

## OCURRENCE AND REGULATION OF THE RICE WHITE-TIP NEMATODE, *Aphelenchoides besseyi* IN CERTAIN PADDY AREAS OF SOUTH DAKAHLIA GOVERNORATE.

Khalil, A.E.M.\* and A.G. El-Sherif \*\*

\* Plant Pathology Res. Inst., Agric. Res. Center, Giza

\*\*Nematology Res. Unit., Fac. of Agric., Mansoura University, Egypt.

### ABSTRACT

The occurrence and regulation of *Aphelenchoides besseyi*, Christie, 1942 recovered from soaking either twenty grams straw or one hundred rice grains of four varieties i.e. Sakhia 101, Giza 177, 171 and Rehoo for 48 or 48 and 96 hrs was investigated under room temperature (25 + 2°C). Results indicated that the population density of *A. besseyi* obtained every month after harvest from soaking rice grains or straw tested was higher than that of at harvest or pre-maturity stage. After harvest grains of Rehoo variety gave the highest numbers of *A. besseyi*, whereas, Sakhia 101 showed the least with values of 57.0 or 76.4 and 33.8 or 43.6 individuals when rice grains were soaked for 48 or 96 hrs, respectively. Tahwaai village where paddy areas were cultivated with Giza 171 and Rehoo achieved the highest levels of nematode infestations in rice grains as well as straw.

**Keywords:** Occurrence of white tip nematode, Rice varieties, level of nematode infestation.

### INTRODUCTION

White-tip disease of rice plant *Oryza sativa* L. caused by a seed-borne nematode, *Aphelenchoides besseyi*, Christie, 1942 has been widely distributed in many rice growing countries in Asia, Tropical America, formerly USSR and Africa (Franklin & Siddiqi, 1972; Fortuner & Williams, 1975 and Ou, 1985). Recently, it was recorded by Amin (2002) for the first time in Egypt during a survey of plant parasitic nematodes in the paddies of Dakahlia and Sharkia governorates in the Nile Delta of Egypt. He also reported that the observed nematode (*A. besseyi*) is the causal agent to the white tip leaf disease symptoms of 3-5 cm of the rice leaf tip which become necrotic followed by reduction in size of the panicle and decrease in the size and number of grains. *A. besseyi* caused variable yield losses in different countries ranging from 14.5 to 46.7% in Japan (Nishizawa & Yamamoto, 1951), 40-50% in formerly U.S.A. (Atkins & Todd, 1959), 29 to 46% in Taiwan (Hung, 1959), 41 to 71% in USSR (Tikhonova, 1966) and 20 to 60% in India (Rao *et al.*, 1985). Moreover approximately 25% of the seed samples collected from farmer's seed stores or field at harvest, were found to be infested with this nematode in deepwater rice areas in Bangladesh (Rahman and Miah, 1989). *A. besseyi* can survive for one year inside the rice seeds and 53 days in water under 10°C (Qiu *et al.*, 1991). The white tip nematode infected the rice plant ectoparasitically in the beginning and penetrated the rice flowers and hibernated beneath the seed glumes as fourth stages juveniles and adults (Nandakumar *et al.*, 1975). Once the nematodes revive, leave the seeds to attack new rice seedlings. Therefore, the aim of this study

was to determine the occurrence and population density of *A. besseyi* in seeds and straw of certain rice varieties that previously showed symptoms of white tip disease during rice growing season in south Dakahlia governorate.

