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RESEARCH ARTICLE

EFFECT OF PHYTOCHEMICALS AGAINST DIFFERENT PEST: A REVIEW.

Amaninder kaur riat and shiva ohri.

Department of zoology, school of biosciences and bioengineering, lovely professional university, phagwara, india.

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Abstract

The medicinal plants have known from the past of their incredible ingredients which can heal the many diseases as well as for the control of many pest. Many agricultural pests are known to damage crops and cause economic loss to the mankind whereas in case of medically important pest, they are the route of spreading of many deadly diseases. To eradicate pest, today we are mainly depending upon synthetic chemicals at the cost of environment and non-target organisms. Resistance of pest against pesticides is of the major problem all over the world. There is another category of chemicals known as phytochemicals which are much safe and environment friendly and can compete well with the man-made chemicals to control the target organism. Phytochemicals has a mixture of complex compounds due to which the development of resistance in the pest is much slower. The constituents present inside the plants as their defense can be incorporated in pesticides industry which led to the formation of Bio-pesticides which can effective control the population of different pests in a much safe manner.

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Introduction:-

Medicinal plants are also known as medicinal herbs. Since prehistoric times, these plants are used in medicine practices. Many phytochemicals are present in plants which show different activities like larvicidal effect, antibacterial effect, antifungal activity etc. Compounds which are found in plants are alkaloids, terpenes, polyphenols and glycosides. Medicinal plants are mainly used because they are easily available and cheaper [1]. About hundred billion dollars the botanical medicines and extracts was estimated in global market in 2017. These plants face threats like habitat destruction and climate change. Nowadays plants are also used as spices and culinary. Not only Humans but also primates, sheep and monarch butterflies use medicinal plants. In 1806, Morphine, an alkaloid was first isolated from Medicinal plant. 50,000 plants are used as Medicinal plants; it was estimated by The Food and Agriculture Organization in 2002 throughout the world [2]. There are many benefits of using Medicinal plants like financial and health benefits. There are different plants which act as good larvicides and pesticides. By using natural products to control the population of pest, we can protect our environment.

Pest includes animal and insects which effect humans, crops, livestock and food. Insects are called pest when they cross Economic injury level. Stages of insect pests which are damaged by plants are larvae, nymphs and adults. The pests are mainly categorized into agricultural and medically important pest. There are many different types of pest like ants, wasp, bees, bed bugs, fleas, flies, rodents, mosquitoes and their control is basically depending upon the synthetic chemicals and mode is similar.

Corresponding Author:- Amaninder kaur riat.

Address:- Department of zoology, school of biosciences and bioengineering, lovely professional university, phagwara, india.

Phytotoxins:-

The compounds present in plants has potential to develop changes which are responsible to form any adverse effects in an organism. Plants produce such toxic compounds which has a considerable potential in the formation of new plant based pesticides.

The well-known medicinal plant neem known as *Azadirachta indica*. This plant control about 200 species of insects i.e. Aphids, leaf miners, looper, thrips, mealy bugs etc. It kills all chewing and sucking insects, also disrupts their life cycle and sexual behavior. Azadirachtin is a component present in neem responsible for the control of the pest [3]. Although there are many other components present in the neem extract which are also toxic against the pest but very meager reports are available. It can be sprayed on fruit crops and vegetable crops as it is safe. It acts as good repellent for mosquito species and mites [4]. Neem oil is very effective than Neem seed and leaves. Neem is not toxic to fish, wildlife, birds etc. Aloe vera also acts as larvicide. It contains amino acids, sterols, salicylic acid, saponins, tannic acids; lignin etc. which shows larvicidal activity against many pests. Different extracts of these plants show different activities like anti-bacterial, anti-fungal etc. Aloe vera also has effect on the nervous system of pest as the researchers reported various alterations in the organs of the head regions of mosquitoes like disintegration of the brain and other structures [5].

Plants against vectors of disease spreading organisms:-

House fly i.e. *Musca domestica* is mechanical barrier of helminthic, bacterial and viral infections. Medical pests or vector for transmission of malaria is *Anopheles stephensi*. Different extracts from medicinal plants like *Aloe vera*, *Murraya koenigii*, *Eucalyptus globulus*, *Myristic fragrans*, *Solanum xanthocarpum* and *Pyllanthus emblica* are a rich source of bioactive compounds that are responsible in controlling number of pests [6]. Methanolic crude extract of these plants has been used against 3rd instar larvae of *Plutella xylostella*, *Anopheles stephensi* and *Musca domestica*. Different LC₅₀ and LC₉₀ values were recorded after exposure for 24 and 48 hrs. The plant extract has eco-friendly approach and have potential for the control of veterinary, agricultural and medical vectors and pests.

