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GREEN WALL IMPACT ON BENEFICIAL INSECTS IN AN URBAN FRUIT ECOSYSTEM

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Abstract

Green walls are a component of urban green infrastructure and contribute to a range of ecosystem services including habitat provision for urban biodiversity, screening out aerial particulate matter, improving air quality, attenuating noise, and enhancing aesthetics of the cityscape. Insects can be the organic grower's best friend. Whether pollinators or predators, they will help manage pests and keep urban gardens healthy. The organic growers encourage flowers, along with trees, shrubs and water, to provide a valuable and diverse ecosystem.
The green wall was set in the experimental fruit field of the Faculty of Horticulture within USAMV Bucharest, at the border between the vineyard and the organic apple and cherry growing sector. Observations were made on the green wall impact on beneficial insects, as pollinators, hoverflies (Diptera), ladybirds (Coleoptera), parasitic wasps (Hymenoptera), butterflies and moths (Lepidoptera), lacewings (Neuroptera), ground beetles (Coleoptera, Carabidae). The preliminary results indicate that Lonicera japonica, Hedera helix, Mentha, Parthenocissus quinquefolia, Akebia Quinata,Campsis radicans they attract beneficial insects such as pollinators or aphid eaters.

Key words*: Green wall, wild flowers, organic apple, biodiversity, pollinators.*

INTRODUCTION

Urban green infrastructures have the potential to support biodiversity not only within its boundaries, but also nearby due to a landscape-mediated 'spill over' effect of energy, resources, and organisms across habitats. Such effect may be an important process for the persistence of pollinating insects, because allotment gardens often exhibit a rich abundance of flowering plants and thus a prolonged season for nectar supply, allotment gardens can support urban pollinators for long periods of time (Colding et al., 2006; Lin et al., 2015).
Plant-pollinator interactions have valuable impact in agricultural food production and provide indispensable ecosystem functions that support global biodiversity (Ollerton, 2017). It is estimated that 87.5% of flowering plants depend on animal pollinators for reproduction (Ollerton et al., 2011). In agriculture, 87% of the leading global food crops and 35% of global production volumes from crops are dependent upon animal pollination (Klein et al., 2007). Reports of declining pollinators from different parts of the world may constitute an urgent ecological challenge (Potts et al., 2016; Christmann, 2019). Pollination by native honeybees and other pollinating insects is very important for the farmers and the ecosystems. Pollinating insects are crucial for many naturals habitats and the production of a majority of food crops. More than 80% of European crop types, including many fruit and vegetables, depend directly on them (Gardi et al., 2015). However, numbers of pollinators and other beneficial insects have significantly declined across Europe in recent years (Gardi et al., 2003; Gardi, 2004; Gardi, 2010).
Understanding the correlations between the vegetation component of urban ecosystems and pollinating insects helps to understand the needs of current landscape design under new environmental policies, in order to benefit from biodiversity at socio-economic and cultural level within the capital city (Dragoș et al., 2018).

For decades, the conservation of biodiversity has been limited only to protected areas, which currently cover about 15% of the land surface (McDonald, 2008) and where biodiversity is protected from human threats. Biodiversity plays a fundamental role in the functioning of ecosystems and its ability to deliver long-term ecosystem services (Rosenfeld et al., 1998; Konijnendijk et al., 2000; Oberndorfer et al., 2007; Eysenbach, 2008).

Several beneficial insect species play an important role for urban gardens health. The most important group of beneficial insects are pollinators, biological control agents, and soil decomposers. Pollinators are insects which pollinate plants. Insect pollinators include honey bees, beetles, flies, ants, moths, butterflies, bumble bees, solitary bees, and wasps. Butterflies and moths are important pollinators of flowering plants in wild ecosystems and managed systems such as gardens and parks. Biological control of pests is part of an integrated pest management (IPM) strategy. It is the reduction of pest populations by natural enemies and typically involves an active human role. In fact, all insect species are also suppressed by naturally occurring organisms and environmental factors, with no human input. The natural enemies of insect pests, also known as biological control agents, include predators, parasitoids, and pathogens.

