Romanian Journal for Plant Protection, Vol. VII, 2014
ISSN 2248 – 129X; ISSN-L 2248 – 129X

PRELIMINARY DATA ON THE ARTHROPOD BIODIVERSITY ASSOCIATED WITH SWEET POTATO (*Ipomoea batatas*) CROPS UNDER SANDY SOILS CONDITIONS FROM SOUTHERN ROMANIA

Iamandei Maria[*1], *Draghici Reta*[2], *Diaconu Aurelia*[2], *Drăghici I.*[2], *Dima Milica*[2], *Cho Eun-Gi*[3]
[1]Research-Development Institute for Plant Protection, Bucharest, Romania
[2]Research - Development Centre for Field Crops on Sandy Soils, Dăbuleni, Romania
[3]Institute of Agricultural Science and Technology of Kyungpook National University, Korea

[*] correspondence address
Research - Development Institute for Plant Protection, 8 Ion Ionescu de la Brad Blvd.
District 1, 013813, Bucharest, Romania
Phone: + 40 21269 32 31/32/34, Fax: + 40 21269 32 39
maria_iamandei@yahoo.com

ABSTRACT: *In 2013, the Research - Development Centre for Field Crops on Sandy Soils, Dăbuleni have initiated a study about the behavior of some Korean sweet potato (Ipomoea batatas) cultivars, under specific climatic and pedological conditions, in order to be subsequently introduced in culture in Romania. One of the most important technological factors on which depends the quantity and quality of production is represented by the protection against various pests. This paper brings original data on the biodiversity of arthropod species associated with sweet potato crop variety Pumpkin, under irrigated sandy soils in two variants: with and without chemical treatments. Fifty-one species or genera of arthropods observed on sweet potato or collected in sweep net and pitfall traps in experimental plots were identified during 2013 season of vegetation and listed according to trophic category and the systematic group they belong to.*

Key words: arthropod biodiversity, sweet potato, *Ipomoea batatas*, sandy soils.

INTRODUCTION

Sweet potato (*Ipomoea batatas* Lam.) is a dicotyledonous plant species that belongs to the Convolvulaceae family. It is an herbaceous perennial plant, generally cultivated as an annual crop from vegetative tissues using storage roots or vegetative cuttings (Huaman, 1992; Ngailo et al., 2013). Sweet potatoes can play a major role in the food industry and human nutrition because of their valuable content being a rich source of carbohydrates, some amino acids, vitamins, minerals, dietary fiber and other bioactive compounds. Asia is now the largest sweet potato-producing region in the world, with figures showing over 90 million tons produced annually and China is the world's leading sweet potato producing country with 75.4 million tons (FAOSTAT, 2013).
Within a Bilateral Cooperation Protocol between Kyungpook National University (KNU) South Korea and the Academy of Agricultural and Forestry Sciences "Gheorghe Ionescu SISESTI" Bucharest, at the Research Center for Agricultural Development Plant on Sand Dăbuleni (R.C.A.D.P.S.D), in 2012 were initiated the first research regarding the agricultural potential of the culture of sweet potato in Romania. During 2012-2013, first research for testing of some Korean sweet potatoes genotypes using different planting methods and periods were performed in order to develop and promote the agricultural technology of this plant suitable in this area from Romania (Draghici et al., 2013). The production of sweet potato could be affected by several biotic constraints such as viral diseases, insect pests and weeds (Harrison and Jackson, 2011). Because Integrated Pest Management (IPM) relies on competent crop monitoring, careful control method selection and treatment decisions based on sound biological and economic need, a Research-Development Institute for Plant Protection-Bucharest team was invited in 2013 to join the research. Knowledge and proper

identification of key pest are critical and logical first step in sweet potato IPM program development. The aim of this preliminary study is to bring original data on the arthropod fauna associated with the sweet potato crops in southern Romania.

MATERIAL AND METHODS

Study area

Field experiments were conducted at the R.C.A.D.P.S.D fields, located in southern Romania, in a region known for the sandy areas surrounding it. The soils of the area are sandy soil with low natural fertility (0.42 to 0.77% humus) and pH (H2O) = 5.9 to 6.8. The climate conditions registered in 2013 at weather station R.C.A.D.P.S.D. on the sweet potato vegetation period in comparison with multiannual average are presented in table 1.

