



Methods of Control Land Snails "A review"

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A B S T R A C T

This article provides a comprehensive review of how to combat land snail species, which are dangerous agricultural pests that threaten the agricultural sector and thus cause huge losses to the economy. The article explains all mechanical, chemical, biological, and even innovative methods, in addition to the development in methods and tools used and followed over time in combating snails. The article shows land snails as agricultural pests , the role of technology in control, the most important species that can be considered dangerous pests that threaten farmers and agriculture in general, and the effects of types of control on the environment and ecosystems. The article also points out the most important difficulties or obstacles facing those in charge of comprehensive control management in applying control.

1. INTRODUCTION

Land snails represent terrestrial molluscs and include a wide range of gastropods, specifically the lungworts. They feed on agricultural crops as their primary and main food. At the same time, they can be considered agricultural pests due to the damage they cause to agricultural crops and the destruction of the ecosystem, as well as the negative effects that result from that. Since ancient times, humans have resorted to inventing ways and means to limit the harm of these organisms and reduce economic and agricultural losses

The most important methods adopted are agricultural control methods, which represent an attempt to modify the agricultural environment to reduce the impact of agricultural pests, including terrestrial snails, such as removing rocks or some unwanted plants that may provide the snails with a place of protection, such as shelters or holes to protect the snails from environmental factors such as or drought. [1,2]. One of the most important methods of agricultural control, especially in the Arab world, is how to manage the agricultural environment and reduce the conditions suitable for pests, including land snails.

For example, controlling the humidity factor, where water is continuously drained from the soil to reduce moisture, which in turn attracts land snails and is one of the most important factors encouraging the

spread or removing weeds and harmful plants because they do not provide shelter for snails or use agricultural plant traps, such as planting certain plants to attract snails to this area and not others. Thus, they can be collected and exterminated , Another important method that has been used and been successful is the biological control method, which includes the use of natural enemies as an effective means of getting rid of pests. An example of this is the use of pathogens such as nematodes *Phasmarhabditis*, which infect snails and kill them, or the use of natural enemies such as enhancing the presence of birds and some types of beetles or even the use of fungi, for example, such as mushrooms *metarhizium anisopliae*, which, if they attack snails, reduce their populations [3-5]. There is another method that has been used for many years, which is chemical control, which includes the use of anti-snail and anti-snail pesticides to get rid of harmful pests, which are snails. There are many chemical substances that have proven effective against snails, including metaldehyde, which is one of the common snail pesticides. However, one of its disadvantages is that it may be toxic to non-target species. For instance, some types of earthworms are beneficial to the soil and other living organisms present in the same environment. Therefore, the use of this pesticide is polluting and harmful to the environment itself. There are other materials, such as the use of iron phosphate, which is a pesticide that is less toxic to non-target species and can be decomposed in the soil into natural components in addition to the

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pesticide methiocarb. Nevertheless, it has negative effects on the environment, which lead to its restricted use. Sometimes, repellent materials are used, such as calcium or magnesium, which are sprayed around plant traps. They have a good effectiveness in repelling snails and thus ground pests. [6-9].

One of the many ways to combat terrestrial snails as agricultural pests is physical control. The origin of this method relies on manual methods and mechanical methods to prevent the entry of snails or to exterminate them. For example, making traps filled with oils or alcohol, or using materials that attract snails, thus making them easy to collect or collecting them manually. This requires effort from the farmer physically, in addition to choosing the appropriate times to curb them, for example, after rain or collecting at night when they are more active, or using ash or coarse sand around the plants to deter snails and prevent them from entering the farm. This itself has many drawbacks and disadvantages. [10-13].

All of the above-mentioned methods have multiple disadvantages and drawbacks. Among their disadvantages is that they may harm the entire ecosystem and not just the pest, as in chemical pesticides, or are very expensive, such as physical control, or require effort and time, such as physical ones. Therefore, alternative methods must be used to get rid of land snails, and here a safe alternative one has emerged, which is extracts. Plants, which are used as a wonderful environmental alternative to chemical pesticides or traditional methods of combating land snails. Here, most researches that deal with alternative control focus on the work of these plant extracts, as they contain effective compounds such as essential oils, terpenes, and alkaloids that may be toxic or repel snails and agricultural pests in a way. At the same time, it is less harmful to the environment and reduces risks to humans, animals, and even the affected ecosystem [14].

