

***Asclepias syriaca* L. is a threat to biodiversity and agriculture of Ukraine**

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Abstract. The problem of weed control has been facing mankind since the beginning of agricultural development, and is especially relevant today. Weeds began to evolve not only under the influence of natural factors, but also human activities, especially with the introduction of herbicides, which have become the most powerful factor in the evolution of segetal vegetation. Over the past two decades for biodiversity of forests, green areas of settlements and agricultural lands. Invasive species have properties that increase their ability to suppress Aboriginal species populations and compete with them for space and resources. Threats from invasive species are one of the most important environmental problems of our time, which is especially acute in the process of globalization.

1 Introduction

Global climate change has caused a significant push towards the prevalence of invasive plant species in the biodiversity environment. This is also facilitated by the intensification of trade and the movement of transport (land, water, air) flows between countries and continents. In addition, in Ukraine in particular, invasive species have become widespread as a result of the reform of the agricultural sector and the transformation of collective and state-owned land into private.

Invasive species are a major threat not only to biodiversity but also to human health and the economy worldwide. Among these crops, the prominent place is occupied by *Asclepias syriaca*, an invasive species that, despite being an invader of disturbed semi-natural vegetation, prefers agricultural lands. Even its insignificant density in the agrocenosis can lead to a complete loss of crop yields [1, 4, 10, 11, 20, 21].

Homeland *Asclepias syriaca* - North America. It grows successfully on railway embankments, along roads, in fields and edges. The first *Asclepias syriaca* came to Europe in the XVII century. as a technical culture and became widespread in France, Germany and other European countries.

They tried to get rubber from *Asclepias syriaca*, because its juice contains components of rubber and resin. For this purpose, it was cultivated in the botanical gardens of St.

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Petersburg, and later - in the Kiev Botanical Garden and Bila Tserkva. It was also grown as an ornamental plant. After attempts at industrial cultivation, this species freely "penetrates" into natural plant communities.

1.1 Botanical characteristics

Asclepias syriaca belongs to the Asclepiadaceae family. It is popularly called wild cotton, freckles, wild silk, common silk. *Asclepias syriaca* is widespread in North and South America, Africa, the Baltic States, Belarus, Ukraine and the Caucasus.

Asclepias syriaca – a herbaceous perennial up to 2-2.5 m. Stem – thick straight, mostly porous. At the slightest lesion of the stem or leaves stands out thick milk juice, hence another popular name of the species - "milky grass", "swallow grass". Sometimes such a large amount of juice flows that its drops even fall to the ground.

The leaves are large, oblong-elliptic in shape, 13-20 cm long, 4-12 cm wide, located opposite, rarely - alternately, dense, with a thick midrib, whitish below. The lower leaves always fall in mid-summer (Fig.1).

The flowers are pinkish-red, small, resembling small stars, fragrant, gathered in inflorescences – an umbrella. The petals of the calyx are protruding, ovate in shape, 3-4 mm long, pointed to the apex. Corolla incised, its blades oval 6-7 mm long, slightly narrowed to the apex, curly-fluffy on the outside. The crown of the stamens consists of five cap-shaped blades with two teeth and a keratinized flat appendage, which protrude from the inner plane of the cap [1, 3, 5, 7, 8].



Fig.1. *Asclepias syriaca* L. near the Hrybovyske landfill, located near Lviv (July 25, 2020).

The fruit is a swollen crescent-shaped green box with a corrugated surface 10-12 cm long, during ripening it opens on the sides. The seeds are dark brown, ovoid, flattened, with long white silky hairs, resembling cotton wool (hence the name - cotton wool). The seeds have a so-called "parachute", which helps to carry the wind over a considerable distance.

It only takes three weeks for a newly sprouted plant to become "perennial", able to reproduce from underground roots. Wind-borne seeds ripen only in dry and warm long autumn. The plant blooms for 3-4 weeks in the second or third year of the growing season in the second half of summer.

Root system - rod with thickened horizontal rhizomes, which are branched in different directions.

