Organisms associated with johnsongrass [*Sorghum halepense* (L.) Pers.] in Honduras[1]

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Abstract. Johnsongrass is one of the most important weeds in agriculture. In addition to interfering with crop development, johnsongrass hosts pests and beneficial organisms. A study was conducted in 1993 and 1994 at the Escuela Agrícola Panamericana, El Zamorano, Honduras, to create an inventory of organisms associated with johnsongrass. Six soil insect species were found associated with johnsongrass root systems; four species were identified as crop pests. There were 33 species of foliar insects found associated with johnsongrass; 48% were indentified as crop pests and 40% were identified as beneficial species. Six fungal pathogens were found in johnsongrass leaves; three were important crop diseases. Ten genera of nematodes were found in the soil around johnsongrass root systems; three genera were considered crop pests. This inventory indicates that johnsongrass presence in fields could be adverse or beneficial to developing crops depending on the type of organism harbored, management strategies employed and environmental conditions.

Key words: Weed, inventory, insects, diseases, nematodes, beneficial organisms, pests.

Resumen. El pasto johnson es una de las malezas más importantes en la agricultura. Además de interferir con cultivos, el pasto johnson es hospedero de plagas y organismos benéficos. Este estudio fue conducido en la Escuela Agrícola Panamericana, El Zamorano, Honduras, para crear un inventario de organismos asociados al pasto johnson. Seis especies de insectos del suelo fueron encontradas asociadas con el sistema radicular del pasto johnson; cuatro especies son consideradas plagas. De las 33 especies de insectos foliares encontradas asociadas al pasto johnson, 48% y 40% son consideradas plagas. Diez géneros de nematodos fueron encontrados en el suelo alrededor del sistema radicular del pasto johnson; tres géneros son considerados plaga. Este inventario indica que la presencia del pasto johnson es un campo cultivado puede ser adversa o benéfica, dependiendo del tipo de organismo asociado con el pasto johnson, estrategias de manejo empleadas y condiciones ambientales.

Palabras claves: Maleza, inventario, insectos, enfermedades, nematodos, organismos benéficos, plagas.

INTRODUCTION

Johnsongrass [*Sorghum halepense* (L.) Pers] has been reported as a weed in at least 30 crops (Holm et al., 1977) and reduces crop yields through competition and allelopathy (Lolas and Coble, 1982). However, johnsongrass may also act as a host for pest species and beneficial insects. A large list of insects, bacteria, fungi, nematodes and virus harbored by johnsongrass was reported by McWhorter (1989). Johnsongrass has been reported to host the maize dwarf mosaic virus (MDWV), maize chlorotic dwarf virus (MCDV) (Knoke et al., 1983 and Rodriguez, 1993), rice blast (*Pyricularia orizae* Cav.) (Pitty and Muñoz, 1991) and sorghum midge [(*Contarinia sorghicola*

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(Coquillet)] (Gilstrap and Brooks, 1991 and Andrews, 1989).

Johnsongrass could also host the natural enemies of many crop pests and thus serve a positive function in a crop field. Altieri (1989) reported an association between johnsongrass and a predatory spider mite (*Metaseiullus occidentalis*); increases in spider mite populations may help to regulate populations of the Pacific spider mite (*Eotetranychus willamettei*), a grape (*Vitis vinifera* L.) pest. In addition, some of the organisms found associated with johnsonsgrass could be harmful to the weed and represent potential agents for biological control. Chiang and Van Dyke (1989), Chiang et al., (1989) and Winder and Van Dike (1990) conducted studies with several fungi that are highly virulent on johnsongrass and considered as potential mycoherbicides.

The objective of this study was to create an inventory of insects, diseases and nematodes associated with johnsongrass under several ecosystems at the Escuela Agrícola Panamericana, El Zamorano, Honduras.

MATERIALS AND METHODS

This research was conducted at the Escuela Agrícola Panamericana, El Zamorano, Honduras, Central America. El Zamorano is located in the Yeguare valley south of Tegucigalpa, at 800 meters above sea level, 14° latitude and 87° longitude. El Zamorano has a dry tropical environment, with a rainy season from May to November and a dry season from December to April. The annual average rainfall is 1100 mm and the average minimum and maximum temperature are 18.5 and 29.7 C, respectively. Insects, foliar diseases and nematodes associated with johnsongrass were sampled in several ecosystems. Five johnsongrass plants were sampled at every site; plants sampled had eight or more leaves and may have developed the inflorescence. Samples were taken randomly from June to August in 1993 and 1994.

