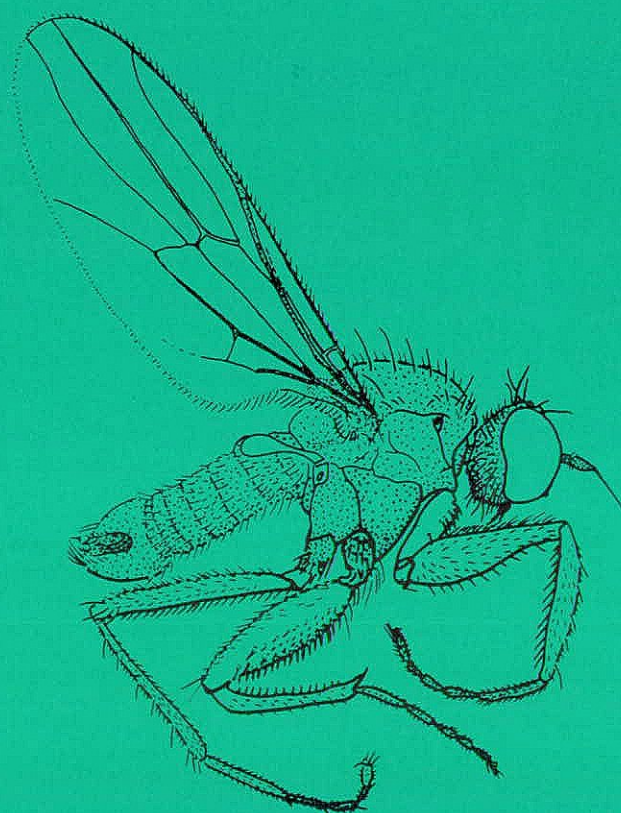


## **Dipterists Forum**

## **Starter Pack**

**Alan Stubbs**





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Illustration of *Platypalpus agilis* (Meigen) (Hybotidae) by Ian McLean (after Collin, 1961)

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*Dipterists Forum*

*Starter Pack*

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## ***PREFACE***

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Welcome to Dipterists Forum. Our philosophy is to welcome all those starting to study flies in Britain and we recognise that it is so much easier and more enjoyable if you are in the company of those who are willing to share their knowledge and experience with you. No matter what your current level of understanding, we aim to help you increase your skills and assist you to get the most out of your time spent finding and investigating these intriguing insects.

Dipterists Forum is a society for those interested in the study of Diptera. It was established in November 1994 to provide an organisation to run recording schemes and to promote the study of Diptera as a whole. Dipterists Forum is affiliated to the British Entomological and Natural History Society, the leading society in Britain for the field entomologist. The objectives of Dipterists Forum are:

- To foster the study of Diptera, including linking with other disciplines where there is a relationship with other animals and plants.
- To promote the recording of all aspects of the natural history of flies, including the advancement of distribution mapping.
- To promote the conservation of flies.
- To encourage and support amateurs in harmony with professionals in museums, institutes and universities.
- To organise indoor meetings, workshops, field meetings and other related events.
- To disseminate information through newsletters and other publications.
- To focus on the flies of the British Isles whilst maintaining an interest in those of continental Europe and elsewhere.

Therefore, Dipterists Forum is very much concerned with encouraging people to develop an interest in flies and then helping them to become proficient in a branch of entomology that is full of interest and where it is still possible for amateurs to make original contributions to scientific knowledge. Dipterists Forum produces the *Bulletin of the Dipterists Forum* twice a year with information about forthcoming events, accounts of recent meetings and results from recording schemes. The journal *Dipterists Digest* contains papers on British and European flies, including accounts of their behaviour and ecology as well as identification keys and descriptions of new species. Members of Dipterists Forum are most welcome to attend meetings of the Forum and of the British Entomological and Natural History Society.

Dipterists Forum welcomes the support of the Biological Records Centre and the Joint Nature Conservation Committee in the production of the Starter Pack. This underlines the significance of the activities of Dipterists Forum in contributing towards improved understanding of the status and conservation needs of Diptera. Further information about Dipterists Forum can be obtained by writing to The Secretary Dipterists Forum, C/O BENHS, Dinton Pastures Country Park, Davis Street, Hurst, Reading RG10 0TH.

*Alan Stubbs*  
*Dipterists Forum*

*June 2003*

## ***INTRODUCTION***

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Diptera means 'two-winged', and this is the scientific name for the order of insects called true flies. As the name implies, they are distinguished by having only one pair of wings, in contrast to most other insects which have two pairs of wings. There are over 6,750 species known from Britain, but additional species are found regularly, even by those with little previous entomological experience. They are often the most abundant insects in many habitats, with many species that have significant interactions with plants and other animals. Hoverflies and soldierflies are two groups of flies containing many large and attractive species that are often evident when seen feeding at flowers or resting on foliage. Therefore, Diptera are numerous and ecologically important, as well as including many colourful and interesting species. Flies are worthy of our interest and attention, being fascinating insects to study because of their varied life histories and behaviour, as well as their complex relationships with other organisms.

Dipterists Forum was established in November 1994, after 20 years experience in organising events and distributing newsletters for the various Diptera recording schemes. It arose from the Central Panel of Diptera Recording Schemes, launched in 1976, when new schemes were added to the Crane-fly Recording Scheme that had started in 1973. Dipterists Forum now incorporates 13 recording schemes covering a wide range of Diptera families. A journal, *Dipterists Digest*, which started in 1988, also became the responsibility of Dipterists Forum. We are affiliated to the British Entomological and Natural History Society (BENHS), a leading national entomological society.

Britain has a tradition, much envied elsewhere, of amateur and professional entomologists working collaboratively together. We have had many people who first attended field meetings with little experience, in one case never having used a net before, who have gone on to make major contributions to recording and to other studies of flies. There are few professional dipterists employed in museums or other organisations in Britain, so most studies of flies are by amateurs as a spare time activity. Without the efforts of numerous volunteer recorders our knowledge of the taxonomy, ecology and distribution of British flies would be poor indeed.

This Starter Pack aims to provide an introduction to the study of Diptera, principally for the newcomer, but it also includes plenty of interest for those who have progressed beyond the initial stages of exploring one or two families of flies. It gives information about recording schemes, as well as including a guide to the study of the British fly fauna, with a review of the identification literature that is currently available. Collecting techniques and equipment are summarised, with references to more detailed published accounts where necessary. There are also sections on photographing flies, on handling records and organising data, on museum collections, on publishing, on conserving flies and there is a list of some British museums with collections of Diptera. Some of the information about techniques and the lists of addresses and websites may also be of interest to entomologists other than dipterists.

## ***ACKNOWLEDGEMENTS***

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Drafts of this Starter Pack have been reviewed and commented upon by Paul Harding (BRC) and members of Dipterists Forum, including organisers of recording schemes and study groups. Their comments and suggestions were extremely helpful in clarifying the text and adding information that will assist those starting to study flies. Peter Chandler advised on identification references and provided figures for the number of species currently known for each family, Stuart Ball contributed the section on *Handling records and organising data* and Ian McLean did the final compilation and editing.

## ***WHY STUDY FLIES?***

---

Despite the poor reputation that flies have among many people, largely due to the activities of a handful of biting flies and those few species that occur on domestic rubbish, they are fascinating and often beautiful insects worthy of serious study. The following list may go some way towards giving a more balanced view of the significance of flies and why they are worthy of detailed investigation.

- Britain has over 6,750 known species of flies, which is about equal to the other large order of insects, the Hymenoptera (bees, wasps and ants).
- Flies are often the most abundant insects to be found; hence you can find many species even if your time for fieldwork is limited.
- Flies are numerous in most terrestrial and freshwater habitats.
- You can find adult flies in any month of the year.
- Flies have diverse interactions with plants and many other animals, so they appeal to those with wide natural history interests.
- Their behaviour and ecology is varied and rewarding to study, with much still to discover.
- There are many opportunities to add to our knowledge of the natural history and distribution of our fly fauna.
- New British species are found regularly, including some that are previously undescribed.
- Flies have great potential for evaluating conservation site quality, as well as for monitoring the effects of habitat management and wider environmental changes.
- Flies are excellent subjects for photography, which is an important means of recording their natural history.
- Help is available from Dipterists Forum.

### ***How to begin***

The late Len Parmenter, a leading amateur who spent many years intensively recording in the London area, wisely reflected that anyone can collect 10,000 flies a year but it is another matter identifying them.

While there are a few people who can quickly master an amazing number of Diptera families, the best advice is to start with one or two groups that are manageable. It is better to do a few things well, resulting in your records or other studies being reliable, rather than to over-reach your capacity. Once you have mastered your initial group, you can add families at a pace you feel confident that your identifications are correct. Many people start with hoverflies. They are reasonably large and attractive, there is a well-illustrated identification book, an active recording scheme and workshops or field meetings where you can seek help and receive encouragement.

The big question is where you go from hoverflies. Your best bet is to move onto other families with recording schemes and study groups. For one thing, help is available, for another there is the satisfaction of helping to advance those recording schemes, rather than spread your efforts more widely so that tangible results are not achieved.

Remember that initially it is not necessary to attempt to identify difficult species in a family. Instead, your approach can be to select those species that you can cope with more easily. As



your experience grows, you will probably find that you can identify the more difficult species quite naturally.

### ***Developing your experience***

It is difficult to develop skills in isolation, and your ability and confidence will develop more quickly if you are in contact with people who have more experience. Such contacts will arise from attending events organised by Dipterists Forum and the BENHS. These events may be grouped under three broad headings.

**Workshops** are training sessions on particular themes, usually on the identification of one or more families of Diptera, and are organised by both Dipterists Forum and BENHS.

**Field meetings** are aimed at finding and recording Diptera. Those based in residential accommodation are particularly helpful to beginners. Even without formal instruction, being in a group of about 20 dipterists gives an opportunity to pick up field craft, to obtain help with identification, to receive named voucher material and to seek advice. It is an excellent way of getting to know fellow dipterists.

**Indoor meetings**, notably Dipterists Day, provide talks, demonstrations, exhibits and contact with fellow dipterists; the BENHS Annual Exhibition and bimonthly indoor meetings are further opportunities to meet with dipterists and other keen entomologists.

Not everyone is able to get to these main events, but you may be in a position to join in recording activities locally. There are county or area recording initiatives and, even if there are none in your district, the Dipterists Forum address list will help you to contact other nearby members who may share your interests. The main thing is to take advantage of opportunities to meet with other dipterists and to learn from them.

### ***How you can help contribute to our knowledge of Diptera***

This starter pack is intended to help you. Also, we want you to enjoy your studies. Part of that enjoyment, and feeling that your time and energy has been well spent, will come from knowing that your observations and records add to scientific knowledge and can be applied to activities such as conservation.

- Even if you are only able to devote a little time to recording flies, your contributions to recording schemes will be very welcome to help improve our knowledge of the distribution and status of our fauna.
- You may like collecting for a purpose but don't have the time or enthusiasm for identifying more difficult groups. You can still help by collecting material that recording schemes and other dipterists are requesting for identification.
- Possibly you can rarely travel far to get out into the field. There is plenty of scope for monitoring hoverflies and other flies in your garden or a nearby plot of urban land or adjacent countryside, see Stubbs (1991). If more of us did this type of monitoring, it would give a much better picture of the flight periods and changing abundance of flies from year to year.

- With field entomology, so much can depend on being in the right place at the right time (and this can be as true for those with much experience as for the beginner). Thus recording behaviour, or keeping specimens of unfamiliar species, may be opportunities that prove almost impossible to repeat.
- Flies have many interactions with other organisms; their ecology and behaviour are rich fields for study by those who wish to observe living insects or to study their relationships with plants and animals. The inexpensive series entitled *Naturalists' Handbooks* includes many helpful suggestions for conducting original investigations, with the volumes on hoverflies (Gilbert, 1993), on mosquitoes (Snow, 1990), on blowflies (Erzinçliođlu, 1996), on plant galls (Redfern & Askew, 1992), on aphid predators (Rotheray, 1989) and on insects and thistles (Redfern, 1983) being particularly good starting points for those interested in Diptera.
- The conservation of flies has been given relatively little attention compared with other insect groups such as butterflies and dragonflies. In addition to employing the recording and monitoring approaches suggested elsewhere in this section, investigating the ecology of the different life stages of flies and discovering their habitat requirements as well as observing adult behaviour, will help to increase our chances of success with conserving many rare and threatened species. Taking the time and trouble to find out where these species occur and what they doing is immensely interesting in itself and there are many opportunities to make valuable contributions to conservation. The activities and contacts for the UK Biodiversity Action Plan (UKBAP) are one possible starting point (see the website at [www.ukbap.org.uk](http://www.ukbap.org.uk)), while getting in touch with recording scheme organisers is another way of discovering what is already happening to help conserve different groups of flies.
- You could do great service by adopting one or more sites or habitats and really getting to know the fly fauna, even if for only selected families. We still know very little about ecological assemblages or their responses to habitat management, and of course the conservation movement welcomes information on threatened sites as well as for secure nature reserves.
- If you have a flair for finding larvae and rearing them, there are big gaps in knowledge awaiting your attention. Adults can be so abundant, but finding the larvae is quite another matter – at present it almost seems that most adult flies arise by spontaneous generation, as was commonly believed two or three hundred years ago! Recent good progress with finding and rearing hoverflies and soldierflies shows what can be achieved given patience and ingenuity.
- If you like sorting flies into families, without necessarily wishing to identify them to species, then your help in sorting samples from traps will be invaluable. Many projects need this kind of assistance in order to supply material of individual families to specialists who do not have time to sort bulk samples into families prior to identifying species for their favoured groups.
- Data from museum collections needs to be collated, most urgently for the families covered by recording schemes. Of course the collection may have to be re-identified first. Museums welcome help from competent entomologists in checking their collections and the recording schemes also benefit since historic data is invaluable for assessing changes in the status of species by making comparisons with present distributions.
- Help is needed combing through the literature for records, again especially for the recording scheme groups. The species indexes in some journals are invaluable since important fly records can otherwise remain undetected in, say, a paper on beetles. Even volunteering for a limited run of a journal will help.

- If you are a photographer, you may have the patience and skill to record the natural appearance and behaviour of flies, as well as obtaining pictures of the places where particular species live. Such photographs can be of much interest to other dipterists, some of whom will be seeking photographic illustrations for their publications.
- We all like to see well-illustrated books and papers, and often wish that more were available. Your skills may lie in accurate drawing. There is a great need for more people to help prepare the artwork for books, keys and papers. The techniques of portraying whole insects and such parts as genitalia may be very different and require a different kind of skill (and the specification of your microscope may restrict what you can do). Rather than launch straight away into preparing time-consuming illustrations, it is best to seek advice as to where help is needed, and to team up with a specialist who needs an illustrator. Project advice can be obtained from the Dipterists Forum Secretary, or contact someone on the advisory panel of specialists (see p. 68); for whole insect portrayal techniques contact Steven Falk and for genitalia illustration techniques contact John Ismay or Michael Ackland.
- If you enjoy making genitalia preparations, or slides of wings and other parts, then you may be able to collaborate with a specialist who needs help, and in the process develop your knowledge of the family concerned.
- Should your talent and skills be for computing, then there is plenty of data that needs processing (especially onto Recorder 2002 or other National Biodiversity Network compatible software), as well as word processing hand-written manuscripts for newsletters and other publications.
- Thus, whatever your interests and skills, and whether you are keen on working indoors or venturing out into the field, there are plenty of ways that you can make a worthwhile and valued contribution to Dipterists Forum and to the study of flies.

# ***FIELDWORK***

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## ***Collecting techniques***

An outline of the basic techniques is given here to introduce the principal ways of finding and collecting flies. Details of most methods currently in use are given by Stubbs & Chandler (1978), Stubbs & Drake (2001) and Stubbs & Falk (2002). Some groups require special collecting techniques, which are described in the appropriate literature references for identifying and studying the species concerned.

## ***Searching and observing***

Adults of many species of flies can be found simply by looking carefully in the right places. The following list is not comprehensive, but will give you some ideas of where to start.

- On flowers (usually in sun, but sometimes in shade).
- On foliage of grasses, herbs and trees.
- On fruiting bodies of fungi.
- On tree trunks, often in sun but also at sap runs or on damaged bark.
- On standing and fallen dead timber (or even on fences etc).
- On bare ground, both dry and wet.
- Hovering or swarming in the air, including over water.
- Skating over water surfaces and resting at water margins.
- On warm surfaces including walls or rocks, as well as attracted to hot cars in summer (particularly horseflies).
- On domestic animals (horses, cows and sheep etc.).
- On dung, carrion and rotting vegetation (including compost and cut grass or sedge heaps).
- In tussocks of long grasses or sedges, at any time of year
- On windows, windowsills and in light fittings within buildings.

Diptera seen at rest may be taken individually with a net (one of small diameter can be more effective in cramped situations), or the more docile species may be captured with a glass tube (closed with a cork or plastic stopper). Other adult flies will be hiding out of sight within vegetation, where they can be caught with a net, sought with a pooter, or extracted with a vacuum sampler. Even in winter there are some species concealed in grass and sedge tussocks, as well as in small mammal runs and nests. The greater the variety of situations that you can search the larger the number of species you are likely to find.

The early stages of flies are often concealed within the substrate or host plant where they develop. Finding larvae, and pupae or puparia of flies can be difficult and rearing them through successfully requires care and patience. In many families of Diptera, relatively few species have been reared and their early stages and life histories described. There are tremendous opportunities to make original discoveries here and in most cases little equipment is needed; instead careful searching and good powers of observation, coupled with the ability to maintain healthy livestock in captivity, are the principal requisites. Diptera larvae and pupae or puparia are typically fragile and so they should be extracted gently, or allowed to remain undisturbed within their development medium until they emerge. It is important to label each rearing container with the origin of its contents, plus the date of collection, and to



label the reared adults (or any preserved immature stages) with the same information and the date of emergence where appropriate. Further information on finding and rearing the early stages of flies is given by Stubbs & Chandler (1978) and Smith (1989).

Many flies have parasites such as entomophagous fungi, parasitoid wasps and even other flies. Make sure that you retain specimens and record details of any parasites or parasitoids that appear when rearing Diptera and keep voucher material for identification. When rearing flies from plants or other material there may be more than one potential host species present in the developmental medium, so it is important to verify the host association wherever possible by looking for the host and parasite or parasitoid pupae or puparia. When this is not possible and there is any doubt as to the origin of the species reared, this should be stated on the accompanying data label. Further details of rearing techniques and best practice for mounting and labelling parasites and parasitoids are given by Gauld & Bolton (1988), Noyes (1982) and Belshaw (1993).

A field notebook is essential for taking down observations of live flies, for keeping track of samples collected (each of which should be individually labelled at the time) and for recording details of habitats, host plants or other species associated with the flies that you have encountered. Some dipterists prefer to use a small cassette recorder to note such observations in the field. This may save time in the field, but adds to the burden later because of the need for transcribing the notes; there is also the possibility of the recorder malfunctioning in the field, in which case it may be impossible to recall all the missing information.

### *Sweeping*

This requires a moderate-sized net (typically 16 inches in diameter) and in many habitats it is a rapid means of collecting many flies. Thus, when walking through grassland or other open habitats, the net is swung through the top of the vegetation with alternate fore-hand and back-hand strokes (as in tennis), in rhythm with each stride. Those flies selected to be kept may be tubed or pooted (see p. 13) afterwards from the tip of the net, while pointing the end of the net bag towards the strongest light (at the same time gathering the net together to prevent the insects escaping), or by putting the net over your head (similarly, to prevent escapes via the mouth of the net), again directing the end of the net towards the strongest light. Sweeping can also be used in other situations, such as around dead wood and fungi, through tree and bush foliage, beside ponds, rivers and streams, in sheltered places beside hedges and walls, or through the air when large numbers of flies are on the wing (for example, along woodland rides). Varying the speed of each stroke and the depth swept into vegetation, can alter the species composition taken, so it is worth experimenting with alternative styles to see what you can find. Sweeping is not a consistent technique for taking similar samples; results vary according to the structure of the vegetation and between different people, so trapping techniques are preferred where standardised samples are needed. Sweeping is difficult to employ in windy conditions or when it is wet, so it is a fine weather technique.

