

BRITISH
VEGETABLE GALLS

The D. H. Hill Library



North Carolina State

SB767

C7

NORTH CAROLINA STATE UNIVERSITY LIBRARIES



S00785131 P



Philip
13th April

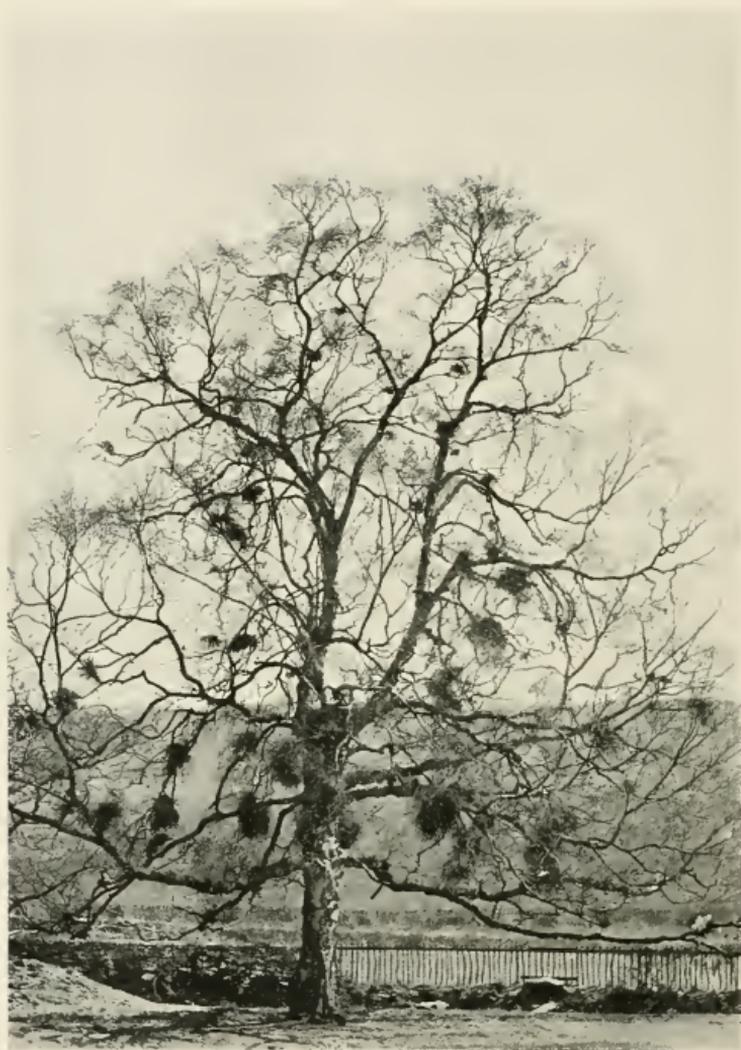
Grenville

This book is due on the date indicated below and is subject to an overdue fine as posted at the Circulation Desk.

NOV 2 1966
16-7195271
WVV-4-12-95

BRITISH VEGETABLE GALLS

"Rerum Natura sacra sua non simul tradit,"—SENECA



A BIRCH-TREE, *Betula alba* Linn.,
IN BROOMHAM PARK, GUESTLING, NEAR HASTINGS.

(See page 55.)

BRITISH VEGETABLE GALLS

AN INTRODUCTION
TO THEIR STUDY

BY
EDWARD T. CONNOLD

HONORARY GENERAL SECRETARY TO THE HASTINGS
AND ST. LEONARDS NATURAL HISTORY SOCIETY

ILLUSTRATED WITH
ONE HUNDRED AND THIRTY FULL-PAGE PLATES
AND TWENTY-SEVEN SMALLER DRAWINGS

London: HUTCHINSON & CO.
Paternoster Row . . . 1901

*[The right of Translation
and Reproduction is reserved]*

PRINTED BY
HAZELL, WATSON, AND VINEY, LD.,
LONDON AND AYLESBURY.

PREFACE.

FOR several years past it has been one of my favourite pastimes to collect vegetable galls, and to observe the many peculiarities connected with their growth. The accumulation of a large number of specimens and a mass of notes resulting from these researches has awakened the desire to arrange them in book form. The purpose of this volume is not to deal exhaustively with the subject, but rather to afford the collector and the student a medium of reference, whereby about two-thirds of the number of vegetable galls at present discovered may be determined. Complete lists of all known galls are also given, with a brief description of each. The art of photography has been employed to represent the specimens as they appeared in a living condition. I have not attempted to produce pretty pictures ; my endeavour has been to arrange the specimens in such a manner that the various distinctive features of the galls themselves may be easily recognised. All the illustrations (except plate 1) are my own production. No illustrations are given of the oak-galls. They will probably appear subsequently in a volume devoted exclusively to oak-galls. In giving the average dimensions of each gall, it has been considered advisable to employ the millimetre as the unit (25 mm. = 1 inch).

Very much remains to be done in this section of natural history, and it is hoped that the perusal of the

following pages will act as an incentive to other students of Nature to continue their researches.

My heartiest thanks are due to the Rev. E. N. Bloomfield, M.A., F.E.S., of Guestling Rectory, near Hastings, for the most valuable help and information which he has given me from the time I commenced the study of vegetable galls.

I also gratefully acknowledge the assistance rendered in many details by my wife and my sons Russell Ernest and Harold Thomas. On several occasions my sons have discovered very fine specimens.

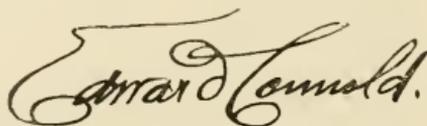
Prof. Dr. Alfred Nalepa of Vienna has kindly identified many of the galls caused by mites.

Mrs. Coupland and Miss M. Bates have rendered invaluable service in translating Dr. Nalepa's works on Mites and his most helpful correspondence.

To Mr. Frank B. Fermor I am deeply indebted for the time and patience which he has so kindly and unreservedly bestowed upon the correction and revision of the proof-sheets.

I am also very grateful to Miss R. D. Roff King for her valuable assistance with the notes, photographs, proof-sheets, and various details connected with the compilation of the MS.

For the gift of specimens I desire to thank most sincerely Miss Ethel Sayer, Rev. E. N. Bloomfield, Messrs. Frank Hall, R. R. Hutchinson, Walter Field, F. W. Terry, W. Furlonger, and G. C. Walton.



CONTENTS.

	PAGE
PREFACE	v
LIST OF FULL-PAGE PLATES	ix
LIST OF SMALL ILLUSTRATIONS	xii
CHAPTER I.	
WHAT IS A VEGETABLE GALL?	1
CHAPTER II.	
THE SIZES, SHAPES, AND COLOURS OF GALLS	9
CHAPTER III.	
THE COLLECTING, MOUNTING, AND PRESERVING GALLS	14
CHAPTER IV.	
THE EMERSION OF THE IMAGINES	21
CHAPTER V.	
THE MODE OF GROWTH AND CLASSIFICATION OF GALLS	24
CHAPTER VI.	
THE AGENTS CONCERNED IN THE PRODUCTION OF GALLS	31
CHAPTER VII.	
THE ROOT-GALLS	39
THE STEM-GALLS	53

	PAGE
THE LEAF-GALLS	119
THE FLOWER-GALLS	267
A TABLE OF MONTHS IN WHICH THE GALLS ILLUSTRATED IN THIS VOLUME MAY BE FOUND	295
A LIST OF PLANTS ILLUSTRATED IN THIS VOLUME	298
NAMES OF MAKERS OF GALLS NOT ILLUSTRATED IN THIS VOLUME	301
A LIST OF GALLS FOUND ON QUERCUS	305
A LIST OF WORKS CONSULTED.	307
INDEX	309

LIST OF PLATES.

PLATE		FACING PAGE
1.	A birch-tree in Broomham Park, Hastings	<i>Frontispiece</i>
2.	Glands on petioles of leaves of <i>Prunus avium</i>	6
3.	Thickened roots, or pseudo bulbs of grass	8
4.	Stem of <i>Betula alba</i> , with aborted branches	8
5.	Collecting impedimenta used by the author	12
6.	Apparati employed by the author when photographing	20
7.	Bottles, etc., used for rearing makers of galls	22
8.	<i>Brassica Napus</i> , galled by <i>Ceuthorhynchus sulcicolis</i>	42
9.	" <i>rutabaga</i> " " " " "	44
10.	" " " " " " "	46
11.	" <i>sinapis</i> " " " " "	48
12.	<i>Pyrus Malus</i> " <i>Schizoneura fodiens</i>	50
13.	<i>Potentilla reptans</i> " <i>Xestophanes potentillæ</i>	52
14.	<i>Corylus Avellana</i> " <i>Eriophyes avellanae</i> , var.	58
15.	" " " " " " "	60
16.	<i>Betula alba</i> " " <i>rudis</i>	62
17.	" " " " " " "	64
18.	" " " " " " "	66
19.	" " " " " " "	68
20.	" " " " " " "	70
21.	<i>Populus tremula</i> " <i>Saperda populnea</i>	72
22.	<i>Salix Caprea</i> " " " "	74
23.	" <i>cinerea</i> " <i>Agromyza schineri</i>	76
24.	" " " " " " "	78
25.	<i>Galium verum</i> " <i>Cecidomyia galii</i>	80
26.	<i>Salix Caprea</i> " " <i>saliciperda</i>	82
27.	" " " " " " "	84
28.	" <i>cinerea</i> " " <i>salicis</i>	86
29.	<i>Sisymbrium officinale</i> , galled by <i>Cecidomyia sisymbrii</i>	88
30.	<i>Tilia grandifolia</i> " " <i>tiliæ</i>	90
31.	<i>Rubus fruticosus</i> " <i>Lasioptera rubi</i>	92
32.	<i>Arundo Phragmites</i> " <i>Lipara lucens</i>	94
33.	<i>Carduus arvensis</i> " <i>Urophora cardui</i>	96
34.	<i>Abies excelsa</i> " <i>Adelges abietis</i>	98
35.	<i>Pyrus Malus</i> " <i>Schizoneura lanigera</i>	100
36.	<i>Populus alba</i> " <i>Hedya aceriana</i>	102
37.	<i>Pinus sylvestris</i> " <i>Retinia resinella</i>	104
38.	<i>Hieracium sylvaticum</i> " <i>Aulax hieracii</i>	106

List of Plates

PLATE		PAGE
39.	<i>Hypochoeris radicata</i> , galled by <i>Aulax hypochoeridis</i>	108
40.	<i>Rubus fruticosus</i> " <i>Diastrophus rubi</i>	110
41.	<i>Ammophila arundinacea</i> " <i>Eurytoma hyalipennis</i>	112
42.	<i>Rosa spinosissima</i> " <i>Rhodites spinosissima</i>	114
43.	<i>Potentilla tormentilla</i> " <i>Xestophanes breviarismis</i>	116
44.	" <i>reptans</i> " " <i>potentillæ</i>	118
45.	<i>Ajuga reptans</i> " <i>Eriophyes ajugæ</i>	122
46.	<i>Pyrus aucuparia</i> " " <i>aucupariæ</i>	124
47.	<i>Corylus Avellana</i> " " <i>avellanæ</i>	126
48.	<i>Alnus glutinosa</i> " " <i>axillaris</i>	128
49.	" " " " <i>brevitarsus</i>	130
50.	<i>Cratægus Oxyacantha</i> " " <i>cratægi</i>	132
51.	<i>Galium Aparine</i> " " <i>galli</i>	134
52.	" <i>verum</i> " " <i>galiobius</i>	136
53.	<i>Cratægus Oxyacantha</i> " " <i>goniothorax</i>	138
54.	<i>Alnus glutinosa</i> " " <i>lævis</i>	140
55.	<i>Betula alba</i> " " <i>lionotus</i>	142
56.	<i>Acer campestre</i> " " <i>macrochelus</i>	144
57.	" " " " <i>macrorhyncus</i>	146
58.	<i>Salix alba</i> " " <i>marginatus</i>	148
59.	<i>Pyrus communis</i> " " <i>piri</i>	150
60.	<i>Taxus buccata</i> " " <i>psilaspis</i>	152
61.	<i>Populus tremula</i> " " <i>pustulatum</i>	154
62.	<i>Ribes nigrum</i> " " <i>ribis</i>	156
63.	<i>Betula alba</i> " " <i>rudis</i>	158
64.	<i>Poterium sanguisorba</i> " " <i>sanguisorbæ</i>	160
65.	<i>Prunus spinosa</i> " " <i>similis</i>	162
66.	<i>Salix Caprea</i> " " <i>tetanotrix lævis</i>	164
67.	<i>Tilia europæa</i> " " <i>tetratrichus</i>	166
68.	" " " " <i>tiliæ (typicus)</i>	168
69.	" " " " <i>tiliarius</i>	170
70.	<i>Juglans regia</i> " " <i>tristratus, var. erinea</i>	172
71.	<i>Viburnum opulus</i> " " <i>viburni</i>	174
72.	<i>Fagus sylvatica</i> " <i>Monochetus sulcatus</i>	176
73.	<i>Acer pseudo-platanus</i> " <i>Phyllocoptes acericola</i>	178
74.	<i>Fraxinus excelsior</i> " " <i>fraxini</i>	180
75.	<i>Juglans regia</i> " <i>Eriophyes tristratus, var. erinea</i>	182
75.	<i>Glechoma hederacea</i> " <i>Aulax glechomæ</i>	182
76.	<i>Cratægus Oxyacantha</i> " <i>Eriophyes goniothorax</i>	184
76.	<i>Pyrus aucuparia</i> " " <i>aucupariæ</i>	184
77.	<i>Achillea millefolium</i> " <i>Tylenchus millefolii</i>	186
78.	<i>Glechoma hederacea</i> " <i>Cecidomyia bursaria</i>	188
79.	<i>Cratægus Oxyacantha</i> " " <i>cratægi</i>	190
80.	<i>Lathyrus pratensis</i> " " <i>lathyri</i>	192
81.	<i>Salix viminalis</i> " " <i>marginem-torquens</i>	194
82.	<i>Polygonum amphibium</i> " " <i>persicariæ</i>	196
83.	<i>Pteris aquilina</i> " " <i>pteridis</i>	198
84.	<i>Ranunculus repens</i> " " <i>ranunculi</i>	200

List of Plates

xi

PLATE		PAGE
85.	<i>Salix aurita</i> , galled by <i>Cecidomyia rosaria</i>	202
86.	" " " " "	204
87.	<i>Rosa canina</i> " " rosarum	206
88.	<i>Taxus buccata</i> " " taxi	208
89.	<i>Spiræa Ulmaria</i> " " ulmariae	210
90.	<i>Urtica dioica</i> " " urticæ	212
91.	<i>Veronica chamædrys</i> " " veronicæ	214
92.	<i>Viola canina</i> " " violæ	216
93.	<i>Fraxinus excelsior</i> " <i>Diplois botularia</i>	218
94.	<i>Populus tremula</i> " " tremulæ	220
95.	<i>Salix Caprea</i> " <i>Hormomyia capreæ</i>	222
96.	<i>Fagus sylvatica</i> " " Fagi	224
97.	<i>Achillea millefolium</i> " " millefolii	226
98.	<i>Fagus sylvatica</i> " " piligera	228
99.	<i>Ranunculus repens</i> " <i>Polycystis pompholygodes</i>	230
100.	<i>Viola canina</i> " " violæ	232
101.	<i>Atriplex angustifolia</i> " <i>Aphis atriplicis</i>	234
102.	<i>Stellaria holostea</i> " <i>Brachycolus stellariae</i>	236
103.	<i>Juncus articulatus</i> " <i>Livia juncorum</i>	238
104.	<i>Populus nigra</i> " <i>Pemphigus bursarius</i>	240
105.	" " " " <i>spirothecæ</i>	242
106.	<i>Ribes nigrum</i> " <i>Rhopalosiphum ribis</i>	244
107.	<i>Ulmus montana</i> " <i>Schizoneura ulmi</i>	246
108.	" <i>campestris</i> " <i>Tetraneura ulmi</i>	248
109.	<i>Glechoma hederacea</i> " <i>Aulax glechomæ</i>	250
110.	<i>Salix Caprea</i> " <i>Nematus bellus</i>	252
111.	" <i>fragilis</i> " " gallicola	254
112.	<i>Rosa canina</i> " <i>Rhodites eglanteriæ</i>	256
113.	" " " " <i>nervosus</i>	258
114.	" " " " <i>rosæ</i>	260
115.	" " " " " "	262
116.	" <i>rubiginosa</i> " " <i>rubiginosæ</i>	264
117.	<i>Rubus fruticosus</i> " <i>Lasioptera rubi</i>	266
117.	<i>Populus tremula</i> " <i>Diplois tremulæ</i>	266
118.	<i>Ajuga reptans</i> " <i>Eriophyes ajugæ</i>	270
119.	<i>Daucus carota</i> " <i>Asphondylia pimpinellæ</i>	272
120.	<i>Betula alba</i> " <i>Cecidomyia betulæ</i>	274
121.	<i>Tilia europæa</i> " " <i>tilicola</i>	276
122.	<i>Vicia sepium</i> " <i>Diplois loti</i>	278
123.	<i>Pyrus communis</i> " " <i>pyrivora</i>	280
124.	<i>Arcetium lappa</i> " <i>Tephritis bardanæ</i>	282
125.	<i>Centaurea nigra</i> " <i>Urophora solstitialis</i>	284
126.	<i>Prunus insititia</i> " <i>Exoascus insititiæ</i>	286
127.	<i>Lonicera periclymenum</i> " <i>Siphocoryne xylostei</i>	288
128.	<i>Papaver dubium</i> and <i>P. Rheas</i> , galled by <i>Aulax papaveris</i>	290
129.	<i>Prunus insititia</i> " <i>Exoascus insititiæ</i>	292
129.	<i>Potentilla reptans</i> " <i>Xestophanes potentillæ</i>	292
130.	A charming spot for galls	294

LIST OF SMALL ILLUSTRATIONS.

	PAGE
The millimetre scale	8
Fig. 1. A fine specimen of gall caused by <i>Lasioptera rubi</i> . . . facing	92
A. As growing. Natural size	
B. Longitudinal section. Natural size	
„ 2. <i>Urophora cardui</i>	96
A. The imago. $\times 5$	
B. The larva. $\times 10$	
C. Section of gall showing larval chambers. Natural size	
„ 3. Leaves of <i>Urtica dioica</i>	212
A. Three leaves showing under surfaces	
B. Upper surface of a leaf	
C. Lower portion of B, showing sections of galls	
„ 4. Hairs from exterior of gall of <i>Cecidomyia veronicae</i> . . .	214
„ 5. Portion of stalk of <i>Ranunculus repens</i> twisted by <i>Polycystis pompholygodes</i>	230
„ 6. Five stages in the spiral formation of a petiole of <i>Populus nigra</i>	242
„ 7. Galls on stem and edge of leaflet of <i>Rosa canina</i> . . .	256
„ 8. Thirteen galls on seven leaflets of <i>Rosa canina</i> . . .	256
„ 9. The gall and larva of <i>Rhodites rosea</i>	260
A. The cells	
B. A fibre from exterior (enlarged)	
C. The larva. $\times 22$. Ventral and profile views	
„ 10. The gall of <i>Urophora solstitialis</i>	284
A. The gall with hairs. $\times 2$	
B. The gall denuded of hairs. $\times 2\frac{1}{2}$	
C. Section showing larval chambers. $\times 2\frac{1}{2}$	
D. The larva. $\times 4$.	
E. The pupa. $\times 4$.	

BRITISH VEGETABLE GALLS.

CHAPTER I.

What is a Vegetable Gall?

THE Vegetable Galls constitute a branch of study and research that seems to have been much neglected by students of Nature generally. The galls, and the agents concerned in producing them, have not received the attention of botanists and entomologists which they deserve, since they are such valuable adjuncts to both classes of students and collectors. This is somewhat remarkable, since the botanist, while in pursuit of specimens for examination or the herbarium, must frequently find plants with galls upon them. The practical entomologist, in gathering the food-plants for the home-reared larvæ, cannot fail to notice the deformities and protuberances on the leaves; while if it be desired to secure the tiny Diptera, Hymenoptera, and other imagines, in their pristine beauty, rearing from the galls is almost a *sine qua non*.

But there are persons who, in their study of Nature, have not met with galls, or if they have, little or no attention has been paid to them.

Like all pursuits, when for the first time prominently brought to notice, the subject of galls and gall-collecting calls forth enquiries as to what they are, and where they are to be found. Before attempting to give a concise reply to the question, What is a vegetable gall? it will be as well briefly to consider the etymology of the word "gall"; its history in English literature, in so far as it throws any light upon the answer; and also to consider the opinions of some English writers who have given the subject their attention.

British Vegetable Galls

The word "gall" is derived from three sources, and has many significations. The first comes from the Anglo-Saxon word "*ge'lla*," and, when used as a noun, denotes anything extremely bitter, the fluid secreted in the glandular substances of the liver being the most familiar example; but under this derivation, when used in another sense, it denotes implacable enmity and spite. The next derivation is from the French word "*galer*," the active verb "to gall," and supplies a meaning to such expressions as to tease, to fret, to annoy, or harass a person; it also implies a wearing away, or breaking of the skin by rubbing. The third is from the Latin "*galla*," and is used to signify the excrescences which make their appearance on various parts of many plants.

It will not be difficult to show in due course how particularly applicable is the word gall, inasmuch as most kinds not only possess the bitterness of flavour which renders them objectionable to the palate, but, by their very mode of growth, tend to annoy and harass the vegetable substances upon which they may be found, causing them to bulge and swell to abnormal sizes, and producing deformities and contortions which are wholly foreign to all natural vegetable growth.

Originally the word was used only in connection with a painful swelling, pustule, or blister in cattle, more especially the horse. In later use it indicated an external sore or wound produced by rubbing or chafing.

With regard to the history of the word, the New English Dictionary informs us that the first mention of the word gall, as applied to the excrescences produced on trees, occurs in "Trevisa." Barth. De. P. R. XVII. civ. (Tollem MS.): "The mall (Mandragora) haþ white leues . . . and apples groweþ on þe leues, as galles groweþ on oken leues." The next use of it was in 1440, and in 1481 it was used by Caxton. In 1562 Turner, in his "Herbal," ii. 109 b., says: "A gall is the fruite of an oke, and especially of the lefe." Fifty-four years afterwards Surfl. and Markh. in "Country Farme," p. 28, remark: "He shall know a fruitfull and fertile yeare if he see the Oke apples, commonly called Gals, a Flie engendred and bred." In 1697 Dryden used the word, Virg., "Georg." iv. 389: "To these add pounded Galls and Roses dry." In

1776-96, "Withering British Plants" (ed. 3), ii., 388, it is stated that "the balls or galls upon the leaves are occasioned by a small insect with four wings." Tennyson, in 1842, speaks of a gall, "Talking Oak," 70:

I swear (and else may insects prick
Each leaf into a gall).

Most of these quotations without doubt refer to the oak-apple (*Teras terminalis*). Probably only a very few of the other oak-galls were known prior to 1840. But for some years previous to that date the excrescences on other trees and plants had been noticed, and the word gall was brought into general use by English naturalists.

The early writers on the subject of gall-growths appear not to have been able to determine how galls were produced, but were greatly puzzled to account for the ova and the larvæ which they found within the tissues of the plant. It was supposed that the ova were deposited by the parent insect in the ground, and from thence drawn up with the sap and carried throughout the tree, until, having reached a certain point, the course was arrested, and the formation of gall-structure commenced. It was also considered possible that the larva, when newly hatched, ate through the cuticle of the leaf, and waited until the sap flowing from the wound enveloped it. Pliny ("Nat. Hist." xvi. 9, 10) was aware that flies emerged from gall-growths; but, instead of associating the latter with the former, he thought that galls were of fungoid origin and grew as rapidly. J. Rennie ("Insect Architecture," vol. ii., p. 116) was aware "that the mother gall-fly makes a hole in the plant for the purpose of depositing her eggs," and also that "she is furnished with an admirable ovipositor for that express purpose"; but he does not appear to have penetrated the mystery which then surrounded the development of their growth, for he proceeds to quote from "our older naturalists," that the parent fly "ejects into the cavity a drop of her corroding liquor, and immediately lays an egg or more there; the circulation of the sap being thus interrupted, and thrown, by the poison, into a fermentation that burns the contiguous parts, and changes the natural colour. The sap, turned from its proper channel, extravasates and flows round the eggs,

while its surface is dried by the external air, and hardens into a vaulted form."

Many galls, however, do not begin to grow until the larva is hatched and commences to eat.

Redi ("De Insectis," p. 233 *et seq.*), not having witnessed oviposition by the parent fly, assumed that the "plant had a vegetable soul which presided at the origin of galls, with their eggs, larvæ, and imagines, while it again gave issue to fruits."

About the middle of last century the true nature of galls began to be understood.

In Tomlinson's Cyclopædia, published about 1850, in the section "Gall-Nuts," p. 735, the following appears: "These galls are produced by the punctures of an insect *Cynips gallæ tinctoriæ*, which deposits its eggs in the vegetable tissue, and thereby causes the shoot or bud to swell, and become an excrescence or gall, within which the larva is developed." Another publication of the same kind, in circulation about the same date, states that "galls are the result of morbid action excited in the leaf-buds of several species of the genus *Quercus*, or oak, occasioned by an insect *Cynips quercus* depositing its ova in the bud." Kirby and Spence (Intro. to "Entomology," ed. 7, p. 254), in describing "vegetable excrescences termed galls," state that "all these tumours owe their origin to the deposition of an egg in the substance out of which they grow." Rev. J. G. Wood ("Homes Without Hands," p. 484), after describing the operations of the parent insect depositing the ova, continues: "The effect of the wound is very remarkable. The irritating fluid which has been projected into the leaf has a singular effect upon its tissues, altering their nature and developing them into cells filled with fluid. As long as the leaf continues to grow, the gall continues to swell, until it reaches its full size, which is necessarily variable, being dependent on that of the leaf." Edward Steep was of the opinion that "the egg or the fluid which is ejected with it causes irritation in the plant, and an effort is made to cover up the annoying substance." Dr. Stratton ("Alternating Generations," p. 9) says: "A gall is an abnormal growth of plant tissue produced by animal agency acting from within." The "Encyclopædia Britannica," vol. x., contains a long article on the subject. The following

has special reference to the point now in review: "What are commonly known as galls are vegetable deformities or excrescences due to parenchymatous hypertrophy. The exciting cause of the hypertrophy, in the case of the typical galls, appears to be a minute quantity of some irritating fluid, or virus, secreted by the female insect, and deposited with her egg in the puncture made by her ovipositor in the cortical or foliaceous parts of the plant. This virus causes the rapid enlargement and subdivision of the cells affected by it, so as to form the tissues of the galls. Oval or larval irritation also without doubt plays an important part in the formation of many galls. Though a certain relation is necessary between the 'stimulus' and the 'supporter of the stimulus,' as evidenced by the limitations in the majority of cases of each species of gall-insect to some one vegetable structure, still, it must be the quality of the irritant of the tissue, rather than the specific peculiarities of the part of the plant affected, that principally determines the nature of the gall."

Other English writers might be cited, but to multiply quotations would be but to reiterate the same ideas. The opinions of French and German writers on the subject of gall formation are identical.

These opinions only concern galls directly due to insect agency. The researches during the past few years in the department of agricultural zoology show us that many galls are due to the presence of nematoid worms within the tissues of the plants, and not only are they present upon the aerial portions of the plants, but are numerously disposed upon and within the roots. This latter fact—*viz.* the presence of galls on roots—does not appear to have been known to any of the early writers. This, however, is not the only agency unsuspected until recently. Various forms of fungi are now known to attack several parts of trees, and are especially destructive to the fruits of the *Prunus* order. Some of the lower orders of plants also are considerably swollen, distorted, and their functions rendered abortive, by the same cause. The boughs of fir-, beech-, ash-, and oak-trees are affected by fungi, and enormous gall-growths are oftentimes the result; while the semi-exposed roots of ash- and birch-trees have been found distorted and swollen in a similar manner.

There is therefore no warrant for restricting the term vegetable gall to an abnormality, the formation of which is due to cellular structure alone, or accumulation of sap alone, or even to insect agency exclusively, since other agents produce swellings which have the same appearance and cause like deformities of the plant. Nor does the etymology of the word permit such limitations. Henceforth the words must spread over a wider range of meaning—a meaning which can be defined, and a range which can be limited only by the systematist.

How, then, shall a vegetable gall be described? What is a vegetable gall?

It is a morbid enlargement of the affected part of the plant, due to parasitic agency.

Very few of the higher forms of plants are altogether exempt from the attacks of gall-producers. Fungi and lichens, however, do not appear to be attacked, although there is no apparent reason why these lower forms should enjoy immunity. The formation of a gall takes place only while the plant is in a growing condition; but the death of the plant is not always an indication that the primary purpose of the gall should cease: so long as sufficient moisture is contained within the tissues of the gall, or that its external crust affords sufficient protection, so long is it fulfilling its main use. Some galls bear no resemblance to the portion of the plant upon which they are situated; but there is generally some organ of the plant, modified upon the exterior of the structure, which imparts a distinctive form. The most remarkable illustration of this feature may be seen in the fibrous covering of the Bedeguar gall (*Rhodites rosæ*), which represent fibro-vascular bundles of leaves with scarcely any parenchyma uniting them.

In degree of complexity of internal structure, galls vary considerably. Some are quite simple with thin walls—*e.g.* *Nematus bellus*, in which the larva feeds voraciously upon the interior until it has a mere shell for a covering, and this it leaves to pupate. Other kinds of a more solid nature have several layers beneath the epidermis, and a central cavity in which pupation takes place. Under such conditions the imago is provided with powerful jaws with which to eat its way out. The characters of galls are remarkably constant, and, as a rule, exhibit certain diagnostic features, some of which are obviously due to the act



GLANDS ON PETIOLES OF LEAVES OF *Prunus avium* Linn.
(NEARLY NAT. SIZE.)

Specimens gathered at Hastings by the Author.

of oviposition, and not to the functions of the parts of the plant upon which they develop. There is a remarkable similarity of form in the galls produced by the *Eriophyidæ*.

The larvæ of some species of the same genus of insects cause galls which are totally unlike each other. *Urophora cardui* deposits ova in the young shoot of the thistle, and a succulent, glabrous, external swelling develops. *U. solstitialis* oviposits in the flower of *Centaurea nigra*, and the result is a very hard, hirsute formation completely obscured by the florets. *Rhodites nervosus* oviposits in the under surface of a rose leaflet, and a unilocular, globular, pedunculated larval chamber grows therefrom; but *R. spinosissima* performs the same operation, and the leaflet itself bulges out on both surfaces to so great an extent that the serrations of its margins are scarcely perceptible. Other instances of the same phenomenon will present themselves to the collector in the course of investigations.

No kind of British vegetable gall appears to be of any service to man in arts or manufactures; nor are they suitable for food. Birds do not eat them, but when food is scarce in winter time, the small birds (Tits) remove the woody exterior of several kinds to get at the larva, which is then devoured.

About 270 kinds of British vegetable galls are known.

Reference may here be made, and illustrations introduced, to show various growths on plants known as glands, lenticles, etc., which are like galls and are misleading to the novice gall-collector. They are not due to parasitic agency, and do not contain ova or larvæ. The glands on petioles of *Prunus avium* (plate 2) are well defined.

Glands as formed on plants are of various shapes and sizes, and of four principal kinds. They occur mainly on the various parts of the leaf, and appear in the form of sessile or pedunculated, wart-like bodies, or embedded in the tissues of the plant, and occasionally contain a resinous or oily substance. A rather loose cellular tissue without epidermis is one of their chief constituents.

The tuberous formations of petioles and roots of various plants demand a passing notice.

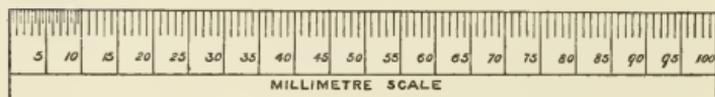
Among the pond weeds there are several whose underground

shoots terminate in a tuber, which in *Scirpus lacustris* Linn. may be as large as a chestnut, and in *Sagittaria sagittifolia* Linn. the size of a hazel nut.

Similar features are also found in the bulbous herbs, *Scilla nutans* Sm. as an example, and in the orchid family also.

The nodulose growths on roots of *Spiræa* are conspicuous examples; but a more familiar example is seen in the thickened roots or pseudo-bulbs of grass. They may frequently be noticed on roadside banks, where the crumbling away of earth leaves them exposed to view; and while in a semi-buried condition they look very like gall-growths. Some specimens are hollow, and closely resemble the empty larval chamber of a true gall. Two specimens of this kind may be seen in the right-hand side of plate 3.

Peculiar swellings of the wood and the bark are also shown on plate 4.





THICKENED ROOTS, OR PSEUDO BULBS OF GRASS.

(NEARLY NAT. SIZE.)

Specimens gathered at Hastings by the Author.



STEM OF BIRCH, *Betula alba* Linn.,
WITH
THREE TRUE AND TWELVE ABORTED BRANCHES.
(FIVE-SIXTHS NAT. SIZE.)

CHAPTER II.

The Sizes, Shapes, and Colours of Galls.

THE chief interest in galls lies in the formations themselves, and not in the creatures which cause them. Yet the galls and their producers are so inseparably associated, that a study of one carries with it a knowledge of the other. This fact is very clearly illustrated when considering the sizes of various galls. It would naturally be expected that the more diminutive the creature the smaller the gall, but this is not always so.

The ♀ imago of *Phyllocoptes acericola* is 120 μ . long and 46 μ . broad (μ . = $\frac{1}{1000}$ th part of a millimetre). It is one of the smallest of the mites. They live upon the leaves of *Acer pseudo-platanus*. A few of them will cause the growth of and live within a globular-shaped gall not more than 3 mm. in girth. *Eriophyes tilie typicus* is a much larger mite. The ♀ is 200 μ . long, 35 μ . broad, yet it causes and lives within a hollow conical gall 8 mm. high and 6 mm. in girth at the base. *E. orientalis* lives on leaves of *Cydonia vulgaris*, in hollow scabious pustules of the same size and character as those caused by *E. piri* on pear leaves. The ♀ of *E. orientalis* is 270 μ . long and 55 μ . broad. It is next to the largest of all the gall-mites. But what these creatures lack in size they supply numerically, and when thousands are living upon any particular portion of a plant, the galled area is proportionate. Examples of such are furnished by *E. macrorhynchus*, *E. piri*, and *E. laevis*, the multiplicity of whose galls oftentimes absorbs an entire leaf.

Among the Diptera a similar disparity is manifested between the size of the gall and the imago issuing therefrom. The action of three or four larvæ of *Urophora cardui* in the stem of *Carduus arvensis* will produce a more or less globular,

succulent gall 24 mm. long and 70 mm. at its greatest girth, whereas the same number of larvæ of *Urophora solstitialis* living at the base of a flower-head of *Centaurea nigra* will cause a hard and woody gall 10 mm. high and 20 mm. in girth, considerably less than half the bulk of the other. The imagines of both species are the same size.

One larva of *Hormomyia Fagi* will cause a hollow cone-shaped gall on a leaf of *Fagus sylvatica* 4 mm. high and 4 mm. in girth at its base; one larva of *Asphondylia pimpinellæ* will cause a hollow, reniform gall 8 mm. long and 15 mm. at greatest girth on the umbels of *Daucus carota*. There is scarcely any difference in the size of these imagines.

Of all gall-producers the *Eriophyidæ* live together in greatest numbers. A leaf-bud of *Corylus Avellanæ* or *Ribes nigrum* in the summer time will contain hundreds of the creatures in each of their stages of growth; while on such masses of deformed and stunted growth as illustrated in plate 62, the mites would possibly number hundreds of thousands.

The number of separate cells, or larval chambers, varies greatly. A large proportion of galls are unilocular, and are seldom of any remarkable size, but the largest number are multilocular. Most of the latter kind are composed of 3 to 8 cells; but in *Rhodites rosæ* there may be from 30 to 50, *Aulax papaveris* 40 to 60, and *Diastrophus rubi* 80 to 110. These cells are all included within one outer covering, whether it be a coating of long hairs, a seed capsule, or the epidermis of the stem.

The smallest unilocular gall is the pustule form caused by *Eriophyes macrorhyncus*. They are very numerous on the leaves of *Acer campestre*. The largest is that caused by *Ceuthorhynchus sulcicollis* on the root of *Brassica napus*. The gall caused by *Lipara lucens* on *Arundo Phragmites* would appear to be larger, but its additional bulk is due to the numbers of leaves which enfold one another, and enclose a relatively small larval chamber.

The shapes of galls vary greatly. About eighteen definite forms can be recognised.

Globular, or more or less so, is the shape of the majority. Many are reniform, not only as a single growth (*Eriophyes macrochelus*), but in clusters (*Xestophanes brevitarisis*) on a

stalk, or arranged along it in a moniliform manner. Several are cigar or torpedo shape, or lemon shape; others are pyriform, bursiform, hemispherical, sessile, or pedunculated. Two at least are rosette in form; and although one, *Cecidomyia crategi*, is exceedingly common, it commands as much admiration as does *C. rosaria*, which is far less plentiful. A few conical forms appear usually on the leaves. Others are pyramidal, spindle shape, or ovoid, and several are pincal in form. One at least (*Monochetus sulcatus*) is cymbiform. The remainder are irregular in outline, being constricted, curved, or dwarfed during growth. The galls formed by *Rhodites nervosus* have sharp-pointed spines or thorns on the surface, and in this respect they are unique.

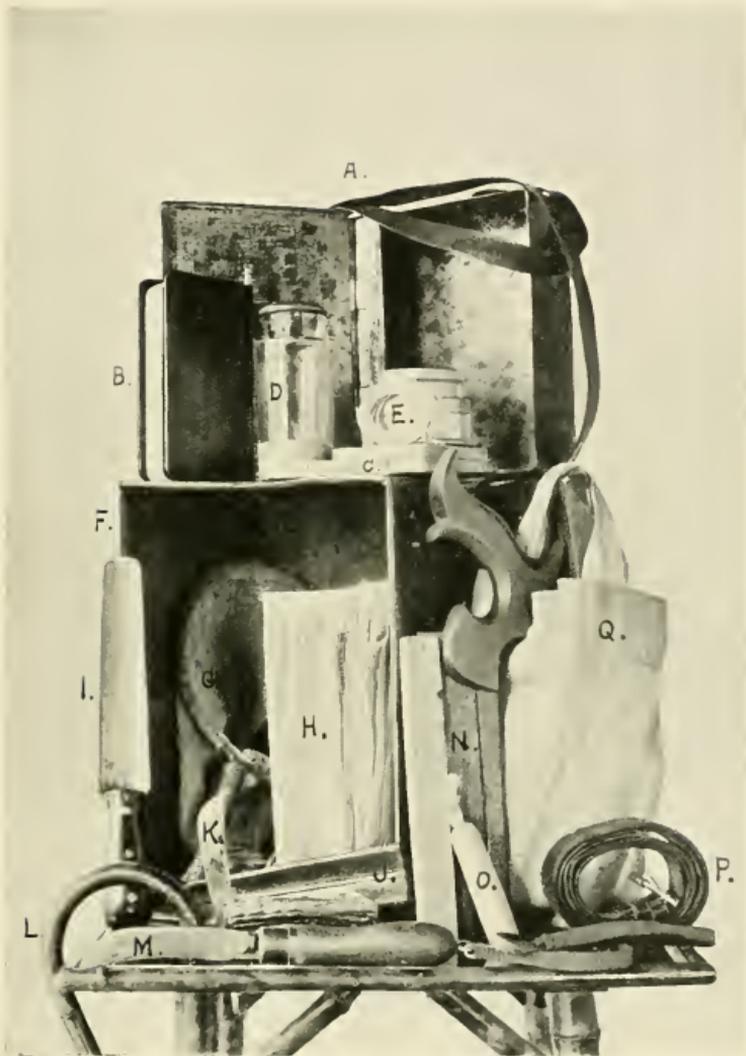
The colours are not so numerous as the shapes. Many galls have most delicate and exquisite shades of colour when nearing maturity of growth.

The predominant colour is green, very delicate shades of which may be seen at various stages in the growth of the galls; in fact, as may be supposed from the positions occupied, they are all more or less green, changing only as they approach or attain maturity. Some galls are of very sombre hues, unrelieved by any colour at all; others have no definite colour, other than green; a large number, however, are very bright and attractive.

Greens of every shade, from a very pale yellowish to a rich olive, are common. Yellows, from a very pale tint passing through all shades until a deep orange is reached, are not so numerous. Reds, from a faint pink blush to a purple or reddish brown which quickly passes into a chocolate-brown are less plentiful. Many galls at first are suffused with pink, which, as growth proceeds, deepens to red, then to purple or reddish brown, and finally chocolate-brown or black. One kind only is silvery white, and remains so until maturity is past. It is caused by the larva of *Hedya aceriana* on twigs of *Populus alba*. The gall caused by the larva of *Eurytoma hyalipennis* is remarkable in gradually losing its colour as growth proceeds. At first the young leaves are striped with pink; this gradually becomes paler, until ultimately the entire gall is an ordinary straw colour. Very few are like *Cecidomyia pteridis*, which, beginning as a very pale green,

British Vegetable Galls

soon turns black. *Asphondylia pimperuellæ* is at first a pale green, upon which, as it changes to a much darker shade, pink stripes appear; these stripes deepen in colour before maturity of growth is reached. The galls on the leaves of *Acer pseudo-platanus* caused by *Phyllocoptes acericola*, and *Eriophyes macrorhyncus* on *Acer campestre*, are very attractive. At first greenish yellow, they pass through yellow, orange-yellow, red, crimson, purple, and finally brown. Those caused by *Cecidomyia persicariæ* are very beautiful. The rolled and thickened margins of the leaves of *Polygonum amphibium* are a much paler green than the other portion of the leaf, and are suffused with pink and purple, which does not change until the leaf withers. Those of *Tetraneura ulmi* are also very attractive, standing upright upon the rich green Elm leaf. The colours of this pedunculated, pyriform gall are pale yellow at base, with pink gradually taking its place higher up, and a bright crimson at the apex. *Aulax glechomæ* is another charming growth. The bright pink or red globular galls are clothed with long, slender, whitish hairs, and when seen nestling among the beautiful green leaves of *Glechoma hederacea* on a wood-side bank, they never fail to excite admiration. The exquisite delicacy of the stems and leaves of *Potentilla tormentilla* is more apparent when numbers of the pretty little globular or reniform galls caused by the larvæ of *Xestophanes brevitarsis* adorn them. At first pale green, they quickly assume a pink tinge, which changes to nut-brown when mature. The larvæ of *Nematus bellus* cause some delicate globular or conical sessile galls on the under surface of leaves of *Salix Caprea*. At first they are pale green, then greenish yellow, upon which red or reddish brown spots appear, and the surface, sometimes glabrous, sometimes sparsely clothed with delicate whitish hairs, produces a pretty contrast against the beautiful green of the leaf. Few galls, however, equal in attractiveness and beauty those caused by the larvæ of *Rhodites rosæ*. From the surface of the conglomerated cells a dense covering of long, many branched, hair-like bristles proceed. These beautiful green, pink, and crimson hair-like or moss-like masses produce an unmistakable and unique appearance. No collection of galls is complete without specimens of this most familiar example.



THE COLLECTING IMPEDIMENTA USED BY THE AUTHOR.

PLATE 5.

Explanation of Figures.

- A. Vasculum, with broad shoulder-strap.
- B. Notebook, with pencil.
- C. Three-inch rule.
- D. Cyanide bottle.
- E. Small pocket tins and coil of string.
- F. A tin, 12 × 9 × 8 inches, to contain most of the implements and the specimens.
- G. Small entomological leno-net.
- H. Newspaper, in which to wrap plants with roots and earth.
- I. Steel blade fern-trowel.
- J. Leather sheath for same.
- K. Supplementary knife.
- L. Curved handle walking-stick.
- M. Hop-knife, with narrow leather strap attached.
- N. Small tenon saw, with edges protected by piece of wood.
- O. Piece of common tallow candle.
- P. A broad leather strap for tin (F).
- Q. Canvas bag, with handles of webbing suspended from lid of tin (F).

CHAPTER III.

Collecting, Mounting, and Preserving Galls.

NO person of average health and strength need refrain from collecting galls. It is as suitable a pastime for ladies as for gentlemen. It is not laborious work. It does not cause fatigue, such as results from chasing Lepidoptera, Diptera, Hymenoptera, etc., nor is it exposed to the fun and jest from the "vulgar mind" so often hurled at the collector of winged insects. It develops and quickens the powers of observation when in the fields, lanes, and woods, and combines the twin studies of Entomology and Botany.

An extensive knowledge of these studies is not absolutely necessary, but a general knowledge of the different orders of insecta and of the habitats of plants is very desirable, and will often save hours of fruitless search when wishing to acquire a particular gall on any given plant. *E.g.* it would be useless to search for the galls of *Eriophyes sanguisorbæ* in a district where the ground is marshy; the salad burnet (*Poterium sanguisorba*) grows only in dry pastures in limestone districts; nor would the galls of *Cecidomyia ulmariz* be found on the hedge-bank of a dry and dusty road; *Spiræa Ulmaria* delights in wet and marshy places, and along the banks of streams and margins of ponds. Much useful information may be easily obtained from handbooks dealing with both these subjects.

The Impedimenta requisite for collecting are neither expensive to purchase nor heavy to carry, and need not be elaborate as regards the number of articles used. Each collector soon finds what the requirements for such purpose will be. As a guide to the beginner in the collection of galls, the

Collecting, Mounting, and Preserving Galls 15

articles enumerated on p. 13, and illustrated on plate 5, are suggested as being suitable.

When searching over new or little-known ground, it is advisable to be provided with all the tools. It is not possible to foretell what may be discovered, or which implement will be required.

When only one or two specimens of the various galls are required, a small vasculum, such as A, is sufficient, which, if fitted with a broad shoulder-strap, is no trouble to carry; but if the gallist's object be to make an extensive collection, or to copy or photograph the various forms, sizes, and aberrations of galls in the manner exemplified in this volume, it is necessary to employ a more spacious receptacle for the specimens.

