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MONOGRAPH

OF THE

BRITISH APHIDES.

VOL. II.

BY

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"Laws may not be enunciated upon insufficient experience . . . . The light of the understanding is not a dry and pure light, but tinctured from the will and affections, and forms the sciences accordingly; for men are most willing to believe what they most desire. Hence difficulties are rejected through impatience; experience is discarded through pride."—BACON, *Novum Organon*.

"How often have we seen some adventurous, and, perhaps, much censured wanderer light on some outlying, neglected, yet vitally momentous province, the hidden treasures of which . . . . he kept proclaiming, till the general eye and effort were directed thither, and the conquest completed thereby, in these his seemingly so aimless rambles, planting new standards, founding new habitable colonies in the immense circumambient realm of nothingness and night!"—CARLYLE, *Sartor resartus*.

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BRITISH APHIDES.

INTRODUCTION.

A FEW remarks by way of preface to this second volume of British Aphides may be permitted.

And first the Author thinks some apology is due to the reader for the large space occupied by the coloured plates of this Monograph. It is felt that through their assistance alone adequate ideas can be given of forms which possibly hereafter, through the suppression of parts, or causes (so styled) evolutionary, may be proved to be in a state of transition. Coloured plates also enable us to mark the gradual deposition of pigment within the integuments of the insects at different ages, and to note the development of form at various periods of the cycle of their persistence.

It has been said that "you have no right to regard that as a species which you cannot accurately describe in words." If to this maxim we should add the conditions of pictorial delineation of form and colour, the truth perhaps would be more obvious; for all that mere words can do in such a case is to enable us to compare in a positive way what lies before us, and leave negative evidence in great measure disregarded. Word-painting may create grand poetic conceptions, but cannot, we will say, realise the exact features of a fine landscape and all its details. The work of the scientific artist is more of a humble character, nevertheless in its way it is creative, for through the eye

forms become accurately present, and shades of difference become cognizable, which no description can make intelligible.

In the next place something perhaps should be said to meet the disappointment of those who might look through the following pages for some substantial help to the modern doctrine of evolution. Possibly it might be thought that something definite should be made out from a complete examination of the almost exceptional group *Aphis*, in which Parthenogenesis is the rule, and Dimorphism by no means uncommon.

But, however much such proof might be desirable, or acceptable to many, the author's observation hitherto has not led him up to phenomena indicating sure paths towards the transmutation of species, although climatal influence has a certain effect on variation.

A great thinker has said "Wise man was he who counselled that speculation should have free course, and look fearlessly towards the thirty-two points of the compass, whithersoever and howsoever it listed."*

Certainly the How, the Why, and the Whither, are questions not unasked by the thoughtful of the present day; but we are warned by another no mean authority "lest we do injury to the future by a too free use of hypothesis." Exact science is securely *built* on experiment and rests not on speculation. Every step proved is a kind of Archimedean "πῦ στω," efficient for a fresh start, and, not being a mere opinion, it is different in character from that which has not been definitely determined.

Professor Virchow has well said "that each essentially new truth of the former kind must necessarily influence the whole conception of man—the method of thinking."

Again, "Human knowledge is but piecework, and all who call themselves naturalists only possess pieces of natural science."

The outer world from necessity must accept the

* Vide 'Sartor resartus.'

authoritative teaching of the professed scientist, inasmuch as it trusts to the development of his more special knowledge. But the public will often with confidence a thousandfold propagate and expand ideas, which the originator with his larger acquaintance with facts has put forth with reserve. "Let truth be fearlessly taught, but let not that called by us a truth to-day be shown up as a falsehood to morrow."* Some half truths of the present day carried to their legitimate consequences have their dangerous sides, and such do efficiently forward the work of the socialist with his "plastidule soul," and his paralysing doctrines of despair. Surely the philosopher who has but few words and teachings to cancel will have the least cause to ask forgiveness of posterity.

Should science hereafter lift the veil and clearly show us phases through which a passage is effected from form to form, deep will be the interest; but even such steps when attained will scarcely touch the great question wrapped in the as yet inscrutable secret, of what causes variation *at all* in organic growths.

Perhaps the difficulty of explaining what forces are in action, and what determines the change from the lithesome greyhound to the sturdy mastif, or the swift carrier to the heavily cropped pouter-pigeon, is as great as the task of showing the cause of a specific transmutation, should such a passage ever prove more than a theory. Darwin has well shown that even vertebræ are sometimes lost in varieties produced by the artificial breeding of pigeons; and who shall say that the laws in operation here may not in ages past have produced by a varied intensity, distinct results in specific development?

The cause of the differentiation of parts, and the marvellous selective and aggregative power of cells round definite centres as yet is beyond our ken, and

* Address delivered in 1877 at the Munich Meeting of the German Association, by Prof. Rudolf Virchow, of Berlin.

we seem hardly yet to have placed our foot on the first rung of the ladder, which leads to its elucidation.

Professor Allen Thomson says,* "To recognise the possibility of continuous derivation in the history of the origin of plants and animals doubtless has proved most valuable as a working hypothesis." Thus working theories and fair hypotheses will ever have their due weight, but both these helps must sit loosely on the student of truth. He will hold fast that he has received till a higher truth bids him modify his knowledge, which knowledge after all, from his circumscribed position and limited number of senses, he will candidly admit can have reference to but a minute section of the grand Kosmos.

But whatever weight we may give to the modern doctrine of evolution, it would seem to render more and more difficult a natural and therefore a scientific definition of species. The early and generally received formula has undergone a change, and the hitherto accepted tests of a species, as to its historic persistence and its fertility *inter se*, to the virtual exclusion of other species as intermixing with it, now no longer is thought to yield a decisive answer, inasmuch as such proofs partake too much of a negative character.

In the words of Professor Huxley, "the proof that all members have descended from one parental stock would ordinarily be considered sufficient to entitle them to the rank of a physiological species, and some have considered species defined as the offspring of a single primitive stock." But there is always a certain deviation in the offspring from the precise character of the single parent, and sometimes an exact mean may be found between the two parents. Reaumur long ago showed in the case of Gratio Kelleia, and elsewhere more recently we have had notice of other examples,† that peculiarities affecting the number of

* Vide Address on Embryology to Brit. Assoc., 1877.

† Vide 'Nature,' Oct. 18, No 448, p. 116; and "Hereditary Transmission," 'Encyc. Britan.,' sixth series.

the digits may be perpetuated amongst descendants for a considerable time. Such cases have a parallelism with the loss of certain vertebræ in tame pigeons, as noticed above. Professor Huxley again says, "the word 'species' has a double sense, and denotes two very different orders of relations. When we call a group of animals or plants a species, we may imply thereby either that all these animals or plants have some common peculiarity of form or structure, or may mean that they possess some common functional character. That part of biological science which deals with form and structure is called morphology, that which concerns itself with function physiology, so that we may conveniently speak of those two senses or aspects of species. Once more, "regarded from the former point of view, a species is nothing more than a kind of animal or plant which is distinctly definable from all others by certain constant, and not merely sexual, morphological peculiarities."*

De Candolle says a species is a collection of all the individuals which resemble each other more than they resemble anything else, which can by mutual fecundation produce fertile individuals, and in such a manner that we may suppose them sprung from a single individual.

The characters of a species to be complete should include all its forms, perfect and imperfect, modified and unmodified; since in this way only can their "capacity for variation" be determined.†

If we exhaustively carry out the modern (ancient ?) doctrine of evolution into transmutation, we would appear in great measure to eliminate all ideas of constancy or permanence of species, for here persistent varieties are conceived to arise from the stimulus of a suitable environment, if only the operating conditions be spread over a sufficient lapse of time. The explanation of this change is surely only eluded by the introduction

* Huxley's 'Lay Sermons,' p. 283—289.
† Dr. W. B. Carpenter, 'Elements of Physiology.'

of this undetermined element of time, though it be true that such changes are supposed to be slow in operation. The causes of these changes, indeed, are so obscure that they have been styled by no mean authority "spontaneous"—a term which is doubtless convenient, as it enables us to mask our ignorance.

For classificatory purposes, however, we must assume that species are permanent until they are proved to be transmutable. The question how long they are permanent need not here be discussed. *Lingula*, *Terebratula*, and other forms have had a permanence from early geological times, and they are eminently specific; whilst on the other hand *Pterichthys* and *Cephalaspis* apparently have either died out, or have their hypothetical dilution through other lines of life.

When external characters of a group only partially suit our purposes of arrangement, we may in many cases obtain material help from an examination of the internal anatomy of its members. Notwithstanding the difficulties to be expected in following up such inquiries relating to the Aphididæ, Balbiani has made some advance to our knowledge in this direction.* He states that, to a certain extent, there is a constant variation in the number of the ovarian chambers which compose the two great branches of the oviducts in particular genera. Thus, in *Siphonophora* the number on each side, he says, is pretty generally from six to seven. In *Drepanosiphum* it is five, and in *Lachnus* there appear to be seven loculi. These "gâines de l'ovaire" also would seem to have some numerical relation to the development of the male spermatic capsules.

These interesting facts, however, will be hardly available for the identification of species; for the sexual forms of Aphides are in many species very rarely met with, and then, when captured, they would require some manipulative address under the microscope to make these details available.

* 'Mém. sur le Génération des Aphides,' p. 4, Balbiani.

The foregoing remarks, it is feared, will be criticised as having too much of a desultory character, and the author perchance has, through misapprehension, laid himself open to censure in the words of our illustrious countryman, William Harvey, so happily quoted the other day by Professor Clark Maxwell :—"Whoever they be that read authors and do not by the aid of their own senses abstract true representations of the things themselves, they do not represent true ideas, but deceitful idols and phantasms by which means they frame to themselves certain shadows and chimeras, and all their theory and contemplation (which they call science) represent nothing but waking men's dreams and sick men's phrenzies."

Now-a-days, when the multiplication of books is one of the marvels of the age, we run some risk of an intellectual indigestion and repletion, through the neglect of such mental athletics as are afforded by healthy experimental exercises, and appeals to, and wrestles with nature for her momentous secrets.

In conclusion, I wish to express my obligations to those friends who have given me their aid by procuring living specimens for my examination. Particularly I would name Sir Sidney S. Saunders, who not only lent me specimens from his own cabinet, but kindly perused my manuscript notes on the predacious Hymenoptera. I also thank cordially M. Jules Lichtenstein, of Montpellier, for providing me with several hitherto undescribed sexual forms of Aphides common to both Great Britain and the South of France, and also I thank him for much interesting matter conveyed to me in his correspondence.

SYNOPSIS OF THE TRIBE APHIDINÆ.

Upper wings with a doubly forked cubitus, and lower wings with two oblique veins.

- Antennæ with seven joints.
  - 1 Siphonophora.
  - 2 Phorodon.
  - 3 Myzus.
  - 4 Drepanosiphum.
  - 5 Amphorophora.
  - 6 Megoura.
  - 7 Rhopalosiphum.
  - 8 Melanoxanthus.
  - 9 Siphocoryne.
  - 10 Aphis.
  - 11 Hyalopterus.
  - 12 Chaitophorus.
  - 13 Pterocomma.
  - 14 Cryptosiphum.
  - 15 Brachycolus.
  - 16 Callipterus.
- Antennæ with six joints.
  - Pterocallis.
  - Lachnus.
  - Dryobius.
  - Stomaphis.

GENERA.

A comparison of this table of genera with that furnished in p. 94, vol. i, will show a slight difference; but this difference will readily explain itself if we remember that new forms are likely to present themselves, which may make certain modifications desirable.

Family—APHIDIDÆ.

Tribe—APHIDINÆ.

Genus VII.—RHOPALOSIPHUM,* *Koch.*

Kolbenläuse. Clubbed Aphis.

Rostrum as in Siphonophora.

Antennæ rather short. Frontal tubercles small and inconspicuous; remote at their bases. Vertex flat or slightly convex.

Cornicles long, clavate, or dilated in their midst. Mouths trumpet-shaped.

Wings and legs as in Myzus.

Tail conspicuous and often large.

Rhopalosiphum ribis, *Linn.* Plate XXXIX.

Aphis ribis, Linn., Schr., Kalt., Walk.
Rhopalosiphum ribis, Koch, Pass.

Apterous viviparous female.

	Inch.	Millimeters.
Size of body	0·100×0·050	2·54×1·27.
Length of antennæ	0·090	2·27.
,, cornicles	0·025	0·62.

Large, oval, convex. Wholly shining green, mottled with darker green. Antennæ, nectaries, and legs, paler green. Cornicles much dilated. Eyes red. Cauda large, projecting beyond the tips of the cornicles.

Numerous from April to July upon the black currant, *Ribes nigrum*. It crowds under the leaves during early summer, and raises upon them bright orange, red, and brown blisters, causing them to curl into knots and

* From Ῥόπαλον, a club, and σίφων, a tube.

bunches, within which the insects nestle by thousands. Often the entire crop of this fruit in a garden is ruined by the blighting influence of the above Aphis.

The pupa is green, and does not greatly differ in form from the larva.

Winged viviparous female.

	Inch.	Millimeters.
Expanse of wings	0·260	6·62.
Size of body	0·080 × 0·030	2·02 × 0·76.
Length of antennæ	0·090	2·27.
,, cornicles	0·015	0·38.

Yellow or yellowish green. Head, thorax, band on prothorax, antennæ, knees, and tarsi black. Abdomen bright green, with three or more dark green patches on the dorsum, and several spots on the sides. Cornicles yellow, attenuated at their necks, and much dilated in their midst. Legs ochreous, with dark femoral and tibial joints. Third antennal joint tuberculate. Wing-insertions yellow.

This insect also infests the red currant, *Ribes rubrum*, and the gooseberry, *R. grossularia*. I have taken it also feeding on the nipplewort, *Lapsana vulgaris*, and the guelder-rose, *Viburnum opulus*. The winged fly appears as early as May. This Aphis is not to be confounded with *Myzus ribis*, which unfortunately has the same specific name.

Rhopalosiphum lactucæ, *Kalt.* Plate XL.

Aphis lactucæ, Kalt., Walk. ?
Rhopalosiphum lactucæ, Pass.

Apterous viviparous female.

	Inch.	Millimeters.
Size of body	0·075 × 0·035	1·89 × 0·88.
Length of antennæ	0·065	1·64.
,, cornicles	0·015	0·38.

Body oblong and pointed at the apex, shining, pale yellow or pale drab. The young are carinated and ringed. Eyes red. Cornicles dilated in the middle. Legs short and rather hairy; tarsi dark. Tail conspicuous. Some specimes are white and translucent, showing the red eyes of the embryos through the integuments. The antennæ of the adults are black at their articulations.

Pupa.

Rather larger, sides carinated. Wing-cases pale yellow. Antennæ ringed, with black at the joints.

Winged viviparous female.

	Inch.	Millimeters.
Expanse of wings	0·280	7·10.
Size of body	0·080×0·035	2·02×0·88.
Length of antennæ	0·110	2·79.
,, cornicles	0·017	0·32.

Body broad, colour fine green. Head, band on the prothorax, thoracic lobes, antennæ, and scutellum black or dark brown. The third antennal joint is tuberculate. Eyes red. Four confluent bands form a large dorsal spot, and there are four black dots on each lateral abdominal edge. Cornicles vasiform, green, and black at their insertions. Legs ochreous, with black femora and tibial points. Cauda green. Wings long; insertions ochreous; cubitus greenish; stigma grey; veins black.

Common at Haslemere, Cowfold, and elsewhere, during June and July.

This Aphis feeds commonly on *Sonchus oleraceus*, but also it is found on *Cichorium endivum*, *Picris hieracioides*, *Lapsana vulgaris*, and other plants.

Unfortunately, here also the same specific names have been given to different insects. *R. lactucæ* must not be confounded with *Siphonophora lactucæ* of Pass., nor with *S. lactucæ* of Koch. All these three are

different insects, and their involved synonymy must be attributed to the fact that they all feed on *Sonchus* and *Lactuca*.

RHOPALOSIPHUM NYMPHÆ, *Linn.* Plate XLI, figs. 1—3.

Aphis nymphææ, Linn., Kalt., Walk.
Rhopalosiphum nymphææ, Koch, Pass.

Apterous viviparous female.

	Inch.	Millimeters.
Size of body	0·070×0·040	1·77×1·01.
Length of antennæ	0·055	1·39.
,, cornicles	0·015	0·38.

Oval, dark olive-green, rather glaucous. Head broad. Eyes dark brown. Antennæ stout, sooty grey. Vertex round. Abdomen carinated and blotched with lighter green towards the sides. Head, cornicles, and legs somewhat sooty grey. Some specimens are less ovate than others.

Winged viviparous female.

	Inch.	Millimeters.
Expanse of wings	0·220	5·58.
Size of body	0·065×0·025	1·64×0·63.
Length of antennæ	0·060	1·52.
,, cornicles	0·012	0·30.

Dark green. Head and thoracic lobes black; the latter shining. Eyes dark brown. Abdomen oval, shining brassy-green, and convex. Cornicles pale, vasiform, and dilated at their mouths. Legs yellowish green. Antennæ, femora, tarsi, and tibial tips dark olive. Wings rather short, but broad; insertions yellow; cubitus and stigma warm brown; veins rather coarse and black. Rostrum long, reaching just beyond the third coxæ. Some winged forms are darker

coloured than others. Taken on *Alisma plantago* at the Wanstead ponds. It feeds, however, on a variety of other water plants, such as *Butomus umbellatus*, *Potamogeton natans*, *Hydrocharis morsus-ranæ*, *Lemna gibba*. To this list Passerini largely adds. In some years it attacks the leaves of the water-lily, *Nymphæa alba*, so vigorously that the plants on large sheets of water disappear for the whole year. Occasionally it is but too common at Hampton Court, but at other years the Aphis is difficult to find at all.

Passerini in his 'Gli Afidi,' makes *Aphis nymphææ* the type of his genus *Siphocoryne*, but subsequently in his 'Aphididæ Italicæ' he takes *A. xylostei* for the type of that genus.

As the water-lily Aphis certainly possesses frontal tubercles, though they may be but small, I exclude the insect from Siphocoryne, which does not possess them.

RHOPALOSIPHUM LIGUSTRI, *Kalt.* Plate XLI, figs. 4, 5.

Aphis ligustri, Kalt., Koch.
Rhopalosiphum ligustri, Pass.

Apterous viviparous female.

	Inch.	Millimeters.
Size of body	0·055 × 0·035	1·39 × 0·88.
Length of antennæ	0·060	1·52.
,, cornicles	0·015	0·12.

Globose, shining, smooth, convex, bright yellow or greenish. Head broad. Frontal tubercles marked, and almost gibbous in form. Antennal joints tipped with black. Cornicles long and tipped with black. Legs wholly green. Taken in July at Wanstead.

Winged viviparous female.

	Inch.	Millimeters.
Expanse of wings	0·220	5·58
Size of body	0·060 × 0·025	1·52 × 0·62.

	Inch.	Millimeters.
Length of antennæ	0·070	1·77.
,, cornicles	0·013	0·32.

Stout. Bright yellow. Head broad; frontal tubercles projecting forwards; one ocellus placed on the pointed vertex, the other two ocelli near the antennal insertions, as is usual. Head and antennæ brownish; the two first antennal joints yellow. Three thoracic lobes brown. Scutellum greenish. Abdomen oval, shining, domed, with several transverse, pale brown streaks, and several more or less confluent dashes between the cornicles. Cornicles dilated in the middle, and much curved. Cauda yellow, and about one third the length of the cornicle. Legs yellow. Wings moderately long, rounded at their tips; insertions and cubitus yellow. Other veins stout, rich brown. Stigma grey. Rostrum does not reach to the second coxa. Under side green, with the pectus brown.

Taken during September at Norwich, feeding, but not numerously, on the common privet, *Ligustrum vulgare*. The winged form does not occur so plentifully as the apterous.

RHOPALOSIPHUM BERBERIDIS, *Kalt.* Plate XLII, figs. 1—3.

Aphis berberidis, Kalt., Walk
Liosomaphis berberidis, Walk.
Rhopalosiphum berberidis, Koch, Pass.

Apterous viviparous female.

	Inch.	Millimeters.
Size of body	0·080×0·042	2·02×1·05.
Length of antennæ	0·050	1·27.
,, cornicles	0·025	0·62.

Globular, but rather flat. Wholly greenish-yellow. Head broad, and slightly ochreous. Segments of the

body increase in diameter from the prothorax, and then widen much towards the middle of the abdomen; again, these rapidly narrow towards the tail, which last organ is obtuse, and of a yellow colour. Cornicles large, thin at their origin, but dilated in the midst. They generally are full of yellow oil-globules. Legs and antennæ green.

Taken at Wanstead in June; at Albery, Herts, in July, and in both cases on the berbery, *Berberis communis*.

Winged viviparous female.

	Inch.	Millimeters.
Expanse of wings	0·260	6·60
Size of body	0·090 × 0·030	2·27 × 0·76.
Length of antennæ	0·070	1·77.
,, cornicles	0·015	0·38.

Wholly green. Head browner green. Ocelli very distinct. Eyes red, vertex pointed. Antennæ pale green, joints smoky at their tips. Prothoracic band and thoracic lobes pale brown. Abdomen, cornicles, legs and tail, green. Tarsi smoky grey. Wings broad. Cubitus and stigma green. Other veins dark brown. The rostrum reaches to the third coxa. The cornicles are skittle-shaped, with slight attachments. As this insect somewhat differs from the rest of the genus *Rhopalosiphum*, Mr. Walker proposed for it a new genus, *Liosomaphis*;* but this variation seems to me to be hardly sufficient to separate it thus from its congeners.

RHOPALOSIPHUM DIANTHI, *Schrank*. Plate XLIII, figs. 1—4.

Aphis dianthi, Schr., Kalt., Walk.
— *persicæ*, *Puceron du pecher*, Morren.
— *rapæ*, also *A. floris rapæ*, and *dubia ?* Curt.
— *vastator*, Smee.

* Walker, 'Zoologist,' 2nd series, vol. iii, p. 1119.

Aphis persicæcola, Boisduval.
Rhopalosiphum dianthi, Koch.
— *persicæ*, Pass.

Apterous viviparous female.

	Inch.	Millimeters.
Size of body	0·080 × 0·040	2·02 × 1·01.
Length of antennæ	0·060	1·52.
,, cornicles	0·020	0·50.

Colour shining green, ochreous yellow, or brownish yellow. Skin finely punctured. Ovate. Pointed towards the apex. Head broad. Antennæ shorter than body, and placed on rather large frontal tubercles. Cornicles green, with black tips. Cauda green, about one third the length of cornicles. Abdomen convex, and being transparent, often seen mottled with yellow young embryos.

The colour is, however, exceedingly variable. In autumn it is often of an ochreous red, and deeply furrowed or wrinkled.

Pupa.

Much like the larva. Wing-cases tipped with brown. Points of antennæ brown.

Winged viviparous female.

	Inch.	Millimeters.
Expanse of wing	0·340	7·62.
Size of body	0·080 × 0·040	2·02 × 1·01.
Length of antennæ	0·080	2·02.
,, cornicles	0·017	0·19.

Head, thorax, and the band on prothorax, black. Abdomen shining reddish yellow, with a broad black dorsal spot, and several dark lines. Four dark spots on each lateral fold. Legs ochreous. Antennæ black; as also are the femora, the tibial points, and tarsi.

Cornicles brown. Wing-insertions and cubitus yellow. Stigma grey. Rostrum reaches to the second coxæ.

Very common throughout the summer up to the end of October. The imago appears of various colours such as green, ochreous, and even black.

The larva may be called almost polyphagous. Walker says that it feeds on at least sixty known plants. Amongst those to which it is most destructive are the potatoe, the sweet turnip, and the swede; but it also attacks *Brassica rapæ*, *Dianthus caryophyllus*, *Amygdalus persicæ*, *Hyacynthus orientalis*, *Ranunculus bulbosus*, *Canna indica*, the tulip, crocus, fuschia, oleander, tobacco, mesembrianthemum, and numerous other plants. It infests the peach and nectarine in autumn, after *Myzus persicæ*, the spring species, has for a time apparently left the trees.

Confusion in the synonymy of this Aphis is very great. Passerini identifies this insect with Morren's Aphis of the peach, and accordingly he adopts Morren's specific name *Aphis persicæ*.

As Schrank more than thirty years previously described this same insect under the name *Aphis dianthi*, I consider that it ought to revert to its original designation. As it is neither *Aphis persicæ* of Fonscolombe, nor *A. persicæ* of Sulzer,* nor *A. persicæ* of Kaltenbach, Boisduval proposes to call it *A. persicæcola*.

Charles Morren, at a comparatively early date, illustrated the internal anatomy of this insect by many descriptive plates. He notices their first (recorded ?) appearance in Belgium, and states his belief that the countless swarms that spread over the country during the September and October months of 1834, traversed the sea from the English shores. One must think there is some exaggeration in the remark then made, that the clouds of Aphides obscured the light of day,

* Prof. Passerini has lately pointed out to me that his *Myzus persicæ* is not *Aphis persicæ* of Sulzer, as I have stated in vol. i, p. 178. "Humanum est errare," at least in the matter of these synonyms.

and covered the walls of the houses so as partially to conceal them.

I have no doubt that the Aphis figured by Mr. Smee in his work on the potatoe plant, under the name of *Aphis vastator* is *Aphis dianthi* of Schrank and other authors. Amongst the numerous food-plants he mentions, we find the poisonous *Atropa belladonna*, *Solanum dulcamara*, and *Euphorbia peplus*.

That there is any necessary connection between the potatoe disease and the attacks of this Aphis on the haulm it is believed no one now can reasonably sustain; yet it is undoubtedly true that a sickly and diseased condition is induced on many plants through exhaustion caused by the crowding and swarming of Aphides. It is not improbable that Aphides, like many of the Cimicidæ, throw highly irritant juices, elaborated by their salivary organs, into the wounds made by the piercing setæ of their rostra. These juices may assist in the preparation of the sap for assimilation by the insect.

Mr. Berkeley has urged that the commencement and root of the potatoe disease is to be traced to the ramifications of the mycelial threads of the fungus, *Peronospora infestans*, which burrows throughout the substance of the potatoe tuber, stem, and leaf.

Mr. W. G. Smith has recently made the very remarkable observation, that the penetration of the above mycelium is not confined to vegetable tissues alone for its propagation. An examination of numerous specimens mounted in balsam for the microscope has led him to believe that these fungoid spawn-threads grow both outside and inside the bodies of Aphides. "Sometimes the oogonia, which eventually become resting-spores, are deeply buried in the body of the Aphis, whilst the whole insect is traversed by mycelial threads; many of the oogonia are inside the legs, sometimes inside the feelers." "These oogonia and antheridia are presumedly the same with those found in diseased potatoes. The

fruit is identical in size and form with the fruit of *Peronospora infestans*."

These observations, accompanied by a characteristic woodcut, may be found in the 'Gardener's Chronicle' for April 8th, 1876.

Without calling in question the ability of Mr. W. G. Smith at once to recognise a mycelial thread, I may state that a view of the above drawing of the leg of an infested Aphis at once suggested to me the nervous filament or filaments that may be traced in the legs of almost every full-grown living Aphis, reaching from the coxa to the tarsal claws. The same drawing also recalled to my mind the nervous filaments which proceed from the ganglionic mass situated in the head of the insect, and which extends throughout the length of the antennæ to the tip.

Once more, it should be borne in mind that the bodies of Aphides are largely supplied with tracheal tubes. Although these silvery threads seem to want the spiral fibre by which tracheæ can be identified in most insects, the true functions of these threads in Aphis can be certainly known from the fact that they uniformly take their rise from the respiratory stomata, as is shown in Plates B and C in the first volume of this Monograph.

The fact that oogonia and mycelium are present in the microscopic slides containing the Aphides in question need cause no surprise, if we consider that the insects examined possibly were bred on potatoe leaves infected by the Peronospora.

On the other hand, the history of Muscardine and *Botrytis bassiana* in the silkworm; of Empusa, the fungus of the house-fly; and the occurrence of fungoid growths on living animal tissues of low vitality, will make less strange or improbable to us the appearance of similar growths on Aphides. Furthermore, on the leaves of peach trees in summer, often may be found isolated specimens of *Rhopalosiphum dianthi*, whose bodies have been entirely destroyed by what would

appear to be a species of *Penicillium*. The outer surface of the body, to the eye, appears like the pile of reddish velvet, which under a high magnifying power resolves itself into a mass of jointed threads. On cutting into the body of such an Aphis, the adipose matter, usually so abundant, appears to have undergone something like a saccharine degradation.

De Bary says that the zoospores of Peronospora are capable of attaching themselves to the moist legs of flies and mites, and that these zoospores afterwards produce on them a plentiful crop of mycelium.

Passerini remarks that *R. dianthi* is one of the most destructive Aphides in foreign greenhouses. They there give rise to a kind of mould on the plants they infest, to which the French give the name *Fumagine*.

Some have ascribed the disease peculiar to the turnip plant, and variously known as *Anbury*, *Clubbing* or *Fingers and Toes* to the attacks of Aphides; but, so far as I can discover, the disease is not due to any Aphis attack, but probably is caused by insect punctures on the tap-root when the plant is young. Such wounds would probably produce excrescences similar to those we find on the barks of our young trees. The root of the turnip which, when healthy, may weigh more than fourteen pounds, by clubbing may be reduced to two or three ounces, whilst below the first bulb numerous excrescences occur which finally become half rotten. Simultaneously fibres are given off the knots, each of which becomes disfigured by its own dilatation.

To satisfy myself, I searched the roots and the surrounding earth of four such diseased plants in September. I found only five Aphides on the leaves, and none on the roots. Several Elateridæ and Myriopoda, however, had established their quarters in the half-rotten cavities, but none of these insects obviously had anything to do with the "clubbing." Curtis in his 'Farm Insects' states his opinion that Aphides are not the cause of this evil to the turnip.

Prof. Rupert Jones, F.R.S., informs me that at Sandhurst, and thereabouts, the turnips mostly escape "clubbing," but nearly all cabbage, brocoli, and such-like cruciferæ are much affected.

In Russia the disease is known by a word meaning cabbage-hernia.*

Genus VIII.—MELANOXANTHUS,† *Buckton.*

Body elliptical, rather flat. Vertex flat between the antennæ.

Antennæ short. The third joint double the length of the fourth. The seventh equal to the sixth. Frontal tubercles inconspicuous.

Nectaries short and pear-shaped, with trumpet-like mouths. Prothorax marked by two lateral teeth. Abdomen oval. Legs strong and short.

Tail inconspicuous or none.

Wings moderately long. Stigmatic veins with their apices reflected.

Melanoxanthus salicis, *Linn.* Plate XLII, figs. 4—6.

Aphis salicis, Linn., Kalt.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·150 × 0·080	3·81 × 2·02.
Length of antennæ	0·080	2·02.
,, cornicles	0·015	0·38.

* Mr. Percival Wright has called attention to this subject in 'Nature,' July, 1878, p. 279. In the 'Botanische Zeitung' for May, 1875, there appears the short abstract of a paper in Russian by M. Woronin, who has satisfactorily traced this disease to the destructive agency of a parasitic vegetable having some affinities with Myxomycetes, and called *Plasmidiophora brassicæ*. The spores of this plant attach themselves to the delicate root-hairs of various Cruciferæ, penetrate into the cells, and destroy the tissue. The roots of the turnip then lose all their starchy matter, and swell into the knobs in question, which become crowded with nucleated spores.

† From μέλας, black; ξανθός, yellow. It is not, however, intended to

Very large. Long oval. Abdomen pointed. Dull sooty black or greyish black, with a faint greyish medial stripe. Prothorax with a blunt tooth-like process on each side. Two broad pale grey patches on each side of the first abdominal ring, smaller patches on each of the succeeding rings, those at and below the insertions of the cornicles being the largest. Antennæ orange red. The seventh joint small, hardly equal to the sixth. The cornicles bright orange, skittle-shaped, with dilated mouths; very short. Legs orange, with dark tibial points and tarsi. The whole insect pilose. The under side is of obscure greyish green. Rostrum long, reaching to the third coxæ. The young insects are black and prettily streaked with grey. Their rostra are longer than those of the adult.

Winged viviparous female

	Inch.	Millimètres.
Expanse of wings	0·400	10·16.
Size of body	0·120 × 0·050	3·04 × 1·27.
Length of antennæ	0·080	2·02.
,, cornicles	0·020	0·50.

Very large, greyish black, pilose. Antennæ short, having all joints black except the third and fourth, which are orange. Abdomen with two or more grey dorsal patches. Cornicles bright orange. Legs as in the larva. Eyes dark brown. Wings ample. At the tips there is shown a tendency to a cloudiness of the membrane, as is more decidedly shown in the genus *Callipterus*. All the veins are black, and strongly marked. The stigmatic vein much curved downwards. Stigma pale grey. Rostrum long, reaching beyond the third coxæ. Its insertion is very near the anterior coxæ, somewhat removed from the base of the head.

convey by this term that all species of this genus of necessity shall be yellow and black.

Relatively the winged female is smaller than the apterous.

Found feeding on *Salix viminalis* at Shere, near Guildford, and kindly forwarded to me by Dr. Evershed. At the same time examples of *Siphocoryne capreæ* were numerous on the willow leaves. The apterous females occur at the end of April, and the winged forms towards the end of June.

In September I received the following notice from Mr. McLachlan: "An interesting fact is observable every year in the garden of a friend at Kentish Town. A species (of Aphis) infesting the willow and poplar is the prey of a species of Aphidius (*Aphidius gregarius*, Marshall), to an extraordinary degree, the stung individuals collecting in masses round the leaves of the twigs. The other day I saw a mass on one willow twig that must have consisted of many thousands, each of which I believe to have been stung; later on they will become merely inflated skins, with the characteristic hole whence the parasite emerged."

This Aphis proved to be *Melanoxanthus salicis* here described. As the insect is both large and conspicuous from its bright colour, it is remarkable that so few authors have noticed it. I believe it has not been before recorded as British. It does not appear to be *Lachnus viminalis* of Passerini, notwithstanding some resemblance on the description he gives, and the resort of his insect to the same plant for food.

Genus IX.—SIPHOCORYNE,* *Pass.*

Rostrum rather short.

Head without any frontal tubercles.

Cornicles long and vasiform.

This genus partakes of the characters of both *Rhopalosiphum* and the following genus *Aphis*.

* From σιφων and κορύνη, a club.

SIPHOCORYNE PASTINACEÆ, *Linn.* Plate XLIII, figs. 5—7.

Aphis pastinaceæ, Linn., Fabr.
Rhopalosiphum pastinaceæ, Koch.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·055 × 0·030	1·39 × 0·76.
Length of antennæ	0·023	0·57.
,, cornicles	0·013	0·07.

Oval, broader across the abdomen. Bright green, rather transparent. Abdomen shagreened or minutely punctured. Head blunt, vertex rounded. Antennæ and legs relatively short. Cornicles dilated in the middle, and protruding beyond the tip of the abdomen. Cauda long and green.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·240	6·09.
Size of body	0·080 × 0·030	2·02 × 0·76.
Length of antennæ	0·040	1·01.
,, cornicles	0·013	0·09.

Colour yellow-green. Head, band on prothorax, thoracic lobes, and a large irregular spot on the back, dark olive green. Antennæ and tarsi brown. Legs ochreous yellow. Cornicles clear brown, clavate, and equal to or longer than the tail. Third antennal joint tuberculated. Wing-insertions, cubitus, and stigma greenish yellow. In some specimens the abdominal spot is faint. The wing-membranes are finely punctured, and the stigma is slightly scaly.

Taken in June whilst feeding on the garden celery, *Apium graveolens*, and in July found abundantly on the carrot at Haslemere.

Kaltenbach appends a note to Koch's description

of this species,* to the effect that *Rhopalosiphum pastinaceæ*, Koch, is only a "sport" (Spielart) from the true *R. capreæ* of Fabr., or else from *R. cicutæ*, Koch. He also states that under a lens the corrugations and markings are very similar. Passerini, on the other hand, puts *S. capreæ* into his new genus *Siphocoryne*, which does not possess frontal tubercles. The last author also notices that *R. pastinaceæ*, Koch, wants the minute horn over the tail to be seen in *R. capreæ*.

I consider the insects are quite distinct. They differ in the relative size of their wings and the form of their vertices, and they do not appear to feed on the same plants.

SIPHOCORYNE XYLOSTEI, *Schrank*. Plate XLIV.

Aphis xylostei, Schr., Kalt., Walk.
Rhopalosiphum xylostei, Koch.
Siphocoryne xylostei, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·065×0·030	1·64×0·76.
Length of antennæ	0·050	1·27.
,, cornicles	0·019	0·25.

Long oval. Head broad. Thorax and abdomen widening till they become broadest just above the cornicles. Bright green. Dorsum much domed and marked by rings. Antennæ green, tipped with black. Cornicles black, expanded at their mouths. Cauda rather long and yellow. Legs moderate.

Pupa.

Dull glaucous green. Head with two black marks between the eyes. Abdomen with minute, black,

* 'Die Koch Pflanzenläuse,' p. 42.

lateral dots. Wing-cases tipped with black Tail black. Legs dark olive.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·240	6·19.
Length of antennæ	0·070	1·77.
,, cornicles	0·010	0·025.
Size of body	0·065 × 0·030	1·64 × 0·76

Head and thorax broad. Abdomen carinated, green. Antennæ black, third joint slightly serrated. Eyes dark brown. Head, band on prothorax, whole of thorax, and a narrow crossbar above the tail, black. Cornicles as in the larva. Legs brownish yellow, with black femoral and tibial joints, and black tarsi. Cauda green. Wing-insertions greenish yellow. Stigmata pale ashy grey. Veins brown.

The underside green, with black coxæ and black anal and vaginal spots. Rostrum reaches to the second coxa, and rises from a black buccal patch.

Taken at Edgware and at Wimbledon towards the middle of June.

This insect clusters in thousands amidst the flower-stalks, and also under the leaves of both the honeysuckles, *Lonicera xylostei* and *Lonicera periclyneum*. It often converts branches of these flowers into disgusting, sticky, and moving masses of life.

The species is rather local and particular in its haunts.

Siphocoryne fœniculi, *Pass.* Plate XLV,* figs. 4—6.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·080 × 0·040	2·02 × 1·01.
Length of antennæ	0·040	1·01.
,, cornicles	0·020	0·50.

* An error has occurred in the lettering of Pl. XLV. Figs. 4—6 relate to *Siphocoryne fœniculi*, and figs. 1—3 to *S. capreæ*.

Ovate. Wholly green, much punctured. Head narrow. Thoracic segments and abdomen marked by sutures. Antennæ short, as also are the legs. Eyes brown. Cornicles green, and slightly curved. Tail rather large.

Younger specimens are luteous in colour, and very broad above the nectaries.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·190	4·81.
Size of body	0·050 × 0·022	1·27 × 0·58.
Length of antennæ	0·032	0·81.
,, cornicles	0·011	0·30.

Small. Head broad, black. Vertex convex. Eyes red. Antennæ black. Third joint tuberculate. Thorax black and dull. Abdomen flat, broad, and green. Cornicles curved and moderately dilated. Tail green. Legs short and green, with olive femora and tibial points. Wings broad, and rounded at the tips. Insertions and cubitus greenish. Stigma grey. Rostrum reaches to the second coxæ.

Numerous on the garden fennel, *Fœniculum vulgare*, at Haslemere, and also at Wanstead, during May and June.

Passerini remarks that the winged insect is sometimes rusty red between the cornicles. It may be distinguished from *S. capreæ*, the next species, by its diminutive size and the absence of a little horn above the tail.

SIPHOCORYNE CAPREÆ, *Fab.* Plate XLV,* figs. 1—3.

Aphis capreæ, Fabr., Schr., Kalt., Walk.
— *ægopodii*, Fabr.
Rhopalosiphum pastinaceæ, Koch ?
— *cicutæ*, Koch ?
— *capreæ*, Koch.

* *Vide* footnote p. 26.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·080×0·035	2·02×0·88.
Length of antennæ	0·030	0·76.
,, cornicles	0·010	0·25.

Oblong, green, coarsely punctured. Eyes brown. Abdomen carinated. Tail short and green. Above the tail there is a small horn-like process, which distinguishes it from *S. fœniculi.*

Pupa.

Oblong, pointed behind. Glaucous green, with four dark green blotches on the thorax, and a double green stripe down the abdomen. Tips of wing-cases and tarsi darker.

Winged viviparous female.

	Inch.	Millimètres.
Expansion of wing	0·260	6·60.
Size of body	0·080×0·030	2·02×0·76.
Length of antennæ	0·060	1·52.
,, cornicles	0·010	0·25.

Head, band on prothorax, thorax, and a large square spot on the dorsum, black or dark olive green. This spot sometimes is divided into three separate, sharp bars. Cornicles long, thin, and green; sometimes they are dark olive. Tail small and fine. Legs yellowish, with brown tibiæ and tarsi. Wings very long, insertions and cubitus fine yellow. Stigma grey and scaly. Antennæ black, and rising directly from the vertex. The clavate character of the cornicles is much less marked in some specimens than in others. Rostrum reaches nearly to the second coxæ.

This insect feeds on various species of Salix. Kaltenbach says that it is identical with *Rhopalosiphum pastinaceæ* of Koch, and therefore I add his synonyms, but it is with some hesitation. The

two insects certainly have a considerable resemblance, but the former has frontal tubercles, though small, and the proportions and size of the insects differ. The wings also show a less breadth and a less obvious development.

I would lay some, but not a great deal, of stress upon the different characters of their food. *S. capreæ* may be taken on several kinds of willow, from April to July, at Guildford, Haslemere, and elsewhere.

Walker describes the male as small, with a red or yellow abdomen, and as having black antennæ, eyes, and head.

APHIS

- Tail none or inconspicuous
  - Adult apterous forms black. → Sambuci. / Opima.
  - Apterous form green. → Myosotidis.
  - Both forms rufous. → Amygdali.
- Tail black
  - Cornicles green
    - . . . . → Epilobii.
  - Cornicles black
    - Body rufous-brown. → Euonymi. / Lychnidis / Hederæ. / Ancupariæ.
    - Pupa or winged female with thoracic spines. → Viburni. / Jacobææ. / Acetosa.
    - Pupa with white spots. → Rumicis. / Atriplicis.
    - Stigma and wing-veins yellow. → Laburni. / Papaveris.
    - Stigma black. → Sedi.
    - Body more or less ferruginous. → Cardui. / Sambucaria. / Instabilis. / Pyri. / Bellis.
- Tail green
  - Cornicles green
    - Body mealy. → Brassicæ. / Cratægi. / Cratægaria. / Subterranea. / Abietina. / Pedicularis. / Mali.
    - Body not mealy. → Edentula. / Malvæ. / Urticaria. / Penicillata. / Saliceti. / Pyraria.
  - Cornicles black
    - Body of winged female without a dorsal patch. → Scabiosæ. / Cucurbiti. / Sorbi. / Lentiginis. / Padi. / Tanacetina.
    - Body of winged female with a dorsal patch. → Pruni. / Hieracii. / Farfaræ. / Petasitidis.

Genus X.—APHIS,* *Linn.*

Blattlaus, Puceron, Pidocchio, Plant-louse.

Rostrum moderately long; the last joint skittle-shaped, and as long as the preceding.

Antennæ shorter than the body. Frontal tubercles none or rudimentary. Seventh joint setaceous, and as long as the third.

Cornicles cylindrical, and equally thick throughout.

Cauda short, sometimes hardly visible.

Legs moderately long.

Wings generally shorter than in the preceding genera, but veining similar.

During the lapse of the last twenty years several perfect sexual forms of this genus have been discovered. The males are sometimes apterous and sometimes winged, and occasionally even both varieties occur in the same species. As to the general character of Aphis, it may be observed that all the forms show the wings, antennæ, and cornicles in a less developed state than in *Siphonophora*.

An artificial grouping of this genus has been attempted in the foregoing synopsis, and a certain value has been given to the attribute of colour, just as has been done in the synopsis appended to *Siphonophora*.

Passerini has adopted a similar course, but he has made his first great division to depend on the varying length of the tail. From the power possessed by some Aphides of withdrawing this organ into the abdominal cavity, I have not so prominently brought forward this character. In some cases it is difficult even to decide whether the insect possesses a true tail at all.