### *Use of a pooter ("pooting")*

A pooter is a glass suction barrel, tube or bottle into which insects are sucked by a sharp intake of breath. There is a gauze filter over the exit tube (through which you suck) to prevent the insects being inhaled and it is common practice to insert some paper tissue or a piece of blotting paper to allow the flies and other insects to settle and to prevent them

becoming damp from any build up of moisture. A pooter is by far the most efficient method of capturing small species, whether from a net, or when searching tree trunks, looking along water margins (including amongst moss next to streams or waterfalls) and on seepages, when grubbing through grass tussocks or searching other places where there is insufficient room to wield a net. To get flies out of a pooter, a small twist of paper tissue is given a dab of ethyl acetate at one end and threaded down the inlet tube (but left in for minimal time if the pooter has corks which will become impregnated with fumes). When the insects have ceased moving, tip the contents of the pooter into a tube lined with some paper tissue or a piece of blotting paper and insert a label to show the origin of the sample. A small twist of toilet tissue paper lightly moistened with ethyl acetate should be placed in the tube for 20 minutes to kill the insects. Keep the tube cool and out of the sun to prevent the flies becoming damp and greasy. Some dipterists prefer to kill their captures in a larger killing jar, which can be made by using a wide-necked jar, such as a jam jar, which has a secure lid that does not allow the fumes of the killing agent to escape. A wad of tissue impregnated with ethyl acetate, or chopped laurel leaves placed under a piece of blotting paper, are the most frequently-used killing agents in a killing jar. The flies should not be allowed to come into contact with liquid ethyl acetate, or with moisture in a laurel jar, because this will cause them to become greasy and hard to mount and identify. **Take care** – ethyl acetate is highly inflammable and the vapour should not be inhaled; ensure that the pooter is free from ethyl acetate vapour before air is inhaled again through it.

### ***Trapping***

Traps can be a very effective means of collecting samples of Diptera from many habitats. They have the advantages that they collect insects all the time, not just when you can go out into the field, as well as catching many species that are not readily found using the searching and collecting techniques summarised above. Traps are also best for comparing the numbers of flies occurring in different places or when recording changing numbers over time (whether through the seasons of a year or over a period of years). When emptying multiple traps, ensure that each sample is accurately labelled in the field to prevent the origin of the material becoming confused later.

- Water traps: white or yellow plastic bowls with water containing 10% ethylene glycol solution (**take care** to prevent animals drinking this toxic solution) plus a few drops of detergent; these traps should be emptied about weekly outside of the winter season to prevent the insects disintegrating. Ethylene glycol is available as antifreeze for cars at different concentrations (the dye added to the solution will affect the colour spectrum reflected from the water traps, so clear ethylene glycol from a laboratory supplier should be used where comparative, quantitative studies are being carried out). Where there are animals present that might drink the ethylene glycol solution, they can be excluded by wire netting, or water and detergent only can be used (in which case the traps will need to be emptied every two days in summer to prevent the catch from decomposing). Material from each trap can be collected by pouring the liquid through a tea strainer and then transferring the insects with forceps to a tube containing 70% alcohol and the appropriate locality label. Water traps are good for sampling many groups of flies.
- Malaise Traps: interception traps made from fine netting material supported by poles and guy ropes like a tent. The collecting bottle can be half-filled with 10% ethylene glycol solution (**take care** to prevent animals drinking this toxic solution). Malaise traps are expensive and they are also conspicuous and liable to be vandalised in areas where there is much public access, so they should be used selectively. They can catch huge numbers

of insects, so they should not be used indiscriminately in areas with many rare species (ancient woodlands or small, fragile wetlands, for example); you should be prepared for much sorting of the abundant catch to separate out the groups of flies that you are interested in!

- Emergence traps: these catch insects emerging from an area of ground, or can be placed over samples of dead wood etc. Good for recording what is emerging from specific areas or habitats, and usually only modest numbers of insects are caught.
- Pitfall traps: small containers sunk into the ground with the rim flush with the soil surface and 10% ethylene glycol solution (**take care** to prevent animals drinking this toxic solution) plus a few drops of detergent. Ethylene glycol is available as antifreeze for cars at different concentrations. Pitfall traps are primarily used to sample beetles and spiders, but they can also collect interesting Diptera in small numbers.
- Bait traps: can be made from lemonade bottles with the top removed and inverted inside the body of the bottle, with fruit, fungi or other decaying material added according to taste! Good for attracting many groups of flies that are otherwise elusive.

Note also that a hot car with doors open is excellent for catching horseflies, while leaving house doors or windows open, particularly in conservatories, will result in adult flies entering the building. These flies can then be collected from the inside surface of windows using a pooter or glass tubes. Also, grapefruit-half skins placed face down in damp situations can attract soldierfly larvae, which can then be collected and reared.

## ***MAINTAINING AND USING COLLECTIONS***

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### ***Identification tactics***

The main tools for identifying flies, or any groups of insects for that matter, are illustrations, keys and collections. Detailed illustrations show you the best diagnostic features for each group or species. Dichotomous keys consist of a series of numbered paired choices, designed to help you decide which of the two contrasting alternatives best fits your specimen. Looking at a few characters at a time helps you to make a series of accurate decisions, which should lead to a correct identification. When keys are well-constructed and have drawings alongside each couplet to show the identification characters, they can be both efficient and reliable in helping you to identify your captures. Some older keys, without illustrations and lacking explanations for technical terms, can be hard going and ultimately frustrating, so it is a good idea to begin with keys that have been extensively tested and are well-illustrated, such as those by Stubbs and Falk (2002) for hoverflies, by Stubbs and Drake (2001) for soldierflies and their allies, and Belshaw (1993) for Tachinidae. A reference collection consists of reliably named specimens that can be compared with your material to help confirm your identification. Such collections are housed in museums, are kept by specialists for their reference and of course you can compile one yourself.

An identification guide with detailed illustrations of whole insects can be a partial substitute for a reference collection, and will help act as a "reality check" at the end of the identification process. While there is merit in adopting a methodical approach to identifying flies, by patiently working each specimen through a set of dichotomous keys, this needs to be balanced by other approaches to save time and improve accuracy. Looking through available illustrations to see what your specimen looks like is not "cheating"! Making quick comparisons in this way can help you recognise groups and species more rapidly, and aid field recognition, but sometimes can lead you astray when unrelated species closely resemble each other and you have made a comparison with the wrong half of the pair. Obvious characters, such as wing patterns, can seem distinctive enough, but unfortunately very similar or identical patterns can be shared by several species. Working specimens from a reliably named collection through a key that you are starting to use can save much time and increase your confidence and ability greatly.

When you have made your identification, prepare the determination label to attach to the specimen (on the direct or staging pin, or on the slide as necessary), with standard reference details (see p. 22). If you have doubts about the identification, or have noted any points of difference from the key, illustrations or description, then it is worth noting these on the determination label for future reference. As a check, it can be worthwhile going back to a series of specimens in your collection that you have identified as the same species and checking them against each other to make sure that they are the same. New species are regularly split off from those previously recognised, and checking a series of what appears to be the same species taken from different places, or in different seasons, will sometimes reveal extra species to be present. Overall, there is no substitute for patience and persistence in learning the necessary skills, but given time it all becomes easier and quicker.

Like all other entomological skills, identification improves with practice, while tuition from somebody with more experience can help speed up the learning process and result in greater accuracy. This tuition can come from a more experienced dipterist who may live nearby, or



if you do not know any dipterists then attending an event organised by one of the entomological societies will assist you. There are identification workshops and courses organised by Dipterists Forum ([www.dipteristsforum.org.uk](http://www.dipteristsforum.org.uk)), the British Entomological and Natural History Society ([www.benhs.org.uk](http://www.benhs.org.uk)) and the Field Studies Council ([www.field-studies-council.org](http://www.field-studies-council.org)) respectively; these are friendly and enjoyable events that can aid you with starting to identify flies or with breaking into a new group. Details of these events are available from the appropriate websites. Some museums and county wildlife trusts are also active in organising similar courses.

### *Curating your collection*

If you spend much time travelling to find flies in the field, plus more time collecting samples and then even more time identifying them carefully, then it is well worth retaining the resulting voucher specimens for future reference and study. A good permanent collection has multiple purposes and will more than repay the time spent in setting it up and maintaining it in a well-organised state, free from pests and other damage. The principles of good organisation (setting out the specimens in a consistent order, such as following the most recent checklist), good labelling (with the provenance of each specimen and who has identified it) and careful curation to keep the material in good condition (free from mould and the attacks of other insects) will all help you succeed in the task. A little time spent regularly in checking the condition of the collection and in measures to prevent its deterioration, will be a sound investment in the long term.

There are good published accounts of how to establish entomological reference collections and there is much practical advice in Stubbs & Chandler (1978) and in the introductory sections of RES Handbooks and other identification manuals. There is space here to mention only some of the basic points to help to get you started.

### *Mounting and labelling*

#### *Pinning*

Adult flies can be preserved dry and then pinned or glued to card. Because they dry out rapidly and become brittle, ideally flies should be pinned within a few hours of being killed. Although the onset of stiffening can be delayed by placing flies in humid conditions in a tube or bottle for up to a day, this will not work for small species and many others will deteriorate through shedding bristles or legs, or by becoming greasy. Flies can be stored in tubes with absorbent paper and then placed in a freezer, but again they are liable to dry out and be less easy to keep in a tidy condition to facilitate identification, so there is no real substitute for rapid processing and pinning. Once flies have dried out it is difficult to relax and pin them because they tend to become greasy and shed bristles and legs if they are placed in a relaxing bottle, which is a common technique used for Lepidoptera and Coleoptera.

Larger species can be direct pinned onto 38mm long continental steel pins, and placed in a storebox with a label each, while smaller species are best micro-pinned and placed in a shallow clear plastic box (125×80×20mm) lined with 10mm thick Plastazote, with one label for a series with the same data. Direct pinning is more usually done from above to enable the wings and legs to be pulled away from the body so as to expose identification characters to view; micro-pinning is usually best from the side for most groups, with the wings pulled

gently upwards and the legs downwards. When side pinning it helps to arrange all the specimens with the same orientation, facing either to the right or to the left, to facilitate comparison with your other specimens. There is no agreed convention for orientation of side-pinned specimens, although the majority of the standard identification works for British Diptera illustrate adult flies facing to the right. Micro-pinning through the side of the thorax is best done slightly obliquely so that the pin does not go through the same part of the thorax on both sides and hence possibly destroy a character useful for identification. When using either micro-pins or continental pins, the wings and legs can be braced using suitable additional pins for holding them in position until they dry, while for those families where diagnostic male genitalia characters can be seen without dissection (ranging from some hoverflies through to Dolichopodidae and certain calyptrates) the genitalia may be hinged back for easier examination.

Micro-pinned (or carded – see next section) specimens need to be staged for long term storage, which involved pushing the micro-pin into a strip of Polyporus (obtained from the fruiting body of this fungus) or into the modern alternative of Nu-poly (both termed the 'stage'). The stage is attached to a pin 30 to 38mm long, with the locality and determination labels placed under the stage. A pinning stage (available from Watkins and Doncaster (p. 49), or this can be made from a block of wood or metal) helps to maintain a neat collection with all specimens, their mounts and labels being at consistent heights on the staging pins. Genitalia preparations can be kept on the same pin using mountant on a small strip of acetate sheet, or on a coverslip on a piece of card; or the preparation can be kept in a short length of stoppered plastic tube to store the dissected parts in glycerine.

Do not glue small species to the side of continental pins; this technique is sometimes used to avoid the use of micro-pins on stages, but it is unsatisfactory because it can obscure taxonomically useful features and the specimens are vulnerable to being dislodged from their pins if their storage container is knocked, or when the specimens are removed for study. **Take care** – avoid dropping pins to the floor or on furniture where they may later hurt others (including children or pets). A magnet can be useful for retrieving dropped pins that may be hard to see on furnishings, or on a wooden floor or carpet.

### *Carding*

Attaching adult flies to card with glue is a technique that is not used frequently for most groups, being more commonly used for beetles (glued with their ventral surface to rectangular pieces of card), or for small Hymenoptera (where the side of the thorax is glued to the point of a triangular piece of card; termed "point-mounting"). However, craneflies can be glued to rectangular card mounts that protect their fragile legs and hence reduce the chance of them being accidentally knocked off when the insect is being examined. Each cranefly, or winter gnat, should be carefully arranged when fresh by placing the insect on its side on a piece of Plastazote and then arranging the wings above the body and the legs downwards, holding them all in place using micro-pins set at a shallow angle. When the fly has dried (after one or two days), it should be glued to a slightly larger piece of card (it is best to use a few standard sizes that can be pre-cut in batches in advance of use) using a spot of water soluble glue. A quicker alternative is to place craneflies in envelopes (see p. 24) so that they dry flat, but take care to avoid crushing that will damage identification features. Specimens that you wish to keep, before or after identification, can then be point-mounted onto the flat plane of the card triangle by gluing the side of the thorax to the apex of the triangle, with the legs orientated towards the mounting pin if possible.

Tiny Diptera (in the size range of 1-2mm approximately) can be glued to the tip of a card point, in a similar manner to that employed to mount Hymenoptera Parasitica (Gauld & Bolton, 1988). However, many tiny Diptera may be better mounted on slides (see p. 21) or micro-pinned as these techniques may cause less damage and leave more vital taxonomic characters visible for detailed examination.

### *Genitalia preparations*

Genitalia preparations are vital for accurate identification for many families of flies and they are not as difficult to make as you might at first think. Details of a traditional technique for making these preparations are given by Colyer & Hammond (1968), who recommend Canada balsam as the mountant. Canada balsam is known to work well over long time periods (as is Euparal), whereas other mountants may be less good over periods as long as several decades (also see below under methods for preparing slide mounts, p. 21). When in doubt, or when making preparations of valuable specimens, it is safest to use Canada balsam or Euparal as the mountant. Storage of specimens in glycerine in micro-vials is best regarded as a short term method of storage (specimens stored in this way are easy to examine from multiple viewpoints when placed in an excavated glass block, half-filled with glass chromatography beads and with glycerine added until it reaches the surface of the beads; the specimen can then be placed on the surface of the beads and held in almost any position for detailed examination). The Colyer & Hammond technique can be modified by substituting DMHF (=Dimethyl Hydantoin Formaldehyde resin) as the mountant, which avoids the necessity of dehydrating the dissected parts before mounting because DMHF is a water-based mountant. In summary, the sequence of steps using DMHF is as follows.

- 1 Remove the tip of the abdomen (post-abdominal segments of some authors) using fine pointed forceps and a gentle twisting movement; for small species it may be better to detach the whole abdomen from the thorax; carry out this operation over a white surface (piece of card or a shallow plastic tray). Alternatively, micro scissors used in eye surgery can be used to remove the end of the abdomen, but these scissors are expensive and require care and practice to obtain the best results (a supplier for micro scissors is given on p. 47). Some entomologists advocate relaxing the specimen prior to removal of all or part of the abdomen by placing the fly in a humid plastic box (ensuring that the insect does not touch the water directly); however, this procedure is not without risk due to the possibility of causing the fly to become damp and 'greasy'. Tiny flies will become less brittle in 1-2 hours, while large flies will take up to 12 hours to become rehydrated.

- 2 Place the abdominal parts in a small glass tube containing 10-15% Potassium hydroxide (KOH) (or Sodium hydroxide, NaOH) solution: **take care** – KOH and NaOH are dangerous, corrosive alkalis that must be treated with great care; avoid contact with the skin and eyes, keep off clothing. If kept at room temperature, the parts will be macerated and suitable for mounting in about 24 hours [note: lightly sclerotised species, with yellow chitin may be ready in 12 hours; large, dark and heavily chitinised parts may take 36-48 hours].

- 3 Remove the parts from the KOH and place in a small amount of glacial acetic acid (the acid neutralises the alkali): **take care** – glacial acetic acid is a dangerous chemical, do not inhale fumes and keep away from skin.

4 Remove the parts from the acid once bubbles cease to be produced (usually after 3-5 minutes); wash in 70% alcohol to remove the acetic acid. The best alcohol to use is industrial methylated spirit (IMS), but this requires a licence from HM Customs & Excise (see the telephone book for the address of your local Customs & Excise office). Alternatives to IMS are surgical spirit or propanol.

5 Dissect the parts in a drop of the 70% alcohol to show the features illustrated in the identification key using fine mounted needles and fine forceps. Careful manipulation and positioning of the parts is essential to be able to see tiny features on the specimen and to avoid damaging fragile characters. Dissection in the mountant (DMHF) may be advisable for very small species, but take care to avoid the introduction of air bubbles, which may obscure or distort the appearance of diagnostic characters.

6 Place the parts on a slip of acetate sheet (5×15mm) and add a drop of DMHF with the head of a 38mm continental pin and arrange the parts neatly (ideally to match the orientation shown in the relevant identification guide) with fine forceps before the mountant starts to harden (it develops a thicker consistency first). Use a small drop of 70% alcohol to remove any air bubbles that are trapped in the preparation at the final stage. The acetate slip is then pinned through at one end by the staging pin on which the remainder of the fly is mounted, so that the fly and the genitalia preparation remain associated together for future examination and study. When it is necessary to examine the specimen by transmitted light, the acetate slip should be placed upon a 75×25mm glass slide on the microscope stage. Alternatively, the parts can be mounted on a 10mm diameter coverslip glued to a small rectangular piece of card that is pinned through by the staging pin. A circular hole may be made in the card by a hole punch (prior to the coverslip being glued on), in order to allow the specimen to be examined using transmitted light, once again placed upon a 75×25mm glass slide.

If Canada balsam is used as the mountant, the parts will need to be dehydrated in three successive washes of absolute alcohol before transfer to clove oil. Such dehydration renders the chitin stiff and difficult to dissect without damage, so it is preferable to carry out the dissection as at step five above and then carry out the dehydration and final mounting steps. The sequence for Canada balsam is therefore the same up to step 5; then after dissection:

7 Wash the parts gently three times in different containers with fresh absolute alcohol (a small amount in three excavated glass blocks will suffice). Note: absolute alcohol is expensive, so use only a small amount each time, just sufficient for the number of preparations that you are doing that day.

8 Transfer the dissected parts to a drop of clove oil on a 75×25mm excavated glass slide to clear the preparation and render the fine details more readily visible.

9 Place the parts on the acetate slip and then add Canada balsam, carefully arranging the parts in the required position and orientation. Add more solvent (preferably clove oil, or alternatively xylene: **take care** – xylene is a known carcinogen and should be used only in situations where the vapour is not inhaled; avoid contact with skin; it also dries much faster than clove oil) to the Canada balsam to allow easy manipulation if the consistency stiffens, or to remove any air bubbles.

An alternative procedure, when using Canada balsam as the mountant, is to place and then dissect the parts in clove oil at step 5; clove oil has a thicker consistency than alcohol, which



supports the specimen during dissection, but it also has the similar drawback of causing the specimen to become brittle, so the dissection should be carried out immediately. After dissection in clove oil, the parts can be placed in a drop of clean clove oil and then transferred onto the acetate slip for mounting in Canada balsam.

#### *Dealing with material preserved in alcohol*

Diptera collected by trapping should be preserved in 70% alcohol; they can be sorted into families (or further) while still in alcohol, with the decision then made as to which are to be identified in alcohol, which need to be slide-mounted and which are to be pinned and dried out (where dusting or bristle characters are needed). Those to be pinned are best dealt with by pinning while still wet in the alcohol, with the wings spread flat onto a 75×25mm glass slide, the legs pulled away from the body and then the flies dried out (gentle heat from a light bulb can accelerate the drying process). Ethyl acetate can be placed on the slide, and used at the final stage before drying, to help to harden the wings and prevent them curling up after drying. A refinement of this technique that gives better results is to pin the fly while wet in alcohol (as above) and then, after blotting off the alcohol with tissue, to transfer the specimen to 2-ethoxyethanol for 12 hours, then remove from the 2-ethoxyethanol and blot off the excess fluid before placing the fly in ethyl acetate. Tiny flies will need to be left in the ethyl acetate for about an hour, while larger species should be left for up to 4 hours, before placing the fly on a 75×25mm glass slide and arranging it as above. **Take care** – ethyl acetate is highly inflammable and the vapour should not be inhaled.

