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Botanicals – The promising alternative to chemicals in stored pest management

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Introduction:

Storage of grains is a prevailing phase for the transfer of goods from producer to processor and from processor to consumer. During storage, the grains are prone to get spoiled due to rodents, birds, microbes, and insects. The chemical insecticides like deltamethrin, phosphine, malathion and dichlorvos are widely used for the management of stored product insects, although many studies reported development of insect resistance. Consumer become aware about the ill effects of using chemical insecticides and due to their changing lifestyle, they began to pay even more than the normal rate just to consume hygienic foods. The grains can be well preserved and stored for a long period of time through proper Integrated Pest Management (IPM) strategies.

The proper preventive measures like grain hygiene, storage hygiene, regular monitoring of storage area and grains for insect infestation are followed in IPM to avoid / reduce the risk of insect infestation and spoilage of stored grains. The UV light traps can also be used for regular monitoring of insects. The insect repellent materials from plants can also be used to reduce the insect infestation. The phytochemicals present in plants seem to be the prime alternative that can help to minimise the infestation which in turn reduce chemical usage during storage of grains. The researchers have performed screening studies and identified different bioactive substances from diverse plant parts (Fig.1). The suitable extraction methods like solvent, microwave assisted, ultrasound assisted, solid phase extraction or supercritical fluid extraction can be used depending on the plant and compound of interest. The researchers reported that botanicals have repellent and toxic effect to the stored product insects (Table 1). Perhaps it is the right time to focus on the development and application of the known botanicals to satisfy the growing safety concerns of the consumers.

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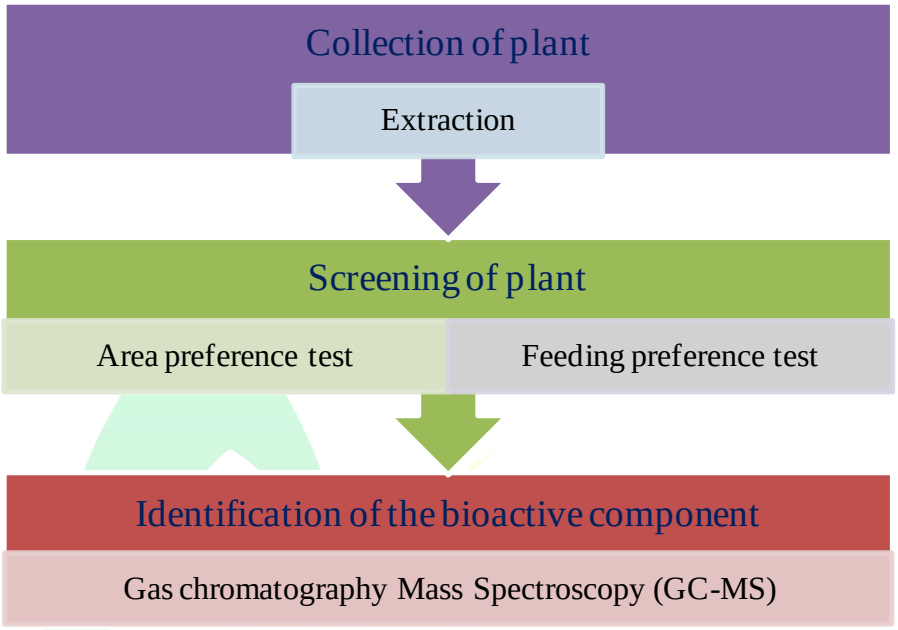

(Mangang, Tiwari, Rajamani, & Manickam, 2020)

Fig.1. Steps in screening and identification of botanicals from the parts of the plant

Table 1. Some plants possess repellent and toxic effect to the stored product insects.

Scientific name of the plant	**Bioactive component**
Tanacetum cinerariifolium	Pyrethrum
Cympobogon citratus	Citral
Allium sativum	Diallyl disulphide and diallyl sulphide
Curcuma longa	Curcumin
Acorus calamus	α and β-asarone
Cinnamonum aromaticum	Cinnamaldehyde
Andrographis paniculata	Andrographolide
Ocimum basilicum	Estragole

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Azadirachta indica	Azadirachtins
Mentha spicata	*Carvone*
Annona squamosa and Annona reticulate	Squamosin

(Isman, 2020; Manickam, Mangang, & Rajamani, 2021)

Application of the known botanicals

The botanicals can be applied in the storage godowns for repelling and managing the insects. The present research is concentrating on developing insect repellent packaging material for safe storage of food materials. The insect repellent packaging material can be developed by incorporating or impregnation of active component of botanical which are having insect repellent or toxic properties. These packaging materials will be very useful for the grain storage, food processing industries and for packaging of food products for keeping their product with more shelf-life without insect infestation.

Conclusion

The plant based repellent or toxic materials are found to be effective against insects. But the studies on the environment while applying in the grain storage places needs to be studied. The plants having the medicinal value can be exploited to safeguard the grains from insects and beneficial to the health of the consumers. In spite of its effectiveness in managing stored product insects in a short time, botanicals do have a drawback of limited efficiency in the long run. Hence, the researchers are attempting to use the advance technologies like microencapsulation of active component to obtain control release and make it applicable for large scale and longer duration (Kim, Park, Na, & Han, 2016; Licciardello, Muratore, Suma, Russo, & Nerín, 2013).

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