

**INVESTIGATION OF HOSTING STATUS OF BARNYARD GRASS [*ECHINOCHLOA CRUS GALLI* (L.)] AND SMALL FLOWER UMBRELLA SEDGE (*CYPERUS DIFFORMIS* L.) TO RICE WHITE TIP NEMATODE (*APHELENCHOIDES BESSEYI* CHRISTIE, 1942) IN RICE GROWING AREAS OF TURKEY#**

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**ABSTRACT:** In this study, it has been investigated that barnyard grass [*Echinochloa crus galli* (L.) P. Beauv. Poaceae] and small flower umbrella sedge (*Cyperus difformis* L., Cyperaceae) which are major weeds in rice growing fields are the host plants for rice white tip nematode (*Aphelenchoides besseyi*) or not. For this purpose, barnyard grass and small flower umbrella sedge were collected in fields planted to Halilbey rice variety which is susceptible to white tip nematode and having 77% white tip symptoms on flag leaf at flowering and average 324 *A.besseyi* per panicle. In analysis against nematode, while no nematode was found in small flower umbrella sedge, average 30 *A.besseyi*/10 g seeds, 400 *A.besseyi*/plant with 15 tiller (flag leaf + panicle), 435 *A.besseyi*/plant with 6 tiller (flag leaf + panicle) were found in barnyard grass. These results are the first recorded research data in Turkey.

**KEY WORDS:** Rice, rice white tip nematode, *Aphelenchoides besseyi*, *Echinochloa crus galli*, *Cyperus difformis*, Turkey.

The study conducted a series of research on two species of different weed families which could be host for nematode and thus problematic in the field of rice planted fields. It was determined whether plants such as barnyard grass (*Echinochloa crus galli*, Poaceae) and small flower umbrella sedge (*Cyperus difformis* L., Cyperaceae) could be hosts for *Aphelenchoides besseyi* or not in the rice field infected by rice white tip nematode.

The rice white tip nematode, *A.besseyi*, first described by Christie (1942), belongs to the class Aphelenchida and family Aphelenchoididae. It was discovered by Kakuta in 1915 (Mc Gawley et al. 1984). According to Franklin & Siddiqi (1972), the species is a synonym of the pest *Aphelenchoides oryzae* Yokoo, 1948.

Major source of inoculums for rice is seeds. When seeds have been planted, nematodes grow active and move towards stems, branches, leaves where growth points exist. Rice white tip nematode feed on branches and leaves, meristem tissues and flower organs as an ectoparasite (Yoshii & Yamamoto, 1950).

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Sections on leaves of tillers (stem) in affected rice plant have whitening in a distance of 3-5cm whose signs are often confused with those of lack of zinc and magnesium. Later, whitened sections recoil, preventing panicle from shooting out of leaf sheath. Infected panicle seems shorter and flower sections at ends have been atrophied. Flowers can be infertile and weak and amorphous seeds incapable of germination are obtained (Tamura & Kegasewa, 1959).

Rice white tip nematode is the second species to be quarantined in rank according to international quarantine regulations, by which *Globodera rostochiensis* is the first in 106 and *Aphelenchoides besseyi* in 70 nations (Anonymous, 2011a). Rice white tip nematode has been in the list A2 of pests under quarantine since 1981 according to OEPP/EPPO.

Rice white tip nematode was first discovered in Ipsala (Edirne) and Gönen (Balıkesir) in Turkey in 1995 (Öztürk & Enneli, 1997). The study by Tülek et al. (2011) in 2008-2009 attempted to explore effect of rice white tip nematode on yielding and its related components in rice cv. Halilbey. In the first year *A.besseyi* infected plots showed decreases of 57.91%, 22.35% and 12.78% in yielding, in weight of 1000 kernel and rice output (milled rice yield) respectively ( $P<0.01$ ). In the second year falls occurred in 28.11% in yielding and 12.11% in weight of 1000 kernel ( $P<0.01$ ).

Water grass (*Echinochloa spp.*) is the most competitive and difficult weed to control in Turkish rice fields. The principal grasses are *Echinochloa crus-galli*, *Echinochloa conunum*, and *Echinochloa oryzoides*. Annual and perennial sedges and broadleaf weeds also infest rice fields in Turkey. The most important sedges are *Cyperus difformis*, *Scirpus mucranatus* and *Scirpus maritimus* (Sürek, 2011).

Barnyard grass (*Echinochloa crus-galli*) is a monocot weed in the Poaceae family. Barnyard grass is an annual weed that is native to Asia and found throughout the world. The broad ecological tolerance and competitive ability of *E. crus-galli* makes it most important weed species in rice growing areas (Kaya, 2007).