However, this method of control requires the preparation of plant extracts for what is to be prepared from the plant. It includes multiple methods, for example, infusion, which is soaking the plant parts in warm water to release the active compounds, or the steam distillation method which involves extracting essential oils from plants or preparing the extract with alcohol or solvents, such as soaking in Solvents to extract effective compounds for the purpose of using them as pesticides for control. The methods of applying them are either by spraying which is the process of diluting the extracts with water and spraying them directly on the affected areas or infested plants, or by making baits, which means mixing the extracts with materials that attract snails, such as flour with sticky materials or those with a pungent odor. It attracts snails and distributes them in infected places, thus attracting

snails to them, which are similar to traps for them, and getting rid of them. [15-18].



Figure 1. Method of spraying against pests [19]

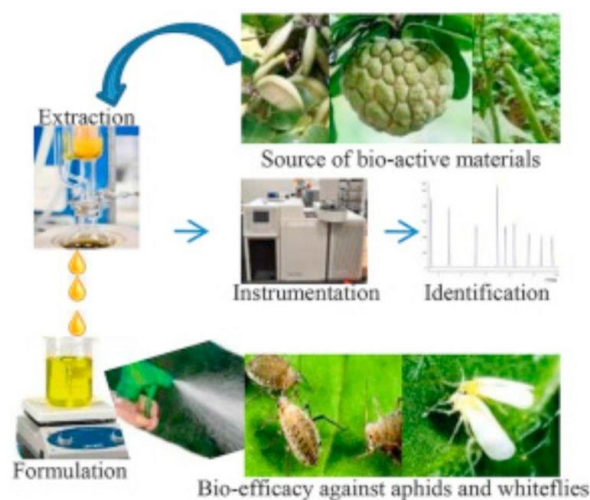


Figure 2. How To convert plants into extracts and use them as pesticides [20]

Many researches have been conducted on this field in the use of some plants and converting them into aqueous or alcoholic extracts, hot or cold, for the purpose of using them as repellent or even lethal pesticides to get rid of agricultural pests. The most important of which are wild snails, but here it must be noted that the overall researches focus on using high concentrations to demonstrate the effect or using plants. It has a pungent smell or prominent taste for the purpose

of attracting these snails, as the sensitivity of the snail species to the extracts differs, and even their sizes, capabilities, and environmental resistance. The most important things that have been used as plant extracts are garlic and *Allium sativum*, which contain the sulfur compounds allicin. They are considered toxic to snails. Here I use garlic cloves [21], or neem *Azadirachta indica* is used. This plant contains azadirachtin, which inhibits the growth and reproduction of snails, as it uses its oils or even aqueous extraction and sprays [22], and hot pepper *Capsicum spp*, which contains capsaicin. It works as a natural snail repellent.

It can be used easily by soaking or boiling it in water and using it by spraying or using it as a spray, as it is considered a natural repellent for land snails [23] or pomegranate *Punica granatum* tannin and polyphenol compounds that act as natural pesticides. An extract from pomegranate peels can be used or prepared and applied directly to snails. Pomegranate peels have general benefits and they are considered a pesticide not only for snails, but for a wide range of different organisms. There is a lot of research that has used types of plants as extracts, such as [24-36].

The development of modern technologies and technology has helped in combating land snails, especially in recent years, to include innovative solutions that combine biological sciences and technology, and in fact have given ideas towards sustainable practices. The purpose of these technologies is to improve and develop the effectiveness of control and thus reduce the impact on the environment. One of the most important technologies is the use of advanced biological control, such as the use of genetically modified nematodes "*Phasmarhabditis hermaphrodita*" that infect snails and kill them more effectively, or the use of biologically improved bacteria *Bacillus thuringiensis* genetically improved to provide longer protection. It has a more specific lethal effect on snails, and this technology allows precise control with limited side effects, as well as modern devices and tools made through modern technology. It has contributed to improving control, such as technical applications that combine modern devices and software to improve methods of control and monitoring, such as using robots and drones to monitor and collect snails effectively and significantly. To reduce farmers' effort on large farms, the purpose of this technology is to increase efficiency and reduce the need for intensive manual labor. One of the benefits of technology is the use of smart sensors or monitoring devices connected to programs and applications to analyze data, determine snail groups, and send instant notifications. [37-46].

