4th ESENIAS Workshop: International Workshop on IAS in Agricultural and Non-Agricultural Areas in ESENIAS Region

16-17 December 2013
Çanakkale, Turkey

PROCEEDINGS

Edited by:
Ahmet ULUDAĞ, Teodora TRICHKOVA, Milica RAT, Rumen TOMOV

Published by:
Çanakkale Onsekiz Mart University, Turkey
East and South European Network for Invasive Alien Species (ESENIAS)
Institute of Biodiversity and Ecosystem Research, BAS, Bulgaria

Çanakkale Onsekiz Mart Üniversitesi Yayınları No: 109

4th ESENIAS Workshop: International Workshop on IAS in Agricultural and Non-Agricultural Areas in ESENIAS Region

Yasal Uyarı: Bu kitapta yer alan içerikler, Çalıştay Bilim Kurulu tarafından kabul edilmiş ve şekilsel açıdan düzenlemeye tabii tutulmuştur. Bu kitabın yayın hakkı Çanakkale Onsekiz Mart Üniversitesi Ziraat Fakültesi'ne aittir ve tüm yayın hakları saklıdır. Kitabın herhangi bir bölümünün kopya edilmesi, başka dillere tercüme edilmesi, basılması ve çoğaltılması editör iznine bağlıdır. Kaynak göstermek suretiyle alıntı yapılabilir.

1. Baskı: Ankara-Çanakkale 2014

ISBN: 978-605-4222-28-5

İletişim Adresi
Çanakkale Onsekiz Mart Üniversitesi
Ziraat Fakültesi
Terzioğlu Yerleşkesi 17020 ÇANAKKALE
Tel: 0286 218 05 44 - Fax: 0286 218 05 45

Kapak Tasarım
Uzman Mürsel Mehmet GÜVEN

Basım Yeri
Pozitif Matbaa
Çamlıca mah. 145. Sk No:10/19 Yenimahalle / ANKARA
Tel: 0312 397 00 31
pozitif@pozitifmatbaa.com

4th ESENIAS Workshop: International Workshop on IAS in Agricultural and Non-Agricultural Areas in ESENIAS Region

16-17 December 2013
Çanakkale, Turkey

PROCEEDINGS

Organized by:
Çanakkale Onsekiz Mart University, Turkey
East and South European Network for Invasive Alien Species (ESENIAS)
Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences

Under the Patronage of:
Prof. Dr. Sedat LAÇİNER, Rector of Çanakkale Onsekiz Mart University
Prof. Dr. Feyzi UĞUR, Dean of Faculty of Agriculture,
Ali Rıza TEKİN, Head of Çanakkale Provincial Assembly

Funded by:
Çanakkale Onsekiz Mart University, Turkey
Çanakkale Provincial Assembly

Editors:
Ahmet ULUDAĞ, Teodora TRICHKOVA,
Milica RAT, Rumen TOMOV

4th ESENIAS Workshop: International Workshop on IAS in Agricultural and Non-Agricultural Areas in ESENIAS Region

16-17 December 2013, Çanakkale, Turkey

COMMITTEES

International Committee

Ahmet ULUDAĞ, Prof. Dr., Plant Protection Department, Faculty of Agriculture, Çanakkale Onsekiz Mart University, Turkey (Cochair)

Teodora TRICHKOVA, Dr., Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-BAS), Bulgaria (Cochair)

Milica RAT, Dr., Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad, Serbia

Piero GENOVESI, Dr., Chairman of IUCN-ISSG

Local Organizing Committee

Canan ÖZTOKAT KUZUCU, Assoc. Prof. Dr., Vice Dean, ÇOMÜ, Faculty of Agriculture

M. Mürsel GÜVEN, ÇOMÜ, Faculty of Agriculture

Deniz AYDIN, ÇOMÜ, Faculty of Agriculture

Esengül ERDEM, ÇOMÜ, Faculty of A griculture

Ali Kürşat ŞAHİN, ÇOMÜ, Faculty of Agriculture

Emre Eren MUSLU, ÇOMÜ, Faculty of Agriculture

Scientific Committee:

Güler EKMEKÇİ, Prof. Dr., Hydrobiology Section, Biology Department, Faculty of Science, Hacettepe University, Ankara, Turkey

Hüseyin ÖNEN, Prof. Dr., Plant Protection Department, College of Agriculture, Gazi Osman Paşa University, Tokat, Turkey

Milica RAT, Dr., University of Novi Sad, Serbia

Riccardo SCALERA, Dr., Programme Officer, IUCN/SSC Invasive Species

Rumen TOMOV, Prof. Dr., Vice Rector, University of Forestry, Bulgaria

Teodora TRICHKOVA, Dr., IBER-BAS, Bulgaria

Ahmet ULUDAĞ, Prof. Dr., Çanakkale Onsekiz Mart University, Turkey

4th ESENIAS Workshop Message

16-17 December 2013
Çanakkale, Turkey

Introduction

Invasive alien species (IAS) are among the most important drivers of biodiversity loss and in the last decades biological invasions have been recognised as a major environmental issue at local, regional and global level. The impact of IAS in agricultural areas, and on human health shows that biological invasions can also have some major negative economic impact. Therefore, many countries are developing measures for the control and eradication of IAS. The European Union has recently drafted an EU regulation on IAS. All relevant measures will affect not only the EU Member States, but also all other European countries and beyond.

The necessity of a regional network in what is identified as the Western Balkans or the East European countries (which covers an area occupied by countries which are not MSs of the EU) was recognized in 2010 at a first workshop held in Zagreb (Croatia) *"EEA/EIONET Workshop on Invasive Alien Species in West Balkan Countries".* Since then, every year dedicated workshops were organized in other West Balkan Countries, in particular in 2011 in Sofia (Bulgaria) and in 2012 in Belgrade (Serbia). The **ESENIAS** (*East and South European Network for Invasive Alien Species*) network was formally launched at the Workshop in Sofia. Further details on the outcomes of the workshops are available on the ESENIAS website.

The forth workshop *"International Workshop on IAS in Agricultural and Non-Agricultural Areas in ESENIAS Region"* was organized on 16-17 December 2013, by Faculty of Agriculture, Çanakkale Onsekiz Mart University (ÇOMÜ) (Canakkale, Turkey), ESENIAS, and Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (Sofia, Bulgaria). The Workshop was funded by ÇOMÜ and Çanakkale Provincial Assembly in premises of Faculty of Agriculture, ÇOMÜ, Çanakkale, Turkey.

Participants were government representatives and national expert representatives, as well as scientists, experts and students from Albania, Bulgaria, Croatia, Greece, Montenegro, Romania, Serbia, and Turkey.

The workshop aimed at:

- Sharing information on IAS in agricultural and non-agricultural areas;
- Exchanging knowledge on related initiatives carried out at the regional level, such as national and local monitoring schemes, risk assessments, control and eradication projects, management plans and national strategies, citizens activities and responsibilities;
- Checking the follow up of the work plan of the ESENIAS network, which was prepared in the previous meeting;
- Discussing the new EU Regulation on IAS;
- Checking the progress toward the requirements of CBD 2020 Strategy and reviewing the relevant developments in the region;
- Seeking further improvement of cooperation and networking on IAS in the region and collaboration with other networks.

The workshop included oral and poster presentations focusing on the current situation of IAS in natural and agricultural areas in the region. Round tables with discussions were also organized. Recent developments in EU aquis and work plan of ESENIAS and CBD 2020 Strategy has been analyzed and discussed.

The Çanakkale workshop participants:

1. Recognize the invasive alien species as a cause of economic losses in agricultural areas, pollution in environment and health problems as well as a major driver of biodiversity loss. Especially pests (all kind of them) are more detrimental because of lack of control practices and environmental defense mechanisms.
2. Stress again the importance of regional cooperation on IAS.
3. Suggest the following developments in EU aquis in order to have scientifically sound and acceptable results.
4. Recommend to non-EU members of ESENIAS establishing rules and develop aquis on IAS in line with the new EU Regulation on IAS.
5. Urge to countries to follow up CBD 2020 Strategy.
6. Require completing ESENIAS book as soon as possible to increase the visibility and impact of the ESENIAS network, to facilitate the circulation of information on the IAS in the target region and beyond.

Çalıştay Sonuç Bildirgesi

16-17 Aralık 2013
Çanakkale

Giriş

İstilâcı Yabancı Türler (İYT) biyoçeşitlilik kaybının en önemli sebepleri arasında yer almaktadır ve geçtiğimiz yıllarda biyolojik istilâların ülke, bölge ve dünya düzeylerinde önemli bir çevre meselesi olduğu kabul edilmiştir. İYTlerin tarım alanları ve insan sağlığı üzerine olan etkileri, biyolojik istilâların bazı önemli ekonomik etkilerinin olduğunu da göstermektedir. Bu yüzden, birçok ülke istilâcı yabancı türlerin kontrolü ve ortadan kaldırılması için tedbirler geliştirmektedir. Avrupa Birliği (AB) IAS ile ilgili bir kanun teklifini görüşmektedir. Konu ile ilgili önlemler sadece AB ülkelerini değil, aynı zamanda diğer Avrupa ülkeleri ve Avrupa dışındaki ülkeleri de etkileyecektir.

Batı Balkanlar ve Doğu Avrupa ülkeleri olarak tanımlanan ülkelerde, bir bölge ağının gerekliliği ilk olarak 2010 yılında Zagreb'de (Hırvatistan) gerçekleştirilen " EEA/EIONET Batı Balkan Ülkelerinde İstilâcı Yabancı Türler Çalıştayı" çalıştayda onaylanmıştır. O günden bu yana her yıl, Batı Balkan ülkelerinde, 2011 yılında Sofya (Bulgaristan) ve 2012 yılında Belgrad (Sırbistan), belirli konulara ithaf olunmuş çalıştaylar düzenlenmiştir. **ESENIAS** (Doğu ve Güney Avrupa İstilâcı Yabancı Türler Ağı) Sofya'da düzenlenen çalıştayda resmen kurulmuştur. Çalıştayların çıktıları ile ilgili daha fazla ayrıntı ESENIAS genelağ sitesinde mevcuttur.

Dördüncü Çalıştay "ESENIAS Bölgesinde Tarım ve Tarım Dışı Alanlarda İstilcı Yabancı Türler Çalıştayı" 16-17 Aralık 2013 tarihlerinde Çanakkale Onsekiz Mart Üniversitesi (ÇOMÜ) Ziraat Fakültesi, ESENIAS ve Bulgaristan Bilimler Akademisi Biyoçeşitlilik ve Ekosistem Araştırmaları Enstitüsü (Sofya, Bulgaristan) tarafından düzenlenmiştir. ÇOMÜ Ziraat Fakültesi'nde gerçekleştirilen çalıştay, ÇOMÜ ve Çanakkale İl Genel Meclisi tarafından finanse edilmiştir.

Arnavutluk, Bulgaristan, Hırvatistan, Yunanistan, Karadağ, Romanya, Sırbistan ve Türkiye'den bilim adamı, uzman ve öğrencilerin yanısıra Türk kamu kurumlarının temsilcileri ve uzmanları toplantıya katılmıştır.

Çalıştay,

- Tarım ve tarım dışı alanlardaki İYT ile ilgili bilgilerin paylaşılmasını;
- Millî ve mahallî izleme plânları, risk değerlendirmeleri, kontrol ve ortadan kaldırma projeleri, mücadele plânları, millî stratejiler, vatandaşların faaliyetleri ve sorumlulukları gibi bölge seviyesinde gerçekleştirilen teşebbüslerle ilgili bilgilerin değişimini;
- Önceki toplantıda hazırlanmış olan ESENIAS çalışma plânının uygulamalarının tâkip edilmesini;
- AB'deki yeni IAS hakkındaki kanun teklifinin görüşülmesini;
- Dünya Biyolojik Çeşitlilik Sözleşmesi (CBD) 2020 stratejisinin gerekliliklerin yerine getirilmesi yönündeki ilerlemelerin irdelenmesi ve bölgede bununla ilgili gelişmelerin incelenmesini;
- Bölgede daha gelişmiş bir işbirliği ve İYT ağı oluşturulması ve diğer ağlarla işbirliğinin araştırılmasını amaçlamıştır.

Çalıştay, bölgedeki tabii alanlar ve tarım alanlarında bulunan İTYlerin mevcut durumlarına odaklanan poster ve sözlü sunumları içermiştir. Bunlara ilaveten yuvarlak masa tartışmaları da organize edilmiştir. AB müktesebatındaki, ESENIAS'ın çalışma plânındaki ve CBD 2020 stratejisindeki en son gelişmeler analiz edilmiş ve görüşülmüştür.

Çanakkale çalıştayı katılımcıları:

1. İstilacı yabancı türlerin biyolojik çeşitliliğin kaybındaki esas etkenlerden biri olmasının yanı sıra; tarım alanlarında ekonomik kayıpların, çevre kirliliğinin ve sağlık meselelerinin sebebi olduğunu kabul etmişlerdir. Özellikle zararlılar (bütün zararlı etmenler), mücadele yöntemlerinin olmaması ve çevrenin savunma mekanizmalarının yokluğundan dolayı daha yok edicidirler.
2. İYT konusunda bölge bazında işbirliklerinin önemini bir kere daha vurgulamışlardır.
3. AB müktesebatındaki gelişmelerin bilime uygun ve kabul edilebilir olmasının takibini önermiştir.
4. Avrupa Birliği üyesi olmayan ESENIAS üyesi ülkelerin AB İYT gelişmelerine paralel İYT müktesebatı geliştirmelerini tavsiye etmiştir.
5. Ülkeleri CBD 2020 stratejisini takip etmeye teşvik etmiştir.
6. ESENIAS ağının etkisi ve görünürlüğünün artırılması ve hedef bölgeler ve diğerlerinde İYT hakkındaki bilginin dolaşımını sağlamak için mümkün olan en kısa sürede ESENIAS kitabının tamamlanmasının gerekliliğini ifade etmiştir.

MESSAGE OF THE RECTOR

Loss of biodiversity is one of the concerns of human being, which is resulted from the global change that has affected environment as well as many other things in the world. Invasive alien species are among the main drivers of biodiversity loss. Combatting with invasive alien species is not an easy task because of their unavoidable introductions and spread beyond political borders. Regional collaborations are necessary as much as national measures and worldwide common perception. ESENIAS is one of the organizations aims to protect biodiversity in a regional base. In spite of its short history, it is getting visible because of its activities in the region targeted. We are glad to hosting and supporting 4th workshop of ESENIAS in our university. Our aim is to produce scientific information, convey knowledge to public and create international environment to have more livable world for all of us. We believe that this workshop will be a step to reach our ideals to have happier, wealthier and healthier world to be inherited to next generations. I wish a successful meeting to all participants and also do hope that the all participants will enjoy while staying in our university, city and country.

Prof Dr Sedat LÂÇİNER
Rector
ÇOMÜ

REKTÖRÜMÜZÜN MESAJI

Bir çok şeyi olduğu gibi çevreyi de etkileyen global değişikliğin sonuçlarından biri olan biyolojik çeşitliliğin kaybı insanlığın endişe duyduğu konulardan biridir. Biyolojik çeşitliliğin kaybolmasının önemli sebepleri arasında istilâcı yabancı türler de bulunmaktadır. İstilâcı yabancı türlerle mücadele etmek kolay bir iş değildir. Çünkü yeni bölgelere girmeleri ve politik sınırların ötesinde yayılmaları kaçınılmazdır. Ülkelerin kendi içlerinde tedbirler almaları ve dünya çapında ortak bir anlayışın oluşması kadar bölgeler çapında iş birliği de gerekmektedir. ESENIAS biyolojik çeşitliliği korumayı hedef almış bir bölge kuruluşudur. Kısa bir tarihçesi olmasına rağmen bölge çapındaki faaliyetleri ile görünürlüğü gün geçtikçe artmaktadır. Üniversite olarak ESENIAS'ın dördüncü çalıştayını desteklemekten ve ev sahipliği yapmaktan şeref duyuyoruz. Bizim amacımız herkesin daha iyi yaşayacağı bir dünya yaratmak için bilgiyi üretmek, bunu topluma aksettirmek ve beynelmilel bir ortam oluşturmaktır. Biz bu çalıştayın gelecek nesillere daha mutlu, sağlıklı ve zengin bir dünya bırakma ideali yolunda bir adım olduğuna inanıyoruz. Bütün katılımcılara başarılı bir toplantı diliyorum ve ülkemizde, şehrimizde ve üniversitemizde kalmaktan hoşlanacaklarını ümit ediyorum.

Prof Dr Sedat LÂÇİNER
Rektör
ÇOMÜ

MESSAGE OF THE DEAN

We, as the Faculty of Agriculture of Çanakkale Onsekiz Mart University, are continuing our work successfully and intensively on education, training and scientific publication. In addition, we are aware about the importance of participation into both national as well as international meetings, and organizing such kind of activities. This activity has very special importance for us because it is the first international workshop which is organized by our faculty. Furthermore, respected national participants have enriched the meeting. I express my gratitude to all of them.

The Faculty of Agriculture cares about considering different subjects to study and the multi discipline approaches. Invasive alien species in agricultural and non-agricultural areas are confronted worldwide as one of the most important subjects of the present age. In this meeting, leading scientists of concern subject have discussed the different aspects of invasive alien species presented the latest situation that has been reached in related field. Cordially, I wish that the findings are obtained and the evaluations presented will conduce to advantageous results.

The workshop has been organized under the leadership of our University's Rector with the collaboration of the presidency of Çanakkale Provincial Assembly. The presidency of Çanakkale Provincial Assembly has given an impeccable support to the workshop by ensuring the coordination between local government and stakeholder institutions. I extend my gratitude to all of the supported institutions. I thank to the organizing committee of our faculty because of their devoted laborious work, to the scientists who have provided support and to the respectable participants. I also remark my belief that this workshop will be fruitful and useful for our city as well as country. I pay my respects to all of you.

Prof. Dr. Feyzi UĞUR
Dean, Faculty of Agriculture
COMU

DEKANIMIZIN MESAJI

Çanakkale Onsekiz Mart Üniversitesi Ziraat Fakültesi olarak eğitim, öğretim ve bilimsel yayın çalışmalarımızı başarıyla ve yoğun bir şekilde sürdürüyoruz. Yanısıra, gerek ulusal ve gerekse uluslararası toplantılara katılma ve düzenleme faaliyetlerinin de önemli olduğunu değerlendiriyoruz. Bu çalışma, Fakülte olarak düzenlediğimiz ilk uluslararası çalıştay olması bakımından bizim için önemli olmuştur. Ayrıca, ulusal anlamdaki değerli katılımcılar da toplantıya zenginlik katmıştır. Kendilerine şükranlarımı sunuyorum.

Ziraat Fakültesi olarak farklı çalışma konularını değerlendirmeyi ve bu alanları farklı disiplinlerle ele almayı da ayrıca önemsiyoruz. Tarım ve tarım dışı alanlardaki istilacı türler konusu, dünyanın son yılların önemli güncel konularından biri olarak karşımıza çıkmaktadır. Bu toplantıda; konunun önde gelen bilim insanları istilacı yabancı türler konusunu farklı yönleriyle tartışmışlar ve ilgili alanda gelinen son noktayı ortaya koymuşlardır. Tespit edilen bulguların ve ortaya konulan değerlendirmelerin hayırlı sonuçlara vesile olmasını yürekten dilerim.

Çalıştayımız, Üniversitemiz Rektörlüğü'nün liderliğinde ve Çanakkale İl Genel Meclisi Başkanlığı ile birlikte düzenlenmiştir. Çanakkale İl Genel Meclis Başkanlığı Çalıştaya destek konusunda ilimizdeki yerel yönetim ve paydaş kurumlarımız arasındaki koordinasyonu kusursuz bir şekilde yerine getirmiştir. Katkı sağlayan tüm kurumlarımıza sonsuz teşekkürlerimi sunuyorum. Ayrıca, çalıştaydaki fedakârca emekleri nedeniyle, Fakültemiz düzenleme kuruluna, katkı sağlayan bilim insanlarına ve değerli katılımcılara teşekkür ederken, bu çalıştayın kentimiz ve ülkemiz için yararlı ve hayırlı olacağına olan inancımı belirtiyor, saygılar sunuyorum.

Prof. Dr. Feyzi UĞUR
ÇOMÜ Ziraat Fakültesi Dekanı

ON ESENIAS WORKSHOP

The Provincial Assemblies as an important organ of Provincial Administrations are the institutions which continue their activities with the objective of serving our country. As being the Provincial Assembly, we are trying to do our duties as a part of the state and also as an important agent of the political system.

Çanakkale is an important city has revealed the vision of agriculture, tourism, history, environment and culture. Initiating from this principle; we think that such activities support, understand and raise the voices of our people who are contributing in social, cultural and scientific activities in the important areas of farming, olive, milk and its products, environmental protection, history and archeology of our city.

I consider that this workshop is valuable in this context and I would like to emphasize that it gives me an immense pleasure to host such important scientists in our city. I wish that the results of this workshop would contribute our country and I hereby present my respects and regards from the depths of my heart to our people.

Ali Rıza TEKİN

Head of Çanakkale Provincial Assembly

ESENIAS ÇALIŞTAYI ÜZERİNE

İl Genel Meclisleri, İl Özel İdaresinin önemli bir organı olarak faaliyetlerini ülkemize hizmet etme hedefi çerçevesinde sürdüren bir kurumdur. İl Genel Meclisi olarak, devletin bir parçası ve aynı zamanda siyaset kurumunun önemli bir temsilcisi olarak görevlerimizi yerine getirmeye çalışıyoruz.

Çanakkale, vizyonunu tarım, turizm, tarih, çevre ve kültür olarak ortaya koymuş önemli bir ilimiz. Bu ilkeden hareketle; ilimizin hayvancılığı, zeytinciliği, süt ve ürünleri, çevre koruma, tarih ve arkeoloji gibi önemli alanlardaki sosyal, kültürel ve bilimsel çalışmalarına, katılma, katkı sağlama, insanımıza ulaşma, onları dinleme ve anlama gibi çalışmaları desteklemenin önemli olduğunu düşünüyoruz.

Bu çalışmayı da bu kapsamda değerli görüyor, böylesine önemli bilim insanlarını ilimizde ağırlamaktan mutluluk duyduğumu belirtmek istiyorum. Çalıştayda ortaya konan bulguların ülkemize katkı sağlamasını yürekten temenni eder, bu vesile ile tüm halkımıza en kalbi hürmet ve selamlarımı sunarım.

Ali Rıza TEKİN

Çanakkale İl Genel Meclisi Başkanı

CONTENT

WORKSHOP PROGRAM XIX

LECTURES 1

An alien species commonly known as native: The olive fruit fly, *Bactrocera oleae* (Rossi) (Diptera:Tephritidae) (Hanife GENÇ) 3

TOPIC I: IAS AS PESTS IN AGRICULTURE 5

Tuta absoluta Povolny (Lepidoptera: Gelechiidae), the exotic pest in Turkey (Sevcan ÖZTEMİZ) 7

Adult population development of Tomato leaf miner (*Tuta absoluta* Meyrick, 1917, Lepidoptera: Gelechiidae) in Çanakkale province (Burak POLAT, Ali ÖZPINAR, Ali Kürşat ŞAHİN) 9

An alien species in Çanakkale, Turkey: Jasmine moth (*Palpita unionalis* Hübner, Lepidoptera: Pyralidae) (Çiğdem ŞAHİN and Hanife GENÇ) 10

Ten economically important alien plant pest species in Turkish agriculture (Ali Kürşat ŞAHİN, Esengül ERDEM, Burak POLAT, Ali ÖZPINAR) 11

TOPIC II: SITUATIONS OF IAS 13

The Danube River as an invasive alien species corridor: Alien bivalve molluscs, decapods and fish, Bulgaria case study (Teodora A. Trichkova, Zdravko K. Hubenov, Lyubomir A. Kenderov, Vesela V. Evtimova, Ivan S. Botev) 15

Invasive alien plant species in Montenegro, with special focus on *Ambrosia artemisiifolia* (Danijela STEŠEVIĆ, Nedeljko LATINOVIĆ, Danka CAKOVIĆ) 17

Invasive alien plants in Croatia as a threat to biodiversity of South-eastern Europe (Božena MITIĆ) 32

Invasive alien species of vascular plants in Bulgaria (Vladimir VLADIMIROV) ... 33

TOPIC III: IAS IMPACT ON NON-AGRICULTURAL AREAS 35

The current status of invasive fish species in Turkish freshwaters and potential impacts of the invasions (F. Güler EKMEKÇİ, Ş. Gülsün KIRANKAYA, Baran YOĞURTÇUOĞLU, Lale GENÇOĞLU, F. Kübra ERBAY) 37

Range expansion of translocated Aegean endemic species *Oxynoemacheilus bureschi* (Pisces: Nemacheilidae) in the Iskar River, Danube River basin, Bulgaria (Tihomir Stefanov, Eliza Uzunova, Lyubomir Kenderov, Teodora Trichkova) 38

Considerations on the potential conflicts between some invasive American aquatic turtles and native *Emys orbicularis* - analysis of the feeding behaviour (Nikolay NATCHEV , Yurii KORNILEV, Georgi POPGEORGIEV, Nikolay TZANKOV) 39

Neophytes in protected areas. Case study: the Danube Delta Biosphere Reserve (Paulina ANASTASIU, Gavril NEGREAN, Daniela SMARANDACHE, Sanda LITESCU, Corina BASNOU) 41

TOPIC IV: INVASIVE ALIEN PLANTS 43

A new threat in cotton fields in the West Mediterranean Region of Turkey: *Ipomoea* spp. (Ayşe YAZLIK, İlhan ÜREMİŞ, Ahmet ULUDAĞ, Kayahan UZUN) . 45

The list of exotic ornamental plants potentially invasive in Turkey (Necmi AKSOY) 47

Agricultural ecosystems as a pathaway for invasive alien plant species (Milica RAT, Bojana BOKIC, Milica RADANOVİC, Boris RADAK, Slobodan BOJCİC, Goran ANACKOV, Pal BOZA) 48

Invasion status of Common Ragweed *(Ambrosia artemisiifolia L.)* in Turkey (Hüseyin ÖNEN, Hikmet GÜNAL and Selçuk ÖZCAN) 50

TOPIC V: AQUATIC ENVIRONMENTS 51

Alien species in ESENIAS countries by 2013: A subregional approach focusing on marine species (Argyro ZENETOS, Paraskevi K. KARACHLE) 53

Predicting potential invasive species in Bulgaria using GIS – key study on aquatic turtles (Nikolay TZANKOV, Georgi POPGEORGIEV, Yurii KORNILEV, Nikolay NATCHEV) 56

