

A SMALL STUDY OF THE ROSE BEDEGUAR GALL AND ITS INHABITANTS

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Summary

Twenty-nine Rose Bedeguar galls caused by *Diplolepis rosae* (Linnaeus) were collected and the emergent insects identified. The results are discussed and compared with the results found in other British and European surveys.

Introduction

The study of plant galls does not only involve the identification of the various gall-inducers and the recording of their distribution. The larger plant galls contain whole communities of different insect species which are intimately inter-dependent, and the study of these insect communities can be an interesting exercise.

For example, the well-known Marble Gall on oak results from one female gall-wasp of the species *Andricus kollari* laying one egg into a developing bud. From the egg hatches one larva which initiates the formation of the gall within which eventually the larva pupates. From this in due course one adult gall-wasp emerges which bites its way out of the mature gall leaving a very obvious exit hole. Yet, by autumn or winter each Marble Gall examined will reveal numerous exit holes, often up to 20 – 25, not just the one caused by the gall-inducing wasp. There are 28 known species of inquiline and parasitoid insects which can inhabit marble galls as well as the gall-causer.

One of the galls which is particularly easy to study is the Robin's Pincushion or Rose Bedeguar gall found on wild roses especially Dog Rose *Rosa canina* and caused by the gall-wasp *Diplolepis rosae* (Hymenoptera; Cynipidae).

This gall has been much studied by British and European biologists and was recorded from the Isle of Wight in Morey (1909) by Claude Morley who described it as common here. Somewhat strangely E.W. Swanton (1937) described the gall from *Rosa rubiginosa*, giving Staplers and Mot-tistone as sites, whereas most authorities would suggest that *Rosa canina* is the most common rose host species (Randolph, 2005)

Dr. K.G. Blair retired to Freshwater in 1943 having been Deputy Keeper in the Department of Entomology at the British Museum (Natural History) in South Kensington. He had a particular interest in this gall and its inhabitants and published several papers on the subject (Blair, 1943, 1945, 1951).

As I have been recording the distribution of this gall on the Island since 1975 I decided to perform my own small study of the *Diplolepis rosae* gall and its inhabitants to compare my results with those of others in Britain and Europe, especially comparing them where possible with those of Blair.

Method

Twenty-nine galls were studied, 27 taken on 10 October 2001 from short plants of *Rosa canina* growing on downland turf on Brook Down at SZ391852 and two galls taken on 2 February 2002 from tall sucker growth of a *Rosa* cultivar from my garden in Gurnard at SZ476954.

Each gall was removed with secateurs and after cleaning with a dry artist's brush was placed in a sterile airtight numbered container together with a single crystal of thymol to inhibit mould growth.

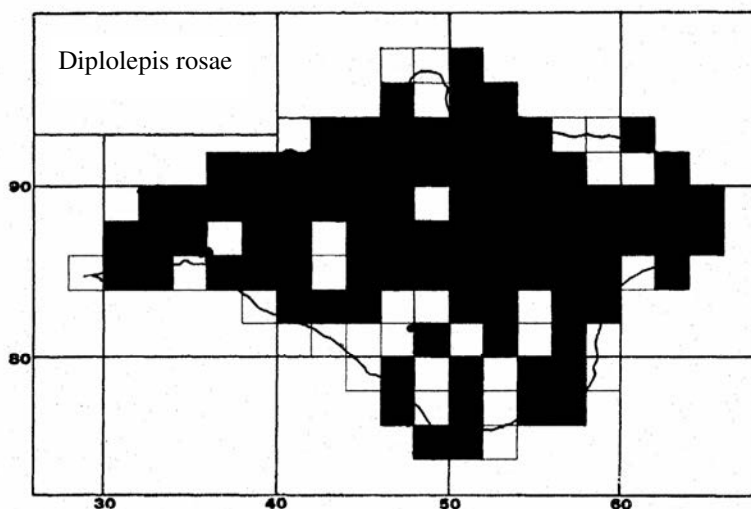
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The pots were examined regularly for emergent insects until 25 September 2005. They were kept throughout this time in an unheated garden outhouse protected from both frost and direct sunlight.

Results

The first insects to emerge during the period December 2001 to April 2002 were single individuals of three weevil species, *Polydrusus tereticollis*, *Polydrusus undatus* and *Sitona lineatus*. There was also a thrips species (Thysanoptera), a tick *Ixodes sp.* (Acarina) and an unidentified insect larva. None of these species is specific to Bedeguar galls but is simply an opportunistic inhabitant. From May 2002 to October 2002 however, many of the specialised *Diplolepis rosae* gall inhabitants emerged.

