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NOTES TO CONTRIBUTORS

Recommended guide-lines, when writers have the facilities:-

Type in double spacing on one side of the paper only. Give margin of 2 cm at upper and left -hand margins.

Include a second (e.g. carbon) copy; a third copy is useful, and writers should also keep a copy.

Give sketches on a separate sheet, in black and white. Indication of scale and any other writing at least 5 cm. clear of sketch(es).

Underline scientific names, and nothing else; use a separate sheet to indicate any other special printing instructions.

Copy should be received by the Editor by end of February/August for publication in May/November. Approximately intermediate dates apply to the *Newsletter* prepared by the Secretary.

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29th February 1988 for all material for *Cecidology* No. 3.1 addressed to Mr. F.B. Stubbs.

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CECIDOLOGY

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Journal of the British Plant Gall Society
Editor — F.B. Stubbs

EDITORIAL

After unfavourable weather in many places over the past three summers, there are signs that galls may have been affected. In September two years ago, an oak tree was found to have acorns the size of match-heads, some carrying Knopper galls of corresponding stature and obviously doomed. If that was a widespread state of affairs, it could account for several reports of reduced numbers of these galls in 1987, and other examples have been quoted. A general decrease seems to be evident.

In the opinion of several members who have been studying plant galls for some time, the marble gall is declining and that has been the case for more than three years. The article in this issue from Mrs. K.W. Amoore, of East Sussex, reflects this theme. Her assessment of fluctuations illustrates clearly some of the vagaries of the insect world. No doubt there are other factors, but how important are weather conditions over a period – rainfall and humidity, temperature and hours of sunlight? How quickly will there be a recovery when the country enjoys a long and cheerful summer?

The Annual General Meeting of the British Plant Gall Society in July painstakingly sorted out a constitution. An important aim was to strike a balance between firmness and flexibility, allowing development of whatever possibilities arise in the future without frequent changes in the formal structure. Other matters were discussed, the most useful being the project initiated by Dr. Brian Spooner for the compilation of a Bibliography of Literature referring wholly or in part to Plant Galls in the British Isles. A good response from members now will hasten the time when arrangements for publication of the Bibliography can be made.

After the leaves have fallen, persistent galls are easier to see; even if faded, some will produce adult insects by the spring. Then we can look forward to the Society's 1988 programme, which is now taking shape.

Administrative problems are largely solved, but a few are still coming to light. If any BPGS material (Newsletter, Cecidology, Keys) has not been received as expected, inform the Secretary; and if you know of anyone else in that situation, pass word to them.

Questions or specimens cannot always be dealt with promptly. Reference to specialists or to a stack of literature may be needed and even then the answer could be a probability calling for further investigation.

The telephone is often useful for straightforward messages or enquiries; please pass your Tel. No., if available, to the Secretary unless already given to the BPGS in some way.

STUDYING GALLS WITHOUT A LABORATORY

For some of us, it is sufficient to learn to identify galls and, by recording their occurrences, contribute to the growing appreciation of our fauna and flora. For many, however, there is an inner desire to contribute to cecidology in a much more specific way by providing answers to distinct problems concerning the biology of galls. In short, we would like to do some research. In this article, we seek to demonstrate that research is not just the prerogative of "professionals" with well equipped laboratories; contributions to the advancement of cecidology can be made by anyone with the ability to observe and a willingness to expend a little time.

Two communications received recently prompt ideas on how simple observations, carefully recorded, may aid us to either abandon supposition or to turn it into substantiated fact. Mrs. Beryl Kay of Basingstoke writes of her time during the 1960s as a teacher at Daneshill, a school for girls. The school had a small copse of 28 oak (*Quercus robur*) trees in its grounds. Our correspondent relates how she attempted to interest the girls in their surroundings (a commendable aim) by recording the occurrence of galls on these oaks and to record the extent of growth of each tree. To do this, numbers were painted on the trees and the trees examined at intervals. The results obtained showed, as many experienced cecidologists, might expect, that some trees were heavily galled by a variety of cynipids, the others were virtually unmolested. Interestingly, a similar patchy occurrence of galls was observed in subsequent years, but the patterns of trees infected were different! Thus within the oak copse of Daneshill School there appears to have been a selection of hosts by the wasps and that the trees selected were different for different reasons. Such observations, consistent with the feelings of many of us have about the local distribution of these galls, poses the questions "On what basis are host trees 'selected' by cynipids" "Are they truly 'selected' or are they infected by the mere chance of the wasps being driven onto them by wind?". Hough (1953) and Askew (1962) both provided some evidence that suggested that the "physiological" age or state of the leaves or buds were important in the selection of sites for ovipositioning by the adults of both generations of *Neuroterus quercus-baccarum*. Could it be that the patchy distribution of cynipid galls on the oaks of Daneshill arose because the selected trees were "in the right state?".

How do cynipid wasps find their hosts and choose the sites for ovipositioning? There are many possible answers many of which are open to experimental verification.

We could, for example, propose the hypothesis that the adults of the agamic generation of *N. quercus-baccarum* (which emerge from spangle galls in spring) only select oak buds at a particular stage of development. How can we test this hypothesis? One way could be to sleeve oak twigs with muslin cages and to insert single adult wasps into each sleeve. Careful observation would allow records to be kept of which buds were visited, at which buds ovipositioning took place and from which buds galls subsequently developed. If a careful record is taken as to when the buds burst then a correlation between ovipositioning and the nearness (or otherwise) to bud burst might be established. To make the results meaningful

this would of course, need repeating with several insects in different 'sleeves' on several trees or shrubs.

An alternative approach would be to use an approach analogous to that described by Mrs. Kay. By observing the extent (%) of bud burst on specific trees at time intervals over a period stretching from bud dormancy through to full leaf and to record the distribution of currant galls which subsequently develop, it may be possible to throw light on bud selection by the wasps. Care would need to be taken to try and select very similar plants in very similar surroundings.

We could also ask of these wasps, – does smell play an important part in finding hosts? By using a few crushed buds from oak and other plants in small open containers in a chamber (a shoe box covered with cling film) and by introducing a few wasps bred from spangle galls, observation may indicate if smell is important in host recognition.

In all such experiments, it is necessary to use sufficiently large samples to enable proper statistical analysis. This should not daunt the budding cecidologist; once the data has been gathered there are several tame statisticians within the Society who might help. Take for example, Shaun Hexter from Leytonstone, who conducted a study on the distribution of the various spangle galls induced by species of *Neuroterus* on oak leaves. Mr. Hexter reports that his study was similar to that of Askew (1962) in which the height of each leaf studied from the ground and its distance from the trunk was recorded. Like Askew, he was able to show that silk button galls (*N. numismalis*) occurred towards the end of branches; smooth spangle galls (*N. albipes*) near the base of the tree and close to the trunk, common spangle galls (*N. quercus-baccarum*) and cupped spangle galls (*N. tricolor*) occurred in between these two. (Figure 1)

Mr. Hexter's studies were extended to examine the distribution of these galls on individual leaves. For this, leaves were divided into ten equal sections lengthwise and the galls in each section counted (Figure 2a). This study showed the galls of *N. numismalis* were near the edges and tips of leaves, those of *N. albipes* were near the petiole and midrib, while those of *N. quercus-baccarum* and *tricolor* were between the two (Figure 2b).