Under the name Aphis was formerly comprehended not only all the *Aphidinæ*, but also the allied tribes

* For the derivation of the word Aphis *vide* Introduction to vol. i, p. 4.

Chermesinæ, *Schizoneurinæ*, *Pemphiginæ*, &c. Though now much restricted by its subdivision into other groups, the genus *Aphis* still continues to be by much the richest as regards the number of its included species.

As might have been expected, the elimination of the more typical forms has left a residuum in which the characters hitherto relied on for classification present themselves in a less marked and pronounced degree, and consequently it happens that this original Linnæan genus, which now gives the name to the whole family, no longer furnishes its most typical forms. These special family characters must now rather be looked for in the foregoing genera of *Siphonophora* and *Drepanosiphum*.

This absence of sharp external characters renders a natural and scientific grouping difficult, and the want will be the more felt should we find the essential attribute of form, as well as the less important one of colour, liable to variation; and also suspect phases of inconstancy from the action of external surroundings.

Mr. J. Monell, of the Botanical Gardens, St. Louis, Missouri, who is doing some good work in this department of Entomology, writes to me: "The great difficulty with the American Aphides is to distinguish them from allied European species." Also Professor J. W. Trail, of Aberdeen, tells me that at his higher latitude the measurement of several apterous forms of identical species even exceed those I found on the Surrey Hills.

Mr. Wallace has more than once interestingly discussed the question of dependence of colour and size upon physical climatic conditions. He has shown that many insular Papilios like *Heliconius* and *Mechanitis* partially change their liveries when differently bred on the slopes of either the northern or the southern Andes. Again, that some insects are more richly banded and coloured when bred on continental rather than on insular tracts. And what is true of insects also seems in this particular to obtain in some

birds; thus, the usual prevailing green colour of the parrot's plumage passes into the crimson colours of the Molluccas and New Guinea species, &c.

Recently the same investigator seems to deny in great part the direct modifying action of solar heat and light, or at any rate he points out that they are inadequate by themselves to produce such colour modifications. He rather would look to the superior activity and vitality of the male as a cause for the often greater brilliance of his hues, although, singularly, such increase of brilliance is often attended by a reduction of size in reference to the female.

The large increase of brilliancy of plumage amongst many birds at the breeding season is patent to all, and it has been suggested that some *quasi* molecular change might take place in the cases of both insects and birds under the excitement of anger, jealousy, and sexual pugnacity, which by some unknown process might be perpetuated and intensified, by developmental or the like causes, presumably for the benefit of the individual.

Such questions form the legitimate subject of scientific inquiry, and he who adds to our accurate knowledge in such difficult paths of research earns the hearty thanks of the Biologist.*

APHIS BRASSICÆ, *Linn.* Plate XLVI, figs. 1—6. Linn., Schr., Fabr., Kalt., Walk., Koch, Pass.

Aphis raphani, Schr., Mosley.
„ *floris-rapæ*, Curtis.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·090×0·050	2·27×1·27.
Length of antennæ	0·060	1·54.
„ cornicles	0·010	0·25.

* *Vide* Mr. Wallace's Address to the Biological Section of the British Association at Glasgow, 1876.

Body long, oval. Plentifully covered with a whitish mealy coat, both on the upper and under sides. When this is removed by a drop of spirits of wine the body below is greyish green, with eight black spots ranged down each side of the back, which increase in size as they approach the tail. Antennæ green, with black tips, shorter than the body. Eyes and legs black. Cornicles very short and black. Tail also small and black.

The young when first hatched are oval, shining, and bright yellow. They are divested of the mealy coat above noticed. Their antennæ are rudimentary and deficient in the true number of joints.

Pupa.

Dirty green, much corrugated. Wing-cases dark olive green or grey black.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·270	6·85.
Size of body	0·080 × 0·035	2·02 × 0·088.
Length of antennæ	0·060	1·54.
,, cornicles	0·005	0·12.

Head, neck, and thoracic lobes, black. Antennæ and nectaries dark brown. Eyes black. Rest of the body yellowish green. Abdomen with a row of fine punctures on each lateral edge, with several obscure transverse dorsal marks. Legs dusky brown, pilose. Tail dark green or brown, hairy. Cornicles short and brown, as also is the tip of the rostrum. This last organ reaches to the second coxæ. Wings rather short, with stout coarse veins and dark stigma.

This species feeds on a variety of plants, such as *Raphanus sativus*, *Sinapis arvensis*, *Capsella bursa-pastoris*, and the garden cabbage, *Brassica oleracea*, both the upper and under sides of the foliage of which last plant it often crowds in such numbers that the leaves become hidden by the living mass. Indeed,

sometimes, weight for weight, there is more animal than vegetable substance present. The leaves then become putrid, offensive in odour, and quite disgusting to the eye.

Several species of *Syrphidæ* and *Ichneumonidæ* act effectively as checks upon the increase of *A. brassicæ*. The larvæ of the former dipterous flies, living in the midst of such plenty, soon gorge themselves and become of great size. Amongst the latter hymenopterous parasites may be mentioned several genera of Aphidivorous ichneumons, as *Ceraphron*, *Trionyx*, and *Coruna*.

A common form is a fly which appears to be *Trionyx rapæ*,* Curt. In September often nine tenths of a a colony will be struck by this parasite, and the Aphides, instead of passing from their pupa state into the imago, will turn brown and hard from the deadly action of the grub, which solitarily inhabits each individual.

The ichneumon which finally emerges is pitchy brown, with four or five yellowish abdominal rings. The antennæ are 16-jointed, including the basal member. There are 5 joints in the tarsi, the fifth of which is more than twice the length of the fourth.

A figure of this insect (Pl. XLVI, fig. 7) is added to those of *Aphis brassicæ*, from which the simple character of the wing-venation can be most easily seen.

APHIS CRATÆGI, *Kalt.* Plate XLVII, figs. 1—3. Kalt. ?, Walk., Koch ?, Pass. ?

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·065 × 0·030	1·64 × 0·76.
Length of antennæ	0·035	0·88.
,, cornicles	0·010	0·25.

* *Vide* Curtis, 'Farm Insects,' p. 73, and Curtis, 'Guide to Gen. Ent.,' p. 547.

Bright green, slightly mealy, punctured. Head convex and smooth. Eyes brown. Abdomen long, oval, carinated, and deeply pitted. A row of seven minute spots or pore-marks on each side. Cornicles straight, dark at the tips, and one sixth of the length of the body. Tail conspicuous and green. Antennæ short, thick at their bases, ochreous, with dark tips. Vertex and legs slightly pilose. Legs ochreous, with black tarsi.

Pupa.

Much smaller than the larva, and more mealy coated. Abdominal rings much corrugated. General colour bright green, with a brown head, and dark nectary tips. Wing-cases and thoracic lobes yellow.

	Inch.	Millimètres.
Expansion of wings	0·200	5·08.
Size of body	0·065 × 0·035	1·64 × 0·88.
Length of antennæ	0·050	1·27.
,, cornicles	0·020	0·50.

Head, neck-ring, thorax and its lobes, black. Head broad and convex. Abdomen shining, bright green, with the same marked carination and minute pore-marks of the larva. Cornicles long and straight. Colour olive green. Antennæ and legs ochreous, pale, and hairy. Rostrum reaches to the second coxæ. Tail conspicuous and green. Eyes bright red.

There are two obvious tubercular spines on the sides of the neck or prothorax, the use of which is not known. Wings rather short and rounded at the tips, with greenish insertions. Veins fine and black. Stigma and cubitus greyish.

It is exceedingly difficult to reconcile the descriptions of the various insects named *Aphis cratægi* by authors. It cannot be said entirely to agree with any of the synonyms I have above appended. Thus, *A. cratægi* of Kaltenbach has little or no tail, and the abdomen is

barred with black. *A. cratægi* of Passerini has rusty-red spots at the base of the cornicles, like *Aphis padi*. Koch says *A. cratægi* of Kaltenbach is *Aphis pyri* of Boyer de Fonscolombe, which is a brown or reddish insect. Again, Koch's *A. oxycanthæ*, feeding, like the present insect, on the hawthorn, *Cratægus oxycantha*, is black, and certainly must be different. Some of these discrepancies probably are due to physico-climatal causes, as before noticed.

This insect is not uncommon at Haslemere from May to late July. It blisters and rolls up the tender leaves at the top shoots of the whitethorn. In this way tangled and curled masses are formed, mostly of a reddish-brown colour.

APHIS CRATÆGARIA, *Walker*. Plate XLVII, fig. 4. Ann. Nat. Hist., ser. 2, vi, No. 93.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·070 × 0·045	1·77 × 1·13.
Length of antennæ	0·040	1·01.
,, cornicles	0·020	0·50.

Body round and flat. Head, antennæ, and legs pale ochreous brown. Eyes brown. Thorax and prothorax distinctly separated; dull leek green, somewhat mottled; a marked yellow carination edges the whole abdomen. Cornicles straight, dark brown. Tail large, and also dark. Femoral tips and tibiæ dark brown. The sides of the prothorax and the abdomen are furnished with small spines.

Taken at Haslemere and at Wanstead on the leaves of the hawthorn.

As this insect, notwithstanding some differences, most nearly approaches the description given by Walker, I conclude that the forms are identical. The winged female is grass-green, with the head and

thoracic disc brown. "A row of black dots runs down each side of the abdomen."—Walker.

APHIS SUBTERRANEA, *Walk.* Plate XLVII, fig. 5.

Aphis carotæ, Koch, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·060×0 035	1·54×0·88.
Length of antennæ	0·035	0·88.
,, cornicles	0·003	0·07.

Globose. Head broad, front slightly convex or nearly flat. Dull green. Body lightly covered with a meal-like powder. Usually there is an obscure whitish line down the dorsum. Abdomen much domed and carinated. Tips of the antennæ, the nectaries, and the tibia, black, as also are the eyes and the tarsi. The nectaries are very small. The tail rather inconspicuous. The rostrum rather long, and reaches a little beyond the third coxæ.

Found in the middle of September at Norwich, feeding numerously on the roots of the garden pink, *Dianthus plumarius*.

I have no doubt that this is the same insect as that described by Koch under the name of *Aphis carotæ*, and also so called by Passerini. The former author found it, however, under the umbels of the flowers of the wild carrot, *Daucus carota*, but he omits to describe the winged female, although he apparently found it in company with the rest. I have never seen the winged form alive, but I find the insect described in Walker's 'Catalogue of the Homoptera,' vol. iv, p. 1033, under the name of *Aphis subterranea*, from which notice I collate the following:

" Winged viviparous female.

" More slender than the apterous insect. Antennæ more than half the length of the body. Thoracic lobes dark. Cornicles about $\frac{1}{15}$th of the length of the body. Legs moderately long. Feet, tips of the thighs, and the shanks brownish. In July on the roots of the parsnip, occasionally at the depth of one foot beneath the surface, whereto (wherefrom?) it crawls when the wings are about to be developed."

There appears to be several other true Aphides having seven joints in the antennæ, which also have this singular underground habit. *Aphis farfaræ* will be presently mentioned, and there is *Aphis terricola* also of Rondani and of Passerini. This last insect has not, as yet, been noticed in this country. It may be recognised by its extended rostrum projecting far beyond the extremity of the body.

If *A. carotæ* be identical with *A. subterranea* the insect must have two distinct modes of life, being, at different times, aërial or subterranean in habit. This peculiarity will recall the fact that has been well authenticated, that the great vine-scourge, *Phylloxera vastator* of Lichtenstein, has a similar habit of attacking either the root or the leaf, according to certain local causes, of which, at present, we seem to know nothing.

In France the underground apterous Phylloxera is by far the most destructive, but in America the aërial leaf-destroyer seems to be doing the greatest damage to the vineyards.

APHIS EDENTULA, *Buckton*. Plate XLVIII, figs. 1—3.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·055 × 0·030	1·39 × 0·76.
Length of antennæ	0·050	1·27.
,, cornicles	0·010	0·25.

Body oval, pale green, slightly punctured. Not mealy. Antennæ nearly the length of the body. Faintly-marked pores are usually seen down the thorax and abdomen. Legs and nectaries slightly olive. Eyes warm brown.

Pupa.

Much like the larva in form and colour, but paler green. Four darker green marks or folds occur on each side of the back. Wing-cases green, as also are the antennæ and legs.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·220	5·55.
Size of body	0·070×0·025	1·77×0·62.
Length of antennæ	0·050	1·27.
„ cornicles	0·010	0·25.

Head broad. Neck-ring, thorax, abdomen, antennæ, and legs, pale yellowish green. The rest of the neck, thoracic lobes, scutellum, and nectaries, pale brown. Femoral tips brown. Wings greenish, with pale stigmata and light brown veins.

The prothorax is devoid of the two spines which occur in the last species described.

Apterous oviparous female.

Oval, smooth, shining, sienna-brown, often mottled with yellow, from the five or more eggs which appear through the skin. Head slightly olive. Eyes brown. Antennæ very short, brown or black, and darkest at the tips. Cornicles small and dark olive. Legs much shorter than in the other forms. The hind tibiæ flattened, and tapered towards the tarsi. Tail pale yellow and small.

Some specimens are much darker than others, and approach to a reddish brown.

	Inch.	Millimètres.
Size of body	0·060×0·030	1·54×0·76.
Length of antennæ	0·025	0·62.
,, cornicles	0·007	1·77.

Plentiful on the whitethorn at Wanstead in November, where it was mixed with the pupæ and the winged females. These insects were sent to me by Mr. Walker, who, nevertheless, could not satisfy himself of their species.

It does not appear to be *A. cratægaria* of Walker; and, as it wants the thoracic spines, and also does not, so far as I can discover, possess the two small tubercles on the abdomen characterised by Kaltenbach, it cannot be his *Aphis cratægi*.

I think it is therefore well to give it the provisional name of *A. edentula* from its abdominal toothless character.

APHIS PEDICULARIS, *Buckton*. Plate XLVIII, figs. 4, 5.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·065×0·040	1·64×1·01.
Length of antennæ	0·040	1.01.
,, cornicles	0·010	0·25.

The general colour of this insect is dull yellowish-green; form broadest across the nectaries. Head convex. Eyes brown. Abdomen very transparent, showing the underlying tracheæ like a plaiting of silver threads. Embryos also visible through the skin. Nectaries and the legs stout, the last a little clouded at the tips of the femora and tarsi. Tail large, green, and hairy. Rostrum reaches nearly to the second coxæ. Body slightly mealy.

The young, just born, measure 0·025×0·012 inch. The nectaries are at this time very short, whilst the rostrum reaches considerably beyond the third coxæ.

Found numerously between the seed-pods of the louse-wort, *Pedicularis palustris*, in the Norfolk fens, about the middle of July. No winged forms could be secured at that time, and I have failed to procure them since.

APHIS MALVÆ, *Walk.* Plate XLIX, figs. 1, 2. Walk., Koch, Mosley, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·060 × 0·030	1·52 × 0·76.
Length of antennæ	0·060	1·52.
,, cornicles	0·015	0·38.

Body somewhat oval. Head brown between the antennæ; but sometimes the colour is reddish. Rest of the body yellow or pale green. Legs rather short, pale green; tarsi darker. Cornicles straight and cylindrical. Tail but little developed. The vertex and the cauda pilose.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·190	4·81.
Size of body	0·0·50 × 0·020	1·27 × 0·50.
Length of antennæ	0.040	1·01.
,, cornicles	0·010	0·25.

Much smaller than the wingless female. Head, part of prothorax, and all the thorax, rich brown. Vertex convex, not pointed. Abdomen arched. Rest of the insect fine yellow, with indistinct lateral punctures. Antennæ shorter than the body, pale brownish yellow. Legs, nectaries, and tail, pale green; tarsi greyish. Eyes red. Wings short and rounded at the tips; insertions and cubitus yellow; veins brown; stigma grey.

Apterous oviparous female.

Very much of the form and colour of the viviparous female. Antennæ half the length of the body. Nectaries olive. Several of these insects, mixed with the viviparous female, in December were taken feeding in the open air on the Chrysanthemum. No males could be discovered.

This is a common species, and is one of the chief pests in the hot-house. It feeds on various plants, as the *Tobacco*, *Verbena*, *Malva*, *Epilobium*, *Achillea*, *Rumex*, and *Aquilegia*. Within certain limits it varies much, and chiefly as regards colour. As many as seventeen varieties have been described by Walker in his 'Catalogue of the Homoptera in the British Museum,' vol iv, p. 970.

The winged form, according to Koch, has two spines on the prothorax. I believe this insect is *A. malvæ*, of Pass., but it must not be confounded with *Siphonophora malvæ* of that author, which probably is *S. pelargonii*, of Kaltenbach.

APHIS ABIETINA, *Walker*. Plate XLIX, figs. 3, 4.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·065 × 0·035	1·64 × 0·88.
Length of antennæ	0·040	1·01.
,, cornicles	0·020	0·50.

Bright green. Slightly mealy. Shagreened. Head luteous. Abdomen long, oval, with a pointed apex. Cornicles long and cylindrical. Two spots on the head, and a row of dark green spots on the connexivum. Tail about two thirds of the length of the cornicle. Eyes red. Rostrum reaches to the third coxæ.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·190	4·81.
Size of body	0·050 × 0·020	1·27 × 0·50.
Length of antennæ	0·045	1·13.
,, cornicles	0·025	0·62.

Smaller than the larva. Fine green. Head olive and somewhat broad. Neck and thorax robust. Thoracic lobes and scutellum dark olive. Abdomen green, with a slight yellow carina. Cornicles long and, like the legs and tail, pale green. Tips of the tibiæ and the tarsi dark olive. Stemmata on the occiput obvious, as also are two depressions behind the eyes. Rostrum reaches to the third coxæ. Eyes bright red. Wings with rounded apices. Cubitus and stigma yellowish green. Veins brown. These are liable to abnormal variation somewhat similar to that shown in Pl. LV, fig. 4, where three furcal veins appear on one wing, and in Pl. LXXXIV, fig. 3, where the cubital nervure has a furcation in excess.

Found pretty numerously at Wanstead, on the spruce-fir, *Pinus abies*, from the middle of May to the end of November. Specimens were kindly sent to me by Mr. Walker.

I believe that this is the only known British Aphis belonging to that section of the Aphidinæ which has seven antennal joints, and finds its food on a conifer.

The pupa is entirely green, with short antennæ. This insect does not appear in the lists of Kaltenbach, Koch, or Passerini.

Aphis mali, *Fab.* Plate L.

Puceron du pomier, Götze.
Aphis pomi, De Geer, Reaum.
,, *mali*, Fab., Schr., Kalt., Walk., Koch, Fitch, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·110 × 0·080	2·79 × 2·02.
Length of antennæ	0·050	1·27.
,, cornicles	0·010	0·25.

This insect varies so much in form and colour that it almost may be considered as dimorphous. The first progeny from the egg, when full grown, called Altmütter by Koch, is considerably larger than the insects subsequently born of her. The adult *queen Aphis* or stem-mother is thus described:

Body globose, domed, of a dark slaty grey, mottled with green. Head, neck, and thorax distinctly separated. Abdomen globular and soft; each segment is furnished with a minute spine at each edge. Antennæ and legs short, dark grey. Cornicles black and inconspicuous, as also is the tail. Eyes dark brown.

The subsequent viviparous broods have a variety of colours, as bright green, yellowish, ferruginous red, or brown. Probably these tints in great measure are dependent upon the more or less recent stages of growth after a moult. Their form is considerably more oval than that of the first spring form, from which, indeed, they so much differ, that, if the individuals were not indifferently mixed and feeding together on the same leaf, we might hesitate to think them of the same species.

The synonyms of this insect are very numerous and much involved. The American forms seem to be equally variable.

The Pupa.

This much resembles the larva in form, but usually its colour is paler yellow, with three green abdominal stripes. The head shows two rudimentary stemmata between the antennæ, which become developed only in the imago. Wing-cases reddish. Cornicles yellow, tipped with brown.

Both larvæ and pupæ are plentifully powdered with very fine white, mealy, fibrous particles.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·300	7·62.
Size of body	0·080 × 0·030	2·02 × 0·76.
Length of antennæ	0·060	1·54.
,, cornicles	0·010	0·25.

Head, thorax, and antennæ, black. Abdomen green, with four lateral dots on each side. Legs ochreous or dingy yellow, with black knees and tarsi. Rostrum reaches to the second coxæ; yellow, with a brown point. Cornicles rather short, black or dark olive. Some specimens have darker interrupted bands on the abdomen, and a dark patch above the cornicles.

Wings long, much longer than those of *Aphis cratægi*, with which *Aphis mali* has sometimes been confounded. Cubital vein with its second furca very near to the wing-margin. Insertions and stigmata pale green.

Common on the leaves of the garden apple and the wild crab, *Pyrus malus*. According to Kaltenbach, also on the pear, and the whitethorn, *Cratægus oxycantha*.

The apterous forms are most plentiful in May and June. The winged insects abound most in July, when they spread their colonies so much, that sometimes the vast orchards of Devonshire are wholly robbed of their fruit through the shrivelling of the leaves. The bark of the trees sometimes is blackened by the glutinous secretions voided by these Aphides. Often, however, a crop is saved by the timely appearance of lady-birds (*Coccinella*), a single individual of which has been seen to suck dry upwards of one hundred Aphides in an hour.

Soon after the multiplication by parthenogenesis had been proved in this family of insects an opinion seems to have been entertained by many that the process of a-sexual viviparism could be prolonged for an indefinite time, and an extreme idea arose, that there

were no true males amongst Aphides. It is difficult to explain why, notwithstanding their completeness, De Geer's observations seem in effect to have been at one time almost ignored or else forgotten. His words are of interest. Their substance is as follows:

Towards the end of autumn in August, 1746, I found this Aphis of the apple-tree sparsely scattered. I saw the male in conjunction with the female, and I also witnessed the process of oviposition by the latter.

Again he says, at another time, amongst these Aphides I found two individuals, one of which sat on the back of the other. I watched under a lens the actual process, and saw a connection of their hinder parts. To convince myself of the accuracy of my observation, I touched the uppermost insect, which I considered to be the male. Immediately it put itself into an agitated state in order to disengage itself. "Hier sah ich deutlich, das sie einen kleinen häutigen, durchsichtigen Theil aus dem Leibe des Weibchens zog, der auch noch eine Zeitlang aus ihr herausging, hernach aber allmälig wieder zuruchgezogen werde."

He then says that he subsequently saw other males *in coitu*, and unexpectedly, that they were apterous, like those of the fir-feeding Aphides which he describes. The chief difference between the males and the complete females of this species, he states, is the more slender form and ringed abdomen of the former, and that a row of dark spots occurs down the sides of the back.

After noticing the colour of the eggs and the spots chosen by the mother for depositing her ova, he remarks that after the coitus and the completion of the egg-laying they both died.

Kaltenbach queries De Geer's remark that the male is always apterous. Since Kaltenbach's time Mr. Walker has described a winged male of *Aphis mali*, and he seems to have seen it pair in October. This alate character seems to militate against De Geer's previous discoveries. But Leuckhart dissected the

apterous male of *Aphis padi*, and this unusual form of the male I have since found to obtain in *Chaitophorus salicivora* and other species. In *Lachnus quercûs* it also obtains, so that the wingless condition of the male occurs after all not so very infrequently, and sometimes even when there is also in existence a winged male.

Through the kindness of M. Jules Lichtenstein I am enabled here to describe such an apterous male, and to figure in Pl. LXIX bis, the viviparous female with her egg. Four specimens were placed between ground watch-glasses and posted to me on the 28th of November from Montpellier, situated almost on the shores of the Mediterranean. The tenacity of life in the fecundated females was well shown by the fact that two eggs were laid by them whilst travelling through the post, and an additional egg was deposited by one of them whilst placed under my microscope on the 3rd of December. The two very diminutive males forwarded to me under the same glasses had succumbed, but they were still in good condition for description. M. Lichtenstein wrote—"He could send any quantity of sexuated lice and their eggs from the quince-tree, *Cydonia vulgaris*," presumably of the same species.*

Oviparous female.

	Inch.	Millimètres.
Size of body	0·065 × 0·040	1·64 × 1·01.

Short, oval, almost globose. Head and thorax narrow. Apex of abdomen much swelled out, if a

* As the existence of males to Aphides has been, as above noted, often doubted, I append De Geer's words as quoted by Kaltenbach:

"Unter diesen Blattläusen fand ich zwei, deren eine der andern auf dem Rücken sass. Durch die Lupe merkte ich ihre wirkliche Begattung, in dem sie beide mit den Hintertheilen zusammenhingen. Um mich abermal davon recht gewiss zu überzeugen, berührte ich die oberste, die ich für das Männchen hielt. Sie sezte sich gleich in Bewegung, sich loszumachen. Hier sah ich deutlich, das sie einen kleinen häutigen, durchsichtigen Theil aus dem Leibe des Weibchens zog, der auch noch eine Zeitlung aus ihr herausging, hernach aber allmälig wieder zurückgezogen wurde. . . . . .

"Die Männchen dieser Art haben keine Flügel, wie die Fichtenblattläusmännchen, &c."

mature ovum happens to be in the oviduct. Colour brownish green, with a ferruginous stain on the head and part of the thorax. Two brown spots occur, like papillæ, at the anterior orifice of the vulva. The tail and anal rings are very hirsute.

Wingless male.

Inch.	Millimètre.
Size, 0·020 × 0·013	0·50 × 0·33.

Exceedingly minute, perhaps $\frac{1}{8}$ the size of the female. Head and thorax together nearly as long as the abdomen. Antennæ longer than the body. Legs long, colour ferruginous. This variety of sex has a rostrum almost equal to the entire length of the body, consequently the insect takes nourishment and does not pair immediately after its birth, as is the case with some of the non-rostrated males of the *Pemphiginæ*. The male of *A. mali* is furnished below with two very obvious genito-anal claspers.

These sexual forms mostly occur in November and December. Dr. Asa Fitch* says that the winged viviparous female of the Aphis infesting the apple-trees of North America is invariably black, except on the abdomen, which is green. Nevertheless, he has no doubt now that the American species is identical with that of Europe, and that it must have been imported simultaneously with young trees from the East.

The black eggs of *A. mali* may be found deeply buried in the crevices of the bark, and these hatch as soon as the spring sap begins to swell off the buds. The young Aphides puncture the backs of the thick fleshy leaves, which pricking causes them to curve backwards from their points, and in this manner safe retreats are formed and shelter from the effects of rain and hot sun.

Several remedies have been put forward to destroy these pests, which blacken the branches by their voided

* Fitch, 'On Noxious Insects,' Reports 1 and 2, 1856, p. 50.

excretions, and give when numerous a sickly and disgusting odour to the apple-trees.

Where practicable, a syringing with tobacco water, made by pouring four gallons of hot water upon a pound of tobacco, will be found efficacious. Anointing the branches with soft soap or strong soapsuds kills all bark-pests, and the alkali has been said so far to act on the sap passing to the leaves that it sickens the Aphides, and causes them to fall and die on the ground. These remedies, however, are insignificant when compared with the clearing effects produced by many *Coccinellidæ* and *Ichneumonidæ*.

Aphis mali must not be confounded with the pest known as the *American blight*, which also is an apple Aphis, but belongs to quite another tribe and genus, afterwards to be described.

Aphis urticaria, *Kalt.* Plate LI, figs. 1—4.

Kalt., Walk., Koch.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·075 × 0·040	1·89 × 1·01.
Length of antennæ	0·045	1·13.
„ cornicles	0·015	0·12.

Body oval or globular, domed, dark green, mottled with pale green patches. Eyes brown. Antennæ pale, much shorter than the body. Nectaries pale yellowish, straight, slightly dilated at their bases. Tail broad, about half the length of the nectary, pilose. Legs short, pale ochreous, hirsute. Rostrum with a brown tip, reaching to the second coxæ.

Pupa.

Coloured much as the larva, but the head is broader and the legs are paler. Tarsi dark. Wing-cases olive green.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·230	5·84.
Size of body	0·060 × 0·030	1·54 × 0·76.
Length of antennæ	0·035	0·88.
,, cornicles	0·010	0·25.

Dark green, mottled with pale green. Head, neck, and thorax black. Eyes bright red. Antennæ rather short; the first three joints greenish; the remaining four black. Abdomen marbled green, globose, and without corrugations. Cornicles and tail green. Legs fine ochreous brown, with dark femoral and tibial tips. Wings ample, and broad. Cubitus and stigma grey; insertions yellow; veins black. The membrane is often coarse in texture.

Numerous during June and July on the stinging nettle, *Urtica dioica*, and *U. urens*. Kaltenbach says it frequents the blackberry, *Rubus fruticosus*, and *R. idæus*. Though he appears to have witnessed the union of the sexes, he does not describe the male. The young specimens just born are globose, and of a yellowish white, with black-tipped nectaries. Mr. Walker has taken the insect on the potato, and I have taken it feeding on the gooseberry and on the vegetable marrow. Its food, indeed, is of a mixed character.

APHIS PENICILLATA, *Buckton*. Plate LI, figs. 5, 6.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·065 × 0·040	1·64 × 1·01.
Length of antennæ	0·040	1·01.
,, cornicles	0·020	0·50.

Bright green, rather glaucous, deeply carinated and domed. Antennæ, legs, and nectaries pale drab. Genua, tips of antennæ, tarsi, and tibial tips, ochreous brown. Tail green.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·225	5·70.
Size of body	0·060 × 0·025	1·54 × 0·62.
Length of antennæ	0·050	1·27.
,, cornicles	0·010	0·25.

Head, antennæ, and thorax black. Eyes dark brown. Abdomen dark green. Prothorax and edge of abdomen furnished with black spines or papillæ. Cornicles dark green, with paler tips. Legs black, with upper parts of the tibiæ ochreous. Tail dark green. Rostrum reaches to the second coxæ. Sternum black. Under side of abdomen green. Wings greyish, with black veins which are sharply defined. From this character the specific name has been taken. Stigma smoky.

Taken at Pembroke in July on the Willow-herb, *Epilobium montanum*, and subsequently at Haslemere feeding on the flower-stalks of the same plant. The very old specimens, apterous and otherwise, are often nearly black.

Aphis saliceti, *Kalt.*, *De Geer* (*?*), *Koch.* Plate LI, bis.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·065 × 0·035	1·64 × 0·88.
Length of antennæ	0·045	1·13.
,, cornicles	0·017	0·04.

Oval, broad across the nectaries. Variable in colour. Young often reddish. Head convex. Prothorax with two spines. Colour bright green, mottled with numerous paler oval spots. Tibiæ and nectaries yellow with black tips. The latter long and cylindrical. Eyes brown. Cauda thick at its base and rather long. Some specimens have orange-red stains, which are more pronounced on the under side. Coxæ, base, and apex of the rostrum, and also the anal plate, dark brown.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·220	5·58.
Size of body	0·075×0·030	1·89×0·76.
Length of antennæ	0·055	1·39.
,, cornicles	0·015	0·38.

Proportionally larger than the preceding form. Colour variable, generally bright yellowish green. Head, prothorax, and thoracic lobes black. Third antennal joints tuberculate. Abdomen smooth, with a series of irregular pale brownish bands more or less confluent on the dorsum, and three or four dark spots on each abdominal edge. Cauda and nectaries greenish. Legs olive, with black tarsi and tibial tips. Wings with greyish stigma and brown veins. Insertions yellowish. Antennæ same colour as the legs. Eyes black. Rostrum reaches to the second coxæ.

Taken at Fernhurst, Surrey, on *Salix caprea*. The winged forms become scarce in the month of August. Koch figures two other insects taken in company with the above, which I agree with Kaltenbach are only varieties of the same species. Almost every shade of dark green, yellow green, and reddish yellow, may be seen in the same swarm of the species described above. This Aphis certainly is not *Aphis salicis*, of Linnæus.

APHIS PYRARIA, *Pass.* Plate LII.

Myzus pyrarius, Pass. (?)

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·060×0·030	1·52×0·76.
Length of antenna	0·050	1·27.
,, cornicles	0·005	0·12.

Body flat, oval. Dorsum rather convex. Segments clearly defined. Lateral edges conspicuous. Sooty black

or bluish brown. Under a lens the skin is finely reticulated, and covered by a fine cottony pile. Antennæ yellow, fine. Cornicles small. Cauda obtuse and black. Legs wholly bright yellow. The young when first born are white, with dark cornicles and red eyes. Taken at Haslemere on the pear in August, when they were injuring the trees greatly by the excretions made by countless numbers. Later in the year certain specimens were sent to me from Clifton infesting the dahlia; these I consider to be the same Aphis, notwithstanding the difference of food-plant mentioned.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·220	5·58.
Size of body	0·060 × 0·025	1·52 × 0·55.
Length of antennæ	0·060	1·52.
,, cornicles	0·005	0·12.

Variable in tint, the fresher specimens having yellow abdomens with numerous brown bands and spots. These bands increase with age and by widening out finally obliterate all the yellow. The adult winged form is greenish black or sooty brown. Belly greyish. Antennæ, legs, tail, wing-insertions, and cubitus ochreous yellow. Eyes red. The stigma and veins brownish yellow. Rostrum reaches to the second coxæ. The cornicles very short and yellowish brown.

This insect, on account of the presence of small frontal tubercles, might almost be grouped with Myzus; but from the form of the cornicles and the general appearance of the body it better assimilates to Aphis. If it really be *A. pyrarius* of Passerini, this is its first noted appearance in this country, and it then should go, perhaps, into the genus he has placed it.

Mr. Walker informed me that he had never seen a pear-tree attacked by Aphides. Yet for two consecutive years I found a tree so infested by this species that it appeared as if it had been dusted with soot. The tree

was nearly stripped of its leaves, and wholly gummed over by the Aphis secretions.

APHIS SCABIOSÆ, *Kalt.* Plate LIII.

Aphis chloris, Koch (?).
„ *scabiosæ*, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·060 × 0·030	1·54 × 0·76.
Length of antennæ	0·040	1·01.
„ cornicles	0·012	0·03.

Body oval, somewhat flat. Under a strong light it appears of a fine dark velvet-green. Sometimes to the naked eye it is nearly black. The dark specimens are mottled with paler green. Eyes red. Cornicles black. Antennæ and legs ochreous yellow. Cauda green, and about half the length of the cornicles. Rostrum yellow, with a black tip, reaches to the second coxæ. The under side also is of a fine dark green colour.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·220	5·58.
Size of body	0·060 × 0·040	1·54 × 1·01.
Length of antennæ	0·040	1·01.
„ cornicles	0·012	0·30.

Head and thorax shining black. Abdomen globose, shining green, smooth, with paler motlings. Cornicles and antennæ black. Cauda green. Legs ginger-yellow, with darker femoral and tibial points. Wings rounded at the tips, and finely iridescent; insertions yellow; cubitus and stigma pale brown.

The winged insect does not appear to be very plentiful.

Taken numerously at Norwich on *Scabiosa arvensis*, and at Pembroke on *Parietaria officinalis* and *Ballota*

nigra. June to September. It likewise attacks the melon plants in my forcing frames, and much weakens the plants. From similar places at Carshalton I have also received specimens.

The synonymy is somewhat difficult. The insect is not unlike *A. urticaria*, but the nectaries are different. The larvæ do not possess the spots down each side, as Koch describes his *A. centaurea* (which he says is *A. scabiosæ*, of Kalt.), as having. It better agrees with Passerini's insect. Also it might prove to be *A. chloris*, of Koch, notwithstanding that his insect quite close to the ground feeds on *Hypericum perforatum*.

APHIS CUCURBITI, *Buckton*. Plate LIV, figs. 1, 2.

Apterous viviparous female.

Bright green, more or less covered with a mealy powder; some specimens are more brilliantly coloured than others. The cornicles are short. The rest of insect like the pupa.

Pupa.

	Inch.	Millimètres.
Size of body	0·055 × 0·030	1·39 × 0·76.
Length of antennæ	0·035	0·88.
,, cornicles	0·005	0·12.

Orange or warm ochreous. Long oval. Head, thorax, tips of cornicles, and lower part of the abdomen bright dark green. Antennæ and legs pale green. Cauda obtuse and pale. Eyes brown. Wing-cases ashy, tipped with brown. Abdomen ringed.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·280	7·10.
Size of body	0·070 × 0·030	1·77 × 0·76.
Length of antennæ	0·040	1·01.
,, cornicles	0·010	0·25.

Pale yellow-green. Head, prothorax, thorax, and nectaries black. Eyes red. Antennæ and legs fine ochreous colour. Neck-ring, abdomen, and tail fine yellow. Cornicles short, black. Three or four spots on each abdominal edge, and two dotted bars across the dorsum. Wings pale, with yellow cubitus, stigma, and insertions. Other veins pale brown.

This pretty Aphis infests the under sides of the leaves of the melon plants at Carshalton, Surrey; specimens were sent to me in September by the late Mr. Smee. I have also taken this insect on the vegetable-marrow. Mr. Walker has pointed out in the 'Zoologist' an Aphis destructive to this last plant, which he names *Aphis illata*, but it does not appear to be the Aphis above described.

An Aphis much infests various Cucurbitaceæ of North America, but is not clear from the description to what species it may be referred. A Canadian writer strongly expresses his opinion in favour of Morren's view as to the honey-dew being employed as a nourishing fluid for the young Aphides. He says that he "saw the mother Aphis which infests *Cucurbita ovifera*, acting in obedience to the child's wish (expressed by caressing its parent with its antennæ), by slowly elevating the posterior part of her abdomen, and ejecting a drop on the head of the latter." He ascribes to the ant also the power of communicating to its fellows facts which are beneficial to their general economy. "Thus, at one time the Aphis was a juicy morsel for an ant, but at last there appeared an ant more sagacious than its fellows, who discovered the hidden virtues of this Aphis secretion, and then diffused the news through its own and other colonies. From this time the most friendly relations have arisen between these insects."* Such has been the march of intellect in this direction according to our author!

* 'Canadian Entomologist,' No. 1, 1874, vi, pp. 5–8. *Vide* 'Zoologist,' vii, App. xliii.

APHIS SORBI, *Kalt.* Plate LIV, figs. 3—5.

Kalt., Walk., Koch (?).

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·050 × 0·025	127 × 0·62
Length of antennæ	0·040	1·01
,, cornicles	0·003	0·07

Small, oval, yellowish green. Rostrum hardly reaches to the second coxa. Nectaries very short. Cauda rounded, inconspicuous. Walker describes it as reddish brown or orange with three tubercles.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·260	6·62.
Size of body	0·075 × 0·030	1·89 × 0·76.
Length of antennæ	0·070	1·77.
,, cornicles	0·010	0·25.

Head, neck-ring, and thorax shining black. Eyes red. Rest of body dark olive-green. Antennæ blackish, with third joint tuberculate. Abdomen carinated, with four or more obscure spots on each side. Cornicles green at the bases, and black at the tips. Tail very small and green. Wings ample, with yellowish insertions; stigma and veins fine brown; cubital vein forked close to the margin. On each side of prothorax there appears a small spine.

The winged insect is very active, and takes wing readily if disturbed.

Apterous oviparous female.

	Inch.	Millimètres.
Size of body	0·060 × 0·030	1·54 × 076.
Length of antennæ	0·040	1·01
,, cornicles	0·010	0·25

Oval, domed, smooth, nearly white or else warm grey, shining, not mealy. Head ferruginous. Eyes red. Thoracic and abdominal rings strongly marked. Eight distinct dots or pore-marks on each side of the dorsum. A broad, ferruginous band extends between the nectaries, which band becomes much broader at the bases of the same. Cornicles short, white, with black tips. Tips of the antennæ, femora, and tarsi, blackish. Cauda white. Rostrum very short.

Two large eggs which occupied the greater part of the abdominal cavity were obtained by dissection.

Numerous colonies were found under the leaves of the service-tree, *Pyrus tormentalis*, at Wanstead, in the month of October. This Aphis also feeds on *Sorbus aucuparia*. I have no doubt that it is *A. sorbi*, of Kaltenbach and of Walker, although my specimens very inconspicuously shewed the abdominal papillæ (Höckerchen) indicated by Kaltenbach.

Koch seems to have had some doubt whether the winged insect he describes really belonged to the colony feeding on the service-tree; and Kaltenbach shares his doubt, since Koch does not name the "characteristic papillæ on the last two hinder body-rings."

Koch's figure, with its barred ferruginous abdomen, scarcely accords with the form of my insect, but his apterous insect much better agrees with my corresponding female.

I possess specimens, mounted and named by the late Mr. Walker, which show well the abdominal processes referred to above.

APHIS LENTIGINIS, *Buckton*. Plate LV, figs. 1, 2.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·080×0·060	2·02×1·54
Length of antennæ	0·080	2·02
,, cornicles	0·015	0·38

Globose, dull black to the naked eye, but deep brown under a lens; somewhat fuscous in the neighbourhood of the head and tail. Eyes and antennæ black. Cornicles black as to three parts of their length, and rising from two conspicuous orange-yellow spots situated at the base of the dorsum. Legs black, except as to the upper halves of the tibial joints, which are yellow. Tail very obtuse and inconspicuous.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·290	7·35.
Size of body	0·065 × 0·035	1·64 × 0·88.
Length of antennæ	0·060	1·54.
,, cornicles	0·010	0·25

Head, eyes, antennæ, and entire thorax dull black. Abdomen green, with three dark spots on each side. Legs pale ochreous, with black femora and tibial points. Cornicles dark green. Cauda small and green. Rostrum short, reaching to the second coxæ. Under side of the belly green. Wings long. Veins somewhat liable to variation. Insertion cubital and other veins pale brown. Stigmata rather darker brown.

At least three species of Aphis feed on the pear, and the specific names given to them by authors are very confusing.

Koch describes an *Aphis pyri*, which feeds on *Pyrus pyraster*, but it does not appear to be the insect under the above notice; and it is not *Aphis pyri* of Boyer de Fonscolombe. On account of the rusty blotches on the dorsum, I give to my insect the trivial name, *lentiginis*.

The figures on the accompanying plate were drawn from specimens captured on the leaves of the garden-pear in early June by my friend Mr. Borrer, of Cowfold, Sussex, whose zoological "proclivities" are well known.

APHIS PADI, *Réaum.* Plate LV, figs. 3, 4.

Réaum., Linn., Fab., Schr., Kalt., Walk., Koch, Von Siebold, Leuckart, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·075 × 0·035	1·89 × 0·88
Length of antennæ	0·050	1 27
,, cornicles	0·007	0·17

Obtuse, oval, domed. Antennæ rather short. Eyes black, small. Colour yellowish green, with three more or less obvious greenish olive stripes. Lower abdominal rings stained with fine ochreous red, which is mostly due to the presence of a coloured mealy powder. Antennæ, legs, and cornicles, yellow; the former with darker tips. Cornicles thin and dilated at the bases. Cauda short and stout.

The Pupa.

Greyish green. Thoracic lobes and prothorax pale. Eyes and cornicles black. All the lower portion of the abdomen, and parts of the carina fine orange, and mealy. Antennæ and legs olive green.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·260	6·60.
Size of body	0·080 × 0·035	2·02 × 0·88.
Length of antennæ	0·055	1·39.
,, cornicles	0·010	0·25.

Head, neck, and thorax ochreous brown. Abdomen shining, obscure green, with darker stainings: three spots occur on each lateral edge. Antennæ, eyes, and legs brown. Cornicles and tarsi black. Wings ample. Cubitus, stigma, and veins pale ginger-brown. In Plate LV, fig. 4, the cubital vein on one wing is abnormally thrice forked.

This handsome and distinctly marked insect occasionally is plentiful on the bird-cherry, *Prunus padus*. The apterous female occurs in April, but the winged fly is by far the most plentiful form in June.

Aphis padi was one of the species chosen by Leuckart to illutrate that portion of his important discoveries in 1858 which treated on the generation of Aphides.* He says that the males are wingless, but probably they occur in two forms.

We are, however, at present ignorant of the different functions performed by such variously formed males in the economy of other species of Aphis.