## **MATERIALS AND METHODS**

During a scientific tour to rice fields on September 1<sup>st</sup>, 2001 at Simbellawian district, south of Dakahlia governorate (Nile Delta of A.R. Egypt), symptoms of white tip leaf (Flag Leaf) caused by *Ahelenchoides besseyi*, Christie, 1942 were observed based on chlorotic discoloration of the leaf sheath just below the collar of the 3 month-old plants of rice varieties i.e. Sakhia 101, Giza, 177 or 171 and Rehoo grown in Sobaeen, Bcrg-El-Nour-El-Arab, Tahwaai (A) and Tahwaai (B) villages, respectively. Five locations of infested rice plants within each of the four varieties were selected and marked by bamboo stakes for collecting samples of plants leaves, stems and panicles of each infested location per variety at each growth stage as follows: -

- 1- At pre-maturity stage and harvest, a twenty grams of flag-leaf plus stem and panicles per location of each variety were collected in paper bags and brought to the nematology laboratory, kept in a refrigerator at 5°C. These materials were cut into 0.25 cm pieces and soaked in tap water in a 10-cm-diam. plastic cup. Twenty four hours after incubation into water, suspension was sieved through 60 mesh and the nematodes were concentrated through Cobb's sieve 350 mesh (Cobb, 1918), counted, recorded and their identity confirmed microscopically.
- 2- At harvest, 1400 rice grains of each variety per location was collected and stored in a plastic container at room temperature, then divided into 2 groups with 700 rice grains each. At harvest time immediately as well as every month for a period of 6 months, two sets of one hundred rice grains each, one from each group was soaked in a plastic cup 10 cm diam, filled with tap water for 48 hrs and the other set was soaked and separately kept for 96 hrs. Each set separately sieved with 60 mesh. The nematodes were concentrated through Cobb's sieve 350 mesh (Cobb, 1918) examined, counted and recorded.
- 3- Stock of rice straw/location of each variety tested was collected and stored in a safety place for nematode extraction. At harvest and one month after harvest; and every month for a period of 6 months, twenty grams from the stock of rice straw/location of each variety was cut into 0.25 cm – pieces, soaked in a tap water in a plastic container 20 cm – diam, for 24 hrs, sieved by 60 mesh and concentrated through 400 mesh (Cobb, 1918) counted and recorded.

Nematode extraction in each procedure mentioned above was conducted in darkness at 25 ± 2°C as this temperature is within the suitable range for extraction of *A. besseyi* from the soaked seeds or straw (Tamura and Kegasawa, 1957).

Data were subjected to analysis of variance (ANOVA) (Gomez and Gomez, 1984) and means were compared by Duncan's multiple-range test (Duncan, 1955).

## RESULTS

Data presented in Tables (1) and (2) show the occurrence and regulation of *A. besseyi* recovered from soaking 100 rice grains (seeds) of each rice variety tested i.e. Sakhia 101, Giza, 177, 171 and Rehoo for 48 or 96 hours at 25 + 20C, respectively. It is evident that the population density of *A. besseyi* obtained by soaking rice grains for 96 hrs was significantly greater than that of 48 hrs for all rice varieties examined. The average number of *A. besseyi* during six months after harvest was significantly increased for the soaking grains of 48 or 96 hrs with values of 14.8 or 28.8 individuals per 100 rice grains of Sakhia 101 at harvest which became 33.76 or 43.63 individuals per month, respectively. Among the rice grains varieties tested, Rehoo gave the highest numbers of *A. besseyi* per 100 rice grains soaked for 48 or 96 hrs, followed by Giza 171 and 177 with values of 57.13 or 76.43 and 53.13 or 70.63 and 43.06 or 54.50 individuals, respectively. On the other hand, grains of Sakhia 101 that were soaked either for 48 or 96 hrs revealed the least average numbers of *A. besseyi* recovered during the six months after harvesting time.

It is also obvious that Tahwaai village where paddies areas were cultivated with Giza 171 and Rehoo varieties, the soaked rice grains/variety for 48 or 96 hrs revealed the highest numbers of *A. besseyi* with level of infestation percentages reached to 49.59 and 52.39% or 68.6 and 72.0%, respectively (Tables 1 & 2).