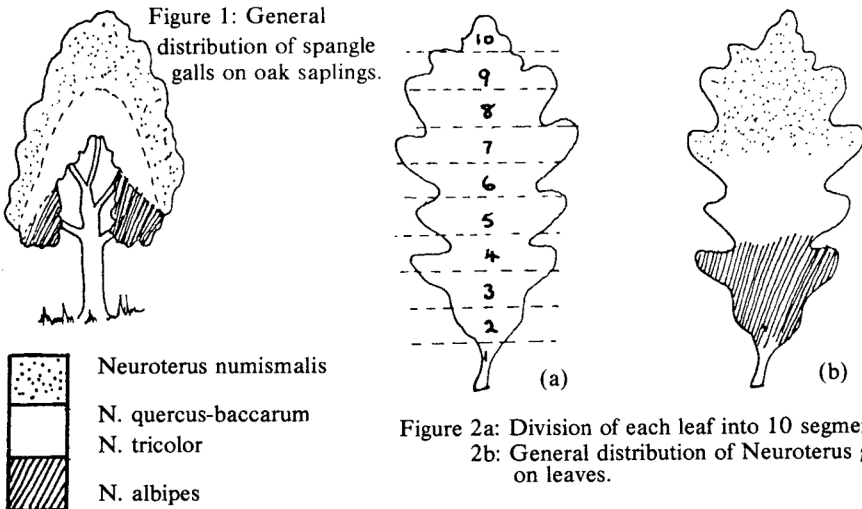


Figure 2a: Division of each leaf into 10 segments.
2b: General distribution of *Neuroterus* galls on leaves.

This whole experiment with its important conclusions can be done with a tape measure, ruler, pen and a note book. In his study, however, Mr. Hexter used a whole array of statistical analysis to obtain properly evaluated conclusions. For the initiated, amongst the analysis he carried out, aided by an IBM 370 computer, were X^2 test, cluster analysis, principle co-ordinate analysis and canonical variates analysis. This brief description indicates some of the styles of experiments readily accessible to many of us which will enlarge our knowledge of galls. We might ask for example, are the mite galls of maple, sycamore and lime randomly distributed on leaves? (A method based on that of Askew, 1962 might be used). Are the galls of *Eriphyes macrochelus* and *E. macrorhyncus cephalodes* ever found on the same leaves? If so, are their distributions on the leaves affected? There are many more examples like these (eg Marble and Cola nut galls) where two, or more, gall causers appear to be competing for sites but for which we have no real evidence for such competition.

In choosing your area for study remember that the art of doing research depends upon asking simple specific questions. Choose a gall type and hosts which are readily accessible and keep detailed written records.

We look forward to your reports.

C.K.L.

References:

Askew, R.R. (1962) "The Distribution of Galls of *Neuroterus* (Hym: Cynipidae) on Oak". *J. Animal Ecology* **31**, 3, 439-455.

Hough, J.S. (1953) "Studies on the Common Spangle Gall of Oak (iii) The Importance of the Stage in Laminar Extension of the Host Leaf". *New Phytol.* **53**, 229-237.

BOOK REVIEW

Forest Insects, by Dermot Bevan. Pp.153, illustrated; H.M.S.O. £6-95.

To foresters, woodpeckers may be more welcome than insects, yet entomology is appreciated for its own sake as an absorbing study. Recently retired from a senior post at Alice Holt Research Station, the author presents an impressive survey of his subject. Whilst he acknowledges the work of his former colleagues in the Forestry Commission, his own grasp of the entire field is evident.

Each genus of trees is taken in turn, the Broadleaves and the Conifers in separate sections. The wide double pages carry tabulated descriptions of each insect, in juvenile and adult stages, and of its effects on the trees. Those which are serious pests are described more fully, with historical details and exact life cycles. Natural parasites and predators are quoted where control measures are discussed.

Gall forming species are mentioned as such in the tabulated pages and well represented among the attractive coloured photographs. The bibliography has many useful references. Here is an essential guide for the forester which, in style and scientific content, should appeal to any entomologist or general naturalist. The caption "Forestry Commission Handbook 1" implies the start of a series; Dermot Bevan has set a high standard.

F.B.S.

WINGED TWIGS ON ELM

A number of reports have been received to follow the note on elm twigs in *Cecidology* 2.1 (page 6). No final verdict is yet possible, but the most consistent observation is that young growths are the most susceptible. One complication is that about ten species of *Ulmus* grow in Britain, two being native. Subspecies, natural hybrids and cultivars are numerous, and elm from nurseries may be grafted on different elm root stock. A summary of reports may provide a clue which some reader will recognise as significant.

1. In spring 1983, Mrs. D.F. Boyes of Cambridge noticed that elms in the hedge of the Cavendish Laboratory carried winged corky growths along the stems. At first glance these were reminiscent of the garden shrub *Eunonymus alatus*. Specimens were referred to the Plant Clinic at Cambridge, to the BM and to Dr. T.F. Preece of Leeds. No evidence of any causative agent could be traced. Later in 1983, Mrs. Boyes added "It starts on young lateral growths near to the main stem and grows rapidly upwards, increasing to an inch on either side of the stem. It is swiftly lethal, but luckily host-specific; the hawthorn in the hedge is untouched."

2. (The rest of these communications are dated 1987)

Mr. C. Binden sent a specimen from Dover, on a sapling some ten years old.

3. Dr. L.K. Ward of Wareham writes:- This phenomenon occurs in the hedges near Furzebrook. I have observed it for several years and like your other correspondents noticed that botanical texts refer to it e.g. Bean, W.J. *Trees and Shrubs hardy in the British Isles* 8th ed. 1980 p.643. "var. *suberosa* (Moench) Rehd. — Branchlets developing corky wings when two years old or later. This variant occurs occasionally in the wild and is said to be often rather dwarf and to occur in dry habitats".

As no animal or fungal attack is visible when the corky wings are present, I examined *Ulmus* twigs during the time that the stems are elongating in April to June. It can be observed that the wing formation is early in the growth of the twig and is less later on. Very close examination under the microscope revealed the presence of Eriophyid mites on the young stems. I surmised that these might be present in numbers sufficient to cause damage to the formation of the bark, and that later on this might cause the splitting and cork formation. Last year I sent mite samples to Dr. Macfarland (British Museum (Natural History)) who replied that he could not identify the species. He also said that I would need to prove my theory about the cause of the bark splitting. I therefore devised an experiment with acaricides, but being very busy was unable to run the test this year.

4. Mrs. K.W. Amooore, enclosing a photograph, finds that all young elms round Seaford are like this until the trees grow to about 6-8 feet tall.

5. Dr. C.K. Leach has found examples at Leicester on young growth.

6. Mrs. H.J. Ward has specimens in the garden hedge at Malvern; the stems here arise from the bole of a large tree felled some years ago.

7. Mr. P.R. Shirley has found examples in the West Midlands, rather stouter than usual — a "basic" 8mm. in diameter while 2-4 mm. more often applies.

9. Mr. M.E. Venables of Chichester noticed similar twigs sixty years ago near Bognor Regis. A field path led beside an old mixed hedgerow, extended by a stretch of elms planted about twenty years previously. The whole hedge was

trimmed in the autumn to about 3 ft. high, and each spring the elms would throw up growth twigs, mostly vertical but some at an angle. "I distinctly recall that vertical twigs exhibited longitudinal corky processes, exactly as Mrs. Boyes describes". These wings started at least 2 or 3 inches above the base of the twigs, increased in breadth to about 1-inch and then tapered off again leaving the top few inches bare of wings, but with leaves thereon. The corky processes were notched irregularly at their edges and about 1½ mm. thick.

9. Mrs. Boyes confirms that four years after her first observation, the elms in the hedge of the Cavendish Laboratory in Cambridge continue to be affected.

Reference to the literature offers no clear and immediate answer. The introductory paragraph to the genus *Ulmus* in the RHS Dictionary of Gardening states "... shoots often corky winged.", yet the "often" seems to be qualified when the following sections describe some fifty species, hybrids and varieties; here, mention of "wings" occurs only four times, as if it were a diagnostic feature. In our BPGS correspondence, only Mrs. Amooore says "All the elms around here are like that." Flora of the British Isles ("CTW") gives:- "*Ulmus hollandica* var. *hollandica*, assumed on scanty evidence to be *U. carpinifolia x glabra* – suckers and epicormic shoots numerous, with corky flanges up to 2 cm. wide."

In summing up, a few footnotes may be added. All reports are from southern and midland counties of England; does this have any bearing on the fact that the dominant elm in the north is *Ulmus glabra*, the wych elm, in which bark is comparatively smooth?