#### *Slide mounting*

Methods for preparing slide mounts vary according to the group concerned and the diagnostic features that need to be observed. Pinder (1978) gives details for mounting Chironomidae, Disney (1999a) for mounting Dixidae and Thaumaleidae, and Disney (1983) for mounting Phoridae. There is continuing debate as to which is the best mounting medium, with proponents for traditional media such as Canada balsam or Euparal having the benefit of long term stability of these mountants on their side. They are opposed by advocates of newer materials that are generally considered to be quicker and easier to use, such as Berlese Fluid or DMHF (=Dimethyl Hydantoin Formaldehyde resin), which may not be so stable in the long term.

#### *Labelling specimens*

Labels are essential for each specimen in your collection. Without accurate labels, even specimens of rare and unusual species are of little interest or significance. Neat and legible labels, in a consistent layout and style, will help you and others retrieve the information easily.

A suggested layout (with example) for a locality label is:

Locality name	Chippenham Fen NNR,
Grid reference	TL 646695, comp. 5,
County	Cambridgeshire (VC29).
Date	25.VI.2002.
Collector	A.E. Stubbs.

The locality name should include a field or compartment number etc, where appropriate. The grid reference should preferably be 6 figures, in the form TL646695 (or four figures if the sample is from a larger area, in the form TL6469). The county should be given as the Vice-County (each of which has a unique number, which can be added after the name in the form VC29); this facilitates checking against the grid reference (see p. 32). The date should be written with the month given as Roman numerals, to help avoid confusion with the American practice of giving the month first, rather than the day. Some entomologists prefer placing the Vice-County on the first line of the label before the locality and grid reference. An extra label can be used to add such details as ecological associations, micro-habitat origin, behaviour, host plant etc. Always place all relevant information with the specimen on the pin or slide; never, ever use a reference number with the details kept elsewhere in a notebook or file. When specimens become separated from separately held data, as they almost invariably will when the collection changes hands, they become worthless.

Determination labels should comprise the genus and species names of the specimen, the author of the species name (which may be abbreviated and should follow the British checklist, Chandler 1998a, and subsequent additions), the sex of the specimen, the name of the person who identified the specimen (the determiner) and the date the identification was completed.

A suggested layout (with example) for a determination label is:

Genus species	Tipula pagana
Author, sex sign	Mg. ♀
Determiner's name	A.E. Stubbs.
Determination date	Det. 25.XII.2002.

Labels can be printed in a small font (such as 5 point Times New Roman) using a laser printer, with extra details added later with a fine (0.18 or 0.2mm nib) drawing pen filled with black ink (Rotring pens and ink have been found to be very satisfactory for this purpose). Avoid the use of inkjet printers or biro, both of which fade and will be dissolved by alcohol. Bulk production of the required number of labels for a sample from a locality is speedy using a word processor, pasting up the required number of labels to a page, with different details dropped in using the "find and replace" feature. White card of 160g/m<sup>2</sup> is a suitable thickness for most printers (but check this with the specifications for your printer) and gives the labels sufficient rigidity.

If identifications have been confirmed by a specialist, he or she may add a determination label. All determination labels should be kept associated with each specimen, particularly when the identification has changed or when there is a mistake in a published record based on the specimen. If a specialist identifies a series but does not label all of them you can add individual determination labels to each specimen inserting the word "Teste" (which means "On the authority of") before the name of the specialist who identified the material.

Diptera larvae need careful preparation and storage to observe their identification features; Smith (1989) gives details of the techniques required.

### ***Storage of collections***

For pinned specimens, the main choice is between storeboxes (available from Watkins and Doncaster (p. 49) and other entomological suppliers) and traditional entomological cabinets.

The latter have become very expensive (new or second-hand), but have the advantage of being attractive items of furniture in their own right, as well as offering secure storage conditions with the insects better protected against the knocks that can beset storeboxes. Both storeboxes and cabinets are sometimes available from museums or societies when collections are acquired, re-housed or dispersed, so it is worth asking around to find out if there are any items for sale from these sources. If in doubt, ask an experienced entomologist to help you check the condition and suitability of second-hand storage units; there can be both bargains and duds on offer and you need to be able to distinguish them!

Modern storeboxes can be lined with Plastazote, which is easier to use when moving specimens around than the traditional cork lining. Larger sizes of storeboxes are more efficient for storage and if you are using 38mm length pins for direct pinning or staging ensure that the boxes are sufficiently deep to prevent pins clashing with specimens on the opposite side of the box. Some museums have now adopted the unit tray system for use in cabinets. This involves placing open card boxes, with a Plastazote lining, in the drawers, with typically one species stored per box. The boxes are of different standard sizes, to accommodate series of different lengths, and can be readily taken out of a drawer for closer examination using a microscope. Unit trays greatly speed up the process of consulting a collection, facilitate re-arrangement and reduce wear and tear on the specimens. If you intend to build up a large reference collection, the extra investment involved with adopting the unit tray system may well be worthwhile. Whether using storeboxes or entomological cabinets, employing a consistent sequence for setting out the families, genera and species, will save much time when consulting the collection and retrieving specimens for study. Clear labelling of the boxes or cabinet drawers (using the names in Chandler, 1998a and supplements) is essential once your collection grows to any size beyond a few hundred specimens, which can happen remarkably quickly! It is usual to place the genus name above the series of species included in the genus and to place the species name below each series of specimens for that species.

#### *Pest control*

Insect collections are very vulnerable to the attacks of other insects, such as *Anthrenus* (museum beetles) and Psocoptera (book lice). Pest control is best achieved by a combination of measures, including frequent inspection of collections, tightly-closed storage units, and keeping the collection room free of dust and fluff where many pests can survive and develop. The use of insect deterrents, such as naphthalene or paradichlorbenzene (available from Watkins and Doncaster or from laboratory chemicals suppliers) can also reduce the incidence of infestations. **Warning:** these deterrents are known to be carcinogenic and should not be used in domestic rooms which are used regularly.

It has been found that certain essential oils (citronella, camphor, cedarwood and sandalwood) can also deter insect pests; they are not harmful, have a pleasant fragrance and should be placed in pin-mounted glass fumigant cells (available from Lydie Rigout, see p. 49) in each storebox or drawer. A large freezer can be used to kill all stages of any infestation by placing the affected box or drawer in the freezer for a month; this is safer than using chemical fumigants (such as ethyl acetate) in a domestic setting. It is advisable to place the box or drawer in a sealed plastic bag to reduce condensation and to keep this bag in place immediately after the storebox is removed from the freezer while the temperature rises gradually. When removing insects from a storebox after freezing, ensure that they do not

become damp through condensation by placing them in a warm, dry situation with a gentle current of air until they have reached room temperature.

#### *Storage of material in envelopes*

Flies can be stored temporarily in envelopes prior to identification, although great care is necessary to prevent the specimens becoming crushed after they have dried out. This technique has been used most frequently for craneflies, where voucher specimens for retention can be point-mounted after identification. For craneflies (or any other flies) stored in photographic envelopes (for suppliers see p. 50), each envelope must be labelled with the locality and other information, as for any sample of insects. The envelopes and the enclosed flies should be dried out before being transferred to storage containers to avoid mould. This can be done by leaving the top off the box for a few days, ensuring that pests cannot gain access to the specimens, or by using a drying oven or silica gel if conditions are damp. It is important to exclude pests as is the case for pinned specimens; the use of plastic boxes with tightly fitting lids and then sealing the lids with adhesive tape will help, while placing a box in a freezer for a month after it is sealed will kill any pests that may have gained access before closure.

#### *Storage of slide-mounted material*

For slide-mounted specimens, small numbers can be kept in wooden storage boxes (as sold by Watkins and Doncaster (p. 49) and other firms selling microscopy equipment), while larger numbers can be stored in metal cabinets. Wherever possible, 75×25mm slides should be stored flat, to avoid the possibility of coverslips moving slightly and the mountant and specimens suffering distortion as a result. Each slide must have a locality label and a determination label for specimens that have been identified. As with pinned specimens, a good cataloguing and indexing system will help with rapid retrieval of your reference specimens when they are needed for comparison or checking.

#### *Storage of material in alcohol*

Collections stored in alcohol (sometimes termed 'spirit collections') need to be stored in secure conditions where they cannot be accessed by children, and away from any fire hazards. Fire-proof steel cabinets are ideal if you are storing substantial amounts of material in alcohol, and these must be lockable when storing alcohol to meet Customs & Excise regulations. Keeping alcohol collections in the dark is important to avoid the specimens becoming bleached. The specimens can be stored in glass tubes (see p. 45) with ribbed plastic closures to reduce leakage and evaporation. For long-term storage it is best to place the tubes (typically 12.5×50mm or 25×50mm) inverted in a large storage jar, which can be topped with alcohol when required to replace that lost through evaporation. Each tube must contain a locality label and a determination label for material that has been identified.

#### *Loans and posting specimens*

It is possible to post pinned specimens or slide mounts through the post, but because of the risks of loss or damage it is best to take valuable material to its destination yourself (or ask a friend who can act as a courier). Solid wood postal boxes are available from entomological suppliers such as Watkins and Doncaster (p. 49); these should be packed inside layers of 'bubble-wrap' or similar material, about 50mm thick, to absorb impacts and the outside of the

packing box or container securely fastened and labelled with the sender, the recipient and their address, and marked "Fragile". Remember to place a note or letter inside the packing, with the names and addresses of the sender and recipient, in case the package is damaged in transit. Some dipterists have used 35mm plastic film containers to send individual specimens through the post, with the container packed inside a small padded envelope, which should be labelled as above, but this method is likely to be less secure. All pins should be driven firmly into the cork or Plastazote lining to prevent them being jarred loose in transit. Stage-mounted specimens should be further secured with crossed long pins to prevent the stages spinning and damaging the specimens. When making or receiving loans, it is a good idea to make an inventory in a loans book, so that you are aware of what material you have sent or received (it is easy to lose track of how many specimens have been involved in a loan unless you make a note at the time).

## ***KEEPING SAFE***

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The study of Diptera is essentially safe (as are most recreational pursuits), but there are some precautions that will help you to avoid most of the likely risks and hazards. Several of these points will apply to anyone walking in the countryside.

- Avoid stepping on wet smooth wood; it is as bad as ice. Board walks without a surface of wire mesh can be hazardous. Wet rocks can also be very slippery (particularly when covered by algae or mosses), including when you are trying to cross a stream.
- Be cautious of treacherous ground. Coastal landslips with mud-flows easily trap the unwary (especially in the spring before they have started to dry out). Boggy ground and pond margins may have floating rafts of vegetation that may give way suddenly and bare mud or peat without very solid mats of tough roots can be hazardous.
- When walking any distance from your residence or means of transport, ensure that you take sufficient food and water to last until your return.
- When in the field, particularly in remote areas, consider taking a mobile 'phone with you (but check whether reception extends to the area concerned); also, bringing a small first aid kit may help you or somebody else in the event of an accident. Take the usual precautions when walking in upland areas; wear appropriate clothing and footwear, take a plastic whistle (for use as a distress signal in an emergency), maps, a compass and always tell somebody where you have gone and when you will return. The British Mountaineering Council (177-179 Burton Road, Manchester M20 2BB; Tel: 08700 104878; website: [www.thebmc.co.uk](http://www.thebmc.co.uk)) publish a booklet, *Safety on Mountains*, that contains useful advice on walking in upland areas.
- Be very careful of glass pooters, tubes etc. in the field; broken glass can cause deep cuts that bleed profusely! When on the move, keep all glassware safely in your field bag. In any case it is best to keep tubes in a cardboard box where they will be insulated from heat that causes "sweating" of insects.
- Pooters need fine mesh material that will prevent dust and pathogens from being inhaled. It is also best to replace the mesh at intervals once it looks dirty. Fine ladies' stocking material, several layers deep and stretched across the inlet tube, works well. If too many layers are added it becomes difficult to suck in enough air, so the right balance needs to be struck. If saliva goes down the tube and wets the stocking material, dry this promptly otherwise fungi and bacteria will build up on the damp deposits.
- Flies resting on noxious materials, or likely to have been in contact with such substances, should be tubed individually. Never poot off carrion, dung or spore-producing fungi, and also be wary of flies that may have been resting upon noxious materials when pooting from your net.
- Check your anti-Tetanus immunisation is still effective, beware of the risks of Weil's disease from contaminated water, do not handle live bats because of possible rabies transmission and avoid tick bites because of the danger of contracting Lyme disease.
- Spending long hours looking down a microscope or working at a computer may cause eye strain or, in the case of using a computer keyboard, repetitive strain injury. Take frequent breaks and ensure that your seating height and posture do not cause backache or other problems.
- Most laboratory chemicals have unpleasant side effects so always be careful when handling them and ensure good ventilation when using them inside.



## ***PHOTOGRAPHING DIPTERA***

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There is space here only to give a short general introduction to the challenging and enjoyable occupation of photographing flies. The two main branches of photographing flies recognised here are photographing live flies and photographing dead specimens from collections. The techniques and equipment needed are very different, but what is shared is the need for care and patience to achieve good results – as well as a large supply of film! The performance of digital cameras is improving all the time, but as most photographers are still using conventional film, this is the medium that is dealt with here. In future, the results from digital cameras should improve further, and their price is likely to continue to fall, so it is worth reading equipment reviews in photographic magazines and taking advice from experienced insect photographers on new developments in this area.

### ***Photographing live flies***

The most popular and effective equipment for photographing live flies is still the 35mm single lens reflex (SLR), with through the lens metering and interchangeable lenses. Because flies are mostly tiny insects, a macro lens (or other lens with extension tubes) coupled with electronic flash to increase the amount of light on the subject (and to freeze any movement) is almost essential. Photographing live flies in the field is difficult, because they are small and tend to move away rapidly unless approached with great care. This makes keeping the subject properly positioned in the frame and in focus a real challenge, and time and patience are required to obtain acceptable results. A still day (to reduce movement of vegetation and hence of the flies resting on leaves or flowers), which is bright but not too hot (to reduce the activity of the flies) is ideal. It is usually best to avoid the warm middle part of the day in summer and to stalk your subject towards the sun (or at an angle of up to 90° to the sun) to avoid casting a shadow over the fly and thereby causing it to fly away. Dropping down on hands and knees avoids looming over the insects, while gentle, slow movements will enable you to get close to the fly without causing it to become disturbed by your presence.

Most of the major manufacturers of good quality 35mm SLRs produce suitable equipment for taking close up photographs of flies. Up to life size on the film is possible for most good macro lenses, but specialised micro lenses are also available from some manufacturers that can magnify up to about  $\times 20$  on the film. Because of their small field of view and limited depth of focus, these micro lenses are really only suitable for indoor use, with the camera set up on a tripod and with cold light illumination from a fibre optic system. An electronic flash system that mounts twin flash heads close to the front of the lens is ideal for macro photography. Ring flash systems are also available, but unless these are used in such a way as to avoid even illumination from all around the lens, the resulting photographs tend to look very flat and unnatural. By using electronic flash, it is possible to stop the lens down to f22 or less in order to increase the depth of field sufficiently to place the subject properly in focus. Modern colour reversal films ranging from 25 to 200 ASA will give very good results, with the slower films giving sharper and less grainy slides.

Digital cameras are improving rapidly, but as yet are not capable of delivering high definition results when taking images of smaller flies alive in the field. However, progress is rapid in this area, with prices falling and performance increasing for the top of the range models.

With practice it is possible to find flies in the field and then observe their behaviour through the viewfinder, taking photographs to record what is happening. Courtship rituals, mating positions and behaviour, egg laying, prey capture and the characteristic resting postures of many species, can all be documented much better on film than any verbal account can achieve. If you have the time, patience and equipment, moving images reveal much more of these behavioural aspects of the life of flies. Camcorders have given excellent results recording the behaviour of larger flies, with high quality results now possible using light weight and portable equipment. It is a good idea to record the time, weather and habitat conditions when photographing Diptera, and in many cases it will be necessary to capture the fly or flies at the end of the session in order to ensure accurate identification.

### *Photographing specimens*

Photographing dead specimens can be every bit as difficult as taking good quality pictures of live flies, but for different reasons. Photographing whole specimens ideally requires neatly set specimens if the overall appearance of the image is to give a recognisable impression of the insect. Getting even illumination on the insect, avoiding excessive highlights or dark areas, can be difficult. If the illumination is too diffuse, the image can lack sharpness and any impression of depth, while if the subject is too close to the background then shadows can be distracting. Taylor (2001) has published an account of how to construct equipment that has given consistently good results with 35mm SLR cameras, while a future article by the same author is planned to cover the use of digital equipment.

Photographing parts of flies, such as wings or dissected parts mounted on a slide, requires specialised equipment, including a good quality microscope and a suitable adapter to link the camera to the optical tube of the microscope. Some binocular microscopes are sold with a trinocular head, which enables the camera to be mounted securely to the third, vertical tube, rather than being attached to one of the two inclined tubes used for normal viewing. There is very limited depth of field at high magnifications, so even slide mounted parts (such as dissected genitalia) can be difficult to photograph satisfactorily. Wing photographs can be valuable for comparative purposes or to include in identification keys; the main challenge here is to get the illumination adjusted correctly so as to reveal any subtle wing markings.

Video microscope equipment has been successfully used to demonstrate even tiny features on flies at identification workshops. A Leitz system can be seen in action at many BENHS identification workshops at Dinton Pastures. These systems are expensive and are likely to be of interest mainly to organisations running courses, rather than for the private individual.

## ***HANDLING RECORDS AND ORGANISING DATA***

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Even if studying flies is quite a casual hobby, or if you have only limited time available, you can gain much interest in the long term by keeping a record of your findings and observations. Current developments in biological recording and the support given by the Biological Records Centre (p. 43) and the National Biodiversity Network (p. 44) to recording activities is summarised under their respective entries on the pages cited. This section is intended to help you get the maximum return for your time and effort when dealing with the results of your fieldwork. There is also much useful general guidance available from the BRC website at: [www.brc.ac.uk](http://www.brc.ac.uk)

A collection of properly labelled specimens (see p. 21) provides both the records and the vouchers (or proof of identity) for those records. A collection of photographs does much the same thing providing that the flies can be identified from what is visible on the photograph (which is often not possible) and that the details of where and when they were taken are stored on each slide or print. Capturing and keeping the fly after it has been photographed will ensure that its identity can be established with certainty.

As your experience grows you will become more interested in keeping track of where and when you have found particular species and in listing those species that you have found at a given locality. It saves a lot of time and trouble if you start proper record keeping at the outset. While distribution maps are arranged by species, most recording scheme organisers find it easier to process records organised as a list of species from each visit (or each trap sample). Very often conservation is site based and the ideal is to be able to cross reference by species or site, and this is where personal computers are increasingly seen as the best option that is efficient both for you and for those who collate data. There are various biological recording packages, of which *Recorder 3*, *Recorder 2002* and *MapMate* are the most widely used at present. If you are not into computers, don't worry – just be methodical on paper by using a suitable combination of record sheets, a field diary or card indexes.

If you keep your records on paper, please spare a thought for the person who may try to interpret those records in future and write clearly and use pen (for permanence and clarity preferably use Rotring pen and ink, rather than biro), **not** pencil. When stacks of cards or paper sheets are stored together for long periods, pencil tends to rub off on the adjoining card and may become unreadable in time.

Straightforward species/locality data are of limited use by themselves. Your studies can be much more interesting if you develop the knack for recognising and noting instances of interesting behaviour or ecology. Many common events, such as mating behaviour, oviposition, resting behaviour, predation (in some groups), flower associations, etc. are totally or largely unrecorded even for common species. To find oneself observing one of these 'common' events may actually be rare, or indeed for the first time. Everyone has these opportunities, but their significance has to be grasped and the details recorded at the time. Knowledge of insects rarely advances in great leaps – more typically progress depends on the accumulation of small observations that build up into a fuller picture. Even if the repertoire of flies that you can identify is small, there is still something new to find out about these species.

One possibility, when you can identify only a limited number of species, is to monitor the seasonal and year to year fluctuations in their numbers. For instance, monitoring common hoverflies in a garden or urban plot can yield very interesting results. The fluctuations in migrant species and the dispersal of apparently countryside-bound species can give important insights into the context of faunal lists compiled for nature reserves.

### ***Submitting records***

Some individual recording schemes have issued advice on the ways of submitting records that they prefer; please see the section on recording schemes starting on p. 56 for contact details of the schemes. When in doubt, get in touch with the recording scheme organiser before compiling and sending in your records.