Data presented in Table (3) show occurrence and regulation of the average number of *A. besseyi* recovered by soaking twenty grams of rice straw per each variety tested at the pre-maturity stage, harvesting time and after harvest every month for six months. It is clear that the average population density of white-tip nematode, *A. besseyi* obtained every month after harvest was obviously higher than that at harvest or the pre-maturity stage for the soaked straw of the four varieties tested with values of 85.6, 35.6 and 34.2 individuals for Sakhia 101; 141, 49.6 and 48.2 individuals for Giza 177; 276.1, 112.0 and 101.6 individuals for Giza 171; and 206.4, 73.2 and 60.8 individuals for Rehoo, respectively.

Among the soaked straw of the four rice varieties tested, straw of Giza 171 variety revealed the highest average number of *A. besseyi* recovered either at the pre-maturity stage or at harvest or during the six months after harvest (Table, 3). The highest total population density of *A. besseyi* obtained from soaking twenty grams of rice straw was 1870.2, 1372.6 and 943.8 individuals for Giza 171, Rehoo and Giza 177, respectively, whereas, Sakhia 101 gave the least total population density of *A. besseyi* with value of 583.4 individuals/160 grams straw.

Moreover, the highest average number of *A. besseyi* per one gram of rice straw was achieved with Giza 171, followed by Rehoo and then Giza 177 with values of 11.68, 8.58 and 5.89 individuals, respectively, whereas Sakhia 101 had the least value of 3.65 individuals (Table 3). However, there were varietal differences both in infestation levels and the number of nematodes in rice seeds and straw (Tables 1, 2 and 3).

**Table (1): Occurrence of white tip nematode, *A. besseyi* recovered from one hundred rice grains/rice variety after 48 hrs of incubation in water at 25 + 2°C.**

Village	Variety	At harvest	Population density of <i>A. besseyi</i> **						Total number/100 rice grains and % of infestation*	
			After harvest by month							
			1	2	3	4	5	6		
Sobaeen	Sakha 101	14.8 d	27.0 b	26.2 b	24.6 b	33.0 c	46.8 d	45.0 d	33.76	217.36 (31.05)
Borge El-Nour El-Arat	Giza 177	17.0 c	32.2 b	34.2ab	35.8 a	41.6 b	55.8 c	58.8 c	43.66	278.96 (39.85)
Tahwaai A	Giza 171	28.4 a	45.2 a	39.0 a	38.0 a	50.4 b	73.8 b	72.4 b	53.13	347.18 (49.59)
Tahwaai B	Rehoo	24.0 b	48.2 a	39.8 a	38.4 a	52.4 a	82.8 a	81.2 a	57.13	366.78 (52.39)

\* Figures within the parenthesis are the % infestation of seeds with *A. besseyi*.

\*\* Means of five replicates.

**Table (2): Occurrence of white tip nematode, *A. besseyi* recovered from one hundred rice grains/rice variety after 96 hrs of incubation in water at 25 + 2°C.**

Village	Variety	At harvest	Population density of <i>A. besseyi</i> **						Total number/700 rice grains and % infestation*	
			After harvest by month							
			1	2	3	4	5	6		
Sobaeen	Sakha 101	28.8 c	37.8 c	29.2 b	36.4 c	47.0 b	55.4 d	56.0 c	43.63	290.58 (41.5%)
Borge El-Nour El-Arat	Giza 177	34.8 c	48.6 b	40.6 a	46.4 b	52.8 b	69.2 c	69.4bc	54.50	361.80 (51.7%)
Tahwaai A	Giza 171	56.2 a	72.4 a	45.2 a	63.4 a	66.8 a	88.4 b	87.6 b	70.63	479.98 (68.6%)
Tahwaai B	Rehoo	46.0 b	72.8 a	49.0 a	60.6 a	67.4 a	99.6 a	109.2 a	76.43	504.58 (72%)

\* Figures within the parenthesis are the % infestation of seeds with *A. besseyi*.

\*\* Means of five replicates.

