Aphids on the World's Herbaceous Plants and Shrubs

Some superb early illustrations of aphids and other small insects from Sulzer (1776), *Abgekürzte Geschichte der Insecten nach dem Linnaeischen System.* **1.** “(Aphis) Opuli. Die Schneeballenlause.” (*Aphis viburni* Scopoli); **2.** “Opuli. Die Schneeballenlause, in copulation”. **3.** “(Aphis) Persicae. Die Pfersichlaus.” (Original illustration of alata of *Myzus* persicae (Sulzer)); **4.** “(Aphis) Polianth. tuberos.” (*Aphis fabae* Scopoli, ovipara and male); **5.** Ditto, immature male; **6.** “(Aphis) Salicis.” (*Pterocomma salicis* (L.)); **7 and 8.** “(Chermes) Buxi.” (*Psylla buxi* (L.)); **9.** “(Coccus) Persicorum.” (*Parthenolecanium persicae* (Fabricius)); **10.** “(Coccus) Fol. Quercus.” (*Kermes quercus* (L.)); **11.** “(Coccus) Fagi.” (a nomen dubium); **12.** “(Thrips) Fuscus.” (*Melanthrips fuscus* (Sulzer)).

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VOLUME 1 Host Lists and Keys

R.L. Blackman and **V.F. Eastop**

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NATURAL HISTORY MUSEUM

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VOLUME 2 The Aphids

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Cover shows a Stereoscan photograph of an apterous vivipara of *Myzus persicae* (Sulzer) feeding from mid-rib of a Pe-Tsai (*Brassica pekinensis*) leaf. Reproduced by kind permission of Cho-kai Chan. Inset is a colony of *Liosomaphis berberidis* (Kaltenbach) feeding on the underside of a *Berberis* leaf.

Contents

Preface

The events leading to this book started a quarter of a century ago, and since then it has very much been a story of one thing leading to another. It was in about 1980 that we first conceived the idea of a crop-oriented identification and information guide to the world's aphids. We were motivated in that project by two thoughts. First, it seemed evident to us that it would be very useful to adopt a world scale for the book, because the same main crops are grown on all continents, and pest aphids are rather good at eventually finding them wherever they are grown. Second, relatively few aphid species are pests, and those that occur on any one crop tend not to be closely related, so that it is possible to compile relatively simple keys for their identification. Thus, *Aphids on the World's Crops* came into being (1984), and was well-enough received to be followed by a CD-ROM (1998) and a second edition (2000).

These publications included aphid pests of fruit trees, but they did not include aphids on trees grown commercially for their timber, even though the Aphidoidea include some of the most important pests of temperate softwoods and hardwoods. We had good reason to exclude tree-dwelling aphids, as we knew that compiling keys to these was a very different task, needing to distinguish between many closely-related species and to compile accounts that were essentially, if rather superficially, world revisions of major aphid genera. Eventually, however, we produced *Aphids on the World's Trees* (1994), with aphids listed and keyed according to tree genera. The subject matter – the trees as well as the aphids feeding on them – forced us to adopt a far more comprehensive approach, as we could find no justification for including some species – both of trees and of tree-dwelling aphids – and omitting others. There was also no good reason to exclude such tree genera as *Prunus* and *Malus*, so there was some overlap with the crops book, compounded by the fact that many pests of field crops exhibit host alternation and migrate to trees for their sexual phase.

About 40 per cent of the world's aphid fauna (1760 species in 355 genera) live wholly or partly on trees. So, having completed this task, we started to contemplate whether the other 55 per cent living on herbaceous plants and shrubs could be treated similarly (the host plants of the remaining 5 per cent are unknown). The utility of a complete host plant-oriented treatment of the world's aphids – something as yet unavailable for any major group of plant-feeding insects – seemed undeniable, and this provided motivation as well as lending a certain inevitability to the project, but we had no illusions about the task ahead. The number of species involved was in reality about 70 per cent of the total world aphid fauna rather than 55 per cent, because of those that host-alternate between trees and herbaceous plants, and a significant proportion were little-known species requiring consultation of original literature. After the first year, we had not even completed keys to aphids on plant genera beginning with 'A', stuck on *Artemisia*, which is amazingly host to 260-plus aphid species, and seriously wondering whether the task could ever be finished. However, one of us kept compiling host lists and the other writing keys, and gradually through many more years the project progressed towards a conclusion.

One factor spurring us on was the knowledge that we were in a uniquely advantageous position to do such work. To hand was a collection of about 600 000 microscope slides of aphids, which is probably the largest, certainly the most representative, and perhaps also – we like to think – the best-curated collection of this group of insects in the world. Sitting on top of the long double-decker row of cabinets containing these slides is a double row of box files containing reprints or copies of about 95 per cent of the taxonomic papers about aphids ever written, some dating back more than 100 years, and sharing the same building is the world's largest library of books and journals relating specifically to insect taxonomy. With such a unique resource at our fingertips, should we not do our best to find a way make all this information more readily available?

Museum collections and libraries are essential resources, but they do not of course in themselves ensure good taxonomy. Taxonomy strives to name and classify organisms in such a way as to truly reflect their phylogenetic relationships – a fundamental requirement if we are to understand how organisms have evolved to live and interact with each other. As in many branches of biology, it is mainly a matter of correctly interpreting variation. In practice this inevitably means *morphological* variation, because the idea that adequate molecular data will ever be available to construct molecular phylogenies and define meaningful boundaries for all the thousands of taxa *at the species level* is still a pipe-dream.

Of course, morphological variation has the big disadvantage of being greatly influenced by the environment in which an organism develops. Different environmental factors , e.g. host plant, stress, humidity and temperature, affect morphology in different ways, and in aphids their environmentally conditioned polymorphism (polyphenism) adds a further complication, because under certain conditions forms intermediate between two morphs may be produced. Such is the variation within aphid species that its correct interpretation requires a collection large enough to contain many specimens of each species, including both apterous and alate morphs, and many samples from different localities and seasons.

The correct interpretation of variation also requires lots of acquired knowledge and experience, because the various ways in which morphological features interact with the environment not only have to be recognised, but also viewed and made sense of in the context of the probable biology of the species – life cycle, host plant relationships, polymorphism – based on knowledge of the genus or species group to which it belongs. Species in some groups, e.g., Hormaphidinae and Pemphiginae, and some of the host-alternating Aphidinae, have completely different morphology on primary and secondary hosts, such that different morphs of one species have often been described in different genera. Some characters such as the relative lengths of antennal segments vary according to temperature, others such as the shapes and lengths of hairs vary more according to humidity, and some characters can differ greatly between alatae and apterae, so that intermediates exhibit a wide range of variation. All these different aspects of aphid variation provide traps for the unwary.

Between us we have nearly 100 years' experience of working with aphids, which has perhaps made us more aware of the potential pitfalls, and of ways to avoid them. We hope therefore that we have produced a work that will be a helpful and reliable tool for both the newcomer to the world of aphids and to the more practised researcher. However, such experience also makes us very aware of our own fallibility, and we will publish this work with near certainty that, like its predecessors, it will contain some glaring errors. We can only hope that there are not too many of them. We would be grateful for notification of errors, omissions and difficulties with the keys, especially if supported with slide mounted specimens.

This work would not have been possible without the BMNH aphid collection, and the many people who have helped make it what it is today. A list of all those who have donated slides or assisted with curation would be a very long one, and we can only here mention major contributors over the years. The largely but by no means exclusively European collections of F. Walker, G.B. Buckton, F.V. Theobald, J.P. Doncaster and H.L.G. Stroyan, and the European and African collections of W.J. Hall, were massively enhanced by the D. Hille Ris Lambers bequest in 1984 which added much type material. That North American aphids are so well represented is mainly due to specimens and slides donated by others who are no longer with us; E.O. Essig, G.F. Knowlton, H.G. Walker, J.O. Pepper, C.F. Smith and A.G. Robinson. Many other aphid taxonomists have donated or lent specimens, sent copies of their publications, and been always ready to provide assistance, advice and unpublished data. Specifically we would like to mention S. Barbagallo, S. Chakrabarti, C.-k. Chan, S.K. David, A.K. Ghosh, S.E. Halbert, S.H. Hodjat, J. Holman, R. Kh. Kadyrbekov, M. Miyazaki, J.M. Nieto Nafría, W.H. Paik, N.F. Pashtshenko, G.-x, Qiao, F.W. Quednau, G. Remaudière, M. Sorin, A.V. Stekol'shchikov, M.B. Stoetzel, H.L.G. Stroyan, D. J.Voegtlin and G.-x. Zhang. On the BMNH staff, J.H. Martin's collecting trips have added valuable new specimens to the collection from four continents, and P.A. Brown has rescued much type and other unique material that would otherwise have been lost, by skilfull remounting and restoration of slides.

The last two years' work was facilitated by an Emeritus Research Fellowship to R.L.B. from the Leverhulme Trust.

R.L. Blackman and V.F. Eastop

VOLUME 1
Host Lists and Keys?

