1989

Diseases caused by nematodes.

J M. Stanton

Title:	Annual ryegrass toxicity roadside survey
Experiment:	88PE99
File:	3218 EX
Location:	Esperance, Albany and all District Offices which had previously recorded stock losses due to ARGT.
Aim:	To determine the distribution of the nematode and bacteria which cause ARGT.

Methods:

Sampled

November 1988-January 1989. About 200 g of dry seed heads were collected on roadsides. Sampling sites were about 5-10 km apart. Over 540 samples were collected, threshed and numbers of nematode and bacterial galls per 10 g seed counted.

Results:

Figure 1 shows the extent of the survey and the distribution of nematode and bacteria which cause ARGT. Nematode galls were found in shires which had never recorded ARGT. These are Boyup Brook, Kojonup, Plantagenet, Narembeen, Koorda and Nungarin. Bacterial galls were also found in the Kojonup shire. Nematode galls were found much more extensively than were bacterial galls.

Comments:

The reduced spread of bacterial galls compared with nematode galls may be the result of the roadside environment rather than the distribution of the organisms.

There has been little spread of ARGT west of Katanning and the Great Southern Highway even though the nematode and bacterium are present on roadsides. This may be due to environmental restrictions on the organisms involved, e.g. higher rainfall or higher night temperatures than in other regions which have recorded deaths due to ARGT. However, if conditions in neighbouring paddocks were suited to the growth and reproduction of the nematode and the bacterium (e.g. if there were more frequent cropping) then ARGT may become a problem in that region.

Title: Effect of benzimidazoles on ARGT

Experiment: 88NA75

File: 3218 EX

Location: A. Price, Bulyee. Site has history of stock deaths due to annual ryegrass toxicity. Little twist fungus was present.

Aim: Some benzimidazoles are effective against animal parasitic nematodes. Some systemic benzimidazoles such as benomyl, thiabendazole and thiophanate have shown nematicidal action on an above-ground nematode related to *Anguina funesta*. The aim was to test these chemicals for nematicidal action against *Anguina funesta*.

Treatments:

Chemical	benomyl (Benlate)	500 kg/ha
	thiophanate (Topsin)	500 kg/ha
	thiabendazole (Tecto)	125, 250, 500 kg/ha

Application times
- 6, 9 and 12 weeks after break
- 6 weeks after break
- 9 weeks after break
- 12 weeks after break

Methods:

Experimental design: Randomised blocks with 4 replicates with untreated covariate plots on each edge of each treated plot

Plot size: 2 x 2 m

Harvested: All plots were mown on November 17, 1988, samples threshed and numbers of nematode and bacterial galls counted.

Results: No significant differences between treatments were found in numbers of nematode and bacterial galls per 10 g seed (Table 1).

Table 1. Production of nematode and bacterial galls per 10 g threshed seed as % of mean production in four adjacent untreated plots, after application of three chemicals at different times

Chemical	Application time (weeks after break)	Nematode galls per 10 g	Bacterial galls per 10 g
Benomyl	6, 9 & 12	104	41
(500 kg/ha)	6	91	134
	9	74	111
	12	133	57
Thiophanate	6, 9 & 12	69	124
(500 kg/ha)	6	103	127
	9	94	63
	12	144	93
Thiabendazole	6, 9 & 12	53	67
(125 kg/ha)	6	118	101
	9	64	65
	12	82	68
Thiabendazole	6, 9 & 12	52	57
(250 kg/ha)	6	192	127
	9	111	116
	12	101	124
Thiabendazole	6, 9 & 12	51	83
(500 kg/ha)	6	91	94
	9	215	114
	12	171	121

Title: Relationships between organisms involved in ARGT

Experiment: 88KA103

File: 3218 EX

Location: Katanning Advisory District

Aim: To determine relationships between the organisms involved in ARGT.

Methods: After head emergence, transects 2 x 40 m were fenced in paddocks incorporating areas of apparently high and low ARGT risk. After heads had dried, they were cut from 25 x 25 cm quadrats at 1 m intervals. Heads were counted and those infected by twist fungus were noted. After threshing, the number of seeds and nematode and bacterial galls were counted in each sample.