Material and experimental variants

Sweet potato tubers variety Pumpkin, received from Korea were planted in the greenhouse at R.C.A.D.P.S.D. on April 19 in order to obtain the necessary vine(stem) cuttings for setting up of culture in field. Planting in greenhouse was done in modeled layer, under tunnel protected with transparent polyethylene (plastic) mulch. During the 30 cm phase of development, which coincided with the last decade of May, vine cuttings were harvested by cutting with a scissors from 10 cm above the ground, with 6-7 nodes. After harvest, the cuttings were shaped by making an oblique cut at a distance of 1 cm from the first node, stored for 24 hours at a temperature of 20 ° C and the next day were planted in the field. The planting method was ”in a kneeling position”, with three nodes buried under soil. Planting in the field was done in variant with plastic mulch and drip irrigation. At planting and throughout the growing season the soil moisture content was maintained above the 80% minimum threshold of active humidity interval. The soil was fertilized with 300 kg / ha complex fertilizers (15:15:15 type), and the nutritional regime of the plant was completed during the growing season by applying a mixture of 200 kg ammonium nitrate plus 100 kg of fertilizer complex (15:15:15 type) / ha. Pathogens prevention and control was achieved by treatment with a product with contact action, Dithane M-45 - 0,2% and a product with systemic action, Topsin 500SC - 0.07%. In order to control pest attack the plots of variant 1 have been treated with a systemic action insecticide, Calypso 480EC at a dose of 80 ml/ha.

Arthropod sampling and identification

Monitoring of arthropod fauna in sweet potato crop started before planting (last decade of May) and subsequently once a month from June to August. The biological material analyzed within the paper was obtained by few methods depending on the type of fauna. The epigeic fauna on the surface of the soil was collected by the means of two methods: Pitfall traps and visual observations. For the fauna on the plants were used: the method of sweeping the sweet potato crop with a net and also visual observations method. Beneficial insects easily identified to species in the field were not collected but were added to the list. The collected material was preserved and transferred in R.D.I.P.P. entomology laboratory where the arthropods composition and abundance were later analyzed. Although the sampling are not quantitative, comparison between the abundance of each variant was based on the total number of the specimens collected, species being classified as: absent, rare, fairly common, common and abundant.

RESULTS AND DISCUSSIONS

Worldwide sweet potato production is challenged by numerous pests, over 270 insect species are known to attack these crop either by feeding on plants or as vectors for many diseases. The pest complex associated with sweet potato is very diverse and includes insects from a broad spectrum of orders such as Coleoptera, Diptera, Hemiptera, Homoptera, Lepidoptera and Orthoptera (Amalin and Vasquez 1993; Jansson and Raman 1991; Schalk and Jones 1985; Talekar 1987).

The arthropods collected during our study were classified to species or family level and grouped into the following functional groups: herbivores, detritivores, necrophages, coprophages, omnivores, predators, and parasitoids (table 2). From the fifty-one species or genera of arthropods identified in 2013, fourteen potentially pest for sweet potato can be noticed. Of these, *Anoxia villosa L.* and *Agriotes obscures* soil-inhabiting larvae may cause extensive damage because they feed directly on the edible storage roots or tubers, making more or less superficial holes and internal galleries but has been rarely found in our study. In contrast, very abundant were some species of Chrysomelidae beetles (*Cassida viridis* L., *Psylliodes chalcomerus* Illig., *Aphthona* spp., *Haltica* spp.), well known as pest of sweet potato as root feeder as well as foliage feeders. Their presence was the cause of characteristic holed leaf damage observed in June and requiring the application of one chemical treatment with a systemic action insecticide. Also, two aphid species (*Aphis gossypii* Glov. and *Myzus persicae* Sulzer) one thrips species (*Frankliniella* spp.) and one whiteflies (*Bemisia tabaci* Gen.), recognized as efficient sweet potato vectors, were found in sweet potato fields.

During our study, a large number of beneficial species were observed. The most common in both variants were the Araneae species from the Lycosidae, Pisauridae and Salticidae Families and insect species from Hymenoptera Formicidae and *Labidura riparia* Pall. (Dermaptera Labiduridae). Also, very abundant in untreated variant were the hemipteran *Orius* sp., *Xylocoris* sp.(Hemiptera:Anthocoridae) and *Nabis ferus* L.(Hemiptera:Nabidae), the coleopteran species *Coccinella 7-punctata* L and larva of dipteran species *Episyrphus balteatus* De-Geer. These species are the main antagonists of aphids, contributing indirectly to crop protection against sweet potato virus diseases.

