Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 12, pp.63123-63126, December, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

THE DISTRIBUTION AND DENSITY OF RICE WHITE TIP NEMATODA (*APHELENCHOIDES BESSEYI* CHRISTIE, APHELENCHIDA: APHELENCHOIDIDAE) IN RICE PLANTING AREAS OF EASTERN BLACK SEA REGION OF TURKEY

[1]Seçil EKER, [2]Gökhan AYDINLI and *,[3]Sevilhan MENNAN

[1]Ordu University, Agricultural Faculty, Plant protection department, Ordu, Turkey
[2]Ondokuz Mayıs University, Bafra Vocational High School, Samsun, Turkey
[3]Ondokuz Mayıs University, Faculty of Agriculture, Department of Plant Protection, Samsun, Turkey

ARTICLE INFO

Article History:
Received 25th September, 2017
Received in revised form
08th October, 2017
Accepted 16th November, 2017
Published online 31st December, 2017

Key words:
Aphelenchoides besseyi,
Rice white tip nematode,
Distribution

ABSTRACT

The most widely spreading nematode species is rice white tip nematode (*Aphelenchoides besseyi*) causing economic losses in rice production areas in Turkey. It was aimed to determine the distribution and population density of rice white tip nematode in rice growing areas of Samsun, Sinop, Çorum, and Kastamonu as a first time in this study. For this purpose, in August 2009, rice samples were collected by making systematic sampling from 102 areas where rice production was made in Samsun, Sinop, Çorum and Kastamonu provinces in Eastern Black Sea Region of Turkey. The Whitehead tray method was used to determine the nematodes in the laboratory samples. As a result of the laboratory studies, 7 of 102 samples were found to be infested with different population levels of rice white nematode. Kastamonu province was the highest infected with 13,3%, while Sinop, Samsun, and Çorum were found as 8,33%, 5,88% and 4,54% infested respectively. When considering the population density of sampling areas where nematode is detected, it is observed that Laçin county (Çorum provinces) was the densest with 18 nematodes and Osmancık (Çorum) with 13 nematodes per 100 g of paddy seed.

***Citation*: Seçil EKER, Gökhan AYDINLI and Sevilhan MENNAN, 2017.** "The distribution and density of rice white tip nematoda (*Aphelenchoides besseyi* christie, Aphelenchida: Aphelenchoididae) in rice planting areas of eastern black sea region of turkey", *International Journal of Current Research*, 9, (12), 63123-63126.

INTRODUCTION

Rice, which is the main food source for more than half of the world's population, is herbaceous Gramineae plant species widely distributed after wheat and corn in the world. The temperature and soil conditions that in Turkey especially Black Sea Region, are optimum for rice cultivation in summer and agriculture is carried out in the and valley basins of rivers (Taşlıgil and Şahin, 2011). Rice cultivation areas in our country are getting more and more increasing every year with a lesser presence than other grains. Rice production, which is at 648 thousand tons in 2007, has reached to the level of 920 thousand tons with a 42% increase in 2016 in Turkey (http://www.tmo.gov.tr/Upload/Document/hububat/hububatrap oru 2016.pdf). The most widely spreading nematode species is rice white tip nematode (*Aphelenchoides besseyi*) causing economic losses in rice production areas in Turkey (Tülek et al., 2015). The damage caused by the white tip nematode was first discovered in the Kyushu region of Japan by Kakuta in 1915 (Fortuner and Williams, 1975; Van Nieuwenhuyzen, 1977). The nematode was called the *Aphelenchoides oryzae*, by Yokoo in 1948. In the first half of the 1900's, the symptoms of nematode existed in rice growing areas in Japan as well as in the United States, and it was understood that the nematode species was *A. besseyi*, first identified in strawberry by Christie in 1942, (Fortuner and Williams, 1975). Rice white tip nematode causes damage to the upper parts of the plant, unlike most plant parasitic nematodes. According to Siddiqi (1980), it is not possible to be root parasites because of the weakness of their stylets. *A. besseyi* feeds on meristems in the stalks and leaves of susceptible plants, first whitening at 3-5 cm in the tip of the leaves of the plant, and then preventing them from extinguishing from the leaves of the cluster with the twisting of these areas. Infested plants have shorter flower buds, flowers are either barren or grain-formed, but are extremely fragile, malformed and low in germination potential (Tamura and Kegasawa, 1956, Tülek and Çobanoğlu, 2010; Youssef 2014). The most important factor for dissemination of *A. besseyi* is firstly the seeds and economic damage is based on the density of the pest, the variety of rice, the agronomic practices and the environment conditions. (Cralley and Adair, 1949), Fukano (1962), stated that 30 or less nematode per 100 g grain would