Trophic level and niche width of introduced Prussian carp (*Carassius gibelio*) and native fish species in a Turkish river (Şükran YALÇIN ÖZDİLEK, Roger I. JONES) 58

TOPIC VI: IAS IN AGRICULTURE 59

Effect of normal and elevated CO_2 levels on the growth of some invasive weeds in Turkey (Khawar JABRAN, M. Nedim DOĞAN, Özkan EREN) 61

The Nightmare: genetically modified organisms as alien species (Meliha Merve HIZ, Cüneyt AKI) 63

The role of antioxidants in the Orobanche-cultivated plants interaction and broomrape invasion (Okan ACAR, Sefer DEMIRBAS) 65

POSTERS 67

Invasive plant species in Çanakkale (Ersin KARABACAK, Onur ESEN) 69

A field trip to Musaköy for observation of broomrape infestation (Sefer DEMIRBAS, Okan ACAR, Burcin SEN, Hülya Nur GORKEM) 70

Invasive Weeds in Black Sea Region of Turkey (Dogan ISIK, Kubra GOZUKARA, Gulhanim TURKMEN, Zeynep KARNAS, Salih BİNGÖL, Adem AKÇA and Hüsrev MENNAN) 72

Seeds as a pathway: Speculation on *Diplachne fusca* spreading in Turkey (Emre E. MUSLU, Ahmet ULUDAĞ) 78

Population variability of weedy sunflower as invasive species (Markola SAULIC, Darko STOJICEVIC, Ana MATKOVIC, Dragana BOZIC, Sava VRBNICANIN) 79

Allelochemical explanation of *Heracleum sosnovskyi* invasiveness (Ligita BALEŽENTIENĖ) 86

Invasive potential of *Bromus* species in wheat fields in Turkey (Süleyman TÜRKSEVEN, Mehmet DEMİRCİ, Ahmet Tansel SERİM) 88

Expansion status of two invasive vines: Bur-Cucumber and Mile-a-Minute, in Turkey (Hüseyin ÖNEN, Cumali ÖZASLAN, Hikmet GÜNAL, Nihat AKYOL, Uğur ÇALDIRAN) 89

Situation of Invasive Alien Species in EPPO A2 list in Turkey (Zübeyde Filiz ARSLAN, Ahmet ULUDAĞ, İlhan ÜREMİŞ) 91

Pontogammarus robustoides G. O. Sars, 1894. – New potentially invasive amphipod species to the Bulgarian inland waters (Lyubomir KENDEROV, Teodora TRICHKOVA, Yanka VIDINOVA, Svetoslav CHESHMEDJIEV) 95

Distribution of the invasive blue crab *Callinectes sapidus* Rathbun, 1896 along the Albanian coast (Ermira MILORI, Alba ZHORI, Irma AGOLLI, Sajmir BEQIRAJ) 96

Lake Ohrid tributaries: Natural and potential pathways for invasive alien species introductions (Sasho TRAJANOVSKI, Biljana BUDZAKOSKA, Lyubomir KENDEROV, Konstantin ZDRAVESKI, Ivan BOTEV, Teodora TRICHKOVA) 101

Native and non-native fish species in the tributaries and outflow of ancient Lake Ohrid (Teodora TRICHKOVA, Trajce TALEVSKI, Ivan BOTEV, Lyubomir KENDEROV, Sasho TRAJANOVSKI) 103

Distribution of *Gambusia* (Mosquitofish) in Turkey and its potential impact on aquatic ecosystems (F. Kübra ERBAY, Baran YOĞURTÇUOĞLU, Ş. Gülsün KIRANKAYA, Lale GENÇOĞLU, F. Güler EKMEKÇİ) 105

Rapid expansion in distribution area of a marine fish, the sand smelt, in inland waters of Turkey (Lale GENÇOĞLU, Ş. Gülsün KIRANKAYA, F. Güler EKMEKÇİ, Baran YOĞURTÇUOĞLU)....107

A review of pest status of recently recorded alien insects in Bulgaria (Rumen TOMOV, Katia TRENCHEVA)....108

A new approach to control the Colorado potato beetle *Leptinotarsa Decemlineata* (Say) (Coleoptera: Chrysomelidae): Botanicals (Esengül ERDEM)....115

The potential use of entomopathogenic nematodes against tomato leaf miner *Tuta absoluta* (Lep: Gelechiidae) (Çiğdem GÖZEL, Uğur GÖZEL)....116

INTERNATIONAL PARTICIPANTS....117

TURKISH PARTICIPANTS....118

STUDENTS AND FARMERS....120

WORKSHOP PROGRAM

15 December 2013

17:00-19:00 Registration

20:00 Welcome cocktail

16 December 2013

08:30-09:30 Registration

09:30-10:30 Opening ceremony

Opening lecture

Moderator Ahmet ULUDAĞ

An invasive species commonly known as native: The Olive Fruit Fly, Bactrocera oleae (Rossi) (Diptera: Tephritidae) (Hanife GENÇ)

COFFEE BREAK (With poster viewing)

11:00-12:00 Scientific session I: IAS as pests in agriculture

Moderators: Danijela STEŠEVIĆ and Ahmet ULLUDAG

** Tuta absoluta Povolny (Lepidoptera: Gelechiidae), the exotic invasive pest in Turkey* (Sevcan ÖZTEMİZ)

** Adult population development of Tomato Leafminer (Tuta absoluta Meyrick, 1917, Lepidoptera: Gelechiidae) in Çanakkale Province* (Burak POLAT, Ali ÖZPINAR, Ali Kürşat ŞAHİN)

** An invasive species in Çanakkale, Turkey: Jasmine Moth (Palpita unionalis Hübner, Lepidoptera: Pyralidae)* (Çiğdem ŞAHİN, Hanife GENÇ)

** Ten economically important alien plant pest species in Turkish agriculture* (Ali Kürşat ŞAHİN, Esengül ERDEM, Ali ÖZPINAR, Burak POLAT)

12:00-13:00 Scientific session II: Situations of IAS

Moderators: Tihomir STEFANOV and Necmi AKSOY

** Danube River as an invasive alien species corridor: alien bivalve molluscs, decapods and fish, Bulgaria case study*

(Teodora TRICHKOVA, Zdravko HUBENOV, Lyubomir KENDEROV, Vesela EVTIMOVA, Ivan BOTEV)

** Invasive alien plant species in Montenegro* (Danijela STEŠEVIĆ, Nedeljko LATINOVIĆ, Danka CAKOVIĆ)

** Invasive alien plants in Croatia as a threat to biodiversity of South-eastern Europe* (Božena MITIĆ)

** Invasive alien species of vascular plants in Bulgaria* (Vladimir VLADIMIROV)

LUNCH

14:15-15:15 Scientific session III: IAS impact on non-agricultural areas

Moderators: Argyro ZENETOS and Hüseyin ÖNEN

* *The current status of invasive fish species in Turkish freshwaters and potential impacts of the invasions* (F. Güler EKMEKÇİ, Ş. Gülsün KIRANKAYA Baran YOĞURTÇUOĞLU, Lale GENÇOĞLU, F. Kübra ERBAY)

** Range expansion of translocated Aegean endemic species Oxynoemacheilus bureschi (Pisces: Nemacheilidae) in the Iskar River, Danube River basin, Bulgaria* (Tihomir STEFANOV, Eliza UZUNOVA, Lyubomir KENDEROV, Teodora TRICHKOVA)

** Considerations on the potential conflicts between allochton, invasive and native turtles - analysis of the feeding behaviour of the European pond turtle Emys orbicularis and some American aquatic turtle species, freely available on the pet market* (Nikolay NATCHEV, Yurii KORNILEV, Georgi POPGEORGIEV, Nikolay TZANKOV)

** Neophytes in protected areas. Case study: the Danube Delta Biosphere Reserve* (Paulina ANASTASIU, Gavril NEGREAN, Daniela SMARANDACHE, Sanda LITESCU, Corina BASNOU)

COFFEE BREAK (With poster viewing)

15 :45-16:45 Scientific session IV: Invasive Alien Plants

Moderators: Vladimir VLADIMIROV and Tansel SERİM

* *A new threat in cotton fields in the West Mediterranean Region of Turkey: Ipomea spp.* (Ayşe YAZLIK, İlhan ÜREMİŞ, Ahmet ULUDAĞ, Kayahan UZUN)

* *The list of exotic ornamental plants potentially invasive in Turkey* (Necmi AKSOY)

* *Agricultural ecosystems as a pathway for invasive plant species* (Milica RAT, Bojana BOKIĆ, Boris RADAK, Goran ANACKOV, Milica RADANOVIC, Slobodan BOJCIC, Pal BOZA)

* *Invasion status of Common Ragweed (Ambrosia artemisiifolia L.) in Turkey* (Hüseyin ÖNEN, Hikmet GÜNALI, Selçuk ÖZCAN)

16:45-17:45 Roundtable: Work plan of ESENIAS and CBD 2020 Strategy

Moderators: Milica RAT and Teodora TRICHKOVA

17:45-19:15 Roundtable: New EU Regulation on IAS

Moderator: Ahmet ULUDAĞ

20:00 GALA DINNER

17 December 2013

09:00-09:45 Scientific session V: Aquatic environments

Moderators: Nikolay NATCHEV and Gülsün KIRANKAYA

* *Marine non indigenous species in South-eastern Europe* (Argyro ZENETOS, Paraskevi KARACHLE)

* *Predicting potential invasive species in Bulgaria using GIS – key study on aquatic turtles* (Nikolay TZANKOV, Georgi POPGEORGIEV, Yurii KORNILEV, Nikolay NATCHEV)

* *Trophic level and niche width of introduced Prussian carp (Carassius gibelio) and native fish species in a Turkish river* (Şükran YALÇIN ÖZDİLEK, Roger I. JONES)

09:45-10:30 Roundtable: Changes on EU Plant Health Directive

Moderator: Ahmet ULUDAĞ

COFFEE BREAK (With poster viewing)

11:00-12.00 Scientific session VI: IAS in Agriculture

Moderators: Paulina ANASTASIU and Ayşe YAZLIK

** Effect of normal and elevated CO_2 levels on the growth of some invasive weeds in Turkey* (Khawar JABRAN, M. Nedim DOĞAN, Özkan EREN)

** The nightmare: genetically modified organisms as alien species* (Meliha Merve HIZ, Cüneyt AKI)

** The role of antioxidants in the Orobanche – cultivated plants interaction and broomrape invasion* (Okan ACAR, Sefer DEMİRBAŞ)

12:00-13.30 Closing followed by lunch

14:00 Field trip

POSTERS

1. Invasive plant species in Çanakkale-Turkey (Ersin KARABACAK, Onur ESEN)
2. A field trip to Musaköy for observation of broomrape infestation (S. DEMİRBAŞ, O. ACAR, B. ŞEN, H.N. GÖRKEM)
3. Invasive weeds in the Black Sea region of Turkey (Doğan IŞIK, Kübra GÖZÜKARA, Gülhanım TÜRKMEN, Zeynep KARNAS, Salih BİNGÖL, Adem AKÇA, Hüsrev MENNAN)
4. Seeds as a pathway: Speculation on *Diplachne fusca* spreading in Turkey (Emre E. MUSLU, Ahmet ULUDAĞ)
5. Weedy sunflower as invasive weed species (Markola SAULIC, Darko STOJICEVIC, Ana MATKOVIC, Dragana BOZIC, Sava VRBNICANIN)
6. Allelochemical explanation of *Heracleum sosnovskyi* invasiveness (Ligita BALEŽENTIENĖ)
7. Invasive potential of *Bromus* spp. on wheat fields in Turkey (Süleyman TÜRKSEVEN, Mehmet DEMİRCİ, Tansel SERİM)
8. Expansion status of two invasive vines: Bur-cucumber and Mile-a-minute, in Turkey (Hüseyin ÖNEN, Cumali ÖZASLAN, Hikmet GÜNAL, Nihat AKYOL, Uğur ÇALDIRAN)
9. Situation of invasive alien species in EPPO A2 list in Turkey (Zübeyde Filiz ARSLAN, Ahmet ULUDAĞ)

10. *Pontogammarus robustoides* G. O. Sars, 1894 – New potentially invasive amphipod species to the Bulgarian inland waters (Lyubomir KENDEROV, Teodora TRICHKOVA, Yanka VIDINOVA, Svetoslav CHESHMEDJIEV)
11. Distribution of the invasive Blue Crab *Callinectes sapidus* Rathbun, 1896 along the Albanian coast (Ermira MILORI, Alba ZHORI, Irma AGOLLI, Sajmir BEQIRAJ)
12. Lake Ohrid tributaries: Natural and potential pathways for invasive alien species introductions (Sasho TRAJANOVSKI, Biljana BUDZAKOSKA, Lyubomir KENDEROV, Konstantin ZDRAVESKI, Ivan BOTEV, Teodora TRICHKOVA)
13. Native and non-native fish species in the tributaries and outflow of ancient Lake Ohrid (Teodora TRICHKOVA, Trajce TALEVSKI, Ivan BOTEV, Lyubomir KENDEROV, Sasho TRAJANOVSKI)
14. Distribution of *Gambusia* (Mosquitofish) in Turkey and its potential impact on aquatic ecosystems (F. Kübra ERBAY, Baran YOĞURTÇUOĞLU, Ş. Gülsün KIRANKAYA, Lale GENÇOĞLU, F. Güler EKMEKÇİ)
15. Rapid expansion in distribution area of a marine fish, sand smelt, in inland waters of Turkey (Lale GENÇOĞLU, Ş. Gülsün KIRANKAYA, F. Güler EKMEKÇİ, Baran YOĞURTÇUOĞLU)
16. A review of pest status of alien insects in Bulgaria (Rumen TOMOV)
17. A new approach to control the Colorado potato beetle *Leptinotarsa decemlineata* (Say) (Coleoptera: Chrysomelidae): Botanicals (Esengül ERDEM)
18. The potential use of entomopathogenic nematodes against tomato leaf miner *Tuta absoluta* (Lep: Gelechiidae) (Çiğdem GÖZEL, Uğur GÖZEL)

LECTURES

An alien species commonly known as native: The olive fruit fly, *Bactrocera oleae* (Rossi) (Diptera:Tephritidae)

Hanife GENÇ[1]

The olive fruit fly, *Bactrocera oleae* (Rossi) (Diptera:Tephritidae), is an important pest of olive orchards. Distribution of the olive fruit fly is limited to olive growing regions. It is commonly known as restricted to the Mediterranean basin however; recently it is reported thought the Mediterranean basin, South and Central Africa, Canary Islands, Central America, California, The Near and Middle East. There are also reports showing the presence of the olive fruit fly in China, in Asia. So far, the only place olive fly infestation has not been reported is Australia. Because of the abundance and intensive olive cultivation, traditionally, the olive fruit fly is believed and known as indigenous in the Mediterranean basin. However, some researchers reported that it is probably originated in the sub-Saharan Africa region, where wild native olive varieties are primarily found, and where there are more biological control agents that most likely expanded into the Middle East and southern Europe. The olive fly is monophagous on cultivated and wild olive *(Olea europaea*) fruits. Adult females deposit their eggs inside the fruits. The newly hatched larvae feed upon and grow in the mesocarp of the fruit by tunneling. Bacteria and fungi may be introduced to the infested fruits and cause further rotting. Economic damages are caused by the female oviposition stings on the fruits which destroy the value of the table fruits and decrease the quality of the olive oil by increasing acidity. In the Mediterranean basin, the olive fruit fly is responsible for losses of almost 100% of table cultivars and 70-80% of oil value in epidemic years. It has been estimated that economic losses are around $800 million/year. Various aspects of the olive fruit fly laboratory rearing, biology, ecology and management have been studied for many years. The detailed analyses of natural population of the olive fruit fly need to be investigated because

1 Çanakkale Onsekiz Mart University, Faculty of Agriculture, Department of Agricultural Biotechnology, Çanakkale,Turkey; E-mail: genchanife@hotmail.com

of its agricultural importance and invasion pathway. Currently, taxonomy, relationships among the species and widespread of the pests are being improved based on molecular approaches. Two important molecular techniques, microsatellite markers and mitochondrial DNA, have been used to monitor natural pest populations and to understand the origin of species and invasion pathways of the pest. Microsatellite markers are a nuclear co-dominant markers based on Mendelian inheritance, show polymorphism which is caused by variation in the number of repeat units. Mitochondrial DNA (mtDNA) is an another important tool for reconstructing evolutionary processes. Both techniques have been used to understand genetic polymorphisms in olive flies. The studies revealed that there are three distant groups of olive flies, distributed in Pakistan, Africa and the Mediterranean region. The recent genetic studies indicated that the origin of the olive fruit fly is Africa followed by an expansion into the Mediterranean area and finally introduced into the America. In this study, the geographic origin and invasion pathways of the olive fruit fly are discussed based on molecular studies.

Keywords: *Olea europaea,* Olive*, Bactrocera oleae*, Olive fruit fly, invasive species.

TOPIC I: IAS AS PESTS IN AGRICULTURE

Tuta absoluta Povolny (Lepidoptera: Gelechiidae), the exotic pest in Turkey

Sevcan ÖZTEMİZ[1]

The tomato leafminer, *Tuta absoluta* Povolny (Lepidoptera: Gelechiidae) is an alien pest of tomato and other Solanaceae crops. It is native to South-America and at present is distributed in Europe, North Africa and Asia. *T. absoluta* was first detected in the Aegean and Marmara Regions of Turkey in 2009 (KILIC 2010), but now almost all the Regions of Turkey are infested. *T. absoluta* spread with agricultural trade between countries and continents (CACERES 1992).

Tomato (*Solanum lycopersicum* L.) is the first most important vegetable crop in Turkey where production is 11 million tons (TUIK 2012). With the entry of pests into the country, there has been a decrease in the production of tomatoes in Turkey, and 45 million € loss has occurred in the economy. If no control measures were taken, *T. absoluta* reduces yield and fruit quality, causing up to 100% yield losses in both greenhouse and open-field tomato production. If control measures were applied, crop losses range from 1-5%. In Turkey, pesticides were applied about 13 times per season against *T. absoluta*. Considering tomato production area, the annual cost of chemical control is 160.7 million €. *T. absoluta* is a multivoltine species with high reproductive potential to spread. *T. absoluta* continues development as long as the food and weather conditions are favorable and has 10 to 12 generations in the warm and humid conditions in Mediterranean. The oligophagous leaf miner, *T. absoluta* has many alternative hosts in order to maintain the viability and spread in the invaded areas. Plants of four different families including Solanacaeae, Fabaceae, Convolvulaceae and Chenopodiaceae have been identified as hosts of *T. absoluta* in Turkey (ANONYMOUS 2011, PORTAKALDALI *et al.* 2013). The use of chemical pesticides is a common practice to control the pest, but due to the risk of developing resistance of the pest (SIQUEIRA *et al.* 2000), it is very

1 Biological Control Research Station, Adana,Turkey; E-mail: sevcanztemiz@yahoo.com

important to combine all the control measures available and not to rely only on insecticide sprays and take into account all information in the origin of the pest.

Conclusions/ Suggestions/ Remarks

Invasion of pest is irreversible. Management requires coordinated efforts of research scientists, extension services and growers in invaded countries. Integrated pest management (IPM) is the most promising strategy to control *T. absoluta* in Turkey.

Keywords: *Tuta absoluta*, exotic, invasive, management, Turkey.

References

ANONYMOUS (2011) Plant Protection Technical Instructions: Tomato leafminer, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). Ministry of Agriculture and Rural Affairs, General Directorate of Agricultural Research, Ankara, Turkey.

CACERES S (1992) La polilla del tomate en Corrientes. Biologı´a y control. *Estacio´n Experimental Agropecuaria Bela Vista*, INTA,19 pp.

KILIC T (2010) First record of *Tuta absoluta* in Turkey. *Phytoparasitica* **38 (3)**: 243-244.

PORTAKALDALI M OZTEMIZ S KUTUK H (2013) A New Host Plant for *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in Turkey. *Journal Entomological Research Society*, **15 (3)**: 21-24.

SIQUEIRA HAA GUEDES RNC PICANCO MC (2000) Insecticide Resistance in Populations of *Tuta absoluta* (Lepidoptera: Gelechiidae). *Agricultural and Forest Entomology*, **2 (2)**: 147-153.

TUIK (2012) Plant protection statistics. Available at: http://www.tuik.gov.tr, (Accessed: March 28, 2012).

Adult population development of Tomato leaf miner (*Tuta absoluta* Meyrick, 1917, Lepidoptera: Gelechiidae) in Çanakkale province

Burak POLAT[1], Ali ÖZPINAR[1], Ali Kürşat ŞAHİN[1]

Tomato leaf miner (*Tuta absoluta* Meyrick, 1917, Lepidoptera: Gelechiidae) was first recorded in Peru in 1917. Its first record in Turkey was in tomato fields of İzmir – Urla in 2009, and the pest reached a considerable population density till the end of the same year. The farmers were alarmed against this pest because of its rapid dispersal in the whole country. The pest caused severe yield losses on tomato, which has an important place in economy of Çanakkale and the control practices for the pest became unavoidable. Since the knowledge about population development is important for the successful control, two tomato fields in Central district (Batakovası and Dardanos) and one in Biga district were selected for investigations in 2012 and 2013. Pheromone traps containing tetradecadienyl acetate were used for the monitoring of flight of the pest. The pheromone traps were installed on 0.5 m high poles in the fields before the plantation of tomato seedlings and the numbers of adults in the traps were recorded twice per week. The population development of the tomato leaf miner was evaluated by relating the adult numbers with climatic data. First catches were recorded on 27.03.2012 and 08.03.2013, respectively, and the flight continued till the end of December. Six flight activity periods were observed during the survey - at the end of April, at the beginning of June and in the middle of July, August, September and October with a total of 6 flights. First flight was recorded on weeds and other flights were recorded on tomato plantation in Çanakkale.

Keywords: *Tuta absoluta*, tomato leaf miner, Çanakkale, tomato.

1 Department of Plant Protection, Faculty of Agriculture, Canakkale Onsekiz Mart University, Turkey; E-mail: bpolat@comu.edu.tr

An alien species in Çanakkale, Turkey: Jasmine moth (*Palpita unionalis* Hübner, Lepidoptera: Pyralidae)

Çiğdem ŞAHİN[1] and Hanife GENÇ[2]

Jasmine moth was first reported in 1961, in Israel as *Glyphodes unionalis* Hübner (Lepidoptera: Pyralidae). Later, the pest was renamed as *Palpita unionalis* Hübner. The pest is distributed in Italy, Greece, Swedish, Poland, Portuguese, Egypt, Iran, USA and Japan. In Turkey, *Palpita unionalis* was first recorded in 1969 in the Aegean region. In 1999 it was detected in the city of Bursa of Marmara province. In Çanakkale, the pest was first detected in 2008 after investigation of complaints by olive producers in the Ayvacık district. During a survey conducted in the period 2009-2011 the pest was detected in the central, Intepe and Bozcaada districts, as well as the towns of Kumkale and Dardanos. The first larvae of the pest were detected on the 30th of July in Bozcaada in 2009. Different instars of the pest were reared on natural host plants and artificial diets in the laboratory where all biological parameters of the pest were determined. The hosts of the pest are olive (*Olea europaea*), jasmine (*Jasminum* sp.), *Phllyrea* sp., privet (*Ligustrum* sp.) and *Fraxinus* sp. The pest causes important economical losses in the olive orchards by feeding on shoots of saplings and younger trees. The pest also may cause a decrease in the quality of the product by feeding on all phenological stages of the olives.

Keywords: Jasmine moth, *Palpita unionalis*, olive, alien species.

1 Plant Protection Research Station in Bornova, İzmir, Turkey; E-mail: cigdemyilmaz88@hotmail.com

2 Çanakkale Onsekiz Mart University, Faculty of Agriculture, Department of Agricultural Biotechnology, Çanakkale, Turkey

Ten economically important alien plant pest species in Turkish agriculture

Ali Kürşat ŞAHİN[1], Esengül ERDEM[1], Burak POLAT[1], Ali ÖZPINAR[1]

In this study ten economically important alien plant pest species introduced in Turkey from different geographical regions are presented. Information about their first record and present distribution both worldwide and in Turkey is given. The current situation regarding these pests is discussed in the context of plant protection. These species are as follows: Tomato Leafminer, *Tuta absoluta* (Lepidoptera: Gelechiidae); Colorado Potato Beetle, *Leptinotarsa decemlineata* (Coleoptera: Chrysomelidae); Bayberry Whitefly, *Parabemisia myricae* (Hemiptera: Aleyrodidae); Citrus Leafminer, *Phyllocnistis citrella* (Lepidoptera: Gracillariidae); Serpentine Leafminer, *Liriomyza trifolii* (Diptera: Agromyzidae) Western Flower Thrips, *Frankliniella occidentalis* (Thysanoptera: Thripidae); Pink Bollworm, *Pectinophora gossypiella* (Lepidoptera: Gelechiidae); Grapevine Phylloxera, *Viteus vitifoliae* (Hemiptera: Phylloxeridae), Horse Chestnut Leaf Miner, *Cameraria ohridella* (Lepidoptera: Gracillaridae); and Khapra beetle, *Trogoderma granarium* (Coleoptera: Dermestidae).

Keywords: Alien, pest species, first report, first location, plant protection.

1 Canakkale Onsekiz Mart University, Faculty of Agriculture, Department of Plant Protection, Canakkale, Turkey; E-mail: aksahin@comu.edu.tr

TOPIC II: SITUATIONS OF IAS

The Danube River as an invasive alien species corridor: Alien bivalve molluscs, decapods and fish, Bulgaria case study

Teodora A. TRICHKOVA[1], Zdravko K. HUBENOV[2], Lyubomir A. KENDEROV[3], Vesela V. EVTIMOVA[1], Ivan S. BOTEV[1]

The Danube River is the second longest in Europe. It is navigable, and 87% of the total river length serve as an international waterway. Heavily modified navigational waterways are suitable recipient areas for invasive alien species. Among the four principal aquatic invasion corridors in Europe, the Southern corridor links the Black Sea basin with the North Sea basin via the Danube–Main–Rhine Canal. This complex waterway facilitates an intensive dispersal of previously geographically isolated species in both northwest and southeast directions throughout the Danube River basin. In most of the cases of introduction and establishment of aquatic alien species through the Danube River, negative impact was reported, such as changes in biodiversity and communities, alterations of the food webs and ecosystem services.

In the Bulgarian section of the Danube River, 3 alien bivalve mollusc species, one decapod species and 12 fish species have been recorded so far. Most of these species have established stable and abundant populations. Two field surveys were carried out in September 2012 and September 2013 to monitor the occurrence and abundance of the aquatic alien species. A total of 15 sites were sampled in the Danube River section from Vrav (840 rkm) to Ryahovo (466 rkm).

A total of 9 mussel species were recorded, of them 3 alien species (*Dreissena bugensis, Corbicula fluminea, Anodonta woodiana*). Most

1 Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin Str., Sofia 1113, Bulgaria; Email: trichkova@gmail.com

2 National Museum of Natural History, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel Blvd., Sofia 1000, Bulgaria

3 Biological Faculty, Sofia University, 8 Dragan Tsankov Blvd., Sofia 1164, Bulgaria

frequently found and most abundant among all species was *C. fluminea*. It was found at all sites, but most abundant at substrates dominated by coarse sand and gravel. The second abundant species was *A. woodiana,* which preferably occurred at substrates dominated by mud. A total of 28 fish species were recorded, of them 5 alien species (*Carassius gibelio*, *Hypophthalmichthys molitrix, Pseudorasbora parva*, *Syngnathus abaster*, *Lepomis gibbosus*). Among them, most frequently found were *P. parva, S. abaster* and *L. gibbosus*, and most abundant was *C. gibelio*, followed by *S. abaster.* The results were compared with previous studies and analyzed in terms of changes in alien species populations and potential impact on native aquatic communities.

The study was supported within the frames of the East and South European Network for Invasive Alien Species (ESENIAS) and the International Association for Danube Research (IAD).

Keywords: Aquatic invasive alien species, pathways of introduction, abundance, the Danube River, Bulgaria.

Invasive alien plant species in Montenegro, with special focus on *Ambrosia artemisiifolia*

Danijela STEŠEVIĆ[1], Nedeljko LATINOVIĆ[2], Danka CAKOVIĆ[1]

Abstract

Unlike some worldwide regions where invasive ecology is well developed, in Montenegro the interest for this rather new field in ecology appeared in the last 10 years. According to up to date research, 51 species of alien flora are considered as invasive in Montenegro. In the last 2 years special attention was paid to the common ragweed (*Ambrosia artemisiifolia*). Although in many regions of the World, the species is known as one of the most noxious agricultural weeds, in Montenegro it mainly inhabits roadside vegetation, very rarely agricultural land. In respect to the legislation about IAS, on 14th March 2013, the Government of Montenegro on the proposal from the Environmental Protection Agency adopted a Regulation on the National list of indicators in environmental protection. According to this regulation, the alien and invasive species are an indicator (B05) of pressure on DPSIR (Driving forces - Pressures - State-Impact-Response) model. Therefore, in the coming period their annual dynamics will be systematically monitored and summary data will be published each 10 years. Very recently, on 28th of November 2013 the Regulations about phytosanitary measures for *Ambrosia artemisiifolia* was adopted. In near future some improvements in the treatment of IAS are expected.

In this paper we will present results of the Ambrosia Survey undertaken in southern, central and one part of northern Montenegro, in the period from 2012 to 2013.

Keywords: IAS, Montenegro.

1 Faculty of Natural Sciences and Mathematics, University of Montenegro, Džordža Vašingtona bb, 81 000 Podgorica, Montenegro; E-mail: danijela.denist@gmail.com

2 Biotechnical Faculty, University of Montenegro, Kralja Nikole bb, 81 000 Podgorica, Montenegro

Introduction

Unlike some worldwide regions where invasive ecology is well developed, in Montenegro the interest for this rather new field in ecology, that study a human mediate transfer of organisms to areas outside their natural dispersal range and the consequences of such transfer, developed in the last 10 years (STEŠEVIĆ & JOVOVIĆ 2005, STEŠEVIĆ & JOVANOVIĆ 2006, 2008, STEŠEVIĆ & JOGAN 2006, 2007, TOMOVIĆ & STEŠEVIĆ 2007, STEŠEVIĆ et al. 2009, STEŠEVIĆ & PETROVIĆ 2010, STEŠEVIĆ & CAKOVIĆ 2013, BUBANJA 2013). According to up to date research, 51 species of alien flora are considered as invasive in Montenegro (STEŠEVIĆ & PETROVIĆ 2010, STEŠEVIĆ & CAKOVIĆ 2013). The most common invasive alien species (IAS) in the non-agricultural land are: *Ailanthus altissima* (Mill.) Swingle, *Aster squamatus* (Spreng.) Hieron, *Artemisia verlotiorum* Lamotte, *Bidens subalternans* DC., *Conyza albida* Willd., *Conyza canadensis* (L.) Cronq., *Datura stramonium* L., *Erigeron annuus s.l., Euphorbia maculata* L., *Helianthus tuberosus* L., *Oenothera* spp., *Reynoutria japonica* Houtt., *Robinia pseudacacia* L., *Sorghum halepense* (L.) Pers., and *Xanthium strumarium* L. *italicum* (Moretti) D.Löve, while in the agricultural land are: *Amaratnhus retroflexus* L., *A. hybridus* L., *Erigeron annuus* s.l., *Galinsoga parviflora* Cav., *Portulaca oleracea* L., *Sorghum halepense,* etc. (STEŠEVIĆ & PETROVIĆ 2010, CAKOVIĆ et al. 2012, STEŠEVIĆ & CAKOVIĆ 2013).

Taking into account rather small size of the country (13 812 km^2), this number can be considered as troublesome, while in Croatia, for the state area of 57.000 km^2, number of alien species is 64 (NIKOLIĆ *et al*. 2013), in Serbia for the state area of 88 361 km^2 number of IAS is 68 (LAZAREVIĆ *et al*. 2012), in Vojvodina for the area of 21 506 km^2 number of IAS is 152 (ANAČKOV et al 2013), in Slovenia for the state area of 20.151 km^2 number of IAS is 32 + 71 naturalized and potentially invasive (JOGAN et al. 2012), in Bulgaria for the state area of 110 000 km^2 number of invasive and potentially invasive species is 60 (PETROVA *et al*. 2013), etc.

Although in some regions of Montenegro, problem with IAS become very obvious, almost no action of its control and removal, as well as prevention of their introduction and establishment were undertaken. Speaking about legislation, majority of aspects of IAS are well covered both by EU and national legislation. According to recently adopted Regulation on the National list of indicators in environmental protection, the alien and invasive species are considered as an indicator (B05) of pressure on DPSIR

(Driving forces - Pressures - State-Impact-Response) model. Therefore, in the coming period their annual dynamics will be systematically monitored and summary data will be published each 10 years (OFFICIAL GAZETTE OF MONTENEGRO No 29/2013). Very recently, on 28th of November 2013 the Regulations about phytosanitary measures for *Ambrosia artemisiifolia* was adopted. So in near future some improvements in the treatment of IAS are expected.

In this paper we will focus on *Ambrosia artemisiifolia,* its distribution in Montenegro and patterns of spread. The Ambrosia Survey was undertaken in southern, central and one part of northern Montenegro, in period from 2012 to 2013 and present one of rare IAS actions financed by the Government.

Material and Methods

Mapping of *Ambrosia artemisiifolia* populations was undertaken in period from July to October 2012 and 2013. Each location where plants were recorded were geo-coded by using a GPS device Garmin e-Trex Vista C. Field data about the habitats, population size and impact on human health were also collected.

Results and Discussion

Before the Ambrosia survey undertaken in period from July 2012 to October 2013, only accurate data about distribution of common ragweed in Montenegro were available for city area of Podgorica (STEŠEVIĆ 2009). Common ragweed is for the first time recorded in 2005 on the gravel deposit along the left bank of river Morača, just below the Junion Bridge, and its population counted up to 50 scattered individuals. Due to rather fast urbanization, construction of new bridges, buildings and roads, disturbance regime become very extensive and resulted with appearance of additional ruderal and/or waste sites favorable for *Ambrosia,* and in the same time with its spread. Now days it is distributed over major part of the city area, but still in small populations. In autumn 2013 it is recorded in the Forest Park Gorica, which was known as a site with smallest number of IAS. Summarizing the data about habitat types, we can suggest that in the city area of Podgorica ragweed preferred sites along railways, roadsides and on gravel deposit along Morača river. It is rarely found at the construction

sites, waste places or agricultural land, which are also known as its habitats (BOHREN 2006, BRANDES & NITSCHE 2007, CHAUVEL *et al.* 2006, ESSL *et al.* 2009). Although common ragweed is of particular concern because of production of highly allergenic pollen in huge amounts, that in late summer and early autumn cause serious problems for public health (DECHAMP & MEON 2002, WAYNE *et al*. 2002, TARAMARCAZ et al. 2005), it still doesn't cause significant problems to inhabitants of Podgorica. According to the study of FUMANAL *et al.* (2005) one-gram of ambrosia pollen contains ca 30-35 million pollen grains, and one well-grown plant can produce more than 45 grams of pollen in one year, depending on the quality of the habitat. The most drastic example of sensitivity of human population to ambrosia pollen in Europe is recorded in Hungary, where 80% of all allergies caused by pollen are to ragweed pollen (KAZINCZI *et al.* 2008a). Speaking again about Montenegro, ambrosia allergies were reported for only one city- Herceg Novi (pers. comm. with Municipal Service of Herceg Novi). It is small settlement, situated at the sea-side, near the border to Croatia. In personal communication with representatives of local government, we found out that in autumn 2012 local inhabitants had huge problems with allergy and they suggested that main cause was ambrosia. In the survey undertaken in September 2013 ragweed was not found in the surveyed sites. Also, autumn pollen allergies were not reported. There are two possible explanations: i) plants were uprooted by hand before pollen production, given to the waste and were destroyed, or ii) allergies in 2012 were cause by some other agent and referred to the ragweed.

Along the coast, common ragweed is recorded at few localities: i) Mrčevo Polje, between Budva and Tivat (N 42º 17′ 33′′ E 18º 48′ 42′′), ii) Sutomore (N 42º 08′ 23′′ E 19º 03′ 00′′), iii) Bar (N 42º 05′ 13′′ E 19º 06′ 19′′), iv) and Stari Bar (N 42º 05′ 27′′ E 19º 07′ 33′′).

At the first locality common ragweed formed almost monodominant community (Fig. 1), in the flagged of area just by the major road side from Budva to Tivat. It covered approximate 200m^2 and was accompanied by scattered individuals of *Paspalum dilatatum* Poir., *Echinochloa crus-galli* (L.) Beauv., *Aster squamatus* and *Xanthium strumarium* subsp. *italicum*. Due to long distance between other ragweed populations (Sutomore and Bar), and the fact that ragweed seeds are not adapted for dispersal by wind or animals (BASSETT & CROMPTON 1975), we suggest that the pathway was transport of construction materials and substrates.

In the city of Sutomore only several scattered individuals of common ragweed were recorded along the railway lines. They were rather small due to mechanical injuries and only one had developed inflorescense, while others were cut of much below it. It is explained by recent reconstruction of the railroad.

In the city of Bar common ragweed is also recorded along the railway lines, but situation with plant habitus was preferably (Fig. 2). Individuals were up to 60cm tall, and with good vitality. Population was more numerous (ca. 85 individuals along the 100m transect between two railway lines). Individuals were denser in the area between major and secondary railway lines than between major lines, what is explained by lower mechanical influence.

In Stari Bar (old part of the city of Bar), common ragweed was recorded at few near distance localities and the same habitat type (construction site), with only several individuals.

The survey between Bar and Ulcinj (town near the border with Albania) didn't result with ragweed records. Taking into consideration that ragweed was most frequently found near the railway lines, we followed the railway network and got following results. Besides the major railway station in Podgorica, ragweed was recorded in the cities of Danilovgrad (N 42º 33′ 34′′ E 19º 06′ 36′′), Kolašin (N 42º 49′ 09′′ E 19º 33′ 10′′) and Bijelo Polje (N 43º 03′ 14′′ E 19º 46′ 09′′). Along newly reconstructed railroads between the cities of Danilovgrad and Nikšić, as well Kolašin and Mojkovac, ragweed was not recorded. Also, vegetation in general was poorly developed and presented with scattered individuals of *Conyza canadensis, Erigeron annuus, Artemisia verlotiorum* etc. The most continual distribution of common ragweed was recorded between cities of Spuž (N 42º 30′ 41′′ E 19º 11′ 52′) and Danilovgrad. Besides the railway lines, common ragweed occurred with numerous individuals: i) along the local roads (Fig. 3), ii) the watercourse of Zeta River below the bridge (Fig. 4), iii) and at the construction sites (Fig. 5). Only at one locality, placed nearby the railway station in Danilograd (N 42º 33′ 31′′ E 19º 07′ 02′′), it was recorded on agricultural land (Fig. 6), precisely at the small abandoned tilled field. So it is more likely that the field was infested from non agricultural land than opposite. In major part of Europe ragweed is considered as significant agricultural pest, which invades almost all crops and cause significant yield loss (SHEPPARD *et al.* 2006, BOHREN 2008). The most drastic example is Hungary where almost 80% of the agricultural surface is infested

(KAZINCZI *et al.* 2008b). Although ragweed is not on the current list of noxious weed in Montenegro, its enormous spread potential shouldn't be underestimated, therefore its biological control needs to be set as priority.

Apart from above mentioned localities, ragweed is recorded: i) at the several construction sites along the magistral road Podgorica-Nikšić (Fig. 7), ii) the road margins from Podgorica to Crkvine (Fig. 8) and iii) the regional road from Bijelo Polje to Priboj (Fig. 9). On the first and last locality individuals were well developed and with high vitality, while on the second one, they were rather small due to specific geomorphology of terrain and microclimate and often injured because of intensive trafic.

According to the survey ragweed occurs mainly in lowland of southern and central part of Montenegro, while towards the north it follows railway lines and regional vehicle road to Serbia (Fig. 10). It is not recorded in the N, NW and E part of the county, what can be explained by unfavorable ecological conditions (priory temperature) and land-use factors. Several studies suggested that distribution of *Ambrosia artemisiifolia* is closely related to temperature and that global warming will disproportionally enhance its invasion success (ESSL et al. 2009, CUNZE *et al.* 2013). N, NW and E part of the country might be considered as too cool for *Ambrosia*. In addition, above mentioned regions of the country are less developed and disturbance regime is not intensive.

Because of the lack of historical data, just on the base of current information about spatial distribution of common ragweed in Montenegro it is hard to suggest which way it arrived and which pathways were crucial. Due to the facts that building construction materials and substrates were often imported from neighboring or nearby countries, that might be one pathway of its arrival and later spread over the territory of Montenegro. Furthermore, seed contaminant is considered as one of the main ways of ragweed introduction into several European countries, while seeds of ragweed were often found in commercial bird mixes, contaminated cereal seed, like sunflower and sorghum (BOHREN 2006).

Several studies about common ragweed (CHAUVEL *et. al.* 2006, BRANDES & NITZSCHE 2007, ESSL *et al.* 2009) showed that the species change habitat preferences during the invasion. Therefore, in the future survey, besides locating of new places where suitable habitat conditions for *A.*

artemisiifolia prevail, attention should be paid on changes in habitat preferences.

Conclusions

Before the *Ambrosia* survey were undertaken in period from July 2012 to October 2013, only accurate data about distribution of ragweed in Montenegro were available for city area of Podgorica. Species was for the first time recorded in 2005 on the gravel deposit along the left bank of river Morača, in population of up to 50 scattered individuals. Due to rather fast urbanization, construction of new bridges, building and roads, and high level disturbance now days it is distributed over major part of the city area, but still in small populations. Although, common ragweed is of particular concern because of huge production of highly allergenic pollen, it still doesn't cause significant problems to inhabitants of Podgorica. Up to date it is recorded at few localities at the coast, in the central and lowland part of Montenegro, while towards the north it follows railway lines and regional vehicle road to Serbia. It is not recorded in the N, NW and E part of the county, what can be explained by unfavorable ecological conditions (priory temperature) and land-use factors.

Acknowledgements: Authors would like to thank Phytosanitary Directorate of Montenegro for supporting the program "Mapping of the weed plant Ambrosia artemisiifolia L. in conducting phytosanitary measures for its control".

References

ANAČKOV GT RAT MM RADAK BD IGIĆ RS VUKOV DM RUĆANDO MM KRSTIVOJEVIĆ MM RADULOVIĆ SB CVIJANOVIĆ DL MILIĆ DM PANJKOVIĆ BI SZABADOS KL PERIĆ D KIŠ AM STOJŠIĆ VR & BOŽA PP (2013) Alien invasive neophytes of the Southeastern part of the Pannonian Plain. *Central European Journal of Biology* **8**: 1032-1043

BASSETT IJ & CROMPTON CW (1975) The biology of Canadian weeds. 11. *Ambrosia artemisiifolia* L. and *A. psilostachya* DC. *Canadian Journal of Plant Sciences* **55**: 463–476.

BOHREN C (2006) *Ambrosia artemisiifolia* L.-in Switzerland: concerted action to prevent further spreading. Nachrichtenblatt des Deutschen Pflanzenschutzdienste **58 (11):** 304-308

BOHREN C (2008) *Ambrosia artemisiifolia* – a motivation for European-wide control. Available at: http://www.ewrs.org/iw/doc/ambrosia_motivation.pdf

BRANDES D & NITZSCHE J. (2007) Verbreitung, Ökologie und Soziologie von *Ambrosia artemisiifolia* L. in Mitteleuropa. *Tuexenia* **27**: 167–194.

BUBANJA N (2013) *Elodea canadensis* new species of flora of Montenegro. *Natura Montenegrina* **12(1)**: 7-12

CAKOVIĆ D STEŠEVIĆ D IKOVIĆ V KNEŽEVIĆ M & LATINOVIĆ N (2012) Contribution To The Knowledge Of Weed Flora In Bjelopavlići Plain. *Agriculture & Forestry* **58 (4)**: 25-41

CHAUVEL B DESSAINT F CARDINAL-LEGRAND C & BRETAGNOLLE F (2006) The historical spread of *Ambrosia artemisiifolia* L. in France from herbarium records. *Journal of Biogeography* **33**: 665–673

CUNZE S LEIBLEIN MC & TACKENBERG O (2013) Range expansion of *Ambrosia artemisiifolia* in Europe is promoted by climate change. *ISRN Ecology,* Available at: http://www.hindawi.com/isrn/ecology/2013/610126/

DECHAMP C & MÉON H (2002) *Ambroisies – polluants biologiques*. Arppam edition Lyon, France.

ESSL F DULLINGER S & KLEINBAUER I (2009) Changes in the spatio-temporal patterns and habitat preferences of *Ambrosia artemisiifolia* during its invasion of Austria. *Preslia* **81:** 119–133

FUMANAL B ROULAIN A GAUJOUR E CHAUVEL B & BRETAGNOLLE F (2005) Estimation de la production des pollens et de semences d'une plante envahissante en France :*Ambrosia artemisiifolia* L. In: *Proceedings 17ème Colloque pluridisciplinaire de l'AFEDA*, *Ambroisie* (25 November 2005, Lyon, France). 12, Association Française d'Etude des Ambroisies, Saint-Priest, France.

JOGAN N BAČIČ M & STRGULC-KRAJŠEK S (2012) *Neobiota Slovenije*, končno poročilo projekta. Oddelek za biologijo BF UL, 271, Ljubljana.

KAZINCZI G BÉRES I PATHY Z & NOVÁK R (2008a) Common ragweed (*Ambrosia artemisiifolia* L.): A review with special regards to the results in Hungary: II. Importance and harmful effect, allergy, habitat, allelopathy and beneficial characteristics. *Herbologia* **9(1)**: 93-118

KAZINCZI G BÉRES I NOVÁK R & BÍRÓ K (2008b) Common ragweed (*Ambrosia artemisiifolia* L.): A review with special regards to the results in Hungary: I. Taxonomy, origin and distribution, morphology, life cycle and reproduction strategy. *Herbologia* **9(1)**: 55-91

LAZAREVIĆ P STOJANOVIĆ V JELIĆ I PERIĆ R KRSTESKI B AJTIĆ R SEKULIĆ N BRANKOVIĆ S SEKULIĆ G & BJEDOV V (2012) A Preliminary List Of Invasive Species In Serbia, With General Measures Of Control And Reduction As A Basis Of Future Legal Acts, *Protection of Nature* 62/1: 5-31

NIKOLIĆ T MITIĆ B MILAŠINOVIĆ B JELASKA S (2013) Invasive alien plants in Croatia as a threat to biodiversity of South-Eastern Europe: Distributional patterns and range size. Comptes Rendus Biologies 336: 109–121

OFFICIAL GAZETTE OF MONTENEGRO No 29/2013. Available at: http://www.sluzbenilist.me/SluzbeniListDetalji.aspx?tag={4C2E475F-D312-4879-8B33-C033E4803081}

PETROVA A VLADIMIROV V & GEORGIEV V (2013) *Invasive Alien Species of Vascular Plants in Bulgaria*. Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences Sofia, Sofia

RICH TCG (1994) Ragweeds (*Ambrosia* L.) in Britain. *Grana* **33(1)**: 38–43, 1994

SHEPPARD AW SHAW RH & SFORZA R (2006) Top 20 environmental weeds for classical control in Europe: a review of opportunities, regulations and other barriers to adoption. *Weed Research* **46**: 93–117.

STEŠEVIĆ D & JOVOVIĆ Z (2005) *Sicyos angulatus* L. - The New Non Indigenous Species In The Flora Of Montenegro. *Herbologia* **6(3)**: 17-25

STEŠEVIĆ D & JOGAN N (2006) Two new neophytes in the flora of Montenegro: *Artemisia verlotiorum* and *Sporobolus vaginiflorus*. *Natura Montenegrina* **5**: 173-175.

STEŠEVIĆ D & JOGAN N (2007) Additions to the flora of Montenegro: *Setaria verticilliformis* Dumort., *Setaria viridis* (L.) PB. subsp. *pycnocoma* (Steud.) Tzvel., *Impatiens balsamina* L. and *Catalpa bignoniodes* Walt.. *Natura Montenegrina* **6**: 153-160.

STEŠEVIĆ D & JOVANOVIĆ S (2006) Contribution To The Knowledge Of Non Indigenous Flora Of Montenegro. In: *Proceedings 2005*

Contemporary mathematics, Physics and Biology (ed S Terzić) (8-9. Septembar, Podgorica, Crna Gora). 65-78, University of Montenegro, Podgorica, Montenegro

STEŠEVIĆ D & JOVANOVIĆ S (2008) Flora Of The City Of Podgorica, Montenegro (Taxonomic analysis). *Archives of Biological Sciences* **60 (2)**: 245-253

STEŠEVIĆ D (2009) *Ecological And Phytogeographical Analysis Of Flora Of The City Of Podgorica*. PhD thesis, University in Belgrade, Serbia

STEŠEVIĆ D JOVANOVIĆ S & ŠĆEPANOVIĆ S (2009) Flora Of The City Of Podgorica- A Chorological Structure, And Comparative Analysis With Floras Of Roma, Patra, And Thessaloniki. *Archives of Biological Sciences Belgrade* **61(2)**: 307-315

STEŠEVIĆ D & DRESCHER A (2010) Additions To The Flora Of Montenegro. *Natura Montenegrina* **9(3)** 10(1): 7-16

STEŠEVIĆ D & PETROVIĆ D (2010) Preliminary List Of Plant Invaders In Montenegro. *Biologica Nyssana* **1 (1-2)**: 35-42

STEŠEVIĆ D & CAKOVIĆ D (2013) Contribution To The Alien Flora Of Montenegro And Supplementum To The Preliminary List Of Plant Invaders. *Biologica Nyssana* **4 (1-2)**: 1-7

TARAMARCAZ P LAMBELET C CLOT B KEIMER C & HAUSER C (2005) Ragweed (*Ambrosia*) progression and its health risks: will Switzerland resist this invasion? *Swiss Medical Weekly* **135(37-38)**: 538–548.

TOMOVIĆ I & STEŠEVIĆ D (2007) *Duchesnea indica* (Andr.) Focke, New Alien Species In The Flora Of Montenegro. *Natura Montenegrina* **6**: 161-163.

WAYNE P FOSTER S CONNOLLY J BAZZAZ F & EPSTEIN P (2002) Production of allergenic pollen by ragweed (*Ambrosia artemisiifolia* L.) is increased in CO2-enriched atmospheres. *Annals of Allergy, Asthma, & Immunology* **8**: 279-282

Fig. 1. Ragweed (*Ambrosia artemisiifolia*) in Mrčevo Polje (between Budva and Tivat).

Fig. 2. Ragweed (*Ambrosia artemisiifolia*) along the railway lines in Bar.

Fig. 3. Ragweed (*Ambrosia artemisiifolia*) along the road in Spuž.

Fig. 4. Ragweed (*Ambrosia artemisiifolia*) along the river bank of Zeta in Spuž.

Fig. 5. Ragweed (*Ambrosia artemisiifolia*) at the construction in Danilovgrad.

Fig. 6. Ragweed (*Ambrosia artemisiifolia*) in the small abandoned tilled field in Danilovgrad.

Fig. 7. Ragweed (*Ambrosia artemisiifolia*) along the road Podgorica-Nikšić.

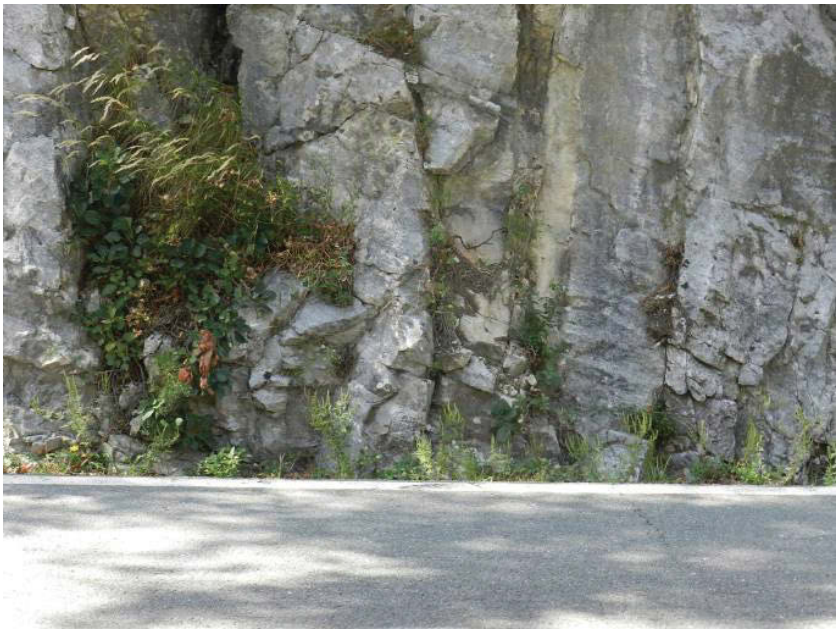

Fig. 8. Ragweed (*Ambrosia artemisiifolia*) along the road Podgorica-Crkvine.

Fig. 9. Ragweed (*Ambrosia artemisiifolia*) along the road Bijelo Polje-Priboj.

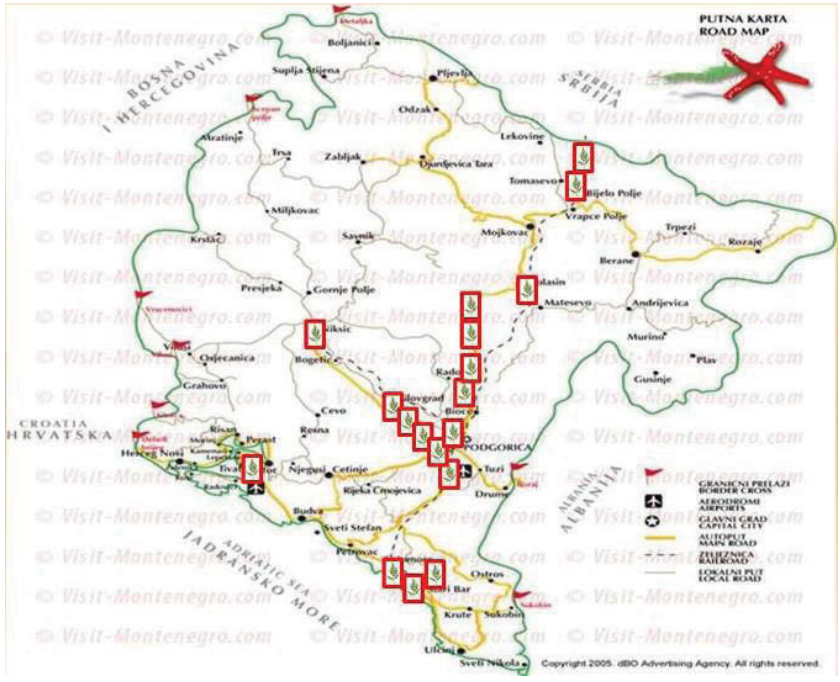

Fig. 10. Distribution map of the ragweed (*Ambrosia artemisiifolia*) in Montenegro.

Invasive alien plants in Croatia as a threat to biodiversity of South-eastern Europe

Božena MITIĆ[1]

During the analysis of alien and invasive flora of Europe, as a threat to biodiversity, data for Croatia were missing. Therefore, we prepared a preliminary list of invasive alien plants in Croatia, which resulted with 60 taxa, for which distributional patterns and range size for the state area (57,000 km^2) were analysed. They were detected on 49% of the state territory, averaging five taxa per 35 km^2. At least one invasive alien species is reported in almost 50% of the area of Croatia. The greatest number of invasive plants (> 30 per grid cell) was recorded in the major urban centres located at the intersection of main continental transport corridors and seaports. The number of invasive plants is increasing in the south-east direction and reflects a positive correlation with the temperature and negative with the altitude. The invasive plants occurred in a relatively wide altitude range, but mostly up to 1100 m a.s.l. The most endangered areas are in the Mediterranean region, especially on the islands. The number of invasive plants increased with habitat diversity and almost 75% of all sites with invasive plants are located within a few habitats with direct anthropogenic influence. The most invaded habitats are the agricultural areas, artificial surfaces, and affected forests. These results should provide a reliable regional and global basis for strategic planning regarding the invasive alien plant management.

Keywords: Croatia, invasive alien plants, threat to biodiversity, distribution patterns, range size.

1 University of Zagreb, Faculty of Science, Division of Biology, Department of Botany and the Botanical Garden, Marulićevtrg 9a, HR-10000 Zagreb, Croatia;E-mail: bozena.mitic@biol.pmf.hr

Invasive alien species of vascular plants in Bulgaria

Vladimir VLADIMIROV[1]

The current list of invasive and potentially invasive alien vascular plants in Bulgaria comprises 60 species. The selection of the taxa is not a result of strict criteria-based approach but it is based on the available literature data and field observations taking into account the current distribution and abundance of the species, the trends in distribution and abundance, recorded invasiveness of the taxa in other parts of Europe with similar climatic conditions, and impacts registered on the Bulgarian territory. The 'top ten' species are: *Acer negundo*, *Ailanthus altissima*, *Ambrosia artemisiifolia*, *Amorpha fruticosa*, *Bidens frondosus*, *Elodea nuttallii*, *Fallopia ×bohemica*, *Opuntia humifusa*, *Paspalum distichum* and *Robinia pseudoacacia*. The taxonomic structure, biological type, origin and type of introduction of the species will be discussed. Several cases based on different distribution patterns and impacts will be presented with particular emphasis on the invasive alien plants in agricultural ecosystems.

Recently a book '*Invasive alien species of vascular plants*' has been published and will be presented during the workshop. It provides information about the invasive and potentially invasive plants in Bulgaria, including concise description of the morphological, biological and ecological characteristics of the taxa and their origin, as well as colour photographs and a distribution map for each taxon.

Keywords: Bulgarian flora, invasive alien plants, invasive plants in agricultural ecosystems, worst invasive alien plants.

1 Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Acad. Georgi Bonchev Str., Bl. 23, 1113 Sofia, Bulgaria; E-mail: vladimir_dv@abv.bg

TOPIC III: IAS IMPACT ON NON-AGRICULTURAL AREAS

The current status of invasive fish species in Turkish freshwaters and potential impacts of the invasions

F. Güler EKMEKÇİ[1], Ş. Gülsün KIRANKAYA[2], Baran YOĞURTÇUOĞLU[1], Lale GENÇOĞLU[2], F. Kübra ERBAY[1]

Among the Mediterranean countries, Turkey has the richest freshwater fish fauna. Turkey is located in the intersection of different zoogeographic regions and Anatolia is highly rich in terms of biodiversity. Freshwater fish fauna of Turkey consists of more than 350 species and about one-third of these species are endemics. Many freshwater fish species from different families are listed as Critically Endangered (CR) and Endangered (EN) by the IUCN. During the last century, changes in the hydrological regime due to human activities such as dam construction, drainage and irrigation have resulted in habitat degradation, fragmentation and loss in many freshwater environments in Turkey and the habitat of many fish species has been altered severely. In addition to these effects, overfishing, pollution and introduction of exotic species into the freshwater environments have also threatened the freshwater fish biodiversity. However, the extinction of two endemic species, *Pseudophoxius handlirschi* and *Alburnus akili,* following the introduction of a translocated fish species, is an example of the fact that non-native fish species are one of the most important threats for the freshwater fish diversity in Turkey. More than 30 species were introduced into the freshwater systems during the last few decades in Turkey. Many exotic fish species are able to survive and establish sustainable populations in the new habitats, especially in the absence of their predators. The invasive species are more successful in terms of competition for habitat and niche, so they can rapidly expand their distribution area and invade new environments. In this study, we aimed to present the adverse effects of non-native and translocated fish species on the native ichthyofauna of Turkey.

Keywords: Biodiversity, invasive freshwater fish species, endemic freshwater fish species, Turkey.

1 Hacettepe University, Faculty of Science, Department of Biology, Hydrobiology Section, Freshwater Fish Biology and Ecology Laboratory, Turkey: E-mail: gulere@hacettepe.edu.tr, yokbaran@gmail.com

2 Düzce University, Faculty of Arts and Sciences, Department of Biology, Konuralp Campus Merkez/Düzce, Turkey

Range expansion of translocated Aegean endemic species *Oxynoemacheilus bureschi* (Pisces: Nemacheilidae) in the Iskar River, Danube River basin, Bulgaria

Tihomir Stefanov[1], Eliza Uzunova[2], Lyubomir Kenderov[2], Teodora Trichkova[3]

The Struma loach *Oxynoemacheilus bureschi* is endemic for the Aegean Sea basin. The recent distribution of the species in Bulgaria is investigated and compared with our previous studies, as well as with published data in the ichthyological literature. A tendency for expansion of the species range out of its native range in the rivers Struma and Mesta, part of the Aegean Sea watershed, has been established. The species was found in Palakariya River, a small tributary in the upper reaches of the Iskar River, Danube River basin, in the 1980s, and recently spread upstream and downstream in the same catchment. In 2011 it was recorded for the first time in the middle-lower reaches of the Iskar River, in the section from Reselts village to Glava village, of comparatively high abundance. A coexistence with the other species of the same family – *Barbatula barbatula* is reported. The way of colonization of the Struma loach is not yet known, most likely it was a result of human-assisted introductions. Potential negative consequences for native species are discussed.

Keywords: Nemacheilidae, *Oxynoemacheilus bureschi*, Bulgaria, distribution, range expansion.

1 National Museum of Natural History, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel Blvd., 1000 Sofia,Bulgaria;E-mail: tishos@gmail.com

2 Sofia University, Faculty of Biology, Department of Hydrobiology and Aquaculture, 8 DraganTsankov Blvd., 1164 Sofia, Bulgaria

3 Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin Str., 1113Sofia, Bulgaria

Considerations on the potential conflicts between some invasive American aquatic turtles and native *Emys orbicularis* - analysis of the feeding behaviour

Nikolay NATCHEV[1, 2], Yurii KORNILEV[3], Georgi POPGEORGIEV[4], Nikolay TZANKOV[5]

The invasion and the impact of non-native turtles on the local species in Europe has been a subject of several studies during the last decades. Unfortunately, until now this problem in Bulgaria has not been a focus of the scientific community and publications on the topic are scarce. The main goal of our study is to fill this gap because of the major conservation implications and the high conservation status of the European pond turtle (*Emys orbicularis*). The comparison of feeding behaviours and performance are important tools to estimate the threat of potentially invading turtle species that could be competitors to the local species. We consider the invasion of the North American species *Trachemys scripta elegans* as the most direct and already existing threat. The Red-eared slider is an extremely popular pet in Bulgaria. The hatchlings and the young animals are attractive and easy to take care of, but the large adult animals are often released in the wild, as noted in the scientific literature. *T. s. elegans* is an agile omnivorous aquatic turtle that manages to survive cold winters; it is relatively aggressive and in the wild it competes with the local species (specifically with *E. orbicularis*) for food and basking spots. We analysed

1 Shumen University, Department of Biology, 115 Universitetska Str., Shumen 9700, Bulgaria

2 Vienna University, Department of Integrative Zoology, Althanstrasse 14, Vienna 1090, Austria; E-mail: Natchev@gmx.at

3 Bulgarian Society for the Protection of Birds, PO Box 50, Sofia 1111, Bulgaria

4 Regional Natural History Museum of Plovdiv, 34 Hristo Danov Str., Plovdiv 4000, Bulgaria

5 National Museum of Natural History, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel, Sofia 1000, Bulgaria

and compared the feeding behaviour of *E. orbicularis* and *T. s. elegans* to assess the impact of the invasion on the local populations. Additionally, we present the feeding mechanisms and the feeding behaviours in other turtle species which are readily available in the pet markets and because of their ecological plasticity are potential competitors to the European pond turtle in Bulgaria.

Keywords: Biological invasions, feeding patterns, prey capture, pond turtles, kinosternids.

Neophytes in protected areas. Case study: the Danube Delta Biosphere Reserve

Paulina ANASTASIU[1], Gavril NEGREAN[1], Daniela SMARANDACHE[1], Sanda LITESCU[1], Corina BASNOU[2]

The Danube Delta is a relatively young territory, formed about 10,000 years ago. It has quadruple status: Biosphere Reserve, Ramsar site (wetland of international importance), UNESCO World Heritage site, Natura 2000 site. Water and human activities are the most important factors influencing the flora of this area, including the penetration and spread of alien plants. The main goal of our research in this area was to inventory the alien plants in the Danube Delta Biosphere Reserve, and to identify those species which are invasive and potentially invasive in the natural and semi-natural ecosystems in order to propose measures for their prevention and mitigation. An inventory of these plants, conducted between 2009 and 2012 and based on bibliography and field research, comprises over 160 taxa. About half of them originated from America and less than a quarter of them from Asia. A relatively high number of species (42 taxa) have unknown status in the Danube Delta; they were reported only from one or two localities and we did not record them during our extensive field work. In this category we also included some taxa of *Xanthium* without a very clear taxonomy. Other 59 taxa are casual, usually ornamental plants escaped from cultivation; however among them there are some species which are known as invasive in other areas of Romania, as well as in Europe. We can mention here: *Asclepias syriaca*, *Helianthus tuberosus*, *Parthenocissus inserta*, *Rudbeckia laciniata* and *Solidago gigantea*. There are 26 naturalised species, two of them are established here over one hundred years ago (*Calibrachoa parviflora*, *Heliotropium curassavicum*). 36 invasive species were identified. Many of them were recorded in natural

1 University of Bucharest, Faculty of Biology and Botanical Garden "D. Brandza", Intr. Portocalelor 1-3, 060101-Bucuresti, Romania; E-mail: anastasiup@yahoo.com

2 CREAF, Edifici C, Universitat Autònoma de Barcelona, 08193 Bellaterra, Spain

or semi-natural places. One of the newest invasive plants in the Danube Delta is *Ambrosia artemisiifolia,* which was found in Sulina town, and also on the saltmarshes in Sacalin Island, which is a strictly protected area. In order to prevent and mitigate the spread of plants recognised as invasive, we propose the implementation of some measures such as providing relevant information to local communities and raising awareness about the damages caused by the alien species, ensuring permanent monitoring of the main entrances into the Danube Delta (e.g. harbours), the prohibition of deposits of vegetal waste, and promoting further research on alien plant species in this protected area.

Keywords: Alien plants, Danube Delta, invasive, neophytes.

Acknowledgements: The fieldwork in Danube Delta was funded by CNCSIS PNII-IDEI 611/2008.

TOPIC IV: INVASIVE ALIEN PLANTS

A new threat in cotton fields in the West Mediterranean Region of Turkey: *Ipomoea* spp.

Ayşe YAZLIK[1], İlhan ÜREMİŞ[2], Ahmet ULUDAĞ[3], Kayahan UZUN[4]

Turkey is among foremost cotton producing countries. The West Mediterranean Region of Turkey has still kept its importance as a cotton producing area in spite of cotton acreage has decreased. Cotton fields in Turkey have very diverse weed species although there are about ten common species which can be said associated with cotton production systems (ULUDAG & UREMIS 2000). However, shift in weed flora due to several reasons such as introduction of alien species occur. A new *Ipomea* species has been detected in the Antalya province in the West Mediterranean Region. This is the second record of an *Ipomea* sp. in cotton fields in Turkey followed by a record from the South Anatolia Region (ULUDAG & KATKAT 1991). *Ipomoea* L. with 500 species worldwide (MABBERLEY 2008) comprises of the largest genus in the number of species of family Convolvulaceae. The genus, which is called morning glories, occurs throughout the tropical and subtropical regions of the world, and comprises from annual herbaceous plants to small trees. Three species of *Ipomoea* have been recorded in the Flora of Turkey: *I. stolonifera, I. sagittata* and *I. purpurea*; they all are alien to Turkey, which have origins from Americas. *I. stolonifera* and *I. sagittata* were established in natural areas with high water table. *I. purpurea* is an ornamental plant but there are records about its escape to the natural and agricultural habitats. Another *Ipomoea* species was found in the cotton fields in the western Mediterranean part of Turkey few years ago and its large spread has been reported (Antbirlik/ Keskin, personal comm.). Its

1 Batı Akdeniz Tarımsal Araştırma Enstitüsü Bitki Koruma Bölümü – Antalya, Turkey; E-mail: ayseyazlik77@hotmail.com

2 Mustafa Kemal Üniversitesi Ziraat Fakültesi Bitki Koruma Bölümü – Hatay, Turkey

3 Çanakkale On sekiz Mart Üniversitesi Ziraat Fakültesi Bitki Koruma Bölümü – Çanakkale, Turkey

4 Uygar Tarımsal Mühendislik – İzmir, Turkey

identification has not yet been verified although it is assumed as *Ipomoea lacunosa*, another alien species to Turkey. No control method has been suggested, which makes this weed more important for the agricultural areas. Identification, distribution and containment studies are immediate research works for these species.

Keywords: *Ipomoea lacunosa*, *I. stolonifera, I. sagittata, I. purpurea,* cotton, alien.

References

MABBERLEY D.J. (2008) Mabberley's plant-book (3th ed.). Cambridge University Press, Cambridge: XVIII + 1021 p.

ULUDAG A and I. UREMIS, 2000. A perspective on weed problems in cotton in Turkey. The Inter-regional Cooperative Research Network on Cotton, A joint Workshop and Meeting of the All Working Groups (20-24 September 2000, Adana, Turkey) 194-199.

ULUDAĞ A. and M. KATKAT, 1991. Güneydoğu Anadolu Bölgesi'nde pamuk ekim alanlarındaki yabancıotların yayılış alanlarının ve yoğunluklarının belirlenmesi üzerinde araştırmalar. Türkiye VI. Fitopatoloji Kongresi (7-11 Ekim 1991, İzmir) Bildiriler: 125-131.

The list of exotic ornamental plants potentially invasive in Turkey

Necmi AKSOY[1]

Recently, there have been many herbaceous and woody exotic ornamental plant taxa increasingly used in reforestations and landscape design in Turkey. It became urgent to prevent using the invasive alien ornamental plants, especially by landscape designers and gardeners. If the 171 alien and 71 cultivated taxa are included, the number of exotic taxa occurring in the Flora of Turkey rises to 242. Some of the exotic plant taxa that are used for ornamental purposes became invasive, they are devastating natural forest ecosystems, urban parks and the natural biological diversity. The species have been sorted according to invasive behaviour (from higher to lower). The most aggressive species have been sorted by their morphology (herbaceous, woody habitat, etc.). These species with the invasion scale (0. No list, 1. Low invasive, 2. Invasive, 3. Highly invasive, 4. Extremely invasive) are also included in the phytogeographical regions of Turkey. The checklist of alien and exotic ornemantal plants considered as potentially invasive in Turkey will be used by planting and landscape designers, nurseries, gardeners and foresters. In addition, it will help in the prevention of futher planting of alien plant taxa already introduced or new introduction of new alien ornemantals not yet introduced to Turkey. The list is the first tool that Turkey has in order to prepare the invasive plants' code of conduct for nurseries and landscapes.

Keywords: Exotic, ornamental plants, invasive alien plants, Code of conduct, Turkey.

1 Düzce University, Faculty of Forestry, Department of Forest Botany & DUOF Herbarium, 81620 Konuralp, Düzce, Turkey; E-mail: necmiaksoy@duzce.edu.tr

Agricultural ecosystems as a pathaway for invasive alien plant species

Milica RAT[1], Bojana BOKIC[1], Milica RADANOVİC[1], Boris RADAK[1], Slobodan BOJCİC[1], Goran ANACKOV[1], Pal BOZA[1]

Invasive alien plant species (IAPS) are one of the biggest threats to biodiversity in several last and supose to be during next few decades. All their acitivities (introduction, dispersal, spreading) are directly and indirectly connected with human activities. Some of these impacts are hardly to be perceived at the time and are not measurabeld. Nowdays, the core of the projects dealing with IASP is monitoring with relevant prevention measurements. The preliminary list of IAPS for the pannonian part of Serbia is created in 2011 and since then several times is abdated. List consists from biological and ecological data. Distribution data aren't present but data on habitats were included. Further investigations were conducted in the field, were data about 10 „the most inasive" IAPS were collected. Data includes GPS coordinates for each populations (consider form few to many individuals) and habitats details. Based on these, prediction of the areal spread was defined and evaluation of habitats infected by them. Prediction of areal spread as a method were considered with circumspection because of unkown of a large number of unpredictable variables. Because of that data on habitats present a far more important informations. By them, we can indirectly, with existing data about the preferd habitats, theri interconnections and present IAPS distribution predict their spread. The agricultural ecosystems find out to be center of the habitats network. For the most of the IAPS they are either the initial (input) or transient (transport) habitats. Since pannonian part of Serbia is mainly (cc.75%) agricultural area this is the main pathaway for the invasive plants spread. Lack of adequate protection, especially the border region of

1 University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology; Novi Sad, Serbia; E- mail: milica.rat@dbe.uns.ac.rs

agricultural ecosystems with roads and ruderal habitats, these irrigated and fertile soils are ideal for easy adaptations of invasive plants. Later inappropriate caution during the processing of fields, yield transport and residual plant material additionally contribute to the spread of invasive plants.

Keywords: Invasie alien plants, Serbia, GPS, pathway, agriculture.

Invasion status of Common Ragweed *(Ambrosia artemisiifolia L.)* in Turkey

Hüseyin ÖNEN[1], Hikmet GÜNAL[2] and Selçuk ÖZCAN[3]

Turkey with its special location, various climates and landscapes is suitable for the expansion of invasive plant species. However, negative economic and ecological effects of invasive plants such as Common ragweed (*Ambrosia artemisiifolia)* have not seriously been taken into account by scientists and government officials. Since the first report of the plant in Turkey (1998), no one has studied common ragweed. We aimed to demonstrate the present invasion status of the plant in Turkey. The research area of the initial survey was from Sinop to Hopa-Georgia border, which was approximately 650 km long. The survey was conducted in September and November 2012. The frequency of occurrence and density of ragweed increased gradually from west to the east in the surveyed area. The weed was first encountered in the Samsun province. The ragweed was rarely observed between Samsun and Trabzon provinces. But, the weed extensively populated the area between Rize and Georgia border. Common ragweed was found in highly perturbed habitats such as roadsides and waste areas in the region. The observations indicated that common ragweed has already settled in the East Black Sea region of Turkey, and has been probably introduced from one of our northern neighbors (Georgia). It is also speculated that the ragweed expansion in Turkey was probably associated with the construction of the Black Sea Highway, since the highway construction cleared the land from all native plants and created suitable conditions for the invasion of the weed.

Keywords: Common ragweed, *Ambrosia artemisiifolia*, Turkey, invasion, distribution.

Acknowledgements: This study was implemented within a project funded by the Gaziosmanpasa University (BAP Grant Number: 2012/106).

1 Gaziosmanpaşa Üniversitesi, Ziraat Fakültesi Bitki Koruma Bölümü, 60240 Taşliçiflik/ Tokat, Turkey; E-mail: huseyin.onen@gop.edu.tr

2 Gaziosmanpaşa Üniversitesi, Ziraat Fakültesi Toprak Bilimi ve Bitki Besleme Bölümü, 60240 Taşliçiflik/Tokat, Turkey

3 Fıstık Araştırma Enstitüsü, 27060 Gaziantep, Turkey

TOPIC V: AQUATIC ENVIRONMENTS

Alien species in ESENIAS countries by 2013: A subregional approach focusing on marine species

Argyro ZENETOS[1], Paraskevi K. KARACHLE[1]

Inventories of Non-Indigenous Species (NIS) are available for ESENIAS countries mostly on the marine and freshwater habitats, with few exceptions on NIS inhabiting terrestrial ecosystems. Here, we present up-to-date information regarding the state and trends of introduction of marine NIS for all ESENIAS countries, and identify pathways of introduction at sub-regional Sea level for all Seas surrounding ESENIAS countries.

For the present analysis, the Hellenic Centre for Marine Research/ European Environment Agency (herein called HCMR/EEA) offline database of marine alien species was used. The HCMR/EEA data for the Mediterranean Sea are also stored in the Mediterranean Marine Invasive alien species system (MAMIAS: www.mamias.org). For data in the Black Sea countries, but also to get an overall picture of the distribution of all alien taxa we used the European Alien Species Information Network (EASIN: http://easin.jrc.ec.europa.eu/). Using search functionality powered by a widget framework in EASIN, it is possible to make a tailored selection of a subgroup of species based on various criteria (*e.g.* environment, taxonomy, pathways).

A total of 10 countries (*i.e.* Albania, Bulgaria, Croatia, Greece, Italy, Montenegro, Romania, Slovenia, Turkey, and Ukraine) with borders in the five Seas (*i.e.* Adriatic, Aegean, Black, Ionian and the Sea of Marmara) were analysed. For the analyses per regional Sea only the respective coastal sea area was considered for countries with marine borders in more than one regional Sea, whereas for the country analyses all sea areas per country were lumped. Finally, species were linked to their most probable pathway(s) of introduction in European waters, defined on a human activity basis [*i.e.* shipping, Suez Canal, aquaculture, aquarium trade and inland canals, and

1 Institute of Marine Biological Resources and Inland Waters, Hellenic Centre for Marine Research, Anavyssos, Greece; E-mail: zenetos@hcmr.gr

"other" (including live food, bait trade, packaging material, game animals, etc.)]. From EASIN we extracted the distribution of species occurring in terrestrial, freshwater and marine environments in all ESENIAS countries including Serbia.

The distribution of all taxa in ESENIAS countries as mapped in EASIN is illustrated in Fig. 1.

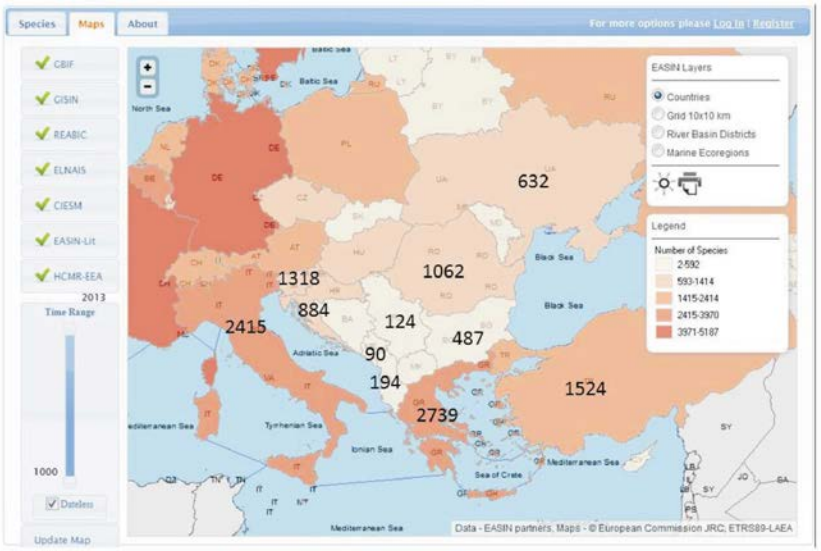

Fig. 1. Distribution of all taxa archived in EASIN. Accessed in 17.12.13.

According to our analyses, there is an increasing trend in the number of introductions in the study area, with Turkey being the country with the highest number of recorded marine alien species, followed by Italy, Greece, and Ukraine. Bulgaria, Romania and Croatia have approximately 50-70 NIS, while Albania, Montenegro and Slovenia have less than 20 alien species each (Fig. 2). This is expected for Slovenia and Montenegro that have a limited coastline, whereas for Albania the low number may be attributed to lack of reporting/ scientific work addressing the issue. Additionally, Turkey, Greece, Montenegro and Croatia appear to be the countries with the highest number of new species collected since 2010 (with 22, 10, 8, and 6 species, respectively). These numbers, however, should be considered carefully because: a) they refer to collection dates - many more species have been reported that were collected earlier, and b) the increase in Montenegro is a result of increased scientific effort. The different picture derived from EASIN and HCMR/EEA data bases highlights the lack of compiled national

lists/online databases in environments other than the marine. Such is the case for countries rich in marine aliens as Turkey and Ukraine for which updated lists have been published and archived in EASIN. EASIN allows extraction of alien species information from online information systems for all species included in the EASIN catalogue.

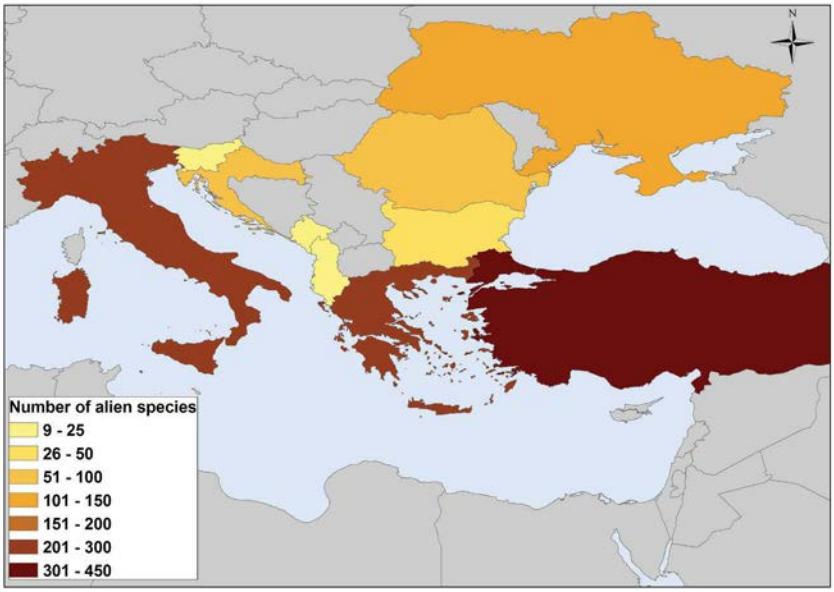

Fig. 2. Distribution of Marine alien species in ESENIAS countries by December 2013.

The major pathway of introduction is shipping, followed by progressive immigration via the Suez Canal and aquaculture. Shipping is the main vector of NIS introduction in the Black Sea, and its significance drops south-west-wards; it increases from the Aegean (50%) to the Ionian (54%), the Adriatic Sea (57%) climbing to 83% in the Black Sea where it became the principal pathway/vector. Penetration via the Suez Canal (Lessepsian immigrants) display the opposite trend to shipping (Aegean Sea: 50%; Ionian Sea: 23%; Adriatic Sea: 13 %; Black Sea: 1%).

Acknowledgement: This work is part of the DEVOTES (DEVelopment Of innovative Tools for understanding marine biodiversity and assessing Good Environmental Status) project funded by the European Union under the 7th Framework Programme, 'The Ocean of Tomorrow' Theme (Grant Agreement No. 308392), www.devotes-project.eu. We wish to thank Dr. Stelios Katsanevakis for preparing Fig. 1 using combined criteria from EASIN.

Predicting potential invasive species in Bulgaria using GIS – key study on aquatic turtles

Nikolay TZANKOV[1], Georgi POPGEORGIEV[2], Yurii KORNILEV[3], Nikolay NATCHEV[4, 5]

The European continent bears an extremely poorly represented aquatic turtle fauna, especially compared to hotspots of turtle diversity such as the SE North American and East Asian regions, mainly caused by specific paleoclimatic oscillations during the Pleistocene. The long term isolation of European species made them more negatively susceptible to competitive interactions with non-native species. The present study introduces a forecasting system for determining the potential species and respective areas in Bulgaria prone to the establishment of invasive, non-native aquatic turtles by assessing their ability to adapt to local conditions, specifically climate and habitats. The core of this system is based on predictive GIS models of the potential distribution of a number of species occurring in similar geographical conditions that potentially or in practice could get established in the European Union and in particular in Bulgaria. Two approaches were combined. In the first type as a model species was chosen the European pond turtle (*Emys orbicularis*) because of the wide distribution of this species: most of Europe, as well as northwest Africa and western Asia. The present day spatial model of the real distribution of this species was extrapolated to a worldwide scale. From the regions covered by this model a set of potentially invasive species was extracted.

1 National Museum of Natural History, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel, Sofia 1000, Bulgaria; E-mail: ntzankov@gmail.com

2 Regional Natural History Museum of Plovdiv, 34 HristoDanov Str., Plovdiv 4000, Bulgaria

3 Bulgarian Society for the Protection of Birds, PO Box 50, Sofia 1111, Bulgaria

4 Shumen University, Department of Biology, 115 Universitetska Str., Shumen 9700, Bulgaria

5 Vienna University, Department of Integrative Zoology, Althanstrasse 14, Vienna 1090, Austria

The second type uses the reverse approach, in which the geographic range of 13 potentially invasive species popular in the pet trade were extrapolated and those falling within the area of interest were selected. Such approaches are applicable both to a small and large scale areas. The full list could be further reduced by considering additional various specific environmental parameters and habitat requirement of the species. To successfully accomplish conservation goals after determining the list of the invasive species a set of species specific measures have to be implemented, including stricter border control, importing bans, improved tracking of specimens in commercial networks, control of already sold or possessed specimens in a centralized database.

Keywords: Non-native, spatial models, European Union, chelonian, invasion.

Trophic level and niche width of introduced Prussian carp (*Carassius gibelio*) and native fish species in a Turkish river

Şükran YALÇIN ÖZDİLEK[1], Roger I. JONES[2]

Carbon and nitrogen stable isotope analyses were made to determine the trophic position and dietary niche width of the invasive species *Carassius gibelio* to help assess the potential impact of this species on the native fish fauna in the Karamenderes River, northwest Turkey. The trophic level of *C. gibelio* was 2.43±0.5, 2.04±0.4 and 3.35±0.5 estimated by three different methods. Filamentous algae were the most important diet component according to the stable isotope mixing models. Filamentous algae and detritus were also considerable percentages of the gut contents. The niche width of this invasive species was larger than those of the native species. The isotopic niche of *C. gibelio* overlapped with that of *Barbus oligolepis* with a significance of 0.903. In terms of isotopic composition, the *C. gibelio* population shared 60% with *B. oligolepis,* 33.3% with *Squalis cii* and 25% with *Albumus chalcoides*. Our results indicate that the high dietary plasticity of *C. gibelio* and its extensive niche overlap with the native fish species make it a strong competitor and a threat to the native fish fauna.

Keywords: Feeding ecology, Prussian carp, niche width, trophic level, Turkey.

1 Çanakkale Onsekiz Mart University, Science and Letters Faculty, Department of Biology, 17100 Canakkale, Turkey; Email: syalcionozdilek@gmail.com

2 University of Jyvaskyla, Department of Biology and Environmental Science, PO Box 35, FIN-40014 University of Jyväskylä, Finland

TOPIC VI: IAS IN AGRICULTURE

Effect of normal and elevated CO_2 levels on the growth of some invasive weeds in Turkey

Khawar JABRAN[1], M. Nedim DOĞAN[1], Özkan EREN[2]

Climatic changes can severely impact the biological and physical components of our earth. Invasive species are considered a threat to native species owing to their competitiveness. The changing climate particularly the increasing CO_2 levels in the atmosphere can increase the proliferation of invasive weeds. The information regarding the response of invasive weeds to increasing CO_2 levels will be useful for formulating the management plans for these species. We supposed that the increasing atmospheric CO_2 can improve growth of invasive weeds in Turkey. The effect of normal (400 ppm) and elevated CO_2 (800 ppm) levels was evaluated on the growth and dry matter accumulation of some important invasive weeds in Turkey. The invasive species tested included *Avena barbata*, *Bromus tectorum*, *Capsella bursa-pastoris*, *Poa bulbosa,* and *Carduus nutans*. These invasive weeds were grown under normal and elevated CO_2 in a controlled environment glasshouse and the data regarding the plant height, chlorophyll, fresh weight, dry weight and number of leaves per plant was recorded. The results indicated that *C. nutans* and *P. bulbosa* were not affected by increased CO_2 levels in terms of plant height, chlorophyll, fresh weight, dry weight and number of leaves. *C. bursa-pastoris* was negatively affected by the increased CO_2 levels having lower height, fresh and dry weight at higher CO_2. *A. barbat* and *B. tectorum* were positively influenced by the increased CO_2 level. A significant increase in the dry matter accumulation of both weeds was recorded when grown under the elevated CO_2 levels. In conclusion, the invasive species will respond variably to the changing climate. Hence, some of these will not be affected, the others will have negative effects on their growth, and some will increase their growth in

1 Department of Plant Protection, Adnan Menderes University Aydın, Turkey-9100; Email: khawarjabran@gmail.com

2 Department of Biology, Adnan Menderes University Aydın, Turkey-9100

response to changing climate. The information is important for managing the invasive weed species under the scenario of changing climate, especially the increasing CO_2 levels in the atmosphere.

Keywords: Invasive weeds; climate change; growth; dry matter.

Acknowledgement: Thanks to TÜBİTAK for funding the stay of Khawar Jabran in Turkey in order to complete this research work.

The Nightmare: genetically modified organisms as alien species

Meliha Merve HIZ[1], Cüneyt AKI[1]

The power of the genetic recombination allow to respond different compulsive situations in nature and by that way all organisms adopt and survive in different environment conditions. The scientist mimics the natural process to obtain desirable genotype and by that way gain ability to transfer the genes via *Agrobacterium sp*. or lentiviruses. Later the power of genetic modifications are started to use in industrial area such as producing novel or value added products, improving existing production processes increasing productivity and yield or reducing the toxic products of industrial process. Metabolic engineering approach allow to rational design of the microorganisms and by that way the toxicity of the industrial process can easily modified and toxicity of the process gets lower than traditional protocols. Metabolic engineering approach in biotechnological applications not only helps to reduce toxicity but also allow clean up contaminated natural and semi-natural aquatic, semiaquatic and terrestrial area.

Biotechnological applications in agriculture allow to gain resistance pests or herbicides and y that way allow to increased production capability or quality of economically important plants such as maize, soy bean and rice. Beside the advantage of high incomes, low product cost and increased food quality, the transgenic plants has been accepted as Franken food by consumers and rejected to purchase of GM products. African and Asian countries are supporting cultivation due to their necessity of advantage of genetic modifications, yet these countries are also alarmed to upgrade their scientific groundwork to break down multinational companies and

1 Çanakkale Onsekiz Mart University, Faculty of Science and Arts, Department of Biology, Subdivision of Molecular Biology, 17020, Canakkale, Turkey; E-mail: mervemeliha@comu.edu.tr

international research agencies dependency to gain economic welfare from GM products.

In ecological aspects, transgene dispersal is important problem for natural and semi-natural aquatic, semiaquatic and terrestrial area. The gene flow between transgenic plants and wild type race or related species can cause reducing the genetic diversity and increase recessive allele frequencies and cause potential risk to biodiversity. Transportation of the transgenic plants is also potential risk because the transgene is also found different private and public area that near a transportation routes. Another concerns related to GM products are long term cumulative effects or toxicity of the products because there are different and speculative publications related to topic.

In conclusion, the scientific researches that focus on health and environmental risk of GM products, loss of biodiversity and genetic pollution will be the answers of the all question. Thus until the safety and acceptability of GM products are demonstrated by scientific research, the regulations must be followed to protect health and environment. If handed properly genetic modifications can be solutions of different problems and enhanced industrial applications, yet the careless and non-ethical usage of transgene technology may be results damage on biodiversity.

Keywords: Genetically modified organisms (GMO), Biotechnology.

The role of antioxidants in the Orobanche-cultivated plants interaction and broomrape invasion

Okan ACAR[1], Sefer DEMIRBAS[1]

Orobanche and *Phelipanche* spp. (broomrapes) are obligate root parasites that are leafless and devoid of chlorophyll. Their growth and development is entirely dependent upon their host. Broomrape species significantly reduce the yield of many cultivated plants such as sunflower, tobacco, tomato, potato by infecting these plants. The occurrence of broomrape in many agricultural areas is increasing (PARKER 2013). Environmental stresses also reduce the yield of many cultivated plants. New crop cultivars resistant to biotic and abiotic stress factors are required to maintain the yields (GILL & TUTEJA 2010). Numerous studies show that the antioxidant capacity of plants correlates with resistance to environmental stresses. This capacity to tolerate stress is determined by enzymatic and non-enzymatic antioxidants (PARIDA & DAS 2005).

The results of our researches indicate that some tomato varieties grown in Çanakkale, exposed to broomrape infection, exhibit differential antioxidant capacities (ACAR *et al.* 2009; SEN 2013). Similar results were observed in some sunflower (DEMIRBAS & ACAR 2008), pepper (AYDIN 2010) and eggplant (GÖRKEM 2011) varieties. Additionally, an exposure to salt stress induced an increase in the resistance to the broomrape infection in *Arabidopsis* stimulated by increased levels of antioxidant enzymes (DEMIRBAS 2011).

In this review, recent research results on the interactions between the antioxidant enzymes and the broomrape infection were analyzed. We focused on the infestation of broomrape in agricultural areas based on antioxidant capacities of some plants.

1 Çanakkale Onsekiz Mart University Faculty of Arts and Sciences Biology Department 17100 Terzioglu Campus Çanakkale, Turkey; E-mail: oacar@comu.edu.tr

Keywords: *Orobanche*, *Phelipanche*, broomrape, antioxidants, tomato, sunflower, eggplant, *Arabidopsis*.

References

ACAR O, DEMIRBAS S, AYDIN B & YILDIZ V (2009) An investigation into changes of antioxidant enzymes activities and lipid peroxidation levels in resistance to broomrape (*Orobanche ramosa* L.) in Simita, 8354 and Rio Grande cultivated in Çanakkale. TUBITAK TOVAG Project No: 107O905, Turkey.

AYDIN B (2010) An investigation into broomrape changes in antioxidant enzymes levels on some pepper varieties cultivated in Çanakkale (Turkey). MSc thesis, Çanakkale Onsekiz Mart University, Çanakkale, Turkey.

DEMIRBAS S (2011) Investigation of physiologic, biochemical and gene expression level changes caused by *Phelipanche ramosa* (L.) Pomel and salt stress in *Arabidopsis thaliana* (L.) Heynh. PhD thesis, Çanakkale Onsekiz Mart University, Çanakkale, Turkey**.**

DEMIRBAS S & ACAR O (2008) Superoxide dismutase and peroxidase activities from antioxidative enzymes in *Helianthus annuus* L. roots during *Orobanche cumana* Wallr. penetration. *Fresenius Environmental Bulletin* **17(8a)**, 1038-1044.

GILL SS & TUTEJA N (2010) Reactive oxygen species and antioxidant machinery in abiotic stress tolerance in crop plants. *Plant Physiology and Biochemistry* **48,** 909-930.

GORKEM HN (2011) Effects of broomrape (*Phelipanche ramosa* (L.) Pomel) on antioxidant defence system in some eggplant varieties. MSc thesis, Çanakkale Onsekiz Mart University, Çanakkale, Turkey.

PARIDA AK & DAS AB (2005) Salt tolerance and salinity effects on plants: a review. *Ecotoxicology and Environmental Safety* **60**, 324-349

PARKER C (2013) The parasitic weeds of the Orobanchaceae. In: *Parasitic Orobanchaceae* (eds. DM JOEL, J GRESSEL & LJ MUSSELMAN), 313-326, Springer-Verlag Berlin Heidelberg.

SEN B (2013) Biochemical and physiological effects of salt stress (NaCl) and biotic stress (*Phelipanche aegyptiaca*) on some tomatoes varieties. MSc thesis, Çanakkale Onsekiz Mart University, Çanakkale, Turkey.

POSTERS

Invasive plant species in Çanakkale

Ersin KARABACAK[1], Onur ESEN[1]

The present study provides first preliminary results on invasive plant species in Çanakkale. We evidenced the presence of 15 invasive vascular plant species, including 9 native and 6 naturalised. The invasive plants are mostly distributed around town centres and agricultural areas. Some of the native invasive plants have rhizomes and they mostly develop in large areas. Some exotic invasive plants, which are planted as ornamentals on touristic places, succeed in reproductive growth and successfully spread in nature. Currently, the exotic plants are not a threat, but some native invasive species such as yellow foxtail (*Setaria glauca*), horseweed (*Conyza canadensis*) and dog's tooth grass (*Cynodon dactylon*) cause big problems in agricultural areas. When planting exotic plants, they must be surrounded by barriers to prevent them from spreading in nature.

Keywords: Çanakkale, exotics, invasive plants, Turkey.

1 Çanakkale Botanic Garden & Biology Department, Çanakkale Onsekiz Mart University; Address; E-mail: krbersin@comu.edu.tr & onuresen86@gmail.com

A field trip to Musaköy for observation of broomrape infestation

Sefer DEMIRBAS[1], Okan ACAR[1], Burcin SEN[1], Hülya Nur GORKEM[1]

In Çanakkale, there are many crops (e.g. tomato, eggplant, pepper, sunflower) affected from broomrape species. *Orobanche* and *Phelipanche* spp. (broomrapes) are obligate root parasites, completely devoid of leaves and chlorophyll. Their growth and development fully depends on its host (JOEL 2000). In Çanakkale, 550158 tons tomato was produced in 2012. Its 20 percent was done in center of Çanakkale. 152994 tons pepper was produced in Çanakkale in 2012. Its 4 percent was done in center of Çanakkale. Eggplant production was 799285 tons in Turkey in 2012 (TUIK 2013). All these plants are used as a food all around the world. The aim of this study was to determination of the most infected area with broomrape in Umurbey plain.

In field trip to Musaköy village (40°19'55''N, 26°54'05''E), it was determined that heavy infected tomato, pepper and eggplant plants with broomrape. This broomrape species was identified morphologically as *P. aegyptiaca* (Pers.) Pomel which is a species of broomrapes attacks crops in Solanaceae, Fabaceae, Apiaceae, Asteraceae, Cucurbitaceae, and also occur on woody species, e.g. on olive in different part of the world (PARKER 2013). According to the broomrape number per plant, the most infection was observed in tomato plants. At least infection was found to be in pepper plants. And also, it was determined that although fruit development was observed in these plants, this parasitic plant declined the growth of these crops.

This situation in Musaköy village has indicated that the number of *P. aegyptiaca* plants increases uncontrollably. Moreover, in addition to *P. aegyptiaca*, *Cuscuta* sp. parasitic plant on tomato plants was also observed in the same field. Regardless of how effective control methods against to

1 Çanakkale Onsekiz Mart University Faculty of Arts and Sciences Biology Department 17100 Terzioglu Campus Çanakkale, Turkey; E-mail: sefer.demirbas@gmail.com

broomrapes in the other fields adjacent to this field are, the broomrape infestation risk in other fields will still continue when the high seed production potential of *P. aegyptiaca* in this field is regarded.

Keywords: *Phelipanche aegyptiaca*, Umurbey plain, tomato, eggplant, pepper.

Acknowledgements: We thank Buket KESER ÖZKAL and Selim COBANOGLU for technical assistance in laboratory studies.

References

JOEL DM (2000) The long-term approach to parasitic weeds control: Manipulation of specific developmental mechanisms of the parasite. *Crop Protection* **19**, 753-758.

PARKER C (2013) The parasitic weeds of the Orobanchaceae. In: *Parasitic Orobanchaceae* (eds DM JOEL, J GRESSEL & LJ MUSSELMAN), 313-326, Springer-Verlag Berlin Heidelberg.

TUIK (2013) Seçilmiş göstergelerle Çanakkale.Turkish Statistical Institute Puclications, Ankara, Turkey. pp 126-135.

Invasive Weeds in Black Sea Region of Turkey

Dogan ISIK[1], Kubra GOZUKARA[1], Gulhanim TURKMEN[1], Zeynep KARNAS[1], Salih BİNGÖL[1], Adem AKÇA[1] and Hüsrev MENNAN[2]

Abstract

The Black Sea Region covers approximately 18 percent of the land in Turkey, with a surface area of 141,000 km^2. Weeds are constant component of the agro-ecosystem of the Black Sea Region of Turkey. In this study 10 invasive species in the Black Sea region of Turkey are listed. Those species are *Ambrosia artemisiifolia* L., *Persicaria perfoliata* (L.) H. Gross, *Sicyos angulatus* L., *Hedera helix* L., *Pteridium aquilinum* (L.) Kuhn, *Smilax rotundifolia* L., *Sambucus nigra* L., *Rubus* spp, *Urtica dioica* L., and *Artemisia vulgaris* L.

Keywords: Invasive weeds, Turkey, Black Sea Region.

Introduction

The Black Sea Region covers approximately 18 percent of the land in Turkey, with a surface area of 141,000 km^2. The Black Sea Region, which gets its name and characteristics from the adjacent sea, extends from the border of Georgia in the east to the eastern edge of the Ada pazari Plain in the west. The great majority of the people in the region earn their living from the land. The most important feature of the agriculture in this region is that corn is grown in the coastal parts of this region rather than wheat, which is the main grain type in the other regions. Wheat is sown mostly on the plains beyond the coastal mountains. Rice is cultivated in the Kizilirmak

1 Erciyes University Faculty of Agriculture, Department of Plant Protection Kayseri Turkey; E-mail: zorludogan@hotmail.com

2 Ondokuz Mayis University Faculty of Agriculture, Department of Plant Protection Samsun Turkey

and Yesilirmak deltas, and at the Boyabat section of the Gokirmak Valley and at the Tosya section of the Devrez Valley.

Hazelnuts are the main fruit of the Black Sea Region, especially, in the eastern sections. The Black Sea coastal strip is covered with hazelnut trees. Tea which is grown only in the Eastern Black Sea Region in Turkey, is also among the most important crops in the region. Apple growing is also considerable in the region, and in recent years, fruits such as kiwi and avocado have started to be grown (BALKAYA 2009).

Weeds are constant component of agro-ecosystem of Black Sea Region of Turkey and alternative control methods have been used to control them in different crops. However many seeds and propagules of exotic species are introduced in new regions by accident and some of them may settle and become component of the natural flora. Growing international trade and movement of people increases the probability of introducing alien species into the environment including risk that the species could become invasive and damage native biodiversity (MENNAN *et al.* 1999; BRUNDU *et al.* 2011).

Main invasive weeds in the region

Invasive species have traits favoring establishment and spread into new locations. Invasive plant species are tolerant to extreme environmental conditions. New locations keep them away from herbivore and diseases. Genetic variation, competitive adaptations, aggressive reproductive strategies and efficient dispersal methods allow them to explore new habitats and displace slower growing native plants including other weeds. In this study 10 invasive species in Black sea region of Turkey are listed (DAVIS *et al.* 1965–85; BYFİELD & BAYTOP 1998; MENNAN *et al.* 1999; TERZİOGLU & ANSİN 1999; ULUDAĞ *et al*. 2009; BRUNDU *et al*. 2011).

1. *Ambrosia artemisiifolia*: (Asteraceae) Common ragweed

Common ragweed is native to North America and has spread from there to many other areas in the World. *A. artemisiifolia* is an annual weed which competes strongly with crop plants for water and nutrients. It is very prolific (one plant may develop 30,000 - 40,000 seeds and up to 100,000); seeds remain viable for 5-14 years). It can seriously reduce yields, in addition, its pollen is strongly allergenic in man (hay fever) and can cause dermatitis

on contact. *A. artemisiifolia* can infest practically all field crops meadows, pastures, orchards and also rangeland. However, it is commonest along waterways, roads and in wasteland.

2*. Persicaria perfoliata* (L.) H. Gross: (Polygonaceae) Mile-a-minute-vine

Persicaria perfoliata is a herbaceous, annual, trailing vine of the buckwheat family that is native to Asia. It generally colonises open and disturbed areas, along the edges of woods, wetlands, stream banks and roadsides. It also occurs in environments that are extremely wet with poor soil structure. Available light and soil moisture are both integral to the successful colonisation of *P. perfoliata*. Birds are probably the primary long-distance dispersal agents, but water is also an important mode of dispersal, especially during storm events when high water may spread the plant throughout watersheds. *P. perfoliata* is also spread by the transporting of nursery stock.

3. Sicyos *angulatus* L.: (Cucurbitaceae) Bur-cucumber

The native range of *S. angulatus* is in North America. This herbaceous plant is an annual vine up to 6 m long that develops multiple lanky stems. This vine can climb over adjacent vegetation and fences using its branched tendrils, otherwise it sprawls across the ground. The stems are light green, terete, furrowed, and quite hairy. The leaves are alternate, broadly heart-shaped with five angular pointed lobes, and finely toothed; they are orbicular-angular with 3-5 palmate lobes that are shallow to moderately deep. Leaf margins are slightly serrated. Relatively recently, it became a more serious and actively spreading weed in some southern EPPO countries.

4*. Hedera helix:* (Araliaceae) English Ivy

Hedera helix is an evergreen climbing vine of the ginseng family (Araliaceae).It is an aggressive invader that threatens all vegetation levels of forested and open areas, growing along the ground as well as into the forest canopy. It is widely used as a fast-growing, low maintenance, evergreen groundcover and once established at a site, *Hedera helix* can be expected to move beyond its intended borders by vegetative means or by seed. Seeds are dispersed to new areas primarily by birds.

5. *Pteridium aquilinum*: (Dennstaedtiaceae) Bracken Fern

Bracken (*Pteridium aquilinum*) is a conspicuous fern that forms large clonal colonies in a variety of habitats. The large, more or less triangular leaves develop from fiddle heads that develop widely spaced along the branches of an extensive subterranean rhizome that may reach nearly 400 m in length. The taxonomy of the genus remains controversial, but most botanists currently favor a classification involving five or more species. In this sense, *Pteridium aquilinum* is distributed widely in mostly the northern hemisphere, in both the New and Old Worlds.

6. *Smilax rotundifolia:* (Smilacaceae) Roundleaf greenbrier

Moist to dryish thickets and woods. Considered to be an obnoxious pest in America. *Smilax rotundifolia* is a deciduous climber growing up to 12 m. It is hardy to zone 4. It is in flower in June. The flowers are dioecious (individual flowers are either male or female, but only one sex is to be found on any one plant so both male and female plants must be grown if seed is required). The plant is not self-fertile.

7. *Sambucus nigra:* (Adoxaceae) European elder, elderberry

European elderberry and European black elderberry grows in a variety of conditions including both wet and dry fertile soils, primarily in sunny locations. It is a deciduous shrub or small tree growing to 6m tall and wide (rarely 10m tall). The bark, light grey when young, changes to a coarse grey outer bark with lengthwise furrowing. The leaves are arranged in opposite pairs, 10–30 cm long, pinnate with five to seven (rarely nine) leaflets, the leaflets 5–12 cm long and 3–5 cm broad, with a serrated margin.

8. *Rubus* spp.: (Rosaceae)

Rubus is a large genus of flowering plants in the rose family, Rasberies, blackberries, and dewberries are common, widely distributed members of the genus. Most of these plants have woody stems with prickles like roses; spines, bristles, and gland-tipped hairs are also common in the genus. The *Rubus* fruit, sometimes called a bramble fruit, is an aggregate of drupelets. The term "cane fruit" (or "cane-fruit") applies to any *Rubus* species or hybrid which is commonly grown with supports such as wires or

canes, including raspberries, blackberries, and hybrids such as loganberry, boysenberry and tayberry.

9. *Urtica dioica:* (Urticaceae) Nettle, bigstringnettle

Urtica dioica is a dioecious herbaceous perennial, 1 to 2m tall in the summer and dying down to the ground in winter. It has widely spreading rhizomes and stolons, which are bright yellow as are the roots. The soft green leaves are 3 to 15 cm long and are borne oppositely on an erect wiry green stem. The leaves have a strongly serrated margin, a cordate base and an acuminate tip with a terminal leaf tooth longer than adjacent laterals. It bears small greenish or brownish numerous flowers in dense axillary inflorescences.

10. *Artemisia vulgaris:* (Asteraceae) Common wormwood

It is native to temperate Europe, Asia, northern Africa and Alaska and is naturalized in North America, where some consider it an invasive weed. It is a very common plant growing on nitrogenous soils, like weedy and uncultivated areas, such as waste places and roadsides. It is a tall herbaceous perennial plant growing 1–2 m (rarely 2.5 m) tall, with a woody root. The leaves are 5–20 cm long, dark green, pinnate, with dense white tomentose hairs on the underside. The erect stem often has a red-purplish tinge. The rather small flowers (5mm long) are radially symmetrical with many yellow or dark red petals.

Results

The ten important invasive species in the Black Sea Region of Turkey are *Ambrosia artemisiifolia* L., *Persicaria perfoliata* (L.) H. Gross, *Sicyos angulatus* L., *Hedera helix* L., *Pteridium aquilinum* (L.) Kuhn, *Smilax rotundifolia* L., *Sambucus nigra* L., *Rubus* spp, *Urtica dioica* L., and *Artemisia vulgaris* L.

Early detection of invasive alien plants and quick coordinated responses are needed to eradicate or contain invasive plants before they become widespread and control becomes practically and/or financially difficult.

The principle and concepts of early detection and rapid response to incipient plant invaders have been promoted internationally, nationally,

and locally as a potentially cost-effective strategy in addressing plant invasions (GENOVESI *et al.* 2010).

Acknowledgements: The author thanks The Scientific and Technological Research Council of Turkey (TÜBİTAK) for supporting participation in the ESENIAS workshop (the project number TOVAG 111O647).

References

BALKAYA A. (2009) Exploring variation and sustainable progress of vegetable genetic resources in the Black Sea Region, Turkey. In: 1st International Symposium on Sustainable Development, June 9-10, 2009, Sarajevo, Bosnia and Herzegovina.

BRUNDU G., N. AKSOY, S. BRUNEL, P. ELIA´S & G. FRIED (2011) Rapid surveys for inventorying alien plants in the Black Sea region of Turkey. EPPO Bulletin Volume 41, Issue 2, pages 208–216, August 2011.

BYFIELD, A.J.; BAYTOP, A. (1998) Three alien species new to the flora of Turkey. Turkish Journal of botany, 22(3), 205-208.

DAVIS PH (Ed) (1965, 1985) Flora of Turkey and the East Aegean Island, Vol. 1–9. Aldine Publishing Co., Edinburgh (UK) and DavisPH,MillRR & TanK (Eds), Supplement, vol. 10 (1988).

GENOVESI P, SCALERA R, BRUNEL S, ROY D & SOLARZ W (2010) Towards an early warning and information system for invasive alien species (IAS) threatening biodiversity in Europe. EEA Technical report, no. 5/2010, 52 pp.

MENNAN H., KUTBAY H., IŞIK D. (1999) Determination of weed species in hazelnut orchards in the Black Sea Region of Turkey.Journal of weed science society of Turkeyp.13-21, 1999.(in Turkish)

TERZIOGLU S & ANSIN R. (1999) A contribution to exotic plants of Turkey: Sicyosangulatus L. Turkish Journal of Agriculture and Forestry 23, 359–362 (in Turkish)

ULUDAĞ A., OCAK Y., ŞAHIN M., IŞIK D. (2009) Status of some invasive alien species in Turkey.Türkiye III. BitkiKorumaKongresiBildirileri, VAN, 15 Temmuz-18 Temmuz 2009, ss.270 (in Turkish)

Seeds as a pathway: Speculation on *Diplachne fusca* spreading in Turkey

Emre E. MUSLU[1], Ahmet ULUDAĞ[1]

Diplachne fusca is an invasive alien species and a weed in the rice fields. It is invasive alien species in Europe and the Middle East with a large native range worldwide, which is controversial. Its introduction to Europe and spreading country to country is not clear similar to Turkey. Plant was seen for the first time in Trace part of Turkey in early 2000s. The primarily plant identification was wrong, and later it was identified correctly. Today, it can be found in almost all rice producing areas of Turkey, which are not documented well. Among the introduction pathways to Turkey, the most acceptable one is the entrance with rice seeds imported for consumption, which is either used as seed to propagate rice illegally or refined for consumption in a factory. In both cases seeds of *D. fusca* were spread and established in Trace and after that rapidly spread all over Turkey. Its spread in Turkey most likely happened through rice seed trade. Trace is the main rice producing area for consumption and propagation purposes. It is necessary to adopt legal measures for producing propagating materials and raw food material processing factories to prevent entries of new invasive alien species.

Keywords: Introduction, spread, rice, unintentional pathway.

1 ÇanakkaleOnsekiz Mart University, Faculty of Agriculture, Plant Protection Department, Çanakkale, Turkey; E-mail: emreerenmuslu@outlook.com

Population variability of weedy sunflower as invasive species

Markola SAULIC[1], Darko STOJICEVIC[1], Ana MATKOVIC[1], Dragana BOZIC[1], Sava VRBNICANIN[1]

Abstract

Three populations of weedy sunflower were investigated with the aim to assess its population variability. The following parameters were evaluated: vegetative parameters - plant height (cm), leaf lenght (cm), leaf width (cm), number of ray flowers, number of bract; generative parameters - head diametar (cm), mass of achene per head (g), number of achene per head; and achene parameters - achene lenght (μm), achene width (μm), mass of 100 achenes (g). Except that, achene morphology as indicator of population variability was studied. The studied populations significantly differed regarding to most measured parameters, while only plant height and number of ray flowers were similar in all three populations.

Keywords: Invasive species, population variability, weedy sunflower.

Introduction

Sunflower (*Helianthus annuus* L.) belongs to the genus *Helianthus* with 49 species native to North America (NOORYAZDAN *et al.* 2010). It was introduced into Europe, probably through Spain, in the sixteenth century, first as an ornamental plant. Breeding of oilproducing varieties started in Russia in the nineteenth century, and from there, sunflower expanded as an oilseed crop in other European countries and all over the world (MULLER *et al.* 2009). The genus *Helianthus* displays substantial phenotypic and genetic diversity and habitat variation and is composed of wild, weedy and domesticated species (RİBEİRO *et al.* 2010). *H. annuus* species include

1 University of Belgrade,Faculty of Agriculture, Nemanjina 6, 11080 Zemun-Belgrade, Serbia; E-mail: sava@agrif.bg.ac.rs

several forms („normal" crop plants, atypical plants known as "off type" crop plants, volunteer plants, wild and weedy plants) which are clearly phenotypic and genetic different. Wild *H. annuus* is considered ancestor of the cultivated sunflower (*H. annuus var.macrocarpus*) and despite many phenotypic differences between them, they are interfertile (URETA *et al.* 2008). Weedy forms are morphologically clearly different from the volunteers that arising from the segregation of hybrid-F1 varieties (MULLER *et al.* 2009). Weedy populations are characterized by a high morphological diversity with plants combining in different proportions cultivated and wild traits, from typical F2 plants to typical wild-like phenotypes (POVERENE *et al.* 2006). Those plants have adapted to different environment in an undesired way, becoming of harmful and invasive weeds (MULLER *et al.* 2009). PRESOTTO *et al*. (2011) consider that the main features that make sunflower invasive species are its invasiveness, potential herbicide tolerance and competitiveness.

Weedy sunflower populations are made of a wide diversity of phenotypes, constituting a continuum between wild and cultivated morphotypes (MULLER *et al.* 2010). In Europe, where *H. annuus* is not native, weedy plants showing typical wild phenotypic traits: strong branching, presence of anthocyanin pigmentation in various organs, reduced size of head and achenes, seed dormancy, seed shattering and sporophytic self-incompatibility (MULLER *et al.* 2009). URETA *et al.* (2008) in their studies obtained that hybridization reaches 42% and alleles from cultivated sunflower persist in frequencies up to 38% in wild sympatric populations.It is confirmed that wild plants flower longer (20–40 days) and that it affects the hybridization (URETA *et al.* 2008). The invasive process has probably been concomitant with the occurrence of new mutations, gene flow and recombination, which is enough to maintain high infraspecific variability (PRESOTTO *et. al*. 2011).

Distribution of weedy sunflower in Europe and Serbia are presented in Fig. 1 and Fig. 2, respectivelly. According to survey the weedy sunflower composed the biggest population on southern Srem (around 1 000 ha of crop and non-crop fields) and southern Banat (around 7-8 000 ha of crop and non-crop fields) in Vojvodina Province (north part of Serbia). This invasive form of sunflower grows along with other weed species in row crops, where its coverage varies, but tends to increase over the years. Analysis and monitoring of invasive species in a wider area of the Vojvodina Province in row crops (maize, sugar beet, soybean, *etc.*) have indicated a

significant presence of this weed in regional weed vegetation suggesting a need to take a closer look at these populations in order to develop a strategy for suppressing further spread of this species (STANKOVİC-KALEZİC *et al.* 2008). Therefore, the aim of our study was to determine the populatuion variablity in fitness parameters of three weedy sunflower populations from Serbia.

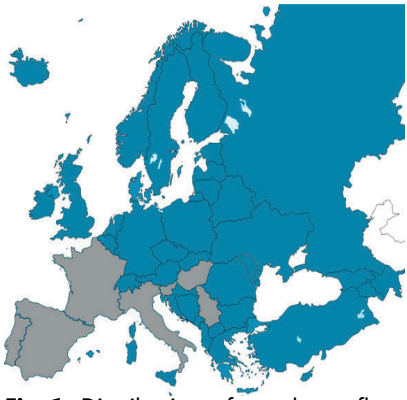

Fig. 1. Distribution of weedy sunflower in Europe (gray color).

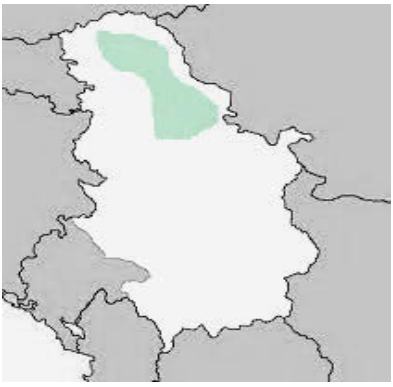

Fig. 2. Distribution of weedy sunflower in Serbia (green colour).

Material and Methods

During 2012 three weedy sunflower populations (P1, P2 and P3) were observed on three different locations in the southern Srem (around 1 000 ha of crop and non-crop fields) and southern Banat (around 7-8 000 ha of crop and non-crop fields) area in the Province of Vojvodina (northern Serbia). Populations were examined at the stage of plant maturity. Twenty plants were chosen from every location and three heads were taken from each plant for the analysis. Heads were packed in paper bags and were kept in laboratory conditions until the further analysis. The following parameters were evaluated and described: vegetative parameters (plant height (cm), leaf lenght (cm), leaf width (cm), number of ray flowers, number of bract), generative parameters (head diametar (cm), mass of achene per head (g), number of achene per head) and achene parameters (achene lenght (μm), achene width (μm), mass of 100 achenes (g)). We believe that these parameters determine the level of fitness of a plant and that they can be used to determine plant productivity in the following year, as well as their dispersal in the ecosystem. Achene samples were examined under binocular Leica XTL 3400D, photographed with a digital

camera LEICA DC 300 and length and width of achene were measured using the LEICA IM 1000 software.

The results were processed using software Statistica 5.0 by the descriptive statistics and student´s t-test to determine the significance of differences between means.

Results and Discussion

Variability of the weedy sunflower populations was evaluated based on vegetative, generative and achene parameters. Analysis of the results showed that the studied populations significantly differed regarding to most measured parameters ($P<0.01$), except regarding plant height and number of ray flowers (Table 1-4). At the stage of maturity plant leaf length (20.55 cm) and width (19.50 cm) of population P2 differed highly significant in comparison to the same parameters of populations P1(length: 16.94 cm; width: 15.08 cm) and P3 (length: 16.05 cm; width: 13.75 cm). Number of bract were similar (about 35) in populations P1 and P2, while it was significantly smaller in population P3 (31.36).

Table 1. Vegetative parameters (mean±sd) of weedy sunflower populations.

Parameters	P1	P2	P3
Plant height (cm)	204.00±31.97	202.00±42.29	197.00±30.18
Leaf length (cm)	16.94±2.81	20.55±3.68	16.05±2.61
Leaf width (cm)	15.08±3.79	19.50±3.00	13.75±2.66
Number of ray flowers	26.03±3.66	38.55±4.49	25.22±5.63
Number of bract	35.16±5.69	34.91±6.31	31.36±5.38

Studied weedy sunflower populations showed very pronounced variability in all generative parameters (Table 2, 4). Head diameter was between 3.37 and 5.18 cm and very significant differed between populations ($P<0.01$; Tab. 4). Also, it was higher then head diameter of wild form of sunflower (2.75-3.79 cm) studied by NOORYAZDAN *et al.* (2010) and *Helianthus petiolaris* Nutt (1.98 to 2.5 cm) studied by PEREZ *et al.* (2007). The highest mass and number of achenes per head was obtained in population P2 (mass: 3.54 g; number: 216), while the lowest was obtained in population P3 (mass: 1.66 g; number: 159). Using t-test to compare between populations we found that both parameters differed significantly ($p<0.05$) between all three populations (Table 4).

Table 2. Generative parameters (mean±sd) of weedy sunflower.

Population	Head diameter (cm)	Mass of achenes per head (g)	Number of achenes per head
P 1	4.51±1.23.23	2.16 ± 2.26	181 ± 86.26
P 2	5.18 ± 0.67	3.54 ± 1.44	216 ± 82.64
P 3	3.37 ± 0.86	1.66 ± 0.86	159 ± 68.76

Achene morphology, including colour, hair presence , stripes and dots, was very variable between the studied populations (Fig.3).High level of intrapopulation variability was observed. Percentage of achene surface covered by hairs and hair length was a highly variable parameter in the studied populations (data not shown). Similarly, PEREZ *et al.* (2007) showed that the surface of the achenes of *H. petiolaris* has abundant straight hairs which can serve as a defence mechanism against diseases.

Fig. 3. Achene morphology of weedy sunflower.

Data in Table 3 represent some achene parameters of studied weedy sunflower populations. Those results indicate that achene length of population P2 (6.1mm) is significantly higher then achene lenght of other two populations (P1: 5.8 mm; P3: 5.5 mm), while achene width is similar in populations P1 (2.7 mm) and P2 (2.8 mm) and considerably smaller in population P3 (2.5 mm). NOORYAZDAN *et al.* (2010) and PEREZ *et al.* (2007) measured achene length and width of wild form of sunflower and *H. petiolaris*. The achene length in their studies was generally smaller in comparison with weedy form, while achene width in our study is similar like in their studies. In contrast, cultivated sunflower achenes had higher length (9.52 mm) and width (5.12 mm) (GUPTA & DAS 1997). Mass of 100 achenes (between 1.09 and 1.78 g) was greater then for population of *H. petiolaris* (about 0,7 g) from Argentina (PEREZ *et al.* 2007) and USA (DORRELL & WHELAN 1978).

Table 3. Achene parameters (mean±sd) of weedy sunflower.

Population	Achene length (µm)	Achene width (µm)	Mass of 100 achenes (g)
P 1	5774.91 ± 479.86	2722.43 ± 208.19	1.20 ± 0.08
P 2	6096.67 ± 386.37	2763.41 ± 332.90	1.78 ± 0.64
P 3	5509.92 ± 594.25	2489.64 ± 147.88	1.09 ± 0.10

Table 4. Level of the differences between populations for nvestigated parameters (t-test).

Parameters	P1:P2	P1:P3	P2:P3
Plant height	*ns*	*ns*	*ns*
Leaf length	**	*ns*	**
Leaf width	**	*ns*	**
Number of ray flowers	*ns*	*ns*	*ns*
Number of bract	*ns*	**	**
Head diameter	**	**	**
Mass of achenes per head	**	**	**
Number of achenes per head	**	*	**
Seed length	**	*ns*	**
Seed width	*ns*	**	**
Mass of 100 achenes	**	*ns*	**

Conclusions

In conclusion, high level of populations' variability was observed for three weedy sunflower populations from northern Serbia. The most variable were generative parameters (head diametar, mass of achene per head, number of achene per head).For many vegetative (except plant height and number of ray flowers) and achene parameters was confirmed level of variability between populations.

Acknowledgements: We thank the Ministry of Education and Science of Serbia for support in this investigation (Project III46008) and EU project FP7-REGPOT-AREA 316004.

References

DORRELL D G & WHELAN E D P (1978) Chemical and morphological characteristics of seeds of some sunflower species. *Crop Science* **18**, 969–971.

GUPTA R K & DAS S K (1997) Physical properties of sunflower seeds. *Journal Agricultural Engineering Research* **66**, 1–8.

KANE N C & RİESEBERG LH (2008) Genetics and evolution of weedy *Helianthus annuus* populations: adaptation of an agricultural weed. *Molecular Ecology* **17**, 384–394.

MULLER M H, DELİEUX F, FERNANDEZ-MARTINEZ J M *et al.* (2009) Occurrence, distribution and distinctive morphological traits of weedy *Helianthus annuus* L. populations in Spain and France. *Genetic Resources Crop Evolution* **56**,869–877.

MULLER M H, LATREİLLE M, TOLLON C (2010) The origin and evolution of a recent agricultural weed: population genetic diversity of weedy populations of sunflower (*Helianthus annuus* L.) in Spain and France. *Evolutionary Applications* **4**, 499–514.

NOORYAZDAN H, SERİEYS H, BACİLİERİ R, DAVİD J, BERVİLLE A (2010) Structure of wild annual sunflower (*Helianthus annuus* L.) accessions based on agro-morphological traits. *Genetic Resources Crop Evolution* **57**, 27-39.

PEREZ E E, CRAPİSTE G H, CARELLİ A A (2007) Some Physical and Morphological Properties of Wild Sunflower Seeds. *Biosystems Engineering* **96**, 41–45.

POVERENE M, CANTAMUTTO M A, CARRERA A *et al.* (2006) Wild sunflower research in Argentina. Helia **29**, 65-76.

PRESOTTO A, FERNÁNDEZ-MORONİ I, POVERENE M, CANTAMUTTO M (2011) Sunflower crop-wild hybrids: Identification and risks. *Crop Protection* **30**, 611-616.

RIBEIRO A, GOUVEIA M, BESSA A, FERREIRA A *et al.* (2010) Population Structure and Genetic Diversity of Wild *Helianthus* Species from Mozambique. *Russian Journal of Genetics* **46**, 967–975.

STANKOVİC-KALEZİC R, RADİVOJEVİC LJ, JANJİC V, SANTRİC LJ, MALİDZA G (2008) A new association of ruderal weeds at Pančevački rit in Serbia. *Helia* **31**, 35-44.

URETA M S, CARRERA A D, CANTAMUTTO M A, POVERENE M M (2008) Gene flow among wild and cultivated sunflower. Helianthus annuus in Argentina. *Agriculture, Ecosystems and Environment* **123**, 343–349.

Allelochemical explanation of *Heracleum sosnovskyi* invasiveness

Ligita BALEŽENTIENĖ[1]

Among the reasons of species invasiveness success in new environment is its chemical interaction with the recipient community determined by the absence of tolerance of resident flora to new chemicals produced by the invader, in this particular case by Heracleum sosnovskyi Manden. The allelopathy is expected to be an important mechanism in the plant invasion and may encourage the development of general research models of invasive susceptibility in the ecosystems. H. sosnovskyi is native to the Caucasus region and is a dangerous invader which successfully spread worldwide, as well as has naturalized in Lithuanian habitats and plant communities. *H. sosnowskyi* exhibited high biochemical activity due to the accumulation of phenolics. The assessment of the total phenolics content (TPC) and biochemical impact of *H. sosnovskyi* on perennial ryegrass (monocots) and winter rapeseed (dicots) seed germination was done *ex situ*. The aqueous exudates of 2-year old *H. sosnovskyi* exhibited higher phytotoxicity than 1-year old plant exudates. The phytotoxic effects of *H. sosnovskyi* aqueous exudates on the germination depended on the extract concentration (0.02-0.2%), plant age (1-year, 2-year), plant parts (shoot: stem, leaf, blossom, seed, root) and growth stage (rosette-ripening). The phytotoxicity of *H. sosnovskyi* determined extract was most strong at flowering stage due to highest TPC (30.42 mg ml^{-1}). All parts of *H. sosnovskyi* produced phenolics, which inhibited the acceptor-species seed germination. The exudates inhibited the seed germination. The level of inhibition was concentration depended. The phenolics content varied throughout the plant age (0.22-81.03 mg ml^{-1}), growth stage (0.17-81.03 mg ml^{-1}) and across different plant parts (2.97-92.61 mg ml^{-1}) inhibiting the germination of acceptor plants. The results suggested that the invasive plant species may acquire spreading advantage in new territories through

1 Aleksandras Stulginskis University, Lithuania; E-mail: ligita.balezentiene@asu.lt

the use of their allelochemicals to inhibit germination. Nonetheless, the species evidence for allelopathic effects should not be restricted to analysis of the plant exudates in the lab, but should also include research in the natural environment.

Keywords: *Heracleum sosnovskyi,* phenolics, phytotoxicity**,** allelopathy, germination**.**

Invasive potential of *Bromus* species in wheat fields in Turkey

Süleyman TÜRKSEVEN[1], Mehmet DEMİRCİ[2], Ahmet Tansel SERİM[3]

Wheat has been by far the most important field crop in Turkey in terms of land area planted (9 million ha) and amount of grain produced (20 million t). Weeds are considered as one of the most important factors limiting the wheat yields in all regions of Turkey. In the group of the problematic weeds: *Avena*, *Lolium*, *Sinapis*, *Phalaris*, *Alopecurus*, *Galium,* species can be ranked according to their importance. But, recent studies conducted in Turkey show that the density and frequency of *Bromus* species in wheat-growing fields have increased. In a survey that was carried out in 2009, *B. tectorum* and *B. japanicus* were detected in the wheat-growing fields. In addition to these *Bromus* species, three other *Bromus* species (*B. rubens*, *B. madritensis* and *B. rigida*) were observed in the wheat-growing fields during another survey two years later. According to the last survey done in 2011, the number of *Bromus* species in the wheat reached five. Among these *Bromus* species, *B. rubens* and *B. madritensis* are especially crucial because they are categorized as invasive species in many countries. In this study, the density and frequency of *Bromus* species detected during the surveys conducted by other researchers and our survey in the wheat-growing fields are compared and discussed.

Keywords: *Bromus tectorum, B. japanicus B. rubens, B. madritensis, B. rigida.*

1 Ege Universty, Faculty of Agriculture Department of Plant Protection, Bornova-Izmir, Turkey; E-mail: suleyman.turkseven@ege.edu.tr

2 Agrobest Grup, Kemalpasa-Izmir, Turkey

3 General Directorate of Agricultural Research and Policy, Ankara, Turkey

Expansion status of two invasive vines: Bur-Cucumber and Mile-a-Minute, in Turkey

Hüseyin ÖNEN[1], Cumali ÖZASLAN[2], Hikmet GÜNAL[3], Nihat AKYOL[1], Uğur ÇALDIRAN[1]

Bur cucumber (*Sicyos angulatus* L.) and mile-a-minute (*Persicaria perfoliata* (L.) H. Gross) are annual invasive climbing vines. While the origin of bur cucumber is North America, mile-a-minute is originated from Eastern Asia. The earliest records on the weeds in Turkey were from 1984 for the mile-a-minute and from 1996 for the bur cucumber. Since then there has been almost no detailed studies conducted. Therefore, we aimed to study the distribution, biological and ecological aspects of the vines together with some other invasive species such as the common ragweed in Turkey. Within a TUBITAK funded project, the surveys on vines were initiated in 2013. The surveyed area was extended from Samsun to the Georgia border, which was approximately 600 km through the Black Sea Region of Turkey. Initial results revealed that both species are already found in a broad geographic range, and the vines have been established in the region. The species were first encountered in the Giresun province. They also extensively populated the Trabzon and Rize provinces. The plants were found in agricultural and nonagricultural habitats such as roadsides, riversides and wastelands, on the borders of forestlands, hazelnut and tea plantations, and in the vegetable grown areas of the region. Although the observed effects of the bur cucumber and mile-a-minute were often limited at the borders of forests, orchards and tea plantations. The climbing nature of the invasive vines, which reached the top of the native tree canopies (forest trees, hazelnut, chestnut, mulberry, tea, etc.), as well

1 Gaziosmanpaşa Üniversitesi, Ziraat Fakültesi Bitki Koruma Bölümü, 60240 Taşliçiflik/Tokat, Turkey; E-mail: huseyin.onen@gop.edu.tr

2 Dicle Üniversitesi, Ziraat Fakültesi, Bitki Koruma Bölümü, Diyarbakır, Turkey

3 Gaziosmanpaşa Üniversitesi, Ziraat Fakültesi Toprak Bilimi ve Bitki Besleme Bölümü, 60240 Taşliçiflik/Tokat; Turkey

as the covering effect of the weeds (particularly the herbaceous plants on the ground) may prevent the use of light and inhibit the further growth of the covered plants. The above-mentioned effects of the vines may severely influence the native plant diversity and with the increase of the population of weeds in the future the economy of the region might be threatened. The human-generated disturbances have promoted the spread of the invasive plants in the region. The lack of concern for the management of invasive species in Turkey has also enhanced the expansion. Therefore following the assessment and monitoring of plants in Turkey, management activities to combat with the vines is needed. Otherwise, the established populations of vines most likely will further expand and spread dramatically and become persistent in the region.