There are five main alternatives.

- For single records, BRC provides pink GEN 7 cards which are particularly designed for special species where space for plenty of annotation is possible. The back of the card includes space for a sketch map to show exactly where a species was found.
- For reporting a number of records of a single species, use GEN 13. This is ideal for going through museum collections or literature that lists a number of localities for particular species. Go onto more than one line if there is plenty of useful ecological or biological information.
- If you have a list of flies from a single visit, then consider using the special RA cards issued by BRC for crane flies (RA11), fungus gnats (RA64), mosquitoes (RA53), Brachycera (RA34), Empidoidea (RA66), Dolichopodidae (RA67), Conopidae (RA69), hoverflies (RA33) and Tachinidae (RA75) (the last card is available as a downloadable pdf from the BRC website). Scheme organisers prefer data in this format rather than individual species cards since data entry to a computer is far more efficient when your records are organised this way. For each card, you fill in the details about the visit (locality, grid reference, date, etc.) in the header section, then put a line through the name of each species recorded in the list printed on the card. Please draw a neat line through each name on the list (a ruler helps). **Don't** put ticks next to names – it is often difficult to be sure to which name a tick is intended to apply. **Don't** use such a thick pen that you obliterate the name entirely – the person processing the card will then have to refer to another card to look up the name and that is time consuming! **Do** use a separate card for each visit to each locality. **Don't** use one card for several visits and then list a series of dates after each name on the list – this is very time-consuming to process.
- If you record at a large number of places for large numbers of species, it becomes very time-consuming filling in an RA card for each fly group for each visit. For field meetings in particular, where recording extends beyond the groups covered by recording schemes, data will be accepted in any format which can be understood by the collator of records. Check whether a scheme organiser is happy with a photocopy of your record book, or some other means of passing on data to avoid you spending hours filling in cards.
- Data may also be submitted electronically if this is acceptable to the scheme organiser. Scheme organisers may be able to accept records transferred directly from packages such as *Recorder* and *MapMate*, or it may be necessary to export records in another format

such as a comma delimited text file. Another common format which can usually be handled quite readily is to use a spreadsheet such as Excel and enter one observation on each row with a column for each of the data fields described below. It is possible to set up such a spreadsheet so that names are looked up from a predefined list (to avoid constantly having to type the names of species or localities, with the consequent misspellings, for example) and to perform basic validation (*e.g.* to check that the syntax of dates and grid references is acceptable). If you intend to submit computerised records, contact the scheme organisers first and they should be able to suggest a suitable format that is convenient to both of you. Also, the scheme organiser may be able to provide useful material, such as a file containing the names of the species for the recording scheme. They may also have an E-mail address to which files of records can be sent.

All records must have the following attributes.

**The name of the species.** Use names from a recognised check list (**and** make sure you have noted somewhere which check list this was!). Avoid abbreviating names or replacing them with codes – when someone (even yourself) tries to interpret your records in future, the coding scheme will inevitably have become separated and lost! For flies, records are normally assumed to be of adults, so it is important to record when this is not so (*e.g.* records of larvae or puparia).

**Date.** Preferably day, month and year concerned but year as minimum, *e.g.* 01/06/1996 = 1 June 1996. If you are reporting results from a trap that was run over a period, then give the range of dates for which the trap was set, *e.g.* 21/06/2001 – 05/07/2001. One point to watch for people who are submitting records electronically is that when you install the Windows operating system on a computer it normally defaults to “American English” settings which would present dates in the format ‘month/day/year’ (*e.g.* 1 June 1996 would come out as 06/01/1996 and might therefore be confused with 6 January). You may need to change your regional settings to “British English” to achieve the normal European format for dates of ‘day/month/year’.

**Locality name.** Try to use a name that can be cross-checked on readily available maps, *e.g.* O.S. 1:50,000 *Landranger* or O.S. 1:25,000 *Explorer* series.

**Grid reference.** Give to at least 1 km square (*e.g.* TQ5689), but preferably to 100 metres (*e.g.* TQ562894). The method for obtaining accurate grid references is given on each Ordnance Survey map. Note that grid references **always** have an even number of digits so “TQ56589” is **not** valid. **Do** use the alphanumeric form of grid references (TQ562894), **don’t** use the all numeric format (51/562894) which used to be advocated by BRC – experience has shown that the latter is much more prone to errors both on the part of the original recorder and by the person doing data entry. Grid letters are now printed on OS maps making the whole process much easier. You should always aim to give a reference that is as accurate as the available equipment (maps or Global Positioning System (GPS)) allows for each set of records. However, if you just made a list of everything you found as you wandered around a site it may be necessary to give a more general reference, or a centre point, for the area visited – please indicate the nature of your grid reference (*e.g.* “site centroid”, “GPS reading”). It is desirable to separate records for each distinguishable block of habitat. In any event, if you intend to contribute to a distribution mapping scheme, it is essential to separate records from different mapping units (10km, tetrad, etc depending on the

scale the scheme is working to) where your recording may have extended into more than one such square during a visit.

**Recorder's name.** The person who saw the species or collected the material, plus the name of the person who identified the specimen if different (the latter is often referred to as the 'Determiner').

**Source.** It is essential to give the origin of records from a museum collection or from the literature. Museum records always need to give the recorder and the determiner where these are known. It is also worth noting if you have confirmed the identification (you cannot assume a specimen is correctly identified just because it is in a museum collection!). If the information was extracted from literature, then give the full citation (e.g. "Jones, R.A. 2000. More of *Phasia hemiptera* (Fabricius) (Diptera, Tachinidae) in 1999. *Dipterists Digest* (second series) 7: 80.").

The following additional information is also highly desirable.

**Vice-county.** The vice-county system was devised in 1852, initially as a way of reporting the distribution of plants. It was based on the counties that were extant at the time (and remained largely unchanged until 1974), but the larger ones were divided into two or more 'vice-counties'. The system has remained in use by the biological recording community because the boundaries are fixed, in contrast to current administrative boundaries which change frequently. The vice-county provides a useful check on the accuracy of grid references (is the grid reference within the stated vice-county?). A pair of map sheets at a scale of 10 miles to 1 inch were published by the Ray Society showing the vice-county boundaries, and these are now available from BRC (see p. 43); folded maps will be sent on receipt of a self-addressed envelope, minimum size 14"×12", stamped for 200g postage (75p First Class, 56p Second Class as of May 2003); unfolded maps may be collected from BRC, at CEH Monks Wood, by prior arrangement.

**Abundance.** Even a basic indication, such as whether there was one or many present, can be helpful. In many species it is possible to distinguish the sexes, so recording how many you saw of each sex is useful. Anything that establishes that a species is breeding (like presence of larvae, puparia), or is suggestive of this (pairs seen copulating, females laying eggs, or presence of newly emerged individuals) is invaluable. It is sometimes worth recording that a species was **not** found – you went looking for some particular species that you have found before on a site at a time when you knew it was active elsewhere, but failed to find it in the typical situation, although conditions seemed to be right.

**Habitat description.** This can be descriptive in your own words, but please use NVC (National Vegetation Classification) and other recognised ecological systems and terms if you are familiar with them. Many nature reserves and some other sites will have had their plant communities documented and mapped, so enquire of the relevant person whether the site(s) that interest you have been recorded in this way. It is better to use an authoritative source for identification of habitats, rather than make mistakes over allocating areas to the wrong categories if you have not had the training or experience to use these systems accurately. Remember that the NVC does not distinguish, for instance, between well grazed and ungrazed grassland, but the flies can! Try to be specific (e.g. in a broad glade with flowering hawthorn bushes in hazel and ash coppice with oak standards); a very general list of habitats in the area (e.g. ponds, hedges, woods) is not very useful.



**Observations.** A note of behaviour, ecology, site management or biology that may be relevant to understanding a species (or assemblage of species) and its distribution, should be added to help build up a picture of the associations involved.

## ***MUSEUM COLLECTIONS***

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It helps greatly if you can gain access to museum collections. Your local museum may have some flies, possibly un-named, but the curator should be able to advise you where you can consult larger reference collections. The major benefit from using good museum collections is that you can examine accurately named specimens to compare with your own material or to run through keys that you use. If you are remote from these facilities, remember that generally more will be gained by being in contact with other dipterists, seeing their collections, however humble, and sharing experience for both your successes and difficulties with identification and finding species in the field.

Always contact a museum before your visit to check that it is convenient for them to receive you. You may wish to visit their website to check the scope of their collections, or you might ask whether they have material of the group(s) that you are working on. In addition, the curator will need to assess whether you will need much help and attention or if you are experienced enough to be left unsupervised. Before you examine museum collections, or those of other dipterists, you should build up your experience of handling direct pinned and staged specimens from your own collection. If you only need to extract data from specimen labels, do so without taking the specimens out of cabinet drawers if possible. It is very easy to damage pinned flies, which are fragile and also vulnerable to being knocked or jarred when taken from their place of storage for examination under a microscope. Remember that old storeboxes or cabinet drawers may be lined with hard material that can grip pins very tightly (unlike modern storage units lined with Plastazote, where pins are both gripped safely and may be withdrawn easily). Removing specimens where the pins are held tight is difficult and requires great care and patience; careful rotation of the pin using fine, curved watchmakers' forceps near the drawer surface, while holding the top end to prevent sudden springing, is the safest method in most circumstances. Some collections are very crowded, with many specimens crammed into each drawer, sometimes with overlapping wings or legs; a patient approach that involves calmly working towards the specimens to be examined is the only solution in these circumstances. If in doubt, it is best to ask the curator (or owner) of the collection to take the responsibility of moving a valuable specimen from a drawer to a small, Plastazote-lined box or tray.

Always replace specimens in the same place in the collection, but make a new pinhole if the cork or other lining is hard and will not grip a pin replaced in the same hole. If a collection is old and has not been curated or consulted for many years, the pins may corrode and break off near the surface of the lining material when specimens are removed. For broken staging pins it is a relatively simple matter to re-mount the stage on a new pin. For broken pins used for direct pinning it is a difficult and time-consuming process to relax the specimen and mount it upon a new pin, but this is the only option in order to be able to keep the specimen intact and available for future consultation. For gentlemen, neckties can be a hazard (they should be tucked firmly inside the shirt front out of harm's way before leaning over open drawers or boxes containing specimens). For ladies, larger sleeves can be hazardous, but doubtless new fashions may evolve with their own entomological drawbacks! The best advice is to build up experience with your own collection and to take your time when examining specimens, particularly in unfamiliar surroundings.

When you visit a museum and gain access to their facilities, you should ask the curator questions about the following aspects concerning the history of the collections and how you can use them.

- Whether he or she believes the specimens have been reliably identified, by whom and when (there may have been species splits etc. since the collection was last studied and revised). Not all collections will have every specimen with a determination label, which gives this vital information in the most useful place.
- What protocols and particular procedures apply, especially if you are seeking to handle and examine individual specimens. Where collections contain important material, such as original type specimens from which species have been described, only experienced workers will be permitted to have access to the drawers and to remove insects for close examination under a microscope.
- How you may indicate identifications that you believe are erroneous. If you have sufficient experience to make reliable determinations, by far the best method is to place your determination label on the pin (see p. 22 for details). However, you should follow the protocol as instructed by the person responsible for the collection you are studying. Older collections often relied upon moving specimens around to stand above a species name for a series of specimens. This has the grave disadvantage that no record is left of who made the identifications and when the specimens were determined, or when identifications were revised. In some cases specimens have been simply mis-placed when they were last returned to their box or drawer and many collections contain errors as a result of this practice. Other mistakes with identifications can be the result of inexperience by the determiner or from the use of out of date keys.

Make sure you go fully equipped with all you need. A basic museum kit might include forceps (of different types for holding pins), a dissecting kit if you will be allowed to prepare mounts from parts of specimens (this kit might include chemicals and slides or mounts), your writing implements (including fine pens for writing data labels), stationery, record cards and/or laptop computer for handling the information that you wish to keep, identification or other reference literature (checklists and bibliographies can be helpful, as are gazetteers, if these are not in the library associated with the collection), corks and small pieces of Plastazote for microscopic examination of pinned specimens, pins and blank determination labels if you will be identifying material. A camera for recording the layout of drawers, or other aspects of the collections and the host institute, might be helpful, while if there are no suitable microscopes available you may have to take your own instrument together with a lighting unit.

### ***Museums with Diptera collections in Britain***

For further information about museums, see the following websites.

[www.24hourmuseum.org.uk](http://www.24hourmuseum.org.uk) lists of UK museums, news, events etc.

[www.fenscore.man.ac.uk](http://www.fenscore.man.ac.uk) The Federation for Natural Sciences Collections Research, includes a searchable database of collections with a large number of entries for Diptera.

[www.brisce.org.uk](http://www.brisce.org.uk) Biological Recording in Scotland, includes details of biological records centres in Scotland.

The major natural history museums all contain significant Diptera collections. The following is a short summary of the major collections. The following list mentions where there is a dipterist in post or otherwise working at the institution [given in brackets].

*National and university museum collections*

Entomology Department, The Natural History Museum, Cromwell Road, London SW7 5BD. The largest collection of Diptera in the world, with comprehensive coverage of the British fauna. Excellent literature and research facilities. [Howard Mendel, John Chainey and Nigel Wyatt staff members who deal with visiting dipterists].

Cambridge Museum, Zoology Museum, Downing Street, CB2 3EJ. Substantial Diptera collections, including the Disney collection of Phoridae. [Henry Disney].

Oxford University Museum of Natural History, Hope Entomological Collections, South Parks Road, Oxford OX1 3PW. Substantial Diptera collections, including the famous collection assembled by G.H. Verrall and his nephew J.E. Collin as well as a good reference collection of Diptera. [John Ismay and Adrian Pont].

National Museums of Scotland, Chambers Street, Edinburgh EH1 1JF. Extensive Diptera collections, particularly strong for Scotland. [Graham Rotheray and Andy Whittington].

National Museum of Wales, Cathays Park, Cardiff CF1 3NP. Extensive Diptera collections. [John Deeming].

National Museum on Merseyside, William Brown Street, Liverpool L3 8EN. Extensive Diptera collections.

In addition, some local museums have good entomological collections, including Diptera. The following selective list also mentions where there is a dipterist in post [given in brackets].

*Local museum collections*

Bolton Museum, Le Mans Crescent, Bolton, Lancashire BL1 1SE.

Carlisle Museum & Art Gallery, Tullie House, Castle Street, Carlisle CA3 8TP. [Steve Hewitt].

Coventry, Herbert Museum & Art Gallery, Jordan Well, Coventry CV1 5QP.

Doncaster Museum & Art Gallery, Chequer Road, Doncaster DN1 2AE.

Dundee Museum & Art Gallery, Albert Square, Dundee DD1 1DA.

Fleetwood Museum (part of Lancashire County Museum Service), Queen's Terrace, Fleetwood, Lancashire FY7 6BT. [Simon Hayhow].

Glasgow Art Gallery & Museum, Department of Natural History, Kelvingrove, Glasgow G3 8AG. [Geoff Hancock].

Hereford City Museum, Broad Street, Hereford HR4 9AU.

Inverness Museum & Art Gallery, Castle Wynd, Inverness IV2 3ED.

Ipswich Museum, High Street, Ipswich IP1 3QH.

Leeds City Museum, Calverly Street, Leeds LS1 3AA.

Leicester City Museums, New Walk Museum & Art Gallery, 53 New Walk, Leicester LE1 7EA.

Leicestershire Environmental Resource Centre, Holly Hayes, 216 Birstall Road, Birstall LE4 4DG. [Darwyn Sumner].

Luton Museum & Art Gallery, Wardown Park, Luton LU2 7HA.

Maidstone Museum & Art Gallery, St Faith's Street, Maidstone, Kent ME14 1LH.

Manchester Museum, University of Manchester, Oxford Road, Manchester M13 3PL.

Newcastle-upon-Tyne, Hancock Museum, University of Newcastle, Newcastle-upon-Tyne NE2 4PT.

Nottingham Museum, Wollaton Hall, Wollaton Park, Nottingham NG8 2AE.

Norwich Castle Museum, Norwich, Norfolk NR1 3JU. [Tony Irwin].

Oldham Museum & Art Gallery, Greaves Street, Oldham OL1 1DN.

Perth Museum & Art Gallery, 78 George Street, Perth PH1 5LB.

Reading Museum & Art Gallery, Blagrove Street, Reading RG1 1QH.

Rotherham City Museum, Clifton Park, Rotherham S65 1JH. [Bill Ely].

Sheffield City Museum, Weston Park, Sheffield S10 2TP.

Shetland Museum, Lower Hillhead, Lerwick, Shetland ZE1 0EL.

Ulster Museum, Botanic Gardens, Belfast BT9 5AB.

Warwick Museum, Market Place, Warwick CV34 4SA. [Steven Falk].

## ***PUBLISHING***

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Sooner or later you are likely to have something worth publishing, either by yourself or in conjunction with someone else who may have helped you by confirming your identification, assisting with literature references or has provided additional information. The most important points to bear in mind are that every care must be taken to ensure that your contribution is factually accurate, that any identifications have been confirmed if you are inexperienced with the group concerned, and that you differentiate between observations and inferences or interpretations. It is a good idea to get others to check your piece before it is submitted; a more experienced dipterist may be able to help you by supplying background knowledge or information, while a non-specialist will be best for assessing whether your piece is intelligible to the general reader.

A good way to begin is to report interesting observations of fly behaviour or biology, species lists for sites, and records of rare or unusual species, by starting with the recording scheme and study group newsletters. *Dipterists Digest* is the journal of Dipterists Forum, where papers on a wide range of subjects concerning British and European Diptera are published after being refereed by an editorial panel. If you have not had experience with writing more formal papers for this type of journal previously, then it is a good idea to seek advice at an early stage from authors who can advise you how best to prepare your findings for publication. As with any journal, looking at previous issues will help you with preparing your paper in the required style and format, using standard headings, appropriate illustrations and the correct way for citing references in the text and in the concluding list. Don't worry if you are inexperienced in writing this type of material, the best way to start is by writing short notes on individual finds or discoveries and then extending your range to longer articles.

You can also help promote an interest in flies by publishing light pieces of general interest in the newsletter of your local wildlife trust or more detailed reports in publications of your local natural history society. The national entomological journals also include papers on Diptera, including the *Entomologist's monthly Magazine* (where papers on Diptera are particularly welcome), the *Entomologist's Record & Journal of Variation* and the *British Journal of Entomology & Natural History* (the latter is the BENHS journal).



## ***CONSERVATION***

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The results of recording schemes, and findings from other studies of flies, provide much of the basis on which the conservation of our fly fauna can be advanced. Thus, the status of species (including designation of Red Data Book and Nationally Scarce categories), and their ecological and habitat management requirements, has to be based on sound knowledge. The defence of important sites for flies, when faced with development and other pressures, is critically dependent on good up-to-date information.

Surveys that seek to discover the distribution and status of threatened species, or detailed investigations of their abundance and habitat requirements, depend upon careful and accurate work, with identifications and observations checked by specialists where necessary. There is plenty of scope to make valuable contributions to the conservation of flies and their habitats, but it is best initially to seek advice and guidance if you are new to the study of Diptera or if you have not done this type of work previously. Recording scheme organisers may be able to suggest who can help you to get underway with conservation work.

We encourage Dipterists Forum members to be in contact with their local conservation organisations and to help record flies on conservation sites and advise on the needs of the fly fauna where possible. It is also helpful to be in contact with local record centres and to encourage other naturalists to take an interest in flies so that they are aware of the need to conserve these insects.

There is no published account specifically on the conservation of flies, although Stubbs & Falk (2002) and Stubbs & Drake (2001) both include short accounts. The following publications review conservation principles and practice in an entomological context.

