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Review article

Invasive Flora of Albania

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Abstract: Biodiversity loss caused by invasive species may soon surpass the damage done by habitat destruction. Biological invasions are an important component of human-caused global environmental change in this content invasive alien species are now a major focus of global conservation concern. The decisions need to be made on whether benefits derived from the invasive spread of an alien species outweigh the reduced value of ecosystem services, e.g. *Ailanthus altissima* (Mill.) Swingle is a rapidly growing. Mature trees can reach 80 feet or more in eight. *A. altissima* occurs most frequently in lowland roadsides, in Western part of Albania. Tree-of-heaven is a prolific seed producer and can overrun native vegetation. Once established, it can quickly take over a site and form an impenetrable thicket. An *Ailanthus* tree also produces toxins that prevent the establishment of other plant species. The root system is aggressive enough to cause damage to sewers and foundations. Invasion by *A. altissima* in Albania is result of wrong planting practices of foresting in the past. It is necessary to consider actions to deal with the current problems caused by invasive species and to reduce the magnitude of the problem in the future. The aim of the paper is the assessment of the alien flora of Albania and its traits. These data consist of a total of 84 alien taxa. Regarding flowering traits, most of the aliens have a long flowering period (over 1 month) and flower in late spring, summer, and autumn, when few of the native plants are in bloom. The diversity of the ecological characteristics of the plants suggests a potential of impacts that needs to be further assessed. Terms "alien" and "invasive" species are used without regard to their economic, sanitary, aesthetic, ecological, or evolutionary impact. Due to the lack of consensus among authors in the use of these terms, we adopted the following meaning. Invasive alien species in an area is a non-indigenous species that evolved elsewhere and is present in the area of interest.

Keywords: alien flora, invasive, non-indigenous, taxa.

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Introduction

Although the phenomenon of biological invasions has been noted for some time it is only during the last decade that the biological consequences of exotic invasions have been researched extensively. Invasive species are one of our most pressing environmental concerns (Cox, 2004; Charles et al., 2005) and humans have been identified as a major vector in the dispersal of invasive species throughout the world (Sharma et al., 2005).

The problem of invasive aliens has attracted much attention both at the international and national levels (Maheshwari and Paul, 1975;

This is due to the realisation of the significant losses of the biological diversity and function of the ecosystems invaded and the economic and social impacts caused. Vascular plants are among the most ubiquitous invasive organisms, most of the plants have been introduced for agricultural, silvicultural, ornamental, or medicinal purposes.

Two basic questions have fascinated ecologists since biological invasions have become a focal issue of the global change. The first question articulated was "which species invade and under which conditions?" This question has stimulated the search for traits that make plant species potential successful invaders. The second question was "what features of ecosystems make them either prone or resistant to invasions?" This has led to studies on community characteristics and environ- mental conditions under which an invasive event is realised.

Due to climate change and the geographic position of Albania, we (Botany team of Agriculture University) undertake the field trips focused on the new records of flora and study of IAS, their spreads, life forms, statues, and origins.

The study of the alien vascular flora of Albania started in the early 1990's (Demiri, 1983). It became more intense and systematic during the last two decades and many new records were added.

Material and Methods

This study has been realized in 2020-2021 period in different stages: The field trips consist in realizing of floristic inventory accompanied by quantitative and qualitative coefficient (quantity-cover, A-D), sociability, topography, soil, climate etc. Main stage, correlated to the survey process, regards the size determination (Method of minimum area) and selection (method of Mashrut) of survey. Plants are collected equipped with root system, tuber root, leaf, flower etc. Collected plants are conserved in small plastic packet, accompanied by a small card where are written: type of habitats, locality and place of collection. Species determination was made based on: Excursion Flora of Albania, Vangjeli J, 2015.

Records are collected among periods April-May following these stages: - Preparatory stage, Collection of Plant during the field trip and their determination, Elaboration, and data analyses.

Preparatory stage

Collected material in field trip have been elaborated in laboratory, using stereomicroscope, excursionist flora, naphthalene for the herbarium of material collected, presence of rarely and risked species based on Excursion Flora of Albania, Vnagjeli J, 2015.

Collection of Plant during the field trip and their determination

In field trips are realized more than 200 surveys. They consist in realizing in floristic inventory accompanied by quantitative and qualitative coefficient (quantity-cover, A-D), sociability, topography, soil, climate etc.