Keywords: Invasion, Turkey, invasive plant, distribution, Bur cucumber, *Sicyos angulatus,* Mile-a-Minute, *Persicaria perfoliata.*

Acknowledgements: This study was implemented within a project funded by the TUBITAK (Grant Number: 113 O 790).

Situation of Invasive Alien Species in EPPO A2 list in Turkey

Zübeyde Filiz ARSLAN[1], Ahmet ULUDAĞ[2], İlhan ÜREMİŞ[3]

The EPPO A1/A2 Lists are to recommend that organisms of serious phytosanitary concern should be regulated as quarantine pests by the EPPO member countries (A1 pests are absent from the EPPO region and A2 pests are locally present in the EPPO region). There is not any species in A1 list of EPPO, while A2 list (Table 1) consists of 11 plant species (EPPO 2013). *Heracleum persicum, H. sosnowskyi, Ludwigia peploides* and *Polygonum perfoliatum,* which are in the A2 list of EPPO and recorded in Flora of Turkey (GUNER et al 2000). *Solanum elaeagnifolium*, another species in EPPO A2 list has been recorded in Turkey as well (ELCİM & BEHCET 2007). *H. persicum* is an Irano-Turanian plant and native to Turkey, the others are alien species to Turkey. There has been no detailed distribution data about these species so far. Fig. 1 and Fig. 2 shows that images of species, recorded and not-recorded in Turkey from EPPO A2 list.

Table 1. Species in EPPO A2 list (pests recommended for regulation as quarantine pests) and their presence in Turkey.

Number	Species (Latin names)	Plant Type	EPPO	Presence in Turkey	Alien / Native for Turkey
1	*Baccharis halimifolia*	Tree, shrub	A2 in 2013	-	-
2	*Crassula helmsii*	Aquatic	A2 in 2006	-	-
3	*Eichhornia crassipes*	Aquatic	A2 in 2008	-	-
4	*Heracleum persicum*	Herb	A2 in 2009	+ (2)	Native (Irano-Turanian)

1 Gap Agricultural Research Institute, Department of PlantHealth, 63040 Sanliurfa, Turkey; E-mail: farslan@gaptaem.gov.tr

2 Onsekiz Mart University, Department of Plant Protection, 17100 Çanakkale, Turkey

3 Mustafa Kemal University, Department of Plant Protection, 31000 Hatay, Turkey

Number	Species (Latin names)	Plant Type	EPPO	Presence in Turkey	Alien / Native for Turkey
5	*Heracleum sosnowskyi*	Herb	A2 in 2009	+ (2)	Alien
6	*Hydrocotyle ranunculoides*	Aquatic	A2 in 2005	-	-
7	*Ludwigia peploides*	Aquatic	A2 in 2011	+ (2)	Alien
8	*Ludwigia grandiflora*	Aquatic	A2 in 2011	-	-
9	*Polygonum perfoliatum*	Vine Climber	A2 in 2008	+ (2)	Alien
10	*Pueraria lobata*	Vine Climber	A2 in 2006	-	-
11	*Solanum elaeagnifolium*	Herb	A2 in 2006	+ (3)	Alien

Fig. 1. Species recorded in Turkey from EPPO A2 list.

Fig. 2. Species not-recorded in Turkey from EPPO A2 list.

Furthermore, existance of *Eichhornia crassipes* (in EPPO A2 List) *Baccharis halimifolia* (in EPPO A2 List) and *Limnophila sessiliflora* (in EPPO Observation List) in Turkey has been speculated because some forum sites in internet related to ornamental plants mention those plants seen in the nature in Turkey. There is a need to verify if these species have already naturalized or not.

Fig. 3. Some species not recorded but seen in Turkey.

Keywords: *Heracleum persicum, Heracleum sosnowskyi, Ludwigia peploides, Polygonum perfoliatum, Solanum elaeagnifolium, Eichhornia crassipes, Baccharis halimifolia, Limnophila sessiliflora.*

References

EPPO (2013) Web site of EPPO (European and Mediterranean Plant Protection Organization) http://www.eppo.int/INVASIVE_PLANTS/ias_lists.htm#A1A2Lists.

GUNER A, OZHATAY N, EKIM T & BAFLER KHC (2000) Flora of Turkey and the East Aegean Islands, Second Supplement. Vol. 11. p. 656. Edinburgh: University Press.

ELÇIM A, BEHÇET L (2007) *Solanum elaeagnifolium* Cav. in Turkey Turkish Journal of Botany, 2007 31:577:579.

Pontogammarus robustoides G. O. Sars, 1894. – New potentially invasive amphipod species to the Bulgarian inland waters

Lyubomir KENDEROV[1], Teodora TRICHKOVA[2], Yanka VIDINOVA[2], Svetoslav CHESHMEDJIEV[3]

The amphipod species *Pontogammarus robustoides* G. O. Sars, 1894 (Amphipoda, Crustacea) is of Ponto-Caspian origin and in recent years has been reported as invasive alien species in several Central and West European countries. In Bulgaria, the species was reported from the Bulgarian sector of the Danube River and some Black Sea coastal lakes and rivers. This is the first report of the species for the fauna of the inland waters in Bulgaria.

The species was found for the first time in the Mochuritsa River, at the confluence with the Tundzha River (near Yambol Town, Aegean Sea basin), on 03.10.2006 (23 individuals). Subsequently the species was recorded again at the same locality: in 2009 (41 specimens) and in 2013 (100 specimens). Additionally, two native amphipod species, *Gammarus komareki* Schaferna, 1922 and *Gammarus arduus* G. S. Karaman, 1975, were found to occur at closely located sites (the Mochuritsa River at Vodenichane Village, 15 km upstream, and the main stream of Tundzha River). In 2011 *P. robustoides* was recorded in high abundance in the littoral area of the Ovcharitsa Reservoir, which is affiliated to another river basin (Maritsa River, Aegean Sea basin). Because of the high potential of the species to spread in the inland river systems in Bulgaria and to become invasive, further studies of its distribution, vectors of introduction, biological traits and ecological requirements are urgently needed.

Keywords: *Pontogammarus robustoides*, translocated species, Aegean Sea basin.

1 Sofia University, Faculty of Biology, 8 DraganTsankov Blvd., Sofia 1164, Bulgaria: Email: lubomir.kenderov@gmail.com

2 Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin Str., Sofia 1113, Bulgaria

3 SI Eco Consult Ltd., 64 Ralevitsa Str., Sofia 1618, Bulgaria

Distribution of the invasive blue crab *Callinectes sapidus* Rathbun, 1896 along the Albanian coast

Ermira MILORI[1], Alba ZHORI[1], Irma AGOLLI[1], Sajmir BEQIRAJ[1]

Abstract

Since its first confirmed record in 2006, the invasive blue crab *Callinectes sapidus* has been quickly and largely distributed along the Albanian coast. The present study is based on the information gathered in almost all coastal lagoon areas of Albania, such as Vilun, Kune, Vain, Patok, Rrushkull, Karavasta, Narta, Orikum and Butrint, during 2009–2013. Besides direct observations and samples' collection in the studied areas, questionnaires have also been distributed to the local fishermen with the purpose of gathering information about the presence of the blue crab along the Albanian coast, its state in each surveyed area, and assessment of its possible impact on other lagoon populations in the areas where it was present. In the lagoons of Patok, Narta and Orikum more detailed studies have been carried out on assessing the establishment of the blue crab in the lagoons. The blue crab has resulted as already established in those three lagoons and it is expected to be established in several other lagoons and river mouths in the Albanian coast.

Keywords: Invasive alien species, blue crab, Albanian coast.

Introduction

The first publication on the invasive blue crab *Callinectes sapidus* Rathbun, 1896, in Albania has reported its presence in the Patok lagoon since 2006 and has considered it as an established species in this lagoon in 2009 (after BEQİRAJ & KASHTA 2010). However, collected information from local fishermen (personal communications) along the Albanian coast has reported the presence of the blue crab in Albania much earlier. The first investigation

1 Department of Biology, Faculty of Natural Sciences, University of Tirana, Albania; E-mail: ermiramilori@gmail.com

on this species in Albania has been carried out in 2009, with a focus on Patok lagoon, trying to assess its population structure and some ecological characteristics. Information on the presence and state of the blue crab in other areas, especially coastal lagoons and river mouths has also been collected. The present work aims to give data on the distribution of the blue crab along the Albanian coast, and to assess its establishment in the lagoons of Patok, Narta and Orikum, where more detailed investigations were carried out. The study on the state of the blue crab in the Albanian coast is ongoing and, besides the distribution of this species along the coast, is also aiming to assess its establishment, population structure and possible impacts of this species on the biota in the introduced areas.

Material and Methods

Investigations on the presence of the blue crab have been carried out in many areas of the Albanian coast during 2009–2013, such as in the lagoons of Vilun, Kune, Vain, Patok, Rrushkull, Karavasta, Narte, Orikum, and Butrint, as shown in Fig. 1.

Fig. 1. Investigated sites for the presence of the blue crab along the Albanian coast: 1. Vilun; 2. Kune; 3. Vain; 4. Patok; 5. Rrushkull; 6. Karavasta; 7. Narte; 8. Orikum; 9. Butrint.

Most of these areas were visited in March and November, when the migration respectively to and from the lagoons is expected (after CABAL *et al.* 2006, FLORIO *et al.* 2008, GALIL et al. 2006, GENNAIO et al. 2006; ONOFRI et al. 2008, KIRINCIC & STEVCIC 2008, TUNCER & BILGIN 2008),

while in the lagoons of Patok, Narta and Orikum, the investigations had a monthly frequency, aiming to collect some ecological data and to assess the establishment and state of the blue crab in these lagoons. The information on the presence and state of *C. sapidus* has been collected by direct contacts with local fishermen, to whom a questionnaire has been distributed. The questionnaire requested information on the first seeing in each site, the presence frequency, abundance, maximal and minimal size of the specimens in the fishing net bycatch, net size and mesh size of the used nets, months of the highest and of the lowest presence, the presence of juveniles and ovigerous females, the migration period to and from the lagoon, whether the blue crab is considered aggressive by the fishermen and possible concerns, whether they collect the blue crab for commercial purpose, possible changes and/or damages in the autochthonous biota in the introduced areas. Samples of the blue crab have also been collected by the fishing nets, as a bycatch, in most of the visited areas.

Results and Discussion

The blue crab was recorded in all investigated sites. The answers from the questionnaires distributed to the local fishermen reported that the first seeing of the blue crab in the Albanian coast dates in 1975 in the Rrushkull lagoon. Although studies and publications on this species were lacking in Albania, the presence of the blue crab has been recorded several times from the local fishermen during the last 20 years. From the questionnaires, the oldest records are from the lagoons of Rrushkull, Butrint and Karavasta, while in the other areas (Vilun, Kune, Vain, Patok, Narte, and Orikum) the records are from the last 7–8 years. The presence of the blue crab has also been reported from some river mouths near the lagoons mentioned above, such as the Drin, Droje, Ishem, Erzen and Shkumbin rivers' mouths in the Adriatic Sea, as well as in the sea water, west of Vlora Bay, at depths of 50–150 m, in the transitional area between Adriatic and Ionian seas.

a b c

Fig. 2. Adult male (a), juvenile (b) and ovigerous female (c) of the blue crab from the Albanian lagoons.

The highest presence and abundance of the blue crab has been recorded in Vilun, Patok and Karavasta. The continuous abundance of this species in these lagoons, as well as in some others like Narta and Orikum in some periods, has led to the commercial use of the blue crab by the local fishermen. In the recent years, this species has started to become common in the fish restaurants in the coastal areas of Albania and in the fish market of Tirana.

In most of the investigated lagoons the outlet channels are closed with wooden fence (locally named "dajlan") by the local fishermen from early autumn to early spring for fishing reasons. As this closure is very tight and believed to totally isolate the migration of macrofauna to and from the lagoons, it is thought (and also mentioned by local fishermen) that blue crab is obliged to winter within the lagoon, buried in sediments. Such facts about wintering of the blue crab buried in sediments are also mentioned in the existing literature (after HINES *et al.* 1990). This consideration is also supported by the confirmed presence of the blue crab during the winter months, although in small quantity, in many investigated lagoons in this study. Continuous records of the juveniles and ovigerous females from the collected samples in the lagoons of Vilun, Patok, Narta and Orikum, as well as their continuous presence in high abundance lead to the consideration on the establishment of the blue crab in these lagoons. The establishment of this species in the Patok lagoon has already been confirmed by a detailed assessment earlier (after BEQİRAJ & KASHTA 2010). In a general consideration, the fishermen do not confirm any evident change in the autochthonous lagoon biota after the introduction of blue crab, except the decrease of the presence of the other decapod crab *Carcinus aestuarii* Nardo, 1847 (the Mediterranean green crab) that has been the most abundant crab in all Albanian lagoons formerly. However, more detailed data on the impact of the blue crab introduction, its population structure and bio-ecological data need deeper and continuous investigation, which is already ongoing in the Albanian coast.

References

AGOLLI I., MALOLLI E., BEQIRAJ S., KASHTA L. (2012): Data on the presence of invasive alien crab *Callinectes sapidus* Rathbun 1896 along the Albanian coast. MarCoastEcos 2012: International Conference on Marine and Coastal Ecosystems. 25–28 April 2012. Tirana.

BEQİRAJ S., KASHTA L. (2010): The establishment of blue crab *Callinectes sapidus* Rathbun, 1896 in the Lagoon of Patok, Albania (south-east Adriatic Sea). Aquatic Invasions (2010). Vol 5, Issue 2: 219-221

BEQİRAJ S., KATSANEVAKİS S., KASHTA L., MAČIČ V., POURSANİDİS D. ZENETOS A. (2012): Inventory of marine alien species in the Albanian and Montengrin coast. MarCoastEcos 2012: International Conference on Marine and Coastal Ecosystems. 25–28 April 2012. Tirana.

CABAL J., MİLLÁN J. A. P., ARRONTE J. C. (2006): A new record of *Callinectes sapidus* Rathbun, 1896 (Crustacea: Decapoda: Brachyura) from the Cantabrian Sea, Bay of Biscay, Spain. Aquatic Invasions . Vol 1, Issue 3: 186-187.

FLORİO M., BREBER P., SCİROCCO T., SPECCHİULLİ A., CİLENTİ L., LUMARE L. (2008): Exotic species in Lesina and Varano lakes new guest in Lesina and Varano lakes: Gargano National Park (Italy). *Transitional Waters Bulletin* 2: 69-79

GALİL B. S., FROGLİA C., NOËL P. (2006): CIESM Atlas of Exotic Species in the Mediterranean. Volume 2. Crustaceans: decapods and stomatopods, Check-list of exotic species. http://www.ciesm.org/atlas/appendix2.html

GENNAİO R., SCORDELLA G., PASTORE M. (2006): Occurrence of blue crab Callinectes sapidus (Rathbun, 1896 Crustacea, Brachyura), in the Ugento ponds area (Lecce, Italy). Thalassia salentina 29: 29-3922).

HİNES A.H., HADDON A.M., WEİCHERT L.A. (1990): Guild structure and foraging impact of blue crabs and epibenthic fish in a subestuary of Chesapeake Bay. Marine Ecology Progress Series 67: 105–126.

KİRİNCİC M., STEVCİC Z. (2008): Fauna of the Adriatic Decapod Crustaceans (Crustacea: Decapoda) - Status and outlook. *Natura Croatica* 17(2): 131-139

ONOFRİ V., DULČİĆ J., CONİDES A., MATİĆ-SKOKO S., GLAMUZİNA B. (2008): The occurrence of the blue crab, *Callinectes sapidus* Rathbun, 1896 (Decapoda, Brachyura, Portunidae) in the eastern Adriatic (Croatian coast). *Crustaceana* 81(4): 403-409. doi:10.1163/156854008783797561

TUNCER S., BİLGİN S. (2008): First record of *Callinectes sapidus* Rathbun, 1896 (Crustacea: Decapoda: Brachyura) in the Dardanelles, Canakkale, Turkey. *Aquatic Invasions* (3): 469. doi:10.3391/ai.2008.3.4.19

Lake Ohrid tributaries: Natural and potential pathways for invasive alien species introductions

Sasho TRAJANOVSKI[1], Biljana BUDZAKOSKA[1], Lyubomir KENDEROV[2], Konstantin ZDRAVESKI[1], Ivan BOTEV[3], Teodora TRICHKOVA[3]

The role of the four tributaries (rivers Sateska, Koselska, Grasnica and Cerava), together with the only outflow (River Crn Drim) is rather considerable regarding the sustaining of the water balance of Lake Ohrid. Since the early 1970s, with the intensification of the industrial development in the watershed of the lake, until present times, the negative influence of the tributaries concerning the water quality and habitat destruction in the littoral of the lake has been identified. However, until recently, neither the tributaries, nor the outflow were considered as factors that can directly assist the introduction of alien and invasive species.

The goal of the research was to determine possible existence of alien or invasive macrozoobenthic species in the mentioned water flows, and the existence of potential vectors and conditions for their introduction. By applying the WISER method, samples from different sites throughout the water flows were collected, according to the following criteria: upper flow, middle flow and inflow in the lake; the different anthropogenic impact reflected in the changes in water quality and habitat changes.

A total of 54 taxa from 8 groups (Turbellaria, Oligochaeta, Hirudinea, Bivalvia, Gastropoda, Amphipoda, Isopoda and Insecta) were registered in a total of 19 localities from 7 water flows in the Macedonian part of the watershed of Lake Ohrid. The largest number is classified under the group of Insecta and it is characteristic for the upper flow of the Sateska

1 Hydrobiological Institute Ohrid, Naum Ohridski 50, Ohrid 6000, R. Macedonia; E-mail: trajsa@hio.edu.mk

2 Biological Faculty, Sofia University, 8 Dragan Tsankov Blvd.,Sofia 1164, Bulgaria

3 Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin Str., Sofia 1113, Bulgaria

River, where there were no visible disturbances of the habitat. Unlike the condition in the upper flow of the Sateska River (characterized by "very good" ecological status), the inflows and middle flows of the other rivers indicated disturbed trophic state of the water and "bad" or "very bad" ecological status (Cerava and Grasnica Rivers). Although macrozoobenthos alien species were not registered during the research, the natural location of the tributaries and the increased frequency of anthropogenic activities in the watershed of the lake, as well as the existence of localities with "bad" ecological status and disturbed (destructed) habitats, indicated the need of continuous monitoring for the occurrence and introductions of potential invasive alien species in the watershed of Lake Ohrid.

Keywords: Lake Ohrid watershed, macrozoobenthos, ecological status, alien species.

Native and non-native fish species in the tributaries and outflow of ancient Lake Ohrid

Teodora TRICHKOVA[1], Trajce TALEVSKI[2], Ivan BOTEV[1], Lyubomir KENDEROV[3], Sasho TRAJANOVSKI[2]

The ancient Lake Ohrid, located in Macedonia and Albania, represents one of the most significant hotspots of endemic biodiversity on the Balkan Peninsula. It is known that the aquatic and isolated ecosystems with globally significant biodiversity are most vulnerable to different impacts, such as climate change, habitat change, introduction of invasive alien species and pollution. While the ichthyofauna in the lake has been extensively studied, little is known about the current state of the ichthyofauna in the tributaries and its outflow, the Crn Drim River. In order to study the fish species diversity in the Lake Ohrid catchment in relation to occurrence of non-native species and the influence of some environmental factors, in May 2013, we sampled different sections of 6 tributaries as well as the Crn Drim River.

A total of 15 fish species were recorded. Of them, 12 species are endemic to the Lake Ohrid and Crn Drim River catchments. Two of the species, *Pseudorasbora parva* and *Carassius gibelio*, are alien to the ichthyofauna of Macedonia. Most frequently found were *Pachychilon pictum* and *Squalius squalus,* which also had the highest relative abundance in the lower and middle sections of the rivers. They were followed by *Alburnus scoranza*, which was abundant in the lower sections of the rivers, and by *Barbus rebeli* and *Phoxinus lumaireul*. The alien *P. parva* was found in two tributaries and the Crn Drim River, while *C. gibelio* in 2 tributaries, both in comparatively low abundance. The relation of the fish species distribution

1 Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin Str., Sofia 1113, Bulgaria; E-mail: trichkova@gmail.com

2 Hydrobiological Institute Ohrid, Naum Ohridski 50, Ohrid 6000, R. Macedonia; Email: tratal2001@gmail.com

3 Biological Faculty, Sofia University, 8 Dragan Tsankov Blvd., Sofia 1164, Bulgaria

and abundance to the physicochemical and substrate characteristics was analyzed. The identified threats, such as the occurrence of non-native species, although in low number and abundance, water pollution and some hydromorphological changes in the river courses indicate the need of urgent measures for the protection of the endemic ichthyofauna in the Lake Ohrid catchment.

Keywords: Endemic fish species, non-native species, threats, Lake Ohrid catchment.

Distribution of *Gambusia* (Mosquitofish) in Turkey and its potential impact on aquatic ecosystems

F. Kübra ERBAY[1], Baran YOĞURTÇUOĞLU[1], Ş. Gülsün KIRANKAYA[2], Lale GENÇOĞLU[2], F. Güler EKMEKÇİ[1]

The mosquitofish, *Gambusia sp.,* is one of the most widespread freshwater fish genera all over the world. Although it is native to America, the distribution area of *Gambusia sp.* has rapidly expanded since it has been intensively used for mosquito control. This species was introduced into the inland waters of Anatolia in the 1930s and has invaded almost all freshwater ecosystems in Turkey. The mosquitofish is highly tolerant to poor water quality, especially high turbidity, extreme ranges of temperature and salinity and low dissolved oxygen conditions. Today, the mosquitofish is considered as one of 'The World's Worst Invasive Species' (http://www.issg.org/worst100_species.html) due to its wider ecological and physiological tolerance in harsh environments, and to its negative ecological impact. The mosquitofish has a wide food preference; it can adversely affect phytoplankton, zooplankton, other invertebrate, fish, and amphibian populations, as well as mosquito larvae. Therefore, the small viviparous fish, *Gambusia sp.*, can disrupt the entire ecosystem function. The invasive characteristics of the mosquito fish are strongly related to its reproductive success due to high fecundity, multiple-spawning in a breeding season, live-bearing, short duration of both gestation and pre-adult periods, and sperm storing ability of females. The invasive mosquitofish is known to prefer similar habitats and even has similar niche with *Aphanius* species. Therefore, the presence of this introduced species should be regarded as a serious threat to populations of *Aphanius* due to its invasive characteristics and even direct predation on the fries

1 Hacettepe University, Faculty of Science, Department of Biology, Hydrobiology Section, Freshwater Fish Biology and Ecology Laboratory, Turkey; E-mails: fatmakubra.erbay@gmail.com, yokbaran@gmail.com, gulere@hacettepe.edu.tr

2 Düzce University, Faculty of Arts and Sciences, Department of Biology, Konuralp Campus Merkez/Düzce; E-mails: gkirankaya@gmail.com, lalegencoglu@duzce,edu.tr

and eggs. Our aim is to determine the relationship between *Gambusia sp.* and *Aphanius sp.* and to present a conservation strategy for *Aphanius*. In this study, we present the distribution of mosquitofish in Turkey and its possible effects on the endemic and endangered *Aphanius* species.

Keywords: Mosquitofish, biodiversity, Anatolia, invasive species.

Rapid expansion in distribution area of a marine fish, the sand smelt, in inland waters of Turkey

Lale GENÇOĞLU[1], Ş. Gülsün KIRANKAYA[1], F. Güler EKMEKÇİ[2], Baran YOĞURTÇUOĞLU[2]

The sand smelt (*Atherina boyeri* Risso, 1810) is known as a marine-estuarine species having a wide distribution area covering coasts of northern Atlantic Ocean, Mediterranean Sea, Black Sea and Caspian Sea. This euryhaline species is also known to live in lower parts of rivers, estuaries and costal lakes. This species was recorded from all coasts of the seas surrounding Anatolia, also from lagoons and lakes having connection with the seas. After the first record of the sand smelt in inland waters from lake Sapanca in mid 1940s, the sand smelt was reported from İznik lake, which has not a direct connection to the sea. During the last decade there were new records from different natural lakes and reservoirs of Anatolia such as the reservoirs on Kızılırmak, Sakarya, Aksu and Orontes rivers. The sand smelt established successful populations in many inland waters of Turkey which are isolated and have no connection with sea. In Turkey, the distribution of this species in the inland waters has been expanding conspicuously during the last decade by illegal introductions and becoming popular for fishers due to the economic value. The common feature of these sand smelt populations in confined to freshwater, are successful breeding and filling vacant pelagic niches and becoming dominant fish. The ecological impacts of sand smelt such as predation on zooplankton, competition with endemic fish species and fishes having economical value should be considered. Due to life history traits such as short life cycle, early maturation, and prolonged reproduction period, this species has a great potential of being an invasive species in the inland waters of Turkey.

Keywords: *Atherina boyeri*, freshwater systems, Anatolia.

1 Düzce University, Faculty of Arts and Sciences, Department of Biology, Konuralp Campus Merkez/Düzce, Turkey; E-mail: gkirankaya@gmail.com, lalegencoglu@duzce,edu.tr

2 Hacettepe University, Faculty of Science, Department of Biology, Hydrobiology Section, Freshwater Fish Biology and Ecology Laboratory, Turkey

A review of pest status of recently recorded alien insects in Bulgaria

Rumen TOMOV[1], Katia TRENCHEVA[1]

Abstract

Bulgarian biodiversity and economy are threatened by the introduction of alien insects because of increasing transport and the global warming. The alien terrestrial insects recorded so far in Bulgaria account for 300 species and 108 of them have been detected during the last 20 years. The highest number belongs to Hemiptera (101) and Coleoptera (88), followed by Lepidoptera (34), Hymenoptera (23), Phthiraptera (16), Diptera (15), Thysanoptera (8), Orthoptera (6), Blattodea (3), Psocoptera (3), Zygentoma (1), Siphonaptera (1), and Dermaptera (1). Most of them originate from Asia, followed by Americas, Africa, etc. The species with cosmopolitan distribution and considered as cryptogenic are 82. The trade with plant material and in particular ornamental plants is considered as a main pathway for the introduction of the alien species.