If the beginner is not already familiar with the fact that most plants when carried in the hand during a hot day quickly fade and droop, some never to revive again, one experience will perhaps suffice to show the advisability of having a tin with a lid to it: for, although the specimens are put in the tin, a midsummer sun will speedily cause them to wither, unless protected by a closed lid.

This tin (F) may with advantage be of sufficient size to hold all the articles enumerated. One of the most necessary articles for the gallist to have is a strong and sharp knife, of any pattern preferred. The pattern of knife the author has found most serviceable is that known as a hop-knife (M) with a wooden handle. Into the end of the handle a screw-eye is fixed, to which is attached one end of a narrow leather strap, the other end of which is formed into a loop sufficiently large to pass over the hand. By this means the knife is tethered to the wrist, and, when not being used, both hands are left free for turning over leaves, etc. With ordinary care the chances are very few of being cut by the unprotected blade. The short-handled entomological lino-net (G) and the cyanide bottle (D) may not be required by some collectors; the author, however, has repeatedly found them of the utmost value during the months when insects are on the wing. When on a long expedition, a small tenon saw (N), with the edges protected by a slip of wood, should always be carried. Small boughs and young saplings are more speedily and easily severed with it than with the knife. A small piece of common

tallow candle (O) rubbed on the saw when used upon green wood will facilitate the work and prevent "binding." A walking-stick (L) with a curved handle is very useful in reaching high branches. The collector, however, may dispense with it, and rely upon cutting a crook bough from a hedge or wood when required. One or two pocket-tins (E) for small or fragile specimens are of great service; as also is a coil of stout twine. A note-book and pencil (B) are absolutely necessary. Particular spots where galls have been or are to be found should be entered, with dates when found, or when the places should be revisited to observe developments in growth, or to remove the specimens under observation. Rough outlines of the places, such as will refresh the memory and act as guides without loss of time, are also of great value.

Collecting. A considerable amount of patience and leisure is required for collecting galls. They are seldom seen, and less seldom found, while walking quickly. Examples such as *Eriophyes rudis* on birch-trees, and *Cecidomyia crategi* on almost every wayside hedge, are among the exceptions. They are too large and too conspicuous to escape observation. It is often necessary to crawl on hands and knees, using the eyes diligently at the same time. At all times it is best to saunter along the hedge or bank, by the stream, across the field, or through the wood, and by retracing your steps specimens will occasionally be found which have been previously undiscernible. When searching over a bush, such as a willow, it is advisable, after examining the inner boughs, to walk all round it two or three times, scrutinising on the first occasion the boughs nearest to you, and on the next round those farthest from you. Oftentimes a gall which cannot be seen from one side of a bough, twig, or leaf, may be detected from the opposite side of the bush. Fix the eyes on a branch, bough, or twig, and look carefully up and down it before passing to another. Looking at them with the sky as the background is a great help in discovering abnormal swellings.

Many kinds of galls can be easily seen by stooping, or even lying down, and looking at the shrubs or bushes from beneath. This is particularly applicable to the *Rhodites* galls when the wild rose bushes are in leaf.

A windy day is not recommended as a suitable occasion on

which to search for galls growing on bushes and trees. The continual movement of the foliage makes detection very difficult and wearies the eyes.

An attempt has been made in each synoptical table to direct the collector to the most likely places in which the galls are to be found, and for further information in this section reference thereto must be made.

Mounting galls and the imagines which emerge from them may be accomplished in various ways. The particular method of arrangement in the cabinet or wall-case may be left with the gallist to adopt which ever is most suitable to the conveniences at command. One thing is most essential: the galls should be allowed to dry thoroughly before placing them in their final positions.

The following suggestions may prove useful to the gallist who has not decided upon any definite plan of arrangement. A small label should be affixed to each specimen, or cluster of specimens, bearing (*a*) name of plant, (*b*) name of creature producing the gall, (*c*) locality where found, (*d*) date of find, (*e*) a number corresponding with the same in note-book or catalogue. Imagines of average size may be fixed on a small piece of white card, or put in a small glass phial, which has upon it a number corresponding with that on the label and date of emergence.

Parasites and inquilines should be put in a separate phial labelled accordingly, and placed by the side of that containing the imagines.

Very small imagines which require a lense or microscope for their examination may be mounted in the following manner. Cut a piece of card, of about double the thickness of a post-card, the same size as a microscope glass slip—*viz.* 75 mm. × 25 mm.—and with a steel punch of 12 mm. diameter make a hole in the card. A slight burr will be caused on the under surface of the card, which should be removed with a sharp knife or rubbed down with the thumb-nail. This surface of the card must then be seccotined, and one of the glass slips placed upon it and allowed to dry. When dry, affix a name-label on the card, fill in particulars such as have already been suggested, and then place the creatures in the cavity of the card. Seccotine the outer margins of the card, and place the other slip on, and

set aside to dry, with a small weight on it to keep it flat and firm. By using two glasses any part of the creature can be easily examined. The glasses should be carefully cleaned before the creatures are placed in the cavity.

Microscope slips may also be obtained with cavities of various depths in them, in which the creatures can be placed, and kept secure by a cover slip affixed, and ringed in the usual manner. This kind obviates the necessity of card.

When a large number of any of the small-sized galls can be obtained, it is preferable that they should be mounted in shallow wooden trays with glass tops, rather than occupy a quantity of space in the cabinet. The trays should measure 10 in. long, 7 in. wide, and 2 in. deep inside, with sides $\frac{1}{2}$ in. thick. The glass lid should fit dust proof. The interior may be papered or painted white, cream, or French grey, one corner being partitioned off to form a carbon cell. The outside can be polished, painted, or covered with black paper. The advantages with these cases are that they save cabinet room and floor space, can be hung on a wall, and easily removed for examination or exhibition purposes. Galls produced by *Lasioptera rubi*, *Diplois tremulae*, *Pemphigus bursarius*, *Nematus bellus*, and others are very suitable for mounting in this manner.

For larger galls, such as those caused by *Schizoneura lanigera* and *Eriophyes rudis*, glass-fronted cases 18 in. square and 4 in. deep inside will be found a very suitable size.

The specimens must be fastened in their places, and may be pinned or seccotined, according to their requirements. Large and heavy galls should be held by screws.

This arrangement is very suitable by which to exhibit the aberrations from the type form, immature growth, transverse and longitudinal sections, and any other feature which it may be desirable to illustrate.

To prevent mites, which are so destructive in all collections of natural history specimens, the cases should be kept replenished with albo-carbon. It is inexpensive, and may be obtained at almost any ironmonger's or oil-shop.

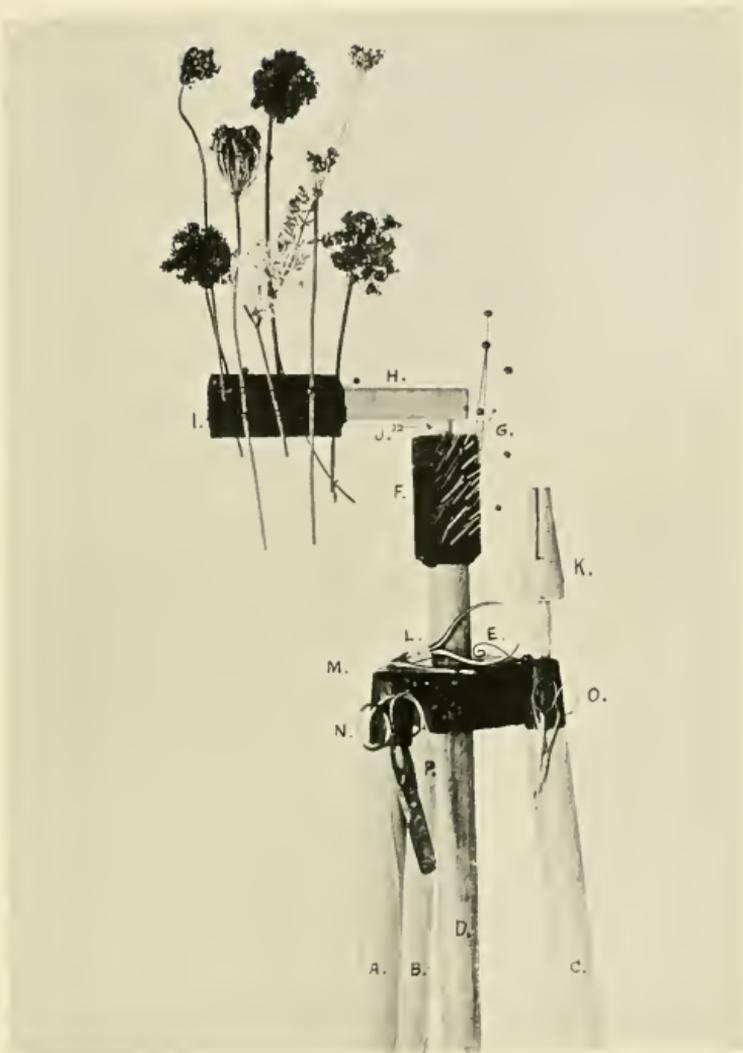
Preserving galls in their natural beauty is a very difficult matter. There does not appear to be any known or recognised method by which they can be preserved from shrivelling and loss of colour. If gathered when mature, the hard and woody

kinds do not alter very greatly. The succulent kinds, however, shrivel quickly and lose their colour. It does not seem to be possible to preserve their colours nor shape in any way comparable with their pristine condition. A few experiments with fluids as preservatives show that methylated or even pure spirit is of no value, as it extracts the colours. Pure glycerine, or a mixture of equal parts of glycerine and water, is of little value. Solutions of corrosive sublimate, and also of formalin, are not always successful, for in many cases the leaf, the stem, or the gall itself loses more or less of the natural colours, and then the true value is deficient.

PLATE 6.

Explanation of Figures.

- A. } Three ordinary wooden broom-handles fastened to a 5-in. triangular-
- B. } shaped platform 2 in. thick, held more rigid at 18 in. from the ground
- C. } by a similar shaped but larger platform, which causes the feet to
- } spread 12 in. apart.
- D. A 2-ft. length of broom-handle which slides up or down through the top platform.
- E. A bent spring, pressing against D to retain it at any height required.
- F. A long strip of black cloth wound round the top of D, serving the purpose of a pin-cushion.
- G. Pins of various makes, thicknesses, and lengths.
- H. A cross-bar of wood, having square sides; one end encircled with a padding of black cloth, the other end having a wooden pin projecting downwards at right angles.
 - I. The padding of cloth upon which specimens are to be pinned.
 - J. The wooden pin, 2 in. long, descending in a hole prepared for it in the top of D, and allowing H to revolve when necessary.
- K. An accessory to take the place of H when required. It is cut in the centre for holding twigs or branches at any angle necessary.
- L. A pair of small pliers, useful in manipulating the pins.
- M. Brass forceps, for suitable arrangement of leaves.
- N. Strong, blunt-pointed scissors, for cutting twigs.
- O. Fine-pointed scissors, for removing leaves which obstruct view of galls.
- P. String, useful in numerous ways.



THE APPARATI EMPLOYED BY THE AUTHOR WHEN
PHOTOGRAPHING THE SPECIMENS.

CHAPTER IV.

The Emersion of the Imagines.

THIS branch of the study of vegetable galls is beset with many difficulties and attended with very variable successes.

The emersion of the imagines is of very great importance to the gallist, especially with new forms of galls, but it is often very disappointing in its results.

Half-grown galls cannot be relied upon to complete their growth under artificial conditions and yield the imagines. Some may continue to grow, others will speedily shrivel. To remove the plants to your garden, or in pots in your conservatory or study, is perhaps the best plan to ensure their continued growth; but the artificial surroundings are not always suitable, and "something goes wrong."

Greater difficulties have to be overcome as regards galls growing on bushes and trees. One exception to these, however, is found in the willows, the twigs of which, if gathered in the early spring and put in water, will throw out a number of rootlets, the catkins and leaves unfold, the galls arrive at maturity, and the twigs themselves may afterwards be planted in pots or in the open ground.

The succulent summer galls require great care. Those of the autumn are more trouble, and seldom yield any satisfactory results.

Each twig bearing a gall which shows a difference from any others of the same species should be kept separate, and for such purpose the ordinary medicine and perfume bottles are very suitable. When these conditions are not possible, none but mature galls should be gathered. Those which do not require moisture to keep them in such a condition as to allow the

imagines to make their way out, may be put in a glass-top box, a bottle, or glass jar. The neck of the bottle should be closed with a plug of cotton wool and the mouth of the jar covered with leno or tulle. Others requiring moisture should be put in a glass jar which has a depth of about an inch of sand or earth at the bottom. Nothing besides the galls and a label should be in the jars, or other insects may appear from buds, leaves, petioles, etc., and cause confusion in determination.

The sand for this purpose must be thoroughly washed and baked. The earth also must be baked. This will destroy minute organisms which might grow and disturb the accuracy of the observations. Both the sand and the earth should be moistened with water which has been boiled and allowed to get cold. The addition of two or three drops of carbolic acid to each wineglassful of water will still further prevent the possibility of fungoid growths.

Do not remove the galls as soon as the first imagines appear. Parasites and inquillines, and sometimes hyper-parasites, appear a long while afterwards, and these are also required for identification.

Small plants such as the violet, wood hawk-weed, veronica, bedstraw, etc., should be dug up (with as much earth as convenient left around the roots), wrapped in paper, and replanted upon the return home. All leaves not galled should be carefully removed.

When specimens growing on trees are of the kinds which will not continue their development after being removed from the tree, it is advisable to place over them a bag of leno or tulle, and secure it to the branch with fine string in such a manner as to prevent the escape of the imagines. The spot should be visited frequently to make observations, and to renew the leno if damaged by wet or other causes.

Imagines of large size, as compared with the average gall-producers, are the easiest to rear. Little difficulty is experienced with *Urophora cardui*, *Rhodites rosæ*, and *Aulax glechomæ*, provided the galls are gathered at the right time. The galls of the *Eriophyidae* always contain imagines, as also individuals of the previous stages, and may be gathered at any time.

The methods of securing the imagines upon emersion are



BOTTLES, JARS, GLASSES, ETC., USED FOR REARING
THE MAKERS OF GALLS.

numerous. Each class of gall requires some variation in its treatment, as compared with that of another kind. Some galls may be put in a box with a glass lid; others must have earth for the larvæ to pupate in; some require a bag of leno of very fine mesh tied over the twig; other imagines are captured best in a lamp-chimney, with leno or tulle stretched across one opening, the galled leaves or twigs being placed in the other end, both then being stood in a glass of water. Some galls require the influence of the atmosphere, and must be kept out of doors; to other kinds this is quite immaterial. Very small galls may be put in glass phials, kept in an upright position by being sunk in a block of wood, as shown in the centre of the illustration (plate 7).

In every case it is necessary to put a label in the bottle, box, or jar, with the date when the specimen was placed there and other items of reference. They must be examined each day, and upon the first sign of decay, or growth of fungus (which has the unfortunate habit of appearing when least expected and of growing very rapidly), they must be removed, and various expedients adopted to prevent the galls becoming useless.

CHAPTER V.

The Mode of Growth and the Classification of Galls.

THE remarkable diversity in the shapes and sizes of galls is surpassed by the many and various manners in which they grow, and the positions which they occupy on the plants and trees.

The mode of growth is very interesting, and should be carefully observed and thoroughly noted by the student and collector.

Galls may be found on every part of plants and trees, from the roots to the flowers and seeds. When upon the roots, trunk, branches, twigs, stems, stalks, or leaves, their growth does not interfere with the fructification of the plant, nor, as a rule, with its general development; but when the petals, seed-vessels, or other reproductive functions are involved, injury of a more or less derogatory character is the result. The following are the predominant modes of growth with typical examples of each, which galls assume. The characteristic features give to each growth an individuality which is valuable in one method of classification.

- | | |
|--|--|
| I. Axillary = <i>Eriophyes axillaris</i> . | IX. Hirsute = <i>Rhodites rosæ</i> . |
| II. Coalescent = <i>Hormomyia caprea</i> . | X. Imbricated = <i>Adelges abietis</i> . |
| III. Conglomerated = <i>Diastrophus rubi</i> . | XI. Pedunculated = <i>Tetraneura ulmi</i> . |
| IV. Cymbiform = <i>Monochetus sulcatus</i> . | XII. Pilose = <i>Aulax glechomæ</i> . |
| V. Elongated = <i>Diplosis botularia</i> . | XIII. Pubescent = <i>Hormomyia piligera</i> . |
| VI. Glabrous = <i>Diplosis tremulæ</i> . | XIV. Pustulate = <i>Eriophyes pustulatum</i> . |
| VII. Glossy = <i>Urophora cardui</i> . | XV. Rugose = <i>Aulax hypocharidis</i> . |
| VIII. Gregarious = <i>Phyllocoptes acericola</i> . | XVI. Rosaceous = <i>Cecidomyia rosaria</i> . |

The Mode of Growth and Classification of Galls 25

- | | |
|---|---|
| XVII. Scabious = <i>Schizoneura lanigera</i> . | XXII. Rolling and thickening of the leaf = <i>Cecidomyia persicaria</i> . |
| XVIII. Separate = <i>Asphondylia pim-pernellæ</i> . | XXIII. Upon the upper surface of the leaf = <i>Eriophyes tilie typticus</i> . |
| XIX. Sessile = <i>Cecidomyia ulmaria</i> . | XXIV. Upon the under surface of the leaf = <i>Nematus bellus</i> . |
| XX. Solitary = <i>Eurytoma hyalipennis</i> . | XXV. Upon the margins of the leaf = <i>Eriophyes marginatus</i> . |
| XXI. Spiny = <i>Rhodites nervosus</i> . | |

This list does not include all the different modes of growth, but the few remaining are more of the nature of variations from a given form, and do not convey any idea of individuality, being very irregular in outline and arrangement. *E.g.* the gall caused by *Cecidomyia taxi* might be classed as an imbricated gall until a dissection is made of it; it will then be seen that the leaflets are imbricated, and not the larval chambers, as in *Adelges abietes*, the larva being ensconced in a small cell at the bases of the leaflets. The gall therefore is solitary and unilocular.

The Classification of Galls. Hitherto there does not appear to have been any special system adopted by English writers for the classification of vegetable galls. There are, however, several ways in which they may be classified, among which are the following :

I. According to the natural order in the animal world of the creature which causes the growth and issues therefrom.

II. According to the botanical order of the plant upon which the gall grows.

III. According to the situation of the gall upon the various organs of the plant.

IV. According to the mode of growth of the gall.

V. Whether the gall consists of one larval cell only, or of two or more larval cells.

VI. Anton Kerner, in his "Natural History of Plants" (translated from the German by F. W. Oliver, M.A., D.Sc.), makes two broad primary groups—simple and compound. By simple is meant when a gall-growth is limited to a single plant-organ. This group is subject to three sub-divisions.

(a) Felt galls, which are due chiefly to hypertrophied epidermal cells growing out into hairy coverings, of various sorts. The majority of these are caused by mites.

(b) Mantle galls. These are hollow, in a multiplicity of forms, and have for a lining a portion of the surface of the affected organ, and in many cases a cavity or open communication.

(c) Solid or tubicular galls, in which a spot is pierced by an insect and the ova deposited in the tissues, not on the surface. These differ from mantle galls in that there is no cavity nor opening, the imago having to bore its way out. They are, however, subject to numerous modifications.

The other group is composed of compound galls, and comprises those in which several plant-organs are concerned in the production. They are arranged according to structure, and named scroll, pocket, and covering galls.

It will now be necessary to review these various methods of classification, in order to form a judgment as to which is the least involved, and at the same time the most efficient.

I. According to the natural order in the animal world of the creature which causes the growth and issues therefrom.

It is not in every case possible to determine from the gall alone what creature has caused its growth, more especially in the case of galls found for the first time by the galler, or new to science. The difficulty of keeping the gall in a living condition until the emergence of the tenant has to be overcome. And supposing this to be successfully accomplished, not the rightful inhabitant issues from it, but parasites, inquiline, and hyper-parasites are very frequent, and the difficulty of assigning them to their respective families is considerable. Sometimes the rightful inhabitant itself dies within the gall. Yet another difficulty presents itself: the larvæ of many species leave the gall to pupate either some distance away or in the earth, and they invariably die when kept under artificial conditions.

II. According to the botanical order of the plant upon which the gall grows.

A classification of galls under this head is too elaborate. There are about a hundred natural orders into which the British flora is divided. An arrangement based upon so many sections is suitable only for a very large and comprehensive, world-wide collection.

III. According to the situation of the gall upon the various organs of the plant.

The Mode of Growth and Classification of Galls 27

While neither adapting itself to every requirement, nor satisfying each detail, a classification based upon the position the gall occupies upon the main divisions or organs of a plant appears to fulfil nearly all the necessary qualifications in as comprehensive a manner as possible, and to provide a basis upon which the gallist can construct any more elaborate system which may be thought desirable.

IV. According to the mode of growth of the gall.

Although this would not be so extensive as No. II., a classification based upon the twenty-five or more different modes of growth, is too wide in its scope to possess the advantages offered by one of a more concise character. Some galls which during their earliest stages of growth are glabrous become pubescent before attaining maturity. Some which are sessile while growing ultimately assume a pedunculated form. Others which on one portion of a leaf will be separate, are gregarious and coalescent on another part of the same leaf. In fact, no reliability can be placed upon the features, which are quite of a secondary character.

V. Whether the gall consists of one larval cell only, or of two or more larval cells.

Most descriptions of galls have been based upon the number of the cells or larval chambers. The terms which have thus been employed are unilocular, or monothalamous; and plurilocular, or polythalamous.

A unilocular gall consists of a definitely formed separate cell, solitary or gregarious, embedded or not embedded in the tissue of the plant, and irrespective of its size, shape, or the position which it occupies on the plant.

A plurilocular gall consists of two or more cells, coalescent or conglomerated, embedded or not embedded in the tissue of plant, and irrespective of their size, shape, or the position which they occupy on the plant.

There are several objections to a definite classification according to these terms.

The larvæ of some species do not inhabit a definitely constructed cell, yet they produce gall-formations. Many galls which, when occupied by the rightful larva, are unilocular, become plurilocular when the larva or larvæ of parasites also inhabit the gall. Other galls which normally consist of a single

cell are occasionally so numerous and crowded together that they coalesce, and the final condition is plurilocular. The hypertrophied growths caused by various fungi are destitute of larval chambers. As an adjunct to the description of a gall when applicable and to indicate the normal number of cells of which it should consist, these uni- and plurilocular designations are of considerable value, and for that purpose alone they are used in most of the following synoptical tables.

VI. Anton Kerner's method of classing all galls under two main divisions, simple and compound, divided into various sub-sections, is excellent, but the numerous modifications which are necessary do not appear (in our opinion) to be defined clearly enough for actual use. Neither are the terms applied to the galls so suitable as might be employed, nor calculated to be of much assistance to the beginner. Several of the foregoing nomenclatures do not possess all the qualifications suited for a lucid and comprehensive description of vegetable galls.

As the result of an examination of hundreds of galls and a thoughtful study of the various classifications, the author has arrived at the conclusion that a definite, yet simple, accurate, and easily remembered nomenclature is the great desideratum which requires supplying in this branch of natural history. It is therefore proposed that galls shall be classified according to the positions which they occupy on the plant; and although this arrangement cannot be made to suit every detail, it possesses all the qualities that can be obtained without employing a very elaborate and much divided grouping of the specimens.

In commending a scheme of classification based upon four primary divisions of the plant for adoption by the collector and student, we are fully alive to the many difficulties surrounding the subject, and are conscious that any outline laid down for the purpose is simply a convenience for arranging and grouping specimens, and useful for purposes of study or generalisation: it is, therefore, not to be considered as an absolutely true expression of all the details.

A perplexity of this kind is well known by all writers upon morphological subjects, and it is realised and allowed for by the student generally.

The word "plant" is held to include all vegetable growth, from the loftiest and largest tree to the humblest form.

The Mode of Growth and Classification of Galls 29

Four main divisions of the plant have been made and used as terms to express the particular part of the plant upon which the gall may be sought. They are root, stem, leaf, and flower.

I. The root-galls are those situated upon or within the roots, adventitious, fibrous, tuberous, or the taproot, or the rhizomes.

II. The stem-galls are those situated upon or within the main stem (erect or climbing), the branches, or the suckers.

III. The leaf-galls are those situated upon or within or enclosed by the blade, the petiole, the stipules, the bract, or the scales; or any of these parts enfolding larvæ.

IV. The flower-galls are those situated upon or within or enclosed by the calyx, the corolla, the catkin, or the subsequent fruit or seed.

The fruit, botanically, is acknowledged as a definite and separate organ of the plant, but its inclusion with the flower is due to a three-fold reason:

(a) It is a direct outcome of the flower, and appears only when the flower has fulfilled its functions.

(b) In each case that it is galled the galling agency is present before it arrives at maturity.

(c) There are so few galled fruits that it is not necessary to make a separate division to represent them.

It may have been noticed by the reader that no reference has been made to the number of the larvæ which inhabit the galls. There is, however, a certain uniformity in this respect with all galls, and although it is not of sufficient importance to form a specific feature in nomenclature, reference is made to it in some descriptions of the galls.

For this purpose the terms "unilarval" and "multilarval" are employed to indicate whether the gall normally contains one larva or two or more larvæ. In the case of the aphides, in which there is no larval condition, the term "multinymphal" is used. These terms are applicable to the rolled and thickened leaves more than to other kinds.

The modes of pupation and the spots selected for it by those species which pass through a quiescent stage are noted in the synoptical descriptions, to enable the student to know under which conditions to keep living examples of galls.

- UNILARVAL. Normally one larva only living within a catkin, cluster of leaves, or rolled and thickened leaf-margin—*e.g. Cecidomyia betulæ, C. rosaria, C. taxi, Lipara lucens, C. pteridis, C. ranunculi.*
- MULTILARVAL. Normally two or more larvæ living within a catkin, cluster of leaves, rolled, thickened, or conduplicated leaf, the flower or fruit, and the stem—*e.g. Cecidomyia cratægi, C. lathyri, C. veronicæ, C. violæ, C. marginemtorquens, C. persicariæ, C. rosarum, Lasioptera rubi.*
- MULTINYMPHAL. *E.g. Pemphigus bursarius, P. spirothecæ, Tetraneura ulmi.*

CHAPTER VI.

The Agents concerned in the Production of Galls.

FIVE different orders of insects and two classes of worm-like creatures are the principal producers of galls. Several species of fungi added to these complete the list of all the agents at present known as operating upon British plants for this purpose. They are as follows:—

- I. Acarina, or Mites.
- II. Anguillula, or Eelworms.
- III. Colcoptera, or Beetles.
- IV. Diptera, or Flies (with two wings).
- V. Fungi, or Fungus.
- VI. Hemiptera-Homoptera, or Aphides.
- VII. Heterocera, or Moths.
- VIII. Hymenoptera, or Wasps (small).

It has been found more convenient to place them in alphabetical order, rather than according to the natural order which they severally occupy in the animal kingdom, or in relation to the numerical preponderance of the species embraced in each class.

I. The Acarina, or Mites.

These creatures are chiefly remarkable for their exceedingly diminutive size.

Andrew Murray, F.L.S., appears to have been the first in this country to collate the information concerning the mites in general. He isolated those which cause deformities on plants, and placed above them the name of Gall-mites, classing them as the sub-family Phytoptidæ; and in his "Economic Entomology" he gives a most excellent account of their habits, etc.

Within the last few years elaborate researches have been made into the economy of these creatures by Dr. Alfred Nalepa, of Vienna. To his writings all gallists are indebted for a more extended knowledge of gall-mites. He has determined and named 227 Continental species, and is familiar with about twenty others; some thirty of these are at present known in Britain, and doubtless dozens more will in time be discovered.

He has established various genera, families, and sub-families, the gall-producers among them being Eriophyinae, Phyllocoptinae, and seven others. These creatures vary in size from 250 μ long, 60 μ broad in the δ , and 310 μ long, 60 μ broad in the η , of *Eriophyes mentharius*, which is the largest known species, to 90 μ long, 30 μ broad in the δ , and 100 μ long, 37 μ broad in the η of *E. parvulus*, a difference in the $\delta\delta$ of 160 μ long, 30 μ broad, and in the $\eta\eta$ of 190 μ long, 23 μ broad. The largest species is scarcely visible to the keenest naked eye.

The entire creature is long and cylindrical, of a vermiform shape, the head being fused to the thorax, and that in turn to the abdomen.

The head and thorax are hidden from above by a hemispherical, shield-like plate, bearing upon it characteristic sculptural markings, which form important features in the nomenclature. The head is slightly bent in a downward direction, and is pointed, or snouted. The mandibles are needle-shaped. The maxillae are three-jointed, and are used as antennae.

The abdomen is greatly elongated, diminishing in size towards the tail; it is ringed all round. The number of the rings varies from 40 in *E. goniothorax* to 95 in *E. buxi*. Several (generally seven) pairs of long, stiff bristles, or *setae*, are always present on the body, and they appear to serve the purposes of organs of touch. The tail is divided into two semi-circular flaps, which can be closed together at will and withdrawn; it bears at its extremity one pair of whip-like bristles much longer than the other pairs. The anal opening is close to the flaps. The generative organs are partially external, situated on the ventral surface of the abdomen, close to its union with the thorax; they are known as *epiandrium* for the δ , *epigynium* for the η .

The mites have no special respiratory or circulatory organs. The exchange of gases takes place through the body. Nor is there any organ like a heart; the fluid, therefore, which is

The Agents concerned in the Production of Galls 33

analogous to blood moves freely and irregularly throughout the body. The nerves are in four pairs. The cesophagus passes through the brain ganglia.

They are devoid of stomach, digestion taking place in the larger intestine. Salivary glands are wanting, and also Malphigian tubules.

The skin is an exceedingly thin, colourless layer of chitin. Beneath it lies a network of branched cells which contain slight colouring pigments.

The legs are four in number, all exactly the same size and shape; they are five-jointed, situated close to the head, and always point forward. A very few small bristles are upon them. Mostly they are furnished with a small claw, but some have a knob instead.

The tarsi have a number of fine bristles arranged upon them, producing a feathered appearance. The colours are pure white, yellowish white, orange-yellow, and brownish yellow when old.

The ♀ lays great numbers of eggs, the membrane of which is composed of chitin. In shape they are round, elliptical, or ovoid. When deposited late in the year they do not hatch in the following spring, their vitality being destroyed by frost; those deposited in spring and summer hatch quickly. From them emerge larvæ very similar in appearance to the parents, and can be distinguished only by slighter size, a less number of *setæ*, and absence of sexual organs exteriorly. Ecdysis occurs twice at least during the larval stage, the sex not being manifest until after the second. The nymphal stage is characterised by the progress of development, and a slight protrusion of the sexual organs.

The imagines spend the winter on plants—by preference in the buds—and in the ground. Some species exude a flocculent substance from portions of the back. They are very sensitive to the action of light upon their bodies, and evade the sunlight which kills them. They do not all make galls; some live as parasites and inquilines upon those which do. Their two chief enemies are gamasides, which attack them when away from the galls, and a fungus (sp. ?), the hyphæ of which penetrate the body and cause death.

The foregoing notes are derived mainly from Dr. Nalepa's publications.

II. The Angullula, or Eel-worms.

The minute nematoid worms popularly known as Eel-worms are very destructive to many kinds of plants, more especially cereals. Their name is indicative of their shape which under magnification is seen to bear a very close resemblance to an eel. They are very small, thin-skinned, and live in enormous numbers. About six species produce galls.

The ova of these creatures are relatively large; the larvæ quickly develop from them, and at once commence to suck the sap from young roots and to bore into them. When fully grown they are not quite 1 mm. long. They attack the roots and other parts of wheat, rye, oats, clover, parsnips, beet, lettuces, tomatoes, cucumbers, and peach-, pear-, and walnut-trees. Several wild plants are also affected, *Poa annua*, *Achillea millefolium*, and *Polygonum persicaria* amongst them.

The mouth is furnished with an exertile, sharply pointed spine, which is employed to penetrate the tissues of the plants. They bore into and live within the plant, producing galled growths, and considerably retard its development.

The generations succeed each other very rapidly. About thirty days only is necessary from the emersion of the embryo from the egg to the mature sexual adult form.

Kühn's investigations have supplied many details concerning the species *Heterodera schachtii*, which affects the beetroot. The ♀ may be found attached to the rootlets of the beet. At a certain stage of growth she becomes distended into the shape of a lemon, which causes her death. The skin is then a mere sac, which may contain as many as 400 ova. The larvæ emerge from the majority of these within the sac, but, owing to the pressure from within, it ultimately ruptures, and the larvæ are liberated; they at once commence to attack the rootlets around them, and cause the formation of gall-growths.

III. The Coleoptera, or Beetles.

The galls caused by beetles are known as Coleopterous Galls. It is very remarkable that among all the British beetles, which number about 3,300 species, only about fourteen cause gall-formations in the plants upon which the larvæ feed. Probably

The Agents concerned in the Production of Galls 35

there are more, which will become known as the knowledge in this department of natural history increases.

The beetles deposit their ova in various parts of the plants, including the roots, stem, flower-head, and seed-cases. They are mostly unilocular galls, and are not of any very great size.

The family of the Weevils embraces almost all the gall-makers, and in point of size the imagines themselves are not large. *Saperda populnea* is the largest and the principal species.

IV. The Diptera, or Flies (with Two Wings).

The order of Diptera is represented amongst the gall-making creatures by about 105 species. They are usually spoken of as Gall-gnats and Gall-midges. The most renowned of them all is the formidable and dreaded yet diminutive insect, the Hessian fly (*Cecidomyia destructor* Say.). So much has been written about this destructive fly that we forbear to add any further remarks concerning it.

The sub-genus of *Cecidomyia* Lw. embraces the largest number and the smallest in size of the British Diptera, and also several species whose natural life is numbered by a few hours only. The sub-genus *Diplosis* Lw. contains about twelve gall-making gnats, the most interesting species being *Diplosis tritici* Kirby (the wheat-midge). The sub-genus *Hormomyia* Lw. contains about ten species. The larvæ of *Hormomyia piligera* Lw. produce one of the prettiest of the small galls. The remaining sub-genera and families (for which see Tables at end of volume) embrace fifteen other species. The largest of the gall-making Diptera is *Lasioptera rubi*.

The gall-gnats have very small bodies, with relatively long and broad wings, which are narrowed at the point of attachment to the thorax and rounded at the distal end; they are generally covered on both surfaces with exceedingly fine hairs. The anterior margin of the fore wing is edged with hairs; the posterior margin having attached to it a number of small scales, similar in shape and appearance to lepidopterous scales. Owing to the presence of hairs, the wings are highly iridescent. A large number of the hairs, and almost all the scales, are lost after the fly has been on the wing for some time.

They are possessed of two large and well-developed eyes. Ocelli are present in but few species.

The antennæ are composed of numbers of spherical or cylindrical joints, which in several species of *Cecidomyia* number 22 to 24; they are moniliform in character. From each joint proceeds a number of long, slender, spreading hairs. The legs are very long and slender. The abdomen is cylindrical, and in the ♀ terminates with a long, pointed ovipositor, which projects considerably. The ♂♂ are usually smaller than the ♀♀.

The colours of the gall-gnats are usually very bright, yellow, orange-yellow, or red being the most usual, all of which, unfortunately, fade at death.

V. Fungi, or Fungus.

Of the known species none is excessively destructive as regards its ravages upon the foods of man.

The fruits mostly affected are the various varieties of *Prunus*. Occasionally quantities of plums are affected, resulting in a loss to the fruit-grower. *Exoascus institiæ* Kerner, is the cause of the peculiar distension of the fruit. Some fine examples of the manner in which bullaces are rendered unfit for use will be seen on plates 126 and 129.

Anton Kerner ("Nat. Hist. Plants," ii. 526) proposes the term "Myco-ceedium for a gall that owes its origin to the attacks of fungus." It appears to be very suitable for such.

It has recently been stated by M. Noel Bernard, a French botanist, that the potato is the result of the growth of the fungus *Fusarium solani*:

"M. Bernard took sixteen tubercles of the variety called in France 'Marjohn,' and planted them in flower-pots filled with fine silicious sand. Eight flower-pots were put aside under a glass frame. The other eight pots, in the soil of which a few chips of potato had been sown bearing *Fusarium* fungus, were placed in another frame-house. Every one of the latter lot brought forth potatoes after a couple of months, while the eight flower-pots of the first lot were found to contain long, slender roots. . . . It is suggested that early potatoes might be obtained by sowing the soil with cultures of *Fusarium solani*."—*Daily News*, March 16th, 1901.

VI. The Hemiptera-Homoptera, or Aphides.

The ravages of several species of Aphides, commonly termed Green-fly and Plant-lice, are only too well known by floriculturists, professional and amateur. There are, however, a very large number of species of aphides, all of which live on plants, and very few genera are exempt from their attacks.

The life-history of an aphid is exceedingly interesting, but it is too lengthy to be given here.

The body is divided into three sections—head, thorax, and abdomen.

The most noteworthy organ of the head is the rostrum. It is a long, hollow bag, and contains three exceedingly fine lancets. With them the insect punctures the plant, and sucks the sap through the rostrum. In some species it is short, but in the majority it is long. It projects from the head, and when not in use is recurved beneath the body. The long rostra project beyond the body and produce the appearance of a tail.

Some species of aphides have neither eyes nor cornicles, but these features are almost entirely confined to subterranean species.

The wings are very large in comparison with the body. When in flight a compound hamulus on the costal margin of the hind wing fastens in a fold of the posterior margin of the fore wing, keeping both in the same plane. The legs are long and thin; in some species smooth, in others hairy.

The chief external feature of the abdomen is a pair of cornicles; they are of a horny nature, diverse in form and size, upright and mobile, tubular in form, and they act as excretory ducts. The fluid which exudes from them is known as honey-dew. Within the abdomen a substance is secreted in certain glands, from which it exudes in the form of a flocculent substance, often entirely covering the insect.

One remarkable feature about aphides is that many species have, in addition to mature winged ♂♂ and winged ♀♀, an alate form.

VII. The Heterocera, or Moths.

Very few indeed are the species of moths the larvæ of which are known to produce galls. Not half a dozen can be enumerated. At present five only are known. None occur

on roots. Two are illustrated in this volume, the descriptions of which will be found on plates 36 and 37.

VIII. The Hymenoptera, or Wasps (Small).

The insects belonging to the order of Hymenoptera that produce gall are known as Gall-wasps.

The imago has four wings. The pair on each side of the thorax are held together, while employed in flight, by means of hooklets, or *hamuli*.

This order includes bees, wasps (social and solitary), ichneumons, and ants, but none of these appears to produce galls. It is among the family of *Cynipidæ* that the gall-producing hymenoptera are found.

The bodies of these insects are of very beautiful and bright metallic colours. Red, green, orange, and blue colours predominate. The wings also are exceptionally iridescent.

Gall-wasps are very agile and graceful in their movements. The ♀ possess an instrument of very fine and delicate construction known as a seta, or terebra, which is used for the purpose of oviposition. The terebra is very long, and can be made to penetrate deeply into the vegetable tissues, or between the scales of a leaf-bud. Each ovum when deposited in a mass of tissue has an elongated appendage known as the eggstalk, the end of which is very near the surface of the plant. From its arrangements and its contents, it has been considered an organ of respiration to convey oxygen to the embryo deep down in the tissues.

The phenomena of parthenogenesis and alternation of generations are the most wonderful features connected with the *Cynipidæ*. These subjects can be more suitably treated in a contemplated volume on the oak-galls, than here.

The larvæ are apodus, white, and fleshy; they move very little. The length of time required for development is very variable. The pupæ are white, and all the limbs and the wings can be clearly seen through the puparium. The imagines are peculiar, not only in the manner of oviposition, but in taking no food, and in not frequenting flowers; they also feign death. All the galls they produce are completely closed, and are of two kinds, soft and succulent, or hard and woody.

Some species of the *Cynipidæ* disregard the cold of winter and lay their eggs during very unfavourable weather.

THE ROOT-GALLS.

The Root-galls are those situated upon or within the Roots (Adventitious, Fibrous, Tuberos), or the Tap-root, or the Rhizomes.

Galls caused by the larvæ of **Ceuthorhynchus
sulcicollis** Gyll.

on

the root of **Brassica napus** Linn.

PLATE 8.

SYNONYMY OF INSECT.

Ceuthorhynchus pleurostigma Marsh.

„ *sulcicollis* Payk.

HABITAT OF THE COMMON TURNIP.—It may be obtained from the fields of almost every farm or any greengrocer's shop throughout the country.

THE GALL IS FORMED by the irritation to the tissues caused by the feeding of the larva.

POSITION.—On the subterranean portion of the root, but seldom on the tap-root.

MANNER OF GROWTH.—Generally gregarious ; glabrous.

COLOUR.—Same as the root itself.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 13 mm. ; girth, 50 mm.

MAY BE SOUGHT during the months of September, October and November.

THE GROWTH is complete by the end of October.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the ground. The imago emerges during the spring.

The gall is also figured by Miss Ormerod, "Injurious Insects," p. 35 ; "The Royal Natural History," section xi., p. 151.

The ravages of this species in the bulbous portion of the root of the common turnip and also that of the swede turnip are sometimes very considerable. They do not, however, greatly diminish the value of the turnips; but sometimes the rapid decay of a root is due to moisture getting in the cavities after the larvæ have vacated them. The tap-root is not often galled, although the root-fibres are frequently caused to swell to enormous proportions (see plate 10). The gall-growths assume the shape of mammillated protuberances or warty excrescences. They are variable in number, some roots having but very few, others as many as forty. They are mostly separate from each other; occasionally, however, several will coalesce, especially when there are many galls on a root. The author has seen an example in which fifteen had coalesced.

The specimen in the illustration measured $9\frac{1}{4}$ in. in girth immediately beneath the row of galls; $11\frac{1}{2}$ in. over the top of them; and $13\frac{1}{2}$ in. in girth in its vertical circumference. The tap-root was $1\frac{1}{2}$ in. long. It had upon it twenty-three well-defined larval chambers, ten of which can be seen.

The larva is apodus, and lies in the cavity it makes by feeding on the gall-substance, with head and tail close together, after the manner of a *Cynips* larva. When fully fed it eats a way out and pupates in the earth, particles of which it uses in the formation of the cocoon.

The specimen illustrated was taken out of a field near Hastings by the author.



ROOT OF *Brassica napus* Linn.

GALLED BY

Ceuthorhynchus sulcicollis Gyll.

(FOUR-FIFTHS NAT. SIZE.)

CEUTHORHYNCHUS SULCICOLLIS Gyll.

PLATE 9.

Galls caused by the larvæ of **Ceuthorhynchus
sulcicollis** Gyll.

on

the root of the Common Swedish Turnip,
Brassica rutabaga De C.

PLATE 9.

This specimen furnishes a typical illustration of a galled swede turnip. It is also interesting because of the symmetrical arrangement of the galls around the base of the root. It still further shows that the ova are always deposited on or in the subterranean portion of the root, and not on any part which is above ground. The lower third only of this root was below ground. The root has around it seventeen larval chambers. None have coalesced.

The illustration, which is half natural size, is of a specimen taken out of a field near Hastings by the author.

For details connected with this species, see pp. 41 and 42.



ROOT OF *Brassica rutabaga* De C.

CALLED BY

Centhorrhynchus sulcicollis Gyll.

(HALF NAT. SIZE.)

CEUTHORHYNCHUS SULCICOLLIS Gyll.

PLATE 10.

Galls caused by the larvæ of **Ceuthorhynchus
sulcicollis** Gyll.
on
the root and root-fibres of the Common Swedish Turnip,
Brassica rutabaga De C.

PLATE 10.

The specimen shown in the illustration was taken out of a field near Hastings by the author.

It is remarkable on account of the enormous proportions of the swelling on one of the root-fibres as compared with the slender nature of the fibre itself. The root has upon it twenty-eight larval chambers, eighteen of which may be seen in the illustration, seven of them on the left-hand side having coalesced.

For details connected with this species, see pp. 41 and 42.



ROOT AND ROOT-FIBRES OF *Brassica rutabaga* De C.

GALLED BY

Ceuthorrhynchus sulcicollis Gyll.

(FOUR-FIFTHS NAT. SIZE.)

CEUTHORHYNCHUS SULCICOLLIS Gyll.

PLATE 11.

Galls caused by the larvæ of **Ceuthorhynchus
sulcicollis** Gyll.

on
the roots of **Brassica sinapis** Visiani.

PLATE 11.

SYNONYMY OF INSECT.

Ceuthorhynchus pleurostigma Marsh.

„ *sulcicollis* Payk.

HABITAT OF THE CHARLOCK.—A most abundant weed in every part of Britain, affecting railway banks, edges of fields, road sides, and waste ground generally.

THE GALL IS FORMED by the irritation to the tissues caused by the feeding of the larva.

POSITION.—On the subterranean portion of the stem, and the roots.

MANNER OF GROWTH.—Singly and gregarious; glabrous; globular (usually).

COLOUR.—Same as the root itself.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (globular form).

Girth, 48 mm.

MAY BE SOUGHT during the months of June, July, August, and September.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the ground. The imago emerges during the spring.

On the common charlock the harm which the larvæ do to the growth of the plant is not worth notice. But with the cultivated *Brassica* it is quite different. Among these the larvæ cause considerable destruction by diverting the sap for their own nourishment, and, when they leave the larval chamber to pupate, they make a hole through which wet and fungus penetrate and cause premature decay.

The gall is also figured by Miss Ormerod, "Injurious Insects," p. 35.

The illustration is of specimens gathered at Hastings by the author.



ROOTS OF *Brassica sinapis* Visiani.

GALLED BY

Cuth-rhynchus sulcicollis Gyll.

(HALF NAT. SIZE.)

SCHIZONEURA FODIENS Buckton.

PLATE 12.

Galls caused by the queen, larvæ, and nymphs of
Schizoneura fodiens Buckton
on
the roots of **Pyrus Malus** Linn.

PLATE 12.

SYNONYMY OF INSECT.

HABITAT OF THE APPLE-TREE.—Grows in orchards and gardens throughout Britain.

THE GALL IS FORMED by the exudation of the sap resulting from the continuous punctures of the rostra of the aphides.

POSITION.—On the roots, under ground.

MANNER OF GROWTH.—Irregular-shaped scabious swellings.

COLOUR.—The same as the cortex of the root.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Girth, 150 mm.

MAY BE SOUGHT during any month in the year.

