

College of Environmental and Natural Resources, South China
Agricultural University, Tianbe, 510642 Guangzhou, P.R. China

SPECIES OF *HIRSCHMANNIELLA* ON RICE AND THEIR DISTRIBUTION IN CHINA

by

J. L. LIAO, Z. X. FENG, S. M. LI and Y. M. HU

Summary. A survey was carried out in China on the species of *Hirschmanniella* occurring in association with rice (*Oryza sativa*). A total of 16 species were identified in the different provinces. They were morphometrically slightly different from the type populations. *H. oryzae* was prevalent and the most widespread. *Hirschmanniella* spp. constitute a major phytopathological problem of rice in China.

China is one of the main rice producers in the world and requires large supplies for its numerous and expanding population.

Species belonging to the genus *Hirschmanniella* are important nematode pests on rice, causing 10-30% yield losses (Ou, 1972).

There have been several investigations of *Hirschmanniella* species affecting rice in China (Feng and Li, 1983; Zhang, 1987; Wu *et al.*, 1995) but not a comprehensive report on the geographical distribution of species. The results of a survey carried out in China during 1980-1995 are reported here.

Materials and methods

Totally, 521 populations of *Hirschmanniella* species from the 17 provinces in China where rice is grown were studied. Soil and root samples were collected in each of the provinces. Rice (*Oryza sativa* L.) plants at different stages of development were uprooted from fields and nursery beds and put in plastic bags, to avoid dehydration. In the laboratory, roots were com-

minuted into small pieces, then the roots and soil samples were placed in a Baermann funnel to extract nematodes. Nematodes were preserved in TAF, mounted in anhydrous glycerin and observed under a light microscope.

Identification was determined by reference to original descriptions of species (Sher, 1968; Mathur and Prasad, 1971; Ahmed, 1972; Siddiqi, 1973; Sivakumar and Khan, 1982).

Results and discussion

A total of 16 species of *Hirschmanniella* were identified. The species lists and population measurements, are given in Table I. Morphometrics of the Chinese populations varied slightly from the original descriptions, mainly in body length and stylet length of females. However, they were within the specific range, as indicated by Lamberti *et al.* (1998) for populations of *H. oryzae* from Sri Lanka.

Hirschmanniella oryzae (Van Breda de Haan, 1902) Luc *et* Goodey, 1964 was the most common and widely distributed species. It oc-

TABLE I - *Biometrics for populations of Hirschmanniella spp. from China* (μm).

