CORA Cork Open Research Archive
Cartlann Taighde Oscailte Chorcaí

Title	Leaf galls in our native trees and shrubs
Authors	Walsh, Eileen G.
Publication date	1945
Original Citation	Walsh, E. G. 1945. Leaf galls in our native trees and shrubs. PhD Thesis, University College Cork.
Type of publication	Doctoral thesis
Rights	© 1945, Eileen G. Walsh - http://creativecommons.org/licenses/by-nc-nd/3.0/
Download date	2026-11-04 13:14:26
Item downloaded from	https://hdl.handle.net/10468/1667

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

Leaf Galls of Our Native Trees and Shrubs.

EILEEN C. WALSH, M.Sc., H.Dip.

1945

ACKNOWLEDGMENT.

My deepest thanks are due to Professor Renouf, D.Sc. of the Zoology Department, University College Cork, for the most valuable help, suggestions and infofmation which he has given me from the time I commenced this study; also for books and apparatus which he has kindly lent to me.

To Mr. R. Kennedy,M.Sc., of the Chemistry Department, U.C.C., for help and suggestions in relation to the chemical aspect.

To Dr. A.M. Massee of East Malling Redearch Station Kent, England, and Mr. H.H.Keifer, State Department of Agriculture, California, for much information and bibliographical knowledge concerning the Phytoptidae.

To Dr. H.A.Barnes,Rothampsted Experimental Station Harpenden, Herts., England, for assistance with the identification of the Cecidomyidae.

My thanks are specially due to Mr. A.W.Stelfox, of the National Museum, Dublin, for the time and patience he has so often bestowed on the identification of various parasites bred from the galls.

Lastly to Mr. J. Philpott of the Zoology Department U.C.C. for the willing and able assistance rendered in breeding and otherexperiments as well as in all practical details.

Cork 1944. Eileen G. Walsh.

This work is divided into the following sections:-

I. General note on Galls.

(a) Size.

(b) Colour.

(c) Shape.

(d) Texture.

(e) Internal Structure.

2. List of plants affected.

3. Collecting, Rearing and Preserving.

4. List of Gall-makers.

5. Detailed descriptions of those collected.

6. Tables of Galls collected and Plants affected.

7. Notes on microtome sectioning and chemical analysis.

8. Classification and Key.

9. Bibliography.

IO. Plates.

LEAF GALLS OF OUR NATIVE TREES AND SHRUBS.

Plant galls constitute a branch of study and research which has been to me a subject of much interest for some time. At the start of this work, it was intended to include plant galls in general, but after some months this was found to be too comprehensive a field and would in fact take a great many years to study fully. Even leaf galls alone, both of herbs and trees, provide so large a field of investigation that ultimately I decided to confine my attention to those of our native trees and shrubs.

Upon looking up the literature on this subject, it will be found that in nearly all cases, either the gall is described fully and mere mention made of the agent concerned in its production, or vice versa. This state of things is most unsatisfactory, as in studying galls, both the gall-maker and the gall formation must be examined in detail before it is safe to apply nomenclature. This work, therefore, sets out to give accurate and scientific descriptions of both galls and gall-makers.

The difficulties encountered are manifold; firstly, our trees are all deciduous, hence the collecting period is necessarily restricted to that time of the year between the appearance of the buds and the fall of the leaf. Secondly, the rearing of imagines is always difficult, especially in the case of the autumn galls; more will be said on this matter later. Lastly, due to war-time conditions much trouble was experienced in obtaining suitable literature and many

invaluable books on this subject were unprocurable.

The Plates at the back have all been copied from original material except in the case of the Phytoptid mites which have been sketched with the help of illustrations, the reason for this being the difficulty of making suitable mounts of these minute creatures, Where possible all stages or at least larva and imago have been sketched, together with the host plant and the type of gall-formation produced. Slides have also been made of most larvae and the imagines attached to cards and pinned on to pith or cork in the usual manner.

(S̄=slide. Pl.=plate)

General Note on Galls .

Very few of the higher forms of plants are altogether immune from the attacks of gall-producers. Most of our native trees are subject to them, but the death of the plant does not always result. In fact, the greatest evil caused by the majority of these galls is distortion of the foliage. However, this is not always the case, as for instance, the attacks of Eriophyes Avellanae on Corylus Avellanae, by which the buds are prevented from unfolding. This is a great source of annoyance often to the arboriculturist. The horticulturist is likewise troubled by Eriophyes ribis which causes "Big Bud" disease on the Black Currant. Many Cecidomyids attack willows, the result being that these are unsuitable commercially for use in basket-making.

Some galls, while not seriously damaging the host plant, present a strikingly beautiful picture. Among these may be mentioned Eriophyes tiliae-typicus, their brilliant red colour contrasting magnificently with the light green of the lime leaf.

Each species of tree will not necessarily have its own particular type of gall, but in fact, may have several varieties caused by the same or different animal groups. Similarly, although certain insects exhibit a marked preference for one specific host plant, many of them are Phytophagous. I have noticed in the Hymenoptera, taking the group as a whole, a decided liking for the Oak leaf and many species attacking this will never be found on any

other type of leaf. Since the Hymenoptera include such a large number of gall-makers, it naturally follows that oak trees present a far greater number of galls than do any other trees or shrubs (there are up to 20 different leaf galls on oak)

Next in favour, I should think, comes the Willow. Here we have many species of Salix and I have found a greater variety of insect species galling its leaves than in any other plant. Various species of Hymenoptera, Lepidoptera, Diptera (Cecidomyidae) and Phytoptidae have been found. Alnus glutinosa too provides quite a good variety, while Lonicera appears to be very popular with the Agromyzidae.

The following is a list of plants affected with the number of different types of leaf galls found on each:-

Acer Pseudo-platanus (Sycamore) 2.

Alnus glutinosa (Alder) 6.

Crataegus Oxyacantha (Hawthorn) 2.

Fagus Sylvatica (Beech) I.

Fraxinus excelsior (Ash) 2.

Ilex Aquifolium (Holly) 2.

Juglans Regia (Walnut) I.

Lonicera Periclymenum (Woodbine) 2.

Prunus spinosa (Sloe) 2.

Pyrus Aucuparia (Mountain Ash) I.

Pyrus communis (Pear) 2.

Pyrus malus (Apple) 2.

Quercus Robur (Oak) I7.

Ribes nigrum (Blackcurrant) 3.

Rosa canina (Rose) I.

Rubus fructicosus (Blackberry) I.

Salix alba
" aurita
" caprea
" cinereae
" fragilis (Willows) I6.
" pentandra
" purpurea
" viminalis

Tilia europea (Lime) I.

Ulmus campestris (Elm) I.

Many leaf galls quoted by different authors as being of very frequent occurrence have, strangely enough, not been found, whereas, the search for such rare varieties as Eriophyes aucuparia, proved successful. Among the former are such familiar members as Rhodites rosae, which though carefully sought has not so far been discovered. It may be that these galls are recurrent in this area every few years as it seems extremely unlikely that being so widely distributed, they should be absent entirely from here. I have also failed to secure any type of gall from the Birch, although many Hymenoptera are known to attack the leaves; and the only insect found on the Beech was the Coleopterous Orchestes fagi (Pl.I9)

even though this plant is recorded as also harbouring several Cecidomyidae and Phytoptidae. The Elm, too, seems here to be immune from attack , with the exception of Schizoneura ulmi. The Horse Chestnut likewise yielded nothing, nor have I come across mention of it in any literature on galls.

(The numbers in brackets in the above list indicate the number of different types of gall found on each plant.)

As regards the insects themselves, judging by the number of Hymenopterous galls collected as compared with Dipterous, it would seem as if these flies were more impartial to trees and shrubs, while the latter evidently prefer herbs and garden produce. Phytoptidas galls are also widely distributed on trees but those of Coleoptera are very rare.

The following list indicates the number of species of each group found producing galls:-

HYMENOPTERA I9.

DIPTERA IO.

LEPIDOPTERA II.

HEMIPTERA 5.

COLEOPTERA I.

ACARINA I4.

In this work I have included leaf blisters and many other types of deformity as well as the "true" gall such as those found so frequently on Quercus. Almost every

transition may be seen from the simple erineum of Eriophyes tristriatus (Pl.30) on Juglands regia ,to the most highly evolved types which are only connected to the plant by a narrow neck of tissue e.g.Dryophanta divisa (Pl.2) In the Cynipidae we have an alternation of generations, the agamic brood in many cases producing a completely different type of gall to that of the sexual generation.

(a) SIZES OF GALLS.

It may be thought by amateur naturalists that the size of the gall will depend on the size of the agent responsible for its presence and that the more diminutive the creature, the smaller the gall, but this is not so. Very often the smallest creature will cause the greatest deformity. This is best illustrated in the Phytoptidae. If we consider the gall caused by Eriophyes tristriatus on Juglands regia,(Pl.30), the female mite measures only I85μ in length by 45μ in breadth, yet they cause an elevation of the upper surface of the leaf, measuring,on an average I6mms. xIImms. x I6mms., whereas the larvae of Hormomyia caprea which are quite easily visible to the naked eye, cause galls on Salix caprea of average dimensions 6mms. x 4mms. (Pl.I5). The mites of course are gregarious and occur in large numbers whereas the galls of Hormomyia caprea, though plurilocular, seldom contain more than eight larvae.

Among the Hymenoptera a similar disparity is manifested between the size of the gall and the imago issuing therefrom, e.g. the case of Biorhiza terminalis. This tiny insect causes an enormous swelling on the twigs of Quercus Robur, the fly itself being 3 to 7mms. while the gall may measure up to 25mms.

Some of the Aphididae cause very large deformities by sucking the juices of the leaves e.g. Schizoneura ulmi on Elm (Pl. 35) and Rhopalosiphum ribis on Black Currant (Pl.34), whilst such small Coleoptera as Orchestes fagi whose larvae measure only 2mms., yet are capable of destroying whole beech forests by their large blister-like mines on the leaves which give the trees a withered appearence(Pl.I9).

(b) COLOUR

The colour of leaf galls varies enormously, and as may be expected, green ~~of course~~ is predominent, but every transition may be seen from yellowish green, through yellow, orange, brilliant reds and purples to dull brown of almost black. Some have very beautiful colouration. Very often the young gall is pale green and as it reaches maturity it bedomes tinged with pink or purple(Nematus viminalis Pl.8), and when old may turn completely black. Many Hymenopterous galls, are white and succulent at first, becoming suffused with pink and eventually turn quite hard and buff coloured when mature e.g. Dryophanta divisa (Pl.2). Yellowish

green and olive are very prevalent. The edges of the leaf lobes of Crataegus Oxyacantha (Pl.28) when rolled backwards by Eriophyes goniothorax are at first pale yellowish green, but later become suffused with pink, while the galls of Eriophyes tristriatus become tinged with brown.

Here again we find great diversity in the colours of galls formed by members of the same natural order. Among the Phytoptidae pale green is of common occurrence, whilst the galls of Phyllocoptes acericola on Acer pseudo-platanus (Pl.27) are brilliant carmine. These conical galls when very young are greenish yellow, gradually changing to yellow, orange, red, crimson, purple and finally dark brown when very old. I have found the carmine colour remaining in some cases as late as October. The "nail" galls of Eriophyes tiliae typicus on Tilia Europæa (Pl. 37) are similarly coloured. Those of Eriophyes laevis on Alnus glutinosa (Pl. 24) are very numerous and vary in colour from green ,yellow, orange, reddish, purple or even chocolate brown, all colours appearing on the one leaf at the same time.

Cecidomyid galls are generally pale green or yellowish when young, but change gradually through yellow, red purple to a dark brown or black as they mature. This is seen particularly well on the case of Salix viminalis whose edges are rolled by the larvae of Rhabdophaga marginem-torquens.

Hymenopterous galls exhibit a good variety of colour also. The larvae of Nematus viminalis form the well-known green-pea galls on the ventral leaf surface of Salix caprea

while those of Nematus Gallicola form bean-shaped bright red galls projecting from both surfaces of the leaves of Salix fragilis (Pl. 6,7). These are one of the most brilliantly colored which I have found and are readily seen at a distance.

Many of the Hymenopterous oak galls have very beautiful colourings although this may not be evident to the naked eye. The so-called "spangle galls" vary from light green to olive, and may be yellow suffused with pink, carmine, purple or orange. The larvae of Neuroterus numismatis form one of the prettiest galls of all which is popularly termed the "button gall". In shape it is round but deeply depressed in the centre and when examined with the aid of a lens is found to be red itself but has the sides covered with silky golden hairs (Pl.I,37).

Lepidopterous galls do not show much variety as regards colour, since these larvae generally content themselves with folding or rolling the leaves and feeding on the cuticle.

Very often the ventral surface of a gall is of a much lighter colour than the dorsal and is in many cases covered with whitish silky hairs e.g.Eriophyes tristriatus on Juglands regia(Pl.3o)

(c) TEXTURE

Here again we see a gradual transition from the perfectly smooth type to the roughly wrinkled or hairy

gall. It is probable that the texture has much to do with the protection of the larva inside. Protcetive colouration is not well exhibited in the leaf galls except in a few instances, such as Neuroterus lenticularis (Pl. I,37), which are at first green as is the young leaf, but become gradually brownish. These galls fall to the ground before they are fully developed, their brown colour thus assimilating to the withered herbage. In this manner alsa the period during which they are subje subject to enemy attack is considerably reduced. The presence of hairs undoubtedly affords protection to the young larva, and the hard woody nature of many galls will provide a sure means of defense. The presence of tannins also helps. Smallness of size speaks for itself, rendering them less conspicuous, but conversely, largness of size may also prove a help rather than a hindrance. If the walls are very thick not many enemy insects will have sufficiently long ovipositors to reach the interior, thus reducing the possibility of the presence of parasites, while if the larval chamber be large, both inquilines and the original larva can survive comfortably.

(d) SHAPES

Like the colour, the shapes of galls are many and varied. Many authors use different classification and nomenclature with regard to shapes, but I have adopted simple terms which will be given below.

(e) INTERNAL STRUCTURE.

Leaf galls may be either unilocular , as in the case with most of those caused by Phytoptidae, or else plurilocular. In the latter, the number of compartments will vary e.g. the galls of Hormomyia caprea (Pl.I5) are typically 8-celled while those of Cecidomyia saliciperda have 6 cells. Similarly they may be unilarval or multilarval; generally one larva occupies each cell in the latter instance. Where the galls coalesce as in Rhabdophaga marginem-torquens(Pl.II,I6), several larvae are found to occupy the rolled leaf edges. The multinymphal condition occurs in many Aphid galls.

The following lists with examples of types collected will serve to illustrate the preceding notes:-

I. TEXTURE and FORM.

Leaf galls may be:-

(I) SUCCULENT(Neuroterus baccarum) or HARD and WOODY (Dryophanta divisa)

(2) SMOOTH (Neuroterus laevisculis) or WRINKLED (Eriophyes tristriatus)

(3) GLABROUS (Phyllocoptes acericola) or RUBESCENT (" tetanothrix laevis)

(4) SOLITARY (?) or GREGARIOUS (Neuroterus lenticularis)

(5) SESSILE (nearly all) or PEDUNCULATED (Eriophyes laevis)

(6) FREE (nearly all) or COALESCENT (Rhabdophaga marginem-torquens)

II. SHAPES

May be:-

(I) GLOBULAR (Nematus viminalis)

(2) FLAT (Neuroterus laeviusculis)

(3) OVAL (Andricus ostreus)

(4) LENTICULAR (Neuroterus lenticularis)

(5) KIDNEY-SHAPED (Eriophyes axillaris)

(6) ROSETTE (Dasyneura cmataegi)

(7) BLISTER (Orchestes fagi)

(8) PUSTULATE (Eriophyes aucupariae)

(9) CONICAL (Phyllocoptes acericola)

(I0) POUCH-LIKE (Eriophyes tetanothrex laevis)

(II) MINE-LIKE (Agromyza rubi)

(I2) POD-LIKE (Cecidomyia rosarum)

(I3) NAIL GALL (Eriophyes tiliae typicus)

(I4) ERINEUM (Eriophyes tristriatus)

(I5) BEAN SHAPED (Nematus gallicola)

III. POSITION ON LEAF.

(I) PETIOLE (Andricus testaceipes)

(2) AXILLARY (Eriophyes axillaris)

(3) MIDRIB (Andricus ostreus)

(4) ON LATERAL VEINS (Dryophanta divisa)

(5) BETWEEN LATERAL VEINS (Eriophyes tristriatus)

(6) UPPER SURFACE (Eriophyes tetanothrix laevis)

(7) LOWER SURFACE (Nematus viminalis)

(8) PROJECTING FROM BOTH SURFACES (Nematus gallicola)

(9) SCATTERED THROUGHOUT LEAF BLADE (Phyllocoptes acericola)

(IO) ON MARGIN (Neuroterus albipes)

(II) ROLLING BACK MARGIN (Rhabdophaga marginem-torquens)

(I2) DRAWING EDGES TOGETHER (Cecidomyia rosarum)

COLLECTING AND REARING THE IMAGINES.

The great draw-back in the study of leaf galls is the short period during which they are available i.e. from Spring to Autumn. Some, such as many of the Hymenopterous parasites on Quercus Robur, may still be found after the leaves have fallen, but here again difficulties are encountered. The autumn galls are seldom very successfully reared. On the whole, the spring and summer galls have produced much more satisfactory results. In many cases, the length of time between hatching of the larva and emersion of the imagines is quite short. Very often a new type of gall has been discovered, only to find that the imagine has already escaped. This I found to be the case with Andricus curvator. I first discovered these galls on the petioles of Quercus Robur in late July but when examined a tiny hole was noticed in the inner seed gall which told at once that the fly had escaped.

When collecting, glass tubes and air-tight boxes of various sizes are necessary for separate leaves such as for example, the Beech, which has delicate blister-

like mines. If not handled gently, these are often injured and the larvae or pupae escape. The leaves are kept fresh in this manner also. Very often it is necessary to tie a muslin net securely over the affected leavesin in situ. The spot must then be visited frequently and careful field-notes made. Some leafy twigs were kept quite well in a special cage(fitted withcelluloid side-pieces and gauze top) in the laboratory; the flies on escaping from the galls were kept securely within the cage. For Dipterous and other mining insects I found that by placing the leaves in shallow air-tight tins fitted with glass tops and allowing in a certain amount of air each day, the larvae successfully developed in due course. The pupae were than transferred to small glass tubes whose ends were plugged with cotton wool which was moistened daily.

Great care must be taken in rearing all gall-flies. If too much moisture is allowed, fungal growth rapidly appears and destroys the insects. On the other hand, if kept too dry the gall will shrivel up and become useless. It is very necessary to keep each species separate in order to avoid errors in the records of parasites and inquilines.

Another method employed was baking some fresh earth to remove foreign matter, placing this in the bottom of a wire cage and placing galled leaves on top

The larvae when ready to pupate can do so in the earth provided.

It is always necessary to examine leaves from both dorsal and ventral aspects as gall formations may appear on either surface. Windy days are unsuitable for collecting.

PRESERVING.

I have so far failed to discover any satisfactory method of preservation. Various media were tried but in all cases the colour was eventually lost.

Permanent slides have been made where possible, of the agent producing the gall. The usual method of dehydrating with alcohol and mounting in Canada Balsam has been followed with all relatively large larvae and pupae but where the creature was very tiny, Euparol proved a more satisfactory mounting medium, since this did not necessitate the use of a clearing agent such as clove oil, at which stage specimens are most easily lost.

Dr. H.F. Barnes of the Rothamsted Experimental Station kindly sent the following method for dealing with Cecidomyidae:-

Transfer the flies to 95% alcohol for one hour; dip them in a mixture of carbolic acid crystals (40%) and rectified spirits of turpentine (60%) for roughly as long as it takes to clean a slide and cover slip. Then place on slide, dissect off head, and if male, the genitalia. Next soak off the mixture as it does not

mix well with Canada Balsam. Replace with the balsam. The head and genitalia must be kept flat, dorsal surface upwards, and are mounted under the same cover slip as the rest of the midge. One slide for each midge.

Untold difficulties were encountered with the Phytoptidae. These creatures are so minute and their structure so delicate that any of the ordinary mounting methods do not give satisfactory results when applied to them. At first the irrigation method was attempted, using Euparol as the mounting medium, but the inevitable result was the disappearance of the mite in the late stages. The next attempt was the picking out of the individuals under low power by means of a glass pipette which had already been drawn out to a very fine hair-like point in the gas flame, but this again was unsatisfactory.

Quite good immediate results were obtained in the following manner. Small portions of the galls were examined under low power, and those pieces containing mites were then put through the alcohols up to 85%, and then into Euparol essence. Some Euparol was then placed on the slide and the gall portions transferred to this and teased out. A cover slip was next placed over the whole lot. In this way some rather good slides were made, but on standing the mites appeared to shrivel up.

Eventually the most successful medium for making

permanent preparations was found to be Berlese fluid and the formula used was that of Keifer (Eriophyid Studies VIII. Agric.Bull.Calif. Vol.XXIX.). It is as follows :-

H_2O.	IO - I2ccs.
Chloral Hydrate	53 - 55grs.
Gum Arabic	8grs.
Glycerine	6ccs.
Iodine crystals	Small amount.

"This is most easily made by obtaining the best grade of powdered gum. The chloral crystals are then crushed in a mortar with the gum arabic powder. This mixture is added to the water in a permanent container and allowed to dissolve for several days with occasional stirring. Gum arabic powder, if placed alone in water tends to form insoluble lumps. After solution is well under way, add the glycerine.

Iodine, which is the staining element, can be put in the dry mixture or in the final solution. It dissolves slowly. The mites are needled over into a drop of this medium on a slide, the coverslip is placed, and the mount is discretely warmed. Unfortunately, this medium leaves much to be desired.

Mites transferred from this medium to resinous media, shrivel up and become worthless for recognition purposes; alcoholic mites shrivel in this chloral hydrate medium."

LIST OF GALL - MAKERS.

The following orders include leaf gall-makers:-

(I) ACARINA (Phytoptidae)

(2) DIPTERA (Agromyzidae, Cecidomyidae)

(3) HYMENOPTERA (Tenthredinidae, Cynipidae)

(4) LEPIDOPTERA (Tortricinae, Tineina)

(5) COLEOPTERA (Curculionidae)

(6) HEMIPTERA (Aphididae, Psyllidae)

I. ORDER COLEOPTERA.

Although the members of native Coleoptera comprise a very large number, all the leaf-gallers are confined to one family, namely Curculionidae.

General Characteristics of Family and Order.

Forewings modified into leathery elytra, meeting to form a straight dorsal suture. Hind wings membraneous. Prothorax mobile; mouth parts adapted for biting. Metamorphosis complete. Larvae have well developed head; abdominal feet absent but thoracic legs generally present.

Family Curculionidae characterised by the head being prolonged in front to form the Rostrum which is variable in length. Tarsi 4-jointed; palpi small, represented by single-jointed tubercles; labrum absent; antennae elbowed. Larvae maggot-like with vestigial antennae,

reduced mouth parts and cerci absent.

ORCHESTES FAGI(Linn.) (Pl.I9. Sl.I4)

Plant affected = Fagus sylvatica.

Type of gall = Blister-like mine.

Position on leaf = Outer half.

Colour = Brown and withered looking.

Date and Locality = Cork May '44; Bantry, June to Sept.

Typical Condition = Unilarval.

Distribution = Very widely distributed.

Although Curculionidae comprises one of the largest natural families, only this one member was discovered damaging the foliage of trees. While hunting for galls in Lota, Cork on May IOth.,I observed that part of the leaves of all the beeches were very brown and had quite an autumnal appearance. Attack by frost was thought to be the cause, but the question remained,why only the outer part of each leaf ? Upon examination it was found that this brown area was in reality a blister-like mine occupying generally that area of the leaf nearest the apex and when held against the light the larva could be seen inside. The mine in each case, started from the midrib, about half way down as a very thin thread, widening gradually until evehtually the whole outer part of the leaf was involved. Most of these threads went in the same general direction as the lateral veins. Enclosed within each mine was a circular mass of very fine white threads, measuring 4mms.in diameter, and within which the

larva lived. These threads were spun by the larva prior to pupation, issuing from the anal segment.

The larva was perfectly white in colour, with a pale-green food canal. Consists of a flattish head and I3 body segments; apodous with 5 pairs of locomotary swellings; ventral surface has 3 olive-brown markings just beneath the head; pale markings also on dorsal surface of head. Leaping movements noticed.

May I5th. Some larvae had emerged from the mines. This may be due to the fact that the leaves got crushed since they definitely spun the cocoon within the mine. A few, found in the act of metamorphosing, made springing movements when touched. Pupae transferred to glass tubes plugged with cotton wool and moistened daily. Leaping movements were now clearly visible.

May I9th. Adult weevils emerged.
Colour = brown, clothed with short whitish hairs, and having coarse lines of punctures on the elytra.
Length = $\frac{1}{8}$" with head small, and upper surface mostly occupied by the eyes. Elytra are twice as long as head and thorax together. Antennae distinctly elbowed, basal joint stout, 2nd. half as long, 3rd, shorter and slender, last four joints forming a club-shaped structure. Mandibles three-toothed, upper tooth being smallest. Palpi very short. Hind legs have the femora well developed which aids in the leaping movements so characteristic of this beetle. Claws with curved tooth near the base.

The damage done by this weevil is very extensive and it attacks the Copper Beech also. Larvae similar in every respect except for green food canal which was not evident here. The adults feed on the leaves, eating out small round portions of the blade and giving rise to the familiar "shot-holes".

II. ORDER ~~COLEOPTERA~~ HEMI.

FAMILY (a) APHIDIIDAE.

The injuries caused by green-fly are familiar to all horticulturists. They damage the plant in either of two ways :-

(I) By sucking away the sap and thus weakening the plant.

(2) By their excrement falling on the leaves and clogging the stomata.

The usual position of Aphid galls is on a leaf or leaf-stalk. They either roll the leaves of trees or build up gall-structures on their surfaces; others construct habitations for concealment in the petioles. Only three members are included in this work i.e. Myzus ribis, Schizoneura ulmi and Aphis Pomi.

General Characteristics of Family and Order.

The Hemiptera are 4-winged flies having the anterior pair usually of harder consistency than the posterior. Mouth parts suctorial. Prothorax free from the other thoracic segments. Metamorphosis incomplete.

Family Aphidiidae.

Small insects with long antennae. Wings when present membraneous; tarsi 2-jointed, first joint often very short. 5th abdominal segment often with a pair of cornicles or honey-tubes situated dorsally. Aphids exhibit many curious phenomena such as parth-

genesis, viviparous and oviparous reproduction etc., and present a most intensive study in themselves.

SCHIZONEURA ULMI. (Pl.35)

Plant Affected = Ulmus campestris.

Position on Leaf = On one half of leaf blade.

Type of Gall = One half of leaf is curled backwards and inwards presenting a very distorted and swollen appearance.

Colour = Not very ~~much~~ different from remainder of leaf; may be a paler green.

Date and Locality = Lota, Cork June 6th. '43.

Typical Condition = Multilarval and multinymphal.

Distribution = Does not appear to be widely distributed as I have only found it twice and in the same district on both occasions.

The winged female is 2mms x 1mm; body measurement. Wings measure 7mms in expanse and antennae 1mm in length. Found in large numbers on the leaves in June. Body entirely black, having abdomen much ringed. Rostrum is short. Eyes black and prominent. Antennae 6-jointed with the 3rd joint longer than all others together 3rd and 4th joints are ringed. Cubital vein forked once only. Wings membraneous, having a smoky tint. Stigmata large and dilated. Legs rather long and black.

In May of the following year I again visited the same locality and this time the Queen mother was present in the gall. Apterous, almost 3mms x 1mm.

Antennae .3mms. Dark olive-green with slightly blueish tinge. Four series of pores are arranged longitudinally on the back which give rise to a cottony exudation which sparsely clothes the body. Head and thorax small and black. Antennae and legs also short and black, hence the creature has a very squat appearance. Rostrum very short.

APHIS POMI (Pl.34)

Plant affected = Pyrus malus.

Type of gall = Curling of leaves.

Colour = Same as remainder of leaves of paler green.

Date and Locality = Cork July '43.

Typical Condition = Multinymphal.

Distribution = Supposed to be common in orchards throughout the country but I have not found it to be so.

The Aphids feed on the lower leaf-surface imbibing the juices which cause the leaves to curl up and then fall off. These aphids attract a great many ants by reason of their secretion of honey-due.

Winged female = 2mms x.7mms Wing expanse = 7½mms Antennae = 1½mms. Antennae, head and thorax black. Abdomen green with 4 lateral black dots on each side. Legs ochreous with knees and tarsi black. Rostrum long. Cornicles short and blackish. Cubital vein bifurcated. Stigma pale greenish. I have noticed the bark of apple trees quite blackened by the glutinous secretions of

these insects.

RHOPALOSIPHUM RIBIS (Linn.) (Pl.34)

Plant Affected = Ribes nigrum.

Type of Gall = Pustulate swellings causing the leaf to curl downwards.

Position on leaf = Scattered over upper surface.

Colour = Reddish of reddish-yellow.

Date and Locality = U.C.C. gardens 22/3/'44.

Typical Condition = Multinymphal.

Distribution = Common.

This is quite a common peat in fruit gardens. Winged female measures 2mms x .7mms. Expanse of wings = 6½mms. Length of antennae = just over 2mms and cornicles are not quite ½mm. Yellowish green; Head , thorax and antennae black.; band on prothorax balck also. Abdomen bright green with 3 or more darker-green patches on dorsum and several spots on sides. Cornicles yellow, tapering at both extremities. Legs ochreous with knees and tarsi black.

Occurs also on Gooseberry.

MYZUS RIBIS (Linn.) (Pl.35)

Plant affected = Ribes grossularia.

Type of Gall = Pustulate swellings causing curling of leaf.

Position on Leaf = Upper surface.

Colour = Reddish, purplish or brown.

Date and Locality = U.C.C.gardens June '43,'44.

Typical Condition = Multinymphal.

Distribution = Commom.

W Winged female measures $2\frac{1}{8}$ x Imm. Expanse of wings = $7\frac{1}{8}$mms. Antennae = a little over 2mms and cornicles meaaure $\frac{1}{8}$mm. Colour = bright greenish-yellow, with darkem olive-tinted head and eyes red. Ocelli (3) obvious. Antennae come off small tubercles. Prothorax also has an indented olive band. Thoracic lobes very dark brown. Abdomen has 6 or 7 transverse very irregular bands and 4 or 5 spots situated laterally. Cornicles olive green, cylindrical. Legs green with darker femora and tarsi,, Wings rather broad and stigma greyish.