Small flower umbrella (*Cyperus difformis*) grows well in flooded or moist fertile soils and common in lowland rice. Also found on poorer sandy or clay soils in fallow lands but cannot tolerate deep flooding. It has a short life span; propagates by seeds and produces seeds throughout the year (Anonymous, 2011b).

Barnyard grass and small flower umbrella sedge were found to be widespread with 94.56% and 80.88%, respectively, in Edirne rice fields which have more than 50% rice plantation areas in Turkey. Considering square meter density of weeds, barnyard grass was the most problematic species by 7.13 plant/m<sup>2</sup> followed by small flower umbrella in 5.66 plant/m<sup>2</sup> (Damar, 2006). In addition, 29.4% of rice seed samples in 2007 and 2008 in the same province were found to have been infected by rice white tip nematode (Tülek, 2010).

## MATERIALS AND METHODS

Weeds used in the study were collected from the farmer field where Halilbey rice cultivar was planted and infected by rice white tip nematode in Ipsala, Edirne in 2008. In the field where the study was conducted, percentage of infection by white tip nematode (rice plants with evidence of white tip symptoms on flag leaves) in the unit area using 0.25m<sup>2</sup> frames during rice flowering. Halilbey cultivar of rice infected by a 77% nematode provided us with 324 *A. besseyi* per panicle. Plants of barnyard grass (*Echinochloa crus galli*) and small flower

umbrella sedge (*Cyperus difformis* L.) collected from the present field were brought to the laboratory for inspection during flowering and seed filling.

Baermann funnel method was used to isolate nematodes from weeds for barnyard grass while whitehead and Baermann funnel methods were used for in small flower umbrella (Whitehead & Hemming, 1965) Samples in by Baermann funnel were removed 3 days after the process and water involving nematodes precipitated on the bottom and eliminated from seeds and green parts on the bottom of the Baermann funnel in 20ml glass tubes.

Whitehead method used 40cmx20cmx5cm plate to obtain nematodes and filtering papers were placed in them to for nematodes to pass through. Then 20 micron filter and vacuum pump were employed to collect nematodes with in approximately 20ml water volume.

## RESULTS AND DISCUSSION

Some previously conducted studies managed to determine plants which are hosts for *A.besseyi*. It follows from the list by Fortuner & Williams (1975) that *Cyperus iria* L. (Yoshii & Yamamoto, 1950), *Echinochloa crus-galli* Syn. *Panicum crus-galli* (Ino, 1971) in Japan and *Cyperus* sp. (Vuong & Rabarijoela, 1968) in the Comoro Islands are reported to be hosts for *A.besseyi*.

The present study examined and discussed barnyard grass (*Echinochloa crus galli*, Poaceae) and small flower umbrella sedge (*Cyperus difformis* L., Cyperaceae) as weeds that could host for *A.besseyi* and therefore lead to losses of crops of great economic value importance in terms of rice planted fields.

From the study on a plant with 15 tiller of barnyard grass during flowering and seed filling, it was clear that some 400 *A.besseyi*/plant were obtained from examination of flag leaf and panicle of the plant. It is important to note that only flag leaf and panicle were studied in particular. In addition, of 6 tillers, 2 were infected by barnyard grass to obtain 435 *A.besseyi* individuals.

Six panicle of barnyard grass were randomly collected from different places of the same field. Every panicle was separately analyzed under microscopy in terms of presence of nematodes with 2 of 6 panicles being infected with 12 and 35 individuals of *A.besseyi* respectively. Another study on 10gr barnyard grass seeds among the plants collected from the infected field showed a total of 30 nematode individuals.

Samples of small flower umbrella sedge (*Cyperus difformis* L.) plants collected from the same rice field heavily infected by *A.besseyi* during flowering stage. Laboratory analyses found no infection with *A.besseyi* both in seeds and green plant sections.

