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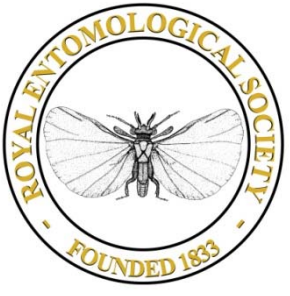

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ROYAL ENTOMOLOGICAL
SOCIETY OF LONDON

Vol. VIII. Part 1 (*a*).

HANDBOOKS FOR THE IDENTIFICATION OF BRITISH INSECTS

HYMENOPTERA

CYNIPOIDEA

Key to families and subfamilies
and CYNIPINAE (including galls)

By

R. D. EADY and J. QUINLAN

LONDON
Published by the Society
and Sold at its Rooms
41, Queen's Gate, S.W. 7

28th February, 1963

Price £1 0s. 0d.

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HYMENOPTERA

CYNIPOIDEA

Key to Families and Subfamilies, and Cynipinae (including Galls)

By R. D. Eady and J. Quinlan

Introduction

The Cynipoidea is one of the smaller superfamilies of the parasitic Hymenoptera, the British species, as listed in Kloet and Hincks (1945), numbering just over two hundred. Most are very small to medium-sized insects, and are usually black, red or yellow, or combinations of these colours, smooth or sculptured, but without the brilliant metallic colouring found in some other Hymenoptera. The majority are parasitic, but one subfamily, the Cynipinae, consists in greater part of species that are phytophagous and cause galls on a number of plants. It is this subfamily that forms the subject of the present work.

Revisions of the group, other than the Cynipinae, have been few. The only comprehensive work on the European species, which also includes a number of American species, is that of Kieffer (1910). The more recent work of Weld (1952) gives keys to the Cynipoid genera of the world. Thomson (1861, 1877), in a series of papers, dealt with the Swedish species. The recent history of the classification of the Cynipoidea may be followed in Kieffer (1910), Hedicke and Kerrich (1940), Hedicke in Ceballos (1943), Weld (1952) and Richards (1956).

The Cynipinae have attracted more attention than the other families and subfamilies, mainly because of the phenomena of gall formation and the alternation of generations. In addition to the works of Kieffer and Thomson mentioned above, those of Mayr at the end of the last century, and of Tavares in the third decade of the present century, deal systematically with the majority of European species. Cameron (1903) covered the British species and their life histories, though adding nothing to the classification. Further information on the life histories and distribution of the British species may be found in the works of Niblett (*Entomologist*, 1932–33, 1939–55).

The major works on alternation of generations in the Cynipinae are those of Adler and Beyerinck. This phenomenon in the gall-making species associated with *Quercus* has produced problems of taxonomy in the past. The two generations, one consisting of normal sexual forms, and the other entirely of agamic females reproducing parthenogenetically, are so different in external morphology that they have frequently been described under different genera.

When the present work was commenced, it was not intended to include a key to the galls, as most of these have been adequately described and figured in the past in the works of Connold, Cameron, Mayr, Swanton and Kieffer. It became increasingly obvious, however, that to bring the galls and insects together in the one part would be most desirable, and the authors are indebted to Mr. R. B. Benson for the suggestion that this should be attempted. The keys to the adult insects are intended to demonstrate, wherever possible, what the authors consider to be a reasonable classification of the Cynipinae. With this in mind several groups and species which do not occur in the British Isles were examined during the preparation of the original manuscript. The framework based on the external morphological characters of the adults was tested by relating it, in many instances, to life histories, characteristics of the galls, and selection of host-plant and position thereon. Once it had been decided to include a key to, and figures of, the galls to supplement the keys to the insects, a second problem arose : whether the key to the galls should be arranged primarily on some of the characters which, although probably fundamental, are to be seen only by dissection, or on the more obvious external characters. The former system would be more in harmony with the keys to the adult insects, but it has not been fully investigated ; the latter would provide a more useful supplementary key for field-work and collecting. The latter arrangement was finally adopted. Wherever possible the galls were drawn from fresh material ; otherwise from dried specimens, frequently with the valuable assistance of coloured photographs taken in the field. While the present work has been in progress, M. Roger Folliot in France has been conducting experiments on the biology of some of the species of Cynipinae attacking plants other than *Rosa* and *Quercus*. The results to date from this independent source support much of the arrangement of the genera in the present work.

Changes in the arrangements of groups and species have fortunately been few. In the key to families and subfamilies, the only departure from Richards (1956) is the elevation of the Eucoilidae once more to family level. It was felt that this step had to be taken to emphasise that the difference between the Eucoilinae and the group of the subfamilies Anacharitinae, Figitinae and Aspicerinae was greater than the differences between these three subfamilies of the Figitidae ; the Eucoilinae possess some characters that relate that subfamily equally closely to the Cynipidae. It was also considered to be in the interest of the serious student to include the family Liopteridae and the subfamily Pycnostigmatinae in this key, though neither occurs in the British Isles.

As with all parasitic Hymenoptera, groups at any level in the Cynipoidea are seldom completely isolated, and an almost infinite variety in degree of completeness of isolation can be seen, even in groupings at lowest levels, when studied closely. In the Cynipinae, however, there appears to be a broad group pattern of relationship between plants, gall-makers, inquilines and parasites (at least those belonging to the Chalcidoid family Torymidae). Some of these, admittedly provisional, observations are tabulated below, and demonstrate a progression in associations and complexity.

Host Plants	Gall-makers	Inquilines
Herbaceous Plants		
Compositae, Labiatae, Papaveraceae, *etc.* Aromatic or with milky juice	*Phanacis* *Aulacidea* *Aylax* *Isocolus* *Liposthenus*	None
Rosaceae		
Potentilla, *Rubus*	*Xestophanes* *Diastrophus*	None
Rosa	*Diplolepis*	*Periclistus*
Fagaceae		
Quercus	*Callirhytis* *Neuroterus* *Cynips* *Andricus* *Trigonaspis* *Biorhiza*	*Saphonecrus* *Synergus*

The genera of Cynipinae below are placed together in groups when the relationship is apparently very close, or the genera cannot be adequately separated from each other, or when they are known to be linked by intermediate species. The association in the first three groupings was indicated in greater part by Mr. R. B. Benson, in his arrangement of the material in the British Museum collection, on which the present study is based.

(1) *Phanacis*, *Timaspis*.
(2) *Aulacidea*, *Aylax*, *Isocolus*, *Liposthenus*.
(3) *Xestophanes*, *Diastrophus*.
(4) *Synergus*, *Saphonecrus*.
(5) *Neuroterus*, *Andricus*, *Cynips*.

The groups are set out below, with the reasons for grouping, and the treatment of each group in the present work.

(1) *Phanacis* Foerster, 1860 = *Timaspis* Mayr, 1881 (=*Gillettea* Ashmead, 1897) **syn. n.** As can be seen from the keys, the type species of *Timaspis* Mayr (*T. lampsanae* (Perris) Karsch) is intermediate between the type species of *Phanacis* Foerster (*P. centaureae* Foerster) and the two species *P. hypochoeridis* (Kieffer) and *P. caulicola* Hedicke, which have been transferred from *Aulacidea* and *Aylax* respectively. All the British species form galls in the stems of certain Compositae. The species described as *T. papaveris* by Kieffer, which forms galls in the stems of *Papaver somniferum* and is recorded from France but not hitherto from Britain, is more distinct from the rest of the species formerly included in *Timaspis* than is *Phanacis centaureae* Foerster. Therefore, if *Phanacis* and *Timaspis* were to be maintained as separate genera, it would be necessary to erect a new genus for *T. papaveris*. In view of the very close relationship of all the species concerned, the present authors consider this course undesirable, and accordingly have placed *Timaspis* Mayr as a synonym of *Phanacis* Foerster.

(2) Although the group of genera *Aulacidea, Aylax, Isocolus* and *Liposthenus* forms an exact parallel to the species in the preceding paragraph, having the same range of host plants (with the addition of *Nepeta*), and with the same botanical affinities, it presents greater variety in both location and design of the galls. The characters here separating the genera are the same as the characters used in the separation of species groups in the genus *Phanacis* (= *Timaspis*) ; in the present group they are more sharply defined and are generally supported by secondary characters. These divisions have therefore been regarded as separating genera, though the closeness of *Isocolus* and *Liposthenus* must be emphasised.

(3) No species intermediate between those placed in *Diastrophus* and *Xestophanes* is known, but the two genera are very close indeed.

(4) The characters used for separating *Synergus* and *Saphonecrus* are not entirely satisfactory. The majority of the species placed in *Synergus* form a reasonably compact and definable group on positive characters ; the majority of European species in *Saphonecrus* are placed there at present on negative characters. *Synergus apicalis* Hartig, *Synergus rotundiventris* Mayr, and *Saphonecrus connatus* (Hartig) (the latter the type species of *Saphonecrus*) seem to connect the two genera ; but when these species are placed side by side, they are quite easily separated into the two groups on the combination of characters that on paper appears somewhat indifferent. It is proposed, therefore, to retain these two genera for the present.

(5) The genera *Cynips, Neuroterus* and *Andricus* are quite distinct, and on the characters given in the present keys there should be little difficulty in placing correctly the majority of the species. The species *Andricus ostreus* (Hartig), however, particularly in the sexual generation, has characters linking it with both *Cynips* and *Neuroterus*. *Neuroterus albipes* (Schenck) ♀[1] and *N. aprilinus* (Giraud) also possess characters which are unusual in *Neuroterus* but common to all *Andricus*. These resemblances are noted in the key to genera.

The terms used to describe morphological characters are the same as those in Richards (1956), but the older names for certain veins of the fore wing have been included additionally where it is felt that this departure facilitates the understanding and use of drawings and keys (fig. 1). The term *ventral spine* of the *gaster* refers to the apex of the hypopygium ; the comparative length of this projection beyond the posterior margin of the last sternite is frequently used as a character for determination. The term *face* is used for that area of the head above the clypeus and below the antennal sockets ; and *frons* for the area between the antennal sockets and the anterior ocellus. *Transfacial line* is the shortest distance across the face between the antennal sockets. *OOL* is used as in Richards (1956 : 2) for the distance from the outer edge of a posterior ocellus to the inner margin of the neighbouring compound eye. *POL* is the distance between the inner margins of the posterior ocelli.

Specific names are as in Kloet and Hincks (1945), except that the practice of using hyphenated specific names in some of the gall-making species is

[1] This sign, proposed by Benson (1949, *Ent. mon. Mag.* **84** : 285–6) and subsequently used by Richards (1956), represents the agamic female in the Cynipinae. The signs used to indicate the three types of adult are as follows : ♂ = male, ♀ = female, ♀ = agamic female.

discontinued, and the name is treated and written as one word, e.g. "*quercusfolii.*"

The notes on distribution and relative abundance, where given, appear only in the key to the galls. All Cynipinae are best collected by rearing them from the galls; many species that can be obtained in considerable numbers by this method are rarely taken as adults by ordinary methods of sweeping or netting, unless one is in the right locality at the time of an emergence. Unless otherwise stated the relative abundance of the species is based on the average experience in the south, east and midlands of Britain.

The authors gratefully acknowledge the valuable contribution made by the following: Dr. J. F. Perkins of the British Museum (Natural History) for advice and assistance at all stages in the preparation of this work; Mr. J. Ross, whose bred series of the British species on oak constitutes the greater part of the British Museum collection of this group; Mr. M. Niblett, for supplying material of some species that were difficult to obtain; Dr. M. Fischer of the Naturhistorisches Museum in Vienna, and Mlle. S. Kelner-Pillault of the Museum National d'Histoire Naturelle in Paris, for arranging loans of material from the Mayr and Giraud collections respectively; Mrs. J. A. J. Clark (née Boyer) for collecting additional material and trying out parts of the keys; Mr. B. Eady for the use of his collection of photographs, monochrome and coloured, of many of the galls; and Mrs. R. D. Eady for typing the original manuscript. The authors are indebted to Mr. Arthur Smith for the figures of whole insects I–VII in the text and on the front cover.

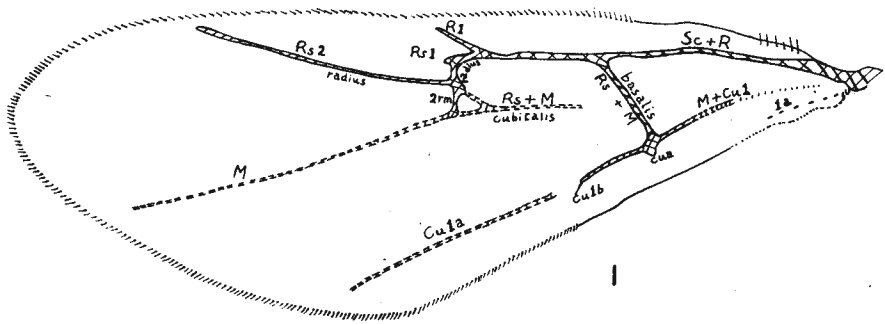

FIG. 1.—Fore wing venation: Cynipinae.

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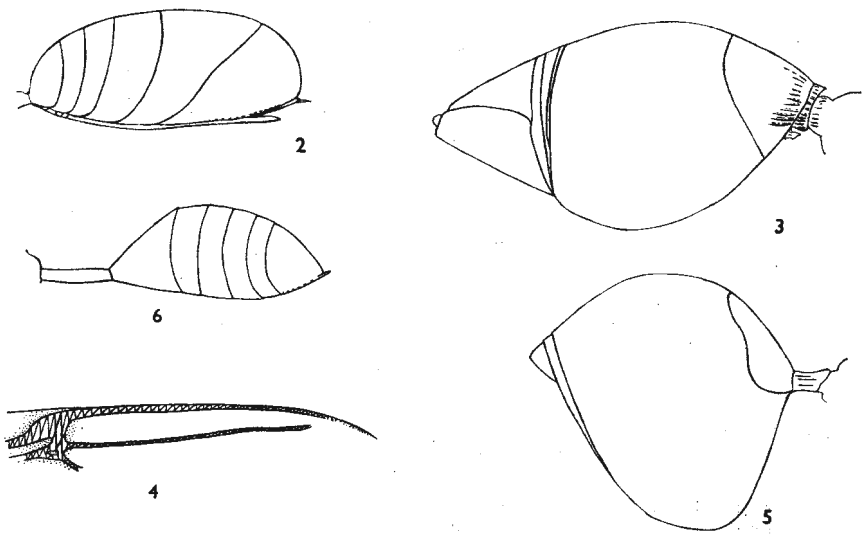


FIGS. 2–3.—Gaster, lateral, ♀ : 2, Ibaliidae ; 3, Figitidae.
FIG. 4.—Radial cell of forewing, ♀ : Ibaliidae.
FIGS. 5–6.—Gaster, lateral, ♀ : 5, Aspicerinae ; 6, Anacharitinae.

KEY TO FAMILIES AND SUBFAMILIES OF CYNIPOIDEA

1 Largest segment of gaster the fourth, fifth or sixth (fig. 2); two or more short tergites preceding the large tergite.....2

– Largest segment of gaster the second or third (figs. 3, 5, 6), or formed by these two fused together (figs. 96–99).....3

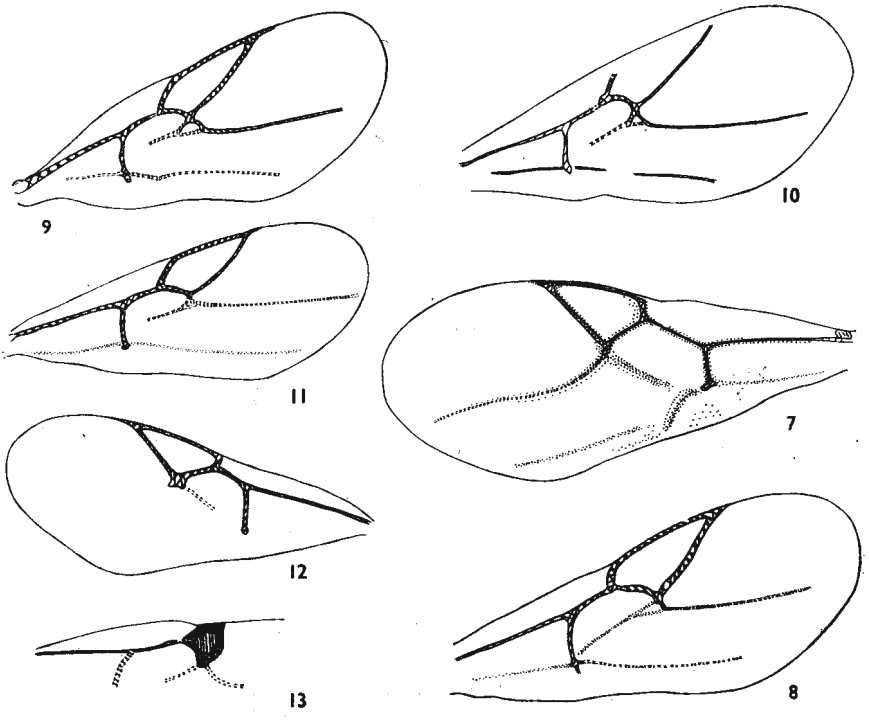
2 (1) Radial cell with length nine times the breadth (fig. 4); first segment of hind tarsus twice as long as segments 2–5 combined.....IBALIIDAE

– Radial cell with length less than nine times the breadth (figs. 7, 8); first segment of hind tarsus not twice as long as remaining segments combined (*mostly exotic; none British*).....LIOPTERIDAE

3 (1) Scutellum with disc or cup dorsally (fig. 14); pronotum often very distinctly raised dorsally into an anterior plate with a strong posterior margin.

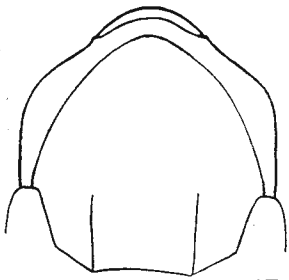
Fore wing with cubitalis ($Rs + M$) usually visible and springing from a point very close to lower end of basalis (near junction with $M + Cu$), or combined with median (Cu_1) for a short distance (fig. 7); segments 2 and 3 of gaster fused without visible suture.....EUCOILIDAE

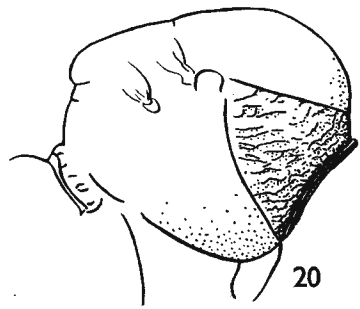
– Scutellum without disc or cup dorsally, sometimes with posterior fovea or apical spine (Aspicerinae); if pronotum raised dorsally into an anterior plate, then this is without a posterior margin, and very often indistinct.....4

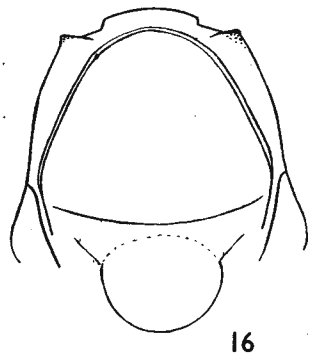


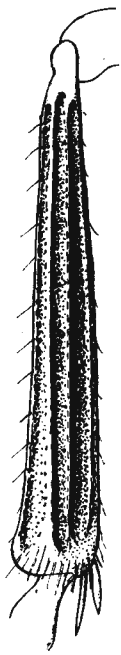
FIGS. 7–12.—Fore wing: 7, Eucoilidae; 8, Figitinae; 9–11, Cynipinae; 12, Anacharitinae.

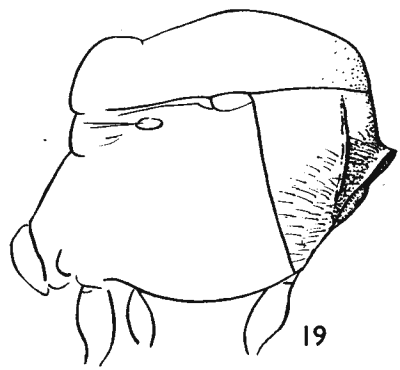
FIG. 13.—Radial cell of fore wing: Pycnostigmatinae.

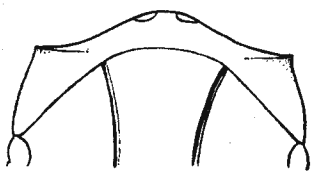


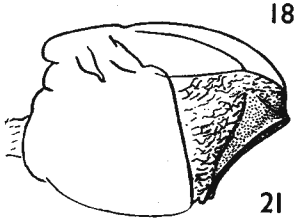












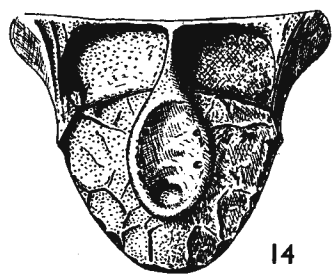


FIG. 14.—Scutellum, Eucoilidae, *Eucoila crassinerva*.
FIG. 15.—Hind tibia, Aspicerinae, *Callaspidia dufouri*.
FIG. 16–18.—Pronotum, dorsal : 16, *Charips victrix* ; 17, *Saphonecrus connatus* ; 18, *Synergus reinhardi*.
FIGS. 19–21.—Pronotum, lateral : 19, *Charips victrix* ; 20, *Saphonecrus connatus* ; 21, *Synergus reinhardi*.

4 (3) Alate ; fore wing with cubitalis ($Rs + M$), when visible, arising from a point at or close to junction of basalis (Rs or $Rs + M$) with median (Cu_1) (fig. 8) ; female more often with third tergite the largest (fig. 3) ; male generally with gaster cylindrical (except Aspicerinae) ; mesopleuron sculptured medially at least, or scutellum with apical spine.....FIGITIDAE..5

– Sometimes brachypterous or apterous ; fore wing with cubitalis ($Rs + M$), when visible, arising from a point nearer the middle of basalis ($Rs + M$) than to the junction of basalis with median (Cu_1) (figs. 9, 10, 11) ; female with the largest free tergite either the second (figs. 169, 170, 171), or the second and third fused together, with or without an obsolete suture visible (figs. 96, 97, 98, 99) ; both sexes with the gaster laterally compressed ; sometimes whole insect entirely smooth and shining ; scutellum never with apical spine CYNIPIDAE..7

5 (4) Second tergite of gaster liguliform (fig. 5).
Hind tibiae in most genera longitudinally ridged or furrowed externally or posteriorly (fig. 15) ; scutellum always with three longitudinal carinae, and subapically with either a spine or a fovea, and thorax sculptured ASPICERINAE

– Second tergite of gaster not liguliform (fig. 6).
Hind tibiae in most genera longitudinally ridged or furrowed externally or fine longitudinal carina or groove internally ; scutellum usually without three longitudinal carinae or subapical fovea, though more frequently apically produced to form a spine ; thorax smooth and shining in most genera.....6

6 (5) Second tergite of gaster as long as or longer than the third (fig. 6) ; first segment of gaster sometimes very long ; fore wing with cubitalis ($Rs + M$) dividing externally at point of emission of vein *2rm* (*i.e.* areolet vestigial) (fig. 12) ANACHARITINAE

– Second tergite of gaster shorter than the third (fig. 3) ; first segment of gaster usually short, sometimes very short ; fore wing with $Rs + M$ dividing externally before point of emission of *2rm* (*i.e.* areolet present, though often obsolete) (fig. 8).....FIGITINAE

7 (4) Radial cell much reduced, closed, its veins thick and heavy (fig. 13) ; gaster with segments two and three completely fused (*Not British*) PYCNOSTIGMATINAE

– Radial cell normal or little reduced, open or closed (figs. 1, 9, 10, 11) ; apterous forms occur.....8

8 (7) Middle tibia often with only one spur ; hind tibia with one spur, or more often with two very unequal spurs ; vertex, mesoscutum, scutellum, mesopleuron and gaster smooth and shining ; pronotum generally sharply angled anteriorly (fig. 16), this forming a lateral vertical carina (fig. 19) ; gaster with pubescent ring at base of second segment ; antenna of male with modified segment, when present, the fourth, rarely the third, sometimes both fourth and fifth.....CHARIPINAE

– Middle and hind tibiae each with two distinct spurs ; sculpture present at least on either vertex, mesoscutum, scutellum, mesopleuron or gaster ; pronotum generally not angled sharply anteriorly (figs. 17, 20), but if some carina indicated (figs. 18, 21), then head and thorax strongly sculptured ; gaster very rarely with pubescence at base of second segment ; antenna of male with modified segment, when present, always the third. (FIGS. I–VII) CYNIPINAE

Subfamily CYNIPINAE

KEY TO GENERA

1 Pronotum dorsally longer (fig. 22) in the median dorsal line, one-sixth at least, usually one-third as long as the greatest length on the outer lateral margin, and frequently with a truncation and pits (figs. 24, 27) ; projection of ventral spine of gaster of female always short (figs. 26, 96–99, 130) ; species always fully alate. (FIGS. I, II, p. 19).....2

– Pronotum dorsally very short (fig. 23), in median dorsal line, one-seventh or less as long as outer lateral margin, and without truncation or pits (fig. 25) ;

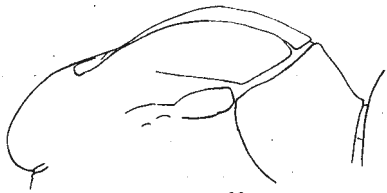
projection of ventral spine of gaster of female usually longer than broad, viewed laterally (figs. 48, 215, 216, 217); or agamic female apterous. (FIGS. III–VII, pp. 47, 57, 58).....12

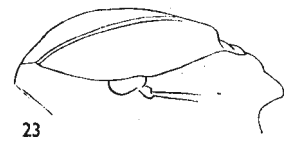
2 (1) Tergites 2 to 7 free in most cases (fig. 26); when 2 + 3 completely fused in female, or showing only a false suture in either sex, then pronotum has two distinct submedial pits (fig. 27); apex of propodeum longitudinally rugose or striate, first segment of gaster smooth and shining, much reduced, generally visible only as a crescent-shaped projecting scale.....3

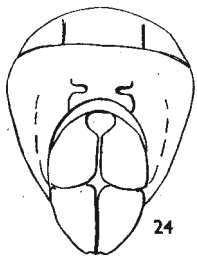
– Tergites 2 + 3 fused in both sexes into one large segment (figs. 96, 97, 98, 99), occupying nearly the whole of the gaster in the female; apex of propodeum and first segment of gaster, which is always distinct, both longitudinally rugose; face entirely with radiating striae. *Inquilines in galls on* Quercus..11

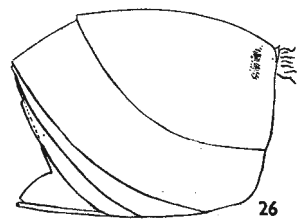
3 (2) Face with two vertical and parallel carinae (fig. 28); frontal carinae absent **Ceroptres** Hartig (p. 17)

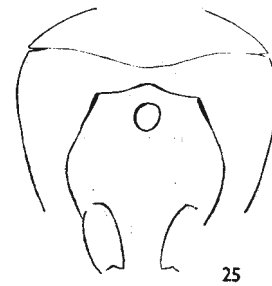
– Face flat or raised medially, striate, reticulate, or coriaceous, but never with two carinae as above.....4











FIGS. 22–23.—Pronotum, lateral: 22, *Aulacidea hieracii* ♀; 23, *Andricus solitarius* ♀.
FIGS. 24–25.—Pronotum, viewed anteriorly with head removed: 24, *Aulacidea tragopogonis* ♀; 25, *Andricus solitarius* ♀.
FIG. 26.—Gaster, lateral: *Liposthenus latreillei* ♀.

4 (3) All claws with a distinct basal lobe or tooth (figs. 31, 32, 33, 34) or mesoscutum and vertex smooth and shining.
Species associated with Rosaceae. (Rosa, Rubus, Potentilla ...).....9

– All claws simple (figs. 29, 30); mesoscutum and vertex rather dull, sculptured; mesopleuron striate or reticulate.....5

5 (4) Mesopleuron longitudinally striate; pronotum with two distinct submedial pits (figs. 24).....6

– Mesopleuron reticulate (fig. 35); pronotum usually without pits, rarely with two rather small and indistinct pits.....**Phanacis** Foerster (p. 17)

6 (5) Subcosta and radius not reaching quite to anterior margin of wing (fig. 37); radial cell clearly open anteriorly (fig. 37); second segment of gaster sometimes completely smooth at base.....8

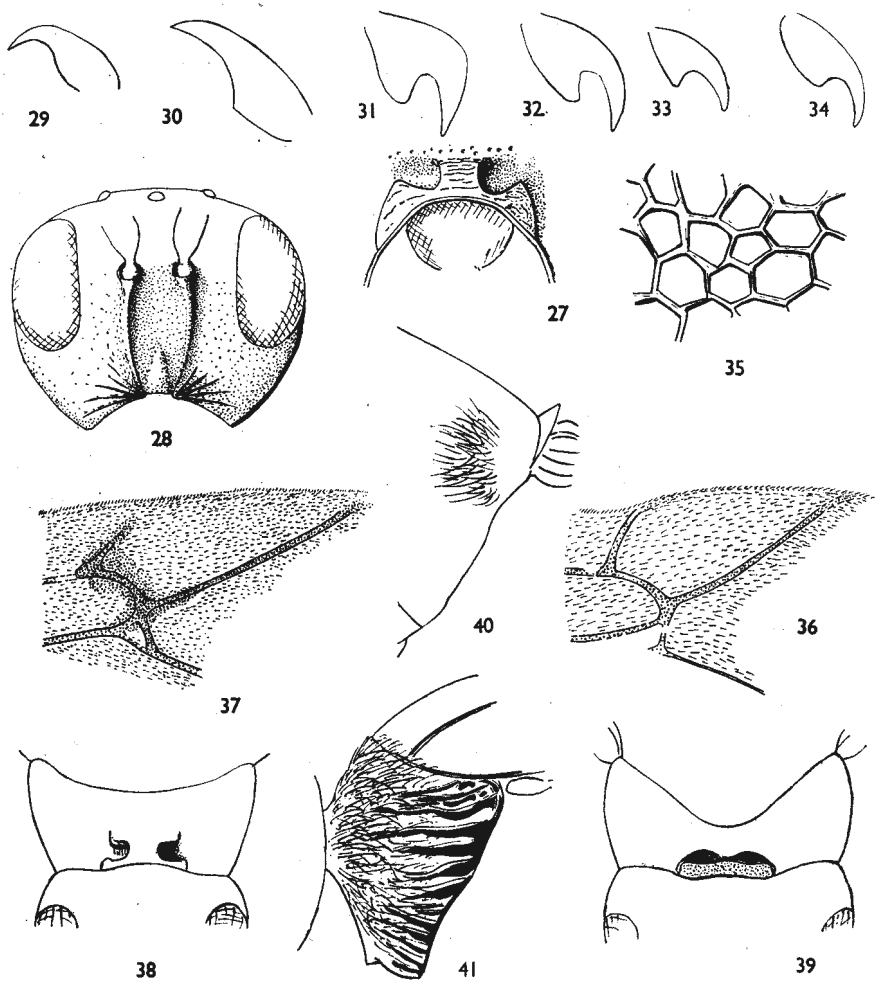


FIG. 27.—Pronotum, anterior, with head removed : *Periclistus brandtii*.
FIG. 28.—Face, anterior : *Ceroptres arator*.
FIGS. 29–34.—Claws : 29, *Aulacidea hieracii* ♀ (hind) ; 30, *Lipsothenus latreillei* ♀ (hind) ; 31, *Diastrophus rubi* ♀ (hind) ; 32, *Periclistus brandtii* ♀ (mid) ; 33, *Xestophanes potentillae* ♀ (front) ; 34, *X. potentillae* ♀ (hind).
FIG. 35.—Sculpture of mesopleuron : *Phanacis caulicola*.
FIGS. 36–37.—Radial cell : 36, *Aulacidea hieracii* ; 37, *Isocolus rogenhoferi*.
FIGS. 38–39.—Pronotum, antero-dorsal : 38, *Aulacidea hieracii* ; 39, *Aylax papaveris*.
FIGS. 40–41.—*Lipposthenus latreillei*, ♀ : 40, second segment of gaster, lateral ; 41, pronotum, lateral.