THE TYPICAL CONDITION of the gall is multinymphal.

The aphides causing these scabious swellings on the roots and rootlets of apple-trees affect also the roots of black currant bushes, but to a somewhat less degree, although the insidious mischief they do is, in both cases, considerable, and the trees suffer in proportion. The study of them is not easy, but if dug up during the summer the chances are many of finding the creatures upon them. Mr. Furlonger, head gardener on a private estate at St. Leonards, kindly dug up the entire roots of an old apple-tree, to afford me an opportunity of securing specimens.

The illustration is of specimens dug up at St. Leonards by Mr. Furlonger.



ROOTS OF *Pyrus Malus* Linn.

GALLED BY

Schizoneura fodiens Buckton.

(HALF NAT. SIZE.)

Galls caused by the larvæ of **Xestophanes potentillæ**
Cam.
on
the rhizomes of **Potentilla reptans** Linn.

PLATE 13.

SYNONYMY OF INSECT.

Cynips potentillæ De Vill.

Aulax splendens Htg.

” *abbreviatus* Thoms.

” *potentillæ* Schenck, Marshall, Mayr.

HABITAT OF THE CINQUEFOIL.—Along hedgerow banks, edges of woods, borders of meadows, by the side of most country lanes; abundant in Britain, except parts of Scotland.

THE GALL IS FORMED by the accumulation of sap around the larvæ, which live in aggregations of about eight in each swelling.

POSITION.—On the rhizome.

MANNER OF GROWTH.—Gregarious; coalescent; glabrous; globular when single.

COLOUR.—Orange-yellow, reddish brown, chocolate-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (globular form of an aggregation).

Girth, 24 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of October.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 8.

THE LARVÆ PUPATE in the gall. The imagines emerge during the spring.

These galls are interesting on account of the large number of larvæ to be found in them. Each larva inhabits a separate cell. The cells have very thick and fleshy walls. They are arranged in clusters, or aggregations (as we have designated them), completely embedded within the swelling, which is somewhat globular in outline and finely reticulated on the surface. The galls are usually just beneath the surface of the ground, and are not difficult to find. *X. potentilla* also attacks the stems and leaf-stalks of *P. reptans*. See also plate 129.

The illustration is of specimens gathered at Battle by the author.



RHIZOMES OF *Potentilla reptans* Linn.

GALLED BY

Xestophanes potentillae Cam.

(THREE-FOURTHS NAT. SIZE.)

THE STEM-GALLS.

The Stem-galls are those situated upon or within the Main Stem (Erect or Climbing), the Branches, or the Suckers.

PLATE 1.

A Birch-tree (*Betula alba* Linn.)

In Broomham Park, Guestling, near Hastings, with galls caused by *Eriophyes rudis* Canest.

This very interesting tree stands just within the confines of the Park. It is remarkable for the large number of bunches of distorted twigs, or galls, which it contains, and probably in this respect it is an unique specimen.

In January, 1901, the number of galls was ninety-seven. They vary in size from a few inches in circumference to one specimen which measures 8 ft. 6 in. in girth, and consists of many hundreds of twigs growing from a solid woody core. About one-third of it may be seen on the right-hand side of the trunk, midway between the two lowest horizontal branches. It is illustrated in detail on plate 18.

The hilly nature of the ground some distance beyond the tree accounts for the hazy appearance of the lower portion of the background. From no photographic coign of vantage can this be avoided.

The tree is probably about 100 years old. The trunk measures 10 ft. 7 in. in girth at its emergence from the ground. At the height of 8 ft. two horizontal branches are given off, immediately beneath them the girth is 5 ft. 10 in., 2 ft. 6 in. above them five other branches extend, and at a similar distance above those the trunk is bifurcated. The height of the tree is about 54 ft.

The photograph was kindly taken expressly for this work by Mr. Sydney Shaw, of Bradshaw's Photographic Studio, Robertson Street, Hastings.

Eriophyes rudis Canestrini.

These mites cause one of the most remarkable and interesting forms of British vegetable gall-growths. They cause deformities which are of prodigious proportions when compared with the extreme minuteness of a single mite.

The deformities, or galls, are known as "witch-knots," "witches' brooms," "rooks' nests," and other local appellations, and may be seen, while walking or driving through the country during the winter or spring, in birch-trees in almost any part of England. They are less noticeable at other seasons because of the foliage of the trees.

They occur in varying numbers, some small trees having many of the galls upon them, while large trees may have but two or three. The variation appears to depend entirely upon the length of time the mites have been established upon the tree and the multiplicity of their numbers, rather than upon any climatic conditions or environment of the tree. Apparently they do little or no harm to its general growth and development.

The origin of these galls is in buds in which the mites have lived during the winter. When the buds begin to expand in the spring, they are retarded from successfully sending out leaves, owing to the mites absorbing for their nourishment a great amount of the leaf-producing sap. A continuation of the twig is also prevented. The bud increases a little in size and assumes a somewhat globular form, which, as summer proceeds, is altered into a rosaceous shape and is composed of a number of irregular-sized, imbricated, leaf-like scales. The outer scales in course of time fall off, the inner ones also fall with the growth of new buds. These new buds appear at the base of the old one, and they are quickly subjected to the same treatment by the mites. The mites increase in numbers very rapidly, and are continually moving from one bud to another, rendering them abortive.

This is repeated again and again, until, after a period of several years, the end of the twig is covered by buds which under normal conditions would have been distributed along several inches of new wood. If, owing to the concentration of attack at one spot, the twig has not the power to lengthen or continue forward growth, a mass of numerous short twigs is formed, which proceed from a hard and woody core. But where the mites are distributed along the twigs a bushy tangle of long and slender twigs is the result. See also pp. 62, 64, 66, 68, and 70, and plates 16, 17, 18, 19, and 20.

ERIOPHYES AVELLANÆ Nal., var.?

PLATE 14.

PLATE 14.

A branch of **Corylus Avellana** Linn.

(Nearly half nat. size.)

Galled by

Eriophyes avellanæ Nal., var. ?

This unique specimen was discovered by the author in a roadside hedge near Guestling, Hastings.

The centre is a hard, solid, and woody mass from which grow hundreds of small twigs, many of them knobbed and swollen in various places. Unfortunately, it was not possible to identify the species of the mites at the time the specimen was found, and when the opportunity occurred they had long before died and shrivelled.

The young leaves on many of the twigs indicate that the branch was removed during the month of May.

The 3-in. measure will assist the reader to form an idea of the natural size.



A BRANCH OF *Corylus Avellana* Linn.

GALLED BY

Eriophyes avellanae Nal. var. (?)

(NEARLY HALF NAT. SIZE.)

ERIOPHYES AVELLANÆ Nal., var.?

PLATE 15.

PLATE 15.

A branch of **Corylus Avellana** Linn.

(One-fourth nat. size.)

Galled by

Eriophyes avellanæ Nal., var. ?

The specimen illustrated on opposite page is another remarkable example of the work of this species of mite. While searching along a roadside hedge in Hollington, near Hastings, the author discovered it.

The branch formed part of a low, stunted, and irregular-shaped bush. Several other branches were galled in a similar manner, but not to so great an extent as this one. No other bushes of *Corylus Avellana* were within several yards' distance.

It was removed during the month of March.

The 3-in. measure will assist the reader to form an idea of the natural size.



BRANCH OF *Corylus Avellana* Linn.

GALLED BY

Eriophyes avellanae Nal. var. (?)

(ONE-FOURTH NAT. SIZE.)

ERIOPHYES RUDIS Canest.

PLATE 16.

PLATE 16.

A twig of **Betula alba** Linn.

(Nearly one-third nat. size.)

Galled by

Eriophyes rudis Canest.

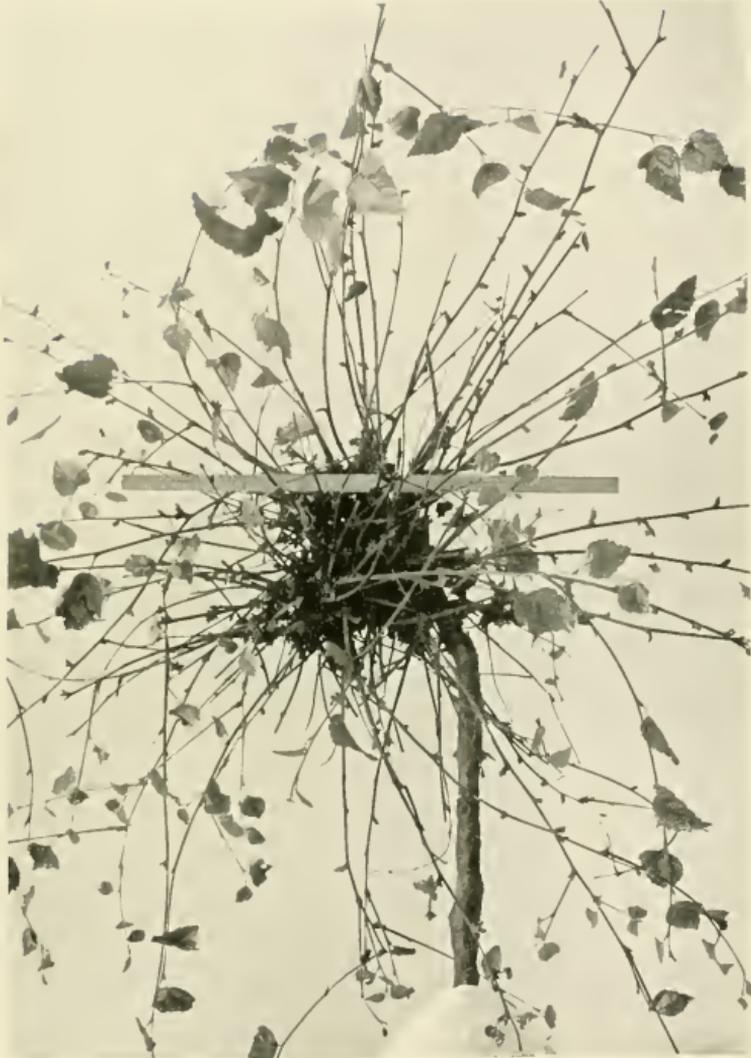
The specimen illustrated on opposite page is, perhaps, the most usual shape these galls affect.

The attacks of the thousands of mites which swarm upon them cause the twigs to grow outwards in all directions, and the common centre to form into a hard, solid, and woody core.

Some specimens, relatively to their size, are very heavy, and cause the bough to bend downwards considerably.

The 12-in. measure will assist the reader to form an idea of the natural size.

The illustration is of a specimen gathered at Hastings by Harold Connold.



A TWIG OF *Betula alba* Linn.

GALLED BY

Eriophyes rudis Canest.

(NEARLY ONE-THIRD NAT. SIZE.)

ERIOPHYES RUDIS Canest.

PLATE 17.

PLATE 17.

A twig of **Betula alba** Linn.

(One-fifth nat. size.)

Galled by

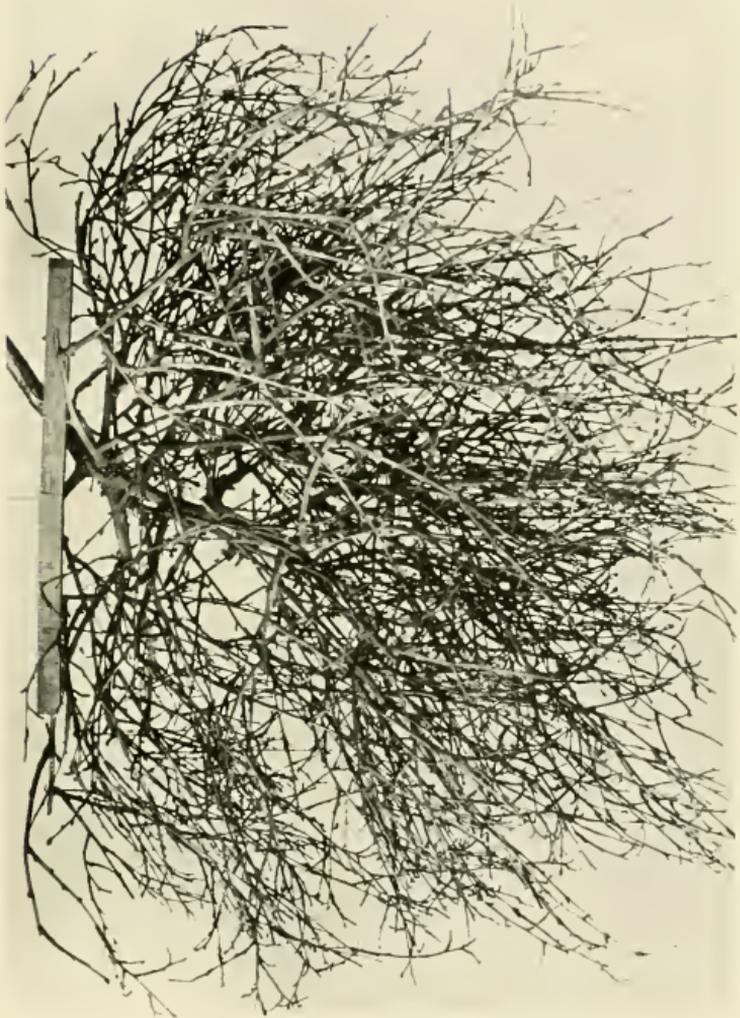
Eriophyes rudis Canest.

The cluster of twigs illustrated on the opposite page furnishes an excellent example of the development in which there is no core, but where, the mites being widely distributed, a bushy tangle of long and slender twigs is the result.

It was taken to pieces for the purpose of ascertaining how many twigs of not less than six inches long it contained. They were very carefully counted. The number was 329.

The measure shown in the illustration represents 12 in.

The illustration is of a specimen from the tree at Guestling, by the author.



TWIGS OF *Betula alba* Linn.

GALLED BY

Eriophyes rudis Canest.

(ONE-FIFTH NAT. SIZE.)

ERIOPHYES RUDIS Canest.

PLATE 18.

PLATE 18.

A branch of **Betula alba** Linn.

(One-fourteenth nat. size.)

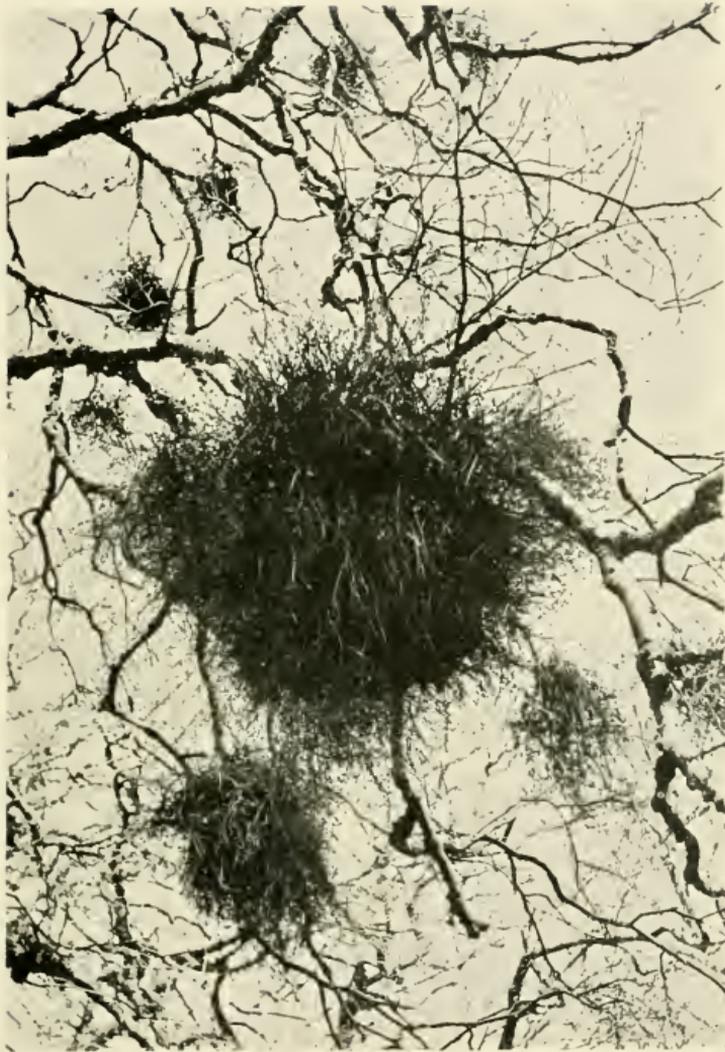
Galled by

Eriophyes rudis Canest.

The magnificent specimen illustrated on opposite page is the largest on the birch-tree in Broomham Park. It is mentioned on p. 55. It is an example of the form of growth in which the development takes place from the side of a branch, with a hard, solid, and woody core which also forms part of the branch.

The two smaller galls beneath it are on separate branches, and are in no way attached to the centre one, nor does the branch which apparently is growing from its base belong to it.

It measures 8 ft. 6 in. in girth and is 10 ft. from the ground. Its weight must be very great; the branch is considerably bent by reason of it.



A BRANCH OF *Betula alba* Linn.

GALLED BY

Eriophyes rudis Canest.

(ONE-FOURTEENTH NAT. SIZE).

ERIOPHYES RUDIS Canest.

PLATE 19.

PLATE 19.

A branch of **Betula alba** Linn.

(Half nat. size.)

Galled by

Eriophyes rudis Canest.

This specimen is introduced for the purpose of illustrating the mode of growth of examples of these galls which develop from the side of a branch, and the appearance of one as seen from above.

The branch continues its growth beyond the galled area, and does not appear to be stunted or weakened in vigour by reason of the attacks of the mites.

It weighed 28 oz. avoird.

Vertical sections of it are shown in the next plate.

The illustration is of a specimen from a tree at Guestling, by the author.



A BRANCH OF *Betula alba* Linn

GALLED BY

Eriophyes rudis Canest.

(HALF NAT. SIZE.)

ERIOPHYES RUDIS Canest.

PLATE 20.

PLATE 20.

Vertical sections of a branch of **Betula alba** Linn.

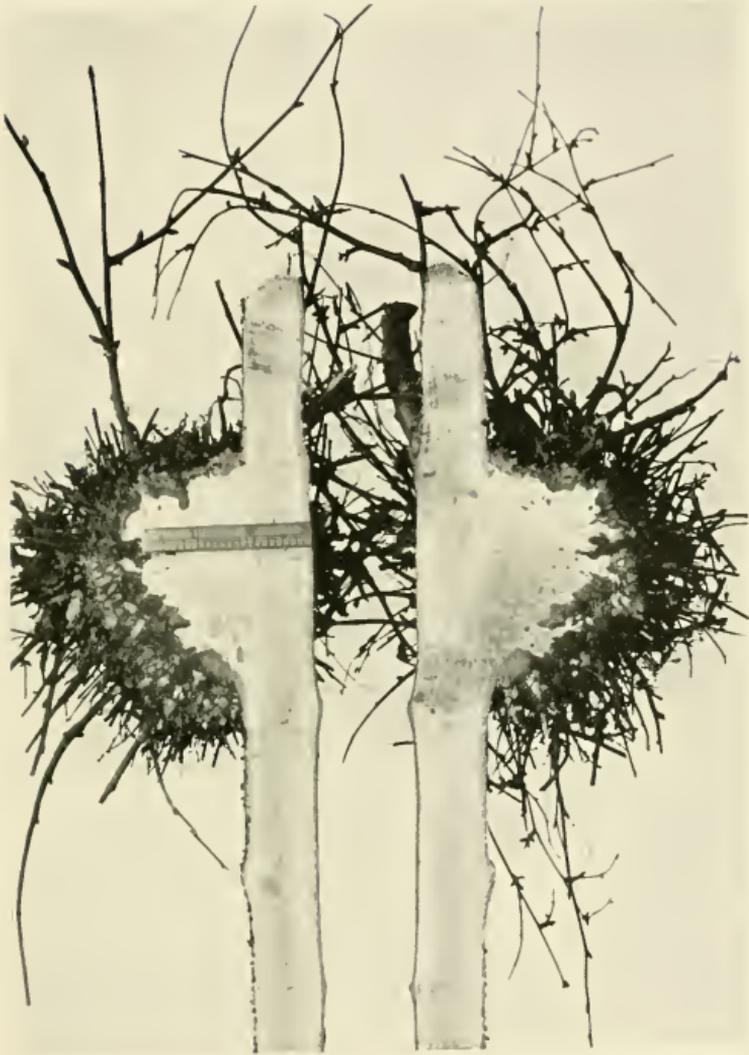
(One-third nat. size.)

Galled by

Eriophyes rudis Canest.

The specimen illustrated on the opposite page is the same as shown on plate 19.

It has been divided into halves vertically, and reveals the solid and woody nature of the core, the grain of which, it may be observed, is quite different from that of the branch.



SECTIONS OF BRANCH OF *Betula alba* Linn.

GALED BY

Eriophyes rudis Canest.

(ONE-THIRD NAT. SIZE.)

Galls caused by the larvæ of **Saperda populnea** Linn.
on
the boughs of **Populus tremula** Linn.

PLATE 21.

SYNONYMY OF INSECT.

HABITAT OF THE ASPEN.—This tree grows well in coppices, woods, and forests; it may also frequently be seen in a flourishing condition on the outskirts of a wood.

THE GALL IS FORMED by the presence of the larva in the pith causing the surrounding tissues to swell and bulge outwards.

POSITION.—On the twigs, small branches, and sometimes on the main stem.

MANNER OF GROWTH.—Singly; seldom coalesced.

COLOUR.—Same as unaffected part of branch.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 25 mm.; girth, 60 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of September.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the gall. The imago emerges during June.

These galls are very local. So far as my observations have extended, they are nowhere plentiful, even in districts where they do occur. The south-eastern counties of England appear to be the most favoured. They are, however, found in the midland and several other counties.

The gall is also figured by Mosley, "Nat. Journal," June, 1898 (from specimens supplied by the author).

Saperda populnea.

The operations of the female beetle for oviposition are both interesting and remarkable. Emerging from a gall during the month of June or early in July, she is speedily mated, and soon afterwards begins oviposition. She selects a suitable branch, and with her jaws gnaws a hole through the bark and a little way into the underneath layer of woody cells. In this hole she deposits one ovum, and passes along further to repeat the operation. The distance between each insertion is generally from 30 to 40 mm. It is seldom that there are more than four insertions in succession on the same branch. As soon as the larva hatches, it eats its way into the pith, and the swelling of the surrounding material begins. The place in the bark where the egg was inserted does not heal; the enlargement of the woody layer beneath causes it to gape more and more as time passes, and a scar-like appearance is the result. The larva feeds upon the pith, eating galleries above and below the point at which it hatched. It remains in the larval condition until the second autumn, when it pupates, and, remaining through the winter in that condition, emerges during May or June following—a period of twenty-two or twenty-three months after birth. In order to emerge it gnaws a circular hole from the larval chamber to the surface of the branch, and this hole generally opens on the opposite side of the branch to that on which the oviposition scar is situated.

The illustration is of specimens gathered at Hastings by the author.



BRANCHES OF *Populus tremula* Linn.

GALLED BY

Saperda populnea Linn.

(THREE FOURTHS NAT. SIZE.)

SAPERDA POPULNEA Linn.

PLATE 22.

Galls caused by the larvæ of *Saperda populnea* Linn.
on
the stems of *Salix caprea* Linn.

PLATE 22.

SYNONYMY OF INSECT.

HABITAT OF THE SALLOW, OR GOAT-WILLOW.—Very common throughout Britain, by the sides of streams, in marshy places, damp open woods, and in thickets and hedges.

THE GALL IS FORMED by the presence of the larva in the pith causing the surrounding tissues to swell and bulge outwards.

POSITION.—On the stem, branches, and sometimes the twigs also.

MANNER OF GROWTH.—Singly; seldom coalesced.

COLOUR.—Same as unaffected part of stem.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Girth, 66 mm.

MAY BE SOUGHT during any month of the year.

THE GROWTH is complete by the end of September.

THE TYPICAL CONDITION of the gall is unilocular.

THE LARVA PUPATES in the gall. The imago emerges during May.

The appearance of these galls is somewhat different from those on the aspen caused by the same species of beetle. In the case of the aspen the puncture made by the ♀ for oviposition results in a scar being formed, but with the willow this does not appear to be the case. The growth of the willow is more rapid. The epidermis does not close over the puncture, and, as the growth of the stem proceeds, a depression is formed. In the lower left-hand corner of the illustration an imago will be seen. It emerged from the hole above it, a short while before the photograph was taken.

The illustration is of specimens gathered at Hastings by the author.



STEMS OF *Salix caprea* Linn.

GALLED BY

Saperda populnea Linn.

(NEARLY NAT. SIZE.)

AGROMYZA SCHINERI Gir.

PLATE 23.

Galls caused by the larvæ of **Agromyza schineri** Gir.
on
the twigs of **Salix cinerea** Linn.

PLATE 23.

SYNONYMY OF INSECT.

HABITAT OF THE GREY WILLOW.—Common throughout Britain, by the sides of streams, in marshy places, damp open woods, and in thickets and hedges.

THE GALL IS FORMED by the presence of the larva in the cambium layer causing it to swell and bulge outwards.

POSITION.—On the side of the twig.

MANNER OF GROWTH.—Gregarious; coalescent; glabrous; slightly glossy.

COLOUR.—Green, with wavy longitudinal lines of paler colour.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 15 mm.; breadth, 5 mm.

MAY BE SOUGHT during any month of the year.

THE GROWTH is complete by the end of September.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the ground. The imago emerges during spring.

These galls occur sometimes singly, but generally from two to fifteen on a stem, and are mostly found on young bushes of *Salix cinerea*. They are oval-shaped, cushion-like swellings which, rising from within the stem, cause the epidermis to crack into longitudinal wavy strands, the edges of which reflect light, imparting to them a whitish colour. This disappears when they are viewed through a lens. Under the same conditions small scars may be seen which indicate the holes made for oviposition by the parent fly.

The illustration is of specimens gathered at Hastings by the author.



SHOOTS OF *Salvia cinerea* Linn.

COLLECTED BY

Agronia schineri Gir.

(SIX SEVENTHS NAT. SIZE.)

AGROMYZA SCHINERI Gir.

PLATE 24

PLATE 24.

Stems of **Salix cinerea** Linn.

(Five-sixths nat. size.)

Galled by

Agromyza schineri Gir.

The stems on the opposite page illustrate the appearance of these galls in the spring and summer of the year following their formation. During the first summer's growth they were the same size and appearance of those in plate 23, the increase in the growth of the wood causing them to present a less elevated condition. The holes through which the imagines emerged may be distinctly seen in the centre specimen.

The illustration is of specimens gathered at Hastings by the Author.



STEMS OF *Salix cinerea* Linn.

GALLED BY

Agromyza schineri Gir.

(FIVE-SIXTHS NAT. SIZE.)

CECIDOMYIA GALII Wtz.

PLATE 25.

Galls caused by the larvæ of **Cecidomyia galii** Wtz.
on
the stalks of **Galium verum** Linn.

PLATE 25.

SYNONYMY OF INSECT.

Cecidomyia molluginis Lw.

„ *galii* Theobald.

HABITAT OF THE LADIES' BEDSTRAW.—Very generally distributed throughout Britain, growing on banks and pastures, preferably in a fairly dry situation.

THE GALL IS FORMED by an enormous accumulation of sap, resulting from the irritation to the tissues and the presence of the larvæ.

POSITION.—On the stems and flower-stalks.

MANNER OF GROWTH.—Singly and gregarious; glabrous, glossy.

COLOUR.—Yellowish white and very pale green.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (globular form).

Girth, 30 mm.

MAY BE SOUGHT during the months of June, July, August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 6.

THE LARVÆ PUPATE in the ground. The imagines emerge during the spring.

These galls attain an enormous size as compared with the slender stems which support them, the diameter of some being twelve times that of the stem. They are very conspicuous. They do not occur in the Hastings district. The author is indebted to the kindness of the undermentioned lady for the specimens of the illustration. From her communications to him it appears that she found the plant to be very local, and the galled stems comparatively few in number.

The illustration is of specimens gathered at Mundesley, Norfolk, by Miss Ethel Sayer.



STEMS OF *Galium verum* Linn.

CALLED BY

Cecidomyia galii Wtz.

(THREE-FOURTHS NAT. SIZE.)

CECIDOMYIA SALICIPERDA Duf.

PLATE 26.

Galls caused by the larvæ of **Cecidomyia saliciperda** Duf.
on
twigs of **Salix Caprea** Linn.

PLATE 26.

SYNONYMY OF INSECT.

- Cecidomyia terebrans* Lw.
" *saliciperda* Theobald.
" *albipennis* Lw., Wtz., Walker.
Rhabdophaga viminalis West.

HABITAT OF THE SALLOW, OR GOAT-WILLOW.—Very common throughout Britain, by the sides of streams, in marshy places, damp open woods, and in thickets and hedges.

THE GALL IS FORMED by the larvæ feeding within the stem, causing it to swell, and the bark to crack and burst through the epidermis.

POSITION.—On the twigs, usually at or near the top.

MANNER OF GROWTH.—Singly or in numbers, separately or coalescent; scabious.

COLOUR.—Dark green suffused with red; light brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 20 mm.; girth, 36 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of September.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 6.

THE LARVÆ PUPATE in the gall. The imagines emerge during the spring.

It is not difficult to find these galls. During the winter is the best time to seek them, the absence of foliage allowing them to be easily detected. They are very irregular in their mode of growth. There may be only one small swelling on a twig, or as many as eight distinct or coalesced swellings within a distance of four inches. Leaf-buds appear on the surface at various points, which, when developed, may have a galled swelling on the petiole.

The illustration is of specimens gathered at Hastings by the author.



TWIGS OF *Salix Caprea* Linn.

GALLED BY

Cecidomyia saliciperda Duf.

(FOUR-FIFTHS NAT. SIZE.)

CECIDOMYIA SALICIPERDA Duf.

PLATE 27.

Galls caused by the larvæ of **Cecidomyia saliciperda** Duf.
on
the twigs of **Salix Caprea** Linn.

PLATE 27.

The illustration on the opposite page gives the appearance of the galls without foliage as seen during the months of December to June, and may be considered as the winter-spring form of these gall-growths.

DIMENSIONS OF THE SPECIMENS.

	Vertical axis.	Horizontal axis,	Greatest girth.
Fig. A. . .	48 mm.	25 mm.	74 mm.
Fig. B. . .	65 mm.	22 mm.	71 mm.
Fig. C. . .	72 mm.	21 mm.	63 mm.

These may be regarded as very fine examples.

The illustration is of specimens gathered at Hastings by the author's sons.



TWIGS OF *Salix Caprea* Linn.

GALLED BY

Cecidomyia saliciperda Duf.

(NEARLY NAT. SIZE.)

CECIDOMYIA SALICIS Schrk.

PLATE 28.

Galls caused by the larvæ of **Cecidomyia salicis** Schrk.
on
the twigs of **Salix cinerea** Linn.

PLATE 28.

SYNONYMY OF INSECT.

- Cecidomyia salicina* Bouché.
" *gallarum-salicis*.
" *Degeeri* Bremi.
" *argyrosticta* Macq.

HABITAT OF THE GREY SALLOW.—Common throughout Britain, by the sides of streams, in marshy places, damp open woods, and in thickets and hedges.

THE GALL IS FORMED by the larvæ feeding upon the pith and causing the woody cells which surround it to swell.

POSITION.—On the top twigs of the tree.

MANNER OF GROWTH.—Separately, seldom more than one on a twig; glabrous.

COLOUR.—Same as the twig upon which it is found.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 20 mm.; girth, 36 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of October.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 20.

THE LARVÆ PUPATE in the gall. The imagines emerge during May.

The peculiar lemon-like shape of these galls distinguishes them very readily from other willow-galls. They occur also on *Salix aurita*. The larvæ live in the centre of the swelling, feeding on the pith; the number in a gall varies from two or three to thirty. The larval chambers are irregularly elongated, and have very thin walls. When fully fed the larvæ work their way towards the exterior of the gall, and upon emersion of the imago about half of the puparium is left projecting from the hole.

The illustration is of specimens gathered at Hastings by the author.



TWIGS OF *Salix cinerea* Linn.

GALLED BY

Cecidomyia salicis Schrk.

(NEARLY NAT. SIZE.)

CECIDOMYIA SISYMBRII Schrk.

PLATE 29.

Galls caused by the larvæ of *Cecidomyia sisymbrii* Schrk.

on

the stalks of *Sisymbrium officinale* Scop.

PLATE 29.

SYNONYMY OF INSECT.

Cecidomyia barbarea Curtis.

„ *sisymbrii* Theobald.

HABITAT OF THE HEDGE-MUSTARD.—This plant grows to the height of from 18 in. to 30 in. in hedges and by roadsides, but less when in waste places and open situations. Abundant throughout Britain.

THE GALL IS FORMED by the larvæ causing a cessation of upward growth and a consequent crowding together of flowers and seed-pods.

POSITION.—At the termination of the shoots.

MANNER OF GROWTH.—Singly; glabrous.

COLOUR.—Slightly paler green than other portions of the plant.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 15 mm.; girth, 30 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is multilarval.

THE LARVÆ PUPATE in the gall. The imagines emerge during the autumn.

It is not improbable that the imagines which emerge during the months of September to November oviposit in some other plants, and that the larvæ therefrom remain in the galls they then cause until the following June.

The illustration is of specimens gathered at Guestling, near Hastings, by the author.



SHOOTS OF *Sisymbrium officinale* Scop.

GALLED BY

Cecidomyia sisymbrii Schrk.

(TWO-THIRDS NAT. SIZE.)

CECIDOMYIA TILLE Schrk.

PLATE 30.

Galls caused by the larvæ of *Cecidomyia tiliæ* Schrk.
on
the twigs of *Tilia grandifolia* Ehrh.

PLATE 30.

SYNONYMY OF INSECT.

Cecidomyia limbivolens Macq.

” *excavans* Macq.

” *tiliæ* Theobald.

HABITAT OF *TILIA GRANDIFOLIA*.—This tree occurs throughout Britain in woods, parks, avenues, etc. It is profuse in its foliage and flowers, and assumes handsome and noble proportions.

THE GALL IS FORMED by the ova being deposited in a bud ; the larvæ, when hatched, feed upon the interior and prevent development.

POSITION.—At the axils of young twigs, and sometimes on the petiole.

MANNER OF GROWTH.—Sessile ; glabrous ; more or less globular.

COLOUR.—Green, greenish yellow, orange-yellow, bright red.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 10 mm. ; Girth, 15 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 20.

THE LARVÆ PUPATE in the gall. The imagines emerge during August.

On young shoots which grow around the stumps of lime-trees, these galls may also be found. They are somewhat variable in shape, mostly quite globular ; others, however, are oblong, and occasionally specimens are to be found spindle-shaped. Their bright colouring causes them to be very noticeable against the beautiful green of the leaves of the tree. It is remarkable what a large number of larval cells are enclosed within a specimen of average size.

The illustration is of specimens gathered at Aylsham, Norfolk, by the author.



TWIGS OF *Tilia grandifolia* Ehrh.

GALLED BY

Cecidomyia tiliae Schrk.

(THREE-FOURTHS NAT. SIZE.)

Galls caused by the larvæ of *Lasioptera rubi* Schrk.
on
the stems of *Rubus fruticosus* Linn.

PLATE 31.

SYNONYMY OF INSECT.

- Lasioptera picta* Mg.
" *argyrosticta* Mg.
" *fusca* Vallot.
" *rubi* Theobald.

HABITAT OF THE COMMON BRAMBLE.—Very plentiful in every part of Britain in waste places, woods, disused country roads, hedges, coppices, etc., asserting itself in every way.

THE GALL IS FORMED by the swelling of the pith and medullary tissue.

POSITION.—On the sides of the bramble-shoots.

MANNER OF GROWTH.—Singly; sometimes close together, rarely coalesced.

COLOUR.—Dark green at first; brown or reddish brown when mature.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 18 mm.; girth, 36 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of September.

THE TYPICAL CONDITION of the gall is multilarval.

THE LARVÆ PUPATE in the gall. The imagines emerge during May.

When these galls are required as specimens for illustration or mounting in a case they should be gathered in September or October; for the purpose of rearing the inhabitants, however, they must be allowed to remain *in situ* until March or April, but not later. See also plate 117.

The gall is also figured in "The Royal Natural History," sect. xi., p. 20.

Lasioptera rubi.

The size of these galls is very variable. From that of a mere swelling they attain dimensions the girth of which is often six or more times that of the stem upon which they are growing. The length of the swelling which they cause seldom exceeds $1\frac{1}{2}$ in. The gall-growth usually takes place on the side of the stem, but specimens are occasionally met with where it is evenly distributed all round the stem. Sometimes the parent fly deposits her ova where a small shoot branches off the main stem, a bulbous growth is then the result; at another time the termination of a shoot is chosen. The interior of the gall shows an irregular-shaped cavity containing from four to seven larvæ surrounded by frass.

These galls are neither easy to find nor to procure, and being usually in the midst of bramble-bushes, where the growth of shrubs and trees is thickest, the search for them is often attended with many scratches.

The illustration on the opposite page is of specimens gathered at Hastings by the author.



FIG. 1. A FINE
SPECIMEN.

NAT. SIZE.

A. As growing.

B. Section.





STEMS OF *Rubus fruticosus* Linn.

GALLED BY

Lasioptera rubi Schrk.

(HALF NAT. SIZE.)

LIPARA LUCENS Mg.

PLATE 32.

Galls caused by the larvæ of **Lipara lucens** Mg.
on
the stem of **Arundo Phragmites** Ben.

PLATE 32.

SYNONYMY OF INSECT.

HABITAT OF THE COMMON REED.—Common in Britain in marshes, streams, shallow pools, ditches by railway embankments, and lakes in private parks.

THE GALL IS FORMED by the leaves overlapping and enfolding one another, this being caused by the larva preventing the upward growth of the stem.

POSITION.—At the top of the stem.

MANNER OF GROWTH.—Singly; glabrous, glossy; torpedo-shaped.

COLOUR.—Yellowish green.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 70 mm.; breadth, 10 mm.; girth, 26 mm.

MAY BE SOUGHT during the months of June, July, August, and September.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is unilarval.

THE LARVA PUPATES in the gall.

These galls are not common. This fact is due mainly to the cutting down of the reeds in many parts of the country during September for thatching purposes. They are often very difficult to obtain, unless the gallist can go amongst the reeds in a boat, or search the stems after they have been thrown on the bank by the mower. In the illustration will be seen, on the right side of the centre galled stem, a panicle, and on the left side an unaffected stem. The galled stems never produce panicles.

The illustration is of specimens gathered in Ashburnham Park, Battle, by the author.



STEMS OF *Arundo Phragmites* Bentham.

CALLED BY

Lipara lucens Mg.
(NINE-TENTHS NAT. SIZE.)

Galls caused by the larvæ of **Urophora cardui** Linn.
on
the stems of **Carduus arvensis** Curt.

PLATE 33.

SYNONYMY OF INSECT.

Trypeta cardui Linn.

” ” Walker.

HABITAT OF THE CREEPING THISTLE.—Grows in fields, on hill-sides, waste places, semi-cultivated places, etc., in sheltered and exposed situations abundantly all over Britain.

POSITION.—At the top of the stem and also at the nodes.

MANNER OF GROWTH.—Singly; glabrous, glossy.

COLOUR.—Pale green, becoming darker with age.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 24 mm.; girth, 70 mm.

MAY BE SOUGHT during the months of July, August, September.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 4.

THE LARVÆ PUPATE in the gall. The imagines emerge during May and June.

The operations of the larvæ of this species are in keeping with those of *Urophora solstitialis*. They develop from the ova simultaneously with the unfolding of the apical portion of the thistle, when it is about to produce the flowers, and arrest its further upward growth. The ascending sap accumulates and gives rise to a large bulbous swelling, which the larvæ eat into in a downward direction. The apertures of the galleries remain open, the frass, however, being allowed to remain in them.

Urophora cardui.

This conspicuous and unmistakable gall may often be seen on the thistles growing on a patch of waste ground. The galls occur at the summit of the plant and also at the nodes, and in almost every instance prevent a continuation of growth. In the early stages of development it is very soft and sappy, the outer layer more so than the interior. It, however, soon becomes more solid, and continues to harden until it is of a woody nature. At first it is a delicate pale green ; this with age changes to a dark green, and ultimately, in unison with the rest of the plant, turns brown. Leaves spring in all directions from the surface of the gall, and at the top form a tuft, imparting a graceful and attractive appearance. Such a specimen may be seen in the lower corner on the right-hand side of plate 33. The larvæ are usually four in number, each occupying a separate gallery. They eat from above downwards, increasing the size of the gallery as they descend.

The illustration is of specimens gathered at Hastings by the author. -

FIG. 2.



A. The imago. $\times 5$.



B. The larva. $\times 10$.



C. Section showing larval chambers. Nat. size.



STEMS OF *Carduus arvensis* Curt.

GALLED BY

Urophora cardui Linn.

(HALF NAT. SIZE.)

Galls caused by the larvæ of *Adelges abietis* Linn.
on
the twigs of *Abies excelsa* De C.

PLATE 34.

SYNONYMY OF INSECT.

Chermes abietis Linn., Fab., Schr., Kalt, Pass., Kerner,
Koch, Ormerod, Ratz., Leuchart.

Adelges gallarum abietis Haliday.

” *abietis* Walk.

Sacchiphantes abietis “Ruricola.”

HABITAT OF THE SPRUCE-FIR.—Indigenous in the Scottish highlands. Planted all over Britain in parks, enclosures, private grounds, and nursery gardens.

THE GALL IS FORMED by the accumulation of sap around punctures made by the queen aphid at the axils of the young leaves, causing their bases to thicken.

POSITION.—At or near the end of a twig.

MANNER OF GROWTH.—The larval chambers are gregarious, imbricated, and sessile.

COLOUR.—At first pale green, darker later, ultimately chocolate-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 40 mm. ; breadth, 16 mm. ; girth, 36 mm.

MAY BE SOUGHT during the months of April, May, June, July.

THE GROWTH is complete by the end of June.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 25.

ECDYSIS takes place in the gall. The imagines emerge during June.

The popular name of pine-apple gall is very appropriate. Before the scales separate to allow the pupæ to emerge, it bears a very close resemblance to a pine-apple. In their dried condition they may be observed on Christmas-trees used at children's parties.

The gall is also figured by Miss Ormerod, “Injurious Insects,” 1890, p. 267; Buckton, “British Aphides,” vol. iv., plate 116; “The Royal Natural History,” sect. xi., p. 199; A. Kerner, “Nat. Hist. of Plants,” vol. ii., p. 534.

Adelges abietis.

If the twigs of a spruce-fir, or Christmas-tree, be carefully examined during the month of April, the chances are very many that the foundress of the colony of aphides, which three or four months later will be swarming on the same twigs, may be seen occupied in depositing ova and in puncturing the axils of the young expanding leaves. The queen, or foundress, has hibernated during the winter, and upon the return of mild weather and ascending sap, emerges a thin and wingless shrivelled creature. By absorbing the sap her condition is speedily changed to that of rotundity. At the conclusion of oviposition she dies. The punctures made by her rostrum at the axils of the young leaves cause a diversion of the sap, and the bases of the needle-like leaves thicken and swell, forming numerous cavities of which the larvæ take possession. The twig attacked forms an axis, around which the larval chambers are arranged, each containing about thirty-five larvæ. The larvæ, by the constant punctures made with their rostra to suck the sap, cause the continual development of the growth. During May they assume the pupal stage. Towards the end of June they make their way through the gaping apertures of the scales, crawl up the needles, emerge from the puparium as imagines, and in twenty minutes or less can fly away. One of these conglomerations of larval chambers may contain from 1,800 to 2,000 insects. At the close of the summer these false cones, as they are termed, dry, turn black, and several years will elapse before disintegration is complete.

The illustration is of specimens gathered at Hastings by the author.



TWIGS OF *Abies concolor* De C.

GALLED BY

Adelges abietis Linn.

(THREE-FOURTHS NAT. SIZE.)

Galls caused by the queen and nymphs of **Schizoneura lanigera** Haus.

on

a branch of **Pyrus Malus** Linn.

PLATE 35.

SYNONYMY OF INSECT.

Aphis lanigera Haus., Ger., Kirby and Spence.

Eriosoma mali Leach, Mosley, Haliday.

” *lanigera* Fitch.

Schizoneura lanigera Htg., Kalt., Pass.

Myzoxylus mali Blot., Tong., Amyot.

HABITAT OF THE APPLE-TREE.—Grows in orchards and gardens throughout the length and breadth of the country.

THE GALL IS FORMED by the exudation of sap resulting from the continuous punctures of the rostra of the aphides.

POSITION.—On the trunk, branches, and twigs.

MANNER OF GROWTH.—Rounded protuberances with rugose surface.

COLOUR.—Brownish, with grey spots and patches.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Girth, 7 in.

MAY BE SOUGHT during any month in the year.

PARTICULARS OF PLATE.—Length of bough, 20 in. ; length of lower twig, $5\frac{1}{2}$ in. ; length of centre twig, 7 in. ; length of excrescence on left hand, 4 in. ; girth of unaffected portion of branch, midway between lower twig and centre twig, 90 mm. ; girth of galled portion of branch, midway between lower twig and centre twig, 160 mm. ; girth of excrescence on left hand at greatest circumference, 156 mm.

The gall is also figured by Miss Ormerod, “Injurious Insects,” 1890, p. 279, “Insects Injurious to Orchard and Bush Fruits,” 1898, p. 1 ; and also Buckton, “British Aphides,” vol. iii., plate 106.

Schizoneura lanigera.

In the illustration opposite is shown the all too familiar 'American blight.' The swellings are the result of the continuous punctures of the rostra of the aphides, causing thereby an ever-increasing flow of sap, and producing large warty swellings on every part of the trunk and limbs of apple-trees. In old and neglected orchards, more particularly in the west of England, trees may often be seen with every branch affected in a similar manner to that shown on the opposite page. Various preventions and remedies are now being resorted to, and apple growers are becoming aware of the fact that it can be checked, as well as prevented from spreading. The presence of the aphides upon a tree in the summer time is unmistakably shown by a quantity of white, downy substance on the trunk, branches, and twigs. This is secreted by the aphides, and with it they surround themselves, and are rendered sufficiently buoyant to be carried a long distance by the wind. The injury done to the tree results from the flow of sap through the wounds made by the aphides. Being drawn away from the young shoots, leaves, and fruit, the sap accumulates into soft, pulpy swellings forced up through the bark. During the autumn and winter these growths dry, and as they do so cracks appear on their surface, producing scabby hypertrophies, many of which attain enormous dimensions. Within the crevices ova are deposited and the imagines hybernate. With the return of spring, and a renewal of attacks, the galls increase in size.

