

Current Status and Future Prospects of Invasive Plants in Turkey

Huseyin Onen

Department of Plant Protection, Faculty of Agriculture,
Gaziosmanpas University Tokat Turkey



Shahid Farooq

Department of Plant Protection, Faculty of Agriculture,
Gaziosmanpas University Tokat Turkey



Introduction

The introduction and invasion of alien species in new habitats and regions have gained enormous pace over the past century. The Invasive Alien Species (IAS) plants in particular, are posing considerable threats to ecosystem, biodiversity, human health and economies etc. at global level. Spread and establishment of Invasive Alien Plants (IAPs) cause heavy economic losses. Total loss of the global economy has been estimated to 5% of annual production (Pimentel et al., 2002). The increased economic activities; trade, transport, travel and tourism have resulted in introduction of new species in non-native habitats. The human agency either deliberately or accidentally, is the pivotal source of introduction and spread of non-native species in the new ranges in general. Some of the IAPs in different countries were introduced by humans to get different benefits (bio-control agents, food and feed, or other such purposes) or for ornamental purposes without knowing their long term impacts in the introduced ranges. Williamson and Brown (1986) suggested ten's rule which states that 10% of the introduced species become established and only 10% of the established species become invasive. However, recent studies revealed that the rate of introduced species becoming invasive is exceeding 50% which shows that invasion process has gained enormous pace.

The introduced plants in new ranges cause disastrous results. IAPs have negative impacts on each and every aspect of habitats and have strong potential to replace native species. They also pose significant concerns to the conservation of endangered plants as they have the potential to replace them from the habitats of high conservation value. IAPs surpass natives by disturbing habitat balance, imbalance plant communities, and are carrier of diseases which might destroy economically important crops and spread to agricultural areas. Aquatic habitats are also severely affected by the invasion of IAPs. Decline in water quality, damage to inland ecosystems, hurdles in irrigation systems, hindrance in navigation system and decline in fish production due to loss of oxygen are some of the damages caused by the aquatic IAPs. Interference in recreational activities and losses to infrastructure are some other negative impacts of aquatic IAPs.

Some allergenic IAPs including *Heracleum mantegazzianum* Sommier & Levier, *Ambrosia artemisiifolia* L. etc. have greatly diverted the attentions of ecologists towards the impacts of introduced species. However, the most significant impacts of IAPs are the drastic changes of ecological balance due to intense competitions for light, nutrients, water, space and other resources with the natives. The replacement of native species by IAPs changes the animal communities associated with them thus disturbs the ecological balance of the invaded habitats.

Climate change, changing land use patterns, continuous disturbance of established habitats and lack of awareness about the negative impacts of IAPs further accelerate the invasion process and create new habitats favorable for invasion (Richardson and Rejmanek, 2011; Lockwood et al., 2013). Phenotypic plasticity, being free from natural enemies, reproductive ability even under extreme climates and excellent acclimatization abilities of IAPs strengthen the invasion under varying climatic regimes and disturbance levels.

Current Status of IAPs in Turkey

Turkey consists of two peninsulas that bridge the Europe and Asia continents. The large peninsula (Anatolia) connected with Asia while, the small one (Thrace) is connected to Europe. The country is bounded by seas on three sides; the Aegean Sea on the west, the Black Sea on the north and the Mediterranean on the south, while the Sea of Marmara is enclosed within the north-west. The country has varying landscapes including arid plains to high mountains (tropical and sub-tropical) with huge latitudinal and climatic variations.

The geological and climatic variations have produced tremendous ecological diversity. On the basis of floral richness; Turkey is one of the richest country in the middle latitudes in terms of plant diversity with a total of 12000 plant species (Arslan et al., 2015), and new species are being added with continuing research. Recent studies (Anonymous, 2015) reported that a new taxon to the flora of the country is added in every 5 and half day. Turkey is among the countries having great number of endemic species (about one third of total species in Turkey are endemic). The country hosts even some exotic crops such as tea, banana, avocado, papaya and kiwi. These facts indicate that the country has suitable habitats for almost all kind of terrestrial and/or aquatic IAPs (trees, shrubs, grasses, herbs or vines etc.).