Foliar insects were collected over a half hour period for each johnsongrass plant. Soil insect samples were collected from a 30X30X30 cm soil volume excavated underneath each johnsongrass plant. Insects were placed in glass containers filled with 95% alcohol and identified by the Diagnostic Center at the Plant Protection Department at El Zamorano.

Foliar diseases samples were collected from the leaves of johnsongrass plants. Leaves were trimmed, placed in plastic bags and taken to the Plant Pathology Laboratory, Department of Crop Protection, El Zamorano, for the visual identification of disease causal agents.

Nematodes samples were composed of five soil subsamples per site. Each subsample was obtained by extracting a volume of soil underneath a johnsongrass plant with an Esser cone sampler, following procedures specified by Domínguez (1992). Subsamples were combined and a representative final sample taken to the Nematology laboratory, at the Department of Crop Protection, El Zamorano, for extraction. Nematodes extraction was conduced using techniques described by Zuckerman et al., (1990). After extraction, nematodes were exposed to 50 C water for two minutes and placed in test tubes containing formaldehyde. The nematodes were identified at the Nematology Laboratory, Department of Plant Pathology, Iowa State University at Ames, Iowa, US.

RESULTS AND DISCUSSION

Six species of soil insects were associated with johnsongrass root systems in most of the ecosystems sampled at El Zamorano. The larvae of four species are pests in several crops (Table 1) and these pests are usually wide-spread, thus johnsongrass may not be an important factor with regard to the prescence of these insects in a field. Most of the insect pest species were found in several ecosystems but *Phyllophaga zunilensis* was found only in two ecosystems. The larvae were always found feeding on johnsongrass roots but may not significantly affect rhizome production.

Table 1. Organisms associated with johnsongrass in Honduras in 1993 and 1994.

Type of organisms, Order and Family	Latin name	Agricultural status	Found in[1] Agroecosystem
Soil insects:			
Coleoptera: Scarabaeidae	*Phyllophaga zunilensis*	Pest	B, J
Coleoptera: Scarabaeidae	*Phyllophaga obsoleta*	Pest	A, C, E, J, I
Coleoptera: Scarabaeidae	*Phyllophaga menetriesi*	Pest	A, B, C, E, F, I, J
Coloeptera: Scarabaeidae	*Phyllophaga valeriana*	Pest	A, C, E, F, J
Coleoptera: Scarabaeidae	*Anomala* spp	Non pest	A, C, E, J, I
Coleoptera: Scarabaeidae	*Cyclocephala* spp.	Non pest	C, I
Foliar insects:			
Coleoptera: Pentatomidae	*Acrosternum* spp.	Pest	D
Homoptera: Cercopidae	*Aeneolamia postica* (Walker>)	Pest	C
Coleoptera: Chrysomelidae	*Cerotoma atrofasciata* Jacoby	Pest	C, D
Hemiptera: Miridae	*Collaria oleosa* (Distant)	Pest	A, C, D
Coleoptera: Chrysomelidae	*Diabrotica variegata* Jacoby	Pest	C, D
Coleoptera: Chrysomelidae	*Diabrotica balteata* LeConte	Pest	C,D
Coleoptera: Chrysomelidae	*Disonycha* spp.	Pest	D
Coleoptera: Coccinellidae	*Epilachna tredecimnotata* Latr.	Pest	D
Lepidoptera: Arctiidae	*Estigmene acrea* (Druru)	Pest	A,B
Hemiptera: Coreidae	*Hypselonotus punctiventris* Stall	Pest	D
Coleoptera: Chrysomelidae	*Megascelis* spp.	Pest	A,B,C
Heminoptera: Pentatomidae	*Oebalus* spp.	Pest	C
Ortoptera: Acrididae	*Orphulella* spp.	Pest	A,I
Hemiptera: Coreidae	*Staluptus marginalis*	Pest	C
Coleoptera: Chrysomelidae	*Zygogramma magina* Stal	Pest	A
Coleoptera: Staphylinidae	*Belonuchus* spp.	Predator	B
Neuroptera: Chrysopidae	*Chrysoperla* spp.	Predator	B
Coleoptera: Coccinellidae	*Coleomegilla maculata*	Predator	A, B, C
Coleoptera: Coccinellidae	*Cycloneda sanguinea* (L.)	Predator	A, B