Main stage, correlated to the survey process, regards the size determination (Method of minimum area) and selection (method of Mashrut) of survey. Plants are collected equipped with root system, tuber. All other data, including the characterisation of species' status, were recorded based on different sources, on a case-by-case basis.

The species entries are supplemented with data on taxonomic position (family), chorology, life habit characteristics (life and growth form, life cycle), habitats, ecological characteristics (flowering period and duration, dispersal type and mode, dispersal agent and dispersal unit) and status.

Status is defined as either casual or naturalised or as unknown if existing information is insufficient for the classification of an alien plant to one of the previous categories.

Life forms are identified according to the system proposed by Raunkiaer (1934, 1937) and modified by Ellenberg (1956) and Ellenberg and Muller-Dombois (1967). Plant chorological categories for the native range of the plants are defined according to Pignatti (1982) while in some cases several additional sources are used.

Results and Discussion

The number of alien taxa (species, subspecies and hybrids) reported so far for Albania is 84 (Table 1). Most of the taxa recorded belong to the families of Amaranthaceae, Fabaceae, Asteraceae (Figure 1). Most of the alien plant taxa in Albania are of Asia origin followed by those of Unknown, American (Figure 2).

As is shown on the Figure 2, we are interested in the regions of the origins of these plants in order to undertake the mitigation measures as well as to accomplish a national strategy related to Invasive plants, Asia is the main continent where these plants come from but the big question is related to unknown statues, it's a big discussion that probably will take time to scientific conclusion related to some of these plants origins.

Table 1. The list of 84 alien taxa (species, subspecies and hybrids) reported from Albania

Family	Species	Status	Chorology
Agavaceae	*Agave americana* L.	N+	N-America
Alliaceae	*Allium cepa* L.	U	W Asiatic
Amaranthaceae	*Amaranthus albus* L.	N+	N-America
	A. caudatus L.	U	Paleotropical
	*A. hybridus*L.	N+	N-America
	A. retroflexus L.	N+	N-America
	A. spinosus L.	C	Neotropical
	A. viridis L.	N+	S-America
	Atriplex hortensis L.	N	Asiatic
	Beta vulgaris L. subsp. Vulgaris	C	Unknown
	Chenopodium ambrosioides L.	N+	Neotropical
	Chenopodium albüm L.	N	America
	Chenopodium ambrosioides L	N+	Neotropical
	Spinacia oleracea L.	C	SW Asiatic
Apiaceae	*Coriandrum sativum* L.	C	SW Mediterranean
	Coriandrum sativum L.	C	SW Mediterranean
	Daucus carota L. subsp. sativus (Hoffm.)	U	Unknown
Asphodelaceae	*Aloe vera* (L.) Burm. f.	N	NE-African
Asteraceae	*Ambrosia artemisiifolia* L.	U	N-America
	Artemisia annua L.	U	Asiatic
	Calendula officinalis L.	C	Tropical
	Cynara scolymus L.	C	Unknown
	Helianthus annuus L.	C	S American
	Xanthium spinosum L.	N+	S American
Brassicaceae	*Brassica napus* L.	N	Unknown
	B. oleracea L.	N	W European
	Lunaria annua L. subsp. annua	U	Unknown
	Sinapis alba L.	N+	Unknown
Cactaceae	*Opuntia ficus-barbarica* A. Berger	N+	Neotropical
	Opuntia vulgaris Mill.	N+	N-America
Campanulaceae	*Campanula medium* L.	C	NW Mediterranean-Mont
Cannabaceae	*Cannabis sativa* L.	U	Asiatic
	Humulus lupulus L.	U	European-Caucasian
Caprifoliaceae	*Lonicera japonica* Thunb.	U	E Asiatic
Convolvulaceae	*Cuscuta campestris* Yuncker	N+	N-America
	Ipomoea purpurea (L.) Roth	N	Neotropical
Cucurbitaceae	*Cucurbita pepo* L.	C	C American
Euphorbiaceae	*Euphorbia maculata* L.	N+	N -American
	*Ricinus communis*L.	N+	Paleotropical
Fabaceae	*Amorpha fruticosa* L.	N	N-America
	Gleditsia triacanthos L.	C	N-America
	Lathyrus sativus L.	N	Unknown
	Lens culinaris Medik.	C	Unknown
	Lupinus luteus L.	U	W Mediterranean
	Medicago sativa L.	C	Asiatic
	Pisum sativum L.	N	Sub-cosmopolitan
	Robina pseudoacacia L.	N+	N-America
	Trifolium hybridum L	C	Asiatic
	Vicia sativa L.	U	Unknown
Hydrocaritaceae	*Elodeae canadensis* L.	N+	America
Iridaceae	*Iris germanica* L.	N	Unknown
Juglandaceae	*Juglans regia* L.	N	America
Lamiaceae	*Lavandula angustifolia* Mill.	U	Unknown
	Melissa officinalis L.	U	Asiatic