– Subcosta and radius reaching to anterior margin of wing (fig. 36); **radial** cell closed, partially closed (*see* figs. 44, 71), or obsoletely closed (fig. 36); second segment of gaster laterally pubescent at base.....7

7 (6) Pronotum longer medially (fig. 38); face with **radiating** striae, coriaceous medially; marginal vein of fore wing partially or completely closing **radial** cell anteriorly. (FIG. I, p. 19)

Gall-makers in stems of Compositae.....**Aulacidea** Ashmead (p. 20)

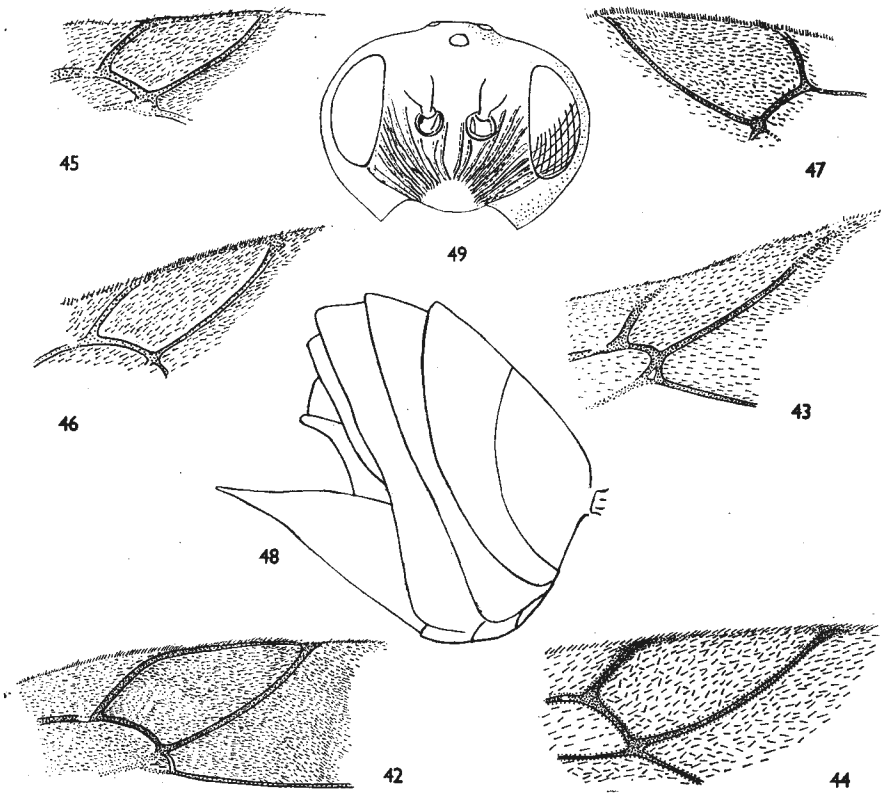
– Pronotum short, and pits more strongly transverse (**fig. 39**); face with radiating striae, medially with an inverted triangular **punctate area**; marginal vein of fore wing obsolete, radial cell appearing open.

Gall-makers in seed capsules of Papaver.....**Aylax** Hartig (p. 22)

8 (6) Second segment of gaster basally smooth without **sculpture** or pubescence, **punctate** posteriorly; following segments clearly **though** finely **punctate**; pronotum coriaceous

Gall-makers in heads and stems of Centaurea (*Compositae*)

Isocolus Foerster (p. 22)



FIGS. 42–47.—Radial cell of fore wing: 42, *Periclistus brandtii*; 43, *Diastrophus rubi*; 44, *Xestophanes potentillae*; 45, *Synergus umbraculus*; 46, *Synergus apicalis*; 47, *Saphonecrus connatus*.

FIG. 48.—Gaster, lateral: *Diplolepis nervosa* ♀.

FIG. 49.—Head, anterior: *Callirhytis erythrocephala* ♀.

– Second segment of gaster with distinct lateral pubescent patch (fig. 40); all segments at least laterally with some very minute obsolete, or very indistinct, punctures; pronotum longitudinally striate and pubescent (fig. 41).
Gall-makers in leaves and stems of Nepeta (*Labiatae*)
Liposthenus Foerster (p. 22)

9 (4) Second segment of gaster pubescent at base; mesoscutum and vertex rather dull, alutaceous or coriaceous.
Subcosta and radius reaching to anterior margin of wing (fig. 42), radial cell closed anteriorly, sometimes indistinctly; second and third segments of gaster completely fused in female, separated by an obsolete suture in male.
Inquilines in Cynipid galls on Rosa.....**Periclistus** Foerster (p. 22)

– Second segment of gaster not pubescent at base; mesoscutum and vertex smooth and shining.
Gall-makers on Potentilla *and* Rubus.....10

10 (9) Claws weakly lobed; subcosta and radius reaching to anterior margin of wing (fig. 44); radial cell sometimes partly closed anteriorly; second and third segments of gaster completely fused in female, separated in male
Xestophanes Foerster (p. 24)

— Claws strongly lobed; subcosta and radius not reaching to anterior of wing (fig. 43), radial cell open anteriorly; second and third segments of gaster completely free in both sexes.....**Diastrophus** Hartig (p.24)

11 (2) Antenna of female with 14 segments, male with 15 segments; notaulices distinct; frontal carinae present, though sometimes weak; frons flat or slightly convex; radial cell closed (fig. 45); head widened behind.
(*Synergus apicalis* and *S. rotundiventris* resemble *Saphonecrus* in having indistinct notaulices, sometimes absent anteriorly, frontal carinae weak or absent, radial cell indistinctly closed (fig. 46), and head narrow and hardly widened behind eyes; but pronotum has lateral carinae like all British species of *Synergus* and unlike *Saphonecrus connatus*). (figs. 18, 21.)
Inquilines in galls on Quercus.....**Synergus** Hartig (p. 24)

— Antenna of female with 13 segments; male generally with 14 segments; notaulices generally absent anteriorly; frontal carinae absent; frons slightly depressed; radial cell open (fig. 47).
(*Saphonecrus connatus* resembles *Synergus* in that the male has antenna of 15 segments, both sexes have narrow head scarcely widened behind eyes, and full-length notaulices, very indistinct in anterior two-thirds; but differs in that pronotum has no lateral carina) (figs. 17, 20).
Inquilines in galls on Quercus. **Saphonecrus** Dalla Torre and Kieffer (p. 33)

12 (1) Mesopleuron with longitudinal furrow, often punctate or reticulate; hypopygium of female ploughshare-shaped (fig. 48); radial cell closed anteriorly (figs. 148, 149, 150, 151); claws simple. (FIG. II, p. 19.)
Gall-makers on Rosa.....**Diplolepis** Geoffroy (p. 33)

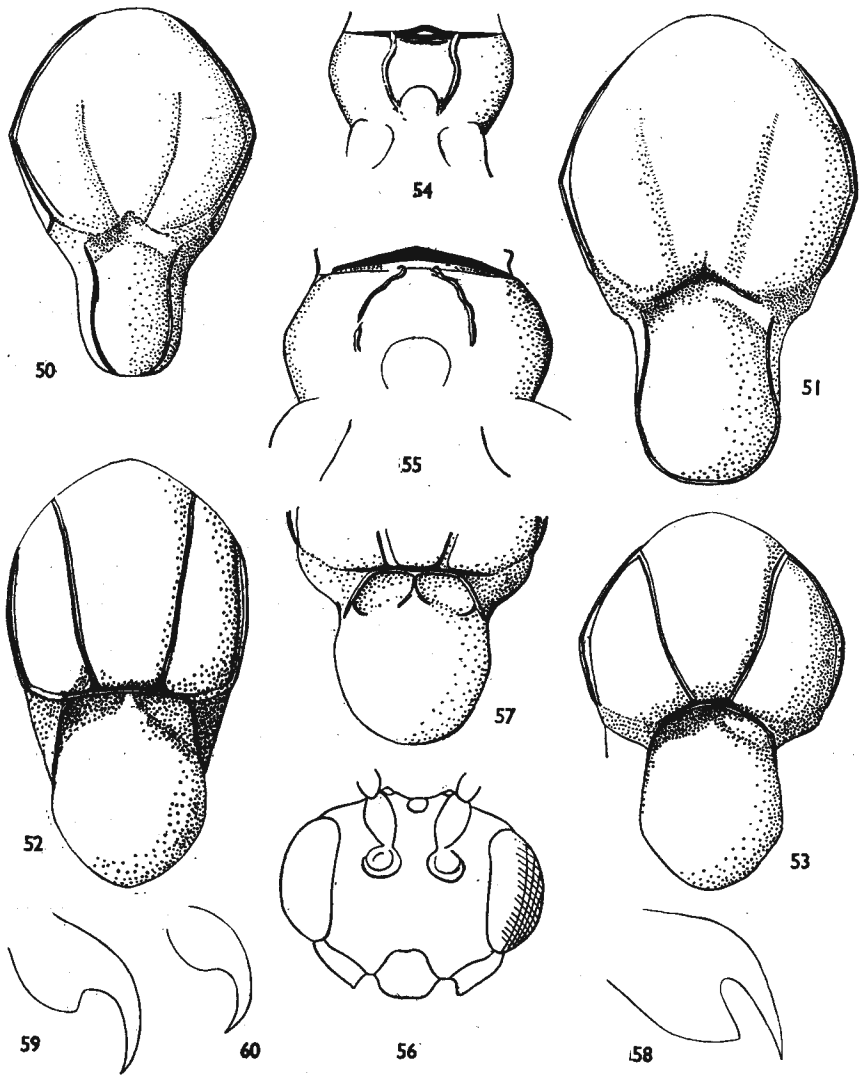
— Mesopleuron without longitudinal furrow; hypopygium of female never shaped as above; radial cell open anteriorly (figs. 1, 218, 219, 220, 221, 257, 258, 259); claws simple or with basal lobe.
Gall-makers on Quercus.....13

13 (12) Mesoscutum with conspicuous transverse rugae; face covered with striae radiating from mouth (fig. 49).....**Callirhytis** Foerster (p. 35)

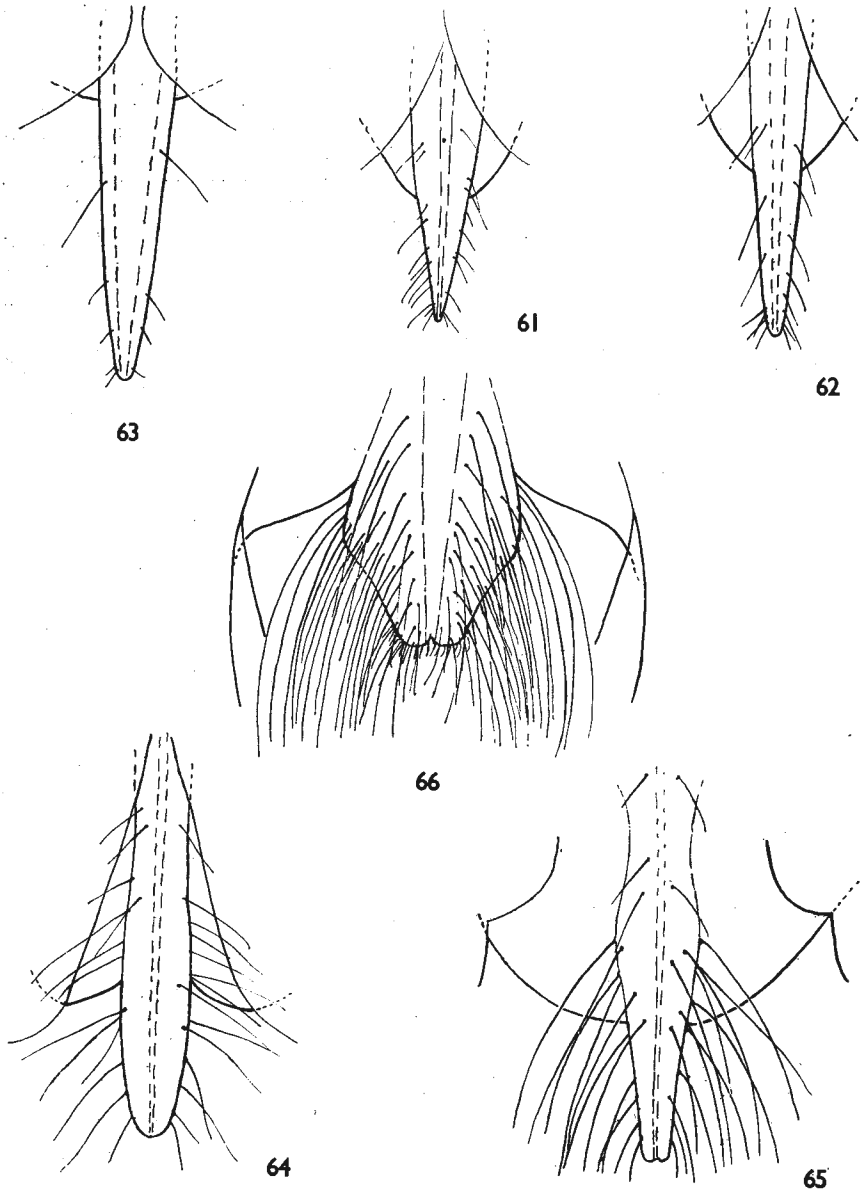
— Mesoscutum smooth, alutaceous, coriaceous, or pubescent; face at most with a few radiating striae.....14

14 (13) All forms fully winged; mesoscutum deeply emarginate behind and joined to scutellum without a suture (fig. 50), rarely with a weak transverse carina (fig. 51); notaulices weak, incomplete or absent (figs. 50, 51).
Scutellar foveae confluent and forming a shallow arcuate transverse depression; propodeum generally without longitudinal submedial carinae..15

— Fully winged *and* with scutellum separated from mesoscutum by a distinct narrow sulcus or suture, which is bordered posteriorly by an arcuate or nearly straight transverse carina (figs. 52, 53), *or* wingless; notaulices complete and distinct in all winged forms (fig. 53).
Propodeum always with two longitudinal carinae (fig. 54), the enclosed medial area generally rather differently sculptured from the external area, and often smooth and shining.....17



FIGS. 50–53.—Mesonotum : 50, *Neuroterus quercusbaccarum* ♀ ; 51, *Neuroterus albipes* ♂ ; 52, *Andricus ostreus* ♀ ; 53, *Cynips quercusfolii* ♀.
FIGS. 54–55.—Propodeum : 54, *Andricus fecundator* ♂ ; 55, *Neuroterus aprilinus* ♀.
FIGS. 56–57.—*Trigonaspis megaptera* ♀ : 56, head, anterior ; 57, scutellar foveae.
FIGS. 58–60.—Claws : 58, *Cynips quercusfolii* ♀ ; 59, *Trigonaspis megaptera* ♂; 60, *Biorhiza pallida*.



FIGS. 61–64.—Spine of hypopygium, ventral, *Andricus*, ♀: 61, *solitarius*; 62, *fecundator*; 63, *quercusramuli*; 64, *ostreus*.
FIGS. 65–66.—Spine of hypopygium, ventral, *Cynips*: 65, *longiventris* ♀ 66, *longiventris* ♂.

15 (14) Mesoscutum joined to scutellum without a carina (fig. 50) ; propodeum smooth, alutaceous, coriaceous or rugulose, sometimes longitudinally carinate dorsally. (Fig. III, p. 47).....**Neuroterus** Hartig (p. 37)

— Mesoscutum separated from scutellum by a weak but distinct transverse carina (fig. 51) *or* propodeum with two longitudinal carinae (fig. 55).....16

16 (15) Mesoscutum separated from scutellum by a distinct carina (fig. 51) ; propodeum without carinae.....*Neuroterus albipes* (Schenck) ♂

— Mesoscutum not separated from scutellum ; propodeum with two longitudinal carinae (fig. 55).....*Neuroterus aprilinus* (Giraud)

17 (14) Females.....18

— Males.....21

18 (17) Ventral spine of gaster slender (figs. 61, 62), often long (fig. 63), sub-basal hairs shorter, straight, and more often sparse, but if long (fig. 64) then not reaching to apex of spine ; all forms fully-winged.....**Andricus** Hartig (p. 39)

— Ventral spine of gaster short, often broad, and always with long subapical hairs, which project beyond the apex of spine to form a distinct broad truncate tuft (figs. 65, 66) ; agamic females sometimes apterous or with wings reduced. (Figs. VI–VII, pp. 57, 58).....19

19 (18) Subocular suture absent ; all forms fully winged ; scutellar foveae confluent, shallow in sexual forms (fig. 53) ; claws always with a distinct basal lobe or tooth (fig. 58) ; sexual forms not pubescent, agamic females pubescent **Cynips** Linnaeus (p. 55)

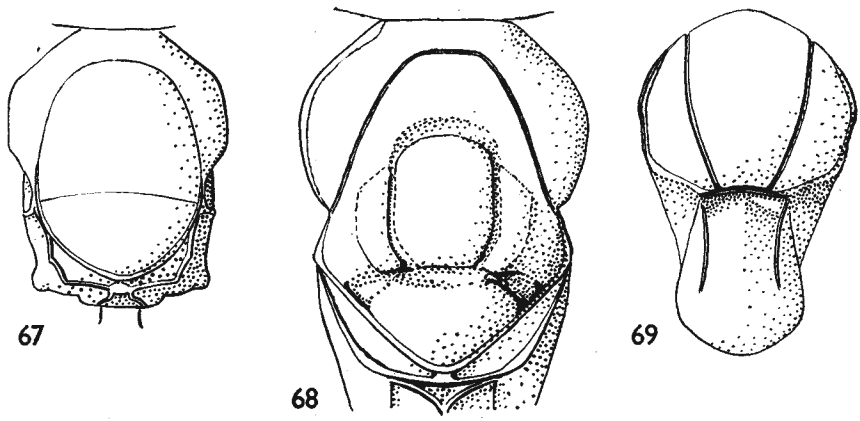
— Subocular sulcus present (fig. 56) ; sexual forms winged, agamic females apterous or with wings reduced ; scutellar foveae distinctly separate in sexual forms (fig. 57), shallow and confluent, or absent in agamic females (figs. 67, 68) ; claws with basal lobe, or simple (figs. 59, 60) ; no forms pubescent. 20

20 (19) Claws with a basal lobe (fig. 59), indistinct in dry specimens of *T. megaptera* ♂ ; apterous forms with the dorsum of the thorax convex and pronotum smaller (fig. 67).....**Trigonaspis** Hartig (p. 59)

— Claws simple (fig. 60) ; apterous forms with the dorsum of the thorax flattened and the pronotum larger (fig. 68).....**Biorhiza** Westwood (p. 59)

21 (17) Claws simple (fig. 60).....**Biorhiza** Westwood (p. 59)

— Claws basally lobed (figs. 58, 59).....22



Figs. 67–69.—Thorax, dorsal : 67, *Trigonaspis megaptera* ♂ ; 68, *Biorhiza pallida* ♂ ; 69, *Andricus ostreus* ♂.

22 (21) Scutellar foveae confluent (figs. 53, 69), forming a broad, shallow transverse depression **23**

— Scutellar foveae clearly separated **24**

23 (22) Scutellar depression bordered anteriorly by a distinct and clearly regularly arcuate carina (fig. 53); subocular sulcus absent... **Cynips** Linneaus (p. 55)

— Scutellar depression with a weaker and almost straight carina (fig. 69); subocular sulcus present, though weak..... *Andricus ostreus* Hartig

24 (22) Subocular sulcus absent; clypeus smaller, the margin less strongly projecting **Andricus** Hartig (p. 39)

— Subocular sulcus present; clypeus large, strongly projecting, and distally truncate (fig. 56)..... **Trigonaspis** Hartig (p. 59)

In the following keys the flight time of a species is given in small Roman numerals, representing the months of the year. Where all the species of a genus have the same flight time, this is given in a note preceding the key. Relative abundance of a species is given only in the key to the galls.

Genus **Ceroptres** Hartig

Only one species known to occur in Britain.

Face with two parallel carinae (fig. 28)..... **arator** Hartig

This has been bred most commonly from twigs containing galls of *Andricus quercusradicis* (F.) ♂♀ (= *trilineatus* Htg.). It has also been bred quite frequently from collections of galls of *Andricus kollari* (Htg.) ♂ and occasionally from galls of *A. testaceipes* Htg. ♂ (= *sieboldi* Htg.), though it is suspected that some of the specimens so bred may have come from cells of *trilineatus* in the twigs. Blair (1949) stated that *C. arator* Htg. was parasitic on *Andricus kollari* (Htg.) ♂.

Genus **Phanacis** Foerster

Key to Species

1 Marginal vein completely pigmented (fig. 70).
Mesoscutum reticulate; scutellar foveae confluent, forming a broad hollow, open externally; radial cell with length two and a half times its width; face reticulate, malar space with some weak radiating striae; third segment of antenna of female one and a half times length of fourth segment.
v–vi. *Gall in stems of* Centaurea *species*..... **centaureae** Foerster

– Marginal vein not completely pigmented anteriorly, radial cell appearing partly open anteriorly (fig. 71)..... 2

2 (1) Mesoscutum less shining, more strongly sculptured, reticulate coriaceous anteriorly, and reticulate posteriorly; notaulices absent in anterior one-quarter to one-half of mesoscutum (fig. 72); female with third segment of antenna equal to or scarcely longer than fourth segment; face with distinct radiating striae, at least laterally..... 3

– Mesoscutum more shining, less strongly sculptured, reticulate alutaceous; notaulices complete (fig. 73); female with third segment of antenna one and a half times length of fourth segment; face coriaceous, malar space with some weak or indistinct striae..... 4

– Mesoscutum and face coriaceous; notaulices absent in anterior half of mesoscutum; female with third segment of antenna a little longer than fourth segment, flagellum red; scutellar foveae small and indistinct; radial cell with length two and a half times its width.
v–vi. *Gall in stems of* Sonchus *species*..... **sonchi** (Stefani), **comb. n.**

3 (2) Mesopleuron reticulate with some longitudinal rugulae or striae in upper portion (fig. 75); scutellar foveae clearly separated and open externally; face completely striate; radial cell with length twice its width.
v–vii. *Gall in stem of* Hypochaeris radicata
hypochoeridis (Kieffer), **comb. n.**

– Mesopleuron entirely reticulate (fig. 74); median scutal furrow **present in** posterior third; scutellar foveae very weakly or indistinctly **separated,** closed externally; only malar space distinctly striate; radial **cell with** length two and one-third times its width.
v–vi. *Gall in stem of* Picris echioides..... **caulicola** (Hedicke), **comb. n.**

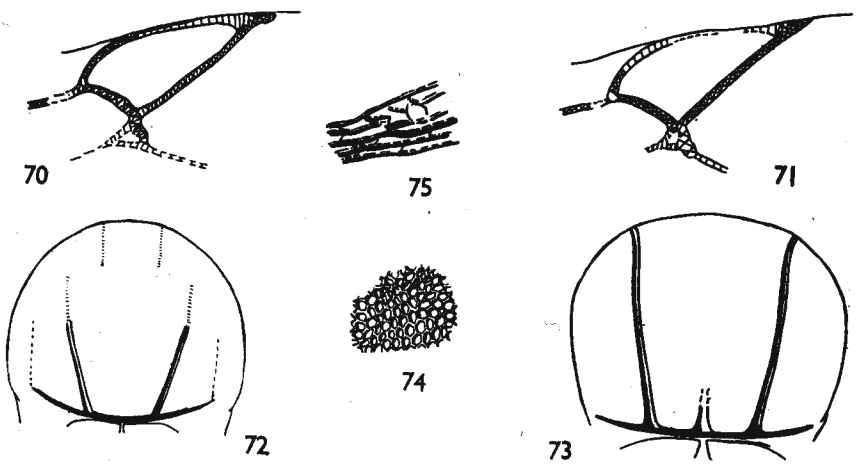
4 (2) Radial cell with length three and a half times its width; median scutal **furrow** obsolete, represented by a short posterior notch.
v–vi. *Gall in stem of* Lapsana communis.... **lampsanae** (Perris), **comb. n.**

– Radial cell with length not more than two and a quarter times its **width;** median scutal furrow present in posterior quarter (fig. 73).
vi. *Gall in base of midrib of* Taraxacum officinale **taraxaci** (Ashmead), **comb. n.**

No material of *P. sonchi* (Stefani) has been seen, and the species is included in the present key solely from the description in Kieffer (1910). The gall was first discovered in Britain by Bagnall and Burkill, and placed on record in 1935 (*Entomologist* **68** : 10; *Lond. Nat.* **1934** : 97).

P. lampsanae (Perris) was included in the list of British species on the authority of Bagnall and Harrison (1934, *Ent. mon. Mag.* **70** : 62), who recorded the gall; the authors were able to examine a single female specimen from the collection in Vienna.

P. taraxaci (Ashmead) was placed in the list of British species by Bagnall (1917, *Ent. mon. Mag.* **53** : 200–1), who recorded the gall; galls were subsequently recorded by Fordham (1917) and again by Bagnall (1918). The authors do not know of any British specimens of the adults, and North American material was examined for the present work.



FIGS. 70–71.—Radial cell of fore wing: 70, *Phanacis centaureae*; 71, *P. hypochoeridis*.
FIGS. 72–73.—*Phanacis*, notaulices: 72, *hypochoeridis*; 73, *taraxaci*.
FIGS. 74–75.—*Phanacis*, mesopleuron: 74, *caulicola*; 75, *hypochoeridis*.

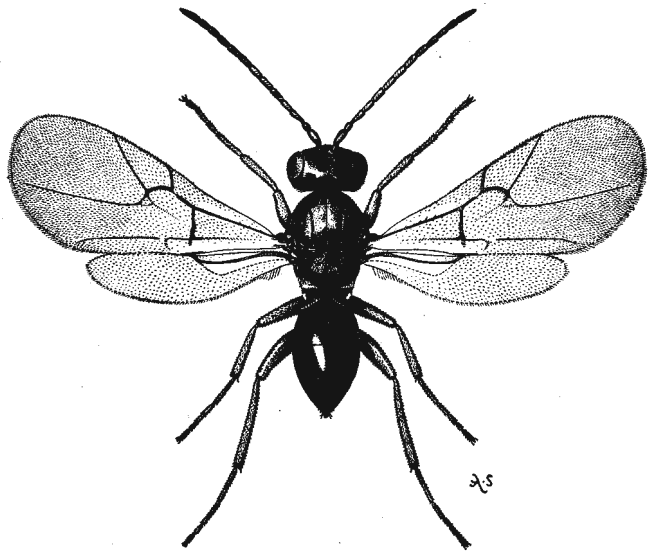


FIG. I.—*Aulacidea hieracii*, ♀.

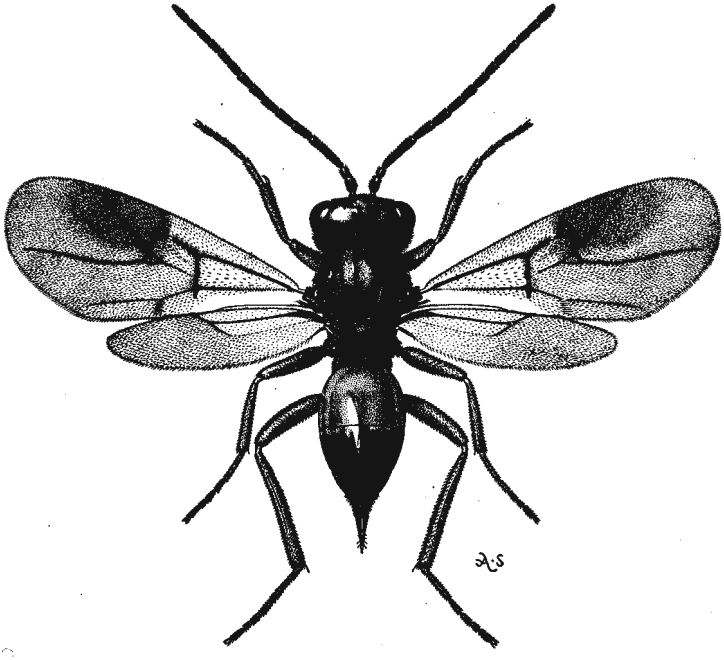


FIG. II.—*Diplolepis rosae*, ♀.

Genus **Aulacidea** Ashmead

KEY TO SPECIES

1 Scutellar foveae shallow, their anterior margins together forming an arc contra to the slight curve of the scutal suture (fig. 76) ; radial cell with length twice its breadth.
Head, viewed anteriorly, trapezoid (fig. 80) ; viewed dorsally, temples not expanded behind eyes ; third segment of antenna a little longer than fourth (fig. 83).
vi–vii. *Gall in stem base of* Tragopogon pratensis **tragopogonis** (Thomson)

– Scutellar foveae deep, round or with their anterior margins together forming a straight or almost straight line parallel to the scutal suture (figs. 77, 78, 79) ; radial cell with length more than twice the breadth.....2

2 (1) Head, viewed anteriorly, slightly transversely ovate (fig. 81) ; viewed dorsally, temples expanded behind the eyes ; radial cell with length three times the breadth.
Anterior margins of scutellar foveae forming together a straight line (fig. 77) ; antenna with third segment at most equal to length of fourth segment (fig. 84) ; radial cell indistinctly or obsoletely closed. (FIG. I, p. 19).
v–vi. *Gall in stems of* Hieracium *species*, Linaria vulgatum *and* Solidago *species*.....**hieracii** (Bouché)

– Head, viewed anteriorly, subrectangulate or trapezoid (fig. 82) ; viewed dorsally, temples not expanded behind eyes; radial cell with length a little more than twice the breadth.....3

3 (2) Anterior margins of scutellar foveae together forming a straight line (fig. 78) ; head, viewed anteriorly, transversely subrectangulate (fig. 82) ; antenna with third segment clearly a little longer than fourth segment ; face mostly coriaceous, radiating striae very weak and limited to two small areas, one on each side of the middle line, cheeks coriaceous.
vi–vii. *Gall on runners of* Hieracium vulgare.....**subterminalis** Niblett

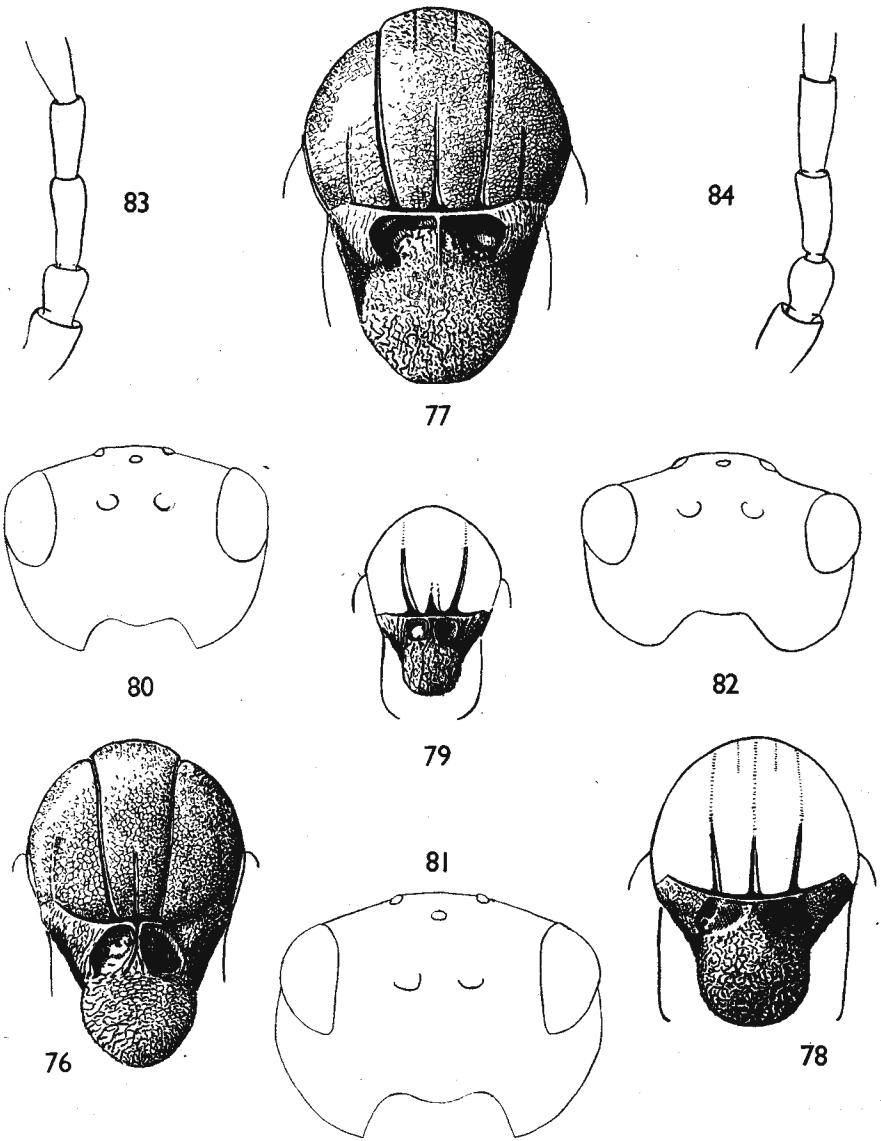
– Scutellar foveae round (fig. 79) ; head, viewed anteriorly, narrowly trapezoid ; antenna with third segment at most equal in length to fourth segment ; radiating striae on face weak, but areas extending from each side of midline below eyes to cheeks.
vi–vii. *Gall in midrib of leaf of* Hieracium pilosella **pilosellae** (Kieffer)

A. hieracii (Bouché) = *graminis* (Cameron), **syn. n.**

A. graminis Cameron, which is reared from galls on roots of *Agropyron repens*, seems to be synonymous with *hieracii* as stated in Cameron (1893). *A. graminis* was reinstated by Bagnall (1917, *Ent. mon. Mag.* **53** : 200–1). A series in the B.M. collection reared from *Solidago* (Thetford, Forestry Commission) also appears to be the same species, and is included under *hieracii*.

