattered on the frenular lobe or forming a faint diagonal band which extends from the tip of Rs across M_1 and M_2 and ends indistinctly at a more mesal spot on M_3. Dark brown scales beginning at the anal margin spread distad into the caudal half of the discal cell and posterior throughout cells M_2, M_3, Cu_1 and Cu_2.

Adult Female (Fig. 43)

The characteristics of the female are similar to those described for the male with the following exceptions. Instead of the dark apical spot on the fore wing, brown and gray scales line the distal ends of R_{2+3}, R_4, R_5, M_1 and the tips of M_2, M_3 and Cu_1. A few black and gray scales edge the costal margin. A single smaller female is in excellent condition. It was caught in July and is completely white except for a few gray scales scattered apically on the fore wing. The abdomen is completely covered with white scales. The ventral surface of the fore wing is basically white with light yellow scales covering the costal margin and apex. The same is true for the hind wing with the

additional area posterior to M_2 being covered by light yellow scales.

This specimen suggests the appearance of a third brood, for according to Ellison and Wiltshire (1939) three broods are found in Lebanon in March and April, June and July and September. The members of the third brood are smaller in size.

The following descriptions of the developmental stages are accoding to Spuler (Seitz 1909).

Egg

The eggs of this species are long, yellowish-white and ribbed longitudinally.

Larva

The larva has a green body with a bright lateral stripe above the legs. It feeds on Lotus, Lathyrus and several species of Vicia.

Pupa

The pupa is ochreous with a reddish-yellow lateral stripe which is broken up by white marked spiracles. The wing cases have reddish-brown stripes.

Remarks

Ellison and Wiltshire (1939) state that in Lebanon this "race" occurs from the hot coastal valleys to the middle altitudes, especially near pine woods.

Material Examined

Ainab	925 m	2-VIII-1963	1 ♂	
Araya	523 m	31-VII-1964	1 ♂	1 ♀ very small and pure white

Beirut River	241 m	21-III-1965	4 ♂	1 ♀
Damour River	400 m	7-IV-1963	1 ♂	1 ♀
	904 m	21-IV-1963	2 ♂	
Kessab, Syria	1000 m	15-VI-1963	1 ♂	
Jouret Arsoun	1084 m	21-III-1965	1 ♂	

Leptidia lathyri aestiva Stgr., 1878

Staudinger, 1878, Hor. Ent. Ross. 14:47.

This genus contains the smallest of the pierid butterflies found in Lebanon. It is readily separable from other Lebanese Pierid genera by the smallness of the discal cell in both wings as well as other venation characteristics.

Seitz (1909) considers lathyri to be a subspecies of L. sinapis and aestiva, a subspecies of L. duponcheli. The specimen in the collection resembles L. duponcheli (Seitz 1909) more than it does L. sinapis. Forms of L. duponcheli are found from southern France, Asia Minor, Armenia and Persia.

The following description is based on a single male specimen from Lebanon collected by Higgins in May, 1962.

Adult Male (Fig. 41)

Head: The antennae are composed of yellow segments covered with dark brown and occasionally white scales ventrally. The apex of the club is yellow where the scales are missing. Only a vestige of grey pubescence remains covering the vertex thereby exposing its black integument. Scattered white scales and hairs clothe the ventral head region and maxillary palpi. The hairs on the ventral surface of the palpus form a fringe which extends to

the dark brown apex of the palpus.

Thorax: The nota are black laterally with a few grey hairs. Ventrally the sternites and leg bases are black, sparsely covered with a few scattered white scales and hairs. The few remaining hairs on the ventral surface of the femur from a fringe while the sparse vestiture of short white hairs on the tiba and tarsus exposes the tan-colored integument of these distal segments.

Abdomen: The single specimen in this collection has only its anterior abdominal segments intact, the posterior ones having been destroyed. In this worn individual a single tuft of grey hair remains on tergite I, with a few white scales scattered over the sternites.

Wings: Both wings appear transparent. On the dorsal surface the base color of the fore wing is white. Light yellow scales fill the discal cell and black ones cover the wing base and extend distally into the costal cell to the tip of Sc + R_1 or along the proximal end of the anal margin. The apex is covered with brown scales a few of which are also scattered between M_2 and Cu_1.

The upper surface of the hind wing is covered with yellow-green scales except for white ones in the proximal and distal portions of cell M_1 and those in cell 3A. Dark brown scales cover the base of the wing and extend caudally for a short distance along 2A.

