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PYRETHRUM CINERARIAEFOLIUM TREV. – SPECIES WITH INSECTICIDAL PROPERTIES RESEARCHED IN THE BOTANICAL GARDEN

PYRETHRUM CINERARIAEFOLIUM TREV. – SPECIE CU PROPRIETĂȚI INSECTICIDE CERCETATĂ ÎN GRĂDINA BOTANICĂ

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Abstract. *The study is focused on the field of introduction, research and use of aromatic and medicinal plants. This article presents the results of some investigations, regarding the biological, morphological and ecological peculiarities of development, propagation and cultivation of the aromatic species with insecticidal properties – Pyrethrum cinerariaefolium Trev. – species introduced and researched in the "Plant Resources" Laboratory. The results obtained suggest the need to continue further studies to establish and explore the insecticidal properties, which open new prospects for the use of this species in the biological protection of plants.*

Keywords: *insecticidal plant, pyrethrum, introduction, phenological stages, biological protection.*

Rezumat. *Studiul este consacrat domeniului de introducere, cercetare și valorificare a plantelor aromatice și medicinale. Această lucrare prezintă rezultatele unor investigații privind particularitățile biologice, morfologice și ecologice de dezvoltare, înmulțirea și utilizarea speciei aromatice cu proprietăți insecticide Pyrethrum cinerariaefolium Trev., specie introdusă și cercetată în Laboratorul resurse vegetale. Rezultatele obținute conduc spre necesitatea continuării studiilor ulterioare pentru a stabili și a explora proprietățile insecticide, care deschid perspective de valorificare a speciei în protecția biologică a plantelor.*

Cuvinte-cheie: *plantă insecticidă, piretru, introducere, faze fenologice, protecție biologică.*

Introduction

Currently, for the cultivation of agricultural plants, it is necessary to use means of biological protection against pests that would not only lead to increased productivity, but would also have a positive effect on product quality. Biologically active substances synthesized by aromatic and medicinal plants as secondary metabolites are used in various fields of the national economy, such as medicine, food, perfumery and the cosmetic industry. In some cases, they can be used as natural food preservatives for grains, legumes and as insecticides. The chemical components from plants offer an opportunity, in the near future, to be used as safe, environmentally friendly, natural, cost-effective, renewable and easily prepared biodegradable sources of insecticides. In this sense, the biologically active substances obtained from plants with insecticidal, antifeedant, repellent action on the pests attacking agricultural crops, which do not have a harmful effect on humans, mammals, beneficial entomofauna and on the environment, are very promising and valuable. Until now, research has been

carried out in order to identify plants with such properties. In the collection of aromatic plants, there is a small group of plants with insecticidal activity such as *Chenopodium ambrosioides* L., *Koellia virginiana* (L.) Mac.M., *Pycnanthemum muticum* L., *Lavandula angustifolia* Mill. etc., on the basis of which, in collaboration with other institutions, preparations were developed for the biological control of pests attacking agricultural crops. One of the species introduced and investigated, which can be recommended as an insecticidal plant is *Pyretrum cinerariaefolium* Trev.

The inflorescences contain essential oil rich in thujone (up to 70%). All plant organs contain substances with insecticidal properties: pyrethrins, cynarines, jasmoline, which are mainly stored in the inflorescences. Mineral substances, nitrogenous principles, lipids, linoleic acid, palmitic acid, oleic acid were also identified [1,4]. Pyrethrins and cynarins are highly toxic substances to insects, but harmless to humans and animals. Therefore, according to some data, they are also used as insecticides to combat intestinal parasites in humans and animals [3].

Nowadays, natural pyrethrins have been virtually abandoned. They have been replaced with available synthetic analogues – pyrethroids. The substance got its name after comparing its chemical composition. Synthetic preparations act in the same way as natural insecticides. Entering the body of an invertebrate, they strike the nervous system and cause instant death. In this case, a much smaller amount of synthetic insecticide is used than the natural one. The plants do not suffer after treatment with pyrethrins or pyrethroids, and the harvest is environmentally friendly [6].

Materials and Methods

The study carried out covers the period of 2019-2023, the experiments were conducted in the experimental field of the "Plant Resources" Laboratory. The biological material used comes from the collection of aromatic plants of the Botanical Garden. The plants were grown in an open field with southern exposure, on a general agrotechnical background. The plants were propagated vegetatively by division, at the beginning of the growing season and generatively – by obtaining seedlings from seeds and sowing them directly in open ground [2]. Phenological observations and biometric measurements were made throughout the growing season [5].

Results and Discussions

Pyrethrum daisy *(Pyrethrum cinerariifolium Trev. = Chrysanthemum cinerariaefolium)* is a species in the family Asteraceae, it is also called Dalmatian pyrethrum. It is native to the southern regions of the Balkan Mountains and grows in the wild flora of the Dalmatian Coast, where it was discovered. Currently, it is cultivated in many European countries, such as Romania, Bulgaria, Ukraine, France, but especially in Central Asia and East Africa. In our country, this species can be cultivated on fertile and calcium-rich soils. Under the conditions of the Botanical Garden, it develops in the soil a brown, short, woody rhizome, about 1 cm thick, from which adventitious roots emerge, thin and 25-35 cm long, as well as many aerial stems. In the first year, it forms a rosette of leaves, and in the second year, the 35-75 cm tall stem grow, with numerous branches, each ending with an inflorescence. The leaves and stem are silver-green due to the very thick and silky bristles that cover them. The basal leaves are alternate, long-petiolate, 8-10 cm long and 1.5-2 cm wide, uni- or bi-pinnatisect, with narrow lanceolate laciniae, glabrous on the upper side and hairy on the underside. The leaves on the stem get increasingly narrow, are pinnatisect, with toothed or entire lacinae. The flowers are grouped in solitary heads, with an involucre consisting of bracts arranged in 4 rows. The

flower head consists of 18-24 ligulate, female ray flowers, white flowers and numerous tubular, yellow disc flowers. The fruits are small, yellow-brown, 5-edged achenes.