Kaltenbach makes the following remarks upon the hybernation of this species; he says † "Already in September I found winged females and males in great abundance, and likewise a countless number of smaller wingless forms, which most probably would hybernate, since the leaves already had begun to change colour, and some had fallen. The following Spring I put my supposition about hybernation to proof. At the end of March, before the appearance of young leaves, I visited the bush on which, during the previous Autumn, I had noticed the winged females and the males, together with thousands of the young; to my astonishment, I found that the herd of young Aphides were in the larval state, and almost grown to their full size. I could find no mother of the colony (Altmütter) though I searched through the whole herd."

As the existence of a winged oviparous female has not been proved amongst Aphides, it is probable that some oviparous female was overlooked amongst the apterous forms of the previous Autumn. The occurrence of the males otherwise would appear to be premature or aimless. If there had been oviposition at that time or subsequently, all cause of surprise at so early a Spring brood would seem to vanish.

* Leuckart, 'Zur Kenntniss des Generationswechsels.'
† 'Kalt. Mon.,' p. 76.

APHIS TANACETINA, *Walker*.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·065 × 0·030	1·64 × 0.76.
Length of antennæ	0·040	1·01.
,, cornicles	0·007	0·17.

Wholly green both above and below, transparent, often showing through the skin an interlacing of tracheæ and numerous green oil globules. Eyes brown. Cornicles very short, somewhat dilated at their mouths. Last abdominal rings slightly pilose. In the older specimens the green approximates to olive.

Pupa.

Very like the larva. Head broad. Eyes nearly black. Wing-cases olive-brown.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·200	5·08.
Size of body	0·055 × 0·025	1·39 × 0·62.
Length of antennæ	0·050	1·27.
,, cornicles	0·005	0·12.

Pea green. Head, thorax, femoral, tibia tips, and tarsi black. Abdomen with a broad patch of olive green, and with one or more interrupted bands of the same colour, accompanied by three dots on each lateral edge. Third antennal joint often coarsely serrated. Wings with blackish cubitus, stigma, and veins.

The newly born imagos are paler on the thorax.

This Aphis swarms on the apical tufts of the tansy, *Tanacetum vulgare*. Also on the stems of the garden chrysanthemum and cineraria. Taken at Norwich, Walthamstow, and Haslemere.

Notwithstanding some discrepancy as to the length of the tail, &c., I believe this is Walker's insect described in the 'Ann. Nat. History,' ser. 2, iv, 46. It does not answer to *tanaceti* of Koch, nor to *tanaceticola* of Kaltenbach.

Aphis pruni, *Réaum.* Plate LVI.

Réaum., De Geer., Fab., Kalt., Mosley, Walk., Koch, Pass.

Aphis prunifoliæ, Fitch. (?)
— *Prunifex*, Amyott.
— *Calamaphis*, „

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·070 × 0·030	1·77 × 0·76.
Length of antennæ	0·030	0·76.
„ cornicles	0·005	0·12.

Oval, attenuated towards the tail. Green, greenish-yellow, or slightly olive-brown. Whole body above and below powdered with a cottony meal. Eyes warm brown. Antennæ short, olive brown. Abdomen with three faint green stripes. Cornicles very small, brown. Cauda green. Rostrum short, reaching to the second coxæ.

Pupa.

Shining green, with shades of ochreous. Two broad marks on the occiput. Wing-cases tipped with dark brown. Cornicles green, with black tips.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·200	5·08.
Size of body	0·055 × 0·025	1·39 × 0·62.
Length of antennæ	0·055	1·39.
„ cornicles	0·007	0·17.

Apple-green. Head, antennæ, thorax, genua, and tarsi black. Third antennal joint tuberculate. Abdomen green. Dorsum with a squarish spot, and two dark streaks below the cornicles. Four lateral spots at each edge. A black spot under the tail. Cornicles dark olive, or only tipped with black. Legs yellowish. Tail green and pilose. Rostrum reaches the second coxæ. Wings broad and rounded; membrane rather coarse and finely punctured; stigma greenish; veins brown.

Winged male.

	Inch.	Millimètres.
Expanse	0·225×0·50	5·70×1·27.

Body small, dingy ochreous. Head, thoracic lobes, prothorax, three blotches on the dorsum, nectaries, genua, and tarsi, all umber-brown. Fore wings very large and broad. Cubitus and stigma pale ochreous. Some males are wholly black.

This sex was satisfactorily made out by a dissection, the generative organs and the testes being well developed.

Taken rather numerously, and in company with the oviparous female, on the apple-tree, towards the middle of November. Mr. Walker also sent me male specimens from the medlar-tree, *Mespilus germanica*.

Apterous oviparous female.

	Inch.	Millimètres.
Size of body	0·065×0·030	1·64×0·76.

Small, pale greenish yellow, transparent, usually shows the mature eggs within. Head broad. Eyes and nectaries brown, the latter variable in length. Ano-genital ring conical. Tibiæ slightly dilated.

The eggs in November are ready for laying, and freely pass from the body by a gentle compression.

This species infests the plum, the peach, and the apple. De Geer also found it feeding on the apricot,

Prunus armeniaca. To these plants I would add the chrysanthemum and the china-aster. Probably the winged female determines the kind of food for the sustenance of her future progeny, which has no opportunity of exerting a choice in the matter.

Aphis pruni is exceedingly destructive. Multiplication takes place by millions, and the insects close up the pores of the leaves by their tenacious secretions and the mealy exudations from their bodies. By the constant irritation of their rostra the leaves roll up, and under this cover from the weather both the winged and apterous forms live, overspread by the before-mentioned mealy powder, which probably to them is a protection.

De Geer describes the male as having wings hardly as long as the body, and the female as laying her eggs in September. Professor Asa Fitch has noticed the discordant descriptions of this Aphis, and is led to believe that the American plum Aphis is distinct from the European. The English species certainly is variable, both as to the length of the antennæ and the forking of the cubital vein. Some winged forms have but six antennal joints, but doubtless this condition is abnormal.

Notwithstanding differences in Kaltenbach's diagnosis, I do not doubt that the German and English specimens are identical.

I am inclined to believe that *Aphis prunifoliæ* of Fitch is a variety of *A. pruni*. In both insects the nectaries of the winged female project beyond the tail.

The china-aster of our gardens is very liable at some seasons to entire destruction by an Aphis which swarms round the flower-stalks, and forms thereon a dark living crust. Where the Aphis frequents, it causes black blotches, which afterwards spread over the plants and cause them to rot off. With the single difference (which, however, is of some consequence), viz. that this Aphis does not appear to have

a mealy coat, I have been unable to distinguish it from *Aphis pruni*. At present I prefer to consider it as a variety rather than make a new species from inconclusive characters.

APHIS HIERACII, *Kalt.*, *Walk.*, *Koch.* Plate LVII, figs. 1, 2.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·070×0·030	1·77×0·76.
Length of antennæ	0·070	1·77.
,, cornicles	0·015	0·38.

Oblong, rather flat. Head and thorax broad. Eyes reddish brown. Antennæ yellow, with the three last joints dark brown. Abdomen carinated, segments well marked, each ring dotted with minute brown tubercles tufted with yellow hair. Cornicles rather long and thin, warm brown. Cauda obtuse, olive green. Legs fine yellow, with shining black femoral and tibial tips; tarsi black. Whole body clothed with fine yellow hair. Rostrum black, reaching to the second coxæ. The under side brownish green or olive.

The pupa is more or less green, with dark antennæ, genua, and tarsi.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·260	6·60.
Size of body	0·070×0·030	1·77×0·76.
Length of antennæ	0·060	1·54.
,, cornicles	0·015	1·38.

Shining rich umber-brown, hirsute. Eyes reddish. Antennæ about the length of the body, and tinted as in the larva. Abdomen variable as to colour, according to the age of the insect. Greenish, marbled with

fuscous brown, or wholly rich brown. Sometimes with darker bands and spots on the dorsum, according to Kaltenbach and Koch. Cornicles black. Cauda brownish. Wings finely iridescent; insertions, cubitus, stigma, and veins amber-yellow. Legs as in the apterous female.

Numerous during June and July, on the leaves and stalks of *Hieracium spondylium*, Norwich. Koch found them crowding the stipules of the lower leaves. Kaltenbach notices the above changes of colour as the individuals become aged.

Aphis farfaræ, *Koch*. Plate LVII, figs. 3, 4.

Apterous viviparous female.

Koch describes this larval form in his Monograph as flesh-red, oval, and dull. It has a remarkably long rostrum, which reaches to the commencement of the ring bearing the cornicles. It feeds underground on the root of *Tussilago farfaræ*.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·350	8·8.
Size of body	0·100×0·050	2·54×1·27.
Length of antennæ	0·080	2·02.
,, cornicles	0·015	0·38.
,, rostrum	0·055	1·39.

Large, shining. Rich ochreous or bright yellow, with greener tones of colour towards the apex of the abdomen. Head, antennæ, and thoracic lobes warm brown. Abdomen with three brown spots on either side, and a large broad one between the cornicles. Wings imbricated or finely punctured at the tips, rather fuscous and iridescent; insertions pale yellow, veins black, stigma grey. Legs ochreous, except at the tibial and tarsal joints. The older specimens are

more suffused with brown than the younger, whilst numerous dark bars appear on the dorsum. The rostrum is very long, but not quite so long relatively as in the apterous female. Tail short and rounded. The head has the unusual number of five stemmata. The third antennal joint is distinctly ringed, and the fourth shows a tendency towards the same character. Taken at Haslemere, but not plentifully, September 12th, on the coltsfoot.

APHIS PETASITIDIS, *Buckton*. Plate LVIII, figs. 1, 2.

Apterous viviparous female.

Bright green, almost transparent. Nectaries very small. Cauda none. Extremity like the pupa. Captured at Holy Island, Northumberland, and at Albury, Hertfordshire.

Pupa.

Wholly green. Head broad, usually tinged with ferruginous red. Abdomen mottled with yellow and green. Antennæ about half the length of the body. Cornicles very small. Tips of the antennæ, nectaries, tarsi, and rostrum black. Eyes red.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·220	5·58.
Size of body	0·055 × 0·025	1·39 × 0·62.
Length of antennæ	0·055	1·39.
,, cornicles	0·007	0·17.

Bluish green. Head broad, front flat. Antennæ black; third joints thick and serrated on their lower edges. Head, thorax, nectaries, points of femora, tibia, and tarsi black. Abdomen shining green, with a large square dorsal spot and three other lateral spots black. Legs slightly pilose. Rostrum reaches

to the second coxæ. Tail very small, green, and hairy. Wings finely punctured; insertions yellow; stigma greyish; veins black and strongly marked.

On first issuing from the pupa the winged females are wholly green, with the exception of the eyes and stemmata, which are pale brown. Some mature specimens become entirely black, through the encroachment of the dark markings on the green.

The insect figured in Plate LVIII gave birth to two young whilst she was under examination by the microscope. At first these young appeared very like shining yellow eggs, for their limbs were enveloped in an exceedingly delicate membrane, which seemed to be lubricated with a viscid substance. It was noticed that some were born with their backs turned downwards, wards, but, like all other Aphides, they uniformly presented their tails foremost. Whilst the head of the young Aphis is still attached to the parent, the membrane is imperceptibly passed or pushed off towards the tail end, where it accumulates as a fine paper-like mass.

The limbs of the young, when first they appear from the vulva, are lubricated by a glairy secretion. The antennæ, rostrum, and legs are disposed in a parallel fashion, so that the fœtus presents a uniformly ovoid shape. The extremities grow rapidly, and soon project beyond the tail. The antennæ are first liberated, then the first and second pairs of legs, and finally the hind legs are disengaged, with which the insect struggles to get free. During the eight or ten minutes required for its birth, the young Aphis doubles its size from the absorption of air. Finally, having thrown off the investing pellicle, the smoothness of which doubtless assists in the act of expulsion from the body of its parent, it shows itself covered with fine hair.

This species was taken plentifully in early June on the leaves of the butterburr, *Tussilago petasites*, at Albury, in Hertfordshire. Afterwards it was, in July, kindly forwarded to me by Mr. Hardy, of Berwick,

who took it at Holy Island, Northumberland, feeding on the hound's tongue, *Cynoglossum officinale*. This insect is characterised by a remarkably strong and black wing-venation.

APHIS EPILOBII, *Kalt.* Plate LVIII, figs. 3, 4.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·090×0·050	2·27×1·27.
Length of antennæ	0·050	1·27.
,, cornicles	0·020	0·50.

Large, oval, pointed behind, dull black, wrinkled, powdered with white dust. Head broad. Eyes black. Third antennal joint, the cornicles, and legs drab-yellow. Cauda conspicuous and black. Rostrum reaches to the second coxæ.

Taken at Wanstead and at Haslemere, in June, on *Epilobium montanum* and *E. pubescens*.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·210	5·33
Size of body	0·055×0·025	1·39×0·62.
Length of antennæ	0·045	1·13.
,, cornicles	0·010	0·254.

Wholly dull greenish black, except the cornicles, femora, and tibiæ, which are drab-yellow. Eyes dark brown. Legs and tail pilose. Wings large and rounded at the tips. Insertions and cubitus dull yellowish; other veins brown. Taken with the above early in July.

Kaltenbach describes his specimens as having brownish-red cloudy stripes on the body. The insect is certainly liable to variation. He also mentions a smaller insect, feeding on the epilobium, of a paler colour, and having two strong papillæ (Dörnchen) on the neck-

ring, and knobs on the sides of the abdomen. He considers these insects as varieties of the above. It is not improbable that they are identical with the insect I have described and named *Aphis penicillata*, which I certainly think is distinct from *Aphis epilobii* as above.

APHIS EUONYMI, *Fabr.* Plate LIX, fig. 1.
Fab., Schr., Kalt., Walk., Koch, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·090×0·055	2·27×1·39.
Length of antennæ	0·050	1·27.
,, cornicles	0·010	0·25.

Bright chestnut-brown, or very dark brown. Head and thorax rather darker. The third, fourth, and part of the fifth antennal joints yellow or else whitish; tips brown. Legs pale ochreous, except the knee-joints and tarsi, which are brown. Abdomen with seven deep brown pits on either side, each spot garnished with a white speck. Nectaries dark brown. Cauda yellow and, like the legs, pilose.

Taken plentifully in August by Mr. Borrer at Cowfold, Sussex. They were feeding on the spindle-tree, *Eunonymus europæus*. Numerous specimens also were kindly forwarded to me by Prof. Trail, of Aberdeen, who in August found them in quantity on the same shrub.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·340	8·62.
Size of body	0·090×0·040	2·27×1·01.
Length of antennæ	0·070	1·77.
,, cornicles	0·015	0·38.

Shining black or deep brown. Eyes, legs, and nec-

taries black. Upper parts of femora and tibiæ ochreous. Wings with greenish cubitus and insertions, and brown veins. Rostrum yellow, with a black tip.

Pupa.

Wholly black, except a few grey patches, ochreous legs, and brownish wing-cases.

Bonnet first discovered in this insect the parthogenetic mode of increase, and noticed that the mature winged condition is not attained until a fourfold moult or change of skin is effected.

Authors have noticed the similarity of this insect to *A. viburni*. I believe them to be distinct. The apterous forms may be distinguished by the white dots or pore-marks. When mounted in balsam the insect stains it of a fine reddish brown, which I have not observed *A. viburni* to do. The winged form is by no means so plentiful as the apterous. It occurs at the end of August.

APHIS LYCHNIDIS, *Linn.* Plate LIX, figs. 2, 3.
Linn., Bonnet, Kalt., Walk., Koch.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·060 × 0·035	1·54 × 0·88.
Length of antennæ	0·040	1·01.
,, cornicles	0·007	0·17.

Globose or semi-globose. Pitchy black, very shining, as if covered with a varnish, "glutinous in appearance" (Walker). Head broad. Eyes brownish. Cornicles rather short and black. Cauda inconspicuous, black. Third joint of antennæ and all parts of the legs, except the tarsi, dark ginger-brown.

The whole Aphis is more or less hirsute. The very young insects are dark olive-green.

Pupæ.

Pale brown. Head, thorax, and wing-cases greenish. Abdomen carinated, with brown nectaries.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·230	5·84.
Size of body	0·060×0·030	1·54×0·76.
Length of antennæ	0·060	1·54.
,, cornicles	0·015	0·38.

Wholly shining pitchy brown. Eyes warm brown. Abdomen carinated. Antennæ, legs, and anterior half of the cornicles ginger-brown. A strong spine occurs on each side of the prothorax, and a somewhat larger one on each side of the abdomen. Cornicles cylindrical. Tail dark green. Rostrum long, reaching beyond the third coxæ. Wings ample; cubitus and insertions yellow; veins brown.

This insect is variable in size. It is not uncommon from June to August at Norwich, Croydon, and Walthamstow, feeding on *Lychnis vescaria*, *L. diurna*, and *L. vespertina*.

Aphides, also in quantity, were taken by me on the young shoots of the ivy. They entirely agreed with the above-described insect, except in possessing shorter antennæ. The fine setaceous seventh joint of Aphis, however, is so liable to injury that this difference is not, perhaps, of great consequence. Mr. Walker says that the oviparous female is entirely red, and that the male is black and very small. He also gives *Aphis cucubali* of Linnæus for a synonym of *A. lychnidis*.

APHIS HEDERÆ, *Kalt.* Plate LX, figs. 1, 2.
Kalt., Walk., Koch, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·055 × 0·035	1·39 × 0·88.
Length of antennæ	0·030	0·76.
,, cornicles	0·005	0·12.

Globose, rather flat. Body uniformly dull brown. Head broad. Eyes pale brown. Nectaries very short, dark brown or black. Cauda small, brown or black. Legs pale brown or else whitish, with black tarsi and black femoral and tibial points. Legs and cauda hairy.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·260	6·62
Size of body	0·060 × 0·030	1·54 × 0·76.
Length of antennæ	0·050	1·27.
,, cornicles	0·010	0·25.

Colour generally like the apterous insect, dull brown. Thoracic lobes rather darker. Legs ochreous or pale brown, with black tarsi and black femoral and tibial points. Rostrum reaches to the third coxæ. Wings rather large, with yellowish insertions, blackish stigma, and brown veins.

Numerous, on the young shoots of the ivy, *Hedera helix*, at Chichester and other places, during June.

Another Aphis, *A. ilicis* of Kaltenbach, less commonly infests the holly, *Ilex aquifolium*. I quite agree with Mr. Walker that this insect should be included among the synonyms of *A. hederæ*. Nevertheless, Mr. Walker says he failed in getting the Aphides to exchange their food-plants when he tied a shoot of ivy, covered with *A. hederæ*, to a young shoot of holly. Similarly I have

failed in getting *Aphis rumicis* to change its ordinary food for the broom, *Sarothamnus*.

APHIS AUCUPARIÆ, *Buckton*. Plate LX, figs. 3—5.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·090 × 0·052	2·27 × 1·28.
Length of antennæ	0·060	1·52.
,, cornicles	0·010	0·25.

Varies much in form, some being globose,* whilst others are more produced at the tail. Colour brownish black or wholly black. Abdomen has a tendency to a dark obscure barring. Eyes, legs, and nectaries black. The whole insect is finely pilose and sparsely covered with a mealy dust, which in the globose form is disposed somewhat in a crescentic shape. Tail very small and obtuse.

Pupa.

Hoary, ferruginous red. Abdomen reddish, which colour becomes somewhat brighter in the neighbourhood of the nectaries. Wing-cases yellow green, tipped with brown. Legs and antennæ slaty grey.

The larva is furnished with two marked infra-abdominal teeth. These larvæ were plentiful in the middle of May at Horsham, on the wild service-tree, *Pyrus torminalis*, and in June many pupæ were found in the same place. The insect may also be found feeding on *Sorbus aucuparia*, but it differs in several respects from *Aphis sorbi* of Kaltenbach.

I failed to capture the winged form, or to breed it from these pupæ.

* Possibly these are the stem-mothers or queen Aphides—the founders of the colony.

APHIS VIBURNI, *Schr.* Plate LXI.
Schr., Fab., Walk., Mosley, Koch, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·075×0·040	1·89×1·01.
Length of antennæ	0·045	1·13.
,, cornicles	0·010	0·25.

Long, oval, smooth, somewhat shining. Head broad. Eyes black. Antennæ pale greenish, two first joints and the tip dark olive. Abdomen arched, and often has a pale, irregular, dorsal patch; seven depressions near the carina, each containing a white speck. A strong spine on each side of the prothorax, and seven or eight smaller spines on each side of the abdomen. Cauda large, dilated, and hirsute. Cornicles short and black. Legs hairy, pale green, except the femora and tarsi, which are black. Rostrum reaches to the third coxæ. The under side pale olive, with darker coxæ. May. Surrey and Essex.

Some specimens have a bronzed hue, and others are dull and lustreless.

Pupa.

Oblong, mealy, ferruginous grey. Head darker. Abdomen much ringed. Wing-cases greenish.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·300	7·62.
Size of body	0·100×0·040	2·54×1·01.
Length of antennæ	0·060	1·52.
,, cornicles	0·010	0·25.

Head, eyes, and thorax shining black. Antennæ black, third joint crenated. Abdomen dark, rusty,

with black bands, and a dark dorsal patch, or else altogether black, sides without perceptible spines. Cornicles short and black. Tail very small and black. Legs ochreous, with black femora and tarsi. Rostrum reaches to the second coxæ. Under side greenish. Wings with yellow cubitus and stigmata; veins brownish yellow. June.

Apterous oviparous female.

	Inch.	Millimètres.
Size of body	0·080 × 0·045	2·02 × 1·13.
Length of antennæ	0·045	1·13.
„ cornicles	0·010	0·25.

Oval, broader than the viviparous female, pointed at the tail. Head blunt and wide; vertex pointed. Colour uniformly dark greyish brown. Abdomen often shining, with three or four mature eggs appearing as green patches. Cornicles very small. Cauda conical. Body furnished with black spines. Legs very pale green, almost white; hind tibiæ much flattened.

On account of the transparency of the legs the curious pulsating sac at the knees, noticed and figured in Vol. I, Pl. A, fig. 12, can be easily seen. By dissection several large eggs were obtained from each specimen. Wanstead, October 30th.

Winged male.

	Inch.	Millimètres.
Expanse of wings	0·350	8·89.
Size of body	0·060 × 0·030	1·52 × 0·76.
Length of antennæ	0·080	2·02.
„ cornicles	0·015	0·38.

Head and eyes large. Antennæ long. Body relatively very small, wholly black, deeply carinated. Legs fine yellow, with black femoral and tibial points, and

also black tarsi. Wings very long; cubitus and insertions greenish; stigma and veins blackish.

Taken in company with the oviparous female and at the same time. It is not an uncommon species. It infests the guelder-rose, *Viburnum opulus*, forming black masses both on the upper shoots and the flowers of the plant. The Aphides cause the leaves to curl into various forms, and to draw themselves into bunches, which are often of a red or brown colour.

Sulzer states that the male of this species, and also that of *A. rumicis*, is apterous. This sex, therefore, appears in two forms, as is the case with *A. padi*, *A. mali*, and others. The cause of these double male-forms is obscure, and at present we are ignorant what points in the economy of these insects they satisfy. The roving powers of the winged male would seem to meet all requirements of impregnation.

APHIS JACOBÆÆ, *Schr.*, *Kalt.*, *Walk.* Plate LXII, figs. 1—4.

Koch, No. 2, p. 95, figs. 127, 128.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·060×0·040	1·52×1·01.
Length of antennæ	0·050	1·27.
,, cornicles	0·010	0·25.

Colour velvet-black, greenish black, or dull greenish. Figure varies from oval to globose. Under side dark green. Legs, antennæ, and cornicles black, but the third antennal joint and the femora are obscure ochreous. A well-marked spine occurs on each side of the prothorax.

Pupa.

Smaller than the larva, but usually of the same

colour; sometimes, however, it is wholly dark green. Thoracic lobes and wing-cases paler.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·200	5·080.
Size of body	0·070 × 0·030	1·77 × 0·76.
Length of antennæ	0·060	1·52.
,, cornicles	0·010	0·25.

Black both above and below. Abdomen velvet-like and of a greener shade. Head broad. Eyes black. Head and thorax together about equal in length to the abdomen. Antennæ, legs, and cornicles blackish; tibiæ obscure ochreous. Abdomen furnished with several spines on each side. Wings rather short, with strong cubitus and deeply marked black veins. Cauda black and pilose. To the naked eye this species often appears to be wholly black. The greenish shades, however, become evident under a lense if assisted by a good light.

Often very numerous during June and July, on the ragwort, *Senecio jacobæa*. *Aphis cardui* also sometimes mixes with the companies. This last insect may be distinguished from the other by its glossy integument.

Koch describes two different insects under the above name, one only of which agrees with Kaltenbach's description.

Aphis acetosæ, *Buckton*. Plate LXII, figs. 5—7.

A. molluginis, Koch ?

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·090 × 0·050	2·27 × 1·27.
Length of antennæ	0·060	0·54.
,, cornicles	0·020	0·50.

Globose or oblong, shining dark brown or nearly black. Head broad, eyes reddish brown; antennæ ochreous with black tips. Abdomen domed with marginal spines. Legs hairy, bright ochreous, with black femoral tips on the third pair; tarsi black.

Pupa.

Head broad, abdomen slaty grey, velvet-like, deeply ringed. Wing-cases and thorax more or less green.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·230	5·84.
Size of body	0·090×0·040	2·27×1·01.
Length of antennæ	0·070	1·77.
„ cornicles	0·015	0·38.

Head and thorax shining black. The latter with two strong spines. Antennæ and legs as in the larva. Abdomen pointed, shining, dark olive green, with obscure transverse bars, spinose. Cornicles black. Cauda moderately long, olive green. Wings short, pale, iridescent, finely veined with yellow; insertions and stigma grey. Rostrum reaches to the third coxæ.

This species has a great resemblance to *A. Jacobææ*, but is larger and more shining. The head and thorax of the winged insect are much less developed in width, and the wing-veins are not so coarse and black.

Taken abundantly on *Rumex acetosa* from June to September. In autumn the larva becomes more linear in form, and decidedly greener in hue.

APHIS RUMICIS, *Linn.* Plate LXIII and LXIV.

Aphis rumicis, Fabr., Schr., Kalt., Walk., Koch, Pass.
— *fabæ*, Kirby and Spence, Curt.
— *genistæ*, Scop., Fonsc., Kalt., Koch.
— *ulicis*, Fabr?

Aphis euphorbiæ, Kalt. ?
— *dahliæ*, Sir O. Mosley.
Cinara rumicis, Mosley.
Rumicifex, Amyot.
Genistifex, Amyot.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·100×0·040	2·54×1·01.
Length of antennæ	0·040	1·01.
,, cornicles	0·010	0·25.

Globose. Head, thorax, and abdomen almost confluent. Eyes black. Antennæ somewhat variable in length. Body wholly black, sometimes shining, sometimes dull. Cornicles and tail black. The three middle antennal joints and the tibiæ obscurely ochreous.

The young are slaty grey, but subsequently they obtain a blackish velvet-like coat. Adult variable as to size.

Pupa.

Larger than the larva. Head and thorax slaty grey. Meso- and post-thorax conspicuously divided into lobes. Wing-cases black. Abdomen black with four strongly marked white downy spots, ranged on each side, followed by a break near the insertion of the cornicles. Two small white patches occur on each side near the tail, and also an exterior row of dots on each lateral edge. These squarish markings give the insect a kind of chess-board or chequered appearance. Legs much like those of the larva.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·130	3·30.
Size of body	0·080×0·035	2·02×0·8.
Length of antennæ	0·060	1·54.
,, cornicles	0·010	0·25.

Wholly black, very shining. Some specimens are slightly ferruginous brown. Antennæ short, stout, black at the tips; the middle joints and also the tibia, amber-yellow. Wings short and coarse; insertions yellow; costa and stigma greenish; other veins brown.

When the imago issues from the pupa the colour is brown, and the cornicles and antennæ are green. The hue soon, however, changes to dusky, and then shining black. Koch does not notice the white flecks on the pupæ, but Kaltenbach points out that in this respect the pupæ of *A. rumicis* are like the pupæ of *Aphis papaveris* and others.

This Aphis greatly varies in its choice of food. Its common food-plant is the curled dock *Rumex crispus*, and the thistle *Carduus lanceolatus*, the flower stalks of which are often hidden by the congregated thousands. The stalks of the broad bean also are very liable to be similarly encrusted by them, and then both the garden and field crops are totally destroyed. In 1854 its ravages in the turnip fields of Yorkshire were very marked, many hundred acres being utterly ruined.

Rustics give the name of the "collier" or the "black dolphin" to this Aphis, as they do the "green dolphin" to the pea Aphis; and Kirby and Spence suggested the name Phthiriasis for the diseased condition it brings on vegetation.

The oviparous female is very like the other apterous form. According to Walker it very generally chooses the common furze for hibernation. In the year 1846 these bushes were profusely dotted with her eggs. The male is black and winged.

The humble-bee, *Bombus*, is said to visit this species of Aphis for the sake of its secretions.*

The elegant pale green brushes composing the flower heads of the garden rhubarb, a plant of the same natural family as our dock, is often made unsightly by

* *Vide* "Migrations of Aphides," Walk., 'Ann. Nat. Hist.,' 1847, xli, p. 373.

a plentiful sprinkling of this black Aphis. It also infests the shoots of the ivy, and once in early March I found a small company sheltered within a curled leaf of the holly, where probably the queen Aphis or "stem-mother" had passed the winter. To these food-plants may be added *Polygonum persicaria*, *Pucidanum palustre*, *Borago officinalis*, *Digitalis purpurea*, garden marigold, and other cultivated plants. I have without success attempted to transfer the Aphides feeding on the foxglove to the common broom. I enclosed a flower-head of the former, crowded with *A. rumicis*, within a fine netted bag, and tied the same over a growing shoot of the latter. The Aphides were in the apterous and winged states. They refused to accommodate themselves to the new food, and soon died, although the broom is often much infested with a small variety of *Aphis rumicis*.

The almost omnivorous character of this insect has misled some authors into making new species. Walker gives twenty-three synonyms, and probably there are more.

Mr. Wallace seems to assign the first steps in the acquisition of colour to the male, and ascribes this change to some unknown law, dependant upon the greater presumed activity of that sex. Climate and character of food possibly have their influence in some way affecting both size and form. Such influences make a decided opinion very difficult as to whether certain Aphis forms uniformly found on different plants are specifically one or not. Thus, variations of *A. rumicis* occur on the furze, the broom,the euonymus, and the evergreen oak. They have all distinct names, according to some authors. *Aphis ulicis* is shining black and deeply pitted. *Aphis genistæ* is dull black with legs wholly black. *Aphis euonymi*, according to some, is dull black with legs wholly luteous.

The winged forms of these insects, however, cannot be distinguished from the winged forms of *A. rumicis*.

Fortunately this destructive species is kept much in check by the attacks of several *Ichneumonidæ*. One of these parasites is a minute but showy little insect belonging to the *Chalcididæ*, which differs somewhat in its habits from other Aphidii, in that it undergoes its metamorphosis within a curious silken tent, which the larva constructs after it has become full fed within the body of the Aphis.

The apterous worm-like grub of this Chalcid perforates the hard Aphis-shell at the belly, and then commences to spin a double-walled tent between the space comprised by the six legs of the insect. The floor of this tent is attached to the leaf on which the Aphis originally fed, the web being carried up to its skin which thus partially forms the roof. Subsequently the edge of the web is reflected downwards so as to form a chamber with double walls, a considerable space being found between them.

The spinning process may be conveniently seen by fixing an infected Aphis on a strip of glass. After the grub of the Coryna has fairly commenced to spin, the operation may be viewed from the under side through a low power of the microscope.

In this cocoon the change into pupa takes place, and after an interval of about nine days the winged Chalcid eats its way out of the silken envelope. On the authority of the late Mr. Walker this insect belongs to the genus *Coruna* (*sic*) of Curtis.

It is interesting to find that there is a controlling economy with reference to this insect very similar to that we have before described in the Ephedrus of the wheat Aphis. Occasionally the silken tent will be found tenanted by several shining black pupæ, which have resulted from the metamorphosis of some larval parasites which, between themselves, have consumed the grub of the Coryna before it could attain its imago state.

In some cases it appears that the Coryna (possibly a different species) does not complete its growth until a

much later period. Here, very curiously, the Aphis passes into its winged condition before its death is effected, the parts consumed apparently being such as are not immediately concerned in the external metamorphosis of the Aphis.

Not unfrequently the empty skin of the winged Aphis may be seen mounted on the summit of one of these parasitic cocoons.

All the species of Coryna do not make constructions similar to the above. In the middle of July I bred several specimens of a closely allied species from the indurated pupæ of *Siphonophora rosæ*. They emerged from holes pierced in the backs of the Aphides. These insects had orange legs. Mr. Walker referred them to the genus Coryna, but, as *Coruna clavata* (*sic*) of Curtis has twelve antennal joints in the female and thirteen joints in the male, in this respect they differ from my insect, and thus I conclude they cannot be specifically identical. Provisionally I will name the former parasite *Coryna dubia*,* Buckton.

The cocoons of both these parasites are figured on Plate LXIV.

APHIS LABURNI, *Kalt.*, *Koch*, *Pass.* Plate LXV, figs. 1—3.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·080×0·045	2·02×1·13.
Length of antennæ	0·050	1·27.
,, cornicles	0·015	0·38.

Wholly black with the exception of the third, fourth, and fifth antennal joints, and the upper halves of the femora and tibiæ, all of which are yellowish. Cauda

* Body bright brassy green. Antennæ pilose, with ten joints, including the minute basal joint; second joint longest. Eyes dark brown. Palpii nconspicuous. Legs greenish, with a single spur on each tibia. Wings pilose, iridescent, with a single costal cell. Cubital vein dilated into a button, as in *C. clavata*.

about half the length of the cornicles. The abdomen is dusted with a white mealy powder.

Pupa.

Rather small. Head very broad. Wing-cases pale green. Abdomen much ringed. Carination marked. Legs pale.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wing	0·240	6·09.
Size of body	0·075 × 0·030	1·89 × 0·76.
Length of antennæ	0·050	1·27.
,, cornicles	0·012	0·30.

Wholly black, somewhat shining. Two strong spines on the prothorax. Legs rather short, upper part of the femora and the tibiæ ferruginous. Wings very delicate. Insertions, cubitus, and stigma pale yellow; other veins pale brown. Eyes black. Three obscure spots on the abdomen.

Taken in July and August whilst feeding on the pods of the laburnum, *Cytisus laburnum*.

APHIS ATRIPLICIS, *Linn.* Plate LXV, figs. 4—7.

Aphis chenopodii, Schr., Kalt.
— *atriplicis*, Pass.?

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·070 × 0·040	1·77 × 1·01.
Length of antennæ	0·040	1·01.
,, cornicles	0·010	0·25.

Larvæ coloured of all shades, from green through olive to black, may be seen feeding at the same time on the same plant of the common orache, *Atriplex patula*.

Var. 1. Body black, with orange tibiæ. Abdomen irregularly spotted with white downy patches.

Var. 2. Wholly black.

Var. 3. Body green, with white bands; legs ochreous or whitish; hind femora, cornicles, and tail sooty-grey.

Var. 4. Head and thorax black; abdomen green, with white spots; apical rings ferruginous; legs pale.

Pupa.

Very variable as to size. Black, marked with white patches, much as in variety 2. Thorax and wing-cases dark olive.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·260	6·60.
Size of body	0·095 × 0·040	2·39 × 1·01.
Length of antennæ	0·040	1·01.
,, cornicles	0·010	0·25.

Body considerably larger than in the wingless form. Dark olive. Antennæ black except third joint, which is ochreous. Abdomen very large, obscurely barred with black, sides spotted. Base of cornicles green, the other part black. Hind femora and tips of other femora black, rest of the legs ochreous. Wings broad; cubitus and stigma smoky; veins brown. Haslemere, middle of July.

Last December I learned from my liberal correspondent, M. Lichtenstein, that *A. atriplicis* is a very common species during the summer at Montpellier, on *Chenopodium*, and in autumn on *Atriplex latifolia*, to which plant possibly it migrates. From him I have received living examples of the perfect female and the male, both of which are apterous. They are much smaller than any of the viviparous forms, and the male,

though by no means less highly organized, is the most diminutive of all.

Apterous male.

	Inch.	Millimètres.
Size of body	0·045×0·012	1·13×0·30

Greenish yellow. Head and thorax very broad. Head and bands on the pro- and post-thorax black. Antennæ as long as the body; third joint tuberculate, seventh joint serrated. Abdomen long-oval; carina with three or four black spots; dorsum with three longitudinal rows of the same colour, widening towards the tail into bands. Legs, antennæ, and cornicles smoky-grey. Genito-anal apparatus largely developed.

The whole insect is more slim and delicate in form than any of the others.

Apterous oviparous female.

	Inch.	Millimètres.
Size of body	0·060×0·035	1·52×0·88

Long-oval, smooth, glaucous green. Head with two occipital smoky spots. Eyes, antennæ, legs, and cornicles smoky-grey. Cauda obtuse. Several specimens contained three large eggs.

On searching some leaves of *Atriplex*, which were closely rolled up in the direction of their length, I found a *débris* of empty skins—old exuviæ, perhaps to the number of thirty. Amidst this mass two females were resting. They had already laid three eggs, one of which was black, and the others yellow, the last obviously very recently deposited.

The position of these eggs within dry leaves suggests the probability, that long after the latter have been shed they are carried about, with their contents, by the winds into other spots. Yet, if this be so, many individuals after hatching out must never arrive at maturity, from the want of necessary food.

It is not impossible that hereafter we shall discover that some of the root-feeding Aphides are dimorphs of aërial species.

Kaltenbach says *Aphis atriplicis*, Linn., is not *A. atriplicis* of Fabr.

APHIS SEDI, *Kalt.*, *Koch.* Plate LXVI, figs. 1, 2.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·060 × 0·030	1·54 × 0·76.
Length of antennæ	0·045	1·13.
„ cornicles	0·010	0·25.

Very small. Oval. Segments deeply marked, dull blackish green, with a greyish or glaucous bloom. Antennæ and legs pale yellow or else whitish. Cornicles and tail black; the last organ thick and obtuse at the point.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·190	4·81.
Size of body	0·050 × 0·020	1·27 × 0·50.
Length of antennæ	0·040	1·01.
„ cornicles	0·007	0·17.

Very small. Head and thorax shining black. Abdomen very dark shining green. Legs yellow. Cornicles and tail black; the last blunt. Belly below dark green. Rostrum pale green, with black tip, reaching to the third coxæ. Wings short; membrane dark and very iridescent; finely punctured. Stigma dark; veins black; last fork of cubital vein short; insertions yellowish.

This active little Aphis was taken at Haslemere in August, crowding the flower-stalks of several kinds of

garden sedum. It does not seem to be a very common species.

APHIS PAPAVERIS, *Fabr.*, *Schr.*, *Kalt.* Plate LXVI, figs. 3—5.

Koch, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·060 × 0·040	1·54 × 1·01.
Length of antennæ	0·040	1·01.
„ cornicles	0·010	0·25.

Small, rather globose, dull olive green under a lens, but nearly black to the naked eye. Abdomen broad behind. Tail very obtuse. Prothorax and sides furnished with small spines. Antennæ and legs very pale greenish, almost white. The new-born young are pale green, with red eyes and ferruginous red stains between the cornicles.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·300	7·62.
Size of body	0·080 × 0·040	2·02 × 1·01.
Length of antennæ	0·060	1·54.
„ cornicles	0·012	0·30.

Considerably larger than the apterous female. Body robust. Head small. Eyes red. Thorax broad, black. Abdomen olive green, with three or more dark lateral spots on each side, and several obscure transverse bands. Cornicles and tail black. Legs very pale, but the points of the femora and of the tibia dark; tarsi dark. Rostrum reaches a little beyond the second coxæ. Wings large, rounded at the tips; cubitus and stigma yellowish green; veins fine and greenish brown.

Passerini says the pupæ are spotted with white on the dorsum. Kaltenbach mentions many plants which are infested by this Aphis. The specimens figured on the above plate were taken late in July from the red poppy, *Papaver rhœas*.

Passerini, I think justly remarks, with reference to this species, "Valde suspicor hanc speciem, sæpe ab auctoribus cum sequente (*A. rumicis*) fuisse confusam. Walkerius perperam, ut mihi videtur, cum *A. rumices* conjunxit, et plantas permultas enumerat in quibus vivit."

Aphis cardui, *Linn.*, *Kalt.*, *Koch* (?). Plate LXVII.

Aphis chrysanthemi, Koch.
— *leucanthemi*, Scop. (?)

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·085 × 0·055	2·14 × 1·39.
Length of antennæ	0·060	1·52.
,, cornicles	0·020	0·50.

Globose, very shining, rich reddish brown, with interrupted black bands on the prothorax and thorax. Two depressions on the head. Dorsum with a large black spot more or less covering it. Dark bands on the abdominal apical segments. Antennæ with dark tips. Cornicles black. Cauda black, small, obtuse, and pilose. Legs ochreous, with black tibial points and femora. Under side brown, with black rostrum reaching beyond the third coxæ, in length about three fourths of the body.

Taken at Haslemere in August on the thistle, *Carduus lanceolatus*.

The young insects are green, with a large dark blotch on the dorsum. They have somewhat of a mealy coat. This Aphis varies much in colour; some are of a bright golden yellow, with the black patch on the

dorsum more or less encroaching on the yellow, so as sometimes to leave only the lateral parts bright. Under side amber, with tip of the rostrum, the coxæ, and the anal plate black.

Pupa.

Bright green, with yellow carination. Nectaries black. Wing-cases pale green.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·280	7·10.
Size of body	0·080 × 0·040	2·02 × 1·01.
Length of antennæ	0·070	1·77.
,, cornicles	0·020	0·50.

Dark olive green or black, shining. Dorsal spot large, irregular, and black, several obscure spots near the carina. Antennæ rather long, third joint serrated. Cornicles long, straight, and black. Tail small and obtuse. Legs dark ochreous, with black femoral and tibial points. Rostrum long, reaching beyond the third coxæ. Wings brownish, with yellow insertions; stigma pale; veins brown.

Under side fine green, with three large black patches on each side. Anal plate black.

Aphis cardui of Pass. does not appear to be the same insect as the above. On the other hand, I think it probable that *Aphis lata* found by Mr. Hardy on Senecio, and described by Mr. Walker ('Zoologist,' vol. viii, Ap. ciii), and *A. Jacobææ* (Appendix civ, of the same), are the same insects.

Feeds on *Cnicus nutans*, *Carduus lanceolatus*, *Anthemis maritima*, and other plants.

The Aphis is much destroyed by an Aphidius. Nineteen insects were ichneumoned on a small sprig of Anthemis only one and a half inches long.

APHIS INSTABILIS, *Buckton*. Plate LXVIII, figs. 1—5.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·050 × 0·025	1·27 × 0·62.
Length of antennæ	0·030	0·76.
,, cornicles	0·010	0·25.

Exceedingly variable as to colour, often pale ochreous, yellow, green, or ferruginous red. Oblong. Head very broad. Eyes brown. Dorsum much furrowed. Cornicles very pale. Cauda small, pilose. Legs short, stout, ashy grey. Two small tubercles occur on the antipenultimate ring.

Pupa.

Var. 1.—Wholly pale yellow. Thorax deeply furrowed. Nectaries pale, with black tips. Cauda black, obtuse. Wing-cases black. Legs sooty-grey. Abdomen slightly hoary, from a grey covering of white powder.

Var. 2.—Head and thorax ferruginous. Abdomen bright green. Legs very pale yellow. Wing-cases luteous.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·260	6·60.
Size of body	0·080 × 0·030	2·02 × 0·76.
Length of antennæ	0·080	2·02.
,, cornicles	0·010	0·25.

On first emerging from the pupa, pale green. Head, thorax, and band on the prothorax black. Eyes red. Abdomen domed, with four pale spots on each carina. Cornicles and tail pale yellow or green. More mature specimens are ferruginous red. Head, thorax, and the greater part of the abdomen black. Cornicles and tail black. Legs reddish, with black femoral and

tibial points. Wings large; cubitus, stigma, and veins yellowish green.

This Aphis, when young, changes its colour, chameleon-like, almost every five minutes, so much so as to render it difficult to copy it with the brush. Great numbers were taken on the feverfew, *Pyrethrum inodorum*, towards the end of July during thundery weather. At that time the pupæ were fast splitting their skins and giving birth to the bright green imagos. This insect also infests *Epilobium montanum* and *E. parviflorum*. Specimens were obligingly sent to me from Pembroke by Mr. Charles Barrett.

