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Jimson Seed in Bio pesticide Application (*Datura Stramonium*)

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Abstract

The purpose of this article was to examine the use of jimson seed (*Datura stramonium*) as a bio pesticide.

The global picture of post-harvest losses of grain and pulse crops is estimated to be 10%, largely owing to insect pests, which is a major problem in underdeveloped nations. Pesticides are compounds or mixtures of substances used to prevent, eradicate, repel, or mitigate pests, such as unwanted plant or animal species, during the production, storage, transit, distribution, and elaboration of food. Synthetic pesticides have a long-term and aggressive impact on the environment and human health. Every year, synthetic pesticides cause a slew of health problems for humans around the world. Aside from its highly ecologically friendly behaviour, Jimson seed offer a promising biopesticide effect in crop productivity and protection against several pests. Its abundance, ease of application, and lack of health hazards make it a better alternative than synthetic pesticides. The extraction of atropine from Jimson seed took place in four phases. Pre-treatment, extraction, separation, and concentration are the four steps. For the suppression of crop weevil, atropine from Jimson seed can be extracted with water or inorganic acidic extraction.

Keywords: Jimson seed; Atropine (crude Jimson oil); Biopesticide; weevil

Introduction

Diseases, insects, and weeds are expected to cost the world $220 billion in lost food output [1]. Pesticides are compounds or mixtures of substances used to prevent, eradicate, repel, or neutralize any pest, including unwanted plant or animal species, during food production, storage, transit, distribution, and preparation [2]. Insecticides, herbicides, fungicides, rodenticides, fumigants, insect replant, and other pesticides are classified according to their source of origin, which can be synthetic (Chemical) or natural (Bio-pesticide), and their application as insecticides, herbicides, fungicides, rodenticides, fumigants, insect replant, and so on [3,4]. Over the next 20 years, crop production will have to increase significantly to meet the needs of a rising human population [5, 6]. Over than 1.6 billon hectares land are used as cropland for production of crop to feed the population [7]. The herbicides, insecticides, rodenticide and fungicides are the widely used chemical pesticides in the world as well as in Ethiopia to produce this amount of crop.

Pesticides were also toxic to humans and had a negative impact on the biosphere as a whole because of their ease of use. When chemical pesticides are released into the environment, they can pollute both ground and surface water, as well as kill soil-dwelling pests, nematodes, and bacterial and fungal disease pathogens [8,9]. A pesticide's effect on a human might be acute or chronic, with acute effects appearing immediately or very shortly after exposure and chronic consequences appearing several years later and whose origins are sometimes difficult to trace.

Non-target species are also harmed by pesticides. A biopesticide is a mass-produced substance made from a living microbe or a natural product that is utilized as a crop protection tool. Biopesticides might be microbes, biochemicals, or Plant-Incorporated-Protectants, depending on the active ingredient. Biopesticides are selective and leave few if any harmful residues [10].

Datura stramonium, often known as Jimson, is a member of the Solanaceae family. In most sections of Ethiopia, the seed was available. The concept of "weeds competing with agricultural plants and developing herbicide resistance" has risen in popularity, making jimson the best choice for biopesticide production. The mode of action of Atropine biopesticide was same to that of organophosphate pesticide. As a result, biopesticide [13] was the ideal solution for this chemical pesticide. The purpose of this article was to examine the use of jimson seed (*Datura stramonium*) as a biopesticide.

Literature Review

Traditional Uses of the Jimson Plant

Ethiopia is primarily found in the tropical and subtropical regions of the world. As a result, the climatic conditions are favorable for the growth of the Jimson plant, and around 35-45 percent of Ethiopia's climate is suited for the jimson plantation. In Ethiopia, Jimson plant has been seen in a number of locations. Oromia, Gambella, Somalia, Southern Nations, Nationalities and Peoples, Sidama, and Amara are just a few of the locations where it can be found. Extracts of *Datura stramonium* are utilized in traditional medicine for their biological activity.