Dr. Lena Ward's report above refers to mites. The *Eriophyidae* are a difficult group, invisible to the naked eye and rarely studied in detail. Some are inquilines while others lead a free existence and their association with galls will then be chance proximity. We wish Dr. Ward well in her further investigations.

One theory, offered by several members, appears to be the most likely so far. The winged structures on juvenile twigs probably foreshadow the ridged trunks of mature trees of many elms; this may apply to certain members of the elm "complex". So we are perhaps well removed from galls, or from plant pathology in any sense. This may well be a natural characteristic of some elms.

SEASONAL PRONUNCIATION OF CECIDOLOGY

Hardly a meeting goes by without a debate arising about the pronunciation of cecidology – should they be hard or soft "c's". thankfully our linguistic expert, John Little from West Bromwich, has come up with an answer which has the merits of offering a truly British compromise and of having a distinguished precedent. John draws his inspiration from the Nobel Laureate Sir Robert Robinson, who, in 1947, had been drawn into a debate on the pronunciation of dodecyl alcohol. Should dodecyl be pronounced with a hard or soft "c". Robinson suggested that "as the melting point was not far from room temperature, the "c" should probably be pronounced hard in winter and soft in summer". We have heard of similar arguments for the hard or soft "g" in margarine. Certainly the preponderance of summer galls are soft, fleshy structures, while those which persist through the winter (marble galls and the like) are hard and woody

GALLS IN EAST SUSSEX

Mrs. K.W. Amooore,

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These notes apply to an area of about 15 miles' radius around Seaford.

As in other areas, we have a wide range of galls on oaks. Up to the drought year, 1976, the spangle and currant galls of *Neuroterus quercus-baccarum* were very numerous, but since that date the spangles have been very scarce and I have seen no currant galls. The leaves fell very early in the drought and it seems reasonable to conclude that the galls were not mature enough to survive. Artichoke galls, *Andricus fecundator* have also been very scarce recently. On the other hand, marble galls, *Andricus kollari*, are very abundant, even colonising newly planted oaks a yard high around Arlington Reservoir. In the explosion year, 1981, knopper galls, *Andricus quercus-calicus*, had affected acorns of pedunculate oak above Offham practically 100%. Since then none have been seen there. It may be interesting that Turkey oak, which I believe is the alternate host, is very frequent in the same wood (we searched these oak catkins for peculiarities, but found none). The cherry gall, *Cynips quercus-folii*, was very abundant in 1986.

I have only seen the spiked pea gall, *Diplolepis nervosus*, once, on dog rose near Firle, but the smooth pea gall, *D. eglanteriae*, is very abundant on burnet rose in the Beachy Head area. Most years there are plenty of beduguars, *D. rosae*, but they were extremely scarce in 1986, and very late in developing: examples less than one inch across being found in September.

The "gooseberry gall" on creeping thistle, *Euribia cardui*, is usually present, but scarce. In 1986 there was an enormous increase in numbers: some plants having half a dozen or more galls. I have only found the swollen stem of cats ear, *Phanacis hypochaeridis*, on The Crumbles, Eastbourne, and the groundsel inflorescence gall, *Contarinia jacobaeae*, seems equally rare: one finding at Plumpton.

Another gall which was very abundant a few years ago, but which seems to have almost disappeared recently is the pouch gall, *Eriophyid viburni*, on wayfaring trees: none were found in 1986.

The two tower galls on beech, *Hartigiola annulipes* and *Miliola fagi*, are not common, but a few can always be found on a casual search while walking in Friston Forest.

Another gall which is not common, but which appears in fair numbers in some years, is that of the midge *Kiefferia pimpinellae* on wild carrot flowers (none found in 1986).

Two galls due to midges, the rosettes on hawthorn, *Dasyneura crataegae*, and on willow, *Rhabdophaga rosaria*, are fairly common.

In 1986 most of the **pouch** galls (on willow, alder, sycamore, etc.) were very scarce, but the red pimple on maple *E. macrorhynchus cephalodes* was, as usual, very common. We have a great many sloes, but it is only occasionally that one finds a bush with nearly all its leaves beaded with the galls of *E. similis*.

I have only seen "cauliflower bud" galls, *Rhopalomyia ptarmica*, on sneezewort once, on Milton Hide, but have been told that it was there many years ago, so it presumably persists at a low level.

I have records (and slides) of some 80 or so galls, but I have written these rather disjointed notes, hoping it will inspire people to do more than just "tick off findings". The fluctuations in numbers must have an interesting relationship with the weather and other environmental changes.

REPORT ON AND AROUND THE A.G.M.

The meeting was held on the 25th July 1987 at Newton Field Centre, Near Kettering. The formal part of the A.G.M. followed a morning field meeting in which our Northern members were overwhelmed by that first sight of Commas. It is not the intention here to write out full minutes of the meeting but to draw attention to the salient points.

The A.G.M. heard brief reports from the Chairman, Secretary and Treasurer, who, between them, described the progress the Society had made. It had fulfilled its first objectives of producing a twice yearly journal, regular Newsletters, and Keys, and was holding regular meetings. Membership continues to grow and the Society was solvent. All concerned expressed a commitment to expand and "professionalise" on the foundations which had been laid. Already this year the journal had been increased, the Keys were rapidly approaching a third printing and plans had been laid for greater variety of meetings.

i) Constitution

This year's A.G.M. spent considerable time and effort on the Society's Constitution. Each section was thoroughly debated and finally a form of words agreed upon. Hopefully this will be the last time we will need to expend such effort on this. Copies of the agreed Constitution are available on request from the Secretary.

ii) Treasurer

Mr. W. Plant felt that for personal reasons he wished to resign as Treasurer of the Society. His resignation was accepted and he was thanked for the service he had given the Society in its formative period. Currently matters of finance should be directed either to the Chairman or the Secretary.

iii) Management Committee

The Constitution places the management of the Society in the hands of a Management Committee (see back cover of Cecidology).

If you have any matters you wish to raise, contact anyone of the Management Committee who will seek to consider it at the first possible opportunity.

Reports on Field Meetings

Reports of field meetings held during 1987 will be given in a Newsletter to be issued towards the end of the year.

C K. L.

ANDRICUS KOLLARI-LIGNICOA-CORRUPTRIX - SPECIES OR RACES?

C.K. Leach & F.B. Stubbs

The idea that there is a very close link between *Andricus kollari*, *lignicola* and *corruptrix* has been in the minds of several of our current cecidologists for quite some time. The notion was recently brought into focus by a letter from Margaret Hutchinson, who reminded us of a circular from Fred Stubbs issued in September 1981 in which he asked "....."could we be dealing with one species assuming several forms or races?".

In order to elaborate on this problem, it is necessary to describe some of the background.

A hundred years ago, Adler published his discovery of the alternation of generations in the oak Cynipidae. He mentioned *Cynips kollari* (now *Andricus kollari*) only briefly in a footnote, probably because the bisexual generation was then unknown. However, the English edition of Adler's work translated by C.R. Straton and published in 1885 contains a very full account of *Cynips (Andricus) kollari* as an appendix. In the present context, the most significant part of Straton's note is a quotation from Professor G. Mayr of Vienna (c1870):

"The fly *Cynips kollari* resembled *Cynips corruptrix* Sch., *C. aries* Gir., *C. lignicola* Htg., *C. tinetoria*: *C. calciformis* and *C. galeata* Gir. — species only to be distinguished from each other by their galls."

Subsequently Buhr (1965) in "Bestimmungstabellen der Gallen" described the features of each gall, but not of the insects. It would appear, therefore, that we are left in the untenable position of according species status to "a number of insects whose only distinctive features are their effects on another organism and which cannot be separated on an intrinsic basis" (Stubbs, 1981). It is on this basis that the argument arose whether or not the three supposed British "species" (*A. kollari*, *corruptrix*, *lignicola*) are really separate species or whether they are races of just one species.