A. tragopogonis (Thomson) = *pigeoti* Kieffer, **syn. n.**

It has not been possible to see the type of *pigeoti* Kieffer, or other authentic material from that source. Of material in the B.M. collection determined by Hedicke as *A. tragopogonis* (Thomson), two out of three specimens agree with the description of that species in Thomson, Mayr, and Kieffer, in having the notaulices obsolete anteriorly. Insects bred from galls collected in Britain as *tragopogonis* and *pigeoti* agree with *pigeoti* in having the notaulices percurrent in all but the smallest specimens, in which they are sometimes obscure anteriorly. It seems unlikely, to the present authors, that two species are present, as in neither the adult nor the gall have they been satisfactorily distinguished. The host plant of *tragopogonis* is not given in the original description, but Mayr (1882) gives *T. major* and *T. orientalis*, and Kieffer (1910) adds *T. pratensis*. The host plant of the type of *pigeoti* was given as



FIGS. 76–79.—*Aulacidea*, mesonotum, scutellar foveae : 76, *tragopogonis* ; 77, *hieracii* ; 78, *subterminalis* ; 79, *pilosellae*.
FIGS. 80–82.—*Aulacidea*, head, anterior, ♀ : 80, *tragopogonis* ; 81, *hieracii* ; 82, *subterminalis*.
FIGS. 83–84.—*Aulacidea*, basal segments of antenna, ♀ ; 83, *tragopogonis* ; 84, *hieracii*.

T. porrifolius. Bagnall (1930, *Ent. mon. Mag.* **66** : 225) recorded both *tragopogonis* and *pigeoti* from *T. pratensis*, distinguishing them solely on the position and appearance of the galls.

A. andrei (Kieffer)

Added to the British list by Bagnall (1931, *Ent. mon. Mag.* **67** : **243**) on the evidence of three specimens of the gall on the host plant ***Hypochaeris maculata***. There does not appear to be any later record. The present authors have not been able to see material of the species, and think it should be deleted from the list of British species.

Genus **Aylax** Hartig

The two forms given below are not satisfactorily separable and have sometimes been regarded as belonging to a single species. Their galls, however, seem to be quite easily separated (figs. 271, 272) so they are here retained as distinct species.

Scutellum rugose, with small anterior area coriaceous and with a shallow medial depression posteriorly; mesoscutum generally with notaulices complete.
iv–vii. *Gall in swollen seed capsules of* Papaver rhoeas *and* **P. dubium papaveris (Perris)**

Scutellum in greater part coriaceous, rugulose apically, and more often without shallow medial depression; mesoscutum generally with notaulices absent anteriorly.
iv–vii. *Gall in normal seed capsules of* Papaver rhoeas *and* **P. dubium minor Hartig**

Genus **Isocolus** Foerster

KEY TO SPECIES

1 Scutellum with distinct longitudinal furrow.
Gall in base of leaves of Centaurea scabiosa *near ground*..... **fitchi** (Kieffer)
– Scutellum without longitudinal furrow.....2
2 (1) Notaulices obsolete or indistinct anteriorly (fig. 85).
vi–viii. *Gall in achenes of* Centaurea *species*..... **jaceae** (Schenck)
– Notaulices complete and distinct (fig. 86).....3
3 (2) Flagellum red.
vi–vii. *Gall in stems of* Centaurea nigra *and* C. scabiosa
– Flagellum black. **scabiosae** (Giraud)
vi–vii. *Gall in involucral bracts of* Centaurea scabiosa **rogenhoferi Wachtl**

It has not been possible to see any material of *I. fitchi* (Kieffer). It was first recorded from Britain by Edward A. Fitch (1877, *Entomologist* **10**: 124–126) as *T. scabiosae* from galls collected in Derbyshire by Mr. W. C. Boyd in 1875. Kieffer (1898, 1899, in André, *Species des Hymenoptères d'Europe* 7) described it under the present name, dedicating it to Asa Fitch, the American entomologist. Niblett (1940) recorded the gall from localities in Surrey.

Genus **Liposthenus** Foerster

One species only.

iii–iv. *Gall on leaves of* Glechoma hederacea..... **latreillei** (Kieffer)

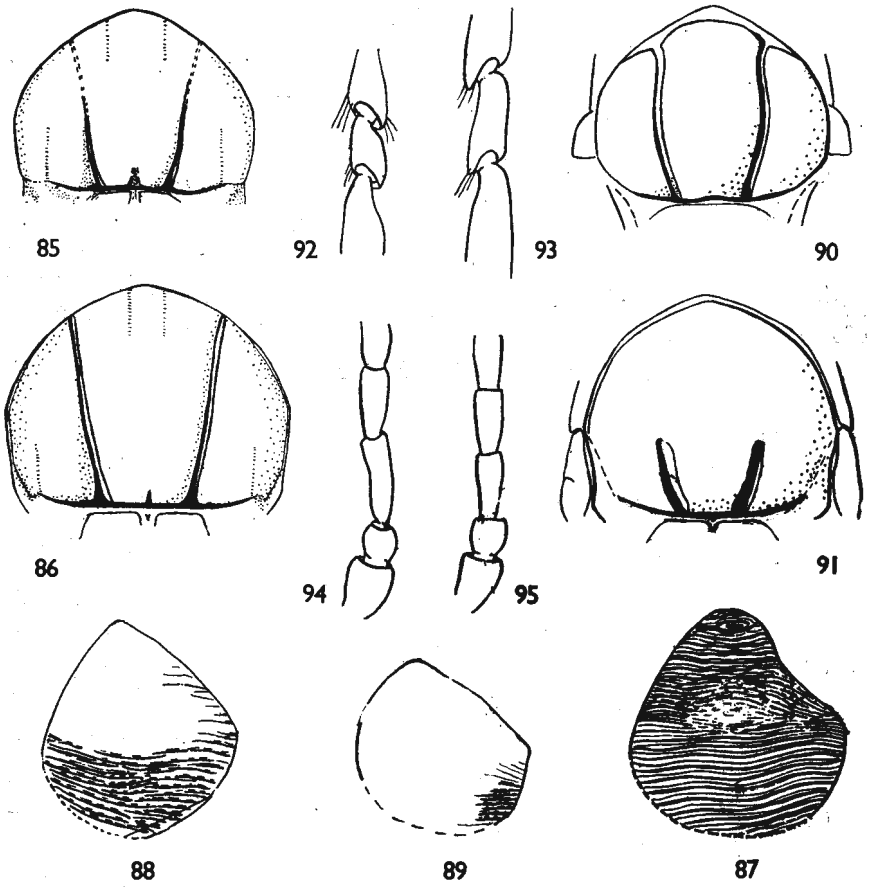
Genus **Periclistus** Foerster

All the species are inquilines in the galls of *Diplolepis* spp. on *Rosa*.

KEY TO SPECIES

1 Notaulices complete, though sometimes faint ; mesopleuron completely striate (fig. 87) ; female with segment 2 + 3 of gaster with complete apical band of fine punctures.
v–vi. *Common in galls of* Diplolepis rosae (*Linnaeus*) *and* D. mayri (*Schlechtendal*) ..... **brandtii** Ratzeburg.

– Notaulices incomplete, absent anteriorly ; mesopleuron with bare shining patch dorso-posteriorly or almost entirely smooth ; female with segment 2 + 3 of gaster with apical punctures sometimes absent dorsally 2



FIGS. 85–86.—*Isocolus*, notaulices : 85, *jaceae* ; 86, *rogenhoferi*.
FIGS. 87–89.—*Periclistus*, mesopleuron, right side : 87, *brandtii* ; 88, *caninae* ; 89, *spinosissimae*.
FIGS. 90–91.—*Xestophanes*, notaulices : 90, *brevitarsis* ; 91, *potentillae*.
FIGS. 92–93.—*Xestophanes*, fourth segment of hind tarsus : 92, *brevitarsis* ; 93, *potentillae*.
FIGS. 94–95.—*Xestophanes*, basal segments of antenna : 94, *brevitarsis* ; 95, *potentillae*.

2 (1) Mesopleuron mainly striate, a smooth shining patch posteriorly (fig. 88).
vi–viii. *Common in galls of* D. eglanteriae (*Hartig*) *and* D. centifoliae (*Hartig*) ..... **caninae Hartig**

– Mesopleuron almost entirely smooth and polished (fig. 89), faint striae ventro-anteriorly only.
v–vi. *Common in galls of* D. spinosissimae (*Giraud*)
spinosissimae Dettmer

Genus **Xestophanes** Foerster

KEY TO SPECIES

Notaulices complete (fig. 90) ; fourth segment of hind tarsus as **broad as long** (fig. 92) ; third segment of antenna longer than fourth (fig. 94).
v–vi. *Gall on stem of* Potentilla erecta ..... **brevitarsis (Thomson)**

Notaulices absent anteriorly (fig. 91) ; fourth segment of hind tarsus **clearly** longer than broad (fig. 93) ; third segment of antenna as long as fourth (**fig. 95**).
vi. *Gall in stem of* Potentilla reptans ..... **potentillae (Retzius)**

Genus **Diastrophus** Hartig

Only one species definitely known as British.

v–vi. *Gall in stems of* Rubus *species, generally on* R. caesius
rubi (Bouché)

Diastrophus mayri Reinhard has been doubtfully included in the list of British species but this has not been confirmed. The species occurs in stems of *Potentilla argentea*

Genus **Synergus** Hartig

KEY TO SPECIES

1 Segment 2 + 3 of gaster closely punctate posteriorly, the fine minute punctures forming a band, subdorsally equal in width to one-quarter to one-half the total length of the segment, and extending the full depth of the segment from dorsum to ventral edge of tergite (figs. 96, 97, 98) ; mesoscutum with mainly rugose sculpture (figs. 101, 102).
Single-brooded species that winter in galls as late-stage larvae or pupae 2

– Segment 2 + 3 of gaster not punctate posteriorly, or with punctures forming a small patch dorsally at apex, or an indistinct narrow band not reaching to ventral edge of tergite (fig. 99), except in *S. nervosus* (*see* Note, p. 33); mesoscutum with weaker sculpture, rugulose or coriaceous (figs. 117, 118, 119).
Species often producing two or more broods in the year 7

2 (1) Mesoscutum with median scutal furrow posteriorly, and extending to at least middle of mesoscutum (fig. 100) ; frontal carinae reaching to lateral ocelli .. 3

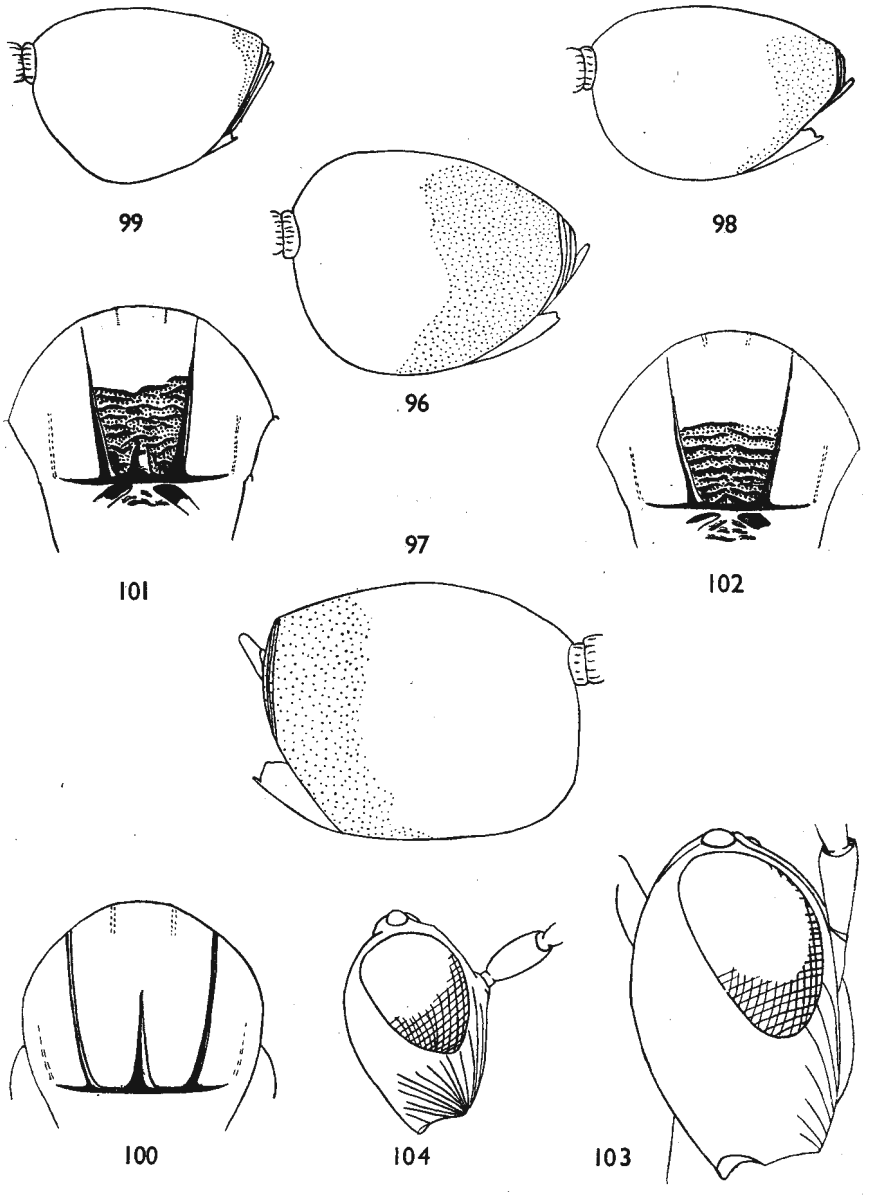
– Mesoscutum without median scutal furrow (fig. 102) ; or with this represented by a short narrow triangle extending from posterior margin to not more than one-eighth of length of mesoscutum (fig. 101), though transverse element of surface sculpture may be more or less depressed along the median line ; frontal carinae not reaching to lateral ocelli 6

3 (2) Second segment of antenna short, only slightly longer than broad (**fig. 109**), sometimes subglobose in the male ; third segment of antenna of male strongly expanded apically (fig. 105).
Abundant in galls of Andricus kollari *Hartig* ♂ ..... **umbraculus** Olivier

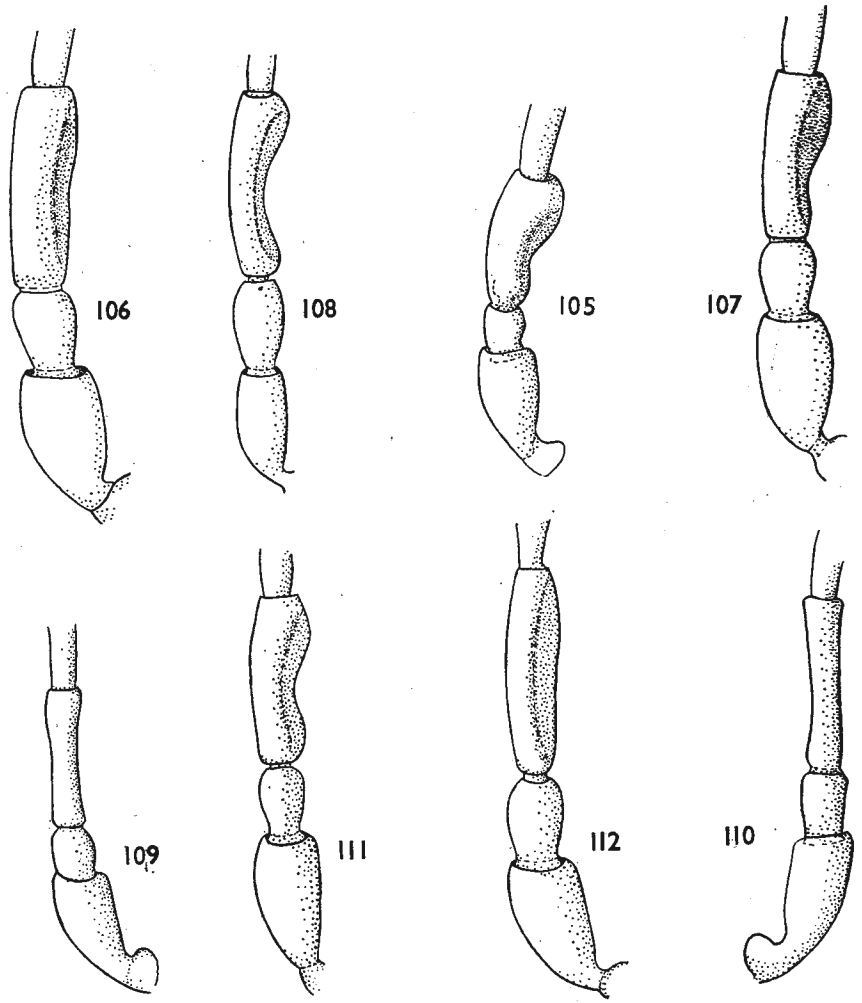
– Second segment of antenna distinctly longer than broad (fig. 110) ; male with third segment of antenna never so strongly expanded apically (figs. 106, 107, 108) 4

4 (3) Face with strong medial carina, which is raised above the striae of the face when viewed laterally (fig. 103).
Abundant in galls of Andricus kollari *Hartig* ♂ ..... **reinhardi Mayr**

– Face without strong medial carina ; medial striae may coalesce, but the resulting carina is never raised above the remaining striae of the face (fig. 104) 5



FIGS. 96–99.—*Synergus*, gaster, lateral, ♀: 96, *reinhardi*; 97, *pallidipennis*; 98, *ruficornis*; 99, *nervosus*.
FIGS. 100–102.—*Synergus*, median scutal line, ♀: 100, *umbraculus*; 101, *evanescens*; 102, *clandestinus*.
FIGS. 103–104.—*Synergus*, face, lateral: 103, *reinhardi*; 104, *pallidipennis*.



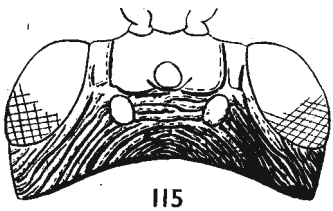
FIGS. 105–112.—*Synergus*, basal segments of antenna: 105, *umbraculus* ♂; 106, *reinhardi* ♂; 107, *pallidipennis* ♂; 108, *ruficornis* ♂; 109, *umbraculus* ♀; 110, *reinhardi* ♀; 111, *evanescens* ♂; 112, *clandestinus* ♂.

5 (4) Gaster with apical punctures of segment 2 + 3 forming a band whose width at its narrowest, laterally, is not less than one-quarter of the length of the segment, and subdorsally may be one-third to one-half the length of the segment (fig. 97).

Scarce in galls of Andricus kollari *Hartig* ♂. (*Recorded from continental Europe in galls of* A. lignicolus *Hartig* ♂) ..... **pallidipennis** Mayr

– Gaster with apical punctures of segment 2 + 3 forming an indistinct band, whose width at its greatest, subdorsally, does not exceed one-quarter of the length of the segment and laterally measures much less (fig. 98).

Rare in galls of Andricus inflator *Hartig* ♂. (*Recorded from continental Europe in galls of* Andricus ostreus *Hartig* ♂) ..... **ruficornis** Hartig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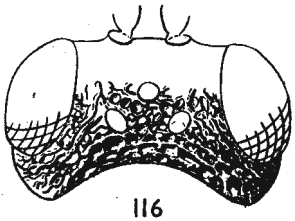
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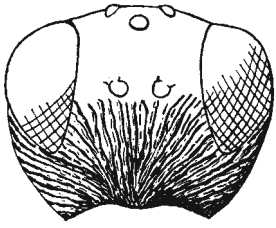
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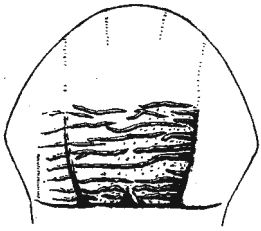
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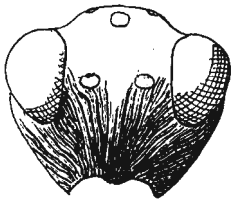
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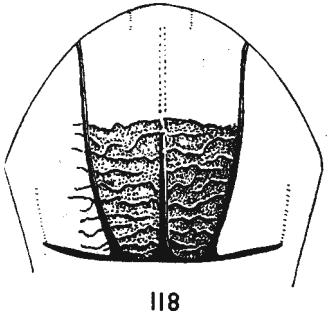
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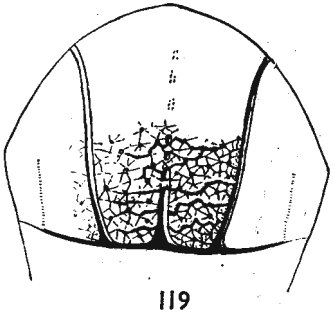
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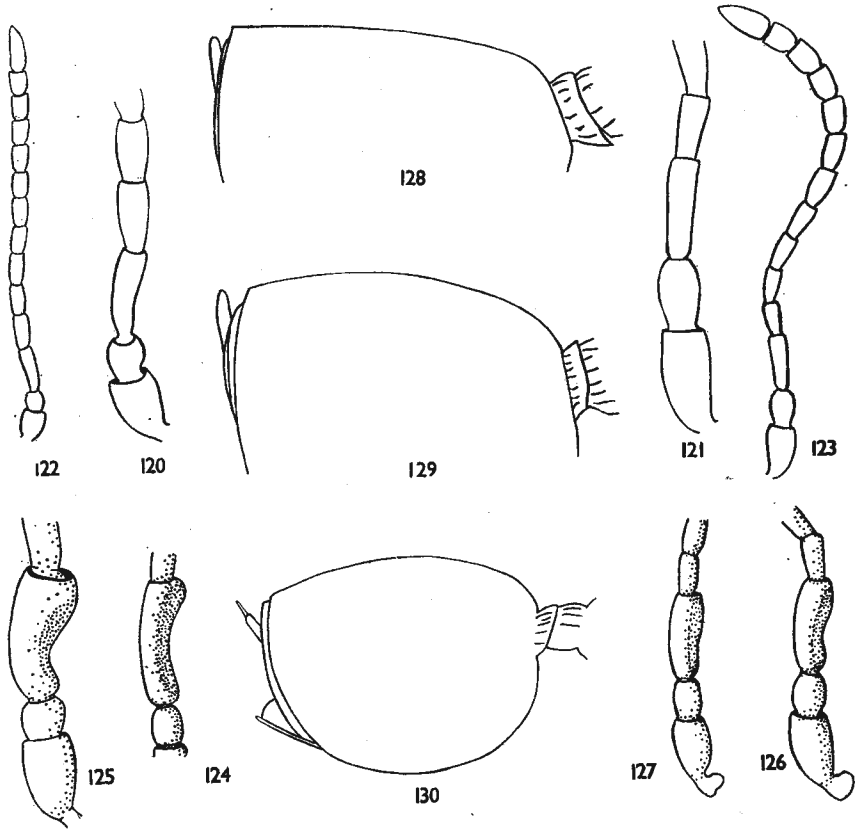
FIGS. 113–114.—*Synergus*, head, anterior, ♀: 113, *pallicornis*; 114, *incrassatus*.
FIGS. 115–116.—*Synergus*, head, vertex, dorsal, ♀: 115, *pallicornis*; 116, *incrassatus*.
FIGS. 117–119.—*Synergus*, sculpture of mesoscutum: 117, *apicalis* ♀; 118, *gallaepomiformis* ♀; 119, *albipes* ♀.

6 (2) Mesoscutum with median scutal line in female represented by a short narrow shining triangle (fig. 101), radial cell shorter, length not more than two and one-third times the width; second abscissa of radius fairly strongly curved; female with segment 2 + 3 of gaster at least slightly excised dorsally at apex; male with third segment of antenna distinctly expanded basally and apically (fig. 111).

Common in galls of Andricus fecundator *Hartig* ♂, *and possibly in* A. curvator *Hartig* ♂♀ *and* A. inflator *Hartig* ♂♀.....**evanescens** Mayr

– Mesoscutum with median scutal line absent (fig. 102); radial cell longer, length at least two and one-half times the width; second abscissa of radius slightly curved; female with segment 2 + 3 of gaster not excised dorsally at apex; male with third segment of antenna not expanded, but slightly curved, with the inner surface of the curve flattened (fig. 112).

Local, sporadically common in stunted acorns on Quercus robur *and* Q. petraea.....**clandestinus** Eady



FIGS. 120–121.—*Synergus*, basal segments of antenna, ♀ : 120, *incrassatus*; 121, *apicalis*.
FIGS. 122–123.—*Synergus*, antenna, ♀ : 122, *incrassatus* ; 123, *apicalis*.
FIGS. 124–127.—*Synergus*, basal segments of antenna ♂ : 124, *pallicornis* ; 125, *incrassatus* ; 126, *apicalis* ; 127, *rotundiventris*.
FIGS. 128–130.—*Synergus*, gaster, ♀ : 128, *rotundiventris* ; 130, *gallaepomiformis*.

7 (1) Head, particularly of female, viewed anteriorly, trapezoid, with straight or nearly straight cheeks not strongly converging (fig. 113) ; face rather flat except for weak medial mound ; frontal carinae strong and often much branched in region of anterior ocellus ; subparallel carinae running transversely between posterior ocelli, and obliquely from each posterior ocellus to margin of occiput (fig. 115) ; third segment of antenna in both sexes long, in the male curved and expanded apically (fig. 124) ; and in the female slender and often nearly twice length of fourth segment. (Species with one generation annually.)

Common in galls of Cynips quercusfolii *Linnaeus* ♀, *and* C. longiventris *Hartig* ♂♀. (*Recorded in addition from continental Europe in galls of* Andricus kollari *Hartig* ♀, A. lignicolus *Hartig* ♀, Cynips divisa *Hartig* ♀, C. agama *Hartig* ♀ *and* C. disticha *Hartig* ♀).....**pallicornis** Hartig

– Head, viewed anteriorly, transversely ovate, ovate triangulate or rotundate, with the cheeks buccate and strongly converging (fig. 114); face rounded and convex, and/or area between the ocelli, or between posterior ocelli and margin of occiput, punctate, rugose, or coriaceous (fig. 116); third segment of antenna in both sexes shorter (figs. 125, 126, 127). (Species with one, two or more generations annually) 8

8 (7) Mesoscutum with interrupted, sharp and widely spaced transverse carinae (fig. 117), the interspaces shining, smooth or with obsolete or sub-obsolete sculpture; frons between frontal carinae and particularly near anterior ocellus always with some punctures, though these may be sparse. (Species with only one generation annually) 9

– Mesoscutum coriaceous, and with mainly transverse rugulae of varying depth (figs. 118, 119); frons with or without punctures. (Species with at least two generations annually) 11

9 (8) Second segment of antenna as broad as long (fig. 120), flagellum not clavate (fig. 122); male with third segment of antenna very strongly expanded apically (fig. 125); median scutal furrow present in posterior half or more of the mesoscutum.

Common in galls of Andricus quercusradicis *Linnaeus* ♂, A. quercuscorticis *Fabricius* ♂, A. testaceipes *Hartig* ♂ ..... **incrassatus** Hartig

– Second segment of antenna longer than broad (figs. 121, 126, 127), flagellum weakly clavate (fig. 123); median scutal furrow at most present in posterior quarter, usually less, and sometimes absent 10

10 (9) Notaulices impressed in at least posterior three-quarters of mesoscutum, posterior medial furrow not usually more than one-eighth of length of mesoscutum in larger specimens, often much shorter, and occasionally absent; male with third segment of antenna slender and expanded apically and basally (fig. 126); radial cell rather narrower, with second abscissa of radius only slightly curved; frontal carinae very short, seldom reaching to middle of frons, which is coriaceous medially and rugulose laterally; gaster of female very slightly convex longitudinally on dorsum, segment 2 + 3 hardly rounded apically (fig. 128); head yellow to red in male, red to black in female, but if latter then at least red-tinged in mouth region and lower part of cheeks; legs yellow to yellowish-brown, sometimes shaded with darker brown.

Sporadically common in galls of Andricus quercusradicis *Linnaeus* ♂♀ **apicalis** Hartig

— Notaulices impressed only in posterior one-quarter of mesoscutum, posterior medial furrow usually absent, sometimes extremely short in larger specimens; male with third segment of antenna thick and hardly expanded (fig. 127); radial cell broader, with second abscissa of radius distinctly curved; frontal carinae often very weak or merging into the lateral rugulose area of the frons, usually represented by rugae reaching to three-quarters of the distance from antennae to lateral ocelli; segment 2 + 3 of gaster of female longitudinally convex, and rounded apically (fig. 129); face black in both sexes, legs mostly dark brown to black.

Scarce in galls of Andricus quercusradicis *Linnaeus* ♂♀ **rotundiventris** Mayr

11 (8) Flagellum filiform or very weakly clavate, with all segments stouter (fig. 131); frons generally with some shallow punctures or punctate rugulose, particularly in front of lateral ocelli and near anterior ocellus, but punctures sometimes sparse or weak (figs. 135, 136); vertex behind ocelli with distinct punctures, or these hidden in rugulose sculpture; median scutal line long and deep, at least three-quarters of length of mesoscutum, and often nearly complete, and posteriorly very distinctly broad 12

— Flagellum clavate with the proximal segments slender (fig. 132); frons coriaceous between frontal carinae (figs. 137, 138), which may be branched in region of ocelli, and with very occasionally some small sub-obsolete punctures (fig. 137); vertex coriaceous, sometimes with a few weak rugulae, but without punctures; median scutal line shallow, more often short, rarely exceeding half length of mesoscutum, and posteriorly not so conspicuously broad 13

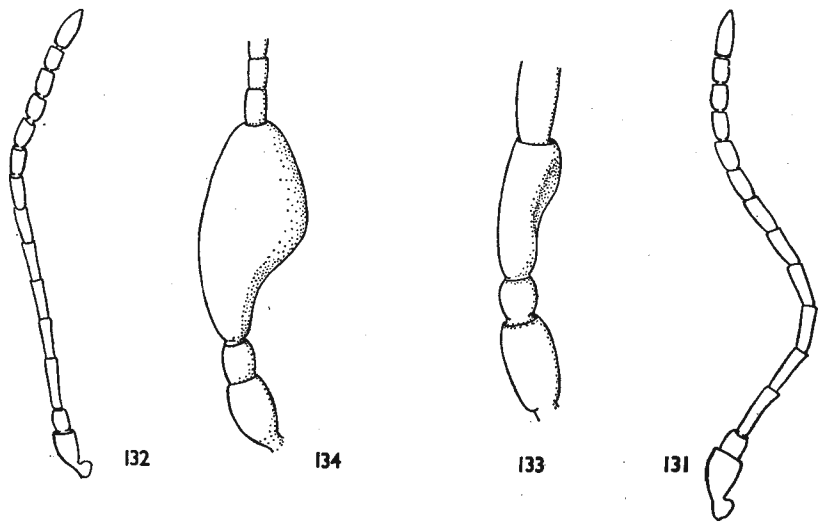
12 (11) Frons coriaceous, and closely though often shallowly punctate, at least in front of anterior ocellus (fig. 135); vertex behind lateral ocelli with some deep punctures, or punctate rugulose; male with third segment of antenna curved, weakly excavate and flattened dorsally and clearly expanded just before apex (fig. 133); remaining segments of antenna with lengths 2 to 3 times breadth, and fourth not shorter than fifth; female gaster (fig. 130).

Emergences in summer of first calendar year of gall having face yellowish-red to red, darker in female, and radial cell a little shorter.

Emergences in spring of second calendar year of gall having face black, at most yellowish or reddish near mouth, and radial cell a little longer.

Usually abundant in galls of Biorhiza pallida *Olivier* ♂♀, *also in* Andricus curvator *Hartig* ♂♀, A. albopunctatus *Schlechtendal* ♂, A. solitarius *Boyer de Fonscolombe* ♂, A. quercusramuli *Linnaeus* ♂♀, Andricus quadrilineatus *Hartig* ♂, A. seminationis *Giraud* ♂, A. callidoma *Hartig* ♂, A. ostreus *Hartig* ♂, A. kollari *Hartig* ♂, Neuroterus quercusbaccarum *Linnaeus* ♂♀, N. tricolor *Hartig* ♂♀, Trigonaspis megaptera *Panzer* ♂♀

gallaepomiformis Boyer de Fonscolombe



FIGS. 131–132.—*Synergus*, antenna, ♀: 131, *gallaepomiformis*; 132, *nervosus*.
FIGS. 133–134.—*Synergus*, basal segments of antenna, ♂: 133, *gallaepomiformis*; 134, *thaumacerus*.

