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# FURTHER RECORDS OF ZYGAENA FABRICIUS (LEP., ZYGAENIDAE) FROM TURKEY

By W. G. TREMEWAN

In 1959, 1960 and 1962 three entomological expeditions were made to Turkey; the first was undertaken by K. M. Guichard, the following two by K. M. Guichard and D. H. Harvey. The main purpose of all three expeditions was to collect Hymenoptera and Orthoptera, but in 1959 and 1962, a number of Lepidoptera of the genus *Zygaena* F. was also taken. The following notes are based on this material which is preserved in the British Museum (Nat. Hist.). These records supplement those of my earlier paper (Tremewan, 1968) and those of Holik & Sheljuzhko (1953 *et seq.*).

The data recorded below are taken from the pin-labels under the specimens but are supplemented, and corrected where necessary, from the list of localities compiled by Guichard & Harvey (1967).

*Zygaena laeta akschehirensis* Reiss
1929, *Int. ent. Z.*, **23**:151

BURSA: 10 km S. of Karacabey, 70 m, 5.viii.62, one male, six females.

These specimens, which were taken on the government farm known as Karacabey Harası, are provisionally referred to ssp. *akschehirensis* Reiss which was described from Ak-Schehir, 900–1100 m.

*Zygaena punctum anatoliensis* Reiss
1929, *Int. ent. Z.*, **23**:148

ANKARA: Ankara, Dikmen, 3000 ft (1000 m), 5.vii.59, two males.
AMASYA: Sırıklı (near Merzifon), 2400 ft (800 m), 21.vii.59, one female.

This subspecies was described from Ak-Schehir, 1000–1500 m.

*Zygaena punctum* Ochsenheimer ssp.

SINOP: Sinop(e), sea level, 14.vi.59, one male.
SINOP: Sinop(e), 50 ft, 17.vi.59, three males, two females.

The specimens from Sinop apparently represent an undescribed subspecies, differing from ssp. *anatoliensis* Reiss in the larger size, colder red coloration of the forewing spots and hindwings, and the broader hindwing border. The forewing spots are confluent but not so strongly as in ssp. *anatoliensis* Reiss.

*Zygaena diaphana* Staudinger ssp.

ANKARA: above Hasanoğlan (north of), 1500 m, 29.vi.62, one male.
ANKARA: Ankara, Dikmen, 3000 ft (1000 m), 5.vii.59, two males (worn).

Similar to specimens from Beynam (Tremewan, 1968:55).

*Zygaena purpuralis pseudodiaphana* Tremewan
1958, *Ent. Gaz.*, **9**:184

BURSA: Uludağ, 500 m, 8.viii.62, one female (worn).

This worn female is provisionally placed under ssp. *pseudodiaphana* Tremewan, described from Karacabey, but differs slightly in the somewhat darker coloration and the denser scaling.

*Zygaena purpuralis* Brünnich ssp.

ANKARA: above Hasanoğlan (north of), 1500 m, 29.vi.62, one female (worn).

This single female agrees well with the specimens from Beynam which were

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placed under ssp. *barthai* Reiss (Tremewan, 1968:55). However, it is now apparent that the Ankara populations represent an undescribed subspecies; the description awaits further material.

*Zygaena purpuralis tirabzona* Sheljuzhko
1936, *Folia Zool. Hydrobiol., Riga*, **9**:17

TRABZON: Zigana Dağı, 5000 ft (1700–2000 m), 11.viii.59, one female.
The subspecies was described from Villajet Trapezunt (Trabzon).

*Zygaena formosa* Herrich-Schäffer ssp.

1852, *Systematische Bearbeitung der Schmetterlinge von Europa*, **6**:45;
1851, *ibidem*, **2**, pl. 14, fig. 99 (non-binominal)

ANKARA: Ayac Dagi (Ayaş Dağı), 3800 ft (1300 m), 12.vii.59, one female (worn).

*Zygaena freyeriana* Reiss
1933, *Ent. Rdsch.*, **50**:221, pl. 1 and 2

AMASYA: Sırıklı (near Merzifon), 2400 ft (800 m), 21.vii.59, one male.

*Zygaena carniolica amasina* Staudinger
1879, *Horae Soc. ent. Ross.*, **14**:326

ANKARA: Ayac Dagi (Ayaş Dağı), 3800 ft (1300 m), 12.vii.59, five males, three females.
KÜTAHYA: Gediz, 824 m, 29.vii.62, 13 males, five females.
This subspecies was described from Amasia (Amasya). The placing of the specimens recorded here under ssp. *amasina* Staudinger is provisional.

*Zygaena carniolica europaea* Burgeff
1926, *Mitt. münchen. ent. Ges.*, **16**:61

İSTANBUL: Alaçali, 100 m, 9.vii.62, one male, ten females.
EDIRNE: Edirne (Keşan area), 125 m, 6.vii.62, one female.
The subspecies *europaea* Burgeff was described from Therapia near Constantinople (İstanbul), and lacks the whitish cream edging of the forewing spots, while the red abdominal belt is confined to one segment. The specimen from Edirne, which has the forewing spots broadly edged with whitish, is provisionally placed under ssp. *europaea* Burgeff; it is possible that this specimen is an aberrant form.

*Zygaena loti pontica* Holik & Sheljuzhko
1955, *Mitt. münchen. ent. Ges.*, **44/45**:143

AMASYA: Amasya, 1400 ft (500 m), 9.vi.59, one male, one female.
ANKARA: Ankara, Dikmen, 3000 ft (1000 m), 7.vii.59, one female.
The female from Dikmen, a hill on the southern outskirts of Ankara, is provisionally placed under ssp. *pontica* Holik & Sheljuzhko, described from Amasia (Amasya).

*Zygaena loti* Denis & Schiffermüller ssp.

EDİRNE: Edirne (Keşan area), 125 m, 6.vii.62, one female.

*Zygaena dorycnii wagneriana* Reiss
1929, *Int. ent. Z.*, **23**:151

KÜTAHYA: Murat Dağı, 1500 m, 30.vii.62, two males, two females.
The specimens from Murat Dağı have the characteristic small forewing spots of

ssp. *wagneriana* Reiss, which was described from Sultan-Dagh near Ak-Schehir, 1300–1700 m.

*Zygaena dorycnii* Ochsenheimer ssp.

SINOP: Sinop(e), c. 50 ft, 17.vi.59, four males.

Compared with the specimens from Kütahya, the four males from Sinop differ in the darker red coloration of the forewing spots and hindwings, the greener sheen of the forewing ground colour (bluish in ssp. *wagneriana* Reiss) and the relatively broader hindwing border.

*Zygaena laphria laphria* Herrich-Schäffer
1852, *Systematische Bearbeitung der Schmetterlinge von Europa*, **6**:44

AMASYA: Tavsan Dağı (north of Merzifon), 5000 ft (1700 m), 20.vii.59, one female.

Described from Amasia (Amasya).

*Zygaena filipendulae anodolitia* Reiss
1929, *Int. ent. Z.*, **23**:152

ANKARA: Beynam, 1000 m, 16.vi.62, one male, two females.
ANKARA: above Hasanoğlan (north of), 1500 m, 29.vi.62, one male, one female.
KÜTAHYA: Murat Dağı, 1500 m, 30.vii.62, five males, two females.

The Beynam specimens have the forewing spots confluent in pairs whilst in the Hasanoğlan specimens, spots 5 and 6 are hardly separated. The populations from these areas are provisionally referred to ssp. *anodolitia* Reiss. The Murat Dağı specimens are more characteristic of ssp. *anodolitia*, described from Ak-Schehir, with spots 3 and 4 confluent. One female has the forewing spots enlarged and confluent in pairs, the pairs being connected by traces of red scaling.

*Zygaena filipendulae* Linné ssp.

BOLU: Lake Abant, 1000 m, 13.vii.62, five males.
ÇANKIRI: Ilgaz Dağı (Kastamonu-Çankırı border), 1700 m, 22.vii.62, one male.

An interesting subspecies with small forewing spots, red coloration dark, hindwing border comparatively broad. The specimen from Ilgaz Dağı is provisionally placed with those from Lake Abant but has the hindwing border even broader, while spot 6 is reduced and divided by vein 4. Koch (1942:93) recorded 12 specimens from Zintan-Dagh near Sinob (Sinop), which are similar to those from Bolu and Çankırı, according to the description.

*Zygaena filipendulae* Linné ssp.

BURSA: 10 km S. of Karacabey, 70 m, 5.viii.62, one male, one female.

*Zygaena filipendulae akdaghi* Holik & Sheljuzhko
1958, *Mitt. münchen. ent. Ges.*, **48**:185

AMASYA: Tavsan Dağı (north of Merzifon), 5000 ft (1700 m), 20.vii.59, one male.

This subspecies was described from Ak-Dagh, Amasia (Amasya).

*Zygaena filipendulae tirabzonica* Koch
1942, *Iris*, **56**:93

TRABZON: Zigana Dağı, c. 5000 ft (1700–2000 m), 11.viii.59, one female.

This subspecies was described from Trapezunt (Trabzon).

*Zygaena filipendulae* Linné ssp.

İSTANBUL: Alaçali, 100 m, 9.vii.62, four females.
EDIRNE: Edirne (Keşan area), 125 m, 6.vii.62, one male, one female.

*Zygaena lonicerae* Scheven ssp.

BOLU: Lake Abant, 1000 m, 31.vii.62, one female.

*Zygaena lonicerae* Scheven ssp.

SAMSUN: Kunduz Ovacik, 4000 ft (1300 m), 23(22).vii.59, one male.

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*Prodenia littoralis Boisd.*—I would like to make a few comments on Mr. Hagget's remarks concerning this species (1968, *Proc. Brit. ent. nat. Hist. Soc.*, **1**(2):58–61).

In the first place, the specific name; *P. litura* F., which previously included Asiatic and African examples, has been found to cover two species, viz. *litura* (Asiatic) and *littoralis* (African), these are extremely alike in all stages and can, or so I understand, be separated only by the genitalia.

Secondly, the genus; both *litura* and *littoralis* have recently been transferred to *Spodoptera* Boisd., which previously included *mauritia* Boisd., *triturata* Walk. (another recent splitting), *cilium* Guen. and others, and now also includes the *Laphygma* species *exigua* Hübn., *exempta* Walk. and *leucophlebia* Hamps. I am writing here with special reference to the East African species of the combined genus. Personally I find this amalgamation a little hard to digest, particularly the inclusion of the old *Prodenia* species *litura* and *littoralis*. These are both definitely sexually dimorphic, which the other *Spodoptera*, with the exception of *mauritia* which still has a female-like male, are not. Also *Prodenia* larvae are very different in appearance from the others and are almost omnivorous in a botanical sense. On the other hand the other *Spodoptera* species feed exclusively on monocotyledons, often proving serious pests on rice, maize and other cereals, the one exception is *exempta*, which is a more general feeder but with a strong bias towards monocotyledons.—D. G. SEVASTOPULO, F.R.E.S., Mombasa, *16th August 1969*.

# A BIOLOGICAL STUDY OF ARICIA ARTAXERXES ssp. SALMACIS (STEPHENS)

By F. V. L. JARVIS, B.SC., F.R.E.S.

In the *Entomologist* for January 1968 the author published a brief description to define the status of *Aricia artaxerxes* F. s.sp. *salmacis* Stephens in relation to *A. artaxerxes* s.sp. *artaxerxes* F. of Scotland and the separate species *A. agestis* Schiff. of southern England. From field study and examination of series from defined localities it becomes evident that in *A. artaxerxes* s.sp. *salmacis* there is considerably greater pattern variation than is shown in a series of *A. agestis* particularly in relation to the degree of orange marginal lunulation on the upper surface of the wings. A series of *agestis* from East Anglia will differ little between themselves and would be indistinguishable from a collection from Dorset.