Fam. II PSYLLIDAE.

Very easily mistaken for Aphididae. Head somewhat broad and preduced in front; eyes large and conspicuous; 3 ocelli present, one near each eye and one in them middle. Antennae IO-jointed with 2 large basal joints terminated by slender forked bristles. Wings when at rest folded roof-like over body, 4 in number. Venation of upper wing simple; subcostal vein passes obliquely acmss dividing the wing into 7 distinct open cells. Small indistinct stigma present. Front legs shorter than others. Leaping powers remarkable; in fact it has been noticed that they fly very little, depending almost entirely on thss as a means of escape.

PSYLLOPSIS FRAXINI (Linn.) (Pl.2I)

Plant Affected =Fraxinus excelsior.

Type of Gall = Rolling of leaflets backwards and inwards.

Position on leaf = Edges of leaflets.

Colour = Green mottled with purplish and Brownish streaks.

Date and Locality = Bantry, May, June and July.

Typical Condition = Multinymphal and Multiaarval.

Distribution = Not very common.

When this gall was first discovered it was at a glance relegated to the Phytoptid group and named as being caused by Phyllocoptes fraxini. However, after seeking vainly on several occasions for the presence of mites in the tissues, it was set aside for some time. When first found, I noticed the aphid-like creatures inhabiting the gall, but thought that these were merely visitors as so often happens with rolled or curled leaves. Having come across a plate of Psyllopsis fraxini in a book, I again sought this gall and examined it carefully and this time identified it as caused by Psyllidae.

The leaflets are rolled towards the centre and every leaflet is affected. This is not so with Phyllocoptes fraxini. When removed from the stalk, the leaflets appear to become quite flabby and soft. A large amount of white woolly substance is found upon unfolding

Adult insect measures about 2½mms; abdomenisis black above and yellow below. Thorax yellow with black markings and head is yellow with a reddish tinge and large dark eyes. Antennae IO-jointed, tapering towards the extremity which is terminated by a slender forked bristle. Legs reddish-yellow. Wings clouded at edges.

ORDER III. HYMENOPTERA

General Characteristics of Order.

Insects with 2 pairs of membranous wings; hind wings smaller and interlocked by hooklets with anterior pair. Mouth parts biting or biting and sucking; ovipositor present and adapted for sawing, piercing or stinging. Metamorphosis complete; larva various (see below) Cocoon generally present.

The condition of the abdomen is important as regards classification. If joined to thorax by its entire width = Sessiliventres; if joined to thorax by a deep constriction or petiole only = Petioliventres

Included among the former are the families Tenthredinidae (Saw-flies), Siricidae (Wood-wasps), Cephidae (Stem-sawflies) and Oryssidae. Included among the latter are the Cynipidae (Gall-wasps), Ichneumonidae and Chalcididae, the two latter families having many members frequently parasitising the larvae of true gall-makers.

Types of Gall.

The Order Hymenopptera includes a very large proportion of all the known gall-making insects. The Hymenopterous galls are completely closed and are of many kinds; morphologically they may be soft and succulent or hard and woody. We find here, also, a peculiar type of gall such as that formed by Andricus

curvator (Pl.5) which is simply a mass of cellular tissue not differentiated into separate layers but containing an inner seed-like gall lying loose in the cavity and within which the larva lives. From these we arrive at the other extreme where theire is a complete differentiation of tissue, having quite a complicated structure.

The galls of Cynipidae differ from those of the saw-flies both in general appearance and in structure. Among the former, Neuroterus lenticularis will serve as an example. These galls when seen in transverse section will be seen to have the following structures:- (I) On the outside is the Epidermis from which grow unicellular reddish hairs. (2) Parenchymatous tissue made up of several layers of cells. (3) Protective layer of thickened greyish cells (4) Nutritive layer very rich in starch, surrounding the larval chamber. These galls are attached to the leaf by a narrow neck of tissue only.

Even all the galls of the same species of Cynipid will not have similar form. The above described gall of Neuroterus lenticularis belongs to the agamic generation, that is, the agamic or spring generation emerges from them. They may be found as late as November and the imagines do not emerge until the following Spring. These insects then oviposit in the young leaves and the resulting galls are round and succulent

succulent, without the differentiation of tissue mentioned above. The flies which (now) emerge in summer are very often referred to as Spathegaster or Neuroterus baccarum. The agamic brood are all females which must of necessity be parthenogenetic, whereas both male and female are found in the summer brood. The ovipositor is larger in the former brood.

The larvae of most Cynipidae are similar; they are white apodous with well developed chitinous dentate mandibles, small head, I2 body segments and 9 pairs of spiracles (Pl.37), yet the forms of galls produced are endless and occur in every part of the leaf. Those of Andricus testaceipes (PlI,2) are found on the petiole, Andricus ostreus mostly on midrib between two brown scales; Dryophanta divisa on the lateral veins; Neuroterus albipes on the edge of the leaf, whilst Neuroterus lenticularis and numismatis are scattered all over the leaf blade. Shapes may be flat, oval, lenticular, button-shaped, round etc.

The Saw-fly galls differ from these. They are generally green in colour and the larvae continue to feed on the internal layers until a mere shell is left surrounding them. In transverse section they are found to consist of a mass of irregular cells, the outer of which contain chlorophyll. The inner cells are paler and have more inter-cellular spaces. In the Sawflies, the gall is formed before the young larvae quit the eggs, which fact

seems to point to an injection from the ovipositor of the female as causing the gall whilst in the Cynipidae no growth takes place until such time as the larva commences to feed.

Larvae.

May serve as an important means of identification both with regard to form and habit, since in many cases imagines which resemble each other so closely as to be almost indistinguishable, will be easily recognised separately in the larval form. For this reason it is always necessary to breed these flies from the very young stages. It is not sufficient to merely identify the gall and then name the fly which emerges as having caused it, as inquilines, parasites and commensals are of extremely frequent occurrence in these galls, Commensals are generally found in large galls but do not kill the insect. Inquilines prey on the substance of the gall and as a rule indirectly kill the gall-forming insect. The true parasite preys directly on the larva of the gall and kills its host.

At a glance saw-fly larvae resemble Lepidopterous larvae but differ in the following respects:-

(i) Possess only one ocellus on either side of the head while lepidoptera have several.

(ii) Possess a greater number of ventral legs; may have 22, but lepidoptera never have more than 16.

(iii) Lepidopterous larvae never possess legs on the 4th and 5th body segments while Hymenopterous larvae

never have legs on the 4th but may have them on the 5th. Saw-fly larva very often have a pair of cerci on the last abdominal segment and these may be differently colouredd from the surrounding parts. The skin may be wrinkled or beset with tubercles each of which ends in a soft hair or bristle.

Habits of Larvae.

Several of the Tenthredinidae produce galls, principally the tribe Nematina , and here again we have members of the same tribe exhibiting differences in habit; the Nematina include free-living species, leaf-rollers, leaf-folders and gall-inhabitants. Many members of the genus Phyllotoma are leaf-miners and here again care must be taken to watch habits since the mines are similar to those of the genus Fenusa but the latter do not spin a cocoon in the mine whilst the former do.

Structure of Larvae.

Generally cylindrical. Mandibles short, thick and harny. Maxilla bilobed. 3 pairs of jointed thoracic legs each ending in a horny claw. Pro-legs which are more like muscular protuberances and without the circlet of hooklets so characteristic of lepidopterous larvae.

Structural Modifications.

It has been mentioned that Hymenopterous larvae vary greatly in habit. Their structure will also vary

as an adaptation to their mode of life. Leaf-miners such as Fenusa melanopoda (Pl.10) have the head quite flat and triangular in shape; the Nematina never have more than 20 legs, while the gall-inhabiting Cynipidae have maggot-like larvae. In correlation with their mode of life the organs of special sense have degenerated, and they are very sluggish and live rolled up inside the gall. Faecal contents are only ejected at the end of the larval stage, the stomach being merely a blind sack. Thus may be seen a gradual transition from the free living larvae with the maximum number of legs to the apodous type as represented by Dryophanta divisa (Pl.2)

Colouration of Larvae.

Species which roll leaves of plants are mostly green with darker food-canals, while internal gall-feeders will vary from the pale whitish-green of Nematus viminalis (Pl.8) to the perfectly white of Andricus ostreus. This again is closely connected with the surroundings since the gall produced by the former is very definitely green and succulent, while that of the latter is whitish when young, turning woody as it matures. The green food-canal so characteristic of all phytophagous larvae is absent from the latter. I have found the larvae of Nematus viminalis varying greatly in colour. In galls examined from the same tree larvae varied from very pale whitish-green to an almost artificial-looking

bright green.

Some leaf-miners had very characteristic markings by which they were immediately identified. In many of these at the last moult the markings are entirely cast off, so that if examined for the first time after this occurrence it may be very easily mistaken for a distinct species. This phenomenon is exhibited particularly by Fenusa melanopoda (Pl.IO)

NEMATUS VIMINALIS (Led.) (Pl.8 Sl.22,34,38)

Plant Affected = Salix purpurea.

Type of Gall = Pea-shaped, sometimes irregular or with wart-like texture due to presence of fungi.

Position on leaf = Undersurface, attached to midrib. Occur singly or a few coalescing.

Colour = Green or yellowish-green often with pink cheeks.

Date and Locality = Bantry Sept. '43. June ot Sept '44.

Typical Condition = Unilocular and Unilarval. Internal chamber large.

Average Dimensions = 6mms in diameter.

Distribution = Common.

Larva lives in gall with body curved to resemble the letter J. Unlike Nematus gallicola it does not make a hole for the expulsion of frass which is fine, dry and brown in colour, but retains it within the gall

which eventually becomes well-filled with it. Larva continues to feed on inner layers until ready to pupate, when it eats its way out of the gall, which will then shrivel up and become brownish.

Colour-whitish with green food-canal. Head light brown with few hairs; eye-spots black, mandibles dark brown. When full-fed head is narrower than second body segment, greyish with green tinge, body tapering towards posteriot end, shining greenish-white usually, but may vary slightly. Body segments project in ridges, each segment having three folds. Legs greyish-white, claws light brown.

Imagine emerged I0/5/'44.

Length-2½ lines. (female) Colour - Black and shining. Legs pale yellow with darker femora, apex of hind tibiae and tarsi brown. Antennae filiform, slightly longer than abdomen. 3rd antennal joint longer than 4th; apices reddish, wings hyaline. Stigma fuscous with extreme base pale. Male longer with thicker antennae. Stigma fuscous.

NEMATUS GALLICOLA (Cam.) (Pl.6,7,9. Sl.3,I3,33, 39,73,80,83)

Plant Affected - Salix fragilis.

Type of Gall - Bean-shaped, glabrous, rugose. May or may not be coalescent.

Position on Leaf - Projecting equally above and below on either side of midrib but never attached to it.

Colour = Green when young becoming conspicuously deep red when mature.

Date and Locality = Banbury, Oct. '43. July to Sept '44.

Typical Condition = Unilocular and unilarval.

Average Dimensions = ¼"-⅜" x ¼" x ¼".

Distribution = Common.

When young the internal cavity is small and the walls much thicker than in Nematus viminalis.

Larval habits:- Live singly within the galls. When young there is but a very small internal cavity but as the larva matures it feeds on the surrounding tissue until eventually a mere shell remains on the outside. At one end of the gall it makes a round hole for expulsion of frass and may even leave the gall entirely for brief periods.

Larva at first is very tiny and transparent-white with head very dark and shining. Immature specimens measured 1/16" to 1/12" gradually increasing to ¼" to ⅜". Food-canal shows up green after a while and head is dark shining with pale-greenish semi-circle on the face. Mouth and mandibles brown. Legs white, claws brown. Some when mature are yellowish in colour with cloudy-orange food canals.

Larvae found in Autumn galls pupate in the ground and flies emerge in May. The male fly has not been bred and is in any case very rare.

Imagines Smaller than Nematus viminalis with

longer antennae. Length = 2 lines. Colour = black shining, legs pale yellow, part of coxae black and black lines also on femora, base of hind tibiae and tarsi brownish. Antennae slightly longer than abdomen, apices brownish beneath; antennal fovea large and deep. Wings hyaline, stigma slightly longer than broad; hind wings have upper , middle cellule smaller than lower.

Galls collected 5/8/'44 were put into breeding boxes; holes for expulsion of frass appeared I3/8/'44. When examined on 2I/8/'44, the larvae had disappeared entirely from some galls while in all the remainder a brown seed-like structure was discovered. These which measured I line x ⅛" and were cylindrical in shape were found to contain the larvae. Larvae were now very sluggish and rather fat-looking, measuring about 6mms x I½mms. and lay bent indide its new case. Left to develop and at time of writing are still alive but not any bigger.

A fresh supply of galls were gathered on 22/8/'44 and a curious variety of inhabitants discovered (Pl 9) Some of the Nematina larvae were of a rather peculiar bright green colour throughout with a blackish-brown shining head, and when examined under the microscope the food-canal showed up yellow. This green colour is is not that which is usual in larvae; in fact these looked as if they had been dyed a brilliant green.

Length -

Length - about 3½mms. Whitish specimens from other galls were as small as Imm. All these galls it may be mentioned were collected from the one tree. In one of these living in company with the tiny white Hymenopterous larva I also found a very small Lepidopterous larva. Length - 4mms, bright yellow in colour, paler ventrally with brown lines on head; second body segment had a rather faint broken brown mark. Legs paler than dorsal part of body. Two reddish dots situated laterally on each segment. Tubercles present with hairs. This I have failed to identify and the larva did not develop further. In another gall was an apodous dirty-white larva with grey food-canal; two grey triangular marks at anterior end and two short processes at either side. Body I3-segmented, very finely serrated at edge and tapering very much towards posterior end.

Sept. IOth male Pimpla (Ichneumon) emerged ♀ Pimpla vesicaria (Ratz.) Three chalcids were also bred from these galls.

On 3/8/'44 galls were found on broad-leaved Salix (phylicifolia?) of whose identity I am not quite certain. Each contained a single larva with 20 legs. Gall was green in colour projecting above and below leaf. Must be one of three types - Gallicola, Ischniocreus or Vesicator.

Nematus vesicator has galls "pressed closely to

midrib, walls thin and space inside larger than any other gall". This description again does not fit, hence my galls seem to be gallicola. In appearance it is like those on Salix fragilis but green in colour. This may be due to the fact that they are still young. They have the same sculptured appearance. Size of gall = $\frac{1}{4}$" x $\frac{1}{8}$" x $\frac{1}{8}$". One very tiny larva found in each. Body is whitish with darker head; faint green tinge. Legs white with dark claws. Galls had not been eaten away very much as larvae were still very young and no hole was made for the expulsion of frass as yet. Another gall examined had the larva twice as large and a hole made for frass.

Tiny larva = 1½mms. Transparent white except head which is shining brownish-black. Larger specimens measured 4mms in length and had become greenish-yellow in colour. Head brownish-black, mouth light brown, mandibles darker. Body yellowish-green with darker food canal. Legs whitish with brown claws. Green semicircle on face not clear.

NEMATUS LEUCOSTICTUS (Htg.) (Pl.6)

Plant Affected = Salix pentandra.

Type of Gall = Leaves folded backwards along entire length of one side.

Colour = Same as remainder of leaf.

Date and Locality = Bantry 10/8/'43.

Typical Condition = Unilarval.

Larval habits

Lives in willow leaves which a re folded down on under side. Edge of fold appears to be glued down along its edge. Larva feeds on the epidermis inside the fold and brown patches appear on the outside. Finally a mere skeleton of that part of the leaf is all that remains.

Length of larva = 2 lines at time of finding. Reaches 5-7 lines when full-grown. Three other species of Nematus roll Willow leaves namely, bipartitus, nigrolineatus and purpurea. This does not agree identically with any but is nearest to leucosticus. When examined first, it was thought to be one of the many lepidopterous larvae rolling willow leaves, but the position and number of the prolegs at once contradicted this. Head flattened in front, slightly broader than second segment. Colour, whitish with brown claws and over each leg is a broad black band. Abdominal legs whitish. Body pale yellow with lime green food-canal. Skin has many very small tubercles, each ending in a short hair (visible only with aid of binocular) At the sides the body segments project in ridges. Over anal segment are two broad black bands each contracted in the middle. Cerci are prominent and black.

This larva died while being used for identification purposes and another live specimen was not found

therefore no imagine bred.

FENUSA MELANOPODA (Cam.) (Pl.IO. S1.3o, 45)

Plant affected = Alnus glutinosa.

Type of Gall = Blister-like mine.

Position on leaf = Mostly upper surface. Wrinkled below.

Colour = Brownish withered appearance.

Date and Locality = Lota, Cork 30/IO/'43,
Bantry, 28/9/'44, 9/8/'44.

Typical Condition = Unilarval generally but sometimes two larvae may be found together,; suggestive of two mines coalesced.

Distribution = Common.

Larva - Seen inside mine when leaf is held up towards light. Phyllotoma species also affect leaves in the same manner but larva of Fenusa does not spin a cocoon within the mine. In those leaves collected 9/8/'44 most of the larvae had left the mines to pupate. Length of larva = $\frac{5}{8}$". Colour = whitish-green, with green food-canal. Head and legs brownish black. On dorsal part of second segment is a large black plate divided down the middle. Ventrally on the same segment is another large plate of the same colour, which is small and truncated at the base, but spreads and curls out at apex. On 3rd and 4th segments, ventrally, there is a small black round dot. Larva moulted Aug.12th and all these markings were cast off.

Body now yellowish-green with head slightly darker and mouth parts brown. (No cocoon spun in mine)

Imagines. Imagines. Black, shining, antennae slightly curved and pilose, short, same length as thorax, not thickened towards apex, 3rd joint greater than double the length of 4th joint. 9th joint conical in shape, thin and longer than 8th. Head almost same width as thorax with distinct sutures. Thorax very shining and smooth. Abdomen short, wings dark, costa, stigma and nervures black. First radial cellule larger than second which is twice as wide at apex as at base. TRansverse radial nervure curved.

Chalcid emerged from one of these mines in Aug.'44 Also discovered a mine on oak leaf very like that of Fenusa, but larva had escaped. May be FENUSA PYGMAEA (PIS)

CYNIPIDAE.

Cynipidae larvae are white, footless, fleshy grubs having I3 segments including the head, which has well-chitinised dentate mandibles. Pupa is white and fleshy like the larva. Antennae placed along body; legs are outside these and enveloped in pellicles and wings appear as bag-like protuberances on either side of the thorax. There is considerable diversity of time regarding the larval stage.

Imago- male has longer antennae and one or two more

joints than female; smaller abdomen which in female varies in shape according to form of ovipositor.
Two forms, agamic and sexual which may be very similar in appearance and hence it will often be necessary to rely on the galls themselves for the discrimination of species.

NEUROTERUS LENTICULARIS (Adl.) (Pl.I, 37, SL.29, 68,72,77,78,8I)

Plant Affected = Quercus Robur.

Type of Gall = "Spangle Gall" Flat, lenticular, pressing against leaf.flside flat or perhaps slightly curled up, but not noticeably so; raised in centre, tapering to thin edges; covered with stellate hairs above, glabrous beneath; attached to leaf by a tiny knob.

Position on Leaf = Scattered over under surface. Gregarious

Colour = Yellowish-or reddish-brown.

Date and Locality = Cork IO/IO/'43, Bantry July to Sept'43

Typical Condition = Unilarval and unilocular.

Average Dimensions = 4½mms x 2½mms when quite mature.

Distribution = Common.

Some of these galls which were collected in July while still young measured on an average ½-2mms in diameter. They appeared on ventral surface of leaf as marvellous dark-red velvet-like discs and were very beautiful ~~to behold~~. AS they matured they lost this lovely red colour, some of the radiating hairs falling off and the galls gradually becoming barer.

Larva enclosed within small larval chamber. Typical Cynipid white, fleshy grub with reddish mandibles. These galls fall to earth in October and flies emerge in March.

NEUROTERUS BACCARUM (Htg.) (Pl.38)
(Spathegaster Baccarum)

seeb '53

This is the sexual form of Neuroterus lenticulatis but the gall although found also on the oak leaf is very much different in appearance.- Berry-shaped, or pea-shaped, smooth, glabrous, soft and succulent. Attached to under surface of leaf but projects slightly on the upper surface. Green with or without reddish cheeks. Appear in May and June. Flies emerge in June. My specimens were not discovered until Aug.1st and by this time they were rather dry and hardened, but the larval chamber was still surrounded by a whitish layer. Found again Aug 10th with white pupa inside. Length 2mms. Body white with large red spot on either side of head. By Aug 17th segments on abdomen were clearly visible with the aid of a hand-lens and pupa looked quite black and shining to naked eye. However it did not develops any further than this. It was probably a parasitic chalcid or ichneumon fly.

NEUROTERUS FUMIPENNIS (Htg.) (Pl.2, 3)

Plant affected = Quercus robur.

Type of Gall = Very like that of lenticularis but smaller and brighter in colour. Chief difference lies in the fact that the fumipennis gall has the sides distinctly curled up, and there is only a small knob-like elevation in the centre. Upper surface is covered with stellate hairs as is under surface also but to a lesser extent. Becomes bare with age.

Position on Leaf = Scattered over ventral surface.

Colour = Brighter than "spangle-gall" but darker beneath, never being whitish or yellowish.

Date and Locality = Lota, Cork, 3/IO/'43.

Average Dimensions = 2to3mms, never 4mms.

Distribution = Not as common as lenticularis.

The larva is later in its development than in former gall. Imago does not emerge until May.

Length = 2mms. Thorax black, not shining, mesonotum wrinkled at sides. Antennae brown, legs yellow, wings irridescent, smoky at tips.

SPATHEGASTER ALBIPES (Schenck.) (Pl.4)

Plant affected = Quercus robur.

Type of Gall = Smooth, ovoid, seed-like, glabrous, without an inner gall.

Position on Leaf = Marginal, contracting that part of leaf around it.

Colour = Yellowish-white.

Date and Locality = Bantry, 28/7/'44.

Typical Condition = Unilocular and unilarval.

Average Dimensions = 1½mms.

Distribution = Not very common.

Larva is of the typical Cynipid type. Has not yet developed. This is the sexual form of Neuroterus laevisculis.

NEUROTERUS LAEVISCULIS (Schenck)

Plant Affected = Quercus robur.

Type of Gall = Bare, flat, sides slightly raised, with a small well-defined knob in the centre, this being covered with hairs. Border not as distinctly curled up as in fummipennis and differs from lenticularis in not having stellate hairs; irregularly circular.

Colour = Greenish or reddish.

Position on Leaf = Scattered over under surface.

Date and Locality = Cork 1/7/'43.

Typical Condition = Unilocular and Unilarval.

Average Dimensions = 4mms.

Distribution = Not as common as lenticularis.

Larvae killed by parasites Torymus sodalis and hibernans.

NEUROTERUS NUMISMATIS (Mayr) (Pl.I?37) (Sl.48)

Plant Affected = Quercus robur.

Type of Gall = "Button Gall". Round with shallow circular depression in centre, this depression being wider than the sides. Hard, sides covered with golden, silky hairs.

Position on Leaf = Under surface. Gregarious.

Colour = Red with golden, silky hairs giving it a golden or fawn-coloured appearance to the naked eye. Very beautiful

Typical Condition = Unilocular and Unilarval.

Average Dimensions = 2mms in diameter.

Date and Locality = Lota, Cork, Sept'43. Bantry, Aug-Sept. '44.

Distribution = Common.

One fly emerged 6/5/'44. Black with yellowish brown legs. Wings hyaline with brown spot at base of first cubital cellule. Thorax shiny. Length 2mms.

ANDRICUS OSTREUS (Mayr) (Pl.2,3,37. Sl.42,49,69,70, 71,74, 78)

Plant Affected = Quercus robur.

Position on Leaf = Under side, attached to midrib as a rule.

Type of Gall = Oval, situated between two brownish, membranous scales which may be as long as the gall. Smooth, glabrous, shining, moderately hard but when very young inclined to be soft. The basal membranes remain attached to midrib after gall has fallen to earth.

Colour =Whitish or pale yellowish, mottled with pink or red spots and suggestive of a miniature bird's egg.

Typical Condition = Unilocular and unilarval. Walls rather thin and larva is rolled up inside.

Date and Locality = 22/IO/'43, Cork. 20/7/'44, Bantry.

Average Dimensions = I½-2mms.

Distribution = Rather common.

On one leaf were 5 of these galls, 4 on midrib and I on lateral vein. On other occasions also I have found an occasional member on one of the lateral veins.

Larva lives rolled up inside the gall.- White, apodous, with strong, reddish mouth parts which move vigorously when larva is removed from the gall. Flies emerge in October. Easily recognised by the fact that the claws are bifid and the keels on mesonotum are not straight and parallel but bulge outwards. Length = 2mms. Black and shining with duller thorax. Wings and antennae long. Legs yellowish in their thinner parts and darker on top next to body. Antennae thin. Apices of wings have rather long cilia. Abdomen glabrous but thorax pilose.

ANDRICUS CURVATOR (Htg.) (Pl.5)

Plant Affected = Quercus robur.

Type of Gall = Irregular swellings on leaf, containing

an inner seed-like gall. Glabbous.

Position on leaf = On the midrib of young aborted leaves or on the sides of more developed leaves. Hard and solid at first but later expand, and cavity formed inside and in this lies loosely the seed-like gall.

Colour = Green on outside. * Inner gall brown.

Date and Locality = II/7/'44, Bantry.

Average Dimensions = ¼". Inner gall = 1½mms.

Distribution = Not common.

Most of the flies had emerged since July but some seed galls were still intact. 23/7/'44 two small metallic green flies emerged = Synergus sp.

ANDRICUS FECUNDATRIX.(Mayr) (Pl.4)

This gall was also found several times on oak, but I have never succeeded in rearing the fly itself. Many of the galls were abortive and those which developed yielded only parasites. This is called the "artichoke gall" and consists of enormously developed bud-scales. The real gall is enveloped in this and is pointed at basal end. Length = 8mms. Hard and woody, shining, green when young but turning a light brown. Length of artichoke = I" including fringe on top.

ANDRICUS TESTACEIPES (Htg) (Pl. I, ♂)

Found one specimen only together with Andricus curvator Bantry I9/8/'44. Testaceipes was just at the base of

the leaf on the petiole. The gall formed an elongated swelling, one-celled, I½mms long, green in colour, and surrounding the internal cavity is a fine white cellular substance. Seems to be rare.

ANDRICUS GEMMATUS (Adler) (Pl"2)

On Oak 28/7/'44. Only one found and from its position it appears to be Andricus gemmatus.

see p47.

SPATHEGASTER BACCARUM (Htg) (Pl 38)

This is the sexual form of Neuroterus lenticularis but the gall, although found also on the oak leaf is very much different in appearance. Berry-shaped, or pea-shaped, smooth, glabrous, soft and succulent. Attached to undersurface of leaf but projects slightly on the upper surface. Green with or without reddish cheeks. Appear in May and June. Flies emerge in June. My specimens were not discovered until Aug.Ist, and by this time they were rather dry and hardened, but the larval chamber was still surrounded by a whitish layer. Found again Aug I0th with white pupa inside. Length- 2mms. Body white with large red spot on either side of head. By Aug I7th segments on abdomen were clearly visible with the aid of a hand lens and pupa looked quite black and shining to naked eye. However it did not develop any further than this. It was probably a parasitic chalcid or ichneumon fly.

DRYOPHANTA DIVISA (Htg.) (Pl.2) (Sl.23,47, 75,79)

All the Dryophanta galls are found on the under surface of leaf and judging from their frequency of mention in the text-books, are of common occurrence, but, strangely , I have succeeded in finding one species only from which the fly was succesfully reared. This gall was very common on all the oaks in this area.

Type of Gall = Smooth, glabrous, woody, top depressed in centre. Frequently the surface will bears tiny warts. Walls thick, therefore cavity small.

Position on leaf = Ventral surface , attached to midrib and lateral veins.

Colour = Light brown or whitish-fawn with or without red cheeks.

Average Size = 5mms x 3mms.

Date and Locality = Lota,Cork IO/IO/'43, 2/II/'43.
Bantry,July to Sept.'44.

Typical Condition = Unilocular and unilarval. Larval chamber small. Fly emerged Oct.20th. Reddish brown with black abdomen. Antennae I4-jointed, dark brown. Legs reddish-brown. Thorax pilose . Abdomen longer than head and thorax. Laterally compressed. Antennae I4-jointed. Claws bifid. Wings longer than body. Length 4mms.

Unidentified Oak Galls.

I. Dark blotches on oak leaves probably made by Fenusa pygmaea.

2. Unidentified gall in bud (Pl.4) Large scales formed like that of Andricus fecundatrix but here the inner gall was found near the outside, covered only by a few scales. In appearance it was like a tiny brown nut. Colour and texture the same as shell of hazel nut with little beak on top which was paler in colour. Bottom also paler. Not glabular in shape; inclined to be angular. Two different specimens found (one in each bud) Length-I/6".

3. Unidentified gall in bud. Long green tube-like structure projecting out of 'artichoke' This fell off when being picked, but down at base of bud was the remainser of gall which was greenish-brown with larva inside. Evidently Andricus species. (Pl.4)

(Number 2 above was found in same bud.)

Another specimen was examined which had not the tube projecting above. 3/I0"long, green, fairly soft. No hard shell inside. Larva like that of Cynips Kollari, quite fat and almost as large. Length when bent inside gall - ⅛" x I/I2". Mouth parts reddish.

4. July 30th oak leaves found with Neuroterus numismatis and several withered galls like those of Dryophanta divisa. July 3Ist, one was opened and two stages of development found inside. Aug Ist, only

one image had emerged - small green-metallic chalcid. Ventral part of abdomen golden-yellow. Antennae yellow. Head and thorax light metallic-green. Legs yellow. Tip of abdomen black. Length-about 2mms. Second emerged two days later.

ORDER LEPIDOPTERA.

Lepidoptera are 4-winged insects having not more than 4 cross veins. Body, wings and other appendages are covered with scales. Mouth parts suctorial. Metamorphosis complete.

Larvae- Well-developed head, 3 pairs legs and a variable number of prolegs. 4th and 5th abdominal segments never bear prolegs and in this and other ways already enumerated, they may be distinguished from Saw-fly larvae. The thoracic legs are 5-jointed, ending in a curved claw. Prolegs have a circlet of hooklets and those on last segment may be termed claspers. Pro- and metathorax small, mesothorax large. Number of thoracic legs always constant except in cases where there are none at all. The head is well-developed showing the median epicranial suture clearly and the frons is bounded by narrow adfrontal plates. Generally 6 ocelli situated behind the antennae, which are very short. Well-developed mandibles; labial palps vestigial. Number of abdominal legs ~~will~~ variable and ~~in~~ has some leaf-miners they may be entirely absent. Body may be beset with simple hairs or tubercles of various types. Consist of head and 12 body segments.