In part, this issue has been based in an unsubstantiated notion that the insects are indistinguishable. Although it is true that the insects of these three "species" resemble each other, they may be distinguished from each other morphologically providing sufficient care is taken. Eady and Quinlan (1963) for example distinguish between the adults of the agamic generations of *corruptrix* and *kollari* in the following way:

corruptrix — "Carinae of propodium straight and parallel, scutellar foveae shallow internally and widely separated, black; remainder of head, thorax and gaster, red.

kollari — "Carinae of propodeum bowed outwards in middle, scutellar foveae deep, not widely separated black; remainder of head, thorax and gaster, yellow or yellow-brown.

Similarly they were able to distinguish between the adult females of the bisexual generation:

corruptrix — "Mesoscutum reticulate anteriorly, posteriorly with distinct longitudinal striate element medially".

kollari — "Mesoscutum closely reticulate, ventral spine projection rather short".

These authors did not give a description of the males of *A. corruptrix*. Unfortunately Eady and Quinlan's work was published before *A. lignicola* was first recorded (1972) in the U.K. and, as far as we are aware, there is no detailed English description of the adults of this "species".

We can cite further evidence that distinguishes these "species". Apart from, albeit minor, morphological distinctions and the form of the galls induced, they display some different behavioural characteristics. For example, the exit holes produced by the agamic wasps emerging from their galls on *Quercus robur* or *Q. petraea* are quite different in terms of their size and orientation within the gall.

All of this, of course, still begs the original question — are they different species or are they races of the same species? The crux of the matter is on how we define species and race. Unfortunately "species" has never been defined to the satisfaction of all biologists. In attempting to define a species varying criteria have been applied including:

- Y a species is a group of organisms which do not differ from one another more than the offspring of a single pair may do
- Y gradations from one species to a closely related one do not occur. There are no intermediate forms, but sharp and distinct differences between each species and any other
- Y members of a species can interbreed freely with one another but not **usually** with members of another species; if they do, the hybrid offspring are infertile
- Y usually the locations inhabited by a particular species are distinct from those inhabited by most closely related species.

Further study is required to solve the problem as to whether or not the three gall causers under discussion are truly separate species. In attempting to apply some, or all, of the criteria described above there is a need to:

- Y breed out a number of wasps from the relevant galls and to make full descriptions (photographs). Are, for example, the morphological distinctions described by Eady and Quinlan (1963) consistent or is there a variability in the details of the morphology of each wasp type? A comparative morphological investigation of these wasps would make an excellent project.
- examine whether or not the adults of the bisexual generation can interbreed. This would entail breeding out wasps from their galls produced on *Quercus cerris* and to sleeve out mixtures of males and females on *Q. robur* or *petraea*.
- determine the distribution of these three galls over the country to see the extent of their overlap. Many of us sense, for example, that the marble gall of *A. kollari* has become less common since *A. lignicola* has spread so rapidly. Likewise *A. corruptrix* was common in S.W. Surrey and W. Sussex in 1973-74 (M. Hutchinson – personal communication) but is much less so now although Dr. Brian Spooner reports having found three in North Surrey during 1986.

The breeding out experiments described above may provide answers to other problems. Are Cola nut galls parasitised to the same extent as marble galls or are they comparatively free of parasites and how does this degree of parasitisation compare to that found in European cola nut galls? Answers to these questions might throw light on whether or not *A. lignicola* has been recently introduced or has been a long time resident whose presence had escaped notice but which has

now become predominant.

Whether or not these three gall causers turn out to be true species or merely races of the same species, the problem as to how three closely related gall causers have arisen deserves comment. One possible explanation is that we are witnessing the evolutionary diversification of species. An argument can be made that, as a result of the high degree of parasitisation observed in cynipid galls, there is a selective advantage for the wasps to rapidly diversify the forms of the galls they induce. In so doing, the prospect arises that any new form of gall may not be recognised by its erstwhile parasites and inquilines and thereby improve its chances of survival.

Applying this principle to the three gall-wasps under discussion, it might be anticipated that if all three had a common origin then there would be many common features between them. This would explain the remarkably close similarities of the wasps themselves, their hosts, their sites for ovipositioning and features of their life-cycle. The one major difference would be the external morphology of their galls. This is, indeed, what is observed.

Insufficient is known about how gall shape, texture and colour is controlled to be able to predict if a single or a few minor genetic changes in the wasp are all that are required to produce quite distinct galls but, if so, then a single or few mutations in the relevant genes would produce a new race within the original species. Subsequently, as a result of the wasps' ability to reproduce simply through agamic generations (i.e. clonally), the new race may begin, on an evolutionary time scale, to acquire new characteristics. At some stage, such wasps might lose their ability to reproduce sexually with members of the present strain and, at that stage, they would truly become a new species.

If such a pattern reflects reality it might be anticipated that there would be clusters of cynipids at various stages of diversification. Thus, for example, the four species which produce spangle galls on oak (*Neuroterus quercus-baccarum*, *N albipes*, *N. numismalis* and *N. tricolor*) have many features in common (e.g. sites and timing of ovipositioning), and the forms of the galls of each generation bear some similarities. The insects are, however, sufficiently different to allow them the distinction of species. *Andricus kollari*, *lignicola* and *corruptrix*, show remarkably similar features both in terms of life cycles and morphological features. Even more remarkable are the similarities between *Andricus semi-nationis* and *Andricus quadrilineatus*. Figure 1 provides drawings of the galls of

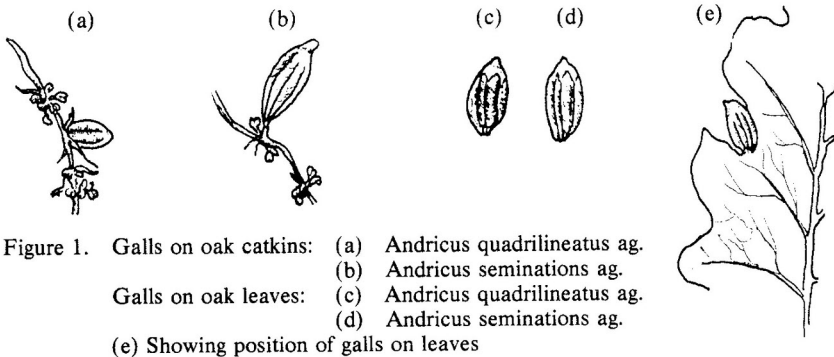


Figure 1. Galls on oak catkins: (a) *Andricus quadrilineatus* ag.
(b) *Andricus seminations* ag.
Galls on oak leaves: (c) *Andricus quadrilineatus* ag.
(d) *Andricus seminations* ag.
(e) Showing position of galls on leaves

the wasps produced on oak and the only distinction between adults of the agamic generation made by Eady and Quinlan (1963) was on the length of the scutal lines. They indicated that in *A. seminationis* the scutal line was longer than the distance between the notaulices at the posterior margin of the mesoscutum whereas in *A. quadrilineatus* this line was "about as long as the distance between the notaulices".

Final verdicts on this fascinating aspect of the cynipids await the results of further experiments and observations by cecidologists.

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COMMON EVERYWHERE

F.B. Stubbs

A railway journey from Manchester to London had long ceased to be exciting. On one morning in summer, the newspaper did not last beyond the suburban sprawl, and all that remained was the prospect of a cup of coffee. So the scenery had to serve as entertainment, with regrets that the route would almost certainly ignore Britain's famous beauty spots.

There were miles of hawthorn hedges, all trimmed a few weeks before and now relieved by the eager young shoots reaching above the trim-level decreed by the rule book. The shoots were even more attractive by reason of the conspicuous rosette galls of *Dasineura crataegi*. Then suddenly, more miles of hedges in just the same condition, but no galls. Further along, the midge had reasserted itself, and so the alternation continued.

The entry "Common Everywhere" was promptly deleted from the Glossary of Cecidological Jargon. Leaving aside inhospitable tracts with their own specialised and limited features, it is reasonable to say that daisies and white butterflies **are** common everywhere, as shown by recent atlases built up from the reports of hundreds of observers. The less spectacular morsels of our wild life do not have that attentive service.