A list of 20 species recorded during the last five years in Bulgaria is presented. The pest status of the alien insects *Cameraria ohridella* Deschka et Dimic, *Phthorimaea operculella* Zeller, *Harmonia axyridis* (Pallas), *Metcalfa pruinosa* Say, *Tuta absoluta* (Povolny), *Nezara viridula* (Linnaeus), *Pseudococcus calceolariae* (Maskell), *Aphis spiraecola* Patch and *Acizzia jamatonica* (Kuwayama) that recently increased rapidly their population density and range of distribution in Bulgaria is discussed.

Keywords: Alien insects, pest status, pathway, Bulgaria.

Introduction

Bulgarian biodiversity and economy are threatened by the introduction of alien insects because of several reasons. The increasing transport

1 Faculty of Agriculture, University of Forestry, 1797 Sofia, 10 KlimentOhridskiblvd, Bulgaria; E-mail: rtomov@yahoo.com

from Turkey and Black Sea region may introduce new insects from Asia. Global warming may allow the movement to the north and establishment in Bulgaria of some Mediterranean species (*Bemisia tabaci* Gennadius, *Ceratitis capitata* Wiedemann and other Tephritidae species, many scale insects, etc.). Alien species can also be imported in Bulgaria from EU countries because of reduction of border control between EU countries. Till now about 190 insects have been treated as quarantine species in Bulgaria, but despite the phitosanitary measures, thirty-one of them have already been introduced to the country. The first analysis of non-indigenous insects of Bulgaria was made by TOMOV *et al.* 2007. Several projects concerning inventory and monitoring of alien insects were conducted in Bulgaria during the last ten years. A short review of main results of the surveys made is presented in this paper.

Material and Methods

The review is made based on literature data and personal observations conducted during the period 2008-2013 in the framework of several projects. General surveys were made within the following projects: "Non-indigenous insects and their threat to biodiversity and economy in Albania, Bulgaria and Republic of Macedonia" and "Alien terrestrial arthropods and their threat to biodiversity of Bulgaria".

Results and Discussion

The surveys on literature data and personal observations showed that the alien terrestrial insects recorded so far in Bulgaria account for 300 species and 108 of them were detected during the last 20 years. The highest number belongs to Hemiptera (101) and Coleoptera (88), followed by Lepidoptera (34), Hymenoptera (23), Phthiraptera (16), Diptera (15), Thysanoptera (8), Orthoptera (6), Blattodea (3), Psocoptera (3), Zygentoma (1), Siphonaptera (1), and Dermaptera (1). (TOMOV *et al.* 2007, TOMOV *et al.* 2009a, TRENCHEVA *et al.* 2012, SİMOV *et al.* 2012)

Most of them originate from Asia (84), followed by Americas (74), Tropic (28) Africa (21), Australia (7) and Mediterraneans (4). The species with cosmopolitan distribution and considered as cryptogenic are 82.

Twenty alien species, new for the Bulgarian fauna, were reported in the last five years (Table 1). Most of them had low population density or were

detected indoors only. At present several species are serious pests on crops and ornamental plants or pose a threat to the biodiversity in Bulgaria.

Table 1. Alien species detected during last five years in Bulgaria.

Species	Reference
1. *Periphyllus californiensis* (Shinji, 1917)	YOVKOVA *et al.* 2013
2. *Corythucha arcuata* (Say, 1832)	DOBREVA *et al.* 2013
3. *Deraecoris flavilinea* (A. Costa, 1862)	SIMOV *et al.* 2012
4. *Pulvinaria hydrangeae* (Steinweden, 1946)	TRENCHEVA *et al.* 2012
5. *Aedes albopictus* (Skuse, 1894)	MEDLOCK *et al.* 2012
6. *Bruchidius siliquastri* Delobel, 2007	STOJANOVA *et al.* 2011
7. *Idiopterus nephrelepidis* Davis, 1909	TASHEVA-TERZIEVA *et al.* 2011
8. *Ceroplastes ceriferus* (Fabricius, 1788)	PENCHEVA & YOVKOVA 2011
9. *Duponchelia fovealis* Zeller, 1847	PENCHEVA *et al.* 2011
10. *Cacoecimorpha pronubana* (Hubner, 1799)	PENCHEVA *et al.* 2009
11. *Aulacaspis yasumatsui* Takagi, 1977	TRENCHEVA *et al.* 2010
12. *Prociphilus fraxinifolii* Riley, 1879	TRENCHEV & TRENCHEVA 2009
13. *Harmonia_axyridis* (Pallas, 1773)	TOMOV *et al.* 2009b
14. *Cinara curvipes* (Patch, 1912)	TOMOV *et al.* 2009a
15. *Acizzia jamatonica* (Kuwayama, 1908)	VÉTEK & RÉDEI 2009
16. *Platygaster robiniae* Buhl & Duso, 2008	TOMOV *et al.* 2009a
17. *Tuta absoluta* (Meyrick, 1917)	HARIZANOVA *et al.* 2009
18. *Argyresthia thuiella* (Packard, 1871)	TOMOV *et al.* 2009a
19. *Obolodiplosis robiniae* (Haldeman, 1847)	TOMOV *et al.* 2009a
20. *Trioza alacris* Flor, 1861	PENCHEVA *et al.* 2009

***Phthorimaea operculella* (Zeller)** was found in 1950 in restricted area of South Bulgaria. Since then it has been detected in several localities in South Bulgaria but in low abundance. Heavy infestation by potato tuber moth was observed during the last 5 years in the south part of Bulgaria. The pest extends it areal to the North and has been detected in the North-East Bulgaria as well. (VANEVA-GANCHEVA & GRİGOROVA 2010).

The horse-chestnut leafminer ***Cameraria ohridella*** **Deschka et Dimic** is the only species with confirmed negative ecological impact. From three to four generations of *C. ohridella* per year were observed in Bulgaria. The trees in Bulgarian natural stand of *Aesculus hippocastanum* – natural reserve "Dervisha" are heavily infested and a total defoliation in August, made by the second summer generation of the moth, occurs every four years. The infestation by *C. ohridella* negatively affects the seed and fruit weight of *A. hippocastanum*. The reduced seed weight may severely impair growth and survival of the horse chestnut seedlings. The long term natural succession in the forest may be altered by the moth, and may even lead to the replacement of *A. hippocastanum* in the last remaining endemic refuges of the species. In addition, *C. ohridella* can affect biodiversity by its high abundance and apparent competition (PERE *et al.* 2010).

The tomato leaf miner ***Tuta absoluta*** **(Povolny)** was reported for the first time in Bulgaria in 2009 (HARİZANOVA *et al.* 2009). An infestation on tomato was observed in glasshouses mainly in the south part of Bulgaria (region of Plovdiv and Petrich).

The multicolored ladybird ***Harmonia axyridis*** **(Pallas)** was observed in Sofia in 2008 (TOMOV *et al.* 2009b). A rapid spread of the ladybird in Bulgaria was observed in the framework of a survey made in 2009. At present the beetle is distributed all over Bulgaria. Initially the infestation by *Eucallipterus tiliae* (L.) on *Tilia cordata* Mill. was the main reason for natural spread of *H. axyridis* in Bulgaria but at present the food web of the species includes more than 70 aphid and other insect species.

In July 2009, the occurrence of the monophagous psyllid ***Acizzia jamatonica*** **(Kuwayama)** was recorded, and damages were observed on a solitary silk tree, *Albizia julibrissin* DurazzinI in Nessebar (VÉTEK & RÉDEİ 2009). At present the species is distributed mainly in southeastern Bulgaria and the Black Sea coast.

Pseudococcus calceolariae **(Maskell)** was reported for the first time in 1968 (TSALEV 1968) as a pest on ornamental plants indoors. Our observations conducted during the last 3 years showed that the pest was able to overwinter in the field in the South Black Sea region producing big colonies on *Catalpa bignonioides* and *Cercis siliquastrum.*

The extremely polyphagous planthopper ***Metcalfa pruinosa*** **Say** was reported for the first time in Bulgaria in 2004. It was found on *Thuja*

oxidentalis L. spp. in small numbers and on restricted area (TRENCHEV *et al.* 2007). Feral populations of *M. pruinosa* were found in 2009 at the Black Sea coast on *Acer campestre* L. and *Robinia pseudoacacia* L. At present the species is distributed mainly in northern Bulgaria and the Black Sea coast on more than 30 plant species.

The polyphagous species ***Nezara viridula* (Linnaeus)** was reported in Bulgaria by STRAWİNSKİ (1959). In the recent years, the species is a serious pest on Solanacea crops mainly in southern Bulgaria. It is an urban pest and also enters the houses in autumn for overvintering.

***Aphis spiraecola* Patch** was detected in Bulgaria for the first time in 2007 (RASHEVA & ANDREEV 2007). At present the pest is distributed mainly in southern Bulgaria where it has almost replaced *A. pomi* in the apple orchards. The species was detected in Sofia and the Black Sea cost (PENCHEVA & YOVKOVA 2011).

Conclusions

About 52 alien insect species are widely distributed crop pests in Bulgaria but only eleven of them are considered as economically important: *Leptinotarsa decemlineata* (Say), *Trialeurodes vaporariorum* (Westwood), *Myzus persicae* Sulzer, *Diaspidiotus perniciosus* (Comstock), *Pseudaulacaspis pentagona* (Targioni, Tozzeti), *Viteus vitifoliae* (Fitch), *Hyphantria cunea* (Drury), *Phthorimaea operculella* (Zeller), *Helicoverpa armigera* (Hübner), *Grapholita molesta* (Busck) and *Frankliniella occidentalis* (Pergande) (TOMOV *et al.* 2010).

A threat to the biodiversity of Bulgaria is posed by the widely distributed species: *Harmonia axyridis* (Pallas) and *Cameraria ohridella* Deshka et Dimic (PERE *et al.* 2010).

A threat to human health is posed by the Asian tiger mosquito *Aedes albopictus* (Skuse), which was detected in Bulgaria in 2011 (MEDLOCK *et al.* 2012). The trade with plant material and in particular ornamental plants is considered as a main pathway for the introduction of alien species.

Acknowledgements: The study was funded by the National Science Fund, Ministry of Education Youth and Science, Republic of Bulgaria, Project ATARTIB D002-191/2008.

References

DOBREVA M, SIMOV N, GEORGIEV G, MIRCHEV P, GEORGIEVA M (2013) First Record of *Corythucha arcuata* (Say) (Heteroptera: Tingidae) on the Balkan Peninsula. *Acta zoologica bulgarica,* 65 (3), 409-412.

HARIZANOVA V, STOEVA A, MOHAMEDOVA M (2009) Tomato Leaf Miner, *Tuta absoluta* (Povolny) (Lepidoptera: Gelechiidae) – First record in Bulgaria. *Agricultural science and technologies,* 3, 95-98.

MEDLOCK J, HANSFORD K, SCHAFFNER F *et al*. (2012) A review of the Invasive mosquitoes in Europe: ecology, public health risks, and control options. *Vector-borne and zoonotic diseases*, 12, Number 6, 435-447. DOI: 10.1089/vbz.2011.0814

PENCHEVA A, VELCHEVA N, YOVKOVA M (2009) New species on Bay laurel (*Laurus nobilis* L.) in Bulgaria. Proceedings of International scientific conference "Good practices in sustainable agriculture", 12-13 November, 2009, Sofia, Bulgaria, 312-320.

PENCHEVA A, YOVKOVA M, VELCHEVA N (2011) *Duponchelia fovealis* Zell. (Lepidoptera: Crambidae) – a new pest in greenhouses of Bulgaria. *Plant protection,* 3, 22 – 23.

PENCHEVA A & YOVKOVA M (2011) Review of alien insect pests on ornamental plants in Bulgaria. 60 years specialty "Landscape architecture", Snezhani, Sofia, 112-117.

PERE C, AUGUSTIN S, TOMOV R, PENG L, TURLINGS T, KENIS M (2010) Species richness and abundance of native leaf miners are affected by the presence of the invasive horse-chestnut leaf miner. *Biological Invasions,* 12, 5, 1011-1021.

RASHEVA D & ANDREEV R (2007) *Aphis spiraecola* Patch. (*Hemiptera: Aphididae*) – a new pest on apples in Bulgaria. *Acta Entomologica Bulgarica,* 13(1, 2), 91-97.

SIMOV N, LANGOUROV M, GROZEVA S, GRADINAROV D (2012) New and Interesting Records of Alien and Native True Bugs (Hemiptera: Heteroptera) from Bulgaria. *Acta zoologica. Bulgarica,* 64, 3, 241-252.

STOJANOVA, A, GYÖRGY Z, LÁSZLO Z (2011) New Seed Beetle Species to the Bulgarian Fauna: *Bruchidius siliquastri*, Delobel (Coleoptera: Chrysomelidae: Bruchinae) *Ecologia Balkanica,* 3, 1, 117-119.

STRAWINSKI K (1959) Heteroptera for the fauna of Bulgaria. *Bulletin de l' Institut de Zoologie et Musée,* 8, 77-81.

TASHEVA-TERZIEVA E, YOVKOVA M, PENCHEVA A (2011) The first note of *Idiopterus nephrelepidis* Davis, 1909 (Hemiptera: Aphididae) from Bulgaria. *ZooNotes,* 26, 1-4.

TOMOV R, TRENCHEVA K, TRENCHEV G, KENIS M (2007) A review of the

non-indigenous insects of Bulgaria. *Plant science*, 44, 3, 199-204.

TOMOV R, TRENCHEVA K, TRENCHEV G et al. (2009a) Non-indigenous insects and their threat to biodiversity and economy in Albania, Bulgaria and Republic of Macedonia. PENSOFT, Sofia –Moscow, Bulgaria, 114 pp.

TOMOV R, TRENCHEVA K, TRENCHEV G, KENIS M (2009b) The Multicolored Invasive Asian Ladybird *Harmonia axyridis* (Pallas, 1773) (Coleoptera: Coccinellidae) New to the Fauna of Bulgaria. *Acta zoologica bulgarica,* 61, 3, 307-311.

TOMOV R, TRENCHEVA K, TRENCHEV G (2010) The alien insects as a problem for sustainable development of Bulgaria. *Management and sustainable development,* 1, 382-389.

TOMOV R, TRENCHEVA K, TRENCHEV G, KENIS M (2007) A review of the non-indigenous insects of Bulgaria. *Plant science,* 44, 3, 199-204.

TRENCHEV G & TRENCHEVA K (2009) *Prociphilus fraxinifolii* Riley (Hemiptera, Ahididae, Eriosomatinae) a species new to the Bulgarian Fauna. *Journal of Sustainable forestry*, 79-82.

TRENCHEV G, IVANOVA I, NICOLOV P, TRENCHEVA K (2007) *Metcalfa pruinosa* (Say, 1830) (Homoptera, Flatidae) a species new to the Bulgarian fauna. *Plant Science,* 34, 3, 195-198.

TRENCHEVA K, TRENCHEV G, TOMOV R, SAN-AN WU (2010) First report of *Aulacaspis yasumatsui* Takagi, 1977 (Hemiptera: Diaspididae) in Bulgaria. *Plant science*, 47, 206-209.

TRENCHEVA K., TRENCHEV G, TOMOV R, IVANOVA S, WU SAN-AN (2012) Scale insects (Hemiptera: Coccoidea) of Bulgaria AS OOD Sofia, Bulgaria pp. 60

TSALEV M (1968) Prinos kum prouchvane faunata na stitonosnite vushki (Homoptera, Coccidea) po parkovite i ukrasnite rastenia v Bulgaria. *Izvestia na zoologicheskia institute s muzei,* 28, 205-218.

VANEVA-GANCHEVA T & GRIGOROVA P (2010) Monitoring and a spread of the potato tuber moth (*Phthorimaea operculella* Zell.) in Bulgaria. *Plant science,* 47, 4, 310-316.

VÉTEK G & RÉDEI D (2009) First record of *Acizzia jamatonica* (Kuwayama) (Hemiptera: Psyllidae) in Bulgaria. *Acta zoologica bulgarica,* 61, 3, 323-325.

YOVKOVA M, PETROVIĆ-OBRADOVIĆ O, TASHEVA-TERZIEVA E, PENCHEVA A (2013) Aphids (Hemiptera, Aphididae) on ornamental plants in greenhouses in Bulgaria. In: Popov A, Grozeva S, Simov N, Tasheva E (Eds) Advances in Hemipterology. *ZooKeys,* 319, 347–361.

A new approach to control the Colorado potato beetle *Leptinotarsa Decemlineata* (Say) (Coleoptera: Chrysomelidae): Botanicals

Esengül ERDEM[1]

The Colorado potato beetle, Leptinotarsa decemlineata (Say) (Coleoptera: Chrysomelidae), is a global destructive pest of potato Solanum tuberosum L. (Solanaceae). The beetle's origin is supposed to be the highlands of Mexico. Its rapid spread to the other parts of the world began in 1874 from Atlantic coast by the Spanish settlers. Over the time it has spread to the other continents for several reasons, especially as a result of its high tolerance to the cold climates. The beetle has been detected for the first time in Turkey in 1963. Since then, there have been some outbreaks in the country. In this study, it is going to be discussed whether the botanical insecticides as a biological control method will be able to regain its real prestige or not. Also the invasion history and management attempts of this pest in Turkey will be described.

Keywords: The Colorado Potato Beetle Leptinotarsa decemlineata (Say) (Coleoptera: Chrysomelidae), botanical insecticides, invasion, biological control.

1 Canakkale Onsekiz Mart University, Canakkale, Turkey; E-mail: e.erdem@comu.edu.tr

The potential use of entomopathogenic nematodes against tomato leaf miner *Tuta absoluta* (Lep: Gelechiidae)

Çiğdem GÖZEL[1], Uğur GÖZEL[1]

Tuta absoluta Meyrick is native to Central America, widely distributed in South America and known as the most devastating tomato pest all over the world which can cause up to 100 % loss of production. The species was first recorded in 2009 in Turkey and showed a rapid spread, causing serious damages in almost all tomato fields. The extensively use of pesticides against *T. absoluta* was not effective enough and negatively affected it's native natural enemies. It is essential that an efficient method for control of the population of the pest to be developed in order the use of insecticides in tomato production areas to be reduced. Entomopathogenic nematodes can be used effectively to control soilborne pests andthe use of entomopathogenic nematodes has been rapidly increased all over the world as well as in Turkey. In this study, an extensive survey has been conducted to identify EPNs in Turkey. In addition, the efficacy and the potential of entomopathogenic nematodes against *Tuta absoluta* in tomato fields in Turkey were investigated. In this respect, the success of native natural enemies against alien species in the biological control were discussed.

Keywords: *Tuta absoluta*, entomopathogenic nematodes, biological control, tomato.

1 Canakkale Onsekiz Mart University, Canakkale, Turkey; E-mail: cigdemgunes@comu.edu.tr

INTERNATIONAL PARTICIPANTS

Name-Surname	Institution	E-mail
Ejaz Ahmad	PMAS Arid Agricultural University	Ejazabbasi2001@yahoo.com
Paulina Anastasiu	University of Bucharest	anastasiup@yahoo.com
Sajmir Begiraj	University of Tirana	s_beqiraj@yahoo.com
Yurii Kornilev	Bulgarian Society for the Protection of Birds	yurii.kornilev@bspb.org
Ana Matkovic	University of Novi Sad	
Ermira Milori	University of Tirana	
Bozena Mitic	University of Zagreb	bozena.mitic@biol.pmf.hr
Nikolay Natchev	University of Vienna	Natchev@gmx.at
Zahid Naseer	PMAS Arid Agricultural University	
Georgi Popgeorgiev	Bulgarian Society for the Protection of Birds	georgi.popgeorgiev@gmail.com
Milica Rat	University of Novi Sad	milica.rat@gmail.com
Markola Saulic	University of Novi Sad	
Tihomir Stefanov	Bulgarian Museum of National History	tishos@gmail.com
Danijela Stesevic	University of Montenegro	danijela.denist@gmail.com
Teodora Trichkova	Bulgarian Academy of Sciences	trichkova@gmail.com
Nikolay Tzankov	Bulgarian Museum of National History	ntzankov@gmail.com
Vladimir Vladimirov	Bulgarian Academy of Sciences	vladimir_dv@abv.bg
Argyro Zenetos	Hellenic Centre for Marine Research	zenetos@hcmr.gr

TURKISH PARTICIPANTS

Name-Surname	Institution	E-mail
Prof. Dr. Sedat Laçiner	Çanakkale Onsekiz Mart University	
Prof. Dr. Feyzi Uğur	Çanakkale Onsekiz Mart University	
Ali Rıza Tekin	Çanakkale Government	
Okan Acar	Çanakkale Onsekiz Mart University	okanacar35@yahoo.com
Necmi Aksoy	Düzce University	necmiaksoy@duzce.edu.tr
Nihat Akyol	Kocaeli University	Hakan.akyol@kocaeli.edu.tr
Sefer Demirbaş	Çanakkale Onsekiz Mart University	sefer.demirbas@gmail.com
Ahmet Durmaz	Çanakkale Onsekiz Mart University	
F. Kübra Erbay	Düzce University	fatmakubra.erbay@gmail.com
Esengül Erdem	Çanakkale Onsekiz Mart University	e.erdem@comu.edu.tr
Hanife Genç	Çanakkale Onsekiz Mart University	hgenc@comu.edu.tr
Lale Gençoğlu	Düzce University	lalegencoglu@duzce.edu.tr
Çiğdem Gözel	Çanakkale Onsekiz Mart University	cigdemgunes16@yahoo.com
Uğur Gözel	Çanakkale Onsekiz Mart University	ugozel@comu.edu.tr
Kübra Gözükara	Erciyes University	
Hikmet Günal	Gaziosmanpaşa University	hikmet.gunal@gop.edu.tr
Meliha Merve Hız	Çanakkale Onsekiz Mart University	mervemeliha@comu.edu.tr
Doğan Işık	Erciyes University	zorludogan@hotmail.com
Khawar Jabran	Adnan Menderes University	khawarjabran@gmail.com
Ersin Karabacak	Çanakkale Onsekiz Mart University	krbersin@comu.edu.tr
Arif Karakaya	Ministry of Forestry and Water Affairs	arifkarakaya@ormansu.gov.tr
Ramazan Karatekin	Çanakkale Onsekiz Mart University	
Zeynep Karnas	Erciyes University	
Şerife Gülsün Kırankaya	Düzce Üniversitesi	gulsunkirankaya@duzce.edu.tr

Yasin Köycü	Ministry of Forestry and Water Affairs	ykoycu@ormansu.gov.tr
Emre E. Muslu	Çanakkale Onsekiz Mart University	emreerenmuslu@outlook.com
Hüseyin Önen	Gaziosmanpaşa University	huseyin.onen@gop.edu.tr
Cumali Özaslan	Dicle University	cumaliz@yahoo.com
Şükran Yalçın Özdilek	Çanakkale Onsekiz Mart University	syalcionozdilek@gmail.com
Ali Özpınar	Çanakkale Onsekiz Mart University	aozpinar@comu.edu.tr
Sevcan Öztemiz	Ministry of Food, Agriculture and Livestock	sevcanztemiz@yahoo.com
Burak Polat	Çanakkale Onsekiz Mart University	bpolat@comu.edu.tr
Tansel Serim	Ministry of Food, Agriculture and Livestock	tserim@tagem.gov.tr
Ali Kürşat Şahin	Çanakkale Onsekiz Mart University	aksahin@comu.edu.tr
Çiğdem Şahin	Ministry of Food, Agriculture and Livestock	cigdemyilmaz88@hotmail.com
Cansu Şevik	Çanakkale Onsekiz Mart University	
Gülhanım Türkmen	Erciyes University	
Süleyman Türkseven	Ege University	suleyman.turkseven@hotmail.com
Abdurrahman Uzun	Uygar Tarım	kayahanuzun@uygartarim.com
Kayahan Uzun	Uygar Tarım	kayahanuzun@uygartarim.com
Ayşe Yazlık	Ministry of Food, Agriculture and Livestock	ayseyazlik@gmail.com
Fikriye Yağmur	Çanakkale Onsekiz Mart University	
Baran Yoğurtçuoğlu	Hacettepe University	baranyog@hacettepe.edu.tr
Melek Argün Yıldız	Çanakkale Onsekiz Mart University	

STUDENTS AND FARMERS

Name-Surname	Institution
İlhan Ulus	Farmer (Head of Çanakkale Agriculture Chamber)
Abdullah Fidan	Farmer
Ahmet Değirmenci	Farmer
Badegül Ünsal	Çanakkale Onsekiz Mart University (Student)
Burçak Ardanuç	Çanakkale Onsekiz Mart University (Student)
Derya Çoban	Çanakkale Onsekiz Mart University (Student)
Erdal Ata	Çanakkale Onsekiz Mart University (Student)
Gülay Polatçelik	Çanakkale Onsekiz Mart University (Student)
Gülsüm Palacıoğlu	Çanakkale Onsekiz Mart University (Student)
Hilal Günyayla	Çanakkale Onsekiz Mart University (Student)
Kadir Tül	Farmer
Kamil Kemal Kaş	Çanakkale Onsekiz Mart University (Student)
Mesut Erdoğan	Çanakkale Onsekiz Mart University (Student)
Mustafa Bodur	Çanakkale Onsekiz Mart University (Student)
Nejdet Irak	Farmer
Neslihan Ateş	Çanakkale Onsekiz Mart University (Student)
Nurcan Büyükkurt	Çanakkale Onsekiz Mart University (Student)
Sami Berkay Ergün	Çanakkale Onsekiz Mart University (Student)
Sefa Kavukçu	Çanakkale Onsekiz Mart University (Student)
Seğmen Ünver	Farmer
Serap Öçal	Çanakkale Onsekiz Mart University (Student)
Sezer Küçükkarakaş	Çanakkale Onsekiz Mart University (Student)
Şadiye Zambak	Çanakkale Onsekiz Mart University (Student)
Yağmur B. Harman	Çanakkale Onsekiz Mart University (Student)