Habits of Larvae- ~~will~~ vary greatly. Here we are only concerned with leaf-miners, leaf-folders, leaf-rollers and those which spin adjacent leaves together.

Many of the Tineina live between united leaves or form a dwelling by drawing together the terminal shoots of plants, especially various species of Salix. The great majority of them mine between the cuticles and these are very easily detected, the mined portions becoming discoloured with age. Some members exhibit a marked preference for one particular kind of plant, while others are polyphagous.

The modes for sheltering themselves adapted by the Tortricina are numerous and varied. They roll, twist or distort the leaves of various plants. Their larvae are naked or very sparingly sprinkled with hairs and are never to be found gregariously. Many of them are leaf-miners in their young state. The folding and twisting of the leaves, so frequently met with, is accomplished by means of white silk spun by the larva ~~which~~ and is evidently of an elastic nature, and hardens on exposure to air. In this manner, opposite edges of the strongest leaves may be drawn towards each other.

Length of larval life varies, most ~~of them~~ species remaining in this state during the winter months. These larvae are all much alike in general appearance. Generally possess 16 feet (8 prolegs and 2 anal) Head and shield horny, and there is frequently a horny plate situated dorsally on the anal segment.

Larvae feeding on the surface of the foliage usually have well-developed legs and are clothed with hairs, while those within the tissues of the plant are either footless or possess partially developed legs and have a smooth surface.

In the pupal stage there is also great diversity as regards form and habit. In many cases the larvae desert the food-plant and search for a suitable place in which to undergo transformation. Larval skin usually loses much of its colour now and is eventually cast off. I have often found the cast skins within the mines after pupation has taken place. The majority of species spin a cocoon. This is often formed of leaves drawn together by a silken meshwork. The body divisions of head, thorax and abdomen are now clearly visible.

The various species of Salix seem to be most prone to Lepidopterous attacks but I have also found the larvae inhabiting holly, oak and alder.

On the whole this group has proved more difficult to identify than any other, since many different larval species have similar habits.

PAEDISCA OPHTHALMICANA (Hub) (Pl.I8)

Plant Effected - Ilex aquifolium.

Type of Gall - Leaves of terminal shoot drawn together

by silken threads to form a kind of rosette.

Colour = Same as remainder of the young leaves.

Typical condition = Unilarval.

Date and Locality = Cork May and June '44.

Distribution = Not very common.

If holly trees be examined during May and June the work of these larvae sill be readily seen. The leaves of the terminal shoots are drawn upwards and fastened securely together by fine white silken threads. This larva which is a Tortrix has I6 feet and is of a dirty-green colour with black horny head and shield. Pupa measures 3/5". Dark brown.

Imago emerged Ist July '44. Head smoky black, tufted with hairy scales. Eyes large, deep brown and having a kind of velvety appearance. Antennae simple, smoky black. Abdomen shining and greyish. Length -over I". Forewings very dark grey and hind wings lighter and rather greenish. Palp longer than head with middle joint twice as long as apical. Terminal joint black. Thorax smoky black. Anterior wings three times as long as broad.

DEPRESSARIA CONTERMINELLA (Zeller)(Pl. 20)

Plant affected = Salix viminalis.

Type of Gall = Leaves at tips of leading shoots joined together.

Colour = Same as other young leaves, pale green or reddis

Typical Condition = Unilarval.

Date and Locality = Lota, Cork I0/5/'44.

Distribution = Common.

If osiers be examined during May (and June also) it will be found that the terminal shoots have the leaves all united. Each leaf is drawn upwards and curved inwards and glued ~~together~~ its neighbours. There may be 7 or 8 or even more leaves involved, and the larva is enclosed in the innermost leaf, Larva is very small, whitish, and wriggles actively when disturbed. One moth emerged 28/6/'44. Anterior wings 2½ times as long as broad, rounded at tip. Hind wings not quite as long. Anterior wings reddish-ochreous, with base pale yellowish-grey with a small dark spot on the inner margin. Above the middle are two black spots united to form a curved streak; below the middle is a yellowish-grey spot surrounded by black. Posterior wings whitish-grey. Head and thorax pale ochreous, Length-I9mms.

LITHOCOLLETIS SP.

Plant Affected = Alnus glutinosa.

Type of Gall = Blister. Transparent when held against light.

Position on Leaf = Between the lateral veins.

Colour = Light green at first, turning brown with age.

These leaves were collected as late as Nov.7th with the larva

with the larvae still within the blister:-I line long, yellowish, food canal showing as a greenish streak. Head black at sides with a black V-shaped mark in the middle. Legs I4 in all. Head narrower than second segment. I have never succeeded in rearing this moth. When examined again on Nov.IIth the mine was found to contain a second case inside in which the larva was situated with its head end towards the midrib and the remainder of the mine contained frass. This second case may be present when the larva is about to pupate. Later found similar galls in May with pupal case protruding from lower surface. This and the fact of larvae having I4 legs seems to point to its being a Lithocolletis species. It also had the 3rd and 4th body segments rather enlarged, which is a characteristic of some members of this family.

Probably Lithocolletis alnifoliella (Zeller).

LITHOCOLLETIS SALICICOLELLA (Zeller)

Plant Affected = Salix Capreae.
Type of Gall = Blotch on under surface which causes the leaf to fold slightly backwards.
Date and Locality = Cork, Wilton I3/12/'43.
Colour = Whitish-brown beneath.

Rather like that of Lithocolletis messaniella on oak. Only found once and this was in December, when the pupal stage had been reached, therefore there

is no certainty that the blotch was formed by this species, but from all appearances a Lithocolletis sp. is indicated. At Easter an Ichneumon fly (♀Hemiteles) had emerged which was evidently a parasite on the owner of the 'gall'.

LITHOCOLLETIS MESSANIELLA? (Zeller) (Pl.39)

Plant Affected = Oak.

Type of Gall = Pucker on upper surface, flat, blister below.

Colour = Pale brown and withered-looking above, whitish below.

Date and Locality = Bantry June '44, Glengarriff Aug. '44 Cork 'Sept. Oct '44.

Typical Condition = Uni♀arval.

Average Dimensions = 5/I2" x 3/I2".

Distribution = Common.

These galls were found several times previously after the imagos had escaped, and it was only this summer that they were successfully reared. The larvae mine the leaves of oak by simply creating a flat blotch on the ventral surface of the leaf in such a manner that a pucker is produced on the upper surface. The gall is quite transparent and when held against the light the larva may be seen inside. When discovered in Glengarriff on Aug.I5th all staged were found on the same tree, that is, larva, pupa and stage after which imago had emerged. The ventral part of this mine is

suggestive of tissue paper pasted on to the leaf and and always has a fold of tissue running lengthwise. Length of larva - 3½mms. Colour - white, with head faintly-coloured brown. Food canal green. Head narrower than second segment. Thoracic legs short. Pro-legs not well defined (3 pairs and claspers). Tapers towards posterior end. Segments bulge outwards at edges and there are minute tubercles with hairs attached. The larvae eat the patches in upper part of leaf. Mouth parts are pale brownish-yellow.

Pupa - 4mms also . Enclosed in a pure-white, silk, cigar-shaped cocoon within the mine. Attached by silken threads to lower part of mine at either end. Lies lengthwise in mine. Later becomes covered with dark frass-like particles.

I3/8/'44. Imago emerged.

9/9/'44 Chalcid emerged from similar mine.

I0/9/'44 Male Hemiteles and female Colastes braconius emerged from similar mines.

EPUNDA VIMINALIS (Pl.20)

Plant Affected = Sallow.

Type of Gall = Leaf folded backwards.

Colour = Green, same as other leaves.

Date = July '44.

Typical Condition = Unilarval.

Distribution = Common.

Larva-⅜" long. Colour - pale green with bright

green

green food-canal. Head shining grey with black lines. Legs black for most part. Second segment has semi-circular black mark broled in middle. Tapers slightly towards each end; flat beneath. Very active larva. Leaves folded along one or both sides. Sometimes almost meet in middle below. White, silken tube inside. One larva only in each leaf. This larva comes nearest to Epunda viminalis but I could not see the white dots on the back of each segment which are characteristic of that species; 3pr. legs, 4 pr. prolegs, and Ipr. claspers.

Parasite bred - female Braconid.

TAENIOCAMPA CRUDA ? (Pl.20)

Found lepidopterous larva rolling willow leaves on Aug Ist of this year. Description corresponds with that of Taeniocampa cruda but the latter, however, is full grown in May or the beginning of June, while my specimen was still only ½" on Aug Ist.
Head shining black, about same width as second segment Legs black. Prolegs dull yellowish-green. Body cylindrical, brownish-green above, ventral surface paler. Shining black plate on second segment, divided in centre; another black plate on anal segment. Ventral surface and prolegs dull yellowish-green. Spiracles black.

Lepidopterous larva rolling leaf of Alder. (Pl.40)

An Alder leaf was found I9/8/'44 rolled completely around and secured with silken threads. Tip of leaf was folded in so that the top of the structure formed by the rolling of the leaf was completely closed at this end but had an opening at the base.

The larva (one only) was 3/I0"in length. Colour - transparent whitish with dark brown food-canal. Legs, same as body. Anal segments blackish. Mouth-parts reddish. Ypsipetes impluviata occurs in folded up Alder leaves but this belongs to the Geometrae, and has not the usual number of legs which my larva had. They are quite alike in colour and markings generally.

May be Gracilaria elongella but I can find no description of this larva apart from the fact that it rolls up the leaves of Alder.

Lepidopterous larva rolling broad-leaved willow.(Pl.20)

On Aug 3rd. found one edge of leaf folded backwards and glued down on ventral surface. Only one larva discovered in each leaf. Length - 4½mms. Head black. Body yellowish. 3 pairs of legs and 4 of prolegs. Claspers present. At first it was thought to be a Hymenopterous larva, but position of prolegs contradicted this. Legs had blackish-grey bands and brown claws. Prolegs same colouration as abdomen.

Project well below abdomen. Orange-brown food-canal passes through body. Head black, mouth-parts reddish.

Lepidopterous larva rolling broad-leaved willows (Pl.40)

Found Aug IOth. Length I/5". Colour whitish with lime-green food-canal. Head shining black, with V-shaped light lines. Legs black for the most part. Mouth-parts brown. No characteristic markings except on head.

Also found tiny white Tineina larva uniting these leaves. Length - I/IO". Looks white to naked eye, but when examined under lens appeared to be pale yellow. Head black. Legs dark grey. First segment has dark brownish-black band. Head heart-shaped with lines of a paler tint.

Also found an osier leaf on 9/8/'44 with a tiny white caterpillar rolling back and glueing down the extreme tip of leaf. No markings whatsoever.

Coleophora sp.

Several times have I found Alder leaves with brown blisters and attached to the blister, a brownish, withered-looking case about ¼" in length, which I had never been able to name. When writing this I accidently came across an illustration of a similar case named as belonging to the "Pistol Case-Bearer", Coleophora malivorella (Riley) on apple leaves. The cases which I found also resembled an old-fashioned pistol in miniature, the butt being the upper end. These little

cases are very tough and afford a good means of protection for the larvae. Since none of these were ~~not~~ kept it must suffice to say that they were Coleophora sp. Perhaps Coleophora fuscedinella (Zell) which is found on Alder.

ORDER IV. ACARINA.

FAM. PHYTOPTIDAE.

The tiny creatures belonging to this family are so destructive to our native trees and have been so little studied, that it may be well here to give an account and also a classification of the group. In most text-books these four-footed mites are referred to as Eriophyidae, but recent research has given Phytoptidae priority over Eriophyidae. The most extensive and important work done is by Nalepa, whose writings are not, however, in English. Keifer, of California, has published many pamphlets in recent years as also has Massee, of the East Malling Research Station.

These mites are of such small dimensions that they must be measured in terms of μ. They may vary from 90μ x 30μ to 250μ x 60μ in the male. The body is elongated and vermiform in shape, and is divided into two parts. (I) Cephalothorax, which is short and broad, and (2) an elongated cylindrical abdomen. When looked on from the dorsal aspect, the distinction between the two is quite distince, but ventrally it is indistinct. The head and thoras proper are hidden by a dorsal shield-like plate, bearing distinctive sculptural markings, which form an impobtant feature of the nomenclature. Close to the head is a pair of 3-segmented palps. The basal segments unite to form the labium. The rostrum lies between

the palps and this is formed by the two maxillae joining to form a groove in which lie the chelicerae or the mandibles. The maxillae are really projections from the sides of the pulpi.

The legs (four in number) are 6-jointed, the segments being known as the trochanter, femur, patella, tibia, tarsus and pretarsus. This last segment i.e. the pretarsus was called "Fiederborste" (Feathered hair) by Nalepa. It is referred to by most authors as the "Feathered Claw". It consists of a central axis with 2-5rays branching from it. At the extremity of the tarsus a stout curved bristle known as the "Krallenborste" (Claw bristle) in situated dorsally.

Usually all the segments except the trochanters of all four legs are provided with bristles. These bristles vary in strength and in length. The bristles on the femora are fine, short and placed ventrally. Those on the patellae are strong, rather long and placed dorsally. Each tarsus has two bristles arising close together from a notch on the dorsal surface. Generally the outer bristle is longer than the anterior one.

Placed ventrally on the Cephalothorax, between the legs are three pairs of bristles, called thoracic seta I,II,and III, respectively. Pair I is longest and pair III shortest, usually. There is generally a

pair of dorsal setae also which may be sessile or arise from prominent tubercles.

The abdomen is very much elongated and tapers slightly towards the posterior end. It is transversely striated, the number of rings or striations varying according to the species. These may or may not be complete, and there may be very tiny or comparatively large tubercled lying on, or in between the striae. As well as the thoracic setae, there are also abdominal setae. These are (I) Genital setae. (2) Lateral setae (3) Ventral setae I,II,III, (4) whip-like Caudal setae (5) Accessory setae, situated between the caudal setae, but these may be absent in some.

The genital openings are situated on the ventral surface of the abdomen. The female consists of a semicircular flap covered by an opening with a raised margin. The male opening is smaller and slit-like with thickened margins.

Colours are generally white, whitish-yellow or orange.

(For diagram of above discription see Plate 43)

The following CLASSIFICATION is that of Nalepa(1918b)

Sub-family Eriophyinae.

Abdomen uniformly striated. The striae appear circular around the abdomen, the number dorsally being about equal to that ventrally. Venter always, dorsum usually, tuberculated.

I. Abdomen without dorsal longitudinal furrows. 2.

Abdomen with one or more longitudinal furrows. 3.

2. Abdomen with narrow striae mostly tuberculated or at most smooth dorsally; generally 3 pairs ventral bristles.

= ERIOPHYES.

Abdomen with broad smooth striae; first and second pairs of abdominal bristles absent. = CECIDODACTES.

Abdomen tuberculated; tubercles carrying I or more upright or backward curving hairs. = TRICHOSTIGMA.

3. Abdomen with I median longitudinal furrow.

= MONOCHETUS.

Abdomen with several dorsal longitudinal furrows.

= PHYTOPTOCHETUS

Sub-family Phyllocoptinae.

Abdomen not uniformly striated. The striae appear as half circles around the abdomen; the number dorsally being usually much less than that ventrally. The ventral striae are narrow and tuberculated. The last posterior 5 striae appear complete, thus encircling the abdomen.

I. Number of dorsal half-rings smaller than that of ventral, which are very narrow, most of them bearing tubercles. 2.

Number of dorsal half-rings larger than ventral, the latter are very broad, overlapping like scales.

= PHYLLOCOPTYCHES.

2. Legs 6-segmented, feathered-claw simple. 3.

Legs 5-segmented, feathered-claw forked=DIPTILOMIOPUS

3. Abdomen not uniformly striated throughout, all dorsal half-rings broader than those of ventral side. 4.

Abdomen back of shield uniformly striated, thence to anal opening not uniformly striated and covered with broader dorsal half-rings. = PARAPHYTOPTUS.

4. Dorsum of abdomen smooth or with tubercles. 5.

Dorsum of abdomen bearing longitudinal rows of recumbent chitinous processes. = CALLYNTROTUS

5. Dorsal half-rings projecting tooth-like at sides.

= OXYPLEURITES

Dorsal half-rings never projecting tooth-like at sides.

= 6.

6. Dorsum evenly arched throughout. 7.

Dorsum strongly arched in middle. 8.

7. Posterior end of abdomen narrowly ringed and sharply differentiated from the rest, which is covered with few broad half-rings. = ANTHOCOPTES.

Posterior end of abdomen not so differentiated.

= PHYLLOCOPTES

8. Dorsum lined with 2 longitudinal furrows, flattened posteriorly; dorsal half-rings mostly narrow, often with tubercles. = EPITRIMMHUS

Dorsum of abdomen roof-like or arched, with furrows and with dorsal half-rings mostly broad, sometimes moderately tooth-like or saddle like. = TEGONOTUS.

Notes on Galls caused by Phytoptid Mites.

This group of mites includes a large number of gall-makers, and the galls thus produced vary much in form and colour. The mites themselves are all somewhat similar in general appearance and structure, yet the diversity of gall-structure is truly amazing. The well-known Eriophyes tristriatus erinea which attacks Juglands regia makes an erineum gall on the leaflets which never differs much in colour from the remainder of the leaf, though sometimes becoming chocolate-brown with age (Pl.30) Eriophyes brevitarsus forms large blister-like swellings on Alder (Pl.22) while two other species also attack this same plant but produce totally different gall-structures, i.e. Eriophyes laevis (Pl.24) Which forms masses of small globular, slightly pedunculated swellings, which, owing to their occurrence in such large numbers considerably distort the leaf, whilst Eriophyes axillaris, as the name suggests, causes small reniform galls which occur in pairs in the axils of the lateral veins from the midrib. (Pl.23) These two latter types of gall vary in colour from light green, yellow, yellowish-orange, orange-red to dark chocolate-brown, and are thus very easily seen at a glance wherever they occur. The mites themselves never vary very much in colour, being generally either white, whitish-yellow or orange, but

their galls exhibit a very wide diversity of colour. Thus, the galls of Phyllocoptes acericola on Acer pseudoplatanus are a brilliant crimson colour and occur in great numbers as fine cone-shaped structures on the upper surface of the leaf,,showing up well against the light green of the leaf itself; similarly the familiar "nail gall" of Eriophyes tiliae typicus on the Lime is also brilliantly coloured (Pl.37) In fact these two latter types are perhaps the most bright coloured of all leaf-galls found so far.

All Phytoptid galls which I have found were on the upper surface of the leaf, and each had an opening ventrally and were never completely closed as in "true galls".

Many appear to be local, as some which are mentioned in most books on the subject, I have failed entirely to perceive. Eriophyes aucupariae I have only once found on Pyrus aucuparia at Caragh Lake, Co. Kerry, and although the Mountain Ash is particularly plentiful around Glengarriff, I have several times looked for it but in vain. Crataegus oxyacantha yielded only Eriophyes ~~crataegi~~ Cecidophyes crataegi, but Eriophyes crataegi which should be very common has not been found. Eriophyes piri has only been discovered once. Here again I have found the Beech quite immune, although Nalepa has recorded species attacking these leaves,e.g. Monochetus sulcatus. Also I have failed to find any growth on Birch leaves.

galls

Phytoptus calycophthirus (Nal) and Phytoptus leionotus (Nal) are both known to attack this plant. The Maple although commonly illustrated with two different types of Phytoptid gall also gave negative results but this tree is not of such frequent occurrence in this area as are the Beech and the Birch.

Alnus glutinosa again yielded great abundance and variety, while Crataegus oxyacantha and Prunus spinosa were quite commonly attacked. Rosa sp. yielded no mite-gall whatsoever, nor did Quercus robur. These two plants seem to be favoured by Hymenoptera more than by any other insect groups, so it seems that even such tiny creatures as Phytoptid mites have their choice host plants also.

These are the most difficult of all gall-makers to work on due to their minute size. Several methods of mounting for microscopical examination have been attempted as above described. Hassan "Biology of the Eriophyidae." gives a very detailed account of microscopical technique as applied in his research, which however, I have not found very successful.

(The drawings of the mites in the Plates at back have been copied from works of Nalepa)

ERIOPHYES TRISTRIATUS ERINEUS (Nal) (Pl.30)

Plant affected = Juglands regia.

Type of Gall = Erineum; glabrous above, densely pubescent below, surface covered with wrinkles.

Position on Leaf = Upper surface of leaflet between the lateral veins.

Colour = Pale green turning brown with age.

Date and Locality.= U.C.C. Oct.'42,'43.Aug-Nov'44

Distribution = Much cannot be said here as this was the only Walnut tree examined.

Average dimensions = 6mms. high x I6mms,long x IOmms

These galls are very noticeable on the leaflets of Walnut occurring between the lateral veins. They may be coalescent . A swelling appears on the upper surface of the leaflet as if it were pushed upwards from below, and the interior becomes filled with a felt-like mass of light buff-coloured hairs among which the mites swarm. The galls were first discovered in Oct. '42, but at this late date no mites were present in the galls. However, the latter were quite plentiful in August and September of the following year, and quite successful slides were made of them,using Berlese fluid as the mounting medium.

Measurements of Male = 170μ x 27μ

" " Female = 190μ x 30μ

Body - elongated, cylindrical. Shield small, triangular

the middle area having three long lines. Dorsal seta I½ times as long as the shield, its protuberance being stiff. Feather-claw 3-radiate. Sternal ridge simple. Thoracic seta II; far removed from the inner coxal angle. Abdomen with about 70 - 80 rings, smooth or sparsely pitted. Lateral seta very short. Accessory seta rather long. Cover-flap strongly arched and smooth. Genital seta short, fixed at base.

Var. Erineus - Same as above description but rings broader. Legs and tarsus proportionately shorter.

ERIOPHYES TETANOTHRIA LAEVIS (Nal)(Pl.24) ?

Plant affected = Salix caprea.

Type of Gall = Gregarious, may be coalescent, woody, pilose above with an opening below.

Position on leaf = Scattered over upper surface.

Colour-= Green, may be tinged with red or brown.

Date and Locality = Bantry, 10/7/'44

Distribution = Fairly common.

Average dimensions = 3mms x 8mms in girth.

I am not satisfied with the identity of these galls. Connold in his description of them (Br,Veg.Galls) says:- The gall-structure is pilose on the upper surface of the leaf and glabrous beneath. When this (the aperture) is viewed under magnification, numerous purple-coloured spots can be seen studding the margin." Those which I

found were not by any means glabrous beneath, and the upper surface was only very sparingly hairy. Again I failed entirely to find the purple spots studding the margin of the aperture. The mite was orange in colour. As I cannot find any means of verification, Nalepa's description of Eriophyes tetanothrix laevis is given below.

Measurements of Male Mite = 140μ x 48μ

" " Female " = 160μ x 60μ

Body mostly slender, spindle-shaped. Shield triangular with netted lines. Dorsal seta long and stiff. Tubercles large, stiff. Rostrum slender. Tarsus shorter than tibia. Feather-claw 4-radiate. Sternal ridge movable. Abdomen with 50 - 60 rings, pitted or smooth dorsally. Ventral setae long. Accessory setae short. Cover-flap striped. Genital setae long.

Var. laevis.

Dorsal surface of abdomen smooth or very finely pitted. Shield-marking not clear. Dorsal seta hardly as long as Ventral seta I.

ERIOPHYES TILIAE TYPICUS (Nal) (Pl.37)

Plant affected = Tilia Europea.

Type of Gall = Glabrous, conical, glossy, gregarious.

Position on Leaf = Scattered on upper surface.

Colour = Yellowish-green turning a brilliant crimson

Date and Locality = U.C.C. 38/IO/'44

Distribution - Very rare here.

Average Dimensions = 8rms high.

Commonly called "nail galls" since they resemble points of small nails sticking up through the leaf. Quite hollow, having the interior filled with long hairs. Although I have searched for these galls for a long time, I did not find them until late October of this year and then only on a few leaves and not in large numbers. I did not find a single mite in any gall, but since the growth of this particular type is complete since the end of July, this was no surprise. Hence I can again give only a copy of Nalepa's account of these mites.

Measurements of Male - 160μ x 34μ

" " Female - 200μ x 35μ

Body vermiform, or cylindrical. Shield semicirculab. Dorsal seta I 1½ times as long as shield, not very straight. Tubercles large near posterior end. Rostrum slender. Featherclaw 4-radiate. Tibia and tarsus fairly long. Sternal ridge not fixed. Thoracic seta II away from inner coxal angle. Abdomen with about 80 rings. Ventral seta I very long, delicate. Ventral seta II somewhat shorter. Caudal seta very long. Accessory seta missing. Coverflap striped. Genital seta fixed, short.

Var, typicus.

Abdomen coarsely pitted.

PHYTOPTUS MACROCHELUS EREBIUS. (Pl.26)

Plant affected = Acer Pseudo-platanus.

Type of Gall = Erineum.

Position on Leaf = Upper surface between the veins

Colour = Greenish at first turning dark brown to black

Date and Locality = Bantry August '44.

Distribution = Rare.

This gall was at first thought to be due to fungi but later the mites were found swarming in the felt-like ventral surface. I am indebted to Dr. Massee of the East Malling Research Station for the identification of this species, as I had not found the gall mentioned in any of the available literature.

Measurement of Male - 164µ x 36µ

" " Female - 196µ x 36µ

Body elongated cylindrical. Shield small with indistinct longitudinal lines. Dorsal seta somewhat longer than the shield, stiff. Legs weak. Claw-bristle more than twice as long as the 4-radiate feather-clav. Sternal ridge simple. Thoracic seta II placed much to fore. Abdomen finely pitted with about 66 rings. Rings near tail-flap distinctly broader. Lateral seta about half as long as Dorsal seta. Ventral seta II somewhat longer than Dorsal seta. Ventral seta II very fine and almost as long as the claw. Cover-flap striped. Epigynum basin-shaped. Genital seta stiff, short.

ERIOPHYES RIBIS (Nal) (Pl.3I)

Plant affected = Ribes nigrum.

Type of Gall = "Big Bud".

Position on Plant = Singly at nodes and in clusters

at apex of branch.

Colour = Greyish brown.

Date and Locality =Bantry, May '43. March,April'44.

Distribution = Rather common.

Causes the well known "Big Bud"disease in black-currant and becomes quite a pest in gardens here. The mites occur in enormous numbers in the buds and may be looked for as soon as buds appear. Newstead ("The Currant Bud Mite" Journ.Roy.Hort.Soc.I90I) records having counted 3,000 individuals in one bud in Jan. and in March, he says " It would be safe to add half as many more" The buds are infested and swell until they are globular in shape and almost twice the size of a normal bud. They dry up early in summer and produce no foliage. I have also found it attacking gooseberry.

Measurements of Male - 150μ x 38μ

" " Female - 230μ x 40μ

Body very elongated, cylindrical. Shield almost triangular, about 5 line s long, in the middle area. Side areas are coarsely pitted and traversed by curved lines Dorsal seta absent. Rostrum short. Tibia and tarsus almost equally long. Featherclaw 5-radiate. Sternal ridge stiff and fixed. Thoracic seta II far removed from inner coxal angle. Abdomen with approximately 70 rings. Ventral seta I long. Ventral seta II short Accessory seta absent. Coverflap striped.Genital seta projecting from side, short.

ERIOPHYES PIRI (Nal) (Pl.3I)

Plant affected = Pyrus communis.

Type of Gall = Gregarious, glabrous, coalescent.

Position on leaf = Scattered in very large numbers over upper surface of leaf.

Colour = Greenish-yellow, reddish turning brown.

Date and Locality = U.C.C.gardens July '43.

Average dimensions = Imm x 2mms.

These galls occur in very large numbers on the leaf. Tiny holes on ventral surface give access to hollow protuberances above. I have only found these once, though always on the watch for them.

Measurements of Male - 170µ x 40µ

" " Female - 200µ x 50µ

Body vermiform. Shield small, semicircular, marked with radial long lines. Dorsal seta a little longer than shield, nearly straight. Tubercles large, very near each other, near posterior end. Featherclaw 4-radiate. Clawbristle almost knobbed. Sternal ridge simple. Thoracic seta I behind anterior end of sternal ridge. Thoracic seta II far removed from inner coxal angle. Abdomen with 80 rings. Ventral seta I fairly long. Ventral seta II very short. Accessory seta stiffish. Epigynum far back. Coverflap striped. Genital seta fairly long.

ERIOPHYES SIMILIS.(Nal) (Pl.33)

Plant affected = Prunus spinosa.

Type of Gall = Gregarious, pubescent, small, irregular in shape.

Position on Leaf = Upper surface or on edges, opening below.

Colour = Yellowish-green turning brownish

Date and Locality = Bantry June - Sept '44

Average Dimensions = 2mms high.x 6 in girth

These galls were not very common on Sloe trees. Some which were found in Oct. were buff-coloured, rather dried up and contained no mites. These were densely pubescent and t rather pointed at the top.

Measurements of Male - 204 x 404

" " Female - 204 x 454

Body cylindrical. Shield triangular, traversed by long lines. Dorsal seta shorter than the shield and directed forwards. Rostrum short. Tibia scarcely longer than tarsus. Featheralaq 5-radiate. Sternal ridge fixed. Thoracic seta II removed from the inner coxal angle. Abdomen with approximately 60 rings, mostly coarsely pitted. Ventral seta I long. Ventral seta II short. Accessory seta absent. Coverflap smooth. Genital seta short.

PHYTOPTUS PADI PRUNIANUS var. HOMOPHYLLA(Nal)(Pl33)

Plant affected = Prunus spinosa.

I am again indebted to Dr,Massee, for the identification of this species. It was thought at first to be Eriophyes similis gall. Colour - yellowish-pink suffused with red

or purple. Occurred mostly on edge of leaves. Irregularly reniform in shape, rather thickened, with opening on the upper surface. Pilose on inside. Very common.

Measurements of Male - 170μ x 60μ

" " Female - 220μ x 60μ

Body cylindrical. Shield triangular, smooth or traversed by indistinct longitudinal lines. Dorsal seta shorter than the shield, directed upwards; protuberances very near to each other, inserted at posterior end. Rostrum very short. Tibia a little longer than tarsus. Featherclaw 4-radiate. Sternal ridge rigid. Thoracic seta II far removed from the inner coxal angle. Abdomen with approximately 55 rings, mostly smooth. Ventral seta I near ventral seta II. The latter is nearly half as long as the former. Accessory seta absent.