The illustration is of specimens gathered at Hastings by the author.



BRANCH OF *Pyrus Malus* Linn.

GALLED BY

Schizoneura lanigera Haus.

(ONE-THIRD NAT. SIZE.)

HEDYA ACERIANA Dup.

PLATE 36.

Galls caused by the larvæ of **Hedya aceriana** Dup.
on
the twigs of **Populus alba** Linn., var. **canescens**

PLATE 36.

SYNONYMY OF INSECT.

Spilonota aceriana Mann.

HABITAT OF THE WHITE POPLAR.—In Britain this tree is seldom found in a wild state. It prefers the edges of streams, ponds, and other damp situations, often forming a striking feature in large gardens and private grounds.

THE GALL IS FORMED by the swelling of the young shoot as a result of irritation due to the presence of the larva.

POSITION.—At the end of the twig.

MANNER OF GROWTH.—Singly; slightly pubescent.

COLOUR.—Silvery white.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 18 mm.; girth, 24 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the gall. The imago emerges during August.

The larva eats its way into the young shoot, causing it to bulge considerably. In course of time cracks appear on the surface, disclosing dark brown decaying tissue within. After the escape of the imago, one crack widens until the interior of the cavity is laid bare. The larva ejects its fras through an opening at the top of the larval chamber, and instead of falling away it is retained, and a bag-like pendant mass is formed on the outside.

The illustration is of specimens gathered at Hastings by the author.



TWIGS OF *Populus alba* Linn., var. *canescens*.

GALLED BY

Holva aceriana Dup.

(THREE-FOURTHS NAT. SIZE.)

RETINIA RESINELLA Linn.

PLATE 37.

Galls caused by the larvæ of **Retinia resinella** Linn.
on
twigs of **Pinus sylvestris** Linn.

PLATE 37.

SYNONYMY OF INSECT.

PARASITE.—*Glypta resinana*.

HABITAT OF THE SCOTCH, NORWAY, OR RIGA PINE-TREE.—
To be found all over Britain. It is indigenous in the
Scotch highlands.

THE GALL IS FORMED by the larva feeding upon the young
shoot and causing an accumulation of resinous sap around it.

POSITION.—At the end of the twig.

MANNER OF GROWTH.—Singly; glabrous; resinous; somewhat
ovoid in outline.

COLOUR—Dull grey with darker patches.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 25 mm.; breadth, 18 mm.; girth, 40 mm.

MAY BE SOUGHT during the whole of the year.

THE GROWTH is complete by the end of the autumn.

THE TYPICAL CONDITION of the gall is unilarval.

THE LARVA PUPATES in the gall. The imago emerges during
March.

These galls appear to be almost entirely confined to Scotland
and the northern counties of England. The ovum is laid
among the buds at the extremity of a young shoot, and as soon
as the larva hatches it feeds upon and within the stem, causing
exudation of sap, which encloses the larva and increases in size
until pupation takes place.

The gall is also figured in "The Royal Natural History,"
sect. xi., p. 120.

The illustration is of specimens supplied by Mr. F. W. Terry,
of South Kensington Natural History Museum.



TWIGS OF *Pinus sylvestris* Linn.

GALLED BY

Retinia resinella Linn.

(NEARLY NAT. SIZE.)

Galls caused by the larvæ of **Aulax hieracii** Schenck
on
the stems of **Hieracium sylvaticum** Sm.

PLATE 38.

SYNONYMY OF INSECT.

Cynips hieracii Bouché.

Aulax sabaudi Htg.

„ *hieracii* Schenck, Mayr, Cameron.

„ *graminis* Cameron, Mayr.

HABITAT OF THE WOOD HAWKWEED.—Grows in open places in woods, on hedge-banks and old walls, also in meadows; very common throughout Britain.

THE GALLS are mostly ovoid or pyriform in shape.

POSITION.—On the roots and the stem usually near the flower-head.

MANNER OF GROWTH.—Seldom more than one gall on a plant.

COLOUR.—Green, sometimes tinged with red, and very pubescent.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 25 mm. ; breadth, 17 mm. ; girth, 40 mm. '

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 20.

THE LARVÆ PUPATE in the gall. The imagines emerge during the spring. If one of these galls be cut open during the winter, the larval chamber will be found to contain both larvæ and pupæ.

PARASITES.—*Torymus hieracii* Mayr, *T. chlorinus* Foer., *T. euchloris* Bohm., *Eurytoma signatus* Nees., *Systole castani-ventris* Gir., and others.

The gall is also figured by Peter Cameron, "British Phytophagous Hymenoptera" (Ray Society), vol. iv., plate 9.

Aulax hieracii.

When situated at the summit of the stem this gall is not conspicuous, being somewhat screened from view by the leaves which cluster around and above it. Some leaves also grow out from its surface. The swellings occur on any part of the stem and on the roots, but the top of the stem is where they are most frequently seen. Generally they are the same colour as the stem, and, like it, thickly clothed with long, silky, greyish hairs; but examples may be found where they are suffused with pink or red and very attractive and pretty. The leaves are not affected in shape or size by the presence of the swelling; they spring from the stem below it and above it, as well as from all parts of its surface. When past maturity the hairs fall off and the surface becomes glabrous, hard, and of a dull brown colour. The growth of the interior, in all its stages, much resembles that of *A. hypochæridis*. The larvæ and pupæ also are not easily observable until approaching maturity; when, however, the gall reaches that condition many larval cells will be found within the tissues. The larvæ pupate within the cells, remaining there during the winter secure from enemies. In the spring the imagines eat their way out, leaving small circular holes as evidences of their departure.

The illustration is of specimens gathered at Hastings by the author.



Hieracium sylvaticum Sm.

GALLED BY

Aulax hieracii Schenck.

(HALF NAT. SIZE.)

Galls caused by the larvæ of **Aulax hypochæridis** Kieffer
on
the flower-stalks of **Hypochæris radicata** Linn.

PLATE 39.

SYNONYMY OF INSECT.

Aulax hypochæridis Kieffer.

„ *hypochæridis* Cameron.

HABITAT OF THE CAT'S-EAR.—This plant may sometimes be found growing profusely on dry spots in disused country roads, also in meadows, around the edges of fields, etc.

THE GALL IS FORMED by the rapid and enormous multiplication of cells in the cellular tissue causing the affected part to distend.

POSITION.—On the main stem, the flower-stalk, and the petioles.

MANNER OF GROWTH.—Elongated, irregular-shaped swellings ; rugose.

COLOUR.—Pale green ; the same as unaffected parts.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 35 mm. ; breadth, 10 mm. ; girth, 30 mm.

MAY BE SOUGHT during the months of July, August, and September.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 12.

THE LARVÆ PUPATE in the gall. The imagines emerge during the spring.

PARASITE.—*Eurytoma cynipsea* Boh.

It is remarkable how little the growth of the inflorescence of this plant is affected, even though a gall be immediately beneath it on the stem.

The gall is also figured by Peter Cameron, "British Phytophagous Hymenoptera" (Ray Society), vol. iv., plate 9.

Aulax hypochæridis.

These galls are among those which do not force themselves upon the notice of the gallist, and probably until one knows that the plant is attacked, they are often passed by. The swelling is exactly the same colour as that of the unswollen portion of the plant, and generally occurs low down the stem near the ground, so that it is somewhat hidden among the other stalks springing from the same root. They vary much in size. Seldom occupying less than 15 mm. of the length of the stem and 12 mm. in girth, they attain 85 mm. in length and 45 mm. at greatest girth. The surface is furrowed longitudinally, the ridges of which are continuations of those on the other portions of the stem. The swelling takes place in the pith, in which is embedded from five to fifty larval chambers. It is very succulent, and quickly shrivels when deprived of moisture. Until approaching maturity the larval chambers are not apparent, and many large galls, which to all appearances are well stocked with larvæ or pupæ, may be cut open, and they will not be discovered until the pith is subjected to magnification.

It appears to be very local in its habitat, but at times considerable numbers are found on spots where the spread of *Hypocharis radicata* has not been interrupted. One such place in a seldom used road through a wood near Hastings has yielded them plentifully for several years in succession, and apparently the plants will remain undisturbed for a long while to come.

The illustration is of specimens gathered at Hastings by the author.



STEMS OF *Hypocharis radicata* Linn.

GALLED BY

Aulax hypocharidis Kieffer.

(NEARLY NAT. SIZE.)

Galls caused by the larvæ of **Diastrophus rubi** Htg.
on
the stems of **Rubus fruticosus** Linn.

PLATE 40.

SYNONYMY OF INSECT.

Andricus Hartigi Marshall.

Diastrophus rubi Marshall, Tasch., Mayr, Cameron.

HABITAT OF THE COMMON BRAMBLE.—Very plentiful in every part of Britain on waste places and disused country roads, and in woods, hedges, coppices, etc., asserting itself in every way.

THE GALL IS FORMED by the enlargement of the larval chambers within the medullary tissues of the bramble.

POSITION.—On any part of stem.

MANNER OF GROWTH.—Irregular, spindle-shaped swellings.

COLOUR.—Dark green while growing; brownish when past maturity.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 60 mm. ; breadth, 12 mm. ; girth, 36 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of November.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 80.

THE LARVÆ PUPATE in the gall. The imagines emerge during the spring.

PARASITES.—*Torymus macropterus*, *T. rubi* Schen., *Eupelmus annulicornis*, *Decatoma quercicola* Foer., *Eurytoma abrotani* Gir.

The gall is also figured by "The Royal Natural History," sect. xi., p. 20; Peter Cameron, "British Phytophagous Hymenoptera" (Ray Society), vol. iv., plate 9.

Diastrophus rubi.

When searching for these galls the hands should be thickly gloved, or painful scratches will be one result. They may often be easily observed on the arch of a long bramble stem rising above its surroundings, but they are more often low down in the bush, or in the middle of a hedge, in a position requiring a patient search and time and perseverance to secure. They are difficult galls from which to rear the imagines and parasites. After the stem is severed from the root, growth ceases, even though placed in water, and the contraction and hardening of the stem prevents the larvæ from pupating or the imagines from emerging. It is advisable to search for the galls during January to April inclusive, or to transplant the stem with its roots to one's garden or a large flower-pot. The swellings of the stem are variable in the length they occupy. Although seldom less than 1 in., they may be found 6 and 7 in. long. The cells being situated on the side of the stem, or completely encircling it, cause growths varying in girth from a few millimetres to 60 mm. The author has a slender stem measuring only 10 mm. in girth which is swollen by the cells to 38 mm. in girth. The colour is greatly subject to the environment of the plant and the situation of the galls upon it. Specimens from the middle of a thick hedge will be much paler than those more exposed to the vagaries of the weather. Some also will be thickly beset with thorns, and others devoid of them.

The illustration is of specimens gathered at Hastings and Aylsham by the author.



STEMS OF *Rubus fruticosus* Linn.

GALLED BY

Diastrophus rubi Htg.

(THREE-FOURTHS NAT. SIZE.)

Galls caused by the larvæ of **Eurytoma hyalipennis**
on
the haulms of **Ammophila arundinacea** Host.

PLATE 41.

SYNONYMY OF INSECT.

HABITAT OF THE SEA MATWEED.—This interesting grass is frequent on the British coasts, more especially in Norfolk, Northumberland, and the coast of Sussex to the eastward.

THE GALL IS FORMED by the irritation caused by the larva, which feeds upon the medullary tissue and prevents further upward growth.

POSITION.—At the top of the haulm; sometimes obscure amongst the other grass.

MANNER OF GROWTH.—Solitary.

COLOUR.—At first the leaves are deep pink, which, as growth proceeds, become lighter, ultimately assuming a straw colour.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 45 mm.; girth, 21 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of October.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA pupates in the gall. The imago emerges during June.

The plant upon which these galls are found is known as the common sea-grass, the sea-reed, the marum, the matweed, and esparto grass. It grows by the seashore beyond high-water mark, and by the abundance of its creeping, fibrous, and entangled roots, assists in producing the elevated ridges known as sand dunes, by retaining the grains of sand which otherwise would be carried by the wind farther inland.

Eurytoma hyalipennis.

The galls caused by this species on the marum grass, are very interesting. The larva lives within the upper part of the haulm, and by its ravages prevents the further extension of that portion of the plant. The leaves, however, continue their growth, but not in the usual manner. The basal portion of one leaf spreads itself around another from the opposite side of the stem; that leaf in turn is enveloped within another. This arrangement is multiplied until fifteen or twenty will thus embrace each other, forming a spindle-shaped bundle of stunted leaves. The leaves, converging just above the gall, continue to grow for a few inches, and assume their ordinary needle-like appearance. If the leaves be carefully removed, the gall proper will be readily found. It consists of a cylindrical-shaped swelling of the haulm, and shows on its surface where the leaves are attached to it. When cut open in the plane of its growth, the larval chamber will be seen. This cavity in some specimens is 40 mm. long and 2 mm. in diameter. The imagines emerge during June from the galls of the previous year and immediately attack the tops of the young and tender haulms. By the end of July the galling agency is plainly visible, and at the end of September the larva is fully grown. It remains in an inactive condition through the winter, pupates within the gall during the spring, and emerges in June. The galls are seldom more than 12 in. above the level of the sand. Among several hundreds the author has collected and examined, none have been seen with two on one haulm.

The illustration is of specimens gathered at Camber, near Rye, by the author.



HAULMS OF *Ammophila arundinacea* Host.

GALLED BY

Eurytoma hyalipennis.

(NAT. SIZE)

Galls caused by the larvæ of **Rhodites spinosissimæ**
Giraud
on
the stems and leaves of **Rosa spinosissima** Linn.

PLATE 42.

SYNONYMY OF INSECT.

Rhodites spinosissimæ, Schen., Tasch., Mayr, Cameron.

HABITAT OF THE BURNET, OR SCOTCH, ROSE.—This rose is common in Scotland, but not in England and Ireland. It is generally found on dry and bushy wastes, and is essentially a maritime plant.

THE GALL IS FORMED by an accumulation of sap around the ova producing large swellings in the medullary tissue.

POSITION.—On the stem, leaves, leaf-stalks, and sometimes flower-buds and petals.

MANNER OF GROWTH.—Conglomerated; glabrous; glossy.

COLOUR.—Green; when mature, dull or bright red.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.—On a stem. Length, 32 mm.; on a leaf, girth, 36 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 8.

THE LARVÆ PUPATE in the gall. The imagines emerge during the autumn.

INQUILINE.—*Periclistus caninæ*.

PARASITES.—*Torymus macropterus*, *T. difficilis* Nees., *Megastigmus transversus* Walker, *Pteromalus inflexus* Foer., *P. incrassatus* Ratz.

The gall is also figured by Cameron, "British Phytophagous Hymenoptera," vol. iv., plate 11.

Rhodites spinosissimæ.

The galls of this species are placed very conspicuously on the plant. At first soft and succulent, they are green in colour, then tinged or suffused with pink, deepening into red, ultimately becoming almost fiery red in appearance, and hard and woody in texture. They are very irregular in outline, and occur on the stem with as much frequency as on the leaves. After the parent insect has deposited her ova, those in stem quickly cause comparatively large swellings in the medullary tissue, the surface being almost as closely beset with prickles as are the unaffected portions of the stem. When the leaves are attacked, the gall-growth may occupy the whole of one side of a leaflet, or both sides, with the serrated edge forming a kind of fringe around the swelling. The leaf-stalk and stipules also are sometimes the bearers of galls, while the flower-buds and the petals are occasionally galled. As compared with the size of the leaves, the galls are very large and cause the premature decay and falling off of those affected.

The plant is known as the burnet, or Scotch, rose. In a wild state it rarely attains more than 10 or 12 in. in height, and is generally found in dry and bushy land near the sea. Even under cultivation it seldom attains more than 2 ft. At Tenby, in South Wales, it is known as the burrow-rose, and is "of very stunted growth, just creeping along the ground, with small flowers which look very pretty among the grass."

The illustration is of specimens gathered at Tenby by Mr. Walter Field.



STEMS OF *Rosa spinosissima* Linn.

GALLED BY

Rhodites spinosissima Giraud.

(HALF NAT. SIZE.)

Galls caused by the larvæ of **Xestophanes breviarisis**
Cam.
on
the stems of **Potentilla tormentilla** Sibth.

PLATE 43.

SYNONYMY OF INSECT.

Aulax breviarisis Opusc.

Xestophanes tormentille Schl., Cameron.

HABITAT OF THE TORMENTIL.—This plant is common in most parts of Britain, in open places in woods and by the sides of footpaths through them; it is also found on moors and heaths.

THE GALL IS FORMED by a gradual and persistent accumulation of sap around the ova deposited beneath the cuticle of the plant.

POSITION.—On the stems.

MANNER OF GROWTH.—Gregarious; conglomerated; sessile; slightly pubescent.

COLOUR.—At first, green, later pink, changing to purple, and, when mature, nut-brown.

AVERAGE DIMENSIONS OF A CLUSTER OF MATURE SPECIMENS.

Length, 13 mm. ; breadth, 7 mm. ; girth, 18 mm.

MAY BE SOUGHT during the months of June to November.

THE GROWTH is complete by the end of October.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 10.

THE LARVÆ PUPATE in the cells. The imagines emerge during the spring.

These galls are very local in their situations, and are very persistent on the same plants year after year. They may be found in plenty in one spot, but a cluster of the same plants fifty yards away will not be affected.

The gall is also figured by Peter Cameron, "British Phytophagous Hymenoptera" (Ray Society), vol. iv., plate 11.

Xestophanes brevitarsis.

The graceful plant which is so freely attacked by this insect is a general favourite with all persons interested in botany. It, however, possesses additional interest to the gallist, because of the swellings caused upon its delicate and slender stems by *X. brevitarsis*. The enormous size of some of the galls as compared with the girth of the slender stem is remarkable. One example may be mentioned. In a wood near Hastings the author found, among other stems, one which measured 3 mm. only in girth. The swelling upon it was 22 mm. in girth; it contained 41 cells, and occupied a space 18 mm. in length.

The galls occur mostly as conglomerated masses of cells, but examples of a single cell are not uncommon. Two such will be seen in the lower right-hand corner of the illustration near the flower. Galls of one cell only are usually spherical in shape, but when numbers are massed together they assume a reniform shape, and the uneven outline then produced distinguishes them from the smooth growths caused by *X. potentillæ* on *R. reptans*.

X. brevitarsis is an interesting species to study; but as the galls will not develop so well after being severed from the root, even though the stems are placed in water, they should be obtained when growth is mature, or the entire plant removed to a convenient place for observation.

The illustration is of specimens gathered at Hastings by the author.



STEMS OF *Potentilla tormentilla* Sibth.

CALLED BY

Xestophanes breviarisis Cam.

(TWO-THIRDS NAT. SIZE.)

Galls caused by the larvæ of **Xestophanes potentillæ**
Cam.
on
the stems of **Potentilla reptans** Linn.

PLATE 44.

SYNONYMY OF INSECT.

Cynips potentillæ De Vill.

Aulax splendens Htg.

„ *potentillæ* Schenck, Marshall, Mayr.

„ *abbreviatus* Thoms.

HABITAT OF THE CINQUEFOIL.—Along hedgerow banks, edges of woods, borders of meadows, by the side of most country lanes; abundant in Britain, except parts of Scotland.

THE GALL IS FORMED by a gradual and persistent accumulation of sap around the ova deposited beneath the cuticle of the stem.

POSITION.—On the stems, and occasionally on the leaf-stalks.

MANNER OF GROWTH.—Conglomerated; sessile; glabrous.

COLOUR.—At first green, later pink, changing to purple; when mature, nut-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 8 mm.; girth, 12 mm.

MAY BE SOUGHT during the months of July to November.

THE GROWTH is complete by the end of October.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 6.

THE LARVÆ PUPATE in the gall. The imagines emerge during the spring.

PARASITES.—*Torymus globiceps* Nees., *T. ater* Nees., *Oligosthenus tibialis* Nees., *Eucyrtus sephyrinus* Dalman, *Pezomachus potentillæ* Gir.

Like *X. brevitarsis*, this species attacks the same plants year after year, leaving other clusters of *Potentilla reptans* untouched.

The gall is also figured by Peter Cameron, "British Phytophagous Hymenoptera" (Ray Society), vol. iv., plate 11.

Xestophanes potentillæ.

The plant *Potentilla reptans* may be easily distinguished from its congener, *P. tormentilla*, by the facts that its leaves are pedunculated instead of sessile, much larger in size, and ordinarily composed of five leaflets coarsely serrated in outline; the petals, although the same colour as those of *P. tormentilla*, are larger and ordinarily five in number, but the stems are not so erect. When *Xestophanes potentillæ* lays its eggs during the month of June, the punctures give rise to peculiar, oval-shaped, and irregular-sized swellings, sometimes projecting more on one side of the stem than another, but generally the swelling is evenly distributed, with a tendency to assume a spindle shape. The gall-growths occur along the stems singly, or in twos and threes at irregular intervals from the root to the last leaf, and also on the petioles. During the first few weeks of growth the swellings are soft and succulent, greenish or pinkish in colour; later, however, the texture becomes more woody, and ultimately hard. The colour changes to a nut-brown, and growth is complete. The dimensions of the galls are very variable. A single cell will seldom be found exceeding 16 mm. in girth, whereas swellings containing six or seven cells will attain 30 mm. in girth and 15 mm. through its long axis. Anastomosis is neither so frequent nor so pronounced as in *X. tormentillæ*, but examples are occasionally found where many grow upon the stems, and resemble small peas threaded on stout string.

The illustration is of specimens gathered at Battle by the author.



STEMS OF *Potentilla reptans* Linn.

GALLED BY

Xestophanes potentille Cam.

(FOUR-FIFTHS NAT. SIZE.)

THE LEAF-GALLS.

The Leaf-galls are those situated upon, within, or enclosed by the Blade, the Petiole, the Stipules, the Bract, or the Scales, or any of these parts enfolding Larvæ.

ERIOPHYES AJUGÆ Nalepa.

PLATE 45.

Galls caused by **Eriophyes ajugæ** Nalepa
on
the radical leaves of **Ajuga reptans** Linn.

PLATE 45.

These leaves grew from the same scions as the galled flower-spikes illustrated on plate 118. The mites establish themselves on the upper surface of the radical leaves and cause the edges to curl upwards and slightly inwards, forming a somewhat irregular-shaped pod, within which may be one or two smaller leaves. At first no change of colour takes place on the exterior of the leaf; but ultimately it becomes suffused with purple and is somewhat swollen. Meanwhile, the interior, or upper surface, is, as a result of the action of the mites, becoming coated with a thick layer of short hairs, which at first are a yellowish colour, afterwards becoming paler and almost white. The exterior remains glabrous and glossy. A few of the scions should be placed in water in a shallow dish for the purpose of observations. The plant will live a long while. See also p. 270.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Ajuga reptans* Linn.

GALLED BY

Eriophyes ajuge Nalepa.

(NEARLY NAT. SIZE.)

ERIOPHYES AUCUPARIÆ.

PLATE 46.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes aucupariæ
on
the leaves of **Pyrus aucuparia** Gærtn.

PLATE 46.

SYNONYMY OF MITE.

Eriophyes pyri Nal.

HABITAT OF THE MOUNTAIN ASH.—Distributed throughout Britain in woods, plantations, and parks.

POSITION OF THE GALLS.—On both sides of the leaflets and on the rachis.

MANNER OF GROWTH.—Glabrous; gregarious, coalescing into patches.

COLOUR.—Pale green, yellow, orange-yellow, red, reddish brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 1 mm.; breadth, 2 mm.; circumference, 6 mm.

MAY BE SOUGHT during the months of May to October.

THE GROWTH is complete by the end of August.

These galls are very similar to those caused by *Eriophyes piri* (p. 150) on leaves of *Pyrus communis*, not only in size, form, and colour, but also as regards coalescence, although this latter peculiarity is not quite so persistent. The swelling is in the form of a lenticular pustule, more fully developed when on the under surface of the leaflet than when on the upper. Although each leaflet may be thickly covered with the pustules, no appreciable difference is caused in the outline. The author has only twice found these galls, and he believes them to be both local and uncommon. See also plate 76.

The illustration is of specimens gathered at Guestling, near Hastings, by the author.



LEAVES OF *Pyrus aucuparia* Gærtn.

GALLED BY

Eriophyes aucupario,

(TWO-THIRDS NAT. SIZE.)

ERIOPHYES AVELLANÆ Nalepa.

PLATE 47.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes avellanæ Nalepa
on
the leaf-buds of **Corylus Avellana** Linn.

PLATE 47.

SYNONYMY OF MITE.

Acarus pseudogallarum Vall.

Phytoptus pseudogallarum Canest, Tar-Tozz.

„ *coryli* Murr., Francuf.

„ *avellanæ* Nalepa.

HABITAT OF THE COMMON HAZEL.—Ubiquitous in Britain in woods, thickets, and hedges.

POSITION OF THE GALLS.—The leaf-buds themselves constitute the galls.

MANNER OF GROWTH.—Singly; slightly pubescent; semi-globular, and cone-shaped.

COLOUR.—Green, suffused with reddish brown and chocolate-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (cone-shape, gathered in February).

Height, 10 mm.; girth, 21 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of May.

In reality these galls may be found all the year round, but they are hardly worth gathering during July and August. The mites transfer themselves from the old to the new buds during that time. They completely destroy the growth of the leaves and catkins which otherwise would unfold from the buds. Some bushes in sheltered places are badly attacked, 75 per cent. of the buds being occupied with the creatures. A bud may consist of twenty-five to forty leaf-scales, the inner ones being somewhat thickened and woolly in appearance.

The illustration is of specimens gathered at Hastings by the author.



LEAF-BUDS OF *Corylus Avellana* Linn.

GALLED BY

Eriophyes Avellanae Nalepa.

(FOUR-FIFTHS NAT. SIZE.)

ERIOPHYES AXILLARIS.

PLATE 48.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes axillaris
on
the leaves of **Alnus glutinosa** Linn.

PLATE 48.

SYNONYMY OF MITE.

Erineum axillare Schl.

Phytoptus alnicola Canes.

„ *alni* Fock.

Eriophyes Nalepi Fock.

„ *lævis* Nal.

HABITAT OF THE ALDER.—Abundant in Britain by the sides of streams, in woods where the ground is wet and swampy, and occasionally in more accessible places.

POSITION OF THE GALLS.—In the axils of the primary offshoots from the mid-rib.

MANNER OF GROWTH.—Always in pairs; glabrous; glossy; globular; ovid; and reniform.

COLOUR.—Yellowish green, red, dark brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (reniform or ovid).

Height, 3 mm.; length, 5 mm.; breadth, 3 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

These galls are remarkable in that they never occur on any other part of the leaf than in the axils of the primary offshoots from the mid-rib, and the bulging is always on the upper surface. The surface of the gall is smooth, but under magnification it is seen to be divided into sections of irregular size owing to cerebriform markings. The gall is hollow, containing a considerable number of hairs of a reddish colour, many of which project for some distance through the opening in the under surface of the leaf.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Alnus glutinosa* Linn.

GALLED BY

Eriophyes axillaris.

(FOUR-FIFTHS NAT. SIZE.)

ERIOPHYES BREVIARSUS Nal.

PLATE 49.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes brevitarsus Nal.

on

the leaves of **Alnus glutinosa** Linn.

PLATE 49.

SYNONYMY OF MITE.

Erineum alneum Pers.

Phytoptus brevitarsus Nal.

„ *purpureum* De C.

Phyllerium alnigenum Kunze.

HABITAT OF THE ALDER.—Abundant in Britain by the sides of streams, in woods where the ground is wet and swampy, and occasionally in more accessible places.

POSITION OF THE GALLS.—On the blade of the leaf; irregularly distributed.

MANNER OF GROWTH.—Gregarious; glabrous on upper surface, slightly pubescent beneath.

COLOUR.—Pale green, very pale yellow, ultimately turning brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 6 mm.; length, 18 mm.; breadth, 12 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

These galls cause considerable disfigurement of the leaf, and are found mostly on the young and expanding leaves near the end of the twig. They are convexo-concave, blister-like swellings. The upper surface is smooth and glossy; the interior is slightly pubescent, the mites living therein. The blisters are somewhat irregular in shape, but are mostly ovoid. They are not restricted to the areas enclosed between the primary and secondary offshoots from the mid-rib, but they also involve the mid-rib itself.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Alnus glutinosa* Linn.

GALLED BY

Eriophyes brevitorsus Nal.

(THREE-FOURTHS NAT. SIZE.)

ERIOPHYES CRATÆGI.

PLATE 50.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes cratægi.

on

the leaves of **Cratægus Oxyacantha** Linn.

PLATE 50.

SYNONYMY OF MITE.

HABITAT OF THE HAWTHORN.—In woods and thickets throughout Britain; also forming artificial hedges by the sides of railways, roads, and lanes.

POSITION OF THE GALLS.—On both surfaces of the leaf.

MANNER OF GROWTH.—Gregarious; glabrous; coalescent.

COLOUR.—Green, orange-yellow, dark brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, $\frac{1}{2}$ mm.; breadth, 2 mm.

MAY BE SOUGHT during the months of May to November.

THE GROWTH is complete by the end of September.

These galls are mostly lenticular in shape, and are fairly evenly distributed on the upper surface, as well as on the under surface of the leaf. They are situated on any part except the mid-rib and its primary offshoots, and are usually not very numerous. An average-sized leaf may have about a hundred galls upon it. The number depends very much upon whether the mites have been long established on the plant, which when in a hedge harbours them more effectually than when they affect the leaves of a hawthorn grown to a tree. In the illustration many of the leaves show the under surface.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Crataegus Oxyacantha* Linn.

GALLED BY

Eriophyes cratagi Canest.

(NAT. SIZE.)

ERIOPHYES GALII Karp.

PLATE 51.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes galii Karp.
on
the leaves of **Galium Aparine** Linn.

PLATE 51.

SYNONYMY OF MITE.

Phytoptus galii Karp.
Cecidophyes galii Nalepa.
Eriophyes galii Nalepa.

HABITAT OF THE GOOSE-GRASS.—This common herb is very abundant in hedges, among brambles, and on banks all over Britain.

POSITION OF THE GALL.—The entire leaf is affected, and forms the gall.

MANNER OF GROWTH.—Gregarious.

COLOUR.—Very pale green, ultimately yellowish green.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 30 mm. ; girth, 5 mm.

MAY BE SOUGHT during the months of May to October.

THE GROWTH is complete by the end of August.

The peculiar contortions assumed by the leaves of this plant when attacked by the *Eriophyes* enable them to be easily recognised. Although the plant is ubiquitous throughout Britain, the galled condition is not often seen ; it appears to be uncommon and local. If gathered in the early part of May, the imagines may be seen (under magnification) in a lethargic condition, as also large masses of ova. Later in the month, and throughout June, the nymphs are very active and numerous. The specimen in the centre of the illustration is of a normally developed stem and leaves, and is introduced for the purpose of comparison with the others.

The illustration is of specimens gathered at Guestling by Mr. F. Hall.



LEAVES OF *Galium Aparine* Linn.

GALLED BY

Eriophyes galli Karp.

(NEARLY NAT. SIZE.)

ERIOPHYES GALIOBIUS Can.

PLATE 52.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes galiobius Canest.
on
the terminal leaves of **Galium verum** Linn.

PLATE 52.

SYNONYMY OF MITE.

Phytoptus galiobius Can.

„ *informis* Nalepa.

HABITAT OF THE LADIES' BEDSTRAW.—Very generally distributed throughout Britain, growing on banks and pastures, preferably in a fairly dry situation.

POSITION OF THE GALL.—At the top of the main stem ; sometimes on the lateral shoots.

MANNER OF GROWTH.—Singly ; glabrous ; mostly pyramidal in shape.

COLOUR.—Pale green, yellowish, chocolate-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 8 mm. ; girth, 15 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

These galls are found plentifully on plants growing on the golf-links at Camber, near Rye, Sussex. The ground is near to the sea, and is very sandy owing to its close proximity to the sand dunes which skirt the sea-shore at that part of the coast.

The galls are deeply grooved or furrowed from base to apex. Some are almost globular in shape, others are elongated, while a few are like a miniature cupola.

The author is indebted to Miss Ethel Sayer for her kindness in sending some very fine specimens from Mundesley, Norfolk.

The illustration is of specimens gathered at Camber, Sussex, by the author.



TERMINAL LEAVES OF *Galium verum* Linn.

CALLED BY

Eriophyes galiobius Canest.

(NEARLY NAT. SIZE.)

ERIOPHYES GONIOTHORAX Nal.

PLATE 53.

Galls caused by the larvæ, nymphs, and imagines
of **Eriophyes goniothorax** Nal.

on

the leaves of **Cratægus Oxyacantha** Linn.

PLATE 53.

SYNONYMY OF MITE.

Erineum clandestinum Gerv.

„ *oxyacanthæ* Vall., Amer., Murr.

Phytoptus goniothorax Nal.

HABITAT OF THE HAWTHORN.—In woods and thickets throughout Britain; also forming artificial hedges by the sides of railways, roads, and lanes.

POSITION OF THE GALLS.—On the edges of the lobes of the leaves.

MANNER OF GROWTH.—The edge of the lobe curls downwards and under.

COLOUR.—Variable, but usually paler than the other part of the leaf.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 10 mm. ; breadth, 1 mm.

MAY BE SOUGHT during the months of May to November.

THE GROWTH is complete by the end of September.

The galled edges are more easily seen when the leaf is looked at from below than from above. Two opposite edges which are attacked will roll towards each other until they meet and transform the lobe into a small spike. It is not often that more than ten lobes of a leaf are attacked ; the usual number is six.

The gall is also figured by Nalepa, "Beiträge zur Systematik der Phytopten," Taf. ix.

The illustration is of specimens gathered at Eastbourne by the author.



LEAVLS OF *Crataegus Oxyacantha* Linn.

CALLED BY

Eriophyes goniothora, v Nal.

(FOUR-FIFTHS NAT. SIZE.)

ERIOPHYES LÆVIS Nal.

PLATE 54.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes lævis Nal.

on

the leaves of **Alnus glutinosa** Linn.

PLATE 54.

SYNONYMY OF MITE.

Phytoptus lævis Nalepa.

Cephaloneon pustulatum Bremi.

HABITAT OF THE ALDER.—Abundant in Britain by the sides of streams, in woods where the ground is wet and swampy, and occasionally in more accessible places.

POSITION OF THE GALLS.—On the upper surface of the leaves.

MANNER OF GROWTH.—Gregarious; glabrous; glossy; more or less globular and pedunculated.

COLOUR.—Green, yellow, orange-yellow, bright red, purple, chocolate-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 2 mm.; girth, 4 mm.

MAY BE SOUGHT during the months of May to October.

THE GROWTH is complete by the end of August.

A little below the centre of the illustration are three galled leaves, the finest specimens possible to obtain. So numerous are the galls upon each leaf that, owing to the swelling of their globular portion, the blade of the leaf has been caused to bend under until a pouch has been formed. Several other leaves are so curved that the galls are seen silhouetted against the background, furnishing an excellent description of the shapes they assume. These galls are extremely plentiful in many places; some trees are loaded with them year after year. A leaf of average size may have as many as 400 galls upon it.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Alnus glutinosa* Linn.

CALLED BY

Eriophyes levis Nal.

(THREE-FOURTHS NAT. SIZE.)

ERIOPHYES LIONOTUS Nal.

PLATE 55.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes lionotus Nal.
on
the leaves of **Betula alba** Linn.

PLATE 55.

SYNONYMY OF MITE.

Phytoptus leionotus (corr. *lionotus*) Nal.

Cephaloneon betulinum Brems.

Phyllerium (Erineum) tortuosum Gerv.

HABITAT OF THE COMMON BIRCH.—Plentiful all over Britain
in parks, plantations, woods, and gardens.

POSITION OF THE GALLS.—In the nerve-axils of the leaf.

MANNER OF GROWTH.—One in each axil ; generally six on
a leaf.

COLOUR.—Reddish brown on upper surface, reddish pubescence
on under surface.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, $1\frac{1}{2}$ mm. ; length, 4 mm. ; breadth, 2 mm.

MAY BE SOUGHT during the months of May to October.

THE GROWTH is complete by the end of August.

These galls are at first somewhat inconspicuous, but during August they become very pronounced in outline, rising above the level of the surrounding surface of the leaf-blade to a height of 2 or 3 mm. They are mostly obtusely elliptical in outline, and sometimes extend from one nerve-axil to the next beyond it, the outline being then very irregular. The convexo-concave swelling is filled with pubescence, which projects considerably, and amongst it the mites may easily be seen under magnification.

The illustration is of specimens gathered at Guestling, near Hastings, by the author.



LEAVES OF *Betula alba* Linn.

GALLED BY

Eriophyes lionotus Nal.

(NEARLY NAT. SIZE.)

ERIOPHYES MACROCHELUS Nal.

PLATE 56.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes macrochelus Nal.

on
the leaves of **Acer campestre** Linn.

PLATE 56.

SYNONYMY OF MITE.

Erineum purpurascens Gærtn.

Phytoptus moniezi Fock.

” *macrochelus* Nal.

Cephaloneon solitarium Bremi.

HABITAT OF THE COMMON MAPLE.—Abundant in southern England, but less plentiful in the north and in Scotland. It is found in woods and hedges, the latter situation being the favourite.

POSITION OF THE GALLS.—On the upper surface of the leaf.

MANNER OF GROWTH.—Usually gregarious; globular, ovoid, and reniform in shape.

COLOUR.—Green, orange-yellow, red, brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (reniform shape).

Height, 4 mm.; length, 6 mm.; breadth, 3 mm.

MAY BE SOUGHT during the months of June to November.

THE GROWTH is complete by the end of August.

These galls are exceedingly variable in many ways. They may be solitary or coalesced, gregarious or single, sessile or semipedunculated, glabrous or pubescent, glossy or dull, and triplicate in shape. They are larger and not so numerous as those caused by *E. macrorhyncus*, and they are more confined to the primary offshoots from the petiole. Occasionally they develop on the under surface of the leaf. The cell-walls are very thick and woody. A leaf of average size may have from fifty to two hundred galls upon it without causing any distortion. Some leaves are entirely covered with them: the deformity is then very great.

The gall is also figured by Nalepa, “Neue Gallmilben,” Taf. xv.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Acer campestre* Linn.

CALLED BY

Eriophyes macrochelus Nal.

(THREE-FOURTHS NAT. SIZE.)

ERIOPHYES MACRORHYNCUS Nal.

PLATE 57.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes macrorhyncus Nal.

on

the leaves of **Acer campestre** Linn.

PLATE 57.

SYNONYMY OF MITE.

Cephaloneon myriadeum Bremi.

Phytoptus macrorhyncus Nal.

" *myriadeum* Murr.

Phyllocoptes aceris Nal.

HABITAT OF THE COMMON MAPLE.—Abundant in southern England, but less plentiful in the north and in Scotland. It is found in woods and hedges, the latter situation being the favourite.

POSITION OF THE GALLS.—On the upper surface of the leaf.

MANNER OF GROWTH.—Gregarious; glabrous; semi-globular pimples.

COLOUR.—Greenish yellow, red, purple, reddish brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 1 mm.; girth, 3 mm.

MAY BE SOUGHT during the months of June to November.

THE GROWTH is complete by the end of August.

It is remarkable how many of these galls are sometimes crowded on the leaves. From 400 to 500 is quite a usual number. In 1899 the author discovered a small maple-bush in a hedge in Norfolk, and upon many leaves of average size he counted from 600 to 850 galls; one rather large leaf contained nearly 1,400. Their number does not very greatly affect the contour of the leaf. When they are purple in colour a very pretty and attractive object is produced. Examination of the under surface with a lens will show numbers of minute depressions, which are the openings of the galls.

The gall is also figured by Nalepa, "Neue Gallmilben," Taf. xv.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Acer campestre* Linn.

GALLED BY

Eriophyes macrorhyncus Nal.

(THREE-FOURTHS NAT. SIZE.)

ERIOPHYES MARGINATUS.

PLATE 58.

Galls caused by the larvæ, nymphs, and imagines of
Eriophes marginatus
on
the leaves of **Salix alba** Linn.

PLATE 58.

HABITAT OF THE WHITE WILLOW.—By the side of streams, in marshes, and in hedges around damp meadows. Common all over Britain.

POSITION OF THE GALLS.—On the margins of the leaf.

MANNER OF GROWTH.—Singly ; glabrous ; sessile.

COLOUR.—Pale green, greenish yellow, orange-yellow, red, brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 1 mm. ; length, 3 mm. ; breadth, 1 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

These galls often have the appearance of being attached to the margin of the leaf by a short peduncle ; they are, however, sessile. They rarely coalesce, but the ends of several when close together meet, and cause the margin of the leaf at that part to curl considerably. They vary in number from two or three to fifteen on one leaf, and are always situated on the margins. The oldest and largest leaves seem to be less liable to attack than those younger and near the end of the twig. They appear to be very local, and are not plentiful where they occur.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Salix alba* Linn.

GALLED BY

Eriophyes marginatus.

(FOUR FIFTHS NAT. SIZE.)

ERIOPHYES PIRI Nal.

PLATE 59.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes piri Nal.

on

the leaves of **Pyrus communis** Linn.

PLATE 59.

SYNONYMY OF MITE.

Phytoptus pyri Murr.

" *piri* Nal.

" *arianus* + *Phytoptus cotoneastri* + *Phytoptus sorbi*
Pgst.

" *aroniæ* Canest.

Typhlodromus pyri Scheut.

HABITAT OF THE PEAR-TREE.—Cultivated in orchards and gardens throughout Britain.

POSITION OF THE GALL.—On both surfaces of the leaf.

MANNER OF GROWTH.—Gregarious; glabrous; coalescent.

COLOUR.—Pale green, reddish, chocolate-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 1 mm.; length, 3 mm.; breadth, 2 mm.

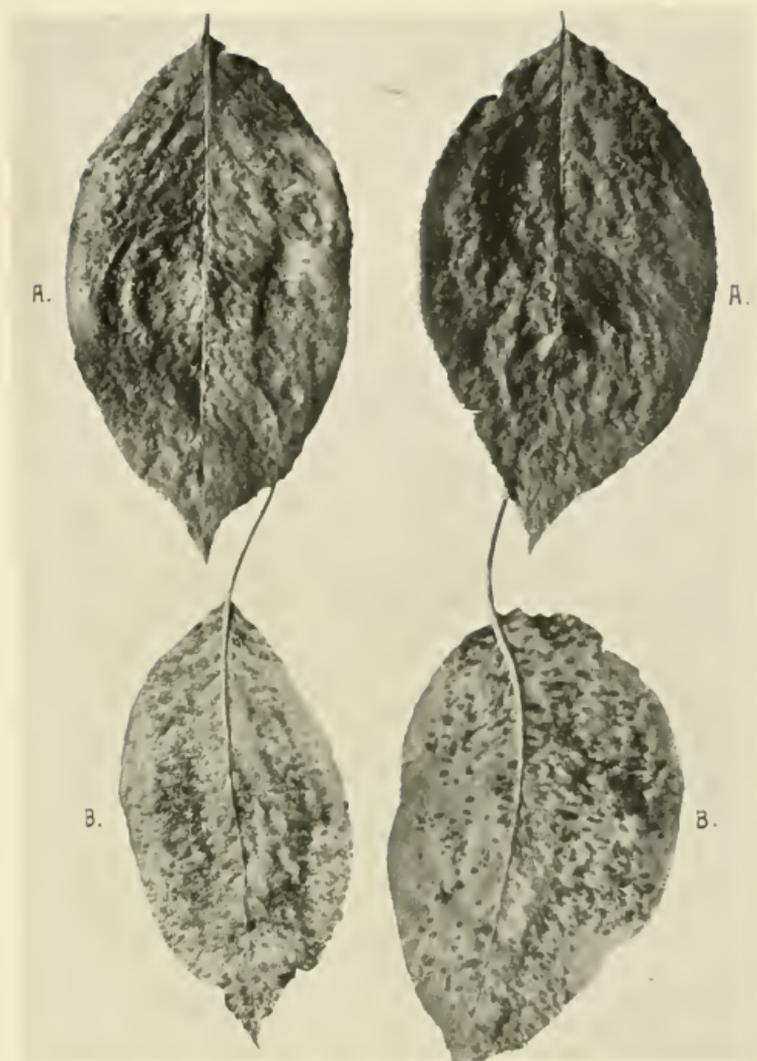
MAY BE SOUGHT during the months of May to October.

THE GROWTH is complete by the end of July.

Not infrequently a leaf will be completely covered with the small eruptive pustules caused by these mites. The outline of the leaf is seldom distorted, but the surface is sometimes much wrinkled and blistered by the large number of the galls. The galls are hollow, and the mites gain access through a minute hole, which, with the aid of a lens, may be seen in the under surface of the leaf. This disease of the pear leaves appears to be very common throughout the country, and sometimes considerable damage is caused to the foliage.

The gall is also figured by Miss Ormerod, "Orchard and Bush-fruit Insects," p. 127; Murray, "Economic Entomology," p. 359.

The illustration is of specimens gathered at Guestling, near Hastings, by the Rev. E. N. Bloomfield, M.A., F.E.S.



A. A. UPPER SURFACE, B. B. UNDER SURFACE,

OF

LEAVES OF *Pyrus communis* Linn.

GALLED BY

Eriophyes piri Nal.

(FOUR-FIFTHS NAT. SIZE.)

ERIOPHYES PSILASPIS Nal.

PLATE 60.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes psilaspis Nal.

on

the buds of **Taxus buccata** Linn.

PLATE 60.

SYNONYMY OF MITE.

Phytoptus psilaspis Nalepa.

" *taxi* Murray.

Tetranychus taxi Murray.

HABITAT OF THE COMMON YEW.—This tree may be found in the graveyards of many rural churches throughout Britain; also in parks and private grounds, where it is frequently cultivated as hedges.

POSITION OF THE GALLS.—The leaf-buds themselves constitute the galls.

