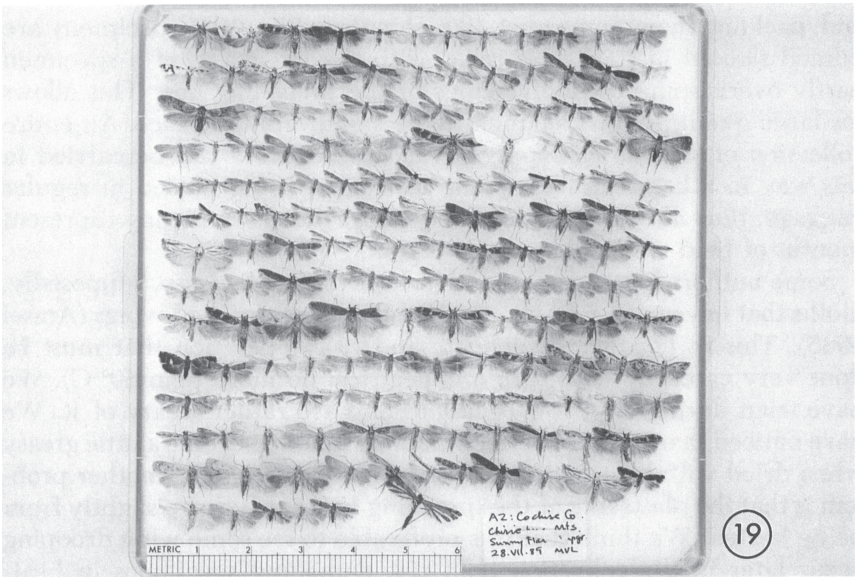


FIG. 19. Example of packed spreading box in which previously set and dry specimens are overlapped like shingles to conserve space. This 11 × 11 cm box contains 166 specimens.

practice, specimens can be set quite closely behind one another into the grooves to conserve space (Figs. 17–18).

Stunning prior to spreading is sometimes used, instead of killing, when time is short (Sokoloff 1980). If specimens are only anesthetized (stunned) prior to spreading, it is necessary to pin a small cotton swab imbibed with ammonia into the spreading box and close it for about 15–20 minutes to kill the moths. If the spreading box is made of polystyrene-base plastic, avoid ethyl acetate because it will dissolve the plastic. We do not use the stunning method because we find it inconvenient, especially in the field.

Label the specimens as usual and leave them in the spreading boxes in a dry place for at least two weeks, or preferably for as long as possible. If one does not provide enough time for the specimens to dry, the tips of some wings may curl up or droop. In humid regions, it is advisable to secure a few crystals of 4-chloro-m-cresol in the boxes to prevent molding. Once the moths are dry, full boxes should be sealed tightly with tape until ready for staging.

When in the field for an extended time and spreading boxes are in short supply, or to reduce the number of boxes being transported, space can be saved by removing specimens from the grooves after drying

and packing them somewhat like shingles (Fig. 19). Specimens are pinned slanted in transverse rows, with the left wings of a specimen partly overlapping the right wings of the preceding one. This allows for large quantities of specimens to be stored in little space. An entire collection of several thousands of microlepidoptera can be carried in this way in a handbag on a plane instead of being placed in regular baggage, thus maximizing the safety of specimens that may represent months of field work in a remote region.

Some authors have recommended heat-drying because, supposedly, moths that have been heat-dried will never have drooped wings (Amsel 1935). This is, however, a delicate and risky operation that must be done very carefully with *very low* heat (ca. no more than 40° C). We have tried drying on a few occasions and are rather weary of it. We have noticed that several microlepidoptera tend to become a little greasy when dried with heat (noticeable under magnification). Another problem is that the plastazote of the spreading boxes may warp slightly from being heated. We think that it is preferable to see some wing drooping occur later in the collection than risk damaging specimens in heat-drying. Wing drooping will be minimized or virtually eliminated if specimens are allowed to remain set in the spreading boxes for an extended period.

STAGING

To be placed in collections, dry minuten-pinned microlepidoptera must be mounted individually on small rectangular blocks, which are inserted on standard (# 3 or 4) insect pins. This is referred to as staging or double-mounting. Specimens should always be mounted *singly* on a block, complete with all necessary labels on the supporting pin, except perhaps in cases of mated pairs which may be staged together. It is very annoying to find two or more microlepidoptera belonging to different but superficially similar species that have been staged together with a single label; such specimens have to be remounted separately and new labels produced. Multiple mounts also increase the risk of misassociation of subsequently made genitalia slides.