PHYLLOCOPTES ACERICOLA (Nal) (Pl.27)

Plant affected = Acer pseudo-platanus.

Type of Gall = More or less conical but not very pointed on top as in Eriophyes tiliae typicus. Glabrous, gregarious.

Position on Leaf = Scattered in large numbers over upper surface.

Colour = Bright carmine.

Average dimensions = 3 x 1½mms.

Date and Locality = Lota 10/5/'44 Bantry 8/8/'44

Distribution = Rather common.

The interior of these galls is filled with hairs. Very

brightly coloured, and since they occur in such large numbers they are very easily detected. Smaller than Eriophyes tiliae typicus to which they agree in colour but Connold (Br.Veg.Galls) describes them as being more or less round, whereas my specimens were definitely elongated and stood upright on the leaf.

Measurements of Female--~~No~~ x 44

Body compressed. Posterior end of shield wide and strong. Shield large with indistinct delineation carried up on to rostrum. Dorsal seta short and stiff. Rostrum long and firm. Legs short. Featherclaw 4-radiate. Sternal ridge not fixed. Abdomen arched with approx. 21 - 23 smooth dorsal semicircles. Ventral seta I very long. Accessory seta missing. Tail flap small. Cover-flap striped. Genital seta fixed at side, rather long.

PHYLLOCOPTES FRAXINI (Nal) (Pl.25)

Plant affected = Fraxinus excelsior.

Type of Gall = Glabrous, leaflets rolled backwards and inwards.

Position on leaf = Edges of leaflets. May be on one side or both. If the latter, may roll in so as to meet in centre

Colour = Pale green becoming suffused with purple, ultimately turning chocolate-brown

Date and Locality = Bantry June '44.

Distribution = Not uncommon.

These rolls are often tenanted by aphids or other animals. Since the ends are open these little creatures gain very easy access.

Measurements of Male - 140μ x 56μ

" " Female - 190μ x 40μ

Body elongated. Shield half-elliptical, smooth. Anterior end little-marked. Dorsal seta almost as long as the shield, situated well apart from each other at the posterior end. Rostrum large. Legs well proportioned. Tibia almost twice as long as the tarsus. Feather-claw 4-radiate. Sternal ridge not fixed. Abdomen with approximately 40 small smooth dorsal semicircles. Lateral seta a little shorter than the very long Ventral seta I. Ventral seta II long. Caudal seta short. Accessory seta very short, delicate. Epigynum large. Coverflap narrowly striped.

ERIOPHYES GONIOTHORAX (Nal) (Pl.28)

Plant Affected = Crataegus oxyacantha.

Type of Gall = Leaf rolled backwards and inwards. Glabrous, coalescent.

Position on leaf = Edges of leaf lobes.

Colour = Either paler green than remainder of leaf or suffused with red.

Date and Locality = Blarney May-Oct. '43.
Bantry June-Aug. '44.

Average Dimensions = 9mms x 1mm.

Distribution = Common.

These galls are best seen if looked for from below. Then the rolled edges show up well and coloured red are still more easily seen. In leaves which are very badly affected the whole leaf may be considerably distorted.

Measurements of Female - [illegible] x [illegible]

Body cylindrical. Shield almost pentagonal. Wavy long (striated) lines traverse the middle area. Side areas wrinkled. Dorsal seta shorter than the shield, inserted in front of posterior end. Rostrum very short. Tarsus somewhat longer than tibia. Featherclaw 4-radiate. Sternal ridge almost fixed. Abdomen broadly ringed, and widely pitted with about 40 rings. Ventral seta I long. Ventral seta II short. Accessory seta absent. Coverflap arched, smooth. Genital seta fairly long.

ERIOPHYES PIRI APICUS (Nal) (Pl.29)

Plant affected = Pyrus aucuparia.

Type of Gall = Pustulate swellings, gregarious hollow, coalescent.

Position on leaf = Upper surface.

Colour = Greenish-yellow, turning red or reddish-brown.

Date and Locality = Caragh Lake. July '44.

Distribution = Very rare.

These galls were found on one occasion only, i.e. at Caragh Lake Co.Kerry, and here only on one tree which was

rather badly affected. I have looked for it several times at Glengarriff but never succeeded in finding it again. Did not succeed in isolating any of the mites. Connold (Br.Veg.Galls) applies the nomenclature Eriophyes aucupariae to this species, but gives no description of the mite; it is probably a synonym of E. piri typicus(Nal) Nalepa's description of this species agrees with that of Eriophyes piri as given above but abdomen is clearly pitted.

ERIOPHYES BREVITARSUS (Nal) (Pl.22)

Plant affected = Alnus glutinosa.

Type of Gall = Blister-like swellings. Gregarious, glabrous above, slightly pubescent below.

Position on Leaf = Any part of upper surface.

Colour = Green, paler than leaf, often with a sort of whitish hue above. Brownish when old.

Date and Locality = Cork June '42. Bantry June-Sept'44

Average dimensions = Very variable.

Distribution = Common.

The average size of one of these galls would be about 7 X 12 x 20mms. but since they are gregarious and coalescent I have found one enormous blister covering almost the entire leaf-surface so that the leaf appears to be almost semicircular in transverse section.

Measurements of Male - 304 x 304

Measurements of Female - [illegible] x [illegible]

Body cylindrical, elongated. Shield small triangular, delineation mostly indistinct, except for three long lines situated in the middle area. Dorsal seta as long as shield, week, stiff on margins. Snout and bristle short. Tibia and tarsus short. Claw bristle longer than the 4-radiate feather-claw. Sternal ridge not fixed.

Abdomen with 55 to 60 rings coarsely pitted. About 16 rings from the tail-flap are smooth. Lateral setae shorter then the dorsal setae. Ventral seta I almost twice as long. Ventral seta II somewhat shorter. Ventral seta III reaching to the end of body, strong, stiff. Accessory seta absent. Epigynum small. Cover-flap smooth. Genital seta almost fixed at base.

ERIOPHYES LAEVIS (Nal) (Pl.24)

Plant affected = Alnus glutinosa

Type of Gall = Globular, slightly pedunculated, glossy glabrous, hollow beneath.

Position on Leaf = Very numerous on upper surface.

Colour = Green, yellowish-green, yellowish-orange, red-purple to dark brown.

Date and Locality = Bantry 16/7/'44, Sept '44 also.

Typical condition = Several mites in gall

Average dimensions = 2½ x 4½mms

Distribution = Very common.

These galls are extremely common and where they occur,

they do so in very large numbers. In many cases the leaf was so thickly covered with the galls that none of the actual blade was visible, and the whole looked like a mass of various coloured warts. The leaf-blade was bent inwards until the two edges met beneath; they are very easily detected both on account of their colour and shape and the numbers in which they occur.

Measurement of Male - 140μ x 40μ

" " Female - 140μ x 42μ

Body cylindrical Shield semi-circular, smooth or with 3 indistinct longitudinal lines traversing the middle area. Dorsal setae short and meeting at posterior end. Featherclaw 4-radiate. Sternal ridge not fixed Thoracic seta II away from inner coxal angle. Abdomen wide-ringed with about 45 rings. Ventral and dorsal surface almost smooth. Ventral seta I somewhat longer than lateral seta. Accessory setae present. Cover-flap smooth, flat. Genital setae standing out from side and fairly long.

ERIOPHYES NALEPAI (Fockeu) (Pl.23)

Plant affected = Alnus glutinosa.

Type of Gall = Reniform, glabrous, glossy, hollow.

Position on leaf = Upper surface. Always in pairs in axils of lateral veins from midrib.

Colour = Yellowish, red; dark brown when old.

Date and Locality = Bantry 11/7/'44, Cork 3/6/'43.

Average dimensions = 3mms x 4½mms x 3mms

Distribution = Not as common as E. laevis.

These galls always occur in the axils of the lateral veins and vary in colour. Viewed from below, they are hollow and filled with rather woolly hairs many of which project through and partly close the opening below. Always glabrous above. Appear to be smooth but when examined with lens they are found to have tiny cerebriform markings. The mites are colourless.

Measurements of Male - 250μ x 45μ

Body large, cylindrical and spindle-shaped. Shield triangular. Anterior end blunt. Posterior end pointed. Shield marking not distinctly lined Dorsal setae similar to thoracic seta III. Thoracic seta III a little longer. Featherclaw 5-rayed. Abdomen with about 70 rings. Caudal seta long. Accessory seta short and stiff. Tailflap very wide.

(Measurements and descriptions of mites after Nal.)

ORDER V. DIPTERA

General Characteristics of Order.

Insects provided with a single pair of membranous wings, which are never very large. Second pair of wings represented by modified structures called "halteres". Mouth-parts adapted for piercing and sucking. Prothorax not distinct but fused with other thoracic segments. Metamorphosis complete. Larvae apodous, often with head very much reduced. Pupa variable.

This is a very large order of insects whose larval habits are extremely variable. Only four families are phytophagous in the larval stage. i,e. Cecidomyidae, Agromyzidae, Trypaneidae and Oscinidae, but of these the two former only are dealt with here.

Family I. Agromyzidae.

Small family of minute dipterous flies. Larvae usually leaf-miners, having a very wide range of food-plants. They seemingly attack herbs more than trees. Larvae cylindrical, tapering anteriorly and truncated posteriotly. Mouth-parts very strongly chitinized and darker in colour than remainder of body. Small sucker-like disc on ventral surface of anal segment. Puparium broad, rather barrel-like, tapering abruptly at both ends. Segments are very clearly defined; colour generally yellow-ochreous. Anterior and

posterior spiracles very prominent and projecting. Those which are mentioned below pupate within the mine. Imagines are difficult to rear as they seem very prone to attack of Ichneumonidae etc.

No costal bristles. First longitudinal vein short, the auxiliary connected with it at tip; posterior transverse vein far distant from the border. Border of mouth has vibrissa on each side. Third joint of antennae rounded, terminal bristles bare or pubescent.

PHYTOMYZA ILICIS. (Kalt) (Pl.I8)

This species is a Holly-leaf miner. Found from late autumn to March, causing a discoloured blotch in the upper surface of leaves. Pupation takes place within the mine. Puparium is oval in shape and flattened It is marked by a number of regular transverse segments. Brownish-yellow colour. Fly does not appear until April of May of the following year. Rather like a small house-fly in general appearance. Expanse of wings = 4mms. Eyes brown and shining. Body black and pilose. Wings hyaline with dark veins. Ventral surface of abdomen has a faint yellow tinge, and dorsal surface may have very narrow whitish bands.

Very common at Lota Cork.

AGROMYZA RUBI.(Kalt) (Pl.I7)

Larva found in July tunnelling in the leaves of Rubus fructicosus. The mine in this case, unlike

that of the former spedies, starts as a small passage, which widens out into a "Cloud-like billowy mass". Pupation does not occur in the mine in this instance. Fly appears in September and is recognised by its black antennae and prominent dark head.

NAPOMYZA ZYLOSTEI. (Pl.I7)

Star-shaped, ramifying mine in upper surface of leaves of Lonicera periclymenum. Whitish in colour with faeces showing through as a black row. Larva white and inactive. Pupa lies at one end of the radiating passage. Yellowish-brown with longitudinal black streaks on sides. Pupation occurs within mine. These were found in Bantry 10/7/'44 and left to breed. 21/7/'44 two 4- winged flies parasitic emerged - small green metallic Chalcididae.

PHYTOMYZA XYLOSTEI.(Pl.I7)

Mine in upper surface; not branched, but blotch-like or blister-like. Faeces lies on a cloudy mass in middle. Brownish in colour. Two types of fly emerged.

(i) On Aug. Ist. and 2nd. two green metallic Chalcids

(ii) On Aug 3rd. Dacnusa species ? near aphanta Marshall Mr. G.E.J.Nixon (Imp.Inst.Ent.London) whose work on these flies is about to be published and to whom this parasite was sent, says of it "It is certainly very like Dacnusa aphanta,Marshall, and were it not that the stigma is less attenuated, I should be inclined to call it this species"

Family Cecidomyidae.

Very minute flies with very characteristic long antennae which are furnished with peculiar whorls of hair. Wings have a very simple venation. Tibiae without spurs. Larvae of the gall-making species are generally of an orange colour, small (those which I have found varied from I - 3mms. in length) narrowed at both extremities. I3 body-segments, pigment spots present but no true eyes. 9 pairs of spiracles which are clearly visible on close examination. The most interesting structure of the larva is the sternal spatula situated on ventral part of thorax whose function is unknown, but in some which I have studied it seems to assist the larva in leaping.

Pupa enclosed in a cocoon of very fine white threads which form quite a tough pellicle.

DASYNEURA CRATAEGI (Htg) (Pl.I3)

Plant affected = Crataegus oxyacantha.

Type of Gall = Rosette formed by top-most leaves. Each leaf is thickly studded dorsally and ventrally with thick, blunt, papilla-like outgrowths. Each outgrowth has a black tip. The number of leaves comprising the rosette varies, I6 is usual but may be up to 40.

Position on Plant = Only one on each shoot, situated

terminally.

Colour = Same as remainder of the leaves.

Date and Locality = Bantry 9/8/'44

Distribution = Not very common.

Connold (Br.Veg.Galls.) states of these galls that they may be found from June to Oct. and typical condition is multilarval the larvae pupating in the ground, but although I found several of the galls during early August in no case did I find the larvae within the galls. This seems to point to the fact that they leave the leaves to pupate sometime before the beginning of August. Consequently no drawings have been made of the various stages.

RHABDOPHAGA MARGINEMTORQUENS (PlII,I6)(S.8,I6,24. 54,55)

Plant affected = Salix viminalis,

Type of Gall = Glabrous, glossy. Leaves rolled under and inwards.

Position on Leaf = Along one or both edges

Colour = Pale green at first, changing to yellow, red purple and finally blackish

Date and Locality = Bantry I/II/'43. IO/7/'44 9/'/'44 I9/8/'44.

Distribution = Common where Salix viminalis occurs. Difficult to state whether the typical condition of the gall is multi- or uni-larval but would suggest unilarval galls which coalesce to give the multilarval condition.

Simon Lucas

Since in breeding these flies, imagines of the same species emerged during the monthe of July, Aug, from galls found in summer and those found in Nov. did not emerge till the following spring, it follows that there must be several overlapping generations each year.

Larva - 2½mms. Pale orange in colour. Typical Cecidomyid characteristics. Pupa - 2mms enclosed in fine white pellicle. Pupate within the mine (Connold states the contrary)

Imago - ½-⅝line. Black with sides of thorax lighter. Wings covered provided with a greyish down. Cubital vein curved in the middle but straight towards the tip. Second branch of anal vein curved to hind border. In the Male the antennae are I5-I6-jointed and almost as long as body. Basal joints twice as long as their petioles., shorter towards tips. Female antennae I5-jointed, half the length of body. Abdomen having broad, black, hairy bands

Rhabdophaga sp. found 3/8/'44 rolling leaf margins of Salix caprea in the same manner as the former species. Upon examination the larvae did not show any peculiar structural differecns. Length 2½mms. Pale orange. Fly did not emerge.

RHABDOPHAGA TERMINALIS (H.Low) (Pl.40)

Plant affected = Salix fragilis.

Type of Gall = Cone-shaped structure formed by the

top leaves being rolled closely together.

Position on Plant = One at apex of each shoot.

Colour = Same as remainder of plant

Date and Locality = Bantry 9/8/'44

Typical condition = Multilarval

Larva- all stages were found in the galls; varied in length from ½-2½mms. Orange in colour; more sluggish in habits than Rhabdophaga marginem-torquens. Flies emerged- I4/8/'44 and I7/8/'44. Length - I line. Brownish in colour, body tapering towards posterior end, antennae brownish at base. Wings smoky-grey with dark brown veins. Cubital vein curved towards the tip, ending a little distance in front of the wing tip. Second branch of the anal vein curved towards the hind border. Male antennae I9-jointed almost as long as the body; joints equal in length with the petioles. Female antennae I6-jointed; half as long as the body. Abdomen tawny beneath.

RHABDOPHAGA HETEROBIA (H.Low) (Pl.33)

Plant affected = Salix triandra.

Type of Gall = Loose rosette with more or less long white hairs which is not abundant.

Position on Plant = Terminal leaves.

Colour = Pale green.

Typical condition = Multilarval.

Date and Locality = Bantry I2/8/'44.

Distribution = Not very common.

Fly is not quite I line long. Blackish. Wing veins dark brown. Cubital vein straight. Male antennae I7-I9 jointed, almost as long as body. Joints equal in length to the petioles. Female antennae I6-jointed, half the length of body.

RHABDOPHAGA ROSARIA (H.Low) (Pl.I4)

Plant affected = Salix caprea.

Type of Gall = Rosette formed by terminal leaves.

Position on Plant = One at apex of each shoot (In this case only one was found on tree)

Colour = Same as remainder of leaves at first, outer leaves turning brown later.

Date and Locality = Bantry 27/8/44.

Typical Condition = Unilarval

Several leaves go to make up rosette (25 in this instance) Outer larger leaves have midrib very much thickened and broadened at base, and edges of leaves are inclined to be wavy in outline, while innerrleaves are small and stunted. A single pale red larva was found tightly enclosed within the inner-most leaves.

Fly Blackish . Thoras with 2 stripes of hairs, which are light in colour. Length - 2½lines. Veins black and thick. Male antennae 20-24-jointed and as long as body. Basal joints longer than their petioles. Other joints as long as their petioles. Female antennae also 22-24-jointed but only half the length of body.

CECIDOMYIA ROSARUM

Plant affected = Rosa canina.

Type of Gall = Edges of leaflet drawn together until a hollow pod is formed. Glabrous, wrinkled.

Position on leaf = One formed from each leaflet.

Colour = Green exteriorly, reddish-brown internally.

Date and Locality = Bantry 20/8/'14

Typical condition = Multilarval, pupation taking place in the ground but when these galls were discovered all the larvae had left.

METHOD OF EMBEDDING AND SECTIONING GALLS.

The following method was tried and found successful with galls of Dryophanta divisa, Neuroterus lenticularis, Neuroterus numismatis and Nematus gallicola.

(I) Fix the galls in Bouin's fluid for 24 hours. Wash in running water overnight. Dehydrate slowly with 5%,- 30%, 50%, 70% (one hour in each) 85%, 95%, absolute (I2 hours in each) The absolute alcohol must be changed several times.

(2) Clearing. Mix chloroform with the absolute alcohol in the following percentages - 2½, 5, I0, 25, 50, 75, and the pure chloroform for at least two changes. (Add chloroform to alcohol gradually)

(3) Material is now ready for infiltration with paraffin. Add very small shavings of paraffin wax (melting point 50°) from time to time to the clearing reagent until this is finally saturated with partially dissolved paraffin. When saturated place on top of oven. Shake or stir occasionally and add more paraffin chips. In about 24 hours the vials may be placed inside the oven. After about three hours pour off the mixture of chloroform and paraffin and replace immediately with pure melted paraffin. Within next I2 hours make at least two more changes. This is necessary in order to get rid of all traces of chloroform, otherwise the paraffin will crystallise after embedding.

(4) Embedding. Grease trays, pour in contents of vial arranging the material in proper order and quickly cooling. in cold water.

(5) Sectioning. Arrange wax blocks on microtome. When good ribbons got (Heat if day is too cold) float in hot water over slides smeared with egg albumen or Meyer's adhesive. Flood slides with xylol to remove wax; place in absolute alcohol and xylol for several minutes, then into absolute alcohol only and so on down to water.

(6) Staining. Haematoxylon used. Leave for hour in strong stain and overnight in weak stain.

(7) Dehydrate again. Dip slides in Xylol and mount in Canada balsam.

CHEMICAL ANALYSIS OF GALLS OF DRYOPHANTA DIVISA.

It was hoped to be able to extract tannin from these galls but upon analysis the surprising result was the absence entirely of both tannin and gallic acid from this species. This was most unexpected since the galls of Cynips Kollari are so rich in these substances and the two species are closely allied.

7 grms of Dryophanta divisa galls were collected and finely powdered. Ether, alcohol and water were added to the powdered galls which had been placed in a separating funnel. This was filtered slowly through cotton-wool a few times. The filtered solution was allowed to settle and 2 layers were evident. (1) Tannic acid layer and this was kept over sulphuric acid in a dessicator. (2) Gallic acid layer which was first left in the air and then put over calcium chloride in a dessicator, to get rid of any water present from the air.

Sol. I yielded 0.01gr. This was dissolved in water and tested, thus :-- (i) Add Gelatin and heat -- no coagulation. (ii) Add Ferric chloride -- No result (iii) Add Sodium Hydroxide -- Slight brown colouration

Therefore no tannic acid or tannin present.

Sol. II yielded 0.11 grm. but of this only 0.0037 grm was soluble in water. This water-soluble portion was tested, thus :-- (i) Add Ferric chloride --very faint yellow colouration (not the usual colour)

Add Sodium hydroxide -- Faint pink colour in cold which rapidly fades away.

Therefore no Gallic acid present.

The residue probably contains some substance of a fatty nature from the odour, but the amount is probably too small to find out the exact nature of this substance.

It is hoped to continue this section of the work in spring when large quantities of the galls will be available.

The following two tables give respectively (I) List of plants galled with name of Gall-maker, Group, and Date when found, (2) List of gall-makers with host plant, position of gall on same and type of gall.

PLANT.	GENUS and SPECIES of GALL-MAKER.	GROUP.	DATE.
Alnus glutinosa (Alder)	Fenusa melanopoda.	Hymenoptera (Tenthredinidae)	July'43,'44
"	Lithocolletis sp.	Lepidoptera (Tineina)	Nov.'44.
"	Eriophyes axillaris.	Acarina (Phytoptidae)	June-July '43 '44.
"	Eriophyes laevis.	"	July-Sept. '43 '44.
"	Eriophyes brevitarsus.	"	June-Sept. '43 '44.
"	Coleophora sp.	Lepidoptera (Tineina)	Oct. '43.
Acer Pseudoplatanus. (Sycamore)	Phyllocoptes acericola.	Acarina (Phytoptidae)	May '44.
"	Phytoptus macrochelus erobius.	"	Aug. '44.
Crataegus Oxyacantha (Hawthorn)	Dasyneura crataegi	Diptera (Cecidomyidae)	Aug.'44
"	Eriophyes goniothorax.	Acarina (Phytoptidae)	May-Oct'43 June-Aug'44
Fagus sylvatica (Beech)	Orchestes fagi.	Coleoptera (Curculionidae)	May'44.

PLANT	GENUS and SPECIES of GALL-MAKER.	GROUP	DATE.
Fraxinus excelsior (Ash)	Psyllopsis fraxini.	Hemiptera (Psyllidae)	May-July'4
"	Phyllocoptes fraxini.	Acarina (Phytoptidae)	June '44.
Ilex aquifolium (Holly)	Paedisca ophthalmicana.	Lepidoptera (Tortricina)	May-June'4
Jugaands regia (Walnut)	Ebiophyes tristriatus var. erinea.	Acarina (Phytoptidae)	Aug-Nov. '43,'44
Lonicera ⊢Periclymenum. (Woodbine)	Phytomyza zylostei	Diptera (Agromyzidae)	July, Aug. '44.
"	Napomyza zylostei.	"	July,'44 Aug '44
Prunus spinosa (Sloe)	Eriophyes similis.	Acarina (Phytoptidae)	June-Sept '44.
"	Phytoptus padi prunianus var.homophylla.	"	Aug.'44
Pyrus communis. (Pear)	Eriophyes piri.	"	June'44
Pyrus aucupariae. (Mountain ash)	Eriophyes aucupariae.	"	July'44
Quercus robur (Oak)	Fenusa pygmaea	Hymenoptera (Tenthredinidae)	July-Aug '43,'44.
Q "	Neuroterus lenticularis	Hymenoptera (Cynipidae)	July-Nov. '43,'44.
"	" fumipennis.	"	Oct. '43
"	" laeviculis.	"	July'43.

PLANT.	GENUS and SPECIES of GALL-MAKER.	GROUP	DATE
Quercus robur (Oak)	Neuroterus numismatis.	Hymenoptera (Cynipidae)	Aug-Sept. '43, '44
"	Spathegaster baccarum.	"	Aug. '44
"	Spathegaster albipes.	"	July '44
"	Andricus ostreus.	"	July-Oct. '43, '44.
"	Andricus gemmatus	"	July 844.
"	Andricus curvator.	"	July '44.
"	Andricus fecundabrix.	"	Aug. '43, '44
"	Andricus testaceipes.	"	Aug '44.
"	Dryophanta divisa.	"	Aug-Nov '43 '44.
"	Lithocolletis messaniella	Lepidoptera (Tineina)	June-Sept '44.
Ribes nigrum (Black currant)	Rhopalosiphum ribis	Hemiptera (Aphididae)	March '44
"	Myxus ribis.	"	June '43, '4
"	Eriophyes ribis	Acarina (Phytoptidae)	May '43 March, April '44.
Rosa canina (Rose)	Cecidomyia rosarum	Diptera (Cecidomyidae)	Aug '44.
Rubus fructicosus. (Bramble)	Phytomyza rubus	Diptera (Agromyzidae)	Oct '43

PLANT.	GENUS and SPECIES of GALL-MAKER.	GROUP.	DATE.
Salix. (Willows) Various species.	Nematus viminalis.	Hymenoptera (Tenthredinidae)	June-Sept. '43, '44.
"	Nematus gallicola	"	Oct. '43. June-Sept. '44.
"	Nematus leucostictus	"	Aug. '44.
"	Rhabdophaga marginem-torquens.	Diptera (Cecidomyidae)	Nov. '43 July-Aug. '44
"	Rhabdophaga terminalis	"	Aug. '44.
"	Rhabdophaga heterobia.	"	Aug. '44.
"	Rhabdophaga saliciperda	"	Aug. '44
"	Rhabdophaga rosaria	"	Aug. '44
"	Cecidomyia bosarum	"	Aug. '44.
"	Depressaria conterminella	Lepidoptera (Tineina)	May '44.
"	Lithocolletis salicicolella	"	Dec. '43
"	Epunda viminalis	"	July '44.
"	Taeniocampa cruda	"	Aug. '44.
"	Eriophyes tetanothrix laevis	Acarina (Phytoptidae)	July '44.
"	Unidentified	Lepidoptera.	Aug '44.

PLANT.	GENUS AND SPECIES OF GALL-MAKER.	GROUP	DATE
Tilia Europea (Lime)	Eriophyes tiliae-typicus.	Acarina (Phytoptidae)	Oct '44.
Ulmus campestris (Elm)	Schizoneura ulmi.	Hemiptera (Aphididae)	June'44.

GALL-MAKER.	GROUP.	PLANT ATTACKED.	POSITION ON LEAF.
Andricus curvator.	Hymen.	Quercus robur.	On aborted leaves or sides of developed leaves.
Andricus fecundatrix.	"	"	Enveloped in leaf bud scales.
Andricus gemmatus.	"	"	Buds or young leaves.
Andricus ostreus.	"	"	Under surface, generally attached to midrib.
Andricus testaceipes.	"	"	Petiole or midrib.
Aphis pomi.	Hemipt.	Pyrus malus.	Whole leaf involved.
Cecidomyia rosaria.	Dipt,	Salix caprea.	All leaves at apex of twig involved.
Coleophora sp.	Lepid.	Alnus glutinosa.	Both surfaces.
Dasyneura crataegi.	Dipt.	Crataegus oxyacantha.	All leaves at tip of twigs involved.
Depressaria conterminella	Lepid.	Salix viminalis.	Top-most leaves involved.
Epunda viminalis.	"	"	EDge.
Eriophyes aucupariae.	Acar.	Pyrus aucupariae.	Upper surface of leaflets.
Eriophyes axillaris.	"	Alnus glutinosa.	Upper surface between midrib and lateral vein.
Eriophyes brevitarsus.	"	"	Upper surface. Midrib may be involved.
Eriophyes goniothorax,	"	Crataegus oxyacantha.	Edges of leaf lobes.
Eriophyes laevis .	"	Alnus glutinosa.	Upper surface.
Eriophyes piri.	"	Pyrus communis.	Both surfaces.
Eriophyes ribis.	"	Ribes nigrum.	Leaf buds.

TYPE OF GALL.

Large green irregular swellings with brown seed-like inner gall.

"Artichoke gall" Small acorn-like gall within the scales.

Oval, narrowing towards base.

Ovoid, yellowish, speckled red, like miniature birds eggs, situated between two brown scales.

Elongated swellings.

Curling of leaves.

Rosette of leaves on tips of twigs. Midrib very thickened and broad.

Blister-like mine at first. Larval case attached to leaf.

Rosette of leaves at tips of twigs. Each leaf has short, thick papillae from both surfaces.

Unites topmost leaves.

Folds back edge of leaf.

Pustulate.

Reniform, always in pairs.

Blister-like swellings.

Margins of leaf lobes curl downwards and under.

Very numerous slightly pedunculate, glabrous.

Gregarious, pustulate.

"Big Bud".

GALL-MAKER.	GROUP.	PLANT ATTACKED.	POSITION ON LEAF.
Eriophyes similis.	Acar.	Prunus spinosa.	Mostly upper surfade.
Eriophyes tetanothrix laevis.	"	Salix caprèa	Upper surface.
Eriophyes tiliae typicus.	"	Tilia Europea.	Upper surface.
Eriophyes tristriatus.	"	Juglands regia.	Upper surface, between lateral veins.
Fenusa melanopoda.	Hymen.	Alnus glutinosa.	Between upper and lower epidermis.
Fenusa pygmaea.	"	Quercus robur.	"
Lithocolletis messaniella	Lepid.	Alnus glutinosa.	Lower surface.
Lithocolletis messaniella	"	Quercus robur.	"
Lithocolletis salicicolella.	"	Salix.	"
Myzus ribis	Hemipt.	Ribes nigrum.	Upper surface.
Nematus gallicola	Hymen.	Salix fragilis.	Projecting equally from both surfaces.
Nematus leucostictus.	"	"	Entire edge.
Nematus viminalis.	"	"	Under surface, attached to midrib.
Napomyza zylostei.	Dipt.	Lonicera periclymenum.	Under aurface.
Orchestes fagi.	Col.	Fagus sylvatica.	Outer half.
Paedisca ophthalmicana.	Lepid.	Ilex aquilifolium.	All leaves of terminal shoot involved.
Phyllocoptes fraxini.	Acar.	Fraxinus excelsior.	Edges of leaflets. Generally only one half of each.

