

## RESEARCH NOTES

### Measuring area and perimeter of second-stage larvae and males with the image-analyzing computer to distinguish between *Globodera rostochiensis* and *G. pallida*<sup>1</sup>

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Measurements of morphological features of different stages of development have been used to distinguish the potato cyst-nematodes *Globodera rostochiensis* (Woll.) and *G. pallida* (Stone) (1, 2, 5, 6, 7). To study European and South American populations (3) further, the image-analyzing computer (Quantimet 720 Metals Research Ltd., Melbourn, Herts, England) was used to compare optically derived images of perimeters and areas of second-stage juveniles and males.

The Quantimet includes a microscope to produce an image from mounted specimens. The image is scanned 10.5 times per second by a 720-line plumbicon scanner, and the output is passed to a detector where features are selected for measurement according to the intensity of the colour, common grey. Accuracy of measurement depends greatly on obtaining sufficient contrast between the specimen being measured and all other material on the slide. A monitor displays the features that are being measured and their numerical values. Results are printed out or punched on computer tape.

Second-stage juveniles and males to be measured were killed and fixed by Stone's method (4). To get good contrast, both were stained in hot cotton blue-lactophenol and mounted in warm clear lactophenol. Area and perimeter of at least 25 juveniles and 50 males were measured for each of six populations investigated (two of *G.*

*rostochiensis*, three of *G. pallida*, and a mixture of both). Table 1 shows means and standard deviations of the area and perimeter of second-stage juveniles and males. None of the measurements made it possible to differentiate between the species: their values were variable and overlapped inseparably. This confirms earlier results (2, 3) that the total length of second-stage juveniles and males is not a distinguishing morphometric character, nor is the area or perimeter. All of these characters are correlated.

#### LITERATURE CITED

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TABLE 1. Means and standard deviations of measurements of *Globodera* populations by the image-analyzing computer.

Populations	Second-stage juveniles			Males			Species*
	n	Area ( $\mu\text{m}^2$ )	Perimeter ( $\mu\text{m}$ )	n	Area ( $\mu\text{m}^2$ )	Perimeter ( $\mu\text{m}$ )	
Colombia	51	20842 $\pm$ 1703	1545 $\pm$ 204	51	16367 $\pm$ 1944	1668 $\pm$ 120	<i>G. pallida</i>
Peru	26	16370 $\pm$ 1810	1445 $\pm$ 78	54	12236 $\pm$ 1678	1466 $\pm$ 126	<i>G. pallida</i>
United Kingdom	28	21439 $\pm$ 1494	1664 $\pm$ 72	50	14626 $\pm$ 1459	1580 $\pm$ 105	<i>G. pallida</i>
Bolivia	27	19396 $\pm$ 1703	1587 $\pm$ 91	49	13390 $\pm$ 1047	1545 $\pm$ 84	Mixture of both
Peru	29	17380 $\pm$ 1807	1485 $\pm$ 61	53	12310 $\pm$ 1349	1441 $\pm$ 90	<i>G. rostochiensis</i>
United Kingdom	26	20330 $\pm$ 1481	1615 $\pm$ 80	52	14807 $\pm$ 1144	1643 $\pm$ 121	<i>G. rostochiensis</i>

\*Previously identified by female colour and/or measurements of second-stage larvae and cysts.