Table (3): Occurrence of *A. besseyi* in twenty grams of rice Straw/variety 48 hrs of incubation in water that previously grown in selected rice fields of three villages within simbellawian district, south of Dakahlia governorate during the growing season of 2001.

Village	Variety	At Pre-maturity stage	At harvest	Population density of <i>A. besseyi</i> *						Total of nematode number in 160 gm.*** straw/variety	Average number/month***
				After harvest by month							
				1	2	3	4	5	6		
Sobaeen	Sakha 101	34.2 c	35.6 c	150.4d	61.0 c	25.4 c	82.8 c	100.2d	93.8 c	583.4 (3.65)	85.6
Borge El-Nour El-Arat	Giza 177	48.2 bc	49.6 c	225.4c	74.0bc	51.0 c	120.0c	191.6c	184.0b	943.8 (5.89)	141
Tahwaai A	Giza 171	101.6 a	112.0 a	347.8a	160.8a	128.0a	312.0a	393.0a	315.0a	1870.2(11.68)	276.1
Tahwaai B	Rehoo	60.8 b	73.2 b	289.8b	102.4b	95.2 b	213.6b	261.0b	276.6a	1372.6 (8.58)	206.4

\* Average number of *A. besseyi* for five replicates.

\*\*Average number of *A. besseyi* per month for the six months examined.

\*\*\* Figures within the parenthesis are the average number of nematode per one gram of rice straw/variety.

## DISCUSSION

Examination of both the fresh and stored seed samples of rice varieties tested at harvest that were soaked for 48 or 96 hrs revealed less number of *A. besseyi* individuals than that of the six months after harvest since their levels of infestation ranged from 14.8 to 28.4% for fresh seeds and from 45.0 to 81.2% for six months stored seeds per 100 grains, respectively. These results agree with the findings of Rahman and Miah (1989) who reported that fresh seeds of rice varieties examined always had fewer nematodes than stored seeds in Bangladesh. Fukano (1962) in Japan, indicated that 30 or more live nematode per 100 grains may be the possible economic threshold level in such susceptible cultivator. The apparent reduced infestation level at harvest could be due to the masking of symptoms on leaves as they die and variety. The same trend was evident in the case of soaked straw of rice varieties tested.

As white-tip nematode, *A. besseyi* is seed borne, the nematode is easily transmitted from locality to another. Under rice environments the nematode may also be water dispersed from an infested field to a healthy one. Therefore, the present results conclude that seeds from infested areas should be treated before sowing to control and prevent further spread of the nematode in water rice.

## REFERENCES

- Amin, W. A. (2002). *Aphelenchoides besseyi* Christie, 1942, on rice; A new record in Egypt. Pakistan J. of Biological Sci. 5(3): 297 – 298.
- Atkins, J.G. and E.H. Todd (1959). White-tip disease of rice. III Yield tests and varietal resistance. Phytopathology, 49: 189 – 191.
- Cobb, N.A. (1918). Estimating the nematode population of soil. U.S. Dep. Tech. Circ. Bur. Pl. Ind. U.S. Dep. Agric., No. 1.
- Duncan, D.B. (1955). Multiple range and multiple F-test Biometrics 11: 1-42
- Fortuner, R. and K.J.O. Williams (1975). Review of the literature on *Aphelenchoides besseyi* Christie, 1942, the nematode causing "white-tip" disease in rice. Helminthol. Abstr. Ser. B., 44: 1-140.
- Franklin, M.T. and M.R. Siddiqi (1972). *Aphelenchoides besseyi* C.I.H. Descript. Pl.-Parasit. Nematodes, Set., 1(4): 3 p.
- Fukano, H. (1962). Ecological studies on white-tip disease of rice plant caused by *Aphelenchoides besseyi* Christie, 1942 and its control. Bull. Fukano Agric. Exp. Statn, 18: 108.
- Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for agricultural research, 2<sup>nd</sup> Ed., John Willey and Sons. Inc. Now York.
- Hung, Y.P. (1959). "White-tip disease of rice in Taiwan" FAO Pl. Protect. Bull., 1: 1 – 6.
- Nandakumar, C.; J.S. Prasad; Y.S. Rao and J. Rao (1975). Investigations on the white-tip nematode, *Aphelenchoides besseyi*, Christie, 1942, of rice (*Oryza sativa* L.), Indian J. Nematol., 5: 62 – 69.
- Nishizawa, T. and S. Yamamoto (1951). Studies on the varietal resistance of rice plant to the nematode disease "Senchu shingara byo", II A