Results: The numbers of nematode and bacterial galls produced appeared to be unrelated to numbers of seed produced (i.e. density of ryegrass) or to incidence of the twist fungus (Table 2). The number of galls as proportion of seed was least in the 'decline' paddock of Butterworth. However, the number of nematode galls per quadrat was not reduced.

Comments: There have been few deaths due to ARGT recorded in recent years from the Gnowangerup area. The reason for this is not apparent and seems to be unrelated to efforts to control the nematode. In a pot trial in 1988, soil cores containing ryegrass plants were taken in June from paddocks which had been toxic in past years but from which there had been no deaths in the last 5 years. These were potted and inoculated with nematode galls and gall production was compared with plants sown in sterilised sand. No difference was found between the number of galls produced by both types of plants. The key to decline of ARGT is not a simple soil factor. This field trial also suggests that the twist fungus is not a major factor involved in the decline. The cause of decline is not obvious from one year's data but the reason may be revealed by studying the change over several years.

Table 2. Growth of ryegrass and ARGT galls in 25 x 25 cm quadrats in five paddocks with previous stock losses due to ARGT

Paddock	Stock losses in last 5 years	Spraytopping in 1988	Heads	Heads with twist fungus	Seeds	Nematode galls	Bacterial galls	Total galls/ no. seed
Butterworth, Katanning	No	No	41	0.1	517	4	0	0.007
Filmer, Dumbleyung	No	Yes	6	0.0	29	1	1	0.079
Thorpe, Needilup	Yes	Yes	41	0.3	154	1	2	0.047
Badger, Nyabing	Yes	Yes	10	0.2	8	2	0	0.352
Bamess, Nyabing	Yes	Yes	6	0.6	112	2	5	0.075

Title: Sampling patterns for ARGT diagnosis

Experiment: 88KA102

File: 3218EX

Location: Katanning advisory district

Aim: To determine the most efficient paddock sampling pattern for diagnosing ARGT.

Methods: Four paddocks were sampled on a grid pattern at 50 m intervals. Uncultivated areas such as fence and creek lines and around dams were noted. At each point, 2, 5 or 20 heads were collected. Heads were threshed and numbers of nematode and bacterial galls counted.

Results: Analysis of data (Table 4) to date indicates that the likelihood of finding galls on uncultivated areas is not significantly different from that on cultivated areas. Increasing the sample size by ten times, from 2 to 20 heads, doubled the chance of finding galls.

Comments: It has been thought that there is a greater chance of finding toxic ryegrass along uncultivated areas than within the paddock. This trial shows that not to be the case. Further sampling and analysis of data will be done to determine the optimum sample size and interval.

Table 4. Per cent of collection sites on cultivated and uncultivated areas of paddocks where nematode or bacterial galls were found after sampling on a grid at 50 m intervals with three sample sizes

Paddock	Cultivated				Uncultivated			
	No. heads			Mean	No. heads			Mean
	2	5	20		2	5	20	
Butterworth, Katanning	3	3	18	9	0	8	6	5
Thorpe, Needilup	18	40	36	45	21	21	33	33
Badger, Nyabing	13	18	39	30	6	14	30	16
Bamess, Nyabing	27	32	42	49	25	20	50	48
Mean	15	23	34	33	13	16	30	26

<u>Title</u>:	Distribution of cereal cyst nematode
<u>Experiment</u>:	88PE20
<u>File</u>:	5440 EX
<u>Location</u>:	Northam - Ballidu, Northam-Narrogin Northam - Merredin and throughout the Avon Valley
<u>Aim</u>:	To determine the distribution of cereal cyst nematode in the Northam and adjacent advisory districts.
<u>Methods</u>:	Sampling was done at mid-tillering, July-August 1988. Crops were selected for sampling at 5-10 km intervals. Two or three adjacent plants with soil were collected at each of 15 sites in a triangle within each crop with 30 paces between samples. Up to 2 additional samples were collected if representative of poor growth patches.
<u>Results</u>:	Only one CCN-infested sample was found and that was in the Avon Valley.
<u>Comments</u>:	The lack of findings of CCN suggests that the nematode is not widespread at high infestation levels. The method was that used in South Australia where CCN was found in 75% of crops sampled.