Seed of Jimson (*Datura Stramonium*)

Plant characteristics of the jimson: Angel's trumpet, Locoweed, Jimson weed, or Datura are all common names for *Datura stramonium*, which belong to the Solanaceae family. It is a pubescent (young) and branching plant that develops to a height of 2-4 feet and typically reaches a diameter of 4-6 feet.

The flowers are big, with 6 cm long corollas. The fruit is a huge, four-ovaled ovate capsule with numerous black to dark brown seeds

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that is quite thorny. Simple, stout, and mainly upright stems. The leaves are big, about 20 cm long, oval in shape, and have a wavy, coarsely dentate edge. The root is long, thick, tapering, and branching in certain places. Datura is a plant that may be found all over the world. The plant can be found on sandy flats, plains, and elevations of up to 2,500 feet. The origin of *Datura Stramonium* is a point of contention. Most temperate and subtropical sections of the earth are home to Datura. It is typically harvested between April and October.

***Datura stramonium* chemical components:** Alkaloids make up 0.2-0.6 percent of the plant. Hyoscyamine and hyoscine are the major alkaloids (scopolamine). Protein albumin and atropine are also present. Racemization produces atropine from hyoscyamine. These alkaloids are normally found in a ratio of roughly two parts hyoscyamine to one part hyoscine; however hyoscine is the dominating alkaloid in immature plants.

Total alkaloids in *Datura stramonium* leaves range from 0.2 to 0.5 percent, with hyoscyamine as the main constituent and scopolamine (hyoscine), apo atropine, tropine, belladonna, and hyoscyamine N-oxide as minor compounds. Anticholinergic, specifically antimuscarinics, include hyoscyamine, atropine, and scopolamine. Atropine is the most widely manufactured and used anesthetic. A pale-yellow oil makes up around 17% of the seed. Unpurified Jimson seed chemical constituents (Nitrogen 3.1; Water 7.7; Fat 18.1; Fiber 17.8; Ash 6.6; Carbohydrate 31.9; Starch 1.1; Sugar 2.1; Reducing sugar 0.3; Glucose 0.13).

The main alkaloids found in *Datura stramonium:* More than 70 alkaloids have been discovered in the plant's various sections. The major chemicals are all tropane alkaloids that are biosynthetically generated from the amino acid ornithine.

Tropane belladonna alkaloids, which have severe anticholinergic effects, are the poisons found in Datura. Hyoscine (roots), atropine (d, hyoscyamine), hyoscyamine (leaves, roots, seeds), and scopolamine (l-hyoscine), as well as protein and sitosterol, are among these alkaloids. The anticholinergic medications atropine, hyoscyamine, and scopolamine, as well as the narcotic cocaine, are tropane alkaloids with a methylation nitrogen atom (N-CH3).

4.2.4. Bio-pesticide based on atropine: In 1850, a Belgian chemist named Jean Servial Stas was the first to successfully isolate an alkaloid poison, extracting nicotine from the tissues of the murdered Gustave Fougnie with a mixture of acetic acid and ethyl alcohol. To keep pests away from plants and crops, Jimson seed is used as a pesticide. This method is effective against insecticide-resistant pests while causing no harm to beneficial insects. Jimson oil and seed extracts, which are used to make pesticides, are known to have germicidal and antibacterial capabilities, making them useful for protecting plants from various pests. One of the most significant differences between Jimson-based insecticides and their synthetic counterparts is that they do not leave any residue on the plants. Jimson insecticides are frequently employed in agriculture because they serve an important role in pest management. There has been a noticeable movement worldwide from synthetic pesticides to non-synthetic pesticides, owing to widespread understanding of the synthetic pesticides' adverse effects not just on plants and soil, as well as other living organisms

Because Atropine has multiple modes of action, insect species are unlikely to develop resistance to it based on just one. Most synthetic pesticides, on the other hand, target the insect's nervous system, and resistance to one chemical leads to resistance to all others that use the same response pathway. Atropine has long been thought to be an environmentally beneficial insect pest management strategy for plant protection.