MANNER OF GROWTH.—Singly and gregarious; glabrous; semi-globular, and pineal in shape.

COLOUR.—Dark green, changing to reddish brown or chocolate-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (pineal form).

Height, 10 mm.; greatest girth, 24 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of May.

The two small twigs have been introduced in the illustration to show the difference between the immature fruit and the growing galls. These galls are very numerous on some yews, more especially when employed as hedges. The mites are very persistent in the buds, and attack them as soon as they develop from the twig, prevent their normal growth, retard the development of the new wood, and produce dwarfed and stunted bushes.

The remark anent collecting the buds of *Corylus Avellana* (p. 126) applies also to these buds.

The gall is also figured by F. V. Theobald, "S.E. Ag. Coll. Journal," March, 1899.

The illustration is of specimens gathered at Hastings by the author.



BUDS OF *Taxus buccata* Linn.

GALLED BY

Eriophyes psilaspis Nal.

(NEARLY NAT. SIZE.)

ERIOPHYES PUSTULATUM.

PLATE 61.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes pustulatum

on

the leaves of **Populus tremula** Linn.

PLATE 61.

SYNONYMY OF MITE.

HABITAT OF THE ASPEN.—This tree grows well in coppices, woods, and forests. It may also frequently be seen in profusion on the outskirts of a wood by the side of a stream.

POSITION OF THE GALL.—Projecting from the upper and under surfaces of the leaf.

MANNER OF GROWTH.—Separate; sessile; glabrous; glossy.

COLOUR.—Greenish yellow, orange-yellow, red, purple.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 2 mm.; girth, 5 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

These galls appear to be very local, and nowhere abundant. About equal proportions of the gall project from each surface of the leaf. There are seldom more than four or five galls on an average-sized leaf. Two leaves on the right-hand side of the illustration show the under surface and the little hole in each gall through which the *Eriophyes* leave and enter the swelling. Unfortunately our illustration does not do fullest justice to these very pretty and interesting little galls.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Populus tremula* Linn.

CALLLED BY

Eriophyes pustulatum.

(TWO-THIRDS NAT. SIZE.)

ERIOPHYES RIBIS Nal.

PLATE 62.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes ribis Nal.
on
the leaf-buds of **Ribes nigrum** Linn.

PLATE 62.

SYNONYMY OF MITE.

Phytoptus ribis West, Nalepa, Murr., Ormerod (Miss).

HABITAT OF THE BLACK CURRANT.—Cultivated in gardens and orchards throughout the whole of Britain. Bentham in "British Flora," p. 164, says: "If anywhere wild, it is in the Lake District and Yorkshire."

POSITION OF THE GALLS.—On the shoots.

MANNER OF GROWTH.—Singly at each node and in clusters at the end of the twig.

COLOUR.—Ashy grey.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (gathered in April).

Height, 12 mm.; girth, 30 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of May.

These galls are, unfortunately for the fruit-grower, only too well known to need any detailed description. Much has been written and published concerning them since they were first brought to public notice in this country in 1869, and the gallist desirous of aiding or confirming his examinations of them cannot do better than consult the under-mentioned works.

The remark anent collecting the buds of *Corylus Avellana* (p. 126) applies also to these buds.

The gall is also figured by Miss Ormerod, "Injurious Insects," p. 303, and "Orchard and Bush-fruit Insects," p. 60; Murray, "Economic Entomology," p. 355; Mosley, "Naturalists' Journal," May, 1895.

The illustration is of specimens gathered at Hastings by the author.



LEAF-BUDS OF *Ribes nigrum* Linn.

GALLED BY

Eriophyes ribis Nal.

(THREE-FOURTHS NAT. SIZE.)

ERIOPHYES RUDIS Canest.

PLATE 63.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes rudis Canest.
on
the leaf-buds of **Betula alba** Linn.

PLATE 63.

SYNONYMY OF MITE.

Phytoptus rudis Canestrini.

„ *calycophthirus* Nalepa.

HABITAT OF THE COMMON BIRCH.—Plentiful all over Britain
in parks, plantations, woods, and gardens.

POSITION OF THE GALL.—On the twigs and branches.

MANNER OF GROWTH.—Singly and in clusters; pubescent
and glossy.

COLOUR.—Outer leaflets dull brown, inner ones silvery grey.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (a single
bud).

Height, 10 mm.; girth, 27 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of August.

The galls are very numerous, and occur in clusters of considerable numbers. They develop into three principal forms: (*a*) at the termination of a twig with a hard, solid, and woody core, from which numerous twigs project, as shown in plate 16; (*b*) from any part of a twig or branch, and without any core, as shown in plate 17; (*c*) from the side of a branch with a hard, solid, and woody core, which also forms a part of the branch, as shown in plates 18, 19, and 20.

The gall is also figured by Miss Ormerod, "Injurious Insects," pp. 212, 214.

The illustration is of specimens taken from the tree at Guestling by the author.



LEAF-BUDS OF *Betula alba* Linn.

GALLED BY

Eriophyes rudis Canest.

(FOUR-FIFTHS NAT. SIZE.)

ERIOPHYES SANGUISORBÆ Nal.

PLATE 64.

Galls caused by the larvæ, nymphs, and imagines
of **Eriophyes sanguisorbæ** Nal.

on

the leaflets of **Poterium sanguisorba** Linn.

PLATE 64.

SYNONYMY OF MITE.

Phytoptus sanguisorbæ Canest.

Erineum boterii De C.

HABITAT OF SALAD BURNET.—In dry pastures; found mostly
in the limestone and chalk districts of England, but scarce
in Scotland and Ireland.

POSITION OF THE GALLS.—On the leaflets.

MANNER OF GROWTH.—Each affected leaflet becomes coated
with pubescence.

COLOUR.—Pale straw colour.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (a single
leaflet).

Length, 8 mm.; breadth, 4 mm.; girth, 10 mm.

MAY BE SOUGHT during the months of June, July, and August

THE GROWTH is complete by the end of July.

These pretty little galls are described by Nalepa ("Katalog
der bisher beschriebenen Gallmilben," p. 298) as "Abnormer
Haarfilz an der Blättern und Stengeln" ("abnormal felt of hair
on the leaves and stalks"). They are exceedingly pubescent,
and in specimens in which the three apical leaflets are swollen
and thickly covered with hairs the appearance is that of a
tuft of wool.

The illustration is of specimens gathered near Goodwood
by Mr. R. R. Hutchinson.



LEAVES OF *Poterium sanguisorba* Linn.

GALLED BY

Eriophyes sanguisorbe Nal.

(NEARLY NAT. SIZE.)

ERIOPHYES SIMILIS Nal.

PLATE 65.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes similis Nal.

on

the leaves of **Prunus spinosa** Linn.

PLATE 65.

SYNONYMY OF MITE.

Cephaloneon hypocateriforme Brems.

Phytoptus attenuatus Murr.

„ *similis* Nalepa.

HABITAT OF THE SLOE-TREE.—Abundant in Britain, in a wild state, in hedges, thickets, and open woods; cultivated in almost every orchard.

POSITION OF THE GALL.—Principally on the upper surface of the leaves.

MANNER OF GROWTH.—Gregarious; pubescent.

COLOUR.—Greenish yellow, yellow, orange, purple.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 2 mm.; girth, 6 mm.

MAY BE SOUGHT during the months of May to October.

THE GROWTH is complete by the end of August.

These galls occur also on the leaves of the plum, greengage, damson, and bullace, and are all so much alike that illustrations of each are not necessary. On some leaves they are so numerous as to cause considerable distortion. The largest number the author has seen on one leaf is fifty-four. They were distributed all over the leaf and also along the margins. The leaf measured 65 mm. long and 35 mm. broad. The aperture of the gall is in the under surface of the leaf; it is irregular in outline, and is fringed with very fine hairs.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Prunus spinosa* Linn.

GALLED BY

Eriophyes similis Nal.

(TWO-THIRDS NAT. SIZE.)

ERIOPHYES TETANOTHRIX LÆVIS Nal.

PLATE 66.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes tetanothrix lævis Nal.

on

the leaves of **Salix Caprea** Linn.

PLATE 66.

SYNONYMY OF MITE.

Cecidophyes tetanothrix Nal.

Phytoptus tetanothrix Nal.

HABITAT OF THE SALLOW- OR GOAT-WILLOW.—Very common throughout Britain by the sides of streams, marshy places, damp open woods, and in thickets and hedges.

POSITION OF THE GALL.—On the upper surface of the leaf.

MANNER OF GROWTH.—Gregarious ; pubescent ; separate and also coalescent.

COLOUR.—Green, red, reddish brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 3 mm. ; girth, 9 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

The mites enter and leave the gall through an aperture which is situated on the underside of the leaf. The aperture may be circular, oval, elliptical, or irregular in outline. When this portion is viewed under magnification, numerous purple-coloured spots can be seen studding the margin. The gall-structure is pilose on the upper surface of the leaf and glabrous beneath. A longitudinal section shows the walls to be very thick. The interior is filled with long, thin hairs, many of which project a short distance beyond the aperture. These galls occur in considerable numbers, some leaves having as many as twenty-five upon them.

The gall is also figured by Murray, "Economic Entomology," p. 337.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Salix Caprea* Linn.

GALLED BY

Eriophyes tetanothrix levis Nal.

(NEARLY NAT. SIZE.)

ERIOPHYES TETRATRICHUS Nal.

PLATE 67.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes tetratrichus Nal.
on
the leaves of **Tilia europæa** Linn.

PLATE 67.

SYNONYMY OF MITE.

Legnon crispum Bremi.

Phytoptus tetratrichus Nal.

HABITAT OF THE COMMON LIME-TREE.—This tree occurs throughout Britain in woods, parks, avenues, etc. It is profuse in its foliage and flowers, and assumes handsome and noble proportions.

POSITION OF THE GALLS.—Around the margins of the leaf.

MANNER OF GROWTH.—A rolling and slight thickening of the edge, which may extend all round the leaf.

COLOUR.—Green, orange-yellow, reddish brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 30 mm. ; breadth, $1\frac{1}{2}$ mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

The serrations on the edge of the leaf are first attacked by these mites, causing them to curl upwards and to bend over until they touch the upper surface of the leaf. The rolling is continued until it has extended all round the leaf, and also until but a small portion remains in the centre, which is much pouched. The exterior of the roll is slightly pubescent, the interior very pilose. The apparently small leaf in nearly the centre of the illustration was originally the size of that next below it. The crinkled appearance of the leaves is due to shrivelling before being photographed.

The illustration is of specimens gathered at Aylsham, Norfolk, by the author.



LEAVES OF *Tilia europaea* Linn.

GALLED BY

Eriophyes tetratrichus Nal.

(TWO THIRDS NAT. SIZE.)

ERIOPHYES TILLÆ (TYPICUS) Nal.

PLATE 68.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes tiliæ (typicus) Nal.

on
the leaves of **Tilia europæa** Linn.

PLATE 68.

SYNONYMY OF MITE.

Ceratoneon extensum Bremi.

Phyllerium (Erineum) tiliaceum Pers.

" " *nervale* Kunz.

Eriophyes tiliæ (typicus) Pgst.

HABITAT OF THE COMMON LIME-TREE.—This tree occurs throughout Britain in woods, parks, avenues, etc. It is profuse in its foliage and flowers, and assumes handsome and noble proportions.

POSITION OF THE GALLS.—On upper surface of the leaf.

MANNER OF GROWTH.—Gregarious; glabrous; glossy; conical.

COLOUR.—Greenish yellow, red, crimson, purple, brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 8 mm.; girth, 6 mm. at base.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of July.

These galls never fail to arrest the attention of the gallist. The shape, the various colours, and the large numbers, all combine to render them very conspicuous. They are known as the "nail-gall," and look very like the points of a number of tacks projecting through the upper surface of the leaf. They are hollow, the interior containing a quantity of long hairs, amongst which the mites swarm in considerable numbers. An average size leaf may have as many as 150 galls upon it, and yet be free from other deformities.

The gall is also figured by Murray, "Economic Entomology," p. 332.

The illustration is of specimens gathered at Aylsham, Norfolk, by the author.



LEAVES OF *Tilia europaea* Linn.

GALLED BY

Eriophyes tilie (*typicus*) Nal.

(THREE-FOURTHS NAT. SIZE.)

ERIOPHYES TILIARIUS.

PLATE 69.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes tiliarius
on
the flower-bracts of **Tilia europæa** Linn.

PLATE 69.

SYNONYMY OF MITE.

Phytoptus tiliarius Mur.

HABITAT OF THE COMMON LIME-TREE.—This tree occurs throughout Britain in woods, parks, avenues, etc. It is profuse in its foliage and flowers, and assumes handsome and noble proportions.

POSITION OF THE GALLS.—On the margin of the flower-bract.

MANNER OF GROWTH.—Separately; sessile; slightly pubescent.

COLOUR.—Green, suffused with red and reddish brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 20 mm.; breadth, 2 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

These galls begin to form on the margin of the bract as small elevations. The feeding of the mites causes the edge of the bract to rise upwards and curl over towards the mid-rib, producing a roll which sometimes extends 30 to 40 mm. in length, and continues to roll over upon itself until the middle of the bract is reached. When thus affected the bract may curve into a crescent shape, the roll itself forming the inner margin of the concavity, or it may be otherwise considerably distorted. No harm is done to the flowers, nor does the bract fall until the usual time, hence the mites are not destructive to the fruit.

The gall is also figured by Murray, "Economic Entomology," p. 356.

The illustration is of specimens gathered at Aylsham, Norfolk, by the author.



FLOWER-BRACTS OF *Tilia europaea* Linn.

GALLED BY

Eriophyes tiliarius.

(NEARLY NAT. SIZE.)

ERIOPHYES TRISTRATUS, var. ERINEA Nal.

PLATE 70.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes tristratus, var. **erinea** Nal.

on

the leaves of **Juglans regia** Linn.

PLATE 70.

SYNONYMY OF MITE.

Erineum juglandinum Pers., Murray.

" *juglandis* Ung.

Phyllerium juglandis Schl.

Phytoptus tristratus, var. *erinea* Nal.

HABITAT OF THE WALNUT-TREE.—It is well distributed throughout Britain in private grounds and parks, and also on farms.

POSITION OF THE GALLS.—On the leaflets, in the areas enclosed between the primary and secondary offshoots from the mid-rib.

MANNER OF GROWTH.—Singly or in numbers; glabrous on upper surface, pubescent on under surface.

COLOUR.—Greenish yellow, suffused with reddish brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 5 mm. ; length, 16 mm. ; breadth, 10 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

The presence of the mites on the under surface of the leaf is first shown by the growth of pale yellow hairs on the parallel secondary offshoots from the mid-rib. The area which they enclose then becomes pilose, and at the same time a slight discoloration and elevation of the upper surface is noticeable. The deformities increase until a convexo-concave swelling is produced, the interior of which is filled with a thick felt of pubescence of a pale buff colour. See also plate 75.

The illustration is of specimens gathered at Guestling, near Hastings, by the author.



LEAVES OF *Juglans regia* Linn.

GALLED BY

Eriophyes tristratus, var. *erinea*, Nal.

(THREE-FOURTHS NAT. SIZE.)

ERIOPHYES VIBURNI.

PLATE 71.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes viburni
on
the leaves of **Viburnum opulus** Linn.

PLATE 71.

HABITAT OF THE GUELDER ROSE.—In woods, coppices, and hedges, more or less plentiful throughout Britain.

POSITION OF THE GALL.—On the upper surface and the under surface of the leaf.

MANNER OF GROWTH.—Irregular-shaped patches.

COLOUR.—Reddish brown, chocolate-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 2 mm. ; breadth, 8 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

These galls vary from the size of a mere speck to aggregations which cover two-thirds of the area of a leaf. They are not common, and appear to be very local ; but where the mites have been long established on a tree, the galls are very numerous. The author once found a twig, $4\frac{1}{4}$ in. long, bearing twelve leaves, nine of which were more or less attacked by the mites. Unfortunately, it was not possible to preserve it for photographing. The illustration on the opposite page is the best procurable at the time of writing the description. It is hoped that it may be some help to the gallist for the purpose of identification.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Viburnum Opulus* Linn.

GALLED BY

Eriophyes Viburni.

(NEARLY NAT. SIZE.)

MONOCHETUS SULCATUS Nal.

PLATE 72.

Galls caused by the larvæ, nymphs, and imagines of
Monochetus sulcatus Nal.

on

the leaves of **Fagus sylvatica** Linn.

PLATE 72.

SYNONYMY OF MITE.

Monaulax sulcatus Nal.

HABITAT OF THE COMMON BEECH.—A large and tall tree of majestic and noble proportions. Grows in woods and forests in every part of England, where it is extensively planted.

POSITION OF THE GALLED LEAVES.—Mostly at the end of a twig.

MANNER OF GROWTH.—Villous; cymbiform; seldom more than six affected leaves on one twig.

COLOUR.—Green on upper surface, grey on under surface.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 35 mm.; breadth, 10 mm.; girth, 24 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

These most interesting galls do not appear to be common; they are very local where they occur. The affected leaves are situated on the new wood of the year. They are attacked while expanding; and instead of opening out into a flat blade, the primary offshoots from the mid-rib are caused to remain as nearly parallel as possible with it, and the areas which they enclose are pushed upwards, giving both sides of the leaf a deeply striated appearance. They continue to grow in length, and ultimately bend inwards, assuming a cymbiform shape. The edges of some meet and produce a pod-like growth. Owing to the excessive pilosity they are like velvet to the touch.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Fagus sylvatica* Linn.

CALLED BY

Monochetus sulcatus Nal.

(FOUR-FIFTHS NAT. SIZE.)

PHYLLOOPTES ACERICOLA Nal.

PLATE 73.

Galls caused by the larvæ, nymphs, and imagines of
Phylloctes acericola Nal.

on

a leaf of **Acer pseudo-platanus** Linn.

PLATE 73.

SYNONYMY OF MITE.

Volvulifex aceris Amer.

Ceratoneon vulgare Bremi.

Phytoptus aceris Mur.

HABITAT OF THE SYCAMORE.—Distributed throughout Britain in gardens, private grounds, plantations, and parks.

POSITION OF THE GALLS.—On the upper surface of the leaf.

MANNER OF GROWTH.—Gregarious; glabrous; glossy; more or less globular.

COLOUR.—Orange-yellow, bright carmine, purple.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 2 mm.; girth, 3 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

These galls are well known to all who observe the sycamore-tree. They appear in very large numbers, sometimes so numerous as almost to cover the leaf. It is not unusual to find as many as 650 on a leaf of average size. What may be lacking as regards size, is partly supplied by their excessive abundance, but mostly by the brilliancy of their colouring. A section of a gall seen under magnification shows the interior well filled with long hairs, amongst which the mites swarm in large numbers.

The gall is also figured by Murray, "Economic Entomology," p. 357.

The illustration is of a specimen gathered at Hastings by the author.



LEAF OF *Acer pseudo-platanus* Linn.

GALLED BY

Phyllocoptes acericola Nal.

(THREE-FOURTHS NAT. SIZE.)

PHYLLOOPTES FRAXINI Nalepa.

PLATE 74.

Galls caused by the larvæ, nymphs, and imagines of
Phylloctes fraxini Nal.

on

the leaves of **Fraxinus excelsior** Linn.

PLATE 74.

SYNONYMY OF MITE.

Phylloctes fraxini Nal.

HABITAT OF THE COMMON ASH.—Common in woods, thickets, plantations, etc., in dry or damp places, and often in hedges near woods. Distributed very generally throughout Britain.

POSITION OF THE GALLS.—The edges of the leaflets.

MANNER OF GROWTH.—The edge of the leaflet curls downwards and under, the opposite edges meeting at the mid-rib.

COLOUR.—Very pale green with purple blotches, ultimately chocolate-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (a single roll).

Length, 20 mm.; breadth, 4 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

The specimen in the centre of the illustration shows the upper surface of the leaflets; those on either side the under surfaces. At the left-hand side will be observed one leaflet in which both edges have curled and met at the mid-rib; it is, however, more usual for only one-half of the leaflet to be rolled. The rolling is very irregular. The ends are open, and other minute creatures find a refuge within, a fact which may have caused these rolls to be labelled, in a public collection of specimens, as "the gall-nidus of *Tettigonia?*—*sp.*"

These galls are often found in company with those caused by *Diplosis botularia*.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Fraxinus excelsior* Linn.

GALLED BY

Phyllocoptes fraxini Nal.

(TWO-THIRDS NAT. SIZE.)

PLATE 75.

ERIOPHYES TRISTRATUS, var. *erinea* Nalepa.

AULAX GLECHOMÆ Htg.

PLATE 75.

A. Leaflets of **Juglans regia** Linn.

(Four-fifths nat. size.)

Galled by

Eriophyes tristratus, var. *erinea* Nal.

FIG. 1. Upper surface of five leaflets, showing eleven convexo-concave swellings.

FIG. 2. Under surface of one leaflet, showing pubescence in three convexo-concave swellings.

FIG. 3. Transverse section of one convexo-concave swelling
See also plate 70.

B. Stems and leaves of **Glechoma hederacea** Linn.

(Nat. size.)

Galled by

Aulax glechomæ Htg.

FIG. 1. Section of gall, showing larval chambers.

„ 2. An old gall, showing holes through which imagines have emerged.

FIG. 3. A very fine specimen, showing coalescence and entire absorption of the leaf. Presented by Mr. G. C. Walton, Folkestone.

See also plate 109.

The illustration is of specimens gathered at Hastings by the author.



2.

1.



1.

3.

2. B.

A. LEAFLETS OF *Juglans regia* Linn.
(FOUR-FIFTHS NAT. SIZE.)

B. LEAVES OF *Glechoma hederacea* Linn.
(NAT. SIZE.)

PLATE 76.

ERIOPHYES GONIOTHORAX Nalepa.

ERIOPHYES AUCUPARLE.

PLATE 76.

A. Seven leaves of **Cratægus Oxyacantha** Linn.

(Nearly nat. size.)

Galled by

Eriophyes goniothorax Nalepa.

FIGS. 1, 2. Upper surface of leaves.

„ 3, 4. Under „ „ „

See also plate 53.

B. Two leaves of **Pyrus aucupara** Gærtn.

(Half nat. size.)

Galled by

Eriophyes aucupariæ.

FIG. 1. Upper surface of leaflets.

„ 2. Under „ „ „

See also plate 46.

The illustration is of specimens gathered at Hastings by the author.

2.

A.

3.

1.

4.

1.

2.



B.

A. SEVEN LEAVES OF *Crataegus Oxyacantha* Lind.
(NEARLY NAT. SIZE.)

B. TWO LEAVES OF *Pyrus aucuparia* Gærtn.
(HALF NAT. SIZE.)

TYLENCHUS MILLEFOLII.

PLATE 77.

Galls caused by the Stem Eelworm **Tylenchus**
millefolii
on
the rachides of **Achillea millefolium** Linn.

PLATE 77.

HABITAT OF THE COMMON YARROW.—One of the most plentiful of British wild plants, varying considerably in size according to situation. It grows on waste ground, meadows, hedge-banks, and roadsides.

THE GALL IS FORMED by the eelworms feeding upon the interior of the rachis.

POSITION.—On the rachis of the leaf.

MANNER OF GROWTH.—Separately ; glabrous ; spindle-shape or irregular in outline.

COLOUR.—Pale green.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 17 mm. ; girth, 15 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

These galls are frequently found on the same leaves as those attacked by *Hormomyia millefolii* Lw. The eelworms, however, appear to confine their attacks principally to the rachis of the leaf and not the leaflets. They are rare and very local. Where there is a patch of *Achillea millefolium* L. having many plants attacked by both gall-makers, a similar patch not many yards away will be quite free from them. On the opposite page five only of the rachides show swellings, while many of the leaflets are galled by *H. millefolii*. An average-size gall may contain from twenty to sixty eelworms.

The illustration is of specimens gathered at Hastings by the author.



RACHIDES OF *Achillea millefolium* Linn.

GALLED BY

Tylenchus millefolii.

(SIX-SEVENTHS NAT. SIZE.)

Galls caused by the larvæ of **Cecidomyia bursaria**
Bremi.
on
the leaves of **Glechoma hederacea** Linn.

PLATE 78.

SYNONYMY OF INSECT.

Cecidomyia bursaria Theobald.

HABITAT OF THE GROUND-IVY.—This plant is very abundant in Britain, growing in waste places and on banks; but its favourite situations are the edges of woods and under hedges.

THE GALL IS FORMED by the vegetable cells arising from the upper surface of the leaf and forming a tubular structure covered with hairlets.

POSITION.—It is situated on any part of the leaf except the mid-rib.

MANNER OF GROWTH.—Gregarious, as many as eleven on one leaf.

COLOUR.—Pale green at first, becoming darker at base and reddish at apex.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 5 mm.; girth, 6 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is unilocular.

THE LARVA PUPATES in the gall. The imago emerges during the following spring.

The development of these galls may be easily watched in one's study or conservatory. If a root of the plant with its runners bearing affected leaves is potted with its natural soil, it will continue to grow and the gall-structures develop; or a leaf may be kept alive in water, but the result is not so certain.

The gall is also figured by F. V. Theobald, "British Flies," p. 71; Bremi, plate 1, fig. 20.

Cecidomyia bursaria.

These pretty little galls may invariably be found wherever *Glechoma hederacea* is growing. Seldom will any considerable patch of this plant be free from attack. One needs to look closely at first in order to see them, although they are neither hidden as regards their position on the leaf, nor so inconspicuous as might be imagined. When removed from their surroundings they are very distinctive. During growth they are the same colour as the leaf, and consequently are not easily discerned. When nearing maturity many specimens show a reddish tinge at the apex; but when mature they all turn a dull brown colour, and very soon afterwards fall to the ground, leaving small circular holes in the leaf. During their vigour they are not easily removed from the leaf without tearing away a portion of it also. Looking at the underside of the leaf, the position of the galls may be determined by depressions, each of which is surrounded by a slightly lighter shade of green. The surface of the gall is thickly covered with short hairs, each of which, when viewed under magnification, is seen to be growing from the apex of a conical swelling. A single cylindrical-shaped larva occupies each gall. The interior of the gall is quite smooth, but at its base a large number of long, pointed hairs appear.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Glechoma hederacea* Linn.

GALLED BY

Coccidomyia bursaria Bremi.

(FOUR-FIFTHS NAT. SIZE.)

CECIDOMYIA CRATÆGI Wtz.

PLATE 79.

Galls caused by the larvæ of **Cecidomyia cratægi** Wtz.
on
the leaves of **Cratægus Oxyacantha** Linn.

PLATE 79.

SYNONYMY OF INSECT.

T. oxyacanthæ Schk.

Cecidomyia cratægi Theobald.

HABITAT OF THE HAWTHORN.—This plant is so universally cultivated throughout Britain for the purpose of hedges around fields and along roadsides, that no further description is necessary.

THE GALL IS FORMED of a tuft of leaves situated at the summit of an upright shoot growing out of the top of the hedge.

MANNER OF GROWTH.—One only on each shoot, although some of the other leaves may be affected.

COLOUR.—The leaves are the same colour as those not affected.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 20 mm. ; girth, 180 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of September.

THE TYPICAL CONDITION of the gall is multilarval.

THE LARVÆ PUPATE in the ground. The imagines emerge during the spring.

These ubiquitous clusters or rosettes of deformed sessile leaves are familiar to all who travel along the country roads during the summer. The number of leaves composing a rosette may be as few as eight, or as many as forty. Each leaf is thickly studded on both surfaces with short, thick, bluntly pointed hairs. The leaflets in the centre of the cluster are stunted in growth, curl inwards, and provide shelter and food for the numerous larvæ.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Crataegus Oxyacantha* Linn.

GALLED BY

Cecidomyia crategi Wz.

(SEARLY NAT. 812'.

CECIDOMYIA LATHYRI Felfld.

PLATE 80.

Galls caused by the larvæ of **Cecidomyia lathyri** Felfld.
on
the terminal leaves of **Lathyrus pratensis** Linn.

PLATE 80.

SYNONYMY OF INSECT.

Cecidomyia lathyri Theobald.

HABITAT OF THE MEADOW-PEA.—Abundant throughout Britain in fields, moist meadows, on hedge-banks, and similar situations.

THE GALL IS FORMED by the larvæ causing the terminal leaves to meet along their edges and enclose the unexpanded leaves.

POSITION.—At the top of the stem.

MANNER OF GROWTH.—Several on a stem; glabrous.

COLOUR.—Pale green, yellowish green.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 20 mm.; breadth, 8 mm.; girth, 20 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is multilarval.

THE LARVÆ PUPATE in the gall and in the earth. The imagoes emerge during the spring.

The disturbance caused to the plant-tissue by the larvæ causes the uppermost pair of expanded leaves to meet along the edges with their upper surfaces inwards, and form a kind of closed bag, the basal half of which becomes considerably swollen, the upper half remaining flat. Within the swollen base the young leaves cluster, and are prevented from expanding by the tightly closed edges of the outer leaves, and the feeding of the larvæ upon their tissues.

The illustration is of specimens gathered at Hastings by the author.



TERMINAL LEAVES OF *Lathyrus pratensis* Linn.

GALLED BY

Cecidomyia lathyri Felsd.

(THREE-FOURTHS NAT. SIZE.)

CECIDOMYIA MARGINEM-TORQUENS Wtz.

PLATE 81.

Galls caused by the larvæ of **Cecidomyia marginem-torquens** Wtz.

on

the leaves of **Salix viminalis** Linn.

PLATE 81.

SYNONYMY OF INSECT.

Cecidomyia marginem-torquens Bremi.

" " Theobald.

HABITAT OF THE COMMON OSIER.—It grows in swampy places and along the sides of streams; it will also grow to a good-sized tree in drier situations. Common throughout Europe.

THE GALL IS FORMED by the margins of the leaf being rolled along the under surface towards the mid-rib.

POSITION.—Along the margins of the leaf.

MANNER OF GROWTH.—Glabrous; glossy; coalescent.

COLOUR.—Pale green, yellow, red, chocolate-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 50 mm.; breadth, 2 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

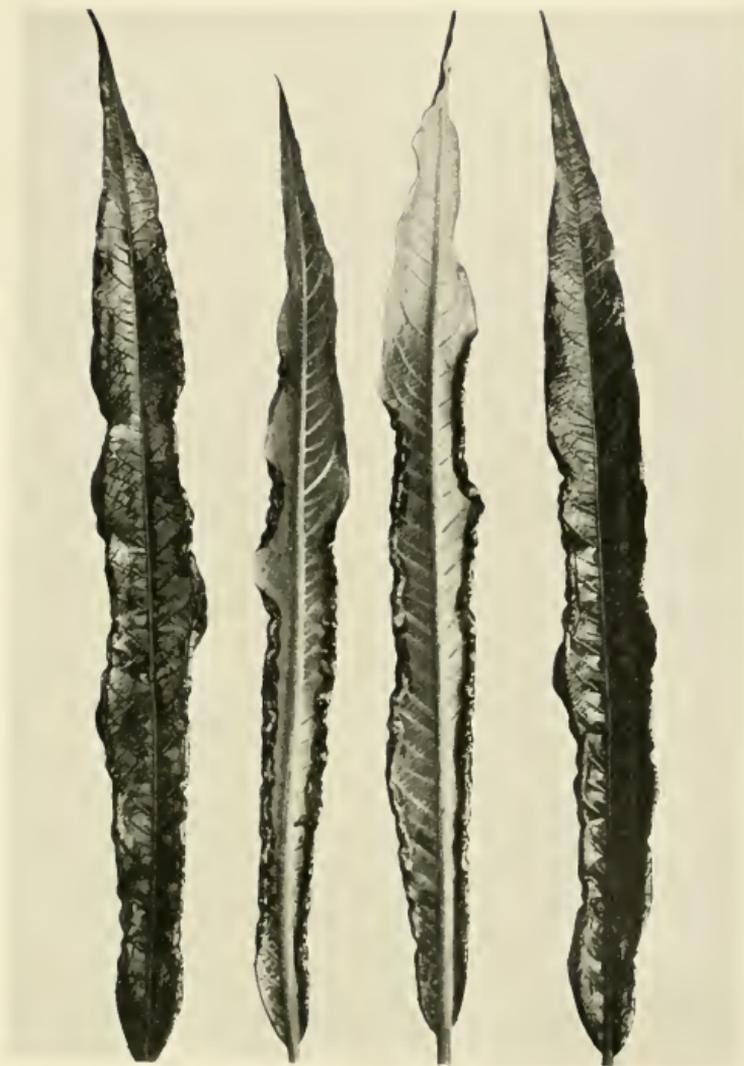
THE TYPICAL CONDITION of the gall is multilarval.

THE LARVÆ PUPATE in the ground. The imagines emerge during the spring.

The two leaves in the centre of the illustration exhibit the appearance of the under surface, the other two the upper surface. It is very seldom that the margins roll sufficiently to meet each other. On some bushes of *Salix viminalis* almost every leaf is galled by this Cecid.

The gall is also figured by F. V. Theobald, "British Flies," p. 71.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Salix viminalis* Linn.

CALLED BY

Cecidomyia marginem-torquens Wiz.

(NEARLY NAT. SIZE.)

CECIDOMYIA PERSICARLÆ Linn.

PLATE 82.

Galls caused by the larvæ of **Cecidomyia persicariæ**
Linn.
on
the leaves of **Polygonum amphibium** Linn.

PLATE 82.

SYNONYMY OF INSECT.

Cecidomyia persicariæ Theobald.

HABITAT OF THE AMPHIBIOUS POLYGONUM.—In ponds and ditches, around the edges of lakes fringed with reeds and rushes, and other similar spots throughout Britain.

THE GALL IS FORMED by the thickening of the leaf, the margins of which are caused by the larvæ to roll under and inwards until they meet under the mid-rib.

MANNER OF GROWTH.—Glabrous; glossy.

COLOUR.—Pale green suffused with pink and purple.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 45 mm.; breadth, 15 mm.; girth, 35 mm.

MAY BE SOUGHT during the months of July, August, and September.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is multilarval.

THE LARVÆ PUPATE in the gall. The imagines emerge during the spring.

This is a very interesting gall, and one which cannot be mistaken. The rolled and distorted leaves are usually those near the top of the stem; and although this plant grows in dense patches, the galled leaves are not difficult to discover, especially after they have assumed the beautiful rose-pink or purple patches of colour with which most specimens are decorated. Attention is directed to the spiral conformation of the galled leaves.

The illustration is of specimens gathered at Guestling by the Rev. E. N. Bloomfield, M.A., F.E.S.



LEAVES OF *Polygonum amphibium* Linn.

GALLED BY

Cecidomyia persicariae Linn.

(FOUR-FIFTHS NAT. SIZE.)

CECIDOMYIA PTERIDIS Müll.

PLATE 83.

Galls caused by the larvæ of **Cecidomyia pteridis** Müll.
on
the secondary pinnæ of **Pteris aquilina** Linn.

PLATE 83.

SYNONYMY OF INSECT.

Cecidomyia filicina Kief.

„ *pteridis* Theobald.

HABITAT OF THE COMMON BRACKEN.—This easily recognised plant is exceedingly abundant in woods and thickets, on heaths and waste places, throughout the whole of Britain.

THE GALL IS FORMED by the larva causing the secondary pinnæ to thicken slightly and form a torpedo- or cigar-shaped roll.

POSITION.—On the under surface of pinna.

MANNER OF GROWTH.—Gregarious; sessile; glabrous; glossy.

COLOUR.—Green, changing to red, finally black.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 5 mm.; girth, 6 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the ground. The imago emerges during the spring.

Although these galls may be detected when the fronds of the bracken are viewed from above, the quickest and simplest manner of finding them is to lie on the ground under the bracken, and examine the fronds from below. The little rolls are torpedo- or cigar-shaped. They grow rapidly. In some localities they are plentiful, in others very scarce. The largest number the author has found on one pinna is twenty-five. The imagines are difficult to rear.

The illustration is of specimens gathered at Hastings by the author.



SECONDARY PINNÆ OF *Pteris aquilina* Linn

GALLED BY

Cecidomyia pteridis Müll.

(FOUR-FIFTHS NAT. SIZE).

CECIDOMYIA RANUNCULI Bremi.

PLATE 84.

Galls caused by the larvæ of **Cecidomyia ranunculi**
Brems.
on
the leaves of **Ranunculus repens** Linn.

PLATE 84.

SYNONYMY OF INSECT.

Cecidomyia ranunculi Fitch.

HABITAT OF THE CREEPING RANUNCULUS.—Very abundant in Britain by roadsides, damp spots in and near woods, in meadows and pastures, and waste places generally.

THE GALL IS FORMED by the two outer segments of the leaf having their edges rolled upwards and inwards until they meet above the mid-vein.

MANNER OF GROWTH.—Singly; pubescent; inflexible.

COLOUR.—Same shade of green as a normal leaf.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 25 mm.; breadth, 12 mm.; girth, 30 mm.

MAY BE SOUGHT during the months of July to November.

THE GROWTH is complete by the end of September.

THE TYPICAL CONDITION of the gall is unilarval.

THE LARVA PUPATES in the gall. The imago emerges during the spring.

The two side segments first show signs of being galled, and after they have rolled up and met each other, the central segment enfolds them, and a firm and compact mass of leaf is the result. The veins become thickened and wrinkled, very pubescent, and of a slightly paler colour than normal.

The gall is also figured by E. A. Fitch, "The Entomologist," July, 1880.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Ranunculus repens* Linn.

GALLED BY

Cecidomyia ranunculi Bremi.

(FOUR-FIFTHS NAT. SIZE.)

Galls caused by the larvæ of **Cecidomyia rosaria** Lw.
on
the terminal leaves of **Salix aurita** Linn.

PLATE 85.

SYNONYMY OF INSECT.

Cecidomyia rosaria Hardy, Theobald.

„ *cinerearum* Lw.

HABITAT OF THE ROUND-EARED WILLOW.—Common throughout Britain in woods, thickets, moist meadows, and damp places generally.

THE GALL IS FORMED by the feeding of the larva upon the end of the shoot, which prevents its further growth, and causes the leaves to assume a rosette form.

POSITION.—At the end of the twig.

MANNER OF GROWTH.—Singly; rosaceous.

COLOUR.—Green, turning brown with age.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 20 mm.; diameter, 40 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is unilarval.

THE LARVA PUPATES in the gall. The imago emerges during the spring.

PLATE 85. Illustrates the appearance of the rosettes during the months of June to December, and may be considered as the summer-autumn form.

PLATE 86. Those found during the months of December to June, illustrating the winter-spring form.

The illustration is of specimens gathered at Hastings by the author.

Cecidomyia rosaria.

No more appropriate name could be given to these galls than the popular one of "rosette."

They are not common nor are they abundant. Some willows, preferably young trees and large bushes, contain a goodly number, while other trees near by have none upon them. They may be found on several kinds of *Salix*, principally on *S. alba*, *S. aurita*, *S. caprea*, *S. cinerea*, and *S. purpurea*.

The rosette may consist of a cluster of thirty to sixty leaves in all stages of development, about half of which are medium-sized leaves, the others are very small. They are all firmly attached to the twig. The outer leaves are usually slightly thickened, hard, and occasionally woody. The edges roll somewhat, and with age become strongly serrated. The inner ones are mere imbricated leaflets; they have a lustrous appearance, due to pilosity. Within this cluster the solitary larva will be found. When fully grown it will measure 3 mm. long and 4 mm. in girth. A typical cluster examined in the month of September consisted of twenty-eight outer leaves more or less fully developed, the largest being 30 mm. long and 18 mm. at greatest width, all arranged around the upper 10 mm. of the length of the twig. Enclosed by these leaves were twenty-three imbricated leaflets, the base of each being attached to the extreme tip of the twig. They varied from 4 to 6 mm. in length, and from $1\frac{1}{4}$ to 2 mm. in width.



TERMINAL LEAVES OF *Salix aurita* Linn.

GALLED BY

Cecidomyia rosaria Lw.

(THREE-FOURTHS NAT. SIZE.)

CECIDOMYIA ROSARIA LW.

PLATE 86.

Galls caused by the larvæ of **Cecidomyia rosaria** Lw.
on
the terminal leaves of **Salix aurita** Linn.

PLATE 86.

The illustration on the opposite page gives the appearance of the rosettes as seen during the months of December to June, and may be considered as the winter-spring form of these gall-growths.

The number of the leaves and leaflets in the rosettes caused by these larvæ is always greater than would be found on a twig, the growth of which has not been arrested. This points to the fact that the embryo leaves in the bud, which under normal conditions would not develop until the following year, are caused to expand and form the imbricated leaflets which immediately surround the larva.

The illustration is of specimens gathered at Hastings by the author.



TERMINAL LEAVES OF *Salix aurita* Linn.

GALLED BY

Cecidomyia rosaria Lw.

(THREE-FOURTHS NAT. SIZE.)

CECIDOMYIA ROSARUM Hardy.

PLATE 87.

Galls caused by the larvæ of **Cecidomyia rosarum**
Hardy
on
the leaves of **Rosa canina** Linn.

PLATE 87.

SYNONYMY OF INSECT.

Cecidomyia rosæ Macq., Bremi.

„ *rosarum* Theobald.

HABITAT OF THE DOG-ROSE.—This is the commonest rose in Britain ; it grows rapidly and luxuriantly in hedges, thickets, and various dry places in every part of the country.

THE GALL IS FORMED by the edges of the leaflet rising above the mid-rib until they approximate and a thin-walled, hollow pod is formed.

MANNER OF GROWTH.—Glabrous ; glossy ; furrowed exterior.

COLOUR.—Green externally, reddish brown internally.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 30 mm. ; breadth, 6 mm. ; girth, 18 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is multilarval.

THE LARVÆ PUPATE in the ground. The imagines emerge in about six days after pupation.

These galls may be found on the same rose-bushes as *Rhodites rosæ*, *R. eglanteriæ*, and *R. nervosus* ; but it is rare to find either of the latter two species on a leaf conduplicated by *C. rosarum*. The juncture of the edges of the leaf is very perfect, and the larvæ, which sometimes number fifty, are unable to get out. At the part where the edges meet a slight viscosness is frequently noticeable. At the approach of autumn the edges gape, and the larvæ fall to the ground to pupate.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Rosa canina* Linn.

GALLED BY

Cecidomyia rosarum Hardy.

(FOUR FIFTHS NAT. SIZE.)

CECIDOMYIA TAXI Inch.

PLATE 88.

Galls caused by the larvæ of **Cecidomyia taxi** Inch.
on
the terminal leaves of **Taxus buccata** Linn.

PLATE 88.

SYNONYMY OF INSECT.

Cecidomyia taxi Theobald.

HABITAT OF THE COMMON YEW.—This tree may be found in the graveyards of many rural churches throughout Britain, also in private grounds and parks, where it is frequently cultivated for hedges.

THE GALL IS FORMED by the leaves being united together, forming a cone-shaped tuft, which ultimately expands somewhat and forms a small rosette.

POSITION.—At the termination of a twig.

MANNER OF GROWTH.—Singly and gregarious; as many as seventy leaves in one cluster.

COLOUR.—The exterior leaves are normal, the inner ones are white and yellow.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 16 mm.; girth, 36 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of May.

THE TYPICAL CONDITION of the gall is unilarval.

THE LARVA PUPATES in the gall. The imago emerges during June.

These galls are due to the deposition of an ovum by *C. taxi* at the extreme tip of the shoot, the action of the larva preventing further growth of that part. The larva lives in the centre of the leaves during the autumn, winter, and spring, and when about to pupate works its way towards the apex of the cone; the emergence of the imago is thereby rendered more easy.

The gall is also figured by F. V. Theobald, "Journ. S. E. Agri. Coll.," March, 1899.

The illustration is of specimens taken at Crowhurst, Sussex, by the author.



TERMINAL LEAVES OF *Taxus buccata* Linn.

CALLED BY

Cecidomyia taxi Inch.

(THREE-FOURTHS NAT. SIZE.)

Galls caused by the larvæ of **Cecidomyia ulmariaë**
Bremi.
on
the leaf-segments of **Spiræa Ulmaria** Linn.

PLATE 89.

SYNONYMY OF INSECT.

Cecidomyia ulmariaë Theobald.

HABITAT OF THE MEADOW-SWEET. — This graceful and attractive plant abounds in most parts of Britain on the banks of streams, ditches, and ponds; in meadows and the corners of fields where damp.

THE GALL consists of a glabrous, hemispherical swelling on the upper surface of the leaf-segment, continued as a pubescent, recurvate, cone-shaped projection on the under surface.

MANNER OF GROWTH.—Gregarious; frequently coalescent.

COLOUR.—From pale green tinged with pink, to reddish brown and dark brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height above the surface of the leaf, 2 mm.; projection below, 4 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is unilocular.

THE LARVA PUPATES in the gall. The imago emerges during August.

These galls coalesce to a remarkable degree; as many as eight will grow together, forming a large swelling on the upper surface. The larval chambers, however, remain separate, and the number of them may be determined by counting the cones on the under surface.

The gall is also figured by F. V. Theobald, "British Flies," p. 71.

Cecidomyia ulmariae.

The leaves on the opposite page are typical representatives of the manner in which this species affects *Spiraea ulmaria*. That on the right-hand side shows the upper surface, the other leaf the under surface: they bear galls upon them numbering 93 and 35 respectively. The largest number of galls the author has seen on a leaf is 218. The mid-rib measured 7 in. long, and had the same number of segments upon it as those in the illustration. In some localities the galls are most abundant, almost every leaf of each plant being attacked. The manner of growth is most interesting. A tiny swelling shows itself on the upper surface of a segment, pale green at first, then slightly tinged with pink, turning later to red, at which period it is very like an ovum of the puss-moth (*Cerura vinula*) in shape and size, but with a depression in the centre. The surface, which is glabrous under magnification in some specimens, shows numerous minute reddish pimples. Meanwhile a cone-shaped projection has been pushing its way through the under surface of the segment, and continues until a length of 3 or 4 mm. is reached. Some remain straight, but most recurvate somewhat. This portion is of a pale colour, and is thickly clothed with long, greyish, silky hairs, more numerous at the base than at the apex. Examples are not uncommon where the cones are suffused with scarlet or reddish brown. The fewness or number of them does not cause any discoloration of the segments, and except they be extremely numerous there is no deformity of growth.

The illustration is of specimens gathered at Battle by the author.



