AN IMPROVED SEMI-MICRO MANIPULATOR FOR PRECISE INJECTION INTO MOSQUITO LARVAE[1]

M. R. SARDELIS, D. W. MISCH[2] AND L. R. BOOBAR

U.S. Army Biomedical Research and Development Laboratory, Fort Detrick, Frederick. MD 21701–5010

A semi-micro manipulator for injection of test substances into the intestinal lumen of mosquito larvae via oral or anal openings was described by Misch and Anderson (1986) and used to evaluate the toxicity of spore preparations of *Bacillus thuringiensis* var. *israelensis* (Misch et al. 1987). Accurate delivery of a substance without damage to larvae is possible; however, the procedure generally requires a proficient technician with a great deal of experience. Through our experience with the semi-micro manipulator, two design efficiencies were noted. First, the

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[2] Department of Biology, University of North Carolina, Chapel Hill, NC 27599–3280.

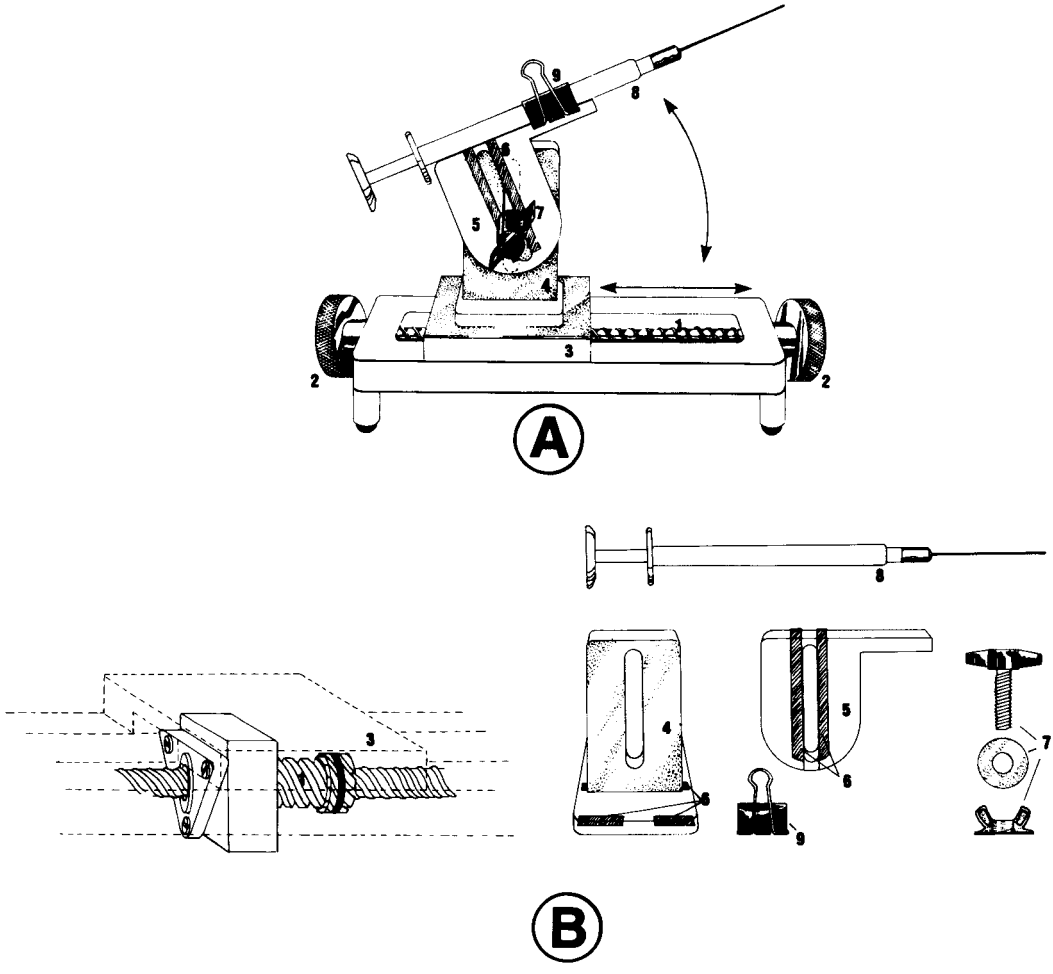

Fig. 1. Improved semi-micro manipulator. a) Assembled, and b) cutaway view of base and disassembled pedestal. 1) helical screw, 2) control knobs, 3) sliding plate with galvanized steel plate, 4) pedestal base with galvanized steel plate, 5) pointer, 6) magnetic strips, 7) lockscrew, washer and nut, 8) microinjection apparatus, and 9) spring clamp.

apparatus lacked a stable base for lateral movement of pointer, making guidance and alignment of the micropipet tip for insertion solely dependent on one's hand. Second, once the micropipet tip was positioned in a larval cavity, unwanted movement or backlash of the tip occurred before injector apparatus could be secured. This paper describes improvements to the semi-micro manipulator that provide for easy alignment and positive securement.

The modified semi-micro manipulator (Fig. 1) consists of a base, an improved pedestal and the microinjection apparatus described by Misch and Anderson (1986). The base is constructed of 17.5-mm thick acrylic (203.2 × 76.2 mm) with four 25.4-mm long legs made from 15.9-mm diameter acrylic rod and neoprene rubber feet. A stainless steel helical screw with an anti-backlash flanged nut (Small Parts, Inc., Miami, FL) is mounted in the base. A sliding 12.7-mm thick acrylic plate (76.2 × 76.2 mm) with a 0.8 mm thick galvanized steel plate is attached to the flanged nut and travels along a 34.9-mm slot in the base. Turning of the helical screw control knobs allows precise movement of the pedestal forward and backward.

The pedestal, as described by Misch and Anderson (1986), is modified to use magnetic attraction rather than vacuum grease to hold the injector in place after positioning. Six magnetic strips (12.7 × 3.2 mm) with adhesive backing (McMaster-Carr Supply Company, New Brunswick, NJ) are attached beneath the pedestal to hold it to the base sliding plate. A 0.8-mm thick galvanized steel plate is glued to the side of the pedestal base, and two magnetic strips (50.8 × 4.8 mm) are attached to the pointer. The use of magnets allows easy movement of the pedestal and pointer during placement of the injector tip and eliminates unwanted movement after release. A lockscrew and nut hold the pointer in place while injecting.

Total cost of the semi-micro manipulator, including labor, was approximately $150.00.

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