1.2 Developmental biology

Asclepias syriaca attracts people and insects with its appearance. It blooms in July and August. The aroma of its flowers resembles the smell of chocolate cake.

The plant forms a powerful rosette, which has a fairly high growth energy, so in June-July can significantly exceed such crops as sunflower, corn, sugar beets, wheat, soybeans, canola and others.

The root system of the species is very powerful, able to penetrate into the soil for 4-5 m for water use and absorption of nutrients. According to the biological classification, vatochnik belongs to the root-sprouting plants.

Propagated by roots and seeds. If the seeds get into the soil, they germinate quickly and form a colony of plants during the growing season, as the bushes grow quickly. New plants from the buds of the root system begin to form in July-August, but they reach the soil surface only the following spring. The growth of roots and root shoots stops in mid-August to early September. A young plant of Syrian butterbur, sprouted from root shoots, begins to form new root sprouts as early as 18-22 days after germination.

In the soil, the seeds of *Asclepias syriaca* retain their viability for three years, but in conditions of soil drought lasting five months, it loses it. *Asclepias syriaca* grows well in open areas. Unpretentious to soils, but grows best on cultivated soils.

This is a drought-resistant and frost-resistant plant, it winters without frost damage, even without shelter. However, the first wintering is delayed, and its seedlings resume vegetation only in early summer, in subsequent years - in April and May.

Asclepias syriaca is not picky about light and moisture. Withstands direct sunlight for a long period. Areas with dry cold or warm conditions, as well as a forest zone are a comfortable growth zone for the weaver. This species is tolerant of precipitation. It consumes from 400 to 1200 mm per year, the optimum average annual temperature is 8-14 °C, the soil pH is 5.5 - 7.3 [1,7,18-21].

2 Materials and methods

The invasion of the *Asclepias syriaca* raises new problems. Large and tall bushes of *Asclepias syriaca* strongly suppress cultivated plants and complicate the harvesting process. According to experts in the United States, the annual loss of *Asclepias syriaca* is about \$ 3.2 million [1, 2, 4, 6-11].

Asclepias syriaca shows aggression where it appears, all cultivated plants and weeds disappear. *Asclepias syriaca* in Ukraine is classified as a weed. Agronomists are concerned about the spread of this plant, as it is difficult to chemically and mechanically destroy, multiplies rapidly and becomes a serious threat to Ukrainian fields.

Studies of the invasive biology of *Asclepias syriaca* indicate stages of the life cycle where plants are most vulnerable to control and adaptive management, climatic and agronomic factors, the stages of morphogenesis and ontogenesis, to assess the nature of population distribution and environmental factors that contribute to its environment. Programs to control its numbers can be most effective in the germination phase, juvenile period, flowering or ripening. Control programs may be most effective at seedling, juvenile, flowering or adult stages. This may be the stage when carbohydrate stores in the vegetative reproductive structures are lowest. Basic information on invasive plant biology is required for inclusion in other types of research, such as modeling the potential distribution of a species.

A prerequisite for successful control of the number of *Asclepias syriaca* plants in agrocenoses is the timely inspection of crops to determine the species composition of weed seedlings in the cotyledon phase in order to implement precautionary measures. Under modern conditions, in order to effectively control the number of *Asclepias syriaca* in agrocenoses, apart from the use of herbicides, there are no other measures that would ensure high efficiency of weed control. Very strong and well-developed root system of the

plant has a high resistance to existing herbicides on the market, so PPE affects only the aboveground part of *Asclepias syriaca*, inhibiting its growth and development.

Therefore, it is best to apply herbicides when the *Asclepias syriaca* appears in the fields. In the cotyledon phase and the formation of 1-2 leaves of *Asclepias syriaca* the effectiveness of herbicides is quite high, they allow you to completely "burn" the aboveground part of the plant and help cultivated plants to compete successfully in the agroecosystem.

A characteristic feature of *Asclepias syriaca* is that in the development phase of 6-8 leaves in the juice appears milk, which blocks the flow of herbicide. Therefore, during this period it is not advisable to perform mowing or other mechanical destruction of plants, which will only stimulate the development of the root system.