Murraya koenigii is a tropical and sub-tropical tree native to India and Srilanka. Also known as Meethi Neem or Curry tree. It can be found in many places of India like Assam, Sikkim, Bengal and Garhwal [7]. Oil extracted from Curry leaves is used for dysentery, blood purifier, and tonic. It is also used as flavoring agent in chutney and curries. It shows different activities like anti-bacterial, anti-inflammatory, antifungal, cytotoxic and antidiarrheal activity [8]. Curry leaves contains many phytoconstituents like Mahanine, a carbazole alkaloid which are extracted from leaves and has been reported to induce apoptosis in myeloid cancer cell. Different Species of mosquitoes are responsible for transmitting diseases like Dengue, Malaria, Chikungunya and Filariasis. It has a larvicidal activity against pest [9-10].

Ethanol and Aqueous extracts of many plants were tested, out of which such showed larvicidal activity against 3rd instar larvae of two species of *Aedes* i.e. *Aedes aegypti* and *Aedes albopictus* [11]. Plants like *Murraya koenigii*, *Euphorbia hirta*, *Jatropha curcas*, *Eucalyptus globulus*, *Capsicum frutescens* and *Ixora coccinea* has great potential to control the population of mosquito species. *C. frutescens* has great effect against dengue spreading mosquitoes as it can control upto 100% population whereas *J. curcas* can control the population upto 80%. Mainly alkaloids, indoles, steroids and tannins were present in most of the plant extracts which were responsible to show larvicidal activities.

Ipomoea cairica, commonly called as Cairo morning glory, Coast morning glory and Railway creeper. It is an evergreen, perennial climbing plant and herbaceous. It contains hydrogen cyanide which stimulates respiration and improves digestion in small quantity and it is also benefit in treating cancer. Steroids and terpenes are present in whole plant [12]. *Aedes aegypti* which plays a major role for spreading dengue and found in tropical and subtropical regions. *Ipomoea cairica* has components which are responsible to show larvicidal and morphological deformities in mosquito species [13]. The plant extract can be extracted with the help of methanol and acetone. But the acetone extract is more effective to control the population of pest against *Aedes aegypti*.

Phyto-extracts and crops:-

Various agricultural and medically important pests are vectors responsible for the transmission of disease and many infections as well as damaging the crops. Pest like diamondback moth are important pest of cruciferous crops and is also economically important. Diamondback moth (*Plutella xylostella*), also known as cabbage moth. This pest causes 90% or more loss in their outbreaks. Approximately \$16 million economic loss has been reported annually in

India [14]. It is one of the most important pests of cruciferous crops. Larvae damage buds, flowers, seed buds and leaves of cultivated cruciferous plants. Larvicidal and antifeedant activity of *Pyllanthus emblica* and *Syzygium cumini* has been reported against *Plutella xylostella* [15]. Different extracts were used from different parts of plant. 90% of mortality was shown by *Pyllanthus emblica* at 3% concentration whereas *Syzygium cumini* showed 50% of mortality by different extracts at maximum exposure and higher concentration. *Pyllanthus emblica* showed better results than *Syzygium cumini*.

The corn earworm or cotton bollworm is a moth which is also known as *Helicoverpa armigera*. It is one of important pest of cotton. In UK, it is known as scarce boarded straw, is migrant species. Other most important crops host are tomato, pigeon pea, rice, chick pea, cow pea, sorghum, alfa alfa and tobacco Different methods are there through which the growth of insect can be controlled like weeding, inter row cultivation, removing crop residues etc. It is distributed throughout North Africa, Europe and even in Himalayas. It is considered as a pest in Asian and European countries. In countries like Turkey and India it causes about 40% or more yield loss of vegetables. In India, this pest is controlled by using Pyrethroids. The plant extracts were used to control these pests and it was observed to induce anti-feedant effect [16-17]. *Solanum xanthocarpum* has great potential to control the population of *Helicoverpa armigera*.

Dysdercus cingulatus is a true bug and called red cotton stainer. It is pest of cotton and feeds on various plant crops like okra, hibiscus, maize and white jute even destroys trees like kapok, silk cotton and teak. Parts which are affected by this bug are flowers and seed capsule. *Adhatoda vasica* is shrub which grows on plains of India and lowers Himalayas. It is cultivated in tropical areas also. Its various parts are used for medicinal applications like roots, leaves, flowers and stem bark [18]. Juice from leaves is useful for dysentery and diarrhea. Powdered leaves are used in southern India for treating malaria. Another plant i.e *Vitex negundo* which is also known as Chinese chase tree or horseshoe vitex. It is also a shrub, native to Southeast Asia and South. It can be found near grasslands, water bodies, mixed open forests and recently disturbed land. It is used for curing cough in Philippines and very effective in controlling mosquitoes. The presence of alkaloids, terpenoids and flavonoids in methanolic extracts of *Adhatoda vasica* and *Vitex negundo* are the toxic compounds having insecticidal properties [19]. Alkaloids were present in more amounts in extract of *V. negundo*. Phenolic compounds were also present in extracts of *V. negundo*. *V. negundo* even possesses both nymphicidal and antifeedant activity.