APHIS SAMBUCARIA, *Pass.* Plate LXVIII, figs. 6, 7.

Apterous viviparous female.

Pale ochreous. Antennæ equal in length to one half of the body. Abdomen punctured, mucronate at the margin. Cornicles black, not much longer than thick. Cauda black, very small; posterior anal ring with two black dots; two little horns behind the nectaries. Rostrum reaches to the middle coxæ.

Winged viviparous female.

Antennæ shorter than the body. Head, prothorax, and thorax black. Abdomen green, with thin fuscous transverse dorsal lines; sometimes these are wanting. Cornicles black. Cauda small, pilose. Wing glabrous. Rostrum reaches to the third coxæ.

As I have not met with these two forms of this insect, I have in the above used Passerini's descriptions.

Winged male.

	Inch.	Millimètres.
Expanse of wings	0·240	6·09.
Size of body	0·065 × 0·020	1·64 × 0·50.
Length of antennæ	0·070	1·77.
„ cornicles	0 010	0·25.

Colour bright green. Head and thorax black; prothorax with a dark transverse band. Eyes red, large, and prominent. Rostrum well-developed, reaching to the second coxæ. Antennæ long, the third joint green and tuberculate. Abdomen small, equal only to the head and thorax taken together; stained at the sides, and at the apex with ferruginous red; a row of short transverse dorsal lines, and a row of small black dots in each side. Cornicles long, thin, and black. Cauda very small, almost obsolete. Legs short, green, with black femoral and tibial tips. Wings ample and broad, insertions greenish, cubitus and stigma sooty grey, other veins black.

	Inch.	Millimètres.
Expanse of wings	0·260	6·60.
Size of body	0·070×0·020	1·77×0·50.
Length of antennæ	0·080	2·02.
,, cornicles	0·008	0·20.

Apterous oviparous female.

	Inch.	Millimètres.
Size of body	0·070×0·035	1·77×0·88.
Length of antennæ	0·030	0·76.
,, cornicles	0.005	0·12.

Ochreous yellow. Head broad, eyes red, antennæ rather short and brown. Abdomen oval, smooth, suffused with rusty red. Cornicles short, black. Last abdominal ring with two brown genito-anal papillæ. Cauda small and green. Legs stout, brown; the hind tibiæ much flattened. Rostrum does not reach to the second coxæ.

By dissection two large eggs were obtained, but some individuals contain four.

Taken in moderate number during October at Wanstead, feeding under the leaves of the elder-tree, *Sambucus nigra*. I believe this is the first notice of its occurrence in Britain. The imperfectly sexed forms had disappeared from the elder for that year.

APHIS PYRI, *Boyer de Fonscolombe.* Plate LXIX.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·065×0·045	1·64×1·13.
Length of antennæ	0·040	1·01.
,, cornicles	0·010	0·25.

Very variable in form and colour according to age. Immature specimens are elongated, oval, olive green, with a ferruginous stain at the base of the abdomen and nectaries. Abdominal edges with minute spines and tufts of hair. Head broad, eyes red, antennæ and cornicles warm olive brown. Legs ochreous green. Tail conspicuous.

Adult specimens are globose, very broad between the nectaries, slightly mealy. By the naked eye sooty black, but under a lens, with a good light, deep, ginger-brown or olive (*Isabellgelb*, Koch). Abdomen with pitchy stains. Legs and antennæ short and brown. Eyes and cornicles black. Tail almost obsolete. Under-side greyish black. Two strong spines in the prothorax. The whole insect is finely hirsute. It has some resemblance to *Aphis Jacobææ*.

Pupa.

Pale salmon colour, with reddish stainings on the dorsum. Head broad with two brown patches on the occiput.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·200	5·08.
Size of body	0·065×0·025	1·64×0·62.
Length of antennæ	0·050	1·27.
,, cornicles	0·007	0·17.

Rather small; warm sienna-brown. Head, thoracic

lobes, scutellum, several bands on the dorsum, and three spots on each lateral edge, black. Antennæ and cornicles black. Legs ginger-yellow. Wings hyaline, with pale grey stigma, and yellow-brown insertions, cubitus, and veins.

Numerous on the crab apple at Blackheath during June. This Aphis attacks the leaves, rolls and distorts them, and causes them to change to a yellow or fine red colour.

The above described *Aphis pyri* of Fonsc. is not to be confounded with *A. pyri* of Koch, which, nevertheless, he found infesting the crab-apple.

APHIS BELLIS, *Buckton.* Plate LXIX, bis, figs. 1, 2, 4.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·070×0·035	1·770×0·088.
Length of antennæ	0·030	0·076.
,, cornicles	0·005	0·127.

Oval, flat, pale green. Head brownish, front convex and hairy. Abdomen carinated, with seven pore-marks ranged on each side. Legs and antennæ very short. Cauda yellow, small, and hairy. Eyes black.

Pupa.

More rufous than the larva, with a reddish stain down the dorsum. Head, edges of the wing-cases, femora, and tarsi smoky brown.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·200	5·080.
Size of body	0·075×0·030	1·890×0·076.
Length of antennæ	0·040	1·016.
,, cornicles	0·005	0·127.

Head and thorax black. Abdomen oval, ferruginous red, with seven or more black dorsal bands and three lateral spots. Nectaries and tail very small and black. Legs reddish, with black femora and tarsi. Antennæ and eyes black. Wings very broad, with rounded tips. Insertions yellow, with smoky-grey cubitus and stigma. Veining black and somewhat coarse. Post-costal nervure of lower wing much curved.

The imago of this species has some resemblance to *Aphis amygdali*. The larval form, however, is quite dissimilar. Specimens were kindly forwarded to me from Aberdeen, in September, by Prof. James Trail, who found them sparingly on the capitula in the axils of the ray-florets of the daisy, *Bellis perennis*.

APHIS SAMBUCI, *Linn.* Plate LXX, figs. 1—4.

Fab., Schr., Kalt., Walk., Koch, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·130×0·080	3·30×2·02.
Length of antennæ	0·080	2·02.
,, cornicles	0·030	0·76.

Large. Globose, wholly dull black, with a greenish shade. Abdomen domed. Cornicles long and straight. Some old specimens have a tendency to show dull grey bars on the abdomen, like *A. rumicis*. The young are bright green, with large heads and small short cornicles. They speedily change colour as they grow, their passage into black being often effected in twenty-four hours. Their rostra are very long and stout, extending to three fourths the length of the body.

Pupa.

These are coloured very much like the larvæ, and have greyish-green wing-cases.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·310	7·87.
Size of body	0·080 × 0·035	2·02 × 0·88.
Length of antennæ	0·060	1·52.
„ cornicles	0·020	0·50.

Wholly black. Head and thorax stout. Eyes reddish. Abdomen carinated and ringed. Legs black, except the femora, which are ferruginous. Wings rather coarse. Stigma grey and veins black.

During the months of June and July very numerous on the soft stalks of the elder-tree, *Sambucus nigra*. They form thick slaty-black encrustations, which are composed of apterous and winged females, interspersed with young and pupæ, and packed so close together that the elder-stalks often cannot be distinguished. These swarms are largely visited by ants, eight or ten of which may be seen on every twig of three or four inches length, coursing backwards and forwards over the backs of the Aphides, and watching for the clear drops of sweet secretion which exude from both the anus and the nectaries.

The ants sometimes drum with their antennæ on the sides of the Aphides, which answer this solicitous action by yielding up their sweets. If no ants are at hand to remove the liquid, the Aphides violently expel the drops to a considerable distance, and thus they bedew the surfaces of the leaves below.

The relations between the ants and Aphides are so remarkable that a sketch of what Huber and others have observed will be inserted in the next volume of this Monograph, where we shall treat of those special Aphides which, up to the present time, have nowhere been found otherwise than imprisoned in ants' nests. On Plate LXX will be found a representation of an ant taking the honey-dew from *Aphis sambucaria*. It is remarkable (and no explanation can at present be given) that *A. sambuci* does not occur in the autumn, and *A. sambucaria* does not occur in summer.

APHIS OPIMA, *Buckton.* Plate LXXI.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·090×0·050	2·27×1·27.
Length of antennæ	0·060	1·52.
„ cornicles	0·010	0·25.

Rather large. Globose, glaucous green, blotched and stained with darker green, transparent. Head broad, eyes reddish brown. Thorax and prothorax nearly confluent. Abdomen domed. Antennæ and legs pale green. Cornicles straight and brown. Tail very obtuse and inconspicuous.

After a few moultings of skin a quantity of brown pigment is deposited in spots on the back and sides. This brown colour extends to the bases of the antennæ, the coxæ, and the tarsi. It encroaches more and more on the green, until the insect by age finally becomes almost wholly brown or shining black. The legs and the middle antennal joints alone are left of a fine amber-yellow.

The underside is green, with black anal and vaginal plates. Rostrum tipped with brown and reaches to the second coxæ.

This insect becomes bloated and distended from the quantity of sap it draws from the axils and leaf-stalks of the Cineraria, to which plant it does great injury. It appears even to poison the plants it attacks, for the leaves droop and rot off in a manner far more marked than could be occasioned by the mere amount of sap abstracted.

A row of pores, distinct from the stigmata, occur down each side of the back. When the insect is irritated by a bristle or otherwise, bright drops exude from these as well as from the nectaries. These drops speedily crystallise into a sugar-like mass.

The young are very active, and rove much up and

down the stems and leaves. Their semi-chitinous covering is marked by sutures, which cut up the back into apparent plates like the carapace of a crustacean. These young forms forcibly recall to mind the very curious dimorph of the Aphis of the maple, *Chitophorus aceris*, which will be afterwards described.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·220	5·58.
Size of body	0·060×0·030	1·52×0·76.
Length of antennæ	0·065	1·64.
,, cornicles	0·008	0·20.

Robust. Bright yellow. Eyes reddish. Thorax, band on prothorax, a double row of lateral spots, and two or more large dorsal bands, shining black. Antennæ, nectaries, femora, and tarsi also black. Underside wholly green. Insertions of wings yellow. Stigmata and veins greyish black. Cauda small and pilose. The winged form does not appear so plentifully as the apterous, and seems to occur late in the year. The only specimens I have taken were from greenhouses, from the end of October to November.

The larvæ are common at Haslemere, Chichester, and Wanstead, from the month of April.

Aphis myosotidis, *Koch, Pass.* Plate LXXII.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·070×0·035	1·77×0·88.
Length of antennæ	0·040	1·01.
,, cornicles	0·010	0·25.

Body long oval, bright green, finely stippled like shagreen, usually much distended with sap, and then it is slightly shining; if less distended the body is pitted

and carinated. Antennæ short. Cornicles green and very short. Body pilose and slightly tufted with bristles. Tail very small or none.

Pupa.

Inch.	Millimètres.
0·070 × 0·030	1·77 × 0·76

Uniformly shining green, or warm yellow, obscurely blotched with darker green.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·230	5·84.
Size of body	0·072 × 0·029	1·82 × 0·72.
Length of antennæ	0·050	1·27.
,, cornicles	0·010	0·25.

Pale green or yellow, slightly shining. Antennæ black, the third joint finely tuberculate. Head, band on the prothorax, thoracic lobes, and a broad, somewhat square spot on the dorsum, shining black. Abdomen with three fine crossbars above the anal rings, and four spots on each lateral edge. Legs yellow, longer than in the larva. Cornicles black and straight. Femora, tibial tips, and tarsi black. Wings moderate, rather pointed at the tips. Stigma pale grey, cubitus and other veins brown. Tail very small.

Found in considerable numbers on the everlasting flower, *Acroclynium roseum*, during June and July, at Haslemere. Koch found an insect feeding on a species of *Myosotis*, the description of which well accords with the above Aphis, and his figures are very like it also.

Early in August I found an Aphis in considerable number, located on *Senecio Jacobæa*, the winged form of which closely accorded with the insect above described. The wings, however, were less pointed at their apices, and the larvæ were globose and destitute of the fine stippled marks. Passerini says that *A.*

myosotidis feeds on the ragwort, and therefore it is probable that these two insects are identical.

Mr. Walker describes, but does not name, a like insect feeding on *Senecio vulgaris* in September. See Zool., vol. viii, Appendix cii, 1850.

APHIS AMYGDALI, *Fonscolombe*. Plate LXXIII, figs. 1—5.

Aphis persicæ, Fonsc.
— — Kalt., Walk., Koch, Pass.

With reluctance I have altered the specific name of this insect to avoid the confusion attending the fact that three different Aphides have been called *A. persicæ* viz. that of Sulzer (*Myzus*), that of Schrank (*Rhopalosiphum*), and the present insect of Boyer de Fonscolombe.

As the insect attacks the nectarine as well as the peach, I propose that it should be specifically named after the former tree.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·070 × 0·040	1·77 × 1·01.
Length of antennæ	0·040	1·01.
,, cornicles	0·010	0·25.

Globose, flat, ochreous, variegated with rich dark brown. Head, prothorax, and thorax, each with a band of brown. Eyes and antennæ brown. Dorsum marked with seven or more broad interrupted bars, some of which are confluent; sides with several large and other small spots. Cornicles short, brown except at their bases. Legs ochreous-yellow, with brown tarsi. Cauda inconspicuous or none.

Pupa.

Green, with ferruginous stains about the head and

the bases of the cornicles. Wing-cases pale green. Legs and antennæ pale brown.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·230	5·84.
Size of body	0·080×0·035	2·02×0·88.
Length of antennæ	0·080	2·02.
,, cornicles	0·012	0·30.

Rusty yellow. Head, thorax, antennæ, and band on the prothorax dark brown or black. Abdomen smooth, domed, with a row of small spots on each lateral edge, and a large brown spot covering the lower portion of the dorsum. Nectaries straight, rather thicker at their bases. Legs dark ochreous, with black femoral and tibial points. Wings broad and rounded; insertions and stigmata pale ochreous; veins fine and brown. The two anal rings show underneath four small papillæ, and one larger one, which last represents the tail.

The new-born young are entirely yellow, except that two broad brown spots mark the head, and five or six longitudinal minute dots show the incipient deposition of dark pigment on the abdomen. The occurrence of this pigment is very inconstant, being sparing in the younger individuals, but often in the older ones covering the whole insects, so as to make them appear black.

This Aphis is perhaps the chief insect-pest on our peach and nectarine trees, causing the leaves to curl and drop, so as finally to leave the branches bare, and leafless. In Italy this diseased state is known as "fillorissema del pesco." This Aphis, however, does not cause the fleshy degeneration and mouldiness of the foliage so commonly seen, which is the effect of the mycelium of the fungus *Exoaseus deformans* of Berkley.

The specimens figured were taken from many

hundreds congregated on a single twig of the peach tree in August. The apterous form occurs as early as April. Sometimes the swarms disappear for two or three months, and again appear in larger numbers late in the autumn.* These Aphides are much resorted to by ants.

Koch found his *Aphis persicæ* feeding on the sloe, and Mr. Walker considered that it migrated like the hop Aphis. I have taken the winged form on the tobacco plant, but the occurrence of winged females on any plant does not prove that it was bred there. *A. persicæ* of Fonsc. may be easily distinguished from *Myzus*, by the absence of frontal tubercles and the shortness of its nectaries.

Passerini identifies the *Puceron de pêches* of Morren with *Aphis rapæ* of Curtis, and proposes to call it *Rhopalosiphum persicæ*. This would still more complicate the synonomy, besides which the original name *dianthi* should be retained. The general form of *Aphis amygdali* is exceedingly bug-like.

It may be mentioned that *Hyalopterus pruni* also attacks the peach-tree.

Parasite on Aphis amygdali. Plate LXXIII, fig. 6.

Late in October I bred from the larvæ of this Aphis several small insects, which Mr. Walker concurred with me in calling *Cynipidæ*. I have been unable, even by the aid of others, to identify the species, and therefore provisionally I name it *Cynips atriceps*, and thus describe it:

Body wholly shining black. Antennæ pilose, with fourteen joints, each after the third slightly increasing in size, the last apical joint being the largest. Thorax robust. Abdomen semi-globose, the last ring furnished

* Examples of migration from one tree to another of a different species are multiplying. Lichtenstein has lately noticed such a habit in some Pemphiginæ.

with an obtuse ovipositor. Wings rounded, the upper wings having only one closed costal cell. Tibiæ armed with a strong spur; tarsi hairy and six-jointed. Parasitic on *Aphis amygdali*.

Aphidivorous Hemerobiidæ. Plate LXXIV.

Amongst the insects destructive to the family of Aphides should be noticed several species of the order Neuroptera, which in their winged condition are remarkable for their beauty. Some are also remarkable for their disgusting odour when handled. These four-winged flies, on account of the extreme brilliancy of their eyes, are commonly known as *golden eyes*. By Curtis the family Hemerobiidæ is divided into four genera, of which *Chrysopa* contains at least twelve British species, and *Hemerobia* about thirty. Of the former, perhaps *C. perla* and *C. abbreviata* are the best known. Their predatory habits have been noted by many early writers, amongst whom may be cited Reaumur, who calls the larvæ "*Leons des Pucerons*," partly from their ferocity, and partly from the formidable mandibles which garnish their mouths, and are somewhat similar to the jaws of the ant-lion *Formica leo*.

These Hemerobiidæ, or lace-flies, are nocturnal in their habits; they usually take wing during twilight, and are at night readily lured by a lighted candle. The winged female deposits her eggs, to the number of about thirty, on a single leaf, but she does not restrict herself to the use of any particular plant. Each egg is supported on the summit of a long bristle, the base of which is generally attached to the ribs of the leaf. It is believed that a glutinous spot is first deposited by the tail of the insect. By raising the apex of the abdomen this drop is drawn into a thread, upon the end of which the egg is expelled and fixed.

The empty egg-membranes, after the hatching of the larvæ, may often be found in a perforated condition.

The larvæ are very serviceable to the agriculturist, for they, like the *Syrphidæ*, are wonderfully voracious. They feed principally, but not exclusively, on Aphides; when this food fails they will attack and devour each other. The body is long and distinctly marked by segments. The head is armed with mandibles, which are not perforated, as Reaumur supposed, but grooved on their under surfaces, and the large maxillæ play within these grooves. The œsophagus appears to have no superior outlet, except at the orifices of these channels.

The larvæ of *Chrysopa* have the singular habit of decking themselves with the skins of their victims, piling them on their backs like trophies. Thus, Reaumur likens them to the skin of the Nemean lion worn by Hercules. The segments of some species of *Chrysopa* are furnished with peduncles, which end with strong bristles like hayforks. These retain the Aphis skins in their place, and allow a vast heap to be constructed which almost wholly conceals the larva. Notwithstanding this encumbrance the insect moves with much activity amongst the Aphis swarms, and the grey mass might well be taken for a piece of lichen.

When an Aphis is seized, it is held between the palpi and mandibles. It is pierced, rolled, and mumbled, until every trace of nutritive moisture is extracted. The head of the *Chrysopa* is then thrown back, and the Aphis skin carefully disposed amongst the rest of the heap, which moves about like a pile of dust. A friend remarks that the promptitude and fury shown in seizing its prey is best likened to the violent shake given by a terrier-dog or a weasel in its attack.

During the summer months the larva does not require more than fifteen days to arrive at its full growth. It then spins a cocoon, in which the inactive pupa passes the winter. In the early spring the

imago cuts a curious spiral slit or flap in the cocoon, through which the fly escapes.*

Reaumur figures one of his Aphis-lions as furnished with fasciculi of hair, and Frisch also thus represents *Chrysopa perla*. I conclude that my insect is of that species likewise.

The larva of *Hemerobius* is not unlike that of *Chrysopa*, and its voracity equally remarkable. A specimen was sent to me through the post, having been imprisoned without food for two days. This larva was gummed on a slip of glass and placed on the microscopic stage for drawing. Thus the limbs were incapable of motion for half an hour or more, yet subsequently, and in this constrained position it devoured three Aphides, one after another, as they were presented to its terrible jaws.

Dr. Bowerbank has written an interesting paper on the circulation of the blood in the wings of *Chrysopa perla*.† The neuration of the wings in his plate well accords with the veining of my figure.

Genus XI.—HYALOPTERUS,‡ *Koch*.

Vertex flat, frontal tubercles none.

Antennæ rather long, seven-jointed.

Cornicles very small, cylindrical, scarcely longer than thick.

Wings long and hyaline; veins slender.

Cauda small, pointed, and recurved.

Legs as in Aphis.

Body oval and rather attenuated, often, both in the larval and winged states, dusted with a white mealy

* Vide M. Audouin, as quoted in 'West. Introd.,' vol. ii, p. 48.

† 'Ent. Mag.,' vol. iv, p. 178.

‡ From *ὑάλινος*, glassy; *πτέρον*, a wing.

N.B. Occasional indications of frontal tubercles may be found; this character, therefore, must not be regarded as decisive.

coat or cotton-like down, under which the insects, in many cases, conceal themselves.

Some species of this genus are very destructive to vegetation, and during some seasons render our orchards unproductive.

The chief character to be observed in this genus, as contrasted with Aphis, is the shortness of the tail and nectaries, and the oval and often linear forms of the bodies.

HYALOPTERUS PRUNI, *Fabr.* Plate LXXV, figs. 1—3.

Aphis pruni, Fabr., De Geer, Schr., Reaum.
— — Kollar, Kalt., Walk.
— — *prunifex*, Amyot.
Hyalopterus pruni, Koch, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·085×0·042	2·14×1·06.
Length of antennæ	0·060	1·52.
„ cornicles	0·005	0·12.

Long oval; rather flat; pale green, with darker green mottling. Back usually has a darker dorsal stripe; more or less dusted with a white meal-like powder. Under side green. Eyes dark brown. Cornicles small, perhaps shorter than the cauda, which is green. Cornicles and tarsi black.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wing	0·240	6·09.
Size of body	0·075×0·027	1·89×0·67.
Length of antennæ	0·055	1·39.
„ cornicles	0·005	0·12.

Smaller and more linear than the larva. Bright

yellowish-green. Head broad, with flat front. Eyes red. Prothorax and three thoracic lobes darker green. From four to six triangular dorsal green marks ranged transversely. Cornicles green and very small. Tail yellow. Legs pale green. Wings hyaline and delicate, with yellow, insertions, stigma, and cubitus. Rostrum very short.

Infests many kinds of plums, both wild and cultivated, being common on *Prunus spinosa*, *P. insititia*, &c. It swarms also by thousands under the leaves of the peach and nectarine, producing thereby white hoary masses, which close the pores of the leaves and gums them up with a glutinous secretion.

Their companies often mix with those of *Myzus persicæ*.

Passerini says it also feeds on the grape-vine, *Vitis vinifera*. Kaltenbach remarks that he has in vain sought for the *Aphis vitis* of Scopoli, which is described as green and punctured, with a yellow stain behind the antennæ, and having a fuscous stain on the back. Walker suggests that this last insect may be *H. pruni*, of Fabr. and others.

De Geer found *H. pruni* on the apricot, *Prunus armeniaca*, and shortly describes both the winged male and the wingless female. In September he found an egg of this species covered with a woolly coat, and fixed in the neighbourhood of a leaf-bud.

HYALOPTERUS ARUNDINIS, *Fabr.* Plate LXXV, figs. 4, 5.

Aphis arundinis, Fabr., Kalt.
— *calamaphis*, Amyot.
Hyalopterus arundinis, Koch, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·070 × 0·030	1·77 × 0·76.

	Inch.	Millimètres.
Length of antennæ	0·055	1·39.
,, cornicles	0·005	0·12.

Small, linear, brilliant green, covered more or less with yellowish meal. One, or sometimes three, darker green stripes down the back. Antennæ and legs pale green. Tarsi smoky. Cornicles dark grey, and very small. Eyes black. Abdomen pointed. Cauda green or smoky-grey.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·240	6·09.
Size of body	0·090 × 0·035	2·27 × 0·88.
Length of antennæ	0·065	1·64.
,, cornicles	0·005	0·12.

Pale green. Head, prothorax, and thoracic lobes shining dark olive-green or olive-black. Abdomen oval, pointed behind; wholly green. Cornicles as in the larva. Tail minute, about as long as the cornicles. Wings delicately veined; insertions, cubitus, and stigma green; other veins darker. Legs green, with dark tarsi. The insect is more or less coated with meal.

The pupa is not unlike the apterous female.

Taken on the river-reeds near Bramber, Sussex, and on *Arundo phragmitis*, in the fens near Norwich. They sometimes are exceedingly numerous on the *upper surface* of the leaves, and powder them with their yellow dust.

In smaller numbers, they form small depressions on the leaf, within which they cluster. Walker considers that this species is identical with *H. pruni*, but says that it is not the insect he took from *Salsola kali*, to which he gave the name *Aphis arundinis*. I consider *H. arundinis* to be distinct from *H. pruni*, from which it differs both in size, in form, and habit. It is much

more active than the plum Aphis, which does not affect the upper sides of those leaves upon which it feeds. The winged form is somewhat solitary in its haunts.

HYALOPTERUS DILINEATUS, *Buckton*. Plate LXXVI.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·060 × 0·027	1·52 × 0·67.
Length of antennæ	0·025	0·62.
,, cornicles	0·002	0·05.

Small, oval, more linear than *H. pruni*. Body bright pale green, with two well-marked longitudinal, blotched, dark green lines down the dorsum. Head and thoracic region broad. Antennæ, cornicles, and legs pale green. Eyes brown. Rostrum short.

Sometimes numerous in July, at Haslemere and at Wanstead, feeding in company with *Siphonophora rosæ* on *Rosa centifolia*. At that time they are adult and full of embryos.

Variety *a*. More linear. Nectaries longer. Head, two thoracic spots, and two broad converging lines down the dorsum, dark brown. Cauda dark and hirsute.

Pupa.

Like the apterous female. Bright green and slightly mealy. Wing-cases with smoky tips. Eyes red.

Many specimens were kindly sent me by Mr. Thomas Hardy, from Alnwick, Northumberland. They were all feeding on the moss-rose at the end of May.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·280	7·8·10.
Size of body	0·070 × 0·030	1·77 × 0·76.
Length of antennæ	0·060	1·52.
,, cornicles	0·007	0·17.

Pale green. Head, thoracic lobes, and scutellum dark brown or black. Antennæ rather long, and partly tuberculate. Abdomen fusiform, shining, with obscure greenish fascia. Nectaries small, rather thicker at their bases. Cauda rather long, acuminate. Legs as in apterous forms. Stemmata distinct. Wings ample, membrane delicate and iridescent; insertions yellowish; veins dark; stigma grey.

Bred from the pupæ at the end of May.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·045 × 0·025	1·13 × 0·62.
Length of antennæ	0·020	0·50
,, cornicles	0·007	0·17

Small, broad oval, colour ochreous-brown, carina paler. Vertex very prominent. Head broad. Eyes red. Cornicles and legs darker brown.

Taken on a dry rose leaf December 8th. On the previous night the thermometer marked 23° Fahr.

Whilst under the microscope this insect commenced to lay her eggs, two in number, of a yellow colour, which speedily darkened to a shining black.

They measured 0·020 inch in their long diameters, that is, nearly half the length of the parent Aphis.

HYALOPTERUS TRIRHODA, *Walk.* Plate LXXVII, figs. 1—4.

Aphis trirhoda, Walker.
Hyalopterus aquilegiæ, Koch.
— *trirhoda*, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·060 × 0·032	1·52 × 0·81.
Length of antennæ	0·035	0·88.
,, cornicles	0·005	0·12.

Body slightly mealy, wholly yellowish green; oval, smooth and shining. Eyes reddish brown. Cornicles small and cylindrical. Cauda yellow. Tibial tips and tarsi brown.

Pupa.

Not unlike the larva. Thoracic lobes yellow and prominent. Wing-cases olive-green. Stemmata evident under the integument.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·260	6·60.
Size of body	0·070×0·025	1·77×0·62.
Length of antennæ	0·065	1·64.
,, cornicles	0·005	0·12.

Stout. Head broad and black. Antennæ rather long, third joint the longest, and either serrated or strongly tuberculate. Prothorax, thoracic lobes, scutellum, and a semicircular streak on the first abdominal segment black; also a broad irregular patch on the dorsum, black. Femoral and tibial tips, and also the tarsi, black. The rest of the insect green, and without any mealy covering. Wings ample and rounded; insertions and cubitus yellow; stigma grey. Like others of this genus the rostrum is very short, and does not reach to the second coxa. Some specimens have dark lateral abdominal spots.

Found in companies of thirty and upwards on the leaves of the common columbine, *Aquilegia vulgaris*, from June to September. Mr. Walker first noticed it feeding on the rose in May, from which, he states, it migrates to the columbine.

On account of priority of discovery, it should retain the name Mr. Walker originally gave it, and therefore I restore it.

From its rounded wings and serrated antennæ, this insect somewhat departs from the type of its genus.

HYALOPTERUS MELANOCEPHALUS, *Buckton*. Plate LXXVII, figs. 5—7.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·065×0·025	1·64×0·62.
Length of antennæ	0·030	0·76.
,, cornicles	0·002	0·05.

Long oval. Head broad, convex, tufted with hair. Smoky-black or grey. Eyes black. Colour of the body buffy white, or very pale green. Abdomen smooth, scarcely marked by rings, but these are distinct at the apical portion. Antennæ white, spotted at the joints. Cornicles and cauda very small, black. Legs white, with sooty knees and tarsi. Rostrum rather long for this genus. The whole insect is plentifully covered with mealy powder.

Pupa.

Coloured like the larva, but the thorax is paler. Points of the wing-cases sooty-grey.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·100	2·54.
Size of body	0·050×0·020	1·27×0·50.
Length of antennæ	0·040	1·01.
,, cornicles	0·002	0·05.

Small, ashy green, slightly mealy. Head, prothorax, and thorax dull black. Abdomen large in proportion to the rest of the body, pale greyish-green, without bands or punctures. Cornicles and cauda very small and black. Wings with greyish stigmata and cubitus. Veins rather coarse and brownish-black. The membrane finely stipled. Legs pale greenish. Antennæ fine and blackish.

Found at Haslemere and at Brandon, near Norwich, crowding within the capsules of *Silene inflata*. It also forms curious distortions and bunches at the summit of the plant, which, when opened, show an abundance of loose woolly matter within.

This Aphis appears in July and August.

In several particulars it departs somewhat from the type of *Hyalopterus*.

Amongst the specimens of Aphides mounted by Mr. Walker and submitted to me, I find an Aphis unnamed, which, from the fact that it was found feeding on the cotton-grass, I have no doubt is the insect described in MS. by Haliday, and afterwards by Walker as *Aphis eriophori*. It appears to belong to the genus Hyalopterus, and as it is somewhat marked in form, I add it to this list of Aphides, although I have not seen it alive, and therefore I cannot figure it.

HYALOPTERUS ERIOPHORI, *Haliday*.

APHIS ERIOPHORI, *Walk*.

	Inch.
Size of body . . .	0·100 × 0·040.

Body hairy, long oval, lead-grey, with a white floccus at the tip of the abdomen. Antennæ about two fifths of the length of the body. Cornicles moderately long. Legs rather short. The winged form unknown.

Taken abundantly on *Eriophorum vaginatum*, at Sally Gap, Wicklow Mountains, Ireland, in August, at more than 1600 feet above sea-level.*

APHIDIVOROUS SYRPHIDÆ.

Although much has been written, and many schemes have been recommended for the extermination of Aphides from our crops, it is very certain that the

* Vide 'Ann. Nat. Hist.,' series ii, p. 46, vol. ii.

natural checks upon the increase of the last insect must prove far more efficacious than any that can be devised by the economist.

Some of the most familiar flies of our summer belong to the family Syrphidæ. They possess two wings, and hover above our heads in the sunny spots, between the branches of the trees; and whilst poising themselves give forth either a continuous hum, or a shriller note, according to the size or the species of the insect. From time to time they dart with wonderful rapidity from their favourite spot, and almost immediately return to it to resume their humming note.*

This hovering has been noticed by De Geer; and doubtless the action is purely one of pleasure to the insect.

Curtis mentions the remarkable circumstance that the males alone practise these gyrations; at least, he found that out of the numerous specimens he captured whilst so employed, he failed to identify a single female.

The family Syrphus is comprised in the order Diptera, and is divided into numerous genera, amongst which are Scæva and Cheilosia, which alone contain upwards of fifty species. Their mouth-parts are highly organised, and the neuration of their wings is more elaborate than we find in most Muscidæ.

Of the Aphidivorous forms, *Scæva pyrastri*, *S. ribesii*, *S. balteata*, and *Cheilosia scripta* may be cited as most common.

The larvæ of the Syrphidæ are apodous, blind, and leech-like in form. They move but slowly from place to place by means of the minute hooklets with which the posterior rings of their bodies are furnished.

* The musical hum of these insects has been traced by Prof. Westwood to a hairy filamentous organ connected with the thoracic organs of respiration. This apparatus is situated at a little distance from the base of the balancer, but how such an organ is vibrated does not clearly appear.—(Westwood's 'Introd. to Modern Class. of Entom.,' vol. ii, p. 557).

They are of various sizes and colours, and usually are traversed by a white, yellow, or purplish stripe down the back, occasioned by the tints of their movable viscera showing through their transparent skins. Some species are provided with two posterior cylindrical processes, the use of which is not known.

Between each advancing step the maggot makes a rapid lashing motion of its head in search of its food, and when an Aphis is struck, it is taken off its legs and hoisted into the air, where its juices are rapidly extracted, and then the empty skin is rejected.

The voracity of the creature has been remarked by Reaumur and Bonnet. The latter says of les Mange-pucerons, "On la voit (la tête) s'allonger et se raccourcir, s'arrondir et s'applatir, se contourner tantôt en un sens et tantôt en un autre, et cela avec un promptitude surprenant. Il-y-a aucun animal carnacier qui chasse avec plus d'avantage" with its trident or dart.

It is said that the smaller kinds often become the prey of the larvæ of the *Hemerobiidæ* or golden-eyes.

When full fed the larvæ attach themselves to leaves or stems, and metamorphose into short, oval pupæ. These hang with their heads downwards, and are covered with a hard and horny skin crossed by numerous transverse bars.

The ova of the *Syrphidæ* to the naked eye are very like the shining oval bodies glued by the bot-fly to the hairs of the horse's forelegs. They are interesting objects for the microscope, as the chorion or outer shell is studded with elaborate bifurcate papillæ. The eggs are singly deposited, and may be often seen on the leaves of the oak, fir, &c., where they are placed in the midst of Aphis food, ready grown for the use of the young grub directly it has hatched out.

By the law of retaliation *Pteromalus ovulorum* and *Chrysolampus tristis* oviposit in the eggs of Syrphus, so that these dipterous larvæ are often doomed before birth.

The Syrphus grub will, notwithstanding its voracity, stand a long fast. Kirby kept one alive for three months without food, and then after giving it a full meal, again he periodically stinted it; still thus it lived on throughout an entire year.

Macrogaster liniola, Curt., and *Pachyneuron formosum*, Walk., also are parasites which often infest the bodies of the *Aphidivorous Syrphidæ*. Many individuals of the last parasite may be detected in one single larva. These insect-scourges must be looked upon as the natural protectors of the Aphis family, and therefore enemies to the farmer. *

I have figured the imago of *Syrphus balteatus*, Ratz., which is one of the common larval forms. The imago somewhat differs from Curtis's description of *Scæva balteata*, and the marking of the body differs also from the figure of *Syrphus pyrastri*, as given by Westwood.

Genus XII.—CHAITOPHORUS,† *Koch.*

Borstenläuse. Hairy Aphis.

Rostrum longer than in the preceding genus Hyalopterus. The second joint as long as the two following taken together.

Head without frontal tubercles. Front tufted with bristles.

Antennæ much as in Aphis. Hirsute.

Abdomen studded with tubercles, each surmounted with a tuft of bristles.

Cornicles very short, sometimes as short as thick. Mouths often dilated.

Cauda obtuse and wart-like.

Legs rather short, clothed with hair.

Wings veined as in Aphis.

* Vide Curtis, 'Farm Insects,' p. 80; also Asa Fitch, 'Report on Noxious Insects of New York,' 1856, p. 101.

† χαίτος, a bristle; φορεω, I bear.

CHAITOPHORUS ACERIS, *Linn.* Plates LXXVIII and LXXIX.

Aphis aceris, Linn., Fabr., Schr., Scop., Kalt., Walk.
Chaitophorus aceris, Koch, Pass.
Puceron de l'Erable, Reaum., Balb. et Signoret.

Much interest attaches to this insect on account of its remarkable dimorphic forms. These characters are so varied that comparatively recent authors have placed the abnormal insect under a different genus; and even more, some have suggested that a new family should be formed for its reception between the Aphidæ and the Coccidæ.

It will be convenient first to describe the normal forms of this insect.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·090×0·050	2·27×1·27.
Length of antennæ	0·060	1·52.
,, cornicles	0·010	0·25.

Dark green, shining, much wrinkled. Head broad, olive-green. Vertex flat, furnished with two tufts of fine bristles. Thorax wrinkled. Abdomen globose, with numerous setose tubercles; posterior rings rapidly narrowing to a blunt apex. Cauda inconspicuous. Antennæ and legs green. The whole insect setose.

Some examples may be found entirely black, and some less tuberculose than others.

Winged viviparous female.

This insect is very variable both in form and colour, and these varieties show, also, certain differences as regards their economy.

Variety α.

	Inch.	Millimètres.
Expanse of wings	0·330	8·38.
Size of body	0·090 × 0·035	2·27 × 0·88.
Length of antennæ	0·075	1·89.
„ cornicles	0·010	0·25.

Bright green. Head and thorax shining black. Abdomen green, with eight or nine transverse black bars, accompanied by four marginal spots on each side. Antennæ yellowish green, very hairy, as also are the legs. Cornicles small and black.

Variety β.

During the spring and summer months, that is, from the middle of May to early August, winged females of this species, which are larger than the above, may be found on the leaves of the sycamore-tree. Their colours are uniformly of a shining black, with the exception of their wing-insertions and tibiæ, which are orange or yellow coloured. The whole insect is pilose, and the wings are longer than those seen in variety *α*. But the principal interest of this insect consists in the different character of the young it produces, which are quite removed from the ordinary type of Aphis. In all the cases I have examined, the young included in the abdominal cavity are abnormal, and after birth present so peculiar a form that they require a special description. This will appear under the heading of Dimorphism of *C. aceris*.

Pupa.

This is smaller and paler in colour, but it does not greatly differ in form the apterous female. The wing-cases are greenish.

The males.

This sex appears under two forms viz. apterous and alate. It is well known that the male of Aphis, like

that of Coccus, is capable of fecundating many successive females, and, in accommodation with such roving habits, in by far the larger number of instances we find him provided with long effective wings suitable for locomotion, and well-developed eyes and stemmata to direct him to the objects of his solicitude. Such being the case it is difficult to discover the special economy of a far less developed form of the same sex in which the same organs for transport, &c., are entirely wanting; and consequently these forms (which are generally verydiminutive) must live and die, it may be said, on the leaves or places of their birth. The fact of this double form cannot be doubted, and indeed we have already considered both apterous and winged males in some foregoing species, although they have not appeared conjointly and supplementary.

It is refreshing to notice the fidelity and strictness to fact often shown by the veteran pioneers of science. It cannot be said that they were wanting in imagination in philosophy—a good quality if kept under due control, yet it is marvellous how much they made out with their comparatively inefficient instrumental means.

De Geer has given us a rough figure of the apterous male of the sycamore Aphis, and also a characteristic one of the apple Aphis.

I am indebted to the kindness of Monsieur J. Lichtenstein for examples of both these male forms, and also for specimens of the viviparous female, concealed in her woody winter nidus amidst her deposited eggs. To him I am indebted for the fact that winged and unwinged males simultaneously occur in *Chaitophorus aceris*. In a letter dated Oct. 29th, 1877, he writes:

"Two days ago I searched my *Acer Monspelliensis*, and I found winged and unwinged insects of both male and female sexes; the male is black or brown, with a well-formed penis, and the antennæ $\frac{1}{10}$ longer than those of the female. This male answers to Koch's Plate III, fig. 19. The female is yellowish-white, and has the usual brown markings. But, mixed with them,

I find also winged insects, both male and female (the last is Koch's fig. 20). The male is very like the winged one in form and colour, but the terminal antennal joint is $\frac{1}{3}$ longer in the winged male. This unwinged generation seems to be produced by the former winged one; and here we have the extraordinary fact of two sexuated generations, one after the other, the first one winged, the second not so. The first gives birth to living young. I cannot yet perceive what the apterous females produce, but I very much think that it can only be the black shining eggs."

In this surmise M. Lichtenstein was correct.

Apterous male.

	Inch.	Millimètres.
Size of body	0·080 × 0·030	2·02 × 0·76.

Long oval, attenuated posteriorly. Head broad. colour buff-yellow, with broad rich brown patches on the head and thorax. Abdomen broadest in the middle, with six or more interrrupted dorsal bars and numerous spots and blotchings on the sides. Cornicles inconspicuous. Antennæ about the length of the body, brown at the articulations. Eyes red. Legs yellow, with a longitudinal forked band on the femora. Dissection unmistakably showed the sex of this insect.

Feeding on the maple in November at Montpellier. Passerini mentions the apterous male of this species, but it does not appear from actual observation of the same.

Winged male.

In general marking this much resembles the apterous variety. It has been before described by Walker. It occurs dark green, with transverse rows of black dorsal spots, and ornamented with a row of dots on each side. Some varieties become dark brown, or even black. I have been able also to verify the sex of this insect from the microscopic preparations sent from

Montpellier. I have not, however, seen the living insect, and thus I am unable to figure it.

Oviparous apterous female.

	Inch.	Millimètres.
Size of body	0·055 × 0·030	1·39 × 0·76.

Rather smaller than the apterous male. Occurs of various colours, such as yellow, green, brown, or wholly black. The lighter specimens have two dark green spots, and a series of black stripes down the back. Legs and antennæ yellowish.

The abdominal cavity, extending into the prothorax, is sometimes occupied by as many as eight large eggs. After pairing, these females secrete themselves in the substance of the harder twigs of the maple, &c., and deposit their ova during November and December. These eggs remain unhatched until the following spring, whence the queen-mothers or foundresses of the colonies issue to begin a new cycle.

I received two specimens of this oviparous family from Montpellier; both of which had been struck by an Aphidius. When unpacked they had deposited three shiny eggs. These were duly figured (*vide* Plate LXXVIII, fig. 6), but the next day, on referring to these eggs (which unfortunately had been left uncovered during the night), something evidently had escaped from them, which I can only suppose were parasites; simply the shrivelled membranes remained.

In a letter from M. Lichtenstein he says, "It is a curious fact that, whilst laying their eggs, both these specimens have been stung by some ichneumonid (Aphidius?), and probably you may see the little Hymenopterum soon issue out of these lice. Here the destructive parasite has lost its time, for the Chaitophorus has already laid its egg for next year's generation. I note that this is often the case."

It is clear, however, that these insects had more than a single egg to lay, and in these either the eggs

of the Hymenopterum were laid, or the larvæ from them burrowed into their substance. Other examples are on record in which certain parasites succeed in ovipositing *within the eggs* of their victims, but in such cases probably the metamorphosis of the parasite is deferred until the larval stage of the infected insect is reached. Probably the parasites above noted were Pteromali, which are known to attack the eggs of insects.

Chaitophorus aceris is plentiful throughout the year on the maple, *Acer pseudoplatanus*, on the sycamore, *A. platanoides*, the field-maple, *A. campestre*, and the Montpellier maple, *Acer Monspelliensis*. Mr. Walker told me that he also took it feeding on the horse-chestnut, *Æsculus parviflora*.

Both the winged and apterous viviparous forms may be seen under the leaves throughout the summer; and, as the parents scarcely move from the spots where they deposit their young, they are usually surrounded by them to the number of twenty, or Walker says "hundreds." These young, which are green and hairy, have mostly their heads turned towards a common centre, and in this manner circular patches are formed. Walker says that these young remain in the same place, and without further growth, for three months, and that they do not begin to increase in size till the September following.