Species	L	Styler	a	b	b'	c	c'	V%·T%	Spicules	Gubernaculum	Bursa
<i>H. oryzae</i> (Van Breda de Haan, 1902) Luc et Goodey, 1964											
18 ♀♀	1311 (1123-1597)	17.9 (15.0-20.2)	55.3 (48.3-69.0)	11.0 (9.0-13.4)	4.8 (4.0-5.8)	16.2 (14.0-18.2)	4.6 (3.5-5.6)	52.9 (50.0-55.7)			
3 ♂♂	1289 (1222-1354)	17.2 (16.0-18.2)	56.7 (54.3-60.0)	10.6 (9.9-13.9)	4.7	17.9 (17.0-29.0)	4.2 (3.9-4.4)		27.2 (25.9-28.5)	7.9 (7.5-8.3)	63.4 (54.6-78.0)
<i>H. caudacrena</i> Sher, 1968											
4 ♀♀	1364 (1175-1472)	18.8 (17.6-20.8)	51.1 (41.1-57.6)	11.6 (11.2-12.2)	4.5 (4.2-4.8)	14.2 (12.7-15.0)	4.5 (4.1-4.9)	52.6 (48.0-56.8)			
1 ♂	1200	18.8	53.0	10.0	3.6	12.9	6.2		34.5	13.5	48.0
<i>H. gracilis</i> (De Man, 1880) Luc et Goodey, 1963											
2 ♀♀	1513-1927	19.5-22.5	51.1-52.2	10.3-12.9	5.1-6.3	15.7-20.0	3.9-4.0	48.4-48.7			
1 ♂	1695	20.4	54.6	12.5		18.3	4.5		40.0	11.0	62.0
<i>H. imamuri</i> Sher, 1968											
3 ♀♀	2464 (2002-2912)	29.5 (28.6-30.0)	61.3 (53.3-72.0)	16.0 (14.7-17.7)	7.6 (7.3-7.8)	17.9 (16.5-18.6)	4.7 (4.2-5.2)	49.0 (48.0-49.5)			
<i>H. indica</i> Ahmad, 1974											
5 ♀♀	1720 (1602-1856)	23.4	53.9 (51.0-56.5)	13.3 (11.7-15.0)	5.8 (5.3-6.4)	20.6 (20.1-21.7)	3.8 (3.6-4.0)	52.1 (49.9-54.8)			
<i>H. mangaloriensis</i> Mathur et Prasad, 1971											
2 ♀♀	1456-1596	20.8	44.8-48.2	12.3-14.0	5.1-5.9	16.4-19.0	3.4-3.8	51.8-52.6			
<i>H. microtyla</i> Sher, 1968											
10 ♀♀	1279 (967-1399)	19.9 (17.6-21.5)	47.9 (43.0-51.8)	10.2 (8.6-13.3)	4.1 (3.3-5.2)	15.3 (13.4-17.3)	4.2 (3.8-4.9)	54.1 (52.2-55.4)			
<i>H. mucronata</i> (Das, 1960) Luc et Goodey, 1963											
12 ♀♀	1900 (1612-2158)	26.4 (24.0-28.6)	58.2 (51.0-66.8)	14.0 (11.3-16.0)	6.2 (5.5-7.9)	21.4 (19.0-26.7)	4.1 (3.6-4.8)	52.3 (48.6-55.0)			
2 ♂♂	1771-1820		59.0-60.9	12.6-12.7	3.4-6.3	19.7-24.6	3.6-4.6		31.5-35.1	13.0-13.5	82.5-84.5
<i>H. sbamimi</i> Ahmad, 1974											
5 ♀♀	1396 (1193-1524)	19.0 (18.2-19.5)	52.6 (38.3-61.6)	11.9 (11.2-12.9)	5.0 (4.0-6.6)	15.9 (14.9-16.8)	4.6 (3.5-5.0)	53.9 (50.4-55.3)			
<i>H. thornei</i> Sher, 1968											
♀	1913	27.3	61.3	14.0	6.3	23.7	3.4	51.6			
* <i>H. marina</i> Sher, 1968											
♀	1390 (1210-1450)	23.1 (21.0-22.4)	45.1 (38.2-55.6)			12.9 (10.2-15.0)		56.8 (48.5-62.1)			
* <i>H. diversa</i> Sher, 1968											
♀	1960 (1560-2310)	26.5 (23.2-29.2)	54.5 (49.3-59.2)	13.9 (12.8-15.0)		19.1 (15.1-29.2)		54.1 (50.4-58.3)			
* <i>H. dubia</i> Khan, 1972											
♀	1700 (1451-2160)	20.0	55.1 (49.7-60.1)	13.8 (12.8-15.4)		16.5 (14.9-18.2)		57.6 (49.0-63.1)			
* <i>H. mexicana</i> (Chitwood, 1951) Sher, 1968											
♀	1390 (1260-1480)	20.6	49.2 (49.1-54.1)	8.0 (6.8-12.0)		15.5 (13.8-17.8)		52.9 (50.1-55.0)			
* <i>H. spinicaudata</i> (Sch, Stek, 1944) Luc et Goodey, 1963											
♀	2480 (1940-2980)	35.0 (29.8-39.2)	44.2 (38.0-52.0)	13.8 (12.0-14.0)		18.3 (14.1-20.8)		53.0 (50.1-54.2)			
♂	2437	35.2	51.0	16.2		18.3				44.5	14.3
** <i>H. belli</i> Sher, 1968											
♀	1530 (1270-1750)	21.0 (18.0-24.0)	55.0 (45.0-62.0)	11.2 (9.8-12.7)		16.0 (13.0-18.0)		53.0 (47.0-58.0)			
♂	1500 (1330-1720)	20.0 (18.0-21.0)	67.0 (54.0-80.0)	11.0 (9.0-13.0)		18.0 (17.0-20.0)			26.0 (25.0-28.0)	8.0 (7.0-9.0)	

* data from Wu *et al.*, 1995, ** data from Zhang, 1987.

curred in all of the provinces that were investigated, and in most cases in high population densities. *H. microtyla* Sher, 1968, *H. mucronata* (Das, 1960) Luc et Goodey, 1963 and *H. caudacrena* Sher, 1968 were also very common and sometimes in population densities exceeding those of *H. oryzae*.

The results of the survey indicated the presence of *Hirschmanniella* species in 17 provinces, almost in all rice producing areas in China (Fig. 1). As indicated in Table II, species varied

from place to place, but it was not infrequent that several species occurred in the same place.

Application of nematicides, such as fenamiphos, ethoprop and carbofuran have been tried in China to control *Hirschmanniella* on rice. But their high cost and associated environmental problems have limited their use. Alternative methods of control such as crop rotations, water and fertilizer management have given acceptable results (Yin and Li, 1984; Zhang and Ai, 1994; Gao *et al.*, 1998).