— Frons coriaceous, often without punctures, or with a few widely spaced sub-obsolete punctures (fig. 136); vertex behind lateral ocelli coriaceous or rugulose with some scattered shallow punctures; male with third segment of antenna grossly inflated distally and rounded (fig. 134), remaining segments of antenna short, a little longer than broad, and fourth segment the shortest.

Antennae and legs yellow; face yellow to red or almost black.

Local and scarce in galls of Trigonaspis megaptera *Panzer* ♂♀ *and* ♂, *and* Neuroterus tricolor *Hartig* ♂♀. (*Also recorded from galls of* Neuroterus quercusbaccarum *Linnaeus* ♂♀.).....**thaumacerus** Dalman

13 (11) Both sexes with second segment of antenna clearly longer than broad (figs. 139, 140, 141, 145); male with third segment of antenna flattened on dorsal or inner face but not strongly curved or expanded (figs. 139, 140, 141).

Frontal carinae distinct and generally branched (fig. 137) in females of summer emergence, but often weak in other forms; apical punctures of segment 2 + 3 of gaster frequently more extensive and reaching almost to ventral edge of tergite in spring emergence from overwintered galls, but limited to a small patch in other forms.

Common in galls of Andricus albopunctatus *Schlechtendal* ♂, A. quadrilineatus *Hartig* ♂♀, A. curvator *Hartig* ♂♀ *and* ♂, A. seminationis *Giraud* ♂, A. solitarius *Boyer de Fonscolombe* ♂, A. ostreus *Hartig* ♂, A. glandulae *Schenck* ♂, Neuroterus quercusbaccarum *Linnaeus* ♂♀ *and* ♂, N. albipes *Schenck* ♂, Cynips divisa *Hartig* ♂ *and* Trigonaspis megaptera *Panzer* ♂. (*Additionally recorded from continental Europe in galls of* Cynips quercusfolii *Linnaeus* ♂, Neuroterus tricolor *Hartig* ♂, Andricus callidoma *Hartig* ♂.)

nervosus Hartig

— Female with second segment of antenna at most only slightly longer than broad (figs. 146, 147). Male with third segment of antenna concave on dorsal or inner face, twisted and expanded distally (figs. 142, 143, 144).

Second segment of antenna longer than broad in males of summer emergence (fig. 143); frontal carinae usually distinct in females of summer emergence (fig. 138), but often weak or obsolete in other forms.

Common in galls of Neuroterus quercusbaccarum *Linnaeus* ♂ *and* ♂♀, N. numismalis (*Geoffroy* in *Fourcroy*) ♂♀ *and* ♂, N. albipes *Schenck* ♂, Andricus ostreus *Hartig* ♂, A. curvator *Hartig* ♂♀ *and* ♂, A. quadrilineatus *Hartig* ♂, A. seminationis *Giraud* ♂, Cynips divisa *Hartig* ♂, Trigonaspis megaptera (*Panzer*) ♂. (*Additionally recorded from continental Europe in galls of* Cynips agama *Hartig* ♂, C. disticha *Hartig* ♂)

albipes Hartig

Although in the generic keys it was stated that *Synergus* species are inquilines in galls formed by other Cynipidae on *Quercus*, the following records should be noted.

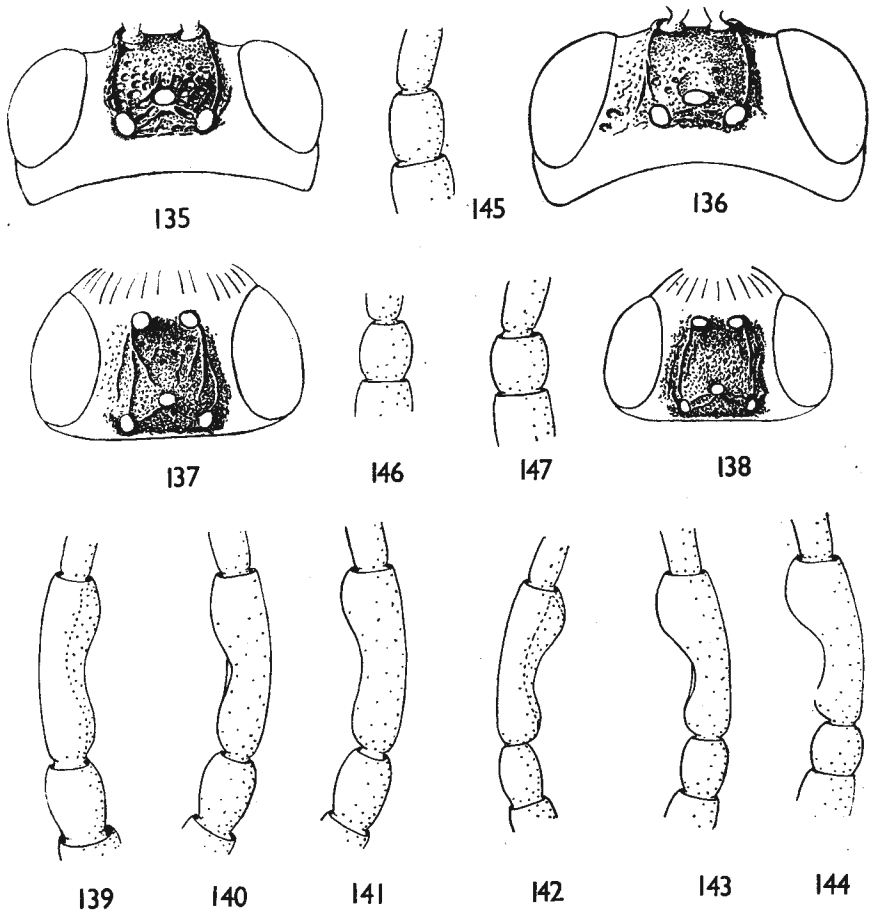
Synergus ruficornis Hartig from galls of *Diplolepis* (=*Rhodites*) species on rose. Recorded by Morley (1931, *Entomologist* **64** : 248–9) and Blair (1943, *Ent. mon. Mag.* **79** : 231–3). The specimens recorded by Morley under this name were examined and determined as *Periclistus brandtii* Ratzeburg (Eady, 1952, *Trans. Soc. Brit. Ent.* **11** : 141–52). It is almost certain that the single specimen recorded by Blair was determined from the same series in the British Museum collection, though the present authors have not seen this specimen.

Synergus sp. from galls of *Aulacidea* (see *Phanacis*) *hypochoeridis* (Ross, 1951, *Trans. Soc. Brit. Ent.* **11** : 81–96). This appears to be the only record; the authors have not seen the material.

Synergus clandestinus Eady. Niblett (1945, *Entomologist* **78** : 72–73) and Benson (1946, *Entomologist* **79** : 46) bred this species from acorns of *Quercus robur* and *Q. petraea*, in which there was no trace of any other species of Cynipid that might have given rise to gall tissue which *S. clandestinus* could inhabit as an inquiline. From the other records of this species (Eady, 1952, *Trans. Soc. Brit. Ent.* **11** : 141–53) it would appear that *S. clandestinus* may well be free-living or itself giving rise to a degree of gall-tissue within the stunted acorns.

The notes below, based on the observations of Ross (1951, *Trans. Soc. Brit. Ent.* **11** : 81–96) and Eady (1952, *Trans. Soc. Brit. Ent.* **11** : 141–52) on the differences between the generations, particularly in *S. nervosus* and

S. albipes, summarise the information gathered up to the time of writing. The individuals that sometimes appear in the autumn of the first calendar year of a gall, and represent a premature partial emergence of the second generation, agree with specimens of that generation in structure and sculpture, but more closely resemble the first generation in colour, or may be somewhat intermediate in appearance.



FIGS. 135–138.—*Synergus*, head, frons, ♀: 135, *gallaepomiformis*; 136, *thaumacerus*; 137, *nervosus*; 138, *albipes*.

FIGS. 139–144.—*Synergus*, third segment of antenna, ♂: 139, *nervosus*, summer emergence (inner aspect); 140, *nervosus*, summer emergence (outer aspect); 141, *nervosus*, spring emergence (outer aspect); 142, *albipes*, summer emergence (inner aspect); 143, *albipes*, summer emergence (outer aspect); 144, *albipes*, spring emergence (outer aspect).

FIGS. 145–147.—*Synergus*, second segment of antenna, ♀: 145, *nervosus*; 146, *albipes* (summer emergence); 147, *albipes* (spring emergence).

S. nervosus Hartig.

Radial cell short, second abscissa of radius distinctly curved in middle; punctures of gaster 2 + 3 often faint and only in upper one-eighth of tergite. Emerging in summer of first calendar year of gall.

Radial cell long, narrower, second abscissa of radius almost straight; apical punctures of gaster 2 + 3 quite distinct in upper eighth, and very often extending down almost to ventral edge of tergite. Emerging in spring of second calendar year of gall.

S. albipes Hartig.

Second segment of antenna slightly longer than broad (figs. 143, 146); male with third segment of antenna slightly less expanded (fig. 143). Emerging in summer of first calendar year of gall.

Second segment of antenna about as broad as long (figs. 144, 147); male with third segment of antenna more strongly expanded (fig. 144). Emerging in spring of second calendar year of gall.

Genus **Saphonecrus** Dalla Torre and Kieffer

One species only.....**connatus** (Hartig)

Fairly common in galls of Andricus quercusradicis ♂♀. (*Additionally recorded from continental Europe from galls of* Andricus inflator *Hartig* ♂♀, A. glandulae *Schenck* ♂, A. ostreus *Hartig* ♂; Cynips quercusfolii *Linnaeus* ♂.)

Genus **Diplolepis** Geoffroy

In this genus males are not common, and it appears that reproduction in most species is from parthenogenetic females (Niblett, 1951, *Proc. S. Lond. ent. nat. Hist. Soc.* **1949–50** : 204–6).

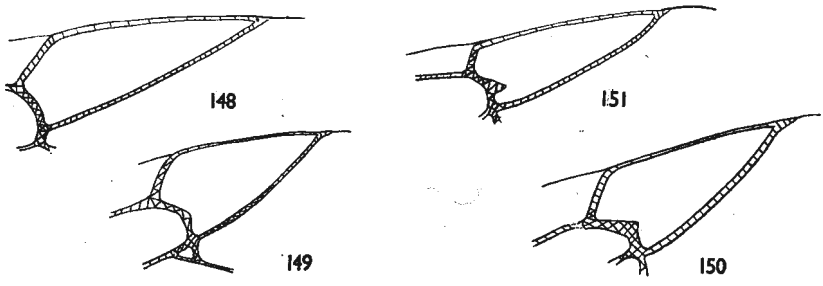
Key to Species

1 Radial cell with length three times the width, first abscissa of radius strongly curved (fig. 148); face and mesoscutum polished, with weak punctures. ix–x. *Gall on* Rosa rubiginosa, R. canina *and* R. micrantha **eglanteriae** (Hartig)

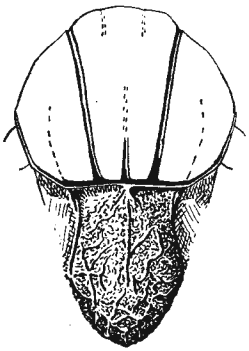
– Radial cell with length seldom more than two and a half times the width, first abscissa of radius angled (figs. 149, 150, 151); face at least medially, and mesoscutum coriaceous, with or without punctures.....2

2 (1) Scutellum elongate and slightly constricted basally; median scutal line present posteriorly (figs. 152, 153).....3

– Scutellum broadly oval to sub-rotund, viewed dorsally; median scutal line often absent (figs. 154, 155).....4



Figs. 148–151.—*Diplolepis*, radial cell of fore wing: 148, *eglanteriae*; 149, *centifoliae*; 150, *rosae*; 151, *mayri*.



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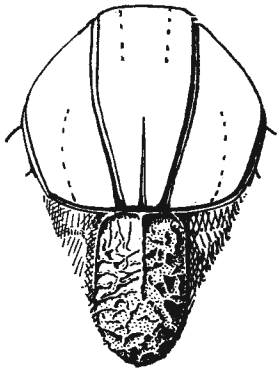

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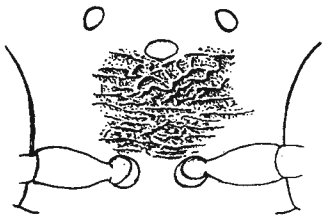

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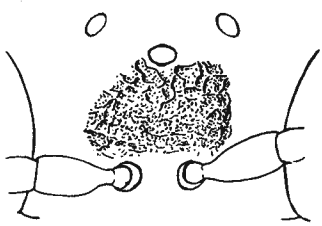

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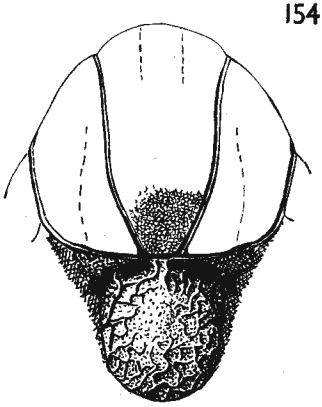

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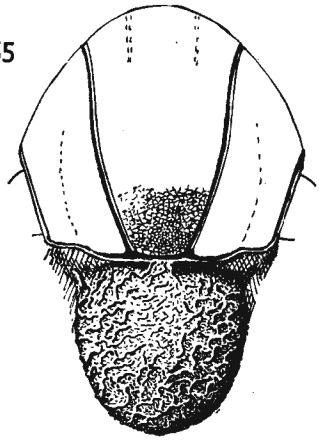

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FIGS. 152–155.—*Diplolepis*, scutellum and posterior mesoscutum : 152, *centifoliae* ; 153, *nervosa* ; 154, *spinossimae* ; 155, *rosae*.
FIGS. 156–157.—*Callirhytis*, head, frons : 156, *erythrocephala* ; 157, *erythrostoma*.

3 (2) Anterior tibiae yellow to pale-red, posterior tibiae red; second abscissa of radius (Rs_2) evenly curved (fig. 149).
ix. *Gall on* Rosa canina *and* R. spinosissima.....**centifoliae** (Hartig)
Anterior tibiae red, posterior tibiae black; second abscissa of radius (Rs_2) sometimes weakly sinuate.
v. *Gall on* Rosa *species*
nervosa (Curtis) (= *dispar* Niblett) **syn. nov.**

4 (2) Gaster black; notaulices sharply converging posteriorly from half-way; mesoscutum coriaceous (fig. 154).
v–vi. *Gall most often on* Rosa spinosissima.....**spinosissimae** Giraud

– Gaster in greater part red; notaulices weakly converging posteriorly: mesoscutum coriaceous with shallow punctures (fig. 155).....5

5 (4) Radial cell at least twice as long as broad, second abscissa of radius slightly curved, first abscissa with angle forming a weak projection into the radial cell (fig. 150); face laterally weakly coriaceous with shallow punctures, medially rugulose; frons and vertex coriaceous with weak punctures. (FIG. II, p. 19).
v–vii. *Gall on* Rosa *species*.....**rosae** (Linnaeus)

– Radial cell with length two and a half times the breadth; second abscissa almost straight, first abscissa with the angle forming a conspicuous projection into the radial cell, emphasised by a darker streak in the light infuscation of the membrane (fig. 151); face lightly punctate, coriaceous medially; frons and vertex coriaceous.
v–viii. *Gall more often on* R. rubiginosa.....**mayri** Schlechtendal

Genus **Callirhytis** Foerster

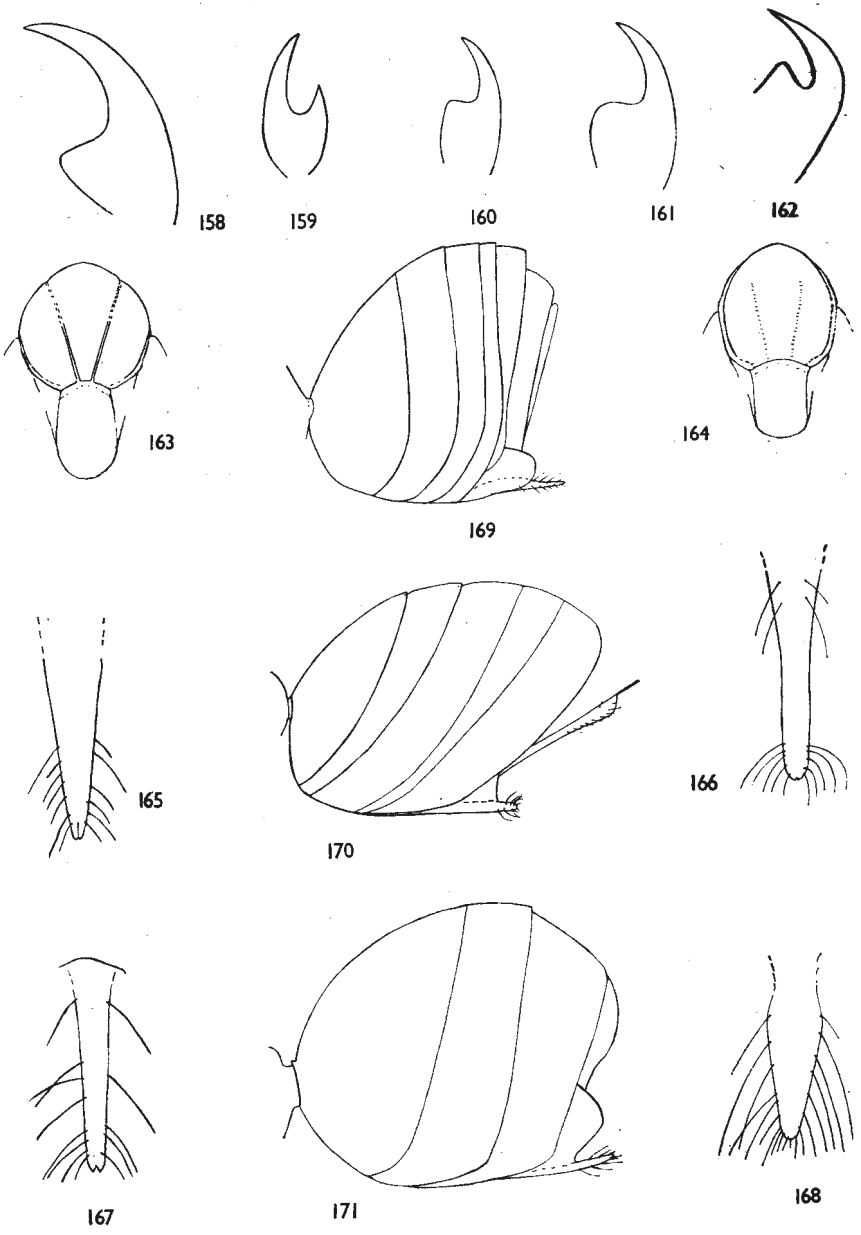
Very little is known about the life histories of the species of this genus in Europe. In 1933 Dettmer summarised the information up to that date, and nothing seems to have been added subsequently. Of the nine named forms listed by Dettmer as species, four are presumed agamic forms; males are known of two others, and the third (*bella* Dettmer), known only from the female, is presumed to be a sexual form. *Callirhytis bella* is now known to occur in Britain, the authors having identified as this species one specimen bred by Niblett in 1937, and a second by Eady in 1959. The species determined as *glandium* (Giraud) in the past is invariably that now known as *erythrocephala* (Giraud), and the authors have no confirmation that *glandium* (Giraud) as interpreted by Dettmer (1933) occurs in Britain. The latter may be distinguished, however, from the species given below by having an acute basal tooth on the claws, and by the sculpture, that of the frons resembling *erythrostoma* and that of the mesonotum resembling *erythrocephala*. Only one specimen of *erythrostoma* from Britain has been seen; this was bred by Blair in 1932 from a gall collected in 1928. It is not certain that *erythrostoma* and *erythrocephala* are really distinct species.

The type species *C. hartigi* Foerster, the species *C. glandulosa* Weld, *C. rufescens* Mayr, and the numerous American species placed in this genus have simple claws. Lewis H. Weld, the American authority on Cynipoidea, is of the opinion that the species with lobed or toothed claws should be excluded from *Callirhytis*. In the absence of further biological evidence this course has not been adopted in the present work. As far as is known, none of the species with simple claws occurs in Britain.

KEY TO SPECIES

1 Claws with at most a weak or blunt basal lobe (fig. 158).....2

– Claws with an acute basal lobe or tooth (fig. 159); notaulices obsolete to absent in anterior half.
iv–v. *Gall in buds of* Quercus robur.....**bella** (Dettmer)



FIGS. 158–159.—*Callirhytis*, hind claw : 158, *erythrocephala* ; 159, *bella*.
FIGS. 160–162.—*Neuroterus*, hind claw : 160, *tricolor* ♂ ; 161, *tricolor* ♀ ; 162, *quercusbaccarum* ♀.

[*continued opposite*

2 (1) Frons rugulose, with some transverse rugae in front of anterior ocellus (fig. 156); mesoscutum more strongly transversely rugose; legs red.
iii–v. *Gall in acorns of* Quercus cerris; *three to eight years in gall*
erythrocephala (Giraud)

– Frons coriaceous medially, rugulose laterally (fig. 157); mesoscutum less strongly and more irregularly rugose; legs, except fore tibiae, largely brown.
iii–v. *Gall in acorns of* Quercus cerris; *at least two winters in gall*
erythrostoma Dettmer

Genus **Neuroterus** Hartig

KEY TO SPECIES

1 Females; petiole short; (figs. 169, 170, 171); third segment of antenna not modified 2

— Males; petiole long (figs. 174, 175); third segment of antenna modified, though sometimes indistinctly (figs. 172, 173) 11

2 (1) Propodeum with two distinct carinae, diverging posteriorly, and sharply bowed or angled outwards posteriorly (fig. 55); notaulices absent; wings hyaline; antenna with 13–14 segments 10

– Propodeum with no distinct carinae, alutaceous, coriaceous, or weakly rugulose medially; ventral spine a little longer and with at least some fine hairs; antenna with 14–15 segments; notaulices usually present, though sometimes very weak; wings sometimes with fuscous blotch surrounding first abscissa of radius 3

3 (2) Hind claws with an enlarged but blunt basal lobe (figs. 160, 161); gaster smooth and shining 4

– Hind claws with distinct projecting basal tooth-like lobe (fig. 162) or claws almost bifid; gaster smooth or shagreened 5

4 (3) Notaulices distinct (fig. 163); genal furrow distinct. Mesoscutum alutaceous; scutellum coriaceous to rugulose, mesopleuron weakly striate.
iv–v ..... **tricolor** (Hartig) ♂ (= *fumipennis* Hartig)

– Notaulices very weak (fig. 164); genal furrow weak.
Mesoscutum alutaceous; scutellum coriaceous medially, rugulose laterally; mesopleuron weakly striate.
vi–vii ..... **tricolor** (Hartig) ♀

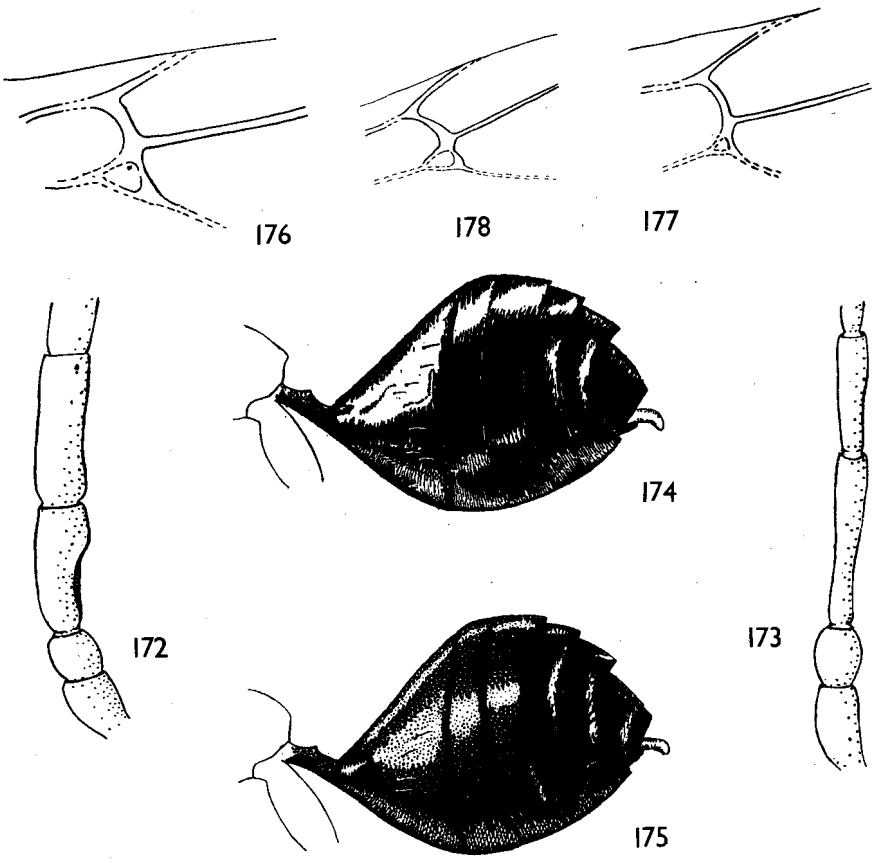
5 (3) Ventral spine projection longer, more slender, and with sparse hairs which are seldom very long, and which, if grouped to form a weak apical tuft, are short, curved and fine (figs. 165, 166, 167); gaster usually lenticular, and shorter than head and thorax together (fig. 169); wings with fuscous patch surrounding first abscissa of radius, and usually another basad in middle of wing 6

– Ventral spine projection shorter, broader at base, and with straight hairs, long at base of spine, and reducing towards apex, and which form with apical hairs a distinct tuft (fig. 168); gaster ovate (figs. 170, 171), sometimes longer than head and thorax together; wings hyaline, or with a very faint and small suffusion about first abscissa of radius only 9

6 (5) Areolet of fore wing large, though sometimes weakly pigmented (*see* fig. 176); sides of gaster smooth and shining; antenna with fifteen segments; ventral spine projection hairy only towards apex, or with small weak apical hair tuft (figs. 165, 166); scutellum oblongate viewed dorsally, rather flattened on dorsal surface viewed laterally 7

– Areolet of fore wing indistinct or very small (*see* fig. 177); sides of gaster rather dull with minute obsolete sculpture; antenna with fourteen to fifteen segments; ventral spine projection sparsely but entirely haired, more closely so towards apex, but not forming hair tuft (fig. 167); scutellum ovate viewed dorsally, distinctly convex on dorsal surface viewed laterally 8

FIGS. 163–164.—*Neuroterus*, notaulices: 163, *tricolor* ♂; 164, *tricolor* ♀.
FIGS. 165–168.—*Neuroterus*, spine of hypopygium, ventral: 165, *quercusbaccarum* ♂; 166, *quercusbaccarum* ♀; 167, *numismalis* ♀; 168, *albipes* ♀.
FIGS. 169–171.—*Neuroterus*, gaster, lateral: 169, *numismalis* ♂; 170, *albipes* ♂; 171, *albipes* ♀.



FIGS. 172–173.—*Neuroterus*, basal segments of antenna, ♂: 172, *aprilinus*; 173, *quercusbaccarum*.
FIGS. 174–175.—*Neuroterus*, gaster, lateral, ♂: 174, *quercusbaccarum*; 175, *albipes*.
FIGS. 176–178.—*Neuroterus*, radial cell of fore wing ♂: 176, *quercusbaccarum*; 177, *numismalis*; 178, *albipes*.

7 (6) Notaulices distinct in middle and posteriorly; genal furrow distinct; scutellum alutaceous or weakly coriaceous medially, longitudinally rugulose laterally; ventral spine very sparsely haired (fig. 165).
ii–iii.....**quercusbaccarum** (Linnaeus) ♂ (=*lenticularis* Olivier)
– Notaulices very weak, present only in middle, or absent entirely; genal furrow weak; scutellum smooth or with obsolete alutaceous sculpture; ventral spine with small but distinct apical tuft (fig. 166).
v–vii.....**quercusbaccarum** (Linnaeus) ♀
8 (6) Notaulices very weak, absent anteriorly, distinct posteriorly; genal furrow distinct; antenna with fifteen segments; posterior margin of second segment of gaster and visible parts of remaining segments dull, with very minute obsolete sculpture.

Mesoscutum with middle lobe with obsolete sculpture anteriorly, lateral lobes and scutellum medially alutaceous; scutellum laterally coriaceous to rugulose; mesopleuron alutaceous.

iii. . . . . **numismalis** (Geoffroy *in* Fourcroy) ♂

– Notaulices completely absent, or absent anteriorly and obsolete posteriorly; antenna with fourteen segments; sides of gaster entirely dull with very minute obsolete sculpture.

Mesoscutum entirely, and scutellum medially, smooth and shining; scutellum laterally finely coriaceous.

v–vii . . . . . **numismalis** (Geoffroy *in* Fourcroy) ♀ (=*vesicator* Schlechtendal)

9 (5) Gaster ovate (fig. 170), longer than head and thorax; antenna with fifteen segments; genal furrow distinct; sides of gaster smooth and shining.

ii–iii. . . . . **albipes** (Schenck) ♂ (=*laeviusculus* Schenck)

– Gaster shorter, at most scarcely longer than head and thorax (fig. 171); antenna with fourteen or fifteen segments; genal furrow very weak; at least second segment of gaster dull.

v–vi. . . . . **albipes** (Schenck) ♀

10 (2) (See note below) Claws with basal tooth; mesoscutum smooth and shining; scutellum shining and smooth dorsally, alutaceous posteriorly; antenna with thirteen segments.

vii–viii. . . . . **aprilinus** (Giraud) ♂ (=*schlectendali* Mayr)

– Claws simple; mesoscutum coriaceous; scutellum coriaceous to rugulose; antenna with fourteen segments.

iv–v. . . . . **aprilinus** (Giraud) ♀

11 (1) Third segment of antenna a little shorter than fourth, slightly curved and expanded distally, proximal two-thirds with excavate and flattened surface dorsally (fig. 172). Gaster smooth and shining; claws simple.

iv–v. . . . . **aprilinus** (Giraud) ♂

– Third segment of antenna longer than fourth, straight, a little constricted in proximal third, no flattened surface (fig. 173). 12

12 (11) All coxae, legs, petiole and basal half of second segment of gaster, yellow; claws simple. Gaster smooth and shining.

vi–vii. . . . . **tricolor** (Hartig) ♂

— At least hind coxae, petiole, and gaster, brown; claws with a strong basal tooth 13

13 (12) Gaster smooth and shining (fig. 174); areolet large (fig. 176) (Fig. III, p. 47).

v–vii. . . . . **quercusbaccarum** (Linnaeus) ♂

— Gaster in large part rather dull, very minutely and obsoletely sculptured (fig. 175). 14

14 (13) Second segment of gaster dorsally smooth and shining, remaining segments minutely and obsoletely sculptured; areolet smaller (fig. 177).

v–vii. . . . . **numismalis** (Geoffroy *in* Fourcroy) ♂

— Second to third or fourth segments of gaster dorsally and laterally minutely and obsoletely sculptured (fig. 175); areolet large (fig. 178)

v–vi. . . . . **albipes** (Giraud) ♂

The authors have not seen the type of *Neuroterus politus* Hartig, 1840, but it would appear to be synonymous with *N. numismalis* (Geoffroy *in* Fourcroy) ♂♀.

The association of *aprilinus* Giraud with *schlechtendali* Mayr has not been confirmed by rearing.

