Quarantine Risk Associated with Exchange of Plant Genera Carrying Hidden Infestation

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A large number of plant germplasm samples are being exchanged throughout the world for crop improvement programmes. In addition, the liberalized trade in the present global scenario (WTO regime) has increased the flow of agricultural commodities across different countries. These exchanges always carry the risk of inadvertent introduction and spread of exotic pests. Such pests, if established may prove more devastating in the new geographical areas in the absence of natural enemies and competitors. The risk of introduction of exotic pests could be minimized by undertaking quarantine of the planting material under exchange. The effective implementation of quarantine measures at National Bureau of Plant Genetic Resources (NBPGR) has resulted in the interception of a number of exotic pests. These include *Acanthoscelides obtectus* in *Cajanus cajan, Phaseolus vulgaris* and *Vicia faba* from Brazil, Bulgaria and Malawi; *Anthonomus grandis* in *Gossypium* sp. and *Hibiscus* spp. from USA; *Bruchophagus gibbus* in *Medicago* spp. and *Trifolium* spp. from France, Germany, Italy, USA and USSR; *Leptinotarsa decemlineata* in potato from Europe and USA; *Popillia japonica* in root stocks of nursery crops from Japan, USA and USSR.

There are groups of insects infesting seeds, *viz.*, seed wasps (Hymenoptera: Chalcidoidea), pulse beetles (Coleoptera: Bruchidae), and a few weevils/borers (Coleoptera:Curculionidae/Scolytidae) which infest the developing seeds without showing external symptoms of their presence within. Such an infestation is called hidden or latent infestation.

The quarantine risk becomes much higher with the exchange of seeds with hidden infestation because these are not detectable through routine visual inspection. There are several examples of movement of such insects across the geographical boundaries. The douglas fir seed chalcid (*Megastigmus spermotrophus* Wachtl.) has spread from its original home in western United States to Scotland (Mac Dougall, 1926), France (Vayssiere, 1931), Germany (Escherich, 1938) and New Zealand (courlay, 1930) alongwith the shipment of douglas fir (*Pseudotsuga taxifolia*) seeds. The rose seed chalcid [*Megastigmus aculeatus* (Swedrus)] was introduced into New Jersey (USA) through the seeds of *Rosa multiflora* from Japan (Weiss, 1917). The crop losses reported to have been caused by various introduced chalcid pests include seed damage over 80% by *Bruchophagus roddi* in the seeds of alfalfa (Strong, 1962) and about 40% by *Systole albipennis* in various umbelliferous seeds (Gupta, 1962). Seed damage to the extent of about 40% has been reported in *Trifolium alexandrium* by bruchids, viz., *Bruchidius alfieri* and *Bruchidius trifolii* (Abou-Raya, 1954).

Detection of Hidden Infestation

During quarantine processing, the seeds of *Glycyrrhiza glabra* imported from Iraq were suspected to carry hidden infestation. Hence, these were detained to observe the emergence of any insect. The insects emerged during detention were identified as eurytomids (Chalcidoidea), *Bruchophagus glycyrrhizae* (Wadhi, 1963, 1967) and bruchid, *Bruchidius* sp. (Wadhi *et al.*, 1966). This highlighted the possibility of escape of such pests during routine quarantine inspection due to hidden nature of infestation and the need for development of specialized detection procedures. Therefore, X-ray radiography technique was standardized for the detection of hidden infestation in seeds at National Bureau of Plant Genetic Resources (Wadhi *et al.*, 1967). The seeds are spread on a sheet of paper that is placed on an envelope containing the Agfa Rapid X-ray film and are exposed to soft X-rays generated at 22 Kv, 3 mA, at a distance of 30 cm from the source for 15 seconds. The envelope containing the exposed film is removed gently without disturbing the seed geometry and the film is developed/ fixer prepared for the purpose. Infested seeds are marked on the X-ray plate and corresponding (infested) seeds are then hand picked from the seed sample with original geometry retained on the paper. The dose, however, is varied with the size, shape or thickness of the seeds

for better resolution of image on the X-ray plate. The dose is also standardized for different seeds as and when required, as was done in case of mango stones (exceptionally large seeds) for detection of mango stone weevil, *Sternochaetus mangiferae* (Kapur *et al.*, 1997).