Title: Hatching pattern of cereal cyst nematode

Experiment: 88NO71, 88GE30

File: 5440 EX

Location: 10 sites in Northam and 5 sites in Geraldton advisory districts with history of CCN

Aim: To determine the pattern of hatching of cereal cyst nematode in Western Australia.

Methods: At 2-3 week intervals from the beginning of the season until no more second-stage larvae were found, 1-2 kg of soil was taken from each site to a depth of about 10 km. Second-stage larvae were extracted from 250 g of soil from each site.

Results: In both, 1987 and 1988, the peak in numbers of second-stage juveniles occurred about six weeks earlier in the season than that in South Australia and Victoria (Fig. 3).

Comments: The hatching pattern corresponds with the temperature requirements for hatching in the laboratory. Optimum temperature for eastern populations of CCN are a period at 10°C followed by 20°C. Once eggs have undergone these two hatching phases they will hatch when water is available. This regime ensures that eggs do not hatch when a host is not present. Preliminary studies of the Western Australian population, however, show that eggs hatch best at constant 15°C. The difference between populations may be the result of introductions from different sources or from adaptation following introduction.

Title: Sowing date and cereal cyst nematode

Experiment: 88N070

File: 5440EX

Location: N. Roe & A. Brown, Northam

Aim: To determine the effect of sowing date on multiplication of CCN and yield of wheat.

Treatments:

Sowing dates: May 16, May 23, June 7 and June 14

Herbicide: +/- Sprayseed at each sowing date until sowing

Methods:

Site preparation: Whole block sprayed with Sprayseed at 2 L/ha before sowing. Wheat cv. Aroona direct drilled.

Experimental design: Split plot with 4 replicates
- main plots: herbicide treatment
- subplots: sowing date.

Plot size: 1.4 x 25 m sown on 2 m centres. Buffer plot of same sowing date on each side of each plot.

Measurements: Initial and final nematode densities.
Grain yield.

Results: There was no effect of weekly herbicide treatment on grain yield. No significant differences were found in multiplication rate of CCN or in grain yield from different sowing dates (Table 3). However, on N. Roe's property there was a marked trend toward lower yields from later sowing.