Growing seasonal food helps to supply with fresh produce for a healthy nutrition. Vegetables, fruits, and nuts are the life blood of a healthy human life. Beneficial insect species play major roles including as pollinators, decomposers, parasitoids & predators, and food to other taxa that contribute to a thriving garden's health and the environment. They are an integral part of urban ecosystem and landscape. Beneficial species richness and their optimum numbers in a garden can play a very important role in enhancing the crop's production levels. Beneficial insects can help suppress populations of serious pests in gardens, reducing plant damage and reducing the need for synthetic pesticides. This is partly true due to the use of non-selective pesticides, habitat destruction, reduction in native flowering plants (wild flowering trees & shrubs, bunch grasses, and cover crops) which provide nectar and pollen for the pollinators. For a healthy garden, conserving beneficial insect species is very important.

At European level, the cohesion policy for urban and peri-urban horticulture should be in line with the objectives of the European Green Deal, the Farm to Fork strategy and the Biodiversity Protection strategy (Mâcnea C.E. et al., 2021).

Proposing the development of urban gardens, green roofs and hydroponic systems, the importance is stressed of enriching urban biodiversity, better waste management with composting, the collection of rainwater and the improvement of air quality. The aim is to produce, process and consume food locally using available alternative plant protection products, with a low environmental footprint (Mir & March, 2017).

This short article emphasizes the best management practices which can help us to conserve beneficial insects in and around our gardens by implementing simple and easy agricultural practices.

MATERIALS AND METHODS

Green walls aim to identify new eco-innovative technologies useful in plant cultivation in urban horticultural ecosystems, by developing a green wall in a fruit orchard. The green wall was built in the experimental fruit growing field of the Faculty of Horticulture within USAMV of Bucharest, at the border between the vineyard and the organic apple and cherry sectors. The research intends to open a new path in urban horticulture, scientifically substantiating the effects of using such modular, mobile green walls near urban gardens. The behaviour of grass species and other annual/ perennial plants used in the construction of the green wall is monitored.

Green wall in urban environment are a component of urban green infrastructure and contribute to a range of ecosystem services:

- habitat provision for urban biodiversity;
- screening out aerial particulate matter ;
- improving air quality;
- attracting pollinating insects;
- aesthetics of the cityscape.

RESULTS AND DISCUSSIONS

In order to build the green wall, the following steps have been taken:
a. Installation of the experimental system to be used as a green wall in urban ecosystems, which included field soil preparation (Figure 1), stretching out the wire mesh as a support for the plants (Figure 2), installing the drip irrigation (Figure 3), planting the desired plant species (Figure 4).
b. Determining the composition of the floristic mixture, in order to maximize the useful effects of the green wall (Figure 5).
c. Observation on green wall impact on beneficial insects, as pollinators, hoverflies, parasitic wasps, butterflies and moths, lacewings, ground beetles (Figures 6, 7, 8, 9).

Figure 1. Field preparation

Figure 2. Stretching the wire mesh as a support for the plants

Figure 3. Testing the operation of the drip system

Figure 4. Planting plant species to test system functionalit

The studied biological material consists of: shrubs with flowers, climbing plants, grasses and cover crops, that provide nectar and pollen for pollinators.
Several beneficial insect species play an important role for urban garden health.
Observation on green wall impact on beneficial insects, as pollinators, hoverflies (*Diptera*), ladybirds (*Coleoptera)*, parasitic wasps (*Hymenoptera*), butterflies and moths, (*Lepidoptera*), lacewings (*Neuroptera)*, ground beetles (*Coleoptera, Carabidae*).