Ventrally the fore wing is tricolored. The discal cell is yellow, the central section white and the apex is covered with a combination of yellow and brown scales.

The hind wing is covered with brown and yellow scales which

are interrupted by white ones in the proximal and distal third of cell M_1.

Adult Female

None available.

Egg, Larva, Pupa

No information. In all probability they resemble those of L. sinapis.

Remarks

Ellison and Wiltshire (1939) record this subspecies as being common on the eastern slopes of the Cedars Range. Individuals were found at the Boharre Cedars in June, on the ridge in July, and once at Baalbek by Zerny.

Additional material is required before any support can be given to the suggestion that the population in Lebanon is "a very distinctive race with yellow ground cover" (Ellison and Wiltshire (1939) p. 13).

Material Examined

Les Cedres	_m	_-V-1962	1 ♂	(Higgins' Specimen)

Discussion

This study of the pierid fauna of the Republic of Lebanon has revealed a number of interesting facts concerning the distribution of butterflies in the eastern Mediterranean region. Most of these are related to the country's unique geographical position and its exaggerated topography. In order to properly explain, or, for that matter, understand the distribution of the twenty-two species under consideration, a brief resume of these physical factors is necessary.

The political boundaries of Lebanon correspond to no known zoogeographical restrictions. According to Wallace (1876) the country in its entirety falls within the Mediterranean subregion of the Palearctic Region. However, as a brief reflection upon the history of the area amply demonstrates the country's position is rather strategic with respect to the passage of terrestrial organisms between southeastern Europe and North Africa.

The geographical position which Lebanon occupies is roughly between $34^{\circ}_{40'}$ N to $33^{\circ}_{10'}$ S, which marks the center of the eastern shore of the Mediterranean Sea. It covers an area of approximately 10,400 square km., and has an altitude range from sea level to 3086 meters east of Bcharré. Topographically Lebanon is divisible into four fairly distinct zones: The Coastal Plain, the Lebanon Mountains, the Bekaa Valley and the Anti-Lebanon Mountains. The Anti Lebanon Mountains are poorly known faunistically for various

reasons and are not considered in the following discussion.

The Coastal Plain consists of a strip of land varying in altitude from sea level to approximately 400 to 500 meters. In width it is narrower in the south than in the north where it expands to merge with the Bekaa and ultimately with the Syrian Desert east to Hama, Syria. This zone includes only the western foothills of the Lebanon Mountains facing the sea and not the Bekaa Valley or the eastern foothills.

In considering the entire rhopaloceran fauna of the country, the zone involving the Lebanon Mountains is subdivided into at least three distinct zones, only two of which are distinct in reference to the pierid butterflies. These zones are the main mountain massif and a series of scattered subalpine habitats on the main mountain peaks. All of the latter are areas which are mostly above 2000 meters and are thus restricted to localities in north and central Lebanon. Only two species of pierids are restricted to these areas although many other species from lower elevations occur there during the appropriate season.

The Bekaa Valley zone includes both the valley floor with an average altitude of 900 meters and the eastern foothills of the Lebanon Mountains. As with the Coastal zone, the separation of this zone from the main mountain mass is indistinct at lower elevations and strongly dependent upon season.

Within these three zones the distribution of the pierid butterflies forms a fairly consistent pattern, which is determined by season-dependent events such as mean daily temperature, the availability of suitable food plants and, to an extent, wind

direction. As will later be discussed, the mountains probably form an effective barrier to the exchange of individuals of certain species between the coast and the Bekaa.

In a typical year there is only one species of pierid butterfly which can be expected to occur on the wing throughout the winter. This species, Pieris rapae, has been seen on the coastal plain during warm periods in all of the winter months, and it appears that the immature stages are capable of growth and development during all but the coldest periods. With this single exception, all of the residents or transients observe a more or less circumscribed flight period.

The first species to occur as adults in the spring, usually in March or early April, are Pieris brassicae, Anthocharis cardamines and Gonepteryx cleopatra. The first of these is never common and is usually restricted to cultivated areas. It appears to be rather short-lived as an adult and the first brood is on the wing for a relatively short period. A. cardamines is never very common in the lower portions of the Coastal Plain and, where it occurs, shows a strong preference for wooded areas which are interspersed with cultivated terraces, frequently of fruit trees. G. cleopatra demonstrates no distinct "brood" and once it appears on the wing may be encountered almost anywhere along the coast until June. It shows little habitat preference but is usually encountered flitting through areas with dense woody vegetation. The males of this species are much more common than the females and emerge earlier in the season.