CONCLUSIONS

This paper is a first contribution to the knowledge in sweet potato pest management recommendation, providing data on the biodiversity of arthropod species associated with sweet potato crop variety Pumpkin in sandy soil condition from southern Romania. Further investigation is needed to enhance the knowledge regarding the soil pest complex, and also to evaluate the predator-prey relationships prior to the development of integrated pest management recommendations.

REFERENCES

AMALIN D.M. & VASQUEZ E.A., 1993. A handbook on Philippine Sweet Potato arthropod Pest and their Natural Enemies. International Potato Center, Los Banos, Laguna, Philippines. 82 p.

AMES, T., SMIT, N.E.J.M., BRAUN, A.R., O'SULLIVAN, J.N., and SKOGLUND, L.G. (1997). Sweetpotato: Major pests diseases, and nutritional disorders. International Potato Center (CIP). Lima, Perú. 152 p.

DRAGHICI R., DIACONU A., DRAGHICI I., TOMA V., CROITORU M., PLOAE M., DIMA M., CHO Eun-Gi, KIM Jong-Sang(2013). *Preliminary results on sweet potato (Ipomoea batatas) on sandy soils*. Analele Univ. Craiova, Seria: Biologie, Horticultură,Tehnologia prelucrării produselor agricole, Ingineria mediului, Vol. XVII (LIV), I.S.S.N. 1453 – 1275. Editura Universitaria.

FAOSTAT (2013). Food and Agriculture Organization of the United Nations, FAOSTAT Database. Available online: http://faostat3.fao.org/browse/Q/*/E (accessed on 29 May 2014).
FAO Statistical Yearbook 2013, Production quantity of primary crops, country statistics. http://www.fao.org/docrep/018/i3107e/i3107e00.htm(accessed on 6 September 2014).
HARRISON HF, Jr., JACKSON DM (2011). Response of two sweet potato cultivars to weed interference. Crop Protec. 30:1291-1296.
HUAMAN, Z.(1992). Systematic botany and morphology of the sweetpotato plant. CIP. p. 25.International Potato Center, 2014.
http://www.cipotato.org
http://www.knrda.go.kr
http://nutritiondata.self.com/facts/vegetables-and-vegetable-products
JANSSON RK, RAMAN KV. (1991). Sweet potato pest management: A Global Perspective. Boulder, Colorado: Westview Press. 458 p.
NGAILO S., SHIMELIS H., SIBIYA J., MTUNDA K. (2013). Sweet potato breeding for resistance to sweet potato virus disease and improved yield: Progress and challenges. African Journal of Agricultural Research, Vol.8(25), p. 3202-3215.
SCHALK J.M., JONES A. (1985). Major insect pests. In: Bouwkamp JC, editor. Sweet Potato Products: A Natural Source for the Tropics. Florida: CRS Press. p. 59 – 78.
SMIT, N.E.J.M., LUGOJJA F. & OGENGA-LATIGO M.W.(1997). The sweetpotato butterfly (*Acraea acerata* Hew.,Nymphalidae): a review. *International Journal of Pest Management* 43: 275–278.
SORENSEN K.A. (2009) Sweetpotato insects: identification, biology and management. In: Loebenstein G, Thottappilly G (eds) The Sweetpotato. Springer-Verlag New York Inc, New York. pp 161–188
TALEKAR, N.S.(1987). Insect pests of sweet potato in the tropics. In: Magallona ED, editor. International Plant Protection Focus on the Developing World. Vol. 2. Proceedings of the 11th International Congress of Plant Protection. 1987 October 5-9, Manila, Philippines. p. 97-109.