Obviously, plant galls must follow the limits of distribution of the host plants — southern, coastal, upland and so forth. Given the presence of the host, a gall agent has its own range, often falling to exploit its potential sites. Many trees and other plants are widespread over the country, but insects whose larvae depend on them can be very local in occurrence. It seems that organisms causing galls will also be seen as confined to certain regions. On visits to the south, members living in the north will find specimens which are not familiar to them at home, while a journey northwards can add to personal lists.

Regular recording will throw light on the situation. Then will come the more difficult and debatable task of finding explanations!

PARASITIC PLANTS AS GALL-CAUSERS

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The study of interactions between species has long been seen as one of the key-stones in our understanding of ecology. Types of interaction are classified according to the nature of the effect on the parties to an interaction: for example, competition is an interaction in which the effect is negative on both parties, whilst predation, herbivory and parasitism (loosely grouped as pathogenicity) are interactions in which one party benefits but the other is adversely affected. The network of interactions between species in a community can be considered as the biological structure of the community, and its elucidation can have many benefits - for example, to the understanding of local and large-scale distributions, and to predictions of the effects of management and other perturbations to the system.

If we focus our attentions on pathogenic interactions, we must take care to differentiate two aspects of the host side of the relationship. Firstly, there may be effects on the host; for example, the host may be killed or lose part of its anatomy. Secondly, the host may show **responses** to the pathogen. Such responses may be physiological, such as the production of defensive chemicals, and have no outward effect on the host. Other responses may be in terms of growth deformations, and it is these responses we class as galls.

Conventionally, we usually consider pathogens to be either animals or micro-organisms, hence gall-causers are also from these two groups. This ignores, however, one very important group of pathogens which display the perhaps more typically animal characteristics of heterotrophy — the parasitic plants. The *recent Provisional Key* pays little attention to the possibility of higher plant gall-causers, other than a brief mention of Mistletoe *Viscum album*. That parasitic plants display 'animal' characteristics (and by inference may be gall-causers) has rarely been explicitly stated, although Raven (1983) draws parallels between animal sap-feeders (eg aphids and cicadas) and plant sap-feeders. In a similar vein, Darwin, (1799) wrote thus about the parasitic Dodder *Cuscuta*:

'Round sire and sons the scaly monsters roll'd
Ring above ring, in many a tangled fold
Close and more close their writhing limbs surround
And fix with foamy teeth the envionom'd wound.'

Fanciful maybe, but it does highlight the animal attributes of parasitic plants.

Parasitism in higher plants is actually a more important and widespread phenomenon than is usually recognised. It has probably evolved independently eight times in various parts of the plant kingdom, and some 3000 species in 15 families are now known to be parasitic. In Britain, there are about 55 species of parasitic plant in 5 families. Because of the independent lines of evolution, there are many different modes of parasitism, and there is much variance in the actual mechanism of interaction with the host. There are two basic divisions; between parasites which attack the aerial and the subterranean parts of the their hosts, and between parasites which possess chlorophyll (hemiparasites) and those which lack chlorophyll (holoparasites).

To return to the distinction between effects and responses, the effects of parasitic plants may be all too apparent, especially in a crop. This is especially the

case with holoparasites which must obtain water, mineral nutrients and photo-synthetic products from their hosts. In crops infected with Broomrapes *Orobanche*, yield losses of up to 80% have been reported. Likewise, Mistletoes (Loranthaceae) are also considered to be major economic pests to forestry around the world. Even such relatively 'mild' parasites as the Yellow-rattle *Rhinanthus* (a root hemiparasite which is actually capable of independent existence) have been cited as pests — there is an Austrian proverb which runs 'Der Klapp frisst das Brot aus dem Ofen heraus' (The Yellow-rattle eats the bread out of the oven). As well as general yield losses, other more specific effects have been described. The most frequent is the reduction in growth or even death of the parts of the host distal to the point of parasitic attack.

The responses of hosts to parasitic plants have been investigated much less extensively. Many of the responses have no morphological manifestation, and may have a genetic component as well as an induced component. The development of genetic resistance to Broomrapes in Broad Beans has been demonstrated conclusively (Cubero 1973), and there are somewhat less convincing reports of responses associated with the strengthening of the epidermis or the cork layer, or the development of physiologically incompatible tissues (eg latex in Poppies, acid tissues in *Oxalis*). That resistance can be induced in a plant has been shown by the fact that mistletoes on trees with previous experience of parasitism survive more poorly than those on trees with no experience of parasitism (Hoffman et al. 1986).

The reports of morphological responses to infection by a parasitic plant (ie gall formation) are diverse, and to some extent inconsistent. The most dramatic example is in the tropical family Balanophoraceae. These are root parasites in which the haustorium (the structure which contains the point of attachment between host and parasite) is a large swollen tuber consisting of intermeshed host and parasite tissue. Similar structures have also been reported in the Broomrapes (Kuijt 1969). These structures should certainly be considered as galls, as no similar structures are found on the roots of uninfected hosts.

Mistletoes, as they are aerial parasites, also cause clearly discernable galls. Typically they take the form of 'witches' brooms', a proliferation of host shoots around the point of attachment. Some Dodders produce obvious anatomical changes in certain hosts (Thomson 1925). For example, *Cuscuta reflexa* on *Pelargonium* causes the host tissue to swell around the point of attachment. This is due to increased cambial activity, which may increase the width of the cortex to such an extent that the haustoria never reach the vascular bundles. Whilst this would seem to be a useful defensive reaction against a sap-feeder, it is largely ineffective as the cortical haustoria simply take water and nutrients directly from the living cells. With *Fuschia* as the host, hypertrophy of the xylem and phloem systems of the host is apparent after attachment, but as there is no corresponding increase in cortical tissue, the stem frequently splits.

Structures which could be considered to be galls have rarely been reported in the hosts of root hemiparasites, although I believe this is largely due to our incomplete knowledge of these species. *Thesium* (Santalaceae) is one such genus of parasites, and includes one British representative *T. linophyllum* (Bastardtoadflax). Weber (1977) reports that a frequent host response is to develop side roots near the point of attachment (a sort of subterranean witches' broom), and to produce irregular lignified proliferations on the main root. Several members of the

Figwort family (Scrophulariaceae) also display this type of parasitic behaviour, and similar responses have occasionally been documented. Saunders (1933) reports that *Striga lutea* causes a profuse development of root hairs around the haustorium. Dorr et. al. (1977) showed that *Alectra vogelii* induces the formation of lateral roots from the haustorial region of the host, together with dilation of the cortical cells and proliferation of cells in the host stele. Likewise, Weber (1976) reports that *Rhinanthus alectorolophus* causes proliferation of root hairs when it attacks *Daucus carota*.

My studies have been largely confined to the common British species of Yellow-rattle *Rhinanthus minor*. I have examined many hundreds of haustoria, and certainly a large proportion display no indication of gall formation. The 'normal' haustorium consists of swollen lobes of the parasite root which envelop the host root, and show no apparent morphological responses on the part of the host. It is not unusual, however, to find grossly enlarged haustorial structures, several times larger than normal haustoria and clearly consisting in part of host tissue. It is also quite normal to see a proliferation of root hairs and fine rootlets from the host root, for up to one centimetre either side of the point of attachment.

In conclusion, I could tend to concur with Kuijt (1969) who states that in all but the most diffuse interactions between a parasitic plant and its host, we could expect to see some degree of host hypertrophy. I would qualify this statement by adding that the response may be negligible in certain hosts and under certain environmental conditions. Nevertheless, I believe that we can add a significant number of species to the British list of gall-causing organisms.