By mid-April, in the foothills of the Coastal Plain Zone,

adults of Pieris ergane, Pieris napi, Pontia daplidice, Euchloe belemia, Gonepteryx farinosa, Colias croceus and Leptidia sinapis may be seen, although our present collection indicates that many of these are rare or uncommon at the lower elevations. In some cases, such as C. croceus, the occurrence of adults is limited to areas where the proper food plants are cultivated so that this species is seldom seen far from fields of alfalfa and other legumes upon which its larvae feed. In other instances such as G. farinosa and L. sinapis the lower portions of the Coastal Plain are apparently unsatisfactory, for unknown reasons, and the bulk of the adults are encountered at elevations above 100 meters.

As the season progresses, all of the species mentioned above may be seen flying at higher elevations and scattered individuals of Euchloe ausonia, Anthocharis charlonia and Anthocharis damone may also be taken in the proper habitats. Unfortunately, these species are so poorly represented in the collection that very little inference can be drawn concerning their distribution and habitat preference. This is likewise true of Goneteryx rhamni and Leptidia lathyri.

A species succession similar to that seen on the Coastal Plain may be observed in the Bekaa Valley. The composition of the fauna is similar to that described above. However, Pieris rapae has not been collected in the Bekaa and it is doubtful that it occurs there. Instead it is replaced by large numbers of P. napi and fewer numbers of P. ergane. Although it is possible that G. cleopatra may occur in the Bekaa Valley, to date only G. farinosa has been taken there. A. cardamines is locally common

but Euchloe ausonia and other species occur erratically. Colias croceus is locally abundant where its food plants are cultivated.

During the late spring, usually in May, the upper regions of the Bekaa Valley and the lower reaches of the Lebanon Mountains support Aporia crataegi in enormous numbers. Unlike any other pierid species in the country the emergence of individuals from the chrysalis is synchronized and it is literally possible to collect hundreds of specimens in a single afternoon. Whether the ratio of males to females is abnormally high in this species or whether the females emerge later has not been established. In either case, field observations indicate a ratio of over ten males to each female. This species has not been taken on the coastal slopes of the mountains although it is known from the interior.

Few of the species mentioned above occur in significant numbers at elevations above 2000 meters. There seem to be only two species which are truly indigenous to the subalpine areas mentioned earlier. These are Synchloe callidice and Colias aurorina. It is possible that Gonepteryx rhamni and Leptidia lathyri also fall into this category but available information is inconclusive on this point. The high altitude forms are poorly represented in the collection since the bulk of collecting activities took place during the spring months, too early for alpine forms to be on the wing.

Lebanese pierid butterfly populations demonstrate two distinctly different types of movement: vertical and horizontal. As mentioned previously, vertical passage is shown to an extent by practically all of the truly indigenous forms and as the season

progresses there is certainly an exchange of adult individuals between the lower and higher elevations. Thus, an analysis of the seasonal distribution of a given species presents a continuum of older individuals at the lower levels and younger individuals at the higher levels. As the temperature increases, individuals decrease in numbers at lower elevations until they have disappeared completely. It is not meant to imply that this disappearance is attributable to migration to higher altitudes. Quite the contrary, it is doubtful if many individuals of any species disperse very far in a vertical direction. Adults simply expire after having mated and oviposited. The result, however, is that during any given spring, the population of a species does move up the mountain range in response to an increase in temperature.

At present, information is not available concerning the maximum altitude attained by any species, and exhaustive collecting efforts would be required to establish this for even a single form. Suffice it to say that each species almost certainly does have an altitude limit past which it does not normally occur and for most of the forms discussed thus far this limit is in the neighborhood of 1500 to 2000 meters. Even at these elevations most of the species mentioned above have disappeared by late June. This is true at least for members of the first generation in multivoltine forms.

Horizontal movement takes the form of more or less distinct migrations of individuals of the species involved. There are four members of the pierid fauna which are usually associated with migrational movements. These are Pieris brassicae, Belenois mesentina, Teracolus fausta and Catopsilia florella.

C. florella is not represented in the collection but it is generally agreed that individuals probably do stray into Lebanon from the south where the species is an indigenous member of the fauna. The genus is African in origin and C. florella is the species which occurs the farthest north.

Belenois mesentina is poorly represented in the collection but this may well be associated with the times of collecting activity and not accurately reflect the actual status of the species in Lebanon. The species is African and Indian in its distribution and there can be little doubt that individuals recorded from the Republic of Lebanon have migrated there from countries to the south. It is not presently established that this species breeds in Lebanon, but the infrequency with which it is encountered would mitigate an argument that it does.

