FACTORS AFFECTING THE DISTRIBUTION OF PLANT FEEDING NEMATODES IN KWAZULU-NATAL

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Data from a survey of nematodes associated with sugarcane conducted in South Africa in 1978 (Spaull, 1981) were re-examined in combination with associated soil, climatic and topographic data. The objective was to identify associations between the distribution of the nematodes and soil, climatic and topographic factors in sugarcane fields in KwaZulu-Natal. The procedures used in the survey are summarized as follows. Soil and root samples were collected from 124 fields on a range of soil types in the 11 extension areas of the sugarcane growing regions in KwaZulu-Natal (Figure 1). Nematodes were extracted from the soil and roots, and the numbers of each genus recorded. Soil texture, organic matter content and pH were recorded using conventional methods. Mean annual rainfall, temperature, A-pan evaporation and solar radiation, as well as the altitude of the sites, were obtained from local records. Irrigation water applied to fields was added to the rainfall figures. Distribution and association of the abiotic factors and the nematode genera were studied separately by principal component analysis (PCA) using ADE4 software (Thiolouse *et al*. (1997). PCA values for the data were projected onto the map of the survey area to study spatial distribution. Association between abiotic factors and nematodes was studied using co-inertia analysis.

On the factorial map of the PCA of the abiotic factors temperature, evaporation, soil pH and the fine sand content of the soil for the 124 sites were correlated with the negative values of the first factor and were opposed to altitude and the clay, silt and organic matter content of the soil (Figure 2A). On the F2 axis, % medium sand was correlated with the positive values of this factor and was opposed to evaporation, radiation and % clay and silt. The factorial map describing the nematode data showed numbers of *Helicotylenchus* and *Rotylenchus* to be correlated with the negative values of the first factor and opposed to the numbers of *Pratylenchus* (Fig 3A).

Numbers of *Meloidogyne* were correlated with the negative values of the F2 axis and opposed to the numbers of *Rotylenchulus*. When the F1 values of the PCA of the abiotic and nematode data are projected on a map of the survey area, distinct patterns of distribution are seen (Figures 2B and 3B). Two areas with contrasting abiotic characteristics could be distinguished; one with negative values corresponding to the coastal region north of Durban and including Pongola and the other, with positive values, corresponding to an area comprising the high altitude sites and those on the coast south of Durban. The nematode characteristics could also be subdivided into two areas: one with positive values, corresponding to the entire coastal region plus the irrigated area of Pongola, and the other, with negative values, corresponding to the inland, higher altitude areas.

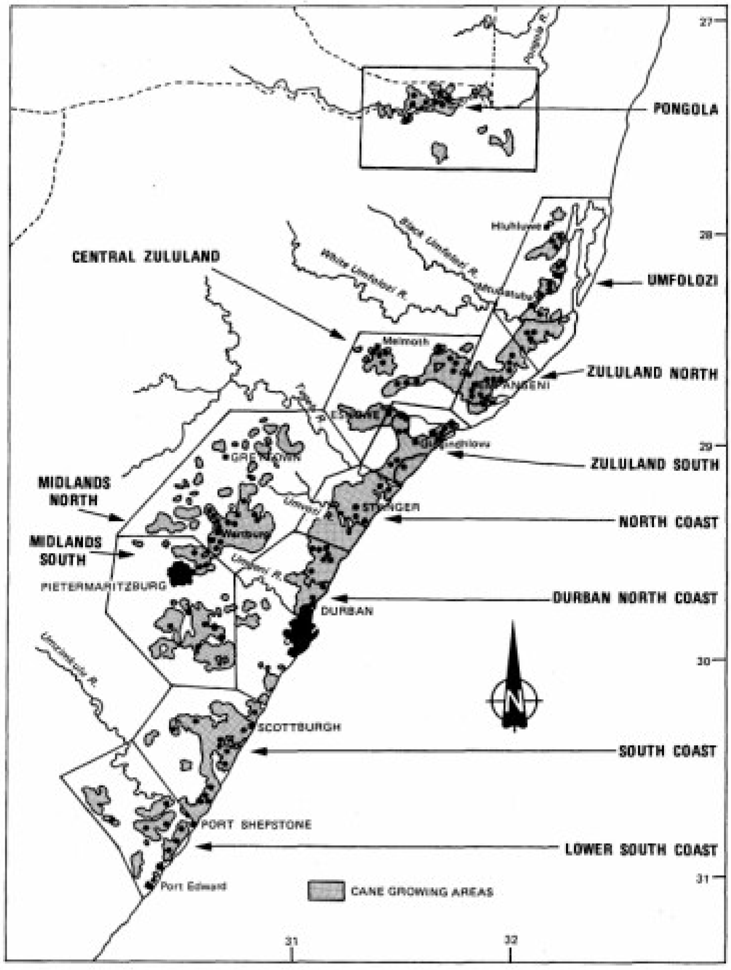

Figure 1. Distribution of sample sites in the 11 extension areas of KwaZulu-Natal.