Fry, R. & Lonsdale, D. (Eds) 1991. Habitat conservation for insects – a neglected green issue. *The Amateur Entomologist* 21: 1-262. *This is a multi-author handbook, including reviews of habitats and other useful information.*

Kirby, P. 2001. *Habitat management for invertebrates: a practical handbook*. RSPB, Sandy. (Reprinted with corrections). *Designed to highlight key points for site managers, mainly under habitat reviews. Available from RSPB.*

All entomologists should abide by the provisions of the *Code of Conduct for Collecting Insects and other Invertebrates* published in 2002 (*British Journal of Entomology and Natural History* 15: 1-6), to ensure that populations of rare and threatened species are not damaged by recording and sampling techniques. Properly conducted collecting will not damage populations of flies or other insects; natural mortality through adverse weather, disease or predators will kill far more insects than the field entomologist could ever achieve. Collecting flies and other insects is a legitimate activity that is essential for conservation and is the only way of obtaining accurate information about the occurrence, distribution and biology of the great majority of insects that cannot be identified reliably when alive in the field. Dipterists should take particular care to avoid damaging the critical habitats of flies that are fragile and may occur only in small amounts. These include dead wood habitats on ancient standing or fallen trees (emergence traps are less damaging than removing material for rearing, although such traps should be deployed sensibly to avoid taking all the individuals emerging from good examples of decaying trees or rot holes), while springs,

flushes and water margins are typically small and fragile features that should not be trampled upon or otherwise damaged. Traps such as Malaise traps or water traps should not be used excessively in locations such as ancient woodlands or on small flushes or seepages where small populations of scarce species might be damaged.

## ***ENTOMOLOGICAL AND OTHER SOCIETIES***

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### ***Dipterists Forum***

The Secretary Dipterists Forum, C/O BENHS, Dinton Pastures Country Park, Davis Street, Hurst, Reading RG10 0TH.

Website: [www.dipteristsforum.org.uk](http://www.dipteristsforum.org.uk)

The society for dipterists in Britain, affiliated to the BENHS (see below) and publishers of both the *Bulletin of the Dipterists Forum* (which includes recording scheme newsletters) and *Dipterists Digest* (both with two issues per year). The Forum organises annual summer and autumn field meetings, as well as a workshop meeting each spring, and holds an annual indoor meeting (sometimes including a dinner) at a weekend each autumn, where there is a programme of talks and the opportunity to bring along exhibits to show the results of your Diptera investigations. Dipterists Forum actively supports national recording schemes for flies in association with the Biological Records Centre (see p. 43). For information about joining Dipterists Forum contact the membership secretary.

### ***The Amateur Entomologists' Society***

Post Office Box 8774, London SW7 5ZG.

E-mail: [aes@theaes.org](mailto:aes@theaes.org)

Website: [www.theaes.org](http://www.theaes.org)

The Amateur Entomologists' Society (AES) caters particularly for younger entomologists and those of all ages starting to study a group of insects. They publish the quarterly *The Bulletin of the Amateur Entomologists' Society* as well as introductory guides, including Stubbs & Chandler (1978) *A Dipterist's Handbook*. The AES organise an annual exhibition in the autumn near London, which is attended by entomological traders and book dealers.

### ***The British Entomological and Natural History Society***

Pelham-Clinton Building, Dinton Pastures Country Park, Davis Street, Hurst, Reading, Berkshire RG10 0TH.

Tel: 01189 321402

Website: [www.benhs.org.uk](http://www.benhs.org.uk)

Dipterists Forum is affiliated to the British Entomological and Natural History Society (BENHS), which is the leading national society for field entomology. It has extensive collections and a library, accessible at open days, at its headquarters at Dinton Pastures Country Park, near Reading. Field meetings and identification workshops are held regularly at this venue. Bimonthly indoor meetings are held in London, usually on the evening of the second Tuesday of alternate months (except July and August), at the Royal Entomological Society, 41 Queen's Gate, London SW7 5HR.

There is also a national BENHS field meeting programme, as announced in the *Bulletin of the Dipterists Forum*. Forum members are very welcome to attend all BENHS meetings, as are other entomologists (there is no charge for admission to any BENHS event). There is an annual exhibition held in the autumn at Imperial College, London at which members of Dipterists Forum are invited to exhibit, followed by an evening dinner. The Society publishes the quarterly *British Journal of Entomology & Natural History*, which regularly contains papers on Diptera. Membership Secretary: Andrew Godfrey, 90 Bence Lane, Darton, Barnsley, South Yorkshire S75 5DA (E-mail: [andy\\_godfrey\\_entomology@hotmail.com](mailto:andy_godfrey_entomology@hotmail.com)). Details of current activities, including all meetings and open days, can be obtained from the BENHS website.

### ***European Mosquito Control Association***

Cité administrative Gaujot, 14 rue du Maréchal Juin, 67084 Strasbourg Cedex, France.

Tel: +33 3 88 76 77 50

Fax: +33 3 88 76 80 19

E-mail: office@emca.asso.fr

Website: www.emca.asso.fr

The European Mosquito Control Association is a European organisation that has the overall objective of promoting control of mosquitoes and disseminating relevant information about this topic to its members and to others in neighbouring countries. It publishes the twice-yearly *European Mosquito Bulletin*.

### ***The Royal Entomological Society***

Royal Entomological Society, 41 Queen's Gate, London SW7 5HR.

Tel: 020 7584 8361

Fax: 020 7581 8505

E-mail: reg@royensoc.co.uk

Website: www.royensoc.co.uk

The Royal Entomological Society (RES) is the leading British society for the professional entomologist, although many keen amateurs are also Fellows or Members. The society owns its own premises in central London (just to the west of the Natural History Museum), where it has meeting rooms and an extensive entomological library. The RES publishes *Antenna*, a house journal with news of RES activities and for entomology in general, as well as the series of *Handbooks for the Identification of British Insects*, technical journals (*Agricultural and Forest Entomology*, *Ecological Entomology*, *Insect Molecular Biology*, *Medical and Veterinary Entomology*, *Physiological Entomology*, *Systematic Entomology*) and produces a symposium volume every two years. These publications are expensive, but can be consulted in many museum and university libraries. The RES also organises local meetings in each of its regions as well as supporting special interest groups for different subjects, including insect ecology and insect conservation.

### ***The British Plant Gall Society***

British Plant Gall Society, c/o C.K. Leach, Secretary, Department of Biological Sciences, De Montfort University, The Gateway, Leicester LE1 9BH.

E-mail: bioted@dmu.ac.uk

Website: www.btinternet.com/~bpgs/

The British Plant Gall Society (BPGS) is a society for those studying plant galls, whether these are caused by insects or by other agents such as micro-organisms. The BPGS organises field meetings and an annual meeting, and has published keys to plant galls as well as the twice-yearly journal *Cecidology* (cecidology is the technical term for the study of galls).

### ***The Malloch Society***

Iain MacGowan, Chair The Malloch Society, Scottish Natural Heritage, Redgorton, Battleby, Perth PH1 3EW, Scotland.

A small but lively group of Scottish Dipterists. They promote research into Scottish Diptera, organise a field meetings programme largely directed towards projects on threatened species and habitats, and publish their findings as *Malloch Society Research Reports*. The Society has a most impressive track record for increasing our knowledge of the biology of flies and for advancing conservation. They have an annual meeting in the autumn, with talks and a dinner.

### ***The Freshwater Biological Association***

The Freshwater Biological Association (Membership Department), The Ferry House, Far Sawrey, Ambleside, Cumbria, LA22 0LP, U.K.

Tel: 015394 42468

Fax: 015394 46914

Email: [info@fba.org.uk](mailto:info@fba.org.uk)

Website: [www.fba.org.uk](http://www.fba.org.uk)

The membership organisation for those with a keen interest in the ecology and natural history of freshwater systems. The FBA publishes the house-journal *Freshwater Forum* (free to members) containing reviews and other articles (published annually); the *FBA Newsletter* (free to members) containing articles, comments and news (produced four times a year); the FBA Annual Report (free to members); members are also entitled to a 25% discount on FBA Scientific Publications (maximum one copy per publication) and a 30% discount on the journal *Freshwater Biology*. Members have access to a major library on freshwater subjects, as well as discounts for attending scientific meetings and conferences organised by the FBA.

### ***The Biological Records Centre (BRC)***

BRC, CEH Monks Wood, Abbots Ripton, Huntingdon, Cambridgeshire PE28 2LS.

Tel: 01487 733381

Fax: 01487 773467

Website: [www.brc.ac.uk](http://www.brc.ac.uk)

The Biological Records Centre is the national custodian for distribution data on wildlife in Britain and Ireland (except for birds), with a total of about 12 million records of over 12,000 species to date. BRC works with volunteer recorders via national recording schemes and specialist groups and societies, and is an important contributor to the National Biodiversity Network (NBN), which is an initiative to co-ordinate national and local recording of wildlife and to share the results via the Internet (see the next section below and at: [www.nbn.org.uk](http://www.nbn.org.uk)). BRC supports recording schemes by advising on the design and operation of schemes, by mailing newsletters and by publishing some of the results as provisional atlases. Provisional atlases for Diptera published hitherto by BRC are:

Ball, S.G & Morris, R.K.A. (2000) *Provisional Atlas of British Hoverflies (Diptera, Syrphidae)*. BRC, Huntingdon.

Drake, C.M. (1991) *Provisional Atlas of the Larger Brachycera (Diptera) of Britain and Ireland*. BRC, Huntingdon.

Pont, A.C. (1986) *Provisional Atlas of the Sepsidae (Diptera) of the British Isles*. BRC, Huntingdon.

Stubbs, A.E. (1992) *Provisional Atlas of the long-palped craneflies (Diptera: Tipulinae) of Britain and Ireland*. BRC, Huntingdon.

Stubbs, A.E. (1993) *Provisional Atlas of the ptychopterid craneflies (Diptera: Ptychopteridae) of Britain and Ireland*. BRC, Huntingdon.

BRC is contributing toward the establishment of the National Biodiversity Network (NBN), see p. 44 below, which aims to co-ordinate and support the activities of local and national

organisations involved with biological recording. BRC has made available datasets for viewing and interrogation via the Internet using the NBN Gateway, which can be found at: [www.searchnbn.net](http://www.searchnbn.net)

BRC are able to supply record cards when required; please state whether you need single record cards (GEN 7 or GEN 13) or cards for particular schemes that list all (or most) of the British species (these cards are currently available for craneflies, fungus gnats, mosquitoes, Larger Brachycera, Empidoidea, Dolichopodidae, Conopidae, hoverflies and Tachinidae (the last also available as a downloadable pdf file from the BRC website)). The cards will be sent post free, but note that it saves BRC time if you are able to stock up at events such as Dipterists Forum AGM, where large supplies of cards are available. Completed cards should be sent or relayed to the relevant scheme organiser.

BRC has a very useful website, which includes contact addresses for recording schemes, references to published atlases, lists of data holdings, news of biological recording initiatives and links to other websites.

### ***National Biodiversity Network***

The National Biodiversity Network (NBN) is a national project that is making UK biodiversity information widely available via the Internet. Eventually, both national and local organisations will be able to share their data and information freely, thereby improving application of the results of biological recording and other surveys for conservation and other purposes. The NBN will also enable individual naturalists and the general public to view the results of recording schemes and other activities freely over the Internet at appropriate levels of detail.

Datasets gathered by volunteers (co-ordinated by BRC and local records centres) and compiled by Government Agencies and NGOs are being made available for browsing or downloading via the NBN Gateway. The data collated for the *Provisional Atlas of British Hoverflies (Diptera, Syrphidae)* by Ball and Morris (2002) comprised the first major dataset on Diptera to be loaded onto the NBN Gateway, which can be viewed at: [www.searchnbn.net](http://www.searchnbn.net)

Other projects contributing towards the NBN include the production of Recorder 2002 software, which is the NBN tool for collating and exchanging biological records between organisations (as well as for use by individual recorders or scheme organisers). The NBN Species Dictionary has been developed to standardise the lists of species and other taxa and thereby facilitate accurate data exchange using a consistent nomenclature. Other projects are establishing ways of working and piloting new techniques for handling data and presenting the derived information clearly for users.

To see what the NBN is doing and to read its reports and newsletters go to the website at: [www.nbn.org.uk](http://www.nbn.org.uk)

## ***EQUIPMENT***

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Stubbs & Chandler (1978) is an important source of information on using the best equipment (although the development of some new techniques since then means that other references should be consulted in addition); only a brief summary is given here.

### ***Nets***

A fine mesh is needed to retain tiny species and to avoid damaging those that belong to fragile groups. White netting is essential if you are to look into the net bag for small flies because most flies are dark and hence stand out better against white material. Black netting is only suitable for large colourful species that you propose netting and tubing individually while viewing them from outside the net, when you can see through black material more easily from the outside. You can make your own nets using fine white curtain netting (Terylene voile is best) for the bag and calico for the material to retain the net on the frame. Folding net frames were available from fishing tackle shops (but 16 inch is now an illegal size!), however, screw-on handles are still obtainable. The standard pole is about 4 feet long but you can obtain your own, and saw it down if it is too long. Extendable fibre-glass poles are useful for reaching high willow catkins etc. but are not suitable for general purposes. If you want a net of smaller diameter than fishing tackle shops can supply, you may have to make your own with a wire frame. Nets are available from Watkins and Doncaster and Lydie Rigout.

### ***Tubes***

Tubes can be used for capturing docile species when at rest, for holding individual flies after they have been captured, or for keeping a batch of dead flies after they have been collected and killed in a pooter. Tubes can also be used for long-term storage of material preserved in alcohol (see p. 24). The most useful sizes are flat-bottomed glass tubes 12.5×50mm, 25×50mm and 25×75mm, with plastic ribbed closures that make them suitable for holding live flies, dead flies or flies preserved in alcohol (these can be obtained from the suppliers listed on p. 51). Some dipterists prefer using corked tubes for retaining live flies, and these can be obtained in a variety of useful small sizes from the entomological suppliers listed on p. 49.

### ***Pooters***

David Henshaw sells a simple, cheap glass pooter or you can adapt a thick glass bottle by obtaining cork, drilling two holes, inserting glass tubes and attaching a piece of rubber tubing (the latter may be available from a chemist, otherwise from laboratory suppliers). You will also need to attach a piece of fine mesh over the exit tube (ladies' stocking is ideal). See diagrams in Stubbs & Chandler (1978) for construction details. Never walk around with a glass pooter in your hand in case you slip over (keep it in your field bag except when using it to capture insects). Pooters are also sold by Lydie Rigout and Watkins and Doncaster.

### ***Killing fluid***

Ethyl acetate can be obtained from equipment traders, such as David Henshaw (p. 49), or from suppliers of laboratory chemicals (see p. 51). Only take a small bottle of the liquid into



the field and label the contents and its danger (in case you lose the bottle). Small plastic bottles of the sort containing Tippex thinner are ideal (beware that other kinds of plastic bottle may be dissolved by ethyl acetate). An alternative is to dampen small pieces of toilet tissue paper with ethyl acetate and to place them in a 35mm film plastic container, which can be closed tight to prevent leakage. This will last several days and avoids taking liquid ethyl acetate into the field. **Take care** – ethyl acetate is highly inflammable and the vapour should not be inhaled.

### ***Field notebook***

A stout field notebook, preferably with a water-resistant cover, is an essential item for keeping track of your field observations (see p. 13). For added protection the notebook can be kept inside a resealable plastic bag to keep out water, mud etc., placed in a pocket or your field bag.

### ***Field bag***

A field bag is essential for keeping field equipment safely stored and readily accessible when needed. A good field bag will last at least several years and will enable you to carry your equipment in all conditions, in fair or inclement weather and in all habitats. There are many designs available from camping and hiking shops or from general suppliers of bags and luggage. It will help if the bag is at least water resistant, if not waterproof, and if there are pockets of several sizes to take tubes, pooter, field notebook and writing implements, ethyl acetate, forceps and maps with compass etc.

### ***Pins***

Micro-pins are quite expensive, but are essential for pinning small flies. They are headless and when properly made should have very sharp points to avoid damaging the cuticle around the point of entry for the pin. Most dipterists use one of two British suppliers (addresses for David Henshaw and Watkins and Doncaster on p. 49) or Entomoravia in the Czech Republic (address on p. 50). The main thing is to use stainless steel pins that do not corrode. David Henshaw is a dipterist and able to advise on the size of pins appropriate for the type of flies you study; his Henshaw-KE entomological pins are available in 0.15mm diameter (lengths 10, 12.5 and 15mm), and 0.25mm, 0.29mm, 0.32mm, 0.38mm, 0.45mm, 0.56mm, 0.71mm diameters (all 15mm long). Watkins and Doncaster (p. 49) sell micro-pins ranging from 0.0056", 0.0076", 0.0089" and 0.01" in diameter and 10, 12.5 and 15mm long that cover the size range of most flies. Entomoravia supply micro-pins 0.1mm, 0.15mm and 0.2mm (all 12mm long). Lydie Rigout also supply a range of micro-pins and continental pins (see p. 49). For large flies, such as the larger hoverflies and horseflies etc., some people prefer to use long pins placed directly through the specimen (heavy specimens need thicker pins). These continental pins are 38mm long, so be sure that your cabinet drawers or store boxes are deep enough, otherwise order shorter pins. Continental pins are available from David Henshaw, Watkins and Doncaster, Entomoravia and Lydie Rigout. For stage mounts, use larger pins from the above suppliers; avoid brass dress-making pins because they corrode in contact with cork.

### ***Forceps and scissors***

Fine entomological forceps (sometimes termed watchmaker's forceps) are needed to sort and pin flies and to manipulate them once micro-pinned. They can be purchased from any of the main entomological suppliers (see p. 49). It is worth buying a pair of high quality forceps (plus a couple of spares), but be careful when using those with fine points because they are easily bent and damaged if dropped or knocked. Micro scissors used for eye surgery may be used to cut small parts from flies; they can be purchased from specialist surgical suppliers (for example, Eye Technology Ltd., 19 Totman Crescent, Brook Road Industrial Estate, Rayleigh, Essex SS6 7UY; website: [www.eye-tech.co.uk](http://www.eye-tech.co.uk)).

### ***Polyporus and Nu-poly***

Polyporus (derived from the bracket fungus of that name) and the modern expanded plastic substitute Nu-poly, are both used to stage micro-pinned insects on long pins. Polyporus is no longer commercially available, although you can collect the brackets and cut them up into strips. Nu-poly is available already cut into staging strips from Watkins and Doncaster (p. 49).

### ***Plastazote***

This is the best substitute for cork, formerly used to line storeboxes and cabinet drawers. It is a dense plastic foam, comes in sheets, 8 or 10mm thick, in white or other colours, and can be used to line storage boxes or to cut into strips for staging. Do not use polystyrene ceiling tiles since they are fragile, do not grip pins well and seem to facilitate infestations of book lice. Unfortunately, Plastazote is only supplied in large quantities from commercial suppliers (which is fine only if you wish to line a large number of cabinet drawers or storage boxes). Two commercial suppliers are Paulamar Company Ltd., and Polyformes Ltd. (their addresses are on p. 50). For smaller quantities, contact Watkins and Doncaster (p. 49) or David Henshaw (p. 49).

### ***Hand Lens***

A small folding pocket lens is very useful in the field to examine flies, either to check identifications or to decide whether a specimen is worth taking home for further study. A hand lens is easy to mislay, so it is safest to attach it to a piece of cord (picture frame cord is tough and neat) placed around your neck. A magnification of  $\times 10$  has the advantage that the focal length is sufficient to view into a glass tube (if the tube is not unduly wide). However,  $\times 20$  gives a much better definition of key characters, is ideal for most hoverflies and is strongly recommended for use at home if you lack a microscope. It is possible to get twinned lenses of different magnification. The optical quality is reflected in the price, so it is worth getting the best that you can afford. Many opticians stock or can obtain hand lenses. Watkins and Doncaster (p. 49) and David Henshaw (p. 49) also stock a range of hand lenses.

### ***Microscopes***

Yes, they are not cheap, but a good microscope will last a lifetime and open up a whole new world in entomology and for possibly other groups as well. Even if it costs £250, £700, or even over £1,500, compare that with other prices such as a TV (15 years life span?), the annual depreciation on a car, or annual expenditure on sports or entertainment; so it is all a

question of priorities. Usually you will need a stereoscopic binocular microscope (two eyepieces give 3D vision). Generally, a magnification range of about  $\times 10$  (to see an entire large fly) to  $\times 40$  (close up) is sufficient for examining characters on large and medium-sized (see p. 63) flies. Most models offer alternative optics, so if you can afford to encompass a total magnification of up to  $\times 80$  (objective magnification times eyepiece magnification =  $\times 80$ ) all the better since this will be necessary if you progress to the flies with more demanding identifications. Relatively few people find a need for higher magnifications, and above  $\times 80$  you start to need more expensive optics to maintain sharp definition.

