

The Zygaenidae of Lebanon (With notes on their parasites)

(Lepidoptera)

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Introduction

The aim of this paper is to give a comprehensive account of the faunistics and taxonomy of the Lebanese *Zygaenidae*. Such an overview is of special importance since the main reviewers of the eastern *Zygaenidae*, Holik and Sheljuzhko (1953—58), had very little Lebanese material at their disposal. Two more recent papers (Tremewan 1963, Wiltshire 1968) do not attempt to deal with the entire fauna, and except in Wiltshire there are no references at all to the *Procridinae*.

Field studies on the Lebanese *Zygaenidae* took place during the period 1972—75 when the author had already spent two years in the country concentrating solely on *Rhopalocera*. This paper would not have been written had it not been for the constant encouragement of Dr. B. Alberti, whose advice permeates the entire paper; however the responsibility for the final decisions in taxonomy rests with the author.

In keeping with my general view on taxonomy, which is influenced by the writings of Mayr, I decided early to use a cautious approach to both species and subspecies. Unless there are strong reasons to the contrary, no more than one subspecies is accepted from Lebanon, and in at least two cases the collections on which this paper is based demonstrate that previously accepted subspecies must fall. This is not to deny that on occasion individual populations may differ somewhat from the neighbouring populations; this is not infrequently due to ecological conditions, but even if it in fact represented the temporary predominance of a peculiar genotype in a localised population, it would not necessarily merit a subspecific name (Mayr 1963). In the *Zygaenidae*, more so than in many other groups, there remains a good deal of difference of opinion concerning the definitions of a species. My decision has been to adopt forms which are not clearly differentiated morphologically as subspecies in a "Rassenkreis". *Zygaena olivieri* and *Z. brizae* are typical examples; much more material from the Middle East, biological studies and cases of demonstrated sympatry are necessary before it can confidently be stated that the multitude of forms constitute true species. In general it may be said that the vast literature on the Palaearctic *Zygaenidae* has been concerned with the description of new taxa rather than with the more fruitful endeavour of relating the many forms to one another on a taxonomic and zoogeographic basis. Although I do not accept the validity of a number of available names used for Lebanese forms, all are mentioned at appropriate points in the text.

No introduction is given to the Lebanon, its geography, ecology, phyto-geography and zoogeographical position. This was covered in detail in my recent book on the Lebanese *Rhopalocera* (Larsen 1974); the terminology and localities cited are the same in the present paper.

Little work has been done on the *Zygaenidae* of Lebanon. Brief notes are included in papers devoted to *Lepidoptera* or *Rhopalocera*, notably in Zerny (1932), Ellison & Wiltshire (1939) and Paulus & Rose (1969). Tremewan (1963) wrote a short, interesting article on the small collection of *Zygaenidae* brought back by Lionel G. Higgins in 1962. The main systematic treatments of the family deal also with the Lebanese fauna (Seitz 1913, Jordan in Seitz 1913, Holik & Sheljuzhko 1953—58, Alberti 1954, Alberti 1958—59), but all had a very limited material on hand.

No complete search for Lebanese material has been made. The paper is based mainly on my own material from the 1973 and 1974 collecting seasons, when Père François Tomb assisted me in especially collecting *Zygaenidae* with great zeal. All references in the literature were duly studied and a number of small collections were also taken into account. The number of *Rhopalocera* known from Lebanon is about 140 (Larsen 1974) and it is unlikely that more than half a dozen or so remain to be discovered. The *Zygaenidae* are obviously less well researched, but given the relatively low number of species already known and our intensive efforts during 1973 and 1974, it seems unlikely that more than two or three additional species will be found. However, the *Zygaenidae* are so much more localised than the *Rhopalocera* and the fact that only three *Zygaena laeta*, two *Rhagades amasina* and one *Procris hector* have been found is sobering in this respect.

The Lebanese *Zygaenidae* in perspective

The family *Zygaenidae*, sensu lato (e. g. Alberti 1954), is conveniently subdivided into six subfamilies with over 100 genera and more than 1000 species. Possibly the family is not monophyletic. In Lebanon, only two subfamilies, the *Zygaeninae* and the *Procridinae* are represented. The former has a single genus with three subgenera each represented by several species. The latter has three closely related Lebanese genera, *Theresimima* Strand, *Rhagades* Wallengren and *Procris* Fabricius. The two first have one Lebanese representative each, the latter four. Clearly the Lebanon and neighbouring areas do not constitute a main dispersal centre of the *Zygaenidae* in quantitative terms, but it does contain a remarkable proportion of species which appear to be geographically or taxonomically isolated, or even endemic forms of larger related groups. No less than five of the six *Procridinae* display one or both of these characteristics, namely *T. ampellophaga*, *R. amasina*, *P. anatolica*, *P. hector* and *P. syriaca*. Of the seven *Zygaeninae* known with certainty from Lebanon, *Z. olivieri* and *Z. laeta* are taxonomically relatively isolated; this is even more true of *Z. graslini* which is in addition endemic. It would appear that the Lebanon has been isolated from the main development centres of the family in Asia Minor at least since the late Tertiary. Certainly Lebanon constitutes the southern border of most of the species which are able to survive only because of the ecological diversity of the high mountains.

Of the Lebanese genera of the *Procridinae*, *Rhagades* and *Procris* are found from the Atlantic to the Pacific with the distribution clearly centered on the Mediterra-

nean. The single species of *Theresimima* is essentially Mediterranean. One of the five known *Rhagades* is found in Lebanon as are four of the approximately fifty *Procris*. The genus *Zygaena* is also found from the Atlantic to the Pacific, and seven of about one hundred members of the genus occur in Lebanon. All told somewhat less than ten per cent of the species belonging to the genera found in Lebanon actually occur there. Asia Minor has twice as many species (about 14 *Procridinae* and 18 *Zygaeninae*) though some of these occur only in Armenia on the fringes of the area.

As one moves south or east into drier areas, the number of species declines rapidly. Even Iraq, with high and relatively well watered mountains, has only three *Procridinae* and four *Zygaeninae* (Wiltshire 1957). Only a single species, *Procris anatolica*, reaches Egypt, and possibly Libya if *Procris kruegeri* Turati, as I suspect, is a form of *anatolica*. Cyprus has no known *Zygaeninae* and two known *Procridinae*. The only representative on the Arabian Peninsula is the extreme relict, *Reissita simonyi* Rebel.

The *Zygaenidae* provide rich scope for the study of insect evolution and zoogeography. It is my hope that this overview of the Lebanese fauna will be useful beyond its aim as a faunistic and taxonomic contribution.

Aknowledgements

Père F. Tomb kindly placed his material at my disposal and during the collecting seasons of 1973 and 1974 concentrated his efforts on the *Zygaenidae*. The fact that he found no species hitherto unknown in Lebanon must be due to the comprehensiveness of the available material. Dr F. J. Gross placed his material of the Lebanese *Procris* at the disposal of Alberti including the only known specimen of *P. hector*; we are most grateful for this assistance. Dr K. Rose gave details of his captures of *Zygaena*-species in Lebanon, thus continuing the collaboration established during my work on Lebanese Rhopalocera. Dr S. Chauderi determined a number of food plants. Mr D. Benjamini sent some *Zygaena* from the southern slopes of Mt. Hermon, almost the only material available from the Antilebanon. Without the material assembled by these collectors, this paper would have been less comprehensive and my deepest thanks go to all of them.

My thanks are also due to Dr M. R. Shaw who arranged for the study of parasites bred from Lebanese material and to the Commonwealth Institute of Entomology for the identification of the egg parasite of *Zygaena carniolica*.

