Der Tropenlandwirt, Zeitschrift für die Landwirtschaft in den Tropen und Subtropen
80. Jahrgang, Oktober 1979, S. 151–155

A study of the effects of Ditylenchus dipsaci on three onion cultivars with different skin colour in Nigeria

Eine Untersuchung über den Einfluß von Ditylenchus dipsaci auf drei Zwiebelkulturen unterschiedlicher Färbung in Nigeria

by R. O. Ogbuji*

1. Introduction

This study got started from chance observation in a home garden in a rural village of Asa in Imo State of Nigeria. Asa village situates some 38 km from the coastal city of Port Harcourt, capital of Rivers State. The village is in the rain forest belt of the country. The garden was prepared on a ground where refuse dump had once been but later decomposed into manure. The soil was muck. In the mixed stands of onion cultivars planted, only eighteen of the thirty stands survived to maturity. Thirteen of the survivors were red in skin colour; five were pink. Nine of the sick (bloated) stands were white in skin colour; three were pink. Microscopic examinations of the sick bulbs showed presence of the bulb and stem nematode, Ditylenchus dipsaci. This study, therefore, was undertaken in a conscious effort to observe responses of onions with varied skin colour to inoculation with onion isolate of D. dipsaci.

2. Materials and Methods

2.1. Field

Twelve raised beds (90 × 450 cm) were made on the same spot in which the home garden was located. The beds were supplied with animal manure. In October 1977, eight-week old seedlings of Red Kano, Yellow Bermuda and EL Toro (white) onion cultivars raised in steamed muck soil were transplanted, one cultivar per bed and replicated four times (Table 1). Inter- and intra-row plant spacings were 30 × 30 cm. A total of 25 seedlings were planted to each bed. Growth was recorded till seven weeks after planting.

*) Dr. R. O. Ogbuji, Department of Crop Science, University of Nigeria, Nsukka, Nigeria.

2.2. Greenhouse

Larvae of D. dipsaci isolated from onions grown earlier in the garden were inoculated to ten 2-month old seedlings of the Texas (Early) Grano onion raised in steamed soil in a wooden box. 200 nematode larvae were added to each seedling. The box was kept in the greenhouse at day temperature of 24°C, a procedure adapted from Sayre and Mountain (1962). The culture remained for ten weeks before nematodes were recovered from soil and plant tissue by a modified Baermam funnel technique (Goodey, 1957). Three clay pots (each 15.0 cm diameter) were filled with steamed muck soil adjusted to soil moisture level near field capacity. 20 onion seeds of each of the three cultivars were sown to a pot. When germination was complete the seedlings were thinned to 15/pot. Each pot was infested with 1500 D. dipsaci extracted from the culture by flooding the surface of the soil with a suspension of the organism in water. The pots were placed in the greenhouse at 24°C. After four days, ten seedlings were removed at random from each pot. From the base of each seedling a section 2 cm long was removed and stained in lactophenol with fuchsin acid added, a modification of Sayre and Mountain (1962). The number of D. dipsaci in each lot of ten seedlings was counted and average taken (Fig. 1). The remaining five seedlings were transplanted, on each into 20 cm plastic pots containing steamed muck soil. Host-parasite interactions were recorded for seven weeks.