Atropine-based bio-pesticides' mode of action: Atropine is a medication that is often classed as anticholinergic or anti-parasympathetic (parasympatholytic). It is referred to as an antimuscarinics agent since it inhibits the muscarine-like effects of acetylcholine and other choline esters. Atropine blocks acetylcholine's muscarinic effects on regions innervated by postganglionic cholinergic nerves as well as smooth muscles that respond to endogenous acetylcholine but are not so innervated. Atropine, like other antimuscarinics, works by creating a competitive or surmountable antagonism that can be overcome by increasing the concentration of acetylcholine at effector organ receptor sites. The peripheral structures triggered or inhibited by muscarine irritate the receptors irritated by atropine. Atropine can also suppress responses to postganglionic cholinergic nerve stimulation, but this happens less frequently than with reactions to injected (exogenous) choline ester[13].

Because it antagonizes the muscarine-like effects of acetylcholine and other choline esters, the presence of Atropine acts as an antimuscarinic agent when an insect larva wants to feed on the leaf and the leaf has been treated with Jimson bio-pesticide. When an insect larva is hungry and wants to feed on the leaf, and the leaf has been treated with Jimson bio-pesticide, the presence of Atropine functions as an antimuscarinic agent, because it antagonizes the muscarine-like activities of acetylcholine and other choline esters. The insect does not feed on the Jimson-treated surface as a result of this perception, and its ability to swallow is also hampered. Second, it functions as an oviposition deterrent, preventing the female from laying eggs, which comes in useful when the seeds are coated with Jimson kernel powder and/or Jimson oil in storage. It is a fascinating and unusual property of Atropine that it works on the juvenile hormone.

The biological effects of a pesticide based on atropine on pests: Jimson products' pest control impact can be seen at many levels and in various ways, similar to the knockout effect of chemical pesticides. Pests are not affected in this way by Jimson extracts, but they are affected in other ways.

The effect of atropine on pest growth regulation: The ability of Jimson products to control insect proliferation is a fascinating feature. The insect larva feeds and sheds its old skin as it grows. Ecdysis, or molting, is the process of shedding old skin and is controlled by an enzyme called ecdysones. The action of ecdysones is reduced when Jimson components, particularly Atropine, enter the body of the larva, causing the larva to fail to molt, remain in the larval stage, and eventually perish. The larva will only perish after entering the pupal stage if the Atropine concentration is not high enough. If the concentration is any lower, the adult that emerges from the pupa will be completely deformed and sterile.

Feeding prevention's atropine effect: An insect larva will seek to feed on a leaf if it is sitting on it. The maxillary glands are responsible for this particular eating trigger. As a result, peristalsis in the alimentary canal is accelerated, and the larva becomes hungry and begins feeding on the leaf's surface. Because Atropine antagonizes the muscarine-like activities of acetylcholine and other choline esters, if the leaf is treated with a Jimson product, it will act as an antimuscarinic agent. The insect does not feed on the Atropine-treated surface as a result of this perception. Its swallowing ability is also impaired.

Atropine has an anti-oviposition action: Another way Atropine keeps pests at bay is by stopping females from laying eggs. When seeds

in storage are covered with Atropine or crude Jimson oil, this ability is known as oviposition prevention, and it comes in useful. The insects will no longer feed on them after this treatment. Further damage to the grains will be prevented, and the female will be unable to lay eggs throughout her life cycle's egg-laying period.

Conclusion

Pollution of the environment and health risks from the presence of synthetic pesticide residues in food and fiber are also big issues. Biopesticides are not likely to cause such issues. This is because biopesticides are less harmful than chemical pesticides because they do not leave harmful residues, generally target one specific pest or a small number of related pests versus broad spectrum chemical pesticides that affect, in addition to the pest, other beneficial insects, birds, mammals, or non-target species, are effective in smaller quantities, decompose quickly and do not cause environmental problems, and are often cheaper than chemical pesticides.

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