***Corresponding author:* Sevilhan MENNAN,**
Ondokuz Mayıs University, Faculty of Agriculture, Department of Plant Protection, Samsun, Turkey

not cause serious yield losses in the rice plant. The yield loss caused by *A. besseyi* is 10-30% in China (Wang et al., 2003), 40-50% in the US (Atkins and Todd, 1959) and 20-60% in India (Rao et al., 1985; Khan et al., (2012). It has been determined that yield loss in sensitive (Halilbey variety) rice field can reach to 57.9% in field trial carried out in Turkey (Tülek and Cobanoğlu, 2010). The species, which is distributed almost completely in the world, was first detected in 1995 in İpsala (Edirne) and Gönen (Balıkesir) in Turkey (Öztürk and Enneli, 1997). It has been known that Balıkesir, Çanakkale, Çankırı, Tekirdağ, Kırklareli, (Marmara Region of Turkey) and Çorum were infected with this harmful species in the areas where rice was grown (Mısırlıoğlu and Pehlivan, 2000, Karataş et al., 2007, Tülek and Çobanoğlu, 2010, Kepenekçi, 2013). In this study, it was aimed to determine the rate of infestation and the distribution of *A. besseyi* in Samsun, Sinop, Kastamonu, and Çorum in Eastern Black Sea Region in that rice has been growing widely, as the first time.

MATERIALS AND METHODS

The survey was carried out in August 2009 in order to determine the distribution and rate of infestation of rice white tip nematode in the rice growing areas of Samsun, Sinop, Çorum, and Kastamonu, in the Eastern Black Sea Region of Turkey. In the rice fields, paddy panicles were collected from the rice-growing areas during the harvesting period using systematic sampling methods. Paddy panicles were collected with the aid of scissors, especially on the plants whose whitening, swelling and developmental defects were observed on their leaf tips. For this purpose, at least a total of 100 plants from 20 different points of each field were taken. A total of 102 rice fields were sampled from these 4 provinces (Table 1). At least 20 paddy panicles (20 in 1 - 3 ha, 40 in 4 – 8 ha, 50 in more than 9 ha) were collected from twenty different points of the same field and taken to the laboratory, where they were held at 10°C until processed. The rice samples were taken from the fields and brought to the laboratory for extraction after the label information was written.

The Whitehead tray method was used to obtain *A. besseyi* from the samples (Whitehead and Hemming 1965). For this, a 100 g sample was cut in 4-5 cm size and placed in a screened tray in the laboratory. Depending on the room temperature, the samples were left in this position for about 48 hours, after that the screen section with the plant parts at the top was removed. The water in the tray was passed through a 450 mesh sieve to obtain nematodes, and the remaining part of the sieve was collected in the beaker. The nematode samples obtained in this way were killed by holding in water at 70 ° C for 2 minutes and nematodes were fixed by adding TAF in 1: 1 ratio (Hooper, 1987). Nematodes that found in 100 g of paddy seeds were counted under stereo binocular microscope and identification was completed by having permanent slides using the Seinhorst (1959) method and the nematodes were identified using Siddiqi taxonomic key (2000).

RESULTS AND DISCUSSION

As a result of the field study, it was determined that just only 7 (6.8%) rice growing fields were infested with *A. besseyi* from totally surveyed 102 rice fields in Samsun, Sinop, Çorum, and Kastamonu. For Samsun province just only 1 rice fields were found infested with rice white tip nematode. The highest infestation rate was determined in Kastamonu province with

Table 1. Surveyed provinces, villages, sample numbers, infested sample numbers and percentage (%) of infestation rates of rice White tip nematode (*Aphelenchoides besseyi*) in Samsun, Sinop, Çorum and Kastamonu provinces