TYPE OF GALL

Pubescent aperture below, fringed with fine hairs.

Thick-walled with aperture beneath. Pubescent above, glabrous below.

Conical, glossy, bright-red or purple. Very numerous.

Erineum.

Blister-like mine.

"

Puckered mine-like blotches.

Puckeredd blotches. Tissue-paper effect beneath.

Puckered blotches.

Pustulate, reddish.

Bean-shaped bright red. May have hole at one end.

Folding back of leaf.

Pea gall.

Mined galleries.

Blister-like blotch.

Unites leaves of terminal shoots.

Edges of leaflets curled downwards and inwards.

GALL-MAKER.	GROUP.	PLANT ATTACKED.	POSITION ON LEAF.
Phyllocoptes acericola.	Acar.	Acer pseudo-platanus.	Upper surface.
Phytomyza ilicis.	Dipt.	Ilex aquilifolium.	Mostly upper surface affected.
Phytomyza zylostei.	"	Lonicera periclymenum.	"
Phytomyza rubus.	"	Rubus fructicosus.	"
Phytoptus macrochelus erobium.	Acar.	Acer pseudo-platanus.	Upper surface.
Phytoptus padi prunianus, var. homophylla.	"	Prunus spinosa.	Mostly edges of leaves.
Psyllopsis fraxini.	Hemipt.	Fraxinus excelsior.	Edges of leaflets.
Neuroterus fumipennis.	Hymen.	Quercus robur.	Ventral surface.
Neuroterus laeviculis.	"	"	"
Neuroterus numismatis.	"	"	"
Rhabdophaga marginem-torquens.	Dipt.	Salix viminalis.	One or both leaflets.
Rhabdophaga rosarum.	"	Rosa canina.	Leaflets.
Rhabdophaga saliciperda.	"	Salix viminalis.	Petioles and twigs.
Rhabdophaga heterobia.	"	"	Terminal buds.
Rhabdophaga terminalis.	"	Salix fragilis.	Topmost leaves.

TYPE OF GALL.

Rather high narrow, bright red, gregarious.

Mined leaves. Blotch-like mines.

Mined leaves. Tortuous mines.

Mined leaves. Tortuous mines.

Erineum.

Pouch-like.

Rolled edges of leaflets. All leaflets usually affected.

Circular, depressed in centre. Sides hairy. 2mms.

Circular, distinct knob in centre, bare sides curled up.

"Button gall". Circular depression in centre.

Edges of leaves rolled downwards and under.

Edges pf leaflets drawn together to form pad-like recess.

Large woody galls.

Terminal bud forming come-shaped structure.

Terminal leaves joined united together.

GALL-MAKER.	GROUP.	PLANT ATTACKED.	POSITION ON LEAF.
Rhopalosiphum ribis.	Hemip$.	Ribes nigrum.	Upper surface.
Neuroterus lenticularis.	Hymen.	Quercus robur.	Ventral surface.
Schizoneura ulmi.	Hemipt.	Ulmus campestris.	Upper surface.
Spathegaster albipes.	Hymen.	Quercus robur.	Leaf margins.
Spathegaster baccarum.	"	"	Ventral surface, attached base appearing through upper surface.
Taeniocampa cruda.	Lepid.	Salix caprea.	Edge of leaf.

TYPE OF GALL.

Blister-like swellings and curling of leaf.

"Spangle gall". Lenticular, very numerous, flat beneath but with small knob for attachment. Sides slightly curled up.

Distortion and oblique curling of leaf.

Oval, pale-yellow, puckering the leaves.

Round, green, soft, succulent.

Folding back edge of leaf.

KEY TO LEAF-GALLS.

I. On ALNUS GLUTINOSA. (alder) II.

(I) In the axils of lateral veins and mid-rib. (2)

(i) Reniform, always in pairs. - - - - Eriophyes axillaris (Acar)

(2) Blister-like swellings on upper surface. (3)

(i) May involve midrib, hollow beneath --- " brevitarsus (Acar)

(3) Very numerous, slightly pedunculated, glabrous galls on upper surface. - - - - - Eriophyes laevis. (Acar)

(4) Mined leaves. (5)

Caused by Hymenopterous larva.

(i) Cocoon spun in mine, larva solitary or 2 or 3 together; Spring or Autumn. - - -Phyllotoma vagans. (Hymen)

(ii) No cocoon in mine; brown blister, shows mostly on upper surface. July-Sept. Fenusa melanopoda. (Hymen)

Caused by Lepidopterous larva.

(a) Larva with I4 feet, pupating within mine, with empty pupal case protruding through skin of leaf after imago has escaped. Mines either on upper or lower surface, not on both

(i) Under surface of leaf, July or Autumn, constructing a firm ochreous cocoon. Lithocolletis alnifoliella.

(ii) Under surface of leaf, resembling(i) " Klemanella.

(iii) Under surface of leaf, July or Autumn. - - - - - - - Lithocolletis Frolichiell

(iv) Upper surface of leaf, small mine placed exactly along a midrib, not between two veins.- Lithocolletis stillinensis.

(b) Whitish or brown mines with round hole in lower cuticle and larva living in case attached to underside of leaf.

† Coleophora sps.

Caused by Dipterous larva.

(i) Upper surface, narrow tunnels at first, later distending considerably - - - Agromyza albitarsus.

(5) Rolled or folded leaves.

Caused by Hymenopterous larva.

(i) Edge of leaf rolled down into a tube, the roll being kept together by silken threads. July. Pamphilius depressus.

Caused by Lepidopterous larva.

(i) Leaf rolled up into a cone. Larva 14-footed, devours interior of cone - discoloured. May or Aug. Gracilaria alnifoliella.

(ii) One side of leaf curled over other or leaves united together. Larva(Geometridae) rests in curve. Loops actively when disturbed. $\frac{7}{8}$". Ypsipetes implutiata

Caused by Dipterous larva.

(i

(i) Leaves folded, veins thickened along basal portion, larva gregarious. Cecidomyia tortilis.

II. On BETULA ALBA. (Birch) III.

(I) Swollen leaf buds. Eriophyes rudis (Acar)

(2) In axils of lateral veins and midrib. (3)

(i) One gall in each axil, generally 6 on leaf, elliptical, reddish-brown, inconspicuous at first, but rising above surface of leaf blade for about 2 or 3mms. in Aug. Found May to Oct. Eriophyes lionotus

(3) Mined leaves (4)

Caused by Hymenopterous larvae.

(i) Mines near edge or tip. Solitary. Cocoon spun within mine, June, July or Autumn. Phyllotoma nemorata

(ii) Cocoon not spun in mine. Gregarious, 7 or 8 in leaf. June or Autumn. Fenusa betulae.

(iii) Cocoon not spun in mine. 4-10 in leaf. Mines separate at first but become united. Larva white, with greenish tinge; head pale brown; 2nd. segment has black dumb-bell shaped mark ventrally with round black dot in centre of 3rd. and 4th. segments. Feet encircled with black.

Fenusa pumila.

Caused by Lepidopterous larva,

(i) Young leaves mined in May and June. Incurvaria pectinea.

(ii) Undersurface of leaves. July and Autumn. Lithocolletis ulmifoliella

(iii) Small tortuous mines in July. Neptiduca argentipodella.

(iv) Leaves mined at first, then edge turned down and flat ochreous cocoon spun. Ornix betulae.

(4) Rolled leaves (Lepidopterous larva) (5)

(i) Leaf rolled into a cylinder and secured with silked threads. Phlaeodes immundana.

(ii) Leaf rolled into a cylinder at right angles to midrib and internal portion eaten. Paedisca Solandriana.

(5) United leaves (Lepidopterous larva) (6)

(i) 2 or 3 leaves drawn together by a conspicuous white web and larva pupates withib this nest. Pemphelia formosa

(ii) Two leaves spun together first or corner of a leaf

turned down where larva feeds for a few days and then a considerable number of threads agglutinate the leaves together in various directions. Pemphelia betulae.

(iii) Leaves united in Sept. Gelechia proximella.

(iv) Leaves united in Sept and Oct. Chemibacche fagella

(6) Leaf puckered by a web of white silk spun in Sept. by Lepidopterous larva. Paramesia ferrugata

(7) Abnormal pilosity without deformation of upper surface Small felt-like masses. Carmine in spring, blood-red in autumn. Eriophyes rudis var, langisesot

III ON FAGUS SYLVATICA. (Beech) IV.

(I) Swollen leaf buds Phytoptus caycophthirus (Acar)

(2) Pyramidal galls, 4mms high, green, yellow, or red; on upper surface of leaf. Hormomyia fagi (Dipt)

(3) Pilose gregarious galls, yellowish, deepening to red; on upper surface near midrib. Hormomyia piligera (Dipt)

(4) Hairy galls on upper surface " bipunctata "

(5) Pod-like formation of leaf Monochetus sulcatus (Acar)

(6) Leaves cut and rolled lengthwise to resemble a funnel. Deporaus betulae (Col)

(7) Mined leaves.

Caused by Lepidopterous larva.

(i) Under surface mined in Autumn. Lithocolletis faginella

(ii) Broad galleries mined towards margins in July and Autumn. Neptiluca tityrella

Caused by Coleopterous larva.

(i) Large blister-like blotches on outer part of leaf,

starting as small thread half way down the midrib, then continuing straight across to outer edge. Gives trees an autumnal tint. Orchestes fagi.

(8) Leaves contracted along lateral veins Phyllaphis fagi.

(9) Eriineum gall on lower surface, hairs white at first, then red, finally brown. Eriophyes nervisequus maculifer(Acar)

(I0) Leaf folded and lateral veins hypertrophied, blade thickened, covered with hairs, sometimes tinted red. Eriophyes stenaspis(Aca

IV. On PYRUS AUCUPARIA. (Mountain Ash) V.

(I) Lenticular pustulate galls on upper surface of leaflets Eriophyes aucuparia (Acar)

(2) Leaf rolled down on either side or 3 upper leaflets spun together. Larva (Hymenopterous) clear bluish-green, head reddish-brown,,shining; on underside of anterior segments are, on each side a black streak, reaching to first pair of legs. Pamphilius sylvaticus (Hymen)

(Caused by Lepidopterous larva.

(3) Leaves united. Sept. and Oct. Chemibacche fagella

(4) Leaflets turned down Aug. and Sept. Semioscopis Steinkellneriana.

(5) Leaves mined Aug. and Sept. Quits mine before pupating and turns down portion of edge of leaf, but this does not assume a conical form. Flat ochreous cocoon. Ornix Scoticel Scoticella

V. On RUBUS FRUCTICOSUS. (Bramble) VI.

(I) Rolled or folded leaves (2)

Caused by Lepidopterous larva.

(1) Rolled or folded leaves, larva very active when disturbed, frequently pupating within these larval habitations Lozotaenia musculana

(2) Leaves united together.

Caused by Lepidopterous larva

(1) Young leaves spun together and much contorted Lozotaenia Udmanniana

(ii) Leaves united, larva full-red in Sept. Lozotaenia sorbiana.

(3) Mined leaves.

Caused by Hymenopterous larva.

(1) Causing great damage to bushes, two broods, July and August, or Sept. and October. Larva 9-10 lines, dirty white, eye-spots black; thoracic legs banded with brown; abdominal marked posteriorly with a semicircular black mark; anal pair surrounded with black. 2nd, segment has a black band on back. 3rd and 4th may also have narrow black band. Markings cast off at last moult. Fenusa pumilio.

Caused by Lepidopterous larva.

(1) Long tortuous galleries which may be found every month of year. Makes singular flattened cocoon with scalloped edges. Neptiluca aurella

(ii) Ordinary mines found July, Autumn and Winter only Tischeria marginea

Caused by Dipterous larva.

(1) Upper surface, wide tunnels. Agromyza spireae.

(ii) Upper surface. Small thread-like mine widening into a "Cloud-like billowy swelling"; July and Aug. Agromyza rubi.
(Fenusa pumilio also affects Rubus idaeus, Raspberry, to which it does such great injury that a proper supply of fruit is not produced for two or three years)

VI. On CORYLUS AVELLANA (Hazel) VII.

(I) Swollen leaf buds. Eriophyes avellanae (Acar

(2) Leaf folded longitudinally by grass-green Lepidopterous larva with coronet of 8 rays on the anal segment. Tortrix corylana (Lepid)

(3) Mined leaves

Caused by Lepidopterous larvae.

(i) Extremely narrow tortuous galleries in July and Autumn. May be up to 30 in one leaf Neptiluca microtheriella

(ii) Broad tortuous galleries. Rarely more than 6 in one leaf. Cocoon very flossy. Neptiluca floslactella.

(iii) Mines on under surface of leaf, July and Autumn. Lithocolletis Nicellii.

(iv) Mines on upper surface of leaf. Large white blotches very conspicuous. When larva is full fed it causes leaves to pucker very much, therefore age known by amount of distortion. Lithocolletis coryli.

(v) Like Lithocolletis mine but larva leaves before pupating, therefore no pupal skin protruding. Turns down portion of edge of leaf and spins here a flat ochreous cocoon. Ornix avellanae.

VII. On RIBES NIGRUM (Black Currant) VIII.

(I) Swollen buds ("Big Bud" disease) Eriophyes ribis(Acar)

(2) Blistered and curled leaves

(i) Bright orange-red and brown blisters causing leaves to curl into knots and bunches. Aphids yellow with head and thorax black. April to July. Rhopalosiphum ribis. (Hemipt)

(ii) Similar deformity due to bright yellowish-green aphids with red eyes. May to July. Myzus ribis(Hemipt)

VIII. On RIBES RUBRUM and RIBES GROSSULARIA. IX.
(Red Currant) (Gooseberry)

Vide VII (2)

IX. On ULMUS (Elm) X.

A. On Ulmus glabra (Wych Elm) B.

(I) Galls on midrib. Pemphigus pallidus(Hem)

B. On Ulmus campestris(English Elm)

(I) One half of leaf blistered and rolled under obliquely Schizoneura ulmi (Hemipt)

(2) Densely hairy gall-like masses at tips of twigs, green or brownish, corrugated . Schizoneura lanuginosa(Hem

(3) Leaves united by Lepidopterous larva (4)

(i) Larva full fed in June Oxygrapha Boscana

(ii) Terminal leaves spun together. Larva pale olive-green

5-6 lines. Head shining black and hairy; shield black; 2nd and 3rd segments having a row of 4 oval greyish spots placed transversely and 2 smaller ones on each side. Anal segment has 2 transverse rows of dots followed by an oval patch of minute greenish dots Hedya trimaculina.

(iii) Two leaves united at first, or corner of leaf turned down and fastened with a few threads, then several leaves agglutinated together in various directions. July and Aug. Pempilia fusca.

(4) Mined leaves. (5)

Caused by Hymenopterous larva.

(i) Several larvae in same leaf, 5 lines, whitish with head pale brown; 2nd segment has black oblong plate ventrally, sometimes with a dot on either side; small black central dot on each of the following segments. No cocoon spun in mine. May and June. Fenusa ulmi.

Caused by Lepidopterous larva.

(i) Minute tortuous mines in August. Bucculatrix Boyerella.

(ii) Mines on under surface in Autumn and July. Blueish-green cocoon. Lithocolletis scherberella.

(iii) Mines on upper surface in Autumn. " tristrigella.

(iv) Bright green larva making convolutions of its narrow mine so close together that they form brown blotches in Autumn. Neptiluca viscerella.

(v) Yellowish larva making long Not intertwined gallery frequently at leaf edges, going in and out of each serrature. Autumn and July. Neptiluca marginicolella.

Caused by Coleopterous larvae.

(1) Blister-like mine on outer part of leaves giving them a frosted or autumnal appearance. Cocoon spun within mine. Orchestes ulmi.

(5) Irregular and pedunculated galls on midrib and upper surface. ¼". Entrance guarded by hairs. Found about middle of May. Tetraneura ulmi. (Hemipt)

(6) Basal part of midrib swollen to form a bursiform growth and leaf bent at right angles. Tetraneura alba. (Hemipt)

(7) Galls projenting 1mm from upper surface, showing as a little cylindrical prominence below. Eriophyes ulmi (Acar)

X. On CRATAEGUS OXYACANTHA (Hawthorn) XI.

(1) Round or lenticular swellings on both surfaces. Very numerous, 2mms. May to Nov. Eriophyes crataegi (Acar)

(2) Rosette of leaves at tip or twig, each leaf studded above and below with thick, blunt papillae. Dasyneura crataegi (Dipt)

(3) Margins of leaf-lobes curled downwards and under Eriophyes goniothorax (Acar)

(4) Swollen pouched and rolled leaves at top of shoots, forming tangled and curled masses. May to late July. Aphis crataegi (Hemipt)

(5) Shrivelled leaves May to July. Aphis mali. (Hemipt)

(6) Leaves united by Lepidopterous larvae. (2)

(1) Leaves united by shining white silk spun by Tortrix larva. 7 lines, yellowish. Head hazel, shining; shield very transparent, yellowish-green shaded with pale brown posteriorly; spots small, concolorous, shining and

elevated; anal segment with a rugose opaque green patch not punctured. Hairs sulphur-coloured. Legs with bases of joints broadly black. Dictyopterix contaminana.

(ii) Leaves united in summer by Tineina larva Exapate gelatella

(7) Leaves folded under. Aug and Sept. Stemioscopis Steinkellneriana (9)

(8) Mined leaves.

Caused by Lepidopterous larva.

(i) Under side of leaf mined. Lithocolletis pomifoliella

(ii) Large, flat dark-brown blotches. Chemiostoma scitella.

(iii) Tortuous mines when young, later larvae feed on leaf. Bucculatrix crataegi.

(iv) Long galleries made by bright green larva in Autumn. Neptiluca oxyacantha

(v) Mines made by yellowish larvae in Autumn. No specific character. } Neptiluca pygmaella, " ignobiella, " gratiolella.

(9) Blackish-brown puckers; single or coalescing; often banded along median vein, forming thus a sort of pucker. Myzus oxyacantha (Hemipt)

XI. On CYTISUS SCOPARIUS. (Broom) XII.

(1) Axillary buds galled to resemble unopened flower-buds with single larva inside. Asphondylea sarothamni.

(2) Axillary buds replaced by spherical mass of leaflets 3-15mm in diam. covered with a grey felt. Leaflets generally have edges rolled upwards. Eriophyes genistae. (Acar)

(3) Leaves mined by Dipterous larva.

(i) Swollen mines beginning on vein at outer edge of leaf June and July Agromyza de meijerei.

(ii) Mines not swollen. Phytomyza cytisi.

XII. On FRAXINUS EXCELSIOR (Ash) XIII.

(I) Leaflets folded or rolled (2)

Caused by Acarina.

(i) Edges of leaflets curl downwards and under. Usually only one half of leaf rolled; pale green with purple blotches, ultimately turning brown .Phyllocoptes fraxini

Caused by Dipterous larvae.

(i) Abnormal swellings on raches or midrib, causing leaflets to bend upwards and meet to form a pea-pod-like recess. Several larvae in cells. Diplosis botulariae.

Caused by Lepidopterous larvae.

(i) Leaf folded longitudinally. Larva 10 lines long, grass-green with anal segment terminated by a coronet of 8 rays. Tortrix corylana.

Caused by Hemiptera.

(i) Leaflets rolled towards centre somewhat obliquely; brown with mottled streaks. Become flabby when removed from plant. Distinguished from (I) by presence of much flocculent matter within roll, and whole of the compound leaf being injured. Psyllopsis fraxini.

(2) Mined leaves. (3)

Caused by Dipterous larvae.

(i) Upper surface. Rather short passages. Napomyza heringi

Caused by Lepidopterous larvae.

(i) Mines leaves in June or Sept. Several larvae living in mine. Later may construct cones by rolling up a portion

of the leaf, then devour inner portion of the cones. Young mining larvae have 3 pr. ventral legs and 2 anal prolegs, but to see them requires a good microscope. Gracillaria syringella.

(3) Pouch-like elongated gall on petiole or midrib, opening by a vent on upper surface. Tinged with red. Larvae gregarious Perrisia fraxini. (Dipt)

XIII On TILIA EUROPEA. (Lime) XIV.

(I) Conical, glossy bright red or purple "Nail gall" on upper surface. Eriophyes tiliae typicus (Acar)

(2) On petioles or stems. Pea-like, green on one side, red on other; contain up to 20 or more cells each inhabited by a bright yellow larva having leaping powers. Dasyneura tiliae-volens (Dipt)

(3) Margins of leaves curled upwards and thickened; central part becoming pouched. Eriophyes tetratrichus (Acar)

XIV. On SYRINGA. (Lilac) XV.

(I) Leaves blistered by lepidopterous larvae living gregariously. Gracillaria syringella

XV. On LABURNUM. XVI.

(I) Dirty whitish-green mine on upper surface. Chemiostoma laburnella (Lepid)

XVI. On HEDERA HELIX. (Ivy) XVII.

(I) Some leaves united and corners of others turned down. Tortrix forestrana. (Lepid)

XVII. On PYRUS COMMUNIS. (Pear) XVIII.

(I) Gregarious pustulate galls on both surface. Eriophyes piri (Acar)

(5) Mined leaves.

Caused by Hymenopterous larva.

(i) Blotch between upper and lower epidermis with opening at edge to expel frass. Cocoon spun in mine. Phyllotoma aceris.

Caused by Lepidopterous larva.

(ii) Mine on under surface. July and Autumn. Lithocolletis sylvella.

XXI. On CARPINUS BETULAE. (Hornbeam) XXII.

(I) Mines caused by Lepidopterous larvae.

(i) Upper surface. July and Autumn. Lithocolletis carpinicolella.

(ii) Under surface. July and Oct. " Messaniella.

(iii) Under surface. July and Autumn. " Gramerella.

(iv) Broad tortuous galleries. Rarely more than 6 in one leaf. Cocoon very flossy. Neptiluca floslactella.

(v) Extremely narrow, tortuous galleries. May be up to 30 in one leaf. Neptiluca microtheriella.

XXII. On PRUNUS SPINOSA (Sloe) XXIII

(I) Pubescent rather numerous galls mostly on upper surface. Aperture below fringed with hairs. Eriophyes similis.(Acar)

(2) Around edges of leaves only; pouch-like formations with thick walls; creamy-yellow suffused with pink or purple. Phytoptus padi prunianus var. homophyll

(3) Galls on leaves (?) Cecidomyia pergandei (Dipt) Eriophyes (Acar)

(4) Leaves united together. Mycelotis marmorea (Lepid

(5) Rolled leaves. Ypsolophus fasciellus "

(6) Mined leaves. July and Sept. Ornix torquilella. "

(7) Large white blotches. July and Autumn. Neptiluca plagicolella.(Lepid)

(8) Leaf slightly deflexed by slight web spun on the under surface by pale green Lepidopterous larva. Enicostoma lobella

(9) Leaves shrivelled up by thousands of aphids which swarm under the leaves, closing the pores and gumming them up with a glutinous secretion. Hyalopterus pruni. (Hemi pt)

XXIII. On ROSA (Rose) XXIV.

(I) Spherical pale green galls, suffused with pink, 3-5mms. May be found either on upper or lower surface of leaf or even on petiole and are attached only by a small point to the stall or leaf-vein. Rhodites eglanteriae (Hym)

(2) "Bedeguar galls" 35mms. Globular, sessile covered with moss-like hairs containing numerous cells. Situated on the stem but originate from a leaf. Rhodites rosae. (Hymen)

(3) Globular pale green galls suffused with pink, 4-6mms. attached by narrow point to under surface of leaf-vein. Distinguished from (I) by having 5 or less stout sharp-pointed spines radiating from the surface. July. Rhodites nervosus

(4) Hard, woody, irregular galls on leaf or petioles, beset with prickles. Distinguished from (I) by forming an integral part of plant and are seldom as irregular. May occupy almost entire one side of leaf and part of latter may extrude through gall; may project through both sides or one only ; may occupy entire leaf or only a fringe of it. Rhodited spinosissima

(5) Like (2) but smaller, more fragile and not as common. Rhodites rubiginosa (Hymen)

(6) Leaflets closed in to form a pod-like growth. Cecidomyia rosarum (Dipt)

(7) Terminal leaves united. Spilonota roborana (LEpid)

(8) Terminal leaf folded longitudinally along midrib and slightly

fastened to contiguous leaves. Croecia Bergmanniana (Lepid)

(9) Bud and overlapping leaf drawn together by silken threads Pterophorus rhododactylus (Lepid)

(IO) Mined leaves

Caused by Lepidopterous larva.

(i) Mines between upper and lower epidermis, then mined portion cut off to form case in which larva lives.

Coleophora gyrphixpennella.

(ii) Long tortuous galleries made by yellow larva. Orange or brown cocoon frequently made in foot-stalk of leaf. Neptiluca anomalella.

(iii) Large blotches made by pale green larva Neptiluca angulifasciella.

Caused by Dipterous larva.

(i) Whitish mines in upper surface. Agromyza spiraea.

XXV. On ACER PSEUDO-PLATANUS. (Sycamore) XXVI.

(I) Numerous bright red, slender, high galls, on upper surface. Phyllocoptes acericola (Acar)

(2) Erineum galls on upper surface. Pale green or yellowish above, brown felt-like texture below. Phytoptus macrochelus erobius (Acar)

(3) Round pea-like galls, yellow or red, on lower surface, scarcely visible on upper surface. Sometimes on petiole. Pedaspis aceris (Hymen)

XXVI. On SAMBUCUS NIGRA (Elder) XXVII.

(I) Mines caused by Dipterous larva, on upper surface of leaf several larvae in one tunnel. Liriomyza amoena.

XXVII. On JUGLANDS REGIA (Walnut) XXVIII.

(I) Erineum galls on upper surface between lateral veins Eriophyes tristriatus var. erinea

XXVIII. On RHUS CERASUS. (Wild Cherry) XXIX.

(I) Rosette of leaves at tips of twigs. Myzus cerasi (Hem)

(2) Leaf folded longitudinally. Tortrix corylana (Lepi

XXIX. On ROSA EGLANTERIA (Sweet briar) XXX.

(I) Terminal leaves spun together. Spilonota robrana (Lep

XXX. On VIBURNUM OPULUS. (Guelder Rose) XXXI.

(I) Reddish-brown spots or patches on both surfaces of leaf. Very local. Eriophyes viburni. (Aca

(2) Leaf folded longitudinally on one side, then upper part folded down at right angles to first fold. Leaves present a very crumpled appearance. Peronea tristana (Lepid)

(3) Lenticular pustules on upper surface, tinted with red; scarcely any projection below where they are yellowish or white. Larva yellowish. Oligotrophus solmsii (Dipt)

XXXI. On QUERCUS ROBUR. (Oak) XXXII.

(I) Folded, rolled or united leaves. (2)

Caused by Lepidopterous larva.

(i) Edges of leaves turned down and secured with 3 or 4 stout silk threads, or part of one leaf joined to another by similar means. Found from August onwards. Larva $\frac{3}{4}$", thick and cylindrical; skin covered with exceedingly short fine pubescence resembling the pile of very fine silk velvet. Herminia derivalis.

(ii) Web of whitish-grey silk holding upper surface of leaf folded together at ends and sides, also drawn up a little so as to form a hollow in middle of leaf. Herminia memoralis

(iii) Upper surface of leaf folded together longitudinally and edges spun closely together from one end to another. Each leaf tenanted by one larva with an accumulation of

frass at one end. Feeds within chamber or inner portion of leaf, leaving venation and outer cuticle untouched. "Vaulted Chamber Maker". Anchylophora mitterbacheriana.

(iv) Both edges of leaf folded upwards to within ¼" of each other and held by means of a quantity of highly spun web. Larva devours leaf by eating holes between the veins. Cryptoblabes bistriga.

(v) Leaves twisted and spun together, having the green cuticle dissected away, and quantities of frass spun up with them. June. Acrobasis consociella.

(vi) Leaves curled up for shelter by larva of "Oak Leaf Roller Moth". Feed most voraciously in May and June, completely defoliating the trees. When disturbed, lower themselves by a slender thread. Tortrix viridana.

(2) Situated on under surface of leaf, not attached to midrib or lateral veins. (3)

A. Attached to leaf by a point, gregarious, found in Autumn. B.

(i) Round, depressed in centre, sides covered with golden silky hairs, gall itself red. 2mms. "Button Gall". Neuroterus numismatis. (Hymen)

(ii) Flat, not covered with golden hairs.

(a) Almost glabrous, irregularly circular, margins slightly curled up, with distinct knob in centre, 4mms. Scattered over leaf but never in very great numbers. Neuroterus laevisgulis. (Hymen)

(iii) Flat, covered with stellate hairs.

(a) Margins not curled up, the top broadly concave, reddish, bottom glabrous, pale yellow, never red. 4½mms. Very numerous. Neuroterus lenticularis. (Hymen)

((b) Margins distinctly curled up, small knob-like elevation in centre, bottom pilose, red or reddish-brown; never

more than 3mms. Neuroterus fumipennis. (Hymen)

B. Round soft, succulent, projecting a little through upper surface of leaf, appearing in Spring or early Summer. C.

(i) Pea-shaped, glabrous, green, with or without reddish cheeks. Larval chamber surrounded by a whitish layer. 5-6mms. May and June. Spathegaster baccarum. (Hymen)

(ii) Small, roundish, covered with long glistening white hairs. 3-4mms. June and July. Spathegaster tricolor. (Hymen)

C. Attached to midrib and, or, lateral veins. D.

(a) Soft and succulent.

(i) Attached to midrib by very small part only, yellowish white with bright red cheeks. Largest of pea-shaped galls found on undersurface of leaf. 3-12mms. July. Dryophanta folii. (Hymen)

(ii) Kidney-shaped, crowded together along the veins, greenish yellow, sometimes reddish, 2-3mms. Autumn. Trigonaspis megaptera renum. (Hymen)

(b) Hard and woody.