The then chairman of the Biology Department, American University of Beirut, Prof. P. Basson placed the resources of his department at my disposal and Dr A. S. Talhouk gave freely from his field experience in the country. The Lebanese National Council for Scientific Research (CNRS) undertook to finance a colour plate photographed by Prof. P. Harrison Smith; because of the current tragic situation in Lebanon it was not possible to include the plate in the paper. I would like to express my gratitude for this cooperation.

Abbreviations

The following abbreviations have been used in the systematic part as regards the current placement of specimens referred to:

| | |
|------------|--|
| Ahrenkiel: | L. & O. Ahrenkiel leg., coll. TBL |
| Coll. AUB: | In coll. of American University of Beirut |
| Benjamini: | D. Benjamini leg., coll. TBL |
| FT: | Père F. Tomb leg., coll. F. Tomb or TBL |
| Gross: | In coll. F. J. Gross |
| Higgins: | L. G. Higgins leg., coll. BM (N.H.) (Tremewan 1963) |
| TBL: | Torben B. Larsen leg. et coll. |
| Rose: | In coll. K. Rose |
| Coll: | Staudinger: in coll. Museum Berlin, DDR |
| Talhouk: | A. S. Talhouk leg. et coll. |
| Wiltz: | E. P. Wiltshire leg. et coll. (Ellison & Wiltshire 1937) |
| Zy: | Zerny leg., coll. Museum Wien (Zerny 1932) |

Zygaenidae

Zygaeninae

Zygaena Fabricius

subgenus Agrumenia Hübner

1. *Zygaena (Agrumenia) olivieri olivieri* Boisduval 1829

Status: The nominate subspecies is from "Beirut, Syrie". Two other forms have been described from Lebanon, both of which may be treated as synonyms. Ssp. *cremonae* Seitz nec Staudinger, which has been wrongly associated with *Z. lydia* Staudinger (Seitz 1913), was correctly sunk as a junior synonym of *olivieri* by Holik and Sheljuzhko (1953—58). The latter accepted ssp. *libanicola* Burgeff 1927, the type locality of which is near Zahlé on the eastern side of the Lebanon range. Its characteristics, according to the original description, are the less dense scaling and a more pinkish ground colour when compared to *cremonae* (= *olivieri*). Many specimens personally bred from several localities share these characteristics to varying degrees and I feel they may be related to the quality of the foodstuffs, often poor in captivity. Individuals which resemble *libanicola* may be met with in most populations, while on the other hand specimens from localities not far from Zahlé are typical as are some from the Antilebanon. I therefore sink *libanicola* as a junior synonym of *olivieri*. There is considerable individual variation in size, extent of red markings, the width of the marginal black band of the HW and in the dimension of the red abdominal band. In heavily marked specimens there may be a black mark in the cell of the UPHW. The race is constant in the weak white borders of the red spots on the UPFW and extreme specimens may have no trace of white. This is in marked contrast to the Lebanese race of *Z. carniolica*.

Range. The species flies in a series of subspecies from the Caucasus to Lebanon and Iran.

Habits. The species is on the wing in June and July in most types of terrain between 1000 and 2000 m in the Lebanon and in the Antilebanon ranges. Records from Beirut, including the type series, are definitely in error. It is rather sporadic

and often single specimens only are met with. On the Jabal Kesrouan it is not unusual to find only one or two among thousands of *Z. carniolica*. The flight is direct and often rather higher than that of other *Zygaena*. It is very fond of the minute white flowers of the *Astragalus* on which the larva feeds; these are spiny and the moth soon becomes very worn. Holik and Sheljuzhko mentions a series (9 males and 4 females) from Djerin (?Jezzine) from 18-X-1926 (in coll. Staudinger/Bang-Haas). If correctly labelled they must represent an exceptional second brood.

Localities: Jezzine, 900 m., 18-X-1926 (Coll. Staudinger); Zahlé, 1000 m., (Burgeff 1927); Kabr Chmoun, 1000 m., 10-VI-1972 (TBL), Ainab, 1000 m., VI-1973, VI-1974 (TBL); Faltoun, 1200 m., 8-VI-1969 (Rose & Gross); Hammana, 1300 m., 3-VI-1965 (Coll. AUB); Mdairej, 1400 m., 17-V-1973 (TBL); Barouk Cedars, 5-VII-1974 (TBL); Lakloul, 1800 m., 12-VI-1973 (TBL); Jabal Kesrouan, 1800 m., 14 & 30-VII-1974 (TBL); Ehden Cedars, 1800 m., 23-VII-1973 (TBL); Cedar Mt., 2000 m., 10-VI-1931 (Zy), end VI to VIII (Wiltshire); VI-1962 (Higgins); 23-VI-1973, 8-VII-1973, 22-VII-1974 (TBL); Mt. Hermon, 1600—1750 m., 20-VI-1976, 2-VII-1975 (Benjamini).

Early Stages: The larva feeds on the leaves of a tall, bushy *Astragalus* which grows commonly in the zone of the cedar, and more rarely as low as 1000 m. in the upper Mediterranean zone. The fully grown larva is lighter than most other species, being smoky tending towards green dorsally. The sides have a row of bright yellow spots, crowned by a single ovoid black spot on each segment. The cocoon is spindle shaped, but not pointed at the ends like *Z. filipendulae*. It is fastened to the woody stems of the food plant, more rarely to stones. The colour is normally a delicate green, but cream coloured cases are sometimes found.

2. *Zygaena (Agrumenia) carniolica illiterata* Koch 1938

Status: The name *praestans* Oberthür was applied to Lebanese material by earlier authors (Zerny 1932; Ellison & Wiltshire 1939). This is a subspecies from Asia Minor which is larger, has proportionately less red on the fore wings and has the red spots less strongly ringed with white. Koch (1938) described two subspecies of *carniolica* from the Lebanon; he considered *illiterata* a mountain form and *incompta* a form inhabiting lower altitudes. The two are both poorly defined and based on a small material, seven and two specimens respectively. In fact, *carniolica* in Lebanon is strictly limited to the subalpine zone and *incompta* falls comfortably within the range of normal variation in a colony of *illiterata*. I accordingly consider *incompta* a junior synonym of *illiterata*. I accept the latter as valid since the Lebanese form differs from all those of Asia Minor through their small size, the relatively large red spots and the extensive white ringing of these spots. A full revision of *carniolica* is long overdue with more than 100 forms described as subspecies and with the availability of many other names. Thus the relationship between ssp. *praestans* Oberthür, *suavis* Burgeff, *eibesiana* Koch and *taurica* Staudinger appears quite unclear. In 1973 I bred a series of 113 males and 57 females ex pupae from Jabal Kesrouan; the following statistics indicate both the range of variation and the sexual dimorphism of the subspecies.

Table 1. Size of *Zygaena carniolica illiterata* Koch, measured from the base of the forewing to the apex.

| mm | males | | females | |
|-------|--------------|-----|--------------|-----|
| | no. | % | no. | % |
| 9.5 | — | — | 1 | 2 |
| 10.0 | 3 | 3 | — | — |
| 10.5 | 15 | 13 | 1 | 2 |
| 11.0 | 35 | 30 | 5 | 9 |
| 11.5 | 28 | 25 | 9 | 16 |
| 12.0 | 24 | 21 | 18 | 31 |
| 12.5 | 7 | 6 | 16 | 28 |
| 13.0 | 1 | 1 | 7 | 12 |
| Total | 113 | 100 | 57 | 100 |
| | Average 11.3 | | Average 11.9 | |

Compared to most other subspecies of *carniolica*, the red spots on the fore wing are relatively large. They are nonetheless strongly circled in white, the result being that the white colour encroaches heavily on the black. Even the kidney-shaped spot, characteristic of the *Agrumenia*, is usually fully encircled by white.