But even on one site with *salmacis* it is possible to find males with forewing lunulation varying from nil to five and females with traces of four lunules up to forms with a set of six as full as anything to be seen in *agestis*. This peculiarity extends into the Scottish white-spotted *artaxerxes,* particularly in the southern half of Scotland; in the north the slightly lunulated forms predominate.

This is not by any means the only variant in *salmacis*. Besides the obvious differences in proportion and lateral shading between *artaxerxes* and *salmacis* larvae on the one hand and *agestis* larvae on the other, there is often a considerable difference in the shading of the subspiracular ridge between members of one female's progeny in the northern species. With imaginal undersides there is variation on a wide scale in ground colour, degree of black pupillation and obsolescence. The white spotted underside of s.sp. *artaxerxes* is now known to be controlled by a single recessive gene, but the subspecies is conspecific with all the forms of *salmacis* and forms a constant small percentage of the population on the Durham coast. The biological background of the univoltine Ariciae of northern Britain is two subspecies of *artaxerxes*; *artaxerxes* in Scotland and filtered into the territory of *salmacis* which inhabits northern England. In this instance we have to allow two subspecies to fly, and breed, together on the Durham littoral.

Between the northern *artaxerxes* complex and the southern English *agestis* it has already been shown by the author that a state of genetic imbalance exists which is the reason for introducing a specific distinction. The purpose of this paper is to describe in some detail a further cross pairing experiment between south and north and to give the results of a breeding analysis from four wild *salmacis* females; cross pairing between *A. artaxerxes* s.sp. *salmacis* from Sherburn Hill (an inland site in Co. Durham) and *A. agestis* from Reading, Berks., and subsequent experiments.

From a female *salmacis* taken 7.vii.67, a cloudy, unrewarding day with the occasional glimpse of sunshine, eggs were laid from 9th July at an average temperature of 24°C in continuous light; hatching began on 14th July and the young larvae, except for 40 which were kept in normal daylight as a diapause control, were reared under continuous light. Eggs were deposited on *Helianthemum*, but from instar II *Geranium pratense* L. was used as a foodplant.

*Geranium sanguineum* L. was included with the *Helianthemum* to test whether the female had any preferences. Out of 120 eggs only five were laid on *G. sanguineum*. This is interesting because no *G. sanguineum* grows at Sherburn, but at the

coast only six miles away the plant is found in profusion mixed with *Helianthemum*. Coastal females will lay up to 20 per cent of their eggs on *G. sanguineum* and the larvae eat it readily. In Scandinavia, *G. sanguineum* is a normal foodplant.

The experimental programme was as follows:

(1) From the Sherburn female *salmacis*, and from the Reading *agestis* females, to raise $P_1$ stocks (SS = *salmacis*; AA = *agestis*).
(2) To cross reciprocally from $P_1$ to give two $F_1$s = ♂S♀A and ♂A♀S.
(3) To obtain the $F_2$s, SA × SA; AS × AS; SA × AS.
(4) To overwinter SA larvae and backcross in 1968 with overwintered AA (second generation from original Reading stock), and then to pair once more from the backcross which contains the combination from the formula SA × AA. With equal quantities of SA and AA elements it was hoped in this *inter se* cross to obtain a percentage of SS and AA as well as a preponderance of SA. This could show a pattern segregation, but it should be possible also to demonstrate the genetic nature of the photoperiod.

### Description of Sherburn larva

Instar I. Very pale green with colourless tubercles, ringed on the dorsum with pale brown. Setae colourless. (In *agestis* the colour is grey-green with blackish ringed tubercles and blackish setae on the dorsum.)

Instar V. Rather elongated; yellowish green with well-marked lateral chevrons and dark green dorsal line. The subspiracular ridge is white with either no shading (a small percentage) or shaded above and below the ridge with reddish brown, ranging from a trace to dark brown in various specimens.

*A. agestis* is a more truncate larva; deeper yellow-green with well-marked chevrons and a nearly blackish-purple dorsal line. The subspiracular ridge is pink broadly shaded on either side with reddish purple.

Both reciprocal pairings SA and AS were fertile, with eggs hatching from 2nd September. Throughout 1967, apart from larvae kept in normal daylight for diapause entry, all subjects were reared in continuous light with temperatures as near as possible to 22°C. The garden *Geranium pratense* was used for food until November when a transfer was made to the winter hearts of *G. rotundifolium*.

In AS more than 50 per cent of the eggs failed to hatch, but practically all SA were fully fertile.

In the first instar SA larvae were nearer in appearance to the Sherburn stock, whilst AS approached the agestis colouring. At maturity in instar V the two sets of larvae were similar in size, proportions and colour, but the shading of the subspiracular ridge was somewhat darker in AS and in 17 per cent of the larvae approached the *agestis* colour of rosy purple.

SA larvae showed only slight mortality, but in AS only 28 per cent of larvae survived, which indicated that the lethality incidence at the egg stage was maintained in the larvae.

### Emergences

SA commenced with one male on 7th October and by 20th October 50 males had appeared; on 20th October the first female appeared. Hereafter there was a preponderance of females, with final emergence on 27th November. Total 84 males and 39 females from 129 hatched larvae, a 2:1 ratio which is difficult to

explain as only six larvae died. On the face of it it looks as though some factor has rendered some of the *x* chromosomes non-functional. There was pronounced proterandry (13 days before a female emerged).

AS commenced with four females on 13th October, one male on 14th October, two females on 15th October; the main emergence terminated on 31st October with two late females on 13th November and 4th December. Total 13 males and 13 females, a 1:1 ratio. There was slight proterogyny.

### $F_2$ Pairings

On 22nd October a pairing was obtained between a male SA and a female AS. The first eggs were laid on 25th October, but unfortunately the female died on 29th October having laid only 14 eggs, the first of which hatched on 7th November. Evidently the weakness shown earlier in the AS crossing was being perpetuated. Finally five imagines similar to *agestis* were obtained between 28th December and 17th January; all males.

Also at the end of October an SA × SA pairing was successful, with over 100 eggs being deposited in the next few days. First hatching was noted on 8th November. At maturity 66 per cent of the larvae showed the red/purple shading to a pink subspiracular ridge typical of *agestis*; the 34 per cent possessed a whitish ridge shaded with tones of reddish brown. Mortality was heavy in instar I, only 39 larvae surviving but after that stage was passed there were few losses.

Emergence took place between 27th December and 31st January. Total 15 males and 18 females, almost a 1:1 ratio with slight proterogyny.

An attempted cross AS × AS produced no fertile eggs.

It may be significant that wing span in both sexes was approximately ten per cent greater in the broods SA, AS, SA/AS, SA/SA, than in the original parents of the $P_1$ stocks, but this was not caused by more favourable food or environment; in fact larvae feeding in November and December received *G. rotundifolium* which is not quite as nourishing as *G. pratense* from summer growth.

Enough over-wintered larvae from SA and second brood *agestis* (original Reading stock) enabled a cage to be set up, 25.iv.68, with two SA males and two AA females for a back-cross. One pairing was observed on 4th May and by 10th May about 200 eggs had been laid. Sixty larvae were selected and reared in normal daylight to give pupation on 15th June and emergence from 3rd July. Two *inter se* pairings were observed on 10th July. Again 60 larvae were chosen to be reared in normal summer daylight and temperature to ascertain if any genetic effect could be detected in relation to diapause behaviour.

Theoretically it would appear simpler to use only the overwintered SA larvae for this purpose but they would have to raise another two generations which it was felt might have weakened the strain too far. Therefore the pure *agestis* element was introduced through the back-cross. There was insufficient material in April to try both methods.

This *inter se* experiment rested on the basis that *salmacis* has a photoperiod of 17·5 hours and *agestis* 15·5 hours at normal summer temperatures.

In the first half of July on the south coast of England the effective daylight period would be about 17·5 hours, falling steadily as the summer progressed. Therefore it could be expected that all 'salmacis' types in the brood would pass directly into diapause as young larvae, whilst the 'agestis' fraction, hatched in the third week in July, could just complete growth beyond the critical third instar and then pupate by the end of August. It was conjectured that the crossed 'SA'

forms might grow to instar IV and then diapause or show some form of delayed development, if there was any truth in the concept that reaction to photoperiod was genetic.

However the following results were encouraging:

8th August (2–3 weeks after hatching).

Nine larvae in instar II; 19 in instar III; 10 in instar IV; and 22 in instar V (rapid growth). Some of the instar II and III were showing diapause colouring; one was the pale dull yellow of *salmacis*; the remainder (14) nearer to the brownish diapause shade of *agestis*—all with darkening of the setae. Twelve of the instar V larvae (of 'agestis' colour and form) were retained as a sample for emergence which took place 24th to 26th August, earlier than expected.

26th August.

Several more instar III larvae were turning yellow whilst two were quiescent; nine in instar IV were yellowing, but one that on 8th August was in instar IV was now nearly mature in instar V. Six in instar II and two in instar III were the pale yellow of *salmacis*; the remainder were the dull brown colour of the original SA or *agestis*. All larvae in instar IV and V resembled *agestis*.

As it was not proposed to overwinter these larvae they were placed on plants of *G. sylvaticum* in the garden and most eventually disappeared, but on 28th October an instar III larva turned loose on 8th August, had changed into instar IV with relatively little growth and was turning yellow. It was placed under continuous light at 20°C and emerged on 30th November: a male with a wing span of 29 mm.

The 'back-cross' and *inter se* pairings are best summarised in tabular form.

COMPARISON OF IMAGINES SA × AA AND SA/AA × SA/AA

| *Pairing* | *male* | *female* |
|---|---|---|
| Back-cross SA × AA (60 larvae) | Wing span 29·5 mm (average) forewing lunules 4 →5, small | wing span 30·5 forewing lunules 5 moderate →6 large. Definite predominance for *agestis* |
| *Inter se* SA/AA × SA/AA (60 larvae) | Wing span 25 mm (21/22 = (2) 29) forewings, 2 with traces of 2 lunules →6 small | wing span 24·5 mm (20 (2) 26 (1) forewing lunules 6 small →6 large |
| | Two males showed resemblance to *salmacis*; otherwise there was a preponderance of SA and *agestis*. | |

The abrupt change to small imagines in the *inter se* cross could be attributed to a weakness of the stock through inbreeding. On the other hand there was one very large male. It does, however, seem to be reasonably demonstrated that there is a relatively simple genetic basis for the inheritance of photoperiod; neither is long photoperiod necessarily linked with pattern formulae. The two 'salmacis'-type males developed with a short photoperiod and a number of 'agestis' larvae entered diapause in August when the natural daylight was sufficiently long to have allowed pure *agestis* to complete growth for a third emergence.

To summarise these experiments it becomes apparent that there are several

phenomena caused by genetic imbalance of which the most important are probably proterogyny, pronounced proterandry and altered ratio from the normal 1:1.