LEAF-SEGMENTS OF *Spirea Ulmaria* Linn.

GALLED BY

Coccidomyia ulmarie Bremi.

(FOUR-FIFTHS NAT. SIZE.)

Galls caused by the larvæ of *Cecidomyia urticae* Perris.
on
the leaves of *Urtica dioica* Linn.

PLATE 90.

SYNONYMY OF INSECT.

Cecidomyia urticae Theobald.

HABITAT OF THE COMMON NETTLE.—Common and abundant throughout Britain by the roadside, waste places, along hedges, corners of fields and meadows, neglected orchards, etc.

THE GALL IS FORMED by the accumulation of sap around the ovum, which continues for some time after the hatching of the larva.

POSITION.—On all parts of the stem, leaves, petioles, flower-stalks, and flower-clusters.

MANNER OF GROWTH.—Singly, and gregarious; irregular-shaped.

COLOUR.—Very pale green, some a pale yellow.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (situated in the blade of the leaf, and more or less globular in outline).

Diameter, 5 mm.

MAY BE SOUGHT during the months of May to December.

THE GROWTH is complete by the end of November.

THE TYPICAL CONDITION of the gall is unilocular.

THE LARVA PUPATES in the ground. The imago emerges during the spring.

These galls vary in size and shape according to the part of the plant they affect. Those on the blade of the leaf are small and globular, with about equal proportions on both surfaces of the leaf; those close to the petiole distend the lower surface only, and are often much larger and very irregular in outline. The axillary leaflets are often swollen into small pear-shaped masses. The petioles of the leaves frequently show bulbous swellings, while the flowers and their stalks have many small pea-shaped galls on them.

Cecidomyia urticæ.

This species, known as "the nettle gnat," causes irregular-shaped galls on almost every part of the plant. In some places it is most plentiful, in others quite unknown. In some beds of *Urtica dioica* leaves and flowers of almost every stalk bear galls. They occur on the leaves in numbers of eight or less, and of fifteen or less on the flower-clusters. When on the leaf they are usually pubescent, more so on the part affecting the under than that of the upper surface. Those on the flower-clusters are usually glabrous. Distortion of the leaf is slight, as may be seen in upper leaflet in A, the most being a small curl as in B. The larval chambers, C, are large with thin walls. The larva eats its way out, falls to the ground to pupate, and decay of the cell-walls takes place until a hole is made in the leaf; or if the gall be situated as in lower leaflets in A, the leaf becomes detached and falls off.

The illustrations are of specimens gathered at Hastings by the author.

FIG. 3.



A. Three leaves showing under surfaces.



B. Upper surface of a leaf.



C. Lower portion of it,
showing sections of galls.



LEAVES OF *Urtica dioica* Linn.

GALLED BY

Cecidomyia urticae Perris.

(HALF NAT. SIZE.)

Galls caused by the larvæ of **Cecidomyia veronicæ**
Bremsi.

on

the terminal leaves of **Veronica chamædrys** Linn.

PLATE 91.

SYNONYMY OF INSECT.

Cecidomyia chamædrys Inch.

„ *veronicæ* Theobald.

HABITAT OF THE GERMANDER SPEEDWELL.—This ubiquitous plant during spring and summer, with its bright blue flowers, adds to the attractiveness of many a roadside, hedge-bank, and waste place.

THE GALL IS FORMED by the two terminal leaves swelling in a convex manner and uniting at their edges, enclosing abortive leaves and the flower-stalks.

MANNER OF GROWTH.—Seldom more than one on each plant.

COLOUR.—The leaves are green, thickly covered with long white hairs.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 18 mm; breadth, 12 mm.; girth, 28 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of September.

THE TYPICAL CONDITION of the gall is multilarval.

THE LARVÆ PUPATE in the gall. The imagines emerge during the spring.

Doubtless many people who gather wild flowers along the hedgerows have often seen these galls. By reason of their whitish colour they are noticeable objects, and sometimes their attractiveness is increased by the mid-rib and the bulbous part of the affected leaves being suffused with purple.

The gall is also figured by F. V. Theobald, "British Flies," p. 71.

Cecidomyia veronicæ.

As a result of the oviposition of the female insect in the spring, the upward growth of the stem of the plant is in most cases completely stopped. Instances, however, are not rare in which, during the summer, the stem has forced its way beyond the galled point, and continued to throw out leaves, but it is never quite of its normal character. The two terminal leaves, which at the time of oviposition are partly expanded, are retarded from further development. They rise up and meet each other, their serrated edges approximating with great accuracy. Meanwhile, the embryo leaves they enclose endeavour to continue their growth, and to a limited extent, are successful, causing considerable concavity in the bases of the outside leaves. The feeding of the larvæ, which by then have hatched, speedily arrests any further development. The colour of the enveloping leaves is pale green; but the excessive pubescence (the peculiar character of which is seen in fig. 4), except at their apices, gives them a whitish and woolly appearance.

The illustration is of specimens gathered at Hastings by the author.

FIG. 4.



Hairs from the exterior of a galled leaf, showing the branched, jointed, and ribbon-like appearance under low magnification.



TERMINAL LEAVES OF *Veronica chamaedrys* Linn.

GALLED BY

Cecidomyia veronicæ Bremi.

(FOUR-FIFTHS NAT. SIZE.)

CECIDOMYIA VIOLÆ F.

PLATE 92.

Galls caused by the larvæ of **Cecidomyia violæ** F.
on
the leaves of **Viola canina** Linn.

PLATE 92.

SYNONYMY OF INSECT.

Cecidomyia violæ Theobald.

HABITAT OF THE DOG-VIOLET.—Freely distributed throughout the whole of Britain in woods, thickets, by streams, on hedge-banks, and other open, dry, or sandy situations.

THE GALL IS FORMED by the basal edges of the leaf rolling upwards and towards the mid-rib until they nearly meet. Always at the basal portion of the leaf; the apex is never rolled.

MANNER OF GROWTH.—Three or four leaves in one cluster may be affected.

COLOUR.—Dark green, sometimes streaked with purple.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 20 mm.; breadth, 8 mm.; girth, 20 mm.

MAY BE SOUGHT during the months of July to December.

THE GROWTH is complete by the end of October.

THE TYPICAL CONDITION of the gall is multilarval.

THE LARVÆ PUPATE in the gall. The imagines emerge during the spring.

Although the months during which these galls may be found are scheduled as July to December, they may nevertheless be obtained on some sheltered roadsides until March or April. For the purpose of rearing the inhabitants, it is best to get them as late in the spring as possible. If a plant be put in a flower-pot in September or October and kept at home, the same results may be obtained with little trouble. No leaf is too small but that it is liable to attack. A cluster was once found consisting of twenty-two leaves, eighteen of which were galled.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Viola canina* Linn.

GALLED BY

Cecidomyia viole F.

(FOUR-FIFTHS NAT. SIZE.)

Galls caused by the larvæ of **Diplosis botularia** Wtz.
on
the leaves of **Fraxinus excelsior** Linn.

PLATE 93.

SYNONYMY OF INSECT.

Cecidomyia fraxini Bremi.

Diplosis botularia Theobald, Kerner.

HABITAT OF THE COMMON ASH.—Common in woods, thickets, plantations, etc., in dry or damp places, and often in hedges near woods. Widely distributed throughout Britain.

THE GALL IS FORMED by the larvæ causing irritation to the plant-tissue, and a consequent abnormal swelling.

POSITION.—On the rachis and mid-rib of the leaflets.

MANNER OF GROWTH.—Elongated; glabrous; glossy.

COLOUR.—Pale green, green, ultimately brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 45 mm.; breadth, 5 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 6.

THE LARVÆ PUPATE in the ground. The imagines emerge during the spring.

The inter-leaflet spaces of the rachis are frequently attacked and swollen in a similar manner to that of the mid-rib. Two examples of this may be seen on the left-hand side of the illustration. The natural groove in the rachis is deepened by the swelling of the sides, which may extend from one petiolule to another, thus producing a labial formation.

The gall is also figured by Theobald, "British Flies," p. 71; Kerner, "Nat. Hist. of Plants," vol. ii., p. 534.

Diplosis botularia.

The large pinnate leaves of the ash may be seen in any wood during summer time. *Diplosis botularia* attacks the leaves of saplings more frequently than those of trees. On some rachides there may be as many as thirteen leaflets, and each one will be galled; it is not usual, however, to find such specimens, the general number being nine or eleven. Towards July and August it may be observed that these leaflets are considerably thickened along the under surface following the course of the mid-rib. This thickening is caused by the presence of the larvæ. The ova are laid on the upper surface of the leaf along the plane of the mid-rib, and when the larvæ hatch, they cause the mid-rib to rise up on each side of them, and with it also the blades of the leaf, until portions of the latter approximate. When this is completed, the continued swelling of the mid-rib causes the leaflet to curve and its free edges to wrinkle.

The length of the galled portion depends entirely upon the number of larvæ within it. A leaflet 70 mm. long may contain six or eight larvæ. One leaflet examined by the author measured 98 mm. long and was galled throughout its entire length. It contained eighteen larvæ.

The interior is divided into larval chambers, which vary in size according to the age of the larva. Some cavities are 8 mm. long by $1\frac{1}{2}$ mm. broad. When the leaves begin to wither, small cracks appear at the thinnest part of the cell-wall, and through these the larvæ escape and fall to the ground to pupate.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Fraxinus excelsior* Linn.

GALLED BY

Diplosis botularia Wtz.

(NEARLY NAT. SIZE)

DIPLOSI^S TREMULÆ Wtz.

PLATE 94.

Galls caused by the larvæ of **Diplosis tremulæ** Wtz.
on
the petioles of leaves of **Populus tremula** Linn.

PLATE 94.

SYNONYMY OF INSECT.

Tipula populea Schrank.

Cecidomyia polymorpha Bremi.

Diplosis tremulæ Theobald.

HABITAT OF THE ASPEN.—This tree grows well in coppices, woods, and forests; it may also frequently be seen in a flourishing condition on the outskirts of a wood by the side of a stream.

THE GALL IS FORMED by a continuous and rapid accumulation of vegetable cells resulting from the irritation to the tissues caused by the presence of the larva.

POSITION.—On the petiole.

MANNER OF GROWTH.—Singly; glabrous.

COLOUR.—Green, suffused with pink or purple.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (globular form).

Girth, 24 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the ground. The imago emerges during the spring.

These galls are very irregular as regards both their size and their contour. They very rarely occur more than three on one petiole. They may be situated at the axil or so far up that the swelling is merged into the base of the mid-rib of the leaf. Young aspen-trees are the best on which to search for them. They are scarce in some districts, and do not occur at all in others. They are very local anywhere; nowhere are they abundant. See also plate 117.

The illustration is of specimens gathered at Hastings by the author.



PETIOLES OF LEAVES OF *Populus tremula* Linn.

GALLED BY

Diplosis tremulae Wtz.

(FOUR FIFTHS NAT. SIZE)

HORMOMYIA CAPREÆ Wtz.

PLATE 95.

Galls caused by the larvæ of **Hormomyia capreæ** Wtz.
on
the leaves of **Salix Caprea** Linn.

PLATE 95.

SYNONYMY OF INSECT.

Cecidomyia capreæ Hardy.

Hormomyia capreæ Hardy, Walker, Theobald.

HABITAT OF THE SALLOW, OR GOAT-WILLOW.—Very common throughout Britain by the sides of streams, marshy places, damp open woods, and in thickets and hedges.

THE GALL IS FORMED by the parent insect depositing ova in the mid-rib as well as in other parts of the blade of the leaf.

POSITION.—On the under surface of the leaf, growing from the mid-rib.

MANNER OF GROWTH.—Singly, but usually a number coalesced; glabrous.

COLOUR.—Pale green, pale yellow.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 7 mm.; breadth, 5 mm.; girth, 15 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 8.

THE LARVÆ PUPATE in the ground. The imagines emerge during the spring.

These galls are amongst the very few kinds in which the mid-rib itself is involved in their development. Looking at the upper surface of the leaf, it will be seen that the mid-rib is broadened and much swollen by their growth. They project from the under surface, forming conical swellings, which, when mature, are very hard. When many are present on one leaf a solid woody mass is formed, and the leaf is much distorted.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Salix Caprea* Linn.

GALLED BY

Hormomyia capreae Wtz.

(1/5 ORIGINAL NAT. SIZE.)

HORMOMYIA FAGI Hartig.

PLATE 96.

Galls caused by the larvæ of **Hormomyia Fagi** Hartig.
on
the leaves of **Fagus sylvatica** Linn.

PLATE 96.

SYNONYMY OF INSECT.

Cecidomyia fagi Mosley.

Hormomyia Fagi Theobald.

HABITAT OF THE COMMON BEECH.—A large and tall tree of majestic and noble proportions. Grows in woods and forests in every part of England, where it is extensively planted.

THE GALL IS FORMED by the deposition of an ovum in the upper surface of the leaf causing a glabrous cone-shaped structure.

POSITION.—On any part of the leaf, but principally near the mid-rib.

MANNER OF GROWTH.—Gregarious ; glabrous.

COLOUR.—Green, then yellowish, and bright red at apex.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 4 mm. ; girth, 4 mm.

MAY BE SOUGHT during the months of July, August, and September.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the gall. The imago emerges during the spring.

As far as the author's observations have extended, these galls are never so numerous as those of *H. piligera*. They are, however, scattered over the leaf in the same manner and mostly near the mid-rib. The under surface of a leaf in the centre of the left-hand half of the illustration shows a number of slightly raised pimples indicating the presence of galls on the upper surface. At the approach of winter the galls fall off, the larvæ remaining within. They pupate in the following spring, and after a few days the imagines begin to emerge.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Fagus sylvatica* Linn.

GALLED BY

Hormomyia Fagi Hartig.

(TWO-THIRDS NAT. SIZE.)

HORMOMYIA MILLEFOLIUM Lw.

PLATE 97.

Galls caused by the larvæ of **Hormomyia millefolii** Lw.
on
the leaves of **Achillea millefolium** Linn.

PLATE 97.

SYNONYMY OF INSECT.

Cecidomyia achilleæ Incbald.

Hormomyia millefolii Theobald.

HABITAT OF THE COMMON YARROW.—One of the most plentiful of British wild plants, varying considerably in size according to situation. It grows on waste ground, meadows, hedge-banks, and roadsides.

THE GALL IS FORMED by the larva causing swellings on the pinnatifid segments of the leaf, and also on the mid-rib of the leaf.

MANNER OF GROWTH.—Gregarious; pedunculated; irregular in shape.

COLOUR.—Pale green, unrelieved by any colours.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (globular form).

Girth, 9 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is unilocular.

THE LARVA PUPATES in the ground. The imago emerges during spring.

In order more easily to discover these galls, the fingers should be drawn along the leaf while it is attached to the plant; the little swellings will then be more easily detected than if simply looked for, as their similarity of colour to that of the leaf makes them difficult to be seen quickly. They are very local, but usually very abundant where they occur. The natural size of the leaf in the centre of the illustration is $7\frac{1}{4}$ in. long, and it bears ninety galls.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Achillea millefolium* Linn.

GALLED BY

Hormomyia millefolii Lw.

(SIX-SEVENTHS NAT. SIZE.)

HORMOMYIA PILIGERA LW.

PLATE 98.

Galls caused by the larvæ of **Hormomyia piligera** Lw.
on
the leaves of **Fagus sylvatica** Linn.

PLATE 98.

SYNONYMY OF INSECT.

Hormomyia annulipes Hartig., Wtz.

„ *piligera* Theobald.

Cecidomyia piligera Mosley.

HABITAT OF THE COMMON BEECH.—A large and tall tree of majestic and noble proportions. Grows in woods and forests in every part of England, where it is extensively planted.

THE GALL IS FORMED by the deposition of an ovum in the upper surface of the leaf causing a pilose, cone-shaped structure.

POSITION.—On any part of the leaf, but principally near the mid-rib.

MANNER OF GROWTH.—Gregarious; pilose.

COLOUR.—Yellowish, deepening to orange, ultimately reddish brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 4 mm.; girth, 8 mm.

MAY BE SOUGHT during the months of July, August, and September.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the gall. The imago emerges during the spring.

In the lower part of the illustration the under surfaces of three leaves are shown, the slightly raised pimples indicating galls on the upper surfaces. Five leaves in the upper part of the illustration show young galls on their upper surfaces. At Battle, Sussex, on August 10th, 1900, the author gathered a very fine collection of galled leaves, two of which are worthy of note.

No. 1, 85 mm. long, 48 mm. at widest part, supported thirty-four separate galls.

No. 2, 97 mm. long, 60 mm. at widest part, supported forty-three separate galls.

The illustration is of specimens gathered at Eastbourne by the author.



LEAVES OF *Fagus sylvatica* Linn.

GALLED BY

Hormomyia piligera Lw.

(FOUR-FIFTHS NAT. SIZE.)

Galls caused by the fungus **Polycystis pompholygodes** Lév.

on

the leaf-stalks and leaves of **Ranunculus repens** Linn.

PLATE 99.

SYNONYMY OF FUNGUS.

Urocystis pompholygodes Lév.

POPULAR NAMES OF THE FUNGUS.

The Buttercup-smut Cooke.

The Crowfoot-smut Cooke.

HABITAT OF THE CREEPING RANUNCULUS.—This plant (often mistaken for the true buttercup) is, however, equally as plentiful in waste places, roadsides, meadows, and wet places all over Britain.

THE GALL IS FORMED by the rapid and enormous multiplication of the spores of the fungus within the tissues of the plant.

POSITION.—On the leaf-stalk and the leaf-segments.

MANNER OF GROWTH.—Singly or gregarious; separate or coalesced.

COLOUR.—Pale green, reddish; after the cuticle has ruptured, fuliginous.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 25 mm.; breadth, 10 mm.; girth, 15 mm.

MAY BE SOUGHT during the months of April to December.

THE GROWTH is complete by the end of September.

A favourite situation for *Ranunculus repens* is by the side of a country road or lane where the ground is very moist, or a little stream of water is running, and the foliage above protects the plant more or less from the sun. Such conditions are very favourable for the growth of the fungus, where at times it flourishes most vigorously, and it is remarkable how little the vigour of the plant is affected by it.

The gall is also figured by M. C. Cooke, "Rust, Smut, Mildew, and Mould," plate 9.

Polycystis pompholygodes.

Polycystis pompholygodes is one of the microscopic fungi known as a complex smut. These smuts attack various parts of many well-known plants, such as violets, anemones, crocuses, and buttercups. The principal parts affected are the leaf-stalks and the leaf-segments. It will be observed, by glancing at the plate opposite, that the fungus forms blotches at irregular intervals along the stalks and on both the upper and under surfaces of the leaves. The stalks are sometimes much distorted. In some examples the growth of the fungus is so vigorous as to cause the severance of the upper portion of the stalk, with the leaf attached, from the lower, which will then occasionally assume a spiral form, as shown at fig. 5. When first attacked, the plant becomes swollen as if a subcutaneous blister were forming, and a reddish brown tinge soon appears. This deepens in colour, and ultimately the cuticle of the plant bursts, with ragged edges, and a mass of fuliginous coloured powder is exposed. This powder consists of enormous numbers of minute spherical forms, the interior of which is divided into several cells containing a brownish endochrome.

The illustration is of specimens gathered at Hastings by the author.

FIG. 5.



Portion of a stalk twisted by the fungus.



PETIOLES OF *Ranunculus repens* Linn.

GALLED BY

Polycystis pompholygodes Lév.

(HALF NAT. SIZE.)

POLYCYSTIS VIOLÆ Bremi.

PLATE 100.

Galls caused by the fungus **Polycystis violæ** Brem
on
the leaf-stalks of **Viola canina** Linn.

PLATE 100.

SYNONYMY OF FUNGUS.

Urocystis violæ Br.

POPULAR NAME OF THE FUNGUS.

The Violet-smut Cooke.

HABITAT OF THE DOG-VIOLET.—Freely distributed throughout the whole of Britain in woods, thickets, by streams, on hedge-banks, and other open, dry, or sandy situations.

THE GALL IS FORMED by the rapid and enormous multiplication of the spores of the fungus within the tissues of the plant.

POSITION.—On the leaf-stalk.

MANNER OF GROWTH.—Singly, usually; seldom more than four on one stalk; glabrous, glossy.

COLOUR.—Green, reddish, purple.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 40 mm.; greatest girth, 18 mm.

MAY BE SOUGHT during the months of April, May, and June.

THE GROWTH is complete by the end of June.

These swellings are very similar to those on *Ranunculus repens*, but are more extensive and, in proportion to the thickness of the leaf-stalk, are much larger. In some specimens the leaf is dwarfed considerably in size; in others it is not materially affected, even though the mid-rib may be swollen as greatly as the stalk to which it is attached. During the growth of the fungus the swellings are hard. There are seldom more than four separate swellings on a leaf-stalk, the length of which is usually about 100 mm.

The gall is also figured by Cooke, "Rust, Smut, Mildew, and Mould," plate 9.

The illustration is of specimens gathered at Battle by the author.



LEAF-STALKS OF *Viola canina* Linn.

CALLED BY

Polycystis violæ Bremi.

(THREE-FOURTHS NAT. SIZE.)

Galls caused by the larvæ, nymphs, and imagines of
Aphis atriplicis Linn.

on

the leaves of **Atriplex angustifolia** Sm.

PLATE 101.

SYNONYMY OF INSECT.

Aphis chenopodii Schr., Kalt.

HABITAT OF THE ORACHE.—Abundant in Britain on the sea-coasts as well as inland, on waste places very near the sea. Springs up as a weed of cultivation almost everywhere.

THE GALL IS FORMED by the larvæ and nymphs puncturing the upper surface of the leaves, thereby causing the blades to thicken and roll upwards and inwards in the direction of their length until they meet.

COLOUR.—Pale green.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 40 mm.; girth, 18 mm.

MAY BE SOUGHT during the months of June, July, August, and September.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is multilarval and multinymphal.

ECDYSIS takes place in the gall. The imagines emerge during August.

Atriplex patula is attacked by *Aphis atriplicis* with as much frequency, and with the same swelling and curling of the leaves, as is the species now under consideration.

Although not a large plant, it is sturdy in growth, and having numerous leaves unfolded from early spring until late autumn, forms an excellent host for this aphid.

Aphis atriplicis.

These galls demand a special notice, in that they are (so far as the author is aware) unique, owing to the fact that they harbour the ova, larvæ, pupæ, the male, and the female imagines all at one and the same time.

In some places the galls are very plentiful. Repeated observations, during several seasons, have been made upon a large number of plants of *Atriplex angustifolia* and *A. patula* growing plentifully in one spot near Hastings. The severity with which they had been attacked is indicated by the fact that upwards of 40 per cent. of the leaves were galled. It is probable that in the autumn the imagines migrate to other plants on which to hibernate during the winter, and that before doing so the females deposit ova within the dying leaves of the orache. When detached by senile decay, these leaves are blown about to other spots; and although many larvæ hatch and perish from want of food, some remain undeveloped until the following spring. The larvæ are "coloured all shades, from green through olive to black." The pupæ are subject to considerable variation in size, and in colour are "black, marked with white patches." The imagines comprise apterous and winged viviparous females, and apterous, oviparous females, and also apterous males.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Atriplex angustifolia* Sm.

CALLED BY

Aphis atriplicis Linn.

(FOUR-FIFTHS NAT. SIZE.)

Galls caused by the queen and larvæ of **Brachycolus
stellaris** Hardy
on
the leaves of **Stellaria holostea** Linn.

PLATE 102.

SYNONYMY OF INSECT.

Aphis stellaris Hardy.

„ *holci* Hardy

HABITAT OF THE STITCHWORT.—Abundant all over Britain in hedges, open woods, and bushy places. Flowers during the spring and early summer.

THE GALL IS FORMED by the punctures of the queen and larvæ producing an accumulation of sap.

MANNER OF GROWTH.—The blade of the leaf is caused to curl upwards and inwards until the edges meet and form a pod.

COLOUR.—The outside of the pod is slightly paler than that of an unaffected leaf.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 24 mm.; girth, 10 mm.

MAY BE SOUGHT during the months of May, June, and July.

THE GROWTH is complete by the end of June.

THE TYPICAL CONDITION of the gall is multilarval.

ECDYSIS takes place in the gall. The imagines emerge during July.

These galls are inconspicuous. Much resembling the tufts of leaves drawn together by lepidopterous larvæ, they are probably often passed over as such. Buckton thus describes the imago: "Body long and narrow, yellow or black; with mealy coat with which it lines the surfaces of the tufts of leaves within which it conceals itself; legs slightly pubescent" ("British Aphides," vol. ii., p. 147).

Brachycolus stellariæ.

These insects invest both *Stellaria holostea* and *S. graminea*. In October the female lays minute black, oval-shaped eggs, from which hatch in the following spring numerous larvæ, which, by the perforations of their rostra, cause the rolling together of the edges of the long, narrow leaves, forming them into hollow pods. James Hardy, in "The North British Agriculturalist," part ii., p. 788, has thus described the species: "It is eminently social, and is not unworthy of the notice of the vegetable physiologist, from the parts of the plants in which it nestles undergoing a fantastic disarrangement. Its favourite plant is the stitchwort, *Stellaria holostea* and *S. graminea*, on which it is found within a hollow pod fabricated from the leaves, each side of the leaf being brought together above to form a canopy. It checks the growth of the shoot in such a manner that the leaves cluster into rigid tufts; vegetable irritation completes the structure. During the summer it migrates from the stitchwort to one of the grasses, *Holcus mollis*. There it likewise revels in the centre of a tuft of leaves, for these leaves, being prevented from receding, embrace each other at the bases like those of a sedge. In this manner a kind of boat is formed for the protection of the colony."

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Stellaria holostea* Linn.

GALLED BY

Brachycolus stellaris Hardy.

(TWO-THIRDS NAT. SIZE.) *



LIVIA JUNCORUM Latr.

PLATE 103.

Galls caused by the larvæ of **Livia juncorum** Latr.
on
the leaves of **Juncus articulatus** Linn.

PLATE 103.

SYNONYMY OF INSECT.

HABITAT OF THE JOINTED RUSH.—Grows in wet places abundantly all over Britain, on the margins of ponds, ditches, and marshes, also on the muddy or sandy parts of railway banks.

THE GALL IS FORMED by the leaves overlapping and enfolding one another, being caused to do so by the larva preventing the upward growth of the stem.

POSITION.—At the base of the stem near the ground among the surrounding grass.

MANNER OF GROWTH.—Like a tassel; two or three on one stem.

COLOUR.—Green; sometimes the leaves are suffused with red.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 80 mm.; breadth, 30 mm.; girth, 65 mm.

MAY BE SOUGHT during the months of July, August, September, and October.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is unilarval.

THE LARVA PUPATES in the gall. The imago emerges during —?

These galls usually affect a very obscure situation. Low down, very near the ground, and hidden by the surrounding herbage, they escape observation until carefully searched for. Very seldom do they appear level with or above the other portions of the plant. When the clusters of leaves are held with their tips pointing downwards, they resemble a tassel in appearance. These clusters of leaves vary in number from three to eight on a single stem, and some clusters consist of from sixty to seventy leaves.

The illustration is of specimens gathered at Guestling, near Hastings, by the author.



LEAVES OF *Juncus articulatus* Linn.

GALLED BY

Livia juncorum Latr.

(FOUR-FIFTHS NAT. SIZE.)

Galls caused by the queen and nymphs of **Pemphigus bursarius** Koch.

on

the petioles of leaves of **Populus nigra** Linn.

PLATE 104.

SYNONYMY OF INSECT.

Aphis bursaria Linn., Fab., Sch., Kirby and Spence.

Eriosoma populi Rennie, Mosley.

Aphioides bursaria Rondani.

Pemphigus bursarius Kalt., Htg., Pass., Kerner.

HABITAT OF THE BLACK POPLAR.—Common in most parts of Britain in woods, gardens, and parks, along the banks of rivers and streams and other moist places.

THE GALL IS FORMED by the queen aphis puncturing the petiole of the leaf; the edges of the swelling thus caused arise and surround her.

POSITION.—On the petiole of the leaf; occasionally on the mid-rib.

MANNER OF GROWTH.—Singly; pear-shaped or oval purse-like swellings.

COLOUR.—Same tint of green as the petiole, frequently suffused with pink.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 15 mm.; breadth, 10 mm.; girth, 30 mm.

MAY BE SOUGHT during the months of July, August, September.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is multinymphal.

ECDYSIS takes place in the gall. The imagines emerge during August.

The gall is also figured by J. Rennie, "Insect Architecture," 1845, vol. ii., p. 135; Buckton, "British Aphides," vol. iii., plate 3, p. 113; A. Kerner, "Nat. Hist. of Plants," vol. ii., p. 534.

Pemphigus bursarius.

In almost every part of England these galls are plentiful. Some branches of the poplar have 25 per cent. of the leaves attacked; and where imagines have remained undisturbed for several years, the galls are exceedingly numerous. Their multiplicity does not appear to retard either the growth of the twig or that of the leaf. They are not difficult to obtain, since they occur near the ground with as much frequency as on the uppermost branches. They may also be found on the Lombardy poplar (*Populus fastigiata*), a cultivated variety. The growth of this gall is very similar to that caused by *Tetraneura ulmi*. In this case, however, the queen pricks the cuticle of the petiole (and occasionally the mid-rib), and not the blade of the leaf; the sap, exuding from the punctures, steadily increases in bulk until she is surrounded, and finally enclosed, with exception of a very narrow opening at the apex of the gall. This material forms a thick, fleshy wall of substance, intermediate in texture between the wood and the leaf, which under magnification will be seen to have a well-defined cellular structure. The shape of the galls is variable. Mostly they are pyriform, and truncated cone-shape; some are elongated into an obtuse beak, while others are subject to considerable genuflexion. Within the cavity the queen brings forth a numerous brood of nymphs, which with their rostra draw nourishment from the inner walls. When arrived at the winged state, they make their exit through the opening previously mentioned.

The speckled appearance of the leaves is due to "honey-dew," exuviae, and puparia. In the lower right-hand corner of the illustration a very large twin gall may be seen; and in the left-hand corner two galls in section, the larger one being filled with nymphs, the smaller one representing the gall after the nymphs had been removed.

The illustration is of specimens gathered at Hastings by the author.



PETIOLES OF LEAVES OF *Populus nigra* Linn.

GALLED BY

Pemphigus bursarius Koch.

(TWO-THIRDS NAT. SIZE.)

Galls caused by the queen and nymphs of **Pemphigus
spirothecæ** Koch.

on

the petioles of leaves of **Populus nigra** Linn.

PLATE 105.

SYNONYMY OF INSECT.

Pemphigus affinis Koch.

„ *spirothecæ* Pass., Kerner.

Puceon de peuplier Réaumur.

HABITAT OF THE BLACK POPLAR.—Common in most parts of Britain in woods, gardens, and parks, along the banks of rivers and streams and other moist places.

THE GALL IS FORMED by the queen aphid puncturing the petiole of the leaf, causing it to assume a spiral form, within the cavity of which she becomes immured.

POSITION.—On the petiole of the leaf.

MANNER OF GROWTH.—Singly; glabrous; spiral and multiniform in shape.

COLOUR.—Slightly darker green than other portion of the petiole.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 8 mm.; girth, 30 mm.

MAY BE SOUGHT during the months of June, July, August, and September.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is multinymphal.

ECDYSIS takes place in the gall. The imagines emerge during August.

Pemphigus spirothecæ appears to be very local and exclusive in its habits. Among several poplars near each other, one only may be attacked, the others showing no signs of gall-growths.

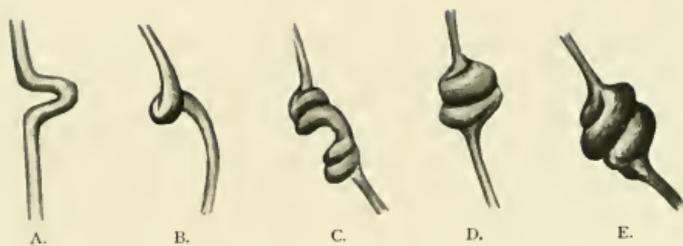
The gall is also figured by Buckton, "British Aphides," vol. iii., plate 112; A. Kerner, "Nat. Hist. of Plants," vol. ii., p. 531.

Pemphigus spirothecæ.

These galls were at one time thought to be but a variety of those caused by *Pemphigus bursarius*. Cameron, however, has by a comparison of the females shown that they are caused by a different species of *Pemphigus*. The hybernation of the foundress is passed in the ground, whence, at the return of spring, she emerges. She then proceeds to puncture with her rostrum either of the flattened sides of the petiole for the purpose of obtaining nourishment. This treatment causes the petiole to bulge in a direction away from her attacks, and at the same time it broadens. Very soon it begins to curve in a spiral manner; this continues until the edges are closely attached, but they do not anastomose. For a time this spiral formation is moderately elastic, and with care may be opened or even partially unrolled. When near maturity and the emersion of the imagines it will yield to the strain and separate. The shape of a mature specimen of this gall is less variable than that of the preceding species, and so distinct is it in all stages of its development that it is not possible to be mistaken.

The illustration is of specimens gathered at Hastings by the author.

FIG. 6.



Five stages in the spiral formation of a petiole.



PETIOLES OF LEAVES OF *Populus nigra* Linn.

GALLED BY

Pemphigus spirotheca Koch.

(FOUR-FIFTHS NAT. SIZE.)

RHOPALOSIPHUM RIBIS Linn.

PLATE 106.

Galls caused by the queen and nymphs of **Rhopalosiphum ribis** Linn.

on

the leaves of **Ribes nigrum** Linn.

PLATE 106.

SYNONYMY OF INSECT.

Myzus ribis Kerner.

Aphis ribis Linn., Schr., Kalt., Walk.

Rhopalosiphum ribis Koch., Pass.

HABITAT OF THE BLACK CURRANT.—Cultivated in gardens and orchards throughout the whole of Britain. Bentham, in "British Flora," p. 164, says: "If anywhere wild, it is in the Lake District and Yorkshire."

THE GALL IS FORMED by the nymphs puncturing the underside of the leaf and feeding upon the sap.

POSITION.—On the upper surface of the leaf.

MANNER OF GROWTH.—Convexo-concave blisters all over the leaf.

COLOUR.—Yellowish green, orange-yellow, red, brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 5 mm.; length, 10 mm.; breadth, 7 mm.

MAY BE SOUGHT during the months of May to October.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is multinymphal.

ECDYSIS takes place in the gall. The imagines emerge during July.

The leaves of the red currant, *Ribes rubrum* Linn., are attacked and galled in the same manner. This is caused by an aphid, which, without the aid of a lens, appears to be of the same species as above-mentioned. The markings and coloration, however, are somewhat different, and the name of *Myzus ribis* Pass., has been given to it.

The gall is also figured by Rennie, "Insect Architecture," vol. ii., p. 137; Kerner, "Nat. Hist. of Plants," vol. ii., p. 531.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Ribes nigrum* Linn.

GALLED BY

Rhopalosiphum ribis Linn.

(TWO-THIRDS NAT. SIZE.)

Galls caused by the queen, larvæ, and nymphs of
Schizoneura ulmi Linn.
on
the leaves of **Ulmus montana** Sm.

PLATE 107.

SYNONYMY OF INSECT.

Aphis foliorum De Geer.

Schizoneura ulmi Kalt., Kotch., Pass., Riley, Thomas,
Kerner, Buckton.

HABITAT OF THE SCOTCH, OR WYCH, ELM.—In parks, plantations, avenues, and gardens generally throughout Britain.

THE GALL IS FORMED by the leaf being rolled, blistered, and thickened by the aphides, which live within the roll and draw nourishment therefrom.

POSITION.—On either half of the leaf.

MANNER OF GROWTH.—Very rarely more than one roll on a leaf.

COLOUR.—Green, yellowish green, pale ashy grey.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 50 mm. ; greatest diameter of roll, 13 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is multilarval and multinymphal.

ECDYSIS takes place within the gall. The imagines emerge during July and August.

Considering how great is the deformity of the galled half of the leaf, it is remarkable that the unaffected half should be so vigorous in its development, which is almost normal. The affected leaves occur on the lowest branches as well as at the summit of the tree.

The gall is also figured by Buckton, "British Aphides," vol. iii., plate 108 ; A. Kerner, "Nat. Hist. of Plants," vol. ii., p. 533.

Schizoneura ulmi.

These rolled, distorted, and swollen leaves are due to the combined attacks of the queen, the larvæ she gives birth to, and the nymphs resulting therefrom. Emerging from an egg laid in the bark of the tree in the previous autumn, or from the dead body of her mother in which the egg had remained during the winter, the foundress of the colony attacks the underside of a leaf soon after it has unfolded, and by puncturing and sucking the sap causes it to blister outwards and form numerous cavities, which are partially divided from each other by the lateral veins. The affected half of the blade of the leaf curls downwards and under, forming an uneven but gracefully shaped roll. The exterior turns from green to pale green, later on to a yellowish green, and finally to a pale ashy grey. Within the distorted portion of the leaf the queen gives birth to a large number of young, enveloped within a semi-transparent membrane, which, however, is soon cast off, and for a brief time they are like larvæ. Changing ultimately into nymphs, they finally emerge as alate imagines, which fly to other leaves and start new colonies. Four other generations are necessary with this species before reverting to the queen aphis. Elm leaves may occasionally be found where the blade has rolled upwards and along the upper surface. They appear to be the work of the same species. The interior of the roll is usually filled with flocculent matter, the exuvizæ of the larvæ, and the puparia of the nymphs, and also minute globular, yellowish drops of moisture.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Ulmus montana* Sm.

GALLED BY

Schizoneura ulmi Linn.

(FOUR-FIFTHS NAT. SIZE.)

To face page 246.

Galls caused by the queen and nymphs of **Tetraneura
ulmi** De Geer.

on

the leaves of **Ulmus campestris** Sm.

PLATE 108.

SYNONYMY OF INSECT.

Aphis gallarum ulmi De Geer, Geoff., Von Gleichen.

Tetraneura ulmi Htg., Kalt., Koch., Pass., Buckton.

HABITAT OF THE COMMON ELM.—Widely spread throughout Britain in parks, gardens, fields, and in hedgerows.

THE GALL IS FORMED by the accumulation of sap caused by punctures made in the leaf by the queen and nymphs.

POSITION.—On the mid-rib and any part of the upper surface of the leaf.

MANNER OF GROWTH.—Pedunculated ; solitary ; glabrous ; perpendicular.

COLOUR.—Pale green at base, darker in middle, suffused with crimson at apex.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 12 mm. ; breadth, 7 mm. ; girth, 18 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is multinymphal.

ECDYSIS takes place within the gall. The imagines emerge during July and August.

The gall is also figured by Buckton, "British Aphides," vol. iii., plate 114 ; Kerner, "Nat. Hist. of Plants," vol. ii., p. 533.

Tetraneura ulmi.

These galls grow on the upper surface only of the leaves of the elm. As soon as the leaves unfold in the spring, the apterous viviparous females begin their attacks. They are the foundresses of the colonies. In consequence of the irritation they thus produce on the tissues of the leaf, there arises around them exudation of sap, which, upon exposure to the air, hardens, and is gradually increased in height until finally the queen aphid is not only surrounded but completely enclosed. The gall-structure has by then risen to a considerable height above the plane of the leaf. Not only is the mid-rib thus attacked, but the blade of the leaf is equally affected. The structure thus formed is always pedunculated, although some examples do not readily show it. Some have two peduncles; others have two cavities growing from one base. The structure is closed in on all sides, there being merely a small opening at the apex. The walls of the cell thus formed are thick, and the queen within procures all her nourishment by sucking the sap through her rostrum. Ecdysis occurs, usually about four times, and then she commences to reproduce her young, to the number of thirty to forty, which in time issue forth as alate females, beginning during June and continuing intermittently through the summer. Some trees are heavily loaded with thousands of these galls; their size also is considerably affected by the vigour of the growth of the trees.

In the extreme lower right-hand corner of the illustration on opposite page a portion of a leaf may be seen in which the basal part of the mid-rib is swollen, forming a bursiform growth and bending the leaf at right angles. This is caused by *Tetraneura alba*. It is figured by Kerner, vol. ii., p. 533.

The illustration is of specimens gathered at Midhurst, Kent, by Mr. R. R. Hutchinson.



LEAVES OF *Ulmus campestris* Sm.

GALLED BY

Tetraneura ulmi De Geer.

(THREE-FOURTHS NAT. SIZE.)

Galls caused by the larvæ of **Aulax glechomæ** Htg.
on
the petioles of leaves of **Glechoma hederacea** Linn

PLATE 109.

SYNONYMY OF INSECT.

Diastrophus glechomæ Schen.

Liposthenus glechomæ Foer.

Aulax glechomæ Mayr, Htg, Cameron, Thoms., Fitch.

HABITAT OF THE GROUND-IVY.—This creeping plant is very abundant in Britain, growing in waste places and on banks; but its more favourite situations are the margins of woods and under hedges.

THE GALL IS FORMED by a rapid accumulation of vegetable tissue resulting from puncture made during oviposition by the parent insect.

POSITION.—On the stem, the petiole, and also the leaf.

MANNER OF GROWTH.—Usually singly; specimens, however, are not uncommon where two or three coalesce.

COLOUR.—Green, and green tinged with pink and red. Covered with long white hairs.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 10 mm.; girth, 30 mm.

MAY BE SOUGHT during the months of June, July, August, and September.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the gall. The imago emerges during May.

PARASITES.—*Torymus splendens*, *T. glechomæ* Foer., *T. singulatus* Nees., *Eupelmus brachypterus* Gir., *Eurytoma rufipes* Brisc.

In no situation do the galls grow more luxuriantly than amongst the grass and other herbage on the banks of lanes and country roads. See also plate 75.

The gall is also figured by Peter Cameron, "British Phytophagous Hymenoptera" (Ray Society), vol. iv., plate 10.

Aulax glechomæ.

These galls occur on almost every part of the plant. The month of June is not too early to seek them; the following month, however, is productive of more plentiful results. They vary from the size of a small pea to that of an ordinary marble. They are usually globular, occasionally pyriform in shape. Frequently two or more will coalesce and form a much larger and more irregularly-shaped swelling. The larval chamber is in the centre, surrounded by the sponge-like substance of the gall-structure. At first the galls are solid, but soft and succulent, and they remain in a sappy condition until October. The nature of the exterior then begins to change. The outer shell hardens and thickens, the inner substance dries, and from it is evolved a number of sustaining processes, which, radiating from the inner walls of the shell, meet around the larval cell, and support it in a central position. In this condition they may be kept without difficulty through the winter; the imagines emerge during May. The colour is at first green, and in sheltered positions remains so, but where exposed, the galls become tinged with pink and red. They are thickly beset with long whitish hairs, which add considerably to their attractiveness. Towards the autumn these disappear and leave the exterior glabrous. According to Réaumur, the galls of this species were at one time eaten by French peasants.

The illustration is of specimens gathered at Hastings by the author.



PETIOLES OF LEAVES OF *Glechoma hederacea* Linn.

GALLED BY

Aulax glechomæ Htg.

(THREE-FOURTHS NAT. SIZE.)

Galls caused by the larvæ of **Nematus bellus** Lad.

on

the leaves of **Salix caprea** Linn.

PLATE 110.

SYNONYMY OF INSECT.

Nematus pedunculi Cam., Kerner.

„ *viminalis* Br. and Lad.

HABITAT OF THE SALLOW OR GOAT-WILLOW.—Very common throughout Britain by the sides of streams, marshy places, damp open woods, and in thickets and hedges.

THE GALL IS FORMED by the action of the larva upon the tissues of the leaf.

POSITION.—On the under surface of the leaf.

MANNER OF GROWTH.—Singly and glabrous, sometimes coalescent; pubescent.

COLOUR.—Greenish yellow, with small red or reddish brown spots.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN (globular form).

Height, 6 mm.; girth, 18 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES away from the gall. The imago emerges during the spring.

The shape of these galls is variable, some being globular, some pyriform, and others conical. They are always firmly attached by the base to the under surface of the leaf, and are mostly close to or upon the mid-rib. On the upper surface of the leaf is a semicircular depression, the elevated margins of which are usually dull brown in colour.

The gall is also figured by Cameron, "British Phytophagous Hymenoptera," vol. i., plate v.; Kerner, "Nat. Hist. of Plants," vol. ii., p. 531.

Nematus bellus.

These hairy pea-shaped galls, which are firmly attached to the undersides of the leaves of *Salix caprea*, are so like those caused by *Nematus salicis-cinereæ* on the smooth leaves of some other willows that it is open to doubt whether both are not produced by the same species of saw-fly. Cameron says ("British Phytophagous Hymenoptera," vol. ii, p. 201): "An examination of long series of both shows that they approximate very closely in all respects, both showing considerable variation in colour and size; there does not seem either to be any tangible difference in the structure of the saws, and I am equally unable to point out any difference between their larvæ. There is no difference in the form of the galls, for although the gall of *bellus* is usually more irregular in shape than that of *salicis-cinereæ*, still, the galls of the latter vary also. The fact of the *bellus* galls being hairy is clearly owing to the willow leaves being hairy." The shape of these galls varies. They are mostly globular, but some assume an ovoid shape. When two coalesce, the outline becomes irregularly oval. The interior is smooth and devoid of hairs. The walls are thin but tough. The frass is retained within the gall. They occur singly and in twos and threes; the presence of five, as shown on one leaf in the illustration, is very unusual. The colour is greenish yellow, with a few purple spots upon small projections; the outer surface is thickly clothed with long greyish hairs. The larva can walk well and rapidly upon a level surface. When fully fed it eats its way out, and soon after the deserted structure shrivels and turns a chocolate-brown.

The illustration is of specimens gathered at Hastings by the author.



LEAVES (UNDER SURFACES) OF *Salix caprea* Linn.

GALLED BY

Nematus bellus Lad.

(NEARLY NAT. SIZE.)

Galls caused by the larvæ of *Nematus gallicola* Steph.
on
the leaves of *Salix fragilis* Linn.

PLATE 111.

SYNONYMY OF INSECT.

Cynips caprea Linn.

Nematus gallicola Cam., André.

" *vallisneri* Htg., Thoms., Müller., Br. and Lad.

Pontania vallisneri Costa, Swam, Réau., Roes., Ratz.

HABITAT OF THE CRACK-WILLOW.—This willow is widely distributed over Britain, preferring damp places, by the sides of streams and marshes; it will also grow in woods and hedges.