Table 1. Continued

Type of organisms, Order and Family	Latin name	Agricultural status	Found in[1] Agroecosystem
Dermaptera: Forficulidae	*Doru taeniatum* (Dohrn.)	Predator	A, B, C
Hymenoptera: Vespidae	*Polistes* spp.	Predator	D, B
Hemiptera: Pentatomidae	*Proxys punctulatus*	Predator	A, B, C
Hymenoptera: Fromicidae	*Solenopsis geminata* (F.)	Predator	A, B, C, I
HymenopterA: Braconidae	*Apanteles* spp.	Parasioid	A, D
Hymenoptera: Chalcididae	*Brachymeria* spp.	Parasitoid	J
Hymenoptera: Ichneumonidae	*Diadromus collaris* (Gravenhor)	Parasitoid	I
Diptera: Tachinidae	*Linnaemyia comta* (Fallen)	Parasitoid	A, J
Hemiptera: Lygaeidae	*Pachybrachius bilobatus* (Say)	Parasitoid	C
Hemiptera: Largidae	*Largus* spp.	Non pest	C
Hemiptera: Coreidae	*Acanthocephala* spp.	Non pest	C
Homoptera: Cicadillidae	*Draeculacephala* spp.	Non pest	A,B,M
Coleoptera: Chrysomelidae	*Nodonata* spp.	Non pest	C,D
Diseases:			
Melaneomiales: Melaneomiaceae	*Colletotrichum graminicolum* (Ces.) W.	Pest	B, C, D, G, J
Momiliales: Dematiaceae	*Helminthosporium turcicum* Pass.	Pest	A,B,C,D,E,G,I,J,K
Uredinales: Pucciniaceae	*Puccinia sorghi* Schw.	Pest	A, B, C, D, E, G, I, J, K
Momiliales: Dematiaceae	*Curvularia lunata* (Wakker) Boed	Non pest	B, C, D, E, J, K
Momiliales: ematiaceae	*Gloeocercospora sorghi* Bain and Edg.	Non pest	A, B, C, D, E, F, I ,J
Sphaeropsidales: Sphaeropsidaceae	*Phyllosticta maydis* Arny and Nelson	Non Pest	B, C, G, J
Nematodes:			
Tylenchina: Tylenchulidae	*Paratylenchus* spp. Micoletzky	Pest	D, C, B, I
Tylenchina: Hoplolaimidae	*Rotylenchulus* spp. Lindford and Oliveira	Pest	A, C, D, E
Dorylaimida: Longidoridae	*Xiphinema* spp. Cobb	Pest	A, C, D, E

Table 1. Continued

Type of organisms, Order and Family	Latin name	Agricultural status	Found in[1] Agroecosystem
Tylenchina: Hoplolaimidae	*Helicotylenchus* spp. Stainer	Non pest	D, J, D, E, A, C, K
Tylenchina: Criconematidae	*Criconema* spp. Hofmanner and Menzel	Non pest	D, C, I, A, E, K
Tylenchina: Criconematidae	*Hemicycliophora* spp. de man	Non pest	D
Tylkenchina: Pratylenchidae	*Pratylenchus* spp. Filipjev	Non pest	A, B, C, D, E
Dorylaimida: Trichodoridae	*Trichodorus* spp. Cobb	Non pest	A
Tylenchina: Belonolaimidae	*Tylenchorhynchus* spp. Cobb	Non pest	A, B, D, I, K
Tylenchina: Tylenchidae	*Tylenchus* spp. Bastian	Non pest	A, C, D, E

1: Agroecosystems A (corn (*Zea mays* L.) on conventional tillage), B (corn on no tillage), C (Citrus), D (ditch), E (mango (*Mangifera indica* L.), F (road side), G (grapes (*Vitis vinifera* L.)), I (vegetable crops), J (sorghum (*Sorghum bicolor* Moench) in conventional tillage), K (dry beans (*Phaseolus vulgaris* (L.) in conventional tillage).

There were 33 species of foliar insects associated with johnsongrass, 48% were identifed as crop pests, 24% were insect predators and 16% were insect parasitoids. The remaining 12% of the species did not fit any of these categories. The inventory suggests that the presence of johnsongrass may have a negative impact on crop production because the weed hosts several insect crop pests. However, several insect species were identified as natural enemies of insect pests, thus the presence of johnsongrass in a field crop may be beneficial.

Foliar insects were not widely distributed and were usually found in no more than four ecosystems without a clear correlation between the insect and the associated ecosystem. It is important to recognize that in some cases these insects were found on johnsongrass leaves by chance and may not be consistently associated with johnsongrass. No significant damage to johnsongrass was caused by any of the insect species listed in Table 1.