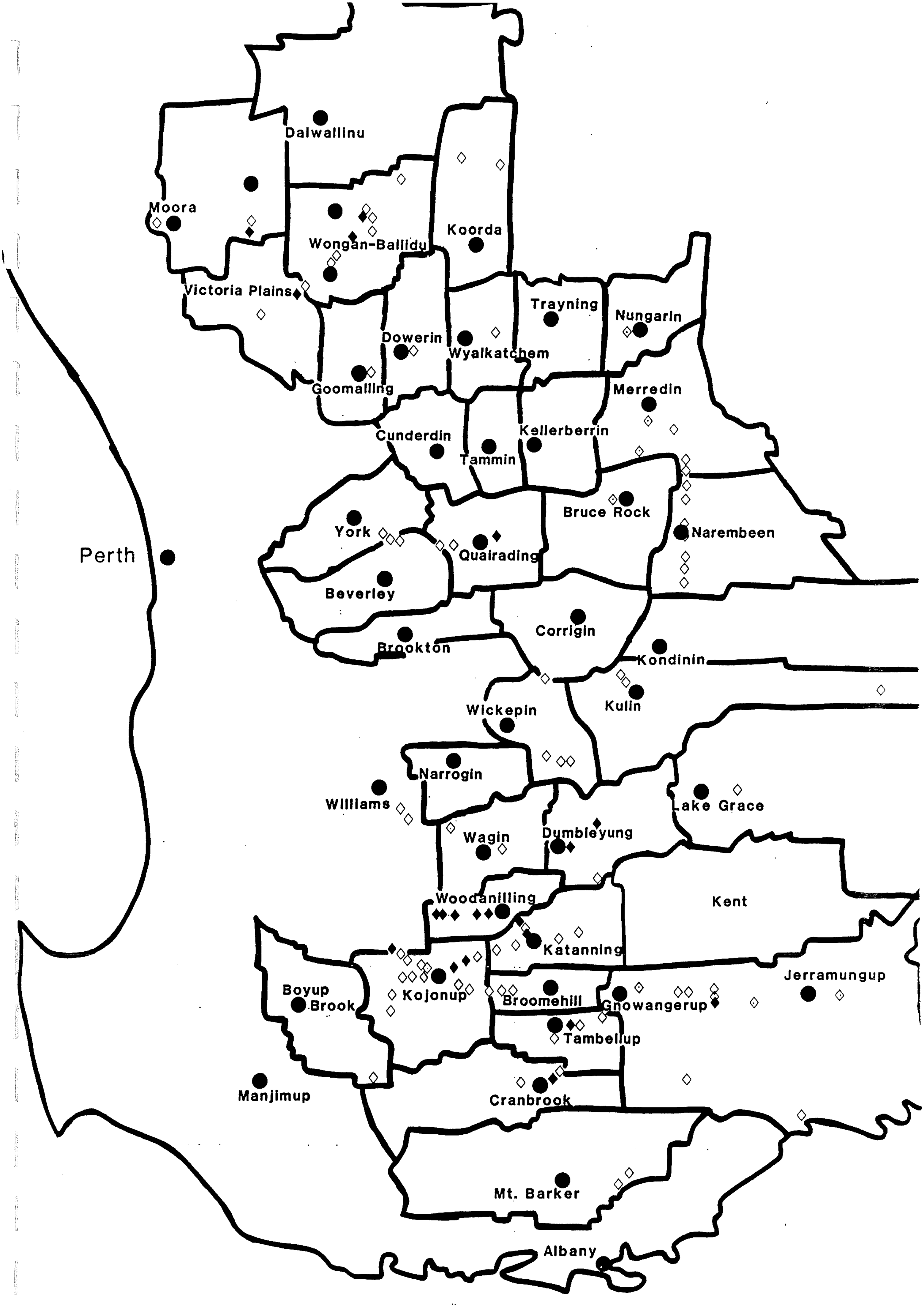
Comments: In 1987, there was a 40% reduction in grain yield when plots were sown on CCN-infested soil on May 28 compared with June 8. This reflected the numbers of second-stage larvae which were present in the soil during the first 6 weeks of growth. In the 1988 season, drought stress was not a limiting factor during the first 6 weeks of growth when most damage is done by CCN.

Table 3. Yield of wheat cv. Aroona on 1.4 x 12.5 m plots following sowing on four different dates on two farms. Half of each plot was sprayed weekly with knockdown until sowing while the other half was sprayed at the break and at sowing

Time of sowing	A. Brown			N. Roe		
	Yield (kg/plot)		CCN multiplication rate	Yield (kg/plot)		CCN multiplication rate
	Sprayed	Unsprayed		Sprayed	Unsprayed	
May 16	1.7	1.3	1.6	1.4	1.2	5.2
May 23	1.8	1.5	4.3	1.1	1.2	21.7
June 7	1.5	1.6	3.9	0.8	0.4	5.7
June 16	1.8	1.4	2.5	0.6	0.8	9.5

Figure 1. Distribution of nematode and bacterial galls on roadsides, 1987-1989. ◇, nematode galls only; ◆, nematode and bacterial galls.

Figure 2. Number of second-stage larvae of cereal cyst nematode/500 g soil. ●——●, Northam 1987; o——o, Northam 1988; Δ——Δ, Geraldton 1988; ▲---▲, Sea Lake Victoria.