Table 2. The extent to which the kidney-shaped spot of *Zygaena carniolica illiterata* is encircled by white.

| Extent of white ringing | Male | | Female | |
|--|------|-----|--------|-----|
| | No. | % | No. | % |
| 1. Full ring of same thickness as rings on other spots | 8 | 7 | 36 | 63 |
| 2. Full ring, slightly thinner than other rings | 96 | 85 | 20 | 35 |
| 3. Small parts of the ring missing | 8 | 7 | 1 | 2 |
| 4. Most of the ring missing as in <i>Z. olivieri</i> | 1 | 1 | — | — |
| TOTAL | 113 | 100 | 57 | 100 |

Often the white rings touch one another, especially in females, and specimens where the black ground colour is almost entirely replaced by white are not uncommon. In summary, ssp. *illiterata* is small, it has a beautiful fresh red colour tinged with pink, with relatively large red spots ringed with strong white markings. It is well characterised and clearly merits subspecific status, which is by no means surprising as it is separated by neighbouring colonies by at least 200 km.

Range: In a succession of subspecies from Central Spain, through southern and central Europe and the Middle East to Siberia.

Habitats: In Lebanon the species appears to be restricted to the subalpine zone of the Lebanon range where its food plant, *Onobrychis cornuta*, grows. It does

not descend below about 1700 metres and is not found south of the Jabal Knissé. There are no records from the Antilebanon, though it possibly occurs there. It is extremely particular in its choice of habitat, preferring rocky terrain with fairly steep slopes (30°). Within a restricted area the species may be superabundant; I (Larsen 1975) once estimated the presence of more than 150,000 individuals in an area the size of a football pitch. There seems to be little interaction between the discrete colonies of this moth; some highly interesting investigations could be made through the careful positioning of a series of Malaise traps. The species is very fond of flowers; thistles and *Centaureae* are particularly favoured, and on occasion up to fifty may be found on one single flowering stem.

Localities: Jabal Kesrouan, 1700 m., July/Oct 1973-75 (TBL); Hadeth Cedars, 1800 m., 1800 m., July/Aug (Wilts); Jabal Knissé, 1800 m., July/Aug (Wilts); above Ehden Cedars, 1900 m., 23-VII-1974 (TBL); Cedar Mountain, 2000—2500 m., July/Sep (Zerny, Wilts, TBL, FT).

Early stages: Eggs are laid in little heaps, averaging 15 in each. They are deposited on twigs and grasses growing out of clumps of *Onobrychis cornuta*, the food plant of the larva. The larva winters in the early instars; it is rather similar to that of *Z. olivieri* but is a brighter green and has a small black spot on each abdominal segment in addition to the prominent oval spot. Pupation usually takes place on the clumps of *Onobrychis*, but sometimes on grasses, twigs or rarely rocks nearby. The cocoon is ovoid, normally white or a very light cream. Exceptionally it may be bright yellow (a sample of 456 cocoons had 111 white, 342 cream and three yellow). It is interesting to note that several cocoons may be attached together in piggy-back; the maximum seen in Lebanon was four on top of each other.

subgenus *Zygaena* Fabricius

3. *Zygaena (Zygaena) filipendulae syriaca* Oberthür 1896

Status: *Z. filipendulae* was first recorded from this country by Zerny (1932) who tentatively referred it to ssp. *syriaca*. Ellison & Wiltshire (1939) also quoted it. In spite of this Holik & Sheljuzhko (1953—58) doubted its occurrence south of the Taurus; it is in fact widespread in the country. The habitus of the Lebanese form is very variable. I have decided to consider it the southernmost population of *syriaca*, the type locality of which is Akbes, Asia Minor. The original description and subsequent elaboration thereof (Oberthür 1910) underlines its relatively large size, the vivid red of the UPS, a variable spotting (five or six, and if six spots, 5 and 6 are often merged) where the entire FW in extreme cases is red. The red shading of the UNFW is often missing. The general impression of *syriaca* is thus one of variability, and this is certainly true in Lebanon. Tremewan (1963) was of the opinion that specimens from Ain Zhalta had too narrow wings with too large spots to be *syriaca* and further thought that a specimen from Cedar Mountain was so different as to belong to another ssp. (see below). Due to the variability I prefer the conservative view and to maintain the Lebanese population as *syriaca*, especially since the distribution is almost certainly not disjunct, though specimens from Syria are lacking. A series of 106 specimens bred from near Beirut show the following pattern of spotting

Table 3. Disposition of spots in 106 specimens of *Z. filipendulae* bred in Beirut

| Sex | 5-spotted | 5 ¹ / ₂ -spotted (merged) | 6-spotted (disjunct) | 6-spotted (merged) | Total |
|--------|-----------|--|-------------------------|-----------------------|-------|
| Male | 5 | 5 | 33 | 6 | 49 |
| Female | 11 | 0 | 32 | 14 | 57 |
| Total | 16 | 5 | 65 | 20 | 106 |

The red shading of the UNFW is rarely entirely missing, but it is not as prominent as in European specimens. It is least pronounced in 5-spotted specimens which may be almost impossible to distinguish from *Z. loniceræ* Scheven. Fortunately the genitalic differences are clear. Specimens from the Cedar Mountains differ from those of other populations. The red spots are larger, are completely merged (also 3 + 4) and the red colour is less intense. I have seen no 5-spotted specimens from the locality. The black margin of the HW is narrow, occasionally absent. All traits are at their most pronounced in certain females. The larva is also slightly different, as is the food plant. However, specimens indistinguishable from coastal ones are not infrequent, while coastal specimens more rarely approximate the Cedar Mountain form. The difference in series may well be accounted for by the special ecological conditions of the Cedar Mountain and the different food-plant. Although a large material is on hand I do not feel justified in separating it, especially as specimens from Laklouk, 1800 m. are somewhat intermediate. The Cedar Mountain population may be more worthy of a name than many other described forms, but I still prefer to consider it the end of a local cline.

Range: Most of Europe, western USSR to Lake Baikal and Asia Minor to Lebanon. It is absent from North Africa and must be considered one of the most temperate of the *Zygaena*.

Habits: Normally the species is not common in a single brood which flies from mid-April till mid-May on the coast and from late May through June in the mountains with the usual precocious and late specimens. There are no known records from the Antilebanon. It prefers cool, lightly wooded areas at lower levels, which apparently provide the best ecological conditions for the butterfly as well as for the food-plant, *Lotus corniculatus*, both of which are temperate. The only locality where it has been found in large quantity is in Hazmiyé, a Beirut suburb. Their main locus is on a steep mountain slope facing due north, rather unusual in such a xerophile genus. The vegetation is non-climax maquis interspersed with abandoned olives and a profusion of the food plant. With increasing construction of residential buildings, the colony is slowly vanishing. In early May it swarms around patches of *Trifolium purpureum*. At middle heights it is fond of open pine forest, *Lavendula* being the preferred flower for feeding. On the Cedar mountain it is found both inside and outside of the cedar forest, and the favoured flower is *Vicia tenuifolia*. Single specimens may turn up almost anywhere in any type of terrain.

