ECOLOGICAL DIFFERENCES BETWEEN FOUR AUSTRALIAN ISOLATES OF *APHELENCHUS AVENAE* BASTIAN*

By A. A. F. Evans†‡ and J. M. Fisher†

Goodey (1963) synonymized all species of the genus *Aphelenchus* Bastian, 1865, under *Aphelenchus avenae* Bastian, 1865, emphasizing the lack of adequate detail in existing species descriptions and urging further close detailed study of different populations. To study variation in *A. avenae* in Australia we collected isolates from various places and maintained them in monoxenic culture on *Rhizoctonia solani* Kühn in the laboratory. Several of the isolates showed distinct ecological differences and the results of experiments to measure these differences are reported here.

Four isolates of *A. avenae*, obtained from the following areas, were compared:

(1) Brownhill Creek isolate—females and larvae from soil near Brownhill Creek, Adelaide.

(2) Tasmanian isolate—females and larvae from a fungal lesion in a potato tuber from a crop grown at Hobart.

(3) Western Australian isolate—males, females, and larvae from soil beneath vines at Middle Swan, near Perth.

(4) Port Vincent isolate—males, females, and larvae from soil beneath a wheat crop near Port Vincent, S.A.

Adults from field and laboratory cultures were examined morphologically and characters of males and females were similar in all isolates with the exception that in Western Australian females, the post-vulval sac was more noticeable. Proportions of males and females in both laboratory and field cultures were distinctly different; males and females in the Western Australian isolate were in about equal proportions, but males were much less numerous in the Port Vincent and extremely rare in the Brownhill Creek and Tasmanian isolates.

Because males and females in the Western Australian isolate were found in about equal numbers, the need for males for reproduction was tested. Larvae selected at random and reared to adulthood in isolation yielded about equal numbers of males and females. These females were kept in isolation for a further 21 days after becoming adult and although they fed and grew quite large, they laid no eggs. Within 1 day of introducing males, eggs were deposited and these later hatched. In all other isolates, males were not necessary for reproduction.

To study the effect of temperature on multiplication, nematodes from all isolates were cultured in small cells containing potato dextrose agar on which *Rhizoctonia solani* strain 48 (Flentje, Stretton, and Hawn 1963) was growing. Five young adult

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† Department of Plant Pathology, Waite Agricultural Research Institute, University of Adelaide, Glen Osmond, S.A. 5064.

‡ Present address: Department of Nematology, University of California, Riverside, California 92502.

females from isolates from each locality were added to each cell; one male of the Western Australian isolate was also added to each cell containing Western Australian females. Six replicates of each isolate were incubated at 30, 25, 20, and 15°C, harvested after 10 days, and the numbers of males, females, and larvae recorded.

All isolates except the Tasmanian one produced greatest numbers of nematodes at 30°C (Table 1), but the latter produced more nematodes at 25°C than at the other temperatures. The rate of multiplication of this isolate at the optimum temperature was much slower than in the other isolates, and individuals extracted into water appeared more lethargic in movement than those of other isolates.

TABLE 1

EFFECT OF TEMPERATURE ON THE NUMBER OF NEMATODES PRODUCED IN 10 DAYS BY ISOLATES OF *A. AVENAE*

Each value is a mean of six replicates

Isolate	Temp. (°C)	No. of Males	No. of Females	No. of Larvae	Totals
Brownhill Creek	30		229	2882	3111
	25	1	127	258	376
	20	1	26	258	285
	15		4	74	78
Tasmania	30	2	25	20	47
	25		80	130	210
	20		4	118	122
	15		4	42	46
Western Australia	30	180	200	5847	6227
	25	110	115	3598	3823
	20	48	58	247	353
	15	1	4	198	203
Port Vincent	30	52	333	6734	7119
	25	3	180	1515	1698
	20	1	24	259	284
	15		4	75	79
Least significant difference at 1% level:		47	47*	790	776

* For temperatures only. Differences between sites not significant.

The most marked difference between populations was the need for males for reproduction in the Western Australian isolate and the almost equal proportion of males and females in all populations of this isolate. In the other populations examined males were rare, as occurred in England (Goodey and Hooper 1965) and North America (Hechler 1962) (1 male for every 10,000–100,000 females).

The differences in reproduction rates could be due either to some property of the nematode or to the suitability of the host fungus for each isolate. We discount the importance of the latter alternative since the low vigour of the Tasmanian isolate was a property which the nematode exhibited on several different host fungi. Therefore, we ascribe the differences in reproduction rate to metabolic differences inherent in the nematodes.

The optimum temperature of the Tasmanian isolate was lower than the other isolates. Mean air temperatures (and presumably mean soil temperatures) in Tasmania are 5–10°C lower throughout the year than in the districts from which the other isolates were obtained and so all isolates presumably show adaptation to their local temperature regime. Adaptation to a different climate may also explain the slow reproduction rates of the Tasmanian isolate, even at its optimum temperature. The Tasmanian climate is relatively mild and has a long growing season (11–12 months) which would allow nematode reproduction to occur throughout the year. In contrast the Brownhill Creek, Port Vincent, and Western Australian isolates come from regions having a period of summer drought of about 4 months duration, which they probably survive in an anabiotic state. Rapid reproduction, when favorable conditions do occur, would favour survival of these three isolates.

The differences in reproduction rates may have been due to the suitability of the host fungus for each nematode isolate, but the association of slow reproduction rate with low vigour in the Tasmanian isolate suggests that some property of the nematode is involved.

Similar experiments carried out on a wide range of isolates of *A. avenae* may lead to a much greater appreciation of intraspecific variation and may provide an ecological basis for classifying isolates.

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