Six fungal diseases were found on johnsongrass leaves and three have been identified as pests in corn (*Zea mays* L.) and sorghum [*Sorhum bicolor* (L.) Moench] in Honduras (Table 1). The majority of the diseases were found in most of the ecosystems sampled at El Zamorano. Thus, johnsongrass presence in a crop field could be a source for disease inoculum and could be utilized as a biological control strategy for johnsongrass management. For example, *Puccinia sorghi* Schw. causes severe damage to johnsongrass leaves. However, this fungus would not be practical for use in the biological management of johnsongrass because it also is a serious pest in sorghum.

There were ten nematode genera found associated with johnsongrass root systems (Table 1). *Paratylenchus* spp., *Rotylenchulus* spp. and *Xiphinema* spp. are considered crop pests in Honduras while the other seven genera are free living or do not cause economic damage to any crop. Most of the genera were found consistently in the ecosystems sampled, although the pest genera were not distributed in every ecosystems sampled. *Hemicycliophora* spp. were found only in ditches adjacent to fields while *Trichodorus* spp. were observed in a corn field.

CONCLUSIONS

Several insects, diseases and nematodes were found associated with johnsongrass in several ecosystems at El Zamorano. Some of these organisms were either crop pests or beneficial organisms and indicated that johnsongrass presence in a crop field may potentially have a positive or a negative impact on crop development. Only the disease *P. sorghi* was observed to cause significant damage to johnsongrass leaves. These data provide valuable information about crop pests that were associated with johnsongrass thus demonstrating the potential for johnsongrass to impact crop production in a manner other than through interference. However, these data also suggest that johnsongrass may be an important host for natural pest enemies and if biological management of specific pests is to be successful, johnsongrass may have to be present in a crop field.

LITERATURE CITED

Altieri, M. A. 1989. Significado de las interacciones entre malezas e insectos en el manejo de plagas en sestemas tradicionales de los tropicos. pp 75-88. In K. L. Andrews and J.R.Quezada (eds.). Manejo integrado de plagas insectiles en la agricultura. Estado actual y futuro. Escuela Agrícola Panamericana, El Zamorano, Honduras

Andrews, K. L. 1989. Maíz y sorgo. pp 547-566. *In* K. L. Andrews and R. Quezada (eds.). Manejo integrado de plagas insectiles en la agricultura. Estado actual y futuro. Escuela Agrícola Panamericana, El Zamorano, Honduras.

Chiang, Mou-Yen., and C. G. Van Dyke. 1989. Evaluation of endemic foliar fungi for potential biological control of johnsongrass (*Sorghum halepense*): Screening and host range tests. Plant Dis. 73:459-464.

Chiang, Mou-Yen., C. G. Van Dyke and W. S. Chilton. 1989. Four foliar pathogenic fungi for controlling seedling johnsongrass (*Sorghum halepense*). Weed Sci. 37:802-809.

Domínguez, H. 1992. Práctica de Campo. El muestreo de nematodos. Escuela Agrícola Panamericana. Departamento de Protección Vegetal. Publicación DPV-EAP #336.

Gilstrap, E. F., and G. W. Brooks. 1991. Sorghum midge and midge parasitism on johnsongrass. J. of Econ. Ento. 84(2):431-435.

Holm, L. G., D. L. Plucknett, J. V. Pancho, and J. P . Herberger. 1977. The world's worst weeds. Univ. Press of Hawaii, Honolulu. 609 p.

Knoke, J. K., R. Louie, L. V. Madden, and D. T. Gordon. 983. Spread of maize dwarf mosaic virus from johnsongrass to corn. Plant Dis. 67:387-670.

Lolas, P. C. and H. D. Coble. 1992. Noncompetitive effects of johnsongrass (*Sorghum halepense*) on soybeans (*Glycine max*). Weed Sci. 30:586-593.

McWhorter, C. G. 1989. History, biology, and control of johnsongrass. Weed Sci. Rev. 4:85-121.

Pitty, A. and R. Muñoz. 1991. Guía práctica para el manejo de malezas. El Zamorano, Honduras. Escuela Agrícola Panamericana. 223 p.

Rodriguez, C. M. 1993. Spread of maize chlorotic dwarf virus from infected corn and johnsongrass by *Graminella nigrifrons*. Plant Dis. 77:55-60.

Van Dyke, C. G., and R. S. Winder. 1985. *Bipolaris sorghicola*: A potential mycoherbicide for johnsongrass. Proc. South. Weed Sci. Soc. 38:373.

Zuckerman, B. N., W. F. Mai., and L. R. Krusberg. 1990. Plant nematology manual. The University of Massachusetts Agricultural Experiment Station. Amherst, Massachusetts. 252 p.