Natural enemies (parasitoids, predators, and pathogens) of pests balance their numbers so that there is no threat to the garden's productivity. The pollinators (honeybees, bumble bees, butterflies, hoverflies, etc.) play a very important role in pollinating crops and ornamental plants. Similarly, plant and animal decomposers (flies and beetles) play a vital role in recycling the organic matter in supporting the soil health. Indeed, natural enemies can help suppress populations of pest species, reduce crop damage and reduce the need for

insecticides. In general, gardens with small sizes, selective & less pesticide use, and more non-crop habitats have the most natural enemies and are able to maintain pests below economically damaging threshold levels. In addition to simply reducing pest damage, native natural enemies can provide benefits such as reduction in the need for pesticides, reduction in the need to release non-native biological control agents, and supporting other facets of wildlife. The conservation of beneficial species is probably the most important and readily available biological control practice available to gardeners

Whether pollinators or predators, these insects\help manage pests and keep the gardens healthy. The organic grower encourages flowers, along with trees, shrubs and water, to provide a valuable and diverse ecosystem.

Figure 5. Determining the composition of the floristic mixture

Figure 6. Bee Hymenoptera - *Apidae, Bombus terrestris*

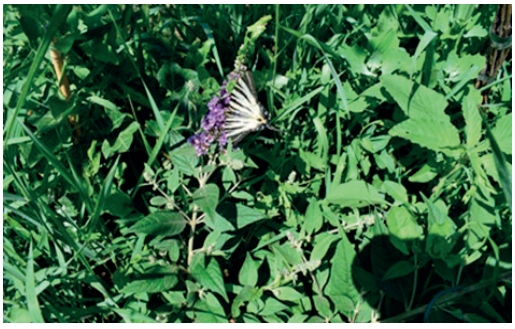

Figure 7. Butterfly *Papilio machaon*

Figure 8. Brown marmorated stink bug (*Halyomorpha halys*)

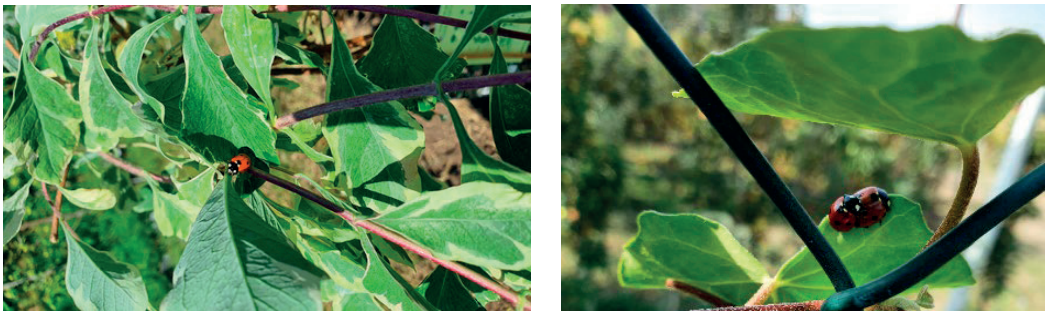

Figure 9. Ladybirds - *Coccinellidae - Coccinella septempunctata*

CONCLUSIONS

For healthy gardens, it is vital to have beneficial species diversity and their suitable population density for sustainability.
Beneficial species are adapted to the local environment and to the target pest(s), and their conservation is generally easy and cost-effective. With relatively little effort, the activity of the biological control agents can be observed. Lacewings, lady beetles, hoverfly larvae, big-eyed bugs, minute pirate bugs, and parasitized aphid mummies are almost always present in aphid colonies in the gardens. Fungus-infected adult flies are often common following periods of high humidity. The biological control is very important and need to be conserved and considered when making decisions based on the IPM strategies. In many instances the importance of natural enemies has not been adequately studied or does not become apparent until synthetic pesticide use is stopped or reduced. Often the best we can do is to recognize that these factors are present and minimize negative impacts on the beneficial species in gardens. If an insecticide is needed, every effort should be made to use bio pesticides which are selective in nature for gardening. In addition, growing native flowering plants (e.g., sweet alyssum, marigold, basil, sunflower, milkweed, and goldenrod) in and around the gardens for the beneficial species is critical for garden(s) productivity and sustainability.

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