Were this treated as an isolated instance the results could possibly be attributed to faulty manipulation, but when this experimental series is compared with other cross pairings made in 1962, the elements of chance and coincidence are eliminated to an infinitesimal degree, with the conclusion to be formed that cross pairing between *A. agestis* and the univoltine *A. artaxerxes* forms can be nothing other than between good species. The following table, taken to $F_1$ in each case, summarises the results:

CROSS PAIRINGS to $F_1$

| *Pairing* | *Summary of Results* |
|---|---|
| (1) 1962<br>♂ *salmacis* × ♀ *agestis*<br>(Warton) (S. England) | Pronounced proterandry<br>Large imagines; excess of ♂ ♂ (24:8) |
| (2) 1962<br>♂ *agestis* × ♀ *salmacis*<br>(S. England) (Warton) | Proterogyny<br>Normal size; slight excess of ♀ ♀ |
| (3) 1962<br>♂ *agestis* × ♀ *vandalica*<br>(S. England) (Jutland) | Proterogyny<br>normal size; 1:1 sex ratio |
| (4) 1962<br>♂ *agestis* × ♀ *artaxerxes*<br>(S. England) (Hawick) | Proterogyny<br>normal size; 1:1 sex ratio |
| (5) 1964<br>♂ *artaxerxes* × ♀ *agestis*<br>(Stonehaven) (S. England) | 28 large ♀ ♀: 4 ♂ ♂ dead in pupae [the only ♂ ♂]. Very prolonged growth period |
| (6) 1967<br>♂ *salmacis* × ♀ *agestis*<br>(Shurburn) (S. England) | Pronounced proterandry<br>Large imagines; excess of ♂ ♂ (84:39) |
| (7) 1967<br>♂ *agestis* × ♀ *salmacis*<br>(S. England) (Sherbern) | Proterogyny<br>normal size; 1:1 sex ratio |

Nos. 1 and 6 are essentially similar, so are 2, 3, 4, 7, which means that when a univoltine male is paired with a bivoltine female, the main result is exaggerated proterandry and an excess of males; and when the pairing is reciprocal proterogyny occurs. Both conditions could, if they ever occurred in nature, lead to extinction. From the agreement in the table the odds against faulty manipulation or accidental happening are very high.

To test experimentally the observations made at the beginning of this paper, that there is what is tantamount to polymorphism in *A. artaxerxes,* it was decided in 1968 to breed to $F_2$ from three females from Warton Crag (N.W. Lancs.) and

three females from Blackhall Rocks (Co. Durham). Broods were to be limited to 50–60 in each case which with 95–100 per cent emergence would give reliable statistical results. This would have entailed, if all went well, 12 broods but as matters turned out we did not get the theoretical number but a very considerable proportion. The Rev. J. H. Vine Hall, Mr. Jefferson and Mr. Lowe are three gentlemen to whom the author owes a debt of gratitude for their efforts in obtaining live females and entrusting them to the post at a particularly difficult time.

The first three females from Warton, owing to postal delays, arrived dead, but Mr. Vine Hall made a second journey to the site and secured three more, which did arrive safely. One survived for only a few days but managed to lay sufficient eggs to bring off an $F_2$; the other two laid reasonable quantities.

Mr. Jefferson and Mr. Lowe ran into difficulties with bad weather, but sent off three females. One was dead on arrival; another (with very small lunules) died in four days without laying, but the third, with marginal lunules that would make an *agestis* envious, laid well.

So instead of six stocks there were only four; three from Warton and one from Blackhall.

From these stocks, each taken to $F_2$, it was reasonably expected to obtain a cross section of the population representative of the proportion of reduced and heavily lunulated forms. At the same time it should have been possible to assess figures for larval colours.

The two extreme imaginal forms can be described thus:

(a) 'parvilunulata'.

Male: forewing lunules nil to traces of two or three.

Female: forewing lunules very small, sometimes with a trace of a fifth near the apex.

(b) 'crassilunulata'.

Male: forewing lunules four to five of medium size; occasionally a trace of a sixth at the apex.

Female: forewing lunules six well formed, as large as, or sometimes larger than, in *agestis*.

Both (a) and (b) possess the same dark chocolate ground colour. Hindwing lunulation is related to that in the forewings, but is not so distinctive, and is therefore omitted in this analysis to reduce complication.

From field observation (a) and (b) with intermediates are about equally distributed in northern England and southern Scotland, but towards the north of Scotland (a) predominates.

(a) resembles many of the Scandinavian univoltines.

(b) resembles a large dark *agestis*, but is definitely not *agestis*.

(a) and (b) are completely conspecific and are found in both *salmacis* and the white-spotted Scottish *artaxerxes*.

Although the end point of this investigation was imaginal characters, it was equally possible to assess a proportion for coloured shading to the subspiracular ridge in the mature larvae. Larval proportion, size and colour were similar to those of the Sherburn parental brood, but the proportion of the shaded to unshaded individuals (in relation to the subspiracular ridge) varied between the four stocks.

ANALYSIS OF LARVAL SHADING AT MATURITY IN INSTAR V

| *First Generation* | *Analysis* |
|---|---|
| Warton 1 | 28% no shading.<br>72% brownish red shading, ranging from a trace to thin dark outlines above and below the subspiracular ridge. |
| Warton 2 | 15% no shading.<br>85% shading as in Warton 1. |
| Warton 3 (only six individuals) | Five unshaded; one shaded medium brown.<br>In 1962 two broods raised from Warton ♀ ♀ gave 12% unshaded; the remainder were shaded in tones of red/brown or pinkish/brown. |
| Blackhall (Durham) | 10% unshaded.<br>83% shaded with tones of red/brown<br>7% shaded with dark purple/brown. |

SECOND GENERATION

In all the three $F_2$ Warton broods the proportion of shaded to unshaded larvae was similar to the first generation. In the Blackhall $F_2$ the unshaded percentage fell to five per cent, but there were no deep purple forms.

To summarise, the unshaded larvae were in a minority at both sites (and at Sherburn). Averaging all the percentages for unshaded larvae gives 33 per cent. This is also the approximate percentage in the Scottish populations. There is no linkage between unshaded larvae and 'parvilunulata' imagines, or vice versa. In Scandinavia the unshaded larva appears to be the dominant form.

IMAGINAL ANALYSIS—ORANGE MARGINAL LUNULATION, FOREWINGS

| *Stock* | *1st Generation* | *2nd Generation* |
|---|---|---|
| Warton 1 | ♂ traces of 2→4 small.<br>♀ 5→6 moderate. | ♂ nil→4 large with intermediates.<br>♀ 5 moderate→6 large with intermediates. |
| Warton 2 | ♂ nil→4 small.<br>♀ 5 small→6 moderate. | ♂ 3→5 small.<br>♀ 4 small (20%).<br>5→6 large with ab. *albiannulata*. |
| Warton 3 | No stock fit for measurement. | ♂ nil→3 small.<br>♀ 4 small→4 moderate. |
| Blackhall | ♂ 2 trace (25%)→5 small with intermediates.<br>♀ 6 moderate→6 very large. | ♂ 2 trace (25%)→5 moderate with intermediates.<br>♀ 6 moderate→6 very large.<br>(This brood contained 1 ♂ and 6 ♀ *artaxerxes*/*artaxerxes*). |

It can be seen that the second generation shows segregation into the original 'parvilunulata' and 'crassilunulata' with heterozygotes (which are the intermediates). The occurrence of the white-spotted *artaxerxes* at Blackhall is very interesting and indicates that one of the original parents was heterozygous for this recessive gene.

As part of the wider European investigation carried out in 1968 by Dr. Høegh-Guldberg and the author, we were able to rear a stock of *A. artaxerxes* s.sp. *allous* (*alpina*) from eggs obtained at Sils (1800 m) in the Upper Engadine. This form not only closely resembles *salmacis*, as will be seen in the plate (A7–D7) but also crossed very easily with it. A healthy $F_1$ generation with no signs of genetic imbalance was produced under continuous light in the autumn of 1968 and sufficient young stock of larvae was overwintered with the object of rearing an $F_2$ early in 1969.

The following description of the mature larva of *allous* should be compared with those of *salmacis*:

Ground colour deep yellow-green with well-defined lateral chevrons. Dorsal line dark green; a few of the darkest larvae showed a trace of brownish in the incisions; subspiracular ridge white, with or without shading as shown in the following analysis:

18 larvae unshaded.
19 larvae shaded with traces to a medium amount of pinkish brown.
5 larvae shaded above and below ridge with dark purple-brown.

The setae are colourless; tubercles both colourless and brown, the deepest brown being in those larvae with the darkest subspiracular shading. Papillae colourless. Thoracic legs pale brown tipped with black.

A peculiarity of this larva was that under continuous light at 22°C, it required only four instars instead of the five usual of northern forms. This may be a forcing effect due to excessive light treatment on a form which would have a short photoperiod (in Switzerland about 14 hours). Growth was extremely rapid, taking 20 days from hatching of eggs to pupation. British univoltines in the same conditions take 24–26 days. Emergence began on 21st September with normal proterandry.

A pairing was obtained from a female *allous* with a male *salmacis* from Blackhall (Durham) stock on 25th September. About 200 eggs were laid in the next few days, 95 per cent on the roof and sides of the gauze cage and only a few on the foliage of *G. sylvaticum* (the native food-plant of *allous*). A number of eggs were sent to Høegh-Guldberg; 90 larvae were allowed to pass into diapause and 45 were reared under continuous light.

A sample of 27 mature larvae, again with four instars, gave the following description:

Ground colour medium green with usual chevrons; dark green dorsal line; 13 larvae with unshaded subspiracular ridge; 13 with a trace to medium shading of reddish brown or pinkish brown; one with dark red-brown shading.

Emergence took place between 19th and 28th November with normal proterandry. Total: 22 males, 20 females; 1:1 ratio.

Four of these $F_1$ imagines are illustrated on the bottom line of the plate (A8–D8). It can be seen that in appearance they are midway between the parental stocks.

In February 1969 it was found that about 40 per cent of the overwintered larvae, entering diapause in instars II and III at the end of October 1968, had

survived and could be induced into healthy growth under continuous light at 22°C.

The number of larvae which survived the winter was 40, and of these 28 survived to pupate early in April 1969, with colouring similar to those reared in continuous light in the autumn of 1968. These larvae completed their growth in five instars compared with the four instars of the autumn section, so that it is probable, in view of rearing other forms in continuous light at high temperature, that the foreshortening to four instars is probably a function of light and temperature. Of the 28 imagines produced, 15 were males and 13 females. The writer attempted in good conditions to obtain a pairing but without success, but he took the stock to Denmark at the end of April and Høegh-Guldberg did obtain a pairing in May which produced 66 eggs, 64 of which hatched.

Of these, 41 larvae pupated; 23 died at various stages; 2 pupae died. Twenty-eight males and 11 females emerged. There obviously was a considerable female mortality if we make the reasonable assumption that the sex ratio in the eggs was 1:1. These imagines were large in size.

In spite of a perfectly normal $F_1$, signs of genetic imbalance showed in the $F_2$ generation (abnormal sex ratio), indicating a subspecific difference between the grandparents which might be expected with a geographical separation of 1,500 km, and a time interval dating from the late Pleistocene.

Pattern segregation was shown in both sexes, towards the grandparents, and in particular there was an excess of sparsely lunulated males which is an Engadine character. The underside ground colour was difficult to define exactly but specimens comparable to both Blackhall *salmacis* and Engadine *allous* were present, but the majority showed the deep brown of *salmacis*.

A small $F_2$ generation was obtained by Høegh-Guldberg in the late autumn of 1968, but from 49 eggs only five imagines (two males and three females) were obtained. These were small specimens and too few in number for statistical purposes.

## DISTRIBUTION

Subspecies *salmacis* is widely distributed in northern England but tends to be localised in colonies on limestone outcrops where there is a good growth of *Helianthemum*. The possibility of *G. sanguineum* as an alternative food-plant cannot be ruled out. The known sites are in Durham (coastal and inland), Yorkshire, the Peak in Derbyshire, north Lancashire, and possibly Westmorland, but in common with other species numbers on most sites have diminished in the past ten years; in fact considerable concern is felt that the interesting colonies on the Durham coast will for one reason or another eventually pass the point of no return.

*Aricia artaxerxes* s.sp. *artaxerxes* in Scotland has a wide distribution in similar localities from south to north, mainly on the east side of the country. Although a few colonies have thinned out, this form does not appear to be in any danger of extinction.