Current Distribution of *Diplolepis rosae* Galls on the Isle of Wight



Known Specialist Bedeguar Gall Inhabitants

HYMENOPTERA

CYNIPOIDEA

CYNIPIDAE

<i>Diplolepis rosae</i>	gall inducer	common
<i>Periclistus brandtii</i>	inquiline	common

ICHNEUMONOIDEA

ICHNEUMONIDAE

<i>Orthopelma mediator</i>	1° parasitoid	common
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CHALCIDOIDEA

EUPELMIDAE

<i>Aulogymsus skianeuros</i>	?	very rare
<i>Eupelmus urozono</i>	1° parasitoid	very rare
<i>Eupelmus vesicularis</i>	1° parasitoid	rare

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EURYTOMIDAE

Eurytoma rosae 1°/2° parasitoid uncommon

PTEROMALIDAE

Caenacis inflexa 1°/2° parasitoid occasional

Mesopolobus sericeus 1° parasitoid very rare

Pteromalus bedeguaris 1°/2° parasitoid common

TORYMIDAE

Glyphomerus stigma 1° parasitoid common

Torymus bedeguaris 1°/2° parasitoid common

Torymus rubi 1° parasitoid rare

Of these species only five were recorded in this survey:

Diplolepis rosae

Periclistus brandtii

Orthopelma mediator

Pteromalus bedeguaris

Torymus bedeguaris

Diplolepis rosae (Linnaeus 1758)

HYMENOPTERA; CYNIPIDAE

This is a small Hymenopteran with an average body length of 3.8mm and dull in general aspect. The head is black and relatively small, with red eyes and black antennae which have 14 segments. The thorax is black and markedly arched, giving it a very 'hump-backed' appearance. The abdomen is relatively long and swollen, bright chestnut in colour and laterally compressed. The legs are brown.

The Bedeguar Gall is caused by the egg-laying actions of the female gall-wasp and the subsequent feeding activities of the developing larvae. This insect is parthenogenetic, laying her fertile eggs without having mated. Males of the species are rare. The eggs are laid into the leaf-buds or the apical bud of a shoot tip. Oviposition occurs from late April to mid-July and larval development goes on from May to October. The act of oviposition initiates the proliferation of the host plant tissues which then develop rapidly after the larva has emerged from the egg which occurs about a week after oviposition. As the larvae begin to feed, differentiation of the plant tissue results eventually in the formation of the mature gall which consists of separate larval chambers surrounding each larva, nutritive tissue on which the larvae feed and specialised vascular tissue connecting the interior of the gall with the normal vascular tree of the host plant's stem. The mechanical action of the larval jaws, enzymes in the larval saliva and chemicals liberated by the damaged host plant cells all play a part in this. The gall is fully developed in four to eight weeks.

The larvae remain in the gall over winter and pupation occurs in April. Emergence usually occurs from late-April to mid-August. Emergence of individual insects from a single gall is usually spread over some three weeks.

The hatched female insects probably only live for three to four days and start their own egg-laying as soon as they have hatched, very often on the same host plant from which they emerged. Females encountering the rare males seem to ignore them.

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Only 12 of my galls produced *Diplolepis rosae* adults:

Pot 1	10f (female)
5	1f
8	5f
9	3f
14	6f
15	1f
19	1f
20	2f
21	3f
23	2f
25	2f
26	1f

All these emergences occurred between 5 June 2002 and 28 July 2002.

The frequency of *Diplolepis rosae* across various European countries as a percentage of all emergent insects as recorded in a series of ten recent surveys (from 1967 to 1980) varied from 9.7% to 42.4%. In my small survey the figure was 9.5%.

Note that no males emerged. The percentage of males in eleven various European and British surveys between 1940 and 1973 ranged between 0.17% and 4.2% giving a sex ratio of males:females ranging from 1:600 to 1:24.

Blair (1943) stated that in observations over nearly 30 years he only came across the males once “in 1940 when two males and 102 females emerged from a large gall taken from near Carlisle.”

Blair (1951) reported a small series of five galls taken from the downs near Freshwater. He dissected the galls and identified the larvae. He found respectively 51, 76, 155, 84 and 201 *Diplolepis rosae* larvae in these galls. Of the 119 gall-wasps which emerged, all were female.

Schroder (1967) hatched 2684 *Diplolepis rosae*, all female, from a large series of galls taken in Austria, France, Spain, Switzerland and southern Germany.

Periclistus brandtii (Ratzeburg 1832)

HYMENOPTERA; CYNIPIDAE

Noticeably smaller than *Diplolepis rosae* with an average body length of 2.7mm, it is very similar to that species in shape but has a shiny black abdomen, legs which are amber coloured, the male with the antennae amber also.

