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## Protection of Pulses from Pulse Beetles using Indigenous Methods during Storage

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Pulses are precious commodities used around the globe in variety of cuisines. They are rich source of plant proteins and contribute in improving nutrition security. They are now gaining attention in value added food market as functional ingredients and in nutraceutical industries [1]. Pulses are annual and seasonal crops that can be stored for several months. However, these are at high risk of damage due to post harvest losses which can be up to 25-50% [2]. These losses are linked to insufficient and poor storage facilities, lack of knowledge of advanced technology in post harvest pulse management and harsh climatic conditions particularly in developing countries like India [3]. During storage, pulse beetles or bruchids attack the pulse seeds and *Callosobruchus chinensis* Linn and *Callosobruchus maculatus* Fab are common bruchid species. These bruchids causes about 5-10% losses during storage [2]. These losses vary widely in different climatic conditions, pulse varieties, geographical locations and processing and storage techniques.

To alleviate the bruchid infestation, wide ranges of pulse protectants are used worldwide with different levels of effectiveness. Most countries employ traditional and indigenous methods to control the insect damage. These insects attack the pods of pulses in the field. At the time of harvest, these insects are carried to the godown or storage area, where they develop inside the pulse seed at faster rate (within a month) and damage the pulse seed up to 100 percent [4]. Moisture content play significant role in stored seeds. Seeds are hygroscopic commodity and absorb moisture from the air surrounding it. Periodic changes in relative humidity of the atmosphere greatly affect the seeds in storage. Thus safe moisture content is one that is in equilibrium with 65 % relative humidity [5]. At harvest stage, moisture content of pulse seeds is about 18-25% which encourages bruchid infestation; but for safe storage, 10-12% moisture is adequate. Sharon et al. [6] advocated that black gram can safely be stored with 11-12 % moisture content at 20°C temperature without losing its viability (germination power) up to 25 weeks. Temperature management is also a crucial issue in insect pest management. Canadian Grain Commission [7] has provided the safe storage guidelines with regard to impact of moisture and temperature on germination of pulse seeds.

Inadequate drying coupled with high ambient temperature not only attracts insects but also favors the microbial growth, high enzymatic activity leading towards degradation of grain quality [8]. Hence adequate drying is essential to protect the pulse seeds during storage. In many parts of world, use of chemical insecticides and fumigants is still rampant to control pulse beetles for various reasons. Continuous use of them have created insect resistance, residual hazards, toxicity to predators, environmental degradation and rendered the food harmful to humans [9,3].

In several geographical areas of the world, different traditional and indigenous methods are being employed to control the insect damage in

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pulses. These include several pre-storage treatments such as sun drying, packing in gunny bags, storage of seeds in earthen mud pot often lined or mixed with ash, dried ash, leaves, smearing of vegetable oils on seeds, storage in triple lining of polyethylene sheets and splitting or dehulling of pulses and roasting [3,10-14]. These substances act as insect repellents, antifeedant and oviposition deterrents. Purdue Improved Cowpea Storage (PICS) are being used successfully in African countries [15]. Among many plant extracts, powders, ash and oil tested, nishinda (*Vitex negundo* L.), eucalyptus (*Eucalyptus globules*), bankalmi (*Ipomoea sepiaria*) @ 3% dose provided protection against pulse beetle in black gram without adversely affecting the germination for three months [16].

Fumigation with essential oils of many aromatic plants is now being experimented. They successfully show their efficacy against bruchid infestation in storage. Eucalyptus oil, mint oil and many other essential oils are effective against bruchid attack [17,18]. Biopesticides are now experimented around the globe as an alternative to chemical pesticides [19]. In addition to traditional storage bags and different storage systems, various novel technologies like ionizing radiation, radio frequency (RF) and micro waves are used to disinfect the pulses [8]. Hence saving pulses from bruchid attack can certainly improve the nutrition security around the globe.

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