

Plant protection strategy with plant extracts-for a diet low in pesticides

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Abstract

Studies exploring allelopathic interactions have developed greatly over time, benefiting from the efforts of large teams of specialists and increasingly efficient biochemical investigation techniques, which have improved the identification of allelopathic compounds and completed the knowledge of their nature, biosynthesis and mode of action accepting, based on clear evidence, that these secondary metabolites synthesized and released by plants can take part in very complex inter- and intra-specific ecological interactions in the environment. The consistent application of preventive plant protection measures aims to minimize the spread of pests, increase plant resistance and reduce the risk of infestation. Ideally, preventive measures can make the use of plant protection products unnecessary. If a disease or pest has nevertheless established itself in a crop, in organic farming, only medium-effective plant protection products are often available. Since even some organic plant protection products can harm beneficial organisms, organic farmers attach great importance to the optimal application of preventive measures represented by the use of plant extracts. The plant protection strategy in organic farming is based on preventive measures, which enhance the natural regulation potential of the system. Only in the case of an (imminent) infestation are measures that act directly against specific pathogens used. The application of this strategy requires regular crop inspections and a good knowledge of the biology of diseases, pests and beneficial organisms, as well as the specific effectiveness of individual measures and their side effects.

Key words: plant extracts; plant protection; reducing the risk of infestation; Biologicals and allelochemical compounds

Introduction

In different regions of the globe, plants do not grow haphazardly, i.e. randomly, but they form well-defined associations and ecological communities, adapted to the specific living conditions, characteristic of a certain geographical area, which has specific constitutive peculiarities. Certain substances released into the environment by plants exert varied, more or less severe influences on them or on other plants (or on many other living things in their immediate vicinity). The action of such secondary metabolism products can favor or disfavor the life of other neighboring organisms, which receive the intercepted "chemical messages" differently, depending on their nature, namely gender, species or genotype, but also on their physiological state. This complex phenomenon has been called allelopathy, a natural phenomenon in which different organisms affect the functioning of other organisms in their vicinity, negatively or positively, by releasing secondary metabolites set of factors in which environmental conditions play a major role [1].

The category of pesticides includes insecticides, herbicides, fungicides and other substances with high toxicity, which serve to destroy insects (mosquitoes, cockroaches), rodents, weeds and infectious agents (bacteria, viruses, fungi). The good agricultural practice guidelines for the safe use of pesticides require, as basic requirements for a phytosanitary plant protection product to be "non-dangerous for the user/consumer", to be effective by applying a small amount, to have low toxicity for health human and not to produce harmful effects on the environment. Pesticides are obtained by formulating and conditioning an ingredient or a complex of biologically active ingredients that are applied during the production process or after harvesting fruits and vegetables, to ensure optimal transport and storage conditions [2].

Organic agriculture renounces, without reservations, the use of herbicides. They destroy the accompanying flora in the fields and therefore the food base for beneficial insects, bird species and other wildlife. Thus, herbicides can have serious effects on the ecological

balance. Instead of using herbicides, in organic farming weeds are kept under control through weed management crop rotations, site-appropriate varieties, intercropping, mulching materials and special machinery and methods such as the "false seeding" technique but also by using plant extracts. Biopreparations are biological means made on the basis of microorganisms useful to cultivated plants or on the basis of natural compounds (plant extracts, suggestively called botanicals in English). Due to their biological nature, biopreparations have a complex action on cultivated plants, the most correct term being that of biopreparations for agricultural use. The interactions between plants and biotic and abiotic factors determined, during their establishment and consolidation, the synthesis in their organs of a large number of secondary metabolites, produced with specific biological properties, of real interest for the pharmaceutical industry or for agriculture, intensively researched at current locally, nationally and internationally [3].