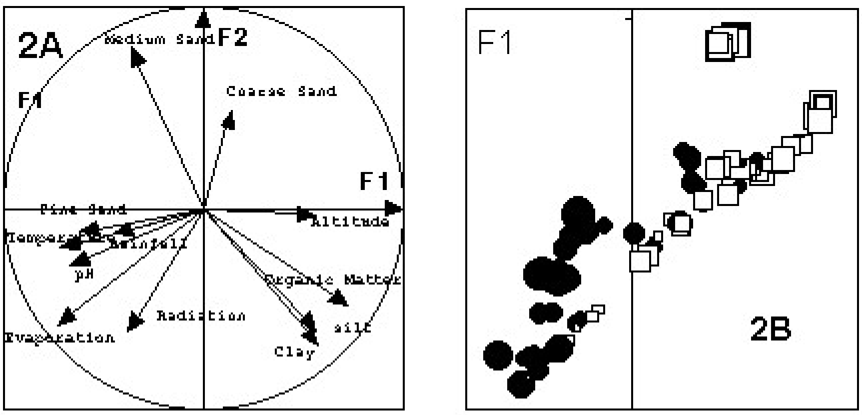

Figure 2A. Factorial plan of the abiotic factors. 2B. First factor values of the PCA of the abiotic characterisics projected on the map of the survey area.

The relationships between the nematodes and abiotic factors were then investigated directly using co-inertia analysis. This showed that the numbers of *Pratylenchus* had a strong positive correlation with temperature and soil pH but a negative correlation with altitude. The reverse was true for *Helicotylenchus* and *Rotylenchus*.

The main interactions identified on the second factor were a negative association between numbers of *Meloidogyne* and % clay and silt, and a positive association with % fine sand. *Rotylenchulus* showed the opposite relationship. The most important determinant abiotic factors were temperature and altitude. Numbers of most of the nematode taxa were associated positively with temperature and negatively with altitude, although in many instances the relationship was not strong. It is perhaps surprising that rainfall did not play a more significant role in determining the distribution of the nematodes. Species of *Meloidogyne*, *Xiphinema* and *Pratylenchus* are particularly important to the South African sugar industry, in that they are widespread and/or highly pathogenic. *Pratylenchus* and *Xiphinema* are inversely associated with altitude and positively associated with temperature. Hence they are likely to be more of a problem along the coast and in the more northern areas. However, this does not mean that the numbers that occur elsewhere in the sugar industry will not cause crop loss. The distribution of *Meloidogyne* depends more on soil type than locality and they are therefore more evenly spread throughout the industry. In the event of the development of ecological methods to control nematodes, attention must be given to the contrasting nematode communities in the sugar industry.

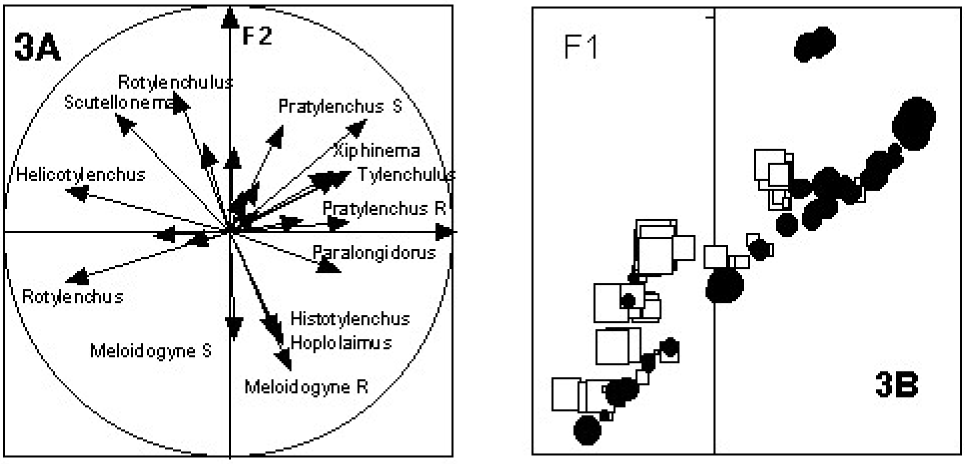

Figure 3A. Factorial plan of the nematode data. Only the genera with stronger correlations with F1 and F2 are indicated. S = soil; R = root. 3B. First factor values of the PCA of the nematode data projected on the map of the survey area.

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