Monocular microscopes do not offer 3D vision and they are less expensive than comparable quality binocular microscopes. Cheaper monocular models have a single eyepiece (twin eyepieces do not give 3D vision, but are more comfortable to use), while all monoculars are suitable for high power magnification (*e.g.*  $\times 100$  to  $\times 300$  is no problem with good makes) to examine slide preparations.

Remember that no matter what your microscope, correct lighting is half the battle. Up to  $\times 50$ , an ordinary Anglepoise type table lamp is often sufficient; the problem with spot lights or under stage lighting is that they can make pale hairs look black. A cold light source, such as a fibre optic system, produces a cold, bright light that can be controlled and modified to reveal fine details on whatever type of material that you are identifying. The lack of heat makes these units particularly suitable for sorting and identifying material in alcohol, and the angle of illumination and the intensity of the light can be easily adjusted to view wing venation, bristles and colour characters on your flies. The best of these fibre optic units are expensive (upwards of £500 at 2003 prices), but are long-lasting and available from most of the major microscope suppliers given on p. 49.

Ask suppliers for a catalogue and price list, and then if possible seek advice from someone who uses a microscope and can advise you on different makes and models. Some suppliers may allow you to use a demonstration model at home for up to a week, which gives the best opportunity to find out whether the microscope really suits you. If you are unsure about which model is best, do try to compare them side by side – it is much easier to choose the one with better performance in this way. When trying a microscope, take time to examine a range of specimens and look at different characters such as fine hairs on eyes, small body and leg bristles and hairs, wing vein and genitalia characters etc., using different lighting arrangements to find out what works best. The major microscope suppliers are listed on p. 49.

It is essential to be sure that the optics are good and that the lighting is bright enough, otherwise you will quickly tire from eye-strain and potentially damage your eyes. You need to be especially cautious about cheaper microscopes that may have poor resolution and a limited magnification range. Be very careful if you buy second-hand instruments since the optics may have been knocked out of alignment. With any binocular microscope, you must ensure the focus of the two eyepieces is in the same plane (usually at least one eyepiece has an adjustable focus that enables both eyes to be brought into sharp focus at the same time).

## ***EQUIPMENT SUPPLIERS***

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### ***Entomological equipment suppliers***

D.J. and D. Henshaw, 34 Rounton Road, Waltham Abbey, Essex EN9 3AR. (Tel: 01992 717663 also Fax & answerphone). *Dipterist trading in pins, forceps, pooters, glass tubes, microscope accessories, stains, chemicals, hand lenses, etc.*

Watkins and Doncaster, PO Box 5, Cranbrook, Kent TN18 5EZ. (Tel: 01580 753133; Fax: 01580 754054). Website: [www.watdon.com](http://www.watdon.com) *Long-established supplier of most general entomological equipment.*

Lydie Rigout, 1 Hillside Avenue, Canterbury, Kent CT2 8ET. (Tel: 01227 769924; Fax: 01227 456013). Website: [www.insects.demon.co.uk](http://www.insects.demon.co.uk) *Supplier of most general entomological equipment.*

Preservation Equipment Ltd., Vines Road, Diss, Norfolk IP22 4HQ. Website: [www.preservationequipment.com](http://www.preservationequipment.com) *Insect cabinets and drawers and a limited range of other equipment.*

Alana Ecology Ltd., The Old Primary School, Church Street, Bishop's Castle, Shropshire SY9 5AE. (Tel: 01588 630173; Fax: 01588 630176). Website: [www.alana-eco.net](http://www.alana-eco.net) *Supplier of a small range of entomological nets, cages and traps (including Malaise Traps) as well as a wide range of general ecological equipment and GPS units.*

Bioquip Products, 2321 Gladwick Street, Rancho Dominguez, CA 90220, USA. (E-mail: [bioquip@aol.com](mailto:bioquip@aol.com)). Website: [www.bioquip.com](http://www.bioquip.com) *Supplier of glass vials for storing genitalia preparations in glycerine, as well as many other zoological and entomological equipment items. You can order via their website using a credit card.*

### ***Entomological equipment trade stands at entomological exhibitions***

The above entomological equipment suppliers are normally present at the Amateur Entomologists' Society Annual Exhibition held in the London area (for date and place see the summer issue of the *Bulletin of the Dipterists Forum*). This is an excellent chance to see what equipment is available, and there are also stands with new and second-hand books. You can ask the enquiry stand to put you in contact with an experienced dipterist if you need advice. A few of the traders may attend other events, such as entomological trade fairs, although these tend to be very Lepidoptera-orientated and therefore of more limited interest to dipterists.

### ***Microscope suppliers***

Brunel Microscopes, Unit 12 Enterprise Centre, Bumpers Way, Bumpers Industrial Estate, Chippenham, Wiltshire SN14 6QA. [www.brunelmicroscopes.co.uk](http://www.brunelmicroscopes.co.uk) (Tel: 01249 462655; Fax: 01249 445156). E-mail: [brunelmicro@compuserve.com](mailto:brunelmicro@compuserve.com) *Suppliers of stereo microscopes, hand lenses and fibre optic illumination units.*

Lakeland Microscopes, Kynance, Charney Well Lane, Grange over Sands, Cumbria LA11 6DB. [www.lakeland-microscopes.co.uk](http://www.lakeland-microscopes.co.uk) (Tel: 01539 534737; Fax: 01539 535026). E-mail: [enquiries@lakeland-microscopes.co.uk](mailto:enquiries@lakeland-microscopes.co.uk) *Suppliers of Russian microscopes.*

Leica Microsystems (UK) Ltd., Davy Avenue, Knowlhill, Milton Keynes, Buckinghamshire MK5 8LB. [www.leica.com](http://www.leica.com) (Tel: 01908 246246; Fax: 01908 609992). *Suppliers of Leica microscopes and accessories, includes the former Wild system.*

Meiji Techno UK, Ltd., The Vineyard, Hillside, Axbridge, Somerset, BS26 2AN. (Formerly Hampshire Micro). [www.meijitechno.co.uk](http://www.meijitechno.co.uk) (Tel: 01934 733655; Fax: 01934 733660). E-mail: [enquiries@meijitechno.co.uk](mailto:enquiries@meijitechno.co.uk) *Suppliers of Meiji microscopes and accessories.*

Nikon UK Ltd., Nikon House, 380 Richmond Road, Kingston upon Thames, Surrey KT2 5PR. [www.nikon-image.com](http://www.nikon-image.com) (Tel: 020 8541 4440; Fax: 020 8541 4584). *Suppliers of Nikon microscopes and accessories.*

Olympus Optical Company (U.K) Ltd., 2-8 Honduras Street London EC1Y 0TX. [www.olympus.co.uk](http://www.olympus.co.uk) (Tel: 020 7253 2772; Fax: 020 7251 6330). *Suppliers of Olympus microscopes and accessories.*

#### ***Plastazote suppliers***

Paulamar Company Ltd, Woodilee Industrial Estate, Kirkintilloch, Glasgow G66 3TU. (Tel: 0141 776 2588; Fax: 0141 777 8101). *Commercial supplier of large quantities.*

Polyformes Ltd., Cherrycourt Way, Stanbridge Rd., Luton LU7 8UH. (Tel: 01525 852444; Fax: 01525 850484). *Commercial supplier of large quantities.*

Smaller quantities are also available from David Henshaw (p. 49) and Watkins and Doncaster (p. 49). If you are lining a large number of storeboxes, pinning boxes and making many stages, the commercial suppliers are worth considering to save money on a larger order.

#### ***Envelopes for storing craneflies***

Bulk samples of craneflies can be stored temporarily in photographic envelopes used for storing negatives. The John Dickinson product "Kristal Glassine Bags" 95×70mm (product code L86069, available in boxes of 4,000 from major stationery suppliers) have proved to be very satisfactory. Lydie Rigout (see p. 49) also supply transparent envelopes for storing insects.

#### ***Continental pins suppliers***

Entomoravia, Slovanska 1074, Slavkov U Brna 684 01, Czech Republic. (Tel: 420 607 889 128; Fax: 420 544 220 873). E-mail: [entomoravia@iol.cz](mailto:entomoravia@iol.cz). Website: [www.entomoravia.zdc.cz](http://www.entomoravia.zdc.cz)

Also David Henshaw (p. 49), Watkins and Doncaster (p. 49) and Lydie Rigout (p. 49) supply continental pins; request their catalogues to check on specifications and prices.

### ***Glass tubes suppliers***

Glass tubes, flat-bottomed, with internal fitting, flat-topped, ribbed plastic closures. Common sizes used are 75×25mm, 50×25mm and 50×12.5mm. The two suppliers listed here are likely to be cheaper for large quantities; smaller amounts can be bought from David Henshaw or Watkins and Doncaster.

Radleys, Shire Hill, Saffron Walden, Essex CB11 3AZ. (Tel: 01799 513320).

Regina Industries Ltd., Parkhouse West Industrial Estate, Newcastle, Staffordshire ST5 7PU.  
(Tel: 01782 565646).

### ***Laboratory chemicals and equipment suppliers***

There are numerous suppliers of general laboratory chemicals (laboratory reagent grade, or LRG, will suffice, not the high purity and more expensive analytical reagent grade, or analar) including ethyl acetate, ethylene glycol, potassium hydroxide, glacial acetic acid, ethanol (Customs and Excise licence required), or isopropyl alcohol, while stains for slide mounts are available from specialist suppliers. You can search the Internet for companies supplying these chemicals (including via The Laboratory Suppliers Website: [www.martex.co.uk/laboratory-supplies/index.htm](http://www.martex.co.uk/laboratory-supplies/index.htm)) and remember that it is well worth shopping around because prices do vary considerably between suppliers.

### ***General suppliers of laboratory chemicals and equipment***

Avonchem, Wellington House, Waterloo Street West, Macclesfield, Cheshire SK11 6PJ. (E-mail: [sales@avonchem.co.uk](mailto:sales@avonchem.co.uk)). *Laboratory chemicals.*

Bibby Sterilin, Tilling Drive, Stone, Staffordshire ST15 0SA. (Tel: 01785 812121; Fax: 01785 813748). (Website: [www.bibby-sterilin.co.uk](http://www.bibby-sterilin.co.uk)). *Laboratory glassware and bijoux tubes.*

Fisher Scientific UK Ltd., Bishop Meadow Road, Loughborough, Leicestershire LE11 5RG. (Tel: 01509 231166; Fax: 01509 231893). (Website: [www.fisher.co.uk](http://www.fisher.co.uk)). *Laboratory chemicals and equipment.*

Griffin & George (now part of Fisher Scientific, see above). (Website: [www.griffinandgeorge.co.uk](http://www.griffinandgeorge.co.uk)). *Laboratory chemicals and equipment.*

Philip Harris Scientific, Novara House, Excelsior Road, Ashby Park, Ashby-de-la-zouche, Leicestershire LE65 1NG. (Tel: 01530 418000; Fax: 01530 418016). (Website: [www.philipharris.co.uk](http://www.philipharris.co.uk)). *Laboratory chemicals and equipment.*

Labpak Chemicals, Mill House, Mill Lane, Fillongley, Coventry CV7 8EE. (Website: [www.labpakchemicals.co.uk](http://www.labpakchemicals.co.uk)). *Laboratory chemicals.*

P&R Group, Brindley Road, St Helens, Merseyside WA9 4H. (Tel: 01744 831800; Fax: 01744 831888). (Website: [www.pandr.co.uk](http://www.pandr.co.uk)). *Laboratory chemicals and equipment.*

*Specialist suppliers of reagents, stains and mountants*

Raymond A. Lamb Ltd., Units 4 & 5 Parkview Industrial Estate, Lottbridge Drive, Eastbourne, East Sussex BN23 6QE. (Tel: 01323 737000; Fax: 01323 733000; E-mail: sales@ralamb.com). (Website: www.ralamb.com). *Microscope slides, coverslips, microscopy stains and mountants.*

Thermo Shandon Ltd., 93-96 Chadwick Road, Astimoor, Runcorn, Cheshire WA7 1PR. (Tel: 01928 566611; Fax: 01928 565845). *Microscope slides, coverslips, microscopy stains and mountants.*

Chemical Intermediates Co. Ltd., Barnfields Industrial Estate, Leek, Staffordshire ST13 5QG. (Tel: 01782 504503). *The supplier for DMHF (=Dimethyl Hydantoin Formaldehyde resin) mountant.*

*Suppliers of microscope slides and coverslips*

David Henshaw (see p. 49), Watkins and Doncaster (see p. 49), Raymond A. Lamb (see p. 52)

## **SUPPLIERS OF BOOKS AND OTHER LITERATURE**

### ***Entomological Societies and AIDGAP publications***

AIDGAP: Field Studies Council, Publications, Preston Montford, Shrewsbury SY4 1HW. (Tel: 01743 852140; Fax: 01743 852101; E-mail: [fsc.publications@ukonline.co.uk](mailto:fsc.publications@ukonline.co.uk)). The AIDGAP series includes keys to Diptera families and to plant galls.

Amateur Entomologists' Society: AES Publications, 1 Tower Hill, Brentwood, Essex CM14 4TA. Publications include Stubbs & Chandler (1978) *A Dipterist's Handbook*, available at £10.75 including postage in the U.K., cheques payable to 'AES Publications'.

British Entomological and Natural History Society: BENHS Sales Secretary, Mr G. Boyd, 91 Fullingdale Road, Northampton NN3 2PZ. Publications include Stubbs & Falk (2002) *British Hoverflies* and Stubbs & Drake (2001) *British Soldierflies and their allies*.

British Plant Gall Society (Society publications, including the provisional keys to galls by F. Stubbs, 1986): Dr C.K. Leach, Department of Biological Sciences, De Montfort University, The Gateway, Leicester LE1 9BH.

Dipterists Forum (back numbers of Bulletins, Newsletters and *Dipterists Digest*): The Secretary Dipterists Forum, C/O BENHS, Dinton Pastures Country Park, Davis Street, Hurst, Reading RG10 0TH.

Royal Entomological Society publications (*Handbooks for the Identification of British Insects*, including the new checklists series): Royal Entomological Society, 41 Queen's Gate, London SW7 5HR. (Tel: 020 7584 8361; Fax: 020 7581 8505). Website: [www.royensoc.co.uk](http://www.royensoc.co.uk)

### ***New and second-hand books and papers***

Alibris: an Internet search service that can trace books from a worldwide network of suppliers. Search via author, title or keywords, pay via credit card. Website: [www.alibris.com](http://www.alibris.com)

Aurelian Books, 31 Llanvanor Road, London NW2 2AR. (Tel: 020 8455 9612; Fax: 020 8455 9612).

Backhuys Publishers b.v., P.O. Box 321, 2300 AH Leiden, The Netherlands. (Tel: +31-(0)71-5170208; Fax: +31-(0)71-5171856). Website: [www.backhuys.com](http://www.backhuys.com)

E.W. Classey Ltd., Oxford House, Marlborough Street, Faringdon, Oxfordshire SN7 7DR. (Tel: 01367 244700; Fax: 01367 244800). Website: [www.classeybooks.com](http://www.classeybooks.com)

Ian Johnson (Pemberley Books), 18 Bathurst Walk, Richings Park, Iver, Buckinghamshire SL0 9AZ. (Tel: 01753 631114; Fax: 01753 631115). Website: [www.pembooks.demon.co.uk](http://www.pembooks.demon.co.uk)



Pendleside Books, Fence, Burnley BB12 9QA. (Tel: 01282 615617).

Lydie Rigout, 1 Hillside Avenue, Canterbury, Kent CT2 8ET. (Tel: 01227 769924; Fax: 01227 456013). Website: [www.insects.demon.co.uk](http://www.insects.demon.co.uk)

### ***Journals with papers on Diptera***

Many general entomological journals contain papers on Diptera, so the list here concentrates upon those with a high proportion of papers on the British or European fauna. In each case the address given is for enquiries and subscriptions.

British Journal of Entomology and Natural History: membership enquiries for BENHS to Mr A. Godfrey, 90 Bence Lane, Darton, Barnsley, South Yorkshire S75 5DA (E-mail: [andy\\_godfrey\\_entomology@hotmail.com](mailto:andy_godfrey_entomology@hotmail.com)). *The quarterly journal of the British Entomological & Natural History Society, free to members; contains many papers and short notes on Diptera.*

British Wildlife: British Wildlife Publishing, Lower Barn, Rooks Farm, Rotherwick, Hook, Hampshire RG27 9BG. *Includes a regular contribution on flies by Alan Stubbs in the Wildlife Reports section.*

Dipterists Digest: The Secretary Dipterists Forum, C/O BENHS, Dinton Pastures Country Park, Davis Street, Hurst, Reading RG10 0TH. *Published twice per year (120-180 pages), the British journal devoted entirely to papers on Diptera.*

Dipteron: Sabine Hilger, Dusseldorfer Strasse 37a, D-10707 Berlin, Germany. E-mail [hilger@zedat.fu-berlin.de](mailto:hilger@zedat.fu-berlin.de). *A journal mainly devoted to Palaearctic Diptera.*

Entomologist's monthly Magazine: Gem Publishing Co., Brightwood, Brightwell, Wallingford, Oxfordshire OX10 0QD. *Despite the name, now a quarterly journal, with many papers and short notes on Diptera.*

Entomologist's Gazette: Gem Publishing Co., Brightwood, Brightwell, Wallingford, Oxfordshire OX10 0QD. *A quarterly journal with occasional papers on Diptera.*

Entomologist's Record & Journal of Variation: The Editor, 14 West Road, Bishops Stortford, Hertfordshire CM23 3QP. *Produced six times per year, includes papers and short notes on Diptera.*

European Mosquito Bulletin: the journal of the European Mosquito Control Association. Editor, Prof. Keith Snow, School of Biosciences, University of East London, Romford Road, London E15 4LZ. To receive the journal join the European Mosquito Control Association, Cité administrative Gaujot, 14 rue du Maréchal Juin, 67084 Strasbourg Cedex, France. *This twice-yearly journal contains papers on mosquito distribution, status and control within the European region.*

International Journal of Dipterological Research: The Editor, Dr Sergei Kuznetsov, Zoological Institute, Russian Academy of Sciences, St Petersburg 199034, Russia. E-mail: [sergeykuznetsov@mail.ru](mailto:sergeykuznetsov@mail.ru). Obtainable from: The Executive Secretary, Gunilla

Stahls (=Stahls-Makela), Zoological Museum, Department of Entomology, P. Rautatiekatu 13, Helsinki SF-00100, Finland. *This international journal is devoted entirely to Diptera.*

Studia Dipterologica: Dr Andreas Stark, Seebener Str. 190, D-06114 Halle (Saale), Germany. Fax: 0049-345-5226726. E-mail: ampyxstark@aol.com. *Published twice per year (400-600 pages), this international journal is devoted entirely to Diptera.*

Volucella: Ulrich Schmid, Staatliches Museum für Naturkunde Stuttgart, Rosenstein 1, D-70191 Stuttgart, Germany. E-mail ulrich.schmid.smns@naturkundemuseum-bw.de. *This international journal has papers exclusively on hoverflies.*

## ***RECORDING SCHEMES AND STUDY GROUPS***

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The national Diptera recording schemes and study groups supported by Dipterists Forum and the Biological Records Centre are listed here in taxonomic order (the same sequence as in Table 1, p. 65), together with their organisers. An updated list of Diptera recording schemes and study groups is maintained at the BRC website ([www.brc.ac.uk](http://www.brc.ac.uk)).

### ***Crane-fly Recording Scheme***

A total of 339 species (Cylindrotomidae, Limoniidae, Pediciidae, Ptychopteridae, Tipulidae and Trichoceridae) are listed in Chandler (1998a). Crane-flies are obtainable in nearly all weathers, with a long season (including the winter for Trichoceridae). The habitat range is wide but they are particularly plentiful in woodlands and wetlands; some species have aquatic larvae. Crane-flies are good ecological indicators and are valuable for site evaluation in many habitats. Many species are large and distinctive in the field, though some are only 3mm long. It is reasonably easy to identify most species, even with old keys, with the big advantage that male genitalia have good characters, often visible without dissection. New illustrated keys are available as test keys from John Kramer, while a new book on British crane-flies is in preparation. Legs tend to drop off, but don't worry – for the most part these are optional extras for identification purposes! Either pin fresh or place in envelopes (ideally those used to store photographic negatives, see p. 50) to point-mount later. The recording scheme began in 1973 and has an enormous amount of data. The scheme has a newsletter and an identification service. Bulk samples for identification are welcomed if the site or district is poorly covered.