THE GALL IS FORMED by the accumulation of sap around the ovum during the development of the leaf.

POSITION.—Along the edges and either side of the mid-rib, but not on it.

MANNER OF GROWTH.—Equal proportions on either surface of the leaf.

COLOUR.—At first green, later deep red above, green or pink beneath.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 12 mm.; breadth, 6 mm.; thickness, 8 mm.

MAY BE SOUGHT during the months of May to October.

THE GROWTH is complete by the end of July (first brood).

THE TYPICAL CONDITION of the gall is unilocular.

THE LARVA PUPATES in the earth. The first brood emerge during May, the second during August and September.

These galls appear to be common everywhere that *Salix fragilis* occurs, and oftentimes is excessively abundant locally. They are popularly known as "Horse-bean galls," because of the shape and resemblance.

The gall is also figured by Cameron, "British Phytophagous Hymenoptera," vol. i., plate 3; Mosley, "Naturalist's Journal," April, 1898.

Nematus gallicola.

The species of saw-fly which causes these galls on the leaves of various willows is double-brooded. The willows it principally attacks are *S. alba*, *S. caprea*, *S. cinerea*, and *S. fragilis*; more frequently on the last named than on any other. It is the most plentiful of all the willow galls. During April or May the parent insect oviposits in the leaf-buds, and as the leaves unfold the gall-structure develops. For several weeks it is solid, containing the ovum in a small cavity in or near the centre; ultimately the larva hatches and feeds upon the store of material, thus producing and maintaining an ample amount of space around itself, until the walls of the cell are reduced to a minimum of thickness. In the meantime a small hole has been eaten at one end of the gall, with the opening on the underside of the leaf, through which the frass is ejected. The swelling is equal in proportion on both surfaces of the leaf, and is situated indiscriminately along the margins and either side of the mid-rib, but never upon it. At first the colour is pale green, afterwards becoming suffused with red or purple. The surface of the upper portion is glabrous, irregularly wrinkled; the other portion may be glabrous or pilose, pale or dark green, coloured or not, all varying much according to the species of *Salix*. In shape they resemble a bean, and hence their popular name of "bean gall." They vary in number, as many as fifteen being found on a single leaf. The imagines of those which have passed the larval stage during the summer lay eggs on leaves in the early autumn, thus giving rise to the second brood, which pass the winter within the gall.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Salix fragilis* Linn.

GALLED BY

Nematus gallicola Steph.

(THREE-FOURTHS NAT. SIZE.)

Galls caused by the larvæ of *Rhodites eglanteriæ* Htg.
on
the leaves of *Rosa canina* Linn.

PLATE 112.

SYNONYMY OF INSECT.

Hololexis eglanteriæ Foer.

Rhodites eglanteriæ Schenck, Mayr, Taschen., Thoms.,
Fitch, Cameron.

HABITAT OF THE DOG-ROSE.—This is the commonest rose in Britain, and grows rapidly and luxuriantly in hedges, thickets, and various dry places in all parts of the country.

THE GALL IS FORMED by an enormous accumulation of sap drawn from the leaf, which passes through the slender pedicle with very great rapidity.

POSITION.—On the upper as well as the lower surfaces of the leaf, on the petioles, and occasionally on the stem.

MANNER OF GROWTH.—Globular; singly; glabrous; never united, although the swellings may be very close together.

COLOUR—Pale green, suffused with pink or red.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Girth, 15 mm.

MAY BE SOUGHT during the months of July, August, September, and October.

THE GROWTH is complete by the end of September.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the gall. The imago emerges during the following spring.

INQUILINE.—*Periclistus caninæ* Cam.

PARASITES.—*Hemiteles imbecilus* Gr., *Torymus difficilis* Nees.,
T. congener Foer., *Oligostenus stigma* Fab., *Eulophus inunctus* Nees.

The gall is also figured by Peter Cameron, "British Phytophagous Hymenoptera" (Ray Society), vol. iv., plate 11.

Rhodites eglanteriæ.

It is remarkable how these galls elude notice until a careful search is made among the wild rose-bushes. One of the best and quickest ways of finding them is to stoop down and look from below upwards among the stems and leaves. On some leaves they are very numerous. The author found on one occasion a twig of *Rosa canina* having upon it three leaves growing close together. One leaf supported four galls, another seven, and the third fifteen, making a total of twenty-six galls on twenty-one leaflets. All the galls were on the underside of the leaflets. It appears from observations made of a large number of leaves, that the styles do not bear galls. The galls grow from all parts of the leaf, including the main stalk. The stems also are occasionally attacked by the parent insect, when a growth similar in all respects to those on the leaf is produced. The galls are of a more or less globular shape, and mostly of a smooth surface which is sometimes marked with slight depressions and sometimes with small tubercles. They have the appearance of being firmly attached, but this is apparent only. A delicate and easily disrupted pedicle forms the connecting point, which is so slight as not to be observable while the gall is on the leaf, nor is the point of attachment visible on the upper side of the leaflet.

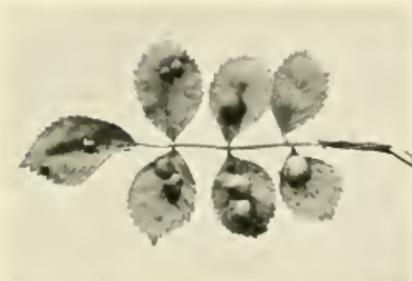
The illustrations are of specimens gathered at Hastings by the author.

FIG. 7.

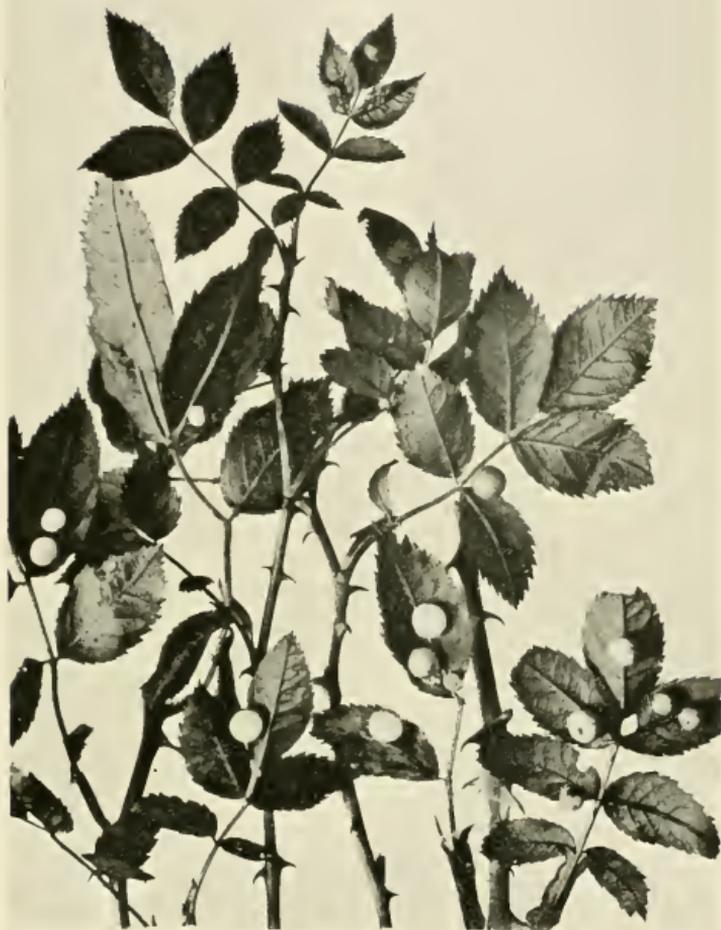


Galls on stem and edge of leaflet.
(Three-fourths nat. size)

FIG. 8.



Thirteen galls on seven leaflets.
(Three-fourths nat. size.)



LEAVES OF *Rosa canina* Linn.

GALLED BY

Rhodites eglanteriae Htg.

(FOUR-FIFTHS NAT. SIZE.)

Galls caused by the larvæ of **Rhodites nervosus** Cam.
on
the leaves of **Rosa canina** Linn.

PLATE 113.

SYNONYMY OF INSECT.

Rhodilus nervosus Curtis, Marshall.

Rhodites rosarum Giraud, Schen., Tasch., Gallen, Fitch,
Cameron.

HABITAT OF THE DOG-ROSE.—This is the commonest rose in Britain, and grows rapidly and luxuriantly in hedges, thickets, and various dry places in all parts of the country.

THE GALL IS FORMED by an enormous accumulation of sap, drawn from the leaf, which passes through the slender pedicle with very great rapidity.

POSITION.—On the under surface of the leaf.

MANNER OF GROWTH.—Glabrous; more or less globular; with stout sharp-pointed spines radiating from the surface.

COLOUR.—Pale green, spotted or suffused with red, turning to dull brown when mature.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Girth, 18 mm.

MAY BE SOUGHT during the months of July to October.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the gall. The imago emerges during the following spring.

INQUILINE.—*Periclistus caninæ* Cam.

PARASITES.—*Torymus macropterus*, *Pteromalus eminens* Foer.,
P. inflexus Foer., *Tetrastichus obtusatus* Gir.

The gall is also figured by Peter Cameron, "British Phytophagous Hymenoptera" (Ray Society), vol. iv., plate 11.

Rhodites nervosus.

This very interesting gall is one which, although by no means uncommon, is not so very frequently seen by the casual observer of the hedgerows. Like *R. eglanteriæ*, it grows with much greater frequency on the under surface of the leaflet than on the upper surface, remaining hidden until searched for; or the leaf is on a twig at a level somewhat above a person's head. But a careful search and turning over of the stems of a rose-bush in a hedge will usually reveal a few of these galls. As regards size, they are a little larger than those of the preceding species, and can be distinguished from them by the peculiar thorn-like projections which grow upon the surface, but cannot be detached, as a thorn may be, from a stem. These thorns, or spines, vary in numbers from two to seven, and are usually as many millimetres long as the gall is in diameter. The galls are more frequently attached to the mid-vein of the leaflet than to any other portion. They are found in such a variety of situations as those of *R. eglanteriæ*. The leaflets are neither deformed nor stunted in growth by the presence of the galls, however numerous. The point of attachment is not visible on the upper surface of the leaflet. The interior is very roomy, the larva or pupa having plenty of space surrounding it. The wall, or shell, of the cell is seldom more than 1 mm. thick. When the galls of this as also those of the former species are attacked by the inquiline *Periclistus caninæ*, the interior is divided into several compartments.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Rosa canina* Linn.

GALLED BY

Rhodites nervosus Cam.

(FOUR-FIFTHS NAT. SIZE.)

Galls caused by the larvæ of **Rhodites rosæ** Htg.
on
the leaves of **Rosa canina** Linn.

PLATE 114.

SYNONYMY OF INSECT.

Cynips rosæ Linn., Rennie.

Diplolepis bedeguaris Geof.

Rhodites rosæ Schen., Marshall, Mayr, Fitch, Cameron.

HABITAT OF THE DOG-ROSE.—This is the commonest rose in Britain, and grows rapidly and luxuriantly in hedges, thickets, and various dry places in all parts of the country.

THE GALL IS FORMED by ova being deposited in a leaf-bud, each ovum becoming surrounded with layers of sap.

POSITION.—On the leaf.

MANNER OF GROWTH.—Conglomerated; sessile; globular; covered with moss-like hairs.

COLOUR.—Greenish, pink, or crimson.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Diameter, 35 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 30.

THE LARVÆ PUPATE in the gall. The imagines emerge during June.

INQUILINES.—*Periclistus brandtii* Htg., *Synergus ruficornis* Htg.

PARASITES.—*Porizon harpurus* Gr., *Hemiteles luteolator*, *Torymus longicaudis* Ratz., *T. bedeguaris* L., *T. rosarum* Gir.

The gall is also figured in "The Royal Natural History," section xi., p. 21; by Peter Camcron, "British Phytophagous Hymenoptera" (Ray Society), vol. iv., plate 10; Robert Brown, "Our Earth and its Story," vol. iii., p. 63; Rev. J. G. Wood, "Homes without Hands," 1892, p. 482; J. Rennie, "Insect Architecture," 1845, vol. ii., p. 119; and in various other publications.

Rhodites rosæ.

This insect, by its oviposition in the leaf-buds, causes the tufts of reddish, moss-like growths so familiar on most wild rose-bushes. These galls are popularly known as "Robin's pin-cushion," "Moss galls," "Bedeguar galls," etc. They appear to grow from a twig or stem, but this is apparent only. They originate from a leaf. Upon reference to the stem on the right-hand side of the illustration, three young growths will be noticed which distinctly show their leaf origin. The accumulated larva cells form a woody mass, firmly attached in a sessile manner to the stem, sometimes on a terminal position. The number of the cells varies very much. Some clusters consist of three, others of forty-five. Thirty is about the average number. They are also of different sizes, the average dimensions being about those of an ordinary pea. They are all more or less firmly fused together; some, however, require very slight pressure to remove them, while others cannot be parted without detaching portions of those surrounding. The thickness of the cell-wall is also subject to considerable variation, dependent mostly on the size of the cell. The large ones may be easily crumbled between finger and thumb; the smallest resist great pressure. The conglomeration of cells is entirely concealed beneath a dense covering of long, many-branched fibres, which grow from the surface of the cells, and give to the structure a more or less globular contour. They may attain a length of 35 mm., having ninety-five branches. Their colour is greenish, pinkish, or crimson.

The illustration is of specimens gathered at Hastings by the author.

FIG. 9.



A. THE CELLS.
(Denuded of Fibres.)



B. A FIBRE.
(Enlarged.)



Ventral.



Profile.

C. THE LARVA. 54.



LEAVES OF *Rosa canina* Linn.

GALLED BY

Rhodites rosæ Htg.

(TWO-THIRDS NAT. SIZE.)

RHODITES ROSÆ Htg.

PLATE 115.

PLATE 115.

A leaf of **Rosa canina** Linn.

(Three-fourths nat. size.)

Galled by

Rhodites rosæ Htg.

The specimen illustrated on the opposite page is the average size of mature growth. It clearly shows the manner in which a leaf is almost entirely absorbed in the formation of the cells and the fibres which surround them. The purpose of these fibres is unknown. As a protection against parasites they are of no use; seven species at least are known to attack these galls, while other small creatures, principally lepidopterous, pupate amongst them. The fibres show well-defined vegetable structure, and have the power of throwing out branchlets; this being the case, they are considered to represent leaves which have been developed with scarcely any parenchyma between their fibro-vascular bundles.

The illustration is of specimens gathered at Guestling, near Hastings, by the author.



A LEAF OF *Rosa canina* Linn.

GALLED BY

Rhodites rose Htg.

(THREE-FOURTHS NAT. SIZE.)

RHODITES RUBIGINOSÆ.

PLATE 116.

Galls caused by the larvæ of *Rhodites rubiginosæ*
on
the leaves of *Rosa rubiginosa* Linn.

PLATE 116.

HABITAT OF THE SWEET-BRIAR.—This plant is not often met with in its wild state. It is rare in all parts of Britain, except the southern and eastern counties of England, where, however, it grows but sparsely in hedges and thickets. Under cultivation it is found in gardens and parks rather plentifully.

THE GALL IS FORMED by ova being deposited in a leaf-bud, each ovum becoming surrounded with layers of sap.

POSITION.—On the leaf.

MANNER OF GROWTH.—Solitary; sessile; globular; covered with moss-like hairs.

COLOUR.—Greenish, pink, or crimson.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Diameter, 25 mm.

MAY BE SOUGHT during any month in the year.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 20.

THE LARVÆ PUPATE in the gall. The imagines emerge during the spring.

These galls are very uncommon, and in some districts quite unknown. The author has seen them only twice during the course of several years of gall-hunting. They closely resemble the bedeguar of *Rosa canina*, but are smaller and more fragile. The fibres are more slender and more branched, but show no difference in arrangement and structure. The larval chambers are quite as hard and as numerous as those of *R. roseæ*.

The illustration is of specimens gathered at Hastings by the author.



LEAVES OF *Rosa rubiginosa* Linn.

CALLED BY

Rhodites rubiginosa.

(FOUR-FIFTHS NAT. SIZE.)

PLATE 117.

LASIOPTERA RUBI Schrk.

DIPLOSIIS TREMULÆ Wtz.

PLATE 117.

A. Stem and leaf of **Rubus fruticosus** Linn.

(Nearly nat. size.)

Galled by

Lasioptera rubi Schrk.

A fine specimen, with a large gall on the stem and two small galls on the petiole. See also plate 31.

B. Twig of **Populus tremula** Linn.

(Two-thirds nat. size.)

With petioles galled by

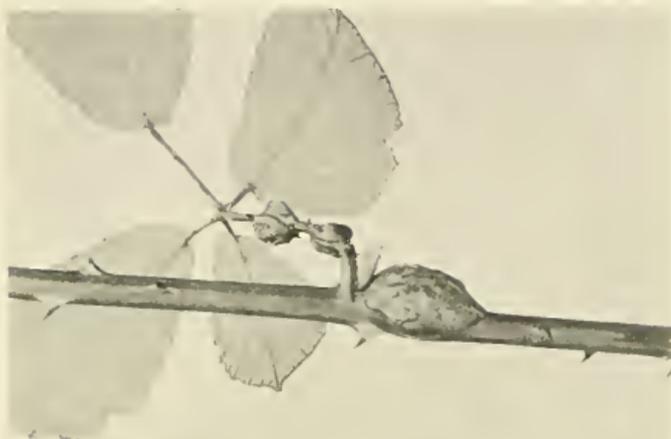
Diploisis tremulæ Wtz.

A very fine specimen, illustrating the globular form of growth. Sixteen galls on eleven petioles; two petioles with three galls on each. See also plate 94.

The illustrations are of specimens gathered at Hastings by the author.

A.

PLATE 117.



B.

A. STEM AND LEAF OF *Rubus fruticosus* Linn.

(NEARLY NAT. SIZE.)

B. LEAVES OF *Populus tremula* Linn.

(TWO-THIRDS NAT. SIZE.)

THE FLOWER-GALLS.

The Flower-galls are those situated upon or within or enclosed by the Calyx, the Corolla, the Catkin, or the subsequent Fruit or Seed.

ERIOPHYES AJUGÆ Nal.

PLATE 118.

Galls caused by the larvæ, nymphs, and imagines of
Eriophyes ajugæ Nal.

on

the flower-heads of **Ajuga reptans** Linn.

PLATE 118.

SYNONYMY OF MITE.

Phytoptus ajugæ Nal.

HABITAT OF THE CREEPING BUGLE.—Abundant all over Britain on pastures, in woods, near streams, and among the grass beneath the fronds of *Pteris aquilina*.

POSITION OF THE GALLS.—On the flower-heads.

MANNER OF GROWTH.—Each affected sessile leaf is covered with pubescence.

COLOUR.—Greenish or yellowish, tinged and striped with purple.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 4 mm. ; girth, 5 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

The mites cause the uppermost ten or twelve leaves on the flowering stem to curve upwards and towards the stem, until the margins of each opposite leaf meet. By this means the young flowers, which are situated in the axils of the leaves, are enclosed and prevented from further development. The interior and exterior of the cluster thus formed becomes very pubescent, and ultimately a woolly looking mass is formed, within which the mites swarm in hundreds. The radical leaves of the plant are also galled by the same species ; these are illustrated on plate 45.

The illustration is of specimens gathered at Hastings by the author.



FLOWER-HEADS OF *Ajuga reptans* Linn.

GALLED BY

Eriophyes ajuge Nal.

(NEARLY NAT. SIZE.)

ASPHONDYLIA PIMPERNELLÆ F.

PLATE 119.

Galls caused by the larvæ of **Asphondylia**
pimpernellæ F.

on

the flower-heads of **Daucus carota** Linn.

PLATE 119.

SYNONYMY OF INSECT.

HABITAT OF DAUCUS CAROTA.—The degenerated or wild form of this plant may be found in some parts very abundantly in fields, pastures, waste places, etc., commonly throughout Britain.

THE GALL IS FORMED by the abnormal swelling of the seed.

POSITION.—On the umbels.

MANNER OF GROWTH.—Gregarious ; pubescent ; separate.

COLOUR.—At first pale green, later dark green striped with purple.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 5 mm. ; breadth, 4 mm. ; girth, 12 mm.

MAY BE SOUGHT during the months of August, September, and October.

THE GROWTH is complete by the end of September.

THE TYPICAL CONDITION of the gall is unilocular and unilarval.

THE LARVA PUPATES in the gall. The imago emerges during October.

These galls while growing are not conspicuous, and may often be overlooked, unless a careful search is made for them. They are extremely variable in size. Some are scarcely larger than a normal seed, while a large one will exceed 8 mm. in length. In shape they are mostly reniform ; occasionally a few of a more or less globular shape may be found. They never coalesce, but several may be partially joined to each other. When mature they are very pretty.

The illustration is of specimens gathered at Hastings by the author.



FLOWER-HEADS OF *Daucus carota* Linn.

CALLED BY

Asphondylia pimpinella F.

(THREE-FOURTHS NAT. SIZE.)

CECIDOMYIA BETULÆ Wtz.

PLATE 120.

Galls caused by the larvæ of **Cecidomyia betulæ** Wtz.
on
the staminate catkins of **Betula alba** Linn.

PLATE 120.

SYNONYMY OF INSECT.

HABITAT OF THE COMMON BIRCH.—Plentiful all over Britain in parks, plantations, woods, and gardens.

THE GALL IS FORMED by the larva feeding upon portions of the catkin and preventing its full and complete development.

POSITION.—The catkin itself forms the gall.

MANNER OF GROWTH.—Deformed; curved; constricted; dwarfed.

COLOUR.—Reddish brown, chocolate-brown, black.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 20 mm.; girth, 12 mm.

MAY BE SOUGHT during the months of October to May.

THE GROWTH is complete by the end of April.

THE TYPICAL CONDITION of the gall is unilarval.

THE LARVA PUPATES in the gall. The imago emerges during April.

These galls are very abundant. Some trees, especially young ones, are very badly attacked. In the spring, as soon as the catkins begin to develop, the larvæ commence their attacks, and cause distortions and deformities which are more or less uniform in character. Some specimens are so completely eaten through that the distal portion falls off, leaving a mere stump on the twig. Such a specimen is shown on the right-hand side of the illustration. Others shrivel, end in a point, turn black, and remain sterile.

The illustration is of specimens gathered at Hastings by the author.



STAMINATE CATKINS OF *Betula alba* Linn.

GALLED BY

Cecidomyia betule Wtz.

(TWO-THIRDS NAT. SIZE.)

CECIDOMYIA TILICOLA Rud.

PLATE 121.

Galls caused by the larvæ of **Cecidomyia tilicola** Rud.
on
the flower-pedicles of **Tilia europæa** Linn.

PLATE 121.

SYNONYMY OF INSECT.

HABITAT OF THE COMMON LIME-TREE.—This tree occurs throughout Britain in woods, parks, avenues, etc. It is profuse in its foliage and flowers, and assumes handsome and noble proportions.

THE GALL IS FORMED by the presence of the larvæ within the pedicle of the flower causing it to swell to enormous proportions.

POSITION.—On the flower-pedicle.

MANNER OF GROWTH.—Singly or in clusters; sessile; glabrous; coalescent.

COLOUR.—Green, greenish yellow, orange-yellow, suffused with crimson.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 7 mm.; girth, 15 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 6.

THE LARVÆ PUPATE in the gall. The imagines emerge during August.

The galls occur in three different situations: (*a*) at the base of the peduncle, where it diverges from the mid-rib of the bract; (*b*) at the top of the peduncle, at the point from which the pedicles branch off; and (*c*) the typical position, as shown in the specimens on the opposite page—*viz.* on the pedicles themselves. Two examples of (*a*) may also be seen at the bottom of the illustration. In the first case, no difference is caused in the nature of the inflorescence; in the second, very little, if any; but in the third, the flowers are entirely abortive.

The illustration is of specimens gathered at Midhurst, Kent, by Mr. R. R. Hutchinson.



FLOWER-PEDICLES OF *Tilia europaea* Linn.

GALLED BY

Cecidomyia tilicola Rud.

(THREE-FOURTHS NAT. SIZE.)

DIPLOSI LOTI De Geer.

PLATE 122.

Galls caused by the larvæ of **Diplosis loti** De Geer
on
the flower-heads of **Vicia sepium** Linn.

PLATE 122.

SYNONYMY OF INSECT.

Tipula loti De Geer.

Cecidomyia loti Meigen.

Diplosis loti Theobald.

HABITAT OF THE BUSH-VETCH.—Plentiful on roadside banks,
in hedges, woods, and shady places throughout Britain.

THE GALL IS FORMED by the larvæ arresting the development
of the blooms and further growth of the stem.

POSITION.—On the flowers.

MANNER OF GROWTH.—Seldom more than one on a stem;
pilose.

COLOUR.—Greenish white.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 16 mm. ; breadth, 10 mm. ; girth, 30 mm.

MAY BE SOUGHT during the months of June to October.

THE GROWTH is complete by the end of August.

THE TYPICAL CONDITION of the gall is multilarval.

THE LARVÆ PUPATE in the ground. The imagines emerge
during the summer.

The galled flower-heads of this plant may easily be mistaken for partly expanded flower-clusters. It will be found, however, upon taking the flowers apart, that the numerous larvæ are securely ensconced within the cluster, feeding upon the young and tender inner portions of the galled growth, causing a cessation of expansion and premature decay of the affected parts.

The illustration is of specimens gathered at Hastings by the author.



FLOWER-HEADS OF *Vicia sepium* Linn.

GALLED BY

Diplosis loti De Geer.

(HALF NAT. SIZE.)

DIPLOSI PYRIVORA Riley.

PLATE 133.

Galls caused by the larvæ of **Diplosis pyrivora** Riley
on
the fruit of **Pyrus communis** Linn.

PLATE 123.

SYNONYMY OF INSECT.

Cecidomyia nigra(?) Meigen, Schmid., Theobald.

„ *pyricola*(?) Nardli.

HABITAT OF THE PEAR-TREE.—The pear here referred to is one of the many cultivated kinds found in orchards and kitchen gardens—*viz.* Catillac.

THE GALL IS FORMED by the premature and abnormal swelling of the young pear, causing it ultimately to turn black, shrivel, and fall from the tree.

MANNER OF GROWTH.—Each young pear forms a separate gall.

COLOUR.—The normal colour of the young pear.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Girth, 36 mm.

MAY BE SOUGHT during the months of May, June, and July.

THE GROWTH is complete by the end of June.

THE TYPICAL CONDITION of the gall is multilarval.

THE LARVÆ PUPATE in the ground. The imagines emerge during May.

The parent insect oviposits in the pear blossom as soon as the petals show themselves. A dozen or more ova are laid, from which larvæ quickly hatch. These immediately begin to eat their way towards the centre of the embryo pear, which, by reason of the irritation, increases rapidly in size, ultimately splitting open and falling to the ground.

The gall is also figured by Miss Ormerod, "Handbook of Insects," 1898, p. 120.

The illustration is of specimens kindly given to the author by the Rev. E. N. Bloomfield, M.A., F.E.S., from his garden at Guestling, Hastings.



ABORTIVE FRUIT OF *Pyrus communis* Linn.

GALLED BY

Diplosis pyrivora Riley.

(NEARLY NAT. SIZE.)

TEPHRITIS BARDANÆ Schrk.

PLATE 124.

Galls caused by the larvæ of **Tephritis bardanæ**
Schrk.

on

the flower-heads of **Arctium lappa** Linn.

PLATE 124.

SYNONYMY OF INSECT.

Trypeta bardanæ Schrk., Walker.

HABITAT OF THE COMMON BURDOCK.—Plentifully distributed over the whole of Britain, growing especially well on roadsides overshadowed with trees, also in woods and waste places.

THE GALL IS FORMED by the larva feeding within the seed capsule thus causing it to become abortive.

POSITION.—In the flower-head.

MANNER OF GROWTH.—Gregarious; glabrous; from three to twelve galls in each head.

COLOUR.—Chocolate-brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 7 mm.; breadth, 2 mm.; girth, 6 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 15.

THE LARVÆ PUPATE in the gall. The imagines emerge during August.

These galls are so completely hidden within the flower-head that their presence cannot be detected; nor will pressure between the finger and thumb be any guide in seeking them. The flower must be taken to pieces and each seed examined. They are very easy to rear. The shoots of *Arctium lappa* will live in water, and as soon as the flowers die off, the heads should be put in a glass jar with fine tulle across the opening, and the imagines will soon after appear.

The illustration is of specimens gathered at Hastings by the author.



FLOWER-HEADS OF *Artium lappa* Linn.

GALLED BY

Tephritis bardane Schrk.

(FOUR-FIFTHS NAT. SIZE.)

Galls caused by the larvæ of **Urophora solstitialis**
Linn.
on
the flower-heads of **Centaurea nigra** Linn.

PLATE 125.

SYNONYMY OF INSECT.

Trypeta solstitialis Linn., Walker.

HABITAT OF THE KNAP-WEED.—This ubiquitous plant flourishes in a great variety of situations, meadows, pastures, hillsides, and hedgerows being among its favourites.

THE GALL IS FORMED by the larvæ feeding upon the developing seed thus causing it to increase abnormally in size and become abortive.

POSITION.—Concealed within the flower-head.

MANNER OF GROWTH.—Singly; thickly covered (except at its base) with long greyish hairs.

COLOUR.—Brown.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Height, 10 mm.; breadth, 8 mm.; girth, 20 mm.

MAY BE SOUGHT during the months of August to June.

THE GROWTH is complete by the end of October.

THE TYPICAL CONDITION of the gall is plurilocular. Usual number of cells, 3.

THE LARVÆ PUPATE in the gall. The imagines emerge during June.

The imagines are not difficult to rear. If the flower-heads be gathered in October and kept in a small bag of leno and hung up in a summer-house or out-house, the flies will emerge during May or June of following summer. The proportion of male and female imagines is about equal. The galls are as ubiquitous as the plant itself, and 25 per cent of the heads of every affected plant will contain galls.

Urophora solstitialis.

The gall formed by this species is one of the most perfectly concealed it is possible to imagine. The flower is not altered in colour, nor is the head itself enlarged. The gall is situated in the centre and in the base of the flower-head, completely obscured by the florets. Its presence can be ascertained only by removing some of the florets, or by squeezing the head between finger and thumb, when a hard substance will be felt. It is extremely hard and woody; and is almost covered with long, silvery hairs, mostly about 8 mm. long, which under magnification are seen to be tubular at the point of attachment, but fasciated at the latter third of their length, and freely branched. The larval chambers are arranged parallel with each other, with an opening at the apex of the gall-structure. In October the larvæ pupate. The pupal skin, which is cylindrical, has a flat top, with a hard, black circular shield upon it, exactly fitting the circumference of the portion of the cell-tube surrounding it. This, doubtless, acts as a defence against parasites and other intruders.

The illustration is of specimens gathered at Hastings by the author.

FIG. 10.



A. The gall, with
hairs. $\times 2$.



B. Denuded of
hairs. $\times 2\frac{1}{2}$.



C. The larval
chambers. $\times 2\frac{1}{2}$



D. The
larva. $\times 4$.



E. The
pupa. $\times 4$.



FLOWER-HEADS OF *Centaurea nigra* Linn.

GALLED BY

Urophora solstitialis Linn.

(HALF NAT. SIZE.)

Galls caused by the Fungus **Exoascus insititiæ** Kerner
on
the fruit of **Prunus insititia** Linn.

PLATE 126.

SYNONYMY OF THE FUNGUS.

Exoascus Pruni De Bary, M. Ward, Connold.

HABITAT OF THE BULLACE-TREE.—It is found wild in woods and hedgerows in various parts of Britain, but in a cultivated condition it is in almost every orchard.

THE GALL IS FORMED by the attacks of the fungus, which absorbs the food substances from the living cells of the growing fruit.

POSITION.—Amongst the unaffected fruit.

MANNER OF GROWTH.—Singly, and in clusters of three to nine on one twig.

COLOUR.—At first pale green, later greyish, spotted with dingy yellow and orange.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 40 mm. ; breadth, 15 mm. ; girth, 40 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

The popular names of the galled and swollen fruits are "pocket-plums" and "bladder-plums." The fungus also attacks other varieties of the *Prunus* genus. When it has established itself on a tree it is difficult to eradicate. Picking off the affected fruit and burning it as soon as it shows symptoms of disease, should not be neglected. Deep pruning is also effectual. Some old trees require vigorous treatment in this respect. See also plate 129.

The gall is also figured by Marshall Ward, "Diseases of Plants," p. 108; Hastings Natural History Society's seventh Annual Report, 1900.

Exoascus insititiæ.

This fungus is one of the most interesting of the parasitic diseases which attack the genus *Prunus*. The word "Exoascus" has special reference to the shape of the hyphæ, or aerial portions of the fungus, which resemble in shape small bladders or pockets. These, when fully developed, contain the spores.

The fungus attacks the young fruit as soon as it begins to swell; the characters of the tissues are changed by the action of the mycelium of the fungus, and a curiously malformed development takes the place of naturally formed fruit. Some specimens attain dimensions three and four times larger than those of a normal-sized fruit. In this condition they are known as "bladder-plums" or "pocket-plums." They are quite useless for the purpose of food. The growth is completed in about six or seven weeks, and very shortly afterwards they shrivel and fall to the ground. A remarkable feature is that no stone or kernel forms, the fungus diverting and absorbing the supplies of nutriment that would otherwise have produced them. When mature the skin is wrinkled, of a greyish or greenish colour tinged and spotted with dirty yellow and orange, and having a kind of bloom on it which is due to a dense covering of the hyphæ.

The fruit shown in the opposite plate is that of the bullace-tree. In the summer of 1900 several trees were growing on a farm in Guestling which were very full of diseased fruit, many clusters of five and six bullaces being attached to one twig.

The illustration is of specimens gathered at Guestling by the author.



FRUIT OF *Prunus insititia* Linn.

CALLED BY

Exoascus insititiae Kerner.

(HALF NAT. SIZE.)

Galls caused by the queen and nymphs of **Siphocoryne xylostei** Schrk.

on

the flowers of **Lonicera periclymenum** Linn.

PLATE 127.

SYNONYMY OF INSECT.

Aphis xylostei Schr., Kalt., Walk.

Rhopalosiphum xylostei Koch.

Siphocoryne xylostei Pass.

HABITAT OF THE COMMON HONEYSUCKLE.—Very plentiful throughout Britain in almost every hedge, and twining around the stems of hazel-bushes in woods and thickets.

THE GALL IS FORMED by the punctures of the queen and pupæ causing a thickening of the base of the corolla.

POSITION.—At the base of the corolla.

MANNER OF GROWTH.—The entire base of the corolla is thickened.

COLOUR.—Pale green, same as the stem of the flower.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Length, 10 mm. ; girth, 12 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is multinymphal.

ECDYSIS takes place within the gall. The imagines emerge during July.

By the attacks of *Siphocoryne xylostei* many lovely clusters of blossoms are spoilt and rendered unpleasing to the eye, which otherwise might be gathered and form a charming addition to a nosegay of wild flowers. Honeysuckle, however, at times and in some places is so plentiful that the depredations caused by this aphid are not so noticeable as they might be. Cultivated plants are also attacked.

Siphocoryne xylostei.

The stunted and thickened condition of the corollas shown in the illustration on opposite page is caused by the flow of sap being retarded in every spot subjected to the punctures of the queen and nymphs; by combined action they transform an otherwise delightfully perfumed cluster of delicate pink, yellow, or white blossoms into a distorted mass, sickly looking and sticky to touch, harbouring hundreds of the creatures. When about to emerge as imagines, the nymphs creep to some elevated portion and there transform, leaving behind the vitreous puparium. Numbers of these may be seen on the cluster in the lower right-hand corner of the illustration. It is a very local species, and is particular where it settles, generally preferring somewhat sheltered situations; sometimes on the top of a hedge. Seldom more than two flower-clusters together are attacked.

The illustration is of specimens gathered at Battle by the author.



FLOWERS OF *Lonicera periclymenum* Linn.

GALLED BY

Siphocoryne xylostei Schrk.

(FOUR-FIFTHS NAT. SIZE.)

Galls caused by the larvæ of **Aulax papaveris** Cameron
on
the seed-heads of **Papaver dubium** and **P. Rhæas** Linn.

PLATE 128.

SYNONYMY OF INSECT.

Diplolepis papaveris Perris.

Aulax minor Htg.

„ *rhæadis* Htg., Schenck, Nass, Tasch, Mayr, Thoms,
Westwood.

HABITAT OF THE POPPY.—In almost every English cornfield,
and in many in Ireland and Scotland, as also upon every
railway-bank, the bright scarlet flowers cannot fail to
be seen.

THE GALL IS FORMED by the swelling of the affected seed, ova
being deposited when the plant is in flower.

POSITION.—Enclosed within the seed-capsule.

MANNER OF GROWTH.—Adherent to each other in clusters
of as many as ten or even more.

COLOUR.—Greyish white, gradually getting greyer with age.

AVERAGE DIMENSIONS OF A MATURE SPECIMEN.

Girth, 5 mm.

MAY BE SOUGHT during the months of June, July, and August.

THE GROWTH is complete by the end of July.

THE TYPICAL CONDITION of the gall is plurilocular. Usual
number of cells, 40.

THE LARVÆ PUPATE in the gall. The imagines emerge
during ——?

PARASITES.—*Pezomachus papaveris* Foer, *Raptracnemis papa-*
veris Foer, *Holaspis militaris* Boh., *Orymus papaveris*
Perris.

If it is desired to rear the imagines, the seed-capsules should
not be gathered until they are fully ripe.

The gall is also figured by Peter Cameron, "British Phyto-
phagous Hymenoptera" (Ray Society), vol. iv., plate 8.

Aulax papaveris.

The plurilocular galls caused by this insect have doubtless been repeatedly passed over and unsuspected for many years past. The cells are so completely hidden within the seed-capsule, and the capsule, relatively, is so little deformed, that it is not surprising its occurrence has been noted from but few localities. Yet some capsules containing larvæ show signs of their presence by abnormal swellings in various parts; they are also distorted in very peculiar ways. Some are constricted, and appear as though a string or band had been tightly tied around them when only partly developed; others as though they had been subjected to considerable pressure between finger and thumb. The position of the galled and swollen seeds may sometimes be located by slightly elevated and rounded protuberances on the walls of the capsule. The colour of the affected capsules is the same as those not attacked, and, in common with them, they turn slightly brown with age. The larval cells are numerous. Sixty is not an unusual number in one capsule, most or all of the septa being entirely filled in such examples. In shape the cells are irregular, solitary examples being generally globular. Compared with their diminutive size, the walls are very thick. They are adherent to each other in clusters of ten or less, and are slightly attached to the interior of the capsule. As the seeds ripen and turn a chocolate-brown colour, the larval chambers assume the same hue. The larva is apodus, cylindrical, fat, and fleshy, yellowish white, two frequently inhabiting one cell.

The illustration is of specimens gathered at Hastings by the author.



SEED-HEADS OF *Papaver dubium* AND *P. Rhoeas* Linn.

GALLED BY

Aulax papaveris Cameron.

(NEARLY NAT. SIZE.)

PLATE 129.

EXOASCUS INSITILLÆ Kerner.

XESTOPHANES POTENTILLÆ Cam.

PLATE 129.

A. The fruit of *Prunus insititia* Linn.

(Three-fourths nat. size.)

Galled by

Exoascus insititiæ Kerner.

- FIG. 1. The first symptoms of swelling.
" 2. The intermediate stage.
" 3. Full growth.
" 4. Sections showing stoneless cavity in centre.
See also plate 126.

The illustration is of specimens gathered at Guestling, near Hastings, by the author.

B. A rhizome of *Potentilla reptans* Linn.

(Nearly nat. size.)

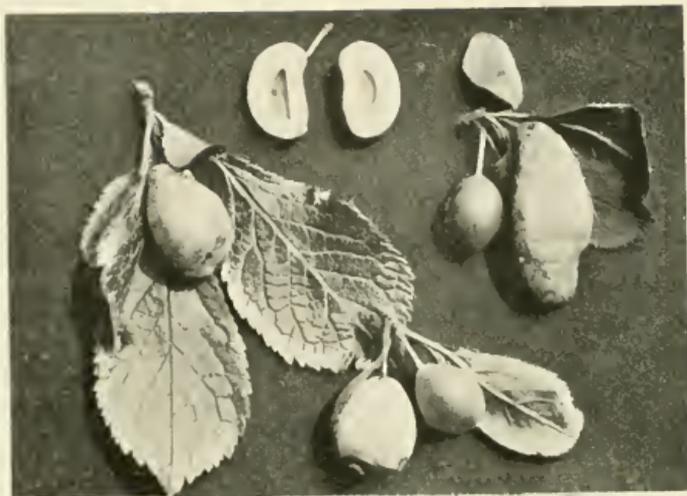
Galled by

Xestophanes potentillæ Cam.

This very fine specimen contained twenty-eight aggregations of larval cells, with an average of eight cells in each, giving a total of 224 larvæ in the rhizome. See also plate 13.

The illustration is of a specimen gathered at Battle by the author.

2.



3.

1.



B.

A. FRUIT OF *Prunus insititia* Linn.

(THREE-FOURTHS NAT. SIZE.)

B. A RHIZOME OF *Potentilla reptans* Linn.

(NEARLY NAT. SIZE.)

PLATE 130

PLATE 130.

A Charming Spot for Galls.



A CHARMING SPOT FOR GALLS

In the vicinity of Hastings, and frequently visited by the Author.

To face page 294.

A TABLE OF MONTHS IN WHICH THE GALLS ILLUSTRATED IN THIS VOLUME MAY BE FOUND.

It indicates the months in which the gall-structures themselves may be found, and does not necessarily imply that they will be in a living condition, nor that the larvæ or pupæ will always be found within them.

NAME OF MAKER OF GALL.	JANUARY.	FEBRUARY.	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUGUST.	SEPTEMBER.	OCTOBER.	NOVEMBER.	DECEMBER.
<i>Adelges abietis</i>				**	**	**	**					
<i>Agromyza schineri</i>	*	*	*	**	**	**	**	**	**	*	*	*
<i>Aphis atriplicis</i>						**	**	**	**			
<i>Asphondylia pimpinellæ</i>							**	**	**	*		
<i>Aulax glechomæ</i>						**	**	**	**			
" <i>hieracii</i>						**	**	**	*			
" <i>hypochæridis</i>							**	**	*			
" <i>papaveris</i>						*	**	**				
<i>Brachycolus stellarie</i>					*	*	*					
<i>Cecidomyia betulæ</i>	*	*	*	*	*					*	*	*
" <i>bursaria</i>						**	**	**				
" <i>cratægi</i>						**	**	**	*			
" <i>galii</i>						**	**	**				
" <i>lathyri</i>						**	**	**	**			
" <i>marginem-torquens</i>						**	**	**	**			
" <i>persicariæ</i>						*	**	**	**			
" <i>pteridis</i>						*	**	**	**			
" <i>ranunculi</i>						*	**	**	*	*		
" <i>rosaria</i>	*	*	*	*	*	*	*	*	*	*	*	*
" <i>rosarum</i>						*	*	*	*	*	*	*
" <i>saliciperda</i>	*	*	*	*	*	*	*	*	*	*	*	*
" <i>salicis</i>	*	*	*	*	*	*	*	*	*	*	*	*
" <i>sisymbrii</i>						*	*	*	*	*	*	*
" <i>taxi</i>	*	*	*	*	*	*	*	*	*	*	*	*
" <i>tiliæ</i>						*	*	*	*	*	*	*
" <i>tilicola</i>						*	*	*	*	*	*	*
" <i>ulmariae</i>						*	*	*	*	*	*	*
" <i>urticæ</i>						*	*	*	*	*	*	*
" <i>veronicæ</i>	*	*	*	*	*	*	*	*	*	*	*	*
" <i>violæ</i>	*	*	*	*	*	*	*	*	*	*	*	*
<i>Ceuthorhynchus sulcicolis</i>						*	*	*	*	*	*	*
<i>Diastrophus rubi</i>	*	*	*	*	*	*	*	*	*	*	*	*
<i>Diplois botularia</i>						*	*	*	*	*	*	*
" <i>loti</i>						*	*	*	*	*	*	*

NAME OF MAKER OF GALL.	JANUARY.	FEBRUARY.	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUGUST.	SEPTEMBER.	OCTOBER.	NOVEMBER.	DECEMBER.
<i>Pemphigus bursarius</i>												
" <i>spirotheca</i>												
<i>Phyllocoptes acericola</i>												
" <i>fraxini</i>												
<i>Polycystis pompholygodes</i>				**	**	**	**	**	**	*	*	
" <i>violæ</i>				**	**	**	**	**	**			
<i>Retinia resinella</i>	*	*	*	*	*	*	*	*	*	*	*	*
<i>Rhodites eglauteriae</i>												
" <i>nervosus</i>	**	**	**	**	**	**	**	**	**	**	**	**
" <i>rosæ</i>	**	**	**	**	**	**	**	**	**	**	**	**
" <i>rubiginosæ</i>	**	**	**	**	**	**	**	**	**	**	**	**
" <i>spinosissimæ</i>	**	**	**	**	**	**	**	**	**	**	**	**
<i>Rhopalosiphum ribis</i>					*	**	**	**	*			
<i>Saperda populnea</i>	**	**	**	**	**	**	**	**	**	**	**	**
<i>Schizoneura fodiens</i>	**	**	**	**	**	**	**	**	**	**	**	**
" <i>lanigera</i>	**	**	**	**	**	**	**	**	**	**	**	**
" <i>ulmi</i>	**	**	**	**	**	**	**	**	**	**	**	**
<i>Siphocoryne xyloster</i>						**	**	**	**	**	**	**
<i>Tephritis bardanæ</i>						**	**	**				
<i>Tetraneura ulmi</i>						**	**	**	*			
<i>Tylenchus millefolii</i>						**	**	**				
<i>Urophora cardui</i>							*	**	**			
" <i>solstitialis</i>	*	*	*	*	*			**	**	*	*	*
<i>Xestophanes brevitarsis</i>						**	**	**	**	**	*	*
" <i>potentillæ</i>	*	*	*	*	*	**	**	**	**	*	*	*

LIST OF PLANTS ILLUSTRATED IN THIS VOLUME.