In this context, it is considered today that the vegetable kingdom represents, through the diversity of species, a rich source of compounds with herbicide potential still insufficiently explored and used by practitioners, allelopathy imposing itself as a pragmatic solution in solving the problems of modern agriculture; thus, multiple approaches such as crop rotation, cover crops, intercropping, mulching, incorporation of crop residues and application of aqueous extracts are just some of the research directions developed with an allelopathic theme, in order to manage agricultural pests, stress mitigation abiotic and biotic on plants of interest and the improvement and increase of agricultural production. Natural plant products possess important benefits, such as chemical diversity and multiple modes of action, which can contribute to the management of resistant pests, shorter half-life than synthetic herbicides, and biodegradability. Bioherbicides seem to have contact effects, while there was one that showed progressive results indicating a potential systemic effect. On the other hand, an antifungal extract prevented certain diseases, such as potato blight. Several natural products act as stimulators of plant immunity. All growing plants are of nutritional interest to the garden. Whether they are turned into compost or extracts, fermented or not, they have a potential that should not be neglected. Plant extracts are molecular mixtures that enable global parasite control, something that cannot be achieved by using a single molecule, as in the case of synthetic treatments. Thus, with an extract of aromatic plants applied to fruit trees, insects are primarily combated and at the same time the shrubs or trees are strengthened, with the help of secondary metabolites present in the extract, minerals and vitamins. The following year, the shrub or tree will be more vigorous and hardier [4].

The numerous active molecules counteract the emergence of induced resistance to parasites. Aphids know how to find defense weapons against any chemical insecticide, so with each treatment many die, but those that resist will give rise to resistant families in turn. The result is that after a few years other molecules have to be used – a profitable thing for the manufacturers, but not for nature or the gardener. Plant extracts do not have such effects: after ten years of use, nettle infusion has the same acaricidal strength as it did on the first day. Plant extracts with a stimulating effect should be administered as early as possible, preventively, while therapeutic extracts will only be applied when a parasite appears. Often, after administering an insecticidal plant extract treatment, you will not find dead insects. However, the product was effective: thus, in the case of apple lice (aphids), the fern extract stops the egg-laying stage, freezes the development at a certain stage or leads to the

appearance of winged insects, which leave on other plants -host, such as the plane tree. Thus, the danger was removed. [5]

To counter the main attacks and boost plants when they need them, you need to have the right plants at the right time. Many of them grow spontaneously – for example nettle. These medicinal plants are often decorative, contribute to biodiversity and attract butterflies or are a food source for bees. These plants can also be harvested from nature. Gardeners and winegrowers who work with extracts have been able to massively reduce the doses of conventional treatment, even those who do not practice organic farming. If nettle extract is added, Bordeaux juice retains its effectiveness even at 1/10 of the concentration! [6]

Plant extracts can also be used very well in the urban environment, in green spaces.

Preparation of plant extracts:

Extract preparation procedures have been developed and tested by specialists for years and years.

Fermented extracts deserve a place of honor, constituting the most interesting category of herbal preparations. Thus, with their help we not only capitalize on plants and their components, but also the action of bacteria and their numerous enzymes. Fermentation is an extraordinarily lively stage. Only fermented extracts combine the stimulation and strengthening of natural defenses with a direct action, often with a revulsive effect.

Herbal decoctions, unlike fermented extracts, decoctions are obtained by boiling plants. The decoction is the only form in which certain active substances necessary to combat diseases and parasites can be extracted from plants. Decoctions are used both to prevent and to combat diseases and parasites. Certain decoctions also have the effect of strengthening plants. For example, the decoction of mumps increases the crown of the plant, fights unwanted insects and also has a slight fungicidal action.

Herbal infusions are especially recommended as an insecticide. For example, nettle infusion is very effective against certain plant lice. The action of infusions is felt especially in balanced gardens. If there are imbalances, you will need to turn to fermented extracts or decoctions in larger doses. Only after a few years of applying compost or considerable amounts of mulch will you be able to limit yourself to applying infusions.