It remains now to consider the extreme dimorphous form of this singular Aphis, which, as far as we know, has no trace of sexuality, and is wholly unable to reproduce its kind by gemmation or otherwise.

On Dimorphism in Chaitophorus aceris.

The world-wide interest that has been evoked by the writings of Mr. Darwin has certainly had one beneficial influence, viz. that of compelling thinkers to regard biological phenomena from more than one

point of view. Whatever may be the modern outcome of the question how variation is caused (for surely more is wanted than the facts, if true, that variation on a large scale is going on around us), and whether certain assigned causes are sufficient to explain the existence of the multitudinous entities regarded by classifiers as species, there can be no doubt that scientific investigation has received a powerful impetus from the new theoretical bias, and that already a rich harvest is being reaped under its influence, much of which is gathered in from channels aside from the main issue.

Thus it is that some will look with much interest on anomalies of development, and possibly in these foresee points of departure leading to other and perhaps more specialised races. Every phenomenon that seems to lend a bearing, positive or negative, on the question will be given a welcome as affording additional materials for forming an opinion on the subject, which, if ever settled, will alone be so through a basis of sound experiment and observation.

The young of *Chaitophorus aceris*, it has been before stated, occurs under two very distinct forms. One of these is normal in its metamorphosis, and requires here no special notice, the other is simultaneously produced, but after a slight growth continues for months in a quasi-arrested condition, and finally dies without having developed in itself any reproductive organs.

In the 'Transactions of the Microscopic Society' of 1852, Mr. I. Thornton described under the name of *Phyllophorus testudinatus* a Hemipterous insect feeding on the common maple, and he justly considered this insect as a larva of some indeterminate Aphis.

Mr. Lane Clark also observed the same insect in the year 1858, and placed it between the families *Aphididæ* and *Coccidæ*, under the name of *Chelymorpha testudo*.

In the year 1862 Vander Hœven, of Leyden, published another memoir on the same insect, and gave it

yet another name, *Periphillus testudo*. He, like Thornton, regarded it as a larva of some unknown Aphis.

Five years later Messrs. Balbiani and Signoret* made known the unexpected fact that the Aphis common on the shoots of the maple, *Acer campestre*, has the faculty of producing two sorts of young, one of a normal type, the other diverse in form and incapable of reproducing its kind.

Subsequently they furnished a joint paper to the Entomological Society of France, which is illustrated by an excellent engraving of this curious and somewhat uncouth insect.

According to these authors the green viviparous female of *Chaitophorus aceris* contains at the same time two descriptions of embryo. The brown variety has characters much as other Aphides show. At birth they are garnished with tufts of simple hair, and even at this early stage of their existence they exhibit distinct embryonic rudiments of other Aphides within them. On the other hand, the bright green variety has a figure and appearance so different, that, except it had been seen that the same female produced both forms, we certainly would have referred them to species altogether separate.

This Aphis I now describe. It has been known under the following synonyms:

Phyllophorus testudinatus, Thornton, Fernie.
Chelymorpha testudo, Lane Clark.
Periphyllus testudo, Vander Hœven.
Puceron de l'Erable, Balb. et Signoret.

Habitat.—England, Sweden, Holland, France, Switzerland.

Form oval, bright green. Eyes dark red or black. Head very broad and large, with two shallow lobes

* "Sur le development du Puceron brun de l'Erable," 'Comptes Rendus,' 1867, p. 1259; also "Notice sur un Homoptere peu connu (Periphyllus)," t. vii, p. 371, *et seq.*, 'Ann. de la Soc. Entom. de France.'

on the occiput. Thorax not visibly separated from the head. Abdomen broad, oval ; dorsum and sides decorated with four rows of plates or pseudo-scales, which gives the insect a somewhat tessellated appearance, and so may be likened to the carapace of a tortoise. Cauda and anal plate very minute.

The legs are short and much flattened. This dilatation appears most strongly in the tibiæ, whose margins are sharply serrated.

But the most remarkable part of the insect is the development of the tegumentary system. Instead of the hairs seen in the normal young, the body and limbs are furnished with a series of flat transparent leaflets, which surround the front, the abdominal margin, and the outer edges of the tibiæ. Each foliole contains a radiating system of vessels (?), which Signoret regards as ramifying nerves. Folioles also are attached to the first joints of the antennæ, which are gibbous, and elongated folioles also sprout from tubercles near the anus.

The tarsi have, in addition to the usual double claw, two minute hairs, the summits of which are expanded into sucking discs or pulvilli. In this and some other respects, the insect somewhat approximates to the genus *Phylloxera*. There are only five joints to the antennæ. The rostrum is short and very stout.

When placed on a slip of glass under a low magnifying power it moves, but with extreme deliberation. Its progression is ludicrous, poising itself on its hind legs, and employing its pulvilli to secure its position before it attempts to make any further advance.

Its habits are quite solitary, strongly fixing itself to the inner angles of the leaf-ribs of the sycamore or maple, on which they appear as small yellow scales. These may be easily detected if the leaf be examined by the transmitted light of the sky.

On account of the transparence of this insect, a slow peristaltic movement of the internal organs may be often noticed, and under favorable circumstances

also a circulation may be detected in all the legs. Globules pass slowly, and by a fitful motion, down the inferior and up the superior portions of the tibiæ. Life seems very tenacious in the legs, for these movements may be watched for a considerable time after the insect has been dismembered and placed under weak syrup.

A still more remarkable fact relates to the extremely rudimentary character of the generative organs. This apparatus is reduced to a few inconspicuous cells, which at the end of the insect's life do not appear to have undergone any alteration or approach to maturity. This is singular, for this dimorph prolongs its existence apparently for four months or more, during which it never leaves the leaf on which it was born.

The antennæ do not pass out of their rudimentary form with five obscure articulations, and no approximation is made towards the development of nectaries.

Balbiani and Signoret affirm that the insect neither moults its integuments, nor assumes wings. I have, however, clear proof that the skin is occasionally shed, and I possess casts complete even to the folioles or flabellæ. Moreover, I have every reason to believe that when such moults occur, the insect emerges without folioles, such organs being replaced by tufts of hair. I am therefore inclined to think that these flabellæ have some reference to these bristles, and that possibly they may be regarded as kinds of developing capillary sacs.*

Should this prove true, the bristles and capitate tufts of insects will show but little analogy with the hairy coverings of vertebrates, the growth of which proceeds from sacs deeply seated in the skin of the animal.

In Plate LXXIX, fig. 8, I have figured an insect which was found so close to the slough, (also figured),

* An examination of the hair on the tubercles of the young of *Chaitophorus aceris* does not, however, show any numerical relation to the radiating vessels contained in the follicles of the pseudomorph.

that I do not doubt that it emerged from it. It is of consequence to remark that the new insect is of a higher type, for its antennæ are more completely jointed, and its nectaries are fully formed.*

These observations do not wholly agree with those made by Balbiani and Signoret in their memoir on Periphyllus. They describe three kinds of embryo "enceinté," one with folioles, another pubescent, and a third having a mixed character, that is to say, having hairs partly developed into folioles. These are when first born enveloped in a delicate membrane, from which the insects shortly afterwards free themselves. Again, they remark "that it was only the scattered (*dessémerées*) winged and apterous females which gave us the foliated embryo, but that the associated females (*agglomerées*) furnished forms hirsute like the mother."

Again, they say, the normal fœtus has much the same form as the foliated fœtus, but the lamellæ are represented by bristles, and the abdomen is not covered with "marquetrie." Besides this, the insect undergoes sundry moults and eventually becomes winged.

I have above described the black alate female of this Aphis, which answers to Koch's figure. This insect cannot be the same as that which Lichtenstein found, and says he is satisfied was a male, and which also he refers to Koch's figure 19. The black insect I I have figured, Plate LXXVIII, fig. 3, is undoubtedly a female, and, contrary to Balbiani and Signoret's experience, it yielded by dissection, June 25th, nine young, each enclosed in its own membrane. By manipulations with needles these unmistakably showed, by the presence of dorsal plating and the characteristic folioles, that they were all of the abnormal kind. Several of the pseudomorphic young were moreover scattered on the same leaf which supported this Aphis, and I conclude were born of her.

* This observation would suggest a doubt whether the non-developmental rule, as regards this dimorph, is strictly rigid.

Afterwards other winged specimens were examined, some of which appeared to be quite barren, but others contained variable numbers of fœtus, from a single example up to twelve. On another occasion two black females were seated on the same leaf, and the immediate proximity of a dozen pseudomorphs led again to the inference that they were the corresponding offspring of these females.

Signoret describes another form of Aphis feeding on the maple, to which he gives the name *Aphis perforatus*, chiefly from the occurrence of tubercles or punctures on the third and fourth antennal joints. I suggest that such slight differences are due to their being individuals of a later brood, for such specimens often approach the characters of the winged adult. The presence of such tubercles is common in Siphonophora and other genera.

What is the significance of this particular phase in the economy of Chaitophorus? Their appearance on the leaves many months before the oviparous females come into existence precludes all idea that they are males. Landois and others have shown that sexual development in insects, as in other animals, is closely connected with conditions of alimentation, and perhaps larval forms are peculiarly, in this respect, plastic. The sexual development of the queen of the honeybee is a familiar case in point.

But in *Ch. aceris* the phenomenon can scarcely be considered as an arrest of development through deficient food, for it has been shown that the perfect sexes may be bred at the same time on the same leaf. If the fact be certain that the same individual produces the two forms simultaneously, the interesting subject invites closer attention than has yet been bestowed upon it.

In searching for analogies to the facts above, the mind naturally reverts to the discovery recently made known, that the larvæ of certain *Tipulidæ* have powers

of reproduction without waiting for their final transformation into the winged state.

Again, the interesting economy of the Mexican Axolotl has also a certain bearing on this subject. From its outward appearance, this reptile, Prof. St. John Mivart says, would be considered as an *eft-tadpole*, for it has external branchiæ or gills. As this creature has, however, freely bred in confinement at Paris, in the Jardin des Plantes, it has been regarded as adult, and free from subsequent metamorphosis. Very unexpectedly, however, and comparatively recently, these Axolotls have undergone important changes in dentition, and in an absorption of their external gills. They have, in short, changed into an animal of a different genus, viz. Amblystoma, which singularly, in addition to their change of form, have their reproductive organs atrophied and incapable. Thus, in a limited sense, it may be said that as Axolotl is to the barren Amblystoma, so is the sexual Chaitophorus to its barren pseudomorph. There is nevertheless a difference in the analogy, inasmuch as Amblystoma is of a higher type, but the pseudomorph of *aceris* certainly is of a lower one.

If we speculated upon the possibility that under peculiar circumstances of growth these pseudomorphs might be able to reproduce their kind, we should perchance find one clue towards the appearance of new forms from dissimilar parents. According to the epigenetic hypothesis of Milne-Edwards and others, we might then qualify the great dictum that "like produces like," and say that nature occasionally acts *per saltum*, as it were, and, "like then would produce unlike," which may be thought a doctrine sufficiently heretical, though perhaps, suggestive.

CHAITOPHORUS SALICIVORUS, *Walker*. Plate LXXX, figs. 1—4.

Aphis salicivora, Walker.
Chaitophorus salicivora, Pass.

	Inch.	Millimètres.
Size of body	0·040 × 0·017	1·01 × 0·42.
Length of antennæ	0·015	0·38.

Very small, green, covered with fine long bristles. Eyes brown. Prothorax large. Abdomen oval, not tuberculate, or else the tubercles are rudimentary. Faint spots ranged in longitudinal rows. Cornicles green, small. Cauda obtuse. Legs stout and short. Tibial tips and tarsi dark olive. This insect greatly varies in colour. Some are luteous, with greenish stains, others are ferruginous red. The rostrum reaches to the third coxæ.

The apterous male.

This may be distinguished by its black head, dark legs, and longer antennæ, and also by a series of black transverse bands, which are connected by a black longitudinal dorsal stripe. Black dots mark the dorsal pores. All the bristles are bifurcate at their tips. The anus well shows on each side one of the two compressing valves ("armature copulatrice" of Balbiani), which cause the exsertion and support of the curved penis.

	Inch.	Millimètres.
Size of body	0·040 × 0·020	1·01 × 0·508.
Length of antennæ	0·030	0·760.

Apterous oviparous female.

This does not greatly differ in colour from the viviparous female, but it is rather more oval in form, and the dorsum often is stained with ferruginous red, with

ashy streaks. The caudal end is rather produced, and terminates in an obtuse point. The female, like the male, occurs in October.

The winged form has never been taken in England, but it is known in the South of France and in Italy. It will be of interest to learn if a winged male occurs in this species as in *C. aceris*.

Walker says upwards of 800 of this little Aphis may be counted, all clustered under a single leaf of *Salix caprea*. I can testify to myriads infesting the young shoots of the "witheys" round the streams of Critchmere, near Haslemere.

CHAITOPHORUS LEUCOMELAS, *Koch, Pass.* Plate LXXX, figs. 5, 6.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·070 × 0·035	1·77 × 0·88.
Length of antennæ	0·050	1·27.
,, cornicles	0·005	0·12.

Head very broad. Eyes bright red. Front flat, tufted with hair. Antennæ with the two first, the sixth, and seventh joints brown; the other joints green. Body pale brownish-green, very hirsute. Two square-like spots on the head, and others also on the thorax. Colour blackish-brown. Abdomen broad, with two increasingly broad brownish-black bands down the sides, interrupted by the green sutures of the back, and an irregular dorsal green stripe. Cornicles very short, black. Cauda green and very small. Femora dark. Legs and tarsi ochreous.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·240	6·09.
Size of body	0·080 × 0·035	2·02 × 0·88.

	Inch.	Millimètres.
Length of antennæ	0·060	1·52.
,, cornicles	0·005	0·12.

Head and thorax pale brown. Abdomen fusiform, pointed behind; pale green, with brownish stains on each segment. Cornicles minute, green. Body hirsute. Legs wholly green, and very hairy. Wings simple, narrow; insertions and cubitus green; stigma greyish; other veins dark green or olive.

Only a single winged specimen could be secured.

Found in companies of about fifty, raising blisters under the leaves of *Populus nigra*, Haslemere. When the insects swarmed together they formed black patches on the upper surfaces of the leaves. The larvæ are of many shades of green and vary much in their markings, some being entirely devoid of the above-described dark bandings. The companies are often mixed with individuals of *Chaitophorus populi*, July.

Koch's figure of the winged insect is much darker than that I figure, but something may depend on the age of the insect, and the time elapsed after emergence from its pupa.

Chaitophorus capreæ, *Koch*. Plate LXXXI, figs. 1—2.

Schr. ?, Pass., Walk.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·065 × 0·035	1·64 × 0·88.
Length of antennæ	0·050	1·27.
,, cornicles wart-like.		

Variable in form and in general markings. Bright green merging into yellow. Head broad, brownish. Eyes red. Antennæ with seventh joint setaceous; tips black. Abdomen prettily but irregularly streaked

with dark green; usually has a well defined furcated dorsal stripe. Legs short, green, with darker tarsi. Whole body covered with tufts of hair which spring from small tubercles. Cornicles very small, little more than perforated, wart-like projections.

Sparsely scattered over the under sides of the leaves of *Salix caprea*, Wimbledon and Wandsworth, Aug. 17th.

I could not procure the winged forms.

Passerini found it within the reflexed margins of the leaves of *Salix nigricans*, "in montibus prope Berceto."

CHAITOPHORUS POPULEUS, *Kalt.* Plate LXXXI, figs. 3—6.

Aphis populea, Kalt., Walk.
Lachnus punctatus, Burm. (?).
Cladobius populeus, Koch, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·080 × 0·040	2·02 × 1·01.
Length of antennæ	0·045	1·13.
„ cornicles wart-like.		

Long oval, yellow or ochreous yellow, very hirsute, the bristles proceeding from tufted tubercles. Head rather brownish. Antennæ yellow, with brown tips; seven distinct joints, the seventh variable in length, but at least as long as the sixth. Abdomen arched and distinctly segmented, blotched with irregular brown spots. Cornicles very short, and appearing merely as perforated warts. Tail rounded and inconspicuous. Legs rather short. Rostrum reaches to the second coxæ.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·240	0·09.
Size of body	0·080 × 0·030	2·02 × 0·72.
Length of antennæ	0·045	1·13.
,, cornicles	0·005	0·12.

Colour dirty greenish yellow (*schmutzig gelbröthlich* of Kalt.). Head brownish. Eyes large and red. Antennæ green, with brown tips, and rather pilose. Seventh joint variable in length, but usually shorter than that seen in the larvæ. Thoracic lobes and scutellum dark brown. Abdomen arched and shining, rather pilose. (Kaltenbach and Koch describe it with numerous black bands.) Cornicles yellow, cylindrical, with a length of twice the breadth. Cauda inconspicuous and brownish-yellow. Legs yellow and rather short. Wings rounded, iridescent; cubitus and other veins brown; stigma greenish.

Kaltenbach remarks upon the inconstant length of the seventh antennal joint and also notices the variability of colour. At first he seems to have thought that this insect might prove a variety of *Aphis salicis* of Linn., but the capture of other specimens proved the great difference between this somewhat dingy Aphis, and the fine black willow Aphis, which is spotted with white, and is conspicuous from its vasiform orange nectaries.

Koch formed a new genus, Cladobius, for this insect. The characters he gives, illustrated only by this sole species, do not seem to me to be sufficiently marked to necessitate a separation from Chaitophorus, to which genus I think *populeus* belongs. Koch grouped it with the lime Aphis under the head Phyllaphiden. Passerini retains Cladobius, and describes under this genus an Italian species, *Cl. lantanæ*, which possesses long nectaries.

Walker says that *Cl. populeus* sometimes occurs in

dense masses near London on the twigs of the willow, "and that each row overlaps the other below it." It feeds also on the Lombardy poplar, *Populus dilatata*, from which tree Prof. Trail forwarded me specimens from Aberdeen towards the middle of September. Amongst these were small red individuals which I think are probably apterous males.

The figure given by Koch must be considered to be a very rough one. It very poorly represents the Scotch insects which I take to be *Aphis populea* of Kaltenbach. Koch says, in his diagnosis of the genus Cladobius, that the seventh antennal joint is very small. Passerini points out, and I agree, that it never is smaller than the sixth, and mostly exceeds it. Passerini further thinks that Koch's figures and characters point more to a Lachnus, and, indeed, that they suggest *L. punctatus*, Burm. The former biologist notices that the oviparous females separate in autumn from the rest of the colony, and in all cases under his observation deposited about the buds, and at the points of the branches, four dirty yellow eggs, which afterwards became black.

CHAITOPHORUS BETULÆ, *Buckton*. Plate LXXXII, figs. 1, 2.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·045 × 0·022	1·13 × 0·55.
Length of antennæ	0·035	0·88.
,, cornicles wartlike.		

In the month of September Mr. Wallace forwarded me certain Aphides, which, as they did not tally with any recognised descriptions, I have thought it best to separate from others, although I had no advantage of an examination of the corresponding winged forms. The apterous female is dark olive, hirsute, and tuberculate. Head broad, with four occipital

tubercles. Thorax with two lateral corrugations, tufted with hair. Abdomen flattish, with a marked carination, and provided with four longitudinal rows of dark shining tubercles. Cornicles just appearing above the surfaces of the back. Cauda small, rounded, dark green, and pilose. Legs and antennæ pale. First and two last joints of the latter dark. Rostrum reaches to the second coxæ.

Feeding on the birch, Walthamstow.

Apterous oviparous female from the same tree and place.

	Inch.	Millimètres.
Size	0·090 × 0·045	2·27 × 1·13.

Oval, broad across the abdomen, tubercular, and tufted with ochreous bristles. Colour ochreous yellow. Head dark brown. A square spot on the thorax, and eight or more interrupted brown stripes across the abdomen. Legs dark brown, hind tibiæ dilated. Antennæ yellow, with the first and the last joints dark brown.

Though Koch found his *Ch. granulatus* feeding on *Acer campestre,* it is possible that the insects above described may be of the same species.

Captured with the male at Walthamstow, in October. This insect contained seven large eggs.

Chaitophorus populi, *Linn.* Plate LXXXII, figs. 3—5.

Aphis populi, Linn., Fab., De Geer (?), Kalt., Ratz. Walk.
Myzægirus Amyot.
Arctaphis populi, Walk.
Chaitophorus populi, Pass.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·070 × 0·035	1·77 × 0·88.
Length of antennæ	0·040	1·01.
,, cornicles	0·002	0·05.

Oval, broadest just above the cornicles, pale yellowish green, blotched with irregular dark green stripes and spots, pilose. Head rufous, eyes red. Antennæ, legs, and cornicles green, the last wart-like.

Pupa.

Larger and more oval than the larva. Colouring much the same, but the dark green stripes are usually gathered more into semicircular curves across the dorsum.

Winged viviparous female.

	Inch.	Millimètres,
Expanse of wings	0·240	6·09.
Size of body	0·080 × 0·035	2·02 × 0·76.
Length of antennæ	0·065	1·64.
,, cornicles	0·005	0·27.

Head and thorax black; the former broad; front rather flat, and garnished with bristles. Eyes red. Antennæ ochreous, with the exception of the two basal and the apical joints, which are black. Abdomen green, with six or more black transverse bands of varying width. Cornicles larger than in the apterous female, with mouths expanded. Cauda very small, green, and hairy. Legs ochreous. The whole insect is hirsute. Wings rather large; membrane delicately punctured; insertions yellow. Cubitus and stigma black. Rostrum reaches to the third coxæ.

Varieties of the winged insect occur wholly black.

The oviparous female usually contains four or five

eggs. Its colouring is not unlike that of the viviparous female, but the hind tibiæ are dilated.

Walker describes the pupa of the male as crimson in colour. The winged male occurs in October. The body is yellow, the thorax and head brown. The wings large, and strongly veined. The cubitus and stigma brown.

Taken at Chichester in June, by thousands, on the leaves and young shoots of the garden-plum; the shoots being encrusted for six or eight inches by the larvæ. A few scattered winged forms nestled under the leaves even at this early date. The trees most commonly affected, however, are the white and black poplars, *Populus alba* and *P. nigra*. Kaltenbach says also it feeds on *P. tremula* and *P. dilatata*.

The form of this insect somewhat differs from the rest of the genus, and Walker proposed a new genus, *Arctaphis* for its reception.

Genus XIII. PTEROCOMMA,* *Buckton.*

Vertex rather flat, frontal tubercles none.

Antennæ short and seven-jointed. The third joint the longest, and the seventh about equal to the sixth.

Body long and oval.

Cornicles short and cylindrical, but longer than in *Hyalopterus* and *Chaitophorus*.

Rostrum rather long.

Legs moderate.

Wings very long and somewhat narrow; the costal and submarginal veins much incurved.

Cauda very small.

As yet this genus is represented only by one species, which has several characters pertaining to the genera *Aphis*, *Hyalopterus*, and *Callipterus*.

* From πτερὸν, a wing; κόμμα, an incision or notch.

PTEROCOMMA PILOSA, *Buckton*. Plate LXXXIII.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·080 × 0·040	2·02 × 1·06
Length of antennæ	0·040	1·06
,, cornicles	0·005	0·12

Oval, green, spotted with darker green. Head broad. Antennæ very short. Legs stout, the femora broad. Nectaries moderately long. The whole insect pilose.

The larva so much resembles the pupa in colour that I have not figured it.

Pupa.

Long oval. Pale green, very hoary and pilose. Head very broad, with two dark green spots on the occiput. Thorax with darker greenish lobes. Wing-cases tipped with dark olive. Abdomen much carinated and ornamented with two rows of dark green spots, decreasing in size towards the tail. Nectaries and antennæ as with the larva. Rostrum three fourths the length of the body.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·400	10·16
Size of body	0·120 × 0·040	3·04 × 1·06
Length of antennæ	0·070	1·77
,, cornicles	0·015	0·38

Large. Long oval. Head and thorax pale ferruginous brown. Thoracic lobes brown. Antennæ nearly two thirds the length of the body; the seventh joint hardly longer than the sixth. Abdomen oval, ashy-grey, covered with fine hair of a brownish tint; base of each abdominal segment marked by a broad brown

band. Cornicles cylindrical, nearly three times longer than thick. Cauda small, not projecting beyond the anal plate. Legs pale brown and hairy. Rostrum reaches beyond the third coxa. Wings somewhat peculiar in form; long, pointed, and slightly incised or incurved inwards, as to the costal and subapical margins. This character has suggested a name for the genus. The cubital and other veins, and also the stigmata, pale brown.

The rostrum of the young is much longer than that of the adult, and nearly equals the length of the body.

In the month of August Mr. Knaggs was good enough to forward to me, from his garden at Kentish Town, several willow twigs which were crowded with specimens of *Melanoxanthus salicis*. Amongst these black and orange-coloured insects numerous examples of the Aphis now under description were intermixed, and these were indiscriminately feeding together on the green bark of the same twigs. This amicable intermingling of different genera is somewhat remarkable, but is not confined to these two species.

Genus XIV. CRYPTOSIPHUM,* *Buckton.*

Vertex convex.

Antennæ very short in the apterous, but longer in the alate form. Seventh joint short, about once and a half longer than the sixth.

Rostrum moderate, reaches to the second coxa.

Cornicles none, or represented by mere pores.

Cauda small, but distinctly seen in the winged forms.

Legs rather short.

Wings short, rounded and veined like Aphis.

The chief characters of this genus are the want of cornicles and tail. In the length of the wings and the rostrum it differs much from *Hyalopterus*.

* From κρυπτὸς, hidden, and σίφων.

CRYPTOSIPHUM ARTEMISIÆ, *Buckton*. Plate LXXXIV.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·065 × 0·040	1·64 × 1·01
Length of antennæ	0·020	0·50
,, cornicles, none or invisible.		

Oval, brown or grey-black, very mealy. Head small, vertex hairy. Eyes reddish. Body much domed and carinated. Coarsely ringed. Apical portion hirsute. Antennæ short; seventh joint perhaps as long as the sixth. Legs very short, and almost concealed when the insect is at rest.

Pupa.

Smooth and shining, but a little mealy. Thorax and wing-cases rather ochreous, sometimes tipped with olive-green.

Winged viviparous female.

	Inch.	Millimètres.
Expanse of wings	0·160	4·06
Size of body	0·052 × 0·022	1·32 × 0·55
Length of antennæ	0·032	0·81
,, cornicles, none or invisible.		

Small. Whole body sooty-grey, with a sparse and mealy coat. Head convex. Antennæ remote at their bases. Third joint obscurely ringed; seventh joint rather longer than the sixth. Rostrum reaches to the second coxa. Cornicles none. Cauda small. Legs short and robust. Wings short, rounded at their tips; fuscous-grey, finely punctured and non-iridescent; membrane rather wrinkled; insertions ochreous, stigma greyish, veins blackish.

This species infests the mugwort, *Artemisia vulgaris*, the leaves of which it punctures, blisters, and distorts

into bunches, which sometimes are of a fine red, and at other times of a golden-yellow colour. These masses at a distance might even be taken for inflorescence of the plant. The Aphides swarm within these cavities, which are partly lined by the natural down of the plant, and partly by the mealy secretions of the insect. Mr. Charles Barrett forwarded insects to me from Brandon, in Norfolk, early in August, at which time both winged and apterous forms were fairly plentiful.

A reference to Passerini's description of *Aphis artemisiæ* will show that *Cryptosiphum artemisiæ* has much in common with it. Yet, as to the apterous viviparous female, for colour he gives "fusco-rubiginosa—antennæ breves a basi ad medium albo-luteolæ, cæterum fuscæ, . . . cauda obliterata. Pedes brevissimi fusci." Again, for the winged females, "nectaria et cauda nulla, &c."

The habitat is "in Artemisiæ vulgaris foliis superioribus bullato-revolutis," the apices of the branches being drawn together, "veluti in gallam."

A comparison of this diagnosis with my own will show some important differences as to colour, and the possession or not of a tail. Such being the case, it will be hardly safe to decide without a reference to the two living insects that they are identical, though it is not impossible that they are so.

Passerini corrects, in his later work, 'Aphididæ Italicæ,' *Aphis artemisiæ*, into *A. gallarum*, Kalt., and gives a reference which I have not been able to consult, viz. 'Die deutsch. Phytoph. aus der-Kl. der Ins.'

Genus XV. BRACHYCOLUS,* *Buckton.*

Vertex rather flat, frontal tubercles none.

Antennæ very short, seven-jointed. First and second

* *βραχὺς*, short; *κῶλον*, a limb.

joints globose; third, fourth, fifth, and sixth nearly equal; seventh slightly ringed and about as long as the fifth and sixth taken together.

Body very long and narrow, mealy.

Nectaries very small and inconspicuous.

Cauda moderately long, pointed.

Legs very short, the hind pair scarcely projecting beyond the apex of the abdomen. Tarsi rather long.

Rostrum very short, hardly reaching to the second coxa.

The shortness of the limbs separates this genus from *Hyalopterus*, and the length of the tail from *Cryptosiphum*. The linear character of the body is unusual. The winged form has not been observed, but, as this Aphis lives on the tufted summits of plants, it is very probable that such exists.

BRACHYCOLUS STELLARIÆ, *Hardy*. Pl. LXXXV, figs. 1—3.

Aphis stellariæ, Hardy.
„ *holci*, Hardy.

Apterous viviparous female.

	Inch.	Millimètres.
Size of body	0·070 × 0·025	1·77 × 0·62
Length of antennæ	0·020	0·50

Cornicles wart-like.

Body very long and narrow, yellow or shining black, dusted more or less freely with a meal-like coat, with which it lines the surfaces of the tufts of leaves, within which it conceals itself. Antennæ very short, the last joint as long as any of the others. Nectaries hardly to be seen. Tail obvious. Eyes black or brown. Legs short and ochreous-brown, slightly hairy.

The winged insect has not yet been discovered. This curious Aphis some years ago was described in the 'North British Agriculturalist,' ii, p. 788, by Mr. James Hardy, under the name of *Aphis stellariæ*, and

allusion was made to the same insect in another number, under the name of *Aphis holci*.

This insect infests both these plants, but as Mr. Hardy has seen them ovipositing on the *Stellaria holostea* he prefers adopting that plant as a nominator of the new species, since it would appear it there takes its origin.

The figures of my plate were drawn from numerous live specimens sent to me from Wooler, in Northumberland, and from Penmanshiel Wood, in Berwickshire, in the month of August. The same competent naturalist has since kindly furnished me with notes on the economy of this Aphis, the substance of which I here append.

Mr. Hardy writes: "*Aphis stellariæ* is eminently social, and is not unworthy of the notice of the vegetable physiologist from the parts of the plants in which it nestles undergoing a fantastic disarrangement. Its favourite plant is the stichwort, *Stellaria holostea* and *S. graminea*, on which it is found within a hollow pod fabricated from the leaves, each side of the leaf being brought together above to form a canopy. It checks the growth of the shoot in such a manner that the leaves cluster into rigid tufts; vegetable irritation completes the structure.

"During the summer it migrates from the stitchwort to one of the grasses, *Holcus mollis*. Here it likewise revels in the centre of a tuft of leaves, for these leaves, being prevented from receding, embrace each other at their bases like those of a sedge. In this manner a kind of boat is formed for the protection of the colony. In the autumn the Aphis reverts to the Caryophillaceæ.

"On the 4th of October I observed it on the terminal shoots of *Cerastium triviale*, growing in the dried-up channel of an upland rivulet, whose leaves were similarly clustered in a boat-like form. The females were then engaged in depositing their eggs—minute, black, oblong-oval bodies.

"Assuming that the Aphis is again resuscitated in May there are about seven months of the year in which the entire species is reduced to a condition analogous to that of an annual plant whose vital powers are transferred to its seeds, liable to dispersion through the sport of accident—to be swept off by the torrent or scattered by the wind."

The nests of this species often contain "blobs of honey-dew," covered with a film of the white dust which covers the insect. I have before noticed that this curious secretion is often abundant in the curled leaf-tufts of the Schizoneura of the elm.

It will be noticed that *Brachycolus stellariæ* has an economy very similar to that of the preceding species, *Cryptosiphum artemisiæ*, which also constructs contorted leaf-tufts.

Aphidivorous Hymenoptera.

The predatory and parasitic habits of the Ichneumonidæ are too well known to allow here of more than a passing sketch, and it will be well to confine our remarks pretty much to such as relate only to the economy of Aphides. Such a notice perhaps, will be thought legitimate, inasmuch as numerous minute species of the Hymenopterous group—a group which Messrs. Kirby and Spence considered probably composed one-fourth of the whole insect world—exert their powerful influence in keeping down the redundance of life of the Aphis family.

The predaceous Hymenoptera of Great Britain have been estimated by Westwood to comprise, at the very least, three thousand species.

Of the two great sections *Terebrantia* and *Aculeata* of Latreille, concerning the first it will only be necessary to remark on the Aphidivorous Cynipidæ, Ichneumonidæ, and Chalcidiæ; and as to the second section, viz. the *Aculeata*, to treat on some of the more impor-

tant Aphidivorous insects under the head of fossorial Crabronidæ.

The Cynipidæ.

Though as a general rule these insects are gall-feeders, several forms are known to be parasitic. Such habits, not in accordance with the usual economy of the group may warn classifiers not to trust exclusively either to unique modes of life or structural peculiarities, in assigning the natural affinities of any animal.

The "Cinips de l'Ichneumon de pucerons" of Geoffroy, Westwood has shown, belongs to the Chalcidiæ; but the latter author, in June 1833, bred a true Cynips from the larva of *Aphis rosæ*, which, he says, is specifically distinct from *Cynips erythrocephala*, of Jurine, which, Haliday says, likewise infests the rose Aphis.*

Curtis remarks also that *Cynips fulviceps* and another species destroy the Aphides of the willow and the parsnip.†

M. Goureau obtained a black Cynips with a red head and rufous legs from *Aphis rosæ*, which, he says is distinct from *C. fulviceps* and *C. erythrocephala*. The same insect also is parasitic on one of the plum Aphides. In addition to those drawn on Plate LXXIII, fig. 6, of this Monograph, may be seen a black Cynips, which I bred from Fonscolombe's peach Aphis, *Aphis amygdali*. On account of its black head and legs, it does not appear to be identical with either of the above noticed Cynipidæ.

Singularly, where there are specific differences, it may happen that foes become friends. This may be instanced by the fact that some Aphides, like *Phylloxera quercûs* (*punctata ?*), occasionally take up their abode in the chambers of galls, the produce of their enemies the Cynipidæ. It is not improbable that the accumu-

* Westwood's 'Intro. Mod. Class.,' vol. ii, p. 132.
† 'Ent. Mag.,' ii, p. 102.

lation of sap in these vegetable monstrosities is one cause of the curious localization of such different insects.

This family of gall-makers has straight, non-flagellate antennæ, each composed of from thirteen to fifteen joints. The ovipositor is sub-spiral and internal. The wings are comparatively simple in character and have but few nervures. The males, where such have been discovered, show one or two antennal joints in excess of the females.

Aphidivorous Ichneumonidæ.

This section was constructed by Leach out of the large group indicated by Linneus. Most of the members are notable for the extraordinary *quasi* intelligence they show in constructing their cells, and storing them with animal food of various kinds for the use of their young and footless larvæ. The somewhat fanciful but expressive appellation of the family relates to the fabulous habit of the quadruped of that name, which formerly was supposed to deposit its young in the open mouth of the sleeping crocodile, from whence it proceeded to eat its way out to liberty through the entrails of the reptile.

Although the Ichneumonidæ chiefly prey upon the Lepidoptera, they attack other orders of insects. Even the chitinous coverings of the Coleoptera are not proof against the penetration of the ovipositors of some species. Westwood has figured an Ichneumon ovipositing in the larva of a Syrphus, whilst the latter was in the very act of extracting the juices from a living Aphis.

Those Ichneumons which attack Aphides are minute, and are often hardly larger than their victims. Such may be considered as the least highly developed members of the family.*

* For a digest of this section of the Ichneumonidæ the reader cannot be referred to a better authority than Westwood's 'Introduction,' &c., pp. 125, 137, 155, 191.

The particular genus Aphidius, was devised by Mr. Haliday, who grouped the parasitic species then known under the sub-family *Ichneumonides adsciti* of Nees ab Esenbeck.

The larvæ are footless grubs, which develope from eggs laid by the winged females (generally singly, but sometimes five or more) within the bodies of the Aphides. These grubs live on the food assimilated by the Aphides, and do not, until at the last moment, attack their vital organs. The pupæ undergo their metamorphosis in silken cocoons; or, rather, the dry skins of their victims form the necessary cells, which are sparsely lined with silk. The number of antennal joints of the perfect insect varies from above sixteen even to sixty. The wings are more elaborately veined than in the Cynipidæ, and yet more markedly so than in the Chalcidiæ.

A few insects of this group may be mentioned under the following genera, of which the genus Aphidius may be recognised by the comparative simplicity of the wing-veining:

Aphidius rosæ (Hal.), a common species which attacks *Siphonophora rosæ*. In the middle of June, I watched for more than a quarter of an hour a sprig of rose bush incrusted with Aphides. Two individuals of the above Aphidius were seated on the backs of two Aphides. They seemed to be pleasurably excited by the wriggles and contortions made by their victims in their attempts to throw them off, for they remained fixed for five or more minutes before they inserted their ovipositors by a sort of thrust. After this act, they took flight in pursuit of other game. This Aphidius had long, straight, unflagellate antennæ, composed of seventeen almost equal joints.

Aphidius cancellatus has a similar parasitic habit on several Aphides. It is figured in Vol. I, Plate IV, fig. 4.

Aphidius avenæ (Hal.) is described in Curtis' 'Farm Insects,' part i, fig. 12, p. 303. It is parasitic on *Siphonophora granariæ*.

Aphidius constrictus infests both *Siphonophora rosæ*, and *S. millefolii*.

Aphidius obsoletus (Westmael) is parasitic on the peach Aphis.

Aphidius varius probably is identical with *Ichneumon aphidium* of Geoffroy.

To these may be added the species cited by Haliday—*Aphidius laricis*, *A. circii*, *A. deltiger*, *A. exoletus*, and *A. plagiator*.

Of the genus Allotria (*Xystus*, Hartig), *Allotria victrix* has been described by Westwood, who saw the process of oviposition in the rose Aphis.

Allotria erythrocephala. Walker states that this insect almost saves the water-lily from destruction, by its attacks on *Rhopalosiphum nymphææ*, which sometimes kills the plants over large surfaces of the Thames and other sheets of water. Mr. Smee has also assured us of the destruction of acres of this beautiful plant by this Aphis at Hampton Court.

M. Bouché says the complete development of Aphidius is effected in about four weeks, which is nearly the period shown in the life of a single Aphis.

Ephedrus plagiator is figured and described in Vol. I, Plate VII, fig. 1, of this Monograph. Also see Curtis' 'Farm Insects,' p. 290.

Trionyx rapæ is also described by Curtis. I have bred it from *Aphis brassicæ*, Vol. II, Plate XLVI, fig. 7.

Aphidivorous Chalcidiæ.

This family is in close relationship with the foregoing Ichneumonidæ. Its parasitic habits are well represented by not a few Aphidivorous species, which may be noted for their diminutive size. The tribe generally is remarkable for their brilliant metallic colours, such as gold and copper, which glance finely in the sunshine.

The antennæ are flagellate or elbowed, and composed of from six to twelve joints, the three first of which are often soldered into one. The wings are exceedingly

simple and almost veinless. There is, however, a strong subcostal vein, which runs parallel for a short distance with the costal vein, with which it for a space unites; and afterwards it descends obliquely into the membrane of the wing. There it ends in a kind of knob or thickening. The antennæ sometimes differ in the two sexes, and the female head is often dilated beyond the breadth of the thorax. Mostly the ova are deposited directly within the larvæ of their victims; but in some instances, as in *Pteromalus ovulorum*, the Chalcid egg is deposited within the egg of its victim. The parasitic egg afterwards discloses the young grub, which attacks the Aphis hardly older than itself. Thus the insect is born with its pest—the fell cause of its ultimate destruction.

The Chalcidiæ differ from the Proctotrupidæ, inasmuch as the latter have longer palpi, and the number of their antennal joints is from ten to sixteen.

The following species of Chalcidiæ are quoted from a list drawn up by Dr. Reinhardt; but some, it will be seen, are only connected with the Chalcidiæ by intervening links.

Agonioneurus flavicornis, Foerster.
— *subflavescens*, Westw.
Callimone auratus.
Chrysolampus aphidiphagus, Ratz.
— *æneus*, Ratz.
— *suspensus*, Nees ab Esenbeck.
Coryna clavata, Walk.
Cyrtogaster vulgaris, Walk.
Diplolepis aphidis, Bouché.
Eurytoma æenea, Nees.
Hypsicamara Ratzburgii, Foerst.
Mesosela elongata, Walk.
Myina chaonia, Walk.
Pteromalus aphidivorus, Foerst.
— *ovulorum*, Foerst.
Spalangia nigra, Latr.
Tridymus aphidium, Ratz.

Mr. Walker has paid much attention to the minute Ichneumonidæ, and it is principally on his authority that the following remarks on the modern synonyms of the above list are founded.

Chrysolampus suspensus is believed to be identical with *Coryna* (*Coruna* of Curtis) *clavata*, which belongs to the Proctotrupidæ. Nees ab Esenbeck saw it emerge from the larva of *Aphis rosarum*. I have bred Coryna from the silken tent which it constructs under and between the legs of the dried larval skin of *Siphonophora rosæ* and of *Aphis rumicis*. Whether it feeds on the larva, or preys on the larva of the parasite within the Aphis, is not yet perfectly clear.

This curious economy of tent-making is not confined to the members of this genus. M. Audouin discovered the same constructive power in *Microtomus terminalis*, an insect which infests *Coccinella punctata*, and spins a like cocoon below its body.

The name Coryna has been altered from Coruna, which was adopted by J. Curtis, who gives a good description of *Coruna Carpenteri* in his useful work on 'Farm Insects.' He there states that it is parasitic on Ephedrus and not on Aphis, which I am also inclined to believe.

Cyrtogaster vulgaris was seen by Haliday to prey on Aphides.

Eurytoma ænea is synonymous with *Asaphes ænea*, one of the Sphegigastridæ. This insect is compact in form, and unlike the lighter made Aphidius, on which the young grub, hatched from the inserted egg feeds. Thus, while the Asaphes proves itself a friend to the Aphis, it is a foe to the agriculturalist, in a manner similar to some Pteromali, which destroy the Coccinellidæ, the natural checks to the increase of Aphides.

Mesolata elongata was seen by Nees to lay its eggs in the bodies of Aphides previously infested by *Aphidius varius*. Walker thinks it is identical with *Asaphes aphidum* and *Eurytoma ænea*.

Myina flava is very small, and oviposits in *Calli-*

pterus quercûs and *C. coryli*. After these larvæ have been struck by the fly they speedily turn to a shining black colour.

To this list of Chalcids may be added *Ceraphron Carpenteri*, Curtis (*Megaspilus*), *Encyrtus atheas*, *Elassus parvicornis*, which Walker thinks is equivalent to *Ephedrus*, Westm., and *Colax dispar* of Curtis, which may prove to be a Pteromalus.

Mr. Walker informed me that he had bred Trioxys and Ephedrus from Aphides.

After an Aphis has been struck by an Allotria or Aphidius it undergoes a peculiar change of form. This alteration is even more remarkable if the Aphis has succeeded in passing into the pupal stage before the parasite wholly kills it. In both cases the skin is hardened into a globular, shining, chitinous or horny box, within which in some cases the transformation into the imago is effected, and out of which in other cases the larva eats its way, in order to construct the above-noticed tent.

The Aphis sometimes dies only at the last phase of its metamorphosis, for some pass out of the pupa into a complete winged condition; but its fell enemy has only delayed its action. In the case of Coryna the tent under the abdomen gives a fanciful resemblance to an ancient tilting casque. Such a helmet is figured under the imago of *Siphonophora rosæ*, Plate LXIV, fig. 1.

There scarcely seems to be a limit to the law that the death of one is the life of another. On tearing open one of these tent-like cocoons, eight or more shining oval bodies were found, which I can only regard as the pupæ of some minute Chalcid of a different kind. As no Coryna grub was present, I could only suppose that it had been consumed. Thus, there would seem to be cases of parasites on the parasite of another parasite of an Aphis! We may ask where does this series stop?