Talking about the agricultural potential, the country has an important position in both imports and exports of agricultural, livestock and forestry products, especially breeding materials (seed and seedling imports etc.). Thus contaminated agricultural products are important pathways for introduction of IAPs. The classic examples of invasive plants introduced to Turkey through importing seeds are; *Physalis* spp., *Cuscuta campestris* Yuncker, *Echinochloa oryzicola* (Vasinger) Vasinger, *Paspalum* spp, *Eleusine indica* (L.) Gaertn. etc. (Onen, 2015).

Turkey is one of earliest human settlements in the world, located at the intersection of transport and migration routes, and a resting location for animals especially birds on their migration between their summer and winter homes. Due to historic and cultural diversity of country millions of tourists visit the country every year. Tourism and animal migrations are some other pathways of introduction and spread of the IAS in the country. Many different imported plants are also being used for ornamental or recreational purposes at touristic resorts/places, parks and gardens such as *Amorpha fruticosa* L., *Albizia julibrissin* Durazz, *Broussonetia papyrifera* (L.), *Lonicera japonica* Thunb. On the other hand aquatic plants such as *Echornia crassipes* (Mart.) Solms and *Ludwigia peploids* (Kunth) P.H. Raven etc (Onen, 2015) are invasive in aquatic and marine habitats of the country. Small aquatic plants are frequently used in aquariums and are easily available through internet at cheap price. Although, *E. crassipes* is listed on quarantine list of country, it is being sold on internet. The plant is thrown out after short term use and thus expanding its range rapidly.

The ongoing projects of road construction, infra structure development, energy project preferences have given the pace to transportation of goods from and across the borders. Moving vehicles, transportation of soil over long distances and movement of workers provide ideal environments for range expansion of exotic plants. The common ragweed in Turkey is an excellent example of the range expansion of the exotic plants which has expanded its range along the newly constructed Black Sea highways (Onen et al., 2013, 2014). The plant was transported from its initial intrusion point to over long distances.

In the current scenarios of increased awareness about IAPs, awareness on invasive plant's adversities in Turkey is still not adequate. Scientific community has been continuously raising voice on the issue of biological invasions by organizing national and international conferences and workshops. The 2nd International Workshop on Invasive Plants in the Mediterranean Type Regions of the World, International Workshop on IAS in Agricultural and Non-Agricultural Areas in ESENIAS Region, 8th European Conference on Biological Invasions: "Biological Invasion, from understanding to action", and Invasive Plants Workshop "Reality or Lurking Horror" have been conducted in Turkey in 2010, 2013, 2014 and 2015 respectively are some of the voices/efforts to create the awareness. The increasing number of alien species is being recorded and is considered as new additions to the flora of country. However, the non-seriousness about the issue is depicted from the fact that only two species are taken on the quarantine list of Turkey. The species included in quarantine list are (*Arceuthobium* spp. and *E. crassipes*).

An estimation of the flora of Turkey indicates that 1.5% of the species in Turkey are exotics (Arslan et al., 2015). The book entitled "Flora of Turkey" describing Turkish flora doesn't describe the origin of many species thus recognition of total number of alien plants is difficult. Therefore, descriptions of native and alien species based on their origin are urgently needed. Although many scientists are describing the species which are alien to the flora of Turkey, but the comprehensive list of alien plants in Turkey is lacking. The lack of collaboration among different public and private organizations and scientific communities and awareness about IAPs are the main reasons of absence of such kind of information.

The field of Invasion Ecology in Turkey is younger than other parts of the Europe due to which scientific studies and administrative attention to IAPs are limited. For example, some of the European countries have already established monitoring and information systems (MIS) for IAS. The countries have greatly benefited from established MIS for early detection and managing IAPs. Monitoring and information system for IAPs in Turkey have not been established yet. In recent years, some surveys have been conducted to determine the current status of a limited number of species. For example a project funded by Gaziosmanpasa University is aimed at mapping the distribution of *A. artemisiifolia* in Black Sea region. The project is accepted as part of Cost Action "Sustainable Management of *Ambrosia artemisiifolia* in Europe" (SMARTER FA-1203). Most recently a project has been initiated for developing "Monitoring and Information System of Invasive Alien Plants in Turkey" funded from The Scientific and Technological Council of Turkey (TUBITAK). The project is accepted as a part of the COST Actions of European Union (Alien challenge - FA-1209).