Distribution suggests origin, and while no one can state definitely what movements have taken place in the late Pleistocene, a few suggestions do not seem out of place. It is obvious that strictly univoltine forms such as *artaxerxes* and *salmacis* adapted to a certain temperature range will find their own ecological niche. They will not, for example, survive naturally in the warmer conditions of southern England. During the colder phases of the Pleistocene the Alpine massifs with the adjacent lowlands to north and south were reservoirs of a great

number of static and evolving species. As conditions ameliorated, the ecological waves moved northwards or upwards in the mountains and the animals followed the climate and vegetation. Britain is an 'ultimate Thule'; many forms must have moved in before the Channel opened 8,000 years ago and many more have flown in, but as Britain slowly warmed up, the insect population crept northwards. Some, reaching the north of Scotland, could go no further, with the result that they either had to adapt themselves or perish. Hence some of our non-migratory insect populations are rather diverse. The *Aricia* come into this category.

It has been shown that in the *artaxerxes/salmacis* population there is a range of lunulated forms, dividing into two major types, both perfectly conspecific and separate from *A. agestis*. It is the author's opinion that both these forms spread into northern England from the Continent after the penultimate cold phase of the fourth glaciation, 50,000 to 40,000 BP. The crossing experiment with *A. allous* from the upper Engadine lends considerable support to this view. When Høegh-Guldberg was in Austria in 1968 he examined several collections and saw in them series of well lunulated univoltine forms described there as 'allous'. This possibly could be the source of 'crassilunulata'. The presence of both 'parvilunulata' and 'crassilunulata' in Scotland suggests that they were there before the formation of *artaxerxes*, which again in the author's opinion, was formed in isolation in northern Scotland in the final, less cold, phase between 30,000 and 20,000 years BP. Anyone reading the 1962 theory should substitute *A. artaxerxes* s.sp. *artaxerxes* and *A. artaxerxes* s.sp. *salmacis* for *artaxerxes* and *agestis* respectively.

We do not think that 'crassilunulata' has formed locally from *A. agestis* for the following reasons:

(a) there is a definite genetic imbalance in pairings between *agestis* and the northern forms;

(b) there is no transition zone between *agestis* and the northern species. *A. agestis* remains in the south as a later wave of immigrants.

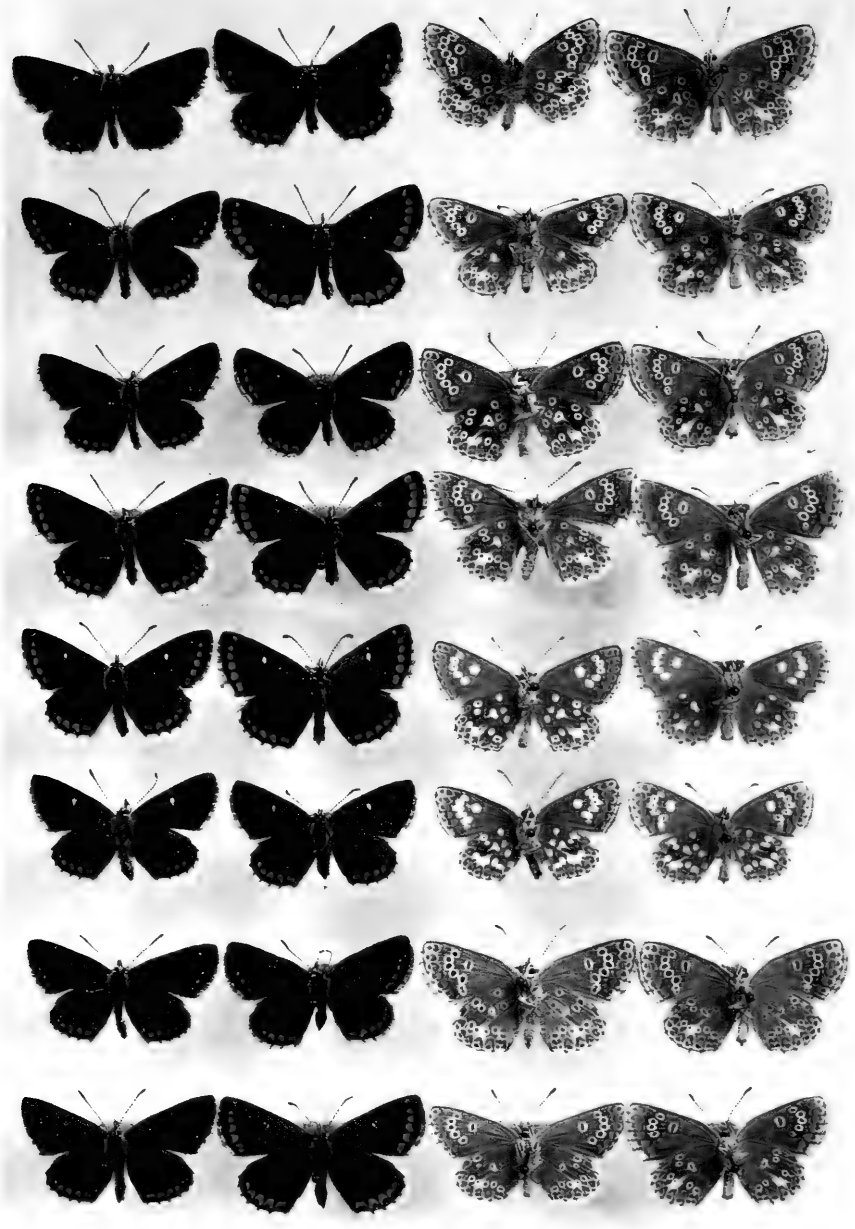
There is a form of incipient univoltinism shown at Royston on the northern edge of the *agestis* distribution, which shows itself as a drawn out first emergence. We have isolated a few larvae from late June females which passed into diapause in instar IV in mid August. These larvae are extremely difficult to bring through the winter by reason of the desiccating effect of the warm autumn, but one that survived produced a female late in April. If both sexes of this type survived in sufficient numbers (as they appear to do at Royston) their progeny would revert to bivoltinism, so it is probable that there is an oscillation between bivoltines and univoltines affecting a small proportion of the population. It is in this manner of course that earlier in the Pleistocene the divergence between the two types of voltinism began; but we do not think this is the origin of any of the north British forms which seem to be related to the Scandinavian and Alpine univoltines.

## SUMMARY

The nature of variation between individuals of the same population of *A. artaxerxes* s.sp. *artaxerxes* and *A. artaxerxes* s.sp. *salmacis* was discussed and compared with that of *A. agestis*.

A cross pairing between s.sp. *salmacis* and *A. agestis* and the subsequent experiments to show genetic imbalance and the genetic nature of diapause were analysed to demonstrate the positive results obtained.

A population-variation cross-section was built up from the results of rearing four separate stocks of s.sp. *salmacis* to $F_2$ generations.



A description of the stages of *A. allous* s.sp. *allous* from the Upper Engadine was given and the results of a pairing between this form and s.sp. *salmacis* from Durham was included to show a possible affinity between these forms.

A brief outline of distribution and a tentative theory of origin of the north British forms was set out.

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*10th March 1969*

## (KEY TO PLATE)

Horizontal line 1. A-D. s.sp. *salmacis* 'parvilunulata', Warton Crag, ♂ ♀ ♂ ♀
2. A-D. s.sp. *salmacis* 'crassilunulata', Warton Crag, ♂ ♀ ♂ ♀
3. A-D. s.sp. *salmacis* 'parvilunulata', Blackhall Rocks, ♂ ♀ ♂ ♀
4. A-D. s.sp. *salmacis* 'crassilunulata', Blackhall Rocks, ♂ ♀ ♂ ♀
5. A-D. s.sp. *artaxerxes*, Blackhall Rocks, ♂ ♀ ♂ ♀
6. A-D. s.sp. *artaxerxes*, Stonehaven, Scotland, ♂ ♀ ♂ ♀
7. A-D. *A. artaxerxes* s.sp. *allous,* Sils, Upper Engadine, ♂ ♀ ♂ ♀
8. A-D. cross-bred s.sp. *salmacis* ♂ (Blackhall) × *allous* ♀ (Upper Engadine) ♂ ♀ ♂ ♀

# AN INTRODUCTION TO THE COLLEMBOLA

By P. N. Lawrence

*British Museum (Natural History)*

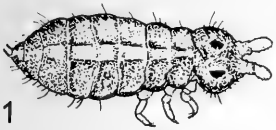
Collembola (Springtails) are one of the groups of the wingless insects, that is those that have never developed wings at all during their evolution. Although occupying only a minor part of general books on entomology, the Collembola form a major part of the insect class, in which they are for convenience included, so far as numbers of individuals are concerned. This indisputable, individual dominance is not often appreciated due to their diminutive size and concealed habit. Most species average about one millimetre in length (fig. 1) although one common British species reaches 5·0 mm (fig. 12). Many springtails escape detection by living under litter or in the soil.

In order to identify the species, it is necessary to use first class optical equipment and refer to many papers in diverse journals. Because these items are expensive or elusive, amateurs are deterred from studying the group. Additional difficulties are provided by the fact that the range of patterns and pigments in Collembola sometimes shows great intraspecific variation which is frequently puzzling. Some sclerotised parts in a single species have been shown to vary under different conditions of temperature and humidity to such an extent that taxonomists have been misled into describing new species or even new genera.

Collembola can be classified in two sub-orders. In the elongate Arthropleona (figs. 1–12, 14–19) the nine body segments show distinct boundaries, although the prothorax may not be visible dorsally, and the last two or three abdominal segments may be fused in some genera. In the globular Symphypleona (figs. 13, 20) the fusion of segments is much more extensive with, at most, only traces of some boundaries being present. In both sub-orders, there are usually four segments to the antenna. In some Arthropleona the basal one or two antennal segments are sometimes subdivided while the third, and especially the fourth, may be annulated. In the Symphypleona the annulations of the fourth antennal segment are more pronounced and subsegments are sometimes developed. Up to eight ocelli are situated on each side of the head. The three thoracic segments each bear a pair of legs but at no stage of development is any trace of wings present, juveniles being rather similar in appearance to adults. Of the six abdominal segments, abdomen I bears the ventral tube, abdomen III may carry a ventral paired series of notches for retaining the forked jumping-organ which, when present, arises from abdomen IV; the genital aperture, leading to non-sclerotised genitalia, opens on abdomen V and the anus is placed on abdomen VI.

The species found in woodland litter are active, darkly pigmented, with long antennae and 16 eyes. They are densely clothed with scales or setae and have a powerful jumping-organ. In species occurring deeper in the humus, these characters are less developed and all stages of degeneration may occur until, in the underlying soil, Collembola species are sluggish, white, with short antennae, sparse clothing and no functional spring. Some species skeletonise leaves, while others feed on fungi. Many make up the diet of arachnids or of other insects but little is known of the actual food preferences of either predators or prey.