**Organisers:** Alan Stubbs, 181 Broadway, Peterborough PE1 4DS. (Tel: 01733 346648); John Kramer, 31 Ash Tree Road, Oadby, Leicester LE2 5TE. [Alan accepts material for identification, mounted, or preferably as bulk samples; John can assist with providing draft keys, giving help with easier identifications and supplying general advice].

### ***Fungus-gnat Recording Scheme***

A total of 526 species (Bolitophilidae, Diadocidiidae, Ditomyiidae, Keroplatidae and Mycetophilidae) are listed in Chandler (1998a), now increased to 531 species. These flies can be abundant, especially in the autumn when many other flies are scarce. They are often plentiful in woodlands and wetlands, particularly in sheltered nooks and crannies and around fruiting bodies of fungi. While some groups within these families are manageable, generally they are difficult unless you are prepared to spend time really getting to know them. There is a RES Handbook to the families other than Mycetophilidae (Hutson, Ackland & Kidd, 1980), which should be supplemented by subsequent papers, while manuscript keys to many Mycetophilidae are available from the scheme organiser on request. You will need a good microscope, the ability to make preparations of the tiny genitalia and the patience to assemble all the dispersed literature. Many species new to Britain are being found, so if you relish the prospect of discovering some yourself these flies may appeal to you. Fungus gnats are not to be taken on lightly but the scheme organiser will be happy to assist those starting out.

**Organiser:** Peter Chandler, 606B Berryfield Lane, Melksham, Wiltshire SN12 6EL. [Peter welcomes samples for identification either pinned, in envelopes or in alcohol depending on source].

### ***Dixidae (meniscus midges) Recording Scheme***

A total of 15 species are listed in Chandler (1998a). The Dixidae are a distinctive family with a well-illustrated identification key that has been recently revised (Disney, 1999a). The early stages can be collected and identified, which facilitates ecological studies of this family, whose larvae live just beneath the surface film of fresh water, either still or flowing (according to the species). Adults can be collected into alcohol, with the identification characters for both sexes visible using a binocular microscope, usually without the need for slide mounting, but in some cases more detailed examination of slide-mounted material may be required.

**Organiser:** Dr Henry Disney, acting scheme organiser, Department of Zoology, University of Cambridge, Downing Street, Cambridge CB2 3EJ.

### ***Mosquito Recording Scheme***

A total of 32 species are listed in Chandler (1998a). This family, the Culicidae, is readily recognised through their distinctive appearance and the blood-feeding habits of the females. The adults need to be collected in separate tubes and kept dry since they are delicate, and the body and wing-scales readily rub off (reared adults are pristine). It is practical to identify the larvae and pupae, which, of course, are found in water. A good time for collecting larvae is in the earliest months of the year when there may be little else to record. A microscope is essential. The keys in the Naturalists' Handbook by Snow (1990) are designed for use by non-specialists. A provisional atlas, giving the recorded distribution of the British species, with notes on their biology and ecology has been produced by Snow *et al.* (1998). The scheme is mainly supported by professional and amateur specialists but the hope is that other dipterists will help record mosquitoes. The *European Mosquito Bulletin* includes progress with the recording scheme (available to view or download at the following website: [www.uel.ac.uk/mosquito/](http://www.uel.ac.uk/mosquito/)).

**Organiser:** Prof. Keith Snow, School of Health and Bioscience, University of East London, Romford Road, London E15 4LZ. E-mail: [k.r.snow@uel.ac.uk](mailto:k.r.snow@uel.ac.uk)

### ***Simuliidae Study Group***

A total of 33 species are listed in Chandler (1998a). The Simuliidae, or blackflies, are an important group of flies because the adult females feed on vertebrate blood, thereby causing harm to people through nuisance biting and transmitting diseases in some parts of the world. The study group is international in scope and encourages ecological, taxonomic and distributional studies of blackflies. The organiser has published detailed results of a long term study of the distribution of blackflies in south east England (Crosskey & Crosskey, 2002a and 2002b). Blackflies have larvae that live in running fresh water, and the larvae and pupae can be identified using the recent key by Bass (1998). The key to adults by Davies

(1968) is now in need of updating to reflect new taxonomic information and revised species limits. The introductory work by Crosskey (1990) contains an extensive review of the biology of Simuliidae. In blackfly studies it is usual to collect larvae and pupae from the aquatic breeding sites and to rear out adult flies from the pupae. This is a very easy procedure and notes on how to do it can be supplied by Roger Crosskey. The reason for this is that adults of many species are difficult or impossible to separate reliably whereas the pupae possess much more usable and reliable characters. Moreover, working from the aquatic stages identifies breeding sites very exactly, permitting them to be known to 100 metres accuracy (2 letter/6 numeral grid references). This family will appeal particularly to those interested in freshwater insects and rearing studies; a good microscope, equipment and materials for preparing slide mounts are essential.

**Organiser:** Dr Roger Crosskey, C/O Entomology Department, The Natural History Museum, Cromwell Road, London SW7 5BD. E-mail: [rwc@nhm.ac.uk](mailto:rwc@nhm.ac.uk)

### ***Chironomid Study Group***

A total of 588 species are listed in Chandler (1998a) with three additional species recently added from Ireland. Some of these midges are small, a few are of moderate size but most are tiny. Although there are a few terrestrial genera, and even a few marine littoral species, most breed in fresh water. Adults can swarm in enormous numbers around water on still evenings. As yet most studies have been carried out by professionals and there is a large literature on the taxonomy and ecology of chironomids. Even the most recent keys (Pinder, 1978) are now well out of date since so many further species have been discovered in Britain. Adults are delicate and so should not be pooted up together with other flies. Adults need to be mounted on slides and identification makes extensive use of male genitalia characters (a high power monocular microscope is required for identifying most species). The taxonomy of pupal exuviae is sometimes easier than that of the adults (see Langton, 1991). There is plenty of scope for discovering further species new to Britain and if you are interested in freshwater habitats, chironomids may appeal to you. A newsletter is produced.

**Organiser:** Patrick Roper, South View, Churchland Lane, Sedlescombe, East Sussex TN33 0PF. E-mail: [patrick@prassociates.co.uk](mailto:patrick@prassociates.co.uk)

### ***Larger Brachycera Recording Scheme***

A total of 159 species are listed in Chandler (1998a) (162 named species in Stubbs & Drake, 2001). Robberflies, bee flies, soldierflies, horseflies and their allies are included in this scheme (Acroceridae, Asilidae, Athericidae, Bombyliidae, Rhagionidae, Scenopinidae, Stratiomyidae, Tabanidae, Therevidae, Xylomyidae and Xylophagidae). They are for the most part large and attractive species and a logical next step after hoverflies. Ecologically they are important, with one of the highest percentages of Red Data Book and Notable species of any insect group. These flies are ideal if you like species with interesting behaviour or if you enjoy searching for larvae. The new keys (Stubbs & Drake, 2001) make most of these flies suitable for the beginner. The scheme has published a provisional atlas (Drake, 1991), and is now working towards publishing an atlas with greater coverage; a newsletter is produced.

**Organiser:** Simon Hayhow, Fleetwood Museum, Queen's Terrace, Fleetwood, Lancashire FY7 6BT. E-mail: simon.hayhow@mus.lancscc.gov.uk. [Simon accepts material of critical species for identification].

### ***Empididae Recording Scheme***

A total of 673 species are listed in Chandler (1998a) now increased to 676 (Atelestidae, Hybotidae, Empididae, Microphoridae and Dolichopodidae; collectively the Empidoidea). These flies have become more popular in recent years. In size they range from minute to quite large, though overall the majority count as small. If one is selective, there are plenty of species that are fairly easy to identify. Many more are of moderate difficulty. The females of some genera are difficult and the males can also demand experience, including those that need genitalia preparations and a high microscope magnification. Genitalia examination is quite straightforward in most Empidoidea. Several years experience and a good microscope are recommended before embarking seriously on this group. With so many species, practically all habitats have a characteristic fauna and this is a useful group for site evaluation. Overall woodland, wetland and water margin habitats contain the richest faunas. A newsletter has been produced.

**Organiser:** Adrian Plant, 9, High Street, Bishops Lydeard, Taunton, Somerset TA4 3AX. [Currently organiser for Empididae only, but is also collating records for other Empidoidea].

### ***Hoverfly Recording Scheme***

A total of 265 species are listed in Chandler (1998a) (271 named species in Stubbs & Falk, 2002 plus one species added subsequently from Ireland by Speight, 2002). This is the family that many people start with because of the attractive and colourful appearance of many species. There are just a few awkward genera but the majority are quite easy. Stubbs & Falk (2002) includes paintings of over 190 species in colour, as well as many diagrams in the keys, plus genitalia drawings of *Cheilosia* species. The recording scheme has published a provisional atlas (Ball & Morris, 2000) which also includes summaries on biology and phenology of each species. A colour guide to larvae (Rotheray, 1993) will encourage further studies of the early stages. A newsletter is produced.

**Organisers:** Dr Stuart Ball, 255 Eastfield Road, Peterborough PE1 4BH (receipt of data) and Roger Morris, 241 Commonsides East, Mitcham, Surrey CR4 1HB (problem specimens and general enquiries).

**Newsletter Editor:** David Iliff, Green Willows, Station Road, Woodmancote, Cheltenham, Gloucestershire GL52 9HN.

### ***Pipunculidae Study Group***

A total of 92 species are listed in Chandler (1998a) with one addition published since. Many people are attracted to these distinctive flies and slowly build up a collection. However, although there are easy species, many are difficult to identify (particularly in the genera *Chalarus* and *Eudorylas*). The purpose of the study group is to develop a new generation of keys, which is a specialist task, but drawing upon the enthusiasm of a number of people who

are keen on the family. New species are being added regularly. A newsletter called *The Piercer* is produced occasionally and test keys are available from the organiser to supplement and update the RES Handbook by Coe (1966) (except for the genus *Chalarus*, which is dealt with by Jervis (1992)).

**Organiser:** David Gibbs, 6 Stephen Street, Redfield, Bristol BS5 9DY.

### ***Conopidae and Lonchopteridae Recording Scheme***

A total of 7 species of Lonchopteridae and 24 species of Conopidae are listed in Chandler (1998a). The Lonchopteridae are a reasonable family to tackle with care and patience, despite their small size and retiring habitats. The adults are frequent in wetlands and woodlands. The Conopidae are very attractive flies of medium to large size, including wasp mimics. They are larval parasites of bees and wasps. This is an ideal family even for the beginner, although it is unusual to see many conopids during a day in the field. There are only a few species that are hard to identify but these are mostly rare members of the genus *Myopa*. There is a newsletter and an illustrated recording scheme key to Conopidae, as well as the RES Handbook by Smith (1969a) for Lonchopteridae and the RES Handbook for Conopidae by Smith (1969b).

**Organiser:** David Clements, 7 Vista Rise, Rhadyr Cheyne, Llandaff, Cardiff CF5 2SD.

### ***Stilt and Stalk Fly Study Group***

A total of 39 species are listed in Chandler (1998a), comprising 1 species of Pseudopomyzidae, 9 species of Micropezidae, 1 species of Tanypezidae, 1 species of Strongylophthalmyiidae, 1 species of Megamerinidae and 26 species of Psilidae. The five small families covered by this recording scheme tend to be elongate species with long, slender legs. They include some little-known and rare species as well as others in the Micropezidae and Psilidae that are more familiar. The identification literature is dispersed in small papers, mainly by J.E. Collin, which although old are still workable.

**Organiser:** Darwyn Sumner, 122 Link Road, Anstey, Charnwood, Leicestershire LE7 7BX.

### ***Picture-winged Flies Recording Scheme***

A total of 34 species are listed in Chandler (1998a) comprising 20 species of Ulidiidae (formerly Otitidae), 2 species of Platystomatidae, and 12 species of Pallopteridae with one species added since. The majority of species have pictured-wings and look somewhat like Tephritidae. There is an illustrated key to support the recording scheme, they are attractive flies and a high proportion of the species are scarce ecological indicator species. Hence this has been chosen as one of the priority groups among the acalyprate families and the scheme was launched in 1996. There is still much to find out about the larval ecology of most species.

**Organiser:** David Clements, 7 Vista Rise, Rhadyr Cheyne, Llandaff, Cardiff CF5 2SD.

### ***Sciomyzidae Recording Scheme***

A total of 69 species are listed in Chandler (1998a), comprising 67 species of Sciomyzidae (with one species added since) and 2 species of Phaeomyiidae. This is a popular group of acalyprates since many of the species are attractively coloured and have wing-patterns, while most of the species are of medium to large in size. They are fairly easy to recognise in general appearance, with the combination of porrect (=pointing forward) antennae and a habit of stretching out their fore legs when walking in a net. The Sciomyzidae are snail-killing flies, the larvae of different species being predators or parasitoids of either aquatic or terrestrial snails (and a few specialise on slugs or pea-clams). The Phaeomyiidae (formerly included as a subfamily of Sciomyzidae) have larvae that feed on millipedes. Identification of both families is fairly easy using Rozkošný (1984) plus some additional papers, although for most species the male genitalia should be checked. They are a very important group for ecological evaluation of various wetlands, and a few terrestrial habitats including calcareous grassland and woodland. The scheme has published a preliminary atlas (Ball & McLean, 1986) and is preparing an identification key and updated atlas.

**Organisers:** Dr Ian McLean, 109 Miller Way, Brampton, Huntingdon, Cambridgeshire PE28 4TZ and Andy Foster, 61 Pittsfield, Cricklade, Swindon, Wilts SN6 6AW. [Ian accepts material of critical species for identification].

### ***Tephritidae Recording Scheme***

A total of 73 species are listed in Chandler (1998a) with two species added since. Nearly all species have wing-markings and many of the species are very attractive. The larvae develop in plants as leaf, fruit and stem miners or they form galls. Often a good way to record the group is to search for the host plants of the different species and look for the adults or early stages according to the season. This is a very popular family of acalyprate flies, and they are ideal if you are interested in plants and rearing from larvae or puparia. Many species are easy to recognise, but some are more difficult. It is quite practical to make good progress as a beginner, especially if you can associate flies with a plant species, but some species require dissection to check the male genitalia or female ovipositor. There is an RES Handbook (White, 1988) and the scheme produces newsletters and has published an atlas (Clemons, 1996).

**Organiser:** Laurence Clemons, 14 St John's Avenue, Sittingbourne, Kent ME10 4NE. [The organiser welcomes records and accepts any quantity of material for identification].

### ***Drosophilidae Recording Scheme***

A total of 59 species are listed in Chandler (1998a). The Drosophilidae, or fruit flies, are familiar small flies that are typically attracted to ripening fruit and alcoholic beverages around the home and outside in summer. A RES Handbook is in preparation, in the meantime keys by Fonseca (1965) and Shorrocks (1972) enable identification of the British fauna. These flies are moderately difficult to identify, requiring a good microscope and the facilities to make preparations of the male and female genitalia to identify some species. Adults can be attracted to bait traps, using fruit and fermenting juices as the lure, and some



species can be reared using the techniques described by Shorrocks (1972). Some species have larvae that develop as leaf miners (for example, in the genus *Scaptomyza*).

**Organiser:** Dr Brian Pitkin, Entomology Department, The Natural History Museum, Cromwell Road, London SW7 5BD.

### ***Anthomyiidae Study Group***

A total of 237 species are listed in Chandler (1998a) with one species added since. Begun in 1996, this is a small study group concerned with testing manuscript keys and supplying illustrations of male and female genitalia. This is a relatively demanding family to identify, with strong reliance on genitalia characters in both sexes. Many of the species have larvae that develop in plants, but other life histories include species that are cleptoparasites of solitary bees and wasps. The Study Group produces newsletters with keys and notes.

**Organiser:** Michael Ackland, 24 The Moors, Kidlington, Oxford OX5 2AJ.

### ***Tachinidae Recording Scheme***

A total of 247 species are listed in Chandler (1998a) with seven species added since. The Tachinidae are typically bristly flies, with the early stages developing inside the developing stages of other insects such as Lepidoptera, Coleoptera, Hemiptera and even other Diptera! They are frequently reared by those keeping and breeding insects, as well as being familiar flies on flowers or basking in warm situations. Adults can be swept or caught in Malaise traps and should be carefully preserved to retain their full complement of bristles, which offer many good identification characters. The RES Handbook by Belshaw (1993) is much easier to use than previous keys, but care and patience is needed for identifying these flies. Keeping a reference collection and making genitalia preparations for some genera will be essential if you wish to make good progress with the family. The scheme has its own website, which contains much useful information (including updates to the RES Handbook); it can be reached at: [www.tachinidae.org.uk](http://www.tachinidae.org.uk)

**Organisers:** Mr Matt Smith, 24 Allnatt Avenue, Winnersh, Berkshire RG41 5AU (E-mail: [matt.smith@tachinidae.org.uk](mailto:matt.smith@tachinidae.org.uk)) and Mr Chris Raper, 46 Skilton Road, Tilehurst, Reading, Berkshire RG31 6SG (E-mail: [chris.raper@tachinidae.org.uk](mailto:chris.raper@tachinidae.org.uk)).

## ***THE BRITISH FLY FAUNA***

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The section on *How you can help contribute to our knowledge of Diptera* (p. 9) suggests some ways in which you can develop your studies and begin to make a contribution to our knowledge of Diptera. Table 1, starting on p. 65, lists all the known families of British Diptera and gives some general guidance as to the practicality of identifying species within each family. Colyer & Hammond (1968) is still the best introductory guide to the British fly fauna and this book, coupled with Table 1, will help you to decide which families to begin recording and identifying.

Points to consider include the range of families that you can find with the type of field work and collecting techniques that you enjoy, the kinds of habitats that you can visit (and hence see their associated fly fauna), and the type of identification that suits you best (large species often with good field characters as opposed to tiny species that require careful examination or dissection). The equipment and literature that you have available, the time you have for field work and identification and whether you enjoy rearing insects or observing their behaviour, are additional factors that will help you to decide where to start and how to proceed further. It is generally best to begin by concentrating upon a few families that you can recognise and build up your identification skills with these before moving on to try a wider range of flies.

There could come a time at which you wish to take on a more difficult group. It is best to seek advice first and ensure that this is something you can realistically tackle. In many respects it is often better to team up with others rather than to go it alone, assuming that there are other dipterists nearby. One possible suggestion for an interesting and original project is to investigate the early stages of a family or group that you can identify as adults. This will give you an excellent chance to contribute to our ecological and taxonomic knowledge, as well as being a project that almost anyone can undertake. Most British Diptera have early stages that are undescribed and life histories that are unknown, so there is ample scope for making original observations and discoveries. Finally, it is worth remembering that there is no one who pretends to be able to identify literally all flies. A few families are very difficult to identify, even for specialists.

### **Explanation of the headings in Table 1**

#### **Number of species**

The totals for each family are those given in the latest checklist (Chandler (1998a) for Britain and Ireland, with the additions since then noted (see each issue of *Dipterists Digest* (second series) for the species added and the literature references; Chandler, P.J., 1999a & 1999b, 2000a & 2000b, 2001a & 2001b, 2002a & 2002b). The totals at March 2003, where different, are given in parentheses.

#### **Size**

Here grouped into four categories according to approximate body length.

<b>T</b>	Tiny	less than 2mm
<b>S</b>	Small	2-5mm
<b>M</b>	Medium	5-10mm

L Large more than 10mm

### Ease of identification

This is somewhat subjective, depending on your previous experience with species identification and using keys, as well as your ability and preferences for recognising identification characters and using microscope techniques. For instance, some people either like or dislike those bristle characters that are used so frequently for identifying calyptrates, while making genitalia preparations needs a steady hand and practice to achieve good results. In addition, many families contain a wide range of genera that differ greatly in their ease of identification, so you can find very difficult hoverflies as well as easy genera in obscure families. As with identifying any small insects, a good microscope and proper illumination (see p. 47) are really helpful for seeing the key characters clearly.