Province	Village	Sample	Infested sample	Percentage of infestation (%)
Samsun	Alaçam	7	1	14,29
	Yakakent	5	0	--
	Ondokuz Mayıs	5	0	--
Subtotal		**17**	**1**	**5,88**
Sinop	Durağan	5	0	--
	Saraydüzü	2	0	--
	Boyabat	17	2	11,76
Subtotal		**24**	**2**	**8,33**
Çorum	İskilip	6	0	--
	Dodurga	6	0	--
	Laçin	3	1	33,33
	Osmancık	11	1	9,09
	Bayat	7	0	--
	Kargı	11	0	--
Subtotal		**44**	**2**	**4,54**
Kastamonu	Tosya	12	2	16,66
	Hanönü	3	0	--
Subtotal		**15**	**2**	**13,33**
TOTAL		**102**	**7**	**6,86**

Table 2. *Aphelenchiodes besseyi* / 100 g of paddy seed in the surveyed fields where rice white tip nematode was detected

Province	Village	*Aphelenchiodes besseyi* / 100 g of paddy seed
Samsun	Alaçam (SA7)	4
Sinop	Boyabat (SI 11)	5
	Boyabat (SI 15)	24
Çorum	Lâçin (CO 2)	27
	Osmancık (CO 3)	53
Kastamonu	Tosya (KA 4)	30
	Tosya (KA 11)	25

13.33% depending on the number of the surveyed fields. The infestation rate in the other provinces was determined as Sinop 8,33%, Samsun 5,88% and Çorum 4,54% respectively (Table 1). Alacam in Samsun province, Boyabat in Sinop province, Tosya in Kastamonu province, Lacin and Osmancık in Corum provinces have the rice fields which is infested with *A. besseyi*. Kastamonu is the most infested province among surveyed provinces, while Laçin is the most infested village. The least infested province was Çorum in which 38 rice growing fields have been surveyed and just 2 of them were found as an infected with white tip nematode.

According to infestation rates, among from the 7 infested fields, where the rice white tip nematode was detected; 53 *A. besseyi* per 100 g of paddy seed were counted in Tosya village, Kastamonu province and 30 *A. besseyi* for Osmancık village, Çorum province (Table 2). The population was 27 *A. besseyi* / 100 g of paddy seed in Laçin village and 25 *A. besseyi* 7 100 g of paddy seed for Tosya. Alacam village in Samsun province, (4 *A. besseyi* / 100 g of paddy seed) and Boyabat village in Sinop province (5 *A. besseyi* / 100 g of paddy seed) have the lowest population density. Fukano (1962) showed that 30 or more nematodes in 100 seeds in Japan are susceptible to economic damage in sensitive species. It can be said that economic damage will occur in areas where nematodes are detected in Tosya and Osmancik.

In Bangladesh, more than 50% of the rice-growing fields were recorded as an infested and the population density is 650 *A. besseyi* / 100 g seeds (Rahman and Mc Geachie 1982, Rahman

and Taylor 1983). Pashi et al. (2017) research the situation of *A. besseyi* in West Bengal and emphasized that this nematode was the most important for that Region. In studies conducted in Nigeria, the infestation rates were in the range of 2-400 *A. besseyi* in 100 g seeds, but this value was below 100 on average (Babatola 1984). In Sierra Leona, it has been reported that the number of individuals in 100 g seeds was as high as 3000-10000 (Fomba 1984) and in Tanzania, it could reach 68 *A. besseyi* per 100 g seed (Taylor et al., 1972).Jamali et al (2006) searched the incidence and distribution of *A. besseyi* in rice areas in Iran. When surveys conducted in some countries were examined, 70% of the samples were found to be infested with *A. besseyi* and the number of nematodes in the samples was 10-140 nematode / 100 g seeds in Brasilia (Huang and Huang, 1972). In the 1950's, US rice yield loss observed from *A. besseyi* were recorded as 17.5%, 4.9%, and 6.6% in sensitive rice varieties for different years (Atkins and Todd, 1959). In Japan, a 10-30% yield loss has been reported (Yosshi, 1951). Tsay et al. (1998) reported that, in a study conducted in China, yield loss could reach up to 45% if plants exceeded 50% of the infestation ratio. Yield loss caused by *A. besseyi* has been reported as 17-54% in sensitive rice varieties and 0-24% in resistant varieties (Atkins and Todd, 1959). In Bangladesh, more than 20% of the samples taken from the seeds were contaminated with *A. besseyi* and 10-615 nematodes were detected in 100 g seeds (Rahman and Siddiquie, 1989). *A. besseyi* was in the just only 9 countries quarantine lists in 1982, but country numbers was increased as 70 in 2002. According to international quarantine laws, nematodes which are subject to quarantine are in 2nd place in terms of the number of countries (Tülek and Cobanoglu, 2010).