Pieris brassicae is a species which reputedly migrates in vast swarms at certain times in the European countries. There is no evidence at present to indicate that the presence of this species in Lebanon is the result of immigration. On the contrary, it is probably a permanent member of the fauna and there is some indication that it passes through two broods each year. Since it is a strong flier and does show a tendency to migrate in other countries it is quite likely that the Lebanese population is periodically reinforced by wandering individuals both from the north and the south. It occurs on the coast and in the Bekaa with equal frequency.

Teracolus fausta is the only species which can definitely be associated with migration based on observations and collected

material. It is totally absent from the country from the beginning of the winter season until the following July or August when scattered individuals begin to appear in the vicinity of Beirut. From then until November in mild years it is the commonest pierid butterfly along the coast. That it reproduces in the country is demonstrated by the presence of freshly emerged adults in the late summer and autumn. It has not been established whether more than one generation is produced in Lebanon before the advent of cold weather which either forces the adults south or kills them.

A similar cycle is known for this species in Palestine as has been cited elsewhere.

There is little information available pertaining to the number of generations per season for most of the Lebanese species. Such forms as Pieris rapae are potentially capable of exceeding five broods a year along the coast at low elevations. The same is probably true to a slightly lesser extent of P. brassicae, P. napi and P. ergane. Conversely, it is known that Aporia crataegi passes through but one generation a year and this is possibly likewise true of such indigenous forms as some species of the genera Euchloe, Anthocharis, and Gonepteryx. A study of the natural life cycles of many of these species should be most rewarding.

In summary, the pierid butterflies of Lebanon include elements of both the European and African fauna but no forms on the species level are unique to the country. The majority of the species are European in their distribution and those of tropical origin appear to extend this far north primarily due to their migratory habits. Of the four migratory forms treated above,

only P. brassicae is of northern origin.

The two high-altitude species are also of northern origin and presently occur only on the mountain tops where satisfactory ecological conditions exist. These refugia also harbor other species of northern animals which exhibit a similar distribution in Lebanon.

There is a seasonal succession related to altitude and temperature involving all but the high altitude and the tropical species. It is thus possible in divoltine forms for individuals of the first generation to be on the wing at higher elevations while individuals of the second generation are flying at lower elevations. This and other factors make an accurate analysis of the pierid population extremely difficult under ideal circumstances and impossible under those which presently prevail.

Summary

1. Literature pertaining to the 22 species of the Lebanese pierid butterflies is reviewed.
2. Methods employed in the study of material used in this investigation are briefly described.
3. A key to both sexes of all the species is presented.
4. The major physical characteristics of both sexes of the adult as well as the developmental stages are discussed.
5. The geographical location and topographical variation of Lebanon are described.
6. The distribution of the Lebanese pierid species is outlined in the order of their appearance during a typical year.
7. Pieris rapae, a permanent resident of the country is not recorded from the Bekaa.
8. Vertical movement of pierid populations and its relation to season is described.
9. The distribution of the two subalpine species indigenous to Lebanon is discussed.
10. Horizontal movements of the four migratory species are reviewed.
11. A Palearctic origin for all but three genera is suggested.
12. No species under consideration are unique to Lebanon.
13. The number of generations per year of the various species is discussed where information is available.
14. A map of collecting localities is included.

15. Wing venation figures for 11 to 12 genera is presented.

16. Color photographs of the majority of the species are included.

Literature Cited

Bodenheimer, F. S. 1935. Animal Life in Palestine, Jerusalem, 506 pp., LXX pls., 77 figs.

Borror, D. J. and Delong, D. M. 1964. An Introduction to the Study of Insects, New York, Holt, Rinehart and Winston, XI + 506 pp. (Rev. edit.)

Ellison, R. E. and Wiltshire, E. P. 1939. The Lepidoptera of Lebanon: with notes on their season and distribution. Trans. R. ent. Soc. Lond., 88:1-56, 1 pl.

Higgins, L. H. 1964. Butterflies of Lebanon. Entomologist, 97:193-200. VIII pl.

Higgins, L. H. 1967 (pers. comm.)

Hogarth, T. G. 1967 (pers. comm.)

Seitz, Adalbert 1909. The Macrolepidoptera of the World. Vol. I. pt. I. The Palearctic Butterflies. Struttgart: Verlag des Seitz' chen Werkes, 379 pp. (English translation by K. Jordan)

Seitz, Adalbert 1909. The Macrolepidoptera of the World. Vol. 2. pt. 2 (plates) 89 pp.