PLANT.	AUTHOR.	PAGE.	PLATE.
Abies excelsa	De C.	97	34
Acer campestre	Linn.	144	56
" " " " " "	"	146	57
" pseudo-platanus	"	178	73
Achillea millefolium	"	186	77
" " " " " "	"	226	97
Ajuga reptans	"	122	45
" " " " " "	"	270	118
Alnus glutinosa	"	128	48
" " " " " "	"	130	49
" " " " " "	"	140	54
Ammophila arundinacea	Host.	111	41
Arctium lappa	Linn.	282	124
Arundo Phragmites	Ben.	94	32
Atriplex angustifolia	Sm.	233	101
Betula alba	Linn.	55	1
" " " " " "	"	62	4
" " " " " "	"	64	16
" " " " " "	"	66	17
" " " " " "	"	68	18
" " " " " "	"	70	19
" " " " " "	"	70	20
" " " " " "	"	142	55
" " " " " "	"	158	63
" " " " " "	"	274	120
Brassica Napus	"	41	8
" rutabaga	De C.	44	9
" " " " " "	"	46	10
" sinapis	Vis.	48	11
Carduus arvensis	Curt.	95	33
Centaurea nigra	Linn.	283	125
Corylus Avellana	"	58	14
" " " " " "	"	60	15
" " " " " "	"	126	47
Cratægus Oxyacantha	"	132	50
" " " " " "	"	138	53
" " " " " "	"	184	76
" " " " " "	"	190	79
Daucus carota	"	272	119
Fagus sylvatica	"	176	72
" " " " " "	"	224	96
" " " " " "	"	228	98
" " " " " "	"	180	74
Fraxinus excelsior	"	217	93
" " " " " "	"		

PLANTS.	AUTHOR.	PAGE.	PLATE.
Galium Aparine	Linn.	134	51
" verum	"	80	25
" "	"	136	52
Glechoma hederacea	"	182	75
" "	"	187	78
" "	"	249	109
Hieracium sylvaticum	Sm.	105	38
Hypochæris radicata	Linn.	107	39
Juglans regia	"	172	70
" "	"	182	75
Juncus articulatus	"	238	103
Lathyrus pratensis	"	192	80
Lonicera periclymenum	"	287	127
Papaver dubium	"	289	128
" Rhæas	"	289	128
Pinus sylvestris	"	104	37
Polygonum amphibium	"	196	82
Populus alba, var. canescens	"	102	36
" nigra	"	241	105
" "	"	239	104
" tremula	"	71	21
" "	"	154	61
" "	"	220	94
" "	"	266	117
Potentilla reptans	"	51	13
" "	"	117	44
" "	"	292	129
" tormentilla	Sibth.	115	43
Poterium sanguisorba	Linn.	160	64
Prinus avium	"	7	2
" insititia	"	285	126
" "	"	292	129
" spinosa	"	162	65
Pteris aquilina	"	198	83
Pyrus aucuparia	Gaetn.	124	46
" "	"	184	76
" communis	Linn.	150	59
" "	"	280	123
" Malus	"	50	12
" "	"	99	35
Ranunculus repens	"	200	84
" "	"	229	99
Ribes nigrum	"	156	62
" "	"	244	106
Rosa canina	"	206	87
" "	"	255	112
" "	"	257	113
" "	"	259	114

PLATE.	AUTHOR.	PAGE.	PLATE.
Rosa canina	Linn.	262	115
" rubiginosa	"	264	116
" spinosissima	"	113	42
Rubus fruticosus	"	91	31
" "	"	109	40
" "	"	266	117
Salix alba	"	148	58
" aurita	"	201	85
" "	"	204	86
" Caprea	"	74	22
" "	"	82	26
" "	"	84	27
" "	"	164	66
" "	"	222	95
" "	"	251	110
" cinerea	"	76	23
" "	"	78	24
" "	"	86	28
" fragilis	"	253	111
" viminalis	"	194	81
Sisymbrium officinale	Scop.	88	29
Spiræa Ulmaria	Linn.	209	89
Stellaria holostea	"	235	102
Taxus buccata	"	152	60
" "	"	208	88
Tilia grandifolia	Ehrh.	90	30
" europæa	Linn.	166	67
" "	"	168	68
" "	"	170	69
" "	"	276	121
Ulmus campestris	Sm.	247	108
" montana	"	245	107
Urtica dioica	Linn.	211	90
Veronica chamaedrys	"	213	91
Viburnum Opulus	"	174	71
Vicia Sepium	"	278	122
Viola canina	"	216	92
" "	"	232	100
Grass	"	8	3

NAMES OF MAKERS OF GALLS NOT ILLUSTRATED IN THIS VOLUME.

WITH AUTHOR'S NAME, CHARACTERISTIC FEATURES OF THE GALL,
POSITION ON THE PLANT, AND NAME OF PLANT.

ABBREVIATIONS :

Astr. <i>Astragalus.</i>	Euph. <i>Euphorbia.</i>	Hype. <i>Hypericum.</i>
Camp. <i>Campanula.</i>	Gale. <i>Galeobdolon.</i>	Onob. <i>Onobrychis.</i>
Card. <i>Cardamine.</i>	Heli. <i>Helianthemum.</i>	Saro. <i>Sarothamnus.</i>
Cera. <i>Cerastium.</i>	Hera. <i>Heracleum.</i>	Sisy. <i>Sisymbrium.</i>
Epil. <i>Epilobium.</i>	Hier. <i>Hieracium.</i>	Trif. <i>Trifolium.</i>

NAME OF MAKER OF GALL.	AUTHOR'S NAME.	CHARACTERISTICS OF GALL.	POSITION ON PLANT.	NAME OF PLANT.
DIPTERA.				
<i>Anthomyia brassicæ</i>	Bos.	swollen	roots	Brassicæ
<i>Asphondylia genistæ</i>	Lw.	swollen	buds	Genista germanica
" <i>sarothamni</i>	Lw.	bud-like	twigs	Saro. scoparius
" <i>ulicis</i>	Traill	swollen	flower-bud	Ulex Europæus
<i>Asynapta lugubris</i>	Lw.	lemon-shape	leaf	Prunus
<i>Cecidomyia acrophila</i>	Wtz.	pod-like	leaflets	Fraxinus excelsior
" <i>Aparinæ</i>	Kief	swollen	stem and flower-head	Galium Aparine
" <i>brassicæ</i>	Wtz.	swollen	flowers, leaves, & pods	Brassicæ
" <i>campanulæ</i>	Müll.	swollen	seed-vessels	Camp. rotundifolia
" <i>cardaminis</i>	Wtz.	deformed	flowers	Card. pratense
" <i>carpini</i>		swollen	mid rib, un. s.	Carpinus betulus
" <i>cerastii</i>	Binnie	swollen	leaves	Cera. vulgatum
" <i>clausilia</i>	Bouché	thickening of	leaf-margins	Salix alba
" <i>corrugans</i>	Löw	folded	leaves	Hera. sphondylium
" <i>destructor</i>	Say.	base of	haulm	Wheat
" <i>equestris</i>	Bos.	swelling of	haulm	Wheat
" <i>Euphorbiæ</i>	Lw.	cluster of	leaves	Euph. cyparissias
" <i>floricola</i>	Rud.	globular, red	twigs, petioles	Tiliae
" <i>foliorum</i>	Lw.	swelling on	leaf	Artemisia vulgaris
" <i>galeobdolonitis</i>	Wtz.	pubescent	stalk	Gale. luteum
" <i>galiicola</i>		clusters of	leaves	Galium Mollugo
" <i>Giraudi</i>	Fefld.	folded	leaflet	Astr. hypoglottis
" <i>heraclei</i>	Kltb.	folded	leaves	Hera. sphondylium
" <i>heterobia</i>	Lw.	artichoke	♂ flowers	Salix amygdalina
" <i>hyperici</i>	Bremi	terminal	leaf-capsule	Hype. humifusum
" <i>inclusa</i>	Fefld.	slight swelling	haulm	Arundo Phragmites
" <i>medicaginis</i>	Bremi	swollen	leaf-stalk	Medicago sativa
" <i>muricatæ</i>	Meade	swollen	flowers and seeds	Carex muricata
" <i>onobrychidis</i>	Bremi	folded	leaflets	Onob. sativa

NAME OF MAKER OF GALL.	AUTHOR'S NAME.	CHARACTERISTICS OF GALL.	POSITION ON PLANT.	NAME OF PLANT.
DIPTERA (continued).				
<i>Cecidomyia papaveris</i> . . .	Wtz.	swollen	seed-capsule	<i>Papaver Rhæas</i>
" <i>pavida</i> . . .	Wtz.	thickened	leaflets	<i>Fraxinus excelsior</i>
" <i>pilosellæ</i> . . .	Binnie	rolled	leaf-margin	<i>Hier. pilosella</i>
" <i>plicatrix</i> . . .	Lw.	folded	leaf	<i>Rubus cœsius</i>
" <i>pruni</i> . . .	Kltb.	bursiform	mid-rib	<i>Prunus</i>
" <i>pustularis</i> . . .	Bremi		leaf	<i>Quercus</i>
" <i>pyri</i> . . .	Bouché	rolled	leaf-margin	<i>Pyrus</i>
" <i>quercus</i> . . .	Binnie	contorted	shoots	<i>Quercus</i>
" <i>rhododendri</i> . . .	Vallot	bud-like on	twigs	<i>Rhododendron</i>
" <i>saliceti</i> . . .	Lw.		leaves	<i>Salix fragilis</i>
" <i>salicina</i> . . .	Schrk.	bud-like on	shoots	<i>Salix caprea</i>
" <i>serotina</i> . . .	Wtz.	swollen	shoots	<i>Hype. humifusum</i>
" <i>terminalis</i> . . .	Lw.	swollen	shoots	<i>Salix fragilis</i>
" <i>thalictri</i> . . .	Traill	deformed	fruit	<i>Thalictrum</i>
" <i>tornatella</i> . . .	Bremi	swelling on	leaves	<i>Fagus sylvatica</i>
" <i>trifolii</i> . . .	F.	tufts of	leaflets	<i>Trif. pratense</i>
<i>Diplosis buxi</i> . . .	Labou.	swollen	leaves	<i>Buxus sempervirens</i>
" <i>callida</i> . . .	Wtz.	swollen	seed-capsules	<i>Papaveris</i>
" <i>dryobia</i> . . .	Löw	rolled	leaf-margin	<i>Quercus Robur</i>
" <i>flava</i> . . .	Mg.	leaf-rosettes	haulm	Wheat
" <i>fraxinella</i> . . .	Meade	clusters	flowers	<i>Fraxinus excelsior</i>
" <i>helianthemi</i> . . .	Hardy	clusters	leaves	<i>Heli. vulgare</i>
" <i>invocata</i> . . .	Wtz.	swollen	leaflets	<i>Fraxinus excelsior</i>
" <i>jacobeæ</i> . . .	Lw.	swollen	flower-heads	<i>Senecio Jacobæa</i>
" <i>linariæ</i> . . .	Wtz.	swollen	buds	<i>Linaria vulgaris</i>
" <i>pini</i> . . .	De G.	swelling	base of leaves	<i>Pinus sylvestris</i>
" <i>rumicis</i> . . .	Lw.	deformed	blooms	<i>Rumex</i>
" <i>tritici</i> . . .	Kirby	swollen	glumes and flowers	Wheat and rye
<i>Hormomyia corni</i> . . .	Gir.	hard, conical on	leaf	<i>Cornus sanguinea</i>
" <i>fasciata</i> . . .	Mieg.	deformed	flower-buds	<i>Epil. angustifolium</i>
" <i>Fischeri</i> . . .	Fefld.	swollen	stem	<i>Carex pilosa</i>
" <i>juniperina</i> . . .	Linn.	cone-like on	twigs	<i>Juni. communis</i>
" <i>Poæ</i> . . .	Bosc.	oval on	stem	<i>Poa nemoralis</i>
" <i>Ptarmicæ</i> . . .	Vallot	deformed	flowers	<i>Ptarmica Achillæa</i>
<i>Lasioptera arundinis</i> . . .	Schin.	slight swelling	haulm	<i>Arundo Phragmites</i>
<i>Scira tilicola</i> . . .	Mos.	oblong and round	shoots, leaves	<i>Tilia</i>
<i>Urophora macrura</i> . . .	Löw.			<i>Senecio vulgaris</i>
HYMENOPTERA.				
<i>Aulax scabiosæ</i> . . .	Mayr	spindle-shape on	stem	<i>Centaurea scabiosa</i>
<i>Biorhiza terminalis</i> . . .		globular	roots	<i>Prunus</i>

NAME OF MAKER OF GALL.	AUTHOR'S NAME.	CHARACTERISTICS OF GALL.	POSITION ON PLANT.	NAME OF PLANT.
HYMENOPTERA (<i>continued</i>)				
Cryptocampus medullarius .	Htg.	swollen	twigs	Salix
Diastrophus Mayri .	Reins.	swollen	stem	Potentilla argentea
Euura angusta .	Cam.	swollen	twigs	Salix
" depressa .	Mos.	globular	haulm	Festuca ovina
" nigritarsis .	Cam.	swollen	leaf-bud	Salix caprea
" pentandræ .	Thoms.	swollen	shoots	" pentandra
" saliceti .	Cam.	swollen	leaf-bud	" aurita
" venusta .	Ladd.	swollen	petiole	" caprea
Nematus baccarum .	Cam.	berry-shape on	leaf	" aurita
" Bridgmanii .	Cam.	oval swelling on	leaf	" caprea
" herbaceæ .	Cam.	globular on	leaf	" herbacea
" ischnocerus .	Thoms.	globular & oval on	leaf	" purpurea
" nigrolineatus .	Cam.	rolled & swollen	leaf-margin	" vitellina
" salicis-cinereæ .	Cam.	pear-shape on	leaf	" purpurea
" vacciniellus .	Cam.	oval shape		Vaccinium
" vesicator .	Bremi	oval & oblong on	leaf	Vitis-idea Salix helix
COLEOPTERA.				
Apion Gyllenhalli .	Kirby	swollen	stem	Vicia cracca
Ceuthorhynchus assimilis	Payk	swollen	seed-pod	Sisy. officinale
" hirtulus .	Germ.	oval & globular on	haulm	Draba verna
" rapæ .	Gyll.	oval & globular on	haulm	Brassica rapa
Gymnetron beccabungæ .	Linn.	swollen	seed-case	Scrophularianodosa
" collinus .	Gyll.	swollen	root	Linaria vulgaris
" villoselus .	Gyll.	globular	seed-case	Veronica Anagallis
Mecinus circulatus .	Marsh.	deformed	flower-head	Plantago lanceolata
" collaris .	Germ.	swelling at	base of fl.-hd.	" maritima
" pyraster .	Herbst.	swelling in	centre of fl.-hd	" media
Miarus campanulæ .	Linn.	swollen	seed-pod	Camp. rotundifolia
Saperda carcharias .	Linn.	lateral swelling of	twigs	Populus nigra
HEMIPTERA- HOMOPTERA.				
Adelges strobilobius .	Kalt.	cone-like on	twig	Abies communis
" pini .	Müll.	cone-like on	twig	Pinus sylvestris
Aphis Cratægi .	Kalt.	swollen & pouched	leaves	Cratægus Oxyacantha

British Vegetable Galls

NAME OF MAKER OF GALL.	AUTHOR'S NAME.	CHARACTERISTICS OF GALL.	POSITION ON PLANT.	NAME OF PLANT.
HEMIPTERA-HOMOPTERA (continued).				
<i>Chermes taxi</i>	Buck.	globular swelling	top of shoot	<i>Taxus buccata</i>
<i>Cryptosiphum artemisiæ</i> .	Buck.	pustules on	leaves	<i>Artemisia vulgaris</i>
<i>Pemphigus pallidus</i> . .	Hali.	swollen	leaf, mid-rib	<i>Ulmus</i>
<i>Phylloxera vastatrix</i> . .	Planch.	swellings on	leaves & roots	<i>Vitis vinifera</i>
<i>Schizoneura lanuginosa</i> .	Hartg.	fig-like swellings	on twig	<i>Ulmus suberosa</i>
<i>Trichopsylla Walkeri</i> . .		bursiform on	leaf	<i>Rhamnus catharticus</i>
ANGULLULA.				
<i>Aphelenchus fragariæ</i> . .	Bos.	swollen	stems and flowers	Strawberry
<i>Heterodera radicolica</i> . .	Müll.	knobs on	roots	Cucumbers, tomatoes, clover
„ <i>Schachtii</i>	Kuhn	swollen	root	Beet
<i>Tylenchus devastatrix</i> . .	Kuhn	bulbous swelling	base of haulm	Rye, oats, clover, etc.
„ <i>scandens</i>	Bos.	swollen	ear	Wheat
„ <i>tritici</i>	Basti.	“cockle galls”	ear	Wheat
HETEROCERA.				
<i>Argyresthia Gœdartella</i> . .		swollen and distorted	staminate catkin	<i>Alnus glutinosa</i>
<i>Asychna æratella</i>	Zell.			<i>Polygonum aviculare</i>
<i>Laverna decorella</i>	Steph.	swollen	stem	<i>Epilobium</i>
<i>Retina buolinana</i>	Linn.	resinous swelling	bud	<i>Larix europea</i>

The author has specimens of 58 galls in addition to the above list, and exclusive of those on the oak, awaiting identification of agents causing them.

A LIST OF GALLS FOUND ON QUERCUS.

ABBREVIATIONS:

Q. ped. <i>Quercus pedunculata</i> .	up.s. Upper surface of leaf.
Q. sess. " <i>sessiliflora</i> .	un.s. Under surface of leaf.
Q. pub. " <i>pubescens</i> .	ax. Axillary.

The popular names under head of Characteristics are the same as given in "Oak-galls and Gall-flies" (Adler and Stratton).

NAME OF MAKER OF GALL.	NAME OF AUTHOR.	CHARACTERISTICS OF GALL.	POSITION ON THE TREE.	SPECIES OF QUERCUS.
Andricus æstivalis . . .	Gir.	globular, hard	twig	Q. cerris.
" amenti . . .	Gir.	pilose	catkin	Q. ped.
" circulans . . .	Mayr.	oval, smooth	bud, ax.	Q. cerris.
" cirratus . . .	Adler	"tufted gall"	catkin	Q. sess.
" clementinæ . . .	Mayr.	longitudinal ribs	bud	Q. sess.
" curvator . . .	Htg.	"curved leaf"	leaf and twig	Q. ped., sess., and pub.
" gemmatus . . .	Adler	"bud-gall"	bud, ax.	Q. sess.
" glandium . . .	Gir.	multicellular	acorn	Q. cerris.
" glandulæ . . .	Mayr.	green, hairy	bud, ax.	Q. ped. and sess.
" inflator . . .	Htg.	"twig-gall"	bud	Q. ped. and pub.
" lucidus . . .	Mayr.	globular, hard	twig	Q. ped.
" noduli . . .	Htg.	"knott-gall"	twig	Q. ped., sess., and pub.
" nudus . . .	Adler	"bald seed"	catkin	Q. sess.
" pilosus . . .	Adler	"hairy catkin"	catkin	Q. sess.
" ramuli . . .	Linn.	"woolly gall"	catkin	Q. ped., sess., and pub.
" solitarius . . .	Mayr.	ovate, red hairs	bud, ax.	Q. ped.
" testaceipes . . .	Htg.	"leaf-vein"	leaf, un.s.	Q. sess.
Aphilotrix albopunctata . . .	Schl.	"spotted bud"	bud	Q. ped., sess., and pub.
" autumnalis . . .	Htg.	"autumn gall"	bud	Q. sess. and pub.
" callidoma . . .	Htg.	"stalked spindle"	leaf, ax.	Q. sess.
" collaris . . .	Htg.	"collared bud"	bud	Q. sess.
" corticis . . .	Linn.	"bark-gall"	trunk	Q. ped., sess., and pub.
" fecundatrix . . .	Htg.	"hop" or "arti- choke"	bud, ax.	Q. ped., sess., and pub.
" globuli . . .	Htg.	"globular gall"	bud	Q. sess. and pub.
" Malpighii . . .	Adler	spindle-shape	bud, ax.	Q. sess.
" marginalis . . .	Schl.	conical and oval	leaf-margin	Q. sess.
" quadrilineatus . . .	Htg.	"furrowed gall"	catkin	Q. sess.
" radialis . . .	Fbr.	"truffle-gall"	root and trunk	Q. ped., sess., and pub.
" seminatiois . . .	Gir.	"barley-corn"	leaves and catkin	Q. sess. and pub.
" Sieboldi . . .	Htg.	"red barnacle"	twigs	Q. sess. and ped.
Biorhiza aptera . . .	Fbr.	globular, gre- garious	roots	Q. ped. and sess.
" renum . . .	Htg.	"kidney-gall"	leaf, un.s.	Q. ped., sess., and pub.
Cynips Kollari . . .	Htg.	marble-gall	twigs	Q. ped., sess., and pub.

NAME OF MAKER OF GALL.	NAME OF AUTHOR.	CHARACTERISTICS OF GALL.	POSITION ON THE TREE.	SPECIES OF QUERCUS.
<i>Dryophanta agama</i> . . .	Mayr.	globular	leaf, un.s.	<i>Q. ped.</i>
" <i>disticha</i> . . .	Cam.	depressed top	leaf, un.s.	<i>Q. ped.</i>
" <i>divisa</i> . . .	Adler	" scarlet pea "	leaf, un.s.	<i>Q. ped.</i>
" <i>longiventris</i> . . .	Htg.	" striped gall "	leaf, un.s.	<i>Q. ped.</i>
" <i>scutellaris</i> . . .	Htg.	" cherry gall "	leaf, un.s.	<i>Q. ped., sess., and pub.</i>
<i>Neuroterus fumipennis</i> . . .	Htg.	" cupped spangle "	leaf, un. and up.s.	<i>Q. ped. and sess.</i>
" <i>læviusculus</i> . . .	Schen.	" smooth spangle "	leaf, un.s.	<i>Q. ped.</i>
" <i>lenticularis</i> . . .	Oliv.	" spangle "	leaf, un.s.	<i>Q. ped., sess., and pub.</i>
" <i>numismatis</i> . . .	Oliv.	" silk button "	leaf, un.s.	<i>Q. ped., sess., and pub.</i>
" <i>ostreus</i> . . .	Htg.	" oyster-gall "	leaf, un.s.	<i>Q. ped., sess., and pub.</i>
" <i>punctatus</i> . . .	Cam.		" in the buds "	
<i>Spathegaster albipes</i> . . .	Schen.	oval, sessile	leaf, edge	<i>Q. sess. and perl.</i>
" <i>Aprilinus</i> . . .	Gir.	globular	bud, ax.	<i>Q. sess. and pub.</i>
" <i>baccarum</i> . . .	Linn.	" currant-gall "	leaf, catkin	<i>Q. ped., sess., and pub.</i>
" <i>similis</i> . . .	Adler	" green velvet-bud "	bud	<i>Q. ped.</i>
" <i>Taschenbergi</i> . . .	Schl.	" purple velvet-bud "	bud	<i>Q. sess.</i>
" <i>tricolor</i> . . .	Htg.	" hairy pea "	leaf, un.s.	<i>Q. sess. and ped.</i>
" <i>verrucosus</i> . . .	Schlt.	" red wart "	leaf and petiole	<i>Q. sess.</i>
" <i>vesicatrix</i> . . .	Schlt.	" blister-gall "	leaf, un.s.	<i>Q. sess. and ped.</i>
<i>Teras terminalis</i> . . .	Fbr.	" oak-apple "	terminal bud	<i>Q. ped., sess., and pub.</i>
<i>Trigonaspis crustalis</i> . . .	Htg.	" pink wax "	bud on bark	<i>Q. sess. and pub.</i>

Cecidomyia pustularis, *C. quercus*, and *Diplois dryobia*, are described on p. 302.

LIST OF WORKS CONSULTED.

- Agricultural Zoology.* Dr. J. Ritzma Bos. 1894.
Alternating Generations: A Biological Study of Oak-galls and Gall-flies.
 Hermann Adler, M.D. Translated by C. R. Stratton, F.R.C.S., etc. 1894.
British Aphides. G. B. Buckton. 4 Vols. Ray Society.
British Flies (Diptera). Fred V. Theobald, B.A., F.E.S. Vol. i. 1892.
British Flora, Handbook of the. G. Bentham, F.R.S., etc., and Sir J. Hooker,
 F.R.S., etc. 1896.
British Fungology, Outlines of. Rev. M. J. Berkley, M.A., F.E.S.
British Gall-insects. Albert Müller, F.E.S. 1871.
British Phytophagous Hymenoptera, A Monograph of the. Peter Cameron.
 4 vols. Ray Society.
Economic Entomology (Aptera). Andrew Murray, F.L.S.
Entomologist, The. Vol. xiii, No. 206.
Insects, A Manual of Injurious. Eleanor A. Ormerod, LL.D., etc. Second
 ed. 1890.
Insects Injurious to Orchard and Bush Fruits, Handbook of. Eleanor A.
 Ormerod, LL.D., etc. Second ed. 1890.
Natural History of Plants, The. Anton Kerner. Translated by F. W.
 Oliver, D.Sc.
Naturalist's Journal, The. 1894, 1895, 1896, 1897, 1898.
Royal Natural History, The. Ed. by Richard Lydekker, B.A., F.R.S., etc.
 Vol. vi.
*Rust, Smut, Mildew, and Mould: An Introduction to the Study of Microscopic
 Fungi.* M. C. Cooke.

The following papers by Prof. Dr. Alfred Nalepa, in Wien.

- Beiträge zur Systematik der Phytopten.* Wien, 1889.
Neue Gallmilben. Mit 4 Tafeln. Halle, 1891.
Neue arten der Gattung Phytoptus Duj und Cecidophyes Nal. Mit 4 Tafeln.
 Wien, 1892.
Die Naturgeschichte der Gallmilben. Wien, 1894
Beiträge zur Kenntniss der Phyllocoptiden. Mit 6 Tafeln. Halle, 1894.
Beiträge zur Kenntniss der Gattungen Phytoptus Duj und Monaulax Nal.
 Mit 4 Tafeln. Wien, 1895.
Zur Kenntniss der Phyllocoptinen. Mit 4 Tafeln. Wien, 1896.
Eriophyidæ (Phytoptidæ). Mit 3 Abbildungen. Berlin, 1898.
Zur Kenntniss der Gattung Eriophyes, Sieb., em Nal. Mit 5 Tafeln.
 Wien, 1899.
Katalog der bisher beschriebenen Gallmilben, ihrer Gallen und Nährpflanzen.
Tegonotus, ein neues Phytoptiden-Genus. Mit 1 lithographischen Tafel.
Zur Kenntniss der Gattung Trimerus Nal. Mit 1 lithographischen Tafel.

INDEX.

	PAGE		PAGE
A vegetable gall defined	6	Caxton	2
Aborted <i>Betula alba</i> branches	8	<i>Cecidomyia achilleæ</i>	226
Acarina	31	" <i>albipennis</i>	82
<i>Acarus pseudogallarum</i>	126	" <i>argyrosticta</i>	86
<i>Adelges abietis</i>	97	" <i>barbarea</i>	88
" <i>gallarum abietis</i>	97	" <i>betula</i>	30, 274
Agents concerned in causing galls	31	" <i>bursaria</i>	187, 188
<i>Aeromyza schineri</i>	76, 78	" <i>caprea</i>	222
Albo carbon	18	" <i>chamædryis</i>	213
Alteration of generations	38	" <i>cineræarum</i>	201
Anatomy of mites	32, 33	" <i>cratagi</i>	11, 30, 190
Andrew Murray	31	" <i>Degeeri</i>	86
<i>Andricus Hartigi</i>	109	" <i>destructor</i>	35
Anguillula	31, 34	" <i>excavans</i>	90
Aphides	31, 37	" <i>Fagi</i>	224
<i>Aphioides bursaria</i>	239	" <i>filicina</i>	198
<i>Aphis atriplicis</i>	233	" <i>fraxini</i>	217
" <i>bursarius</i>	239	" <i>gallarum salicis</i>	86
" <i>chenopodii</i>	233	" <i>galii</i>	80
" <i>foliorum</i>	245	" <i>lathyri</i>	30, 192
" <i>gallarum ulmi</i>	247	" <i>limbivolens</i>	90
" <i>holci</i>	235	" <i>loti</i>	278
" <i>lanigera</i>	99	" <i>marginem-torquens</i>	30, 194
" <i>ribis</i>	244	" <i>molluginis</i>	80
" <i>stellariæ</i>	235	" <i>nigra</i> (?)	280
" <i>xylostei</i>	287	" <i>persicariæ</i>	12, 30, 196
Apparati used when photographing	20	" <i>piligera</i>	228
Application of word Gall	2	" <i>polymorpha</i>	220
Arrangement of specimens and imagines 17, 18		" <i>pteridis</i>	11, 30, 198
Article on Galls in "Encyclopædia Brit."	4	" <i>pyricola</i> (?)	280
<i>Asphondylia pimpinelle</i>	10, 12, 272	" <i>ranunculii</i>	30, 200
<i>Aulax abbreviatus</i>	51, 117	" <i>rose</i>	206
" <i>brevitarisis</i>	115	" <i>rosaria</i>	11, 30, 201, 202, 204
" <i>glechomæ</i>	12, 22, 184, 249, 250	" <i>rosarum</i>	30, 206
" <i>graminis</i>	105	" <i>salicina</i>	86
" <i>hieracii</i>	105, 106	" <i>saliciperda</i>	82, 84
" <i>hypochæridis</i>	107, 108	" <i>salicis</i>	86
" <i>minor</i>	289	" <i>sisymbri</i>	88
" <i>papaveris</i>	10, 289, 290	" <i>taxi</i>	30, 208
" <i>potentillæ</i>	51, 117	" <i>terebrans</i>	82
" <i>rhodis</i>	289	" <i>tiliæ</i>	90
" <i>sabaundi</i>	105	" <i>tilicola</i>	276
" <i>splendens</i>	51, 117	" <i>ulmaricæ</i>	14, 209, 210
Axillary galls	24	" <i>urticæ</i>	211, 212
		" <i>veronica</i>	30, 213, 214
		" <i>violæ</i>	30, 216
Bedeguar, fibrous coverings of	6	<i>Cecidophyes galii</i>	134
Beetles	31, 34	" <i>tetanothrix</i>	164
Bernard, M. Noel	36	<i>Cephaloneon betulinum</i>	142
<i>Brachycolus stellariæ</i>	235, 236	" <i>hypocrateriforme</i>	162
Buttercup-smut, the	229	" <i>myriadeum</i>	146

	PAGE		PAGE
<i>Cephaloneon pustulatum</i>	140	Emerision of imagines, the	21
" <i>solitarium</i>	144	Epiandrium	32
<i>Ceratoneon extensum</i>	168	Epigynium	32
" <i>vulgare</i>	178	<i>Erianeum alneum</i>	130
<i>Ceuthorhynchus pleurostigma</i>	41	" <i>axillare</i>	128
" <i>sulcicollis</i>	10, 41, 43, 46, 48	" <i>juglandinum</i>	172
Characters of gall-agents, the	6	" <i>juglandis</i>	172
Charming spot for galls, a	294	" <i>poterii</i>	160
<i>Chermes abietis</i>	97	" <i>pupurascens</i>	144
Classification of galls	25	" <i>tortuosum</i>	142
Anton Kerner's	25	Eriophyes, hundreds in one gall	10
Author's original	28	<i>Eriophyes ajuga</i>	122, 270
botanical order of plant	26	" <i>aucupariæ</i>	124, 184
mode of growth	27	" <i>avellane</i>	126
natural order of agents	26	" <i>axillaris</i>	128
number of larval cells	27	" <i>brevitarsus</i>	130
situation of gall	26	" <i>buxi</i>	32
Coalescent galls	24	" <i>cratagi</i>	132
Coleoptera	31, 34	" <i>gatii</i>	134
Collecting, hints on	16	" <i>galiobius</i>	136
" impedimenta for	13, 14	" <i>goniothorax</i>	32, 138, 184
" mounting, and preserving	14	" <i>lævis</i>	9, 128, 140
" galls	14	" <i>lionotus</i>	142
Colours of galls, the	9, 11	" <i>macrochelus</i>	10, 144
Comparison of sizes of galls produced	9	" <i>macrohynchus</i>	9, 10, 12, 144, 146
by diptera	9	" <i>marginatus</i>	148
Comparison of sizes of galls produced	9	" <i>mentharius</i>	32
by mites	9	" <i>Nalepi</i>	128
Comparison of sizes of mites	32	" <i>orientalis</i>	9
Complexity of structure of galls, variation in	6	" <i>parvulus</i>	32
Conglomerated galls	24	" <i>piri</i>	124, 150
Crowfoot-smut, the	229	" <i>psilaspis</i>	152
Cymbiform galls	24	" <i>pustulatum</i>	154
Cynipidæ	38	" <i>ribis</i>	156
<i>Cynips capree</i>	253	" <i>rudis</i>	18, 55, 62, 64, 66, 68, 70, 158
" <i>gallæ tinctoriæ</i>	4	" <i>sanguisorbæ</i>	14, 160
" <i>hieracii</i>	105	" <i>similis</i>	162
" <i>potentillæ</i>	51, 117	" <i>tetanothrix lævis</i>	164
" <i>quercus</i>	4	" <i>tetratrichus</i>	166
" <i>rosæ</i>	259	" <i>tiliæ (typicus)</i>	9, 168
<i>Daily News</i> , extract from	36	" <i>tiliarius</i>	170
Date labels	23	" <i>tristratus</i> , var. <i>erinea</i>	172, 182
Derivation of word Gall	2	" <i>viburni</i>	174
<i>Diastrophus glechomæ</i>	249	Eriophyinae	32
" <i>rubi</i>	10, 109, 110	<i>Eriosoma lanigera</i>	99
<i>Dicaloma quercicola</i>	109	" <i>mali</i>	99
<i>Diplosis bedeguaris</i>	259	" <i>populi</i>	239
" <i>botularia</i>	180, 217, 218	Etymology of word Gall	1
" <i>loti</i>	278	<i>Eucyrtus zephyrinus</i>	117
" <i>papaveris</i>	289	<i>Eulophus innunctus</i>	255
" <i>pyrivoræ</i>	280	<i>Eupelmus annulicornis</i>	109
" <i>tremulæ</i>	18, 220, 266	" <i>brachypterus</i>	249
" <i>tritici</i>	35	<i>Eurytoma abrotani</i>	109
Diptera	31, 35	" <i>brachyptera</i>	107
Dissimilarity of galls produced by same	7	" <i>hyalipennis</i>	11, III, 112
genus of agent	7	" <i>rufipes</i>	249
Dryden	2	" <i>signatus</i>	105
Early writers, opinions of	3	Examples of growth, typical	24
Eel-worms	31, 34	<i>Exoascus insititiæ</i>	282, 285, 292
Elongated galls	24	" <i>Pruni</i>	285
		Extract from <i>Daily News</i>	36
		Felt-galls	25
		Fibrous covering of bedeguar gall	6
		Flies (with two wings)	31, 35

	PAGE		PAGE
Flower-galls	29	Galls, the colours of	11
Fruit included with flower	29	" the result of morbid action	4
Fungi	31, 36	" tubicular	26
Fungi and lichens apparently not galled	6	" uncongential places for	14
Fungoid growths on branches of trees	5	" unilarval	29
" " " roots of trees	5	" unilocular	27
Fungus	31, 36	" upon margins of leaf	25
<i>Fusarium solani</i>	36	" " under surface of leaf	25
		" " upper surface of leaf	25
		" variation in complexity of structure of	6
		" variation in shapes of	10
Gall, article on, in "Encyclopædia Brit."	4	Half-grown galls	21
" etymology of word	1	Hamuli	38
" -gnats	35	<i>Hedya aceriana</i>	11, 102
" history of word	1	Hemiptera-Homoptera	31, 37
" -midges	35	<i>Hemiteles buteolator</i>	259
" of <i>Rhodites nervosus</i>	7	" <i>imbecilis</i>	255
" " <i>spinossisimæ</i>	7	Heterocera	31, 37
" " <i>Urophora cardui</i>	7	<i>Heterodera schachtii</i>	34
" " <i>solstitialis</i>	7	Hirsute galls	24
" -wasps	38	History of word Gall	1
" what is a, ?	1, 6	<i>Holaspis militaris</i>	289
Galls, a charming spot for	294	<i>Hololexis eglanteria</i>	255
" classification of	25, 28	<i>Hormomyia annulipes</i>	228
" coalescent	24	" <i>caprea</i>	222
" compound	26	" <i>Fagi</i>	10, 224
" conglomerated	24	" <i>millefolii</i>	186, 225
" cymbiform	24	" <i>piligeræ</i>	228
" dissimilarity of	7	Hymenoptera	31, 38
" elongated	24	Imagines, emersion of	21
" felt	25	Imbricated galls	24
" Flower-, the	29	Impedimenta for collecting galls	13, 14
" found on Quercus	305, 306	Keeping galls, recommendations for	22
" glabrous	24	Kerner's classification, Anton	25
" glossy	24	Kirby and Spence's description of galls	4
" gregarious	24	Labels, date	23
" half-grown	21	Larvæ eaten by birds (Tits)	7
" hirsute	24	<i>Lasioptera argyrosticta</i>	91
" imbricated	24	" <i>fusca</i>	91
" Kerner's classification of	25	" <i>picta</i>	91
" Kirby and Spence's description of	4	" <i>rubi</i>	18, 30, 91, 92, 266
" Leaf-, the	29, 119	Leaf-galls, the	29, 119
" mantle	26	<i>Legnon crispum</i>	116
" multilarval	29, 30	Lichens and fungi apparently not galled	6
" multilocular	-9, 30	<i>Liposthenus glechomæ</i>	249
" multinymphal	29, 30	List of plants, a	298, 299, 300
" not suitable for manufactures nor food	7	" " plates	ix, x, xi
" number known	7	" " small illustrations	xii
" on roots, apparently not known to early writers	5	<i>Livia juncorum</i>	238
" pedunculated	24	Makers of galls not illustrated in this volume	301, 302, 303, 304
" pilose	24	Mantle galls	26
" Pliny on	3	<i>Megastigmus transversus</i>	113
" plurilocular	27	Microscope slips	18
" pubescent	24	Mites, anatomy of	32, 33
" pustulate	24		
" Root-, the	29, 30		
" rosaceous	24		
" rugose	24		
" scabions	25		
" separate	25		
" sessile	25		
" sizes, shapes, and colours of	9		
" solitary	25		
" spiny	25		
" Stem-, the	29, 53		

	PAGE		PAGE
Mode of growth and classification of galls	24	<i>Phytoptus coloneastri</i>	150
Modes of pupation	29, 30	" <i>galii</i>	134
<i>Monaulax sulcatus</i>	176	" <i>galiiobius</i>	136
<i>Monochetus sulcatus</i>	11, 176	" <i>informis</i>	136
Moths	31, 37	" <i>lævis</i>	9, 140
Mounting, collecting, and preserving	14	" <i>letonotus</i>	142
" hints on	17	" <i>letonotus</i>	142
Multilarval galls	29, 30	" <i>macrochelus</i>	10, 144
Multilocular galls	29, 30	" <i>macrorhyncus</i>	146
Multinymphal galls	29, 30	" <i>monieci</i>	144
Mycoc-ecidium	36	" <i>myriadeum</i>	146
<i>Myzoxylus mali</i>	99	" <i>piri</i>	9, 150
<i>Myzus ribis</i>	244	" <i>pseudogallarum</i>	126
		" <i>psilaspis</i>	152
		" <i>purpureum</i>	130
		" <i>ribis</i>	156
		" <i>rudis</i>	158
		" <i>sanguisorba</i>	160
Nalepa, Dr. Alfred	32	" <i>similis</i>	162
Nematoid worms	5	" <i>sorbi</i>	150
<i>Nematus bellus</i>	6, 12, 18, 251, 252	" <i>taxi</i>	152
" <i>gallicola</i>	253, 254	" <i>tetanothrix</i>	164
" <i>pedunculi</i>	251	" <i>tetratrichus</i>	166
" <i>vallisneri</i>	253	" <i>tiliarius</i>	170
" <i>viminalis</i>	251		
Nodulose growths on roots of <i>Spiræa</i>	8	Pilose galls	24
Number of known galls	7	Plant, the word	28
		Plants, removal of	21
		Pliny on galls	3
Ocelli	36	Plurilocular galls	24
<i>Oligastenus stigma</i>	255	<i>Polycystis canina</i>	255, 257, 258
<i>Oligasthenus tibialis</i>	117	" <i>pompholygodes</i>	229, 230
Orchid family	8	" <i>violæ</i>	232
Origin of word Gall	2	<i>Pontania vallisneri</i>	253
<i>Orymus papaveris</i>	289	<i>Porizon harpurus</i>	259
		Potato, the, a gall	36
		Predominant modes of growth	24
		Preservation of galls, difficulty of	18
		Pseudo-bulbs of grass	8
Parthenogenesis	38	<i>Pteromalus emineus</i>	257
Pedunculated galls	24	" <i>incrassatus</i>	113
<i>Pemphigus affinis</i>	241	" <i>inflexus</i>	113, 257
" <i>bursarius</i>	18, 30, 239, 240, 242	Pubescent galls	24
" <i>spirothecæ</i>	30, 241, 242	<i>Puceron de peuplier</i>	241
<i>Periclistus brandtii</i>	259	Pupation, modes of	29, 30
" <i>caninæ</i>	113	Pustulate galls	24
<i>Pezomachus papaveris</i>	289		
" <i>potentillæ</i>	117	<i>Raptrcnemis papaveris</i>	289
<i>Phyllerium olnigenum</i>	130	Recent researches in gall study	5
" (<i>Erineum</i>) <i>nervale</i>	168	Recommendations for keeping galls	22
" <i>tiliaceum</i>	168	Redi's assumption	4
" <i>juglandis</i>	172	Removal of plants	21
" <i>tortuosum</i>	142	Rennie, and deposition of ova	3
<i>Phyllocoptes acericola</i>	9, 12, 178	<i>Retinia resinella</i>	104
" <i>aceris</i>	146	<i>Rhabdophaga viminalis</i>	82
" <i>fraxini</i>	180	<i>Rhodilus nervosus</i>	257
Phyllocoptinæ	32	<i>Rhodites eglanteriæ</i>	255, 256, 258
<i>Phytoptus aceris</i>	178	" <i>nervosus</i>	11, 257, 258
" <i>ajugæ</i>	270	" <i>rosæ</i>	10, 12, 22, 259, 260, 262
" <i>alni</i>	128	" <i>rosarum</i>	257
" <i>alnicola</i>	128	" <i>rubiginosæ</i>	264
" <i>arianus</i>	150	" <i>spinatissimæ</i>	113, 114
" <i>aroniæ</i>	150	<i>Rhopalosiphum ribis</i>	244
" <i>attenuatus</i>	162	" <i>xylastei</i>	287
" <i>avellanæ</i>	58, 60, 126	Rolling and thickening of leaf	25
" <i>brevitarsus</i>	130	Root-galls, the	29, 39
" <i>calycophthirus</i>	158		
" <i>coryli</i>	126		

	PAGE		PAGE
Rosaceous galls	24	<i>Torymus hieracii</i>	105
Rugose galls	24	" <i>longicaudis</i>	259
<i>Sacchiphantes abietis</i>	97	" <i>macropterus</i>	109, 113, 257
<i>Sagittaria sagittifolia</i>	8	" <i>rosarum</i>	259
<i>Saperda populnea</i>	71, 72, 74	" <i>rubi</i>	109
Scabious galls	25	" <i>singulatus</i>	249
<i>Schizoneura fodiens</i>	50	" <i>splendens</i>	249
" <i>lanigera</i>	18, 99, 100	<i>Trypeta bardanae</i>	282
" <i>ulmi</i>	245, 246	" <i>cardui</i>	95
<i>Scilla nutans</i>	8	" <i>solstitialis</i>	283
<i>Scirpus lacustris</i>	8	Tuberous formations on roots	7
Separate galls	25	Tubicular galls	26
Sessile galls	25	<i>Tylenchus millefolii</i>	186
Setæ	32	<i>Typhlodromus pyri</i>	150
Shapes, sizes, and colours of galls	9	Typical examples of growth	24
<i>Siphocoryne xylostei</i>	287, 288	Uncongenial places for galls	14
Situations of <i>Cecidomyia tillicola</i>	276	Unilarval galls	29
Smallest gall	10	Unilocular galls	27
Solitary galls	25	<i>Urocystis pompholygodes</i>	229
<i>Spilota aceriana</i>	102	" <i>viola</i>	232
Spiny galls	25	<i>Urophora cardui</i>	22, 95, 96
Stem-galls, the	29, 53	" <i>solstitialis</i>	10, 95, 283, 284
Stratton's description of gall, Dr.	4	Variation in complexity of structure of galls	6
<i>Synergus ruficornis</i>	259	" " number of larval cells	10
<i>Systole castaniventris</i>	105	" " shapes of galls	10
Table of months, a	295, 296, 297	Vegetable gall defined, a	6
Tennyson	3	Violet-smut, the	232
<i>Tephritis bardanae</i>	282	<i>Volvulifex aceris</i>	178
<i>Teras terminalis</i>	3	Wasps (small)	31, 38
Terebra	38	Weevils	35
<i>Tetraneura alba</i>	247	Wheat-midge	35
" <i>ulmi</i>	12, 30, 240, 247, 248	Wood, Rev. J. G., on effect of deposi- tion of ova	4
<i>Tetrastichus obtusatus</i>	257	Word Gall, application of	2
<i>Tettigonia ?-sp.</i>	180	Word Plant, the	28
<i>Tipula loti</i>	278	Works consulted	307
" <i>populea</i>	220	Worms, eel-	31, 34
"Tomlinson's Cyclopædia"	4	" nematoid	5
<i>T. oxycanthæ</i>	109	<i>Xestophanes brevitarsis</i>	10, 12, 115, 116
<i>Torymus ater</i>	117	" <i>potentillæ</i>	51, 117, 118, 202
" <i>bedeguaris</i>	259	" <i>tormentillæ</i>	118
" <i>chlorinus</i>	105		
" <i>congener</i>	255		
" <i>difficilis</i>	113, 255		
" <i>euchloris</i>	105		
" <i>glechomæ</i>	249		
" <i>globiceps</i>	117		

