

Pathogenicity of the nematode *Scutellonema cavenessi* on peanut and soybean

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SUMMARY

The pathogenicity of *Scutellonema cavenessi* on peanut and soybean as measured by dry weight of shoot and roots, by the number and the dry weight of nodules and by the symbiotic nitrogen fixation, made at different stages of the plant growth, showed that the parasite affected all the parts of the plant and the symbiotic fixation apparatus. Cortical cells of roots infested by *S. cavenessi* exhibited necrotic symptoms.

RÉSUMÉ

Pathogénie du nématode Scutellonema cavenessi envers l'arachide et le soja

Sont exposés ci-dessous les résultats obtenus au cours d'une étude expérimentale de la pathogénie de *Scutellonema cavenessi* sur soja et arachide. Les mesures de cinq paramètres de la croissance (poids de l'appareil végétatif aérien et souterrain, nombre et poids des nodules et fixation symbiotique de l'azote) effectuées à plusieurs époques du cycle végétatif des plantes ont montré que le parasite affecte tous les organes végétatifs et les mécanismes de la fixation symbiotique. Les cellules corticales des racines parasitées par *S. cavenessi* manifestent des réactions nécrotiques.

Improved growth and yield of peanuts after treatment with DBCP in several field experiments in Senegal (Germani & Gautreau, 1977; Germani, 1979) suggested that nematodes could be dangerous pathogens of this crop. Of the various nematode species associated with peanut, *Scutellonema cavenessi* Sher, 1963 was always the most abundant and therefore it was decided to test the pathogenicity of this nematode on both peanut, the main crop in Senegal, and soybean which is being introduced as a new crop in Senegalese agriculture.

Materials and methods

The cultivars used in this experiment were the soybean cv. 44 A 73, and a peanut cv. 53-437 which is a short season variety maturing in about 90 days, the latter cultivar being chosen because its Acetylene Reducing Activity (ARAP) was correlated with yield (Germani, 1981); the peanut was inoculated with the most common *Rhizobium* strain in Senegal

from cowpea (CB 756) and the soybean with *R. japonicum* strain G2Sp.

Seedlings of peanut and soybean were raised from seed and one seedling planted into sterilised sandy soil in each 1.5 l clay pot. Peanuts were inoculated with 10 000 nematodes per pot and soybean with 7 500 nematodes per pot. Replication was five-fold and samples were taken at 25, 34 and 45 days after inoculation and, in the case of soybean, also 55 days after inoculation. Since it was impossible to obtain a pure culture of *S. cavenessi* due to peculiarities in its biology (Demeure, Netscher & Quénéhervé, 1980) the inoculum was obtained by extraction from a field infestation and thus there were a few other nematode genera present e.g. *Helicotylenchus* sp. *Hoplolaimus* sp. and *Peltamigratus* sp. *S. cavenessi* was extracted using Dalmasso's (1966) simplified technique and to ensure that inocula were free of other possible contaminant pathogens, the extracted nematodes were washed several times in sterilised deionized water. Observations on (i) number of nodules per plant; (ii) dry weight

