

Hand lenses and microscopes

In this edition of *Beginner's Corner*, Sharon presents the first part of a discussion about the optical equipment required to study bryophytes.



All photos I. Atherton

The use of optical equipment is essential to help bryologists to clearly see their subjects and thus identify them with confidence, but inappropriate or poor-quality items can be a hindrance rather than a help. In the first part of this article I'll look at some of the important factors to consider when choosing a hand lens and dissecting microscope. In the next edition (in *Field Bryology* 107), high-power microscopes and some basic microscope techniques will be considered.

HAND LENSES

Your hand lens will be one of your most important bits of equipment in the field and for such a simple item there is a bewildering choice available. Key factors to consider when buying include:

▷ **Magnification.** You will need a x20 lens to see most characters in the field. x30 lenses are also available, but are only really useful in conditions of strong daylight as they transmit less light. Avoid dual hand lenses where two different lenses are mounted in one unit – the higher magnification lens is invariably too small to be much use. Aim for a lens where the optics are at least 15 mm in diameter.

▷ **Optical quality and build.** Glass lenses give a clearer image than plastic ones and are not easily scratched, although they usually cost a bit more. Some lenses can also be taken apart for cleaning though do remember to tighten them securely afterwards!

▷ **Ancillary lighting.** Recently, a number of lenses have become available which have integral LED lighting. These can be really useful when looking at bryophytes in the darker months of the year



and in places where ambient light levels are naturally low, such as in woodlands, steep-sided valleys and under overhanging rock faces. I now carry one of these (x15) and my ordinary x20 lens for most bryophyte surveys.

Tip: Carry your hand lens around your neck or you will probably lose it at some point. I use 1.5 mm strong cord sold by my local camping shop, threaded through the ring provided on the body of my x20 lens.

DISSECTING MICROSCOPES

When I go through my moss packets after a survey, I use my dissecting microscope side-by-side with a compound (high-power) microscope.

The dissecting (low-power) microscope fulfils two main functions. First, it's essential for preparing collected specimens for examination at high power. Use this microscope to see what you are doing when you pull off leaves, cut cross-sections of stems, crush capsules to extract spores and mount tissue on slides.

Second, a dissecting microscope can offer numerous short-cuts to identification, especially once you have become familiar with the character-

istics of certain genera. Some examples of the many possible applications include:

- ▷ confirming whether leafy liverwort leaves are succubously, incubously or transversely inserted;
- ▷ searching for bulbils or other gemmae in, e.g. *Pohlia*, *Bryum*, *Syntrichia*;
- ▷ determining whether leaves are recurved, incurved or plane;
- ▷ examining reproductive structures in thalloid liverworts and hornworts;
- ▷ looking at capsule shape and orientation.

Numerous dissecting microscopes are available and the choice can be confusing. If you have never used one before, it may be best to get hold of a cheap model to cut your teeth on, or to try other people's microscopes before you invest a lot of money in your own. Some manufacturers, e.g. Brunel Microscopes, offer free 'try before you buy' demonstrations and a visit to their facilities can definitely be time well spent.

There is also a flourishing second-hand market but clearly additional risks are attached to used microscopes.

As with most things in life, you tend to get what you pay for, so if you feel confident about your requirements, buy the best you can afford.

Key considerations when purchasing any dissecting microscope include:

- ▷ **Monocular or binocular.** Monocular microscopes are cheaper, but can strain the eyes, especially if you are likely to spend a lot of time looking at specimens or if you wear glasses. If you can afford it, consider binocular eyepieces as they are far more comfortable. More advanced microscopes often come with an additional lens where cameras can be attached for photomicrography (trinocular).
- ▷ **Choice of magnification.** It is a good idea to have two or three different magnifications in one microscope. Often the eyepiece will be x10, with a rotating objective offering x1 and x3 (or similar), giving a choice of overall magnification of x10 and x30. Further refinement can be provided for some microscopes by screwing macro lenses, e.g. x1.5, into the objective to offer up to x45. Some microscopes also offer zoom magnification, which can be very useful. Remember that there is an inverse relationship between magnification and transmitted light, so the lowest magnification levels usually provide the greatest optical clarity. I find that x10–x30 magnification suffices for the majority of my dissecting and preparation activities.
- ▷ **Optical quality.** Cheap microscopes frequently use inferior lenses. Buy the best you can afford and try to get a microscope that uses quality lenses from a respectable manufacturer.
- ▷ **Illumination.** Together with the quality of the optics, this is the most important factor to consider when buying a dissecting microscope. You will need strong, directional light to illuminate your specimens. Incident light illuminates the specimen from above and is great for looking at surface features and preparing slides. Transmitted light is emitted from a light source directly below the specimen, and it can be useful in highlighting different features, e.g. papillae on setae. I would recommend both. Modern microscopes generally have integrated mains-powered illumination (though spare bulbs can be



expensive, so treat them well!). Older dissecting microscopes frequently rely on ancillary lights, which you may or may not like. Again, if in doubt, be sure to try before you buy.

- ▷ **Portability.** If you want to take your microscope with you, as I do, when I go on holiday or for surveys, then it may be worth getting a model with a proper carrying case. The case will protect the microscope in transit and will go a long way to ensuring a long life for your equipment.

Tip: Protect your optics from dust and dirt by covering your microscope when it is not in use with a cover. Most modern microscopes come with this as a standard accessory. Clean lenses from time to time using a soft, lint-free cloth. I use spectacle-cleaning cloths, which can be purchased from any opticians for a few pounds and which will last for many years.