Staging blocks. It is more efficient to prepare large quantities of blocks in advance. Traditionally, blocks have been cut from strips of polypore fungi (especially from birch bracket fungus). Normally it is easy to procure polypore strips from naturalist supply houses, but periodically they tend to become very difficult to obtain.

Plastazote provides a superior substitute. It is comparatively inexpensive, available in practically infinite supply, extremely regular in density, practically unalterable, and pest proof (we once had a supply of polypore strips heavily infested with ciid beetles). Plastazote allows

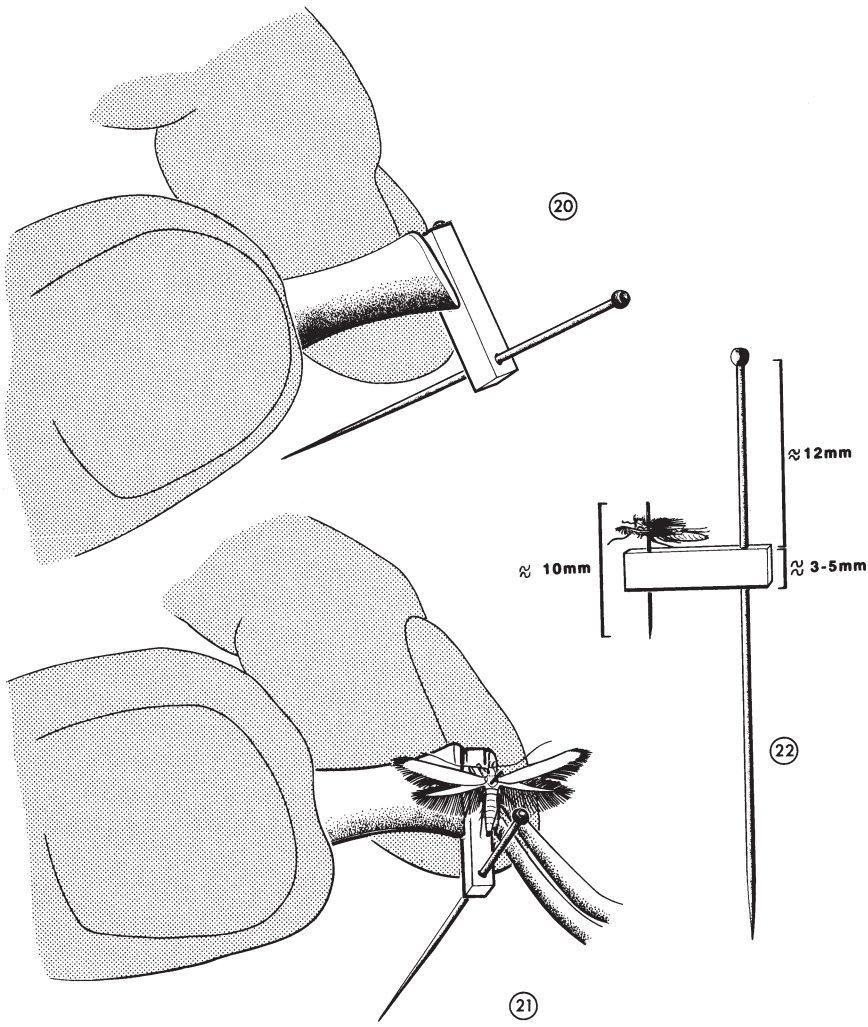
the finest minutens to be inserted without effort and provides remarkable protection from shocks and vibrations. Other materials such as balsa, cork, and polystyrene-based foam ("styrofoam") should be avoided because they are either too hard to insert the minuten without risking damage or are not rubbery enough to hold firmly the pin and the minuten (the latter is a problem of balsa and polystyrene-based foams, on which minutens frequently become loose). Blocks made of a silicon rubber compound are used by some but their durability is uncertain in insect drawers where they may be affected by fumigants; we have seen a set of such blocks that were about 15 years old and that exuded a greasy substance which seeped up the minutens and coated the specimens. It is also harder to insert a minuten into silicon rubber, which is a springy material.

The length of the blocks varies with the size of the specimens. Ideally, we think that they should be about as long as the length of the moth from its head to the tip of its abdomen plus about 3 mm to provide space for the legs and the supporting pin. The width and height vary little and are from 2–3 mm (width) and from 2–4 mm (height). We recommend the use of as few sizes of blocks as necessary to maintain some uniformity to the collection. A cutting board with preset guides and mounted razor blade can be made to speed the cutting of large numbers of uniformly sized blocks. It is essential to mount the blocks on standard pins *prior* to double-mounting the moths. Staging blocks must be inserted up to a height that will leave adequate clearance between the specimen and the head of the supporting pin to allow for safe handling of the whole mount (Fig. 22); we recommend at least a 1 cm clearance.