Dalwallinu
Moora
Koorda
Wongan-Ballidu
Victoria Plains
Trayning
Nungarin
Dowerin
Wyalkatchem
Goomalling
Merredin
Cunderdin
Kellerberrin
Tammin
Bruce Rock
York
Narembeen
Perth
Quairading
Beverley
Corrigin
Brookton
Kondinin
Kulin
Wickepin
Narrogin
Lake Grace
Williams
Wagin
Dumbleyung
Kent
Woodanilling
Katanning
Jerramungup
Boyup Brook
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Cranbrook
Mt. Barker
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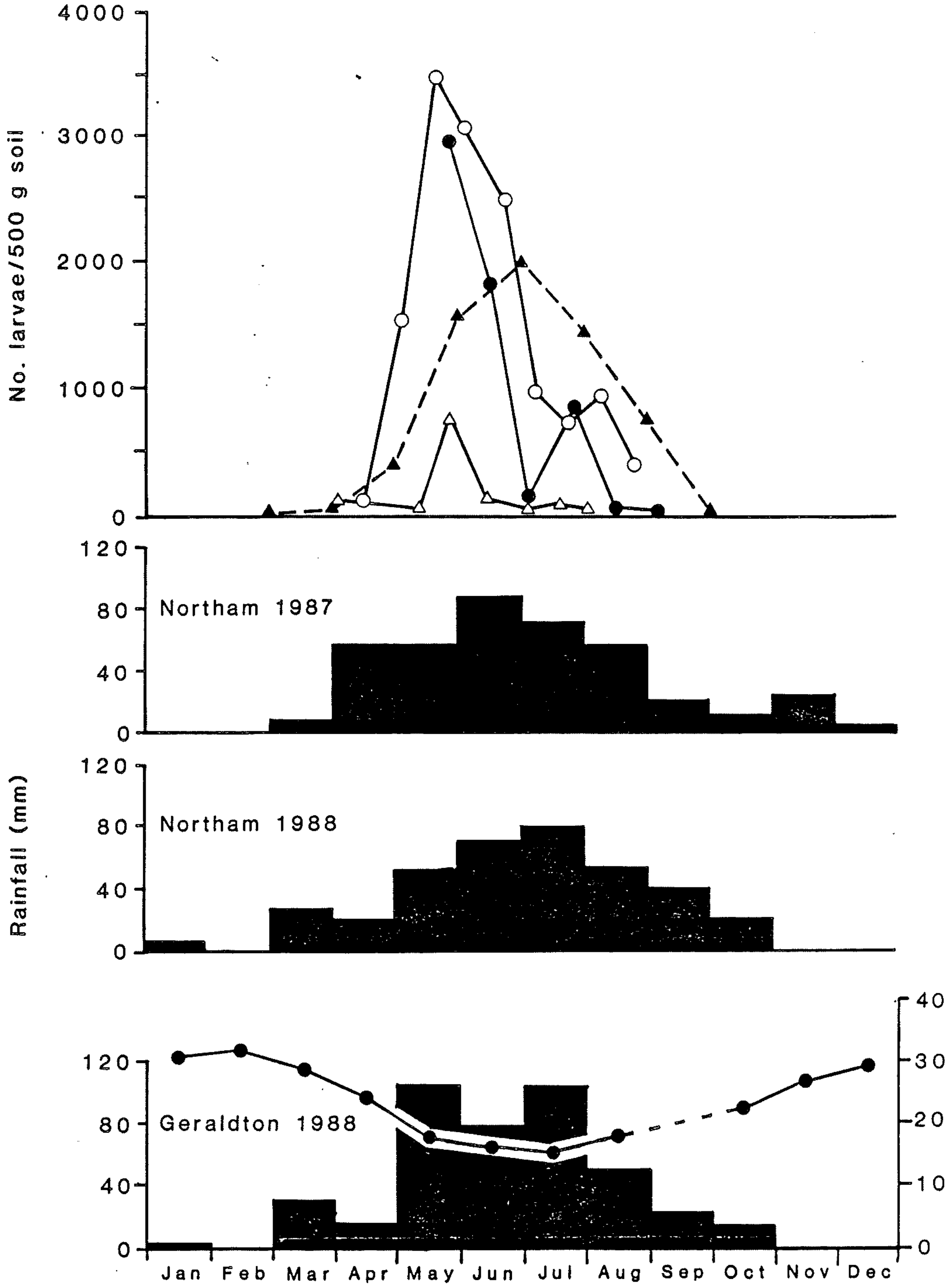

No. larvae/500 g soil
4000
3000
2000
1000
0
120
80
40
0
Northam 1987
120
80
40
0
Northam 1988
Rainfall (mm)
120
80
40
0
Geraldton 1988
40
30
20
10
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec