



Impact of Climate Change and Adaptation in Agriculture

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EXTENDED ABSTRACTS

Josef Eitzinger and Gerhard Kubu (eds.)

Institute of Meteorology (BOKU-Met)
Department of Water, Atmosphere and Environment
University of Natural Resources and Applied Life Sciences (BOKU)

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ADAPTATION TO DISEASES, PESTS AND WEEDS CAUSED BY CLIMATIC CHANGES AND EVALUATION OF ASSOCIATED RISKS IN EUROPEAN REGIONS – RESULTS FROM THE ADAGIO PROJECT

R. Jevtić¹, B. Lalić², D. T. Mihailović², J. Eitzinger³, V. Alexandrov⁴, D. Ventrella⁵, M. Trnka⁶, D. P. Anastasiou⁷, M. Medany⁸, J. Olejnik⁹, M. Nikolaev¹⁰

¹ Institute of Field and Vegetable Crops, Maksim Gorki St. 30, Novi Sad, Serbia; jevtic@ifvcns.ns.ac.yu

² Faculty of Agriculture, University of Novi Sad, Dositej Obradovic Sq. 8, Novi Sad, Serbia

³ Institute of Meteorology, University of Natural Resources and Applied Life Sciences, Austria

⁴ National Institute of Meteorology and Hydrology, Sofia, Bulgaria

⁵ Istituto Sperimentale Agronomico (CRA-ISA), Italy

⁶ Mendel University of Agriculture and Forestry in Brno (MZLU), Czech Republic

⁷ Inst. of Env. Research and Sustainable Development (IESRD-NOA), Greece

⁸ Central Laboratory for Agricultural Climate (CLAC), Egypt

⁹ August Cieszkowski Agriculture University of Poznan, Agrometeorology Department, (ACAUP), Poland

¹⁰ Agrophysical Research Institute (ARI), St. Petersburg, Russia

Abstract

It is evident that certain climatic changes have taken place in recent years. Global warming is one of them. These climatic changes have exerted high effects on agriculture, especially when it comes to the occurrence of plant diseases, pests and weeds. The risk of plant disease, pest and weed damages to agricultural crops has increased significantly. Plant species that have been intensively attacked by harmful organisms are: wheat, barley, oat, maize, sunflower, sugar beet, potato, tomato, different fruits and grapevine in several European regions and olive trees in Greece, Italy and Egypt.

The occurrence of new diseases, pests and weeds is direct consequence of climate changes in: Austria, Italy, Greece, Egypt, Poland, NW Russia, and Serbia. In Bulgaria, occurrence of new harmful organisms has not been directly linked to climate changes but only indirectly. Certain harmful organisms adapted very fast their life histories to the changes and became prevalent in respect to other pests since the climate changes favored their large-scale multiplication and distribution.

If the predictions of global warming (which is often accompanied by drought) in the 21st century come true, frequent mass occurrences of the cotton bollworm and other xerothermophilous pests (grasshoppers, thrips, Sunn pests, weevils, flea beetles, etc.) may be expected as well as some new species, as a result of the expanding geographic distribution of some Mediterranean species. The western corn rootworm (which originated from North America) was observed in Serbia (Baca, 1993) and it is spreading fast in other European countries (Fig. 1). The red palm weevil (*Rhynchophorus ferrugineus*) comes from Egypt and it is spreading in several regions in Italy (found in 1994 in Campania, Toscana, Sicilia).

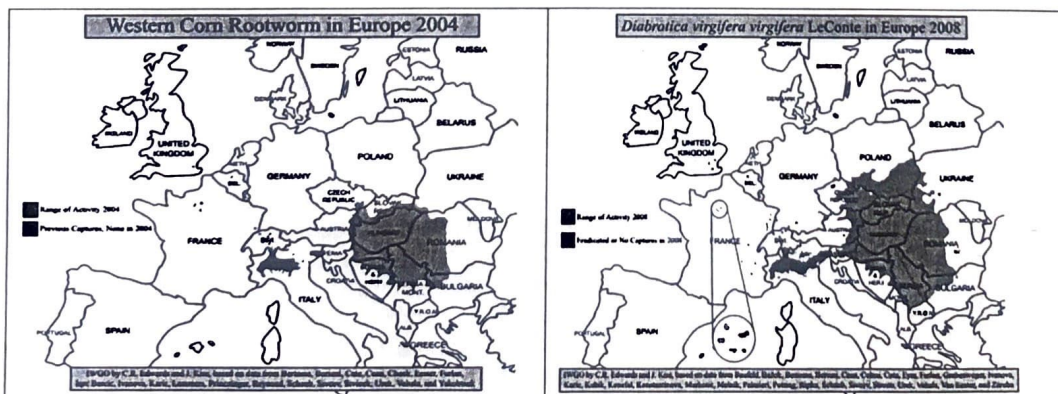


Fig. 1. The Western Corn Rootworm, which is spreading around in Europe, started from Serbia in the 1993 (originated from North America); Source: <http://www.entm.purdue.edu/wcr/>

New disease complexes may arise and some diseases may cease to be economically important if warming causes a poleward shift of agroclimatic zones and host plants migrate to new regions.

Pathogens would follow the migrating hosts and may infect remnant vegetation of natural plant communities not previously exposed to the often more aggressive strains from agricultural crops (Coakley, 1999). The occurrence of new harmful organisms is direct consequence of climate changes in the European regions and Egypt (Tab. 1).

Tab. 1. New diseases as direct consequence of climate changes in the European regions and Egypt

| Country | New Diseases |
|-----------------------|---|
| Austria | Organisms from warmer to previous cooler regions is observed Main direction is from south east to west of Austria, north of the Alps. |
| Egypt | Downy Mildew in Grape Powdery Mildew Late Blight of Potatoes and Tomatoes Leaf and stripe rust on wheat |
| Italy | Citrus tristeza virus |
| Greece | Esca disease <i>Phytophthora</i> species (2) <i>Alternaria</i> species <i>Verticillium dahliae</i> |
| Russia, Northern Part | <i>Helminthosporium</i> spp. <i>Puccinia avenae</i> <i>Pyrenosporioses</i> |
| Serbia | Tan spot The reddish discoloration of corn SBFS complex on apple fruits |

Physiological changes on plants are manifested as disorder of the vascular system, causing plant wilting and intensive occurrences of phytoplasmoses in certain crops. The reddish discoloration of corn leaves was registered in the region of south Bačka (Serbia). Its causal agent is stolbur phytoplasma (Duduk and Bertaccini, A., 2006), and its vector is a cycad *Reptalus panzeri* (Cixiinae, Auchenorrhyncha) (Milićević et al., 2006). Large problems on grapevine have been caused by the occurrence of yellow and red leaf discoloration. The vector of *flavescence dorée* (FD) phytoplasma is a cycad *Scaphoideus titanus* Ball., registered in Serbia in 2004 (Magud and Toševski, 2004). The occurrence of sooty blotch and fly speak (SBFS complex) on apple fruits was described for the first time in Serbia by Knežević et al. (2006).

Burns of apple leaves and fruits due to excessive insolation have become evident in recent years. A mechanical injury of fruits by hail or uncontrolled tree development that causes bark lesions allows a rapid pathogen development and a large production of spores.

In Austria on the wine increasing sun burn of grapes (white wine cultivars) was observed during past years, based on the current leaf reducing measures. Heat stress and damage, also water stress, especially on southern slopes were observed (in alpine grasslands) during past years. In 2008, Ministry of Agriculture and Land reclamation of Egypt declared that the cold wave hit Egypt From 29th January to 1st February 2008 caused physical losses in winter vegetable crop-yields by 20 to 40%. As well as, there were serious losses in mango, banana and citrus by 30 to 40% of the total crop-yield (NOAA, 2009). Diffuse burns on tomato and sweet pepper fruits was observed in Italy. Vegetables and other "cash" crop species have suffered from burns, especially on heat wave periods, as reported by farmers at the project study and data collection areas. Also, other crops such as grapevines and tree fruits have also been reported to be burned by radiation damage in Greece.

Several weeds are considered as increasingly harmful factors in Austria and Serbia in relation with climate warming (*Ambrosia artemisifolia*, *Datura stramonium*, *Solanum nigrum*, *Abutilon theophrasti*). Adaptation to the occurrence of diseases caused by climatic changes can be viewed from several aspects in which a specific relationship exists between the plant (host) and the harmful organisms. Climatic changes alter plant physiological processes and resistance levels, while harmful organisms adapt their life cycles and aggressiveness.

In recent years, increased numbers of chemical treatments have been required in order to control harmful organisms in most field crops, vegetables, fruits and grapevine. The increase in the number of treatments builds up production costs and intensifies environmental pollution. Development of cultivars resistant to pathogens and insects is an important measure of their control. Other important measures

include the planting of healthy seeds, crop rotation, irrigation, balanced fertilizer use and other cultural practices. In order for the adaptation measures to be implemented successfully, the breeding process must be adapted to the newly arisen climatic changes from the points of view of both, the plant and harmful organisms.

Keywords: disease, pest, weeds, climate change, Adagio project.

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