Localities: Nahr el Kelb, sea level, 29-V-1969 (Gross); Saida, near sea level, 26-III-1973 (SA); Hazmiyé, Beirut, 200 m., IV/V-1971, 1972, 1973, 1974 (TBL); Jisr el Qadi, 300 m., 24-IV-1973 (Ahrenkiel); 15-V-1973 (TBL);

Aley, 900 m., 15-V-1973 (TBL); V-1936 (Talhok); Fairtroun, 1200 m., late-V-1969 (Rose); Ain Zhalta, 1400 m., 2-VI-1973 (TBL); 23/29-VI-1962 (Higgins); Lakkouk, 1800 m., 12-VI-1969 (Gross); 12-VI-1973 (TBL), Cedar Mt., 2000 m., early-VI-1931 (Zerny); VI/VII-1970, 1971, 1972, 1973, 1974 (FT, TBL).

Early stages: The full grown larva is a light bluish-green. The side of the body has a row of prominent yellow spots, underneath which there are two ovoid black spots at either end of each segment. The yellow spots are crowned by a prominent black twin-spot of quadrangular shape, the two parts of which are basally linked and which merge with the preceding and following spots, forming a continuous band, deeply bisected in the middle of each segment. They feed on *Lotus corniculatus* and were not found on the many small annuals of the *Lotus*-family. A single larva found on the Cedar Mountain differed in not having the dorsal twospots basally fused. Both larval forms are completely different from those of northern Europe, much more so than is the imago. It feeds on a large, perennial, hirsute, white-flowered *Lotus* identified as *L. gebelia* Vert. var. *libanotica* Boiss by the staff at Kew. The cocoon is normally white, tinged with beige and of the familiar "kayak" form with four dorsal creases. About 25 percent of large series bred in Beirut had bright yellow cocoons, but this seems less common in nature. The larvae are plagued by *Apanteles*, while attacks of Tachinids and Ichneumonids seem somewhat less common than in other species

subgenus *Mesembrynus* Hübner

4. *Zygaena* (*Mesembrynus*) *graslini* *graslini* Lederer 1855

Status: The type series was from Beirut where there is much individual variation in the density of scaling, ground colour tone, the expanse of the red spots on the UPFW and the degree of metallic sheen. The FW spots are often cojoined, f. *confluens* Oberthür 1896, which is probably simply due to ecological conditions. *Z. graslini* is type species for the subgenus *Libania* Holik & Sheljuzhko 1956. *Libania* was incorrectly synonymised with *Zygaena* rather than with *Mesembrynus* by Reiss & Tremewan (1967). Alberti (1958) had already established its affinity to *Mesembrynus* on morphological grounds, and believed that it was unlikely to feed on *Papilionaceae* as suggested by several authors, including Holik. This was later proven by Naumann (1970) who was the first to rear the larva on *Eryngium*. Reiss described two further subspecies from Lebanon, neither of which deserve subspecific status. Ssp. *pfeifferi* Reiss 1932 was described after a limited series from the Cedar Mountain, 2000 m. Two specimens taken at the same locality on 1-VI-1974 (TBL) agree to some extent with Reiss' description of *pfeifferi*. They are small and the red spots are rather less extensive than on most Beirut material, while on the other hand they differ in having less, not more, metallic gloss. This lies well within the scope of normal variation, and *pfeifferi* is probably no more than an ecomorph. There is no reason why Cedar Mt. should have a valid subspecies, contiguous with other populations. Ssp. *kulzeri* Reiss 1932 was described from Zebdani in the Antilebanon, a rather drier locality than Chtaura some 30 km away in the Lebanon range. It appears even less well founded than *pfeifferi*. The two chief characteristics are the shorter and broader wing shape and slightly longer more distinctly clubbed antennae. In short series

these traits are so subjective that I have no hesitation in treating *kulzeri* as a junior objective synonym of *graslini*. There are no zoogeographical or distributional reasons for accepting more than one subspecies in Lebanon.

Range: This butterfly has a restricted distribution in Jordan, Palestine, Lebanon, Syria and southern Turkey. It is an unusual pattern which indicates that *graslini* developed its specific status in the area.

Habits: *Z. graslini* is by far the most common Lebanese member of the family. It is abundant throughout the three Mediterranean zones, becoming scarcer in the zone of the cedar and decidedly rare in the subalpine zone. It is known to occur in the Antilebanon as well. Although common and widespread it does have a slight tendency towards localisation in discrete colonies. The normal habitat is open garrigue, but it may be found also in open pine forests on the coast and on wet meadows in the mountains. There is a graduated emergence starting in mid-March on the coast and in early June in the high mountains. The period of flight is quite extended, about six weeks in most larger colonies. The moths are very fond of the flowers of *Asphodelus microcarpus* on the coast, *Centaurea* and *Scabiosa* being favourites elsewhere. In pine forest localities it may be found in masses on *Lavendula* in the company of *Z. filipendulae syriaca*, occasionally also with *Procris obscura*.

Localities: The species is so generally distributed between sea level and 1500 m. that a listing is unnecessary. It is much rarer above 1500 m. but has been caught as high as 1800 m. on the Jabal Kesrouan and 2000 m. on Cedar Mountain. Benjamins caught it to 1600 m. in the Mt. Hermon region of the Antilebanon.

Early stages: The typical zygaenoid eggs are laid in little clutches near the food plants. The larvae feed on any available species of *Eryngium*, especially *creticum* and *falcatum*. Nauman (1970) raised it on *E. planum*. In captivity I have made the same larva accept five different species of *Eryngium*. It feeds mainly at night, spending the daylight hours under a stone and apparently often returning to the same stone night after night. The larva is jet black, with a prominent row of bright pink spots on the sides. The ganglions and the neck are yellow, but this is not apparent superficially. A mimicry phenomenon may be involved, since some carnivorous coleopterous larvae have a very similar colour scheme and form. The cocoon is flat with some crinkles; it is light beige with a silken sheen and is very well camouflaged on rocks where it normally pupates; cocoons are often found on old tin cans, where they are not camouflaged at all.

5. *Zygaena (Mesembrynus) brizae corycia* Staudinger 1878

Status: The *brizae*-complex is sometimes treated as four or five distinct vicariant species. Ssp. *corycia*, the type locality of which is Deressi in Asia Minor, is smaller than the other races and the subunci of the male genitalia are relatively shorter. It would be the most obvious candidate for specific status, but as there are no documented cases of sympatry I prefer the conservative view. Two subspecies of "*corycia*" have been described from Lebanon, both of which may be synonymised with *corycia*. Reiss (1932) described ssp. *staudingeriana* after specimens taken by Schwingenschuss and Zerny on the Cedar Mountain at 1700 m. The diagnosis in the original description is completely inadequate, emphasising variability of characters rather than the opposite. Large series from

the type locality show considerable variation in size, colour and pattern, although it is slightly larger and with a more dense scaling than most other Lebanese populations, probably because of the exceptionally high quality of the food plants in this locality. They do not, however, differ significantly from true *corycia*, and I sink *staudingeriana* to a junior synonym of *corycia*. Bytinský-Salzl (1936) described ssp. *wiltshirei* from the Jabal Knisse, 1600 m., referring to the description of ssp. *staudingeriana*. All characters cited in the diagnosis are subject to variation, only the somewhat smaller size being significant, though not enough to merit the creation of a subspecies. I also synonymise this form with *corycia*. Bytinský-Salzl described ssp. *amseli* from Ain Karem near Jerusalem as a „transitional form between *staudingeriana* and *wiltshirei* which deserves a name also because of its isolated occurrence in Palestine”, How a race located 100 km. south of the type locality of *wiltshirei* and 150 km. south of that of *staudingeriana* could be considered transitional is a moot point; it rather indicates that one of the other races was superfluous. As *corycia* descends to at least 500 m. in the Lebanon, it is unlikely that the Palestinian population is in fact isolated. The name *amseli* should therefore also be considered a synonym of *corycia*. The species is variable in the form of spot 3 + 5, the sharpness of the border between red and black, the density of scaling and in size, but truly striking aberrations are rare.