Table 1

The climate conditions registered at weather station R.C.A.D.P.S.D. on the sweet potato vegetation period in 2013 and multiannual average

Climatic parameter	Month						
	IV	V	VI	VII	VIII	IX	1-10X
Average temperature (^{o}C)	14,3	20	22,1	23,7	24,1	17,8	8,01
Minimum temperature (^{o}C)	3,1	6,7	11	11,4	13,3	5,5	-1,6
Maximum temperature (^{o}C)	32,2	32,5	36,5	38,4	36,5	31,8	22,4
Precipitation (mm)	38,6	61	105,2	36,2	30,8	36	25,8
Relative humidity (%)	77,3	71	76,78	73,7	68,0	72	83,4
Multiannual mean temperature (1956-2012)	11,7	16,7	21,6	23,1	22,3	17,7	-
Multiannual mean precipitation (1956-2012)	45,5	60,6	67,4	53,3	38,2	45,5	-

Table 2

Arthropod species recorded on sweet potato, their taxonomic group and trophic category

Taxonomic group-species	Abundance/variant		Trophic category
	Untreated	Treated	
Acarina- *Tetranychus urticae*	Common	Fairly common	Herbivores
Araneae Lycosidae	Common	Common	Predators
Araneae Pisauridae	Common	Common	Predators
Araneae Salticidae	Common	Common	Predators
Opiliones-*Phalangium opilio* L.	Common	Rare	Predators
Collembola Sminthuridae- *Sminthurus viridis* L.	Rare	Rare	Herbivores
Collembola Entomobryidae: *Entomobryia arborea* Tullb., *E. multifasciata* Tull.	Common	Rare	Fungivores
Collembola Hypogastruridae *Ceratophysella bengtssoni*	Rare	Rare	Fungivores
Collembola Isotomidae *Folsomia candida* Will., *Isotoma viridis* Will.	Common	Rare	Fungivores
Orthoptera Gryllidae - *Gryllus campestris* L.	Rare	Rare	Omnivores
Orthoptera Acrididae- *Oedipoda caerulescens* L.	Rare	Rare	omnivores
Thysanoptera Thrypidae-*Frankliniella* spp.	Rare	Rare	Herbivores
Dermaptera Forficulidae-*Forficula auricularia* L.	Rare	Rare	Predator
Dermaptera Labiduridae-*Labidura riparia* Pall.	Abundant	Abundant	Predator
Hemiptera Aleyrodidae *Bemisia tabaci* Gen.	Fairly common	Abundant	Herbivores
Hemiptera Aphididae-*Myzus persicae* Sulz., *Aphis fabae* Scop., *A.gossypii* Glov.,	Rare	Abundant	Herbivores
HemipteraPentatomidae- *Nezara viridula* L.	Rare	Rare	Herbivores
Hemiptera Anthocoridae- *Orius* sp., *Xylocoris* sp.	Abundant	Rare	Predator
Hemiptera Nabidae- *Nabis ferus* L.	Common	Rare	Predator
Hemiptera Geocoridae- *Geocoris punctipes* Say	Rare	Rare	Predator
Neuroptera Chrysopidae-*Chrysoperla carnea* Steph. larvae	Rare	Rare	Predator
Neuroptera Myrmeleontidae- *Myrmeleon sp*. larvae	Rare	Absent	Predator
Coleoptera Carabidae- *Carabus glabratus* Payk.	Rare	Absent	Predator
Coleoptera Coccinellidae- *Coccinella 7-punctata* L.	Abundant	Rare	Predator
Coleoptera Scarabaeidae- *Scarabaeus typhon* Oliv	Rare	Absent	Coprophages
Coleoptera Scarabaeidae- *Anoxia villosa L.*	Rare	Rare	Herbivores
Coleoptera Chrysomelidae- *Cassida viridis* L., *Psylliodes chalcomerus* Illig., *Aphthona* spp., *Haltica* spp.	Common	Common	Herbivores
Coleoptera Elateridae- *Agriotes obscurus* L.	Rare	Rare	Herbivores
Diptera Syrphidae- *Episyrphus balteatus* De Geer- larva	Abundant	Rare	Predator
Diptera Calliphoridae- *Calliphora vicina* Rob& Desv.	Rare	Rare	Necrophagous
Diptera Sarcophagidae-*Sarcophaga carnaria* L.	Rare	Rare	Necrophagous
Diptera Tachinidae	Rare	Rare	Predator
Diptera Sciaridae	Rare	Rare	Fungivores
Hymenoptera Formicidae- *Tetramorium caespitum* L., *Lasius brunneus* Latr., *Camponotus herculeanus* L., *Formica rufa* L.	Abundant	Rare	Predators
Hymenoptera Chalcididae	Rare	Rare	Parasitoids
Hymenoptera Ichneumonidae	Rare	Rare	Parasitoids