(i) Depressed at top and bottom, smooth, glabrous, whitish-yellow with bright red cheeks, larval cavity small. Walls thick. 5mms. July to Oct. Dryophanta divisa. (Hymen)

(ii) Apex not depressed, surface rough and gibbous, whitish yellow, frequently marked with reddish bands. Central cavity small. Walls thick. 7-8mms x 4-5mms. August. Dryophanta longiventris (Hymen)

(iii) Oval or ovoid, pale yellow, seldom or never with pink cheeks, surface marked with asperities; walls thin, larval cavity large. 4mms. Rare and local. Dryophanta agama. (Hymen)

(iv) Semicircular depression at top with an elongated elevation in its middle, pale yellow, smooth, narrow towards centre at bottom, 1½

bottom which has a depression with a raised point, by which it is attached to the leaf. Two chambers. 5-6mms x 4mms. Dryophanta disticha (Hymen)

(v) Oval, glabrous, yellow-spotted with red dots, situated between 2 brown scales which persist after gall has fallen. Aug. and Sept. Andricus ostreus.(Hymen)

(β) Projecting from both surfaces of leaf. (4)

(i) Irregularly circular, pale green galls 2-3mms. projecting above and below for about ½mm. Centre of top has small raised point from which radiate to circumference minute keels. Neuroterus vesicator(Hymen)

(4) Situated on margin of leaf without an inner gall (5)

(i) Smooth, ovoid, glabrous, greenish-yellow, I-2mms. June and July. Neuroterus albipes (Hymen)

(ii) Shortly-stalked, spindle-shaped, green, often with red longitudinal lines, apex ending in a point. 6-8mms. Oct. Andricus seminationis (Hymen)

(iii) Sessile, rounded at base and apex, surface shining, granular, greenish-yellow marked with red. Shell very thin, 4mms. Found in May on young half-grown leaves. Dryophanta verrucosa.(Hymen)

(iv) Sessile, glabrous, green, marked with reddish, furrowed longitudinally. 4-5mms. May and June on fully developed leaves. Andricus marginalis.(Hymen)

(5) Irregular green swelling at base of leaf, with large central cavity containing a brown seed-like free inner gall. Andricus curvator.(Hymen)

(6) On midrib or petiole.

(i) Small elongate swelling. Andricus testaceipes and Andricus noduli. (Hymen)

(ii) Gregarious on petiole, oval 2mms. causing irregular distortion. Andricus 3-lineatus.(Hymen)

(7) Galls, wholly or partly enveloped in leaf buds. (8)

(a) In adventitious buds.

(i) Oval, pointed at apex, green, velvety , covered with l long whitish hairs. 2mms. April and darly May. Dryophanta similis.(Hym)

(ii) At foot of old oaks early in May. Oval rounded at apex 3mms. violet, covered with velvety pubescence. Shell thin, larva occupying entire interior of gall Dryophanta Taschenbergi(Hymen)

(iii) At foot of oaks I-3' from ground in May. Roundish or oval, soft and succulent, smooth, white with reddish cheeks or entirely red. Central cavity small, 3-8mms, frequently hidden by moss. Trigonaspis megaptera(Hym)

(iv) Oval, scarcely 2mms. sometimes narrowed at apex; base smooth, green when young, greenish-white or brownish later. May and June. Andricus gemmatus(Hymen)

(b) In terminal buds.

(i) Large polythalamous, whitish-yellow, soft and spongy, I"in diameter. May and June. Biorhiza terminalis,(Hym)

(ii) Conical, green when young, pale when old, apex terminated by conical point or wart of a reddish or yellowish colour. Soft and succulent when young, becoming reticulated or wrinkled. 3-5mms. Much broader and shorter than Andricus autumnalis and A.Collaris. Greener also and projects more out of bud. Andricus globuli.(Hymen)

(iii) Elongated oval, half hidden by scales, green at first, with wart or conical point at apex. When young covered with succulent matter; inner gall with longitudinal striations (not reticulations) Shorter and more spherical than collaris; easily known from globuli by being longer

than broad and succulent; coat does not become reticulated. Andricus autumnalis(Hym)

(c) In lateral buds.

(i) Irregularly pea-shaped, thin-walled, like an undeveloped bud. April and May., Andricus aprilinus(Hym)

(ii) Base dilated, apex with point in middle, covered with long white glistening hairs. Woody. Green. Larval chamber separated from bottom by a hollow space. Andricus glandulae(Hym)

(iii) Spindle-shaped with short peduncle, green or with reddish stripes. October. Andricus malpighii (Hym)

(iv) Elongated at base and apex, dark yellow, surface rugose or glandular, bearing several flattish projections of a deeper colour; incurved glistening white hairs. Inner larval chamber free, being separated from the yellowish outer layer of cells by a small space. 5mms. Andricus clementinae.

(v) Differs from all other galls in having long peduncle at either end, the lowest being longer than gall itself. Generally stand out obliquely from bud. June. Andricus callidoma.(Hym)

(d) In both terminal and lateral buds.

(i) Spindle-shaped, terminal point being sometimes curved and almost bare. Rest of gall covered thickly with large woolly brownish-white hair. Green at first, becoming reddish-brown. 5-8mms. July to Sept. If found issuing from a lateral bud the gall is placed above the developed leaf which accompanies it. Andricus solitarius

(ii) "Artichoke Gall" Gall itself is pear-shaped, woody 10mms long. Green at first, turning shining brown. Lies enveloped in leaf-buds, the scales of which

become enormously developed, so as to give the appearance of a miniature artichoke. Andricus fecundatrix.

(iii) Hidden by scales, so only apex visible; hard woody, conical or oval, sometimes almost roundish, smooth; apex narrowed to a point, forming a blunt cone surrounded by a zone differently coloured from rest of gall. Brownish at apex, rest yellowish. Andricus collaris.

(ii) Hidden by scales, only apex visible, hard woody, conical or oval, sometimes almost roundish, smooth; apex narrowed to a point, forming a blunt cone surrounded by a zone differently coloured from rest of gall. Brownish at apex, rest yellowish. Andricus collaris.

(iv) (On Quercus cerris) Gregarious, 1,4, or 8 in a bud. Glabrous, well-hidden in bud, brownish-yellow to bright red; thin-walled, elongate oval, 2-5mms. Andricus circulans.

(8) Mined leaves.

Caused by Lepidopterous larva.

(i) Several galleries mined in one leaf, becoming united to form a blotch. May and August. Coriscium Brogniardellum

(ii) Large white blotches with larva resting in curved positio inside. Cocoon spun within leaf. Tischeria complanella

(iii) Mines on under surface of leaf in July and Autumn. Pupate within mine. Empty pupal case protruding. Larva I4 footed. Lithocolletis cramerella.

(iv) Mines on under surface of leaf in July and October. Tissue-paper effedt below and slight pucker above. Pupate within mine, empty pupal case protruding. Lithocolletis mellinella

(v) Typical Lithocolletis mine. No specific characters. Lithocolletis hortella.

(vi) Typical Lithocolletis mine. Forms elongate very fine cocoon. Lithocolletis lautella.

(vii) Leaves mined from July to Oct. by larva with 6 anterior legs wanting and replaced by membranous prolegs. I8

prolegs in practically all but none of them have the usual coronet of hooks. Mines always flat, generally of irregular serpentine form, though sometimes spiral and sometimes forming a complete blotch. Do not pupate within mine. Neptiluca atricapitella and ruficapitella

(viii) Leaves mined in autumn. Mine narrow, kept close to midrib but turned upon itself to form a small blotch.

Neptiluca subbimaculella

Caused by Hymenopterous larva.

(1) Brown blotch-like mine. No cocoon in mine. Fenusa pygmaea

(9) Leaf mined at first, then cones constructed by larva(Lepid) rolling up portion of leaf. Inner portion of cone devoured, become discoloured and are easily seen. Gracilaria swederella.

XXXII. On SALIX SPS. (Willows) XXXIII.

A. On SALIX VIMINALIS (Osier) B.

(I) Leaves folded, or rolled under and inwards. (2)

Caused by Dipterous larva.

(i) Both sides affected, chocolate-brown or black. Rhodophaga marginem torquens.

(ii) Caused by Hymenopterous larva.

(i) Both sides affected but edge not much rolled, epidermis eaten first, then holes eaten away. Nematus xanthogaster.

(ii) Leaf folded under along entire length of one side. Nematus leucostictus.

(iii) Leaf folded under along greater part of one side, the fold being very narrow, not much more than one line in breadth. July and August. Nematus nigrolineatus.

(2) Topmost leaves united in May and June. Gracillaria stramineella

(3) Little bundles of leaves on topmost twigs. July onwards Earias clorana.(Lepid)

B. On SALIX ALBA. C.

(I) Rosette of leaves at tips of twigs. Rhabdophaga rosaria. (Dipt)

(2) Rose-like galls. Cecidomyia albipennis(Dipt)

(3) Withered tips of young shoots. Cecidomyia salicina. "

(4) Galls on leaf margins I x ½mms. Green changing to red and brown. Eriophyes marginatus.(Acar)

(5) Leaves rolled downwards and under. Nematus scotaspis(Hym)

(6) See E_1 below. Rhabdophaga terminalis(Dipt)

C. On SALIX PURPUREA. D.

(I)Large oval or oblong galls closely pressed to midrib. Walls thin and space inside larger than in any other gall June, July and Augustl Rare. Nematus vesicator(Hymen)

(2) Round or oval galls placed in pairs on leaf, projecting to some extent above but not at all below; sides have round projecting rings. Green to pupple above. Beneath always pale green. Early June. Nematus ischnocerus (Hymen)

(3)"Pea galls" attached to midrib on lower surface of leaf. Larva solitary, rests within gall with body curved like a J. Does not expel frass. Walls rather thin; May to end of Sept. Nematus viminalis (Hymen)

(4) Folded-down edges of leaves. Hymenopterous larva, feeds on upper epidermis, thus making brown spaces in leaf. Large, bluish green, with 2 black cerci jointed to quadrangular black-dotted spot. June and July, Not common. Nematus leucostigma

(5) Rolled-down edges of leaf. Clear glassy-green larva (Hymen) bearing no black marks on hind segments, thus

differing from most leaf-rolling larvae. Nematus purpurea

(6) See E(I) below. Rhabdophaga terminalis (Dipt)

(7) See G(I) below. Rhabdophaga heterobia

(8) See B(I) above. Rhabdophaga rosaria.

D. On SALIX HERBACEA. E.

(I) Roundish of oval, smooth shining green galls marked perhaps with red. Each contains one larva, and there is as a rule but one gall on a leaf. This is the only gall-inhabiting larva (Hymen) bearing regularly arranged marks on body. Whitish with black dots arranged in 5 rows. Legs dark greenish-white with small black mark over each claw; anal segment bears no marks. Very local. Nematus herbaceae.

E. On SALIX FRAGILIS. F.

(I) Leaves at tips of shoot rolled upright, one on another, thickened and more or less deformed. Larva gregarious. Rhabdophaga terminalis.

(2) Bright red bean-shaped galls projecting from both surfaces of leaf. Nematus gallicola (Hym)

(3) Rolls edge of leaf downwards and under. Larva (Hymen) blueish green, white at junction of segments, skin wrinkled, anal segment has variable number of black spots, cerci black. Head shining brown. Rare. Nematus scotaspis (Hym)

(4) See G(I) below. Rhabdophaga heterobia

F. On SALIX PENTANDRA. G.

(I) One side of leaf folded downwards and under along its entire length. Nematus leucostictus (Hym)

(2) See E(I) above. Rhabdophaga heterobia (Dipt)

G. On SALIX TRIANDRA H.

(I) Loose rosette of leaves on tips of twigs. Pilose, not abundant. Larvae gregarious. Rhabdophaga heterobia (Dipt)

H. On SALIX DEPRESSA. I.

(I) Rosette of leaves on tips of twigs. Rhabdophaga rosaria. (Dipt)

I. On SALIX AURITA. J.

(I) Rosette of leaves on tips of twigs. Unilarval. Not hairy. Rhabdophaga rosaria. (Dipt)

(2) Small rosette, 3-5mms. at axils of leaves. Not hairy. Rhabdophaga rosariella (Dipt)

(3) Galls on upper surface of leaf (?) Cecidomyia peregrina. (Dipt)

(4) Leaves rolled downwards and under. (See A(I)) Nematus xanthogaster(Hymen)

(5) Berry-shaped greyish-green gall covered closely with fine hairs. Larvae do not make hole for expulsion of frass, nor previous to spinning do they become of a slate colour, thus differing from all other larvae found in berry-shaped galls. Found up to end of October. Nematus baccarum(Hymen)

(6) Same as C(3) but gall covered with longish pale hairs. Nematus bellus (Hymen)

(7) Swollen and distorted leaf buds: Euura salicoti.(Hymen)

(8) See G(I) above. Rhabdophaga heterobia (Dipt)

J On SALIX CAPREA or, and, SALIX CINEREA (Sallows) K.

(I) Thick-walled galls occurring in considerable numbers on upper surface of leaf, pubescent above, glabrous below, no aperture below. Eriophyes tetanothrix laevis (Acar)

(2) Attached to midrib. (3)

(a) Upper surface.

(i) Woody, glabrous plurilocular (Usually 8 loculi) Swellings with aperture below. Hormomyia capreæ (Dipt)

(b) Lower surface.

(i) Pea-like galls, green with or without pink cheeks, larva solitary resting within gall with body curved in a J. Nematus viminalis (Hymen)

(ii) Similar, but covered with fine longish pale hairs. Nematus bellus (Hym)

(3) Oval green bean-shaped galls projecting from both surfaces Nematus Bridgmanii

(4) Pustulate galls on upper surface. Cecidomyia capreæ (Dipt)

(5) Withered tips of young shoots. Cecidomyia salicina.

(6) Rosette of leaves at tips of twigs. Not hairy. Unilarval Rhabdophaga rosaria (Dipt)

(7) Swollen and distorted leaf-buds which internally become converted into a green granular matter on which larva feeds. Aug. to Oct. Euura nigritarsus (Hymen)

(8) Leaf-stalks thickened from base to commencement of leaf. Euura venusta (Hymen)

(9) Terminal leaves united together. (IO)

Caused by Lepidopterous larva.

(i) Terminal leaves drawn upwards together in a whorled mass, May and June. Depressaria conterminella.

(ii) Topmost leaves spun together in May by beautiful bright green larva. Antithesia capreana.

(iii) Terminal leaves spun together by pale green larva. Two broods. May and Oct. Peronea hastiana.

(iv) Little bundles of leaves on topmost twigs from July onwards. $\frac{5}{8}$" in length (larva) I6 legs, back gradually rising from 2nd. seg. to 6th. then falling gradually to IIth, rising again on I2th, and falling to end

of I3th. Earias clorana.

Caused by Dipterous larva.

(i) Terminal leaves form oval or round tight mass, the size of a hazel nut, very pilose; larvae gregarious, orange-red. Rhabdophaga iteobia

(I0) Leaves united. (II)

Caused by Lepidopterous larva.

(i) Found during summer (Tineina larva) Dasystoma Salicella

(ii) " " Sept. Oct. " " Chemibacche fagella

(iii) " " April. May (Tortrix larva) Brachytaenia Hartmanniana

(iv) " " " " " " Pale yellow with black shining head, pale brown shield, darker in front and its anterior margin white; spots scarcely darker than the body. Hypermecia augustana

(v) Two leaves drawn together or part of leaf folded over. June to Oct. Geometridae larva. Body verdigris-green, suffused with pink. Ypsipetes ruberaria.

(II) Terminal shoots united in July. Gelechia temerella. and " sorurculella(Lep)

(I2) Cones formed on leaves in August and Sept. Gracillaria straminella (Lepid)

(I3) Rolled or folded leaves. (I4)

Caused by Lepidopterous larva.

(i) Corner of leaf folded under. Psoricoptera gibbosella

(ii) Leaves rolled-up in May and June. Gelechia populella

(iii) Leaves folded under in April and May. Taeniocampa crud

(iv) Leaves folded under with white silk in April and May. Tortrix larva. 9 lines, dull red-brown, stoutest in middle. Head small and heart-shaped, black and shining. Shield black. Spots oval, elevated, shining black. Large

round rugose black plate on anal segment. Legs dull brown with bases of joints black. Penthina salicella

(v) Edges of leaves folded under and secured with 3 or 4 stout silk threads. Larva thick, fat and cylindrical, skin dark,brown, covered with an exceedingly short and fine pubescence resembling the pile of very fine silk velvet. When this catches the light, appears of a pearly whiteness, Herminia derivalis

Caused by Hymenopterous larva.

(i) Leaves rolled by clear bluish-green larva, with two black streaks on ventral surface reaching Ist. pr, legs. Pamphilius sylvaticus

(I2) Mined leaves.

Caused by Hymenopterous larva.

(i) Blotch like mine. Phyllotoma microcephala

Caused by Lepidopterous larva.

(i) Mine between upper and lower epidermis, first, then two or more leaves spun together and larva commences feeding from outside. Pempelia fusca.

(ii) Mine between upper and lower epidermis first, then mined portion cut out to form portable case for larva. Coleophora sp.

(iii) Mines on under surface in July, also Sept and Oct. Larva I4-footed. Lithocolletis Salicicolella

(iv) Mines on under surface in Autumn. " viminetorum

(v) Mines on under surface in July and Autumn. Lithocolletis viminella and L. spinolella

(vi) Small tortuous mines in July and Autumn. Neptiluca salicis

Caused by Dipterous larva.

(i) Blotch like mines in upper surface. Pupation does not

occur in mine. Two generations. Rare. Phytomyza tridentata

(13) Cones on leaves. Gracillaria struminella

K. On Various SMOOTH-LEAVED WILLOWS. L.

(1) Leaves united. Gelechia notatella (Lepid)

(2) Leaves mined below. Phyllocnistis saligna. (Lepid)

L. On SALIX REPENS

(1) Mines on undersurface of leaves. June and July. Agromyza salicina.(Dipt)

XXXIV. On POPULUS (Poplar) XXXV.

A. On POPULUS TREMULA. B.

(1) Red or purple galls projecting from both surfaces of leaf, having tiny hole ventrally; never more than 4 or 5 on leaf Eriophyes pustulatum(Acar)

(2) Red pea-like irregular pink or purple swellings on upper surface of leaves and petioles. Constricted at base. Unilarval. Diplosis tremula (Dipt)

(3) Round carmine-red galls 2.5mms, on upper surface only, opening by a hole below, thin-walled, not constricted at base. Harmandia globuli (Dipt)

(4) Subglobular, slightly elongated, 4-5mms. in diam. projecting from both surface. Green or reddish. Unilarval. Harmandia cavoterrosa(Dipt)

(5) Erineum gall on lower surface. Whitish at first, turning brownish. Phyllocoptes populi(Acar)

(6) Erineum gall on both surfaces, red becoming brown later Eriophyes varius (Acar)

(7) Rolled leaves. (8)

Caused by Hymenopterous larva.

(1) Bright green larva, with black streak on thorax, head shining black with bright reddish-brown vertex. Pamphilius sylvaticus

Caused by Lepidopterous larva.

(i) Two leaves spun together to which frass adheres. Pemphelia hostilis.

Caused by Dipterous larva.

(i) Leaves and extremities of twigs unite to form a thick tuft or bunch. Schizoneura tremulae.

(8) Cauliflower gall of buds. Reddish or greenish. Eriophyes populi (Acar)

(9) On Petiole.

(i) Round swelling on petiole. Harmandia petiola (Dipt).

(ii) Small red irregular roundish galls on glands at extremities of petiole. Eriophyes diversipunctatus(Acar)

B. On POPULUS NIGRA

(I) Mined leaves. (2)

Caused by Hymenopterous larva.

(i) Blotches leaves in July. Cocoon within mine. Phyllotoma ochropoda

Caused by Lepidopterous larva.

(i) Mines great blotches in leaves in June and August. Larva apodous and Cocoon within mine. Phyllocnistis suffusella

(ii) Mines leaves in August and Sept., them constructs case by rolling up portion of leaf. Larva I4-footed. Gracillaria syringella

Caused by Dipterous larvae.

(i) Upper surface, blotch-like mine; pupation not within mine. Two generations. Phytomyza tridentata

(ii) Larger than (i). Phytomyza populicola

(iii) Upper or lower surface; pupation within mine. Pupa yellowish-or reddish-brown with longish black bands. June, July, and Aug, Sept. Phytomyza populi.

(iv) Not easily distinguished from (iii) P. populivora

(v) Upper surfa

(v) Upper surface; narrow tunnels at first, later distending considerably. Pupation not within mine.
Agromyza albitarsus populi.

(2) Rolled leaves (3)

(i) Leaves rolled in May and June by Lepidopterous larva.
Gelechia populella

(3) United leaves. (4)

(i) Leaves united in May by Lepid. Larva. Batrachedra praeangustus

(ii) Two leaves spun together flatwise by Lepid. larva. Brachos not. a

(4) Blisterd leaves (due to Hemiptera) Caithorus leucomelas

(5) Galls on petiole (due to Hemiptera) [illegible]

(i) Smooth pear-shaped or oval purse-like swellings. July or Aug. Occasionally on midrib. Pemphigus bursarius

(ii) Spiral dark green galls. June to Sept. " spirothecae

XXXV On ILEX AQUIFOLIUM (Holly) XXXVI.

(I) Topmost leaves united. May and June. Paedisca ophthalmicana(Lepid)

(2) Either one leaf turned down or two or more fastened together. Steganophyycha naevana(Lepid)

(3) Mines caused by Dipterous larvae.

(i) Late Autumn to March. Large discoloured blotch in upper surface. Pupation within mine. Yellowish-brown pupa. One generation only. Common. Posterior appendages of larva (leaf) possess 6 to 7 nodules. Phytomyza ilicis.

(ii) Mine starts as a very fine tunnel. Posterior appendages of larva (leaf) possess 22 nodules. Phytomyza ilicicola.

XXXVI. On LONICERA PERICLYMENUM. (Woodbine) XXXVII

(I) Leaves folded forward longitudinally along whole length or tip turned down by Lepidopterous larva. GRapholita Albersana

(2) Leaves united. May. Gelechia Mouffetella (Lepid)

(3) Mined leaves.

Caused by Lepidopterous larvae.

(i) Under surface of leaves. Mines nearly as large as leaf itself, but this is not constricted at right angles laterally. Lithocolletis emberizaepenn-ella

(ii) Small mines on under surface, and leaf twisted at right angles. July and April. Lithocolletis trifasciella

Caused by Dipterous larvae.

(i) Several tunnels in one leaf, all proceeding from mid-rib, along lateral veins. Pupation in earth. Phytomyza alpigenae.

(ii) Star-shaped ramifying smooth-surfaced mine. Upper surface. Pupation within mine at one end of the radiating passage. Yellowish-brown pupa with long jet-black streaks on both sides. Napomyza zylostei.

(iii) Swollen star-shaped mine in upper surface. Differs from (ii) by having epidermis always wrinkled, and the faecal pellets always lie farther apart from each other and are not strung together in a definite rowl Pupation within mine. July and August. Phytomyza periclymeni

(iv) Brownish tunnels in upper surface, which often traverse the whole leaf and frequently cross. May and July Phytomyza agromyzina.

(v) Upper surface; white, not very broad passages, often branched. Pupation in earth. May, June. Phytagromyza hendeliana

(vi) Upper surface; passages which wind but little, and are never branched. Faeces lies in 2 rows or in a cloudy mass in the middle. Phytomyza zylostei.

(vii) One long passage near leaf edge; faeces form a fine

moist firm line. Pupa white. Napomyza lonicerae.

XXXVIII. On PYRUS MALUS. (Apple) XXXIX.

(I) Shrivelled leaves. May and July. Aphis mali (Hem)

(2) Rolled leaves, containing numerous insects overspread by mealy powder. Aphis pruni(Hem)

(3) Corner of leaves turned downwards and under in May and June Gelechia rhombella(Lep)

(4) Leaves united in a felted mass resembling moss. Gelechia leucatella(Lep)

(5) Mined leafes.

Caused by Lepidopterous larva.

(i) Flat tortuous mines. July to Oct. Larva I6-footed. Lyonetia clerckella.

(ii) Large flat dark blotches. Chemiostoma scytella

B. On CRAB APPLE.

(I) Leaves distorted and changed to yellow or fine red colour. Insects are small sienna-brown with black head, bands, spots, antennae and cornicles. Legs ginger-yellow. Aphis pyri(Hem)

(2) United leaves. Dictyopterix contaminana (Lepid)

(3) Mined leaves.

Caused by Lepidopterous larvae.

(i) Bright green larva making long galleries in autumn. Neptiluca oxyacanthella.

(ii) Yellow larva making long galleries in July and Autumn Neptiluca malella.

BIBLIOGRAPHY.

Barnes, H.F. "Further Results of an Investigation into the Resistance of Basket Willows to Button-gall Formation" Anns. Appl. Biol. Vol.XVIII. No.I.

" "On the Gall Midges Injurious to the Cultivation of Willows." II. "The so-called "Shot Hole" Gall Midges. Anns.Appl.Biol.Vol.XXII.Pt.I.Feb.'35

" "The Gall Midges attacking Seed-heads of Cocksfoot, Dactylis glomerata" Bull.Ent.Res.Vol.31.P.I

Bentham and Hooker. "British Flora."

" "Illustrations to the British Flora."

British Entomology, Vols.5 and 6 Part I and II.

Buckler, W. "Larvae of British Butterflies and Moths." Vol.I-X. Ray Soc. 1889.

Buckton. "British Aphids". Vol.I-IV. Ray Soc.

Cameron, P. "A Monograph of British Phytophagous Hymenoptera" Vol. I-IV. Ray Soc. 1883.

Collinge, W.E. "Report on the Injurious Insects and Other Animals".

Connold, E.T. "British Vegetable Galls".

Curtis, J. "British Entomology" Vol.I,II. Coleoptera.

Ealand, C.A. "Insect Enemies".

Gillanders, A.T. "Forest Entomology".

Graham, S.A. "Principles of Forest Entomology".

Harshberber, J.W. "Mycology and Plant Pathology".

Hassan, A.S. "Biology of the Eriophyidae with special reference to Eriophyes tristriatus (Nal)

Hatton,R.G.,"Amos,J., and Tydeman,H.M. "Control of Big Bud Mite in Field". Anns.Rept. E.M. Res.St. Nov. '25.

Hering, M. "Die Tierwelt Deutschlands" 6 Tiel. Ord. Diptera. I Agromyzidae. 1927.

Houard,C. "Les Zoocecidies des Plantes d'Europe"Vol I-III.

Imms, A.D. "General Textbook of Entomology".

Johnson, W.G."Fumigation Methods".

Kiefer, H.H. "Eriophyid Studies" Vol. I-XI.

Bull.Dept.of Agric. Calif. Vol.XXVII.No2.Apr. May June 1938.

" Do. Vol.XXVII.No3.July, Aug.Sept.'38

" Do. Vol.XXVIII.No2.Feb.'39

" Do. Vol.XXVIII.No3.Mar.'39

" Do. Vol.XXVIII.No5.May.'39

" Do. Vol.XXVIII.No6.June.''

" Do. Vol.XXVIII.No7,8,9 July,Aug,Sept.'39

" Do. Vol.XXIX.NoI.Jan,Feb, Mar.'40.

" Do. Vol.XXIX.No2.Apr,May, June.'40.

" Do. Vol.XXIX.No3.July,Aug, Sept.'40.

" Do. Vol.XXX.No2.Apr,May, June,'4I.

——— — "List of Common Names of British Plant Diseases" (Compiled by Plant Pathology Committee of Br. Mycol. Soc.)

Massee,A.M. "Diseases of Cultivated Plants and Trees"

" "Life History of Black Currant Gall Mite, Eriophyes ribis." Bull.Ent.Res.Vol.XVIIIP 3. Feb.'28.

" "Control of Black Currant Gall Mite". Ann.Rept.

" "of East Malling Res, St. June 1926.

Massee, A.M. "The Blackberry Mites".Jour.Pom.and Hort.Sc. Vol.IX.No4. Dec.'3I.

" "A New Species of Gall Mite from S. India. Anns. Mag. Nat. Hist. Ser.IO Vol.XI.Pt.20I. '33

" "A New Eriophyid Mite of Black Currant". Anns. Mag, Nat. Hist. Ser.IO.Vol.XII.P.2I3.'3

" "A Species of Gall-Mite (Eriophyidae) injurious to Tomato. Anns.Mag.Nat.Hist.Ser.II.Vol.III P.6I7.June '39.

" "On Some Species of Gall-Mites (Eriophyidae) found on Corylus Avellanae" Bull.Ent.Res. Vol.XXI,Pt.2.'30.

" "An Eriophyid Mite Injurious to Tomato" Bull. Ent.Res.Vol.28.Pt.3.'37

" "An Eriophyid Mite On Apple"Do.VolXIX.Pt2.'28.

" "Two Species of Gall Mites (Eriophyidae) of the Lilic (Syringa vulgaris) new to Britain. Bull.Ent.Res.Vol.XIX.Pt3.'28.

Michael. "British Tyroglyphidae" Vol.I-IV. Ray Soc.I90I-3.

Min. of Agric. and Fisheries Advisory Leaflets.

"Insect Pests and Fungus Diseases of Willows."

"Insect Pests of Crops"

"Insect Pests of TRees"

"Fruit Tree Red Spiders"

"The Black Currant Mite"

"The Pear Leaf Blister Mite"

"Aphids or Plant Lice"

"Bulb or Tulip Mite"

"Pine Weevils"

"Pine Sawfly"

"Gnats Injurious to Willow and Osier"

Large Larch Sawfly"

Nalepa, "Das Tierrich (Eriophyidae) Berlin I898.

Nalepa, "Eriophyidae. Gallmilben."Stuttgart 1911.

Ormerod, E.A. "Text Book of Agricultural Entomology"

O'Kane. "Injurious Insects"

Parker and Haswell. "Text Book of Zoology" Vol.I.

Ritzema Bos,J. "Agricultural Zoology"

Sanderson and Peairs. "Insect Pests of Farm, Garden and Orcha

Soar and Williams. "British Hydracarina" Vol.I-III.Ray. Soc.

Sharp,D. "Insects."Pt.I-II. Camb. Nat. Hist. Vol.5,6.

Thompson, W.R. "The Biological Control of Insect and Plant Pests. June 1930.

Walker, F. "Insecta Britannica".Vol.I-III. Diptera.

Ward,Marshall H. "Disease in Plants"

Wilkinson, S.J. "British Tortrices".

Stainton, H.T. "Lepidoptera, Tineina. Vol.III. Insecta Britannica."

PLATE. I.

1. Neuroterus lenticularis.
   (a) Gall.
   (b) Fly.
2. Neuroterus numismatis.
   (a) Gall.
   (b) Fly.
3. Andricus testaceipes.

PL. 1.

1a.

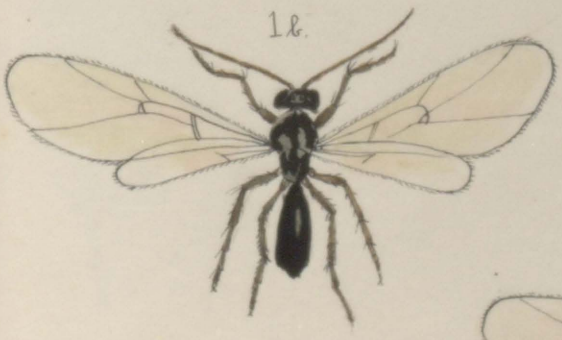


2a.