This is another Cynipid wasp but it is not a gall causer but an inquiline i.e. an inhabitant of the gall, dependent for its existence on the gall, using the gall tissue as its food and for its protection. The word ‘inquiline’ could be translated as ‘lodger’.

Blair (1943) described this species as “an abundant inquiline, present in nearly all the galls sometimes to the exclusion of *Diplolepis rosae*.”

Recent continental European surveys have shown it to represent between 7% and 37% of all insects emerging from Bedeguar galls. There is considerable variation in regional figures from Britain, ranging from 0.7% in Durham to 48% in Lancashire, with none in a series from Glamorgan.

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In my small series I recorded it from only one specimen.

Pot 1 7 males and 6 females

This represents 3.3% of all emerged insects.

The presence of this inquiline seems to have no noticeable effect on the survival rate of the co-existing *Diplolepis rosae* larvae. Note that Pot 1 yielded 10 female *Diplolepis rosae* adults.

Periclistus brandtii is attacked by three Chalcids, *Glyphomerus stigma*, *Eurytoma rosae* and to a lesser extent by *Caenacis inflexa*.

P. brandtii has not been recorded before from the Island.

Orthopelma mediator (Thunberg 1822) HYMENOPTERA: ICHNEUMONIDAE

A relatively large insect for this gall community, the male has an average body length of 4.0mm and the female 4.6mm. It gives the impression of being long and 'gangly', with a black head and thorax, long dark antennae with 20-21 segments, an abdomen coloured a dirty yellowish-brown and dark yellow legs. It has a black waist between thorax and abdomen and the whole body is covered with straight white hairs.

This insect is a primary endoparasitoid in Bedeguar galls. A parasitoid is an insect, the larva of which consumes the tissues of living hosts, leading to their death. (Cf. a parasite, which ideally does not kill its host)

The adult female lays her eggs into the larvae of the gall-causer *Diplolepis rosae* (and perhaps also into the larvae of the inquiline *Periclistus brandtii*) within the gall by piercing the gall tissue with her ovipositor. The egg develops into a larva still inside the larva of *D. rosae* and slowly eats away the host larva's tissues from within. Such an insect is termed an endoparasitoid (Cf. an exoparasitoid which consumes a host larva from outside in.) A primary parasitoid attacks the gall-causer whereas a secondary, or hyper-parasitoid attacks the primary parasitoids themselves, killing them in turn. Tertiary parasitoids occur in some other gall communities.

Orthopelma mediator is the most common parasitoid to emerge from Bedeguar galls, ranging from 1% in the Pyrenees to 94% in Canada. Only three of my specimens did not yield *O. mediator*.

Pot 1	12 males	12 females	11	0 m	3f	21	9m	6f
2	2m	3f	12	10m	10f	22	0m	0f
3	13m	13f	13	4m	0f	23	8m	2f
4	7m	12f	14	2m	4f	24	7m	15f
5	11m	22f	15	0m	0f	25	1m	19f
6	1m	10f	16	2m	4f	26	16m	17f
7	2m	4f	17	0m	1f	27	0m	19f
8	1m	1f	18	0m	0f	28	2m	18f
9	2m	4f	19	3m	3f	29	2m	11f
10	0m	2f	20	1m	2f			

There were 2 emergences in May, 60 in June, 234 in July, 13 in August and one in September. In my series *O. mediator* amounted to 79.5% of all emergent insects and 91% of all parasitoids. This insect was recorded by Claude Morley from Shalfleet (Morey, 1909). It is parasitised by *Pteromalus bedeguaris* which acts therefore as a secondary or hyper-parasitoid (Blair, 1943.)

Pteromalus bedeguaris (Thomson 1878) HYMENOPTERA; PTEROMALIDAE

This parasitoid is a small brightly coloured insect, the males averaging 2.5mm in length and the

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females 3.5mm. The head and thorax are a bright iridescent green or blue-green, with bronze tints. It has thick brassy antennae. The abdomen is golden/bronze in the male, shining purple in some lights; dark brown in the female. The legs are yellowish brown.

It acts mainly as a primary parasitoid of the gall-causer *Diplolepis rosae* but it can also be a secondary or hyper-parasitoid, attacking *Orthopelma mediator*, *Glyphomerus stigma* and *Torymus bedeguaris* (Redfern and Askew 1992).

In recent surveys *P. bedeguaris* has represented between 3% and 17.2% of all emerging insects and between 6.8% and 30.5% of all parasitoids.