Ukrainian scientists [7, 14-16, 21], who study the problem of the invasion of the *Asclepias syriaca*, have established its extremely rapid spread. A few years ago, the plant was distributed mainly in the eastern part of Ukraine: Sumy, Kharkiv and Chernihiv regions. In recent years, the weed has spread to the center of Ukraine: Poltava, Kyiv and Zhytomyr regions. Isolated cases have been registered in Cherkasy and Vinnytsia oblasts, as well as in the western region of the country. We found *Asclepias syriaca* plants near the Hrybovytske landfill near Lviv (July 25, 2020). Therefore, it is not difficult to predict the intensive population of *Asclepias syriaca*, because this plant is able to spread in different ways and ways to free lands. The roadsides serve as the main migration corridors through which the *Asclepias syriaca* extends to adjacent areas of vegetation, which to some extent have been anthropogenic.

3 Results

A significant number of invasive plant control strategies start with species management and evolve into more integrated management strategies, for which it is important to consider the long-term ecosystem impact of the chosen control program.

Literature sources indicate [2, 21-23] that the physical characteristics of soils are the main factor determining the distribution of *Asclepias syriaca*. So not compacted and easy on granulometric structure of soils are favorable for development of this plant. In addition to physical properties, soil type and current soil cover, there are factors that significantly affect the presence of *Asclepias syriaca*, the climatic conditions of the area (annual rainfall, average annual air temperature, intensity of moisture evaporation, as well as slope exposure and direction relative to the sides world).

Based on our many years of research and monitoring of climate change, it has been established that there is a decrease in the amount of precipitation during the growing season and their extremely uneven distribution and an increase in the average annual temperature. Under such conditions, the intensity of annual evaporation of moisture increases, which increases the expansion of the species *Asclepias syriaca* in Ukraine, because in its homeland this plant grows in an arid environment.

4 Discussion and conclusions

It should be remembered that cutting or pruning (mechanical removal) of plants only stimulates the further development of the root system, which, in turn, leads to the growth and spread of the colony. If you do not take any measures to control the number of this plant, then within 3-5 years the field will turn into a continuous colony. It is extremely difficult and difficult to control the number of *Asclepias syriaca* plants, because this problem has not been studied enough. Only in some scientific institutions and farms search

for the use of the most effective herbicide compositions and determine the optimal timing of their application.

In addition to the chemical method of control, we should not forget about the agrotechnical method: observance of crop rotations, implementation of various tillage, "depletion" of weeds in the fields. The best method of "depletion" is now considered to be leaving the field under steam and applying a "lethal" dose of herbicides in the optimal time for the vegetation of the *Asclepias syriaca*. It is also not necessary to allow flowering of the plant and its seeds to fall into the fields. This is where certain problems often arise.

Optimal results in the control of *Asclepias syriaca* can be obtained only by combining chemical protection of crops with a well-thought-out system of agronomic measures and compliance with "safety rules": thorough cleaning of agricultural machinery when moving from field to field, mechanical removal of adult plants to prevent flowering .

Favorable phase for the destruction of *Asclepias syriaca* by herbicide - a period of 2 to 9 pairs of leaves. Given that after spraying under favorable conditions for three weeks the plants can grow, it is impractical to destroy these plants by mechanical tillage measures, so as not to stimulate the development of the root system. If necessary, it is more appropriate to re-apply herbicides [1, 5, 6, 9, 10, 16-18, 22].

Asclepias syriaca has been an interesting and important subject of scientific research in recent years. Long-term observations make it possible to determine whether this invasive species requires the introduction of any preventive measures to limit its further spread.

It is important to remember that *Asclepias syriaca* is a perennial highly competitive root sprout plant and no single extermination action, even with 100% efficiency of destruction of the aboveground part, will ensure complete eradication of *Asclepias syriaca* from the field. It is necessary to carry out purposeful 2-5-year struggle.

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