Staging procedure (Figs. 20–21). To facilitate staging, use one pair of forceps with curved tips and another with broad, flattened tips.

With the flat-tip forceps, hold the pinned block in front of you. With the curved forceps, take the specimen by holding the minuten from beneath the specimen and insert slightly into the block. Check that the plane of the wings is perpendicular with the axis of the pin and adjust the inclination if necessary. Still grasping the minuten from beneath the specimen, pull it down into the block to the point where the venter of the moth is about 1 mm from the surface of the block.

Holding the minuten from beneath the specimen for insertion is especially critical if one is using polypore blocks. Polypore blocks vary markedly in hardness and pushing the minuten down while grasping it from above the specimen may cause the minuten to bend or spring, usually resulting in damage to the moth. Using plastazote blocks generally obviates this danger but grasping the minuten below the moth reduces the risk of damage in case of slippage of the forceps.



FIGS. 20–22. Staging or double-mounting. **20,** Holding with flat-tipped forceps a staging block mounted on a standard pin; **21,** Inserting the specimen on the stage, clasping the minuten from below the specimen; **22,** Staged specimen, showing good heights for safe subsequent handling.

It is important to insert the minuten as far down as possible, while not touching the stage, in order to secure the specimen (Fig. 22). Specimens protruding high on the block risk getting damaged in subsequent handling as much as those with overly long minutens jutting high above the body.

FINAL REMARKS

The techniques described above may seem laborious, but what takes many words to explain is actually executed in just a few seconds. With some practice, one can easily pin and set up to 30–40 microlepidoptera of fine quality per hour.

If there is no time or desire to fully spread all the moths that are collected, one may at least spread the wings partly and brush the fringes. Provisional spreading (Amsel 1935, Zimmerman 1978: pp. 48-ff, Nielsen 1980, Mikkola 1986), with subsequent relaxation and spreading if necessary or desired, is a good compromise where time is short such as during expeditions aiming at sampling as many specimens as possible. Damaged or rubbed specimens that may be worth collecting for some reason may be partially spread to save time.

Generally we do not use light traps and prefer to collect microlepidoptera at light on a sheet. Although light traps afford several advantages in sampling and are often necessary for surveys, we find that one is easily overwhelmed by the abundance of specimens so obtained, that a significant amount of time is necessary to sort the microlepidoptera from other Lepidoptera and insects, and that most specimens sustain a certain amount of rubbing and damage. If there is no time to relax and set trap-collected specimens right away, they should be placed on slightly damp cotton in tight containers and kept in a freezer.

Methods that involve killing the specimens immediately upon capturing them (as in light traps) and storing them for an indeterminate period of time (e.g. by freezing), generally necessitate some period of relaxation in a humid chamber before proper setting can be performed. Such specimens are usually not quite as easy to spread as freshly killed specimens and are not ideal for the point-setting technique described above, although satisfactory results can be obtained with adequate relaxation and using the paper-strip technique. Specimens that have dried unspread usually cannot be subsequently relaxed and spread. Some lepidopterists who have tried our technique complained that it was not quite as easy as we told them but, when pressed for details of how they proceeded, most conceded that they had killed their specimens upon collecting and spread them a little later without relaxation. We reiterate that working from fresh, live specimens killed just before setting is central to the ease and rapidity with which microlepidoptera can be set with the technique described here, and to obtaining high-quality specimens. Of course, some experience is necessary to achieve the best results; one is unlikely to obtain perfect microlepidoptera after attempting to set only a dozen specimens.

It is a truism that fine, well-prepared specimens are easier to identify.

This is particularly true for microlepidoptera, whose small size puts them at a disadvantage over the larger Lepidoptera when it comes to studying them (incidentally, lepidopterists facing space limitations to house their collection of macros should seriously consider taking up the collection of microlepidoptera!). Many well prepared microlepidoptera can be recognized at a glance. On the other hand, rubbed, damaged, or badly mounted specimens may be quite difficult to recognize, even to family, particularly if they are unspread.

Unavoidably, processing microlepidoptera soon after their collecting will take more time and seem more laborious than for larger Lepidoptera that are simply papered or pinned for subsequent setting. It can be argued, however, that the time involved strictly in spreading microlepidoptera is no more than for spreading macros; in fact spreading microlepidoptera is faster. The main difference is that one should do it right at the time of collecting for best results. The resulting quality of the specimens makes it well worth the effort.

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