Wallace, A. R. 1876. The Geographical Distribution of Animals, London: Macmillan, 2 vols.

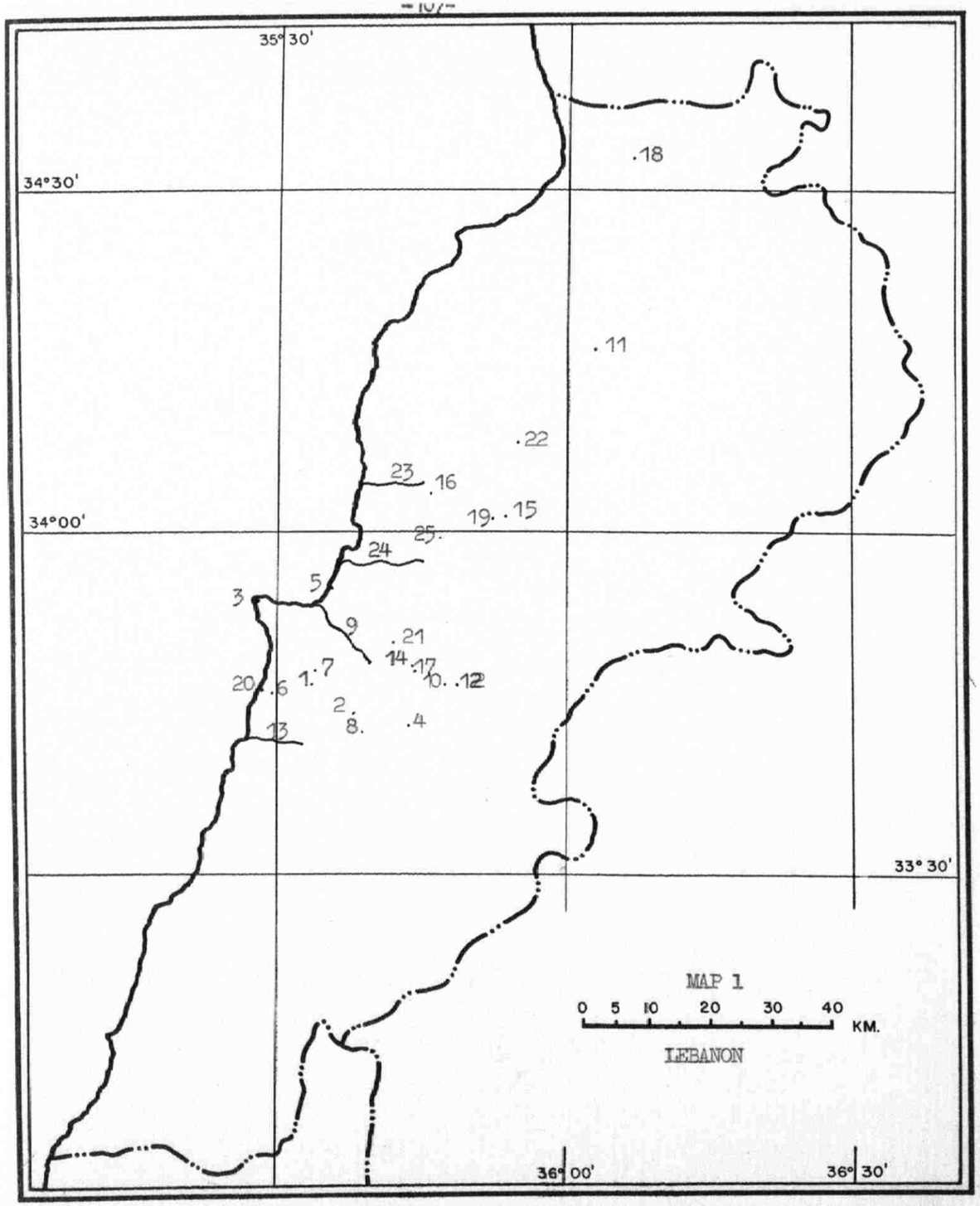
Wiltshire, E. P. 1957. The Lepidoptera of Iraq. London; Nicholas Kaye Limited, 162 pp., XVII pls., (two in color), 6 figs.

Wiltshire, E. P. 1967. (pers. comm.)

Explanation of Map

Following is an alphabetized list of collecting localities. Numbers assigned correspond to numbers on the map.