Range: This is probably a species of Pontomediterranean origin, occurring from southern France (ssp. *vesubiana* le Charles) to the Middle East with northern limits in Austria and the Ukraine. There are no records from the Italian Peninsula.

Habits: The single brood flies over most of the Lebanon range between 500 and 1700 m. A single record is available from 1600 m. in the Antilebanon Range. It is generally of sporadic occurrence and finding it may be very much a hit-and-miss affair. Occasionally moderate numbers are found in a locality, especially in moist places which appear to be attractive to the food plant. Surprisingly, since I have found it widespread, Ellison and Wiltshire only found it in the type locality of spp. *wiltshirei*. It seems less interested in flowers than other members of the genus, though it likes thistles. It is often found sitting in the middle of large leaves where other *Zygaena* tend to prefer straws and twigs.

Localities: Mtolleh, 500 m., spring 1971 (TBL); near Quobaiat, 500 m., V-1973 (FT); above Saida, 500 m., V-1973 (SA); Ainab, 1000 m., 15. 5. 1973 (TBL); Faitroun, 1200 m., late V-1969, 1971 (Rose), 19-V-1973 (TBL); near Chtaura, 1200 m., 18/25-V-1962 (Higgins); Mdairej, 1400 m., 23-V-1973, 10-V-1974 (TBL); Ain Zhalta, 1400 m., 2-6-1973, 18-5-1974 (TBL); 23/29-V-1962 (Higgins); Naba el Aassal, 1500 m., 2-VI-1973 (TBL); Jabal Knissé 1600 m., 16-VI-1934 (Wiltshire); Cedar Mt., 1700 m., VI/VII-1931 (Zerny); VI/VII-1972, 1973, 1974 (TBL, FT) Mt. Hermon, 1600 m., 2-VII-1975 (Benjamin).

Early Stages: The larvae were found by me in five different localities on a tall *Cirsium*, which was unfortunately not positively identified. They were unwilling to accept other species of *Cirsium* and also refused *Onopordon*, which has been questionably advanced as a food plant. The larva is black with a prominent row of yellow spots along the side. It has a white dorsal line which is not clearly defined and which varies somewhat in width. The cocoon is whitish, very like that of a tiny *flipendulae*.

6. *Zygaena (Mesembrynus) cuvieri libani* Burgeff 1914

S t a t u s : *Ssp. libani* was described from "aus dem Libanon" and from Beirut. All the types must have been from the mountains. In the diagnosis the large average size is correctly emphasised, and the red spots are relatively slightly smaller than those of the nominate race. However, the tendency for the spots to revert to the 6-spot type is not apparent in series. There is much variability and the most frequent aberration is towards enlargement of the spots, and on the Cedar Mountain specimens where the entire wing is red except for a black border are not too infrequent. It is easily the largest Lebanese member of the family.

R a n g e : The species inhabits eastern Asia Minor to Russian Armenia, Lebanon and Iran. It is probably of Iranian origin.

H a b i t s : This is basically a species of the subalpine zone of the Lebanon range; so far there are no records from the Antilebanon, but it is likely to occur there. The species exists only in very localised colonies where the number of specimens may be truly astounding. Only colonies of *Z. carniolica* contain a larger number of individuals. On the Cedar Mountain in June and July 1973 it was excessively abundant. Hundreds could be found sucking nectar on every small patch of *Vicia tenuifolia*, and they had no hesitation in flying during bright sunshine although several authors have remarked they are sluggish in sunlight. They are reputed to come to light at night, but I have not observed this.

L o c a l i t i e s : Dahr el Baidar, 1600 m., VI/VII (Wiltshire); Natural Bridge, Faraya, 1700 m., end-VI-VII-1973 & 1974 (TBL); above Ehden, 1700 m., 23-VII-1974 (TBL); Jabal Knissé, 1700 m., (Wiltshire); Cedar Mountain, 2000 m., VI/VII-1931, 1934 etc (Zerny, Wiltshire); VI-1962 (Higgins); VI-1972 (FT), 23-VI/8-VII-1973; 23-VII-1974 (TBL).

E a r l y s t a g e s : Wiltshire (1935) gave the following description of the larva from Cedar Mountain: "is pale yellow tinged with green. The subdorsal line is represented by a large oval spot on the front of each somite, a small one next to it, on the rear of each preceding somite. The spiracles and feet are black. The head black with white cheek-points; the short bristly hairs white. Feeds at night on *Ferulago frigida*. Pupa in a creamish-white spindle-shaped cocoon, low down". This description matches large series found by me at the Natural Bridge, Faraya, but it should be noted that compared to species such as *filipendulae* or *olivieri* the subdorsal spots are not large. The localisation of *cuvieri* is difficult to explain, since its choice of food plants is not conservative. My series fed mainly on *Ferula casii* Zoh. & Davis (Chauderi det.) (= *meifolia* auct.) but many also on *Eryngium glomeratum* Lam. This represents an interesting case of a species feeding on hard and soft leaved *Umbelliferae* in the same spot. On the Cedar Mountain one larva was found on yet another *Ferula*, not identified. The cocoon is either white or yellow, a large series bred in Beirut showing 4:1 respectively. It is rather like a gigantic *filipendulae*, but more squat. Tremewan (1977), rearing the species from eggs which I had sent from Faraya, shows that it needs two years to develop; this probably accounts for its rarity in certain years.

7. *Zygaena (Mesembrynus) laeta laeta* Hübner 1790

Status: Holik and Sheljuzhko (1953—58) clearly emphasise that the species was not recorded from the Levantine zone. The present records are new to Lebanon and represent a considerable extension of its known area of distribution. *Z. laeta* was described from Austria and does not tend towards the formation of races; I have little hesitation in referring the three Lebanese specimens to the nominate subspecies. Reiss (1935) described ssp. *danieli* from Marasch in the Taurus mountains. Alberti has seen the two specimens on which the race is based and doubts its validity at the subspecific level. The description of ssp. *orientis* Burgeff 1926 from Macedonia also indicates that this differs little from nominate material.

Range: The species extends from South Russia to Austria and the Balkans, Lebanon being the southern limit of its distribution.

Habits: Only three Lebanese specimens are known, from two localities. One locality is just on the fringe of the subalpine zone in the Lebanon, the other at the foot of the Antilebanon, and it thus appears to be essentially an insect of the drier zones. This is in reasonable agreement with its distribution elsewhere, and some *Rhopalocera*, including *S. phlomidis* have similar distributions. *Z. laeta* seems scarce and sporadic through most of its range, and it is perhaps not surprising that only three are known from Lebanon. The single specimen caught by me was taken on the same spot as that in coll. AUB, on an expedition arranged primarily to find it. Six subsequent visits in the following month failed to turn up further specimens. The locality at Faraya also houses a vigorous colony of *Z. cuvieri libani*, and possibly like that species it needs several years to develop from egg to imago.

Localities: Terbol, Beea, 1100 m., 8-VII-1971 (Talhok); Natural Bridge, Faraya, 1600 m., 9-VIII-1964 (Lewis, coll. AUB); 31-VII-1974 (TBL).