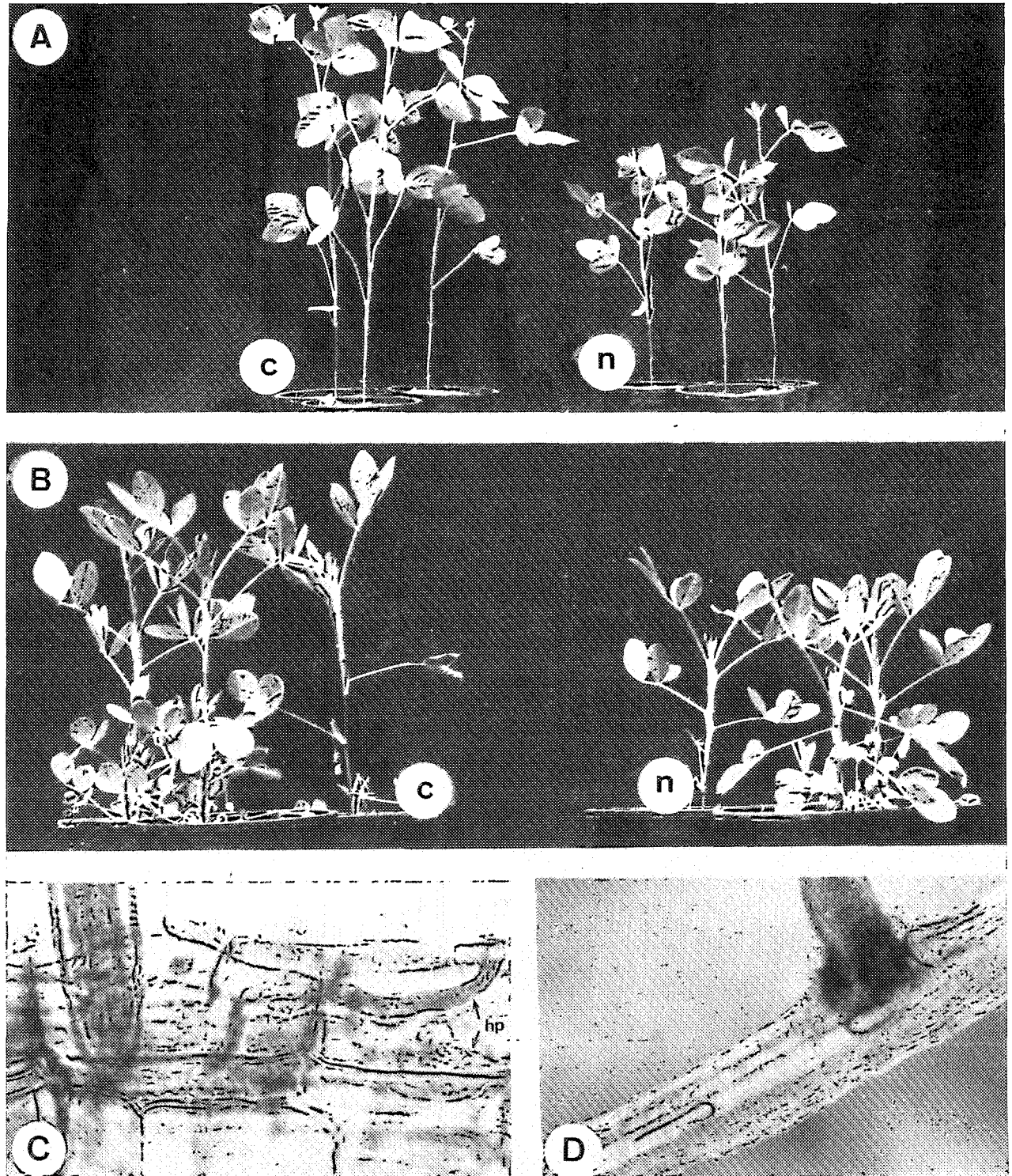


Fig. 1. A : Effect of *Scutellonema cavenessi* on the growth of aerial part of soybean 45 days after inoculation (c = control; n = nematodes). B : effect of *Scutellonema cavenessi* on the growth of aerial part of peanut 45 days after inoculation (c = control; n = nematodes). C : anterior part of a female of *S. cavenessi* partially embedded in the hypodermis of roots of peanuts (hp = hyphae). D : juveniles of *S. cavenessi* completely embedded in the hypodermis of root of soybean.

of nodules ; (iii) dry weight of subterranean parts ; (iv) dry weight of aerial parts ; (v) ARAP value were made on five plants at each time.

The ARAP measured in this experiment gives an indirect evaluation of nitrogen fixation

by the legume and is expressed as the number of micromoles of C_2H_2 reduced per plant and per hour following the procedure of Hardy *et al.* (1968), improved by Germani, Diem and Dommergues (1980).