Tuta absoluta is a moth which is very harmful for tomatoes. Commonly known as Tomato leaf mine. It also damages sweet pepper, egg plants, potatoes and many other cultivated plants. Larvicidal effect of medicinal plants on *T. absoluta* [20]. Different extracts were prepared from different parts of seven plants. After 1 hr. of treatment of ethanolic extracts on second larval stage of pest different mortalities were recorded after. Among all seven plants i.e. *T. vulgaris*, *R. communis*, *P. harmala*, *O. natrix*, *A. spinosa*, *U. dioica* and *L. inermis*; *T. vulgaris* plant showed 98% of mortality rate at different concentration. LD₉₀ value for *T. vulgaris* was 89383mg/l which shows that ethanolic extract of this plant was more effective or toxic then other extracts.

Tetranychus urticae also known as two-spotted spider mite and red spider mite and is considered as pest. It is native to European countries. In 2011, genome of this pest was sequenced. It causes yellowing of leaves and damages open flower [21]. It is a pest of greenhouse ornamentals like roses, chrysanthemum and greenhouse crops like tomatoes, peppers, egg plants. It is resistant to some insecticides which are used for controlling it. Other than Aphids, this pest can only synthesize carotenoids. Effect of plants on oviposition and reproduction on *Tetranychus urticae* [22]. There are many plants which can be used to control the population of the pest i.e *Rhododendron luteum*, *Allium sativum*, *Helichrysum arenarium*, *Tanacetum parthenium* and *Veratrum album* were tested against *T. urticae*. The *R. luteum* was proved to affect its fecundity rate. Whereas *T. parthenium* and *V. album* kill the adult population of *T. urticae*.

Bio-insecticides against stored grain pests:-

Rosmarinus officinalis also called rosemary. It is an herb which is native to Mediterranean region. It is used as decorative plant and important in controlling pests. It contains many phytochemicals like camphor, rosmarinic acid, ursolic acid, carnosic acid and carnosol. Active components of this plant improve immunity by attacking pathogens who affect immune system in humans [23]. Stored product insects like *Trogoderm granarium* and *Tribolium castaneum* attack stored products in many ways. The presence of different compounds in oil of wild and cultivated Rosemary is effective to control the population of pest. Out of which common products in both varieties are L-camphor, L-borneol, 1, 8-Cineole and boranyl acetate. It was proven that *Rosmarinus officinalis* has insecticidal properties against *Trogoderm granarium* and *Tribolium castaneum*, stored products insect [24]. The leaves of Wild

rosemary were found to be more toxic to *T. granarium* and *T. castaneum* than that of cultivated ones. Repellent activity was shown more by *T. castaneum* adults against both wild and cultivated *Rosmarinus officinalis*. Even the essential oils of Rosemary have the potential in controlling the population of stored product insects.

Plant products contains secondary metabolites and are better than synthetic insecticides because they are target specific, environmentally safe and biodegradable while synthetic insecticides harmful to non-target organisms and cause damage to the environment. *Tribolium castaneum*, commonly known as Red flour beetle [25]. It is a pest of many stored products especially food grains. *Tribolium* species can spread parasite *Hymenolepis nana*, causes allergic responses. It is of Indo-Australian origin and is not able to survive outdoor. The plant effect the development of various stages of pest [26]. The plant like *Peganum harmala*, *Aristoelochia baetica*, *Ajugavia* and *Raphanus raphanistrum* has proven to have deleterious effects against *Tribolium castaneum*, stored grain pest. Whereas with the treatment of *P. harmala* plant has toxic effectives against both larvae and adult. These extracts also disrupted the cycle of insects. They inhibited F1 progeny production.

There are two plants which are available today in almost every kitchen i.e *Piper nigrum*, common name is Black pepper and *Mentha piperita* (Pepper mint), its leaves are used in herbal teas and as flavoring agent in fruit preserves, ice cream, candy and alcoholic beverages. Both has good potential to control the population of pest like *Corcyra cephalonica* (rice moth) is a pest which feed on cereals, dry fruits and flour and *Sitophilus oryzae* which is stored grain pest. It destroys many crops includes wheat, grains etc. The insecticidal property in these plants is due to the presence of different compounds i.e. menthol, limonene, cineole and isomenthone in pepper mint while α and β pinene, limonene and caryophyllene in black pepper [27]. Insecticidal activities of these compounds were tested against larval as well as on adult stages of rice weevil. These plants have a promising insecticidal activity against these stored grain pests.

Conclusion:-

Plant products are considered better than chemical and synthetic insecticides. They contain compounds which act as larvicides and insecticides. Compounds like flavonoids, terpenoids, mahanine, cineol, bornyl acetate etc. are present. They are environmentally safer, biodegradable and target specific than chemical insecticides. Chemical insecticides harm other insects also which are not targeted. Pests can develop resistance towards some chemical and synthetic insecticides but in case of plants and natural insecticides there is mixture of ingredients of different plants extracts. As, crude extracts may not give desired results due to the presence of many other compounds. The main ingredient which is present in the plant should be extracted and used against the control of the pest.

Conflict Of Interest:-

The authors confirm that this article content has no conflict of interest.

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