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TAKING DENSITY INSTEAD OF WEIGHT OR VOLUME OF SOIL FOR QUANTIFICATION OF POPULATION OF SOIL ORGANISMS

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A new method for nematode population quantification in which the equivalence of soil volumes based on its density is determined, has been discussed. In this method, first the soil density (d) is determined. This is multiplied by a standard measure (s) to obtain the 'ds'. Thus soil nematode population may be expressed in terms of the number per case-dependent 'ds' instead of fixed volume (cc) or weight (g). This method resolves the problem caused by large differences in soil density in comparing the number of nematodes.

Key words: Nematode population quantification; soil density; nematology methodology.

INTRODUCTION

For the quantification of the populations of soil-dwelling microscopic organisms such as nematodes, some workers use soil mass and count the number of organisms in a specific weight of the soil. Others consider soil volume as a better parameter. Since the weight of soil has less value for comparison of the number of nematodes in different samples, more and more persons working with these organisms tend to use soil volume (cc) for this purpose. Volume too, however, has limitations because it largely depends on soil texture and fabric (soil structure); thus a given mass (weight) of clay soil occupies less volume than the compost amended one, and a soil with big aggregates occupies more volume than the one with smaller aggregates. In order to resolve these discrepancies, we propose another method in which the equivalence of volumes based on densities is taken into consideration.

EXPERIMENTAL

Three soil combinations, viz. (a) sandy loam previously identified by Taylor *et al.* [1] having the composition of sand, silt, and clay in a ratio (w/w) of 69: 21: 10; (b) a + silt in a ratio of 1:1, and (c) a + farmyard manure in a ratio of 1:1 were used. They were dried in an oven for 24 hr and 50 cc of each was taken into a graduated cylinder which was tapped fifteen times on the bench and then the soil was weighed. After noting the weight, 50 g of each of these combinations were taken and the volume was measured in the above manner. This exercise, as would be clear later, was intended to show the discrepancy that prevails when either weight or volume of soil is considered for determining the number of organisms present. After this, particle densities of these three combinations (each cc ml in volume) were calculated and the figures obtained were multiplied by the standard measure (presently 100) of soil in cc used for extraction of nematodes from soil samples. The product thus obtained was named 'ds' in which 'd' stands for density and 's' for the standard measure. Equivalent volumes were calculated by dividing a fixed number (e.g. 100) by the density of the given soil sample.

RESULTS AND DISCUSSION

Weights of 50 cc of the combinations (a), (b) and (c) were found to be 57.75, 61.58, and 44.25 g respectively. When these combinations (each 50 g in weight) were measured, their respective volumes were 44, 39, and 79 cc. Thus it is clear that neither weight nor volume alone can yield a true comparative account of the number of organisms present in the soil samples. It is, therefore, suggested that if the factor of soil compactness is taken into consideration, better results are likely to be obtained. The compactness i.e., densities of these combinations (each 50 cc in volume) were as (a) 1.155, (b) 1.231, and (c) 0.885. When these figures were multiplied by 100, the figures of 116 ds, 123 ds and 89 ds for combinations a, b, and c respectively were obtained. Thus instead of expressing the number of nematodes in a fixed volume (cc), their number would be shown in varying 'ds'. For example, instead of writing 146 *Rotylenchus robustus* per 100 cc of soil, we may write 146 *R. robustus* per 116 ds of soil, or instead of 109 *Meloidogyne incognita* juveniles per 100 cc of soil, we

may write 109 *M. incognita* juveniles per 123 ds of soil for the combination a and b respectively and so on (the number of nematodes given is hypothetical and is intended to make the point). For the sake of uniformity, calibrations may be made earlier and thus in the present situation, we would have to take 87 cc of soil a, 81 cc of b, and 113 cc of c as equivalent volumes, the figures obtained on dividing 100 by the respective densities of the different combinations. Instead of 100, any other convenient figure, 50, 40 or 25 depending on the size of funnel/tray may be taken.

Two principal measures of density are used by soil scientists: (i) bulk density on the basis of volume or space occupied by a specific weight of soil *in situ* in the field, and (ii) particle density which is the actual density of the particulate material of soil. Being rather laborious, the first method cannot be practised as a matter of routine although it may be meaningful for comparing nematode numbers. The method described in the present communication is nearer to the second one and is intended to resolve the problem of large differences in soil density in comparing the number of nematodes.

Measuring the soil provides bulk density and is meaningful in that it includes both solid volume and pores (micropores) where nematodes live. However, it does not take into account the differences caused by soil structure, e.g. aggregates or peds of primary soil particles. The interped spaces (macropores) are larger than the pores. As they do not contain water [2], they are not the habitat of nematodes. But they do affect the bulk density. Thus when soil pores (where nematodes live) are to be considered, it is the soil structure that is more important than the soil texture [3]. Again, large differences in soil density may also occur due to the presence of gravels, or organic matter that is not fully biodegraded. Due to their size, gravels function as separate particles [4]. They do not increase the pore spaces of soil but do affect its bulk density. In such a situation, it is the drawing of volume equivalence that could be helpful.

The method described presently involves only a little of extra effort but would be found useful in comparative studies, population models and data simulation, especially when big differences in density are involved. This communication is intended to initiate a discussion on quantification of soil organisms and may eventuate in providing more rationale to the existing methods.

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