Early Stages: Not recorded in Lebanon. It probably feeds on *Eryngium*.

Procridinae

Theresimima Strand

8. *Theresimima ampellophaga* Bayle-Barelle 1808

Status: This butterfly is readily recognised by the unicolourous blackish brown of all four wings. They vary extensively in size and density of scaling, but the variation is apparently not geographic and no subspecies have been described. The Lebanese form appears to have larger and more bushy antennae than those from other localities, but only an extensive comparative material will tell whether this is constant.

Range: South France and eastwards along the Mediterranean, extending as far north as Austria, the Balkans, and Asia Minor to the Caspian Sea. As far south as Palestine.

Habits: The species seems quite rare in Lebanon, where it flies in two broods throughout the Mediterranean zones where vines are grown. On its status as a pest of vines in Lebanon, see Talhok (1969). Apparently it is not uncommon near human habitation; this may be because it has a preference for ornamental vines. One vigorous colony in Beirut lived at the level of fifth floor in an apartment building.

Localities: Beirut, sea level (Wilts.); Beirut, Raouché, sea level, May 1973 (TBL); Tripoli, sea level, July 1973 (FT); Quobaiat, 400 m., (FT); AUB Farm, Beeqa Valley, 1000 m. (AUB); Aley, 900 m., 15-VII-1939, 25-V-1940 (Talhok); Beit Méry, 1000 m. (Wilts).

Early Stages: Not personally observed in Lebanon; see Talhok (1969) and for a full discussion Issikutz (1957).

Rhagades Wallengren

9. *Rhagades amasina* ? *amasina* Herrich-Schäffer 1856

Status: The species is closely related to *R. pruni* Schiffermüller and *R. predotae* Naufock. In the structure of the genitalia and in morphology they differ so strongly from *Procris* that a separate generic status is indicated. In habitus, distribution and choice of food plant, *Prunus*, the group shows a certain relict character. *R. amasina* is easily distinguished from other known Lebanese Procrids by the brown colour of the forewings, only the body and bases of the wings being green. The two Lebanese specimens caught by me differ from material from Asia Minor in being larger and in having more pronounced cornuti in the male genitalia. A series might provide the basis for isolating a separate subspecies, but at present too little material is on hand from any localities to give firm guidance.

Range: Very locally in Asia Minor, North Syria and now also in Lebanon. Doubtfully recorded from Armenia.

Habits: The only two known specimens from Lebanon, one of either sex, were taken on the same day in mid-June, swarming around a two metre high *Prunus* bush in a rocky area with abandoned agricultural terracing. Their aspect on the wing against the dark background was curious, only the metallic green body and wing-bases being visible. Repeated visits to the locality, where *Z. grasilini* and *Z. brizae corycia* were also flying, during 1974 yielded no further specimens. We may assume it is very localised and rare.

Localities: Faitroun, 1200 m., 16-VI-1973 (TBL).

Early Stages: The larva undoubtedly feeds on *Prunus*, which is supported by the conditions under which the two Lebanese specimens were caught.

Procris Fabricius

10. *Procris syriaca syriaca* Alberti 1937

Status: This is a species closely related to *Procris graeca* Jordan 1909 from which it may be distinguished by the male genitalia which lack the prominent tooth of the valve. Coutsis (1976) gives an excellent illustration of the genitalia of *graeca*. From the other Lebanese *Procris* it may be distinguished by the cornuti of the aedaeagus, which consist of a bundle of minute spikelets, where the others have well defined, large cornuti of varying form.

Range: South Turkey to Palestine.

Habits: The species appears to be very rare indeed and no details of habits or habitats are available. However, its presence in Lebanon was to be expected, especially as there was an old specimen in the Alberti collection, labelled

“Syrien, Libanon”. It was most fortunate that Gross caught a single male on the Jabal Barouk, the first certain Lebanese capture.

Localities: Jabal Barouk, probably about 1600 m., VI-1969 (Gross).

Early stages: Unknown.

11. *Procris hector hector* Jordan 1909

Status: This species was described on the basis of a single specimen from Mersin, and since the original description little additional material has come to hand. Alberti found a single female in the Staudinger collection in Berlin, labelled Beirut, Cremona, 1886. Together with some specimens from Eibes in South Turkey, Alberti (1937) described the latter as *P. staudingeriana* but on examination of the holotype of *hector* subsequently synonymised it (Alberti 1974). *P. hector* is the only Lebanese *Procris* with a prominent tooth on the valve.

Range: Only known from South Turkey and Lebanon.

Habits: Nothing is known about the distribution or habits of this butterfly in Lebanon. The single Lebanese specimen with details as to its capture is from a dry locality on limestone in the mountains near Barouk; both *P. anatolica* and *P. obscura* are found in the same area, but usually at rather lower altitudes than the 1700–1900 metres given for *hector*.

Localities: Maaser es Chouf Cedars, Jabal Barouk, 1700–1900 m., I-V-1969 (Gross).

Early Stages: Not surprisingly these are totally unknown.

12. *Procris anatolica* Naufok 1929

Status: This species varies in both size and colouration. There appear to be two basic forms. One has dark green fore wings and a blue abdomen; the other is a striking green with a golden sheen and a bright green abdomen. Usually the two fly together and no constant features in the male genitalia have been found to suggest that they are more than polymorphs of *anatolica*; there seems no basis for establishing a separate subspecies for the Lebanese material. The names *levantina* Jordan 1931 and *pfeifferi* Naufok 1935 are best considered junior synonyms of *anatolica*.

Range: Anatolia, eastwards to Iran, southwards via Syria, Lebanon, Palestine and Jordan to the Sinai, Egypt and probably Libya.

Habits: This species is widely distributed throughout the country from sea level to at least 2100 metres in the mountains; the colonies are localised, but not as much as in most other Lebanese Zygaenidae. On occasion it may be quite abundant. Contrary to *P. obscura*, with which it is often sympatric, there is a single brood in April and May on the coast, in May and June in the Mountains. Ellison & Wiltshire (1939) mentions a specimen from Dour el Choueir in late July, but this is exceptional and probably represents a delayed hatching rather than a partial second brood. The imagines of both sexes are lively and take readily to the wing even when there is no direct sunshine; they are inordinately fond of feeding from a white Scabious, *Scabiosa prolifera*.

Localities: Beirut, sea level, 30-IV-1933 (Wilts); Nahr el Kelb, sea level, 22/24-IV-1966 (Paulus); Hazmiyé, Beirut, 200 m., 11/29-IV-1973; 28-III/15-V-1974 (TBL, FT); Quobaia, 400 m., 7/14-IV-1973; IV/V-1974 (TBL, FT);

Aley, 900 m., 1-V-1938, 28-V-1939, 18/21-IV-1940 (Talhok); Faitroun, 1200 m., 30-VI-1973 (TBL); Sofar, Wadi Azzouniyé, 1200 m., 30-V-1969 (Gross); Dour el Choueir, 1200 m., 7/13-VII-1933 (Wilts); Ain Zhalta Cedars, 1600 m., 23-V-1973 (TBL); Cedar Mountain, 1700—2200 m., 5-VI/2-VII-1931 (Zy); 23-VI-1973 (TBL).

Early stages: No records from Lebanon.