The Collembola are distributed extensively through temperate and tropic regions from the Arctic to the Antarctic. From the summits of mountains to the depths of caves, from snow-line to shore-line, wherever there is any damp organic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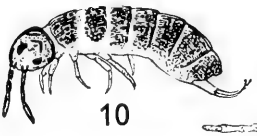
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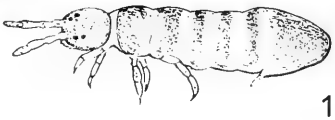
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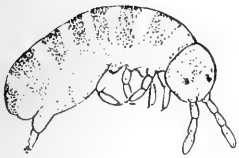
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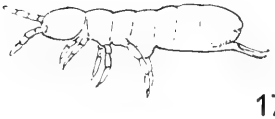
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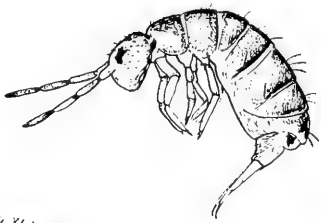
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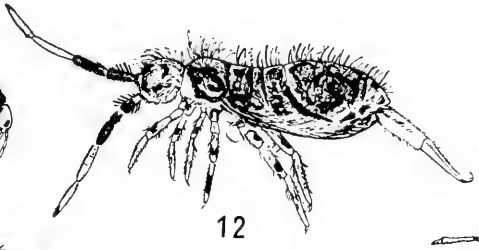
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*Key to figures*

(drawn at various scales)

1. *Hypogastrura denticulata* (Bagnall, 1941). Abundant in lawn-mowings.
2. *Brachystomella parvula* (Schäffer, 1896). Common in wet locations.
3. *Neanura muscorum* (Templeton, 1835). Common on fallen rotten wood.
4. *Proisotoma minuta* (Tullberg, 1871). Under bark and flower pots.
5. *Isotomiella minor* (Schäffer, 1896). Under stones and in conifer litter.
6. *Lepidocyrtus cyaneus* (Tullberg, 1871). Common under tussocks of grass.
7. *Tomocerus minor* (Lubbock, 1862). Common on fallen, rotten wood. Cultures well.
8. *Friesea mirabilis* (Tullberg, 1871). Known to feed on rotifers, widespread.
9. *Xenylla maritima* (Tullberg, 1869). Under bark, xerophilous.
10. *Isotomina thermophila* (Axelson, 1900). Arable land.
11. *Isotoma notabilis* (Schäffer, 1896). Extremely common in humus. Biology unknown.
12. *Orchesella villosa* (Geoffroy, 1764). Active in litter, powerful jumper.
13. *Neelus minimus* (Willem, 1900). Common in humus.
14. *Hypogastrura viatica* (Tullberg, 1872). Swarms in seaweed and sewage. Cultures well.
15. *Onychiurus fimatus* (Gisin, 1952). Common in compost. Similar species in soil.
16. *Folsomia quadrioculata* (Tullberg, 1871). Ubiquitous.
17. *Folsomia candida* (Willem, 1902). Frequent in soil of potted plants. Cultures well.
18. *Isotoma viridis* (Bourlet, 1839). Common in long grass. Much colour variation.
19. *Entomobrya nivalis* (Linné, 1758). Up trees and bushes, often in birds' nests.
20. *Dicyrtoma minuta* (O. Fabricius, 1783). On rotten wood.

The ecological notes give an indication of where the illustrated species might be found although they are by no means confined to them.

material, springtails abound. The greater part of the earth's land surface is still covered with plants such as mosses, lichens, grasses, trees or crops and as Collembola outnumber other insects in such habitats, it may be fairly assumed that they dominate the insect world—in numbers of individuals. The number of species is not so considerable, with about 300 known from Britain and around 4,000 from the world. Although it is probable that more species await discovery this number may be partly balanced by the inevitable detection of further species whose wide distribution has led to their being described twice. The recorded distribution of Collembola at present reflects only the distribution and movements of the collectors. Several species are cosmopolitan so it seems hardly worth individually publishing new county records of these. It would be far more useful, and not beyond the scope of an amateur, to make a detailed study of a single species. The biology, even of common, cosmopolitan Collembola (fig. 11) is still largely unknown.

Because of their small size, winglessness and rapid breeding, many Collembola make ideal laboratory animals or household pets (figs. 14, 17). In the field, springtails may be shaken from branches, knocked from wood (fig. 3), swept from herbage, sieved from litter or floated from soil. The specimens can then be transferred by paintbrush (or sucking tube) into tubes of 80% alcohol. A method often more productive and less time-consuming in the field involves equipment no more sophisticated than an elastic band and a plastic bag. Untrained individuals, who have never seen a springtail, can make profitable collections. All that is necessary in the field is to place a quantity of the habitat into the bag and to seal it with the band. The sample should be insulated against sharp changes of temperature, particularly rises. Although these may not themselves be dangerous, the resulting increase in humidity, within a sealed bag, can be fatal. Suitably looked after, the bagged Collembola can be transported long distances, even intercontinentally, and may, if necessary, be stored, at least for some weeks. When at a suitably equipped base camp, the sample is spread on a sieve in a funnel, the animals therein are driven down into a collection tube by the action of light, heat and desiccation. This method makes best possible use of time in the field and is useful for surveying Collembola and other soil animals from new areas or in recovering fresh topotypes of old species. Although no extraction unit could cope with unsolicited litter from all directions, it is clear that in some cases enthusiastic amateurs could save the expense of costly expeditions. It would be a case of the mountain, complete with Collembola, coming to Mohammed—in plastic bags.

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## A SPECIES OF NORELLIA R.-D. (DIPT., SCATOPHAGIDAE) NEW TO BRITAIN

By P. J. CHANDLER and A. E. STUBBS

This paper records the occurrence in Britain at three localities of a species of *Norellia* R.-D. (Dipt., Scatophagidae) of very distinctive appearance, of which there is no certain previous record from this country. Our captures of this fly may be summarised as follows:

(a) Sheep Leas, Horsley, Surrey. A male was swept from partially shaded chalk grassland, 25.v.65 (AES). A female, obviously of the same species, was taken in the same area, 3.vii.67 (AES).

(b) East Burnham Common, Burnham Beeches, Bucks. A male was swept from bracken in open birch woodland, on gravel, 8.x.67 (PJC).

(c) Hollybush Hill, Stoke Poges, Bucks. Several flies of the species were seen at rest on the upper surfaces of the foliage of young alder shrubs, in a clearing in damp oak woodland, on clay, 29.x.67; one of each sex was taken (PJC). A further visit to the locality, 21.iv.68, produced six males of the fly, all observed at rest on the leaves of daffodils (*Narcissus pseudonarcissus* L.) of which several non-flowering clumps were present in the clearing (PJC).

In the most recent revision of the British species of the family Scatophagidae by Collin (1958) three species are included in the genus *Norellisoma* Wahlgren; two further species *N. armipes* Meig. and *N. striolatum* Meig. (the latter being probably a synonym of *N. armipes*) were included by Kloet and Hincks (1945) but were not recognised as British by Collin. Collin stated that 'the genus *Norellia* having been founded on one species only (*pseudonarcissi-spinipes* Meig.) which is generically distinct from our British species, Hendel's name of *Norellisoma* must take the place of *Norellia* Desv. in our British list'. Vockeroth (1965), however, prefers to regard these as subgenera. The most notable difference between *Norellia* and *Norellisoma* lies in the arrangement of the long spine-like bristles which are present on the front tibiae of these flies: in the former there is only a posteroventral row, while in the latter there is a similar anteroventral row. Our specimens evidently belong to the subgenus *Norellia*.

These flies are best compared with the common British species *Norellisoma spinimanum* (Fall.) since they resemble it superficially in general form and colour, although they are of slightly smaller build; the other British species of the genus, *N. flavicorne* (Meig.) and *N. lituratum* (Meig.) are smaller and darker in colour. They differ, however, from *N. spinimanum* in many characters, the most striking being the possession of wing markings; these consist of dark clouds over the anterior and posterior cross-veins, a dark spot near the apex of the vein R2+3 and a fainter dark shade below this towards the apex of the wing. Some European *Norellisoma* have marked wings but the three British species and also *N. armipes* and *N. striolatum* have the wings entirely unmarked.

The ground colour of the body is reddish-brown, but the dorsal surface of the thorax is a dull grey with a median reddish-brown stripe broadening onto the scutellum and, separated from the latter by grey stripes, there are narrow black vittae along the line of the dorsocentral bristles; the dorsocentrals comprise one presutural and one postsutural pair. In *N. spinimanum* the thorax is sometimes entirely brown, although indications of black stripes along the lines of the dorsocentrals are usually present; there are two presutural and three postsutural dorsocentrals in this species. The abdomen is all dull black except for the brown genital segments in *N. spinimanum*, while in our specimens of *Norellia* the tergites are all shining and are black dorsally but reddish-brown laterally. The legs are brown with narrow dark tips to the hind femora in both species but are more yellowish

in *N. spinimanum*, where the mid femora also may be dark tipped. The coloration of the head also differs strikingly since in *spinimanum* it is mainly brown, including the occiput, with the orbits faintly dusted greyish, while in *Norellia* the pale grey dusting of the orbits is strongly contrasted with the brown frons and the dusting extends diagonally onto the occiput as broad bands which unite behind a triangular black extension of the ocellar triangle. The occiput is also black external to the pale bands, so that the pale 'V' so formed is very distinct.

It is not, however, so easy to assign the correct specific name to the British specimens, since the synonymy within the subgenus is in a state of some confusion at present. Our specimens appear to differ specifically from some Yugoslav material of *N. melaleuca* Loew in the British Museum (Nat. Hist.) collection (the only species of the subgenus represented in that collection), and they were therefore submitted to Mr. J. R. Vockeroth of Ottawa, who is one of the leading authorities on the world species of the Scatophagidae.

He tells us that he had previously regarded the five described European species as synonymous and was using the name *N. tipularia* F. (this name being the first described) with *N. spinipes* Meig., *N. pseudonarcissi* R.-D., *N. maculipennis* Rond. and *N. melaleuca* Loew as synonyms. He found, however, that our specimens differed from all other material available to him (four males and five females from Spain; two females and sketches of terminalia of a male from Italy; one male and two females from Cyprus; and one female, the type of *N. melaleuca*, from Greece) in several important structural features, and they are certainly specifically distinct. All other specimens examined were of one species from southern Europe, and it is likely that the British species will be found to replace the other in northern Europe also. Mr. Vockeroth has kindly allowed us to reproduce the following summary of the differences between the species:

English Species

Mid femur with 6–8 distinct black anteroventrals, 3–4 posteroventrals; hind femur with 7–9 anteroventrals, 3–4 posteroventrals. Posterior surface of thorax, below the base of abdomen and above hind coxae, uniformly sclerotised; thoracic bristles stronger, e.g. postsutural dorsocentral subequal to supraalar; sternopleural bristles black. Male: lobes of 5th sclerite broader with blunter apex, apex of surstylus (superior forceps) slender and subacute, and aedeagus with larger preapical anterior flange (a rather tenuous character, perhaps better ignored). Female: spermathecae with broadened apical portion and distinctly more slender base (only one specimen examined).

Southern European Species

Mid femur with 4–5 anteroventrals and 2–3 posteroventrals; hind femur with 4–5 anteroventrals and 2 posteroventrals; posterior surface of thorax with distinct median suture; bristles of thorax weaker, e.g. postsutural dorsocentral shorter and weaker than the supraalar; sternopleural usually white or yellow, rarely brown. Male: lobes of 5th sternite more slender with apex subacute, apex of surstylus broader and bluntly rounded, aedeagus with smaller flange. Female spermathecae scarcely tapering, not clearly divided into basal and apical portions (three specimens examined).

Vockeroth considers that the southern species should be known as *N. tipularia* F., since the leg spines of the type (from North Africa) which was figured by Coquebert in 1806 agree perfectly with the Mediterranean specimens. *N. melaleuca* is therefore a synonym and *N. maculipennis*, the type of which was from Italy, is also probably a synonym. The type locality of *N. spinipes* is unfortunately unknown as Meigen simply stated that it was from 'Baumhauer's Museum', and

elsewhere in the same volume mentions Baumhauer's specimens from various French localities and from Italy. The type is in the Paris Museum, and its identity will soon be established by Vockeroth. If it is the northern species this name would have priority; if not the name *N. pseudonarcissi* could be used, since this was described from Paris but the type is unfortunately lost.