The seed transparency technique (Kaura, 1959) is used for detection of hidden infestation in small seeds as it is difficult to screen them through X-ray radiography. The seeds are boiled in lactophenol solution containing distilled water, phenol crystalsl, lactic acid and glycerine till these are sufficiently transparent to reveal the internal infestation. However, the fumes of phenol (skin irritant) are hazardous to the workers and also the valuable imported material under test gets destroyed during the process. These two techniques have been extensively used to screen the seeds of plant genera carrying hidden infestation since 1967 (Wadhi *et al.*, 1968).

Techniques such as X-ray micrography or projection micrography need to be developed so that the radiograph of small seeds could be enlarged and accurately analysed. This would overcome the limitations of two techniques.

Need to Identify the Plant Genera Carrying Hidden Infestation

X-ray radiography is a cumbersome and time consuming process. It also requires enormous funds and, thus, it is practically impossible to screen all the exotic seed material. Therefore, need was felt to identify the plant genera which can carry the latent infestation so as to reduce the workload of X-ray radiography and to minimize the quarantine risk of introduction of pests causing latent infestation. Consequently, two lists namely one for plant genera reported to be infested by one or the other species of *Phytophagous chacidoids* (Wadhi, 1967) and other for bruchids of the genus *Bruchidius* (Wadhi and Verma, 1971) were drawn from the published reports. These two lists comprised 148 plant genera that were designated as the *listed plant genera* and their seeds were compulsorily subjected to X-ray radiography (Wadhi, 1980).

Later, during the quarantine processing, seeds of genera other than the listed plant genera were also suspected to carry infestation and the same was confirmed through X-ray screening. The bruchid, *Pachymeus lacerrdae* (Coleoptera: Bruchidae) was intercepted in the nuts of *Orbignya phalerata* from Brazil (Kapur *et al.*, 1988); seed chalcid, *Eurytoma* sp. in the seeds of *Urginea maritima* from Cyprus (Kapur *et al.*, 1992); seed chalcids, *Quadrastichodella eucalypti* in seeds of *Eucalyptus* and *Bootanomyia* sp. In seeds of *Casurina* sp. from Australia (Mathur and Lal, 1996). Analysis of pest risk in respect of various crops through perusal of literature (Kapur *et al.*, 1989) and over experience of exposing the doubtful seeds to X-ray radiography resulted in addition of many more genera to the listed plant genera, requiring X-ray screening. The list was further updated by extensive scrutiny of the catalogues on family bruchidae (Udayagiri and Wadhi, 1989) and phytophagous chalcidoidea (Muesebeck *et al.*, 1975; Krombein, 1958; Peck, 1963), review of Agricultural Entomology, Series A (Anonymous, 2000) and available literature. The list now comprises 340 plant genera belonging to 75 plant families. The families of plant genera (Jackson, 1977a,b; Usher, 1984; Terrell *et al.*, 1986) have been included for future reference because it is well known that the host plant relationship exists between specific taxonomic groups of plants and insects. This would help as a precaution against other plant genera also belonging to these families which may harbour similar infestation. The updated list (Table 1) shows plant genera known to carry hidden infestation of bruchids (194), chalcids (72), both bruchids and chalcids (71) and others as curculionids/scolytids (3).