Introduction

This work is based on the same rationale as our previous ones (Blackman and Eastop, 1984, 1994, 2000), and has a similar format. It is specifically intended to complement the 1994 book *Aphids on the World's Trees*, and thus complete a comprehensive account of the world's aphids in relation to their host plants. The host–aphid lists and keys in this volume demonstrate, and in fact owe their feasibility to, the fact that most aphids are relatively host specific, and that this specificity is most evident at the level of the host genus. The number of aphid species recorded from any one plant genus varies greatly, from one to more than 260 (on *Artemisia*), and the proportion of these that are monophagous, oligophagous or polyphagous also shows considerable variation. The reasons for these differences are presumably part physiological and part phylogeographic. We hope that the lists will serve the supplementary purpose of providing a useful database for anyone studying the origins and evolution of the present-day associations between aphids and their host plants.

The host plant–aphid lists

Aphid/host plant records are extracted from a wide variety of literature sources and will inevitably include a percentage of misidentifications, both of aphid and host plant. As the aim is to list only true host plants we have omitted any records that are clearly spurious, e.g., tree-dwelling aphids such as *Drepanosiphum platanoides* and *Eucallipterus tiliae* that will often be found on vegetation below their respective host trees, and other aphids that were obviously vagrant individuals. When an aphid–host plant association is unusual or doubtful, the aphid species is placed in square brackets. We have used square brackets in all cases where an aphid is listed but not included in the key, not only for records that we consider doubtful, but also for unseen and little-known species where the description does not provide sufficient information to discriminate it from other related ones occurring on the same plant genus. Further information on most of these species can be found in Volume 2 (referring to the index if necessary), or in Blackman and Eastop (1994) if a tree is the normal host plant. In general we have tended to adopt a liberal approach, including species in a key even when we think that their normal hosts are in other genera.

For generic names of plants we have followed Brummit (1992) and Mabberley (1997). Authorities for plant species names are omitted except where there is ambiguity. We have made considerable use of *Index Kewensis* and the Missouri Botanic Garden database (http://mobot.mobot.org/W3T/Search/vast.html) in searching for and verifying plant names. Plant names that were misspelt in the original records have been corrected where we could be reasonably certain of the intended species. Names that could not be identified by reference to any available database of plant names have been included but are followed by '(?)'.

Aphids on the World's Herbaceous Plants and Shrubs by R.L. Blackman and V.F. Eastop
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The keys

A key is provided to the aphid species on each plant genus in all cases except where only one species is recorded from that genus, or where all the species are polyphagous. Sometimes the aphids on related plant genera are combined in a single key. In particular, we found it most convenient to key all grass-feeding aphids (even although some are monophagous or genus-specific) together under *Digitaria*, and a similar procedure was adopted for aphids on ferns (under *Polypodium*), mosses (under *Polytrichum*) and orchids (under *Cymbidium*). There are cross-references to these keys under the host lists of all the relevant plant genera. In two instances – for aphids feeding on *Artemisia* and for grass-feeding aphids – a single key would have been too cumbersome, so there is a master key leading to a series of subsidiary keys.

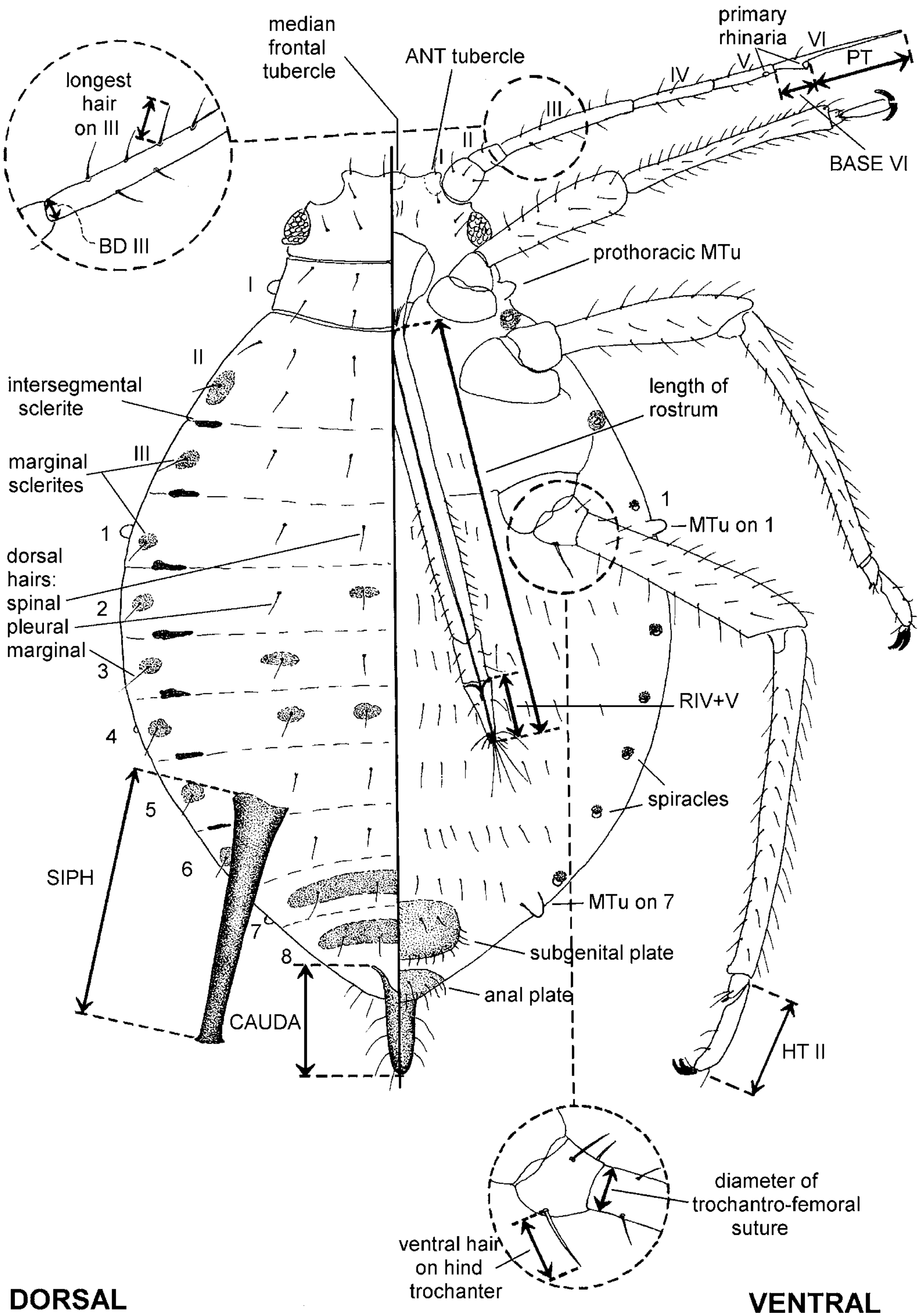
As in our previous identification guides, the keys are intended specifically for aphids found feeding on or colonising a named plant species, and are based almost exclusively on the apterous viviparous morphs (apt.) found in mid to late spring and summer. The stem mother or fundatrix (fund.) developing from the overwintering egg usually has a distinctive morphology, so samples collected early in the season (particularly when consisting of adult apt. with a few progeny) must be treated warily. There are a few inevitable exceptions where there is no apt. to key, either because the viviparous females are all alate (al.) or, in the case of some heteroecious aphids on their primary host plants, because all the progeny of the fund. are al. spring migrants. In all such cases the morph(s) to which the key can be applied are, we think, clearly indicated.

Polyphagous aphids occur on most common plant genera, and to avoid a great deal of repetition most keys at some point lead the user to the key to the 35 most polyphagous aphids, or to some part of it. Most of these polyphagous aphid species are in any case likely to be found on any plant along with aphids with more specific tastes, so it makes sense to transfer the user to the polyphagous aphids key at an appropriate point, even when only rather few polyphagous species have actually been recorded from the plant genus in question. In fact, the first question for anyone setting out to identify an aphid from any plant should be ‘Is it one of the common polyphagous species?’ (See also the introductory comments to the polyphagous aphids key on p. 1020.)

Whereas the keys in *Aphids on the World’s Crops* are relatively simple and can be used for unmounted specimens viewed under a binocular microscope, the user of the keys in this book will need to make microscope slide whole mounts of the aphids to be identified. We recommend that Canada balsam mounts are prepared as these are of proven permanence, and can withstand a range of temperatures and humidities. A simple procedure for preparing balsam mounts is that of Martin (1983); for details of this and other advice on mounting, labelling and storage of aphid specimens see Blackman and Eastop (2000: 363–5). An important additional point to emphasise is that the exposure to and removal of potassium hydroxide need to be carefully carried out, as over-potashing will cause bleaching, and the extent and distribution of cuticular pigmentation is often used as a key character.