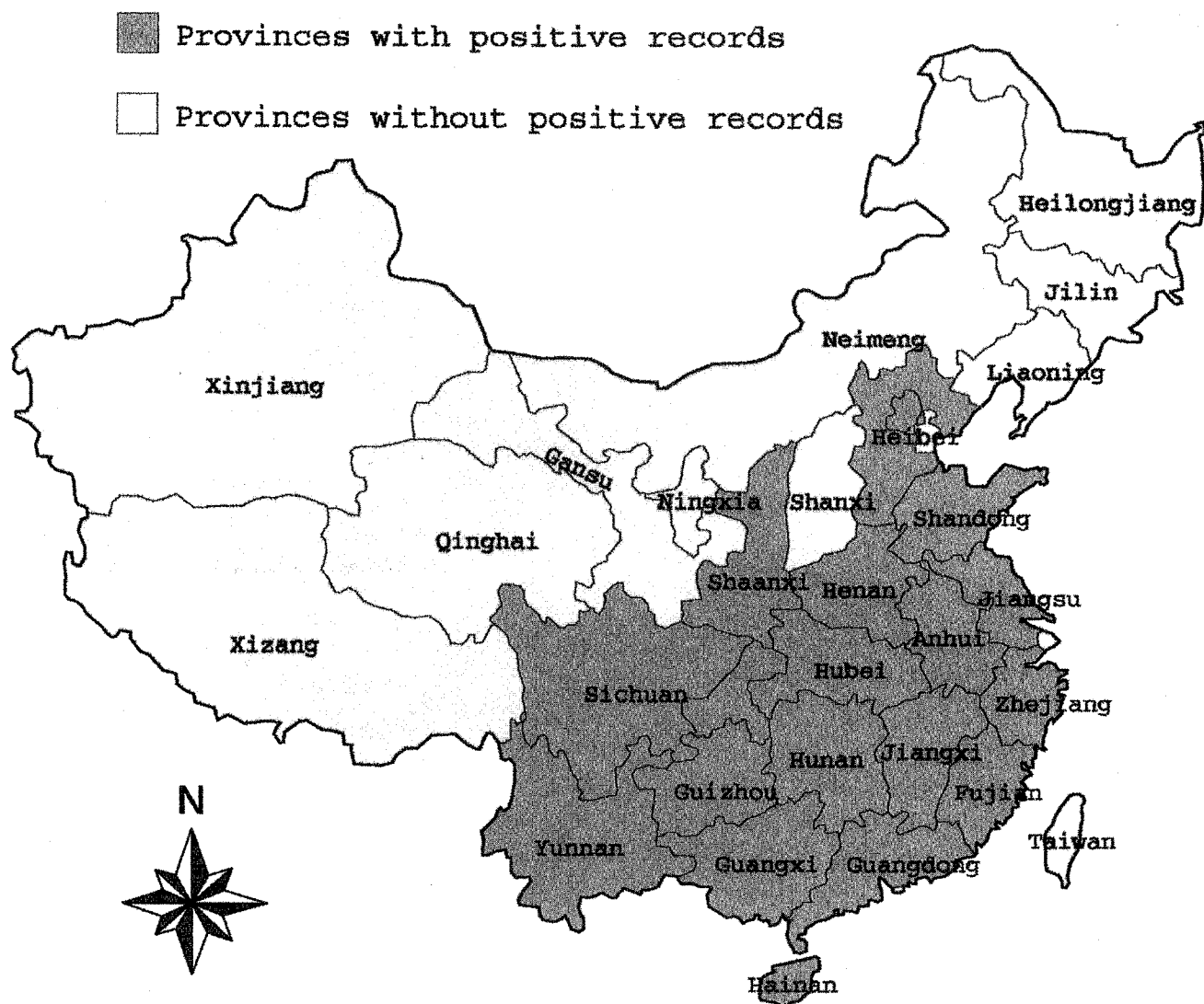


Fig. 1 - Map of distribution of *Hirschmanniella* spp. in China.

TABLE II - *Distribution of Hirschmanniella spp. in China.*

Species	Provinces
<i>H. belli</i>	Fujian, Anhui, Guizhou
<i>H. caudacrena</i>	Guangxi, Hunan, Hubei, Henan, Jiangxi, Fujian, Zhejiang, Jiangsu, Anhui, Shandong
<i>H. diversa</i>	Anhui
<i>H. dubia</i>	Anhui
<i>H. gracilis</i>	Guangdong, Guizhou, Anhui, Shandong
<i>H. imaruri</i>	Yunnan, Guizhou, Hebei
<i>H. indica</i>	Zhejiang
<i>H. mangaloriensis</i>	Jiangxi, Zhejiang
<i>H. marina</i>	Anhui
<i>H. mexicana</i>	Anhui
<i>H. microtyla</i>	Guangdong, Hainan, Guizhou, Sichuan, Hunan, Hubei, Henan, Hebei, Jiangxi, Zhejiang, Anhui, Shandong
<i>H. mucronata</i>	Guangdong, Hainan, Guangxi, Yunnan, Hunan, Hubei, Jiangxi, Fujian, Zhejiang, Anhui, Shandong
<i>H. oryzae</i>	Guangdong, Guangxi, Yunnan, Guizhou, Sichuan, Shaanxi, Hunan, Hubei, Henan, Hebei, Jiangxi, Fujian, Zhejiang, Jiangsu, Anhui, Shandong, Hainan
<i>H. shamimi</i>	Guangxi, Sichuan, Hubei, Jiangxi, Fujian
<i>H. spinicaudata</i>	Anhui
<i>H. thornei</i>	Guangdong, Jiangxi

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