- test of the leading varieties and part of breeding lines of rice plant in Kyushu. Kyushu Agric. Res., 8: 91 – 92.
- Ou, S.H. (1985). Rice diseases, slough, UK, Common wealth Agricultural Bureau, X4 380 p.
- Qiu, T.X.; M.F. Yan and Q. Lu (1991). Study on the occurrence, regulation and control of *Aphelenchoides besseyi*. Zhejiang-Nongye Kexue. 6. 290 – 292.
- Rahman, M.L. and S.A. Miah (1989). Occurrence and distribution of white-tip disease in deepwater rice areas in Bangladesh, Revue Nematol., 12(4): 351 – 355.
- Rao, Y.S.; J.S. Prasad and M.S. Panwar (1985). Nematode pests of rice in India. Non-insect Pest & Predators. 65 – 71.
- Tamura, I. and K. Kegasawa (1957). Studies on the ecology of the rice nematode, *Aphelenchoides besseyi*, Christie 1. On the swimming away of rice nematodes from the seeds soaked in water and the relation to the water temperatures. Japanese Journal of Ecology, 7: 111 – 114.
- Tikhonova, L.V. (1966). *Aphelenchoides besseyi* Christie, 1942 (Nematoda, Aphelenchoididae) on rice and method of control]. Zool. Zh., 45: 1759 – 1766.

تواجد وانتظام نيماتودا القمة البيضاء في حقول أرز معينة بمنطقة جنوب محافظة الدقهلية .

أشرف السعيد خليل\* وأحمد جمال الشريف\*\*

\* معهد بحوث أمراض النبات - مركز البحوث الزراعية - الجيزة

\*\* وحدة بحوث النيماتولوجي - كلية الزراعة - جامعة المنصورة - محافظة الدقهلية - جمهورية مصر العربية .

تم دراسة إنتظام وتواجد نيماتودا *Aphelenchoides besseyi* المسببة لمرض القمة البيضاء في أوراق نباتات الأرز المتحصل عليها من نقع ٢٠ جرام قش أو مائة حبة أرز لأصناف سخا ١٠١ وجيزة ١٧٧ وجيزة ١٧١ وريهو لمدة ٤٨ أو ٤٨ و ٩٦ ساعة تحت ظروف درجة حرارة الغرفة ٢٥ + ٢ درجة مئوية .

أوضحت النتائج أن متوسط تعداد نيماتودا *A. besseyi* المتحصل عليها كل شهر بعد الحصاد من نقع حبوب الأرز أو القش المختبر كان مرتفعا بدرجة معنوية عن تلك المتحصل عليها عند الحصاد أو ما قبل طور النضج (للنش) على التوالي . كما أنه بعد الحصاد أعطى حبوب صنف ريهو أعلى أعداد نيماتودا *A. besseyi* ، بينما صنف سخا ١٠١ أوضح الأقل عددا بقيم ٥٧ أو ٤٦ و ٧٦ و ٣٣ و ٤٣ فردا عندما تم نقع حبوب الأرز للأصناف المذكورة ٤٨ أو ٩٦ ساعة على التوالي إن قرية طهواى المنزرع بها حقول أرز صنف جيزة ١٧١ وريهو أعطت أعلى مستوى إصابة بالنيماتودا في الحبوب وكذلك القش .