13. *Procris obscura?* *obscura* Zeller 1847

Status: *P. obscura* shows so much local variation that diagnosis of valid subspecies is most difficult. The series from Lebanon, even though it is not very extensive, gives some impression of the range of variation. It covers size; the smallest on hand has a forewing of 9 mm, the largest 14 mm. The hindwings may vary from opaque smoky grey to almost transparent. The ground colour of the forewing varies from golden green to a deep metallic green. The former has been described as f. *anceps*, an infrasubspecific name which cannot be employed at the subspecific level. The degree to which the underside of all wings have a golden metallic sheen also varies. There is a continuous range between the extremes of all characters. Series large enough to permit a full investigation of the variability were unfortunately not available. *P. obscura* can be distinguished from the other Lebanese *Procris* by the fact that the last seven to nine segments of the male antennae are thickened; the aedaeagus is very long, recured with a globular base and a very long cornutus filling out two thirds of its length. It is well pictured by Coutsis (1976).

Range: A species of Pontomediterranean origin which has been found in Greece, Asia Minor, Lebanon, Israel, Iran and Transcaucasia.

Habits: This species vies with *anatolica* for the title of the most common of the Lebanese *Procris*; *anatolica* is generally more localised, but often more numerous in its colonies, while *obscura* may turn up almost anywhere. The preferred biotope seems to be open grasslands though more rocky garrigue will also produce it. At middle heights it is often found in open pine woods in the company of a very limited fauna of day flying Lepidoptera, including *Leptidea sinapis* and *Zygæna filipendulae*. *Lavendula* and *Mentha* attract them strongly in such surroundings. The curious ability of *obscura* to turn up almost anywhere may be related to some form of migratory or displacement behaviour. In Hazmiyé near Beirut, while dining on the terrace on the second floor of an apartment building in late May 1974, I noticed five specimens at intervals travelling steadfastly in the same direction more than four metres above ground level. This took place at dusk and seems most atypical for the genus. There are two broods on the coast, but probably only one in the mountains.

Localities: Tripoli, sea level, spring 1972, VIII-1973, late III-1974 (FT); Tabarja, sea level, 31-V-1969 (Gross); Nahr el Kelb, sea level, 22/24-IV-1966 (Paulus); Nahr Ibrahim, 100 m., mid-V (Wilts); Nahr Beirut, mid-V, (Wilts); Hazmiyé, Beirut, 200 m., mid-IV — through V-1973 and 1974 (TBL, FT); Quobaiat, 400 m., early V-1974 (FT); near Zghorta, 1200 m., 15-V-1974 (FT); Ain Zhalta, 1400—1600 m., 23-V-1973 (TBL); Jabal Kesrouan, 1700 m., 23-IV-1974, 24-VII-1974 (TBL); Cedar Mountain, 2000 m., VI-1931 (Zy); 23-VI-1973 (TBL); mid-VIII-1974 (FT).

Early stages: Père F. Tomb hatched a small series of larvae found under stones immediately before pupation. They were in company of the larva of *Zygaena graslini*. He described the larvae as Zygaenoid "avec un aspect blanchâtre". They pupated in rather untidy white cocoons.

Possible further species

A few other species of *Zygaenidae* have been mentioned in the literature which are actually unlikely to exist in Lebanon or which may have been incorrectly determined. Lederer (1855—61) listed *Procris geryon* Hübner and *Procris beydenreichii* Herrich-Schäffer from Beirut. I agree with Ellison & Wiltshire (1939) that these determinations are suspect and have, of course, not been verified through the study of genitalia. Holik & Sheljuzhko (1953—58) mentioned *Zygaena loniceræ* Scheven from Beirut; if the specimens were correctly labelled, which is far from certain, there remains the possibility that they were five-spotted *Z. filipendulae*. There are a few specimens of a species in the *Z. purpuralis* Brünlich complex from Beirut in coll. Daniel in coll. Witt, coll. Staatssammlung München and coll. Alberti. They may all be from the same lot of Burgeff material. Holik & Sheljuzhko question the habitat Beirut and believe them to be mislabelled (1953). It is not entirely unlikely that the two species in question could be found in Lebanon.

Alberti kindly compiled the following list of species which might occur in Lebanon which may serve a purpose in alerting future collectors concerning what to look for:

- Zygaena (Zygaena) achilleae* Esper
- Zygaena (Zygaena) loniceræ* Scheven
- Zygaena (Zygaena) dorycnii* Ochsenheimer
- Zygaena (Zygaena) ramburi* Lederer
- Zygaena (Zygaena) senescens* Staudinger (bon. sp. ?)
- Zygaena (Zygaena) laphria* Freyer (? = *cilicia* Burgeff)
- Zygaena (Mesembrynus) lydia* Staudinger
- Zygaena (Mesembrynus) punctum* Ochsenheimer
- Procris notata* Zeller
- Procris volgensis* Moeschler
- Procris subsolana* Staudinger
- Procris chloronota* Staudinger
- Procris capitalis* Staudinger

It is my personal impression that the likelihood of finding more than two or three additional species is slight.

Chromosome numbers

I made an attempt to study the chromosome numbers of all the Lebanese *Zygaenidae*. In the process it was confirmed that the sperm production in the genus *Zygaena* is very precocious and accordingly study of the imagines was not productive. However, larvae were procured of all Lebanese species except *Z. laeta*; the haploid chromosome number was in all cases identical, $n = 30$.

As far as I am aware, chromosome counts of the *Procridinae* have not been made. Sperm production appears even more precocious than among *Zygaena* and some 19 squashes of *P. obscura* and *P. anatolica* were studied in vain. Larvae were unfortunately not procured. A separate paper outlines the cytological results in comparison with the existing body of knowledge (Larsen 1976).

In the course of the cytological studies, colour drawings were made of the adult larvae. These can be made available to interested researchers. Generally little variation was found from locality to locality within Lebanon; the Lebanese form of the larvae of *Zygaena filipendulae*, on the other hand, differs dramatically from the forms found in Denmark and the United Kingdom.

Parasites

All the Lebanese *Zygaena*-species are heavily attacked by parasites, chiefly Hymenopterous parasitoids. In the course of breeding experiments undertaken in Beirut, any parasites emerging were collected and preserved, though detailed notes were only kept in the case of *Zygaena carniolica*. Dr. M. R. Shaw kindly arranged for the study of this material, details of which are given below. In many cases it proved impossible to arrive at precise specific identifications, but the generic status according to the most modern taxonomic concepts was established.

On two week-ends (23 and 30-IX-1973) a total of 948 eggs of *Z. carniolica* were collected at random. Of these, about 28 percent hatched normally, nine percent never hatched, and 63 percent were parasitised by a minute wasp (*Telenomus* sp. near *kolbei* Mayr, [*Hymenoptera*, *Scelionidae*] [Commonwealth Institute of Entomology det.]). One test tube with eggs almost looked as if it contained a dense smoke as the wasps emerged and buzzed about. Usually all eggs in an egg-clutch were parasitised. The wasps probably have a slightly longer gestation period than the larvae, and in consequence the true level of parasitisation could be lower than indicated by the figures.

The larvae, as is the case of many species of *Lepidoptera*, are strongly plagued by species of *Apanteles* (*Hymenoptera*, *Braconidae*, *Microgasterinae*), though damage on the scale which can be done to for instance European species of *Pieris* was not observed. Specimens bred from *Zygaena filipendulae* resemble, but are not conspecific with, the well known European *Apanteles zygaenorum* Marshall. Specimens bred from *Zygaena carniolica* could not be positively identified; they are close to but not identical with the one bred from *filipendulae*. Larvae parasitised by what was *Microgasterine* Braconids, probably *Apanteles*, were also observed on *Zygaena cuvieri* and *Zygaena graslini*. In the material given to Dr. Shaw, a species of *Gelis* (*Hymenoptera*, *Ichneumonidae*, *Cryptinae*) bred from *Zygaena carniolica* was also found; undoubtedly this must have been a pseudohyperparasite on *Apanteles*. All the *Apanteles* feed gregariously in the living larvae and emerge before attempts at pupation are made.

