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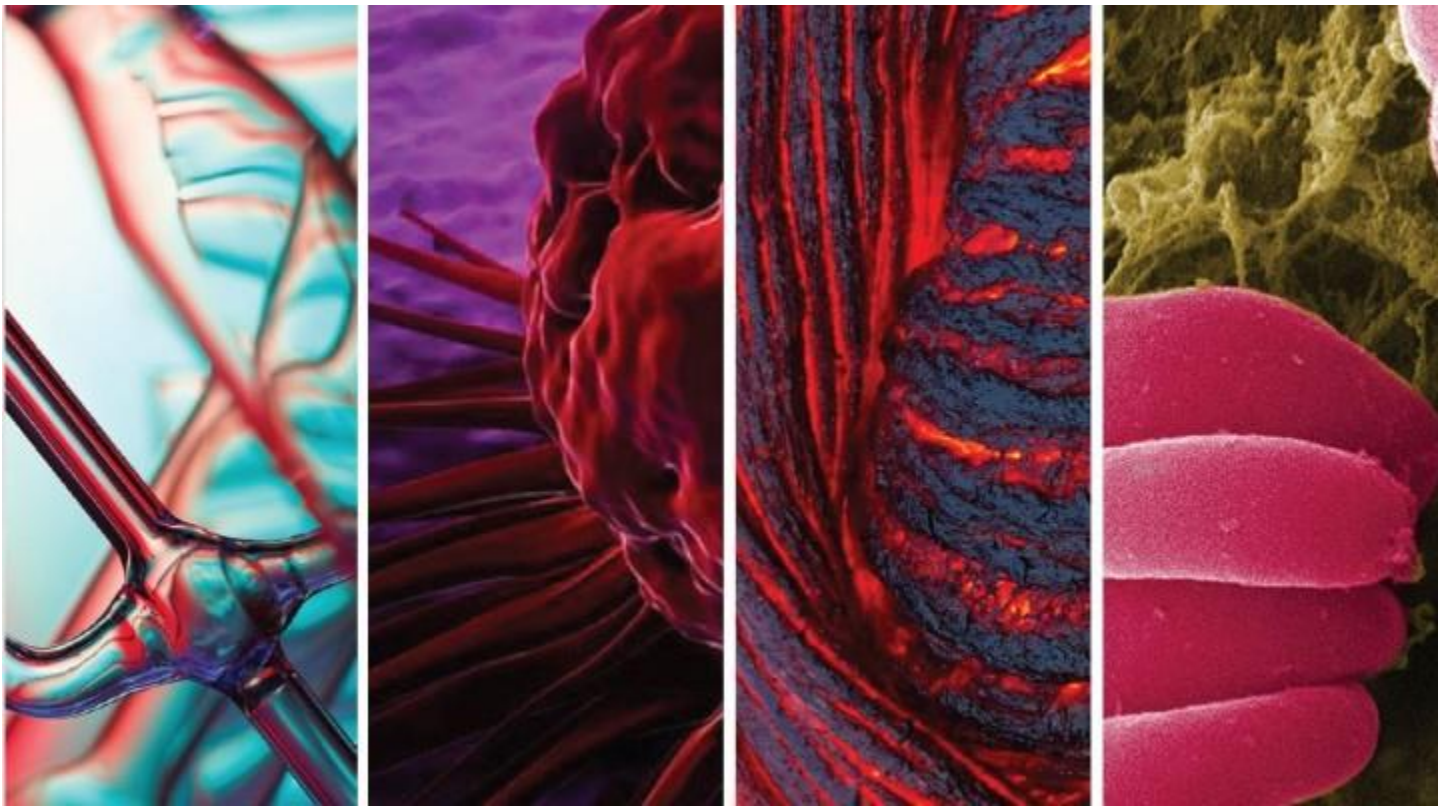

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Application of clove and dill oils as an alternative of salphos for chickpea food seed storage