Genus **Andricus** Hartig

Key to Species

1 Males 2

– Females 15

2 (1) Foveae of scutellum shallow, weakly separated or confluent (fig. 69); antenna with fifteen, rarely sixteen segments, third segment long, dorsally flattened

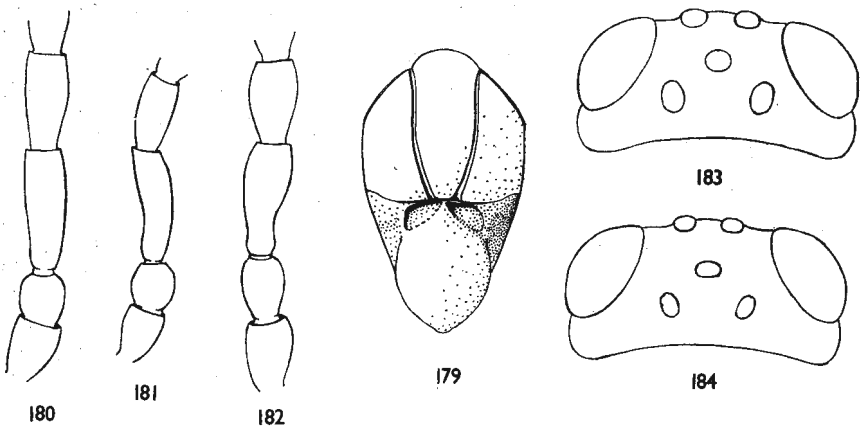


FIG. 179.—*Andricus solitarius* ♀ : scutellar foveae.
FIGS. 180–182.—*Andricus*, basal segments of antenna, ♂ : 180, *curvator* ; 181, *fecundator* ; 182, *kollari*.
FIGS. 183–184.—*Andricus*, head, dorsal, ♂ : 183, *ostreus* ; 184, *curvator*.

or slightly excavate (fig. 180) ; mesoscutum smooth and shining medially, in part at least, remainder very weakly or obsoletely alutaceous.....4

– Foveae of scutellum distinctly separated (fig. 179), often deep, or in colour contrast to rest of notum ; antenna with fourteen to fifteen segments ; third segment more often shorter and broader, always distinctly curved (figs. 181, 182), dorsally flattened and excavate, and sometimes expanded distally....3

3 (2) Antenna with fifteen segments ; third segment distinctly curved, dorsally flattened and excavate (fig. 181).....6

– Antenna with fourteen to fifteen segments ; third segment curved, dorsally flattened, proximally excavate, distally expanded (fig. 182).....14

4 (2) Ocelli larger ; OOL at most equal to greatest width of an ocellus, sometimes less ; POL at least twice OOL (fig. 183) ; carinae of propodeum weak, sometimes obsolete, but when present strongly bowed outwards
v–vi.....**ostreus** Hartig ♂ (=*furunculus* Beyerinck)

– Ocelli usually smaller ; OOL a little longer than greatest width of an ocellus ; POL not more than one and three-quarters OOL, usually less (fig. 184) ; carinae of propodeum distinct, almost straight and sub-parallel.....5

5 (4) Mesoscutum smooth and shining ; OOL a little more than the greatest width of a lateral ocellus.
v–vi.....**curvator** Hartig ♂

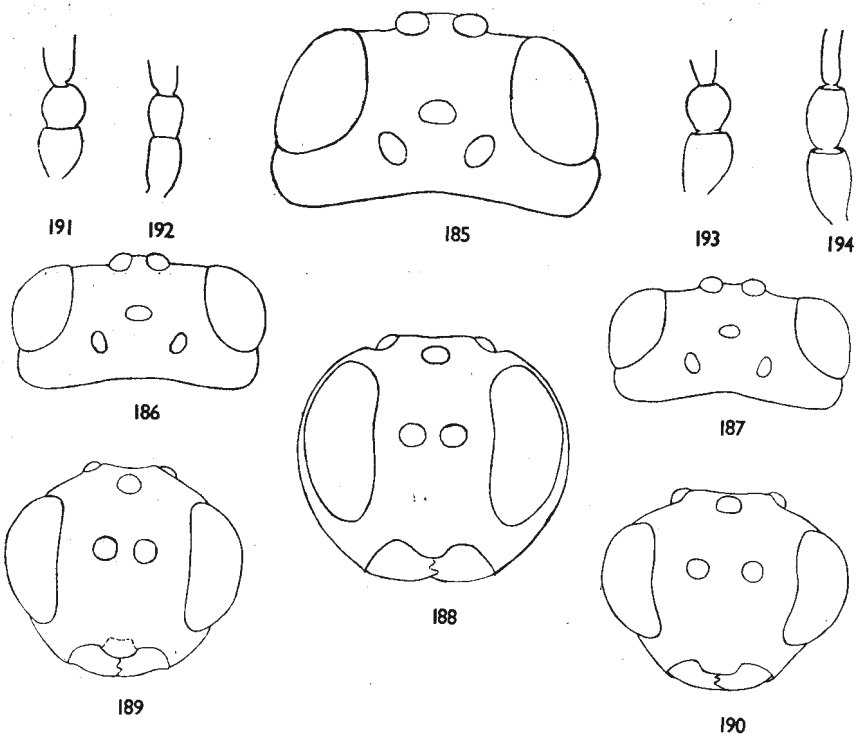
– Mesoscutum weakly alutaceous ; OOL about one and a half times greatest width of a lateral ocellus.
v–vi.....**inflator** Hartig ♂

6 (3) Transfacial line less than the height of an eye (figs. 188, 195, 196) ; ocelli large ; OOL rarely more than greatest width of an ocellus (figs. 185, 197).....12

– Transfacial line at least as long as the height of an eye (figs. 189, 190) ; OOL always more than greatest width of an ocellus, and ocelli sometimes small..7

7 (6) Ocelli slightly larger (fig. 186) ; transfacial line equal to the height of an eye (fig. 189).....11

– Ocelli slightly smaller (fig. 187) ; posterior margin of anterior ocellus very clearly in advance of a line joining the anterior margins of the posterior ocelli ; transfacial line longer than the height of an eye (fig. 190) or head and thorax yellowish-brown to black.....8



FIGS. 185–187.—*Andricus*, head, dorsal ♂: 185, *quercusradicis*; 186, *glandulae*; 187, *fecundator*.
FIGS. 188–190.—*Andricus*, head, anterior, ♂: 188, *quercusradicis*; 189, *glandulae*; 190, *fecundator*.
FIGS. 191–194.—*Andricus*, second segment of antenna, ♂: 191, *fecundator*; 192, *quercusramuli*; 193, *glandulae*; 194, *amenti*.

8 (7) Head, thorax and gaster black; second segment of antenna subglobose (fig. 191); scape short and broad.....9
– Head and thorax yellow or yellow brown; second segment of antenna clearly a little longer than broad (fig. 192); scape longer.....10
9 (8) Scutellum weakly coriaceous medially.
v–vi.....**fecundator** (Hartig) ♂ (= *pilosus* Adler)
– Scutellum smooth and shining medially.
vi.....**nudus** Adler ♂
10 (8) Head, thorax, and gaster yellow brown; legs and underside of scape, pedicel and third segment of antenna pale yellow; remainder of antenna brownish-yellow, sensoria pale and very distinct.
v–vi.....**callidoma** (Hartig) ♂ (=*cirratus* Adler)
— Head and thorax yellow to red, gaster dark brown; legs and antennae yellow, the former a little paler, and sensoria scarcely paler than segments of flagellum.
v–vi.....**quercusramuli** (Linnaeus) ♂
11 (7) Second segment of antenna slightly flattened but in broadest aspect appearing subglobose, slightly longer than broad (fig. 193); the following parts reddish-brown to brown: vertex, dorsum of thorax medially in part, venter of thorax entirely, gaster entirely
v–vi.....**glandulae** (Schenck) ♂ (=*xanthopsis* Schlechtendal)

— Second segment of antenna ovoid, with length about one and a half times breadth (fig. 194); the following parts reddish-brown, ocellar triangle, mesosternum medially, gaster dorsally and apically.
v.....**amenti** Giraud ♂

12 (6) Head, viewed anteriorly, transversely ovate; eyes large, with length a little more than distance between them (fig. 195); temples parallel immediately behind eyes (fig. 197).
vi.....**quercuscorticis** (Linnaeus) ♂ (= *gemmatus* Adler)

— Head, viewed anteriorly, subrotundate; or eyes sometimes smaller and scarcely longer than the distance between them (fig. 196); temples dilated behind eyes (figs. 185, 198).
Head and thorax black, gaster brown, legs yellow, antennae dark yellow proximally to brown apically.....13

13 (12) Segments 9–13 of antenna each with length less than twice its greatest width (fig. 199) (*see* Note i, p. 52).
Head, thorax and gaster reddish-yellow; antennae and legs yellow (*see* Notes i and ii, p. 52).....**testaceipes** Hartig ♂

— Segments 9–13 of antenna each with length more than twice its greatest width (fig. 200) (*see* Note i, p. 52).
Head and gaster dark red to black, thorax black; legs and proximal segments of antennae yellow.
vii–xi.....**quercusradicis** (Fabricius) ♂ (=*trilineatus* Hartig)

14 (3) Vertex rugulose (fig. 201); middle area of mesoscutum minutely reticulate, rugulose medially and laterally; mesopleuron longitudinally striate in part (fig. 203).
iv.....**solitarius** (Boyer de Fonscolombe) ♂ (=*occultus* Tschek)

— Vertex reticulate (fig. 202); middle area of mesoscutum reticulate with coriaceous microsculpture; mesopleuron entirely closely longitudinally striate (fig. 204) (*see* Note iii, p. 52).
v–vi.....**kollari** (Hartig) ♂ (= *circulans* Mayr)

15 (1) Head viewed from above, with width across temples not more than two and a half times length, and more often with temples not dilated behind eyes (fig. 205) and width of head at temples not, or scarcely, greater than width of head at eyes; body not pubescent. (All sexual forms, except one).....16

— Head, viewed from above, with width at temples at least three times length, and with temples conspicuously dilated behind eyes (fig. 206); body often pubescent. (All agamic forms).....32

16 (15) Ventral spine projection short, blunt apically, and with long rather close hairs (fig. 64) *and* gaster very strongly compressed; carinae of propodeum strongly bowed outwards; mesopleuron rather smooth and shining.....17

— Ventral spine projection acute apically, sparsely hairy, and often long or very long (figs. 61, 62, 63, 209, 210, 211); gaster not strongly compressed; mesopleuron more often not completely smooth and shining.....18

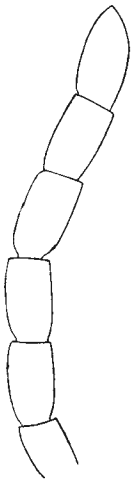
17 (16) Transfacial line (fig. 207) equal to, or a little shorter than the height of an eye; foveae of scutellum not, or very weakly, separated; corpus black; gaster with no pubescence; mesoscutum obsoletely alutaceous, almost smooth.
iv–vi.....**ostreus** Hartig ♀ (= *furunculus* Beyerinck)

— Transfacial line clearly longer than the height of an eye (fig. 208); foveae of scutellum weakly separated; corpus in part yellow brown; gaster, at base, with sparse fine pubescence; mesoscutum weakly alutaceous
x–xii.....**ostreus** Hartig ♂

18 (16) Ventral spine projection short (fig. 209) and with distinct but small apical hair tuft; head and thorax dark reddish-brown; gaster in part dark red; base of antenna, fore and middle tibia, base of tarsi, yellow; antenna with fifteen segments.
vi. *Doubtfully British* (*see* Notes, p. 53).....**sufflator** Mayr ♀

— Ventral spine projection long or very long (figs. 63, 210, 211) and with no distinct tuft; antenna with 13–14 segments.....19

FIGS. 201–202.—*Andricus*, sculpture of vertex, ♂: 201, *solitarius*; 202, *kollari*.
FIGS. 203–204.—*Andricus*, sculpture of mesopleura, ♂: 203, *solitarius*; 204, *kollari*.



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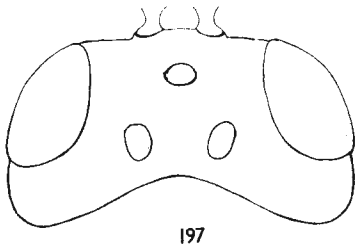

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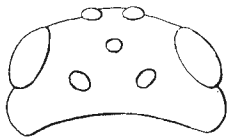

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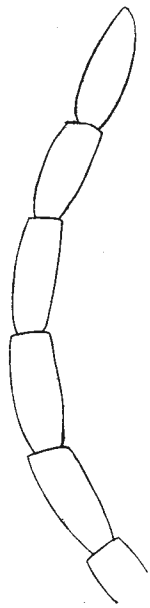

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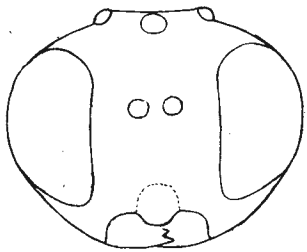

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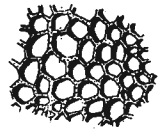

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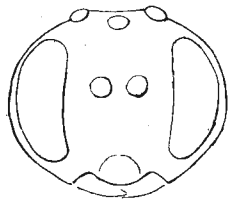

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FIGS. 195–196.—*Andricus*, head, anterior, ♂: 195, *quercuscorticis* (Mayr coll. Vienna); 196, *testaceipes* (Mayr coll. Vienna).

FIGS. 197–198.—*Andricus*, head, dorsal, ♂: 197, *quercuscorticis* (Mayr coll. Vienna); 198, *testaceipes* (Mayr coll. Vienna).

FIGS. 199–200.—*Andricus*, distal segments of antenna, ♂: 199, *testaceipes*; 200, *quercusradicis*.

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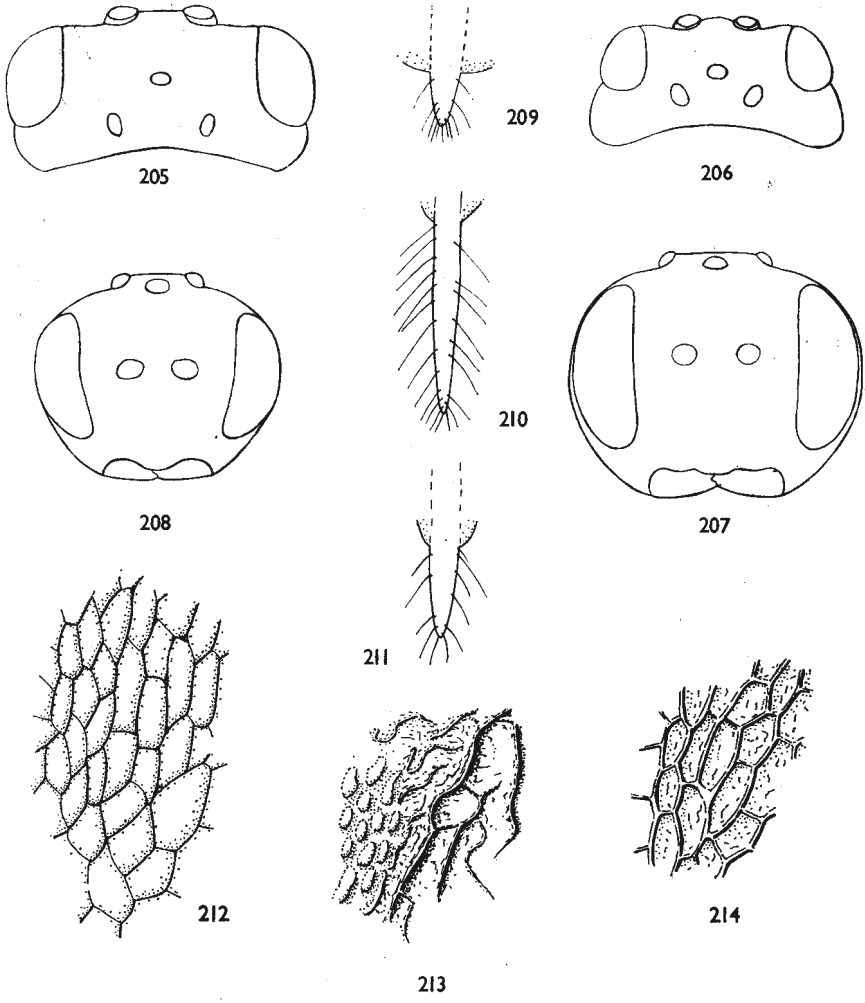
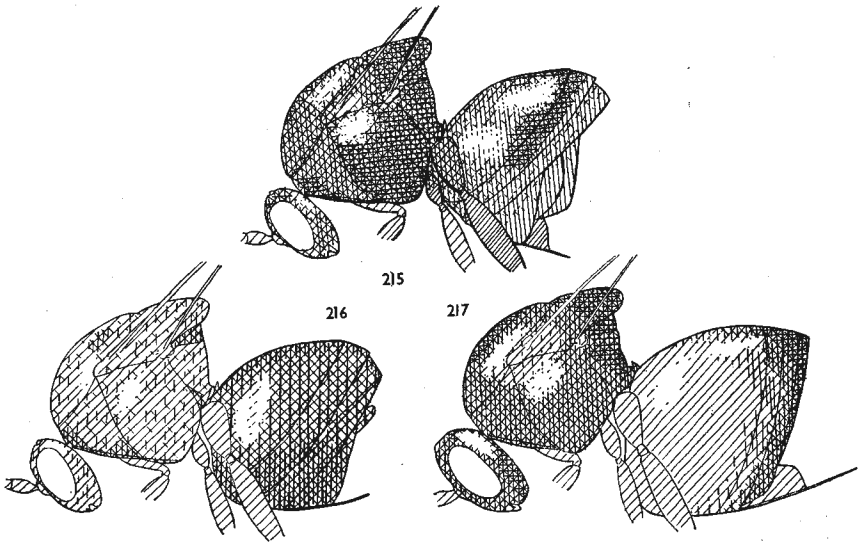


FIGS. 205–206.—*Andricus*, head, dorsal : 205, *fecundator* ♀ ; 206, *fecundator* ♂.
FIGS. 207–208.—*Andricus*, head, anterior : 207, *ostreus* ♀ ; 208, *ostreus* ♂.
FIGS. 209–211.—*Andricus*, spine of hypopygium, ventral, ♀ : 209, *sufflator* ; 210, *curvator* ; 211, *fecundator*.
FIGS. 212–214.—*Andricus*, sculpture of mesoscutum, ♀ : 212, *quercusramuli* ; 213, *solitarius* ; 214, *kollari*.

19 (18) Mesoscutum wholly, or in part, smooth, alutaceous or finely coriaceous (fig. 212) 20
— Mesoscutum pustulate, rugose or reticulate (figs. 213, 214) 30
20 (19) Head and thorax entirely black ; gaster black or dark red (fig. 215), in lateral view gaster equal in size to thorax or a little smaller ; antenna with 13–14 segments ; temples not dilated behind eyes 21



FIGS. 215–217.—*Andricus*, colour patterns of groups, ♀: 215, *curvator*; 216, *quercusramuli*; 217, *quercusradicis*.

— Head and thorax entirely yellow, yellow-brown, or pale red, with or without some darker markings; gaster sometimes darker (fig. 216); in lateral view gaster about equal to thorax or a little larger; antenna with thirteen segments; temples not or very weakly dilated behind eyes.....25

— Head red or black; thorax dark brown to black; gaster yellow to red, sometimes black apically (fig. 217); in lateral view, gaster as large as head and thorax combined; antenna with thirteen segments; temples sometimes clearly but not strongly dilated behind eyes.....28

21 (20) Ventral spine projection very long (fig. 210); mesoscutum and mesopleuron sometimes smooth and shining, with sculpture obsolete or absent.....22

— Ventral spine projection shorter (figs. 63, 211); mesoscutum and mesopleuron always with sculpture.....23

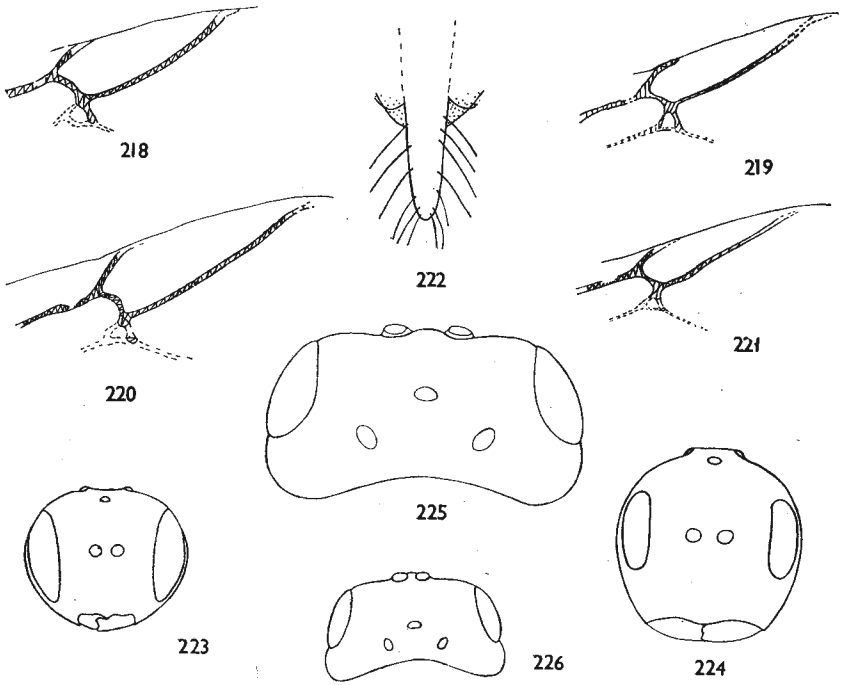
22 (21) Transfacial line equal to, or not visually longer than the height of an eye; mesopleuron smooth and shining; scutellar foveae broad and shining, sharply separated from each other by a thin carina, and from the mesoscutum by a weak carina; mesoscutum obsoletely alutaceous; gaster black
vi.....**curvator** Hartig ♀

— Transfacial line clearly longer than the height of an eye; mesopleuron very weakly, longitudinally rugulose anteriorly; scutellar foveae less broad, separated less clearly from each other by a broad raised rugulose area, and from the mesoscutum by a very distinct carina; mesoscutum alutaceous; gaster mainly red.
vi.....**inflator** Hartig ♀

23 (21) Mesoscutum posteriorly in middle, and mesopleuron in greater part with sculpture obsolete, smooth and shining; gaster entirely black or dark chestnut red.....24

— Mesoscutum and mesopleuron entirely sculptured; gaster red ventrally....26

24 (23) Fore wing with radial cell broader and second abscissa of radius (Rs_2) evenly, though only weakly, curved (fig. 218); all femora in greater part brown, with the extremities dark yellow.
v–vi.....**fecundator** (Hartig) ♀ (= *pilosus* Adler)



FIGS. 218–221.—*Andricus*, radial cell of fore wing, ♀ : 218, *fecundator* ; 219, *nudus* ; 220, *quercusramuli* ; 221, *glandulae*.
FIG. 222.–*Andricus callidoma* ♀ : spine of hypopygium, ventral.
FIGS. 223–224.—*Andricus*, head, anterior, ♀ : 223, *quercuscorticis* ; 224, *quercusradicis*.
FIGS. 225–226.—*Andricus*, head, dorsal, ♀ : 225, *quercuscorticis* ; 226, *quercusradicis*.

— Fore wing with radial cell narrower and second abscissa of radius (Rs_2) weakly curved distally and almost straight proximally (fig. 219) ; all legs yellow, femora dark yellow.
v–vi..... **nudus** Adler ♀

25 (20) Fore wing with second abscissa of Rs_2 diverging from R_1 and very weakly, but evenly, curved over greater part of its length (fig. 220) ; radial cell broader 26

— Fore wing with second abscissa of Rs_2 proximally almost parallel with R_1, weakly curved proximally and almost straight or weakly sinuate distally (fig. 221) ; radial cell narrower.....27

26 (25) (23) Ventral spine projection shorter (fig. 222) ; head, thorax and dorsal apex of gaster yellow to dark brown or black ; mesopleuron almost entirely longitudinally striate.
v–vi..... **callidoma** (Hartig) ♀ (= *cirratus* Adler)

— (25) Ventral spine projection long (fig. 63) ; head, thorax and gaster red, paler or darker ; mesopleuron with large smooth area dorsoposteriorly.
v–vi..... **quercusramuli** (Linnaeus) ♀

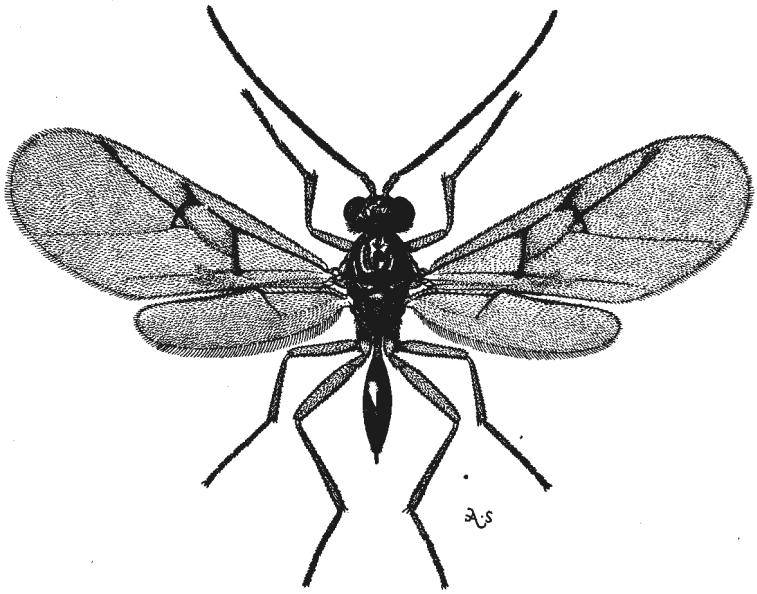


FIG. III.—*Neuroterus quercusbaccarum*, ♂.

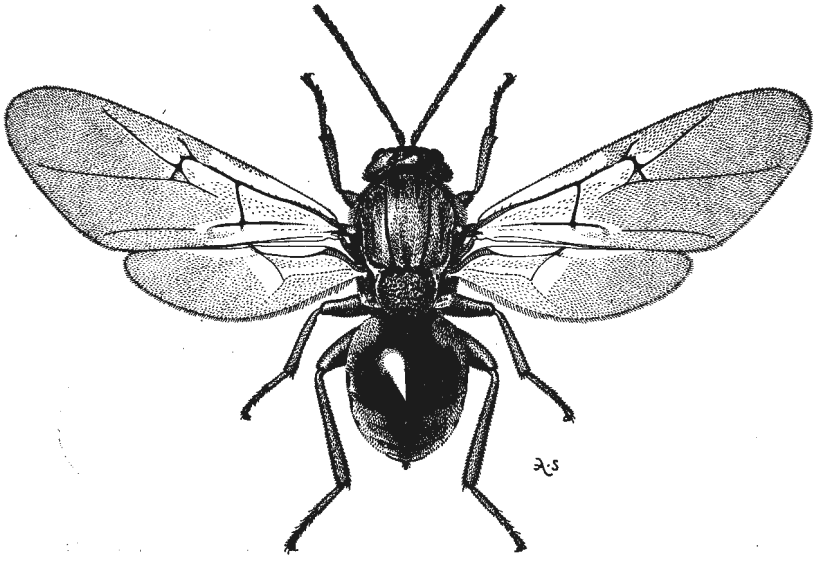
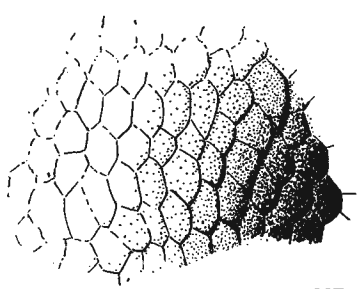


FIG. IV.—*Andricus kollari*, ♀.

27 (25) Thorax with dark brown markings dorsally and ventrally; gaster dark red.
v–vi.....**glandulae** (Schenck) ♀ (= *xanthopsis* Schlechtendal)
— Thorax yellow, sometimes weakly marked with brown ventrally; gaster reddish-yellow, reddish-brown apically. (No agamic generation known.)
v.....**amenti** Giraud ♀
28 (20) Head, viewed anteriorly, transversely ovate (fig. 223); viewed dorsally, distance across head at temples scarcely greater than across head at eyes (fig. 225).
vi..... **quercuscorticis** (Linnaeus) ♀ (=*gemmatus* Adler)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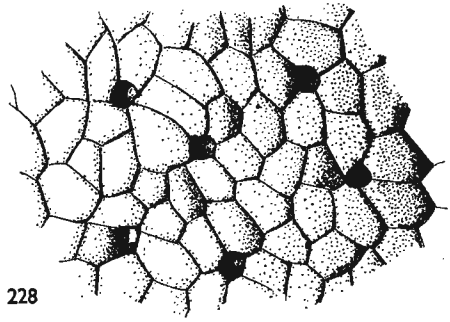
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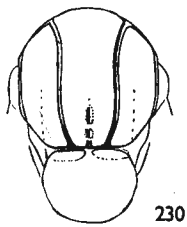
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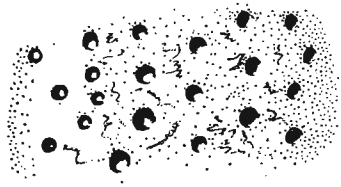
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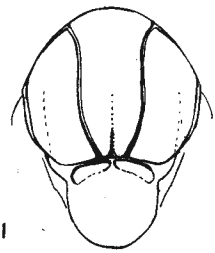
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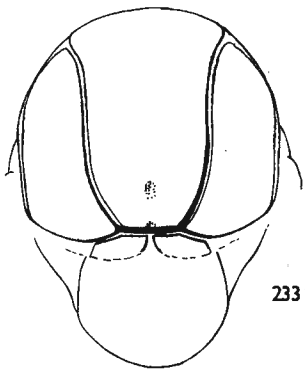
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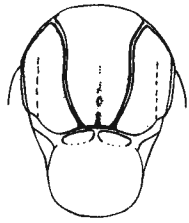
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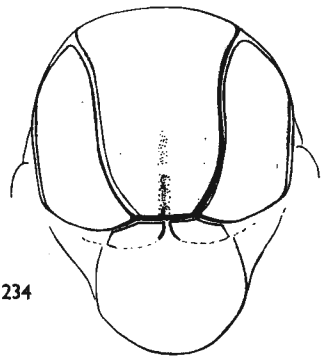
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FIGS. 227–229.—*Andricus*, sculpture of mesoscutum, ♂ : 227, ***curvator***; 228, ***inflator***; 229, ***fecundator***.
FIGS. 230–234.—*Andricus*, median scutal line, ♂ : 230, ***nudus***; 231, ***seminationis*** 232, ***quadrilineatus***; 233, ***albopunctatus***; 234, ***albopunctatus***.

— Head, viewed anteriorly, rotundate (fig. 224); viewed dorsally, distance across head at temples clearly greater than across head at eyes (fig. 226).....29

29 (28) (*See* Notes i and ii, p. 52). At present no satisfactory way of distinguishing the female of these two species in this generation.

viii.....**testaceipes** Hartig ♀ and **quercusradicis** (Fabricius) ♀ (= *trilineatus* Hartig)

30 (19) Mesoscutum pustulate and rugose in parts (fig. 213).

iv.....**solitarius** (Boyer de Fonscolombe) ♀ (= *occultus* Tschek)

— Mesoscutum reticulate, in part at least (fig. 214).....31

31 (30) Mesoscutum reticulate anteriorly, posteriorly with distinct longitudinal striate element medially. (*See* Note iii, p. 52.)

iv–v.....**corruptrix** (Schlechtendal) ♀ (= *larshemi* Doctors van Leeuwen and Dekhuijzen-Maasland)

— Mesoscutum closely reticulate; ventral spine projection rather short.

v–vi.....**kollari** (Hartig) ♀ (= *circulans* Mayr)

32 (15) Head and thorax black; gaster chestnut red; antenna with at least 14 articulated segments; at most very weakly pubescent species.....33

— All yellow, yellow-brown, or red; if sometimes more heavily marked with black then conspicuously pubescent OR antenna with only 13 articulated segments 35

33 (32) Mesoscutum alutaceous, sometimes obsoletely, shining, with no pubescence medially (fig. 227); mesopleuron in greater part smooth and shining

iii–iv.....**curvator** Hartig ♂ (= *collaris* Hartig)

— Mesoscutum coriaceous or punctate (figs. 228, 229), with short sparse pubescence 34

34 (33) Face coriaceous; mesoscutum coriaceous with some shallow punctures (fig. 228); mesopleuron almost entirely smooth and shining

iii.....**inflator** Hartig ♂ (= *globuli* Hartig)

— Face punctate; mesoscutum punctate with smooth interspaces (fig. 229); mesopleuron almost entirely smooth and shining, sparsely pubescent.

ix–x. iii.....**fecundator** (Hartig) ♂

35 (32) Mesoscutum alutaceous or coriaceous, at most weakly pubescent; scutellum more frequently without pubescence, and alutaceous or coriaceous medially at least; mesopleuron often in greater part smooth and shining; scutellar foveae in some species rather shallow.....36

— Mesoscutum closely punctate or strongly coriaceous, conspicuously pubescent; scutellum pubescent, medially rugose, rugulose or punctate; scutellar fovea deep (FIG. IV, p. 47).....41

36 (35) Median scutal line represented posteriorly by a short shallow but distinct furrow, or with equivalent length in a series of distinct foveae, which together are at least as long as the distance between the notaulices at the posterior margin of the mesoscutum (figs. 230, 231, 232).....37

— Median scutal line absent (fig. 233), at most represented posteriorly by a very shallow truncate fovea, or by one or two shallow or obsolete punctures (fig. 234) 39

37 (36) [2]Median scutal line clearly and completely interrupted, narrowly or broadly, once or twice; posterior sulcus of median scutal line conspicuously shorter than the distance between notaulices at posterior margin of mesoscutum (fig. 230). iv.....**nudus** Adler ♂ (= *malpighii* Adler)

— [2]Median scutal line not completely interrupted (fig. 231) or, if interrupted or partially interrupted, then posterior sulcus of median scutal line usually about as long as distance between notaulices at posterior margin of mesoscutum (fig. 232). No sexual generation known.....38

38 (37) [2]Median scutal line clearly longer than distance between the notaulices at posterior margin of mesoscutum (fig. 231), sometimes shallow near middle, and almost interrupted.

iii.....**seminationis** (Giraud) ♂

— [2]Median scutal line about as long as distance between the notaulices at posterior margin of mesoscutum (fig. 232).

iii....**quadrilineatus** Hartig ♂ (= *marginalis* (Schlechtendal) ♂) **syn. nov.**[3]

[2] This character is variable and difficult to appreciate in many specimens. In this generation the species are better separated on the differences in their galls (pp. 67, 70, 72).