1	Ainab	925 m	13	Nahr Damour	400 m
2	Ain Zhalta	1000–1100 m	14	Falougha (5 km SE)	1700 m
3	American University of Beirut Campus	SL	15	Faraya	400 m
			16	Ghebaleh	1100 m
4	Ammik	1000 m	17	Hammana	1500 m
5	Antelias	50–250 m	18	Haouchab	250 m
6	Aramoun	577 m	19	Hrajel	1300 m
7	Araya	523 m	20	International Airport	SL
8	Barouk	1000–1800 m	21	Jouret Arsoun	1084 m
9	Nahr el Beirut	241 m	22	Laklouk	1750 m
10	Bweirj	1300 m	23	Nahr Ibrahim	500 m
11	Bcharré Cedars	2000–2500 m	24	Nahr el Kelb	50–200 m
12	Chtaura	904–1000 m	25	Natural Bridge	1600 m



Explanation of Figures 1 to 11

Venation diagrams of the right fore and hind wings of the following species of the Lebanese pierid butterflies:

Fig. 1 Gonepteryx cleopatra taurica Stgr., 1881 ♂

Fig. 2 Aporia crataegi hyalina Röb., 1907 ♂

Fig. 3 Belenois mesentina Cr., 1777 ♂

Fig. 4 Anthocharis cardamines phoenissa Kalchb., 1894 ♂

Fig. 5 Pontia daplidice laenas Forsk., 1908 ♂

Fig. 6 Synchloe callidice chrysidice H-Sch., 1844 ♀

Fig. 7 Pieris rapae leucosoma Schaw., 1905 ♂

Fig. 8 Teracolus fausta Oliv., 1801 ♂

Fig. 9 Colias croceus Fourcr., 1785 ♂

Fig. 10 Euchloe belemia palestinensis Röb., 1907 ♂

Fig. 11 Leptidia sinapis deserticola Ver., 1908 ♂

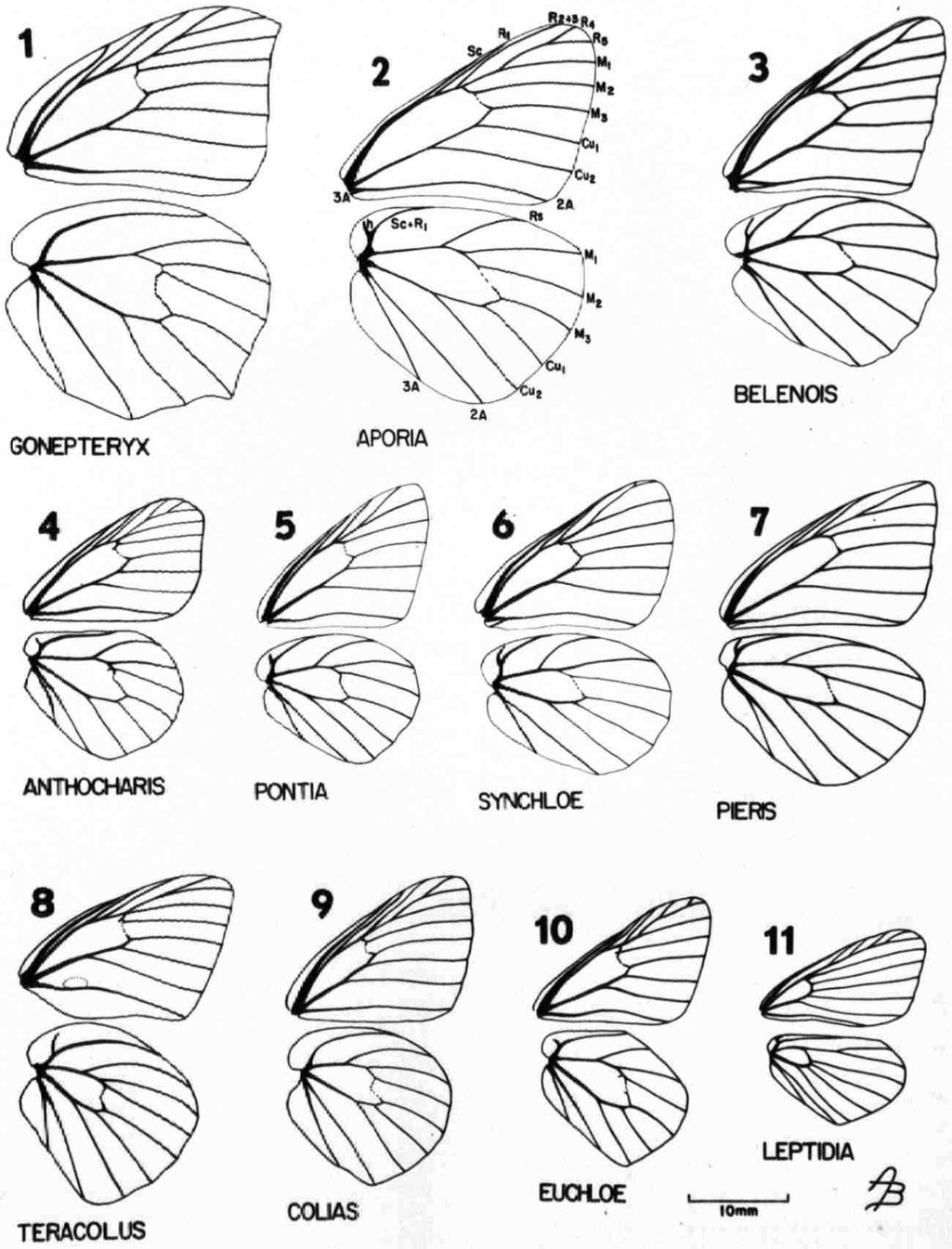
Wing Veins:

Sc = Subcosta M = Media

R = Radius Cu = Cubitus

Rs = Radial Sector A = Anal

h = humeral crossvein



Explanation of Figures 12 to 20

Fig. 12 Aporia crataegi hyalina Röb., 1907 ♂

Fig. 13 Aporia crataegi hyalina Röb., 1907 ♀

Fig. 14 Aporia crataegi hyalina Röb., 1907 ♂ underside

Fig. 15 Pieris brassicae verna Zell., 1847 ♂

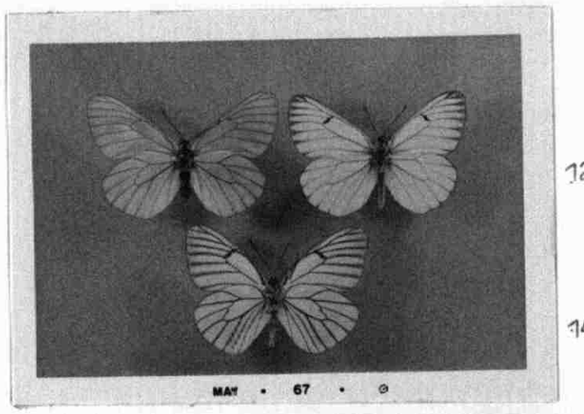
Fig. 16 Pieris brassicae verna Zell., 1847 ♀