*Norellia* under the name *N. spinipes* was reared by Ciampolini (1957), who gave a lengthy account of its life history; the eggs are laid singly in the mesophyll of the host plant, *Narcissus tazzetta* L. var. 'totus albus grandiflorus', and the larvae mine three or four leaves successively, proceeding downwards and finally pupating in an enlargement of the mine at the base of the plant, sometimes injuring the bulb. He stated that the larva may seriously affect the flowering and formation of new bulbs by the plant. It appears probable that he reared the southern species since he was working in Tuscany, Italy. *N. pseudonarcissi* was, however, found in association with daffodils (*N. pseudonarcissus*) and was therefore so named; the most recent series taken by us were also taken in association with daffodils and it seems likely that the northern species also develops in plants of this genus. The plants on which our specimens were found were not flowering or even in bud although in a clearing while plants in nearby gardens were flowering and it is possible that this was due to their having suffered a heavy infestation of *Norellia* larvae the previous year. We are not, however, aware of the presence of daffodils at the other two localities, which are quite different from the geological and botanical aspects, although this is not impossible. The structure of the ovipositor suggests that all the species of *Norellia* sensu lato, have phytophagous larvae, but only one other species has been reared, *N. spinimanum*, which develops in the leaf petioles of various docks (*Rumex* spp.), dicotyledonous plants quite unrelated to *Narcissus*, and suggesting the possibility of a wide range of plant hosts within the genus. This is unusual in the Scatophagidae, as in most other cases where the development is known related flies develop in related or similar plants.

If sought in areas where wild daffodils are still numerous or perhaps even in commercial bulb growing areas, this fly may be found to be more widespread in Britain, and it is hoped that larvae may soon be found in this country. Our dates of capture suggest that there may be two broods a year, the first appearing from late April to early July and the second occurring during October. Ciampolini (*op. cit.*) stated that there was only one generation a year, emerging from March to May—the season would of course be earlier in Italy, but his reference to a possible range of 67 to 95 days for development from hatching of the larvae would suggest the appearance of a second brood of adults later in the year.

It is extraordinary that such a distinctive fly which can occur in three widely different habitats in comparatively well-worked parts of south-east England has not been recorded previously, and we cannot exclude the possibility that it is an accidental introduction with daffodil bulbs as this was most certainly the case with another bulb fly a century ago, i.e. *Merodon equestris* F. (Syrphidae) which is now common in many parts of Britain and infests a variety of bulbous plants.

As an addendum to this paper it may be useful to summarise the known development media of the Scatophagidae, other than *Norellia*, since our knowledge has recently advanced to some extent although much remains to be done. Most genera whose development has been at all worked out appear to be phytophagous, or at least in some way associated with plants. The large genus *Cordilura* develop in the leaf bundles of sedges and rushes (chiefly *Carex* and *Scirpus* species), from which many American species have been reared (Frohne 1938; recent unpublished work). Infested leaf bundles are apparently easily recognised by their whitish appearance. We can take the opportunity here of pointing out

that the common British species usually known as *Parallelomma albipes* Fall. is now placed in the subgenus *Cordilurina* James of the genus *Cordilura* and the record of it mining the leaves of Liliaceae by Kaltenbach probably referred to one of the rather similar species of the true genus *Parallelomma* (formerly known as *Chylizosoma*). The references by Hackman (1956) to its development in various Liliaceae was based on Hering (1935) but later Hering (1957) refers these records to *Chylizosoma*. The two species included in *Americina* by Collin belong to this genus; the Nearctic type species of *Americina* is not congeneric according to Vockeroth. *Cordilura* is well represented in Britain but none of our species nor any Palaearctic species has yet been reared.

*Parallelomma, Delina, Hexamitocera* and probably most other members of the Delininae mine the leaves of Liliaceae, Orchidaceae and (in Japan) Commelinaceae; the mines of the European species are dealt with by Hering (1957). The larvae of the genus *Nanna* (=*Amaurostoma* of British authors) develop in the inflorescences of various grasses (Borg 1959; Collin *op. cit.*; Golebiowska 1949). The records of *Chaetosa* from grasses (e.g. Collin, *op. cit.*) were based on a mistaken identification in 1935 by Balachowsky and Mesnil of a species of *Nanna*.

Records from dicotyledonous plants are few. The general *Gimnomera* and *Gonarcticus* are, however, apparently confined to Scrophulariaceae. Neff (1968), who gave a full account of the rearing of *Gimnomera cerea* Coq. from the seed capsules of Lousewort (*Pedicularis* spp.) and of *Gimnomera incisurata* Mall. from flower buds of *Penstemon* species, conjectured that the association was derived through the hemiparasitism of *Pedicularis* on various Monocotyledons which are regular scatophagid foodplants. A European species of *Gimnomera* has also been reared from *Pedicularis* in Sweden by Ryden (1933) and searching lousewort for our British species might prove productive. Apart from *N. spinimanum* only one other genus is associated with dicotyledons; *Hydromyza* is known to mine the leaves of various species of water-lily (*Nuphar* and *Nymphaea* species) in both Europe and North America (Welch 1914 and 1917; Eberle 1933; de Meijere 1940).

Of the other genera some undoubtedly have carnivorous larvae, e.g. *Spaziphora*, of which the American species *S. cincta* Lw. is known to have free living aquatic larvae (Vockeroth *in litt.*); the references by Collin (*op. cit.*) to the rearing of *S. hydromyzina* Fall., a fly of marshes and riversides, from cabbage roots attacked by the club-root fungus therefore seems unlikely, but on his authority must be at least provisionally accepted. These genera are Scatophaginae but one genus included by Collin in the Delininae but regarded by Vockeroth as a scatophagine related to *Orthochaeta* is also said to be carnivorous, i.e. *Cnemopogon*, which is recorded from the galls of *Lipara lucens* Meig. and *L. tomentosa* Macq. (Dipt., Chloropidae) on *Phragmites communis* Trin. (Seguy 1952; Hackman 1956, who states that Valkeila has confirmed that they are predatory on *Lipara* larvae), but another record associating the same species, *C. apicalis* Meig., with the larva of the Fen Wainscot moth (*Arenostola phragmitidis* Hübn.) which mines the stems of the same plant suggests that they are not confined to these galls (Colyer & Hammond 1951) and Seguy (1952) also record larvae from *Rumex* and *Typha*, whose only relationship to *Phragmites* is the common marsh habitat. Larvae of the large genus *Scatophaga* are saprophagous, a few developing in rotten seaweed (Backlund 1945) but probably the majority on dung of various animals. *S. stercoraria* (L.) may also develop in rotting vegetation, e.g. piles of grass clippings (Vockeroth, *in litt.*).

The development of many genera is still totally unknown, but most will probably prove to be phytophagous. There is clearly considerable scope for further

work on the biology of this family of flies, whose diversity of form and habit makes them an attractive group to work with.

We wish to thank Mr. J. R. Vockeroth for his determination of our specimens and for the considerable help he has given us in the preparation of this paper.

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## COLOTIS DAIRA KLUG. s.sp. NOUNA LUCAS (LEP., PIERIDAE) IN SPAIN

By Brigadier H. L. Lewis, C.B.E.

On 6th September 1968 I was collecting on waste land by the sea-shore east of Almeria in southern Spain when I took what I had thought was a *Pieris rapae* L. flying in a strange fashion. To my surprise I found it was a species of *Colotis*. Despite further search in the area that day and the next I did not see another specimen. However, on the 8th September I drove with my wife and daughter from Almeria to Granada via Guadix, and as I had an idea we might see more of this butterfly we all kept a sharp look-out. It was not till about 10 a.m., when we were some 30 miles inland and virtually behind the Sierra Nevada, that I spotted what I thought might be another. We were then about 1200 ft up in a dry and barren area. After a scrambling chase up and down the mountain side I netted it, and it proved to be a female *Colotis*. For the next 30 miles we drove slowly, and saw and caught a number, both males and females. They were nearly always on steep, barren and stony hillsides, flying fairly fast in the wind, and very occasionally settling on small spiny plants.

Having reached Guadix, we saw no more of these butterflies between there and Granada, nor on the Granada-Motril road by which we returned in the afternoon. In the week I stayed in Almeria I did not see any further specimens along the coast.

At first I thought the example I took by the shore might have been blown over from Africa; however, from my observations of the behaviour of these butterflies, along about 40 miles of road and country bordering it, I now incline to think that they are established there. The insect taken by the sea-shore could have been a stray from the colony inland.

The captures were subsequently identified as *Colitis daira* Klug. s.sp. *nouna* Lucas.

Longford Lodge,
Hampton, Middlesex.
*13th February 1969*,

# PROCEEDINGS

13th FEBRUARY 1969

The President, Capt. J. Ellerton, in the Chair

The death was announced of Mr. Harold Ray.

The following new members were declared elected: Mr. A. D. R. Brown and Mr. B. Merry.

### EXHIBITS

Mr. K. A. Spencer—Two species of Agromyzidae (Dipt.), widely distributed in the Ethiopian and Oriental regions which can be expected on Aldabra Island: *Malanagromyza metallica* (Thoms.), which feed in stems of Compositae, and *M. phaseoli* (Tryon).

Mr. G. Prior—Four live imagines of *Danaus plexippus* L. (Lep., Danaidae)

reared from larvae during December and January by Mr. D. H. Turner in Modbury, South Australia. The pupae were sent by air from Australia on 16th January and arrived on 27th; the butterflies emerged during the first two weeks of February.

Dr. C. G. M. DE WORMS—Two living *Nyssia zonaria* Schiff. (Lep., Geometridae), just hatched, originating from Conway, N. Wales.

Brig. H. L. LEWIS—Nine sets of wings of a *Colotis* sp. probably *C. daira* Klug. s.sp. *nouna* Lucas, taken in Spain at 1,500 ft in the Sierra Nevada, except for one example taken on the fore-shore; apparently the first record for the genus in Europe.

COMMUNICATIONS

Mr. F. T. VALLINS reported for Viscountess Bolingbroke, a Night-heron (*Nycticorax nycticorax* (L.)) seen in her garden; a rare visitor to these islands.

Mr. A. E. GARDNER recorded that a ring-necked duck, *Nyroca collaris* Don., the sixth known record for Britain, had been seen near Dorchester, Oxon. He also gave details of a generous gift by Mr. E. W. Classey of 15 volumes recently published by him, worth £60.

An illustrated talk 'An Entomologist on Aldabra' was given by Mr. B. H. COGAN.

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## 27th FEBRUARY 1969

The PRESIDENT, Capt. J. ELLERTON, R.N., in the Chair

The death was announced of Mr. G. H. W. Crutwell, Mr. E. J. Hare and Mr. C. Mellows.

Mr. W. G. Vosper was declared elected a member.

EXHIBITS

Mr. S. WAKELY—A specimen of *Adoxophyes orana* F.R. (Lep., Tortricidae) taken at light at Camberwell, 7.ix.68. Also a series of the same species from East Malling Research Station where it was first taken in Britain in 1950. Since its discovery at East Malling this insect has been recorded from Bromley and Blackheath village in Kent and at Westcliff-on-Sea, Essex; but there have apparently been no records for the past ten years. The species might easily be overlooked. People using light traps in the Home Counties should look for it in June and September as there are two broods.

Mr. J. A. C. GREENWOOD—A moth which had emerged from a Mexican Jumping Bean. He believed it to be *Enarmonia saltitans* (Lep., Olethreutidae), a species not very far removed from our Codlin Moth, *Laspeyresia pomonella* L.