[3] The present authors decided on this synonymy after careful consideration of the external morphology of the adults and galls of the species concerned. Since then M. Roger Folliot, working quite independently, has published the results of his biological experiments with the same species (Folliot, R., 1961, Sur le regroupement des espèces *Andricus quadrilineatus* Hartig et *Andricus marginalis* Schlechtendal. *C.R. Acad. Sci., Paris* **253**: 3050–3052) and has arrived at the same conclusion.

39 (36) Mesoscutum alutaceous (fig. 235) obsolete medially, anteriorly with some punctures medially; sometimes with median scutal line represented posteriorly by two or three shallow elongate depressions (figs. 233, 234).
iii. . . . . **albopunctatus** (Schlechtendal) ♂

— Mesoscutum coriaceous (fig. 236). 40

40 (39) Area between carinae on propodeum with a short longitudinal carina posteriorly; mesoscutum more shining and almost without pubescence; scutellum sparsely pubescent.
iii–iv. . . . . **glandulae** (Schenck) ♂

— Area between carinae on propodeum without longitudinal carina; mesoscutum less shining; mesoscutum and scutellum finely but clearly pubescent. (*See* Note iv, p. 52.)
iii. . . . . **callidoma** (Hartig) ♂

41 (35) Mesoscutum distinctly punctate; punctures in the middle of the mesoscutum separated from each other by not more than twice the diameter of a puncture, often much closer, and the area between punctures shining and smooth, alutaceous or weakly coriaceous. 42

— Mesoscutum without punctures, or at most with these very sparse, weak, indistinct and obscured by other sculpture; mesoscutum rather dull coriaceous 45

42 (41) Carinae of propodeum of approximately even thickness throughout, bowed outwards in middle, weakly converging anteriorly and posteriorly (fig. 237) . . 43

— Carinae of propodeum distinctly thickened and dorsally flattened anteriorly; or strongly diverging posteriorly to beyond middle, sometimes angled posteriorly of middle and then more abruptly converging; or subparallel. . 44

43 (42) Middle lobe of mesoscutum posteriorly very closely punctate, punctures separated from each other by clearly less than the width of a puncture; mesopleuron closely pubescent but without sculpture except for alveoli; gaster pubescent laterally and posteriorly.
Head brownish-red, very extensively black marked dorsally; more strongly pubescent, at a distance appearing greyish brown and darker.
ii–iv. . . . . (*see* Note p. 53). . . . . **quercuscalicis** (Burgsdorf) ♂

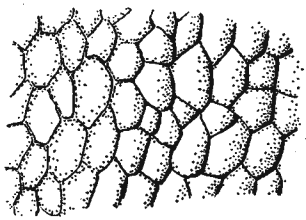
— Middle lobe of mesoscutum posteriorly coriaceous with rather sparse punctures separated from each other by considerably more than the width of a puncture; mesopleuron sparsely pubescent, coriaceous anteriorly, sparsely punctate in middle above and below band of longitudinal striae, more punctate posteriorly; gaster shining and without pubescence except laterally at extreme base.
Head dark red, with face, frons and vertex marked with black; thorax almost entirely black; weakly pubescent, appearing more brownish or reddish and paler.
v–vii. . . . . **quercuscorticis** (Linnaeus) ♂

44 (42) Carinae of propodeum subparallel (fig. 239).
Head and thorax reddish, extensively marked with black, mesopleuron almost completely black; frons and vertex finely coriaceous with weak shallow punctures; scutellum rugulose medially, rugose laterally and apically; mesopleuron pubescent, rather sparsely punctate, smooth medially in upper part.
iii–iv. . . . . **quercusradicis** (Fabricius) ♂

— Carinae of propodeum weakly bowed posteriorly of middle, but conspicuously thickened and dorsally flattened in anterior third.
Head and thorax brownish-red, black-marked, particularly round mouth area and on mesoscutum and venter of thorax, propodeum entirely black; face medially coriaceous, laterally punctate; vertex coriaceous with scattered punctures; scutellum dorsally coriaceous and closely punctate; mesopleuron sparsely pubescent, punctate, sparsely or weakly posteriorly, but sometimes with an anterior longitudinal narrow band of striae extending almost to middle of mesopleuron.
iii–iv. . . . . **rhizomae** (Hartig) ♂

— Carinae of propodeum strongly diverging posteriorly, and bowed sharply posteriorly of middle (fig. 238).
Head and thorax in greater part, and mesopleuron entirely, red or yellow; frons and vertex finely coriaceous; scutellum rugulose, coriaceous in interspaces; mesopleuron sparsely pubescent, coriaceous anteriorly, almost smooth, or sculpture obsolete, ventrally in middle below narrow band of longitudinal striae, punctate posteriorly.
iii–iv. . . . . **testaceipes** Hartig ♂ (=*sieboldi* Hartig)

45 (41) Ventral spine projection short (fig. 240); mesopleuron in greater part smooth and shining beneath fine pubescence, weakly rugulose on anterior margin; antenna with fourteen segments.
viii–ix.....**solitarius** (Boyer de Fonscolombe) ♂
— Ventral spine long and slender (fig. 241); mesopleuron sculptured in greater part, often entirely and always anteriorly; antenna with thirteen segments....46
46 (45) Carinae of propodeum straight and parallel; scutellar foveae shallower internally and widely separated; metanotum entirely, propodeum in greater part, and gaster dorsally, black; remainder of head, thorax and gaster, red.
viii.....**corruptrix** (Schlechtendal) ♂
— Carinae of propodeum bowed outwards in middle; scutellar foveae deep, not widely separated; scutellar foveae, metanotum entirely, propodeum medially, and gaster dorsally, black; remainder of head, thorax and gaster, yellow or yellow-brown (FIG. IV, p. 47).
ix–x.....**kollari** (Hartig) ♂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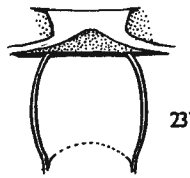
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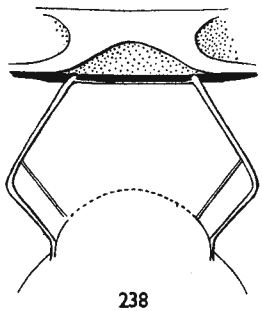
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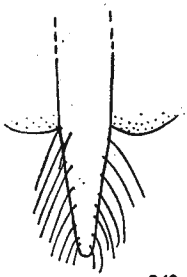
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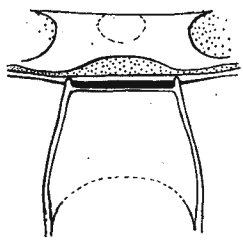
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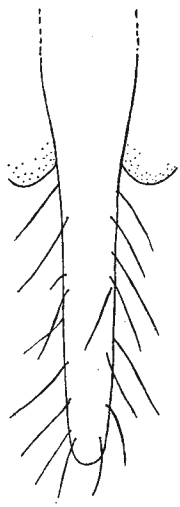
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FIGS. 235–236.—*Andricus*, sculpture of mesoscutum, ♂ : 235, *albopunctatus*; 236, *glandulae*.
FIGS. 237–239.—*Andricus*, carinae of propodeum, ♂ : 237, *quercuscorticis*; 238, *testaceipes*; 239, *quercusradicis*.
FIGS. 240–241.—*Andricus*, spine of hypopygium, ventral, ♂ : 240, *solitarius*; 241, *kollari*.

The following species are known to the authors only from descriptions or from inadequate or unsatisfactory material.

(i) Ross (1946, *Lond. Nat.* **1945**: 31–46), referring to *testaceipes* ♂♀ and *quercusradicis* ♂♀ (= *trilineatus*), indicated a character of the male antennae which appeared to aid in distinguishing the species. He states (p. 37) " in *trilineatus* the five segments up to the last but one (that is segments 9 to 13 inclusive) are not twice as long as broad ; in *testaceipes* the corresponding segments are twice as long as broad, and even longer . . . ." In the material examined for the present work, the single male of *testaceipes* from the Mayr collection has segments 9 to 13 of the antennae not twice as long as broad, whereas males of *quercusradicis* appear to have these same segments twice as long as broad. That is, in fact, the reverse of Ross's statement, which may be a misprint. Ross in the same paper later refers to Niblett's successful rearing of *quercusradicis* ♂♀ (*trilineatus*) from galls arising from oviposition by *quercusradicis* ♀, and comments " A critical microscopic examination of some flies which Mr. Niblett gave me makes me dubious as to the value of measurements of antennal segments in some cases."

(ii) No material of *A. rhizomae* (Hartig) ♂♀ (=*nodifex* Kieffer) has been seen. From description it is indistinguishable from *A. testaceipes* Hartig ♂♀.

(iii) It has not been possible to see specimens of males of *A. corruptrix* (Schlechtendal) but from the description it is very close to *A. kollari* (Hartig) ♂♀.

(iv) No material of *A. quercusramuli* (Linnaeus) ♀ (= *autumnalis* Hartig) has been seen, but it is most probably very close to *A. callidoma* (Schenck) ♀.

The following are to be deleted from the list of British species.

A. aestivalis Giraud. The solitary record of the adult by Cameron (1892) has not been substantiated, and the distinctive gall on staminate catkins of *Quercus cerris* could hardly have escaped the notice of collectors. The gall is figured in the present work (fig. 368). The adults of the sexual generation may be distinguished from all other British species of *Andricus* by the rugose mesoscutum, the stout antennae (segment 13 quadrate in female, segment 3 slender basally and strongly expanded distally in male), large size and general robustness. No agamic generation is known.

A. clementinae (Giraud). The gall only was recorded once by Cameron (1892), but there have been no further records in Britain. Connold (1908) notes that the gall bears a close resemblance to that of *A. inflator* (Hartig) ♀. No sexual generation is known. Specimens of the insect examined during preparation of the present work would run in the key to *A. rhizomae*. The two species may be distinguished as follows :

Antenna with 14 segments (13 and 14 fused but visible) ; carinae of propodeum diverging posteriorly, conspicuously thickened anteriorly **rhizomae** (Hartig) ♀

Antenna with 13 segments; carinae of propodeum converging posteriorly and of even thickness throughout . . . . . **clementinae** (Giraud) ♀

A. lucidus Hartig. Recorded by S. L. Mosley (1892, *Naturalist, Lond.* **17** :

338) from Yorkshire. No further records from Britain are known, and the very distinctive gall (fig. 367) is not likely to have been overlooked. The adult, of which no sexual generation is known, differs from all other British species of *Andricus* in having the genae striate ; the strong sculpture and absence of pubescence also serve to distinguish this insect.

A. trotteri Kieffer. Recorded (Bagnall and Harrison, 1918) on the gall only, and this has not been subsequently verified. The distribution of the species in Europe makes its occurrence in the British Isles unlikely. The gall is figured herein (fig. 366). No sexual generation is known, but the material of the agamic generation examined was placed between *inflator* Hartig ♂ and *fecundator* (Hartig) ♂. The species differed from *fecundator* in having the face coriaceous, and from both *fecundator* and *inflator* in having the notaulices much further apart and the mesopleuron longitudinally striate medially.

The following species are retained for the present on the list of British species, but require confirmation.

A. gemmicola Kieffer. This was brought forward as British by Bagnall and Harrison (1919). No authentic specimens of this species have been seen and the authors are not aware of any subsequent records in Britain. However, a gall of apparently this species was taken in the New Forest in 1959. A single male was bred from this gall, and appears to fit most of the characters given in the original description of *gemmicola*, except that the antenna has sixteen segments. In the present key it would run to *ostreus* ♂♀, from which it differs in the carinae of the propodeum, which are distinct, straight and sub-parallel. The gall figured (fig. 308) was made available by courtesy of the Vienna Museum.

A. rhizomae (Hartig). This gall (fig. 287), recorded by Bagnall and Harrison (1918) and Burkill (1932) may easily have been confused with *A. testaceipes* ♂. The authors have not been able to examine any British material, and have seen only the agamic generation from continental Europe.

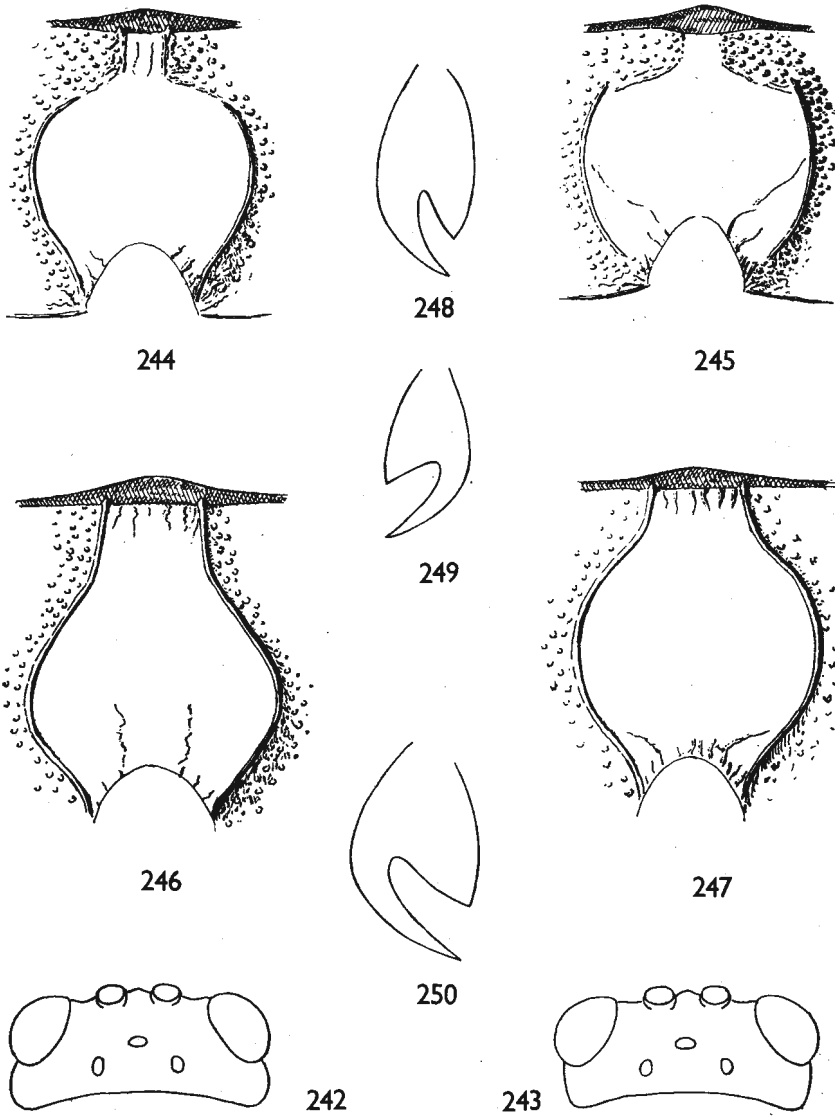
A. sufflator Mayr. This species was added to the British list by Bagnall and Harrison (1918) on the strength of old galls taken near Bath in 1917. A further record of what appeared to be this species, observed by L. B. Hall in Cumberland, is given by Burkill (1922). The gall is sufficiently like that of *Neuroterus numismalis* ♂ to be confused with that species, and this could account for its being overlooked. Females from continental Europe show that the species would run in the present key to the group of *A. curvator* Hartig ♂♀. From *A. curvator* and *A. inflator* it is separated by the short ventral spine with a small apical hair tuft, a character which gives it some resemblance to *A. ostreus* ♂♀. The present authors have not had the opportunity of examining males of the species, so it is not known whether that sex would resemble more closely *A. ostreus* or *A. curvator*. The gall has structural characters that resemble those of the gall of *A. curvator*.

The following is hereby added to the list of British species.

A. quercuscalicis Burgsdorf. Since the manuscript of this work was completed (1961), galls of this species have been taken by Dr. M. F. Claridge and recorded by him (*Entomologist* **95** : 60–61).

It has been possible to include in the present key to *Andricus* the agamic form of this species and the gall, which is found on *Quercus petraea* and *Q.*

robur, is figured at the end of the key to galls (fig. 371). The sexual generation (*Andricus cerri* Beyerinck), which has not yet been recorded from Britain, and of which no material has been seen by the present authors, occurs on



FIGS. 242–243.—*Cynips*, head, dorsal, ♀ : 242, *divisa* ; 243, *disticha*.
FIGS. 244–247.—*Cynips*, carinae of propodeum, ♀ : 244, *quercusfolii* ; 245, *longiventris* ; 246, *disticha* ; 247, *divisa*.
FIGS. 248–250.—*Cynips*, claws, ♀ : 248, *quercusfolii* ; 249, *longiventris* ; 250, *divisa*.

the catkins of *Q. cerris* in spring or early summer. In size and shape the gall appears to resemble more closely that of *Andricus curvator* ♂ (fig. 307).

Genus **Cynips** Linnaeus

Key to Species

1 Mesoscutum and mesopleuron without pubescence; ventral spine projection of female a little longer, pointed and acute apically (fig. 251); antenna of female with 14 segments, of male with 15 segments; sexual generation....2

— Head and thorax usually completely, though not always closely pubescent; ventral spine very short, broad and truncate or sinuate apically (fig. 252); antenna with 13 articulated segments, last segment consisting of two segments fused, and the suture between them indistinct; agamic generation..5

2 (1) Propodeum with carinae incomplete or interrupted anteriorly, and with medial unsculptured area narrower at anterior margin (fig. 244, 245); claws generally a little narrower (figs. 248, 249).....3

– Propodeum with carinae complete, and enclosing a relatively unsculptured area which is broad at anterior margin (figs. 246, 247); claws broad (fig. 250)..4

3 (2) Unsculptured medial area of propodeum with narrow anterior part differentiated from external areas of propodeum by obsolete carinae which project into the anterior transverse sulcus (fig. 244); hind claws with basal tooth narrower (fig. 248); male with frons weakly coriaceous and shining.
iv–v.....**quercusfolii** Linnaeus ♂♀ (=*taschenbergi* Schlechtendal)

– Unsculptured medial area of propodeum with narrow anterior part differentiated from external areas of propodeum by absence of sculpture (fig. 245); hind claws with broader acute basal lobe (fig. 249); male with frons coarsely coriaceous.
v–vi.....**longiventris** Hartig ♂♀ (= *substituta* Kinsey)

4 (2) Head, viewed dorsally, with width across temples equal to width across eyes (fig. 242).
v.....**divisa** Hartig ♂♀ (= *verrucosa* Schlechtendal)

– Head, viewed dorsally, with width across temples less than width across eyes (fig. 243).
v.....**disticha** Hartig ♂♀ (= *indistincta* Niblett)

5 (1) Second tergite of gaster acutely produced posteriorly at dorsum (fig. 253); at least remaining segments minutely punctate, smooth at posterior margins; claws with smaller acute basal lobe (fig. 255).....6

– Second tergite of gaster less acutely produced posteriorly (fig. 254); remaining segments not punctate; claws with very large and less acute basal lobe (fig. 256).....8

6 (5) Medial lobe of mesoscutum with some punctures, at least anteriorly and posteriorly; gaster black.....7

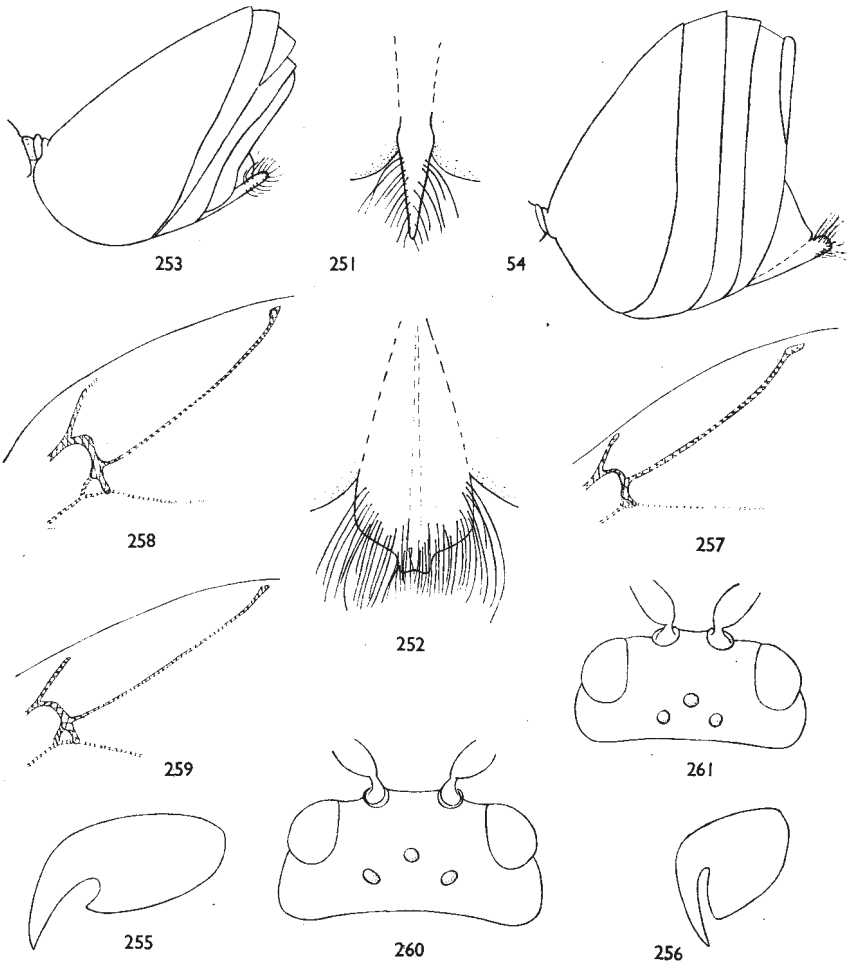
– Medial lobe of mesoscutum completely smooth; gaster red. Head, thorax, gaster and legs red; head with some darker markings; propodeum and bases of hind and middle coxae brownish; first segment of gaster often with a few minute punctures laterally and dorso-laterally near posterior margin; second abscissa of radius curved distally and decurved and expanded at apex (fig. 257).
ix–xi.....**agama** Hartig ♂

7 (6) Second tergite of gaster completely smooth. Head and thorax more pubescent, mostly black, sometimes with some reddish patches, particularly on genae and anterior mesoscutum; legs more infuscate and tibiae mostly black; fore tibiae very robust; second abscissa of radius weakly curved, but clearly expanded apically (fig. 258).
xi–i.....**quercusfolii** Linnaeus ♂

– Second tergite of gaster narrowly and finely punctate posteriorly; head and thorax less pubescent, reddish, black marked; legs dark red; fore tibiae more slender; second abscissa of radius distally weakly curved and not or scarcely expanded (fig. 259).
xi–iii.....**longiventris** Hartig ♂

8 (5) Ocelli forming very strongly obtuse triangle (fig. 260). **Head, thorax and legs, red**; at least face medially, pronotum entirely, mesoscutum anteriorly and laterally, mesosternum and propodeum entirely, gaster proximally, and bases of coxae, black; gaster distally dark red.
xi–i..... **divisa** Hartig ♂

– Ocelli forming less strongly obtuse triangle (fig. 261). **Head, thorax, gaster and legs, red**; pronotum entirely, mesoscutum laterally, mesosternum, propodeum laterally, bases of coxae, black.
x–xi..... **disticha** Hartig ♂



FIGS. 251–252.—*Cynips*, spine of hypopygium, ventral: 251, *longiventris* ♀; 252, *quercusfolii* ♂.
FIGS. 253–254.—*Cynips*, gaster lateral, ♂: 253, *agama*; 254, *divisa*.
FIGS. 255–256.—*Cynips*, claw, ♂: 255, *quercusfolii*; 256, *divisa*.
FIGS. 257–259.—*Cynips*, radial cell of fore wing, ♂: 257, *agama*; 258, *quercusfolii*; 259, *longiventris*.
FIGS. 260–261.—*Cynips*, head, ocelli, ♂: 260, *divisa*; 261, *disticha*.

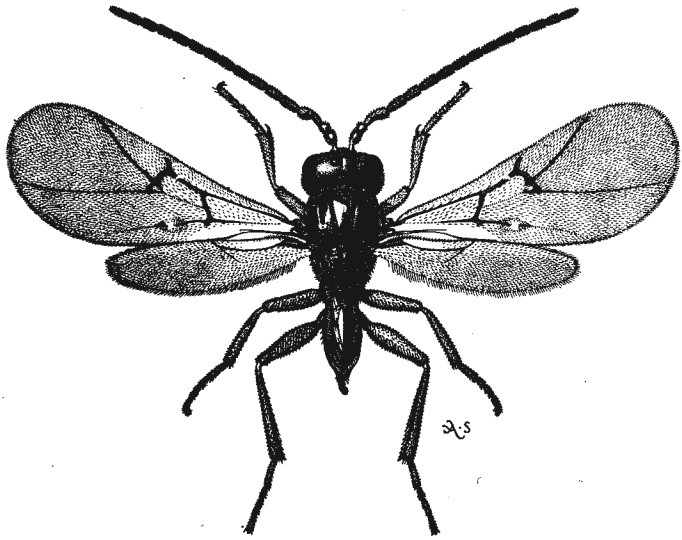


FIG. V.—*Biorhiza pallida*, ♂.

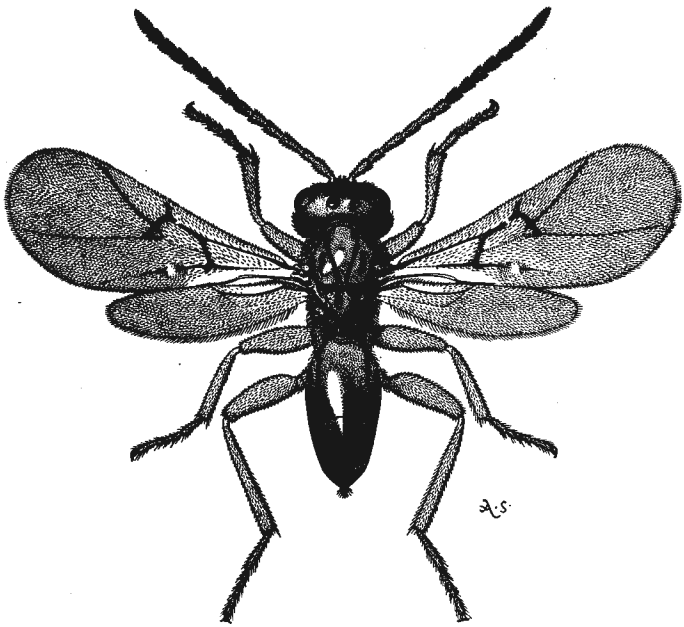


FIG. VI.—*Biorhiza pallida*, ♀.

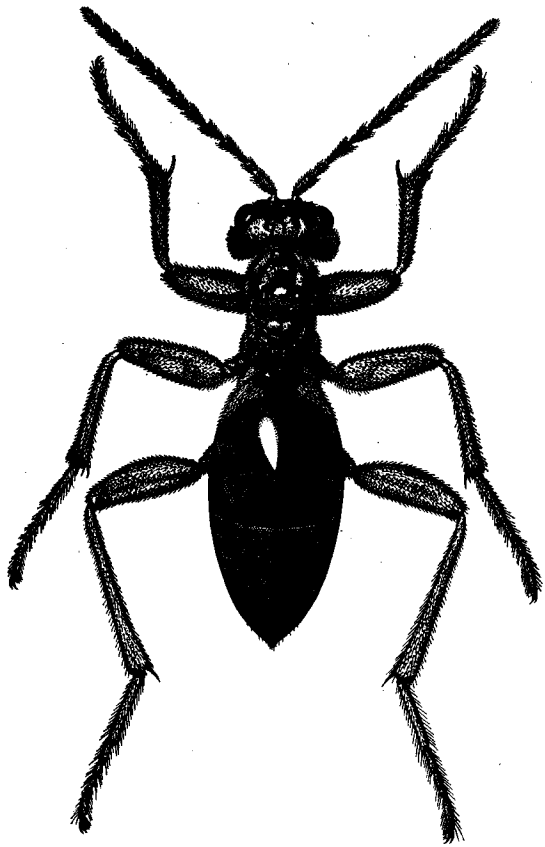


FIG. VII.—*Biorhiza pallida*, ♀.

C. flosculi (Giraud) ♂♀. The galls of this and of the agamic form (= *pubescentis* Mayr) were recorded by Bagnall and Harrison (1918). Neither appears to have been recorded since, and no authentic British material has been located. In central and southern Europe the gall is recorded as occurring on *Quercus pubescens*. The species is not apparently adequately distinguishable from *quercusfolii*, and Kinsey (1929) regarded it as a variety of that species. It seems unlikely that it is a native of the British Isles, and the authors suggest that it be deleted from the list of British species.

C. disticha Hartig ♀. Only one specimen of this form has been seen by the present authors. This specimen was bred by Niblett. Galls of the species have been taken quite frequently, though it is obviously not very common, and rearings of the adult seem to be very rare.

C. agama Hartig ♀. This species is known only from this form. The authors have seen only one authentic British specimen.

Genus **Trigonaspis** Hartig

KEY TO SPECIES

1 Alate. (*See* note).
vi–vii ..... **megaptera** (Panzer) ♂♀ and **synaspis** (Hartig) ♂♀ (= *megapteropsis* Wreise)
– Apterous 2
2 (1) Claws with a very weak tooth ; smaller, less than 2 mm. long.
xi–xii ..... **megaptera** (Panzer) ☿ (= *renum* Hartig)
– Claws with a distinct tooth ; larger, nearly 3 mm. long.
(*See* note) ..... **synaspis** (Hartig) ☿

T. synaspis (Hartig). This was added to the British list by Bagnall and Harrison (1918) on their record of the discovery of the gall. This does not appear to have been confirmed subsequently, and the species must be regarded as doubtfully British. The sexual form is supposedly not distinguishable from the sexual forms of *megaptera*, but the present authors have not had the opportunity of examining material of this sexual generation. Specimens of the agamic generation of *synaspis* from Austria were studied for the purpose of the above key.

Genus **Biorhiza** Westwood

Only one species known in Britain ; the forms may be distinguished as under :

Dorsum of thorax convex ; scutellar foveae distinct ; very rarely other than completely alate. (FIGS. V, VI, p. 57.)
vi–vii ..... **pallida** (Olivier) ♂♀
Dorsum of thorax flattened ; scutellar foveae absent ; apterous. (FIG. VII, p. 58.)
xi–xiii ..... **pallida** (Olivier) ☿ (= *aptera* Fabricius)

KEY TO THE GALLS OF CYNIPINAE

In the following key, distribution is given only where it is known or suspected to be other than throughout suitable localities in Britain, or where records of occurrence are very few.