Plant macerations also called cold water extracts, these preparations are obtained by keeping the pieces of plants in water, soaking, at room temperature, for only 24 hours. Macerates are effective primarily because they are economical, do not heat up, are quick to prepare and do not even need to be diluted. In practice, rhubarb, nettle, lady's wort and horseradish macerations are usually prepared. Macerates are primarily fungicidal, but sometimes have chlorophyll-stimulating properties. Act gently. The key to success lies in the quality of the water, the care with which you shred the plants and the temperature of the water, between 16- and 20-degrees C. [7-9]

Allelopathy refers to the effects of one plant on another, through the release of chemical or biochemical compounds, which are known as allelochemicals. Different parts of a plant (leaves, flowers, roots, etc.) can release these compounds into the environment through leaching, root exudation, volatilization, decomposition of residues or organic matter, both in natural systems and in agricultural.

Allelochemicals belong to a subgroup of plant metabolites, which are not essential for the growth and development (primary metabolism) of plants and, for this reason, are called secondary metabolites. These secondary metabolites mediate plant-environment interactions and are important for plants to cope with stressful conditions. These are key components of plant defense against herbivores, microbial plant diseases (e.g., bacterial or fungal phytopathogens) or competitive plants (ie other plants competing for resources such as water, sunlight or nutrients) [10].

The ability of allelochemical compounds to act on the germination of seeds or to inhibit or delay the growth of other plants, can definitely be a problem for agricultural production due to the interference of weeds with the development of crops. However, the same natural ability makes these plant metabolites natural herbicides or bioherbicides, which can be found in many wild plants that grow especially in certain stressful environments.

Conclusions and Remarks

Many of the agroecosystems constitute an unfavorable environment for the natural enemies of the pests (and especially for the predators / parasitoids of the harmful insects) due to the high degree of imbalance, the result of human disturbances and interventions. Ecological agriculture in Romania is developing in directions complementary to agriculture in the European Union, and one of these directions is land management to increase the role of predators / parasitoids in combating pests of agricultural crops.

Seen from the perspective of the practical effects pursued and expected by farmers, allelopathy is a natural ecological phenomenon, in which different organisms affect the functioning of other organisms in their vicinity in a negative or positive way, through the release of secondary metabolites, at the level of plant-plant interactions. between partner organisms, being generated by chemical substances produced and released by them into the environment in various ways (volatilization, exudation, dissolution, etc.). Within the plant metabolism, the synthesized compounds have various roles: informational, structural, energetic, synthetic, signaling, a separate category representing the compounds with the role of defense or ensuring competitiveness. Among these compounds there are numerous categories, such as alkaloids, flavonoids, tannins, organic acids or volatile compounds, substances that can induce stimulation, at high concentrations, or inhibition, at low concentrations, of the germination and growth of surrounding plants. Thus, phenolic compounds and terpenoids can act differently, in relation to various plant organisms: they can inhibit lipid and protein synthesis, they can alter photosystem I and photosystem II, they can inhibit nutrient processing or germination or they can change the rate of transpiration and respiration.

Chemical communication between plant organisms, but also between them and other types of organisms (microorganisms, animals, etc.) is a phenomenon that appeared and developed during the evolution of ecosystems. This communication, along with other types of interactions, led to the shaping of biocenoses through co-evolutionary effects. The involvement of allelopathic relationships in the organization of ecosystems is valid not only for terrestrial ones, but also for aquatic and marine ones. Allelopathic interactions have found applications in agriculture since ancient times, one of the main problems of large-scale plant cultivation being the presence of invasive species (segetals), which can produce significant harvest losses; as a result, the fight against them required the use, over time, of a wide range of substances with a herbicidal effect. Such substances, currently used, are of synthetic origin, which

introduces a series of disadvantages, among which we mention: the contamination of drinking water with toxic substances, the contamination of the food chain with pesticides and the appearance of herbaceous plants resistant to herbicides. The allelopathic interactions in agroecosystems are the basis of some techniques aimed at increasing productivity and reducing the number of individuals belonging to crop species. Such techniques, among which we mention crop rotation, intercultivation and the use of mulches, are based on chemical substances released by plants during their development or present in plant residues. Also in these agricultural systems, various plant residues or vegetable preparations can be used to combat some pests from the class of phytopathogenic fungi, insects or nematodes.

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