It is one of the most widespread types of land snails that are considered agricultural pests and cause losses and obstacles to plants and their growth in particular, economic and agricultural losses, and environmental

problems in general, such as the brown snail (*Cornu aspersum*). Its original home is the Mediterranean regions, but now it has spread globally in most regions and countries and It feeds on agricultural crops, fruits, strawberries, and citrus, and causes serious damage, as does the giant African conch (*Achatina fulica*).

It is characterized by its large and gigantic size, as well as its great speed in environmental adaptation. Its original homeland is East Africa, but now it has begun to spread throughout the world. The large gray snail (*Deroceras reticulatum*), whose original homeland is Western Europe, is known for its gray-brown color. It feeds on vegetables, legumes, and other snails such as the striped snail (*Theba pisana*). Which affects crops such as wheat, barley, and the Spanish cockle (*Arion vulgaris*), in addition to the pea cockle (*Monacha obstructa* [47-51].

Methods of controlling pests, especially land snails, have developed widely over time, as there were transitional stages between traditional methods and modern technologies. This transitional stage included .It is a combination of the past and its traditional methods and the present with its technology and modern techniques.[52-54].

The control process faces a series of challenges as well as difficulties, as they may affect the effectiveness of the strategies used to get rid of land snails. These challenges include many factors, including biological ones. The development of resistance in snails and the speed of adaptation in snails may reduce the effect of biological methods and products used in control. Environmental: Variation in environmental conditions (humidity, temperature, and soil) affects the effectiveness of different control methods, so the response will be different., Economical, high costs in implementation and development, which causes financial losses. There are challenges such as regulations, regulations and laws that hinder development, new programs and tests, and finally the lack of research, sources and studies on the subject of pests in general and snail pests in particular [55-61].

3. CONCLUSIONS

Combating land snails as agricultural pests includes multiple methods, but each of these methods has its advantages and disadvantages, but in general, most of the methods bear fruit, but in varying proportions. Therefore, those interested in the field of pest control must follow up and pay attention to some of the matters that contribute to controlling this type of pest, such as modifying habitats to reduce Moisture through proper field drainage or the removal of holes or some debris can make environments less suitable for snails. Encouraging the presence of natural predators such as birds, beetles and some nematodes can help control snail populations.

The use of chemical agents such as metaldehyde or pesticides in general can be effective but must be used wisely to avoid environmental damage. Using baits and traps is a good method because it targets snails directly without causing any harm to the environment. The most important thing that can be recommended is Integrated Pest Management (IPM), which represents a combination of all the above-mentioned methods. The use of a group of cultural, biological, chemical and physical methods that represent part of a strategy. Comprehensive pest management is the most effective and sustainable approach. Continuous monitoring and continuous modification of methods and techniques as needed contribute to controlling pests while reducing environmental impact.

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Arabic Abstract

يقدم هذا المقال البحثي مراجعة شاملة لكيفية مكافحة أنواع القواقع البرية، وهي من الآفات الزراعية الخطيرة التي تهدد القطاع الزراعي وبالتالي تسبب خسائر فادحة للاقتصاد. يشرح المقال جميع طرق المكافحة الميكانيكية والكيميائية والبيولوجية وحتى المبتكرة، بالإضافة إلى التطور في الأساليب والأدوات المستخدمة والمتبعة على مر الزمن في مكافحة القواقع. القواقع البرية كآفات زراعية وأيضاً دور التكنولوجيا في المكافحة، بالإضافة إلى أهم الأنواع التي يمكن اعتبارها آفات خطيرة تهدد المزارعين والزراعة بشكل عام، وتأثيرات أنواع المكافحة على البيئة والنظم البيئية. كما يشير المقال إلى أهم الصعوبات أو المعوقات التي تواجه القائمين على إدارة المكافحة الشاملة وتطبيقها.
