Feather-tipped Forceps: A method for handling fragile organisms

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ABSTRACT

Feather-tipped forceps are useful for transferring fragile objects. We have found feather-tipped forceps to practically eliminate specimen breakage and generally facilitate the handling of diverse structures such as nematode cysts and floral anthers. Feather tips allow for complete compression of the forceps eliminating the partial closure of forceps that is necessary when standard forceps are used to handle fragile objects. Partial closure of standard forceps can cause accidental release when too little pressure is applied, and destruction when too much pressure is applied. It is likely that feather-tipped forceps would be useful in diverse subdisciplines of biology wherever fragile parts of organisms are handled. We present the steps necessary for assembly of feather-tipped forceps because they are apparently not commercially available. Published on-line www.phytologia.org *Phytologia 100(3): 1-5 (Sep 21,, 2018).* ISSN 030319430.

KEY WORDS: anther, feather-tipped forceps, nematode cyst, transferring

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Feather-tipped forceps (Figures 1 & 2) are useful for transferring small, fragile living or formerly living organisms or parts of organisms. Feather-tipped forceps are used in entomology for transferring bed bugs (Pfiester et al. 2008; Pereira et al. 2009; Lehnert et al. 2011) but neither a vendor nor instructions for construction are mentioned by these authors. Feather-tipped forceps are apparently not widely used in biology due to lack of awareness and / or lack of commercial availability. We wish to convey the utility of feather-tipped forceps for handling fragile structures, and present the steps necessary for assembly.

MATERIALS AND METHODS

How to make feather-tipped forceps. One of us (M.C.S.) modified off-the-shelf forceps by grinding the tips on a standard grinding wheel until the tip was blunt, but also began assembly with other stock models of forceps having blunt tips. The first cut in the feather was parallel to the rachis, near the midlength, and was about 8 mm long (Figure 1A). This section of vane, when removed, was ready to be fixed to the jaws of the forceps (Figure 1B). E6000® craft adhesive (available at stores such as Hobby Lobby, Michaels, WalMart, etc.) was applied to the inside of the forceps jaws one at a time (Figure 1C). Segments of feather 2 cm long by several mm wide were glued to the inner face of the jaws (distal ends) of forceps, one to each jaw, orienting the feather parallel to the length of the forceps (Figures 1D & E). The jaws of the forceps were then clamped together with a small binder clip until the glue dried, and then the clamp was removed. The feathers were easily trimmed longitudinally, starting at the end of the feather that was glued to the forceps. We then compressed the forceps and cut both feathers at the same time making the tips even (Figure 1F). After trimming, the portion of the feather that came in contact with the specimen (the working face) was 6 to 12 mm long beyond the forceps. Somewhat larger or smaller working faces may be necessary for other applications. In practice, either glue or tape was used to bind the feather segments to the metal, with tape allowing easier replacement of feathers when they became frayed over time.

Feathers found on the ground, likely those of a wild turkey (*Meleagris gallopavo*), were used but it is likely that stiff feathers of other species would be suitable. It is illegal for anyone to take, possess, import, export, transport, purchase, barter or offer for sale, any migratory bird or its parts (U.S. Fish &

Wildlife Service). However, the feathers of domesticated species are readily available for purchase online. Tail or wing feathers (rectrices or remiges) of large domesticated birds (e.g., poultry, ducks) are stiffer than feathers from other parts of the body or smaller birds, and would likely be useful (S. L. Halkin, personal communication).