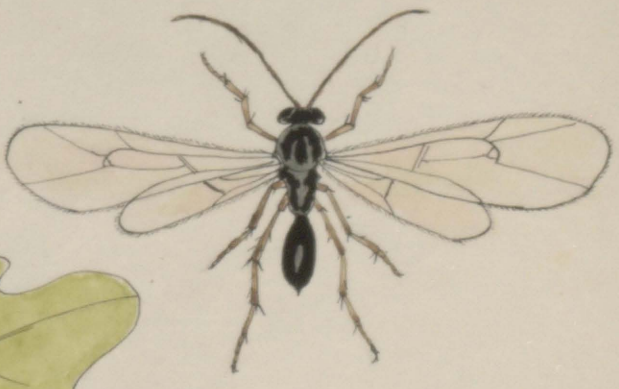
1mm. = $\frac{1}{4}$"

1b.



2b.

1mm. = $\frac{1}{2}$"



3

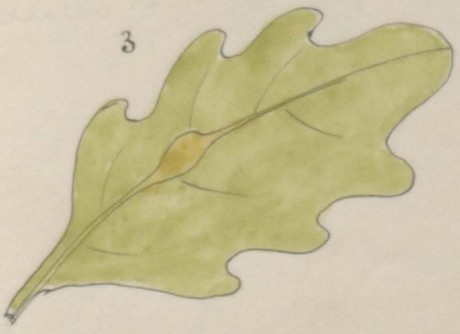


PLATE 2.

1. Neuroterus fumipennis.

2. Dryophanta divisa.

   (a) Gall.

   (b) Larva.

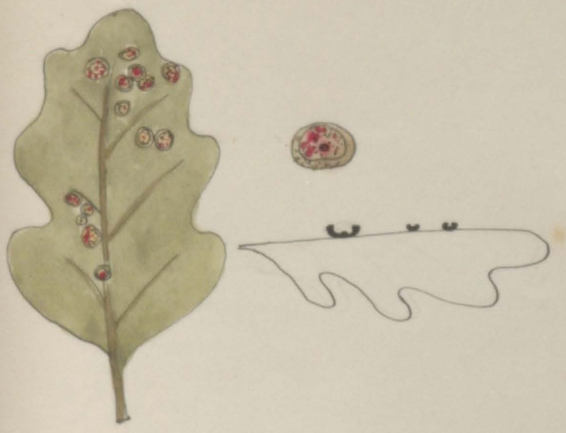
   (c) Fly.

3. Andricus gemmatus.

4. Andricus ostreus.

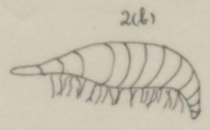
Pl. 2.

1.



2.

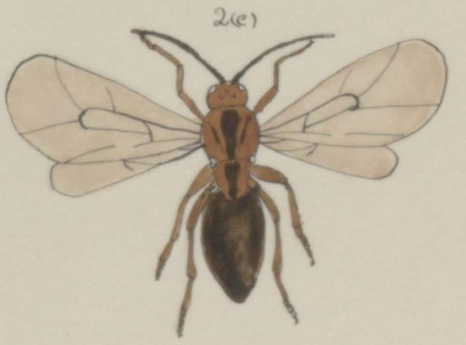




3







4.



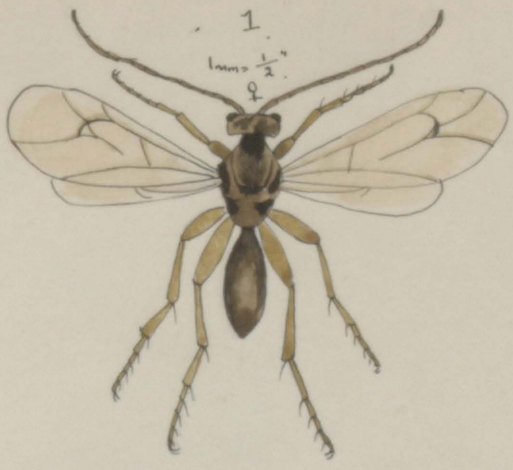
PLATE. 5.

1. Andricus ostreus.

2. Andricus testaceipes.

3. Neuroterus fumipennis.

PL. 3.





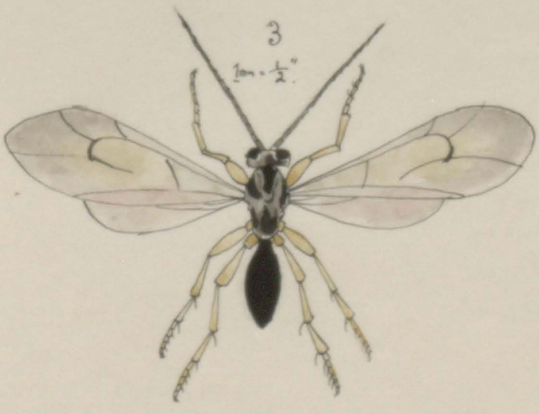


PLATE 4.

1. Neuroterus albipes.
2. Andricus fecundatrix.
3. Unidentified gall in bud.
4. Unidentified gall in bud.
5. Lithocolletis messaniella ?
   (a) Upper surface.
   (b) lower surface.
   (c) Larva.
   (d) Outline of mine showing position of pupa.

Pl. 4.

1.



2.



3.



4.

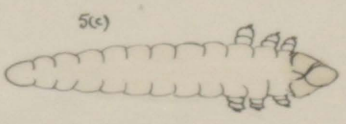


5





5(c)



5(d)



PLATE. 5.

I. Andricus curvator.

(a) Gall

(b) Transverse section of outer gall showing inner like gall.

(c) Gall after fly has escaped.

(d) Transverse section of leaf with gall attached.

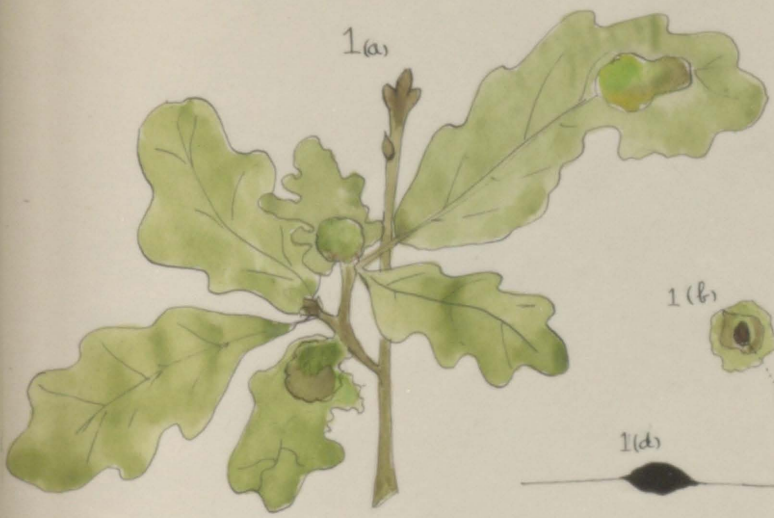
(e) Fly.

2. Fenusa melanopoda.

(a) Larva, upper surface.

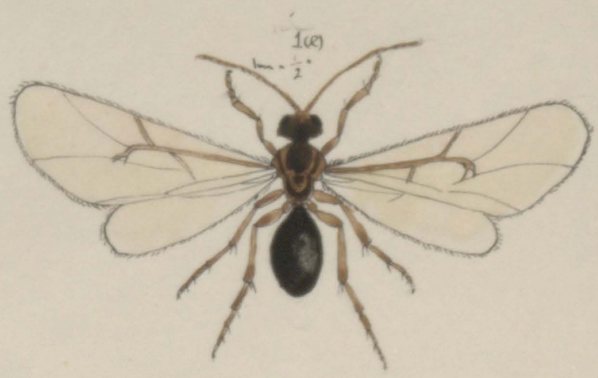
(b) Larva, ventral surface.

Pl. 5.









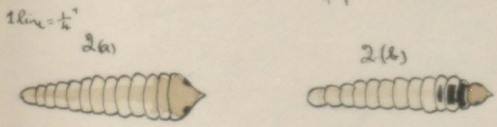


PLATE. 6.

1. Nematus leucostictus.(?) (may be a variety)

(a) Larva.

(b) Hind segments of larva.

(c) Adult.

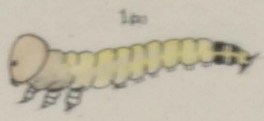
(d) Saw x 200.

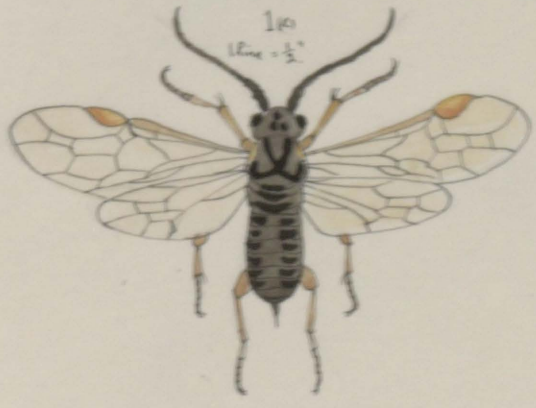
2. Saw of Nematus gallicola x 300.

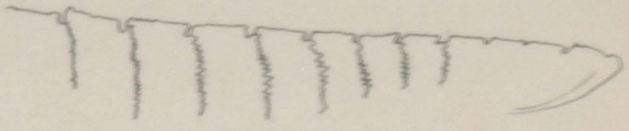
Pl. 6.

1.









2.

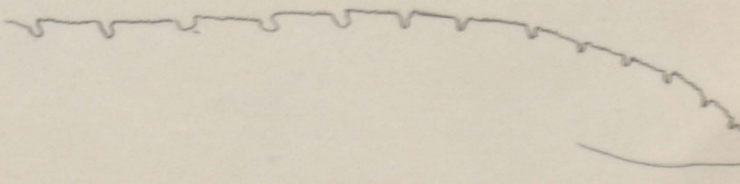


PLATE. 7.

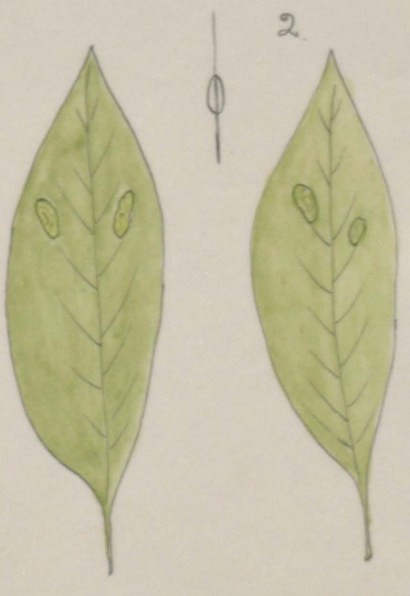
I. Nematus gallicola.

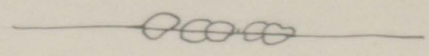
(a) , (b) Larva.

2. Variety of Nematus gallicola.

Pl. 7.







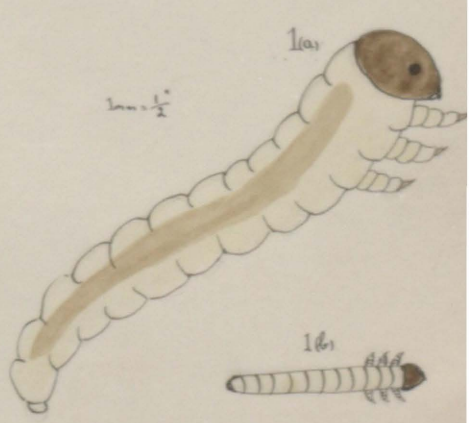


PLATE. 8.

I. Nematus viminalis.

(a) Transverse section of gall.

(b) Position of larva in gall.

(c) Larva.

(d) Fly.

PL. 8



PLATE. 9.

Larvae from galls of Nematus gallicola.

I.(a) Under High magnification.

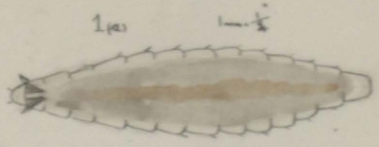
(b) Under Hand lens.

2. Hymenopterous larva.

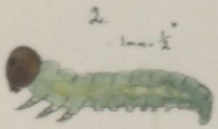
3. Lepidopterous larva, under high and low magnifica

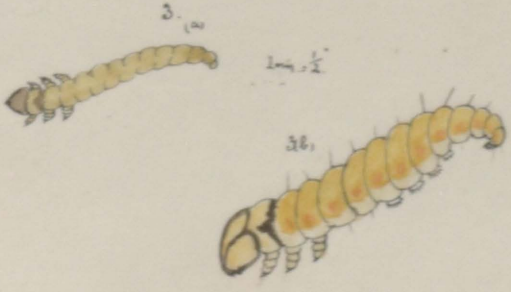
4.Larva taken from brown seed-like structure withih

Pl. 9.











PL

PLATE IO.

Fenusa melanopoda.

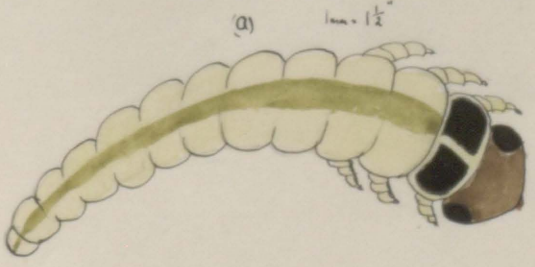
(a) Larva.

(b) Ventral surface, anterior segments.

(c) Larva after final moult.

Pl. 10.







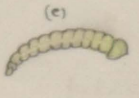


PLATE II.

Rhabdophaga marginem-torquens.

Pl. 11.



PLATE I2.

Cecidomyia saliciperda.

(a) larva.

Pl. 12.

1.



(a)



PLATE I3.

Cecidomyia crataegi.

Pl. 13.



PLATE I4.

Cecidomyia rosaria.

Pl. 14.

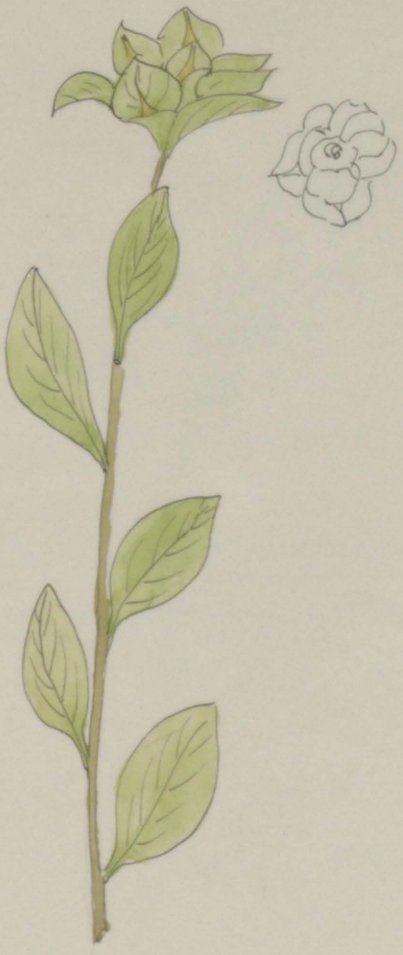


PLATE I5.

Hormomyia caprea.

(a) Dorsal surface.

(b) Ventral surface.

(c) Lateral view of ventral surface.

(d) Lateral view of dorsal surface.

(e) Larva.

Pl. 15.



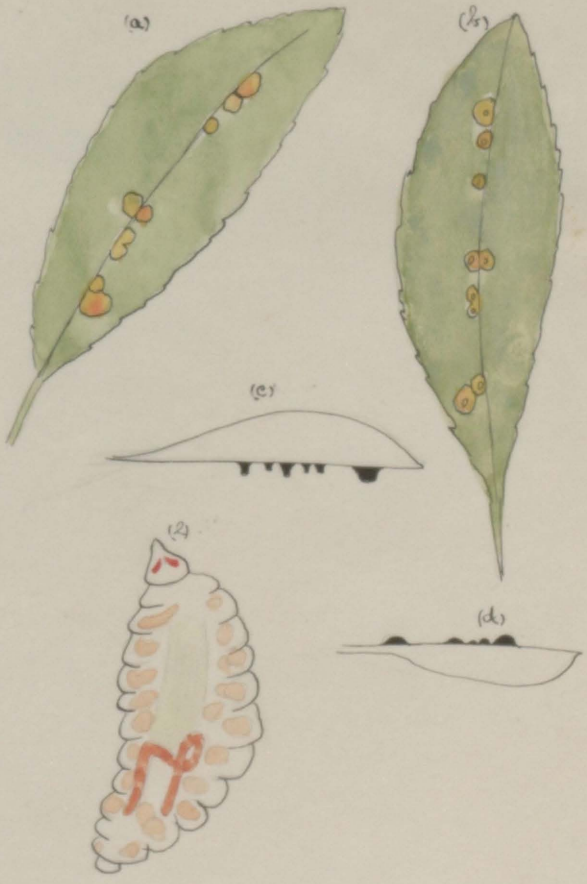


PLATE. I6.

Rhabdophaga marginem torquens.

1. Larva.

2. Pupa, lateral view.

3. Pupa, ventral view.

Pl. 16.

1.



2.



3.

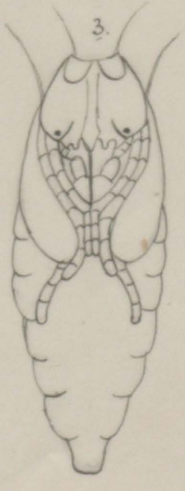


PLATE. I7.

1. Napomyza xylostei.

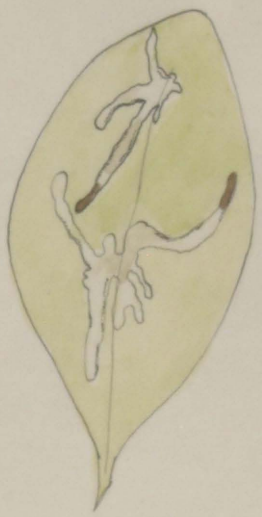
2. Agromyza rubi.

Pl. 17.



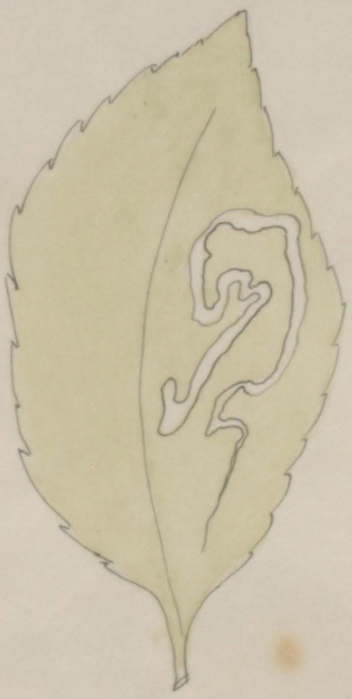
1.





2.





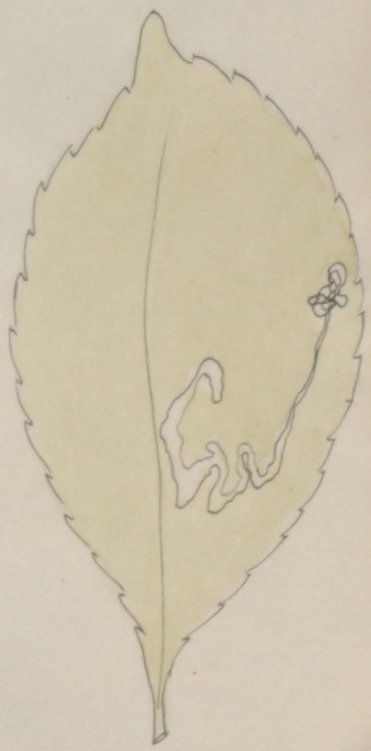


PLATE I8.

1. Phytomyza ilicis.

(a) Dorsal surface of mine.

(b) Opening on ventral surface

(c) Puparium.

2. Paedisca ophthalmicana.

(a) Leaves united by the larva.

R. 18.

1.



(a)





(b)



(c)



(d)



2.



PLATE I9.

Orchestes fagi.

(a) Side view of blister.

(b) Adult weevils

(c) Antennae.

PL. 19.







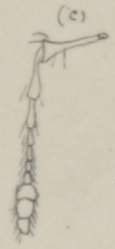


PLATE 20.

1. Lepidopterous larva rolling willow leaves.

2. Taeniocampa cruda.

3. Depressaria conterminella

Pl. 20.



PLATE 20a.

I. Epunda viminalis.

22. Lithocolletis sp on alder.

(a) Upper surface of mine.

(b) Outline of mine with second case inside.

(c) Lower surface of mine.

(d) Larva.

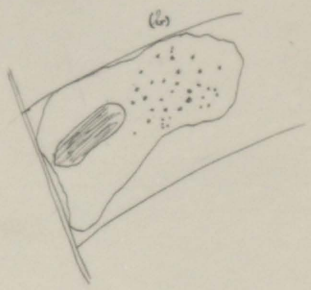
Pl. 20a.

1.



2.





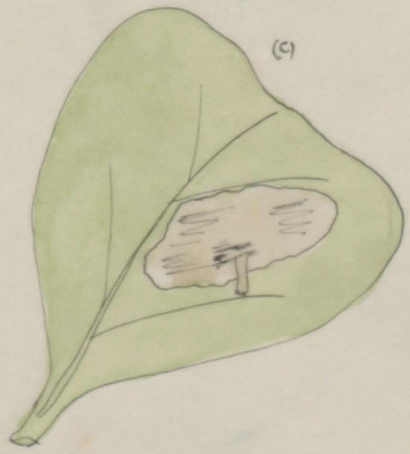




PLATE. 2I.

Psyllopsis fraxinicola

(a) Galled leaves

(b) Adult.

Pl. 21.

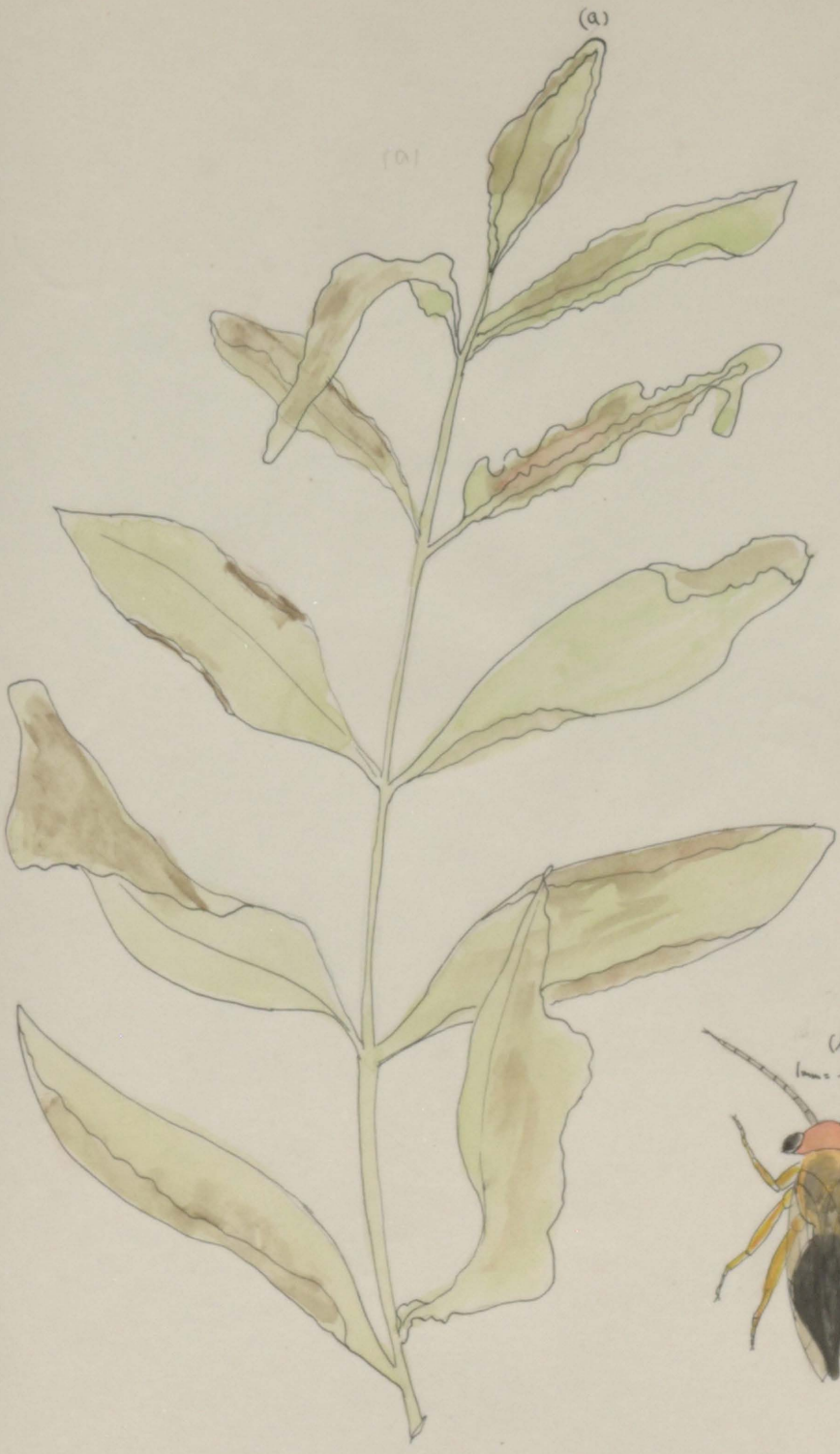


PLATE 22.

Eriophyes brevitarsus.

(a) Ventral view of mite.

Pl. 22.

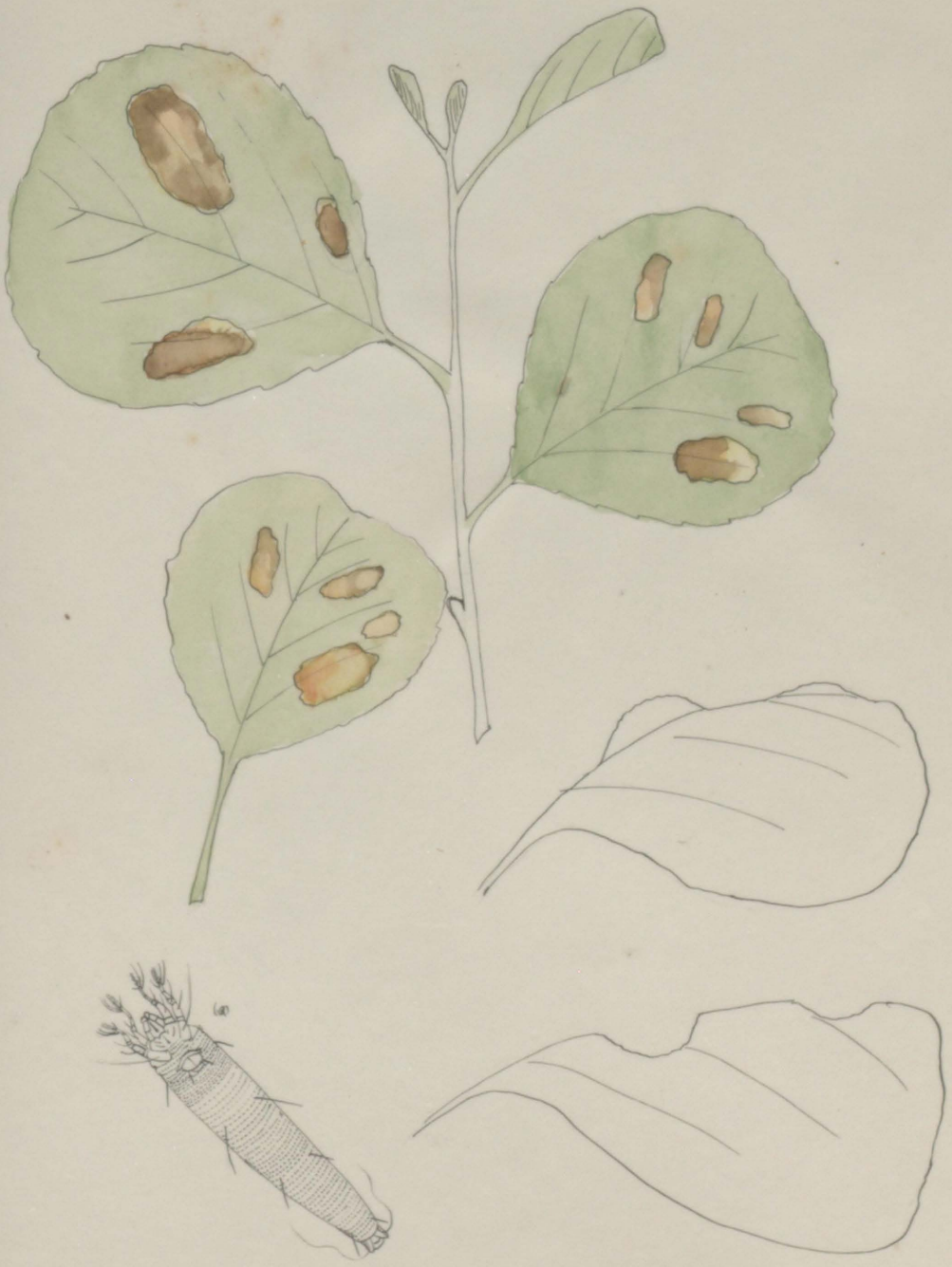


PLATE 23.

Eriophyes axillaris. = E laevis (Nal)

(a) Interior of gall.

PL. 23.



PLATE 24.

Eriophyes laevis.

(a) Interior of gall.

(b) Ventral view of mite.

Pl. 24.



PLATE 25.

Phyllocoptes fraxini.

(a) dorsal surface.

(b) ventral surface.

(c) ventral view of mite

(d) dorsal view of mite

Pl. 25.

