

## ENTOMOLOGICAL ILLUSTRATING

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Gordon Floyd Ferris, in his work "The Principles of Systematic Entomology," says: "The segregation of species and their minor divisions is the first step in all systematic work. The second step in systematic work is the recording of the data obtained in the course of the first in order to make possible its future use for the purposes of identification. In order to obtain a fixed basis, a fixed datum plane, it is necessary that all the data be recorded, and that a technique be developed which will make this possible."

There are two media commonly employed for the recording of data. One is the printed word; the other is graphic illustration, that is, a picture, and it is here contended that all data cannot be recorded without recourse to graphic illustration. Because of the ever-accelerating rate of production of publications by national, state and provincial governments, the tendency has been to avoid illustrations in the interest of economy. This, in our humble opinion, is a mistake. It is infinitely more desirable to issue one well-illustrated publication than to issue two not illustrated. With that end in view, this paper deals with the technique of graphically presenting entomological data, or entomological drafting as Ferris terms it.

The object of all scientific illustrating is to present facts in the clearest and simplest way. Recourse to any technique which will attain this end is permissible and art for art's sake has no place in this scheme. It might surprise you to learn that almost anyone can make an acceptable scientific drawing with a little practice. Let us now turn to the actual technique.

The first consideration is the type of illustration which will show what is required to the best advantage. Will a simple line drawing, a shaded line drawing, a wash drawing, a charcoal drawing or some combination of those be the best? If you simply wish to show the outline of anything, a plain line drawing is sufficient and any amount of shading will not add to the value one whit. If, on the other hand, it is necessary to show conformation within the outline, some form of shading must be resorted to. The rule to follow is to use the simplest type of drawing that will show what you wish to show. Don't let the starkness or the plainness of it trick you into adding anything more.

The second consideration is the material you are going to use in making the illustration. It would obviously be foolish to make a pen drawing on charcoal paper. Suit the material to the type of drawing and use the best quality obtainable. The following materials are recommended:

1. For plain pen and ink work there is nothing better than Reynolds's Bristol Board. Smooth flowing and uniform lines can be made upon it.

2. For wash drawings use any good quality illustration board. It is very difficult to make wash drawings on ordinary drawing or water-colour paper. Illustration board does not warp when wet and the shading goes on very evenly.

3. For charcoal drawings use any good charcoal paper and spray with fixative in order to make them permanent.

4. Use only black waterproof ink, Higgins' preferred. Never use pencil for the finished drawing; the lines will not reproduce satisfactorily. There is a reproducing pencil on the market but it is advisable to "stick to ink."

5. Three brushes—coarse, medium, and fine, should be sufficient for wash drawings.

6. For washes, use lamp black or Chinese black. The former gives a softer tone, the latter a more metallic, hard effect. It is better to buy the separate cakes.

7. The pen to use for line work is largely a matter of individual choice. If the drawing is very large, but to be greatly reduced in the publication, a good ball point nib which will make a uniformly heavy line is recommended. For most work an ordinary pen nib of the stiffer type is quite satisfactory. For very fine, continuous lines there is nothing better than Gillott's crow quill, although some of the Japanese do marvellous work of this kind with a brush. A brush is recommended for hairs and slender spines. A pen does not taper hairs properly.

In the actual process of making a drawing, the first question is "how large should it be?" One answer is that it can be as large as you wish to make it even up to several feet high because it can always be reduced to fit the published page. A reproduction of at least one-half should always be anticipated in reproducing any drawing. Reducing smooths out minute irregularities in lines caused by breathing, heart beat, or unsteadiness of hand.

In planning for the reproduction keep in mind the average size of the page of current entomological publications and make your drawings so that they will be well spaced and in good proportion to this average page, which is roughly 7 by 10 inches.

In general there are three ways to obtain proportion in entomological drawings. There is first, the camera lucida, which is good for small objects or slide mounts capable of being viewed through the compound microscope. The other two methods involve the use of a grid micrometer disc inserted in one of the microscope oculars.

An object viewed through such an ocular, is divided into small squares by the grid on the micrometer disc. The same number of

squares may be drawn with suitable enlargement on the plate. Then, wherever a line of the object passes through a square of the grid on the micrometer disc, a similar line can be drawn through the corresponding square on the plate, thus obtaining the proper proportion.

Another method is to find out by calibration with a micrometer slide, what portion of a millimeter each of the divisions of the micrometer disc represents. Then accurate measurement can be taken, multiplied by the proper enlargement factor and drawn free-hand on the plate. This method has many advantages over others but involves a great many measurements in drawing a single figure.

In conclusion I should like to repeat that almost anyone can make an acceptable scientific drawing of an insect or part of an insect if the following simple rules are observed.

1. Use the simplest type of drawing which will show what you wish to show.
2. Use the materials best suited to the particular type of drawing and use only the best quality.
3. Never trust your eye to give you the proper proportion. Always measure everything with some accurate measuring device.
4. Make your lines with a steady and continuous motion of the pen, using the same pressure throughout. That is all there is to it.

For a more complete discussion of entomological drafting see Ferris, 1928, *The Principles of Systematic Entomology*, Stanford University Publications, Univ. Series Biol. Sci. V (3) 176-199.