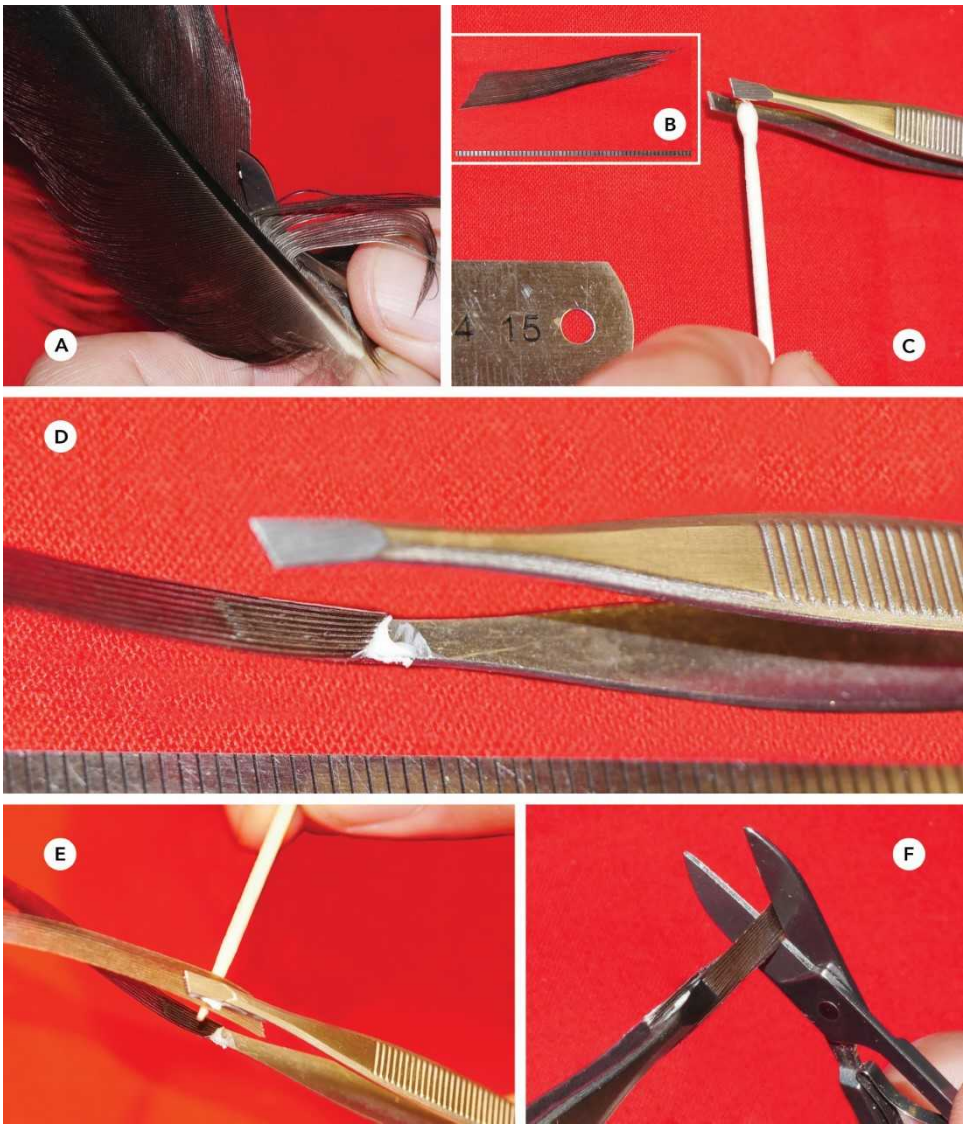

Figure 1. A–Feather was cut parallel to the rachis. B–Feather segment removed from the feather shown in A, units are mm. C–Glue was applied to jaws of forceps one side at a time, smallest units are mm. D–Feather was glued to one jaw of the forceps, units are mm. E–Feather was glued to the second jaw of the forceps. F–Forceps were compressed to cut both feathers at the same time, making the tips even. Photos by T. M.

RESULTS AND DISCUSSION

One challenge commonly encountered in biology is transferring small, fragile organisms without breaking or piercing the organism. In the past we transferred small organisms, or parts of organisms, by manually closing forceps with sufficient pressure to grasp the structure. The drawback of this method, of course, is that insufficient pressure results in accidental release and too much pressure results in

destruction of the structure. Featherweight forceps allow improved handling of fragile organisms over standard forceps but lack feather tips and consequently one can crush fragile structures (featherweight forceps are available from BioQuip.com, among other vendors). In contrast, the use of feathers at the tips allows for complete compression of the forceps without crushing organisms. Feather-tipped forceps (Figure 2A), a modification of standard forceps, are inexpensive to produce, easy to use, and can be customized to meet specific requirements.

Pollen counts, the number of pollen grains produced by each flower, are useful in a variety of plant reproductive biology studies (Mione & Anderson 1992; Kearns & Inouye 1993; Mione et al. 2016; Mione et al. 2017). To estimate pollen production, anthers (prior to dehiscence) are softened in 1 N HCl (Anderson & Symon 1989). After softening but before immersion in the final solution in which pollen is counted, there is the real possibility that handling the anthers with standard forceps will result in breakage, releasing pollen, leading to an underestimate of pollen production. One of us (T.M.) found feather-tipped forceps to be remarkably useful for transferring anthers (Figure 2B) both prior to softening and after the anthers are softened and consequently are most fragile.

Desiccated leaf fragments are hard yet fragile and must be handled for extraction of nucleic acids, and feather-tipped forceps allows leaf fragments to be handled with minimal breakage.