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Mycological investigations of 25 samples of stored chickpea food seeds (*Cicer arietinum* L.) from grocery stores of Gurgaon and Gorakhpur revealed occurrence of seventeen fungal species belonging to genus viz., *Alternaria*, *Aspergillus*, *Chaetomium*, *Colletotrichum*, *Curvularia*, *Fusarium*, *Penicillium*, *Rhizopus*, *Rhizoctonia*, and *Sclerotium*. In these *Aspergillus flavus*, *A. niger*, *Fusarium oxysporum* had dominance in terms of per cent occurrence. Only one species of Bruchid (*Callosobruchus chinensis* L.) *occurred* in all the 25 samples. The biodeterioration of seeds inoculated with fungi: *A. flavus*, *A. niger*, *F. oxysporum* and the insect—*C. chinensis*, revealed their role in seed deterioration. For chickpea food seed protection essential oils *were* extracted from edible commodity(clove(Lavang and dill(sowa) leaf). Clove(Lavang) oil registered highest antifungal activity inhibiting (100%) mycelial growth of fungi, viz. species *Aspergillus flavus*, *A. niger*, *Fusarium oxysporum* at 300 ppm but was fungicidal at 400 ppm. Dill (Sowa) oil showed complete inhibition at 400 ppm and was fungicidal at 500 ppm. While mixture of both the oils (clove and dill) showed complete inhibition (100%) and fungicidal action at 400 ppm against the dominant fungi. The oils showed 100% insect repellent activity and were found fungicidal at 0.02 ml dose and also insecticidal. The mixture of oils was cidal at 0.02 ml dose. The mixture of oils showed a broad antifungal spectrum at 500 ppm while only 70–93% inhibitory activity at 300 ppm. The oils' mixture's activity was not affected by temp, storage and autoclaving up to 150 days. Oils physico-chemical properties were studied. GC–MS analysis of clove(Lavang) oil depicted major components: 75.63%eugenol while dill(sowa) leaf oil had 25.14% apiole. Formulation of Mixture of oils was more effective showing complete seed protection i.e.no growth of fungi and insects upto 150 days storage than salphos (150 days). While salphos controlled only maximum three fungi (*A. terreus*, *C. dematium*, *F. moniliforme*). The formulated oils mixture did not have any adverse effect on the chickpea seeds and increased *their* shelf life.

The chickpea or chick pea (*Cicer arietinum*) is the most important and versatile legume, from Fabaceae, subfamily Faboideae. It is locally known as gram or Bengal gram or garbanzo. This has high nutritional value. Dried chickpea seeds have 61% carbohydrate, (17–22%) proteins and 6% fat by weight. It is one of the earliest cultivated legumes. Its history is 7500-year-old, as the remains have been found in the Middle East. Chickpea is a key ingredient in hummus and chana masala. This is ground into flour to make falafel. It is also used in salads, soups and stews, curry and other food items like roasted/baked channa.

Chickpea is typically stored for 6–8 months after harvest. But more than 90% of farmers do not take any precautions to protect it. Its proper storage enables farmers to earn high profit margins. Most farmers sell their chick pea seeds in village/local and urban markets. Aprox. 20–30% of the stored chick pea food seeds get deteriorated by fungi and insects. Then on scientific storage of chick pea in rural areas leads to heavy losses of chickpea by fungi and insects. But detailed studies on such deterioration of stored chickpea food seeds have not been made so far. The chickpea seeds in the storage condition become more susceptible to fungal infection resulting in the lowering in seed germination and deterioration in storage. A damaged seeds produce abnormal seedlings. Thus farmers are adviced to use pathogen free healthy seeds to overcome the losses in productivity. But without testing for seed health, it is not possible to detect % healthy seeds to ensure better productivity.

A seed borne pathogen whether present internally or externally or associated with the seed as contaminant may result seed rot, seed necrosis, seed abortion, reduction or elimination of germination capacity thereby affecting of seed quality. This also causes seedling damage which produce crop diseases at later stages of plant

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