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PLANT GALLS FROM SKOMER

B.M. Spooner

The tiny island of Skomer lies less than a mile off the Welsh coast, near Haven Point at the southern end of St. Brides Bay, Dyfed. The island is composed mostly of volcanic rocks, with a covering of boulder clay, and rises to c. 260' above sea level at the highest point. It was purchased by the Nature Conservancy Council in 1959 and has, since then, been leased as a nature reserve to the West Wales Naturalist's Trust. Skomer is most important as a haven for sea birds, and attracts large numbers of ornithologists during the months when it is open to visitors, though there is no longer any permanent habitation on the island. It has an area of only c. 22 acres and is completely exposed to the Atlantic gales. There is no tree cover other than mainly shrubby development around old inhabitations. Despite this, Skomer supports about 200 species of flowering plants and ferns (Buxton & Lockley, 1950), and several mammals including the well-known endemic Skomer Vole (*Clethrionomys glareolus* ssp. *skomerensis*). Studies of the natural history of the island have been largely concerned with the vertebrates and vascular plants, and as far as I can determine there has been no study of plant galls. Relevant references dealing with entomology and other invertebrates are given in Smith & Smith (1983). Most of these deal with Lepidoptera or with intertidal and marine invertebrates, although preliminary lists of other insect groups are provided by Hallet (1930), Buxton & Lockley (1950) and Heath (1975). Only a single potentially gall-causing species is included amongst these. This is *Apion apricans*, recorded by Hallet on the basis of several specimens taken by sweeping. Larvae of this species are known to cause inflorescence galls in various species of *Trifolium*, particularly *T. medium* and *T. pratense*.

The small size, exposure and lack of tree cover on Skomer must severely limit the number of gall-causers likely to be present, but many of the plants occurring on the island are nevertheless potentially host to such organisms and a detailed study would surely be worthwhile.

A brief visit to Skomer on 27 May 1987 provided a limited opportunity to search for plant galls, but was too early in the season to be particularly rewarding. Only three invertebrate gall-causers and two potentially gall-causing fungi were noted, and these are listed below. However, one of these, *Dasineura glechomae*, seems, in my experience at least, to be rare. The whitish larvae of this species occur at the shoot tip of *Glechoma hederacea*, lying between the terminal leaves and causing swelling and slight discoloration. This is not the species which induces the so-called 'lighthouse' galls on the leaves, and which is incorrectly identified in Darlington (1968). The latter galls are comparatively very common and caused by another gall-midge, *Rondaniola bursaria*. I have often searched for *Dasineura glechomae*, particularly in early summer when the growing shoot tips are more easily located, but have not previously encountered it. However, I have since found this gall in the Royal Botanic Gardens at Kew.

Skomer Records 27. v. 1987

Invertebrates

Dasineura filicina Old galls on previous year's dead frond of *Pteridium aquilinum*.

Dasineura glechomae Larvae in shoot tips of *G. hederacea*, near western end.

Liposthenus latreillei Galls on leaves of *G. hederacea*, same locality.

Fungi

Puccinia annularis Early stages, on leaves of *Teucrium scorodonia*. Scarce.

Ustilago violacea Another smut of *Silene dioica*. Common.

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APHID GALLS AND HOVERFLIES

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I was interested to read of Peter Cooke's observations on insects attracted to aphid galls (Cooke, 1987). Whilst recording galls in the West Horndon area of South Essex (TQ6289) on 12. viii. 1984, I examined a gall of *Hayhurstia atriplicis* (L.) (Hemiptera, Aphidae) on a leaf of a young specimen of *Chenopodium* sp.. The gall contained no living aphids, only a mass of detritus and aphid exuvae, together with a dipteran puparium attached to the inner surface of the distorted leaf. The gall and its contents were collected for further study and approximately forty-eight hours later a hoverfly emerged from the puparium. It proved to be a specimen of *Sphaerophoria rueppellii* (Wiedemann) (Diptera, Syrphidae). Although widely distributed, this is a very local and uncommon insect, whose stronghold is the dry, grassy flood embankments along the Thames Estuary (Stubbs and Falk, 1983). No account of the larval habits of *S. rueppellii* has been traced and a single observation is insufficient to draw any direct conclusion. However, it would appear that on some occasions at least, *S. rueppellii* and perhaps other species of hoverflies, can successfully utilise aphid galls to undergo their life cycles.

Such a habit would offer both physical protection and an in-built food supply for the immature stages.

It would seem worthwhile to record any early stages of hoverflies or other insects encountered when examining aphid galls and I would be interested to hear of any such observations.

I should like to thank R.G. Payne of Southend Museum for identifying *S. rueppellii*.

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A NOTE ON THE EVOLUTION OF HYMENOPTERAN GALL CAUSERS

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It is generally accepted that the ability of hymenopterans to induce galls had at least two, quite distinct, origins. One of these led to the development of the sawfly gall inducers while the other led to development of the gall (cynipid) wasps. The evidence that this is so, is overwhelming. The morphology and life styles of the two groups and the galls they produce are quite different. In the case of the sawflies, gall development occurs whether or not a viable egg is laid and the galls produced have an entirely different internal tissue layout to that found in the galls induced by the gall wasps. In contrast to the larvae of gall wasps, the sawfly larvae devour almost the entire inner tissues of their galls, they have open guts and produce frass (excreta). This frass either accumulates in the gall chamber or is pushed out of the gall through an exit hole. Frequently, sawfly larvae may leave their gall chambers for short periods during their development and pupation often (but not always) occurs outside of the galls. In contrast, the galls induced by gall wasps do not begin development until after the larvae have emerged from the eggs and premature death of the eggs or larvae results in early cessation of gall development. The larvae of these gall inducers have blind guts and frass is not excreted. Gall wasp larvae never leave their gall chambers and pupation occurs within the galls. Clearly the two types display many fundamental differences indicating diverse origins.

How did the ability to induce galls evolve in these two instances? According to Malyshev (1968), an important step in the evolution of the sawfly gall causers was the development of a change in the mode of behaviour of the larvae when they emerged from their eggs. He visualised that the ancestral sawflies laid their eggs on or in the surface layers of plants. The emerging larvae would have fed on the surface of their host plants as simple phytophagous insects. If, however, the larvae began to penetrate into the plant tissue, then there would be an increased probability that gall induction would take place. Under those circumstances, any development which increased the supply of nutrition to the feeding larvae would have enhanced the survival prospects of the larvae. One such change would be the acquisition of the ability to stimulate the growth of the plant tissue around the area of ovipositioning. Malyshev envisaged, therefore, a scheme whereby phytophagous sawflies evolved from exo-phytophagy through endo-phytophagy to gall-formers.

It would be anticipated that the change from life in an open environment to one closetted within plant tissue would be accompanied by morphological changes to the larvae. Malyshev (1968) cites many specific examples of these modifications. For example, the large head with highly developed sense organs, active legs and coloured integument, required for active or passive defence outside of the plant, all become reduced in the endophytophagic and gall-forming types. Frequently the larvae of gall inducing sawflies have smaller heads with poorly developed sense organs, their legs are small and weak and their integument

thinner and colourless. Nevertheless, these insects have many similarities to free-living exophytophagous types, in methods of feeding, production of frass and in the sites and nature of pupation.

The evolution of gall forming ability in the Cynipidea is not so easy to unravel. In this case we are not seeking merely an ability to cause a proliferation of plant cells. Unlike sawfly galls, the galls of cynipids are highly differentiated structures. They consist of an outer epidermis surrounding a parenchymatous tissue. Embedded in this latter tissue is a hard sclerenchymatous layer within which is found the "nutritive tissues" (see Figure 1). This tissue serves as the food source used by the gall wasp larva. The gall wasp larvae remain within the sclerenchymatous shells until after pupation. For a detailed description of the development of common spangle galls see Hough (1953). There are many variations on this basic pattern. Some have erinea (hair-like structures) protruding from their epidermis, some have thin parenchymatous layers, in others the sclerenchymatous layers are poorly developed. Nevertheless the underlying gall tissue map is remarkably consistent within these cynipid galls.