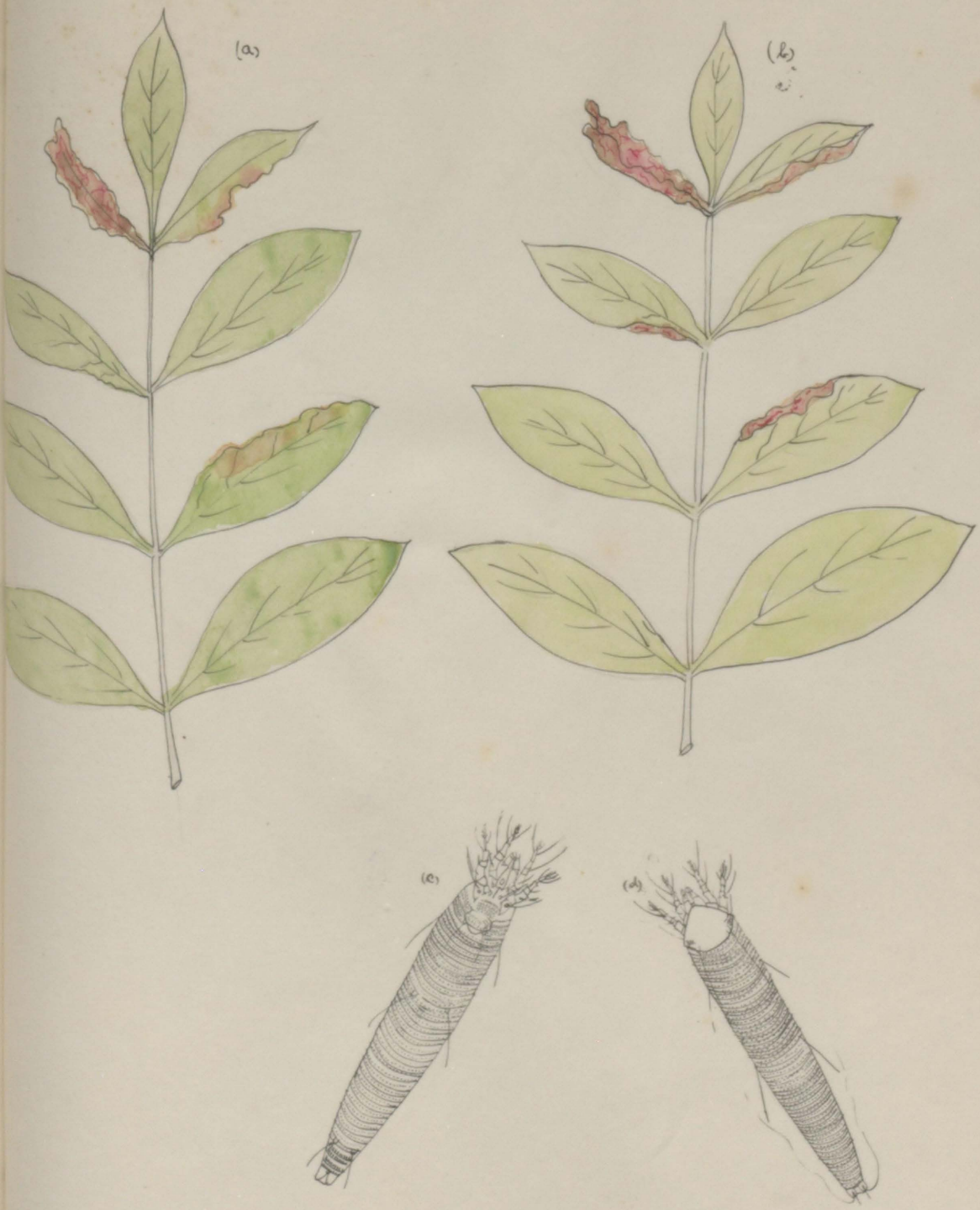


PLATE. 26.

Phytoptus macrochelus erobius.

(a) Ventral view of whitefield.

PL. 26.



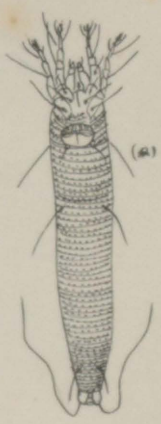






PLATE. 27.

Phyllocoptes acericola.

(a) Dorsal view of mite

PL. 27.



(a)

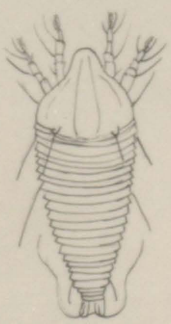


PLATE 28.

I. Eriophyes goniothorax.

(a) Ventral view of leaf.

(b) Transverse section through leaf showing r

2. Myzus oxyacantha

(a) Transverse section through leaf showing d
distortion.

I (c) Ventral view of mite

I (d) Dorsal view of mite

Pl. 28.



PLATE 29

Eriophyes aucupariae. (Conn)

(Eriophyes piri typicus Nal.)

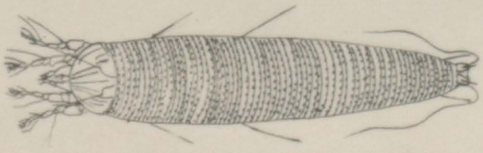
(a) Dorsal view of mite.

(b) Ventral view of mite.

PL. 29.



(a)



(b)

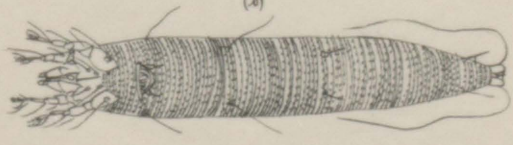


PLATE 30.

Eriophyes tristriatus var. erinea.

(a) Interior of gall.

(b) Ventral view of mite

(c) Dorsal view of mite.

PL. 30

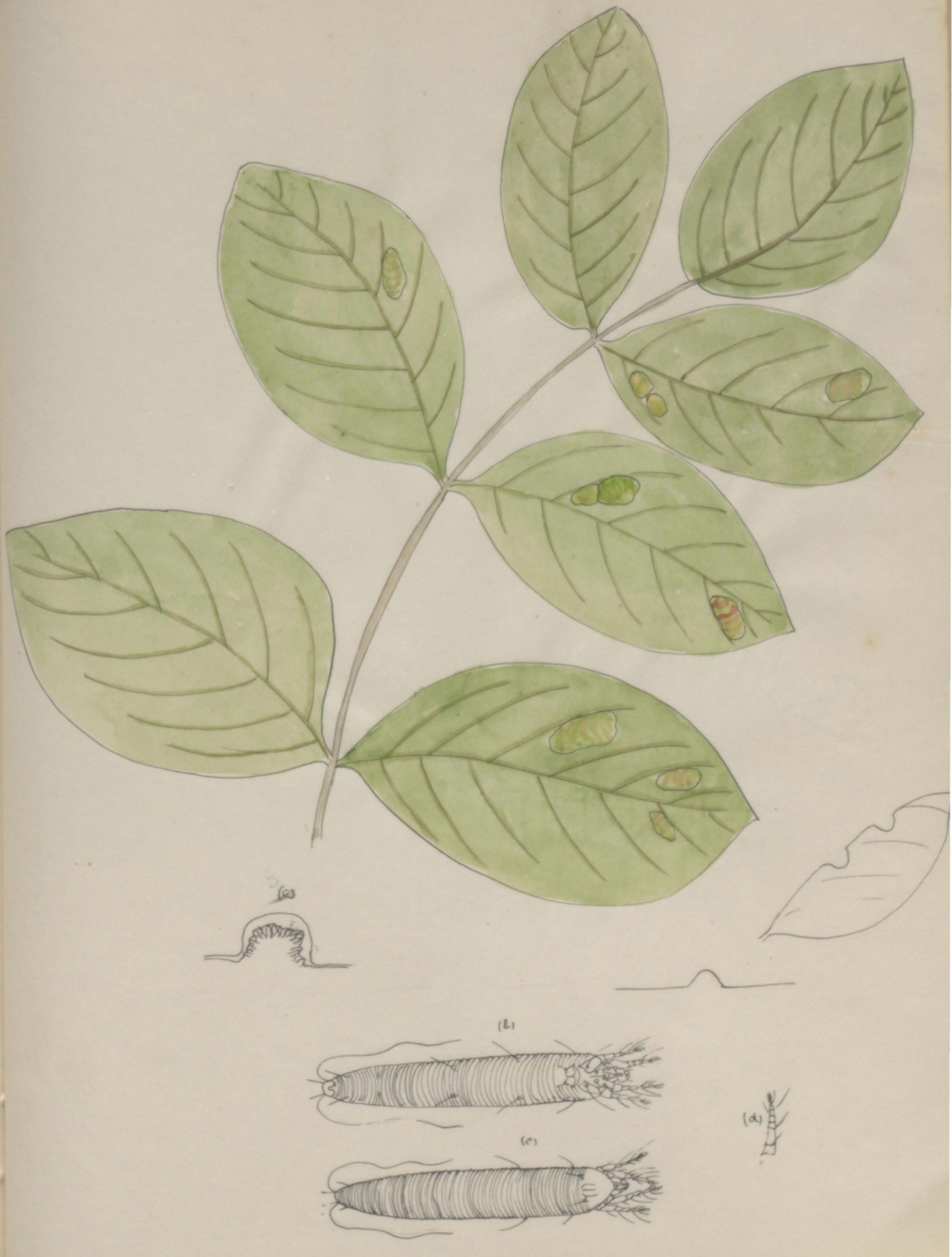


PLATE. 3I.

Eriophyes ribis.

(a) Ventral surface of mite.

(b) Dorsal surface of mite.


(1)
(2)

PLATE 32.

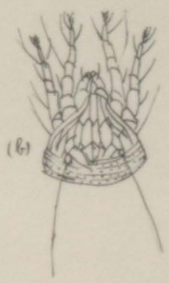
Eriophyes tetanothrix laevis.

(a) Ventral view of mite.

(b) Dorsal view of shield

PL. 32.





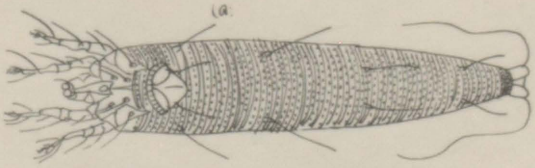


PLATE 33.

I.Eriophyes similis. (Gall)

2. Eriophyes padi prunianus. (gall)

I (a) Ventral view of Eriophyes similis

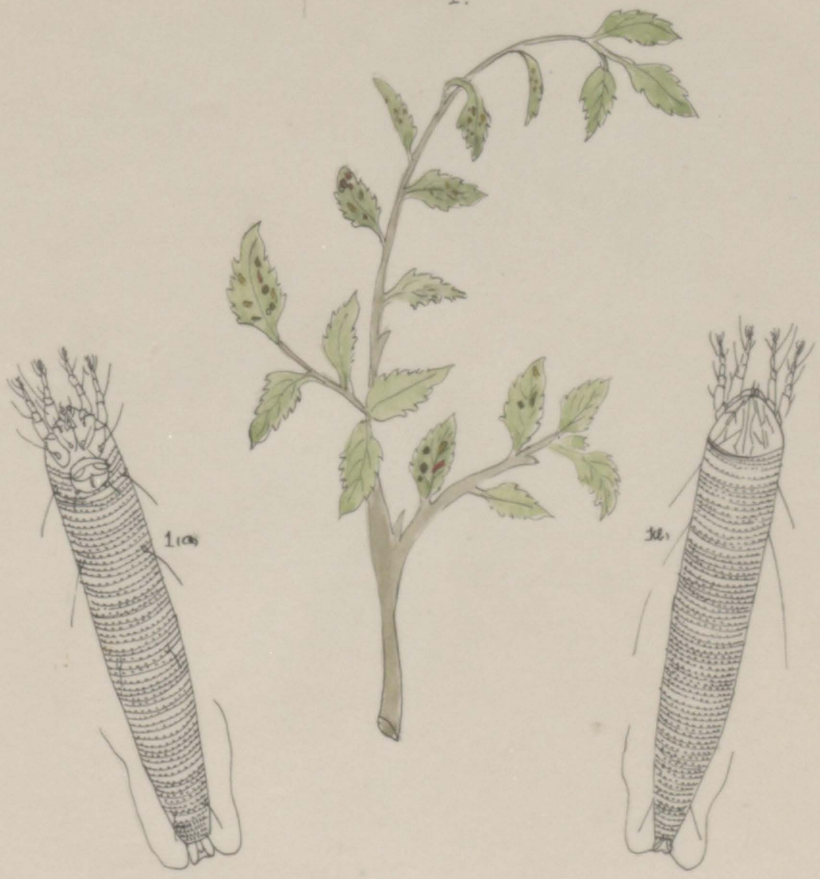
I (b) Dorsal view of " "

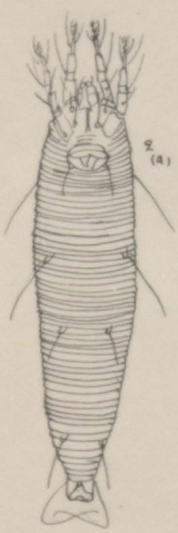
2. (a) Ventral view of Eriophyes padi prunianus

2. (b) Dorsal view of " " "

PL. 33.

1.





2.





PLATE 34.

1. Rhopalosiphum ribis.

(a) Gall.

(b) Winged female .

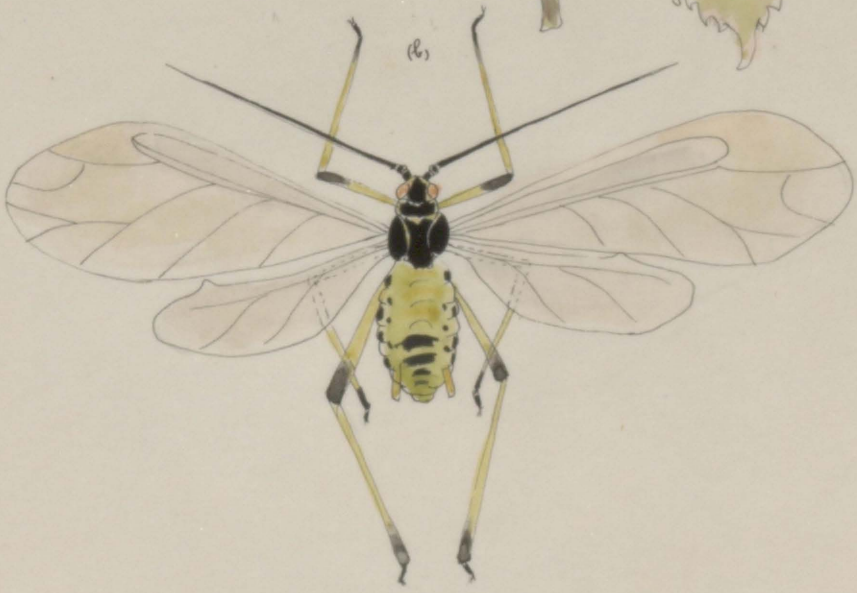
2. Aphis mali.

Pl. 34.

1(a)



(b)



2.

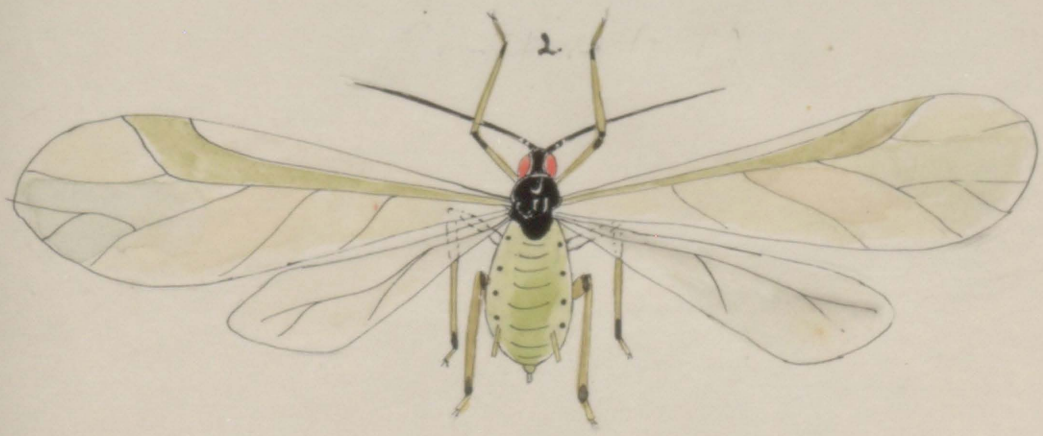


PLATE 35.

I. Schizoneura ulmi.

(a) Galled leaves.

(b) Transverse section of leaf showing roll

(c) Adult Aphid.

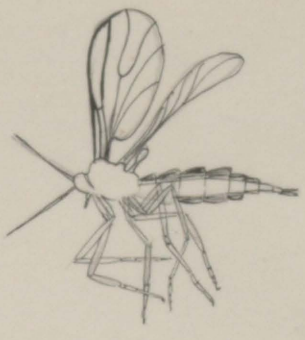
2. Myzus ribis.


1 (a)
2.
(b)
(c)

PLATE 36.

Rhabdophaga heterobia.

(a) Antennae.



(a)

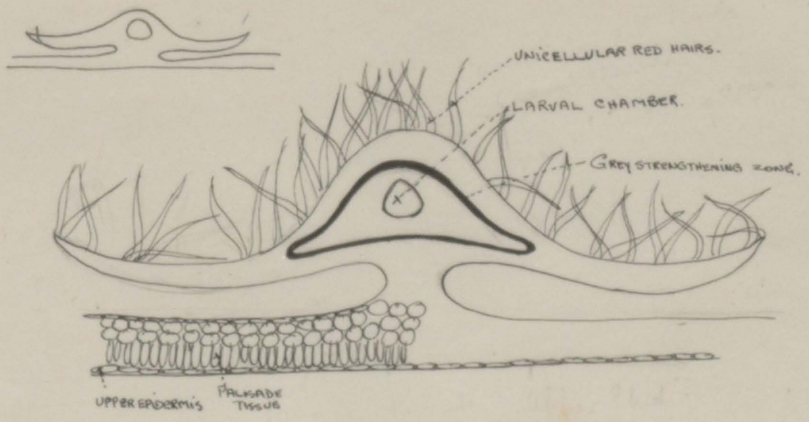
PLATE 37.

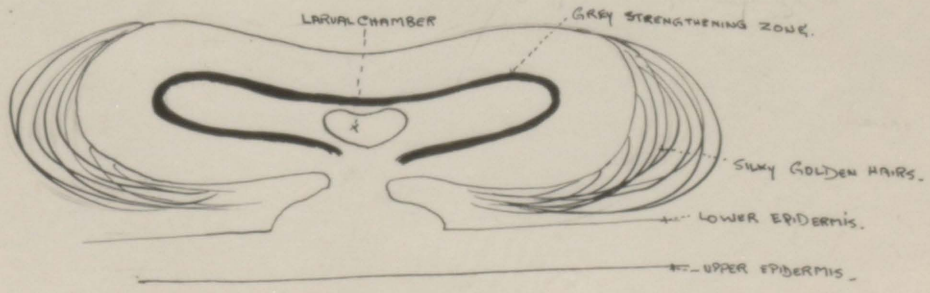
1. Transverse section through gall of Neuroterus lenticular

2. Transverse section through gall of Neuroterus numismatis

3. Mouth parts of larva of Andricus ostreus.

PL. 34.


UNICELLULAR RED HAIRS.
LARVAL CHAMBER.
GREY STRENGTHENING ZONE.
UPPER EPIDERMIS
PALISADE TISSUE


LARVAL CHAMBER
GREY STRENGTHENING ZONE.
SILKY GOLDEN HAIRS.
LOWER EPIDERMIS.
UPPER EPIDERMIS.

3.


HORNY OVERLAPPING JAWS.

PLATE 38.

1. Neuroterus laevisculis.

(a) Neuroterus laevisculis var. reflexa.

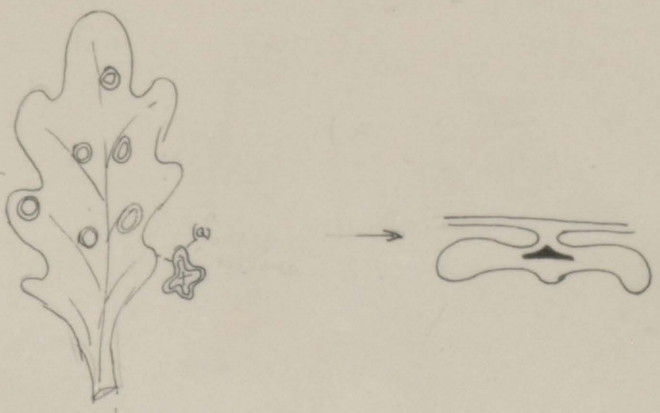
2. Neuroterus lenticularis.

3. Neuroterus fumipennis.

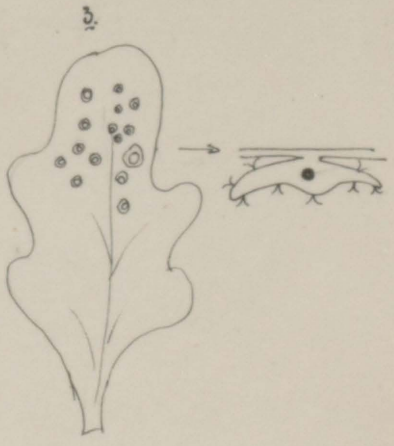
4. Spathegaster baccarum.

PL. 38.

1.



2.



4.

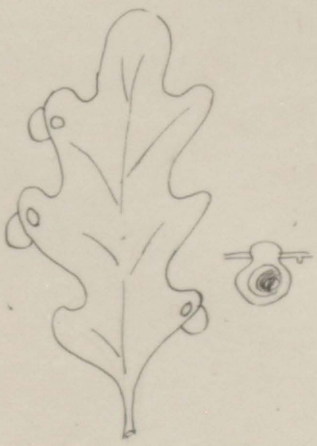


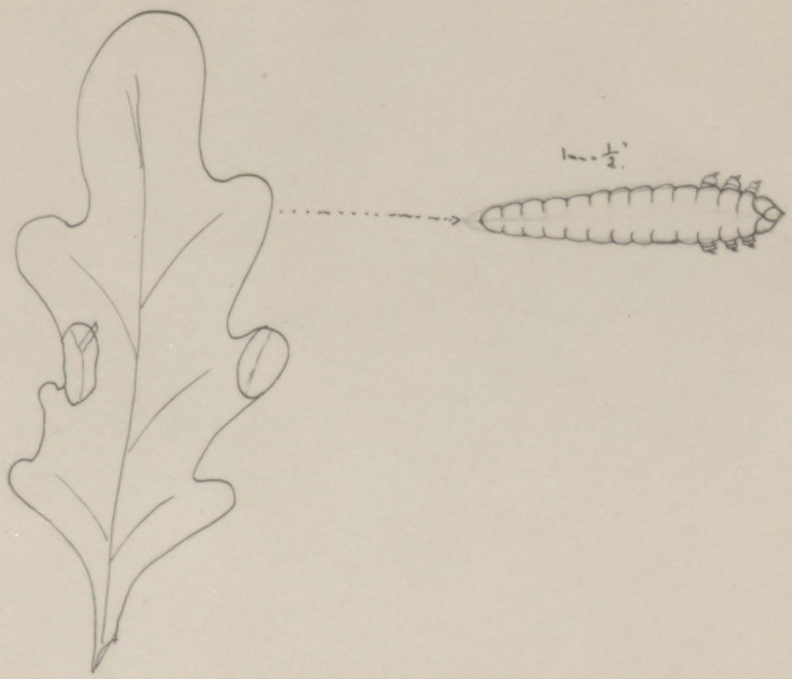
PLATE 39.

I.Lithocolletis messaniella½

2.Transverse section of gall of Nematus gallico

Pl. 39.

1.



2.

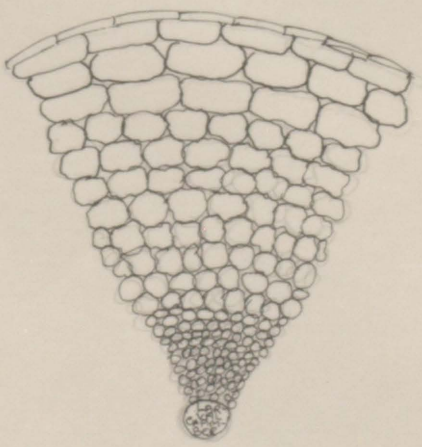


PLATE 40.

1. Rhabdophaga terminalis.
2. Osier leaf with tip folded by Lepidopterous larva.
3. Lepidopterous larvae rolling back willows.
4. Alder leaf rolled by lepidopterous larva.

PL. 40.

1



2.



3(a)



3(b)



4.

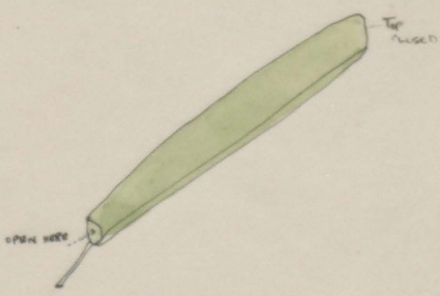


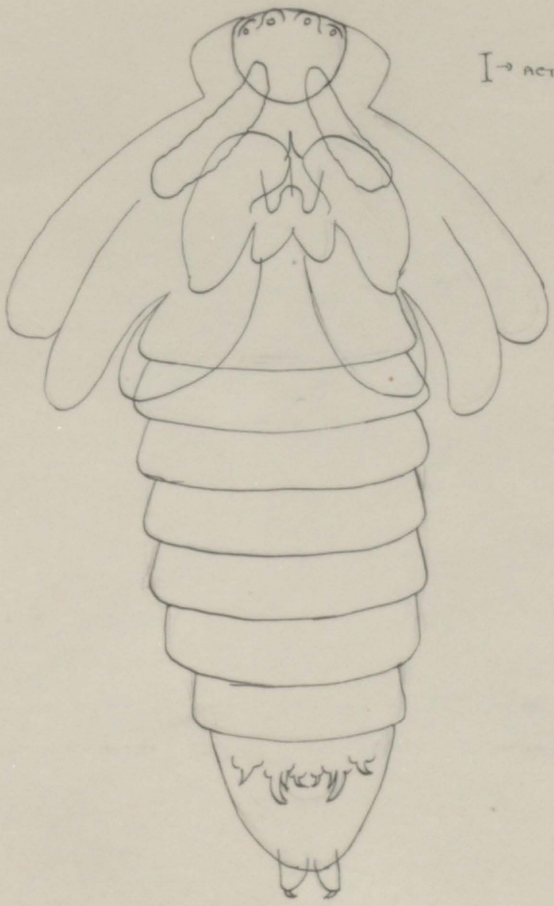




PLATE 41.

Pupa of Orchestes fagi.

PL. 41.



I→ ACTUAL LENGTH.

PLATE 42.

Eriophyes tiliae typicus.

(a) Dorsal view of mite.

(b) Ventral view of mite

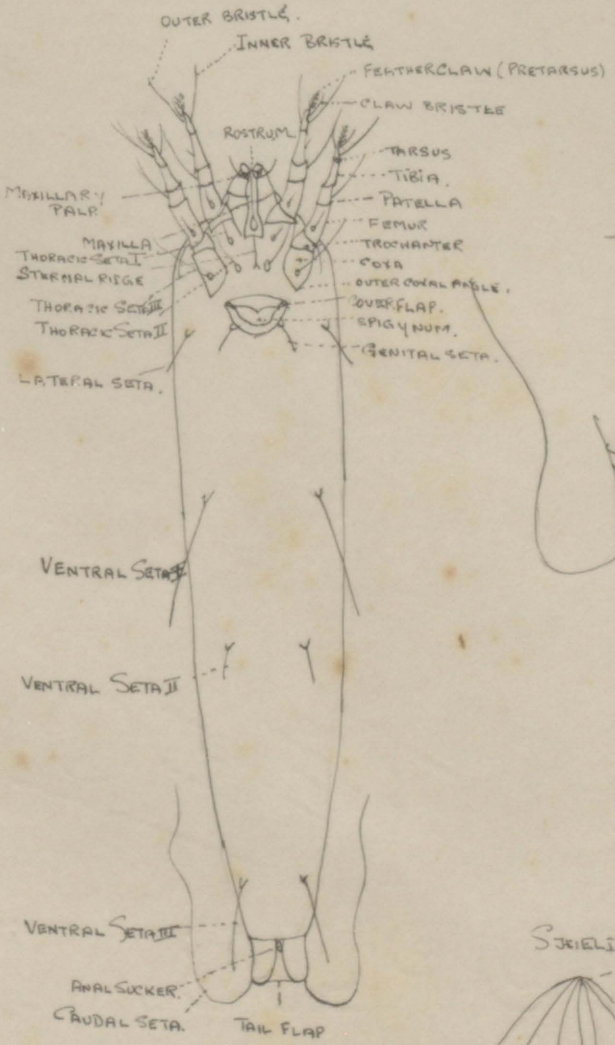
PL. 42.

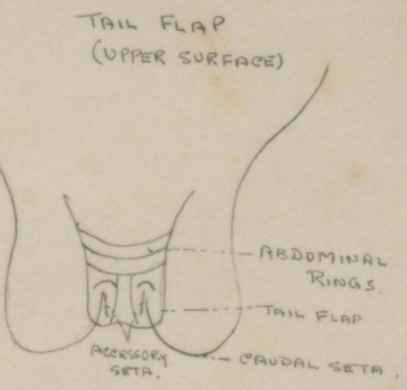


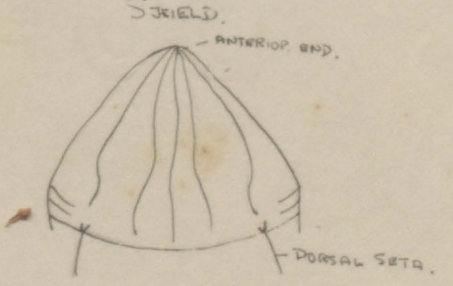
PLATE 44.

Typical Phytoptid mite.

PL. 44.


OUTER BRISTLE.
INNER BRISTLE
FEATHERCLAW (PRETARSUS)
CLAW BRISTLE
ROSTRUM
TARSUS
TIBIA.
PATELLA
FEMUR
TROCHANTER
COXA
OUTER COXAL ANGLE.
UNDERFLAP.
SPIGYNUM.
GENITAL SETA.
MAXILLARY PALP
MAXILLA
THORACIC SETA I
STERNAL RIDGE
THORACIC SETA II
THORACIC SETA III
LATERAL SETA.
VENTRAL SETA I
VENTRAL SETA II
VENTRAL SETA III
ANAL SUCKER.
CAUDAL SETA.
TAIL FLAP


TAIL FLAP
(UPPER SURFACE)
ABDOMINAL RINGS.
TAIL FLAP
ACCESSORY SETA.
CAUDAL SETA.


SHIELD.
ANTERIOR END.
DORSAL SETA.