Nematodes obtained from weeds were morphometrically and morphologically identified. From examination of the results, it follows that hosting of weed species of *Echinochloa crus galli* for *A.besseyi* is the first record for Turkey. The same plant was reported to be host for *A.besseyi* by Ino (1971) in Japan. Fortuner & Williams (1975) put together various studies by different researchers in different nations on plants which are hosts for rice white nematode (Table 1). The present study also presents geographic distribution of rice white tip nematode. The consequence of the study showed that barnyard grass plant hosts for rice white tip nematode, which is an important evidence for Turkey. Both rice white tip nematode and barnyard grass plant are one of the most important problems seen in rice plantations at home and across the world. The study proved that barnyard grass plant can cause significant losses of rice harvest and also hosts for rice white tip nematode, which means that losses of rice harvest increase exponentially. It is

therefore of great importance that the weed with host has been discovered and identified as the first record for Turkey to develop pest controlling strategies against the pest itself. From the studies concerned, it is reported that *Echinochloa crus galli* is the alternative host for Tungro virus disease (vector insect *Nephotettix impicticeps*) (Aluko, 1976), in addition, *Echinochloa crus galli* is an important disease factor of rice in rice planting as an alternative host for rice blast (*Pyricularia oryzae*) as well (Qu, 1972). Accordingly what is to be thought first is that battle against barnyard grass plant should be made in particular in terms of preventing rice white tip nematode and other pests or diseases from spreading.

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### LITERATURE CITED

**Anonymous.** 2011a. Top 15 Regulated Nematodes. Nematodes regulated by twenty or more countries in international quarantine legislation in 2000 distributed by Paul Lehman 2002 <http://nematode.unl.edu/regnemas.htm> 26.12.2011

**Anonymous.** 2011b. Weed Management. <http://www.knowledgebank.irri.org/ipm/index.php/the-dirty-dozen/cyperus-diformis-l#top> 26.12.2011

**Aluko, M. O.** 1976. The role of plant quarantine in the spread of improved rice varieties in West Africa. Paper presented at WARDA's second varietal improvement seminar. 13-18 Sep. 1976 Bouake, Liberia.

**Damar, İ & Kara, A.** 2007. Identification of weeds species and densities in rice fields in Edirne, Turkey. Proceedings of the Second Plant Protection Congress of Turkey, Isparta, Turkey, abstract 153 p.

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

**Franklin, M. T. & Siddiqi, M. R.** 1972. *Aphelenchoides besseyi*. C.I.H. Description of Plant Parasitic Nematodes, Set 1, No. 4.

**Ino, M.** 1971. [On the water dissemination of *Aphelenchoides besseyi*. III. Nematode infestation of weeds and disease occurrence in a heavily infested area] Proceedings of the Kanto-Tosan Plant Protection Society, 18: 123. [In Japanese].

**Kaya, E.** 2007. Determination of morphological and genetically diversity of *Echinochloa crus-galli* (L.) P. Beauv. populations collected from different rice field, Thesis (MSc) Ondokuz Mayıs University, Graduate School of Natural and Applied Sciences, Samsun, Turkey.

**Mc Gavley, E. C., Rush, M. C. & Hollis, J. P.** 1984. Occurrence of *Aphelenchoides besseyi* in Louisiana rice seed and its interaction with *Sclerotium oryzae* in selected cultivars. Journal of Nematology, 16: 65-68.

**Qu, S. H.** 1972. Rice Diseases. Commonwealth Mycological Institute, Kew, Surrey, England, 368 pp.

**Öztürk, G. & Enneli, S.** 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.

**Sürek, H.** 2011. Rice cultural practice in Turkey. CIHEAM - Options Mediterranean's <http://ressources.ciheam.org/om/pdf/c58/03400067.pdf>

**Tamura, I. & Kegasawa, K.** 1959. 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.

**Tülek, A.** 2010. Distribution of Rice White-tip Nematodes (*Aphelenchoides besseyi* Christie, Aphelenchida: Aphelenchoididae) in Rice Growing Areas in Thrace Region and Research on Some Control Methods. Thesis (Ph. D.) Ankara University Graduate School of Natural and Applied Sciences Department of Plant Protection, Ankara, Turkey.

**Tülek, A. & Çobanoğlu, S.** 2011. Effect of White-tip Nematode (*Aphelenchoides besseyi* Christie) on Yield and Yield Component in Rice Cultivar Halilbey. Proceedings of the Fourth Plant Protection Congress of Turkey, Kahramanmaraş, Turkey, abstract 9 p.

**Yoshii, H. & Yamamoto, S.** 1950. A rice nematode disease 'Senchu Shingare Byo'. II. Hibernation of *Aphelenchoides oryzae*. Journal of the Faculty of Agriculture, Kyushu University, 9: 223-233.

**Whitehead, A. G. & Hemming, J. R.** 1965. A comparison of some quantitative methods of extracting small vermiform nematodes from soil. Annals of Applied Biology, 55: 25-38.