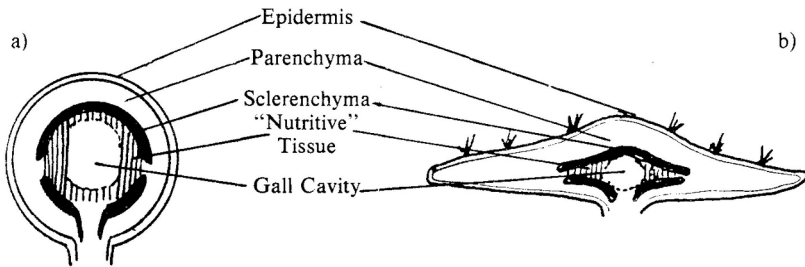


Figure 1. a) General tissue map of cynipid galls
b) Tissue map of a common spangle gall

How did the ability to induce the formation of highly differentiated structures evolve? The problem is even further complicated by the presence of the alteration of generations in the cynipids in which each generation induces its own characteristic gall often at different sites on the host.

It would seem unlikely that the ability to produce two types of galls, each with a complex pattern of tissues could be produced by a more-or-less one step evolutionary process. Yet, search as we may, there appear to be no intermediate forms. We do not, for example, find cynipids which produce galls which do not conform to the general tissue distribution found in cynipid galls. It would appear then that gall-induction is an all-or-nothing process amongst the Cynipidea

A possible explanation for this phenomenon is that the gall wasps evolved from "seed eating" or "seed parasitising" hymenopterans (Chalcidaidea). By "seed-eating" we should more correctly refer to them as oophagous since they devour the endosperm of the plant embryo. There are a remarkable number of similarities between these and the gall causers. Their larvae all have blind guts and do not produce frass; both types show virtually no motility and both types

pupate within their food chambers ("seeds" and "galls"). The external morphology, ovipositors and ovipositioning by both these "seed eating" hymenopterans and cynipid gall inducers closely resemble each other.

The following evolutionary sequence might have taken place. The archaic gall inducers were "seed-eating" hymenopterans which deposited their eggs in the ovary of their host plant adjacent to the endosperm. There was pressure on such insects to lay their eggs early in the development of the ovary otherwise these highly desired sites, rich in food, might be taken by others. Over a period of time, these hymenopterans would lay their eggs earlier and earlier in the development of the host's ovaries. Ultimately they might lay their eggs prior to ovary development. In this case, the larvae would only begin to feed when the development of the seed bud commenced. The one evolutionary step which would be needed to convert these early ovipositioning seed eaters into gall inducers, is for these insects to acquire the ability to induce seed bud development. If this occurred by, for example, acquiring the ability to switch on a master seed forming gene in the plant then the insect larvae would be able to feed on tissues resembling its traditional food. The insect induced growth would produce a structure which would bear a resemblance to the host's seed form, being differentiated into different tissue layers (i.e. the layers observed in modern cynipid galls).

This model is, therefore, based on the notion that seed eating hymenopterans learnt how to switch on seed production. Having acquired this ability, in principle they could then induce "seed" production in any meristematic (ie cells capable of growth, division and differentiation) tissues in its hosts. Thus, having learnt how to induce seed/g ll formation it would be free to invade other tissues (e.g. young buds, stems, roots, etc.) There would have been intense competition between "seed-eaters" and "gall-causers" and the ability of the gall-causers to turn their attention to buds and young leaves would provide them with greater opportunities.

Such a model is rather conjectural but it could serve to explain the remarkable similarities between seed-eating and gall-inducing hymenopterans, the similarities in the tissue maps of "seeds" and cynipid galls, the similarities in modes of life (e.g. early ovipositioning, blind guts, pupation with a plant chamber) and the extent of parasitisation. The diversification of cynipid gall structure particularly their external morphology and texture and the rise of gall inquiline and parasites are, however, different issues.

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RECORDS RECEIVED

Records of gall occurrences continue to be a major part of the correspondence. In addition to the records published in these pages, record cards associated with the BBC WILDLIFE survey continue to arrive and no doubt our friends from the Biological Recording in Scotland Campaign are receiving their quota. In Newsletter No. 5 we indicated that the time is rapidly coming when we will need to get down to rationalising and using this information. The Managing Committee of BPGS are busy developing a strategy to deal with this vital but complex problem. In addition to the survey we have received records from a variety of sources including P. Shirley, B. Kay, S. Hexter, M. Hutchinson and D.T. Biggs. The latter warrant special comment.

Records of Margaret Hutchinson: Margaret began studying galls in 1967 and has painstakingly gone through her records and written them out for us. The record included over eighty different galls and some 250 separate records. Perhaps the most fascinating record is:

Andricus lignicola Hants N. Forest 1972. First for the U.K.

Since then, of course, the cola nut has been recorded by many of us from many different localities.

Records from David Biggs: Dr. D.T. Biggs sent us his records of galls on the Isle of Wight, and included a copy of E.W. Swanton's list for the Island, totalling about 110 galls. This was published in 1937 by the Isle of Wight Natural History and Archaeological Society, which is now planning a survey of plant galls. The final result, at the end of 1988, will be a fully documented catalogue of the Isle of Wight.

Do you know of similar publications in your locality — if so let us know. It will enable us to both add the information to our records and to help Dr. Brian Spooner produce a comprehensive bibliography on galls.

WHAT IS A GALL?

F. B. Stubbs

However important a project may be, its terms of reference must be clearly specified before too much time and energy are invested in it. Every basic concept must be unambiguous, as it will form the foundations of subsequent research and discussion. Should the preliminaries appear to be protracted, that seems preferable to running the risk of finding that they had been inadequate.

The most basic definition is that of a "Gall". Nearly every work over the past century has agreed on this, although a few have taken it for granted that no formal statement is needed. After all, "bird" is not defined in many books on that subject! So for years, cecidologists have been working in accordance with the statement that a gall consists of plant tissue which has been enlarged through the agency of an intrusive organism, whose action is parasitic or in a few instances saprophytic. If a re-assessment is to be made, the only result should, in the eyes of almost all BPGS members who have been approached, be simply a straightforward re-affirmation of the long-standing convention.

At the AGM of the Society in July, it was proposed that the aims of the BPGS should extend to a study of all plant abnormalities. The Management Committee has considered this possibility and has decided not to recommend its adoption. Even within its strict definition, cecidology already offers enough lines of investigation to occupy us fully. Any deviation from this brings us into the field of Plant Pathology, a discipline which is already well served in academic and research circles. In fact, several BPGS members are concerned professionally in this work, their colleagues usually accepting that galls are a valid part of their subject. Certainly we must co-operate with the plant pathologists wherever this would lead to a clearer picture, especially in cases where the cause is not yet determined. That at least is the conclusion of the Committee; there may have been differences in emphasis, but no marked dissent.

No sooner did that question seem to be solved than another arose, so briefly and incompletely that one hesitates to comment, except that it is so far-reaching that it must be immediately considered. A leaflet introducing a most promising European publication includes an extract which classifies galls as any effect of a parasite on a plant – positive or negative, an increase or a reduction of tissues. We can only look forward to discovering the justification for this definition, in terms of the practical researches and international discussion which must surely have been undertaken in advance of such a fundamental pronouncement, together with a clear demarcation between parasitism and predation. Such an approach merits close scrutiny.

Whatever may be the definition of a GALL, the next question is the definition of "A" gall, emphasising the indefinite article singular – A. A few examples will illustrate this problem.

1. The midge *Jaapiella alpina* is known only on *Silene acaulis*.
2. The mite *Eriophyesgoniothorax* causes two galls, of different character, on the leaves of *Crataegus*.
3. The wasp *Neuroterus quercus-baccarum* is associated with several species of *Quercus*, native or introduced.
4. The fungus *Plasmodiophora brassicae* has similar effects on many plants of the family *Cruciferae*.
5. The bacterium *Corynebacterium fascians* attacks plants of many families.

For correct designation, a gall should be identified by referring to both host plant and gall agent. In each of the above cases, how many galls should be counted?