Table 1. Plant genera in their seeds which carry hidden infestation of bruchids, chalcids and others

S.No.	Genus	Family	S.No.	Genus	Family
1.	*Abelmoschus*[b]	Malvaceae	33.	*Astrocaryum*[b]	Palmae
2.	*Abies*[c]	Pinaceae	34.	*Attalea*[b]	Araecaceae
3.	*Abrus*[b]	Fabaceae	35.	*Atylosia*[b]	Fabaceae
4.	*Abutilon*[b]	Malvaceae	36.	*Baccharis*[b]	Compositae
4.	*Acacia*[b]	Fabaceae	37.	*Bactris*[b]	Arecaceae
6.	*Acer*[c]	Aceraceae	38.	*Bambusa*[c]	Poaceae
7.	*Achillea*[c]	Asteraceae	39.	*Banisteriopsis*[b]	Malpighiaceae
8.	*Acrocomia*[b]	Arecaceae	40.	*Baptisia*[b]	Fabaceae
9.	*Acuan*[b]	Fabaceae	41.	*Barcena*[b]	Fabaceae
10.	*Adenocarpus*[b]	Fabaceae	42.	*Bauhinia*[b]	Fabaceae
11.	*Aeschynomene*[b]	Fabaceae	43.	*Bellis*[c]	Compositae
12.	*Albizzia*[b]	Fabaceae	44.	*Bixa*[b]	Bixaceae
13.	*Alhagi*[b]	Fabaceae	45.	*Bonjeanea*[bc]	Fabaceae
14.	*Allocasuarina*[c]	Casuarinaceae	46.	*Borago*[b]	Boraginaceae
15.	*Aloe*[c]	Aloeaceae	47.	*Bothriochloa*[c]	Poaceae
16.	*Amelanchier*[c]	Rosaceae	48.	*Bradburia*[b]	Compositae
17.	*Ammi*[bc]	Apiaceae	49.	*Brassica*[b]	Brassicaceae
18.	*Ammodendron*[b]	Fabaceae	50.	*Bromus*[bc]	Poaceae
19.	*Amomum*[b]	Zingiberaceae	51.	*Buchenania*[b]	Anacardiaceae
20.	*Amorpha*[b]	Fabaceae	52.	*Bupleurum*[bc]	Apiaceae
21	*Anethum*[c]	Apiaceae	53.	*Butea*[b]	Fabaceae
22.	*Annona*[c]	Annonaceae	54.	*Cachrys*[bc]	Apiaceae
23.	*Anthyllis*[bc]	Fabaceae	55.	*Caesalpinia*[b]	Fabaceae
24.	*Apeiba*[b]	Tiliaceae	56.	*Cajanus*[b]	Fabaceae
25.	*Apium*[c]	Apiaceae	57.	*Calapogonium*[b]	Fabaceae
26.	*Apoplanesia*[b]	Fabaceae	58.	*Calliandra*[b]	Fabaceae
27.	*Arachis*[b]	Fabaceae	59.	*Calycotome*[bc]	Fabaceae
28.	*Arenaria*[b]	Caryophyllaceae	60.	*Calystegia*[b]	Convolvulaceae
29.	*Argyreia*[b]	Convolvulaceae	61.	*Camellia*[c]	Theaceae
30.	*Artemisia*[b]	Asteraceae	62.	*Canavalia*[b]	Fabaceae
31.	*Ascelpias*[c]	Asclepiadaceae	63.	*Capparis*[b]	Capparaceae
32.	*Astragalus*[bc]	Fabaceae	64.	*Caragana*[bc]	Fabaceae