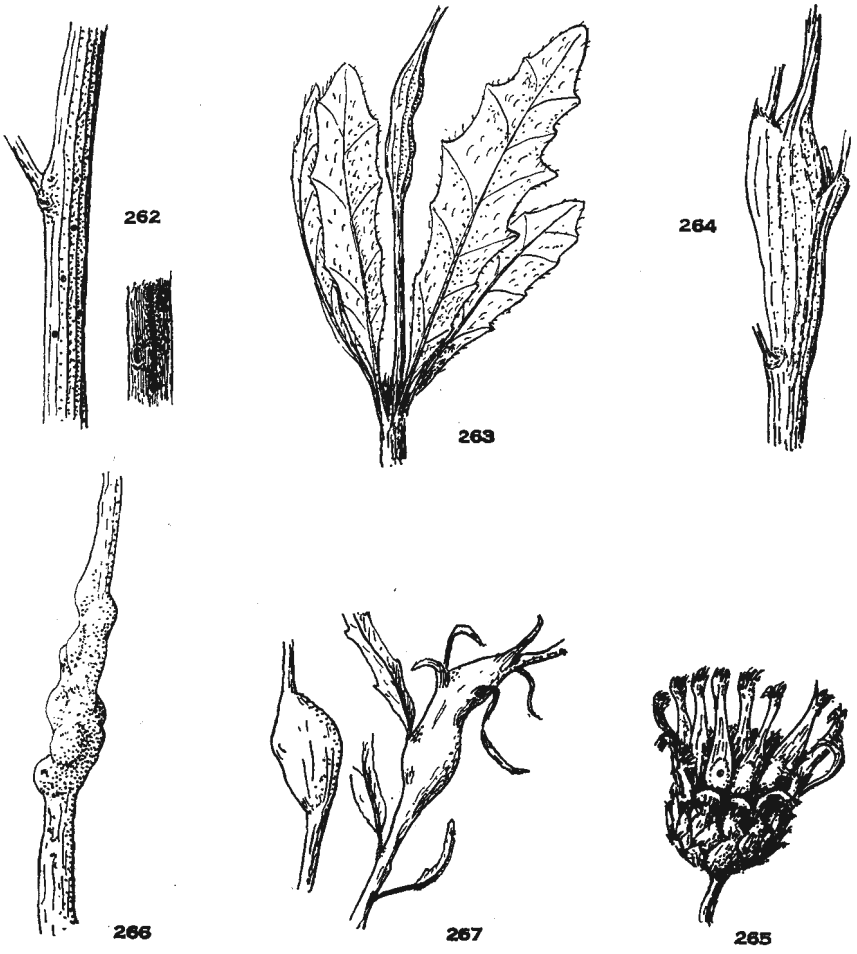
The months in which a gall may normally be found are given in Roman numerals. The best time for collecting galls is when they are close to full growth, so the usual time of maturing is given in cases where the gall may persist beyond maturity (some woody galls persist well beyond the time of emergence of the gall makers).

The names of plants in this work follow the practice of Clapham, Tutin and Warburg (1959 : *Excursion Flora of the British Isles*).

No specimens of the following galls have been seen, and they are included in the present key on the characters given by the previous authors : *Phanacis sonchi* (Stefani), *P. taraxaci* (Ashmead), *P. lampsanae* (Perris), *Andricus nudus* Adler ♂♀, *A. nudus* Adler ☿ (= *malpighii* Adler), *A. quercuscorticis* (Linnaeus) ♂♀ (= *gemmatus* Adler).

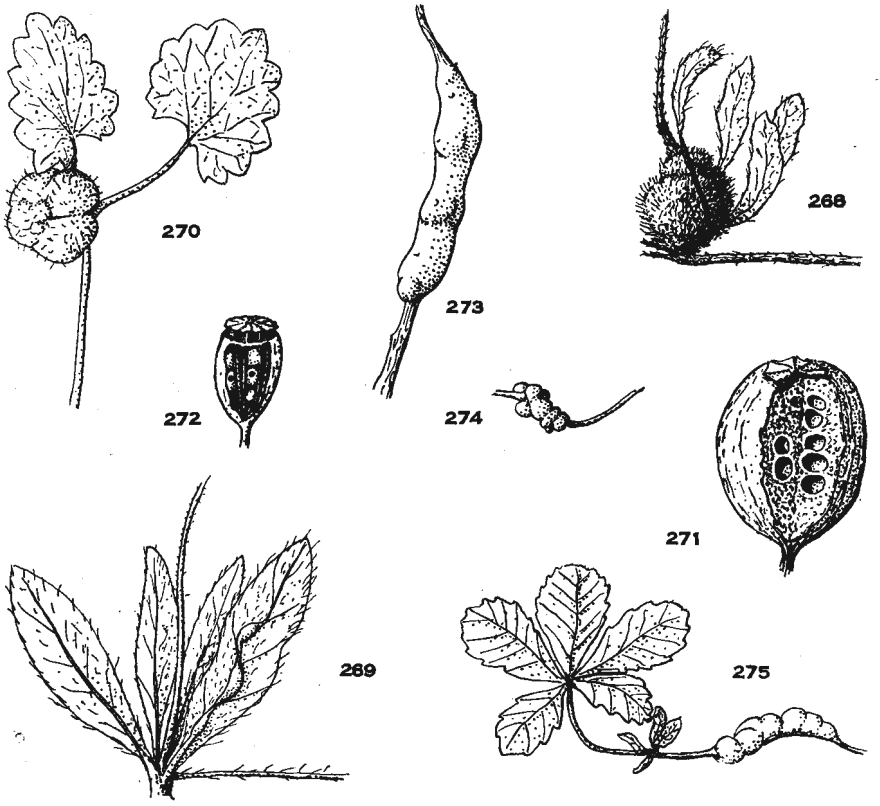
1 On *Quercus* or *Rosa* 17
– On Rosaceae (other than *Rosa*), Papaveraceae, Labiatae or Compositae. Galls appear in late summer, mature in autumn, and overwinter on dead stems or on ground ; adults emerge generally in late spring or early summer of second calendar year 2
2 (1) On *Rubus* or *Potentilla* 15
– Otherwise 3

3	(2)	On *Papaver* 14
–		Otherwise 4
4	(3)	On *Glechoma* 13
–		On Compositae 5
5	(4)	On *Sonchus, Taraxacum, Lapsana, Picris, Hypochaeris* 6
–		Otherwise 7
6	(5)	In stems of *Sonchus* species.
		Recorded from Birmingham area and Surrey .... **Phanacis sonchi** (Stefani)
–		In base of midrib of *Taraxacum officinale*.
		Very rare ..... **Phanacis taraxaci** (Ashmead)



FIGS. 262–267.—Galls on Compositae: 262, *Phanacis caulicola*; 263, *Phanacis hypochoeridis*; 264, *Isocolus scabiosae*; 265, *Isocolus rogenhoferi*; 266, *Aulacidea tragopogonis*; 267, *Aulacidea hieracii*.

– In stem of *Lapsana communis*.
Recorded from Norwich, Kings Lynn and Derby
Phanacis lampsanae (Perris)
– In stem of *Picris echioides* ; (fig. 262).
Rare.....**Phanacis caulicola** (Hedicke)
– In stem of *Hypochaeris radicata* ; (fig. 263).
Very local.....**Phanacis hypochoeridis** (Kieffer)
7 (5) On *Centaurea*.....8
– Otherwise 11
8 (7) In stem.....9
– In achenes.....10
9 (8) In stems of *Centaurea* species.
Local but widely distributed.....**Phanacis centaureae** Foerster
Local and scarce (fig. 264) .....**Isocolus scabiosae** (Giraud)
– In base of stem of *Centaurea scabiosa*.
Scarce.....**Isocolus fitchi** (Kieffer)

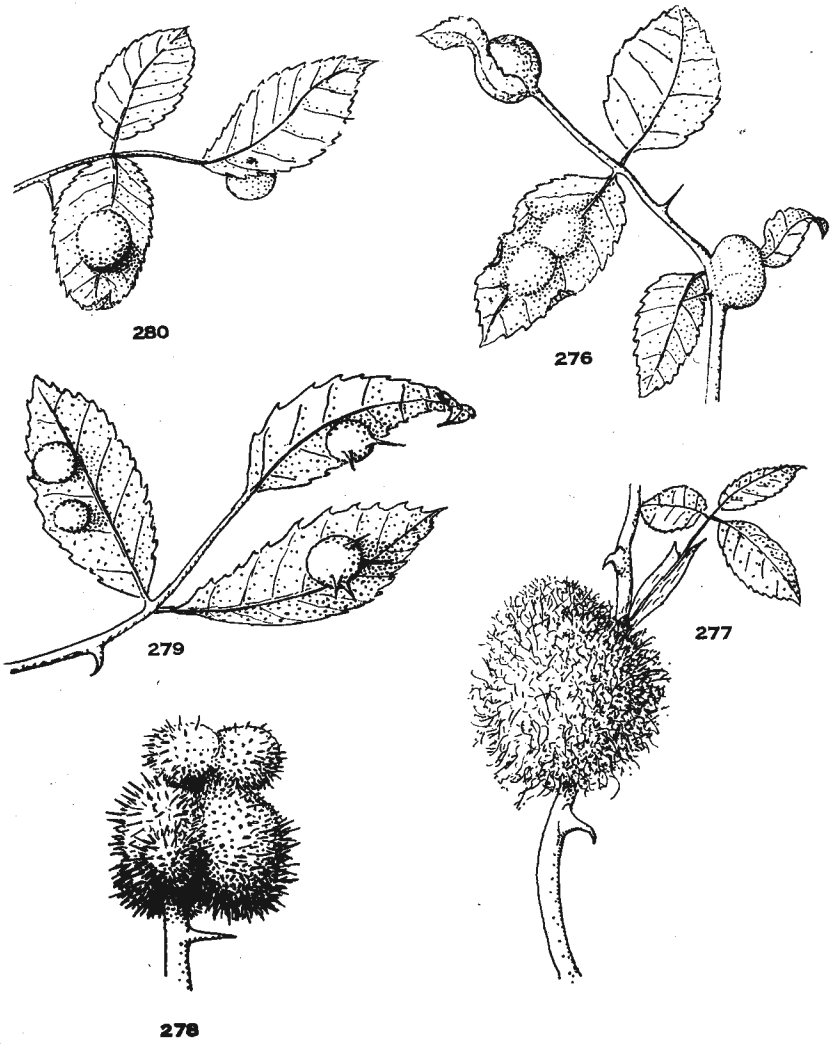


FIGS. 268–269.—Galls on Compositae, *Aulacidea* : 268, *subterminalis* ; 269, *pilosellae*.
FIGS. 270–275.—Galls on *Glechoma*, *Papaver*, *Rubus*, *Potentilla* : 270, *Liposthenus latreillei* ; 271, *Aylax papaveris* ; 272, *Aylax minor* ; 273, *Diastrophus rubi* ; 274, *Xestophanes brevitarsis* ; 275, *Xestophanes potentillae*.

10 (8) In achenes of *Centaurea* species, *nigra-jacea* group.
Common.....**Isocolus jaceae** (Schenck)
– In achenes of *Centaurea scabiosa* ; (fig. 265).
Locally sometimes common.....**Isocolus rogenhoferi** Wachtl
11 (7) In stem base of *Tragopogon* species ; (fig. 266).
Locally common.....**Aulacidea tragopogonis** (Thomson)
— On *Hieracium* species.....12
12 (11) In stems of *Hieracium* species ; (fig. 267).
Locally common.....**Aulacidea hieracii** (Bouché)
— On runners of *Hieracium vulgare* ; (fig. 268).
Rare (Niblett, 1945, *Entomologist* 78 : 72)
Aulacidea subterminalis Niblett
13 (4) In midrib of leaf of *Hieracium pilosella* ; (fig. 269).
Scarce, local.....**Aulacidea pilosellae** (Kieffer)
— On leaves of *Glechoma hederacea* ; (fig. 270).
Locally common.....**Liposthenus latreillei** (Kieffer)
14 (3) In swollen seed capsules of *Papaver rhoeas* ; gall occupying entire capsule, septa visible ; (fig. 271).
Locally common.....**Aylax papaveris** (Perris)
— In normal seed capsules of *Papaver rhoeas* and *P. dubium* ; gall attached to septum (fig. 272).
Common.....**Aylax minor** Hartig
15 (2) In stems of *Rubus caesius* and other *Rubus* species (fig. 273).
Locally common.....**Diastrophus rubi** (Bouché)
— On *Potentilla* species.....16
16 (15) In stems of *Potentilla erecta* (fig. 274).
Locally common.....**Xestophanes brevitarsis** (Thomson)
— In stems of *Potentilla reptans* (fig. 275).
Locally common.....**Xestophanes potentillae** (Retzius)
17 (1) On *Rosa*.....18
— On *Quercus*.....23
18 (17) Galls internal, not breaking through epidermis ; in midrib or leaf petiole of *Rosa spinosissima*, also on *R. rubiginosa* and *R. canina* (fig. 276).
Summer, more often remains attached to shrub over winter ; adults emerge v–vi of second year.
Locally common.....**Diplolepis spinosissimae** Giraud
— Galls external on twigs, leaves or fruit of *Rosa* species.....19
19 (18) Larger, diameter 5–20 mm. but coalesced mass up to 40 mm. diameter, and irregularly globulose (figs. 277, 278) ; hairy or spiny ; on twigs or leaves, rarely on fruit.
Plurilocular ; conglomerate ; coalescent ; pale green to bright red ; appear in summer, mature in early autumn, remain on plant over winter ; adults emerge in early summer of second year.....20
— Smaller, diameter 4–8 mm., pea-shaped ; smooth or spiked (figs. 279, 280) on leaves, generally underside.
Unilocular ; single ; solitary or gregarious ; pale green, yellowish green, pink, red ; appear in summer, mature in late summer or early autumn, falling at maturity and overwintering on ground ; adults emerge in early summer of second year.....21
20 (19) Closely covered in very long, branched tangled hairs, which conceal individual galls in mass ; brightly coloured and conspicuous ; on twigs or leaves of *Rosa* species (fig. 277).
Common.....**Diplolepis rosae** (Linnaeus)
— More sparsely covered with short unbranched spines ; individual galls usually visible in coalesced mass ; on twigs generally, sometimes on fruit or leaves (fig. 278) ; on *Rosa canina, R. micrantha* and *R rubiginosa*.
Local, scarce.....**Diplolepis mayri** (Schlechtendal)
21 (19) Spiked (fig. 279).
Common.....**Diplolepis nervosa** (Curtis)
— Smooth (figs. 279, 280).....22

22 (21) No satisfactory method of distinguishing these species from the galls is known, but the adults may be separated quite easily in the Keys (pp. 33, 35). There may be a tendency for some of them to show a preference for one or other species of rose, but none appears to be confined to any one species.

Common.....**Diplolepis nervosa** (Curtis)
Local.....**Diplolepis centifoliae** (Hartig)
Local.....**Diplolepis eglanteriae** (Hartig)



FIGS. 276–280.—Galls on Rose, *Diplolepis*: 276, *spinosissimae*; 277, *rosae*; 278, *mayri*; 279, *nervosa*; 280, *eglanteriae*.

23 (17) Internal in acorns (figs. 281, 282), sometimes distorting acorn to cover or partly cover its own cupule (*A. quercuscalicis* ♂, *see* Note p. 53).....28
— Otherwise 24

24 (23) On roots, stems of saplings, or breaking out of the bark on trunks of mature trees; found throughout the year, but mature usually in spring of second year 29
— Otherwise 25

25 (24) In or from dormant or opening buds (sometimes on very young expanding leaves) or from base of bud; autumn to spring.....34
— Otherwise 26

26 (25) On male catkins; spring to early summer (*see* Note p. 53, *A. quercuscalicis* ♂♀) 58
— Otherwise 27

27 (26) Internal in twigs or leaf petioles, usually causing swelling or distortion; summer to autumn.....69
— On fully expanded leaves; summer to spring.....71

28 (23) On *Q. cerris*; internal group of cells, causing very slight local swelling and distortion externally (fig. 281); 3 to 8 years on ground.
Local, sporadic.....**Callirhytis erythrocephala** (Giraud) and **Callirhytis erythrostoma** Dettmer
— On *Q. robur* and *Q. petraea*; internal groups of cells, causing stunted growth (fig. 282).
Local, sporadic.....**Synergus clandestinus** Eady

29 (24) Breaking out of epidermis.....30
— On dormant buds on trunk of mature trees (see couplet 37).
Local.....**Trigonaspis megaptera** (Panzer) ♂♀

30 (29) Gregarious clusters of coalesced galls, each cluster irregular in outline; unilocular, unilarval; on subterranean roots and rootlets (fig. 283).
Sessile; pink, red, yellow-brown to dark brown; mature x of second year.
Common.....**Biorhiza pallida** (Olivier) ♀ (= *aptera* Fabricius)
— Single; solitary or gregarious; globulose, conical, or of intermediate shape; on roots, stem-base of saplings, trunk of mature trees.....31

31 (30) Larger, 30–60 mm. diameter; roughly globulose; plurilocular, unilarval; on roots or on stem-base of two- to five-year saplings (fig. 284).
Solitary; sessile; cream, pink, reddish-brown when mature; mature x second year.
Common.....**Andricus quercusradicis** (Fabricius)♀
— Smaller, 6 × 6 mm. approximately; globulose, conical or truncate; unilocular, unilarval.....32

32 (31) Globulose or slightly flattened; smooth or a little irregularly roughened; on trunks of mature trees (fig. 285).
Gregarious, sessile, embedded; greenish-yellow, yellow to pink, purple, brown; mature v.
Local.....**Andricus quercuscorticis** (Linnaeus) ♀
— Conical or apically truncate; longitudinally ridged; on stem-base of two- to five-year saplings, less commonly on twigs on ground or on exposed roots (figs. 286, 287).
Solitary or gregarious; sessile; cream, greenish-yellow, crimson to brown; mature ix of second year.....33

33 (32) Conical (fig. 286).
Locally common.....**Andricus testaceipes** Hartig ♀ (= *sieboldi* Hartig)
— Truncate (fig. 287).
Rare.....**Andricus rhizomae** (Hartig) ♀

34 (25) On *Q. cerris*; generally gregarious; conglomerated, three to eight in each axillary bud (fig. 288).
4 × 1·5 mm. approximately; yellowish-brown, red, reddish-brown.
Common.....**Andricus kollari** (Hartig) ♂♀ (=*circulans* Mayr)
— On *Q. robur* or *Q. petraea*.....35

35 (34) Leaf scales not enclosing gall or point of attachment of gall (figs. 289–92)...36
— Leaf scales visible, at least at base; gall often concealed in a bud, or just projecting from the opened tip (figs. 293–315); unilarval.....39

36 (35) Spherical or impressed apically to form four or five lobes; unilocular and unilarval 37

— Irregularly globular; large, up to 45 mm. diameter; spongy; plurilocular and plurilarval (fig. 289).

Single; solitary; yellowish-white, suffused with pink and red, later brownish-yellow; v–vi and later.

Common, often abundant ..... **Biorhiza pallida** (Olivier) ♂♀

37 (36) Developing from bud; roughly spherical (fig. 290).

Single; gregarious; less than 10 mm. diameter; waxy; white, cream, yellowish-pink, red, reddish-brown; iv–vi, mature v.

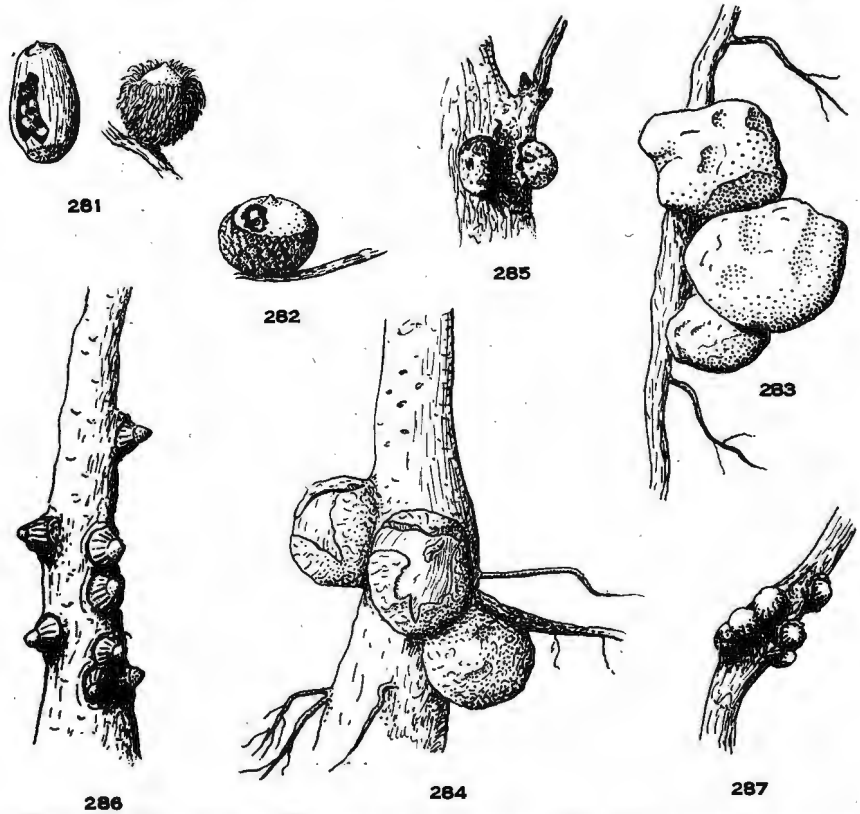
Local ..... **Trigonaspis megaptera** (Panzer) ♂♀

— Developing from base of bud, which remains stunted and sometimes visible at base of gall; hard and woody when ripe 38

38 (37) Spherical; large, up to 20 mm. diameter (fig. 291); specimens stunted or deformed by the presence of inquilines or parasites are common (figs. 369, 370).

Single, sometimes coalescent; solitary or gregarious; pale green, dark green, brownish-yellow, reddish-brown; vi onwards, mature ix.

Common, frequently abundant ..... **Andricus kollari** (Hartig) ♂



FIGS. 281–287.—Galls on Oak, acorns, bole, roots: 281, *Callirhytis erythrocephala*; 282, *Synergus clandestinus*; 283, *Biorhiza pallida* ♂; 284, *Andricus quercusradicis* ♂; 285, *Andricus quercuscorticis* ♂; 286, *Andricus testaceipes* ♂; 287, *Andricus rhizomae* ♂.

— Apically impressed, forming four or five lobes (fig. 292).
Single ; solitary ; yellowish- to greyish-brown ; viii onwards, mature vii of second year.
Rare.....**Andricus corruptrix** (Schlechtendal) ♂

39 (35) Large, 15 × 10 mm. or larger ; composed of large number of imbricated leaf-scales with a small inner gall in the large central cavity ; inner gall falls out when ripe (fig. 293).
Single ; solitary ; green, dark green, reddish-brown ; vi–viii and ix.
.....**Andricus fecundator** (Hartig) ♂

— Small, length not more than 10 mm.....40

40 (39) Stalked ; in axillary buds ; unilocular (fig. 294) 41

— Sessile or completely concealed in bud (figs. 295–315).....42

41 (40) Slender ; spindle-shaped with long apical point, and generally with stalk as long as or longer than body (fig. 294).
Single ; solitary ; pale green, yellowish-green, brown ; v–x mature viii.
Local .....**Andricus callidoma** (Hartig) ♂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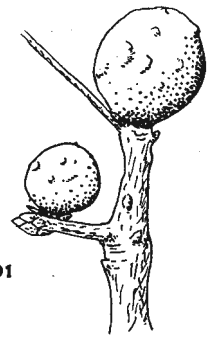
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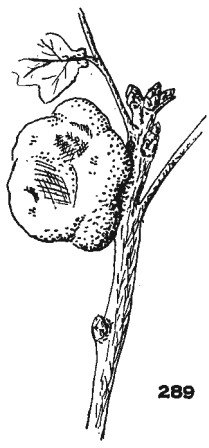
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FIGS. 288–293.—Galls on Oak, twigs, buds : 288, *Andricus kollari* ♂♀ ; 289, *Biorhiza pallida* ♂♀ ; 290, *Trigonaspis megaptera* ♂♀ ; 291, *Andricus kollari* ♂ ; 292, *Andricus corruptrix* ♂ ; 293, *Andricus fecundator* ♂.

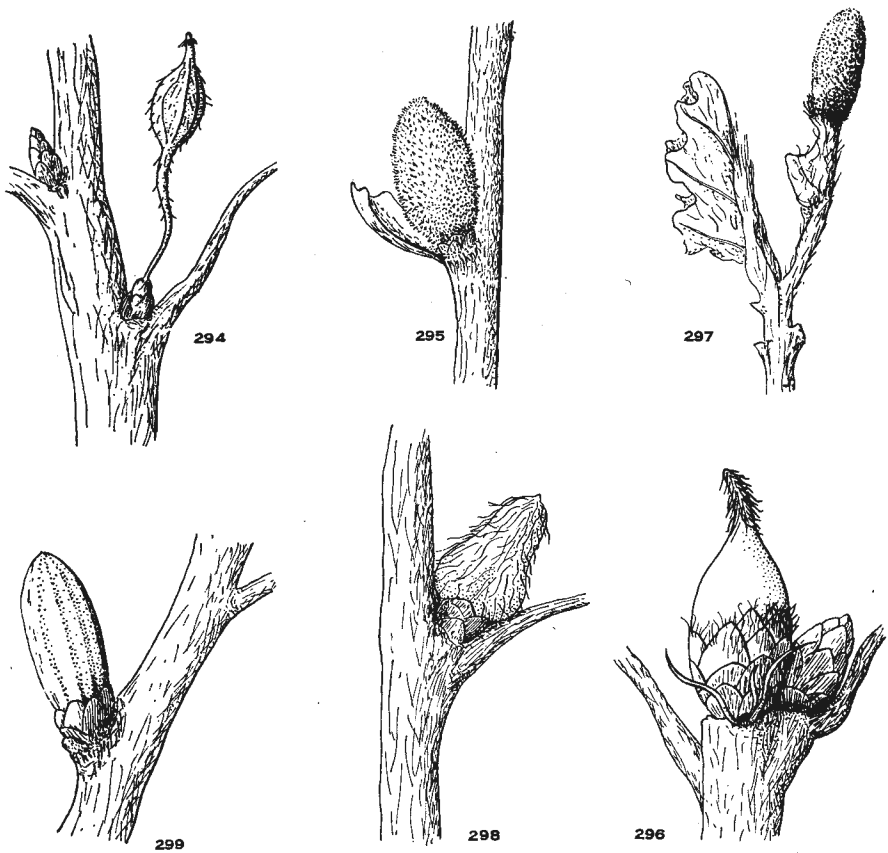
— Spindle-shaped, apical projection shorter, and basal stalk shorter than length of body.
Single; solitary; slightly pilose; green, sometimes with reddish markings; ix and x.
Rare.....**Andricus nudus** Adler ♂ (= *malpighii* Adler)

42 (40) Emerging from unopened buds, and when ripe often with only remains of leaf-scales at base; length not more than 6 mm. (figs. 295–308)..... 43

— Attached to or buried among more or less distorted leaves of the opening bud; unilocular, unilarval (figs. 309–313).....54

— Obscure; completely concealed in unopened bud which is little or not at all distorted; unilocular, unilarval (figs. 314, 315).....57

43 (42) [4]Elongate ovoid or obovate, apically rounded or rather bluntly pointed, attached basally; surface dull, roughened, and closely covered with minute projecting scales or pustules; single, solitary, sessile; unilocular, unilarval; iv–v (figs. 295, 297, 300).....44



FIGS. 294–299.—Galls on Oak, buds: 294, *Andricus callidoma* ♂; 295, *Cynips longiventris* ♂♀; 296, *Andricus solitarius* ♂; 297, *Cynips disticha* ♂♀; 298, *Andricus glandulae* ♂; 299, *Andricus albopunctatus* ♂.

These species are more readily distinguished as adult insects (pp. 55, 56).

— Pear-shaped or very broadly ovoid or roughly spherical, with apical projecting point; if elongate ovoid then longitudinally ridged, at least basally and apically; surface smooth or granulate, sometimes pilose, but never with projecting scales or pustules (figs. 296, 298, 299, 301–8).....47

44 (43) Surface with minute erect or semi-erect scales, pointed apically; in dormant adventitious buds (fig. 295).....45

— Surface with minute projecting pustules, blunt apically; in axillary and terminal buds (figs. 297, 300).....46

45 (44) Dark red to purple to black.
Scarce.....**Cynips quercusfolii** Linnaeus ♂♀ (= *taschenbergi* Schlechtendal)

— Green to golden brown (fig. 295).
Scarce.....**Cynips longiventris** Hartig ♂♀ (= *substituta* Kinsey)

46 (44) Yellow to orange to reddish-brown or greyish-brown (fig. 300).
Common.....**Cynips divisa** Hartig ♂♀ (=*verrucosa* Schlechtendal)

— Green to greenish-grey (fig. 297).
Local.....**Cynips disticha** Hartig ♂♀ (=*indistincta* Niblett)

47 (43) Pilose, at least at apex (figs. 296, 298, 301, 302).....48

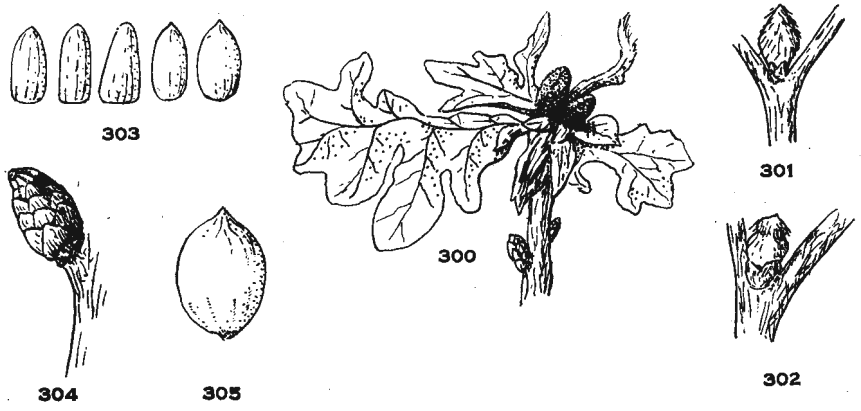
— Glabrous; unilocular, unilarval (figs. 299, 303–8).....49

48 (47) Hairs long, white, silky; varying from pear-shaped to broadly spindle-shaped, sometimes constricted above middle (figs. 298, 301, 302); in axillary buds; leaf-scales at base not persistent; bilocular, unilarval.
Single, solitary; pale green to pale brown; vii–ix, mature ix.
Local.....**Andricus glandulae** (Schenck) ♂

— Hairs reddish-brown generally, mostly falling off after maturity, longer and denser at apex; spindle- or pear-shaped with the apex drawn into a long and slightly curved point (fig. 296); in axillary or terminal buds; leaf-scales persistent at base; unilocular, unilarval.
Single; solitary; green, yellowish-brown to reddish-brown; vi–ix, mature viii.
Common.....**Andricus solitarius** (Boyer de Fonscolombe) ♂

49 (47) Longitudinally ridged, at least apically and basally, though sometimes rather weakly; elongate ellipsoid, pear-shaped, lemon-shaped or roughly spherical; not more than two-thirds hidden in bud scales (figs. 299, 303, 304, 305)....50

— Not ridged; pear-shaped, lemon-shaped or short ovoid; often almost entirely concealed by bud scales (figs. 306–8).....51



FIGS. 300–305.—Galls on Oak, buds: 300, *Cynips divisa* ♂♀; 301, *Andricus glandulae* ♂; 302, *A. glandulae* ♂; 303, *A. albopunctatus* ♂; 304, *A. quercusramuli* ♂; 305, *A. quercusramuli* ♂.