Dr. M. G. MORRIS—A male example of *Phytonomus diversipunctatus* (Shrank) (*elongatus* Payk.) (Col., Curculionidae) found under *Cerastium arvense* L. on Lakenheath Warren, Suffolk, 5.ix.68. This is a rare species known only from the lowlands of Scotland, Midlothian, Dumfries/Kirkcudbright and Selkirk (Kevan, 1960, *Ent. mon. Mag.*, **96**:35–38), and recently recorded from Redgrave and Lopham Fen on the borders of Suffolk and Norfolk. *C. arvense* is one of the recorded foodplants of the species. For comparison, specimens of the other British species in the genus with bifurcate scales were shown: the common *P. posticus* (Gyll.) (*variabilis* (Herbst)), which feeds on Leguminosae and is a pest of lucerne in some countries; *P. suspiciosus* (Herbst) (*pedestris* (Payk.)), a rather un-

common species in the exhibitor's experience, which also feeds on Leguminosae; and the somewhat rare *P. fuscocinereus* (Marsh.) (*murinus* (F.)), which feeds on *Medicago* spp. and probably other Leguminosae. D. K. Kevan's helpful paper (*loc. cit.*) on *P. diversipunctatus* gives figures of the very clear characters which separate these species.

Mr. A. E. GARDNER—A short series of the very local *Encephalus complicans* (Westw.) (Col., Staphylinidae) found in litter at the base of large clumps of Pendulous Sage, *Carex pendula* L., near Stockbridge, Hants, 8.ii.69.

COMMUNICATIONS

Mr. R. F. BRETHERTON said that on 22nd February the temperature had risen appreciably and he had 65 Lepidoptera in his mercury vapour light trap, including no less than 45 examples of *Phigalia pilosaria* Schiff. (*pedaria* F.) (Geometridae).

The LIBRARIAN announced that Mr. E. W. Classey had presented to the Society all four volumes of *Exotic microlepidoptera* by Edward Meyrick, which he had just reprinted.

The PRESIDENT announced that proposals were in hand to have Limpsfield Chart registered as an S.S.S.I. and that the Croydon Natural History Society were anxious to have information regarding its entomological interest. Members who know the area are asked to contact Mr. E. Lewis, 11, Court Farm Road, Warlingham, CR3 9BL.

To conclude the meeting Mr. A. E. STUBBS gave a talk on 'Some Factors affecting Insect Distribution', which he illustrated with slides.

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## 13th MARCH 1969

The PRESIDENT, Capt. J. ELLERTON, R.N., in the Chair

The death was announced of Mr. L. Parmenter.

The President welcomed Dr. Diakanoff of Leiden and Mr. B. Hainiman of New York to the meeting.

EXHIBITS

Sir ERIC ANSORGE—An example of *Cercyon laminatum* (Sharp) (Col., Hydrophilidae), a species not hitherto recorded as British, taken in his mercury vapour light trap at Chalfont St. Peter, Bucks., 1.vii.68.

Dr. C. G. M. DE WORMS—The melanic form of *Phigalia pilosaria* Schiff. (*pedaria* F.) which he had taken from his trap that morning.

Mr. G. M. DE ROUGEMONT—A specimen of *Cisanthobia ariasi* Shaeff., taken from a pupal chamber in oak, 1.vi.68, at Vanelles, Bouches du Rhone, France; the first record for this department.

Mr. S. A. WILLIAMS—*Mycetoporus longicornis* Maekl. (Col., Staphylinidae), taken near Stockbridge, N. Hants, 8.ii.69, in a grass tuft. A very local species easily confused with *M. splendidus* (Grav.).

COMMUNICATIONS

Col. A. M. EMMET gave an account of some microlepidoptera from larvae taken in the west of Ireland last September. *Lithocolletis quinqueguttella* Staint. (Lithocolletidae) and *Ancylis inornatana* H.–S., both from the same food plant,

*Salix repens* L.; these species are new to Ireland and came from Ballyconneely, Co. Galway. *Ancylis* larvae found feeding in *Salix repens* had all pupated in the autumn, producing imagines of *inornatana* in October and November; on the other hand larvae taken on the same ground and day on *Salix aurita* L. were overwintering in hibernacula and were likely to produce *A. geminana* Donovan in the spring.

Amongst the Nepticulidae he had just bred *Stigmella hybnerella* Hübn. from Ballyconneely. This appeared to be the first Irish record for over 100 years. Mr. S. N. A. Jacobs had kindly identified some of the vacated nepticulid mines he had brought back; these included *Dechtiria pulverosella* Staint., on apple, not previously recorded from Ireland, and *Nepticula ignobilella* Staint., on hawthorn, another species not recorded, it seems, for over 100 years.

He concluded by mentioning two species of Coleophoridae from west Galway which were still overwintering. The first was *Coleophora adjunctella* Hodgk., taken on *Juncus gerardii* Lois, another species new to the Irish list. The identity of the second was still in doubt. The larval cases were found on *Juncus articulatus* L. and resembled those of *C. taeniipennella* H.-S., but were larger and darker. If, as he hoped, they proved to be *C. tamesis* Waters, a gap in our knowledge of this group would have been filled.

Mr. P. Lawrence of the British Museum (Nat. Hist.) then gave an interesting talk, illustrated with slides, on 'Collecting Primitive Insects'.

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## 27th MARCH 1969

The PRESIDENT, Capt. J. ELLERTON, R.N., in the Chair

The death was announced of Capt. Dudley Marsh.

The following new members were declared elected: Dr. Howard, Mr. Kirby, Mr. Smiles.

### EXHIBITS

Mr. P. N. CROW—A selection of male specimens of *Erannis defoliaria* Clerck (Lep., Geometridae) showing local variation, from Maenturog, Merioneth, November 1968. Also a female example of the parasite *Peltocarus dentatus* F. (Hym., Ichneumonidae) taken in Cornwall in late June 1968; a known host is the larva of *Lasiocampus quercus* L. (Lep., Lasiocampidae), but the parasite is local and rarely seen.

Mr. J. LABDON—A pale specimen of *Harpyia bicuspis* Borkh. (Lep., Notodontidae) taken at Tilgate, Sussex, May 1967.

Mr. A. E. GARDNER—The archaic dragonfly *Epiophlebia superstes* (Selys) (Aniso-zygoptera) from Mount Tako Tokyoro, Japan, 11.v.57. A brief description of the early stages and the combined anis-zygopterous characters in the adult were given. This, one of two recent species, has remained virtually unchanged since Mesozoic times, some 170 million years ago.

### COMMUNICATIONS

Mr. R. L. E. FORD gave a most interesting talk on the 'Flora and Fauna of the Isle of Wight about 50 million years ago'. This he illustrated with slides.

## 10th APRIL 1969

The President, Capt. J. ELLERTON, R.N., in the Chair

The following new members were declared elected: Dr. Montford and Mr. Dixon. The Westfield College, Zoology Dept., was elected a Corporate Member.

### EXHIBITS

Mr. A. E. GARDNER—A series of the beetle *Byrrhus arietinus* Steff. (Byrrhidae) taken on Hollingworthall Moor, Cheshire, 6.iv.69. A short description of the characters of this recent addition to the British fauna was given.

### COMMUNICATIONS

Mr. C. R. B. Baker gave an illustrated talk on 'Some aspects of the Biology and Behaviour of the Buff and White Ermine Moths'.

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## 24th APRIL 1969

The President, Capt. J. ELLERTON, R.N., in the Chair

The death was announced of Dr. H. B. Williams.

The following new members were declared elected: Mr. D. Ollevant and Miss V. Scarli.

### EXHIBITS

Mr. G. M. DE ROUGEMONT—The following Coleoptera: *Asaphidion flavipes* (L.) (Carabidae), four examples taken 2.iv.69, under loose bark on Plane trees in Hyde Park, London, W.1, where it was very common. *Platypsyllus castoris* Rits. (Leptinidae), a single example from Avignon, France. This beetle is an ectoparasite of the European Beaver (*Castor fiber* L.). The species exhibits extreme structural modification common to many ectoparasites; flattened dorso-ventrally, blind, depigmented, highly sclerotised and possessing a comb-like structure on the pronotum similar to that seen on fleas.

Mr. P. N. CROW—(1) A male *Celastrina argiolus* L. (Lep., Lycaenidae) taken 20.iii.66 at Maidencombe, Devon. (2) A male and a female *Servillia ursina* (Meig.) (Dipt., Tachinidae) taken in April 1969 in Berkshire. The larva of this fly is parasitic on moth larvae. (3) Two male *Melangyna quadrimaculata* (Verrall) (Dipt., Syrphidae) taken in Berkshire in March 1969. The larva of this species feeds on aphids.

Mr. E. S. BRADFORD—(1) Four examples of *Cryptoblabes gnidiella* Mill (Lep., Pyralidae) bred from larva found feeding in pomegranates bought in Boreham Wood, Herts., during October and November 1968. They were kept indoors and the adults emerged between 5 and 10.iii.69. (2) An undetermined micro bred from a larva found feeding on banana also bought in Boreham Wood.

Mr. P. L. COOK—*Elater rufipennis* Steph. (Col., Elateridae) found dead and attacked by fungus in Windsor Forest, Berks. He also showed for comparison, *E. pomonae* Steph. and *E. cinnabarinus* Esch., both from the New Forest, Hants.

### COMMUNICATIONS

Referring to the Lepidoptera noticed on his recent visit to the Highlands of Scotland, Dr. C. G. M. DE WORMS said moths were plentiful. He had found *Brachionycha nubeculosa* Esp. (Noctuidae) south of Aviemore; *Poecilopsis*

*lapponaria* Boisd. (Geometridae) common near Straun, and he had seen *Achyla flavicornis* L. (Thyatiridae), *Archiearis parthenias* L. (Geometridae) and *Xylena exsoleta* L. and *X. vetusta* Hübn. (Noctuidae). He also said he had noted *Aglais urticae* L. (Nymphalidae) in flight.

*Nymphalis polychloros* L. (Nymphalidae) was reported by Mr. P. N. CROW from Pangbourne and Caversham, Bucks.

A report on the Effingham field meeting by Mr. R. F. BRETHERTON drew from Mr. B. GOATER the comment that *Bapta distinctata* H.-S. (Geometridae) was reasonably common in the New Forest, Hants.

A talk on the dangers to the Common Seal was given by Mr. DARBISHIRE, supported by photographs and a cinematograph film. Discussion afterwards centred around the preservation of the species in which Mr. Darbishire was supported by Mr. SMITH.

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## 8th MAY 1969

The President, Capt. J. ELLERTON, R.N., in the Chair

The death was announced of Maj.-Gen. A. L. Ransom.

The following new members were declared elected: Miss S. L. Postbury and Messrs. P. L. Cook, B. L. Jones and W. Parker.

### EXHIBITS

Mr. B. GOATER—Ova of *Orthosia advena* Schiff. (Lep., Noctuidae) laid on dead grass stems on chalk downland in Hertfordshire. Four batches were found on one stretch of downland on 3rd May. In the evening of the same day imagines were discovered in some numbers resting on the grass stems between nightfall and 23.30 hrs. Ovipositing females rested head downwards while other females and males rested head up. No copulating pairs were seen during the period of observation.

Mr. S. A. WILLIAMS—Two examples of *Atheta* (s.gen. *Brundinea*) *meridionalis* (Muls. & Rey) (Col., Staphylinidae) from beneath detritus on the Thames estuary at Highham, Kent, 20.iv.69.

### COMMUNICATIONS

The state of the season was commented upon by Dr. C. G. M. DE WORMS with regard to Lepidoptera, when he mentioned having seen the butterflies *Anthocharis cardamines* L. (Pieridae) and *Celastrina argiolus* L. (Lycaenidae) among others. He added that at Chiddingfold, Surrey, he had obtained a fine female *Saturnia pavonia* L. (Saturniidae). Mr. GOATER added that while he was working for the *Orthosia advena* Schiff. he too had obtained a *Saturnia pavonia* L. Col. A. M. EMMET said that *Saturnia pavonia* was not uncommon on the chalk at Saffron Walden, Essex.

That the species was elusive was the opinion of Mr. R. F. BRETHERTON. He said that in the early 1960s at Ottershaw, Surrey, a female had assembled approximately 40 males, but only twice in the remaining 14 years he was living in the district did he see another male in flight.