The project deals with / aimed at providing information on the current and potential distribution of five troublesome invasive plants in Turkey (*Ambrosia artemisiifolia*, *Sicyos angulatus*, *Persicaria perfoliata*, *Physalis angulata* and *Physalis philadelphica*) along with the characterization of some biological and ecological aspects. Further the most important aim of the project is to develop the early detection and rapid response system of IAS in Turkey through a web based system (www.i-bil.com). The project is continuing and the system is under development.

Although the project is continuing, five plants will not be enough to describe the IAPs of Turkey. Therefore, a strong collaboration is needed among several organizations to map a real picture of IAPs. Furthermore recently, 48 scientists working in diverse fields of research have completed the first volume of "Invasive Plants Catalogue of Turkey" which has been published by the Ministry of Agriculture and Livestock. The Catalogue is published in local language (Turkish) indicating a positive sign that awareness of invasive plants has started to increase. The catalogue will also help to improve web based MIS. In addition, a public awareness campaign has also been initiated about the adverse impacts of IAPs by non-governmental organization (NGO) supported by Ministry of Environment and Urbanization. The organization has mapped the distribution of *Sicyos angulatus* (a troublesome vine in tea plantations) in the Black Sea Region of the country and prepared the leaflets to describe possible management options. Although several works have recently been started, effective combating with IAPs demands a lot more. The mapping and establishment of monitoring and information system will not be enough to win the war. In current scenarios of missing efforts on invasive plants, future invasions are suspected to be stronger and irresistible.

Several scientists working in the field of invasion ecology have pointed out the importance of concerted actions against the spread of other IAS groups and general management options are being practiced (especially crop pests and diseases) in the country. Many invasive plants have been recorded in agricultural (sunflower, cotton, tea plantations, wheat etc.) and non agricultural areas (Onen, 2015) however, no effective management options are being practiced against plants compared to other IAS taxonomic groups. Therefore, serious efforts are needed to accomplish the task related to stop the further invasion and management of IAPs.

Future Prospects

The focus on already established species may give rise to the invasive species of future. While focusing on the established species and trying to understand the invasion process, the newly introduced species are ignored and silently invade their new ranges. The newly recorded alien plants will become invasive in various regions in the future. Although awareness on IAPs is slowly rising in Turkey, the attention on already established species is not enough to tackle the issue of current and future invasions.

The current state of knowledge on IAPs in Turkey suspects a challenging future for the ecologists as the silent invaders in the country will cause considerable losses in multidimensional habitats. The most challenging task in the future is expected in health sector as pollen allergies, dermatitis, phytophotodermatitis and asthma etc. caused by IAPs. Currently, pollen inventory in the country has almost totally been ignored. The awareness is required to warn public adopting safety measures to avoid the negative/allergenic impacts of IAPs. The other important sector that will be affected by invasive plants is the agriculture. Many invasive plants have already been recorded and found to be established in different cropping zones causing considerable yield reductions in sunflower, cotton, corn, soybean, wheat etc. (Onen, 2015). High reproductive potential of these invasive plants coupled with climate change might probably cause significant difficulties in agriculture production in future.

The IAPs observed along the roadsides are expected to expand their ranges inwards as a source of infection thus affecting the arable crops by competition for light, nutrients and space. The costs incurred on mowing along the roadsides, natural and rural areas will be massive. The existence of endemic and endangered plants occurring in natural habitats is likely to be challenged. The future changing climatic scenarios are also important issues likely to yield challenging results in terms of range expansion of IAPs. The warming over Turkey's climatic regions is suspected to be in the range of 2 to 5 °C. These changing climate scenarios will affect the agriculture both by decreasing the yield due to frequent drought episodes, and opening new habitats for already established and new IAPs.