In my survey, only four galls produced specimens of this insect:

Pot 7	2 f (female)
Pot 8	5f
Pot 9	1f
Pot 14	5f

This represents 3.3% of all emergent insects and 3.8% of parasitoids.

Two emerged in May, eight in June and three in July.

There is no previous record of this insect on the Island.

Torymus bedeguaris (Linnaeus 1758)

HYMENOPTERA; TORYMIDAE

A primary ectoparasitoid, this is a brilliantly coloured insect 4mm in body length for the females and 3mm for the males. The head, thorax and abdomen are a glossy bronze as seen from the side and a bright metallic green from above. The antennae are dark and the legs are amber-coloured.

Blair considered this to be a “common” parasitoid of *Diplolepis rosae* but Askew (1960) found that occasionally it attacked the full-grown larvae of *Orthopelma mediator* as well.

Recent surveys have shown that the emergence period extends from early June to early September and that the insect accounts for from 4.2% to 22% of all emerged insects and from 6.1% to 32% of all parasitoids.

In my series this insect was hatched from seven galls:

Pot 9	4f (female)
Pot 14	4f
Pot 15	3f
Pot 21	2f
Pot 24	2f
Pot 26	1f
Pot 28	2f

Of 18 insects, six emerged in July, 11 in August and one in September. This amounted to 4.6% of all emerged insects and 5.3% of parasitoids. This is apparently the first record of this insect from the Isle of Wight.

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Other Parasitoids Not Found

Aulogymnus skianeuros

There have only been two British records of this member of the Eupelmidae which only attacks *Diplolepis rosae* galls exceptionally. Its host within the gall is unknown.

Eupelmus urozonus

This is not confined to *Diplolepis rosae* but in one series (Askew 1980, 1984) it accounted for 0.9% of parasitoids, based on records of 11 males and 19 females from a single site.

Eupelmus vesicularis

So far there are no British records and in Europe it only attacks *Diplolepis rosae* exceptionally.

Eurytoma rosae

This is an uncommon ectoparasitoid of several species of *Diplolepis*, representing only 1% - 2% of emergent parasitoids from *Diplolepis rosae* galls. It mainly attacks the inquiline *Periclistus brandtii*, and less commonly *Diplolepis rosae*. Occasionally it acts as a hyperparasitoid, attacking *Torymus bedeguaris* (Redfern and Askew 1992).

Caenacis inflexa

This species is a hyperparasitoid of *Eurytoma rosae* and a primary parasitoid of *Periclistus brandtii*. Its average frequency as a percentage of all emerged parasitoids in England is 4.7%.

Mesopolobus sericeus

There are only three British records of this Pteromalid parasitising *Diplolepis rosae* galls, it usually being associated with Cynipid galls on oak.

Glyphomerus stigma

It is interesting that I did not record this insect in my series. In European studies it represents between 1.2% (Britain) and 28.4% of emergent insects and between 2.2% and 50% of parasitoids, respectively. Askew (1980) showed that in Britain where it is confined to southern England it accounted for 22% of all emerged parasitoids. Askew did not record it from Hampshire.

Blair (1943) stated that in Britain it was "perhaps somewhat local" having found it only in galls from Oxshott and Ashstead in Surrey, where it was "common enough". It is an ectoparasitoid on *Diplolepis rosae*, *Periclistus brandtii* and *Eurytoma rosae*.

Torymus rubi

Whereas this is a common parasitoid of *Diastrophus rubi* which causes a common and very obvious gall on Bramble (*Rubus fruticosus*) it only rarely parasitises *Diplolepis rosae*. Askew (1984) gives a figure of 0.36% of emerged parasitoids in Britain.

Late Emergences

I persisted in regularly examining my gall specimens for several years because sometimes there are late emergences in years 2 and 3 after collection but I did not hatch any identifiable Hymenoptera after the end of the first season following collection.

In January 2003 I noticed that a gall of the gall-wasp *Diplolepis mayri* had become obvious in Pot 9 growing adjacent to that of *Diplolepis rosae*.

In June 2003 Pot 28 yielded a White-shouldered House Moth (*Endrosis sarcitrella*), a common and widespread species.

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In November 2003 in Pot 3 was a dead Gelechiid moth which I could not identify. I do not know how the two moths came to be in the pots.

In 2004 there were no new hatchings.

In February 2005 the last insects emerged. They were Chalcid parasites but diseased and not identifiable.

Future Studies

I am repeating the above study with 25 *Diplolepis* galls taken from the same site at Brook Down on 17 November 2005 to see if I can confirm the above results or if I can record any other parasitoids.

Acknowledgements

I wish to thank Bill Shepard for identifying the weevils.

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