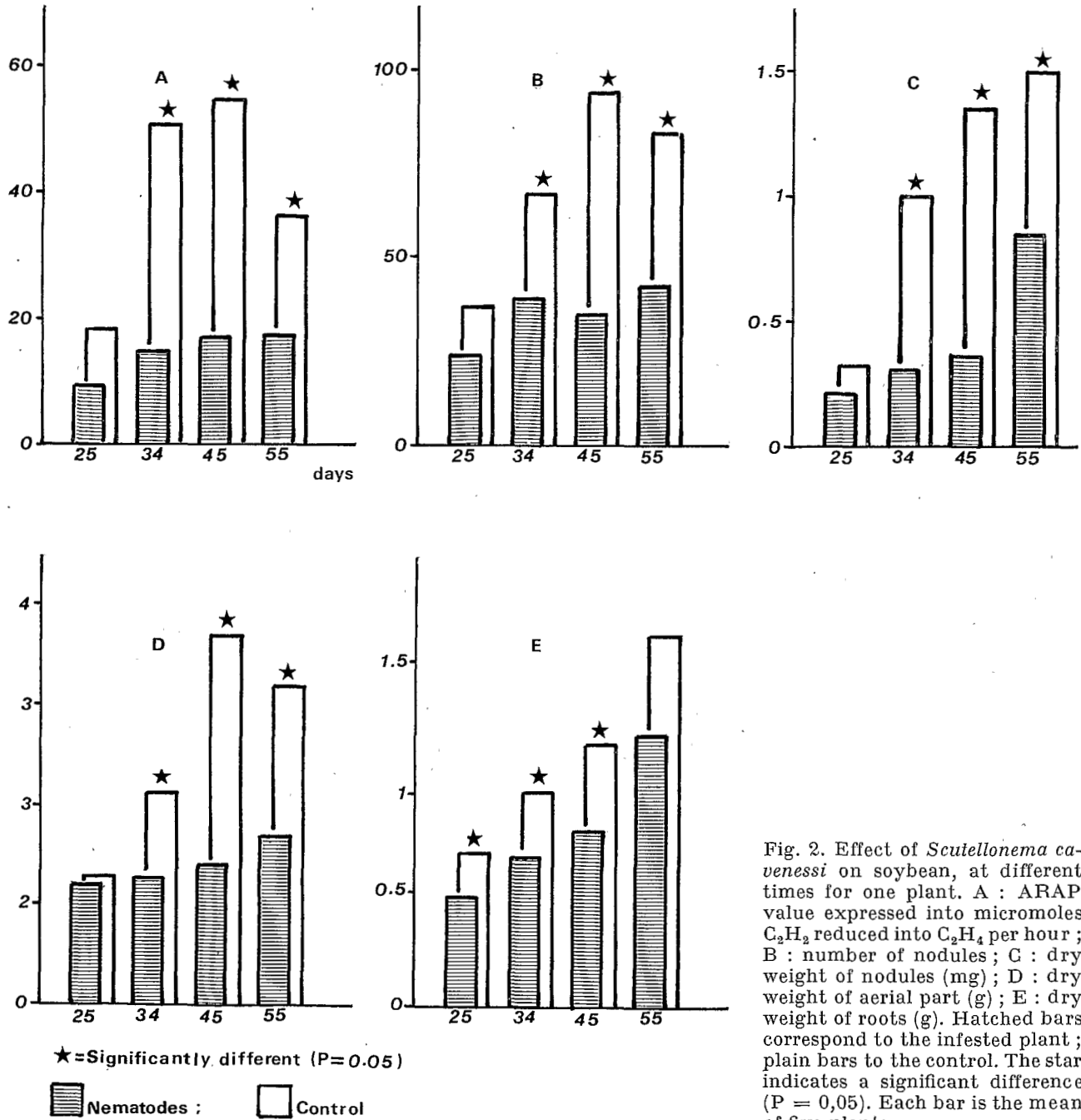


Fig. 2. Effect of *Scutellonema cavenessi* on soybean, at different times for one plant. A : ARAP value expressed into micromoles C_2H_2 reduced into C_2H_4 per hour ; B : number of nodules ; C : dry weight of nodules (mg) ; D : dry weight of aerial part (g) ; E : dry weight of roots (g). Hatched bars correspond to the infested plant ; plain bars to the control. The star indicates a significant difference (P = 0,05). Each bar is the mean of five plants.