The article is concluded with the remarks that the current works on invasive plants are not sufficient to cope with the pace of biological invasions in Turkey. Rapid and intense invasion of IAPs in different habitats due to the coupled effects of climate change and lack of interest is expected in future resulting in severe ecological and economic losses. Some of the endemic endangered species are also expected to be extinct due to their replacement by exotic plants. Therefore, concerted efforts are needed to create the awareness about IAPs to tackle the issue. However, the increased awareness and research efforts are even not sufficient for the successful management / eradication of these plants. It is recommended that the issue of IAPs must be included in top priority agenda of the country.

Bibliography / More information

- Anonymous 2015. Türkiye'nin floristik (Bitkisel) zenginlik (Floral richness of Turkey). <http://biyologlar.com/index.php/kunena/203-Botanik/4057-turkiye-nin-floristik-bitkisel-zenginligi>. Date Accessed: 02.06.2015.
- Arslan ZF, Uludag A, Uremis I (2015) Status of invasive alien plants included in EPPO Lists in Turkey. EPP/EPPO Bulletin 45 (1): 66-72.
- Lockwood JL, Hoopes MF, Marchetti MP (2013) Invasion ecology, Malden, MA, USA, WileyPublishing.
- Onen H (2015) Invasive Plants Catalogue of Turkey. Ministry of Food, Agriculture and Livestock T.C. Gıda, Tarım ve Hayvancılık Bakanlığı, Tarımsal Araştırmalar ve General Policy Directorate. , Plant Health Research Department. ISBN: 978-605-9175-05-0, Ankara. (In Turkish).
- Onen H, Gunal H, Ozcan S (2013) Invasion status of Common Ragweed (*Ambrosia artemisiifolia* L.) in Turkey In: Uludag et al (eds) Proceedings of 4th ESENIAS Workshop: International Workshop on IAS in Agricultural and Non Agricultural Areas in ESENIAS Region. pp 50.
- Onen H, Gunal H, Ozcan S (2014) The Black Sea highway: The Route of Common Ragweed (*Ambrosia artemisiifolia* L.) Invasion in Turkey In: Uludag et al (eds) Proceedings of 8th International Conference on Biological Invasions from understanding to action. pp 76.
- Pimentel D (2002) Biological Invasions: Economic and Environmental Costs of Alien Plant, Animal, and Microbe Species., Boca Raton, FL: CRC., 369,
- Richardson DM, Rejmánek M (2011) Trees and shrubs as invasive alien species - a global review. Diversity and Distribution 17: 788-809.
- Williamson M, Brown KC (1986). The analysis and modelling of British invasions. Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences 314, 505-522.



Participation du CIHEAM à MEDCOP 21

Le CIHEAM a participé à MEDCOP 21, une rencontre des acteurs de la Méditerranée, qui s'est tenue à Marseille les 4 et 5 juin 2015, en amont de la Conférence des Nations unies sur les changements climatiques (COP21) qui aura lieu à Paris fin 2015.

C'est le directeur adjoint du CIHEAM Montpellier, M. Jean-Paul Pellissier, qui est intervenu pour notre Organisation, lors de l'atelier consacré aux villes et aux territoires durables. Insistant sur l'importance du développement rural pour les stratégies de durabilité en Méditerranée, celui-ci avait pris soin de présenter une communication intitulée « *Villes et territoires de Méditerranée face aux défis de la transition écologique* »



MEDCOP 21 a permis de souligner l'engagement commun dans la lutte contre le changement climatique et a mis en lumière la contribution des collectivités locales, des associations, des entreprises, des réseaux constitués œuvrant en tant que catalyseurs du développement durable.

En se fixant pour objectif de contribuer à la construction d'un véritable Agenda positif Méditerranéen cette manifestation vise aussi et surtout à saisir par-delà les contraintes, les opportunités qu'offre la lutte contre le changement climatique. Elle contribue par des propositions concrètes et partagées à une Méditerranée de projets.

La feuille de route pour la protection du climat est un « Agenda Positif Méditerranéen » qui sera présenté lors de la Conférence des Nations Unies sur le climat, COP 21.