Fig. 17 Pieris rapae leucosoma Schaw., 1905 ♂

Fig. 18 Pieris rapae leucosoma Schaw., 1905 ♀

Fig. 19 Pieris ergane Hubn., 1827 ♂

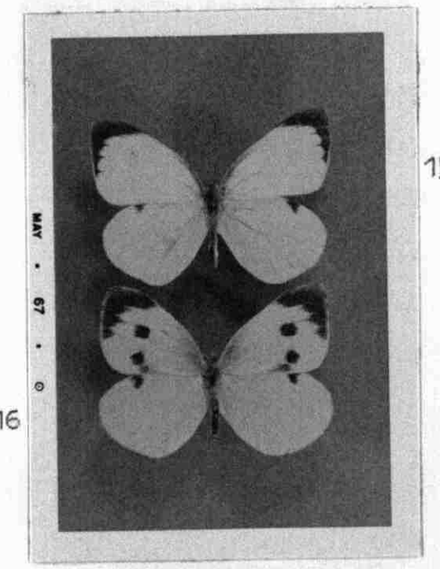
Fig. 20 Pieris ergane Hubn., 1827 ♀



13

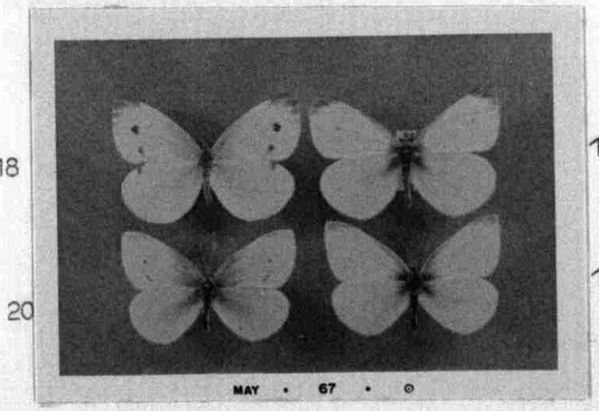
12

14



15

16



18

17

20

19

Explanation of Figures 21 to 32

Fig. 21 Pieris napi pseudorapae Ver., 1908 ♂

Fig. 22 Pieris napi pseudorapae Ver., 1908 ♀

Fig. 23 Euchloe belemia palestinensis Röb., 1907 ♂

Fig. 24 Pontia daplidice laenas Forsk., 1908 ♂

Fig. 25 Anthocharis charlonia mesopotamica Stgr., 1891 ♀

Fig. 26 Euchloe ausonia crameri Butl., 1869 ♂

Fig. 27 Anthocharis cardamines phoenissa Kalchb., 1894 ♂

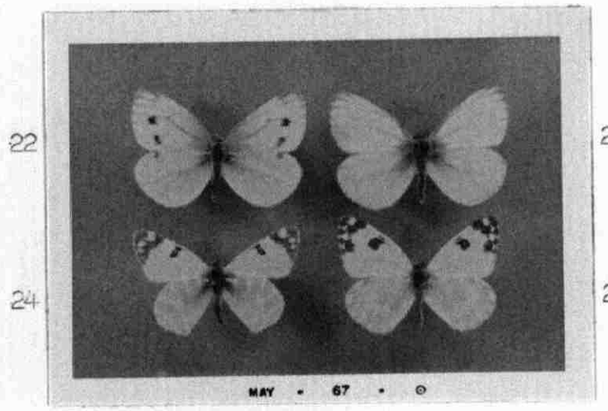
Fig. 28 Anthocharis cardamines phoenissa Kalchb., 1894 ♀

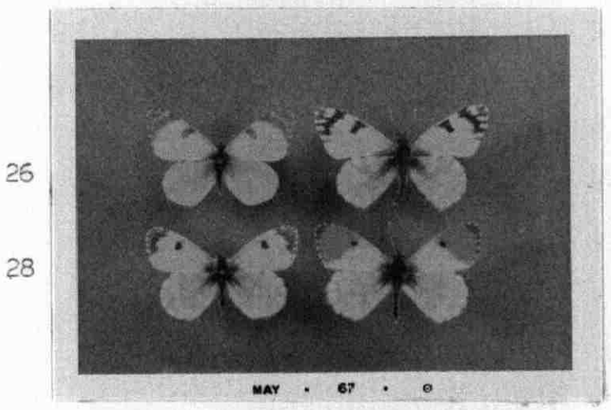
Fig. 29 Teracolus fausta Oliv., 1801 ♂

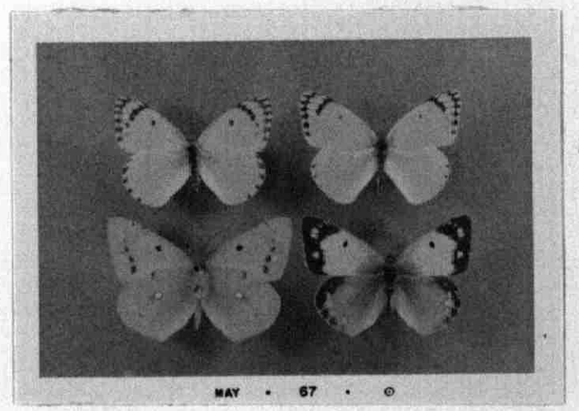
Fig. 30 Teracolus fausta Oliv., 1801 ♀

Fig. 31 Colias croceus Fourcr., 1785 ♀

Fig. 32 Colias croceus Fourcr., 1785 ♀ underside







Explanation of Figures 33 to 43

Fig. 33 Gonepteryx farinosa Zell., 1847 ♂

Fig. 34 Gonepteryx farinosa Zell., 1847 ♀

Fig. 35 Gonepteryx cleopatra taurica Stgr., 1881 ♂

Fig. 36 Colias croceus Fourcr., 1785 ♂

Fig. 37 Colias croceus Fourcr., 1785 ♀

Fig. 38 Colias aurorina libanotica Led., 1858 ♂

Fig. 39 Colias aurorina libanotica Led., 1858 ♀

Fig. 40 Anthocharis damone syra Ver., 1911 ♂

Fig. 41 Leptidia lathyri aestiva Stgr., 1878 ♂

Fig. 42 Leptidia sinapis deserticola Ver., 1908 ♂

Fig. 43 Leptidia sinapis deserticola Ver., 1908 ♀