	Ocimum basilicum L.	C	Asiatic
Linaceae	*Linum grandiflorum* Desf.	C	African
	Linum usitatissimum L.	N	Unknown
	Linum grandiflorum Desf.	C	African
Malvaceae	*Gossypium herbaceum* L.	N	SE Asiatic
	Gossypium hirsutum L.	N	N-America
	Malva sylvestris L.	N	E Asiatic
Moraceae	*Morus alba* L.	N	Asiatic
	Morus nigra L	N	Asiatic
Myrtaceae	*Eucalyptus camaldulensis* Dehnh.	N	Autralian
Onagraceae	*Oenothera biennis* L.	N	Sub-cosmopolitan
Papaveraceae	*Papaver somniferum* L.	C	Asiatic
Plantaginaceae	*Veronica filiformis* L.	C	Asiatic
	Veronica persica Poiret	N+	Asiatic
Poaceae	*Arundo donax* L.	N+	Asiatic
	Hordeum murinum L.	C	Asiatic
	Phalaris canariensis L	N	Macaronesian
	Zea mays L.	C	Neotropical
Polygonaceae	*Fallopia japonica* (Houtt.) Ronse Decr.	U	E Asiatic
Ramnaceae	*Zizyphus zizyphus* (L.) Meikle	U	Asiatic
Ranunculaceae	*Nigella sativa* L.	U	SW Asiatic
Rosaceae	*Malus domestica* Borkh.	C	Unknown
	Prunus domestica L.	U	Unknown
	Pyrus communis L.	U	Asiatic
Salicaceae	*Populus* × *canadensis* hyb. Moench	U	Unknown
Sapindaceae	*Acer negundo* L.	N+	N-America
Simaroubaceae	*Ailanthus altissima* (Mill.) Swingle	N+	Asiatic
Solanaceae	*Nicotiana tabacum* L.	C	N American
	Solanum tuberosum L.	C	S American
Vitaceae	*Vitis vinifera* L.	N+	S American