In nematode biology it is standard procedure to screen (sieve) soil for nematodes (Boeri & Chung 2012). The remaining organic matter along with the cysts is sorted and nematodes are collected. Khan (2008) presents a detailed chapter describing methods of nematode sampling, storage, extraction from soil and extraction from plant tissue. He describes transferring individual nematodes with a “fine steel needle, bamboo splinter, eyebrow, eyelash hair or horse tail hair,” but does not describe how to transfer small numbers of cysts to a vial. One of us (M.C.S.) found that feather-tip forceps in conjunction with a small

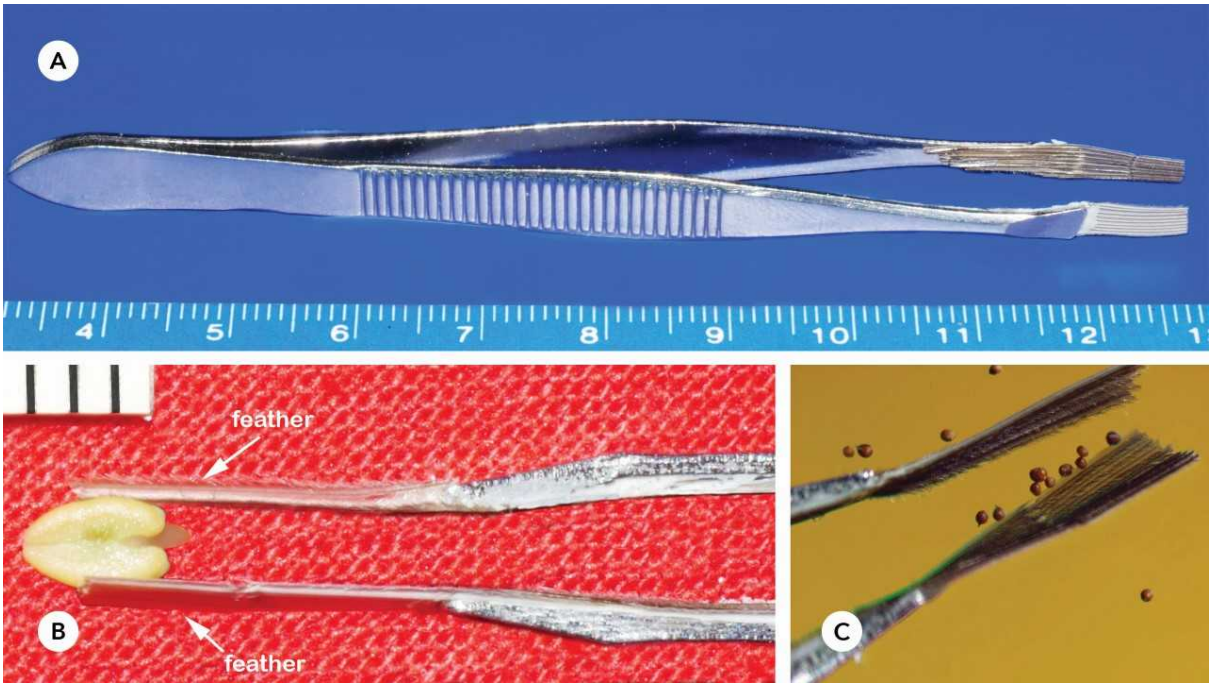

Figure 2. A–Feather tips (at right) were glued to stock forceps, numbered units are cm. B–Feather-tipped forceps holding anther, units in upper left are mm. C–Nematode cysts being transferred by feather-tipped forceps. Photos by M. C. S. & T. M.

spatula can be used to sift through organic matter under a microscope putting the cysts to one side of the dish. The feather tips can be used to sweep the cysts (Figure 2C) into a manageable pile. Feather-tip forceps, with the jaws decompressed, were held at about 45 degrees to the dish. With the feather tip tight

to the dish the tips were completely compressed around the cysts. The feather tips did not harm the cysts. Once the cysts had been separated from the organic matter they were easily transferred into a vial by inserting the tips of the compressed forceps into the mouth of the vial and releasing pressure on the hinge. A gradual wipe against the rim (mouth) of the vial dislodged any cysts stuck to the feathers. When several cysts were to be transferred feather-tipped forceps were better than standard forceps because one can transfer multiple cysts with one sweeping motion and one compression of the forceps (Figure 2C).

CONCLUSIONS

Feather-tipped forceps are useful for handling delicate specimens because they eliminate the need to keep a constant pressure on the forceps. Feather segments were added to the tips of stock forceps (Figures 1 & 2). With this modification sorting and collecting nematode cysts under a dissecting microscope is efficient, simple, and safer for the cysts relative to use of traditional forceps. Feather-tipped forceps allowed transfer of anthers of flowering plants without puncture and allowed transfer of leaf fragments (that had been desiccated for later extraction of nucleic acids) without further fragmentation.

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