50 (49) Very variable in shape, ellipsoid, pear-shaped, lemon-shaped or conical; length more than twice breadth (figs. 299, 303); leaf-scales surround base only; falls after maturity, in lateral and sometimes terminal buds.
Single, solitary; green, greenish-yellow, pale brown; v–vi, mature vi.
Common.....**Andricus albopunctatus** (Schlechtendal) ♂

— Ovoid or lemon-shaped with distinct apical conical point; succulent outer skin; length about one and a half times breadth (figs. 304, 305); more than half concealed in bud scales; falls when mature; in lateral axillary and terminal buds.
Single; solitary; green, brown; ix and x, mature x.
Local, seldom seen.....**Andricus quercusramuli** (Linnaeus) ♂ (= *autumnalis* Hartig)

51 (49) Oblate to spherical when mature, hardly longer than broad, with reticulated succulent outer skin (fig. 306); falls from bud when mature; most frequently on slender twigs from bole of old trees.
In lateral and terminal buds; single; solitary; pale green, green, greenish-brown, bluish; ix–xi, rarely xii, mature, end of x.
Local.....**Andricus inflator** Hartig ♂ (= *globuli* Hartig)

— Roughly spherical when mature; without succulent outer skin; leaf scales at base.
iv–vi.....(*see* couplet 37) **Trigonaspis megaptera** (Panzer) ♂♀

— Pear-shaped or very short ovoid; without succulent outer skin; not more than apical portion projecting from bud when mature (figs. 307, 308).....52

52 (51) Pear-shaped (fig. 307); in lateral and terminal buds.
Single; solitary; green to brown; viii and ix.
Common.....**Andricus curvator** Hartig ♂ (= *collaris* Hartig)

— Short ovoid; in axillary buds (fig. 308).....53

53 (52) Single; sometimes gregarious; green to brown; vi–vii.
Uncommon....**Andricus quercuscorticis** (Linnaeus) ♂♀ (= *gemmatus* Adler)

— Single; solitary (fig. 308); green to pale brown; vii to viii.
Twice recorded (*see* Notes, p. 53), *probably undetected*
Andricus gemmicola Kieffer ♂♀

54 (42) Attached basally by a short peduncle to apex of midrib of unfolding leaf; elongate ovoid or obovate; surface dull, and closely covered with minute scale-like pustules.
Common.....(*see* couplet 46) **Cynips divisa** Hartig ♂♀
Local.....(*see* couplet 46) **Cynips disticha** Hartig ♂♀

— Attached more broadly, without peduncle, to unfolding leaves; ovoid or slightly flattened, sometimes vesiculate and larger.....55

55 (54) Length about 10 mm.; bud scales at base and attached to sides or apex (figs. 309, 310, 311); vesiculate, with large interior cavity and thin walls; grows very rapidly and collapses after maturity, though persisting in distorted bud.
Terminal, sometimes axillary buds; single; solitary; pale green, greenish-yellow, pale pink, light brown; iv and v, mature v.
Common.....**Neuroterus aprilinus** (Giraud) ♂♀

— Length not more than 4 mm.; small interior cavity and stout walls; ovoid or slightly flattened (figs. 312, 313).....56

56 (55) Single; solitary or sometimes gregarious; surface granulate; leaf scales from base of gall, but often fused with surface of gall over broad area (fig. 312).
Common.....(*see* couplet 76) **Neuroterus albipes** (Schenck) ♂♀

— Usually conglomerate, sometimes coalescent; gregarious; surface granulate; leaf scales often attached to side and apex (fig. 313); yellow, pale brown; iv to v.
Common.....**Andricus ostreus** Hartig ♂♀ (= *furunculus* Beyrinck)

57 (42) In terminal or lateral buds.
Common.....(fig. 314) (*see* couplet 56) **Andricus ostreus** Hartig ♂♀
Twice bred (*see* Notes, p. 35).....(fig. 315) **Callirhytis bella** Dettmer ♂♀

— In axillary buds.....(*see* couplet 53) **Andricus quercuscorticis** (Linnaeus) ♂♀ and **Andricus gemmicola** Kieffer ♂♀

58 (26) Pedunculate; spindle-shaped; longitudinally ribbed (fig. 316).
Single; solitary; cream, green, yellowish with pink or red, brown;

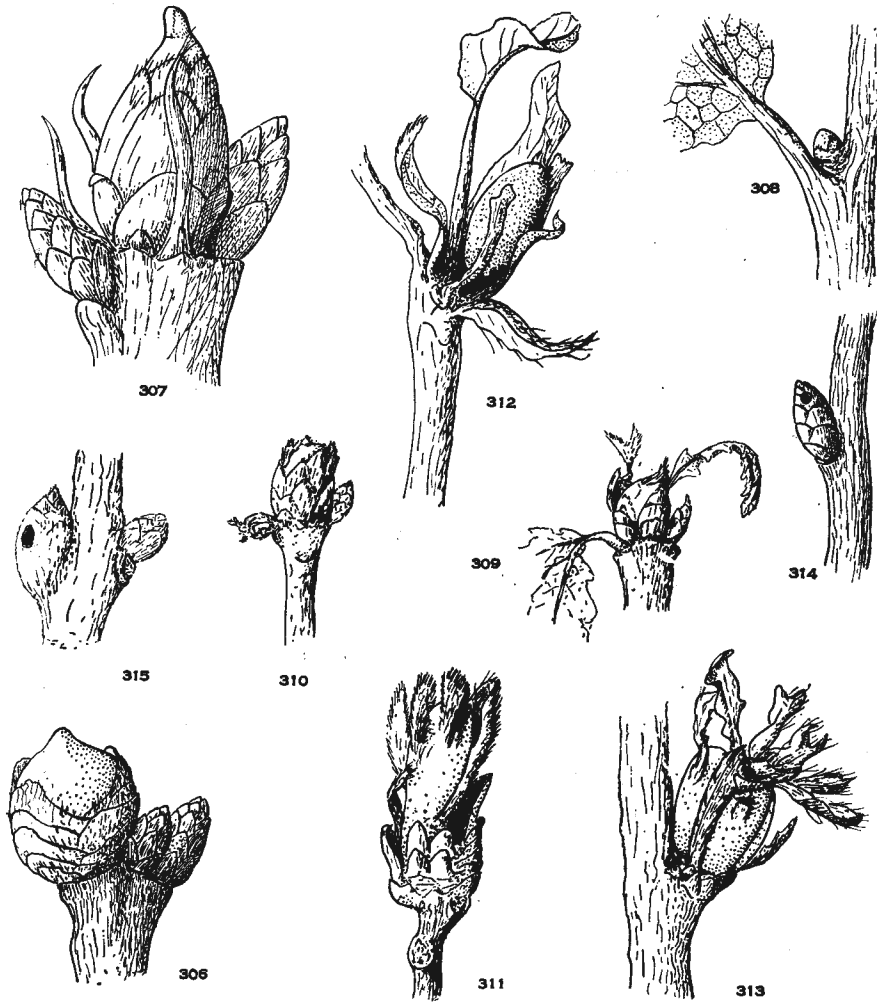
unilocular, unilarval ; v to vi, mature vi ; adult emerges in spring of second year.

Local, sometimes common.....**Andricus seminationis** (Giraud) ♂

— Sessile ; spherical, globulose, ovoid or pear-shaped (figs. 317–26).....59

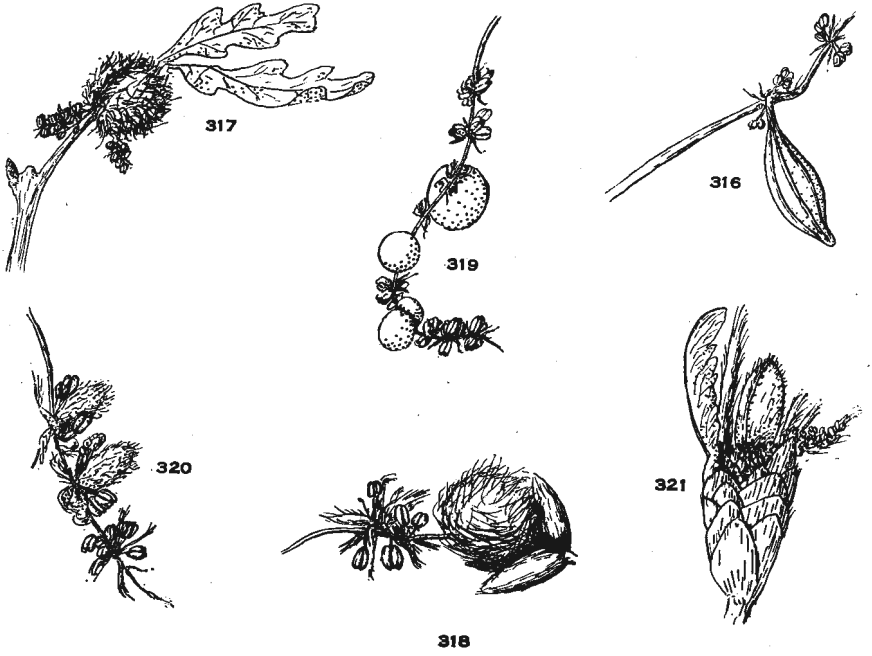
59 (58) Conglomerate, or coalesced globulose group ; densely covered with long white hairs resembling cotton wool (figs. 317, 318).....60

— Single ; solitary or gregarious ; spherical or ovoid ; seldom longer than 3 mm. ; at most with short hairs (figs. 319–26) ; unilocular, unilarval.....61



FIGS. 306–315.—Galls on Oak, buds : 306, *Andricus inflator* ♂ ; 307, *A. curvator* ♂ ; 308, *A. gemmicola* ♂♀ ; 309, *Neuroterus aprilinus* ♂♀ ; 310, *N. aprilinus* ♂♀ ; 311, *N. aprilinus* ♂♀ ; 312, *N. albipes* ♂♀ ; 313, *Andricus ostreus* ♂♀ ; 314, *A. ostreus* ♂♀ ; 315, *Callirhytis bella*.

60 (59) Conglomerate cluster of groups of coalesced cells, forming a larger globulose mass, sometimes measuring up to 20 mm. across (fig. 317); plurilocular but unilarval.
Mature end vi.
Local.....**Andricus quercusramuli** (Linnaeus) ♂♀
— Gregarious; sometimes conglomerate mass, but seldom exceeding 5 mm. across (fig. 318); unilocular, unilarval.
High up on mature trees; mature end v.
Rare.....**Andricus callidoma** (Hartig) ♂♀ (= *cirratus* Adler)
61 (59) Spherical or globular; glabrous; succulent (fig. 319).
Gregarious; pale green, green-yellow, pink, red or purple; v and vi.
Common, often abundant.....**Neuroterus quercusbaccarum** (Linnaeus) ♂♀
— Ovoid; sometimes pilose (figs. 320–6).....62
62 (61) Pilose; ovoid, pointed apically (figs. 320–2).....63
— Surface smooth or granulate, but without pubescence; sometimes a few short hairs at apex (fig. 323).....65
63 (62) Densely pilose, hairs long; solitary (fig. 320).
Pale green, green, pale brown, dark brown, hairs paler; v and vi, mature end v.
Common.....**Andricus fecundator** (Hartig) ♂♀ (= *pilosus* Adler)
— Less closely hairy, hair short (figs. 321, 322); sometimes gregarious.....64
64 (63) One longitudinal ridge on each side, the two ridges joining at apex of gall (fig. 321); solitary at base of stunted catkin.
Reddish-brown, with reddish-brown or yellowish hairs; mature v.
Common.....**Andricus solitarius** (Boyer de Fonscolombe) ♂♀ (= *occultus* Tschek)



FIGS. 316–321.—Galls on Oak, catkins: 316, *Andricus seminationis* ♂; 317, *A. quercusramuli* ♂♀; 318, *A. callidoma* ♂♀; 319, *Neuroterus quercusbaccarum* ♂♀; 320, *Andricus fecundator* ♂♀; 321, *A. solitarius* ♂♀.

— Twin longitudinal ridges visible on each side generally, converging and joining towards apex (fig. 322); solitary or gregarious; causing stunting of catkin only when gregarious and in larger numbers.
Pale green, greenish-yellow, brown, hairs paler, v and vi.
Rare.....**Andricus amenti** Giraud ♂♀

65 (62) Without longitudinal ridges (figs. 323, 324).....66

— With two or more longitudinal ridges (figs. 325, 326).....68

66 (65) Ovoid, rounded at apex; solitary (fig. 323).
Common.....(*see* couplet 76) **Neuroterus albipes** (Schenck) ♂♀

— Ovoid, pointed apically; usually gregarious.....67

67 (66) Surface granular, sometimes with trace of pubescence apically (fig. 324).
Pale green, pale brown; v and vi.
Local.....**Andricus glandulae** (Schenck) ♂♀
(= *xanthopsis* Schlechtendal)

— Surface smooth; possibly favouring *Quercus petraea*.
Pale green, yellow, brown; v and vi, mature end v.
Rare.....**Andricus nudus** Adler ♂♀

68 (65) Larger, length 3–4 mm.; evenly longitudinally ridged and furrowed all round (fig. 325).
Gregarious; pale green, greenish-yellow, reddish-brown; v and vi, mature vi.
Common.....**Andricus quadrilineatus** Hartig ♀

FIGS. 322–326.—Galls on Oak, catkins: 322, *Andricus amenti* ♂♀; 323 *Neuroterus albipes* ♂♀; 324, *Andricus glandulae* ♂♀; 325, *A. quadrilineatus* ♀; 326, *Neuroterus aprilinus* ♀.

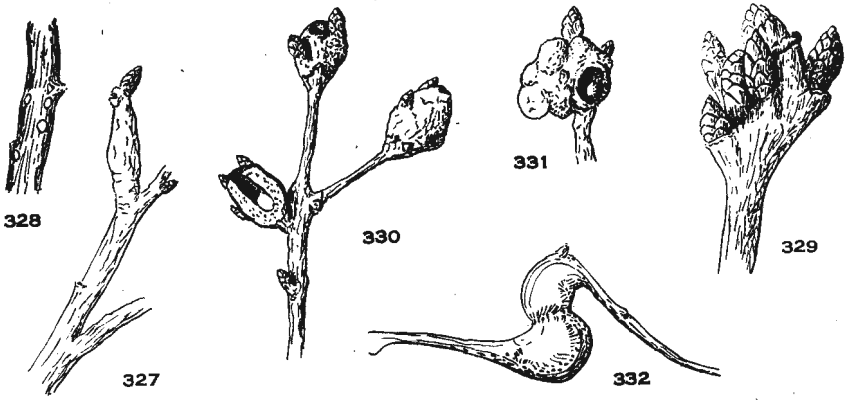
— Very small, length seldom exceeding 2 mm.; twin ridges on each side meeting apically (fig. 326).
Gregarious; greenish-yellow, pale brown, dark brown; v and vi, mature end v.
Common.....**Neuroterus aprilinus** (Giraud) ♂ (=*schlechtendali* Mayr)

69 (27) In twig or petiole, causing slight swelling (fig. 327), sometimes with several small scattered cells in internal tissue (fig. 328).
Separate; solitary or gregarious; vi to viii, mature vii.
Common.....**Andricus quercusradicis** (Fabricius) ♂♀ (= *trilineatus* Hartig)

— Conspicuous swelling of twig or petiole, with considerable distortion; large interior cavity containing small separate ovoid gall (figs. 329–32).
Single; solitary; bilocular but unilarval.....70

70 (69) Causing swelling at apex of twig; interior cavity long and narrow; small inner gall at bottom, ovoid to subspherical, fused to bottom and sides of cavity (figs. 329, 330).
External swelling up to 15 × 10 mm.; green, dark green, brown, dark brown; mature end ix.
Local.....**Andricus inflator** Hartig ♂♀

— Causing swelling and distortion of petiole or thin twigs or distortion of apex of twig; interior cavity large, spherical or ovoid; small ovoid inner gall attached by its base to wall of cavity (figs. 331, 332).
External swelling up to 10 × 8 mm.; pale green, light brown; mature end vii.
Common.....**Andricus curvator** Hartig ♂♀



FIGS. 327–332.—Galls on Oak, twigs, petiole, internal, *Andricus*, ♂♀: 327, *quercusradicus*; 328, *quercusradicis*; 329, *inflator*; 330, *inflator* (winter condition); 331, *curvator*; 332, *curvator*.

71 (27) Gall internal beneath epidermis causing swelling of petiole, midrib or larger vein, or between upper and lower surface of leaf blade (figs. 333–6).....72

— Gall external, attached to midrib, veins or margin of leaf (figs. 337–65)....75

72 (71) Irregular spherical swelling of leaf vein, extending sideways into tissue of leaf blade, and often causing considerable distortion; interior cavity thin-walled; small ovoid inner gall (fig. 333).
Usually conglomerate or coalescent, each about 8 mm. across; pale green, light brown; glossy; mature end vii.
Common.....(*see* couplet 70) **Andricus curvator** Hartig ♂♀

— Blister in leaf blade showing on both surfaces of leaf but causing little distortion (figs. 334, 335); diameter about 3 mm.; single, solitary.....73

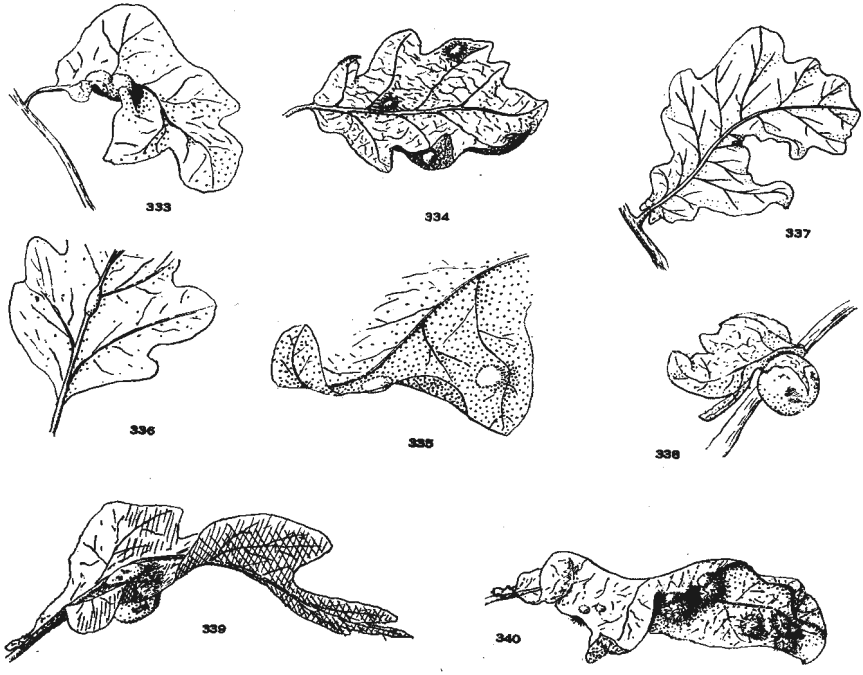
— Small, single, ovoid or spindle-shaped swelling of petiole, midrib or larger vein (fig. 336); unilocular, unilarval; about 3 × 1 mm.; glossy.....74

73 (72) [5]Rather flattened on both surfaces ; bilocular, unilarval ; interior cavity with small separate inner gall (fig. 334).
Pale green, grey, brown ; summer.
Doubtfully British (see notes).....**Andricus sufflator** Mayr ♂♀
— Both surfaces more convex ; sometimes radially striate on undersurface of leaf ; unilocular, unilarval (fig. 335).
Pale green, grey, pale brown ; v to x, mature end v.
Common.....**Neuroterus numismalis** (Fourcroy) ♂♀
(= *vesicator* Schlechtendal)

74 (72) [6]White, pale green, pale brown (fig. 336) ; vi, viii, mature vii.
Common.....(*see* couplet 69) **Andricus quercusradicis** (Fabricius) ♂♀
— Green ; vii to ix, mature viii.
Local.....**Andricus testaceipes** Hartig ♂♀

75 (71) Very broadly sessile, integral with leaf (figs. 337–40) ; unilocular, unilarval..76
— Pedunculate and detachable, though peduncle may be very short and inconspicuous (figs. 341–65).....78

76 (75) Ovoid ; small, length 2 mm. ; inhibiting development of leaf margin beyond area of attachment (fig. 337) ; sometimes on midrib.
Single ; solitary ; yellowish-white, greenish-yellow, pale brown ; iv to vi, mature end v.
Common.....**Neuroterus albipes** (Schenck) ♂♀
— Spherical ; larger, up to 5 mm. across ; on underside of leaf, but area of attachment showing as convex patch on upper surface (figs. 338–40)....77



FIGS. 333–340.—Galls on Oak, leaves : 333, *Andricus curvator* ♂♀ ; 334, *A. sufflator* ♂♀ ; 335, *Neuroterus numismalis* ♂♀ ; 336, *Andricus quercusradicis* ♂♀ ; 337, *Neuroterus albipes* ♂♀ ; 338, *Neuroterus quercusbaccarum* ♂♀ ; 339, *N. quercusbaccarum* ♂♀ ; 340, *N. tricolor* ♂♀.

[5] These species are quite distinct as adult insects.
[6] These species may be separated as adult males (p. 42).

77 (76) Glabrous ; single ; most often gregarious (figs. 338, 339).
Common, often abundant.....(*see* couplet 61) **Neuroterus quercusbaccarum** (Linnaeus) ♂♀

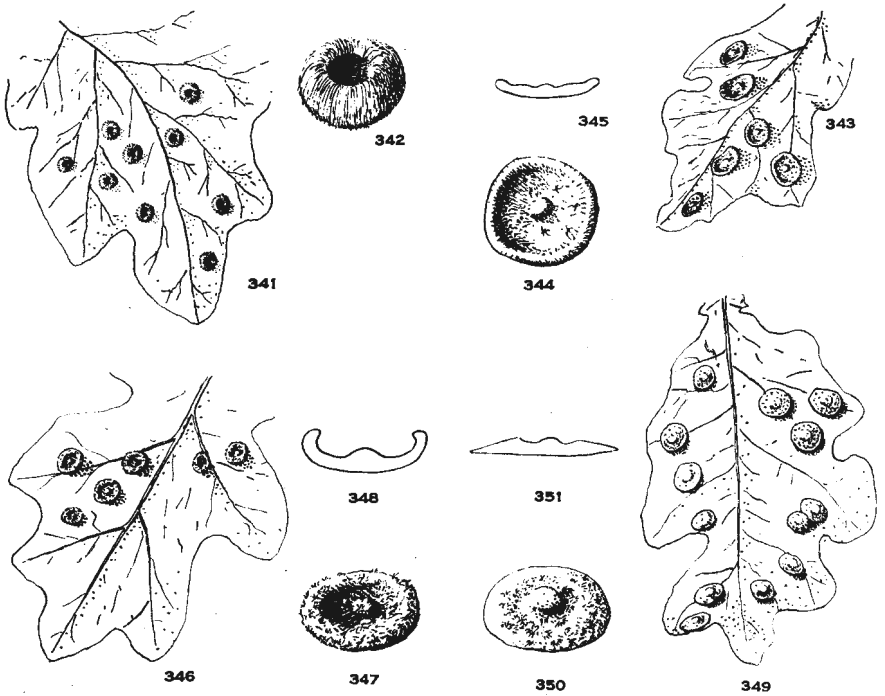
— Pilose, hairs arising from minute warts ; usually conglomerated (fig. 340).
White, pale green, pale yellow ; v to viii, mature end vi.
Local.....**Neuroterus tricolor** (Hartig) ♂♀

78 (75) Discoid, thin or thick ; closely attached to and apparently indiscriminately scattered over underside of leaf (figs. 341–51) ; single ; gregarious ; unilocular, unilarval.....79

— Spherical, globular, ovoid, reniform or spindle-shaped (figs. 352–65) ; on major veins or margin of leaf.....82

79 (78) Hemispherical, with a central pit from which the closely adpressed flattened hairs grow out and down (figs. 341, 342).
Height 1·5 mm., diameter 3 mm. ; golden yellow to golden brown ; viii to x, mature ix.
Common.....**Neuroterus numismalis** (Geoffroy *in* Fourcroy) ♂

— Lenticular or cupulate, thin at the circumference, and with a central mound (figs. 343–51).....80



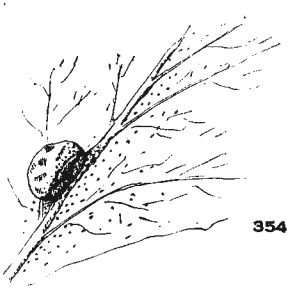
FIGS. 341–351.—Galls on Oak, leaves, *Neuroterus* ♂ : 341, *numismalis* ; 342, *numismalis*, enlarged ; 343, *albipes* ; 344, *albipes*, enlarged ; 345, *albipes*, section ; 346, *tricolor* ; 347, *tricolor*, enlarged ; 348, *tricolor*, section ; 349, *quercusbaccarum* ; 350, *quercusbaccarum*, enlarged ; 351, *quercusbaccarum*, section.

80 (79) Smooth, hairless; cupulate with a very small mound in depressed centre (figs. 343–5).
4 × 3 mm.; height 1 mm.; pale yellow, yellowish-green, green, pink, red; vii to ix, mature viii.
Common.....**Neuroterus albipes** (Schenck) ♂ (= *laeviusculus* Schenck)

— Closely covered with stellate hair patches; cupulate or lenticular (figs. 346–51) 81

81 (80) Usually weakly cupulate, sometimes almost folded in two along a diameter; central mound small; (figs. 346–8).
Diameter 3 mm.; height 1·5 mm.; green, greenish-yellow; hairlets pink to red; vi to ix, mature viii.
Local.....**Neuroterus tricolor** (Hartig) ♂ (= *fumipennis* Hartig)

— Lenticulate; central mound large (figs. 349–51).
Diameter 5 mm.; height 1·5 mm.; green, greenish-yellow; hairlets reddish-orange, crimson, reddish-brown; vii to x, mature viii.
Common, usually abundant.....**Neuroterus quercusbaccarum** (Linnaeus) ♂ (=*lenticularis* Olivier)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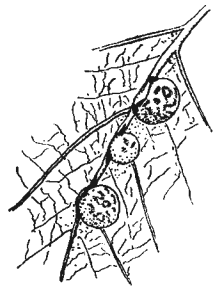
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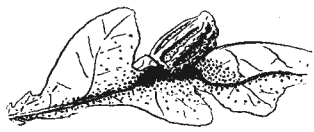
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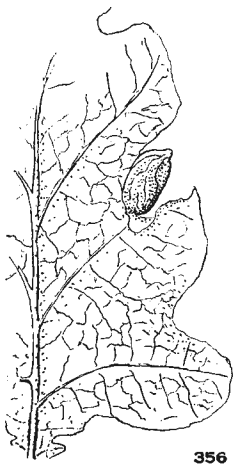
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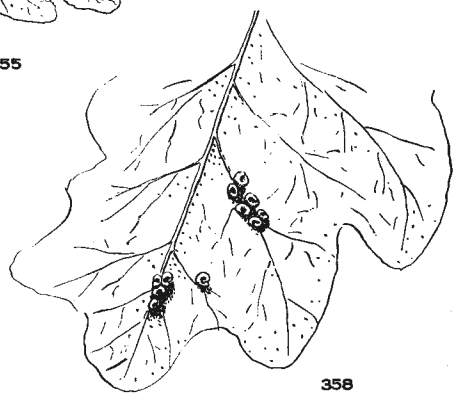
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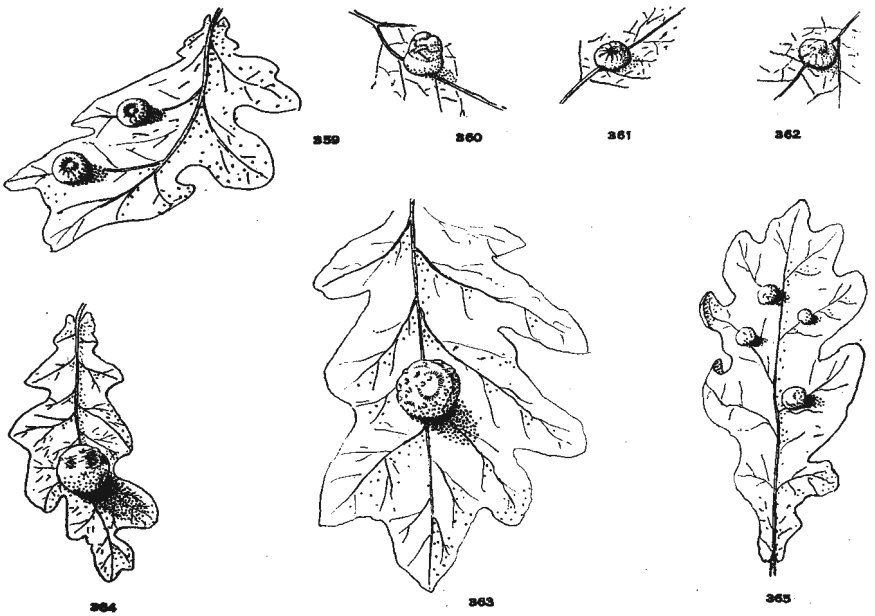
FIGS. 352–358.—Galls on Oak, leaves: 352, *Andricus ostreus* ♂; 353, *A. ostreus* ♂; 354, *A. ostreus* ♂; 355, *A. quadrilineatus* ♂; 356, *A. quadrilineatus* ♂; 357, *A. quadrilineatus* ♂; 358, *Trigonaspis megaptera* ♂.

82 (78) Small, **length 3 mm.**; globulose or ovoid, attached by one side; plain or mottled; on midrib or larger veins, more often on underside of leaf; a small flap of leaf tissue projecting on each side from point of attachment (figs. 352–4).
Single; solitary or gregarious; 3 × 2 × 2 mm.; pale yellow, yellowish-green, pink, pale brown; unilocular, unilarval; viii to x, mature ix.
Common, often abundant.....**Andricus ostreus** (Hartig) ♂
— Without projecting flaps of leaf tissue from point of attachment (figs. 355–65) on underside or margin of leaf.....83
83 (82) On margin of leaf, inhibiting development of surrounding leaf tissue (figs. 355–7); unilocular and unilarval.....84
— On underside of leaf, not inhibiting leaf development (figs. 358–65).....85
84 (83) Spindle-shaped; slightly longitudinally ridged.
Local, sometimes common.....(*see* couplet 58) **Andricus seminationis** (Giraud) ♂
— Ovoid; longitudinally ridged (figs. 355–7).
Common.....(*see* couplet 68) **Andricus quadrilineatus** Hartig ♂
85 (83) Reniform, rarely ovoid or spherical; frequently conglomerate; gregarious (fig. 358)
2 × 1 × 1 mm.; yellowish-green, green, red, purple, dark brown; unilocular, unilarval; ix to x.
Local.....**Trigonaspis megaptera** (Panzer) ♂ (= *renum* Hartig)
— Other than reniform (figs. 359–65); single; usually solitary, or widely spaced if gregarious.....86



FIGS. 359–365.—Galls on Oak, leaves, *Cynips*, ♂: 359, *disticha*; 360, *disticha*; 361, *disticha*; 362, *disticha*, malformed; 363, *longiventris*; 364, *quercusfolii*; 365, *divisa*.

86 (85) Variable in shape, oblate or globular, but generally and typically flattened, with a conspicuous depression dorsally (figs. 359–62); smooth, papillate or nodulose; bilocular but unilarval.
6 × 4 × 4 mm.; yellowish-white, pale yellow, pale brown, reddish-brown; vi to ix, mature viii.
Local.....**Cynips disticha** Hartig ♂

— Not conspicuously hollowed dorsally; spherical or globulose typically (figs. 363–5); unilocular, unilarval.....87

87 (86) Spherical or globulose and conspicuously papillate, the papillae contrasting in in colour with background (fig. 363).
9 × 8 × 7 mm.; pale yellow with pink or red bands, stripes or spots; vi to x, mature ix.
Locally common.....**Cynips longiventris** Hartig ♂

— Not conspicuously papillate (figs. 364, 365).....88

88 (87) Spherical; large, average diameter 17 mm. (fig. 364).
Pale yellow, yellowish-green, pale green, with pink or red patches, pale brown when mature; vii to x, mature viii.
Common, often abundant.....**Cynips quercusfolii** Linnaeus ♂

— Globulose, more often slightly depressed; smaller, diameter not exceeding 7 mm. (fig. 365).....89

89 (88) Pink when ripe; larval chamber small with very thick walls (fig. 365).
Pale yellow, orange yellow, pink, red, light brown; vi to x, mature ix.
Common, often abundant.....**Cynips divisa** Hartig ♂

— Orange yellow when ripe; larval chamber very large with thin walls.
Pale yellow, orange yellow, yellowish-brown; late summer to autumn.
Rare.....**Cynips agama** Hartig ♂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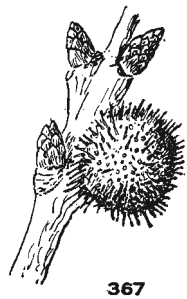
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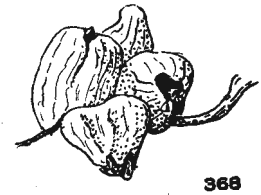
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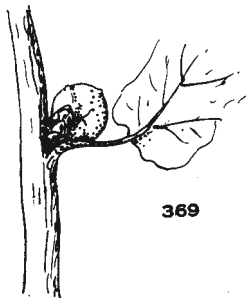
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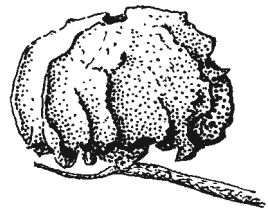
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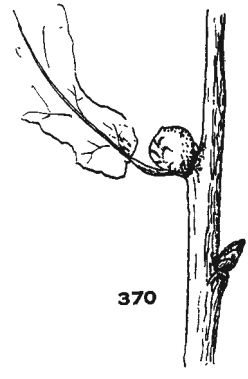
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FIGS. 366–368.—*Andricus*, removed from list of British species: 366, *trotteri* ♂; 367, *lucidus* ♂; 368, *aestivalis* ♂♀.
FIGS. 369–370.—*Andricus kollari* ♂, malformed.
FIG. 371.—*Andricus quercuscalicis* ♂, added to list of British species.

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Principal references are given first: where two or more are in Roman type the first refers to the male and the second to the female; the agamic generation reference is given in italics. Heavy type refers to a page with an illustration. Synonyms are in italics. Where one generation is figured on the same page as that given as a principal reference for the other generation, or where principal references to both generations occur on the same page, the reference number is duplicated in the appropriate type.

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