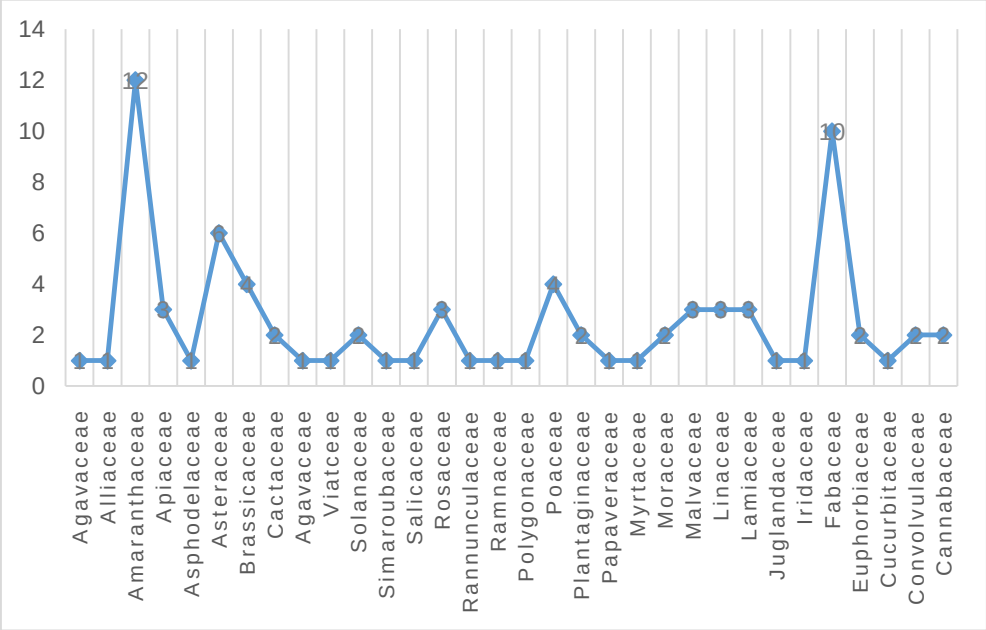

Figure 1. Number of species in each family

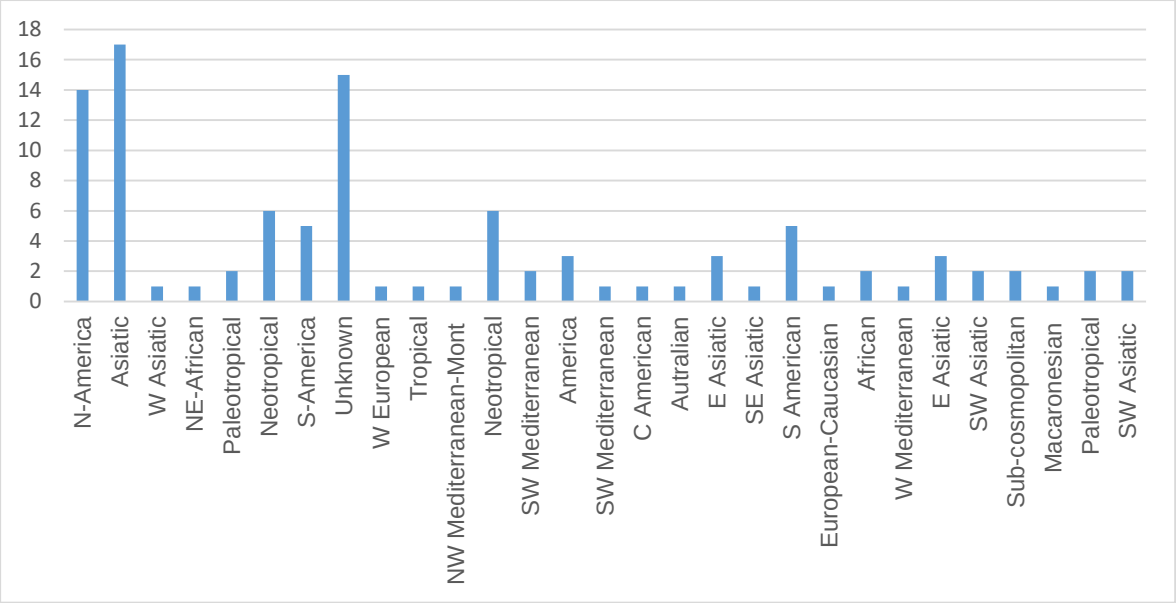

Figure 2. Regions of the origin of the invasive alien plants of Albania.

Notably, most of the alien taxa occur in disturbed or man-made habitats such as cultivations, roadsides, fallow lands and waste deposits and only a limited number intrude natural habitats such as coastal habitats. The alien flora of Albania is not yet fully studied, since several regions and habitats likely to host such species are under-investigated. However, it is expected that even if new data will be available, the trends presented above will not change significantly. Some of these are naturalized but some of them are still uncertain (Figure 3).

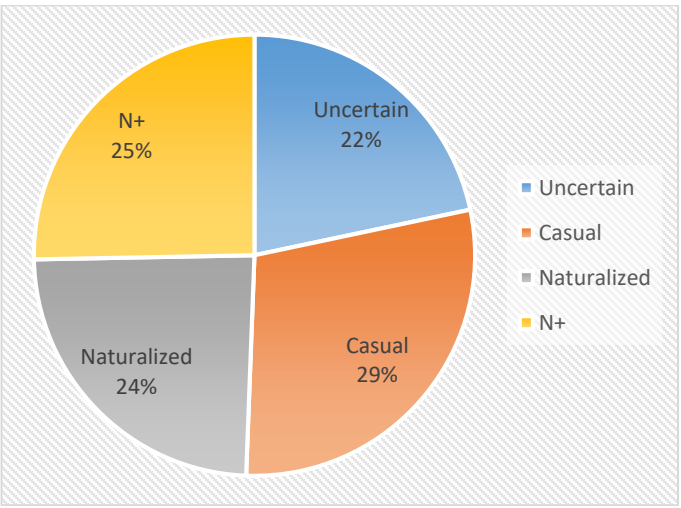

Figure 3. Status of the alien plant taxa of Abania: Uncertain (U), Casual (C), Naturalized (N), Good Naturalised (N+)