It cannot be doubted that atmospheric influences and

the prevalence of natural enemies tend more to the destruction of insect pests than any artificial methods that yet have been devised. Perhaps we might avail ourselves, more than we do at present of these parasitic checks on redundant life. Thousands of *Rhopalosiphum nymphææ* may often be found on the water-plaintain, 90 per cent. of which, perhaps, are attacked by Allotria or other Ichneumonidæ. Such leaves might be introduced into gardens and green-houses with marked beneficial effects, since the emerging parasites do not seem to be confined to preying on single specific forms. In the same manner colonies of the common *Siphonophora Sonchi* often have far more numerous infected than whole members in their community, and these former might be used for a similar purpose.

A change of form occurs in an Aphis after it has been struck by an Aphidius or Allotria; but this form does not apparently alter after the insect has suffered a second attack from a Ceraphron or Asaphes. Walker thinks that suitable Aphides are recognised by Asaphes, &c., by their altered shape, but we do not know how the last insects become aware that an Aphidius-struck Aphis has, or has not been before tampered with by an insect of its own species.

Bibliography of Aphidivorous Ichneumonidæ.

Haliday on "Parasitic Hymenoptera," vol. i, p. 259, 482, of 'Entom. Mag.,' also vol. ii, p. 99.

Curtis, 'Brit. Entomology and Guide,' where fifty-four species of Aphidii are recorded, forming the subgenera Praon, Ephedrus, Toxares, Monoctonus, Trionyx, and Aphidius.

J. Curtis, 'Guide to the Arrangement of Brit. Insects,' 1829.

Nees ab Esenbeck, 'Hymenop. Ichneum. Affinium Monog.' vol. ii, 1834.

J. O. Westwood, 'Introduct.,' &c., vol. ii, pp. 125, 153, 173.

'Brit. Museum Cat. of Chalcidiæ,' 1853.

Rev. O. Morris, 'Third Cat. Brit. Chalcidiæ,' 1865.

F. Walker, 'Notes on Chalcidiæ,' with figures, 1871.

By the same, "Economy of Chalcidiæ," 'Entomologist' for 1873.

Aphidivorous Fossorial Crabronidæ.

The insects of this group of the Aculeate Hymenoptera are placed by Prof. Westwood first on the list of Fossores.

General remarks on their specific characters, and in some cases on their economy, have been furnished by Linneus, Latreille, Panzer, and others; but the peculiar habit shown by some genera of preying on Aphides, and storing them in their nests, was first perhaps shown by our countryman, J. Curtis. Nees ab Esenbeck, W. E. Shuckard (a former librarian of the Royal Society), A. Kennedy, and Dr. J. Giraud, of Paris, have since added to our knowledge of this group.

These insects cannot fairly be regarded as parasitic, for their eggs are not deposited within the bodies of other insects. The latter are simply captured and stored for the use of their young during their larval condition.

On the other hand, if an egg be fixed on, or inserted into, the body of a living animal, the aggressor clearly must be regarded as a true parasite.

St. Fargean, more than thirty years ago, described the attack of a Pompilus upon *Targenaria domestica*, a species of spider, and in a graphic manner showed that the sting is used to numb and paralyse its prey without producing immediate death.

Such a procedure obviously would much facilitate a removal of the insect prey to its own nest, by preventing all inconvenient struggles to get free.*

* 'Hist. Nat. de Int. Hym.,' tome 2, p. 580, Paris, 1841.—St. Far-

It is probable that a like habit of numbing their victims is practised by the Aphidivorous Crabronidæ; but, as many days must elapse between the hatching of the young Crabro and its metamorphosis into the pupa, there is room for some surprise that the stored Aphides during such a protracted period should continue in a state fresh and fit for food. Possibly a torpid condition, something analogous to hybernation, may be induced by the action of the sting-poison, whereby the vital functions are placed in abeyance, or reduced to their minimum state of activity. Certain it is that Aphides and other insects may be artificially preserved alive for weeks deprived of food, if care be taken to check evaporation from their bodies, by keeping them in a damp atmosphere.

Such a humid state obtains within the pith of briars, or the raspings of rotten wood, and as the nursing cells of these Hymenoptera are commonly constructed in such situations, the conditions are eminently favorable for producing a protracted sleep.

It would appear that each species of the fossorial Hymenoptera confines itself, as a rule, to a particular prey, and indeed to a particular species of prey. The number of individuals introduced into a burrow much depends on the size of the insect to be fed. In some cases, where lepidopterous larvæ are used, but one specimen suffices for the food of the young; but in other cases as many as sixty or even one hundred individuals may be huddled together in a single cell. Thus it is that *Crabro vagus* crams its cells with blue-bottle-flies, on which the white fleshy apodous grub feeds.

These larvæ are usually enclosed in thin paper-like cases, the remains of which may be often seen in such

gean's words are interesting: "Recourbant son abdomen la perce (l'arachnide) du fatal aiguillon, qui lance dans la plaie la liqueure vénémeuse qui occasionne sur le champ la paralyse de la victime sans lui ôter la vie. Celle ci conservée, sans être autrement blessée montrait encore au bout de trois semaines de legers signes de vie par le mouvement des pattes et la souplesse des articulations," &c. &c.

empty cells as are excavated in brambles or rotten posts.

The family Crabronidæ is rich in the number of species. The winged forms may be generally recognised by their wasp-like characters, and the bright yellow and brown colouring of their bodies.

For the principal generic characters Professor Westwood's 'Introduction,' vol. ii, p. 191, may be advantageously consulted, but in this slight sketch the head of the Crabronidæ may be described as large and square; the antennæ often thickened at their tips, the abdomen more or less oval, and broadest in the middle, sometimes united to the thorax by a pedicle. The number of the submarginal cells in the anterior wings varies from one to four. The legs are moderate in length; the anterior tibiæ have a dilated spur, which is pectinated on the inside. The basal joint of the fore tarsi has a corresponding ciliated notch.

J. Curtis relates that Mr. Waring, towards the end of August, took him to a summer-house in his garden, and then showed him multitudes of small black Hymenoptera entering the straws of the thatch, many of them carrying Aphides in their mouths. These Hymenoptera belonged to at least four different genera, amongst which Curtis identified *Hylæus annularis*, *Psen ater*, *Pemphredon unicolor*, and a *Diodontus*.*

On splitting these straws he found in some masses of pollen, and in others stores of numerous living Aphides.

In 1837, Shuckard published his essay on the 'Fossorial Hymenoptera,' confirming Curtis' observations, and adding new species to the then known list of Aphidivorous Crabronidæ.†

In the following year A. Kennedy contributed an important paper to the 'Philosophical Magazine,' which contained much new matter and more complete information on the same subject.‡ But, perhaps the best

* *Vide* Curtis, 'Brit. Entom.,' 2nd edit., plates 496, 632, 652, &c.

† W.E. Shuckard, 'Essay on the Indigenous Fossorial Hymenoptera.'

‡ A. Kennedy, "Observ. on Hymenop.," 'Phil. Mag.,' vol. xii, p. 14.

description of the group was furnished to the Entomological Society of France, in 1866, by Dr. J. Giraud. To this Memoir,* which is confined to a description of those Hymenoptera which excavate the pith within the dry twigs of the bramble, I am indebted for many of the details following.

I may be permitted in a general way to extract certain portions, which set forth the curious instinct shown by these insects in the manner of constructing their cells and storing them with suitable food.

Giraud says "that, previous to his own observations, but twenty-seven species of insects were known to excavate the stems of the briar for the purpose of constructing their nurseries, but in 1866 he had been able nearly to double this list."

Dr. Giraud continues, "Their parasites, which are numerous and of various genera, sometimes attack one definite species; in other cases they are less exclusive in their choice of victims, and concern themselves with species of different genera." "Pourvu que les larves dont leur progéniture doit se nourrir puissent fournir une alimentation suffisante. Cette prévoyance de la mere n'est jamais en défaut. Quelque fois elle sépare les sexes et confie les males, qui sont généralement plus petits à des espèces dont la taille est en rapport avec la leur; tandis que les femelles dévorent des espèces différents et de plus forte taille," &c. &c.

These words are somewhat ambiguous, and might be taken to refer either to the larvæ of the constructor of the nests, or the larvæ laid up as provisions for her own young, but Sir Sidney S. Saunders kindly allows me to quote some of his remarks, which seem much to clear the sense of the above passage, and illustrate the remarkable economy of these creatures.

Translating the above, he says, "Sometimes she separates the sexes (of her brood ?) and confides the males, which are generally smaller, to victims of corre-

* J. Giraud, "Insectes qui habitent les tiges sèches de la Ronce," 'Ann. de la Soc. Ent. de France,' tom. xvi, pp. 443—500,

sponding size, while the females devour other species of greater bulk," and then he remarks, "I am surprised that no allusion should have been made by Dr. Giraud, beyond this casual notice, that the mother *sometimes* separates the sexes, giving less food to the *males*, which are usually smaller, and more to the *females*, which are larger, according to their respective requirements."

Instead of these selections being exceptional cases, Sir Sidney Saunders contends that "this separation of the sexes is the ordinary and invariable rule in all cases where these briar cells are constructed in serial sequence; whether among the Crabronidæ, the Andrenidæ, the Eumenidæ, or Apidæ, the lower cells, up to a certain range, being always tenanted by females, and the upper by males; the former retaining their adipose condition longer, and being slower in attaining maturity than the latter." Thus, in inverse ratio to the period of their respective occupancy, the males from the outermost cells, constructed last, are ready to emerge first. We may say with Giraud that nothing is more varied than the industry of these nesting species.

Each constructs its cells in the mode most appropriate to itself, and determines with remarkable precision the quantity of food necessary for the nourishment of the larvæ of the generation to come—a generation, be it remembered, that the mother can never see.*

Thus it is, that when the provisions are exhausted, the larvæ have no further wants; they remain in an inactive condition, and often for a protracted period, until they transform into the pupal and final winged states.

Nevertheless, whatever may be the means employed by the parents in constructing these curious galleries and cells, no species can wholly escape the attacks of its peculiar parasite—nothing can hinder their mission to keep a just balance between the increase and the

* Perhaps she is satisfied with the contemplation of the immortality she creates for herself, in the efforts she makes towards the development of her race yet to come!—*Vide* 'Nineteenth Century Review,' July number, 1877, p. 836, *et seq.*

reduction of these insects, and to act as checks on the development of Aphis life.

It would appear that Aphides form the nourishment of the greater part of the Pemphredonidæ, such as are included in the genera Pemphredon, Cemonus, Diodontus, Passalæcus, and Stigmus. Giraud states that the genus Celia seems to confine itself to the storing of Cocci for its young.

The Crabronidæ do not tunnel in the hard ligneous portions of the bramble stems, but choose the softer pithy parts. They enter those twigs where the pith has been exposed by fractures, or the cut of a knife.

"Leurs premiers travaux sont masqués par l'espèce de toit que forme la section en biseau,"* and what is of greater importance, the mouth of the gallery is protected against the intrusion of rain, which, if allowed to enter, would be most destructive to the inmates.

I append the following short list of Aphidivorous Crabronidæ, with a few remarks on the species, chiefly taken from the observations of the above authors.

Crabo Panzeri, on the authority of Shuckard, provides its larvæ with living Aphides.

Pemphredon lugubris, Fabr., was seen by Kennedy to burrow in decayed wood and to throw out the sawdust, depositing Aphides.† Both Latreille and Shuckard had before noticed its Aphidivorous habit. It does not appear to be a pith borer; at least it is not noticed as such by Giraud.

Pemphredon (Cemonus) *unicolor*, Panz., is common about hedgerows. Giraud observes, under the heading *Cemonus unicolor*, that he had already demonstrated, in a Memoir published in 1863 at Vienna,‡ that this insect excavates the stems of the rose and briar, and "quelle approvisionne ses cellules de petits Aphis aptères et à abdomen bituberculé." He says he is certain of his facts, and that the insect is by no means

* J. Giraud, l. c., p. 446; Shuckard, l. c., p. 174.
† A. Kennedy, p. 17.
‡ Giraud, 'Verhandl. der Zool.-bot. Gesellschaft.'

exclusive as to the choice of plants for its nidification, mentioning, amongst others, the rose, the bramble, the elder, and *Eryngium campestre*. The fact is curious also that it often inhabits the galls forsaken by *Cynips Kollari* and those made by Dipterous flies. He mentions three parasites which attack the Pemphredon in its galleries.*

Psen atratus. — Kennedy observed this insect "making its cells in the straws of thatch, providing them with Aphides. As many as one hundred were found in some of them. The egg of this insect is white and semi-transparent, and is attached to the abdomen of an Aphis at the bottom of the cell."† He remarks that the partitions of the cells appear to be made of the cemented scrapings of the inside of the straw. The imagos appeared in July, by thousands about the thatch. By the kindness of Sir Sidney Smith Saunders I am enabled to figure this insect from his cabinet, and also to represent the mode in which a long series of cells, have been constructed in a bramble stem. There can be little doubt that these cells are provisioned by the mother with Aphides, just as in other like cases we find them stored in straws.

Giraud, describing the cells made by Psen, says, "une cloison mince, dure, lisse, un peu bombée, ressemblant à une rondelle de parchemin formait la séparation des cellules."‡ Further, he says the genus Psen, like the genus Mimesa, which has been separated from it, has been regarded by many authors as parasitic; but this opinion has been combated by the observations of Westwood, Kennedy, Schenck, and by others. Giraud doubts not that *Psen concolor* provisions its cells with Psyllidæ, and he points out the curious fact that all those seen were *nymphs* and not larvæ, for they all had thoracic scales, representing the rudimentary wings. "Amongst the numerous kinds which

* Giraud, 471.
† Kennedy, p. 17.
‡ Giraud, p. 470.

nidificate in the bramble, there is no other that I know which makes the like provision."

Curtis was aware of the Aphidivorus habits of Psen, and figures the insect amongst others.*

The imago measures 2·5 lines across the wings, and sometimes occurs as early as April.

It might seem to be a natural inference that the lowest cells in the series being first stored and completed, the occupants would first undergo their changes, and in the act of liberating themselves disturb the whole series of cells above them. But it is an ascertained fact that the egg is fixed to the first specimen of the prey at the bottom of each cell, and that the larva gradually works its way upwards, for its head is always turned in the direction of the exterior opening. After consuming its provision, it eventually hibernates as an adult larva, and does not change into a pupa until the following year, a few weeks after which it assumes the imago condition. A remarkable circumstance has been communicated to me by Sir S. Saunders, that "in the protracted period which intervenes before the imago is matured, and which may be accelerated or retarded by heat or cold, it matters little whether a month or two more or less should have elapsed."

Psen constructs its cells in sequence, but does not confine itself to a single row of chambers. Three or more series may run parallel to the length of the stem; and in the escape of the imago, as might be anticipated, the dividing walls of one series occasionally break through to the adjoining empty cells. Such an example may be found in my figure on Plate LXXXV, where twenty cells or more succeed each other in a piece of bramble stem not more than six inches long.

Sir S. Saunders informs me "in all instances where these cells are constructed in a serial sequence, such as those of *Psen*, *Trypoxylon*, *Crabro*, and others, the larvæ remain with their heads directed towards the

* Curt., 2nd edit., 'Brit. Ent.,' pt. 25.

next cell in succession, through which they will eventually have to pass in effecting their exit by the top of of the tube. Such is not, however, the case with Cemonus and Stigmus, for generally their larvæ are disposed transversely in irregular sidings, from which they escape through a general corridor of exit.

Passalœcus gracilis occasionally excavates the pith of the bramble and also of the rose, and therein collects black Aphides to feed its young.

Passalœcus corniger, according to Giraud, also has a similar economy.

Diodontus minutus.—Westwood states that this insect burrows only in sand, but, on the other hand, Sir Sidney Saunders informs me "that he has obtained apparently the same species also from briars, without, however, discovering any clue to its pabulum, nor does Shuckard advert thereto." The genus, however, is cited by Giraud as Aphidivorous in its habits, which accords with Kennedy's observation. *Diodontus tristis* is also believed to be Aphidivorous.

By the courtesy of Mr. Fred. Smith I am enabled to figure the last two insects from his collection.

Stigmus pendulus.—Giraud found galleries excavated by this insect, "chargée de petits crottins agglutinnés," amongst which he traced the dry remains of Aphides, such as are found in the nests of Aphidivorous larvæ. He adds that Dahlborn places *S. pendulus* amongst the "Pemphredoniens aphidivores."*

No faith can be given to the accounts which would exceptionally comprise under the same category *Tryporylon figulus* and *Mellinus arvensis*, which are known to provide other food for their larvæ.†

* Giraud, p. 473.
† Shuckard, pp. 117, 205.

List of the Parasitic Hymenoptera which are illustrated in the present and former volume of this Monograph.

Aphidius cancellatus, Plate IV, fig. 4.
**Coryna Carpenteri*, Plate VII, fig. 2.
— *clavata*, Plate LXXXVI, fig. 5.
— *dubia*, Plate LXIV, fig. 1.
Cynips atriceps, Plate LXXIII, fig. 6.
Diodontus tristis, Plate LXXXVI, fig. 3.
— *minutus*, Plate LXXXVI, fig. 4.
Ephedrus plagiator, Plate VII, fig. 1.
Psen atratus, Plate LXXXV, fig. 4.
Trionyx rapæ, Plate XLVI, fig. 7.

Notes on the Colouring Matter of Aphides.

To those who have mounted Aphides for the microscope, in Canada balsam or other preserving fluids, the fact must be familiar that a dye-like substance proceeds from many of the darker kinds, which permanently stains these liquids of a fine violet. The marked blood-like stains proceeding from the bodies of the "American blight," *Schizoneura lanigera*, has been noticed by Smee and others.

The proximity of the two families Coccus and Aphis might perhaps, lead us to think that this colour had something in it analogous to carmine, which is obtained from an aqueous infusion of *Coccus cacti*, precipitated by the joint action of a salt of tin and alumina, or a tartrate. If such an identity of colouring matter were an established fact, a chemist would regard it with some interest.

The colours of Aphides may be roughly grouped into greens, yellows, reds, and dark brown or black,

* In the explanation of the plate this insect is called Coryne. Probably it is identical with *Ceraphron Carpenteri*.

which last hue in reality partakes more or less of intense violet or purple.

In many cases these colours appear to depend on the differing conditions of the vitality of the insect, for it is to be noticed that as autumn approaches and cold weather reduces the activity of Aphides, the lively greens and yellows commonly become converted into ferruginous red, and even dark brown.

These changes have some analogy with the brilliant hues assumed by the maple and other leaves during the process of slow decay, and the changes effected in chlorophyl by different degrees of oxydation. Chlorophyl, thus acted on, successively passes into Erythrophyl, Xanthophyl, and finally into the dense black which in leaves is the mark of death.

This view would appear, indeed, in some cases to pass beyond a mere analogy, for Schultz has shown that chlorophyl is the chief colouring matter in Volvox, and in certain low forms of animal aquatic life, such as Hydra, Stentor, and Ophrydius.

An easy method of obtaining chlorophyl consists in digesting crushed green holly leaves in hot alcohol, and then agitating the cold strained solution with carbonic disulphide. This liquid falls to the bottom of the infusion, after having abstracted the greater part of the chlorophyl.

Prof. Filhol* has shown that an acetic acid solution of chlorophyl produces with a copper or zinc acetate a fine green colour, and advantage is taken of this by some manufacturers to enliven the colour of their pickles, much, however, to the detriment of the consumers of their articles of provision.

Keeping in mind the above properties of chlorophyl, the following experiments were made, to learn how far the colours of Aphides followed the deportment of the colours of leaves under similar treatment.

Separate aqueous solutions were prepared both of the dark-brown and the yellow-green varieties of Aphides.

* 'Extr. Journal Chem. Society,' vol. ii, 112, 1876.

Their bodies were crushed under a small quantity of water, and the infusion, after standing some time, was filtered from the insoluble residue. The solutions showed a decided epipolism or fluorescence, the brownish-red tint, seen by reflected light, being changed into a greenish hue by transmitted light. The colour is extracted from the solution much more readily by boiling alcohol; and carbonic disulphide again takes it up, as with chlorophyl.

The tinctorial properties of Aphides is most markedly shown amongst the Lachninæ, but it also obtains amongst the Aphidinæ and Schizoneurinæ. In the order commencing with the more pronounced characteristics we have—*Lachnus longipes*, *L. saligna*, *L. pinicola*, *L. picea*, *L. juniperi*, *Schizoneura lanigera*, *Aphis rumicis*, *A. padi*, *Dryobius croaticus*, and *Melanoxanthus salicis*.

The purple colouring matter of these insects appears to be a quasi-living principle, that is, it is an educt from the living mass, not a product by a subsequent chemical oxydizing process. This view does not militate against Mr. Sorby's investigations with the spectroscope, but merely supplements them.

Very shortly expressed, the chemical reactions are as follows:—Lead acetate produces a sparing whitish precipitate. Mercurous nitrate produces a pretty abundant brown precipitate. No characteristic precipitate can be obtained by the joint solutions of an alumina and stannous salt, which treatment is the method employed for producing carmines from infusions of *Coccus cacti*.

Hydrochloric or nitric acids turn the solutions yellow, and then bleach them. A marked reaction, however, is observable by the addition of an alkali. Aqueous potash strikes a deep purple, or rather a port-wine red; a colour which permanently stains paper or cotton, but the dye is at once discharged by a weak acid, and does not reappear by recurrence to the alkali.

This fine purple colour is produced in the largest quantity by warming the bruised mass of Aphides with dilute potash or ammonia.

The chief difference between the solutions of brown and green Aphides consists in an alkali changing the latter into a gamboge-yellow instead of a purple.

These experiments lead rather to the conclusion that the colouring matter of Aphides partakes more of the nature of chlorophyl or its derivatives than of the derivatives of carminic acid.

It is worthy of note that in the generality of cases colouring matters, such as indigo, Indian yellow, madder lake, and the like, do not separately exist in the substance of vegetables, but the pigments are disengaged through fermentation or oxygenation. Again, alizarin is itself a reddish-yellow, but alkaline solutions strike it a rich violet, just as we find them act towards the substance Mr. Sorby calls Aphidilutein.

This able experimenter has, as before stated, brought the spectroscope to bear on the solutions of Aphis colouring matter, and particularly he examined that obtained from bruised masses of *Schizoneura lanigera*. This tinctorial matter he likewise collected by agitation with carbon disulphide.*

Such a solution, viewed through a prism, was found to give a broad absorption from the yellow, over the green, to the centre of the blue, without, however, bringing into view any very well marked narrow bands. This colouring matter, which he calls Aphidein, is affected by several chemical agents. It is changed to yellow by citric and other acids, but the colour is restored by the addition of excess of ammonia.

The changes effected by the oxydation of Aphideine are very rapid in some cases, and they are accompanied by a gradation of hues, the reds passing into yellow Aphidilutein, and back again by dioxydation.

* Sorby "On the Colouring Matter of some Aphides," 'Quart. Journ. Mic. Soc.,' xi, p. 352.

Mr. Sorby marks these stages of oxydation by the production of four substances, viz. Aphideine, Aphidiluteine, Aphidiluteoline, and Aphidirhodeine; but before these can be said to be distinct chemical principles, or can have formulæ assigned to them, a further examination is required. The cause of the varying golden spring and autumn tints of our own woods, and perhaps the still more pronounced colours of the forests of America, is worthy of research, and it is believed that Aphis changes, dependent on seasons, have something in common with such phenomena.

INDEX TO VOL. II.

ADDENDA—VOL. II.

Page 31, add to foot-note:—Mr. Frederic Walker, of Oakley House, Abingdon, has suggested an ingenious derivation for the word Aphis, which I may append to the description of that genus. Mr. Walker supposes "the wonder of Linnæus at the numerous progeny from one individual (*ἀπο εἷς*). In such a compound the usual case governed by the preposition would not be expected, and the aspirate of *εἷς*, following *ἀπο*, would convert *ἀπο* into *ἀφ*." Mr. Walker thinks truly there is here less distortion of the letters than appears in the derivations noticed in Vol. I, p. 4, "but the idea is far from being convincing."

Page 106. The original genus Cynips is now split up into smaller genera. Mr. Frederick Smith, on seeing the drawing of the inseet I have named *Cynips atriceps*, says that he believes it to belong to the Proctotrupidæ, and that it closely agrees with a species of Diplolepis of Latreille in the British Museum. Probably it will be more correct, therefore, to call the Cynips *Diplolepis atriceps*.

ERRATA—VOL. I.

In the description of Plate VII, *for* Coryne *read* Coryna.

VOL. II.

Page 144, in foot-note, *for* *κρευπτὸς* *read* *κρυπτὸς*.
Page 150, line 21, *for* Goureau *read* Guérin.
Page 158, line 29, *for* Fargean *read* Fargeau.

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PLATE XXXIX.

RHOPALOSIPHUM RIBIS. (Page 9.)

Fig. 1.—Apterous viviparous female.

Fig. 2.—Winged viviparous female. *a* and *b*, Upper and lower wings. *c*, Clavate cornicles and tail. The former are characteristic of the genus. They are charged with oily globules. *d*, Leaves of the black currant contorted into bladder-like cavities, within which the Aphides conceal themselves. Drawing, natural size.

PLATE XXXIX

Rhopalosiphum ribis.

G. B. Buckton del. et lith. West & Co. imp.

PLATE XL.

RHOPALOSIPHUM LACTUCÆ. (Page 10.)

Fig. 1.—Apterous viviparous female, captured whilst feeding on *Lapsana communis*.

Fig. 2.—Larval form taken whilst feeding on *Sonchus oleraceus*.

Fig. 3.—Pupa of the same.

Fig. 4.—Winged viviparous female. *a*, Head and antenna of the winged female. *b*, Last abdominal rings with their appendages.

PLATE XI.

Rhopalosiphum lactucæ

G.B. Buckton del. et lith

W.W. Saunders imp.

PLATE XLI.

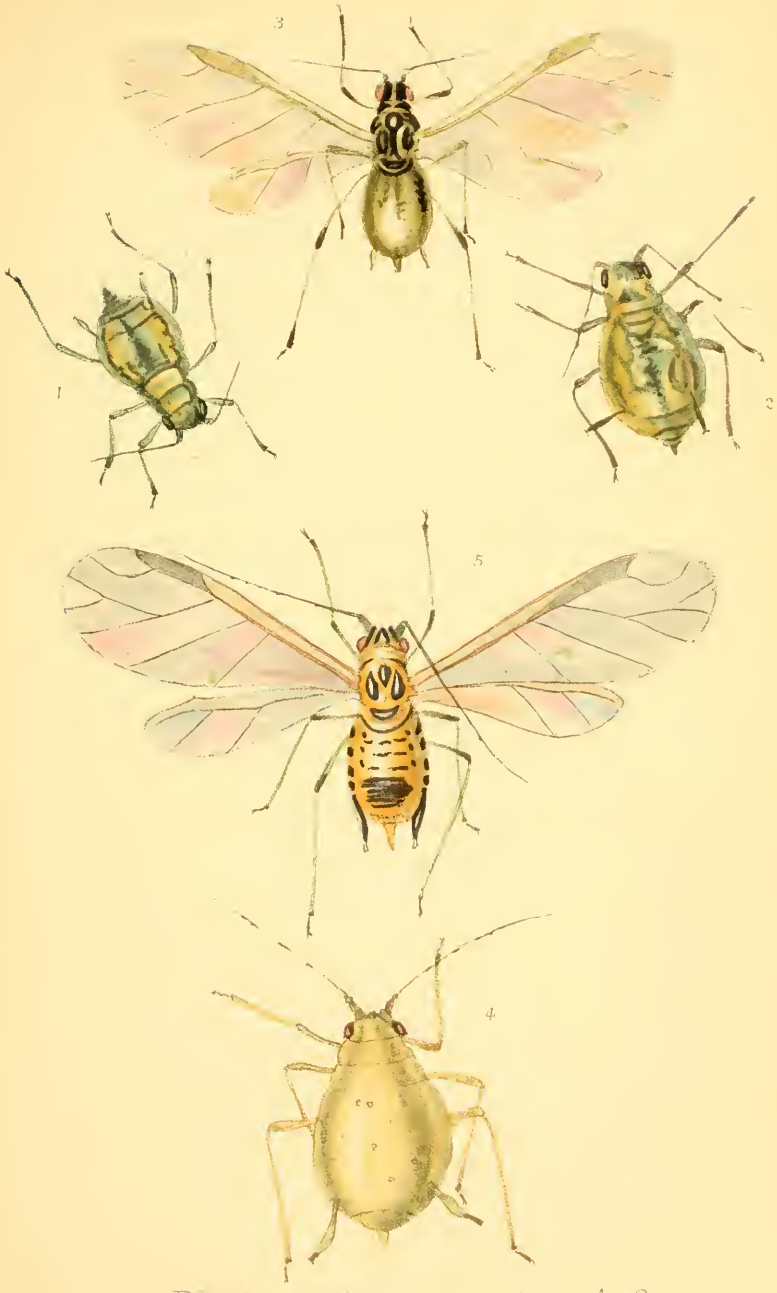
RHOPALOSIPHUM NYMPHÆÆ. (Page 12.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Pupa from the same.
Fig. 3.—Winged viviparous female.

RHOPALOSIPHUM LIGUSTRI. (Page 13.)

Fig. 4.—Apterous viviparous female.
Fig. 5.—Winged viviparous female.

PLATE XLI



Rhopalosiphum nymphææ 1–3
" ligustri 4–5

G.B.Buckton del. et lith. W. West & S.f. Imp.

PLATE XLII.

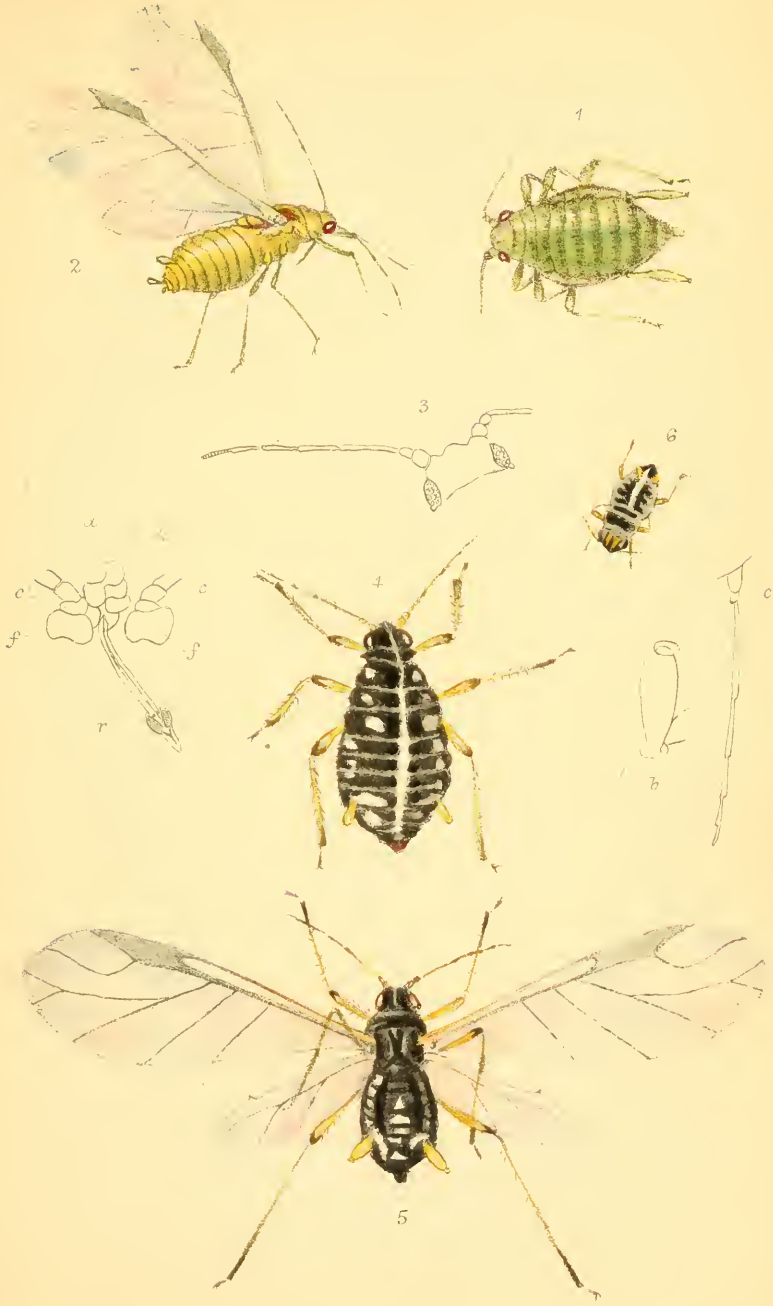
RHOPALOSIPHUM BERBERIDIS. (Page 14.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Winged viviparous female.
Fig. 3.—Head and antenna enlarged.

MELANOXANTHUS SALICIS. (Page 21.)

Fig. 4.—Apterous viviparous female.
Fig. 5.—Winged viviparous female.
Fig. 6.—One of the young brood from the last. *a*, Part of the under side showing—*r*, the rostrum; *c'*, the coxæ; *f'*, the fulcra. *b*, Magnified view of one of the siphuncles. *c*, Enlarged view of an antenna.

PLATE XLII.



Rhopalosiphum berberidis 1–3.
Melanoxanthus salicis 4–6.

PLATE XLIII.

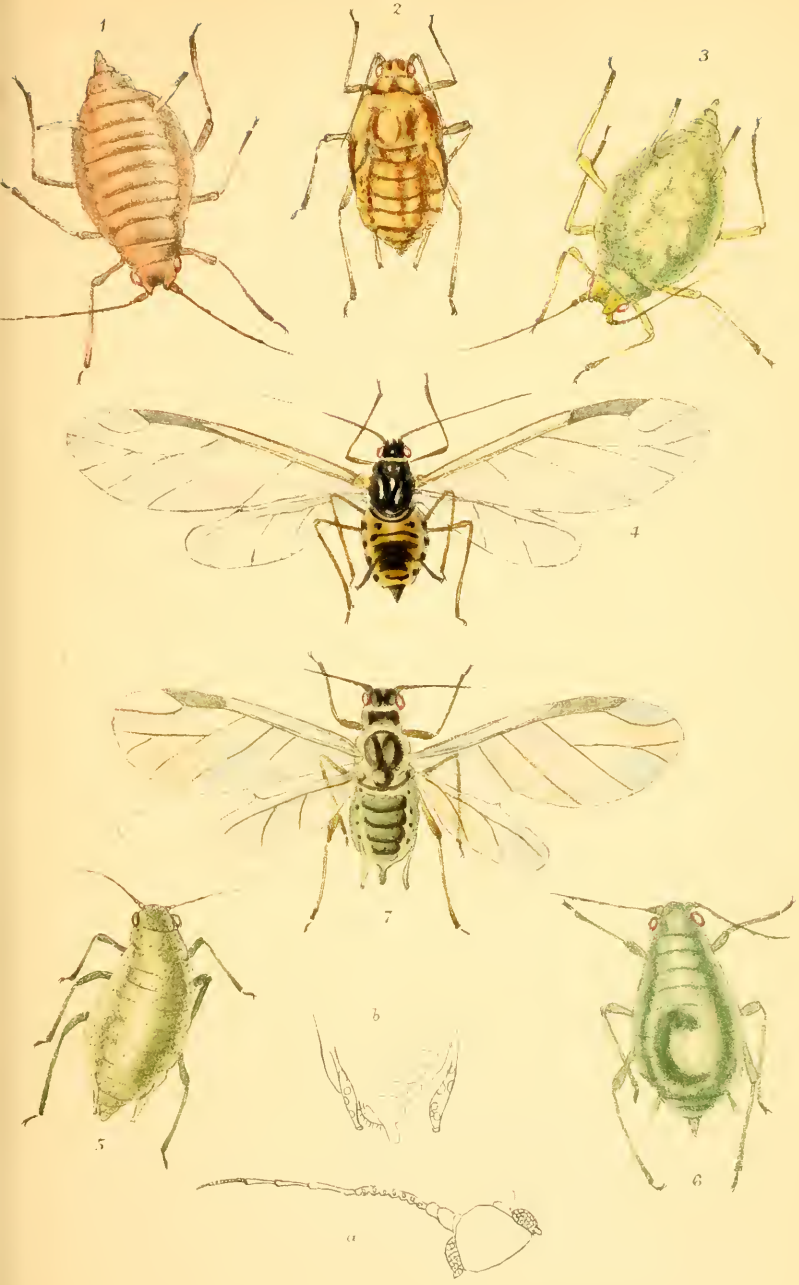
RHOPALOSIPHUM DIANTHI. (Page 15.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Pupa.
Fig. 3.—Green variety of the larva.
Fig. 4.—Winged viviparous female.

SIPHOCORYNE PASTINACEÆ. (Page 24.)

Fig. 5.—Apterous viviparous female.
Fig. 6.—Variety within which a parasitic larva is seen curled into a semi-circle. *a*, Head and antenna. *b*, Cornicles, tail, and anal plate.

PLATE XLIII.



Rhopalosiphum dianthi 1–4.
Siphocoryne pastinaceæ 5–7

G.B.Buckton. del. et lith.

W. West & Co. imp.

PLATE XLIV.

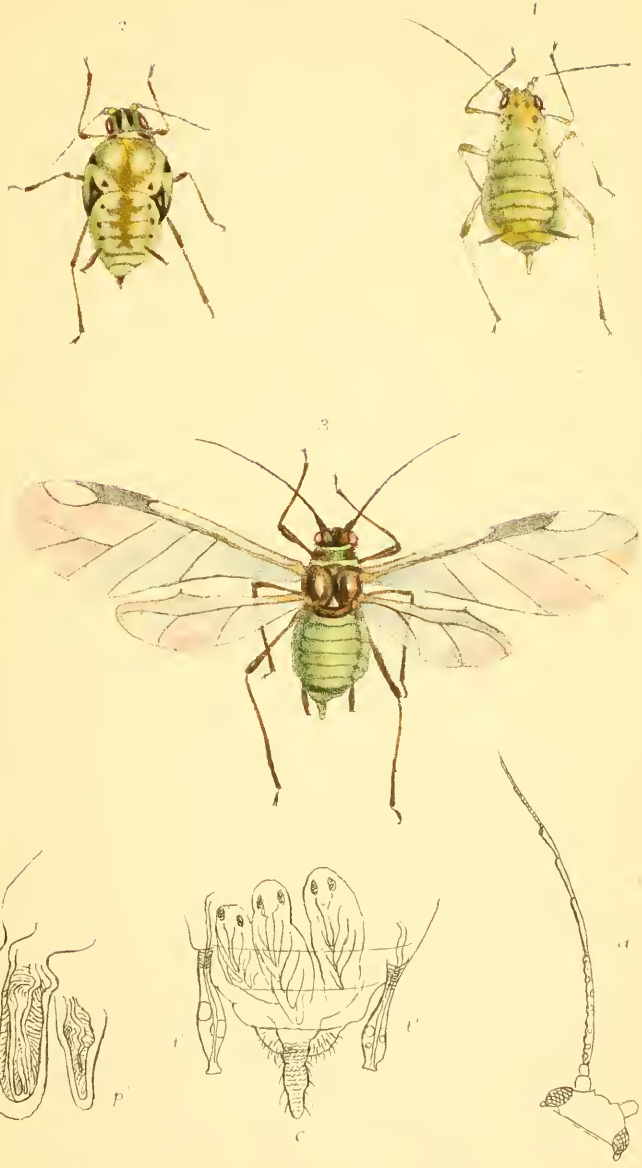
SIPHOCORYNE XYLOSTEI. (Page 25.)

Fig. 1.—Apterous viviparous female.

Fig. 2.—Pupa.

Fig. 3.—Winged viviparous female. *a*, Head and antenna. *b*, Wing cases of the pupa with, *p' p'*, the rudimentary unexpanded wings. From these it will be seen that the development is by a direct growth and not from an unfolding of the membrane. *c*, Posterior abdominal rings containing unborn embryos arranged with their tails towards the vulva. *t' t'*, Cornicles within which are seen the ducts which are continued into the cavity of the abdomen. The oily globules do not seem to pass through these ducts.

PLATE XLIV



Siphocoryne xylostei.

G.E. Bu...ton, Delin. 16th

W. West & Co. Imp.

PLATE XLV.

Siphocoryne Capreæ. (Page 27.)

Fig. 1.—Apterous viviparous female.

Fig. 2.—Young specimen recently born. The rostrum is disproportionately long at this age.

Fig. 3.—Winged viviparous female. *a*, Head and antennæ of the same.

Siphocoryne fœniculi. (Page 26.)

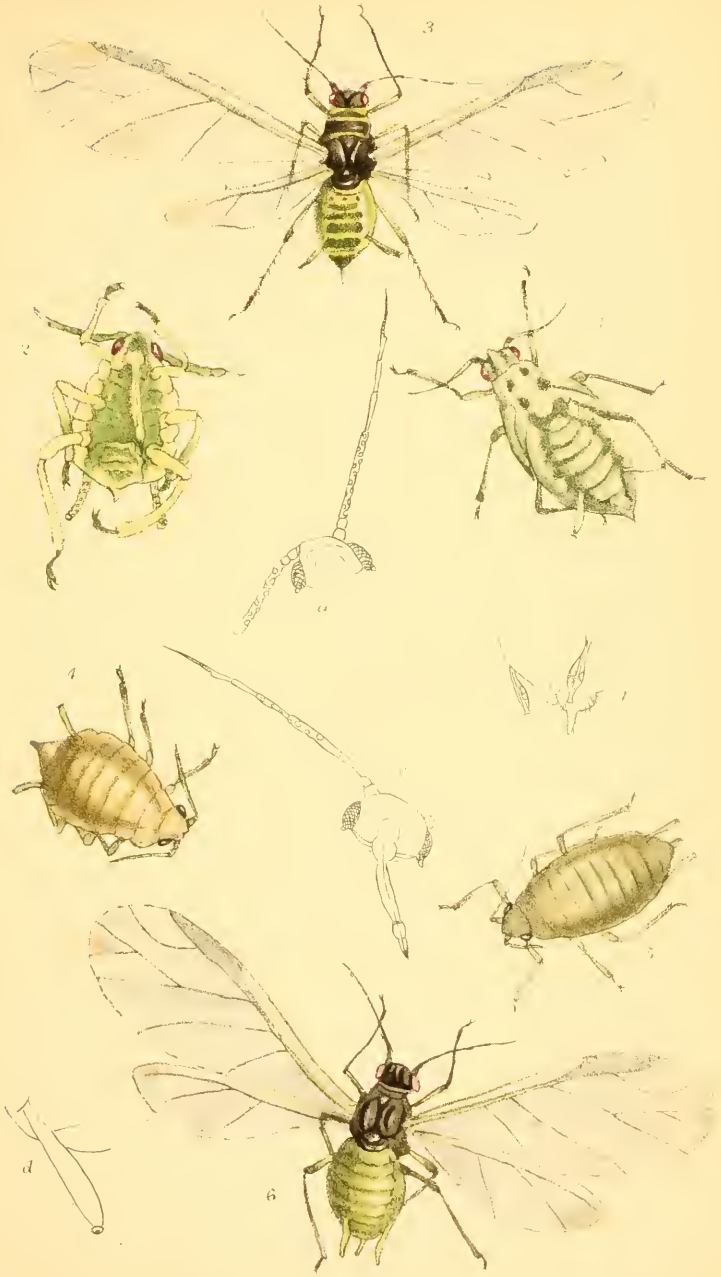
Fig. 4.—Apterous viviparous female.

Fig. 5.—Variety of the same.

Fig. 6.—Winged viviparous female. *b*, Cornicles and tail of winged female magnified. *c*, Head and rostrum of the same. *d*, Altered clavate character of the cornicle of another winged specimen.

An error has occurred in the order of the specific names at the bottom of the Plate. The names should be transposed. (See note, p. 26.)

PLATE XLV



Siphocoryne fæniculi 1 - 6
" " capreæ 7 - 8

G B Burkton del et lith " " W West

PLATE XLVI.

APHIS BRASSICÆ. (Page 33.)