Each pot of peanut was sampled for nematodes both in the soil and in the roots at each observations date and recorded as positive or negative. On soybeans the number of nematodes were counted to establish the increase of the nematode population. Interpretation of data was performed using Mann-Whitney test (Snedecor & Cochran, 1967).

Results

In both soybean and peanut roots, most of juveniles observed were completely embedded in the cortex tissue (Fig. 1 D), whereas adults appeared to be semi-ectoparasites, with their head in the first few layers of cortical cells (Fig. 1 C); necrosis and fungal hyphae were frequently observed in the vicinity of such feeding points.

SOYBEAN

Differences in growth of plants was observed from 34 to 55 days after inoculation and this difference increases with ageing (Fig. 1 A at 45 days). All the growth parameters measured (Fig. 2; A to E) give significant differences between infested and non-infested plants ($P=0.05$) except on the 55th day when root dry weight was not significant probably due to the limited size of the pot. Nematode populations both in soil and roots increased with time (Fig. 3).

PEANUT

Even though the initial number of *S. cavinessi* was greater on peanut than on soybean the growth of infested peanut plants was not reduced as severely as soybean plants. The aerial and root weights were not significantly reduced from the control plant until 45 days (Fig. 1 B & Fig. 4 D, E). Although the ARAP (Fig. 4 A) was significantly reduced, the number of nodules (Fig. 4 B) and their dry weight (Fig. 4 C) are not significantly reduced.

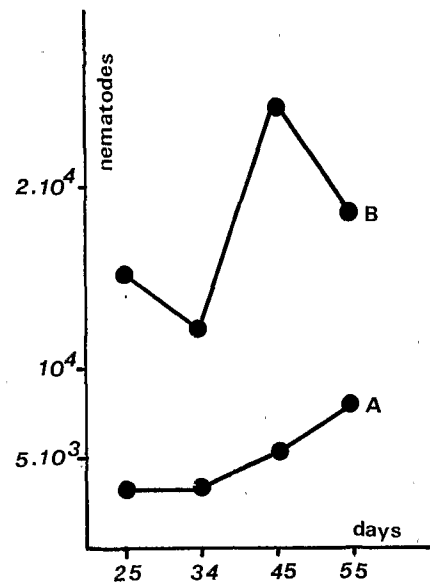


Fig. 3. Evolution of population of *Scutellonema cavinessi* per pot on soybean. A : nematodes in the soil; B : nematodes in the roots (mean of five replicates).

Discussion

This experiment gives clear evidence of the pathogenicity of *S. cavinessi* on soybean and peanut. All the measured parameters during the early growth of the plants were reduced by the nematodes. Although the limited volume of soil in the pots may have affected the results at 45 and 55 days, it seems reasonable to project that heavy field infestations of these nematodes would also reduce seed production.

In peanut the ARAP was significantly lower at the end of observation in infested than in control plants while the number and dry weight of nodules were not significantly different. Observations made on nodules suggest that in infested plant many of these nodules were no longer active; further investigations are required to elucidate this matter.

ACKNOWLEDGMENT

The author is grateful to Drs. N.G.M. Hague and S.D. Van Gundy for their revision of the English text.