Conclusions

To achieve this goal, we must build up an effective and visionary management plane that can be implemented at several scales, from a homeowner working in his or her own backyard to large government agencies taking a nation-wide approach. The decision to eradicate a species versus contain it can depend on several factors, including, but not limited to, the type of habitat, characteristics of the organism, the spatial dimensions of the spread, time available to dedicate to control, and cost. Many of these factors may also play into the decision of which specific control technique(s) to utilize.

Features of IAS

Invasive species possess characteristic features like “pioneer species” in varied landscapes, tolerant of a wide range of soil and weather conditions, generalist in distribution, produces copious amounts of seed that disperse easily, grows aggressive root systems, short generation time, high dispersal rates, long flowering and fruiting periods, broad native range, abundant in native range. Preliminary data, (Shehu, J. 2014) from one interesting study shows that the decision to eradicate a species versus contain it can depend on several factors, including, but not limited to, the type of habitat, characteristics of the organism, the spatial dimensions of the spread, time available to dedicate to control, and cost.

Some aspects of alien plant ecology that influence control strategies are as follows:

- Invasive aliens continue to spread because natural predators were not imported from the plant's home range and native predators are too weak; example- *Robinia*

pseudacacia is found naturalized in all regions of Albania. Black locust has been planted extensively for its nitrogen fixing abilities, as a source of nectar for honeybees, and for fencepost and hardwood lumber. It is commonly found in disturbed areas such as old fields, degraded woods, and roadsides. Due to its rapid growth, black locust has been promoted by foresters.

- After an alien plant is introduced, there is a "lag phase" of decades to centuries before an exponential spread phase. Thus, some species that currently appear non-invasive may eventually begin to spread rapidly. 3. Invasive alien plants can prevent or retard natural succession and reforestation by forming dense infestations.
- Invasion by aliens continues to decrease biological diversity and detract from their primary mission.
- The partial shade tolerance of some alien species allows them to become established underdeveloped forest canopies.
- The initial spread of aliens was observed along highway and utility rights-of-way, "disturbed habitats," and riparian systems, greatly facilitates migration into extensive forest areas; and because many "disturbed habitats" occur in cities, alien plants can present severe problems for urban forestry programs, which is made more difficult by alien species mixtures.
- The invasions potentially lead to an increase in species richness, as invasive species are added to the existing species pool. Also leads to extinction of native species, resulting in decrease of species richness. The negative interactions is primarily the competition with natives for food and sustenance, which may not allow coexistence.

Recommendations

The Ministry of Environment must take some forest measures involving all public and private stakeholders to incorporate the new philosophy of prevention and control of invasive alien species, stopping these wrong.

- There is a consensus that the international introduction of species should be avoided unless detailed assessments show that the benefits of an introduction are much greater than the associated risks.
- The subset of alien species that are invasive can have significant environmental, economic, public and health impacts and present a significant risk of the wholesale homogenization of ecosystems. Invasive alien species can have a major impact on Albania's environment, threatening individual species and reducing overall species abundance and diversity. Prevention of IAS introductions is generally far more cost-effective and environmentally desirable than measures taken after IAS introduction and establishment.
- If an IAS has been introduced, early detection and rapid action are crucial to prevent it.
- Establishment the preferred response is often to eradicate the organisms as soon as possible.
- Where eradication is not feasible or resources are not available, containment and long-term control measures should be implemented. However, it is important to go further than this basically defensive approach. Conservation policies need to include restoration measures for species, natural habitats and ecosystems that have been affected by biological invasions.
- The government must minimize the entry of invasive species into the country thorough inspections of international shipments, customs checks, and proper quarantine regulations.
- To better control the entry of invasive insects' measurements as light and ground traps and early deductions must be applied.
- The public can also participate in invasive species prevention by educating themselves about this problem and by making informed decisions on related issues.

Ethical Approval

No need to ethial approvel for this study.

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The authors do not declare any fund.

Conflict of Interest

The authors declare that they have no conflict of interest.

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