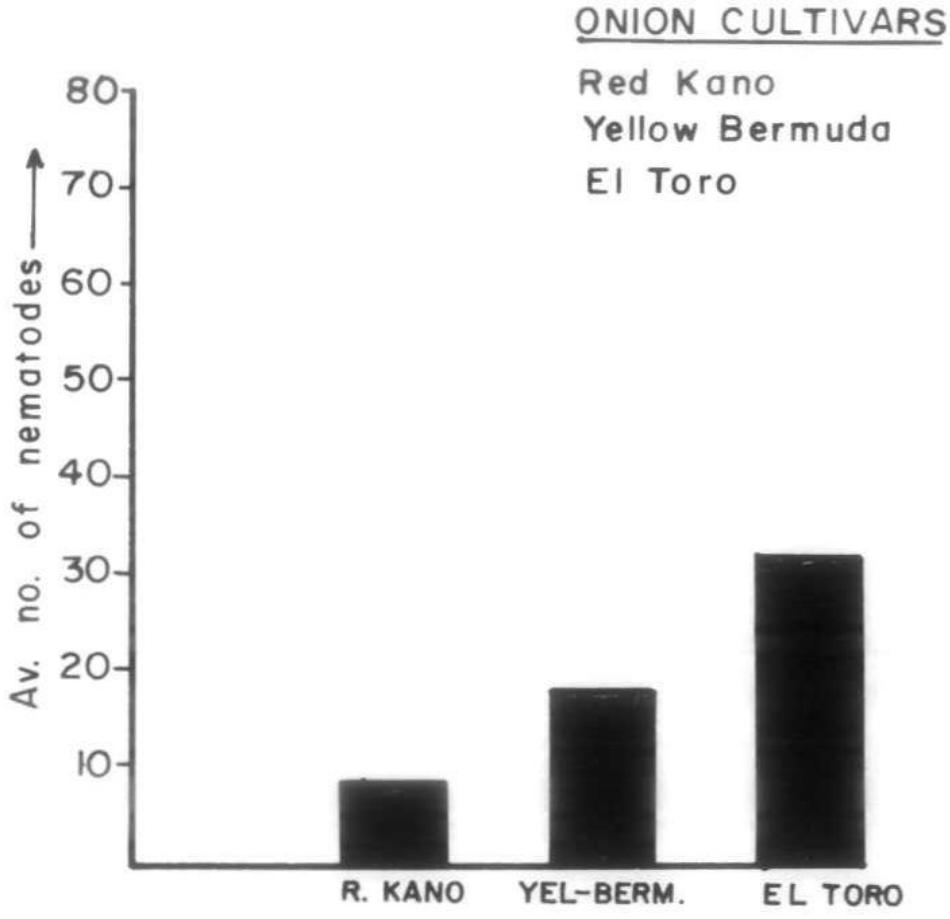

Fig. 1. Average number of Ditylenchus dipsaci larvae which penetrated three different onion cultivars in four days.

3. **Results**

3.1. Field

Results are summarized in Table 1. The highest number of injured plants was recorded on the white onion, cultivar EL Toro; the least injury occurred in Red Kano cultivar. Growth of infected seedlings was impaired. Injury symptoms included stunting, looping, bending of leaves and bloat; bulbs of infected stands were immature. Under microscopy, other organisms observed included maggots, non-parasitic nematode and mites. χ^2 test for El Toro exceeded 5% in every case, so the null hypothesis that all cultivars were similar was rejected.

3.2. Greenhouse

The highest number of D. dipsaci penetrated the white (El Toro) onion cultivar in four days; the least penetration was in Red Kano cultivar (Fig. 1). Symptoms of nematode injury recorded in the infected transplants were similar to those observed in the field. In the transplants, Red Kano cultivar was not bloated; Yellow Bermuda had two bloated seedlings and all five of El Toro were bloated.

4. **Discussion**

Field and greenhouse results showed that an onion isolate of D. dipsaci differed in its ability to infect onions of different skin colour. Its pathogenicity was proportionately greatest in white skin onion and least in the red skin cultivar. Yellow Bermuda (pink outer coating) was moderately infected. Sayre and Mountain (1962) observed that onion bloat and its association with D. dipsaci have been known for many years. Other organisms in addition to D. dipsaci in bloated onion tissue have been quoted in several instances. Chitwood et al. (1940), for example observed fungi, bacteria, onion maggots, onion thrip larvae, bulb mites and a number of saprophagous nematodes in onions affected by D. dipsaci. Sayre and Mountain (1962) observed saprophagous nematodes and insects in bloated onions tissues. The present author also saw non-parasitic nematodes, maggots and mites associated with onion bloat. Nevertheless, D. dipsaci appears to be a true pathogen of onion since the disease syndrome developed in the onions inoculated with D. dipsaci alone.