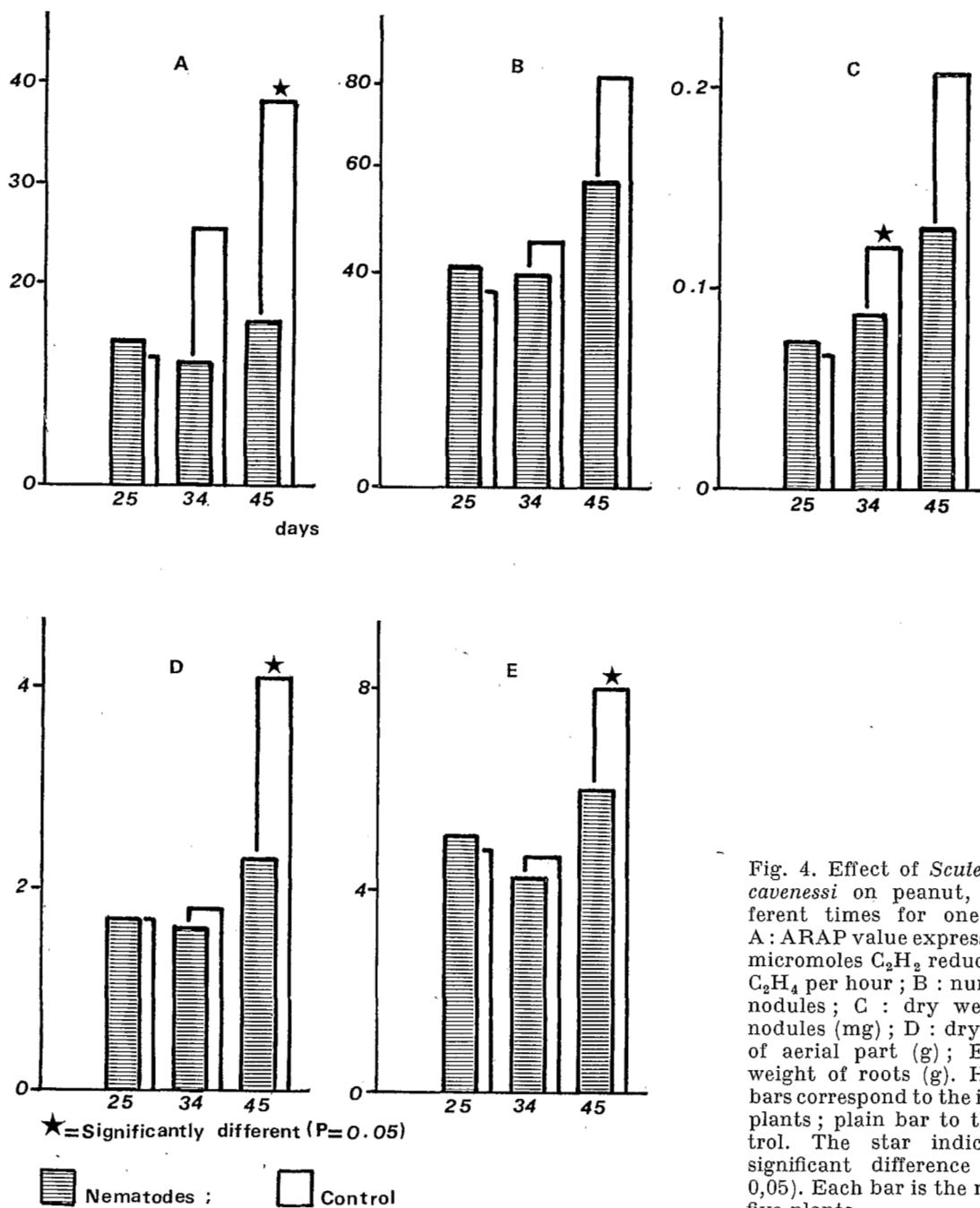


Fig. 4. Effect of *Scutellonema cavenessi* on peanut, at different times for one plant. A: ARAP value expressed into micromoles C_2H_2 reduced into C_2H_4 per hour; B: number of nodules; C: dry weight of nodules (mg); D: dry weight of aerial part (g); E: dry weight of roots (g). Hatched bars correspond to the infested plants; plain bar to the control. The star indicates a significant difference ($P = 0,05$). Each bar is the mean of five plants.

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Accepté pour publication le 2 février 1981.