With reference to Mr. Goater's exhibit, Mr. E. W. CLASSEY said that *Orthosia advena* Schiff. was a difficult insect to rear; and this he believed to be indicative of the fact that we did not really know the normal foodplant. Dr. B. J. MACNULTY, however, said that he had obtained ova at Wirral, Cheshire, and had fed the

resulting larvae on ordinary sallow, successfully bringing the brood through with no difficulty. Mr. S. WAKELY said that he had collected about a hundred larvae last year, but had obtained only two moths this year.

Mr. Classey said this was the normal pattern; one person would bring his brood through easily and others would have difficulty. He still thought our knowledge of the correct foodplant was the basic reason, though this may very well vary from locality to locality.

Another suggestion was put forward by Mr. GOATER, who thought the cause may be an endemic virus. He suggested successful breeding may be due to healthy stock, but often when ova were distributed throughout the country the various people rearing report the same problems. Mr. Classey pointed out that even the wrong foodplant could allow the species to flourish for a while.

In support of a field meeting report he gave, Col. A. M. EMMET showed galls caused by *Laspeyresia zebeana* Ratz. (Lep., Olethreutidae). He pointed out that these had a spongy softness, while other galls from which the moths had emerged the previous year were hard.

A paper was read by Mr. C. O. HAMMOND on 'Some interesting Diptera' which he illustrated with coloured slides made from illustrations from the book *Flies of the British Isles*, a copy of the second edition of which he presented to the Society.

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## 22nd MAY 1969

The President, Capt. J. ELLERTON, R.N., in the Chair

The following new member was declared elected: Mr. A. E. Wright.

### EXHIBITS

Mr. S. A. WILLIAMS—A single example of *Atheta* (*Liogluta*) *hypnorum* (Kies.) (Col., Staphylinidae) taken in damp moss at Bratley Beeches in the New Forest, Hants., 28.iv.69.

Mr. S. N. A. JACOBS—A stem of sprouting broccoli showing a jointing of a leaflet on a lateral with one on the main stem. This occurred at a point some six inches above the junction of the lateral with the main stem. There was no noticeable distortion of either the lateral or the main stem.

Mr. R. L. HARVEY—An example of *Parallela algira* L. (Lep.) taken during August 1967 in a layby a mile or so outside Dover, Kent. The moth was first noticed when it flew into the beam of a car's headlights at approximately 10.5 p.m. The species has not previously been recorded in this country, but was probably introduced by some human agent. The determination was made by Dr. C. G. M. de Worms.

Mr. C. O. HAMMOND—Three interesting Diptera taken at Cosford Mill, 11.v.69: *Sphegina clunipes* (Fall.) (Syrphidae), *Brachyopa scutellaris* R.-D. (Syrphidae) and *Myopa testacea* (L.) (Conopidae). The last named is parasitic on bees.

Mr. R. F. BRETHERTON—Two living larvae of *Thetidia smaragdaria* F. (Lep., Geometridae) which cover themselves with pieces of *Artemisia maritima* L., the foodplant.

Mr. B. GOATER—A living example of the Large Red-belted Clearwing, *Aegeria culiciformis* L. (Lep., Sesiidae) bred ex pupa from a stump of birch at Ash Vale, Surrey.

COMMUNICATIONS

Discussion on the season produced the information that immigrant Lepidoptera were making their appearance. The PRESIDENT reported *Nomophila noctuella* Schiff. (Pyralidae), *Plusia gamma* L. (Plusiidae), *Udea ferrugalis* Hübn. (Pyralidae) and *Apamea ypsillon* Schiff. (Noctuidae) in N. Bucks; and he added that Mr. Philpot had seen *Colias croceus* Fourc. (Pieridae) and *Udea ferrugalis* Hübn. at Portland, Dorset.

Other members also reported *Nomophila noctuella*, *Plusia gamma* and *Apamea ypsillon*, and *Laphygma exigua* Hübn. (Noctuidae) was also recorded. An example of *Vanessa atalanta* (Nymphalidae) was reported.

Col. A. M. EMMET said that the gall of *Laspeyresia zebeana* Ratz. (Lep., Olethreutidae) which he had exhibited at the previous meeting had produced a hymenopterous parasite. This had been identified by Mr. G. J. Kerrich of the Commonwealth Institute of Entomology as a female *Scambus linearis* Ratz. (Ichneumonidae). He said that at one time *linearis* was placed in synonymy with *sagax* Hart., but that it was now thought to be a good species. There was no male of this species in the British Museum, and specimens of both sexes were greatly desired.

Mr. M. W. F. TWEEDIE gave a talk on 'Photographing Insects Indoors' which he illustrated with some excellent colour transparencies of his work in this field.

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## 12th JUNE 1969

The President, Capt. J. ELLERTON, R.N., in the Chair

The following new member was declared elected: Miss Maureen Grogan.

EXHIBITS

Mr. A. E. GARDNER—The following staphylinid Coleoptera: (1) a series of *Gyrophaena strictula* Er. from the fungus *Daedalea quiercina* Fr.; (2) a series of *Philonthus nigrita* (Grav.) and a single example of *Acidota crenata* (F.) from the New Forest, Hants, 26.iv.69, in sphagnum; (3) examples of *Rugilus fragilis* (Grav.), Lymington, Hants, 27.v.69; (4) two specimens of *Conosomus bipunctatus* (Grav.) from under Scots Pine, N. E. Norfolk, 25.v.69; (5) a living female *Velleius dilatatus* (F.), one of several bred from larvae found in a hornet's nest 40 ft up in a hollow beech tree in the New Forest, 23.xi.68. The first imagines commenced to emerge 11.vi.69. Although associated with the hornet, *Vespa crabro* L., there are records of the beetle being found on the Continent in wood mould of hollow trees.

Mr. P. L. COOK—The following Coleoptera from Windsor Park, Berks.: *Grammoptera ustulata* (Schall.) (Cerambycidae), 31.v.69; *Procraerus tibialis* (Lac.) (Elateridae), 31.v. and 7.vi.69; and *Agrilus laticornis* (Ill.) (Buprestidae), 7.vi.69.

Mr. C. MACKECHNIE JARVIS—*Formicoxenus nitidulus* (Nylander) (Hym., Formicidae); male and workers taken in the nest of the Wood Ant, *Formica rufa* L. (Formicidae), 5.v.69, in the New Forest, Hants.

Mr. C. O. HAMMOND—A male and female *Conops vesicularis* (L.) (Dipt., Conopidae), the largest species in the genus and a good example of sexual dimorphism which is uncommon in the Diptera. The male was taken at Wisley, Surrey, 24.v.69, and the female at the field meeting at Alice Holt Forest, 8.vi.69.

Mr. S. WAKELY—A larva and pupa of *Pterophorus spilodactylus* Curt. showing how very much alike the two forms are. Three larval cases the size of those of *Coleophora inulae* Wocke were also shown, together with the smaller case typical of *C. troglodytella* Dup. (several members later reared only *C. troglodytella* Dup. from similarly variable cases from Shanklin); all taken during the previous week on the Isle of Wight.

Mr. B. GOATER—Living larvae of *Orthosia advena* Schiff. in the penultimate and last instars, feeding on plum and bred from a batch of eggs found on a grass stem on the Herts Downs.

COMMUNICATIONS

*Vanessa cardui* L. was reported by Mr. R. S. TUBBS to have been seen in Wimbledon, S. W. London.

The PRESIDENT announced that Mr. E. W. Classey had presented the Society with a copy of *The Bionomics of Entomophagous Coleoptera*; he thanked Mr. Classey on behalf of the Society.

A series of excellent slides were shown by Mr. GATES CLARK of the United States National Museum, Washington, and by Mr. R. W. J. UFFEN.

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## 26th JUNE 1969

The President, Capt. J. ELLERTON, R.N., in the Chair

The President welcomed the following distinguished visitors from overseas to the meeting: Mr. Eong Boek Tay from Sabah, Malaysia; Dr. & Mrs. Diakanoff from Leiden, Holland; Professor & Mrs. Marks from Pennsylvania, U.S.A.; and the Marquess Nabashima from Japan.

The following new members were declared elected: Mr. J. Cooter and Mr. C. G. Lane.

EXHIBITS

Mr. J. COOTER—*Trachys pumila* Ill. (Col., Buprestidae), two examples taken at Goodwood, Sussex, 25 and 29.v.69. This species is not recorded by Fowler (1905, *Victoria County History of Sussex*, **1**:136–64) as occurring in Sussex. The only other record for this county known to the exhibitor is the capture by Mr. A. A. Allen towards the end of June 1945, sweeping in Arundel Park. The beetle is thought to be associated with *Glechoma hederacea* L. (Ground Ivy).

Mr. A. E. GARDNER—Mounted and living examples of *Sipyloidea sipylus* Brunn. (Dictyoptera) (Madagascan Stick Insect). During breeding eggs kept at a temperature of 75–80°F., hatched in one month, whereas other workers reported hatching in ten months to one year at lower temperatures.

COMMUNICATIONS

Dr. C. G. M. de Worms said that on the Broads in Norfolk two week-ends previously *Papilio machaon* L. (Lep., Papilionidae) had been very common indeed. During the previous week-end at Orlestone Wood, Kent, he had noted *Euphyia luctuata* Schiff. (Lep., Geometridae), whilst at Dungeness, Kent, *Calophasia lunula* Hufn. (Lep., Noctuidae) had been seen on *Echium vulgare* L. (Viper's Bugloss).

*Nacerdes melanura* (L.) (Col., Oedemeridae) was reported by Mr. G. M. DE ROUGEMENT to be occurring in thousands along the Regent's Canal about a mile from Regent's Park. He thought they might be originating in a nearby saw mill. He also reported a Beaver in the canal and thought this might have been an escape from the Zoological Gardens.

Referring to the *Nacerdes melanura* (L.) along the Regent's Canal, Mr. F. D. BUCK said that when working at King's Cross during the 1950s this beetle regularly flew into his office window which was alongside Battlebridge Basin on the Regent's Canal. He believed the insect was breeding in the wooden piles and other wharf structures. Mr. S. N. A. JACOBS added that the species regularly occurred in Northumberland Alley just off Fenchurch Street in the City of London.

*Aglais urticae* L. (Lep., Nymphalidae) was reported by Mr. P. N. CROW to have been seen in Pamber Forest, Hants, the previous day (25.vi.69). Many, he said, were in fresh condition and he suspected them to be migrants. Mr. F. D. Buck said he had noticed a few at Tiptree, Essex, but would not have described them as fresh.

A report of the field meeting at Wicken Fen, Cambs., was given by Mr. E. S. BRADFORD and Capt. J. ELLERTON.

Mr. R. FOORD gave the first part of a talk on 'The British Orthoptera', which he illustrated with coloured transparencies, and which was followed by a discussion. The second part is due to take place on 12th February 1970.

# INDEX FOR VOL. 2 (1969)

## CONTRIBUTORS AND EXHIBITORS



## ARACHNIDA



## BIRDS

## COLLEMBOLA



## COLEOPTERA



## DICTYOPTERA

## DIPTERA



## FLOWERING PLANTS

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HYMENOPTERA

## LEPIDOPTERA

MAMMALIA



MOSSES, LICHENS AND LIVERWORTS



NEUROPTERA



ODONATA



PROTOZOA



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SALTATORIA



SIPHONAPTERA



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# CONTENTS



## MEETINGS OF THE SOCIETY

are held regularly at the Society's Rooms, but the well-known ANNUAL EXHIBITION takes place this year on November 1st in the Conversazione Room at the British Museum (Natural History). Frequent Field Meetings are held at weekends in the Summer. Visitors are welcome at all meetings. The current Programme Card can be had on application to the Secretary.

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