A glance at the best known books shows no unanimity here. Buhr, for instance, deals with host plants by genus, mentioning host species only when others of the genus are not affected. Swanton describes galls on separate species, but that description may be no more than a reference back to an earlier entry in the genus, or family; Docters van Leeuwen occasionally follows this plan. In all three, each "gall" has a serial number, leading to a total of galls given.

A difficult decision must be made as to what constitutes "A GALL". From the five cases above, (1.) must clearly be ONE gall. Does (5.) qualify as one gall, or a hundred? By similar reasoning, what is the situation with (2.), (3.) and (4.)? The whole question is very relevant to any project involving a check list or a recording system. It must be resolved before a permanent commitment is undertaken.

GROSSLY DISTORTED FLOWER HEADS ON GRASS

Specimens of grossly distorted flower heads on grasses have been sent in from localities as far apart as the Isle of Wight and Lancashire. The cause of these distortions remains unknown but they could be Mycoplasmal. These specimens prompt a number of questions:

1. Have you seen any such distortions? If so, have you made drawings, taken photographs, kept specimens?
2. Do you know of a site which regularly has such growths? If so can a time be arranged for a fresh sample to be taken from which the causative agent might be isolated?
3. Have you any particular knowledge about the distortion of grass inflorescences?

QUESTIONS RECEIVED

Crown Galls on Rootstocks

William Sibley, a fruit tree nurseryman from Leigh-on-Sea, asked for more information on crown galls on fruit tree rootstocks. He writes that these are frequently encountered and that they grow at an amazing rate attaining the size of a cricket ball on one year old type 9 (dwarf) rootstocks. Indeed, it seems that in his youth, they were used as cricket balls during lunch breaks! This may have been an unwise use of galls for these galls are hard and heavy and likely to wreak havoc if they come into contact with windows or heads. William goes on to explain that they can be 15 cm (6 inches) across by the time the trees are three years old. Despite such size, they appear to do little damage to the trees although he has the impression that there is a slight loss in the weight of the tree rootstock. Although common on all types of apple rootstocks, he cannot recall ever having seen them on quince (pear stock), plum or cherry.

Our reply: The galls described appear to be classic examples of the crown galls caused by the bacterium *Agrobacterium tumefaciens*. This bacterium is a common soil organism which is an opportunistic parasite on a wide range of plants. It commonly invades its hosts at, or just below, soil level at a site of mechanical injury (e.g. wind damage, insect damage etc.). It seems unable to infect intact, undamaged stems. Once inside the plant, the bacterium attaches itself to newly forming cell walls of its host and to "inject" into its host's cells a small amount of genetic information. This genetic information, called a Ti (Tumour inducing) plasmid, has two effects on the host's cells. Firstly, it stimulates the host's cells to rapidly grow and divide. The proliferation of the host's cells results in the production of the tumour or gall. The other effect the Ti plasmid has on the host's cells is to cause them to make considerable amounts of special amino acids (octopines and nopalamines). These are not commonly found in plant tissues but, in crown galls, they fulfil an important function. The invading bacterium *Agrobacterium tumefaciens* use, these amino acids as a source of nutrition.

Crown galls are, therefore, the products of what one might call genetic engineering. The genetic engineer in this case is the bacterium which by transferring new genetic material into its host's cells causes them to grow more rapidly and to produce chemicals of use to the bacterium. As a result of the success of *Agrobacterium tumefaciens*, plant breeders and genetic engineers are attempting to use this system to produce new types of plants. In outline, the approach is to modify the piece of genetic material, the Ti plasmid, in such a way as to destroy its tumour inducing capacity and to replace its ability to cause its host cells to make octopine or nopalamine by more useful products. The enormous potential for using Ti plasmids to create new (better?) plant lines has meant that considerable research efforts have been directed towards this system and much of the molecular biology of this system has been established.

One further point on crown galls. The galls induced by *Agrobacterium tumefaciens* consist largely, but not entirely, of an amorphous mass of cells. There may be some penetration of the gall by conductive tissues (xylem and phloem) and the other epidermis may show a more-or-less ordered structure but, in general, such galls do not show the high degree of order displayed by the normal tissues. This helps to explain why these growths can be removed from fruit rootstocks since the lack of highly organised xylem and phloem fails to provide a fibrous continuum with the root or stem.

In William's words ... "The way we remove them from tree roots is to hit them on one side with a hammer. They usually break off very easily in this way." Has any member anything to add?

GALLS ON ALGAE

A letter from Dedan Butler of the Department of Plant Sciences of the University of Leeds, requested information about galls or gall-like growths in seaweeds. The large brown algae such as the Kelps were of particular interest. We have searched high and low and come up with rather little. The best we can do is to cite the 12 genera of algae bearing galls described by Buhr, H. (1965) in "Bestimmungstabellen der Gallen (ZOO- and Phytocecidien) AND Pflanzen Mittel-und Nordeuropas" published by Fischer. The genera cited were: *Tribonema*, *Vaucheria*, *Draparnaldia*, *Stigeoclonium*, *Coleochaete*, *Cladophora*, *Oedogonium*, *Mongeotia*, *Spirogyra*, *Zygnema*, *Batrachospermium* and *Chantransia*.

Do you know of any others?

GALLS ON CAMELLIA

Help is requested from G.B. Miller of Penzance concerning a substantial gall on *Camellia*. Mr. Miller is of the impression that the gall, a 10 cm long, 2.5 cm wide "sausage" on the stem of a garden *Camellia*, was caused by the fungus "*Exobasidium camellia*" but can only find one reference to the fungus (W.C. Moore "British Parasitic Fungi", C.U.P., 1959).

Again, your help would be appreciated.

SUPPORT FOR THE SOCIETY

To summarise ideas which are proving very helpful

Meetings: Encourage friends and local societies to take notice of galls. Offer to give a lecture or lead a field meeting. If that seems a daunting prospect, many societies hold a Members' Evening with ten-minute talks or an exhibition. Activities open to visitors could attract keen BPGS members from adjoining districts. All naturalists must come across galls and most will be glad to have a few words of explanation.

Recording: Keep records yourself and pass a copy to the **BPGS**. For 1987, **also** remember the record cards issued by BBC Wildlife and by BRISC (In Scotland, **APB**). Send details if you know of any earlier lists (CKL)

Bibliography: Similarly, send details if you know of any papers reports, etc. – however limited or local – which refer to galls (BMS)

Slide Library: Donations, or orders for duplicates or loans. (CKL)

BPGS Keys: You could agree to hold a few copies for personal sale, especially if you expect to go to an appropriate meeting. (FBS)
Comments and criticisms, particularly referring to use in the field, are useful. Most spelling errors have been rectified in re-prints. (FBS)

Publications: Contributions to *Cecidology* (FBS) or *Newsletter* (CKL) on any aspect of plant gall studies. Further observations which refer to previous articles or questions are always welcome.

The Society's publications have benefitted from the work of over forty members, giving a balanced view of the subject.

Do please continue support in any way.

(Initials above indicate Committee Members dealing with the various points. See outer cover for full names and addresses)

Notices of Meetings: Please note dates applicable to *Cecidology* and the *Newsletter* these items may appear in either, according to timing. **Early advice:** Date, Place, Purpose/Topic, Speaker/Leader.

Approaching the date: the following details as appropriate: Date, Time (start and approx. finish). Food/drink to be carried? Meeting place with directions; 6-figure Grid Ref. useful. Type of Meeting, purpose or topic. Speaker or Leader. Book in advance? Visitors can be accommodated? Charge for expenses? Address/Telephone No. for enquiries.

SUBSCRIPTIONS AND FINANCE: The Subscription to the **BPGS** for all purposes remains at £5. Commencing in 1988, there will be a Family Membership rate at £8 to cover two or more members at the same address. All will have normal benefits of membership, but will share one copy of publications.

BRITISH PLANT GALL SOCIETY

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All members are invited

To submit papers, reports or announcements to the Editorial Committee;
To seek advice or information through the Society.

These terms apply equally to Individuals, Societies and Institutions.

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