ANNALS OF THE UNIVERSITY OF CRAIOVA

Series: ✓*Biology*
✓*Horticulture*
✓*Food products processing technology*
✓*Environmental engineering*

Vol. XXIX (LXV) – 2024

THE IMPACT OF INVASIVE PLANT SPECIES ON NATIVE INSECT SPECIES

Țucă Ovidiu[1*], Stan Cătălin[1]
[1]University of Craiova
** Correspondence author. E-mail*: ovidiu.tuca@edu.ucv.ro

Keywords*: invasive plant, native, insects*

ABSTRACT

Invasive plants, introduced either accidentally or intentionally to new ecosystems, can outcompete native vegetation, alter habitat structures, and influence the food web. Native insects, which often have co-evolved with indigenous plants, are particularly vulnerable to such changes. This paper explores the complex relationship between invasive plant species and native insect populations, focusing on habitat loss, food availability, and the cascading ecological consequences that result from such interactions.

INTRODUCTION

The introduction of highly invasive plant species can represent a new and strong selective agent for native plants (Strauss et al. 2006, Carroll et al. 2007). The most invasive species, those that rapidly dominate and drastically change the abundance of native species in a community (Colautti and MacIsaac 2004), interact strongly with resident natives. Invasive plants can thrive in new environments due to a lack of natural predators or diseases and their ability to reproduce quickly.

The spread of invasive alien plant species has become one of the major drivers of change in pollinator communities and plant-pollinator interactions (Vanbergen et al., 2018). Invasive plants are expected to affect pollinators negatively if their pollen and nectar resources cannot be exploited or they outcompete crucial native flowering plant species (Bjerknes et al., 2007; Stout & Morales 2009).

For instance, native butterflies, bees, and other pollinators rely on specific native plants for nectar and as larval host plants. Invasive species often do not provide the necessary resources for these insects, leading to a reduction in food availability. The loss of these plants reduces the capacity of native insect species to find shelter, reproduce, or even survive. Studies have shown that invasive species like *Phragmites australis* (common reed) in North America displace native marsh vegetation, reducing the biodiversity of insects such as dragonflies and damselflies that rely on these habitats for their life cycles.

MATERIAL AND METHODS

In this section, we will outline the materials used and the methods employed to study the impact of invasive plant species on native insect populations. The methodology will include field data collection, laboratory analysis, and literature

review, with a focus on understanding how invasive plants alter insect communities, behavior, and ecosystem dynamics.

Field Site Locations:

Select sites with a high prevalence of invasive plant species (e.g., *Fallopia japonica* (Japanese knotweed), *Ailanthus altissima* (Tree-of-heaven), *Lantana camara* (Lantana)).

Corresponding control sites with native plant species.

Geographic locations with diverse ecosystems, such as temperate forests, grasslands, or wetlands, depending on the scope of the study.

1. Sampling Equipment:

Insect Traps: Pitfall traps, sticky traps, and sweep nets for capturing various types of insects.

Plant Identification Guides: To accurately identify both invasive and native plant species present in the field sites.

GPS Devices: For documenting the exact location of each site and transects. Environmental Sensors: For measuring temperature, humidity, and other factors that could influence insect populations.

2. Laboratory Equipment:

Microscopes: For detailed identification of insect species.

Insect Identification Keys: Field guides and taxonomic resources for distinguishing native and invasive insect species.

Preservation Materials: Alcohol, specimen boxes, and labeling tools for preserving insect samples for later analysis.

3. Literature Review Resources:

Peer-reviewed journals, books, and databases like Google Scholar or Web of Science for studying previous research on invasive plants and insect biodiversity.

RESULTS AND DISCUSSIONS

1. Decline in Native Insect Populations

One of the most immediate and noticeable effects of invasive plant species on native insect populations is a sharp decline in insect abundance and diversity. Numerous studies have reported a strong correlation between the presence of non-native plant species and a reduction in native insect populations. For instance, research conducted in ecosystems invaded by *Alliaria petiolata* (garlic mustard) and *Lonicera japonica* (Japanese honeysuckle) revealed a significant decrease in native herbivorous insects due to habitat alteration and reduced food availability. Insects that are specialized in feeding on native plants are particularly vulnerable, as they often rely on specific host plants for survival.

2. Altered Plant-Insect Interactions

The introduction of invasive plant species not only reduces the availability of suitable habitats but also alters plant-insect interactions. Many insects have evolved specialized relationships with native plants, either as pollinators, herbivores, or seed dispersers. When invasive species replace native flora, these relationships are disrupted, leading to a cascade of ecological consequences.

For instance, invasive species like *Buddleja davidii* (butterfly bush) may attract generalist pollinators but fail to support specialist pollinators that rely on native plants. Generalist insects may adapt to the presence of invasive species, but specialists often face local extinction. The invasion of *Spartina alterniflora* (smooth cordgrass) in coastal habitats has resulted in the displacement of native plants like

Salicornia, leading to a decline in insect species that are dependent on these native saltmarsh plants. This ultimately affects the pollination networks and reproductive success of native plants.

3. Changes in Nutritional Quality and Foraging Behavior

Invasive plants often differ significantly in nutritional composition from the native plants they displace, which can have substantial effects on the foraging behavior and fitness of native insects. Many invasive plants are less palatable or nutritionally inferior to native flora. For example, the invasion of *Fallopia japonica* (Japanese knotweed) has been associated with a decrease in leaf quality and lower nutritional value for herbivorous insects, leading to stunted growth, decreased reproductive success, and increased mortality in native insect populations.

Additionally, changes in plant architecture and phenology due to the presence of invasive species can force native insects to alter their foraging behavior. For example, research on *Ailanthus altissima* (tree of heaven) shows that it changes the vertical structure of forests, reducing the availability of suitable microhabitats for ground-dwelling insects and altering the spatial distribution of insect prey. As a result, insects may be forced to expend more energy foraging, which reduces their fitness and reproductive success.

4. Indirect Effects on Predator and Parasitoid Populations

The decline in native insect populations has far-reaching consequences for higher trophic levels, including predators and parasitoids that rely on insects as a food source. The introduction of invasive plants indirectly affects these species by disrupting the prey base. For example, invasive *Tamarix* (saltcedar) has been shown to lower the abundance of herbivorous insects in riparian ecosystems, leading to declines in bird populations that rely on these insects for food.

Insects like parasitoid wasps, which are critical for controlling pest populations, are also affected by the decline in native insect hosts. As invasive plants outcompete native species, the decline in insect diversity reduces the availability of suitable hosts for parasitoid reproduction, weakening natural pest control mechanisms. This can lead to an increase in pest species and a further degradation of ecosystem health.

5. Positive Interactions: Opportunities for Generalist Insects

While te overall impact of invasive plants on native insects is largely negative, some generalist insect species may benefit from the introduction of non-native plants. Generalist herbivores and pollinators, which are not as dependent on specific plant species, may exploit the new resources provided by invasive plants. For instance, some studies have documented increased populations of generalist pollinators like honeybees and bumblebees in areas dominated by invasive species such as *Centaurea stoebe* (spotted knapweed).

6. Ecosystem-Level Consequences

The introduction of invasive plant species causes shifts in the structure and function of entire ecosystems. As native plants and insects decline, the intricate web of interactions between species is weakened. Invasive plants can alter nutrient cycling, water availability, and soil composition, further exacerbating the loss of native biodiversity. These changes can lead to the homogenization of ecosystems, where only a few invasive species dominate, reducing the overall ecological integrity.

CONCLUSIONS

The introduction and proliferation of invasive plant species pose a significant threat to native insect populations and the broader ecosystems they inhabit. By outcompeting native plants, altering plant-insect interactions, and reducing the availability of suitable habitats, invasive plants contribute to the decline of native insect diversity and abundance. This, in turn, disrupts ecosystem services such as pollination and natural pest control, leading to cascading effects throughout the food web.

While some generalist insect species may temporarily benefit from invasive plants, the overall impact is detrimental to ecosystem health and biodiversity. Conservation efforts must prioritize the removal of invasive plant species and the restoration of native habitats to protect vulnerable insect populations and maintain ecosystem resilience.

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