The larvae of *Zygaena* are also parasitised by flies of the family *Tachinidae*, usually one emerging from each larva. Quantitatively they appear to be less important than the *Apanteles*. At the request of Dr. Shaw, Mr. T. H. Ford of Sheffield kindly identified the Lebanese material as follows. Six specimens of *Compsilura concinnata* (Meigen) were bred from *Zygaena carniolica*; this is a common polyphagous species which is known to feed on *Zygaena filipendulae* in

the United Kingdom. Three *Exorista fasciata* (Fallén) were bred from *Zygaena carniolica*; it is a widespread, polyphagous species, known from *Zygaena filipendulae* in the United Kingdom. Finally a single specimen of *Phryxe nemea* (Meigen) was bred from *Zygaena graslini*; it is also known from *Zygaena filipendulae* in the United Kingdom.

All species of *Zygaenidae* in Lebanon appear to suffer from strong attacks by a group of the *Ichneumonidae*, whose taxonomic position according to Townes (1970) is as follows: *Gelinae* (*Cryptinae* Auct.), *Mesostinini*, *Agrotherentina*. The biology of these species is most interesting. The female wasp seeks out cocoons of the *Zygaena*, containing a prepupa or a fresh pupa. She deposits a single egg inside the cocoon, where it develops as an ectoparasite. When fully fed, in a very short time, the wasp larva reinforces the cocoon with its own silk and may then aestivate or hibernate. The reinforced cocoon of *Mesostinidea* is so strong as to withstand almost any danger, including severe mechanical force and flooding. The wasps favour large cocoons (usually female) and are probably responsible for the odd sex-ratios occasionally met with when hatching specimens ab pupae (Larsen 1974, Shaw 1975). I did not find the wasps on *Z. brizae* or on *Z. cuvieri*, probably simply because all breeding from these two species were ab larva rather than ab pupa; they will probably be found on these species as well, although the two year breeding cycle of *cuvieri* (Tremewan 1977) may offer it special protection, a suggestion of which Shaw is sceptical. *Zygaena filipendulae* is parasitised by a species close to but not identical with *Mesostinidea obnoxius* Gravenhorst, a species well known from several European *Zygaena*, including *filipendulae*. *Zygaena graslini* is parasitised by a species of *Gambrus*; *Zygaena carniolica* is strongly plagued by another? *Mesostinidea*, while a single specimen of as species of *Agrothereutes* was also found. The ?*Mesostinidea* attacking *Zygaena carniolica* is quantitatively very important; of the 456 pupae collected on the Jabal Kesrouan on 19-VIII-1973 (mentioned in Larsen 1975) the following total outcomes were observed:

Outcomes of 456 cocoons of *Zygaena carniolica* collected in the wild, Jabal Kesrouan, Lebanon, 19-VIII-1973

| Outcome | Number | Percent |
|--|--------|---------|
| Hatched <i>Zygaena</i> | 184 | 40 |
| Dead <i>Zygaena</i> (Larva, pupa or imago) | 38 | 8 |
| ? <i>Mesostinini</i> | 211 | 46 |
| 1) <i>Tachinidae</i> | 12 | 3 |
| ? <i>Mesostinini</i> from last year | 5 | 1 |
| Pseudohyperparasites | 6 | 1 |
| TOTAL | 456 | 99 |

1) Hatched in 1974

There were some large Chalcid wasps among the many *Ichneumonidae*; these were studied by Dr. R. Askew. *Brachymeria intermedia* (Nees) emerged from cocoons of *Zygaena carniolica* and *Zygaena olivieri*, while *Hocheria bifasciata*



(Walker) emerged from *Zygaena carniolica*. They belong to different subfamilies of the *Chalcididae* and are almost certainly pseudohyperparasites.

In retrospect it was most regrettable that a larger material of parasites was not systematically gathered, since the provisional evidence suggests that there is a relatively high degree of host specificity among the parasites of Lebanese *Zygaena*. The pattern in *Zygaena filipendulae* most closely resembles that of the United Kingdom, as befits a species with an almost continuous distribution pattern over most of the western Palaearctic. It will be evident from the systematic part of this paper that biotope choice differs from species to species, which may have some bearing on the question of host specificity for the parasites, but the intriguing possibility that zoogeographic origin plays a part seems worth considering.

The Chalcids are deposited in coll. R. Askew, the Tachinids in coll. T. H. Ford and the remainder in the British Museum (Natural History).

Lebanese Zygaenidae

text to plate

| <i>Z. filipendulae</i> | <i>Z. graslini</i> | <i>Z. olivieri</i> | <i>Z. carniolica</i> |
|------------------------|--------------------|---------------------|----------------------|
| Jisr el Quadi | Cedar Mt. | Cedar Mt. | Jabal Kesrouan |
| 15-V-1973 | 1-VI-1974 | 15-VII-1973 | IX-1973 |
| e. l. Hazmiyé | Hazmiyé | Cedar Mt. | Jabal Kesrouan |
| 22-IV-1973 | 17-III-1973 | 15-VIII-1973 | IX-1973 |
| Cedar Mt. | Hazmiyé | e. l. Laklouk | Jabal Kesrouan |
| 22-VI-1974 | 11-IV-1973 | 12-VI-1973 | IX-1973 |
| Hazmiyé | Hazmiyé | Mdairej | Jabal Kesrouan |
| 28-IV-1973 | 17-III-1973 | 17-VI-1973 | IX-1979 |
| | | | Jabal Kesrouan |
| | | | IX-1973 |
| <i>Z. cuvieri</i> | <i>Z. brizae</i> | <i>Z. laeta</i> | |
| Cedar Mt. | Cedar Mt. | Faraya | |
| 23-VI-1973 | 23-VI-1973 | 28-VII-1974 | |
| Cedar Mt. | Ainab | <i>P. anatolica</i> | <i>P. obscura</i> |
| 23-VI-1973 | 15-V-1973 | Hazmiyé | Hazmiyé |
| e. l. Faraya | Faitroun | 11-IV-1973 | 29-IV-1973 |
| VI-1974 | 14-V-1973 | Hazmiyé | Ain Zhalta |
| Cedar Mt. | Mdairej | 11-IV-1973 | 25-III-1973 |
| 15-VII-1973 | 23-V-1973 | Hazmiyé | Ain Zhalta |
| | Mtolleh | 11-IV-1973 | 25-III-1973 |
| | V-1971 | Quobaiat | Hazmiyé |
| | | 7-IV-1973 | 29-IV-1973 |

photo: Peter Harrison Smith

Conclusion

The basic aim of this paper has been to give a taxonomic and faunistic renew of the Lebanese *Zygaenidae*; although they clearly deserve more study also in Lebanon, the present review should be fairly accurate. The *Zygaenidae* once again impress by being of so great taxonomic and faunistic interest. It is a pity that much of the interest which this group has generated has deflected researches towards taxonomic minutiae to the extent where the jungle of subspecific names tends to hinder rather than to enlighten those who could otherwise use the family for zoogeographic and evolutionary studies. Localised species, such as *Zygaena carniolica*, also seem to be among the most promising species for studying ecology, behaviour and population dynamics of insect species under natural conditions. However, any type of research in these fields must obviously be based on sound taxonomic and chorological data; it is my hope that the current paper will contribute to this.

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