**Vuong Huu Hai & Rabarijoela, P.** 1968. "Note préliminaire sur la présence des nématodes parasites du riz à Madagascar: *Aphelenchoides besseyi* Christie 1942, *Ditylenchus angus* (Butler 1913) Filipjev 1936." Agron. trop., Nogent, 23: 1025-1048. [English & Spanish summaries pp. 1047-1048].

Table 1. Host list of white-tip nematodes (Fortuner &amp; Williams, 1975).

Plant	Common name	Author	Country
<i>Allium cepa</i> L.	Onion	Tim, 1965	Thailand
<i>Boehinevia nivea</i> Gaudich.	Ramie	Fortuner, 1970	Philippines
<i>Brassica pekinensis</i> Lour	Chinese cabbage	Tim, 1965	Philippines
<i>Chrysanthemum maximum</i> Ram.		Sher, 1954	Hawaii
<i>Chrysanthemum morifolium</i> Ram.		Sher, 1954	Hawaii
<i>Coleus blumei</i> Benth.		Sher, 1954	Hawaii
<i>Cyperus iria</i> L.		Yoshii & Yamamoto 1950b	Japan
<i>Cyperus</i> sp.		Vuong Huu Hai, 1968	Comoro Isles
<i>Dahlia variabilis</i> Desf.		Sher, 1954	Hawaii
<i>Digitaria adscendes</i> (H.B.K) Henrard	Summergrass	Ino, 1971	Japan
<i>Digitaria sanguinalis</i> (L.) Scop.		Yoshii & Yamamoto 1950b	Japan
<i>Dioscorea trifida</i> L.	Yam	Kermarrec & Anais, 1973	Guadeloupe
<i>Erechtites praealta</i> Raf.		Sher, 1954	Hawaii
<i>Ficus elastica</i> Roxb. (var. decora)		Marlatt, 1966	U.S.A.
<i>Fragaria chiloensis</i> Duch. (var. Ananassa)	Strawberry	Christie, 1942	U.S.A.
<i>Glycine hispida</i> Max	Soybean	Barat et al., 1966a	Hawaii
<i>Hibiscus brachenridgii</i> Gray		Raabe & Holtzmann 1966	Hawaii
<i>Hydrangea macrophylla</i> Ser.		Sher, 1954	Hawaii
<i>Impatiens balsamina</i> L.		Sher, 1954	Hawaii
<i>Imperata cylindrica</i> Beauv.		Vuong Huu Hai & Rabarijoela, 1968	Comoro Isles
<i>Ipomoea batatas</i> Lam.	Sweet potato	Timm & Ameen, 1960	Pakistan
<i>Panicum bisulcatum</i>		Tno, 1971	Japan
<i>Panicum cruss-galli</i> var. Frumentaceum		Tno, 1971	Japan
<i>Pennisetum typhoides</i> (burm. F.) Stapf. F.C.E. Hubbard		Hashioka, 1964	-
<i>Pluchea odorata</i> Cass.		Sher, 1954	Hawaii
<i>Polianthes tuberosa</i> L.		Holtzmann, 1968	Hawaii
<i>Pycnus ploystahyus</i>		Vuong Huu Hai & Rabarijoela, 1968	Comoro Isles
<i>Saccharum officinarum</i> L.	Sugar cane	Fernandez & Diaz Silveira, 1967	Cuba
<i>Saintpaulia ionantha</i> Wendl.	African violet	Allen, 1952	U.S.A.
<i>Seteria italica</i> Beauv.	Italian millet	Yoshii & Yamamoto, 1950a	Japan
<i>Seteria viridis</i> (L.) Beauv.		Yoshii & Yamamoto, 1950b	Japan
<i>Sporobolus poiretii</i> (Roem & Schult.)		Marlatt, 1970	U.S.A.
<i>Tagetes</i> sp.		Sher, 1954	Hawaii
<i>Tithonia diversifolia</i> A.Gray		Sher, 1954	Hawaii
<i>Torenia fournieri</i> Linden		Sher, 1954	Hawaii
<i>Vanda</i> sp. x Miss Joaquim		Allen, 1952	Hawaii
<i>Vanda</i> sp. x Rose Marie		Sher, 1954	Hawaii
<i>Vanda</i> sp. x Miss Deum		Sher, 1954	Hawaii
<i>Vanda</i> sp. x Trimeril		Sher, 1954	Hawaii
<i>Vanda</i> sp. x Luma		Sher, 1954	Hawaii
<i>Vanda</i> sp. x Miss Joaquim x Kapoho		Sher, 1954	Hawaii
<i>Zea mays</i> L.	Sweet corn	Tim, 1965	Thailand
<i>Zinnia elegans</i> L.		Sher, 1954	Hawaii