Chromosome number of Populations of *Radopholus similis* from North, Central, and South America, Hawaii, and Indonesia [1]

Robin N. HUETTEL *, Don D. DICKSON ** and David T. KAPLAN ***

* *USDA, ARS, Plant Protection Institute, BARC-West, Beltsville, Md 20705, USA*
** *University of Florida, Gainesville, FL 32611 U.S.A. and*
*** *USDA, SEA, ARS, Horticultural Research Laboratory, 2121 Camden Rd., Orlando, FL 32803 U.S.A.*

SUMMARY

Chromosome numbers were determined in seventeen populations of *Radopholus similis* from widely separated geographic regions of the world, viz. Honduras, Costa Rica, Panama, Mexico, Ecuador, Guatemala, Hawaii (U.S.A.), Indonesia and Florida (U.S.A.). All specimens examined had haploid chromosome numbers of either n = 4 or n = 5, the same numbers found, respectively, in the banana and citrus race of *R. similis* from Florida. Five populations had been characterized previously as possible biotypes of these races based on differences in their reproductive rates. No variation in chromosome numbers was observed among biotypes. The consistency in chromosome numbers further demonstrates the reliability of the karyotype for distinguishing the banana race (n = 4) from the citrus race (n = 5).

RÉSUMÉ

Nombre chromosomique de populations de Radopholus similis *originaires d'Amérique du Nord, Centrale et du Sud ainsi que des Hawaii et d'Indonésie*

Le nombre de chromosomes a été déterminé chez dix-sept populations de *Radopholus similis* provenant de régions géographiques bien distinctes : Honduras, Costa-Rica, Panama, Mexique, Equateur, Guatemala, Hawaii (U.S.A.), Indonésie et Floride (U.S.A.). Pour quelques pays, plusieurs populations ont été examinées. Dans tous les spécimens observés, le nombre chromosomique était n = 4 ou n = 5, ce qui correspond aux nombres haploïdes trouvés res-respectivement chez les races « banane » et « citrus » de *R. similis* en Floride. Cinq de ces populations avaient déjà été caractérisées comme biotypes probables de ces deux races en raison de différences observées dans leur reproduction. Les résultats obtenus montrent qu'à l'intérieur de chaque biotype il n'existe pas de variations dans le nombre de chromosomes. Ceci confirme que le caryotype est un critère valable pour établir la distinction entre la race « banane » (n = 4) et la race « citrus » (n = 5).

Uniformity in the number of chromosomes seems to be characteristic in all bisexual nematodes species thus far examined (Triantaphyllou & Hirschmann, 1980). For example, the chromosome numbers within three bisexual species of *Pratylenchus* were n = 5, 6, and 7 (Roman & Triantaphyllou, 1969). Populations of these *Pratylenchus* spp. were from several locations, yet their chromosome numbers were consistent. Differences in chromosome numbers within or between populations of a nematode species would indicate a major genic change that would be of evolutionary importance. White (1978) pointed out that 90-95% of all speciation events have been accompanied by karyotypic changes. Such karyotypic differences are also of considerable taxonomic value in many other groups of animals.

The banana and citrus races of *Radopholus similis* from Florida were found to have a chromosome number of n = 4 and n = 5, respectively (Huettel & Dickson, 1981). This difference in chromosome number between the two races may indicate an evolutionarily significant mutational event. It is probable that either a chromosome fusion or a dissociation occurred in one race to give rise to the other. However, because nematodes have either holocentric or polycentric chromosomes (White, 1974 ; Fiil, Goldstein

[1] Florida Agricultural Experiment Station Journal Series. No. 4121. Portion of a dissertation submitted by the senior author in partial fulfillment of the requirements for the Ph. D. degree in Nematology, University of Florida, Gainesville, FL. U.S.A. 32611. This research was supported by a USDA, SEA, ARS, Cooperative Agreement Grant, No. 58-7B30-213 and in part by a grant from United Brands Co., New York, N Y 10020.

& Moens, 1977), the mechanics of which are not well understood, the most probable direction of the mutation cannot be elucidated currently.

The literature on physiological races of *R. similis* is complicated by the description of biotypes of each race (Pinochet 1978, 1979 ; O' Bannon & Ford, 1979 ; Tarte & Pinochet 1981). An "isolate" was defined by Pinochet (1979) as a population of the banana race that differs in reproductive capabilities from other populations of the race. O' Bannon and Ford (1979) described two possible biotypes of the citrus race as populations that can break resistance in root-stocks of *Citrus* spp. The terms "biotype", "isolate", and "race" are often used interchangeably, thus a clarification of their definitions is necessary before describing populations of *R. similis*. "Race" will be used here to denote a selective difference in host preference within a species of plant parasitic nematode (e.g., citrus race). "Biotype" will be used to denote any unusual characteristic exhibited by a population of a described race (e.g., reproductive differences or resistance breaking of a resistant variety of its normal host). Four biotypes of the banana race described by Pinochet (1979) and one citrus race biotype described by O' Bannon and Ford (1979) were included in this study.