In our country, the ratio of infestation with *A. besseyi* in Balıkesir and Çanakkale were reported as 11.75% and the number of nematodes determined in the samples as 1-256 / 10 gr seeds (Mısırlıoğlu and Pehlivan, 2000). Karatas et al. (2007) determined the infestation rate of *A. besseyi* in seeds taken from Çankiri and Çorum rice growing fields, were 7.80% and 5.26% respectively. In Samsun, Kastamonu and Sinop provinces, rice growing fields have not been investigated in terms of *A. besseyi* before. In this respect, 16.6% of the total population in Kastamonu province is extremely important. The level of infestation in Sinop province is 6.6%, and the necessary measures for the increase should be continued. Rice growing fields in the province of Samsun have increased considerably in recent years. It is to be avoided that the level of infestation with *A. besseyi* (6%) is increased by the use of clean seeds in new this fields. Certified seed production in our country has been analyzed and advised since 1998 against *A. besseyi* and this must be continued.

REFERENCES

Atkins, J.G. and Todd, E.H. 1959. White tip disease of rice. III. Yield test and varietal resistance. *Phytopathology,* 49, 189-191.

Babatola, J.O. 1984. Rice nematode problems in Nigeria; their occurrence, distribution, and pathogenesis. *Tropical Pest Management,* 30, 256–265.

Cralley, E.M., and Adair, C.R. 1949. Rice disease in Arkansas in 1948. *Plant Disease Reporter,* 33, 257-259.

Fomba, S.N., 1984. Rice disease situation in mangrove and associated swamps in Sierra Leone. *Trop. Pest Manag,* 30: 73-821

Fortuner, R. and Orton Williams, K.J. 1975. Review of the Literature on Aphelenchoides besseyi Christie, 1942, the nematode causing 'White tip' 125 diseases in rice. *Helminthological Abstract Series B, Plant Nematology,* 44, 1- 40.

Fukano, H. 1962. Control method against rice white tip disease. *Nogyo oyobi Engei,* 37, 689-692.

Hooper, D. J., 1987. Handling, fixing, staining and mounting nematodes. In laboratory Methods for work with Plant-Parasitic Nematodes. 59-81 (Ed.) J. F. Southey. Min. of Agr., Fish. And Food. Reference Book 402.

Huang, C.S. and Huang, S.P. 1972. Bionomics of white-tip nematode, *Aphelenchoides besseyi* in rice florets and developing grains. *Botanical Bulletin of Academia Sinica* 13, 1-10.

Jamali S., Pourjam E., Alizadeh A., Alinia F. 2006. Incidence and distribution of *Aphelenchoides besseyi* in rice areas in Iran. *Journal of Agricultural Science and Technology,* 2 (2): 337–344.

Karataş, S., Aktaş, M. ve Kepenekçi, İ. 2007. Çankırı ve Çorum İlleri Çeltik Ekim Alanlarındaki Bitki Paraziti Nematod Türlerinin Taksonomik Özellikleri, Yoğunlukları ve Yaygınlıkları Üzerine Araştırmalar. Türkiye II. Bitki Koruma Kongresi, 27-29 Ağustos 2007, Isparta.

Kepenekci, I. 2013. Rice white tip nematode (Aphelenchoides besseyi) in rice growing areas of Turkey. *Nematropica*, 43:181-185

Khan, M. R., Z. A. Handoo, U. Rao, S. B. Rao and J. S. Prasad. 2012. Observations on the foliar nematode, *Aphelenchoides besseyi*, infecting tuberose and rice in India. *Journal of Nematology,* 44:391-398

Mısırlıoglu, P. and E. Pehlivan, 2000. Distribution of white tip nematode (Aphelenchoides besseyi Christie, 1942) in the rice fields of Balıkesir and Çanakkale provinces. Proceedings of the Fourth Entomology Congress of Turkey, Pp. 561-568.