Fig. 1.—Apterous viviparous female covered by her mealy coat.

Fig. 2.—The same, divested of her coat by solution in a drop of ether.

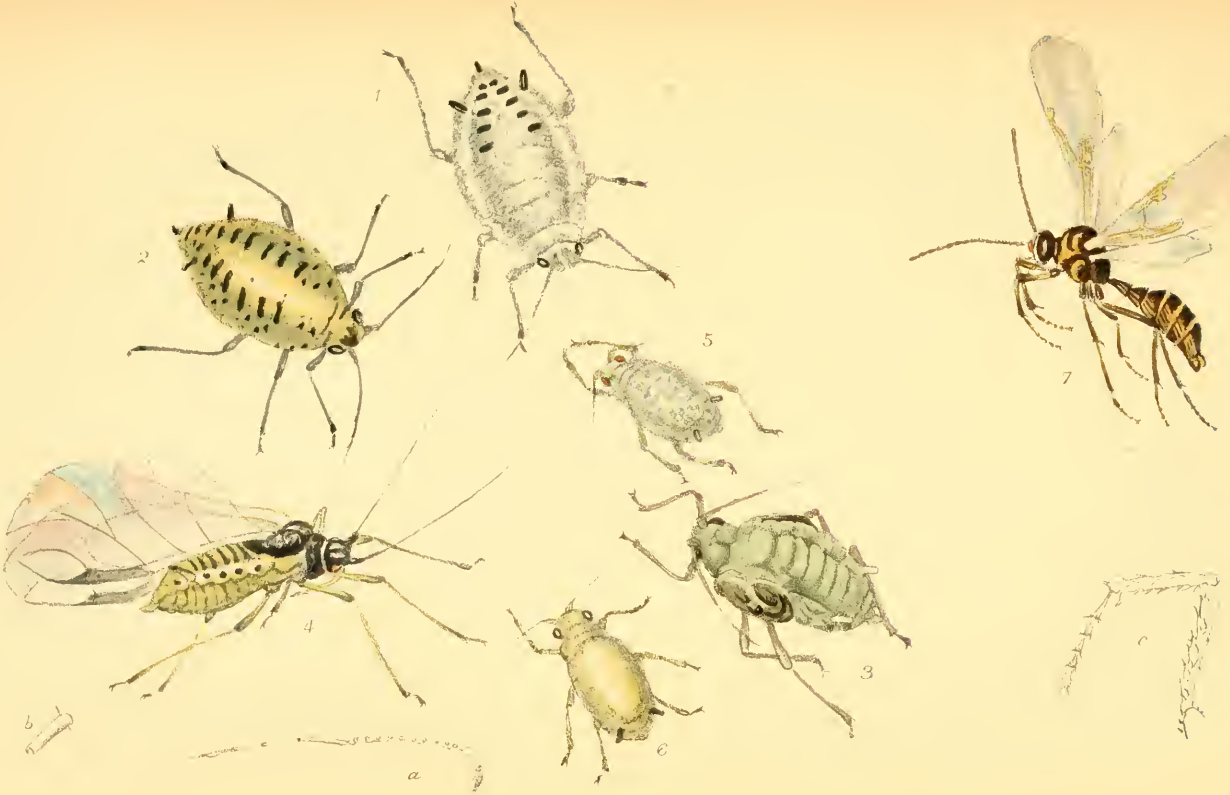
Fig. 3.—The pupa.

Fig. 4.—Winged viviparous female seen in profile.

Fig. 5.—Young with its mealy coat.

Fig. 6.—The same with coat removed. *a*. Head and antenna of winged female. *b*. The cornicle of the same.

Fig. 7.—Trionyx rapæ. *c*, Leg of the same insect.



Aphis brassicæ 1–6. Trionyx rapæ 7.

G.B.Buckton del et lith

W West & Co imp

PLATE XLVII.

APHIS CRATÆGI. (Page 35.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—The pupa.
Fig. 3.—Winged viviparous female.

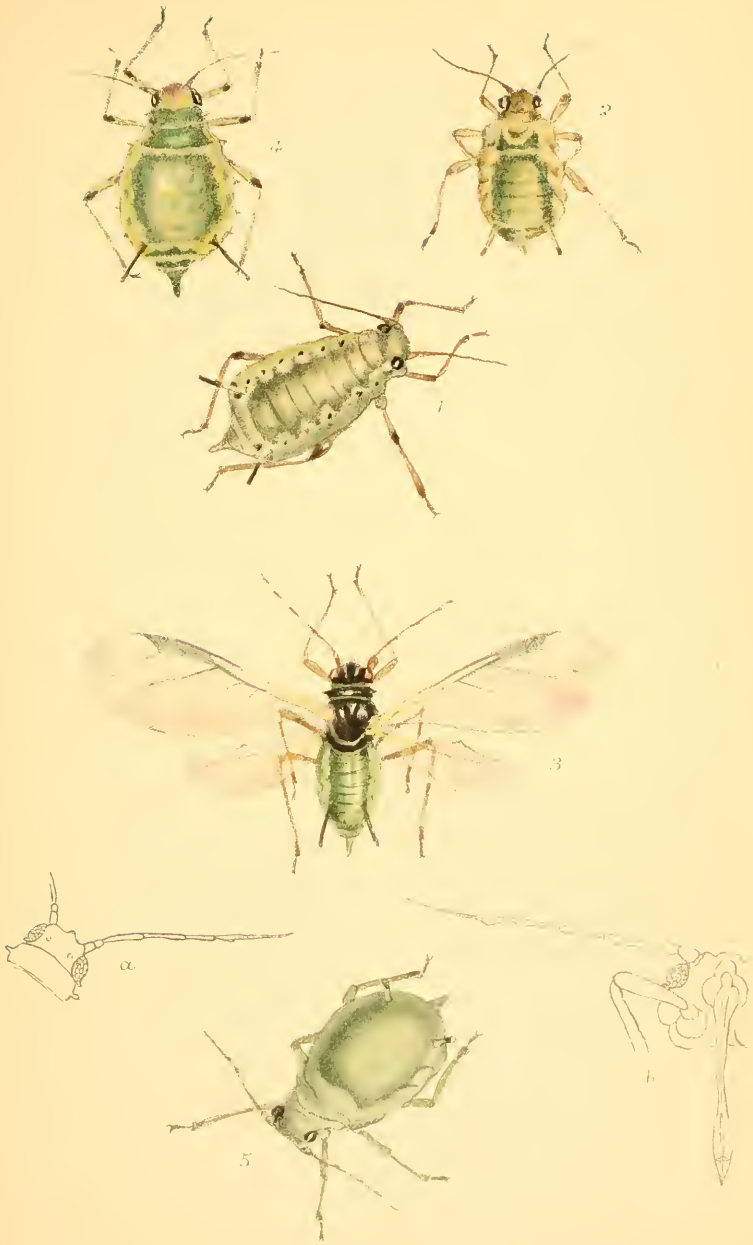
APHIS CRATÆGARIA. (Page 37.)

Fig. 4.—Apterous viviparous female.

APHIS SUBTERRANEA. (Page 38.)

Fig. 5.—Apterous viviparous female. *a*, Head and antenna of *A. cratægi*. *b*, Head, antenna, and largely developed rostrum of *A. subterranea*.

PLATE XLVII.



Aphis cratægi 1–3 A cratægaria 4.
Aphis subterranea 5.

C. B. Buckton del. et lith. W. West & Co. imp.

PLATE XLVIII.

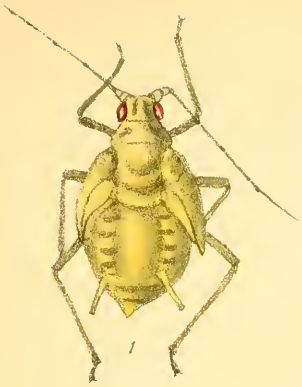
Aphis edentula. (Page 39.)

Fig. 1.—Pupa.
Fig. 2.—Winged viviparous female.
Fig. 3.—Apterous oviparous female, containing ova.
a. Head of the same.

Aphis pedicularis. (Page 41.)

Fig. 4.—Apterous viviparous female.
Fig. 5.—Young of the same immediately after birth.

PLATE XLVIII.



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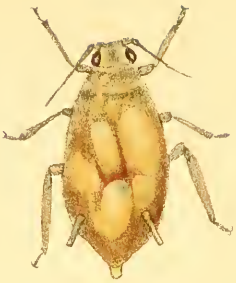

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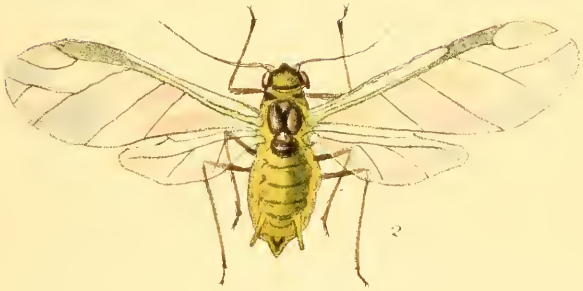

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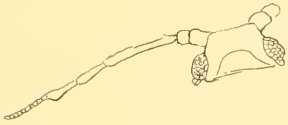

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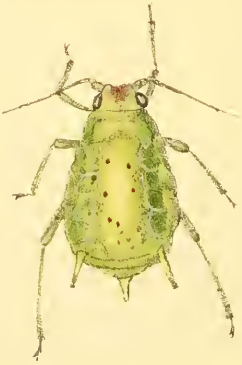


4

Aphis edentula 1-3
„ pedicularis 4-5.

G.B. Buckton del. et lith.

W. West & Co. imp.

PLATE XLIX.

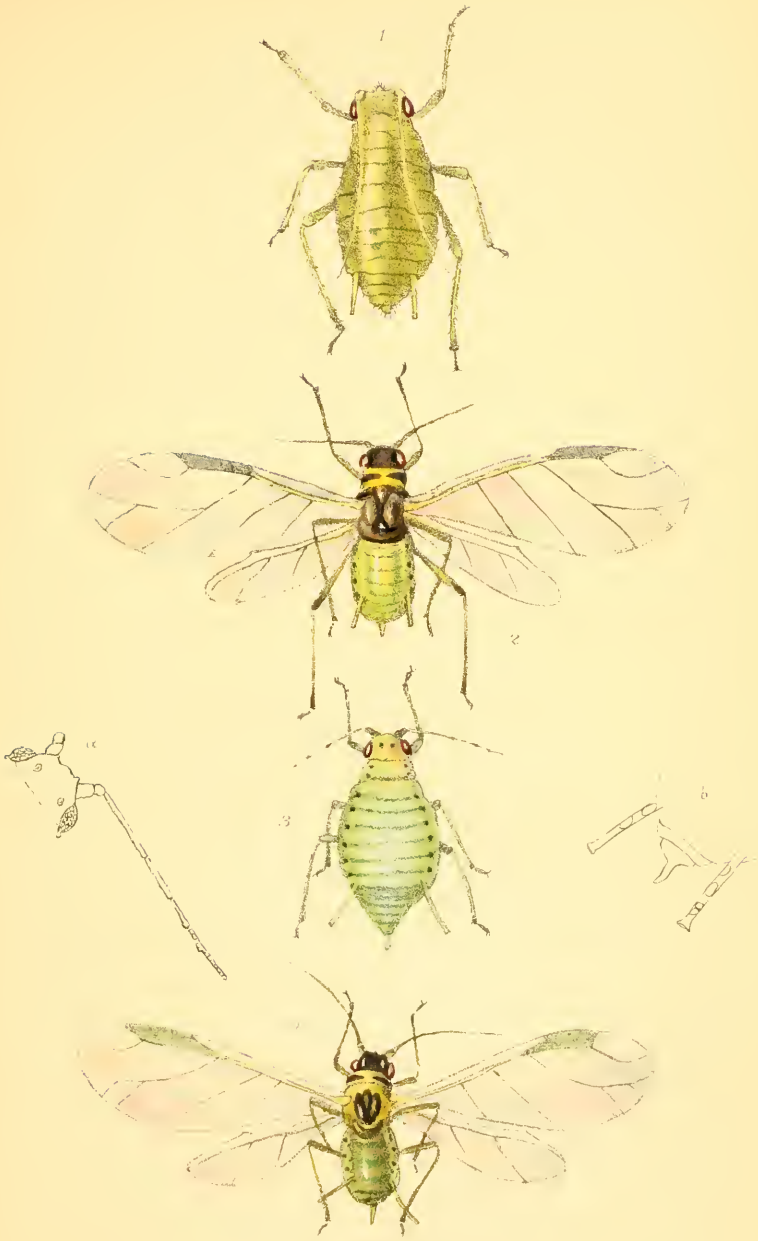
APHIS MALVÆ. (Page 42.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Winged viviparous female.

APHIS ABIETINA. (Page 43.)

Fig. 3.—Apterous viviparous female.
Fig. 4.—Winged viviparous female. *a*, Head of the same. *b*, Cornicles and tail.

PLATE XLIX.



Aphis malvæ 1 2. A abietina 3 - 4.

C.B.Buckton del. et lith.

W.West & Son imp.

PLATE L.

APHIS MALI. (Page 44.)

Fig. 1.—Queen Aphis or foundress of the colony.

Fig. 2.—Apterous viviparous female born from the last.

Fig. 3.—Brown variety of the same.

Fig. 4.—Younger specimen.

Fig. 5.—The pupa.

Fig. 6.—The winged viviparous female. *a*, Head and nectary of the last insect. *b*, Fore and hind wings of the same.

N.B.—A figure of the oviparous female may be found on Plate LXIX bis, fig. 3. The insect was kindly forwarded to me by M. Jules Lichtenstein, and eggs were laid after the mother-Aphis arrived in England from Montpellier.

PLATE L

Aphis mali.

G B Buckton del et lith.

W West & Co imp

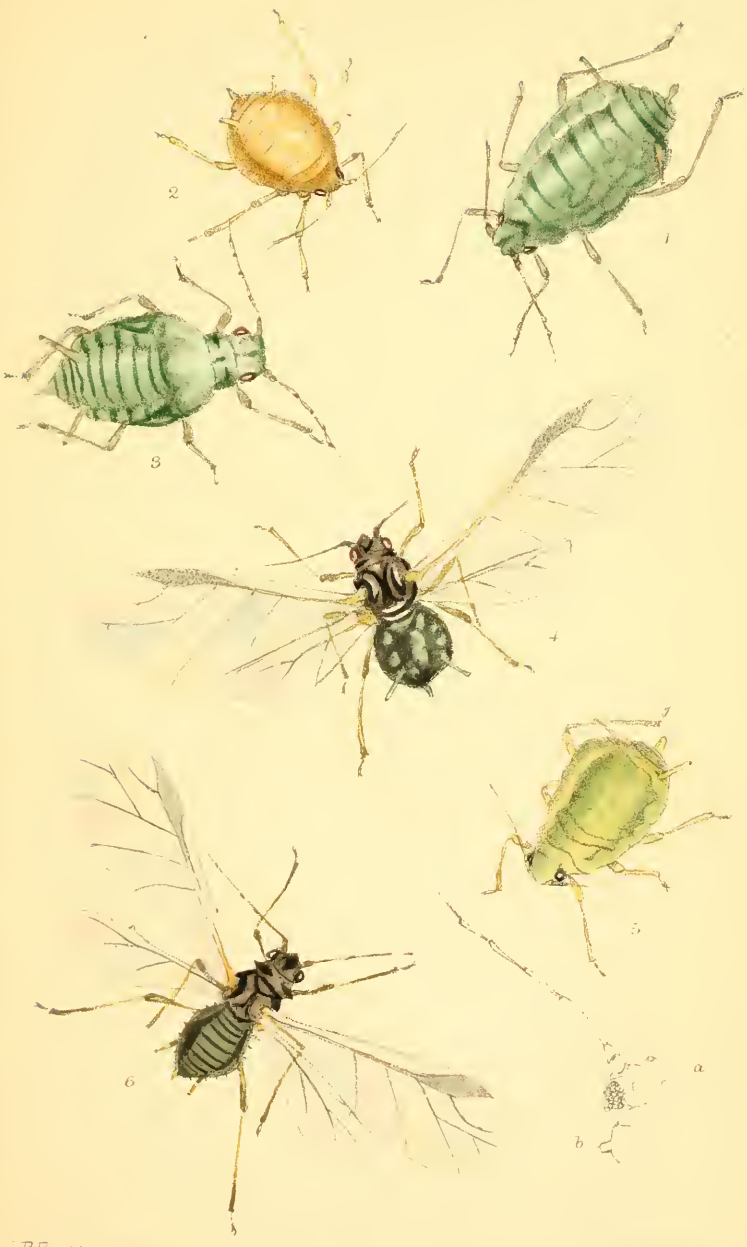
PLATE LI.

Aphis urticaria. (Page 50.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Young specimen, nearly colourless.
Fig. 3.—Pupa.
Fig. 4.—Winged viviparous female.

Aphis penicillata. (Page 51.)

Fig. 5.—Apterous viviparous female.
Fig. 6.—Winged viviparous female. *a*, Head, stemmata, and antennæ of the same. *b*, Thorax, showing the lateral papilla.



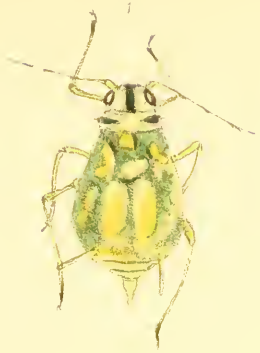
J B Buchan del et lith

Aphis urticaria 1 2
A geminata 3 4

PLATE LI BIS.

APHIS SALICETI. (Page 52.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Underside of the same.
Fig. 3.—Winged viviparous female.



G B Buckton del. et lith.

W. West & co. imp.

Aphis salicet.

PLATE LII.

APHIS PYRARIA. (Page 53.)

Fig. 1.—Apterous viviparous female.

Fig. 2.—Underside of the same, showing the abdominal rings.

Fig. 3.—Young, recently born, and without pigment.

Figs. 4, 5.—Varieties of the winged female. *a*, Head and antennæ of the last. *b*, Portion of the outer integument highly magnified, showing its corrugated character.

PLATE III

G.B.Buckton del et lith

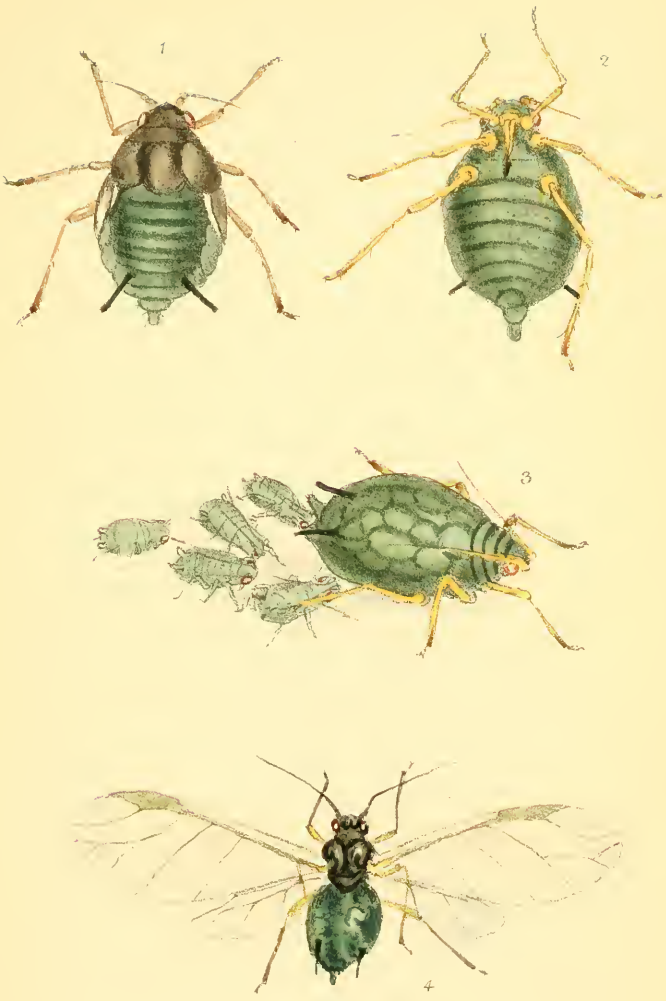
W.West & Co imp

Aphis pyraria.

PLATE LIII.

APHIS SCABIOSÆ. (Page 55.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Underside of the same.
Fig. 3.—Female with her progeny just born.
Fig. 4.—Winged viviparous female.



G.B.Buchan del et lith

W.West & Co. imp

Aphis Brassicae

PLATE LIV.

APHIS CUCURBITI. (Page 56.)

Fig. 1.—Pupa.
Fig. 2.—Winged viviparous female.

APHIS SORBI. (Page 58.)

Fig. 3.—Apterous oviparous female.
Fig. 4.—Underside of the same. Two eggs, nearly matured, occupy the greater part of the abdomen and thorax.
Fig. 5.—Winged viviparous female.

PLATE LV.

APHIS LENTIGINIS. (Page 59.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Winged viviparous female.

APHIS PADI. (Page 61.)

Fig. 3.—Pupa.
Fig. 4.—Winged viviparous female.

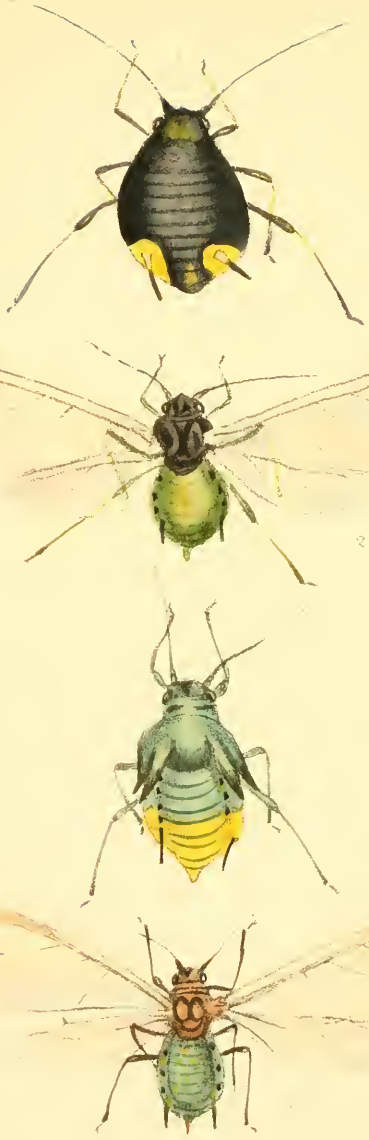


PLATE LVI.

APHIS PRUNI. (Page 64.)

Fig. 1.—Pupa.
Fig. 2.—Winged viviparous female.
Fig. 3.—Male with voluminous wings.
Fig. 4.—Apterous oviparous female. *a*. Rostrum of the female. *b*. Genito-anal rings, with cauda and cornicles of winged female, viewed from under side. *c*. Head, rostrum, coxæ, and tuberculated antennæ of the winged male.

N.B.—The rostra of the males of Aphis are always well developed. The males of some Pemphiginæ, &c., on the contrary, have no rostra or mouth parts.

PLATE LVII.

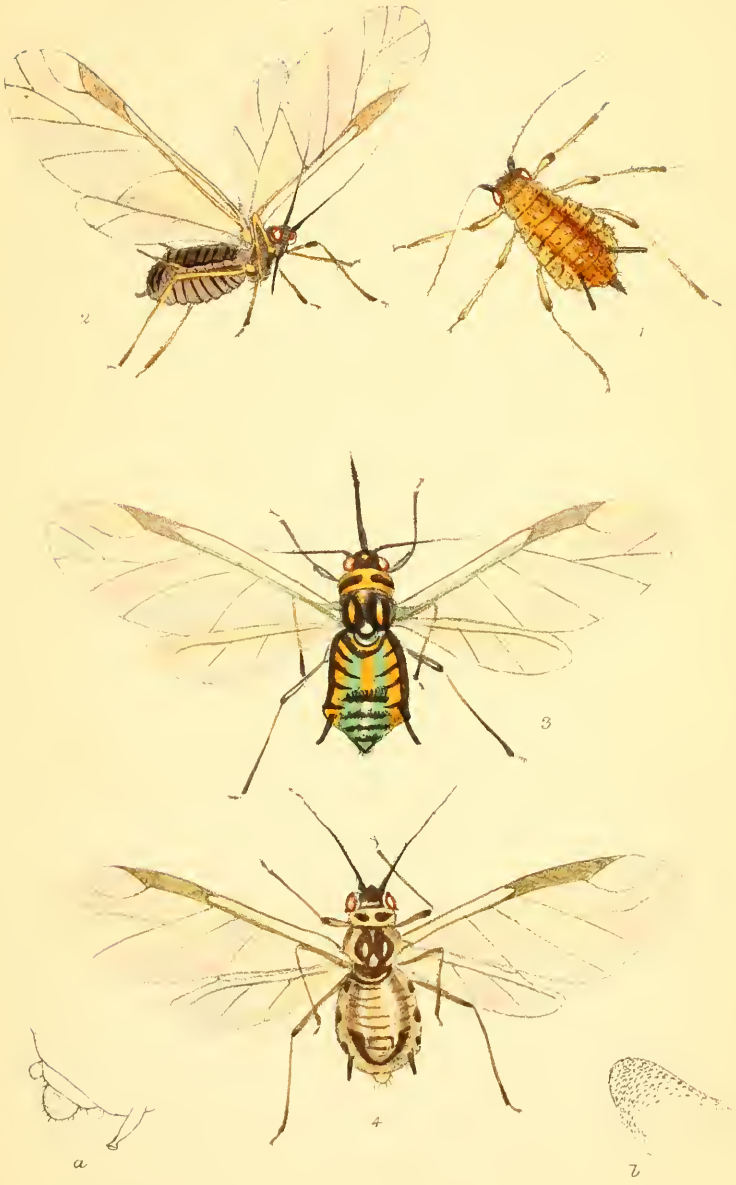
APHIS HIERACII. (Page 67.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Winged viviparous female.

APHIS FARFARÆ. (Page 68.)

Fig. 3.—Winged viviparous female.
Fig. 4.—Variety of the same insect. *a.* Posterior rings of the abdomen, showing the lateral papillæ and obtuse tail. *b.* Apex of the hinder wing, with its imbrication and hooklet.

PLATE LVII



G.B.Brackton del et lith.

W.West & Co imp.

Aphis hieracii 1-2.
„ farfaræ 3-4.

PLATE LVIII.

Aphis petasitidis. (Page 69.)

Fig. 1.—Pupa.

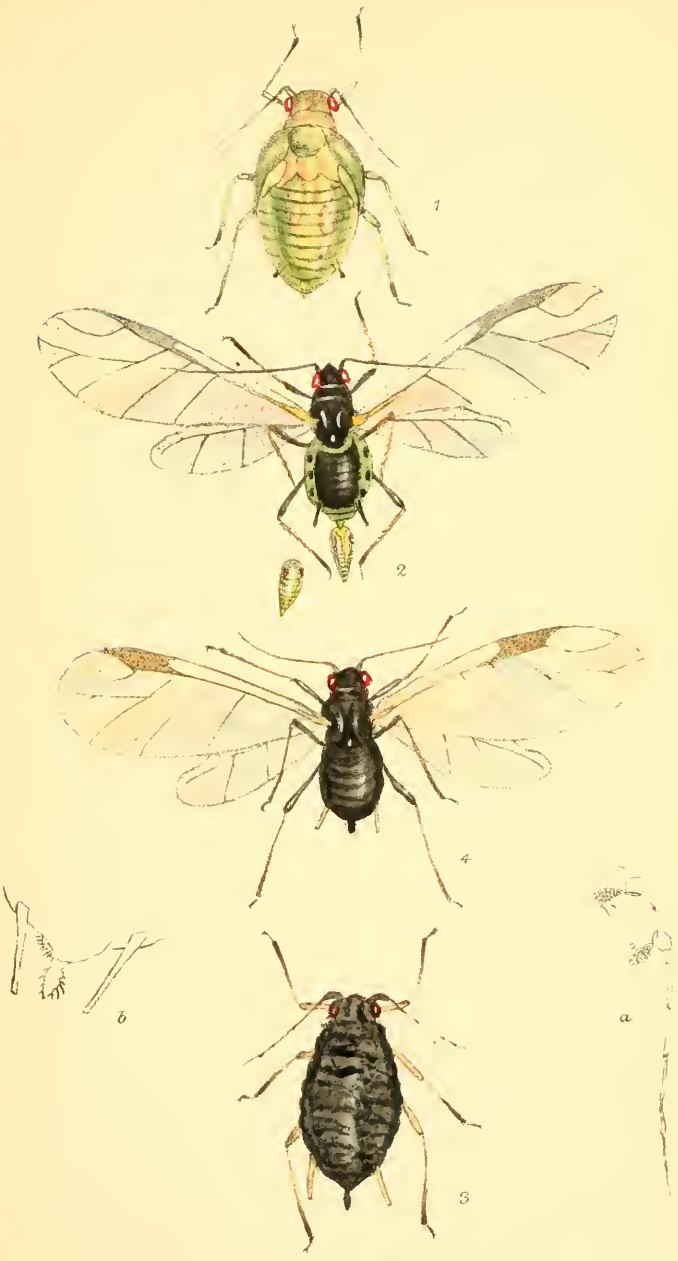
Fig. 2.—Winged viviparous female, showing the birth of the young, tail foremost, and their envelopment in a delicate membrane.

Aphis epilobii. (Page 71.)

Fig. 3.—Apterous viviparous female.

Fig. 4.—Winged viviparous female. *a*. Head and antennæ of the same. *b*. Tail and cornicles.

PLATE LVIII.



G.B.Buckton del. et lith.

W.West & Co. imp.

Aphis petasitidis 1–2.
„ epilobii 3–4.

PLATE LIX.

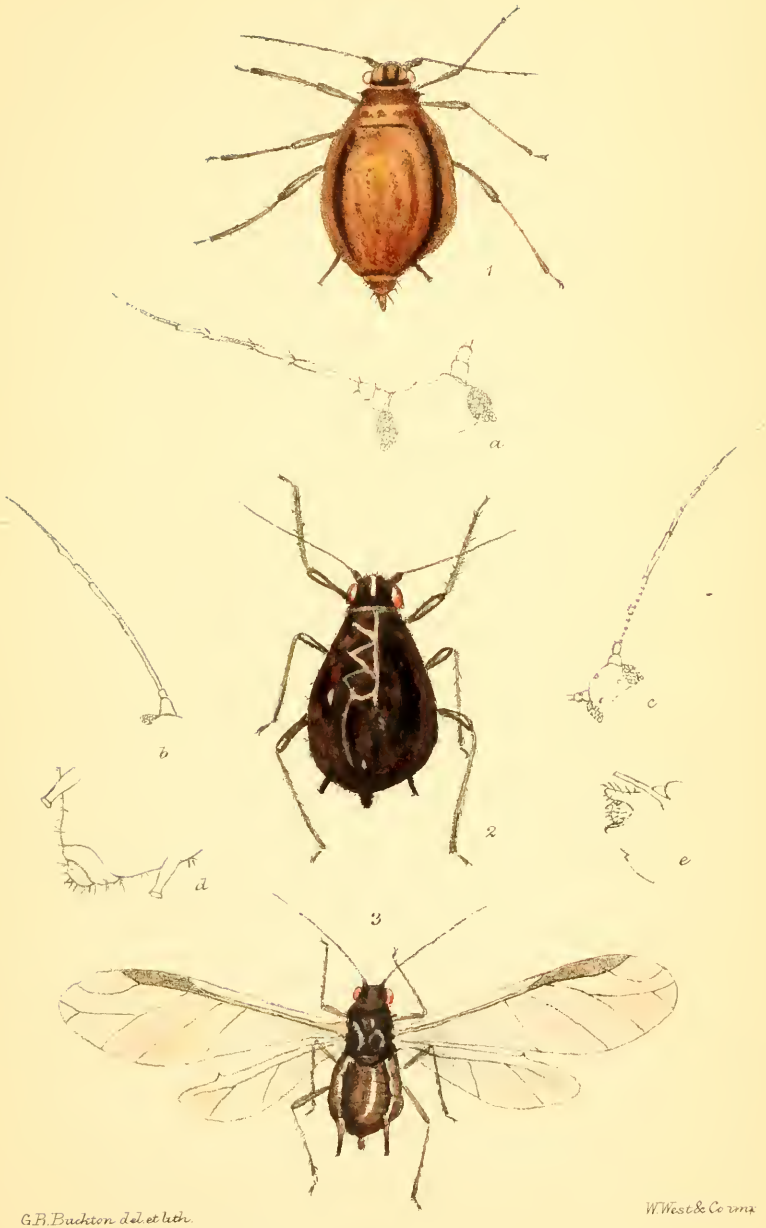
APHIS EUONYMI. (Page 72.)

Fig. 1.—Apterous viviparous female. *a*. Head of the same.

APHIS LYCHNIDIS. (Page 73.)

Fig. 2.—Apterous viviparous female. *b*. Antenna of the same.

Fig. 3.—Winged viviparous female. *c*. Head and antenna of the same. *d* and *e*, Upper and profile view of the apical portion of the abdomens of the apterous and winged females.



G.B.Buckton del. et lith.

W.West & Co. imp.

Aphis euonymi 1.
" lychnidis 2, 3.

PLATE LX.

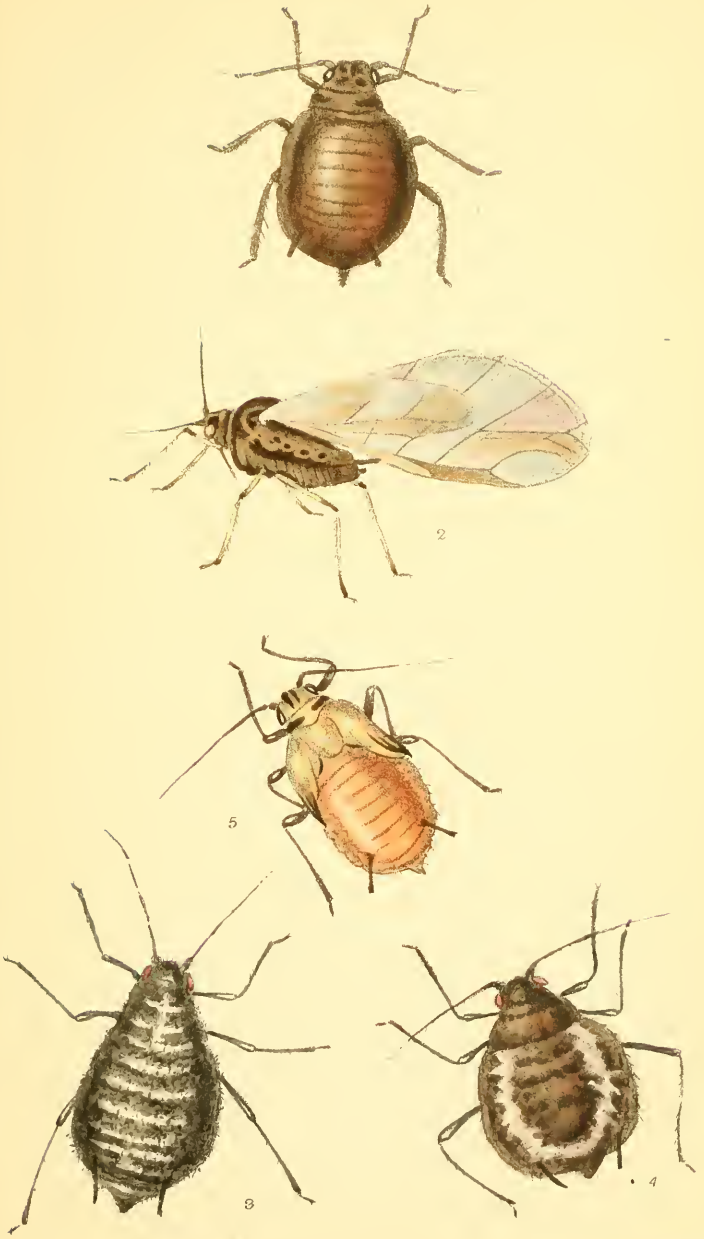
APHIS HEDERÆ. (Page 75.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Winged viviparous female.

APHIS AUCUPARIÆ. (Page 76.)

Fig. 3.—Apterous viviparous female.
Fig. 4.—Queen mother, or first egg-produce.
Fig. 5.—Pupa.

PLATE LX



G.B. Buchton del et lith

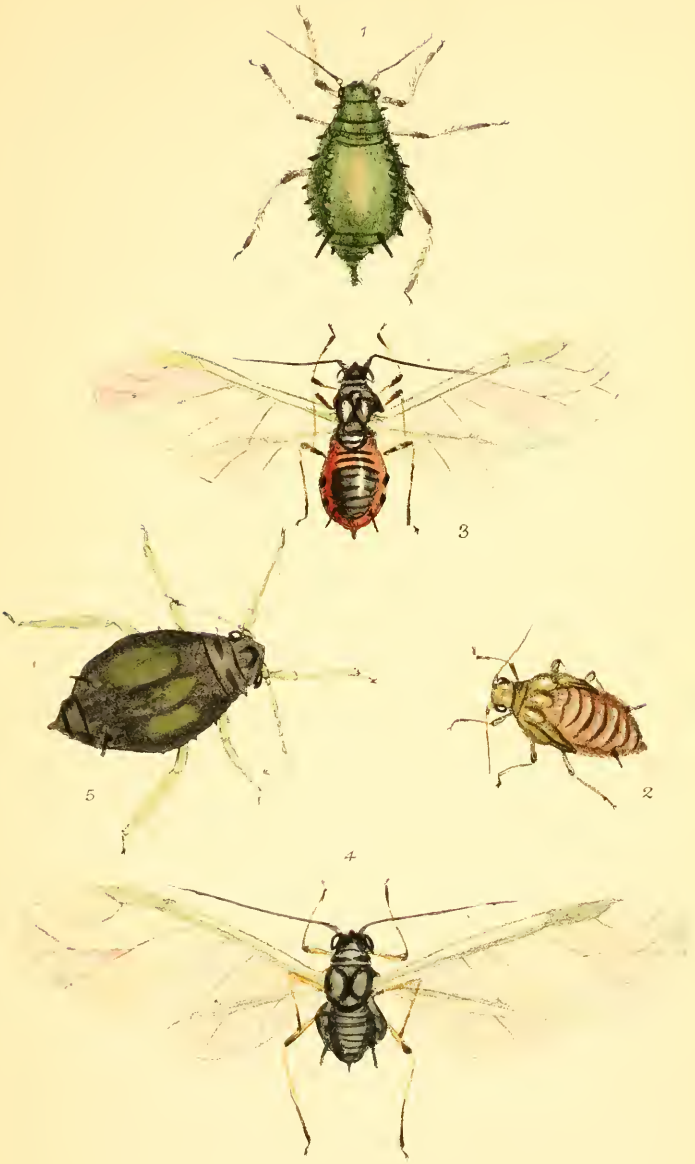
W. West & Co imp.

Aphis hederæ 1–2.
Aphis aucupariæ 3–5.

PLATE LXI.

APHIS VIBURNI. (Page 77.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Pupa. slightly powdered.
Fig. 3.—Winged viviparous female.
Fig. 4.—Winged male.
Fig. 5.—Apterous oviparous female. The dilated hind tibiæ are to be noted.



G.H.Brighton del et lith.

W.West & Co imp.

Aphis viburni.

PLATE LXII.

Aphis Jacobææ. (Page 79.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Paler variety of the same.
Fig. 3.—Pupa.
Fig. 4.—Winged viviparous female.

Aphis acetosæ. (Page 80.)

Fig. 5.—Apterous viviparous female.
Fig. 6.—Pupa.
Fig. 7.—Winged viviparous female.

PLATE LXII.

J.R.Brichton del et lith

W.West & Comp.

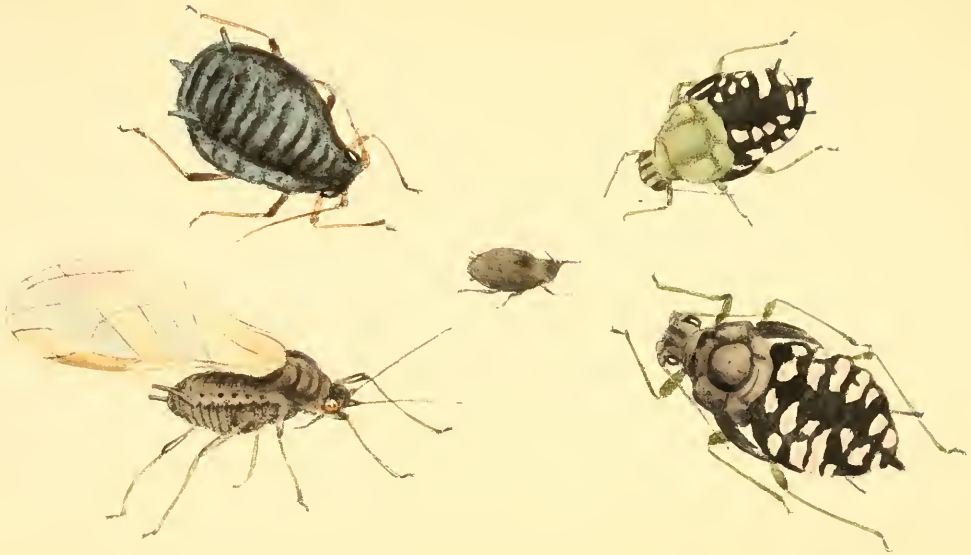
Aphis jacobææ 1-4

" acetosæ 5-7

PLATE LXIII.

APHIS RUMICIS. (Page 81.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Pupa from the same.
Fig. 3.—Larger example, with variation in the marking.
Fig. 4.—Young from the viviparous female.
Fig. 5.—Winged viviparous female.



W.H. Bruton del. et lith.

W. West & Son imp.

Aphis parasites

PLATE LXIV.

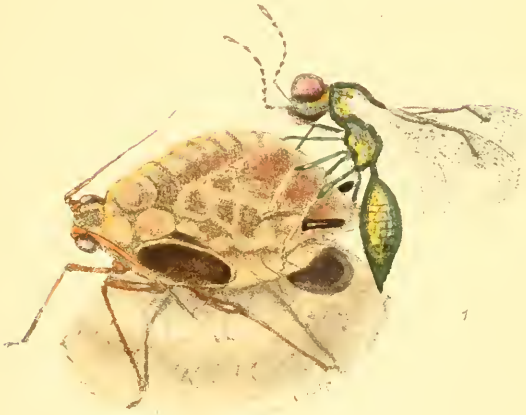
APHIS RUMICIS WITH PARASITES. (Page 85.)

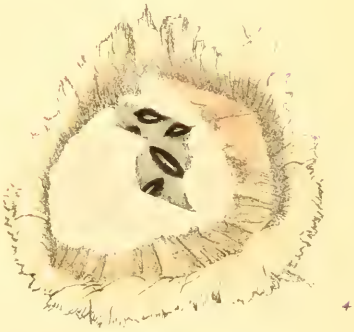
Fig. 1.—Inflated, but empty skin of the pupa of *A. rumicis*, with the imago of *Coryna dubia* issuing from the tent-like cocoon, spun below by the larva, and within which it has undergone its metamorphosis. The round hole through which it has made its exit is seen below the tail of the Aphis.

Fig. 2.—A similar silken tent spun under the exuviæ of the same Aphis, but winged. The whole contents of the body have been consumed by the parasitic Coryna so as to leave the Aphis skin transparent. The pigmental bands are shown embedded in the horny skin, proving that these markings are not due to the colour of the viscera, which sometimes is the case.

Fig. 3.—The cocoon of the last insect in the process of construction and viewed from below, whilst the parasitic larva is in the act of spinning.

Fig. 4.—A similar tent-like cocoon, viewed also from below, showing the construction of its double walls. The bottom has been partly rent, and this opening brings into view five small pupæ of a much smaller parasite, which, in their maggot forms, have consumed the body of the first parasitic Coryna, just as this last has consumed the body of the Aphis.





G.B Buckton del et lith.

W West & Co imp

Coryna dubia

PLATE LXV.

