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BOTANICAL PESTICIDES IN INTEGRATED PEST MANAGEMENT

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Agricultural crops are constantly exposed or threatened by pests which affect their growth and later quality. To protect the crops from pest attack, farmers usually rely on quick pest management options, mainly synthetic chemicals. Plant protection products, such as synthetic insecticides and herbicides, have helped to maintain and increase agricultural yields for a long time. However, the use of chemical pesticides has also had numerous negative effects on human health and the environment. The emergence of resistant insects and weeds still underscores the urgent need for novel and safe products. In developing countries, pesticides and herbicides are still frequently used in agriculture without control. These examples highlight the increasing demand for organic products and alternative eco-friendly approaches to substitute some of the synthetic pesticides. For many years, botanical pesticides have been considered as gained alternatives to synthetic pesticides, due to their limited risk for the environment and humans.

Neem

Neem (*Azadirachta indica* A. Juss) (Meliaceae) is native to the Indian sub-continent. Neem has great potential in the fields of pest management, environmental protection and medicine. All parts of neem like seed, flower, bark, and leaf possess insecticidal activity but seed kernel is the most effective. Neem based compounds can be considered as the most important among all bio-pesticides for controlling pests due to its non-toxicity and environmental safety. More than 140 active principles have been identified from neem. Among several compounds Azadirachtin concentrations of 0.1 to 0.9% in the seed core and 30 to 60g az/ha has found to be the most potent neem fraction. Neem products adversely affects the growth and development of different insects in specific manner by different actions like insect growth regulator, repellent, oviposition deterrent. It is widely used in several countries around the world today either singly or in combination with synthetic pesticides in integrated pest management. Commercial neem products are Welgro, neemark, Margosan-o and Neemguard *etc*. Effectively controls caterpillers, beetles, whiteflies, leafhoppers, thrips, mites, etc.*@10g a.i/ha.*

Pyrethrum

Dalmatian pyrethrum (*Tanacetum cinerariifolium*) plant is native to Eastern Europe and Asia. It produces a natural insecticide, *pyrethrum* is the oldest used botanical insecticide as a mosquito repellent. Pyrethrin is a natural mixture comprising at least six compounds categorized into two groups, namely "Pyrethrins I" (pyrethrin I, cinerin I, jasmolin I; esters of chrysanthemic acid) and "Pyrethrins II" (pyrethrin II, cinerin II, jasmolin II; esters of pyrethric acid). Pyrethrins I and Pyrethrins II are plentiful in *Tanacetum*, especially in the flower heads (10–30 mg/g dry weight). Pyrethrins have been registered for use in pesticides since the 1950's. They have since been used as models to produce longer lasting chemicals called pyrethroids, which are man-made. Pyrethrum first used commercially in present Iran. They are fast-acting broad spectrum contact poisons pyrethrum act as a nerve poisons that modulate the sodium channel on axon neuronal membranes. Pyrethrins insecticides are extremely fast acting and cause an immediate "knockdown" paralysis in insects. Pyrethrins (the active chemicals) are rapidly broken-down by sunlight. Therefore, it is recommended that pyrethrum be applied before dawn or in late evening when the target insect pests are active and present in the

field, and UV light is minimal. Use of UV-inhibiting adjuvants may allow for a longer period of residual activity. Commercial formulation has 20-25% pyrethrins. The leading producer of natural pyrethrin is *Kenya* followed by Tanzania, Rwanda & Zaira.

Ryanodine

Ryania has been used commercially as a pesticide spray since the early 1940's. Formulations were based on an active ingredient isolated from the wood of *Ryania speciosa*. End-use products were powder or wetable powders containing 5.5% to 22% active ingredient. It contains *diterpenic alkaloid Ryanodine* which has insecticidal properties. It is slow acting stomach poison& causes insects to stop feeding after they poisoned. It was found to be a potent modulator of intracellular calcium-release channels. It is photostable, less toxic to mammals than rotenone. It is effective against thrips and worms. Used as dust 20-40%.

Rotenone

Rotenone is an insecticidal flavonoid extracted from the roots of *Lonchocarpus utilis* (contains 8-11%) and *Derris elliptica* (contains 5-9% rotenone). It consists of insecticidal and acaricidal functions, particularly effective against leaf-feeding beetles and certain caterpillar pests. Rotenone works by interfering with the electron transport chain (ETC) in mitochondria, which prevents the conversion of NADH into usable cellular energy. Rotenone is one of the more acutely toxic botanicals. As a matter of comparison, pure, unformulated rotenone is more toxic than pure carbaryl (Sevin®) or malathion, two commonly used synthetic insecticides. First isolated by *Geoffrey* and named *Nicoiulene* in 1892.Rotenone was named so by *Nagai* in 1902. First use as botanical insecticide in Singapore in 1848 against caterpillers. It controls aphids, caterpillers, aquatic larvae, *Chilo partellus,* store grain pests like bruchids, Colorado potato beetle *etc*.

Nicotine

Nicotine is a simple alkaloid derived from tobacco, *Nictiana tabacum*, and other Nicotiana species. Nicotine contitutes 2-8% of dried tobacco leaves. Nicotine is extracted from leaves of *N. rustica* (5-14%) and *Nicotiana tabacum* (6%). Out of the 12 alkaloids from tobacco, nicoitine, nornicoitine and anabasine have insecticidal properties. Pure alkaloid was isolated by Posselt and Reimann (1828) and synthesized in 1904 by Pictet and Rotschy. Nicotine is extracted through alkali and steam distillations or by extraction with benzene, ether or trichloroethylene. It is the first organic compound to be used against insects. Nicotine is commercially available as *nicotine sulphate* (more stable) which contains 40 % nicotine (Black leaf 40%). It is banned for use in India but its manufacture is allowed for export (Japan and Europe). The cost of use and high mammalian toxicity are the reasons for banning this insecticide in India. It is a contact, stomach and fumigant insecticide, mostly used against aphids, whitefly, jassids, thrips, bollworms etc. It competes with acetylcholine, the major neurotransmitter, by bonding to acetylcholine receptors at nerve synapses and causing uncontrolled nerve firing. This disruption of normal nerve impulse activity results in rapid failure of those body systems that depend on nervous input for proper functioning It is safe to coccinellids but toxic to chrysopids. Nicotine is sold as dispersible powder, solude Nico Soap (United Phosphorus Ltd.), No-Fid (Hortichem), XL-All Nicotine (Vitax) and Nicotine 40% Shreds (Dow Agro Sciences).

Strychnine

Strychnine is a highly toxic alkaloid that was isolated from the seeds of *Strychnos nux-vomica*, which is native to India and East Asia, and named after the tree. It is used as a pesticide, particularly for killing small vertebrates such as rodents. Strychnine causes muscular convulsions and eventually death through asphyxia or sheer exhaustion.