Özturk, G. and S. Enneli, 1997. Determination of Aphelenchoides besseyi Christie (Aphelenchida: Aphelenchoididae) (the white tip nematode) harmful on rice for the first time in Turkey. *Turkish Journal of Entomology,* 21:129-132.

Pashi, R., Maity, A., Rahaman M., Sandip K.M. and MukherjeeA., 2017. Incidence of white tip nematode (Aphelenchoides besseyi) in rice in West Bengal. *Journal of Entomology and Zoology Studies,* 2017; 5(2): 1274-1279

Rahman, M. L. and Siddique, A.M. 1989. Occurrence and distribution of White tip disease in deepwater rice areas in Bangladesh 1989. *Revue Nematol.* 12 (4) : 351-355 (1989)

Rahman, M.L. and McGeachie, I. 1982. Occurrence of white tip disease in deepwater rice in Bangladesh. *International Rice Research Newsletter,* 7 (5), 15.

Rahman, M.L. and Taylor, B. 1983. Nematode pests associated with deepwater rice in Bangladesh. *International Rice Research Newsletter,* 8 (5), 20-21.

Rao YS, Prassad JS. Panwar MS. 1985. Nematode pest of rice in India. Non-insect pest and predator. 65-71.

Siddiqi, M.R. 1980. The Origin and Phylogeny of the nematode orders Tylenchida Thorne, 1949 and Aphelenchida n.ord., Helminth. *Abstr. Ser, B,* 49: 143-170.

Tamura, I. and Kegasawa, K. 1956. Studies on the ecology of the rice nematode, *Aphelenchoides besseyi* Christie, V. On the abnormal growth of rice plant and decrease in yield caused by rice nematode. *Japanese Journal of Ecology,* 9, 120-124.

Taşlıgil N., Şahin, G. 2011. Türkiye'de çeltik (*Oryza sativa* L.) yetiştiriciliği ve coğrafi dağılımı. *Adıyaman üniversitesi sosyal bilimler enstitüsü dergisi* ISSN: 1308–9196 Yıl : 4 Sayı : 6

Taylor, D.P., B.N. Ngundo and S.M. Othieno, 1972. Tanzania, rice white tip nematode. FAO Plant Protec. *Bull*., 20: 41-24.

Tsay, T.T., Cheng, Y.H., Teng, Y.C., Lee, M.D., Wu, W.S. and Lin, Y.Y. 1998. Bionomics and control of rice white tip disease nematode, Aphelenchoides besseyi. *Plant protection Bulletin Taipei*., 40, 277-286.

Tulek, A. and S. Cobanoglu, 2010. Distribution of the rice white tip nematode, Aphelenchoides besseyi, in rice growing areas in Thrace Region of Turkey. *Nematologica Mediteranea*, 38:215-217.

Tülek, A. Kepenekçi, I.Çiftçigil, H.T., Sürek., H., Akın, K., Kaya, R. 2015. Reaction of some rice cultivars to the white tip nematode, *Aphelenchoides besseyi*, under field conditions in the Thrace region of Turkey. *Turk J Agric For.* 39: 958-966.

Van Nieuwenhuyzen, A.A. 1977**.** Nematode Diseases of Rice, Plant Protection for The Rice Crop, West Africa Rice Development Association, 240-245.

Wang ZM, Zhou FM, Lu YL, Lu HF, Lu XL, Xu MB. (2003). The causes of small grains and erect ears of rice and its control countermeasures in Jiangsu province. *Jiangsu Agricultural Science, 2003*; 5:1-6.

Whitehead, A. G. and Hemming, J. R. 1965. A comparison of some quantitative methods of extracting small vermiform nematodes from soil. *Ann. appl. Biol.* 55: 25–38.

Yosshi, H. 1951.On the growth habit and yield of rice plants affected with *Aphelenchoides oryzae. Sicience Bulletin of the Faculty of Agriculture, Kyushu University* 12, 133-141.

Youssef, M.M.A., 2014. The Leaf and Bud Nematode, *Aphelenchoides besseyi*, its Identification, Economic Importance and Control Measures. *Middle East Journal of Agriculture Research,* 3(3): 461-464, ISSN 2077-4605.

****