

## Interception of Bruchids in Introduced *Phaseolus* Germplasm

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**Key Words:** Bruchids, *Phaseolus*, Germplasm

Introduction of plant genetic resources has a significant role in improving agricultural production and plant quarantine is important in preventing the entry of exotic pests, which may accompany the planting material. The National Bureau of Plant Genetic Resources (NBPGR) is the nodal agency to undertake the quarantine of germplasm. The effective implementation of quarantine measures has resulted in the interception of number of exotic pests (Khetarpal *et al.*, 2001, Bhalla *et al.*, 2003). These include bean weevil (*Acanthoscelides obtectus*), cotton boll weevil (*Anthonomus grandis*), seed chalcid (*Bruchophagus gibbus*). *Phaseolus* species are important pulse crop and exchanged as seed. The import of *Phaseolus* spp. germplasm from different countries for crop improvement programmes is associated with the risk of inadvertent introduction of exotic pests. The risk is due to the hidden nature of the infestation caused by the bruchids (Coleoptera: Bruchidae), which infest the seeds while they are developing and maturing on plants, in transit as well as storage. The hatched larvae feed, grow, pupate inside the seed, which continue to grow in size and mature, and looks apparently healthy. Such seeds carrying hidden infestation, move across the countries unnoticed and pose a real quarantine risk.

At NBPGR, the specialized technique of X-ray radiography has been developed and standardised for the detection of such infestations (Wadhi, 1967). Therefore, in the present studies, all the *Phaseolus* germplasm imported from different countries for research work was subjected to quarantine examination through X-ray radiography to detect the associated pests and salvage the material so as to release only the pest free material.

During the last twenty five years (1980-2004), 3,815 samples of *Phaseolus* spp. viz., *P. acutifolius*, *P. angularis*, *P. coccineus*, *P. radiata* and *P. vulgaris* imported from over 35 countries were processed for quarantine clearance from entomological viewpoint. The seeds were exposed to X-ray radiography to detect latent infestation. The seeds were spread on the X-ray plate and subjected to X-ray screening. All the seed samples were exposed to soft X-rays generated at 22Kv, 3mA, at a distance

of 30 cm from the source for a period of 30 seconds. The envelope containing the exposed film was removed gently without disturbing the seed geometry and the film was developed/ fixed in a developer/ fixer prepared for the purpose. Infested seeds were marked on the X-ray plate and corresponding (infested) seeds were then hand picked from the seed sample with original geometry retained on the paper.

The infested seeds were detained and kept in the B.O.D. at a temperature of  $28\pm 1^{\circ}\text{C}$  and relative humidity 60-65% for one month for emergence of adults. Seeds without emergence holes were soaked in water for 12 hr and dissected to retrieve the adult insect or its immature stages. Adult insects emerged/ retrieved were identified by using the keys for identification of bruchids (Herford, 1935; Arora, 1977; Udayagiri and Wadhi, 1982). Identity was further confirmed by comparing the specimen with reference collection maintained at NBPGR, New Delhi.

X-ray radiography of all the samples of different species of *Phaseolus* revealed latent infestation of bruchids in their different developmental stages in 248 samples. The bruchids intercepted are presented in Table 1. Among the intercepted bruchids, *Acanthoscelides obtectus* is not yet known to occur in India and has been intercepted repeatedly from Colombia, Italy, Mexico, Netherlands, Peru, Slovakia and USA. *A. obtectus* originated in tropical South America, but has spread to most other warm and hot regions, including one unconfirmed report from India (Pajni, 1987), with the possible exception of Australia. The distribution map includes records based on specimens in the collections of the Natural History Museum, London, UK and the International Institute of Entomology, UK. *Bruchus pisorum* intercepted from Turkey and Hungary, reported to have a wide host range, has a limited distribution in India confined only to the northern India including Jammu and Kashmir and Punjab.

The remaining three bruchids intercepted i.e. *Callosobruchus analis*, *C. chinensis* and *C. maculatus* although reported from India pose a quarantine risk

Table 1. Interceptions of bruchids in the introduced *Phaseolus* germplasm

Insect Pest	Host	Source
<i>Acanthoscelides</i> sp.	<i>Phaseolus vulgaris</i>	USA
* <i>Acanthoscelides obtectus</i>	<i>P. vulgaris</i>	Colombia, Italy, Mexico, Netherlands, Peru, Slovakia, USA
<i>Bruchus pisorum</i>	<i>P. vulgaris</i>	Turkey, Hungary
<i>Callosobruchus analis</i>	<i>Phaseolus</i> spp.	Brazil
<i>C. chinensis</i>	<i>Phaseolus</i> sp.	Bangladesh, Colombia, Philippines
<i>C. maculatus</i>	<i>P. angularis</i>	Colombia, Taiwan, USA
	<i>P. radiata</i>	Taiwan
<i>Zabrotes subfasciatus</i>	<i>P. vulgaris</i>	Colombia
Immature/ larval stages	<i>P. vulgaris</i>	Colombia, USA
Unidentified bruchids	<i>Phaseolus</i> sp.	Taiwan

\* Bruchids not known to occur in India

during import due to their high economic significance and possibility of presence of new biotypes. New strains having greater physiological adaptability pose a higher degree of risk. Both the species of *Callosobruchus*, cowpea seed beetle (*C. maculatus*) and adzuki bean seed beetle (*C. chinensis*), known to occur widely in tropical/subtropical conditions, possess biological strains (Applebaum *et al.*, 1968). The introduction of a mutant strain of such species in a new and climatically suitable environment could trigger off a population explosion.

*Zabrotes subfasciatus* is a major pest of *Phaseolus vulgaris* and *P. lunatum* but sometimes attacks the seeds of other legumes like cowpea, gram and pea. The pest originated in tropical and subtropical Central and South America, where it is an important pest but is now found in many other tropical and subtropical regions, especially Central and East Africa, Madagascar, the Mediterranean area and India. Strain difference in the ability of *Z. subfasciatus* to use various cultivars have been reported.

Besides, there are a large number of other bruchids, which infest *Phaseolus* seeds in different countries of the world but are not yet reported from India (Udayagiri and Wadhi, 1989). These include *Acanthoscelides argillaceus*, *A. caracallae*, *A. comptus*, *A. obvelatus*, *Bruchus atomarius*, *B. rufimanus*, *Caryedes paradisensis* and *Mimosestes mimosae* and so far not intercepted. These species pose a quarantine risk in the movement of *Phaseolus* germplasm, which can be taken care of by using appropriate detection/ disinfestation technique such as X-ray radiography.

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