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Fast, Accurate Method of Measuring Ant Head Widths

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ABSTRACT A wedge micrometer, constructed from two microscope slides, provides a fast and accurate alternative to an ocular micrometer for measuring the width of ant heads and other similarly shaped objects.

The size of an ant generally affects its metabolism, behavior, and longevity. Consequently, the frequency distribution of worker sizes is a basic aspect of colony energetics, social structure, and population dynamics (Oster and Wilson 1978). Worker size distributions are available for several ant species (Wilson 1953, Wilson 1978, Wilson 1980, Corn 1980); however, these frequency plots are generally based on one or at most a few colonies. Quantitative information concerning the effects of colony size and other factors influencing worker size distributions is not very common (Gray 1971, Herbers 1980, Wood and Tschinkel 1981). One reason for this relative dearth of information is that the size of an ant generally has been determined by measuring its head width under an ocular micrometer. Unfortunately, this method is very tedious, especially when hundreds or thousands of ants must be measured.

A wedge micrometer (Fig. 1) is a narrow, "v"-shaped groove formed between two microscope slides; for many purposes it provides a fast, accurate alternative to an ocular micrometer. An object's size is determined by sliding it down a calibrated groove until it wedges lightly against both walls of the groove. This device is at least 50% faster than an ocular micrometer and does not cause eye fatigue. It is also less subjective and considerably more accurate than simple visual estimation of object size. Furthermore, the accuracy of a wedge micrometer is nearly equivalent to that of an ocular micrometer. Ant head width measurements obtained with a wedge micrometer averaged 0.016 mm less than those obtained with an ocular micrometer (Table 1) perhaps due to a slight compression of the head during measurement, or other sources of error. Additionally, repeated wedge micrometer measurements were more precise; the SDs of random measurement errors averaged ± 0.006 mm for the wedge micrometer as compared with ± 0.010 mm for the ocular micrometer (Table 1).

The wedge technique has been used most extensively with the fire ant, *Solenopsis invicta*, and the harvester ant, *Pogonomyrmex badius*, but a spot check of ants from 15 additional genera indicated that it is generally suitable for most ants with head widths greater than 0.6 mm. The technique works most easily on ant heads $>$ 1.0 mm, but with a tender touch it is quite suitable for smaller ants as well. Larger versions of the wedge micrometer might also prove useful in measuring various body parts of bees, wasps, and other hard-bodied insects.

The wedge micrometer is constructed by gluing two standard microscope slides (75 by 25 by 1 mm) side by side onto a larger plate of glass (epoxy cement works well) so that a small groove of decreasing width remains between them (Fig. 1). This groove is adjusted to the appropriate size range and then taped until the glue hardens. Scotch Brand Magic Transparent Tape (Commercial Tape Division, 3M, St. Paul, Minn.) is placed along either side of the groove to allow application of calibration marks. The width of the groove should be calibrated in increments of 0.1 mm, using either a hand-held micrometer or an ocular micrometer. Special care should be taken with calibration, because the edges of microscope slides are not necessarily perfectly straight. Increments of 0.01 mm can be estimated visually. A second layer of Magic Transparent Tape should be placed over the calibration marks to protect them from abrasion.

Standard microscope slides are suitable for measuring ant head widths from 1.4 to 4.0 mm, but a shallower groove is necessary for smaller ants. Three glass cover slips (no. 1; 60 by 24 mm) glued together are suitable for measuring most head widths from 0.9 to 1.5 mm, whereas two cover slips are usually best for heads $<$ 1 mm in width.

Generally, heads must be detached from the body before being used in the wedge micrometer. With large samples, this is most easily accomplished by gently mashing dried ants with the forefinger and then collecting the detached heads. The heads should be placed face up in the micrometer groove with the mandibles down (Fig. 1) and slid gently down the groove with the forefinger until they wedge lightly between the glass slides; care must be taken to ensure that they do not become twisted in the groove. Over 200 heads can be measured per hour with a tally sheet and a little practice.

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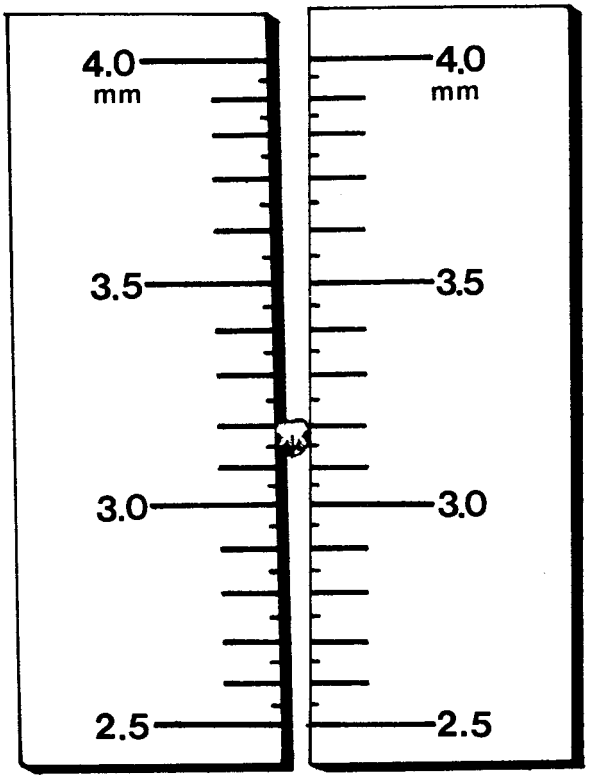

FIG. 1. Wedge micrometer constructed from two microscope slides.

Table 1. Comparison of ant head width measurements made with wedge and ocular micrometers; 15 ants from each of three species were measured three times: first with an ocular micrometer at 60× to the nearest 0.024 mm, and then again with wedge micrometers to the nearest 0.01 mm

Species	Wedge micrometer		Ocular micrometer	
	Mean (mm)	Random measurement error (mm)[a]	Mean (mm)	Random measurement error (mm)[a]
Solenopsis invicta	0.904	±0.005	0.919	±0.010
Pogonomyrmex badius	1.796	±0.007	1.806	±0.010
Formica fusca	1.240	±0.007	1.265	±0.009

[a]SDs of random measurement errors were estimated for the repeated measurements from the mean square error term in one-way analyses of variance.

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