- 1 Easy to moderate. No more difficult than most hoverflies.
- 2 Good to try for those with some experience of flies from the first group above. Only with a small proportion of difficult genera and species. If genitalia characters are needed they are easily seen if the genitalia are hinged out (as for the hoverfly genus *Sphaerophoria*).  
Can be tackled successfully given care and sufficient experience but are quite taxing. The smaller species require a microscope and may need genitalia preparations for accurate species identifications.  
Best left to those with a lot of experience and a good microscope. For the most part best seen as a specialist group, or for those with the time and perseverance to build up their knowledge.
- 5 For all practical purposes impossible due to taxonomic difficulties and/or absence of recent keys.

### Help: an indication of what help is available

**Scheme** BRC recording scheme (sec p. 56 onwards).  
**Study gp** Study group (sec p. 56 onwards).  
**Panel** Advisory panel help (see separate panel list, p. 68).

### Keys and references

Allow for the fact that many reference works are out of date to varying degrees. There may now be extra species (refer to the figures given in the table below) and the definition of species may change even if the names are the same. Occasionally, some species formerly thought to be distinct are combined together again as one species; such changes can be confusing unless you have the latest published papers. Using the identification references together with the check list (Chandler, 1998a) will give the best chance of making correct determinations and using the most up to date names. Table 1 includes identification references for British Diptera, giving the number of each paper in the list of identification references (see p. 73 onwards).

**Table 1** *Diptera families with summary information about each family*

*Nematocera (Suborders Tipulomorpha to Culicomorpha)*

[Suborder] Family	No.	Size	Diff.	Help	Keys and references
<b>[Tipulomorpha]</b>					
Cylindrotomidae	4	M	1	Scheme	100, 184, 348
Limoniidae	212	S-M	1-2	Scheme	100, 184, 201, 348
Pediciidae	19	M-L	1-2	Scheme	100, 184, 348
Tipulidae	87	L	1-2	Scheme	100, 342, 345, 348
<b>[Bibionomorpha]</b>					
Bibionidae	20	S-L	1-3		199
Bolitophilidae	16	S	3	Scheme	56, 63, 70, 181, 182, 186, 221
Cecidomyiidae	620	T-S	5		24, 185, 212, 242, 244, 267, 271, 274, 298, 352
Diadocidiidae	3	S	3	Scheme	56, 63, 181, 182, 221
Ditomyiidae	3	S	3	Scheme	56, 181, 182, 221
Keroplastidae	52	S-M	3	Scheme	56, 63, 67, 69, 70, 181, 182, 186, 221
Mycetophilidae	452 (457)	T-S	3-4	Scheme	51, 52, 53, 54, 56, 57, 58, 59, 63, 65, 68, 70, 72, 73, 74, 75, 81, 87, 181, 182, 186, 200, 355
Sciaridae	153 (156)	S	3-5		196, 197, 198, 217, 218, 245, 247, 264
<b>[Psychodomorpha]</b>					
Anisopodidae	4	M	2-3		100, 210
Mycetobiidae	3	S	2		100, 211
Psychodidae	94 (95)	T	3-4	Panel	100, 365, 366, 367, 368
Scatopsidae	42 (45)	T-S	2-4		77, 78, 199, 247, 281
Trichoceridae	10	M	2-3	Scheme	100, 348
<b>[Ptychopteromorpha]</b>					
Ptychopteridae	7	M	1	Scheme	100, 346
<b>[Culicomorpha]</b>					
Ceratopogonidae	161	T-S	3-4		40, 41, 42, 43, 47, 183, 187
Chaoboridae	6	S	1-3		100
Chironomidae	588 (591)	T-M	3-4	Study gp	100, 133, 248, 284, 358, 359, 360
Culicidae	32	S-M	2-3	Scheme	100, 134, 187, 258, 335
Dixidae	15	S	1-3	Scheme	158, 207
Simuliidae	33	T-S	3-5	Study gp	26, 135, 136, 137, 138, 139, 144, 187
Thaumaleidae	3	S	2		158

***Brachycera Part 1 (Suborders Xylophagomorpha to Muscomorpha Aschiza)***

[Suborder] Family	No.	Size	Diff.	Help	Keys and references
<b>[Xylophagomorpha]</b>					
Xylophagidae	3	M-L	1	Scheme	171, 273, 350
<b>[Tabanomorpha]</b>					
Athericidae	3	L	1	Scheme	171, 273, 350
Rhagionidae	15	S-L	1	Scheme	171, 273, 350
Stratiomyidae	48	S-L	1	Scheme	171, 273, 320, 321, 350
Tabanidae	30	M-L	1-3	Scheme	94, 171, 187, 273, 350
Xylomyidae	3	M	1	Scheme	171, 273, 350
<b>[Asilomorpha]</b>					
Acroceridae	3	S	1	Scheme	171, 273, 350
Asilidae	29	M-L	1-2	Scheme	171, 273, 350
Atelestidae	2	S	2	Scheme	90, 126, 171
Bombyliidae	9	S-L	1	Scheme	171, 273, 350
Dolichopodidae	285 (287)	T-M	1-3	Scheme	66, 82, 105, 106, 179, 180, 194, 246, 250, 251, 266, 282, 287, 288, 289
Empididae	208	T-L	1-3	Scheme	71, 92, 93, 126, 177
Hybotidae	175 (176)	T-S	1-3	Scheme	89, 90, 91, 126, 208, 216
Microphoridae	3	S	2	Scheme	90, 126
Scenopinidae	2	S	1	Scheme	171, 273, 350
Therevidae	14	M	1-3	Scheme	171, 273, 350
<b>[Muscomorpha Aschiza]</b>					
Lonchopteridae	7	S	2	Scheme	332
Opetiidae	1	S	2	Panel	83
Phoridae	315 (326)	T-S	2-4	Panel	44, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168
Pipunculidae	92 (93)	S-M	2-4	Study gp	3, 4, 5, 9, 101, 243, 343
Platypezidae	30 (33)	S	2-3	Panel	48, 49, 83, 85, 86, 239
Syrphidae	265 (272)	S-L	1-3	Scheme	23, 336, 317, 351

*Brachycera Part 2 (Suborder Muscomorpha Schizophora Acalypratae) or acalyprates*

[Suborder] Family	No.	Size	Diff.	Help	Keys and references
Acartophthalmidae	2	T	3		141, 326
Agromyzidae	367 (373)	T-S	3-4	Panel	33, 34, 35, 36, 38, 39, 107, 146, 147, 203, 204, 215, 225, 262, 337, 338, 339, 340, 347
Anthomyzidae	19	S	3	Panel	15, 18, 114, 303, 305, 307, 309, 310, 311
Asteiidae	7	S	2-3		55
Aulacigastridae	1	S	2		326
Braulidae	2	T	3		169, 222
Camillidae	5	S	4		110, 278, 280
Campichoetidae	2	S	2		61, 62
Canacidae	2	S	2		46, 361
Carnidae	13	T-S	3		109, 214
Chamaemyiidae	32	S	3-4	Panel	130, 260, 263, 331, 334, 353
Chloropidae	175 (177)	T-S	2-4	Panel	17, 31, 145, 170, 227, 228, 229, 230, 231, 232, 233, 236, 237, 238, 241
Chyromyidae	8 (10)	S	3-4		14, 16, 110, 118, 140, 240
Clusiidae	10	S	2		141, 344, 363
Coelopidae	2	S-M	2		45, 188
Conopidae	24	S-L	1	Scheme	124, 333
Diastatidae	6	S	2	Panel	61, 62
Drosophilidae	59	S	2-3	Scheme	20, 25, 32, 64, 192, 202, 249, 328
Dryomyzidae	6	M	1		142, 188, 341
Ephydriidae	142 (148)	S	3-4		13, 27, 46, 103, 111, 127, 128, 143, 174, 176, 224, 259, 272, 283, 329, 362, 373
Heleomyzidae	62	S-M	2		112, 119, 234, 277, 364
Lauxaniidae	54	S	2	Panel	10, 110, 117, 131, 190, 205, 206, 276, 279, 327
Lonchacidae	37 (44)	S	3-4		11, 76, 122, 209, 252, 253, 255, 256
Megamerinidae	1	M	1	Study gp	50
Micropezidae	9	S-M	2	Study gp	19, 50, 115, 312
Milichiidae	18	T-S	3	Panel	214, 325, 326
Odiniidae	7 (9)	S	2-3		102, 121, 254, 257
Opomyzidae	16 (17)	S	2-3	Panel	172, 173, 175
Pallopteridae	12 (13)	S	1	Scheme	103, 120, 318
Periscelididae	3	S	3		178
Phacomyiidae	2	M	1	Scheme	22, 322, 323
Piophilidae	13 (14)	S	2-3		103, 142, 261, 349
Platystomatidae	2	S-M	1	Scheme	95
Pseudopomyzidae	1	S	2	Study gp	60
Psilidae	26	S-M	2	Study gp	113
Sciomyzidae	67 (68)	S-L	1-2	Scheme	22, 108, 322, 323
Sepsidae	27 (28)	S	2		290, 292, 296
Sphaeroceridae	130 (135)	T-S	3-4		219, 285, 300, 301, 302, 306, 304, 308, 313, 314, 315
Stenomicroidae	2	T	3		223
Strongylophthalmyiidae	1	M	2	Study gp	104
Tanypezidae	1	M	2	Study gp	50, 115
Tephritidae	73 (75)	S-M	1-2	Scheme	97, 98, 265, 356, 357
Tethinidae	10	T-S	3-4		125, 129, 226
Ulidiidae	20	S-M	1-2	Scheme	95, 96

***Brachycera Part 3 (Suborder Muscomorpha Schizophora Calyptratae) or calyptrates***

[Suborder] Family	No.	Size	Diff.	Help	Keys and references
Anthomyiidae	237 (238)	S-M	2-4	Study gp	1, 2, 6, 7, 8, 37, 213, 268, 269
Calliphoridae	38	S-L	2-3	Panel	189, 299, 319
Fanniidae	60	S-M	2-3	Panel	193, 291, 324
Hippoboscidae	14	M	2		220
Muscidae	279 (281)	S-M	2-3	Panel	193, 293, 294, 295, 297, 316, 330
Nycteribiidae	3	M	2		220
Oestridae	11	M-L	2		189, 374
Rhinophoridae	7	M	2		28, 189
Sarcophagidae	59 (60)	S-L	2-3	Panel	79, 189, 275, 370, 371, 372
Scathophagidae	54	S-M	2	Panel	21, 123, 270
Tachinidae	247 (254)	S-L	1-4	Scheme	12, 30, 80, 88, 99, 132, 189, 191, 195, 235, 286, 354, 369, 372

***Advisory Panel***

The Forum has members who are willing to advise on most groups of flies, additional to recording schemes and study groups. Do not overload them – it is up to each person to say whether they are prepared to look at your material. They can also advise you on the practical aspects of tackling these families. If you are making an enquiry, it helps greatly if you provide a stamped and addressed envelope for a reply. See the address list issued at intervals with the *Bulletin of the Dipterists Forum*.

**Nematocera**

Psychodidae            Phil Withers

**Brachycera: Part 1 (Suborders Xylophagomorpha to Muscomorpha Aschiza)**

Phoridae                Henry Disney  
Platypezidae            Peter Chandler

**Brachycera: Part 2 (Suborder Muscomorpha Schizophora Acalyptratae): or acalyptrates**

Agromyzidae            David Henshaw  
Anthomyzidae           Peter Chandler  
Chamaemyiidae        Ian McLean  
Diastatidae            Peter Chandler  
Chloropidae            John Ismay  
Lauxaniidae            Andrew Godfrey  
Lonchaeidae            Iain MacGowan  
Milichiidae            Peter Chandler  
Opomyzidae            Martin Drake welcomes records

**Brachycera: Part 3 (Suborder Muscomorpha Schizophora Calyptratae) or calyptrates**

Calliphoridae           Steven Falk  
Fanniidae                Adrian Pont  
Hippoboscidae        Neil Redgate Scottish material & records  
Muscidae                Adrian Pont

Nycteribiidae  
Rhinophoridae  
Sarcophagidae  
Scathophagidae

Neil Redgate Scottish material & records  
Steven Falk  
Steven Falk  
Steven Falk & Stuart Ball



## ***REFERENCES AND FURTHER READING***

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This section includes a general bibliography, comprising introductory references that you are likely to need when starting to study flies; they will continue to help you as you gain experience and will become well-used over time. After the general bibliography, there is a numbered list of identification works, distribution atlases and references to individual families of British Diptera. This numbered list is cited and cross-referenced in Table 1 (p. 65) as a guide to the books and papers that you need to acquire when starting to study a particular family.

### ***Obtaining literature references***

A list of suppliers and sources that can be accessed via the Internet for buying books and journals is given in the section on *Suppliers of books and other literature* at p. 53.

Gaining access to the published literature is obviously easier if you can find a specialist library that you can visit but most items can be seen and consulted in other ways.

Museums with entomological collections will often have entomological journals and, depending upon the interests of the curator, may have some key works on Diptera. A county or local museum (or the county records centre if run outside the museum), may be able to give advice on library sources.

If you live within range of Dinton Pastures, near Reading, the BENHS library is open to Dipterists Forum members on Open Days; the Librarian is Ian Sims (Tel: 01734 665503). BENHS and Dipterists Forum members may borrow books and journals; a postal service is available to members, who pay the postage costs.

The Royal Entomological Society has an extensive library which is open 09.30-17.00 Monday to Friday. Those who are not Members or Fellows may be able to arrange a visit, but if you want regular access or loans you will need to become a Member or Fellow. The librarian is Berit Pedersen (Tel: 02075 848361; E-mail: [lib@royensoc.co.uk](mailto:lib@royensoc.co.uk)).

The Natural History Museum General Library has a wide range of natural science journals as well as Zoological Record on CD ROM. A reader's card is required (which can be obtained on your first visit) and an appointment must be made in advance to consult the library.

The Natural History Museum Department of Entomology Library has many entomological journals and key works; most of the latter are located on the Diptera section itself. An appointment must be made in advance to consult the library.

The Hope Entomological Library, Oxford University Museum of Natural History has a good range of modern journals and key works. It has excellent coverage of older (pre-1870) literature and a catalogued offprint collection including many items from the library of J.E. Collin. It is open most week days 09.00-13.00 and 14.00-17.00 and an appointment is recommended. The librarian is Stella Brecknell (Tel: 01865 272982; E-mail: [stella.brecknell@oum.ox.ac.uk](mailto:stella.brecknell@oum.ox.ac.uk)).

Your local library can provide a remarkably good service. Via the National Lending Library service they can borrow just about anything, or obtain photocopies of journal articles for you. Of course, you will have to cover the costs involved, but the alternative travel and time costs to you may be much greater. You may find that the reference section of your library has at least got Colyer & Hammond (1968) *Flies of the British Isles*.

### **General bibliography**

Many of these general references are cited at various places in this starter pack. Those marked "\*" comprise a suite of useful volumes to start a dipterist's library, but you may wish to consult copies in a library (such as that at the BENHS premises at Dinton Pastures, or at the Royal Entomological Society) before deciding whether you wish to purchase any of them. Some of the books are very expensive, while others are out of print, at least temporarily. Comments are given about each reference *in italics* to give an idea of their contents.

- \*Chandler, P.J. 1998a. Part 1: Diptera. Checklists of Insects of the British Isles. Handbooks for the Identification of British Insects **12**. Royal Entomological Society, London. *The latest checklist to all Diptera in Britain and Ireland, this comprehensive treatment includes a short introduction to each family, notes on species added since the previous checklist and many useful literature references.*
- Chandler, P.J. 1999a. Corrections and changes to the Diptera Checklist (1). - Editor. *Dipterists Digest* (second series) **6**: 57-61.
- Chandler, P.J. 1999b. Corrections and changes to the Diptera Checklist (2) - Editor. *Dipterists Digest* (second series) **6**: 112-113.
- Chandler, P.J. 2000a. Corrections and changes to the Diptera Checklist (3) - Editor. *Dipterists Digest* (second series) **7**: 50-52.
- Chandler, P.J. 2000b. Corrections and changes to the Diptera Checklist (4) - Editor. *Dipterists Digest* (second series) **7**: 81-82.
- Chandler, P.J. 2001a. Corrections and changes to the Diptera Checklist (5) - Editor. *Dipterists Digest* (second series) **8**: 67-70.
- Chandler, P.J. 2001b. Corrections and changes to the Diptera Checklist (6) - Editor. *Dipterists Digest* (second series) **8**: 126-127.
- Chandler, P.J. 2002a. Corrections and changes to the Diptera Checklist (7) - Editor. *Dipterists Digest* (second series) **9**: 84-86.
- Chandler, P.J. 2002b. Corrections and changes to the Diptera Checklist (8) - Editor. *Dipterists Digest* (second series) **9**: 150-152.
- \*Colyer, C.N. & Hammond, C.O. 1968. *Flies of the British Isles*. Warne, London. (Second edition). *Although now out of print, this inspirational and well-illustrated book (with beautiful colour paintings of representative species by Cyril Hammond) remains the best general introduction to the British fly fauna. It contains keys to families and references to many species identification works published up to the mid-1960s. The first edition, published in 1951, has superior colour printing. Available second-hand, prices about £30-50.*
- Erzinçioğlu, Z. 1996. *Blowflies*. Naturalists' Handbooks **23**. Richmond Publishing Co. Ltd., Richmond. *Good introduction to the biology of blowflies.*
- Ferrar, P. 1987. A guide to the breeding habits and immature stages of Diptera Cyclorrhapha. *Entomograph* **8**: (1 text) 1-478; (2 figures) 479-907. *Comprehensive guide to the biology and early stages of Diptera Cyclorrhapha. Expensive to purchase.*

- Gauld, I. & Bolton, B. 1988. *The Hymenoptera*. Oxford University Press, Oxford. *An excellent introduction to the Hymenoptera, with much information on techniques and many useful references.*
- Gilbert, F. 1993. *Hoverflies*. Naturalists' Handbooks 5. (Second edition). Richmond Publishing Co. Ltd., Richmond. *Good introduction to the biology of hoverflies.*
- Griffiths, G.C.D. 1972. *The phylogenetic classification of Diptera Cyclorrhapha*. Dr W. Junk, The Hague. *Detailed account of the phylogeny of these flies.*
- Lindner, F. (Ed.) *Die Fliegen der palaearktischen Region*. Schweizerbart, Stuttgart. *The standard reference to identifying Palaearctic Diptera, references to selected families are included under each author in the identification references (p. 73 onwards). Expensive and many parts are now old and out of date (in German).*
- McAlpine, J.F., Peterson, B.V., Shewell, G.E., Teskey, H.J., Vockeroth, J.R. & Wood, D.M. (Eds) 1981. *Manual of Nearctic Diptera*. Volume 1, Agriculture Canada Monograph no. 27: 1-674. *Introduction to Diptera and keys to families.*
- McAlpine, J.F., Peterson, B.V., Shewell, G.E., Teskey, H.J., Vockeroth, J.R. & Wood, D.M. (Eds) 1987. *Manual of Nearctic Diptera*. Volume 2, Agriculture Canada Monograph no. 28: 675-1332. *Keys to families.*
- McAlpine, J.F., & Wood, D.M. (Eds) 1989. *Manual of Nearctic Diptera*. Volume 3, Agriculture Canada Monograph no. 32: 1333-1581. *Phylogeny and classification of Diptera.*
- Noyes, J.S. 1982. Collecting and preserving chalcid wasps (Hymenoptera, Chalcidoidea). *Journal of Natural History* 16: 315-334. *Describes the best techniques for working with these parasitoids including point-mounting.*
- Oldroyd, H. 1964. *The natural history of flies*. Weidenfeld & Nicholson, London. *A survey of the biology of the Diptera and a good general introduction to the order.*
- \*Oldroyd, H. 1970. Diptera I. Introduction and key to families. (Third edition). *Handbooks for the identification of British insects* 9(1): 1-104. *Keys to British families, not including recent changes.*
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### **Identification references**

The major identification references are listed here in alphabetical order by authors. The number against each reference is cited in Table 1 (p. 65) where the information about each family is listed. Comments are given about each reference *in italics* to give an indication of their contents. A few references to the biology of certain families are also included, together with published distribution atlases. Not all the references adding individual species to the British list prior to the publication of the latest checklist by Chandler (1998a) are included; this checklist should be consulted for additional identification and other useful references for many families.

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