Under the local pedoclimatic conditions, pyrethrum seeds germinate at temperatures of 4-7°C and higher, but the optimal germination temperature is 15-20°C. On the surface of the soil, elongated-ovate cotyledons emerge, with a rounded tip and gradually narrowing towards the base. Usually the first 2 leaves are trilobed, with the terminal lobe obviously larger than the lateral ones. The following leaves are long petiolate. In the first days of June, the cotyledons start to dry, and the plants have 4-6 leaves of different sizes forming rosettes. At the end of the month, the first leaves dry up, and a lateral shoot with leaves also arranged in rosettes develops from the axil of each of them. At the same time, the root system develops. From the upper and middle part of the main root, numerous lateral roots grow. Pyrethrum in the first year of vegetation develops 2 types of shoots: vegetative and potentially generative. The vegetative ones do not bear fruit, but every year, from the axil of their leaves, potentially generative shoots develop, which in the first year function as vegetative shoots but, after winter, develop flowering stems, bear fruit and die. Other shoots that develop with age in the second half of the growing season are potentially generative. So the realization of the biological and physiological cycle of pyrethrum is possible only in climatic areas with long growing season.

As a result of the phenological observations carried out in the field, it was found that the growing season of the plants under the climatic conditions of the Republic of Moldova lasts for 130-135 days. The plants obtained from seeds during the first year of vegetation reach the the pre-generative stages, developing only vegetative organs. In the 2nd and 3rd years of vegetation, the growth and development of plants is intense, reaching 47-77 cm in height, and the diameter of the bush 39-55 cm. A perennial bush (4-5 years) consists of 168-182 stems.

The high adaptive potential of the species is already noticeable at the pre-generative stages, which is achieved during the first growing season. In the pyrethrum plants, the differences between the specimens according to the degree of development disappear starting from the age of 3-4 years. Each vegetative shoot extends the monopodial growth, and the underground part gradually increases its size, that is, the younger parts get further and further away from the initial branching zone. Adventitious roots develop along the entire length of the underground parts, and towards the top – several potential generative shoots, which function as vegetative shoots for 3-4 years, then bear fruit and die. The development of numerous vegetative and potentially generative shoots leads to the formation of a compact and hemispherical bush. In this case, the duration of the generative phase obviously increases and then the plants pass simultaneously into the post-generative phase. The 3-4 years old perennial plants start growing in the middle of April, at the end of May the beginning of the flowering stage is recorded. In mid-June (June 14-18), the plants bloom. The full flowering stage lasts 25-30 days. In September the plants produce seeds. As a result of the phenological observations made in the field, it was found that the growing season of pyrethrum plants, under the conditions of the Republic of Moldova, lasts for 130-135 days.

Pyrethrum plants can achieve good results after being sown directly in the field. However, the small size of the seed, the slow growth of the seedlings and the uncertain success of seed germination, led us to resort to propagation by seedlings. Pyrethrum crops can also be propagated by division. By longitudinal sectioning, 4-20 seedlings with roots can be obtained from a bush, which are then transplanted in the final place in spring, before the start of active vegetation.

Pyrethrum inflorescences can be harvested from the 2nd year of cultivation, when 50-60% of the white ligulate ray flowers have opened and have a horizontal position, the harvest should be being

carried out on sunny days. The duration of this period is 3-5 days. An earlier harvesting would lead to losses in production, but also in quality. A later harvesting, when all the flowers have already opened, plant raw material of lower quality is obtained. As for the time of day, it is recommended that the harvest be carried out in the first half of the day, when the plants contain the largest amount of pyrethrins.

Conclusion

The pedoclimatic conditions of the Republic of Moldova are favorable for the growth and development of *Pyrethrum cinerariaefolium* Trev. plants. They are able to complete fully the ontogenetic cycle. The growing season lasts 130-135 days. The plants are characterized by tolerance to frost. The plants reproduce successfully both vegetatively (by division) and generatively (by sowing in open ground and by seedlings grown in the greenhouse). The plants bloom and bear fruit starting from the 2nd year of vegetation, during 6-8 years. Pyrethrins and cynarines are substances that provide the insecticidal properties of the plants. It is recommended to further explore *Pyrethrum cinerariaefolium* Trev., in order to make good use of it in the biological protection of plants.

Bibliography:

1. PĂUN, E. Sănătatea Carpaților (Sănătatea din cămară). București: Arta Grafică, 1995. 270 p.
2. FLOREA, V. Cultura plantelor medicinale. Chișinău: Universul, 2006. 312 p. ISBN 978-9975-9814-1-5.
3. VERZEA, M. Pyretrum cinerariaefolium Trev. – Piretru. Tratat de plante medicinale și aromatice cultivate. București, 1988, vol. 2, pp. 175-183.
4. TELEUȚĂ, A.A. et al. Plante medicinale. Chișinău: Litera, 2008. 334p. ISBN 978-9975-74-009-8.
5. БЕЙДЕМАН, И.Н. *Методика изучения фенологии растений и растительных сообществ*. Москва: Наука, 1974. 280 с.
6. САВЕНКО, Б.И., БОНДАРЕНКО, А.К. Возделывание ромашки далматской. Экспресс информация ЦБНТИ Медпром. Сер. Лекарственное растениеводство. Москва,1982, с.1-9.