APHIS LABURNI. (Page 86.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Pupa.
Fig. 3.—Winged viviparous female.

APHIS ATRIPLICIS. (Page 87.)

Fig. 4.—Apterous viviparous female.
Fig. 5.—Black variety of the same.
Fig. 6.—Pupa.
Fig. 7.—Winged viviparous female.

Aphis laburni [illegible]
,, atriplicis [illegible]

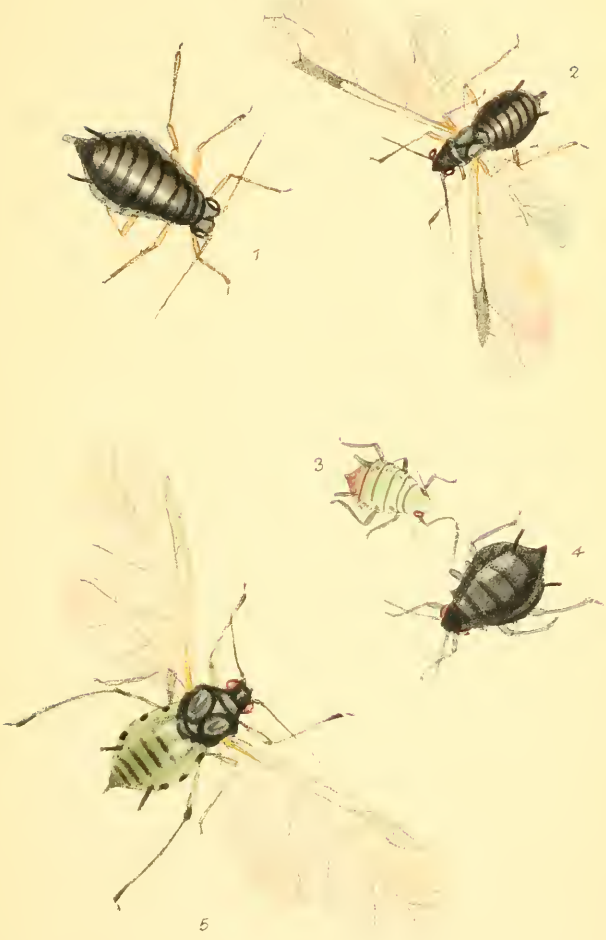
PLATE LXVI.

APHIS SEDI. (Page 90.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Winged viviparous female.

APHIS PAPAVERIS. (Page 91.)

Fig. 3.—Young specimen of the apterous viviparous female.
Fig. 4.—Mature specimen of the same.
Fig. 5.—Winged viviparous female. All these figures are of relative size.



G.B.Buchton del et lith

W.West & Co. imp.

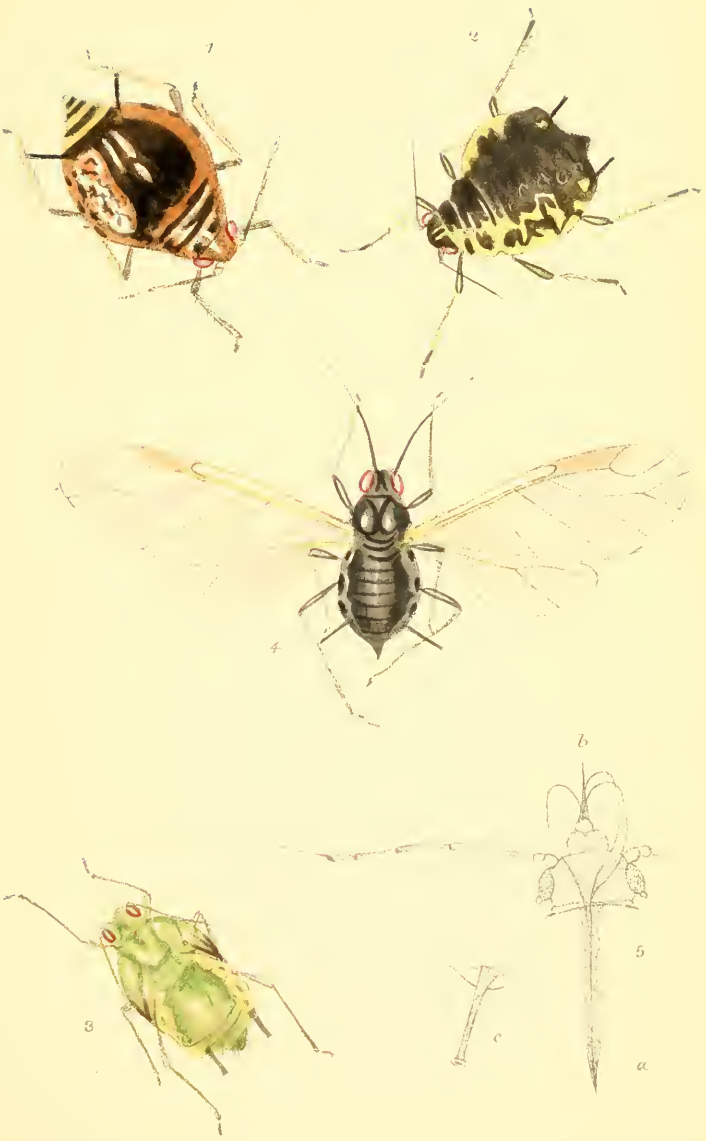
Aphis sedi 1 2.
Aphis papaveris 3–5

PLATE LXVII.

APHIS CARDUI. (Page 92.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Yellow variety of the same.
Fig. 3.—Pupa.
Fig. 4.—Winged viviparous female.
Fig. 5.—Head and rostrum of the last insect.
a. Rostrum with its setæ.
b. Labrum.
c. Cornicle.

PLATE LXVII



G.B Buckton. del. et lith.

P. Westk... imp.

Aphis cardui.

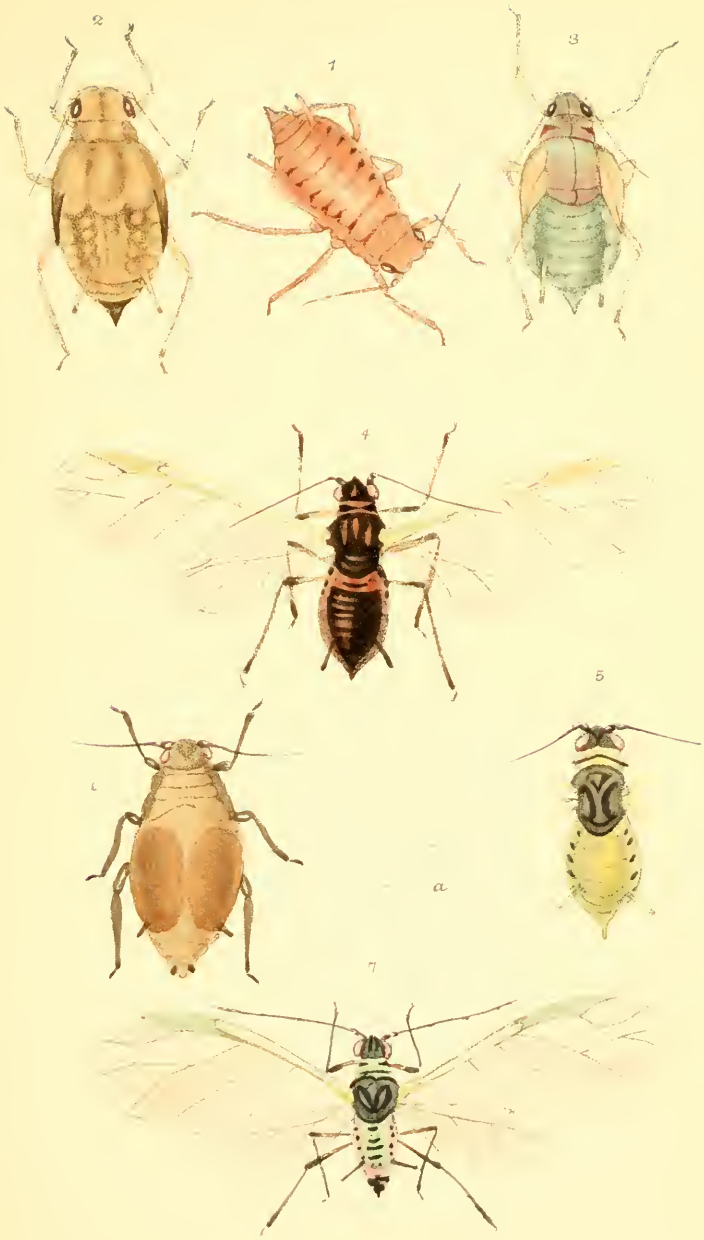
PLATE LXVIII.

APHIS INSTABILIS. (Page 94.)

Fig. 1.—Apterous viviparous female.
Figs. 2 and 3.—Varieties of the pupa.
Figs. 4 and 5.—Varieties of the winged female.

APHIS SAMBUCARIA. (Page 95.)

Fig. 6.—Oviparous female, showing two advanced ova.
Fig. 7.—Winged male. *c.* Cornicle of the viviparous female.



J. F. Brackton del. et lith.

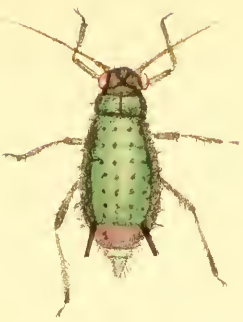
W. West & Co. imp.

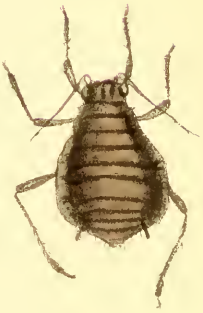
Aphis instabilis 1—5.
„ sambucaria. 6—7.

PLATE LXIX.

APHIS PYRI. (Page 97.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Female of a later brood.
Fig. 3.—Pupa.
Fig. 4.—Winged viviparous female.





G.B Buc[illegible] del. et lith.

W. West & Co. imp.

Aphis pyri

PLATE LXIX BIS.

APHIS BELLIS. (Pages 98 and 47.)

Fig. 1.—Apterous viviparous female. Through the transparent skin two vermiform parasites may be seen preying on the larva.

Fig. 2.—Pupa of the same.

Fig. 3.—Oviparous female of *Aphis mali*, with her deposited egg (see Plate L).

Fig. 4.—Winged viviparous female.

PLATE LXIX (Bis)

Aphis mali. 3.
" bellis 1. 2. 4.

G.B.Buckton del. et lith.

W.West & Co imp.

PLATE LXX.

APHIS SAMBUCI. (Page 99.)

Fig. 1.—Young specimen, showing the rostrum of disproportionate dimensions.

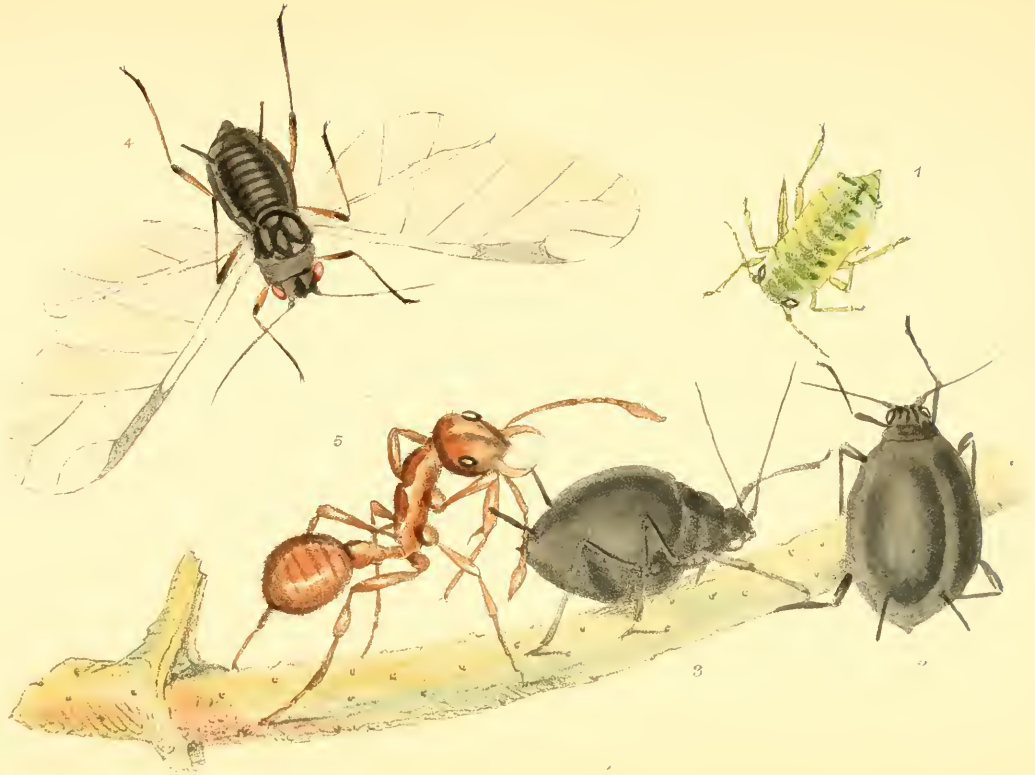
Fig. 2.—Apterous viviparous female.

Fig. 3.—Another example, feeding on a stalk of the elder tree.

Fig. 4.—Winged viviparous female.

Fig. 5.—*Myrmica rubra*, drinking the honeydew from the cornicle of the Aphis larva. The long antennæ of the ant are used for "drumming" the sides of the Aphis, apparently as a signal to the Aphis.

PLATE LXX



J. B. Bracketon del et lith

W. West & Co imp.

Aphis sambuci 1–4
Myrmica rubra 5

PLATE LXXI.

APHIS OPIMA. (Page 101.)

Fig. 1.—Green variety of apterous female.
Fig. 2.—Black variety of the same.
Fig. 3.—Winged viviparous female.
Fig. 4.—Young specimen recently born, showing the rings with their segmented or quasi-plated character. *b.* Apical rings viewed from below. *d.* Head and antenna of winged female.

G.B. Buckton del. et lith.

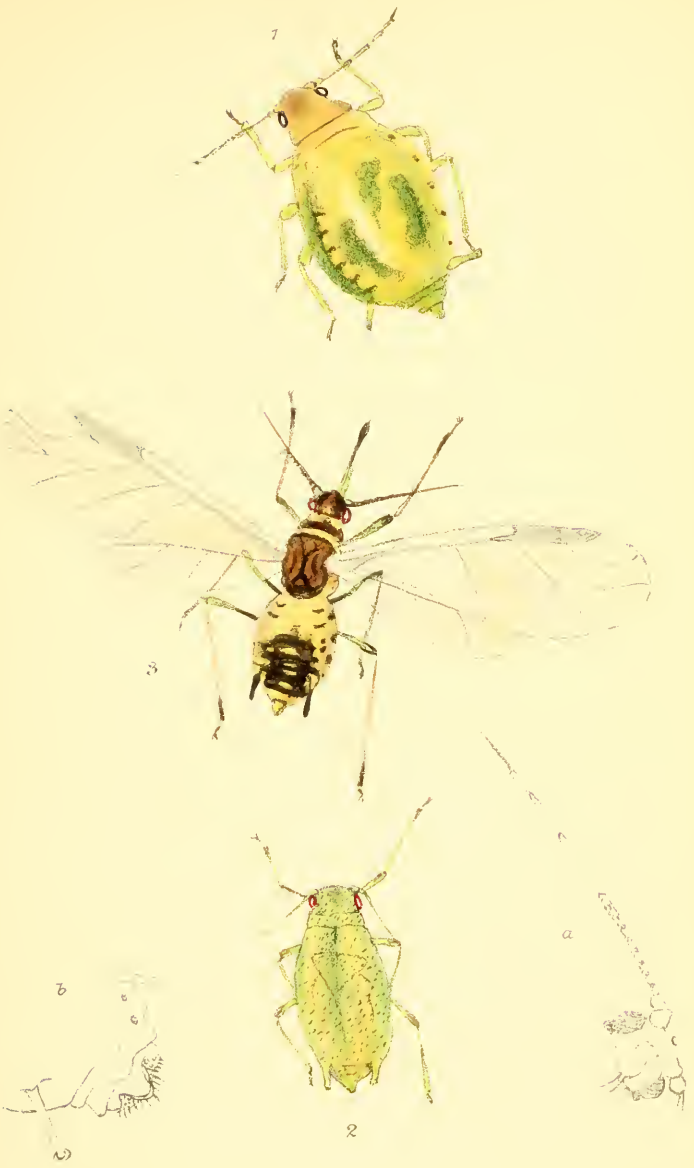
W. West & Co. imp.

Aphis quirma

PLATE LXXII.

APHIS MYOSOTIDIS. (Page 102.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Another brood of the same.
Fig. 3.—Winged viviparous female. *a*. Head of the last insect. *b*. Apical abdominal rings of the same.



G.B Buckton del. et lith

W.West & Co. imp.

Aphis myosotidis.

PLATE LXXIII.

Aphis amygdali. (Page 104.)

Figs. 1 and 2.—Varieties of the viviparous female.

Fig. 3.—Winged viviparous female.

Fig. 4.—Young specimen before the brown pigment has been deposited in the tissues.

Fig. 5.—Specimen just after birth. *a*. Genito-anal portion of the winged female, showing the four abdominal papillæ.

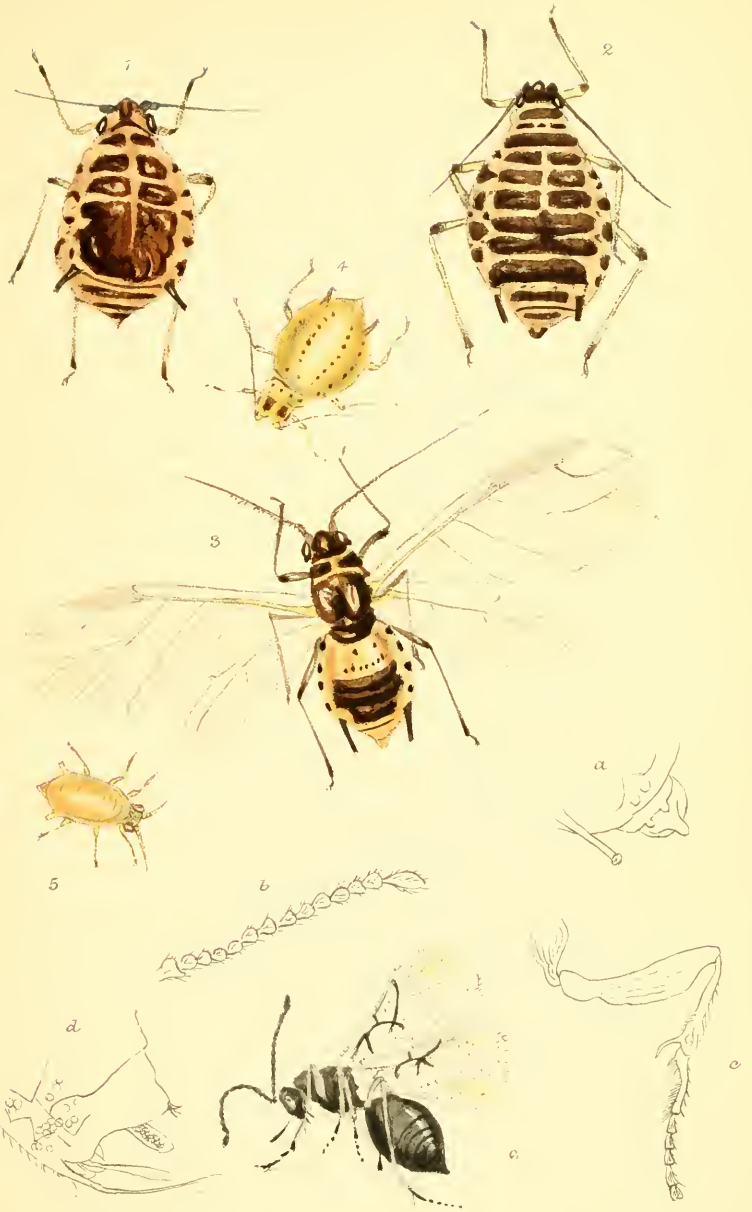
Cynips atriceps. (Page 106.)

This insect is parasitic on *Aphis amygdali*, and was bred from the same.

b. Antenna.

c. Fore leg.

d. Last abdominal rings, showing the ovipositor and adjuncts.



J. B. Buckton del. et lith.

W. West & Co. imp.

Aphis amygdali 1–5.
Cynips ♀ 6.

PLATE LXXIV. (Page 107.)

Fig. 1.—Imago of Hemerobius.

Fig. 2.—Larva of the same, showing its manner of seizing an Aphis for food.

Fig. 3.—Pedunculated eggs of Hemerobius, fixed upon the surface of a leaf.

Fig. 4.—Larva of Chrysopa partially concealed by the skins of its victims. The drawing shows the long processes from which the bristles spring, and the use of these last in packing the matted mass of Aphis skins.

PLATE LXXIV

Hemerobius 1 3
Chrysopa 4

PLATE LXXV.

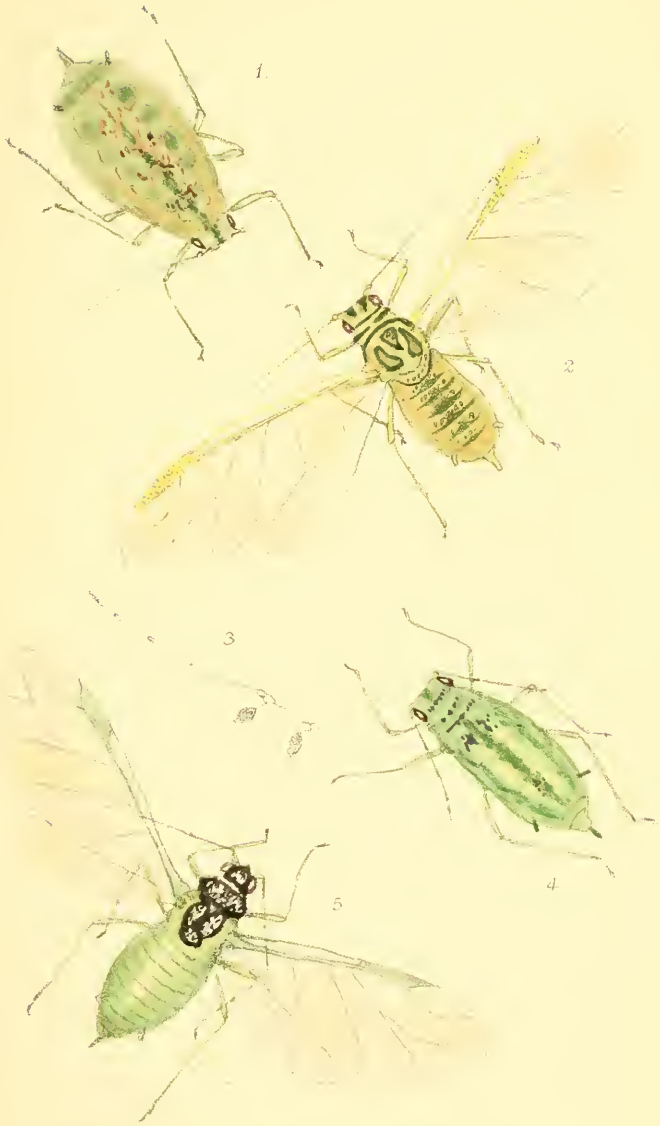
HYALOPTERUS PRUNI. (Page 110.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Winged viviparous female.
Fig. 3.—Head and antennæ of the same.

HYALOPTERUS ARUNDINIS. (Page 111.)

Fig. 4.—Apterous viviparous female.
Fig. 5.—Winged viviparous female.

PLATE LXXV.



Hyalopterus pruni 1-3
" arundinis 4-5

G.B.Buckton del. et lith.

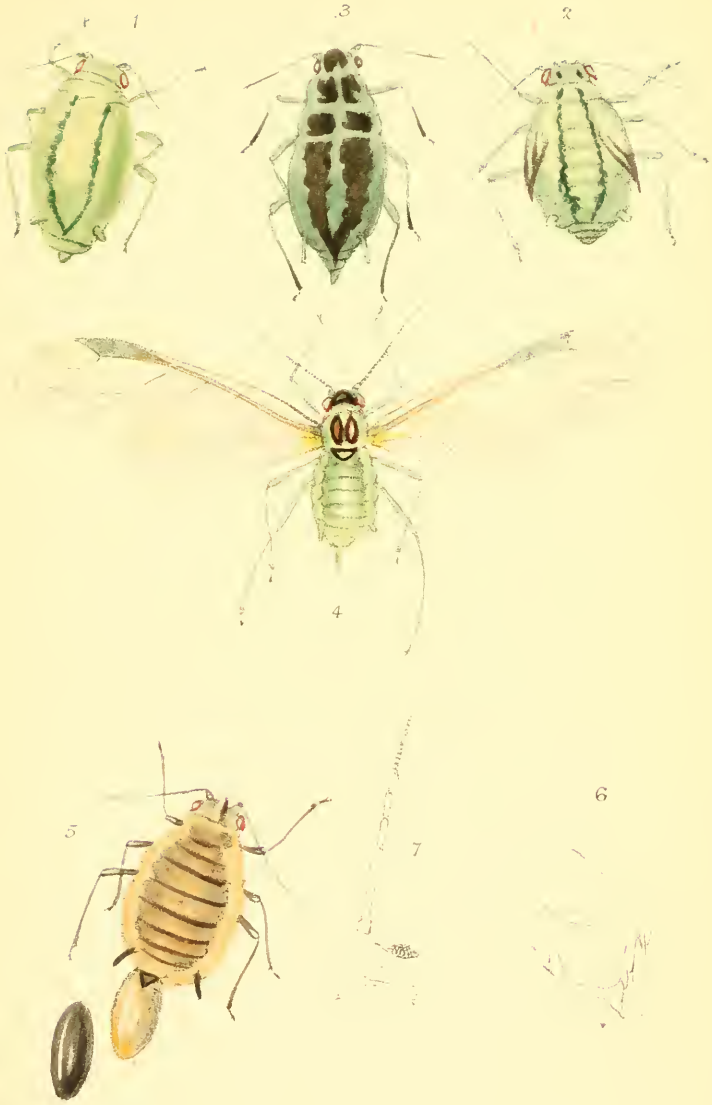
W. West & Co. imp.

PLATE LXXVI.

HYALOPTERUS DILINEATUS. (Page 113.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Pupa.
Fig. 3.—Younger specimen of the larva.
Fig. 4.—Winged viviparous female.
Fig. 5.—Oviparous female in the act of oviposition. The recent egg is yellow.
Fig. 6.—Abdomen of the last, showing the egg *in sitû*.
Fig. 7.—Under side of the head.

PLATE LXXVI.



Hyalopterus dilineatus.

C.B. Fuckton del et lith

W West & Co imp

PLATE LXXVII.

HYALOPTERUS TRIRHODUS. (Page 114.)

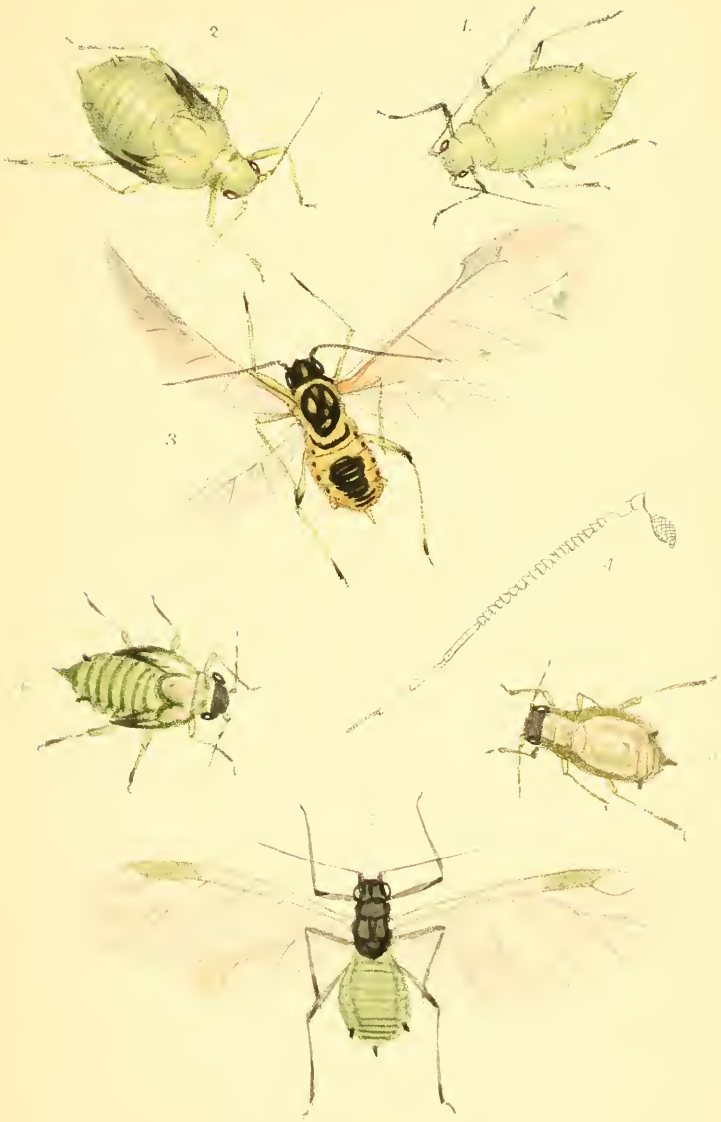
Called in error *H. trirhoda* in the text.

Fig. 1.—Apterous viviparous female.
Fig. 2.—Pupa.
Fig. 3.—Winged viviparous female.
Fig. 4.—Antenna of the last, showing its ringed character.

HYALOPTERUS MELANOCEPHALUS (Page 116.)

Fig. 5.—Apterous viviparous female.
Fig. 6.—Pupa.
Fig. 7.—Winged viviparous female.

PLATE LXXVII.



Hyalopterus trirhodus 1–4.
" melanocephalus 5–7.

C. H. Buckton del et lith. W. West & Co. imp.

PLATE LXXVIII.

CHAITOPHORUS ACERIS. (Page 121.)

Fig. 1.—Apterous viviparous female.

Fig. 2.—Normal form of winged viviparous female surrounded by her young.

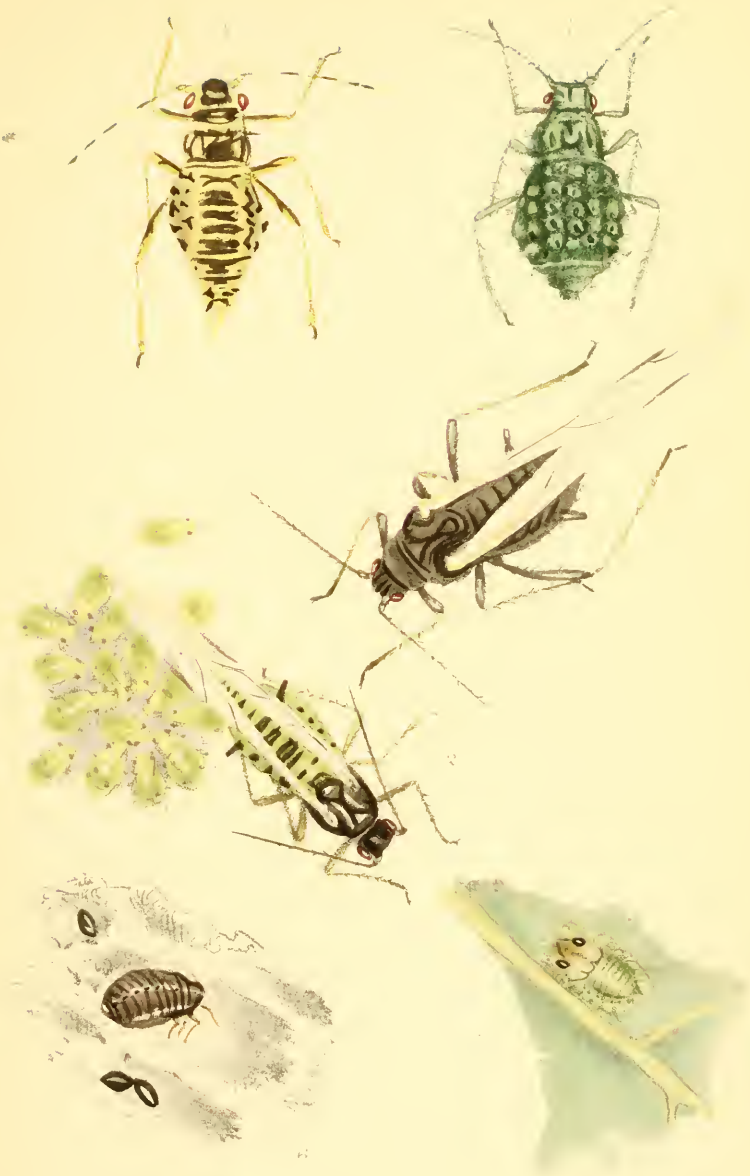
Fig. 3.—Black variety of the same.

Fig. 4.—Apterous male. The genito-anal appendages are distinctly shown.

Fig. 5.—The a-sexual dimorphous form of *A. Aceris*, originally known as *Chelymorpha testudo*, fixed on the under side of a leaf, and sheltered by the mid-rib of the same.

Fig. 6.—Apterous oviparous female concealed in a crevice of sycamore bark. Three shining eggs are in neighbouring crevices, where they would remain until they hatched in the spring following.

N.B.—Two winged males were sent to me from Montpellier, but they were not sufficiently perfect to allow of good drawings.



Chaitophorus aceris.

C. R. Buckton, del. et lith.

Wilson & Co. imp.

PLATE LXXIX.

CHAITOPHORUS ACERIS. (Page 128.)

Fig. 6.—Abnormal form much enlarged (*Chelymorpha testudo*), showing the peripheral flabellæ, and the dorsal plating. This form undergoes no further metamorphosis.

Fig. 7.—Cast or moulted skin from a similar insect. These exuviæ are complete even to the tips of the claws.

Fig. 8.—Underside of the normal young of *Chaitophorus aceris*, which goes through the usual metamorphoses.

Fig. 9.—Head and adjacent parts of the winged female. *a*. Terminal joints of the rostrum. *b*. Labrum. *c*. Salivary glands. *d*. Œsophagus and stomach. The latter appears to be constricted and again expanded before entering the gut.

Fig. 10.—Eye of winged female. *e*. Lenses of cornea. *f*. Retina and pigmental mass, ending in the fibres of the optic nerve.

Fig. 11.—Caudal flabellæ of dimorph (fig. 6).

Fig. 12.—Nectary and tube of fig. 8.

Fig. 13.—Rostrum of dimorph, showing the ducts which ramify into the head.

Fig. 14.—Genito-anal region of the winged male. *p*. Penis, recurved at its termination. *g*. Claspers at the base of the same. *h*. Horny ring, "*Armature copulatrice*" of Balbiani, encircling the penis.

Fig. 15.—Part of the foot of the dimorphous form above described. *i*. Claws at the ends of tarsus. *k*. Pulvilli or discoidal hairs, used for prehension.

PLATE LXXIX.

Charophorus aceris.

PLATE LXXX.

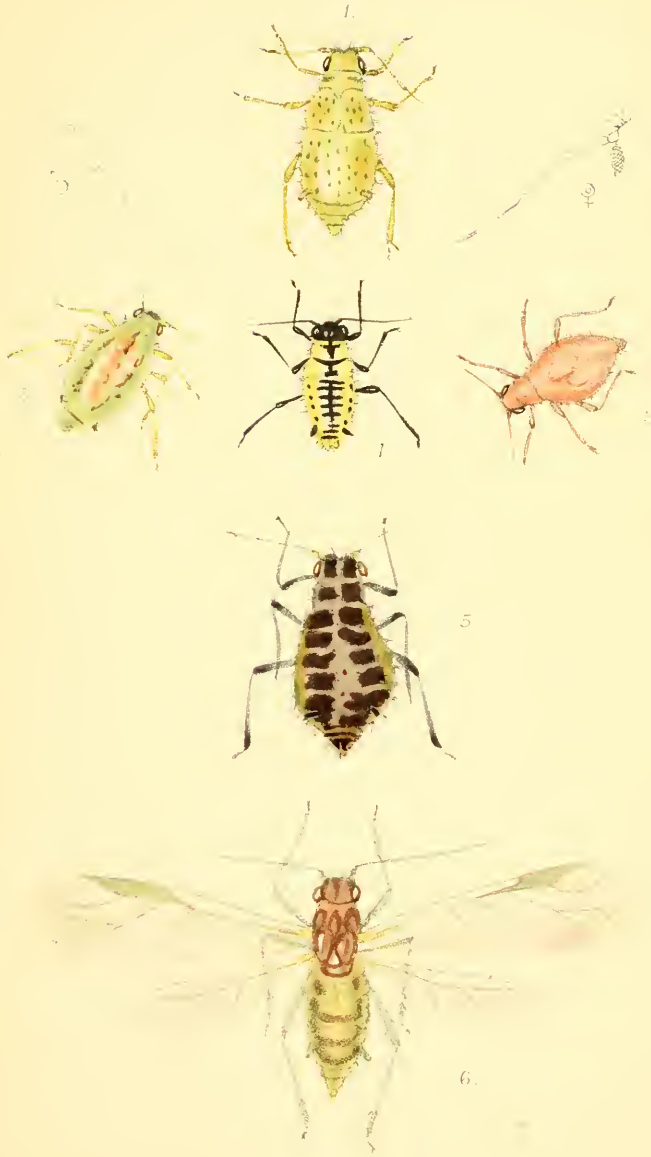
CHAITOPHORUS SALICIVORUS. (Page 134.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Variety of the same.
Fig. 3.—Oviparous female.
Fig. 4.—Apterous male. ♂. Antenna of the male. ♀. Antenna of the oviparous female.

CHAITOPHORUS LEUCOMELAS. (Page 135.)

Fig. 5.—Apterous viviparous female.
Fig. 6.—Winged viviparous female.

PLATE LXXX.



Chaitophorus salicivorus 1 – 4.
" leucomelas 5 – 6.

C. B. Buckton del. et lith.

W. West & Son imp.

PLATE LXXXI.

CHAITOPHORUS CAPREÆ. (Page 136.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Variety of the same.

CHAITOPHORUS POPULEUS. (Page 137.)

Fig. 3.—Apterous viviparous female.
Fig. 4.—Winged viviparous female.
Fig. 5.—Apterous male.
Fig. 6.—Antenna of the wingless female.

N.B.—Called by error on the plate *populea*.

PLATE LXXXI.

Chaitophorus capreæ 1, 2.
" populea 3–6.

PLATE LXXXII.

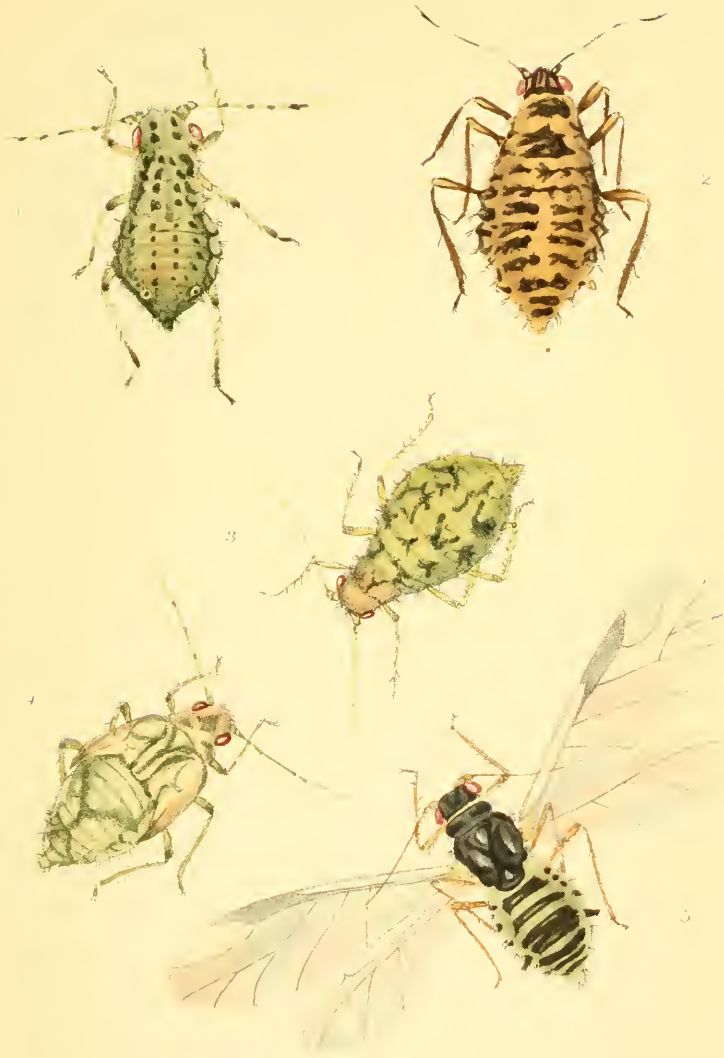
CHAITOPHORUS BETULÆ. (Page 139.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Oviparous female.

CHAITOPHORUS POPULI. (Page 140.)

Fig. 3.—Apterous viviparous female.
Fig. 4.—Pupa.
Fig. 5.—Winged viviparous female.

PLATE LXXXII



Phaiaphorus betulæ 1, 2
" populi 3–5

PLATE LXXXIII.

PTEROCOMMA PILOSA. (Page 143.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Pupa.
Fig. 3.—Winged viviparous female.
Fig. 4.—Nectary or cornicle.
Fig. 5.—Head and antennæ of the winged female.

PLATE LXXXIII

Pterocomma pilosa.

PLATE LXXXIV.

CRYPTOSIPHUM ARTEMISIÆ. (Page 145.)

Fig. 1.—Apterous viviparous female.
Fig. 2.—Pupa.
Fig. 3.—Winged viviparous female.
Fig. 4.—Sprig of distorted leaves of Artemisia, on which variously coloured galls rise, within which the insects congregate.
Fig. 5.—Hinderpart of the female abdomen, distended with young embryos.
Fig. 6.—Head, antenna, and rostrum of the alate female.

PLATE LXXXIV.

Cryptosiphum artemisiæ.

G. B. Buckton del. et lith. W. West & Co. imp.

PLATE LXXXV.

BRACHYCOLUS STELLARIÆ. (Page 147).

Fig. 1.—Apterous viviparous female.
Fig. 2.—Black variety of the same.
Fig. 3.—Head, rostrum, and antennæ viewed from the under side.

PSEN ATRATUS. (Page 164.)

Fig. 4.—Winged female, which channels the pith of the briar, lays her eggs within, and stores the chambers with living Aphides.

Fig. 5.—A portion of a split briar, showing these cells of their natural size. The portion drawn below is magnified, in order that it may better show the occasional double galleries separated by parchment-like partitions (*p p*), and sometimes by partitions of a browner material (*b*). Apparently these last are constructed of pith. *f f*. Are small masses of fæces, and dried skins of the victims which have been consumed by the apodous grubs of Psen.

PLATE LXXXV

Brachycolus stellariæ 1-3.
Psen atratus 4-5.

G.B Buckton del et lith

W West & Cº imp.

PLATE LXXXVI.

SYRPHUS BALTEATUS. (Page 120.)

Fig. 1.—Imago.
Fig. 2.—Larva attached to a leaf by its posterior rings.

DIODONTUS TRISTIS. (Page 166.)

Fig. 3.—Imago of the same.

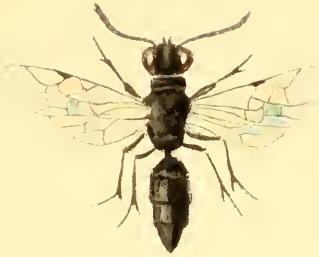
DIODONTUS MINUTUS. (Page 166.)

Fig. 4.—Imago of the same. The last two figures are of relative sizes.

CORYNA CLAVATA. (Pages 86 and 155.)

Fig. 5.—Winged female. The larva is parasitic on *Siphonophora rosæ*, &c.

PLATE LXXXVI



Syrphus balteatus 1 – 2.
Diodontus tristis 3.
„ minutus 4.
Coryne clavata 5.