The objectives of this study were to determine *i*) the existence of karyotypic uniformity among populations of the banana race (n = 4), *ii*) the karyotype of populations of *R. similis* from other host plants from both Florida and other locations worldwide, and *iii*) the occurrence of karyotypic differences within

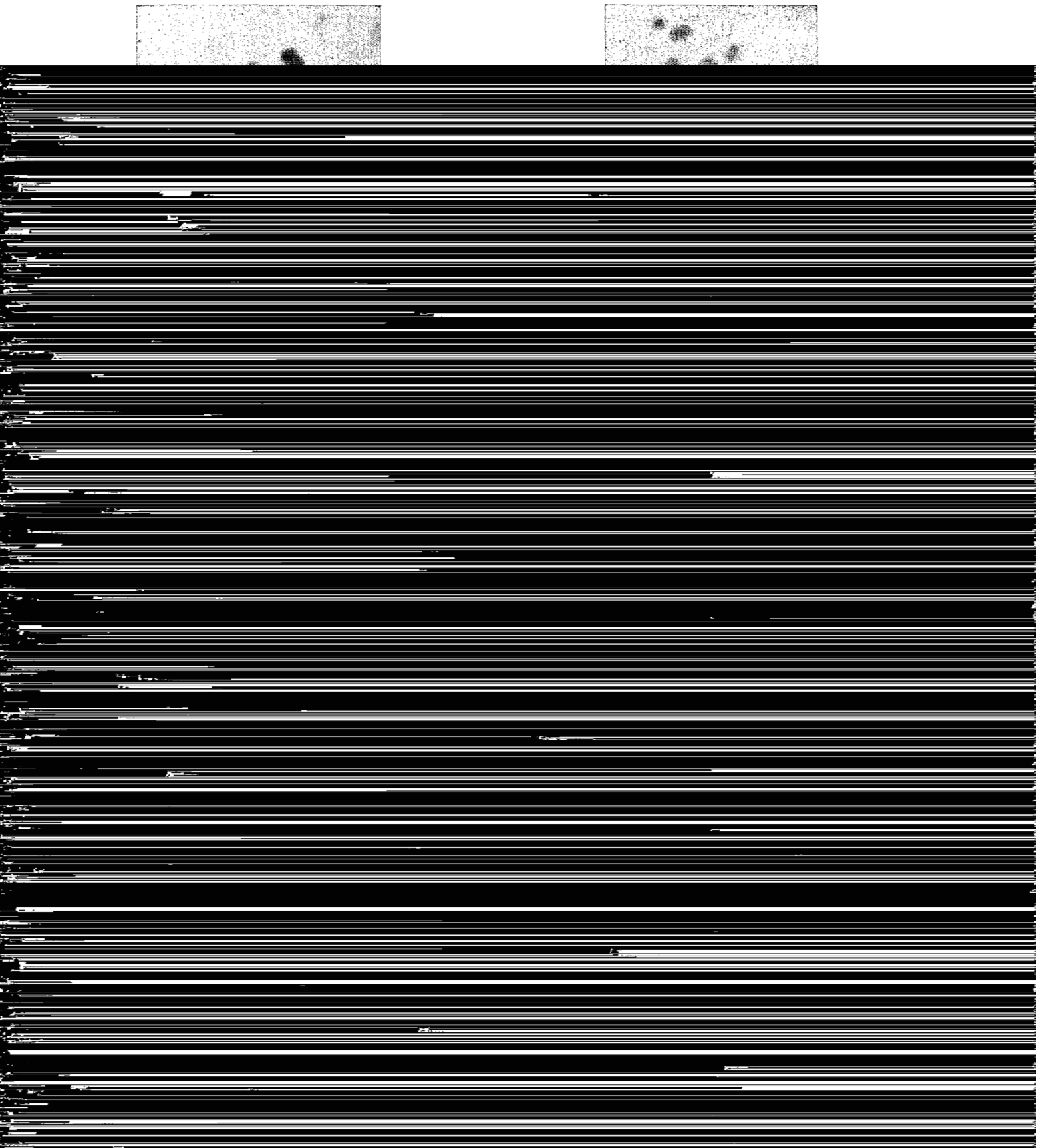
Two populations of the citrus race, one of which was considered to be a biotype by O' Bannon and Ford (1979), were obtained from the U.S.D.A. Horticultural Laboratories, Orlando, Florida. Two populations originating from infected citrus roots growing in Polk County were obtained, also from the Florida Department of Agriculture and Consumer Service (FDACS), Burrowing Nematode Laboratory, Lake Alfred, Florida.

Other populations used in this study were from quarantined shipments of *Philodendron* sp. and *Maranta* sp., FDACS, Division of Plant Industry, Nematology Section, Gainesville, Florida, and *Anthurium andraeanum* L. and *Musa* sp., Department of Plant Pathology, University of Hawaii, Honolulu, Oahu. An Indonesian population from black pepper (*Piper nigrum* L.) was examined at Rothamsted Experimental Station, Harpenden, Herts., England.

The method for determining chromosome numbers was modified from Triantaphyllou (1975) and reported previously (Huettel & Dickson, 1981). Approximately 200 to 500 female nematodes were examined for each population.

Observations

The number of chromosomes established for each population examined is listed in Table 1. All populations from banana had four chromosomes (examples illustrated in Fig. 1). The Indonesian population from black pepper had four chromosomes as did



are not restricted to Florida as previously assumed. Consequently, five chromosome races of *R. similis*

Karyotypic uniformity is expected in sexually reproducing diploid species (White, 1978). Differences