Figures 1–4 illustrate the characters and morphometric parameters in common use in the keys, and the abbreviations. For more detailed information on aphid morphology consult Miyazaki (1987), or Blackman

Figure 1 Diagrammatic illustration of an apterous vivipara of a member of the tribe Aphidini showing dorsal (L) and ventral (R) morphological features used in the keys in this book, the abbreviations used, and ways to measure certain morphometric parameters. Antennal (ANT) and thoracic segments are numbered I–VI and I–III respectively, ANT III onwards being the ANT flagellum, and ANT VI comprising BASE and processus terminalis (PT). The ratio of ANT VI BASE to PT (‘ANT PT/BASE’) is a frequently used discriminant. Abdominal segments are numbered 1–8. Insets show measurements of ANT and trochantral hairs, basal diameter of ANT III (BD III) and diameter of trochantro-femoral suture. The last two segments of the rostrum usually form a combined structure (R IV+V), the length of which is often compared with that of the 2nd segment of the hind tarsus (HT II). Members of the tribe Aphidini typically have marginal tubercles (MTu) on the prothorax and abdominal tergites (ABD TERG) 1 and 7, but some have them also on other segments.


median frontal tubercle
ANT tubercle
primary rhinaria
VI
V
PT
IV
III
II
I
BASE VI
longest hair on III
BD III
prothoracic MTu
I
II
intersegmental sclerite
marginal sclerites
III
length of rostrum
1
MTu on 1
dorsal hairs:
spinal
pleural
marginal
2
3
4
RIV+V
spiracles
5
SIPH
6
MTu on 7
7
subgenital plate
8
anal plate
CAUDA
HT II
diameter of trochantro-femoral suture
ventral hair on hind trochanter
DORSAL
VENTRAL

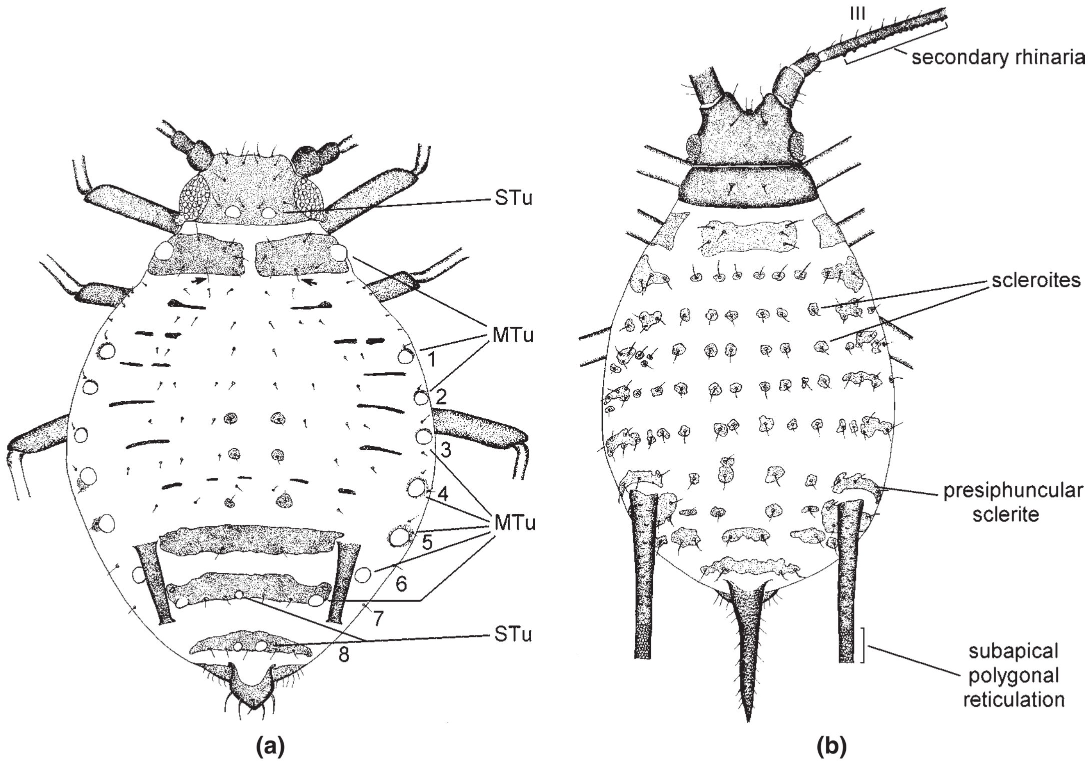


Figure 2 Dorsal facies of apterous viviparae representative of two large genera of Macrosiphini, to show additional morphological features referred to in the keys. (a) A *Dysaphis* species (*D. radicola*), showing a typical distribution of marginal and spinal tubercles (MTu and STu). Arrows indicate a pair of pleural hairs on the posterior margin of the pronotum that are characteristic of the *devecta* species group. (b) A member of *Uroleucon* (subgenus *Uromelan*), showing features typical of this and related genera.

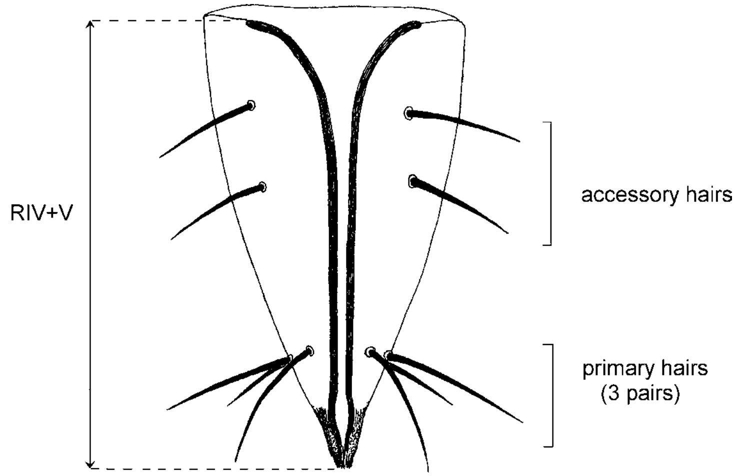


Figure 3 Combined rostral segments IV+V (R IV+V) showing length measurement and arrangement of hairs; the number of accessory hairs is a variable commonly used in the keys in this book.

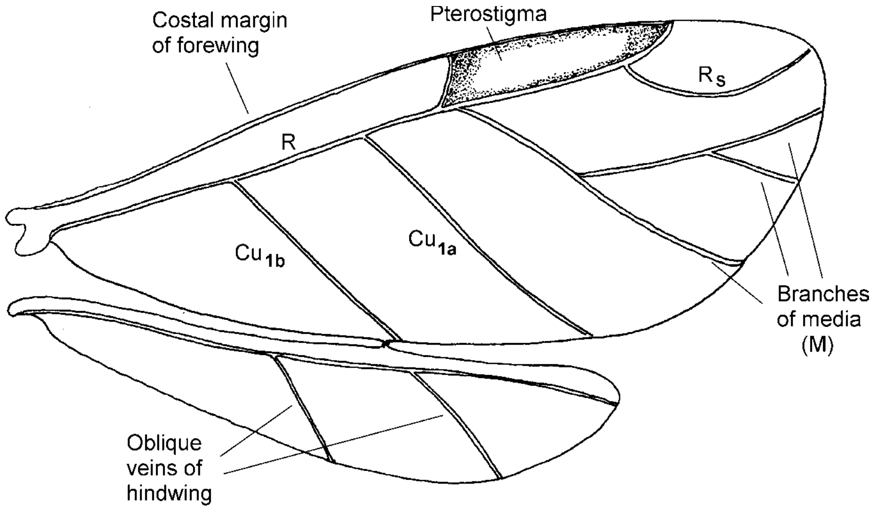


Figure 4 Typical wing venation of an alate viviparous aphid.

and Eastop (2000). Many of the discriminants used in the keys are morphometric, and require measurement of parts of the aphid, such as antennal segments (ANT) and siphunculi (SIPH) with a micrometer eyepiece or a digital measuring system. Correct and accurate calibration of the measuring device is obviously extremely important. The parameters measured are as in Ilharco and van Harten (1987), except that body length (BL) is always measured to the posterior end of the anal plate and does not include any projecting cauda.

Key couplets may offer a choice between two ranges of measurements or ratios. Sometimes when species are particularly difficult to separate these ranges are contiguous, or even overlap. For reliable identifications one should therefore ideally examine a series of 10 or more apterous adult aphids, so that if necessary the range of variation in the sample can be assessed and compared with the range given in the key.

The degree of confidence one can have in any identification made with a key in this book will depend on a range of factors. We have tried to make the keys as comprehensive as possible. This meant including species that we have not been able to examine ourselves on the basis of their published descriptions. Unseen species are indicated by an asterisk (*). Also included are little-known species of which only a few specimens have been described or examined (in some cases only a single specimen), and which potentially have a much greater range of character variation. Where there are discriminants between two nominal species we have used them, even when we suspect that further work may prove them to be unreliable. If we suspect that two species are synonymous then this is indicated in the text for one or other of them in Volume 2.

So as a general rule, specimens that run in a key to a common species are more likely to be reliably identified than those that run to an asterisked name, or to a species that transpires to be little-known or locally distributed when the name is looked up in Volume 2. You need to proceed with caution, for example, if the name that you arrive at is that of a species new to your region, and be extremely skeptical if, for example, you are in Patagonia and you have identified your aphid as a species that is only known from a single sample collected many years ago in Mongolia! If in doubt, always consult an experienced aphid taxonomist.

We have also included in the lists and keys a rather large number of undescribed species from the BMNH collection, providing details of their host, country of origin and collector. The formal naming of new species is, of course, fundamentally important, but describing species properly is very time consuming. Descriptions should normally include both apterous and alate morphs, and if at all possible they should be based on several samples collected at different times of year and in more than one locality. Most of the undescribed material in the BMNH collection does not fulfill these criteria. Also, descriptions of new species are best included in revisions of the groups concerned, so that they can be adequately compared to existing species. Nevertheless, we believe that by including undescribed species in the host lists and keys we can at least make known their existence, so that this material can be borrowed and included in future taxonomic studies.

Host lists and identification keys
(in alphabetical order of plant genera)

Aaronsohnia **Compositae**

A. factorovskyi	*Myzus persicae*

Abatia **Flacourtiaceae**

A. brasiliensis	*Aphis gossypii*

Abelia **Caprifoliaceae**

A. bifora	*Prociphilus xylostei*
A. grandiflora (incl. var. *prostrata*)	*Aulacorthum solani*; *Myzus ornatus*, *persicae*
A. spathulata	*Neotoxoptera abeliae*
A. triflora	*Neotoxoptera abeliae*
***Abelia* spp.**	*Macrosiphum euphorbiae*

Key to aphids on *Abelia*:–

1. ANT PT/BASE less than 0.5. Wax gland plates present on head, thorax and abdomen. Eyes 3-faceted. SIPH absent. (Apt. fundatrix, all progeny of which are al. having unbranched media in forewing and ANT with narrow, transversely elongate secondary rhinaria) *Prociphilus xylostei*

– ANT PT/BASE more than 0.5. No wax gland plates. Eyes multifaceted. SIPH present, tubular. (Al. have forewing with 1- or 2-branched media and ANT with round or oval secondary rhinaria) **2**

2. SIPH slightly to moderately clavate, without any subapical polygonal reticulation, **and** HT II 0.65–0.8× R IV+V. Al. with wing veins broadly bordered with fuscous *Neotoxoptera abeliae*

– SIPH clavate, cylindrical or tapering, with or without subapical reticulation. HT II 0.8–1.4× R IV+V. Al. without fuscous-bordered wing veins . . . go to key to polyphagous aphids, p. 1020

Abelmoschus **Malvaceae**

A. angulosus	*Aphis gossypii*
A. esculentus see *Hibiscus esculentus*	
A. moschatus	*Aphis gossypii*, *Myzus persicae*

Use key to polyphagous aphids, p. 1020.

Abroma **(including *Ambroma*)** **Sterculiaceae**

A. angusta	*Aphis gossypii*

Abrus **Leguminosae**

A. precatorius	[*Aphis* sp. (Leonard, 1968: 269)]; *Aulacorthum solani*

Abutilon **Malvaceae**

A. americanum	*Aphis craccivora*
A. arboreum	*Myzus persicae*
A. avicennae	*Aphis gossypii*
A. darwini	*Aulacorthum solani*; *Macrosiphum euphorbiae*
A. hybridum	*Aulacorthum solani*; *Macrosiphum euphorbiae*; *Myzus ornatus*, *persicae*
A. indicum	*Aphis gossypii*, *umbrella*; *Brachyunguis calotropicus*; *Macrosiphum euphorbiae*; *Myzus persicae*
A. mauritianum	*Aphis craccivora*, *gossypii*
A. megapotamicum	*Myzus persicae*
A. ramosum	*Aphis gossypii*
A. theophrasti	*Aphis fabae*, *gossypii*; *Myzus persicae*
A. umbellatum	*Aphis craccivora*, *spiraecola*
A. vitifolium	*Macrosiphum euphorbiae*
***Abutilon* spp.**	*Brachycaudus helichrysi*

Key to aphids on *Abutilon*:–

1. ANT PT/BASE a little less than 1. SIPH only 0.33–0.40× cauda *Brachyunguis calotropicus*
– ANT PT/BASE much more than 1. SIPH as long as or longer than cauda **2**

2. ANT tubercles poorly developed, SIPH pale or only slightly dusky towards apices, R IV+V clearly longer than (1.2–1.33×) HT II, and marginal tubercles (MTu) often present on ABD TERG 2–6 as well as 1 and 7 *Aphis umbrella*
– **Either** ANT tubercles well developed **or** SIPH dark, R IV+V usually less than 1.2× HT II, and MTu only sporadically on ABD TERG 2–6 go to key to polyphagous aphids, p. 1020

Acacia **Leguminosae**

***Acacia* spp.**	*Aphis craccivora*, *fabae*, *gossypii*, *nasturtii*, *spiraecola*; *Aulacorthum solani*; *Macrosiphum euphorbiae*; *Myzus cymbalariae*, *persicae*

(One or more of the above polyphagous aphid species have been recorded from each of the following *Acacia* spp.; *alata*, *albida*, *arabica*, *ataxcantha*, *farnesiana*, *jonesii*, *karroo*, *longifolia*, *murrayana*, *pennata*, *plumosa*, *rotundifolia*, *scorpioides*, *visite*.)

Use key to polyphagous aphids, p. 1020.

Acaena **Rosaceae**

A. glabra	*Macrosiphum euphorbiae*
A. macropoda	*Macrosiphum euphorbiae*
A. macrostemon	*Acyrthosiphon malvae* group; *Macrosiphum euphorbiae*
A. magellanica	*Aulacorthum solani*; *Macrosiphum euphorbiae*; *Myzus ascalonicus*
A. microphylla	*Acyrthosiphon malvae* group; *Macrosiphum euphorbiae*
A. myriophylla	*Acyrthosiphon malvae* group
A. novae-zealandiae (incl. *anserinifolia*)	*Acyrthosiphon malvae* group; *Brachycaudus helichrysi*; *Macrosiphum euphorbiae*
A. ovina	*Aphis acaenovinae*

A. sanguisorbae	*Macrosiphum euphorbiae*
A. splendens	*Aphis acaenaevora*; [*Cryptomyzus michaelseni* (Schouteden, 1904)]; *Pentamyzus acaenae*

Key to aphids on *Acaena*:–

1. ANT tubercles weakly developed, not projecting beyond middle of front of head in dorsal view. ANT length much less than BL, with PT shorter than head width across (and including) eyes **2**

– ANT tubercles well developed. ANT length at least 0.9× BL, with PT as long as or longer than head width across eyes go to key to polyphagous aphids, p. 1020

2. SIPH and cauda pale. ABD TERG 1 and 7 without marginal tubercles (MTu) **3**

– SIPH and cauda dark. ABD TERG 1 and 7 with well-developed MTu **4**

3. ANT 6-segmented. SIPH short, conical. Cauda helmet-shaped, not longer than its basal width *Brachycaudus helichrysi*

– ANT 5-segmented. SIPH clavate. Cauda tongue-shaped, longer than its basal width *Pentamyzus acaenae*

4. SIPH 0.20–0.25× BL and 1.7–2.0× cauda. ABD TERG 2–4 more usually without MTu *Aphis acaenovinae*

– SIPH 0.11–0.16× BL and 1.0–1.3× cauda. ABD TERG 2–4, and often also 5 and 6, with MTu *Aphis acaenaevora*

Acalypha — Euphorbiaceae

***Acalypha* spp.**	*Aphis craccivora*, *gossypii*, *spiraecola*; *Myzus ornatus*, *persicae*; *Neomyzus circumflexus*; *Prociphilus erigeronensis*; *Toxoptera aurantii*

[One or more of the above polyphagous aphid species have been recorded from each of the following *Acalypha* spp.; *alopecuroides*, *australis*, *boehmeroides*, *capillipes*, *ciliata*, *godseffiana*, *havanensis*, *hispida*, *ornata*, *segetalis*, *villicaulis*, *virginica*, *wilkesiana*.]

Use the key to polyphagous aphids, p. 1020.

Acantholimon — Plumbaginaceae

A. pamiricum	*Chaetosiphella stipae* (as *pamirica*)

Acanthopanax see *Eleutherococcus*

Acanthophyllum — Caryophyllaceae

***Acanthophyllum* sp.**	*Aphidura acanthophylli*

Acanthospermum — Compositae

A. australe	*Uroleucon ambrosiae*
A. hispidum	*Aphis craccivora*, *gossypii*; *Uroleucon ambrosiae*, *compositae*
A. humile	*Uroleucon ambrosiae*
***Acanthospermum* sp.**	*Acyrthosiphon bidenticola*

Key to aphids on *Acanthospermum*:–

1. ANT tubercles poorly developed. ABD TERG 1 and 7 with marginal tubercles (MTu) **2**
– ANT tubercles well developed, with inner faces divergent. ABD TERG 1 and 7 without MTu **3**

2. Dorsal abdomen with a solid black patch. Cauda black *Aphis craccivora*
– Dorsal abdomen unpigmented. Cauda pale or dusky *Aphis gossypii*

3. SIPH pale basally, slender, 20–35× longer than diameter at midlength, and with any polygonal reticulation extending for less than 0.1 of length *Acyrthosiphon bidenticola*
– SIPH uniformly dark, thicker, 6–12× diameter at midlength, with a distal zone of reticulation consisting of numerous polygonal cells on 0.25–0.35 of length **4**

4. Coxae and cauda black *Uroleucon compositae*
– Coxae and cauda pale *Uroleucon ambrosiae*

Acanthus **Acanthaceae**

A. ilicifolius	*Aphis gossypii*
A. lusitanicus	*Myzus ornatus*, *persicae*; *Neomyzus circumflexus*;
A. mollis	*Aulacorthum solani*; *Macrosiphum euphorbiae*; *Myzus ornatus*, *persicae*; *Neomyzus circumflexus*;
A. pubescens	*Aphis gossypii*; *Myzus ornatus*
***Acanthus* sp.**	*Aphis fabae*; *Uroleucon compositae*

Use key to polyphagous aphids, p. 1020.

Acca **Myrtaceae**

A. sellowiana	*Aphis gossypii*

Acerates **Asclepiadaceae**

A. angustifolia	*Aphis asclepiadis*, *middletoni*
A. floridana	*Aphis asclepiadis*
A. longifolia	*Aphis asclepiadis*

Use key to aphids on *Asclepias*.

Aceriphyllum **see** ***Mukdenia***

Achillea **Yarrow** **Compositae**

A. acuminata	*Macrosiphoniella tanacetaria*
A. ageratifolia	*Myzus ornatus*
A. ageratum	*Macrosiphoniella millefolii*; *Pemphigus* [*brevicornis*]
A. alpinum	*Brachycaudus helichrysi*; *Macrosiphoniella millefolii*, *millefolii* ssp. *orientalis*
A. asiatica	*Macrosiphoniella tanacetaria*
A. atrata	*Metopeurum capillatum* (?)
A. aurea	*Aulacorthum solani*; *Myzus ascalonicus*; *Uroleucon achilleae*
A. californica	*Macrosiphoniella cinerescens*
A. carpatica	*Brachycaudus helichrysi*
A. cartilaginea	*Aulacorthum solani*; *Uroleucon achilleae*, *ptarmicae*

A. clavennae	*Brachycaudus helichrysi*
A. coarctata	*Aphis fabae*
A. collina	*Brachycaudus cardui*; *Macrosiphoniella millefolii*, *usquertensis*; *Pleotrichophorus duponti*
A. crithmifolia	*Macrosiphoniella millefolii*, *tapuskae*; *Uroleucon achilleae*
A. distans (incl. *tanacetifolia*)	*Acyrthosiphon malvae*; *Aphis fabae*; *Aulacorthum solani*; *Brachycaudus helichrysi*; *Macrosiphoniella millefolii*; *Uroleucon achilleae*
A. filipendulina	*Brachycaudus cardui*; *Macrosiphum euphorbiae*
A. gerberi	*Macrosiphoniella tapuskae*; *Metopeurum achilleae*
A. grandiflora	*Macrosiphoniella millefolii*
A. kitaibeliana see *pectinata*	
A. lanulosa	*Macrosiphoniella millefolii; Pleotrichophorus hottesi*
A. ligustica	*Aphis ligusticae*, *oligommata*, *spiraecola*; *Aulacorthum solani*; *Brachycaudus helichrysi*; *Coloradoa achilleae*; *Macrosiphoniella millefolii*, *silvestrii*, *tanacetaria*, *tapuskae*
A. lingulata	*Brachycaudus helichrysi*
A. macrocephala	*Macrosiphoniella tanacetaria*
A. macrophylla	*Aulacorthum solani*; *Brachycaudus helichrysi*; *Uroleucon achilleae*
A. magna	*Brachycaudus helichrysi*; *Myzus ornatus*; *Uroleucon achilleae*
A. micrantha	*Aphis pseudocardui*; *Macrosiphoniella tapuskae*
A. millefolium (incl. *rubra*)	*Abstrusomyzus phloxae*; [*Acaudinum longisetosum*]; *Aphis fabae*, *gossypii*, *knowltoni*, *middletonii*, [*obiensis*], *oligommata*, *vandergooti*; *Aulacorthum solani*; *Brachycaudus cardui*, *helichrysi*; *Coloradoa achilleae*; *Macrosiphoniella abrotani*, [*frigidicola*], *millefolii*, *millefolii ssp. orientalis*, [*oblonga*], *pennsylvanica*, *ptarmicae*, *sejuncta*, *sudhakaris*, *tanacetaria*, *tapuskae*, *usquertensis*; *Macrosiphum euphorbiae*; *Metopeurum fuscoviride*, *millefolii*; *Microsiphum heptapotamicum*, *millefolii*, *nudum*, [*ptarmicae* ssp. *minus*]; *Myzus ascalonicus*, *cymbalariae*, *ornatus*, *persicae*; *Neomyzus circumflexus*; *Pemphigus* [*betae*], [*brevicornis*]; *Pleotrichophorus duponti*, *hottesi*, *patonkus*, *patonkusellus*, *pseudopatonkus*; *Trama* [*eastopi*], [*pubescens*], *troglodytes*; *Uroleucon achilleae*, *ambrosiae*, [*erigeronensis*], [*sonchi*], *stoetzelae*
A. moschata	*Metopeurum capillatum* (?)
A. neilreichii	*Coloradoa achilleae*; *Uroleucon achilleae*
A. nobilis	*Aphis vandergooti*; *Brachycaudus helichrysi*; *Macrosiphoniella millefolii*, *tapuskae*; *Microsiphum millefolii*, *nudum*; *Myzus persicae*

A. ochroleuca	*Aphis gossypii*
A. odorata	*Brachycaudus helichrysi*
A. pannonica	*Brachycaudus helichrysi*; *Coloradoa achilleae*; *Macrosiphoniella millefolii*, *usquertensis*; *Pleotrichophorus duponti*; *Uroleucon achilleae*
A. pectinata (incl. *kitaibeliana*)	*Aphis fabae*; *Pleotrichophorus achilleae*
A. ptarmica	*Aphis fabae*, *nasturtii*, *vandergooti*; *Aulacorthum solani*; *Brachycaudus cardui*, *helichrysi*; *Macrosiphoniella millefolii*, *ptarmicae*; *Macrosiphum euphorbiae*; *Microsiphum ptarmicae*;
A. ptarmicifolia	*Aphis achilleaeradicis*
A. rupestris	*Neomyzus circumflexus*; *Uroleucon achilleae*
A. santolina	*Brachycaudus helichrysi*; *Coloradoa santolinae*; *Macrosiphoniella tapuskae*
A. serbica	*Brachycaudus helichrysi*; *Myzus cymbalariae*
A. setacea	*Brachycaudus cardui*, *helichrysi*; *Coloradoa achilleae*; *Microsiphum nudum*
A. sibirica	[*Anuraphis spiranthi* Shinji (nomen dubium)]; *Brachycaudus helichrysi*; *Uroleucon achilleae*
A. stricta	*Macrosiphoniella millefolii*
A. tanacetifolia see *distans*	
A. taygetea	*Brachycaudus helichrysi*
A. tomentosa	*Aphis gossypii*
A. trichophylla	[*Aphis elatior*]
***Achillea* spp.**	[*Macrosiphoniella aktashica hirsuta*] [*Miraphoides achilleae* Rusanova, 1943] [*Triocula distorta* Rusanova, 1943] *Uroleucon alaskense*, [*kamtshaticum*]

For an account of aphids of the genera *Macrosiphoniella* and *Uroleucon* on *A. millefolium* in Germany see Sobhani (1970).

Key to aphids on *Achillea*:–

1. PT much shorter than base of last ANT segment **2**
– PT clearly longer than base of last ANT segment **3**

2. HT II very elongate, more than 0.5 of length of hind tibia. Body and appendages densely hairy *Trama troglodytes* group (incl. *eastopi, pubescens*)
– HT II of normal length. Body and appendages sparsely hairy *Pemphigus* sp(p).

3. Marginal tubercles (MTu) absent or present, but if present they are usually only on ABD TERG 2–4 (–5) and only rarely on ABD TERG 1 or 7 **4**
– MTu always present at least on ABD TERG 1 and 7 **38**

4. ANT tubercles absent or weakly developed, so that front of head has convex outline in dorsal view, with middle part projecting furthest forward **5**
– ANT tubercles variably developed, but if low they are broadly divergent, so that the front of the head is concave in dorsal view **8**

5. Cauda tongue- or finger-shaped, longer than its basal width. Eye with ocular tubercle indistinct and displaced ventrally, so inconspicuous in dorsal view (Figure 5a) **6**
– Cauda helmet-shaped, distinctly constricted at base and as long as broad. Eye with protruberant ocular tubercle, positioned at posterior margin **7**

6. Dorsal body hairs short, inconspicuous. ANT PT only 1.1–1.4× BASE VI. SIPH 1.3–1.8× cauda *Coloradoa achilleae*
– Dorsal body hairs long, with fan-shaped apices (Figure 5b). ANT PT at least 2× BASE VI. SIPH shorter than cauda *Coloradoa santolinae*

7. Dorsal abdomen with an extensive solid black shield. ANT III 0.31–0.47 mm, 2.4–3.4× HT II. R IV+V 0.17–0.24 mm. SIPH dark, imbricated, 1.7–3.4× cauda *Brachycaudus cardui*
– Dorsal abdomen without a black shield. ANT III 0.07–0.25 mm, 0.9–2.2× HT II. R IV+V 0.10–0.15 mm. SIPH pale, smooth, 0.8–2.0× cauda *Brachycaudus helichrysi*

8. Dorsal hairs numerous and long, with fan-shaped or clearly expanded apices (Figure 5c) **9**
– Dorsal hairs short or long, but if long then with blunt or pointed apices **14**

9. SIPH 0.31–1.0× cauda **10**
– SIPH more than 1.5× cauda **12**

10. Dorsal fan-shaped hairs very numerous, e.g., usually more than 25 on ABD TERG 6 between SIPH, and 28–45 on dorsal surface of head (not including those projecting forward between ANT bases). SIPH 0.61–1.0× cauda. ANT III with 1–2 secondary rhinaria. *Pleotrichophorus patonkusellus*
– Dorsal fan-shaped hairs less numerous, e.g., less than 20 on ABD TERG 6 between SIPH, and 14–25 on dorsal surface of head (Figure 5c). SIPH 0.31–0.75× cauda. ANT III with 1–8 secondary rhinaria **11**

11. R IV+V 0.12–0.13 mm long, 0.86–1.09× HT II. SIPH 0.14–0.21 mm long, 0.62–0.75× cauda *Pleotrichophorus patonkus*
– R IV+V 0.09–0.12 mm long, 0.71–0.92× HT II. SIPH 0.08–0.18 mm long, 0.31–0.67× cauda *Pleotrichophorus pseudopatonkus*

12. ANT 0.87–1.17× BL, with PT 3.1–4.1× BASE VI *Pleotrichophorus duponti*
– ANT 1.24–1.57× BL, with PT 4.3–6.2× BASE VI **13**

13. SIPH 0.25–0.29× BL and 2.3–2.9× cauda *Pleotrichophorus achilleae*
– SIPH 0.15–0.21× BL and 1.6–2.0× cauda *Pleotrichophorus hottesi*

14. SIPH tiny, no longer than wide, much less than 0.5 of length of the short triangular cauda, and less than 0.3× HT II (eg. Figure 5d, e) **15**
– SIPH very evident, only shorter than cauda when the latter is long, dark and finger-like, and always clearly longer than HT II **18**

15. Hairs on front of head, cauda and ANT III all less than 0.5× diameter of BD III *Microsiphum nudum*
– Hairs on front of head and cauda longer than ANT BD III. Hairs on ANT III maximally more than 0.5× BD III **16**

16. ANT PT/BASE 6–8. R IV+V with 4 accessory hairs. SIPH 1.4–1.5× longer than their basal widths. Cauda with 9–10 hairs *Microsiphum ptarmicae**
– ANT PT/BASE 3.7–5.7. R IV+V with 5–8 accessory hairs. SIPH 0.85–1.0× as long as their basal widths. Cauda with 12–20 hairs **17**

17. ANT PT 1.7–2.2× ANT III. ANT PT/BASE 5.0–5.7 *Microsiphum heptapotamicum**
– ANT PT 1.2–1.6× ANT III. ANT PT/BASE 3.7–5.2 *Microsiphum millefolii*

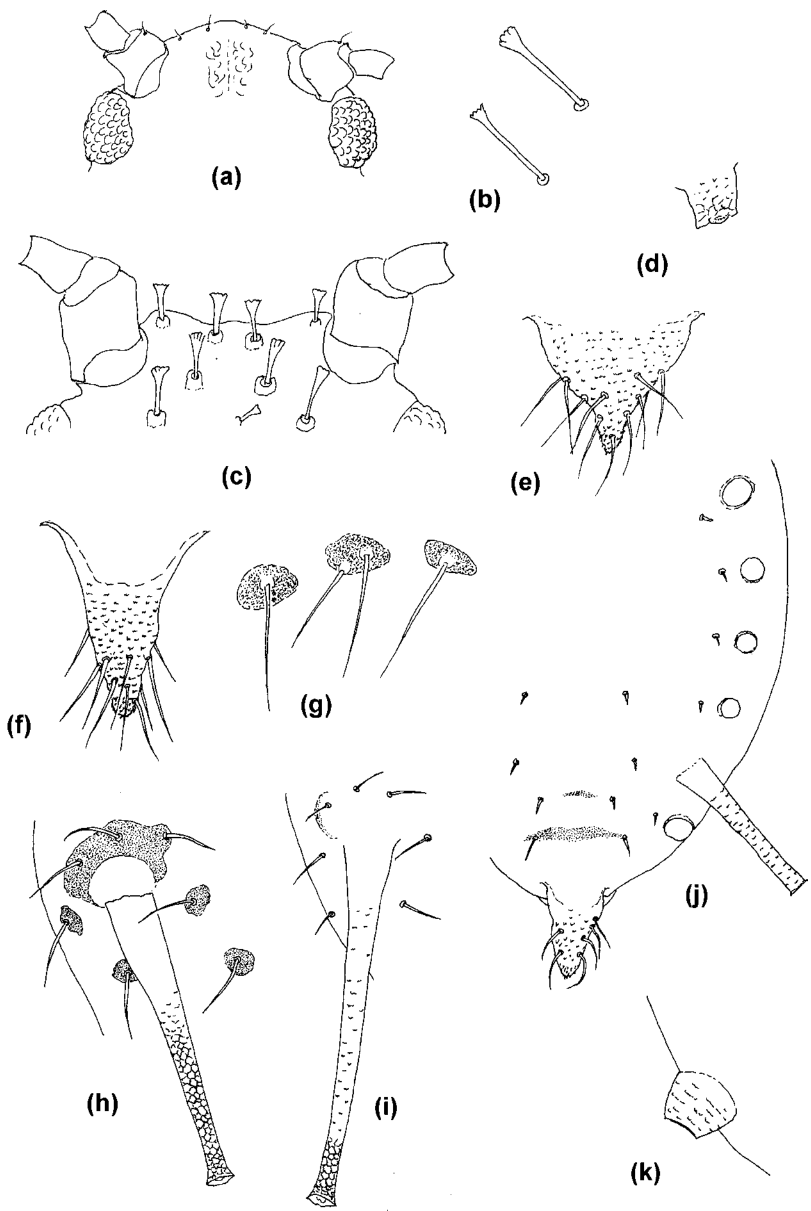


Figure 5 Apterae on *Achillea*; (a) Front of head of *Coloradoa achilleae*, (b) dorsal body hairs of *Coloradoa santolinae*, (c) front of head of *Pleotrichophorus patonkus*, (d) SIPH of *Microsiphum millefolii*, (e) cauda of *Microsiphum millefolii*, (f) cauda of *Metopeurum fuscoviride*, (g) scleroites of *Macrosiphoniella millefolii*, (h) SIPH of *Macrosiphoniella sejuncta*, (i) SIPH of *Macrosiphoniella tapuskae*, (j) abdomen of *Aphis vandergooti* showing MTu, SIPH and cauda, (k) SIPH of *Aphis oligommata*.

18. SIPH pale at least over most of length, sometimes dusky or dark apically, and if with subapical polygonal reticulation then this is confined to distal 0.2 or less of length
go to key to polyphagous aphids, starting at couplet 4 (p. 1020)
– SIPH dusky or dark over at least half of length, with polygonal reticulation usually extending over more than distal 0.2 (if rather pale then reticulated over distal 0.5 or more) **19**

19. Cauda tapering, triangular, less than 1.5 times longer than its basal width (e.g., Figure 5f). ANT tubercles very weakly developed, so that front of head is very shallowly concave in dorsal view **20**
– Cauda finger-like, more than 2 times its basal width. ANT tubercles variably developed **23**

20. Dorsal abdominal hairs very short and blunt **21**
– Dorsal abdominal hairs long, like ventral abdominal hairs **22**

21. Longest hairs on ANT III 0.5–0.6× BD III. cauda with 11–20 hairs *Metopeurum fuscoviride*
– Longest hairs on ANT III about as long as BD III. cauda with c.8 hairs *Metopeurum millefolii**

22. ANT III with 5–8 rhinaria *Metopeurum achilleae*
– ANT III with 28–32 rhinaria *Metopeurum capillatum**

23. SIPH 0.6–1.0× cauda **24**
– SIPH 1.1–2.9× cauda **29**

24. Tibiae entirely dark brown to black **25**
– Tibiae with middle section paler **27**

25. BL only 1.3–1.6 mm. Cauda with 10–12 hairs *Macrosiphoniella sudhakaris*
– BL 2.1–4.1 mm. Cauda with 20–32 hairs **26**

26. All dorsal abdominal hairs arising from conspicuous dark scleroites (Figure 5g). PT 3.3–4.3× BASE VI. R IV+V 0.9–1.2× HT II *Macrosiphoniella millefolii*
– Dorsal abdominal hairs not arising from dark scleroites. PT 2.9–3.5× BASE VI. RIV+V 0.7–0.9× HT II *Macrosiphoniella tanacetaria*

27. ANT III dark except at base, and bearing 8–32 rhinaria *Macrosiphoniella ptarmicae*
– ANT III only dark towards apex, and bearing 3–13 rhinaria **28**

28. SIPH mainly pale/dusky, only dark towards apices, and reticulated over distal 0.5–0.67 of length. R IV+V 0.6–0.8× HT II *Macrosiphoniella abrotani*
– SIPH black and reticulated over distal 0.34–0.45 of length. R IV+V 0.8–0.9× HT II *Macrosiphoniella usquertensis*

29. First tarsal segments with 3 hairs (a sense peg and a pair of lateral hairs); rarely with one additional lateral hair. SIPH often paler basally, and reticulated over distal 0.15–0.7 **30**
– First tarsal segments with 5 hairs (sense peg plus 2 lateral pairs); rarely with only 4 hairs. SIPH wholly dark, reticulated over distal 0.17–0.33 **35**

30. SIPH wholly dark, 1.1–1.3× cauda and 0.16–0.24× BL. Dorsal abdomen with paired dark spinal sclerites, each bearing 2–3 hairs *Macrosiphoniella silvestrii*
– SIPH often pale basally, 1.25–2.3× cauda and 0.2–0.3× BL. Dorsal abdomen without paired spinal sclerites; if with small dark scleroites then these are not fused between hair-bases **31**

31. SIPH 1.7–2.3× cauda **32**
– SIPH 1.25–1.5× cauda **33**

32. SIPH reticulated over distal 0.48–0.69. Dark crescent-shaped presiphuncular sclerites usually present, and dorsal abdominal hairs arising from dusky or dark scleroites (Figure 5h) *Macrosiphoniella sejuncta*

– SIPH reticulated over distal 0.15–0.25. Presiphuncular sclerite usually not evident, and dorsal abdominal hairs not arising from dark or dusky scleroites (Figure 5i) *Macrosiphoniella tapuskae*

33. ANT III and middle part of hind tibia pale. (ANT III with 10–13 rhinaria, cauda with 14–18 hairs) *Macrosiphoniella cinerascens*
– ANT III and hind tibia mainly dark **34**

34. ANT III with 30–44 rhinaria. R IV+V 0.75–0.95× HT II. Cauda with 11–18 hairs *Macrosiphoniella pennsylvanica*
– ANT III with 5–21 rhinaria. R IV+V 1.05–1.5× HT II. Cauda with 8–10 hairs *Uroleucon stoetzelae*

35. SIPH 1.7–2.9× cauda **36**
– SIPH 1.0–1.5× cauda **37**

36. Cauda less than 0.35 mm long and less than twice its basal width. ANT III with 7–24 rhinaria *Uroleucon achilleae*
– Cauda more than 0.4 mm long and more than twice its basal width. ANT III with 30–36 rhinaria *Uroleucon ptarmicae**

37. Marginal tubercles (MTu) well developed and evident on at least ABD TERG 2–5. SIPH 1.0–1.2× cauda and 0.21–0.26× BL *Uroleucon alaskense*
– MTu usually absent. SIPH 1.2–1.5× cauda and 0.25–0.30× BL *Uroleucon ambrosiae*

38. Large transparent marginal tubercles (MTu) present on all of at least ABD TERG 1–4 and 7 (e.g. Figure 5j) **39**
– MTu only always present on ABD TERG 1 and 7 **41**

39. SIPH 0.8–1.2× cauda, which is rounded at apex *Aphis ligusticae*
– SIPH 1.9–2.6× cauda, which tapers to a pointed apex **40**

40. SIPH about 0.16× BL. Cauda about as long as its basal width, and about 0.07× BL. Subgenital plate with 3–5 hairs on anterior part *Aphis achilleaeradicis*
– SIPH 0.18–0.26× BL. Cauda longer than its basal width, 0.08–0.10× BL. Subgenital plate with (2–) 7–16 hairs on anterior part *Aphis vandergooti*

41. ANT always 5-segmented. SIPH very short and flangeless (Figure 5k), 0.5–1.0× cauda . *Aphis oligommata*
– ANT 6-segmented, except in small summer 'dwarfs'. SIPH with a flange, 0.8–2.1× cauda **42**

42. ABD TERG 7 and 8 with dark transverse bands **43**
– ABD TERG 7 and 8 without dark transverse bands **46**

43. Cauda tongue-shaped, much longer than R IV+V. ANT III without rhinaria *Aphis fabae*
– Cauda short, bluntly triangular, as short as or shorter than R IV+V. ANT III often with a few rhinaria on distal part **44**

44. ANT PT/BASE 0.9–1.3 *Aphis pseudocardui*
– ANT PT/BASE 1.4–2.1 **45**

45. Hairs on ANT III all shorter than BD III. SIPH usually longer than cauda *Aphis middletonii*
– Longest hairs on ANT III 1.0–1.5× BD III. SIPH usually shorter than cauda *Aphis knowltoni*

46. SIPH pale except at apices *Aphis nasturtii*
– SIPH dark **47**

47. SIPH clearly darker than cauda, which has no constriction and bears 4–8 hairs *Aphis gossypii*
– SIPH and cauda both very dark. Cauda usually has an evident constriction between basal and distal part, and bears 7–15 hairs *Aphis spiraecola*

Achimenes **Gesneriaceae**

A. longiflora *Neomyzus circumflexus*

Achlys **Berberidaceae**

A. triphylla *Macrosiphum tuberculaceps*

Achnatherum see *Stipa*

Achras see *Manilkara*

Achyranthes **Amaranthaceae**

A. aspera	*Aphis achyranthi*, *craccivora*, *gossypii*, *nasturtii*; *Aulacorthum solani*; *Myzus ornatus*; *Neomyzus circumflexus*
A. aureum	*Myzus ornatus*
A. bidentata	*Aphis glycines*
A. indica	*Aphis craccivora*
A. japonica	*Aphis glycines*, *gossypii*
A. valissiae	*Myzus ornatus*
A. verschafeltii see *Irisine herbsii*	
***Achyranthes* sp.**	*Myzus persicae*

Key to aphids on *Achyranthes*:–

1. ANT tubercles well developed, with inner faces spiculose or scabrous. No marginal tubercles (MTu) on ABD TERG 1 and 7 go to key to polyphagous aphids, p. 1020, starting at couplet 5
– ANT tubercles weakly developed, not exceeding height of medial part of front of head in dorsal view. ABD TERG 1 and 7 with MTu **2**

2. SIPH pale or dark, cauda pale or dusky **3**
– SIPH and cauda both very dark **5**

3. SIPH usually rather pale, only darker at apices *Aphis nasturtii*
– SIPH uniformly dark **4**

4. Cauda 0.08–0.125× BL (only more than 0.12× BL in very small specimens with BL less than 1 mm); pale to dusky, without a constriction, less than 3× longer than its width at midlength, and bearing 2–7 (usually 5–6) hairs *Aphis gossypii*
– Cauda 0.125–0.16× BL, very pale, usually with a slight mid-way constriction, more than 3× longer than its narrowest width at midlength, and bearing 6–9 (usually 8) hairs *Aphis glycines*

5. Dorsum with an extensive dark sclerotic patch. ABD TERG 8 with 2 hairs. SIPH more than 3× their basal widths. Longest hairs on ANT III shorter than BD III. (Al. with sec. rhin. distributed ANT III 3–8 only) *Aphis craccivora*
– Dorsum without an extensive dark sclerotic patch. ABD TERG 8 with 5–6 hairs. SIPH less than 3× their basal widths. Longest hairs of ANT III longer than BD III. (Al. with sec. rhin. distributed ANT III 16–20, IV 6–12, V 3–7 *Aphis achyranthi*

Acicarpha **Calyceraceae**

A. tribuloides — *Aulacorthum solani*

Acinos **Labiatae**

A. alpinus — *Eucarazzia elegans*

A. arvensis — *Aphis calaminthae*, *clinopodii*, *craccivora*, *fabae*; *Ovatomyzus chamaedrys*

Use key to apterae on *Clinopodium.*

Aciphylla **Umbelliferae**

A. aurea — *Schizaphis* (*Euschizaphis*) sp. (New Zealand, BMNH colln)

A. colensoi — *Cavariella aegopodii*; *Macrosiphum euphorbiae*; *Rhopalosiphoninus staphyleae*

A. squarrosa — *Aphis sambuci*; *Brachycaudus helichrysi*; *Dysaphis foeniculus*; *Smynthurodes betae*

Key to aphids on *Aciphylla*:–

1. ANT PT/BASE less than 0.5. Body with numerous fine hairs *Smynthurodes betae*
– ANT PT/BASE more than 0.5, often more than 1. Body not densely hairy **2**