Green (1971) observed that Nigerian consumers prefer red skinned onion bulbs to white or other colours. At present farmers will not grow exotic cultivars unless they are red skinned and if these consistently out-yielded local types. Green (1973) also thinks that this preference for red skin onions is because of their keeping quality. To many farmers this is the most important cultivar characteristic because the main commercial crop is grown in the dry season and a considerable proportion of it is stored for up to five month. Storage observations at Samaru, Nigeria indicated that red skinned cultivars have better keeping quality than non-red bulbs (Green 1973). Jones and Mann (1963) observed that red skinned onions are more resistant to storage pathogens because of the antibiotics associated with the pigments and also because of their higher solid contents. Owen et al. (1950) found that disease resistance in onion was associated with pungency. Such factors of

resistance in red skin onions may confer resistance not only against storage pathogens, but also against soil borne pathogens such as D. dipsaci.

5. Summary

Three onion cultivars with different skin colour were exposed to larvae of bulb and stem nematode, Ditylenchus dipsaci, in the field and also inoculated with the nematode larvae in the greenhouse. Penetration and bloating of seedlings occurred most in the white onion cultivar (El Toro); less in the yellow cultivar (Yellow Bermuda) and least in the red cultivar (Red Kano). The basis of onion resistance to penetration and bloating is thought to be biochemical in nature.

Zusammenfassung

In Feld- und Gewächshausversuchen wurden drei verschieden gefärbte Zwiebelkulturen Larven des Stempelnematoden Ditylenchus dipsaci ausgesetzt. In abnehmender Reihenfolge wurden die Sämlinge der weißen (El Toro), gelben (Yellow Bermuda) und roten Kulturen (Red Kano) unterschiedlich stark befallen. Es wird angenommen, daß die Grundlage der Resistenz von Zwiebeln gegen Ditylenchus dipsaci biochemischer Art ist.

Table 1. Reaction of three onion cultivars to Ditylenchus dipsaci

Rep.	Onion cultivar	No. planted	bloated seedlings	χ^2 (bloated seedlings)
I	Red Kano	25	3	2.53
	Yellow Bermuda	25	6	0.023
	El Toro	25	14	6.15
II	Red Kano	25	1	5.40
	Yellow Bermuda	25	4	1.49
	El Toro	25	17	12.80
III	Red Kano	25	1	5.73
	Yellow Bermuda	25	7	0.047
	El Toro	25	15	7.20
IV	Red Kano	25	2	4.5
	Yellow Bermuda	25	7	0.013
	El Toro	25	15	6.125

$\chi^2.05,^2 = 5.99$, $\chi^2.01,^2 = 9.21$

References

1. CHITWOOD, B. G., NEWALL, A. C. & R. L. CLEMENT, 1940: Onion bloat or eelworm rot, a disease caused by the bulb and stem nematode, Ditylenchus dipsaci (Kuhn) Filipjev. Proc. Helminthol. Soc. Washington, D. C. 7, 44–51.
2. GREEN, J. H., 1971: The potential for the bulb onion crop in Northern States of Nigeria. Samaru Agr. Newsletter 13 (3), 54–60.
3. GREEN. J. H., 1973: Cultivar trials with Allium cepa L. in the Northern States of Nigeria. Niger. Agric. J. 8 (2), 169–174.
4. JONES, H. A. & L. K. MANN, 1963: Onions and their Allies. London. Leonard Hall (Books) Ltd.
5. GOODEY, B. J., 1957: Laboratory methods for work with plant and soil Nematodes. Tech. Bull. No. 2. Her Majesty's Stationery Office, London.
6. OWEN, J. H., WALKER, J. C. & M. A. STAHMANN, 1950: Pungency, colour, and moisture supply in relation to disease resistance in the onion. Phytopath. 40, 292–297.
7. SAYRE, R. M. & W. B. MOUNTAIN, 1962: The bulb and stem nematode (Ditylenchus dipsaci) on onion in Southwestern Ontario. Phytopath. 52, 510–516.