2. ABD TERG 8 with a posteriorly directed process above cauda. ANT PT/BASE 0.6–1.3 *Cavariella aegopodii*
– No supracaudal process. ANT PT/BASE more than 2 **3**

3. ANT tubercles well developed, ANT 0.9–1.4× BL. ANT III with (0–) 1–10 rhinaria on basal half. ANT PT/BASE 4–7 **4**
– ANT tubercles undeveloped or weakly developed. ANT 0.25–0.75× BL. ANT III without rhinaria. ANT PT/BASE 1.7–3.8 **5**

4. SIPH cylindrical or tapering with polygonal reticulation of distal 0.12–0.25 of length. SIPH 1.7–2.2× cauda which bears 8–13 hairs *Macrosiphum euphorbiae*
– SIPH markedly swollen and without polygonal reticulation. SIPH 2.1–3.0× cauda which bears 4–6 hairs . . . *Rhopalosiphoninus staphyleae*

5. ABD TERG 1–4 (–5) and 7 with large flat marginal tubercles (MTu). SIPH dark **6**
– ABD TERG 1 and 7 and usually also 2–5 without MTu **7**

6. SIPH 1.3–1.7× the helmet-shaped (pentagonal) cauda which bears 4–6 hairs. Head and ABD TERG 7 and 8 with spinal tubercles (STu) *Dysaphis foeniculus*
– SIPH 1.7–2.6× the rounded cauda which bears 8–14 hairs. Head and ABD TERG 7 and 8 without STu *Aphis sambuci*

7. Cauda helmet-shaped, not longer than its basal width in dorsal view, and bearing 5–7 hairs. SIPH 0.05–0.1× BL and 0.5–1.2× R IV+V *Brachycaudus helichrysi*
– Cauda tongue-shaped, longer than its basal width and bearing 8–9 hairs. SIPH 0.11–0.14× BL and 1.7–2.1× R IV+V . . . *Schizaphis* (*Euschizaphis*) sp. (New Zealand, BMNH colln)

Acmella **Compositae**

A. caulorrhiza — *Aphis gossypii*

Acnida **see** ***Amaranthus***

Acnistus		**Solanaceae**
A. arborescens	*Myzus persicae*	
Aconitum	**Monkshood, Wolfsbane**	**Ranunculaceae**
A. alboviolaceum	*Delphiniobium hanla*	
A. arcuatum	*Delphiniobium hanla*	
A. arendsii	*Delphiniobium junackianum*	
A. barbatum	*Brachycaudus aconiti*; [*Delphiniobium bogdouli*]	
A. callibotryon	*Delphiniobium junackianum* ssp. *sylvanae*	
A.× cammarum	*Brachycaudus aconiti*, *napelli*; *Delphiniobium junackianum*	
A. carmichaeli	*Delphiniobium junackianum*	
A. chinense	*Delphiniobium yezoense*	
A. columbianum	*Nasonovia wahinkae*	
A. excelsum	*Brachycaudus aconiti*; *Delphiniobium junackianum*; *Nasonovia salebrosus*	
A. ferox	*Delphiniobium junackianum*	
A. firmum	*Delphiniobium junackianum*	
A. fischeri	*Brachycaudus aconiti*	
A. gracile	*Delphiniobium carpaticae*	
A. jaluense	*Delphiniobium hanla*	
A. kirilovii	*Delphiniobium junackianum*	
A. kitadakense	*Delphiniobium yezoense*	
A. kusnezoffi	*Delphinobium aconitifoliae*, *yezoense*	
A. lasianthum	*Delphiniobium junackianum* ssp. *sylvanae*	
A. leucostomum	*Nasonovia alatavica*	
A. lycoctonum	*Brachycaudus napelli*; *Delphiniobium junackianum*, *lycoctoni*	
A. moldavicum	*Delphiniobium junackianum* ssp. *sylvanae*	
A. monticola	*Brachycaudus aconiti*; *Nasonovia alatavica*	
A. napellus	*Brachycaudus aconiti*, *napelli*; *Delphiniobium junackianum* (incl. ssp. s*ylvanae*)	
A. nemorosum	*Delphiniobium junackianum*	
A. orientale	*Delphiniobium junackianum*	
A. paniculatum	*Delphiniobium junackianum*	
A. pulcherrimum	*Delphiniobium hanla*	
A. ranunculifolium	*Delphiniobium junackianum*	
A. rotundifolium	*Nasonovia alativica*	
A. sachalinense	*Delphiniobium yezoense*	
A. septentrionale	*Brachycaudus aconiti*	
A. stoerkianum	*Brachycaudus napelli*, *Delphiniobium junackianum*	
A. superbum	*Brachycaudus napelli*; *Macrosiphum euphorbiae*	
A. tauricum	*Delphiniobium junackianum* ssp. *sylvanae*	
A. toxicum	*Delphiniobium junackianum*	
A. triphyllum	*Delphiniobium hanla*	
A. variegatum	*Brachycaudus aconiti*; *Delphiniobium junackianum*	
A. vulparia	*Delphiniobium lycoctoni*	

A. yezoense	*Delphiniobium yezoense*
***Aconitum* sp.**	*Delphiniobium gyamdaense*; *Myzus persicae*

Key to aphids on *Aconitum*:–

1. Dorsum usually with an extensive dark sclerotic shield (e.g., Figure 6c). Cauda helmet-shaped, shorter than its basal width **2**
– Dorsum without a dark shield. Cauda tongue-shaped, longer than its basal width **3**

2. SIPH 0.31–0.55× ANT III. ANT VI BASE 0.5–0.7× HT II. R IV+V 0.9–1.2× HT II *Brachycaudus napelli*
– SIPH 0.57–1.0× ANT III. ANT VI BASE 0.8–1.1× HT II. R IV+V 1.2–1.6× HT II *Brachycaudus aconiti*

3. Head spiculose with inner faces of ANT tubercles scabrous and apically convergent. SIPH pale and slightly clavate *Myzus persicae*
– Head smooth with inner faces of ANT tubercles divergent. SIPH pale and tapering or cylindrical or, if swollen, then dark at least on distal part and with polygonal reticulation **4**

4. Dorsal abdomen with raised dusky/dark hair-bearing sclerites or scleroites. SIPH 0.07–0.10× BL, pale, without any subapical polygonal reticulation. Cauda pale or dusky **5**
– Dorsal abdomen without dusky/dark sclerites/scleroites. SIPH 0.15–0.35× BL, dark or pale, with a subapical zone of polygonal reticulation. Cauda pale or dark **7**

5. Abdominal spinal scleroites each bearing a single hair (rarely 2), which is longer than the diameter of the scleroite (Figure 6f) *Nasonovia wahinkae*
– Abdominal spinal sclerites/scleroites mostly bearing 2 hairs, which are shorter than the maximum diameter of the sclerite (Figure 6g) **6**

6. SIPH usually a little shorter than cauda which bears 8–12 hairs. R IV+V about equal in length to HT II *Nasonovia salebrosa**
– SIPH 1.1–1.3× cauda which bears 6–8 hairs. R IV+V 1.08–1.22× HT II *Nasonovia alatavica*

7. SIPH pale, tapering or cylindrical, 0.25–0.35× BL. cauda pale. Thoracic spiracles of normal size, like those on abdomen *Macrosiphum euphorbiae*
– SIPH usually dark at least distally, often with a swollen section at about midlength, 0.15–0.20× BL. cauda dark. Thoracic spiracles much larger than abdominal ones (Figure 6h) **8**

8. SIPH 1.1–1.3× cauda and 0.15–0.19× BL, and mainly dark except at their bases. Cauda with 6–18 hairs (Figure 6i) *Delphiniobium junackianum*
– SIPH 1.3–2.0× cauda and 0.19–0.26× BL, and dark on distal half or less. Cauda with 6–10 hairs **9**

9. SIPH 1.6–2.0× cauda which is 0.33–0.43 mm long, bears 7–10 hairs (usually 8–9), and has distal part clearly thicker than hind femur, from where it tapers rather abruptly to a rounded apex (Figure 6j) *Delphiniobium carpaticae* or *lycoctoni*
– SIPH 1.3–1.55× cauda which is 0.44–0.53 mm long, bears 6–8 hairs (usually 6), and has distal part maximally about as thick as or thinner than hind femur, from where it tapers gradually almost to a point (Figure 6k) **10**

10. SIPH tapering from base to flange *Delphiniobium aconitifoliae**
– SIPH with slightly or distinctly swollen middle section **11**

11. ANT III with 44–57 rhinaria extending over basal 0.75 *Delphiniobium gyamdaense**
– ANT III with 10–33 rhinaria restricted to basal 0.5 **12**