S.No.	Genus	Family
65.	*Cassia*[b]	Fabaceae
66.	*Casuarina*[b]	Casuarianceae
67.	*Caucalis*[bc]	Apiaceae
68.	*Cedrus*[c]	Pinaceae
69.	*Cenchrus*[c]	Poaceae
70.	*Centaurea*[bc]	Asteraceae
71.	*Centranthus*[b]	Velarianeae
72.	*Centrosema*[b]	Fabaceae
73.	*Ceratonia*[b]	Fabaceae
74.	*Cercidium*[b]	Fabaceae
75.	*Cercis*[b]	Fabaceae
76.	*Chamaecrista*[b]	Fabaceae
77.	*Chamaecruistata*[c]	Pinaceae
78.	*Chaemaecyparis*[b]	Cupressaceae
79.	*Chesneya*[b]	Fabaceae
80.	*Chrysanthemum*[bc]	Asteraceae
81.	*Cicer*[b]	Fabaceae
82.	*Cichorium*[c]	Asteraceae
83.	*Cissus*[bc]	Vitaceae
84.	*Cnidoscolus*[c]	Euphorbiaceae
85.	*Coccothrinax*[c]	Arecaceae
86.	*Cocos*[b]	Arecaceae
87.	*Colutea*[b]	Fabaceae
88.	*Combretum*[bc]	Combretaceae
89.	*Condalia*[b]	Rhamnaceae
90.	*Convolvulus*[b]	Arecaceae
91.	*Copernicia*[b]	Arecaceae
92.	*Cordia*[b]	Boraginaceae
93.	*Coriandrum*[c]	Apiaceae
94.	*Coronilla*[bc]	Fabaceae
95.	*Coursetia*[b]	Fabaceae
96.	*Cracca*[b]	Fabaceae
97.	*Crataegus*[c]	Rosaceae
98.	*Crotalaria*[b]	Fabaceae
99.	*Cryptomeria*[c]	Coniferaceae
100.	*Cumin*[c]	Apiaceae
101.	*Cupressus*[bc]	Cupressaceae
102.	*Cyamopsis*[bc]	Fabaceae
103.	*Cybistax*[b]	Bignoniaceae
104.	*Cymbosema*[b]	Fabaceae
105.	*Cynoglossum*[c]	Boraginaceae
106.	*Cytisus*[b]	Fabaceae
107.	*Dactylis*[c]	Poaceae
108.	*Dahlia*[c]	Compositae
109.	*Dalbergia*[b]	Fabaceae
110.	*Dalea*[b]	Fabaceae
111.	*Daubentonia*[b]	Fabaceae
112.	*Daucus*[bc]	Apiaceae
113.	*Dendrocalamus*[c]	Poaceae
114.	*Desmanthus*[b]	Fabaceae
115.	*Desmodium*[bc]	Fabaceae
116.	*Desmonchus*[b]	Plamae
117.	*Dialium*[b]	Fabaceae
118.	*Dichostachys*[bc]	Fabaceae
119.	*Dioclea*[b]	Fabaceae
120.	*Diospyros*[bc]	Ebenaceae
121.	*Dodonaea*[b]	Sapindaceae
122.	*Dolichos*[bc]	Fabaceae
123.	*Dombeya*[b]	Sterculiaceae
124.	*Dorycnium*[b]	Fabaceae
125.	*Draba*[c]	Cruciferae
126.	*Drypetes*[b]	Euphorbiaceae
127.	*Earleocassia*[b]	Fabaceae
128.	*Echium*[c]	Boraginaceae
129.	*Elaeis*[b]	Arecaceae
130.	*Enterolobium*[b]	Fabaceae
131.	*Epilobium*[b]	Onagraceae
132.	*Eriosema*[b]	Fabaceae
133.	*Errazurizia*[b]	Fabaceae
134.	*Eryngium*[bc]	Apiaceae
135.	*Erythraea*[b]	Gentianaceae
136.	*Erythrina*[b]	Fabaceae
137.	*Eucalyptus*[c]	Myrtaceae
138.	*Eugenia*[bc]	Myrtaceae
139.	*Eupatorium*[b]	Asteraceae
140.	*Euphorbia*[bc]	Euphorbiaceae
141.	*Euterpe*[b]	Arecaceae
142.	*Fagopyrum*[b]	Polygonaceae
143.	*Festuca*[c]	Poaceae
144.	*Ficus*[c]	Moraceae
145.	*Foeniculum*[c]	Apiaceae
146.	*Galactia*[b]	Fabaceae
147.	*Galega*[bc]	Fabaceae
148.	*Genista*[bc]	Fabaceae
149.	*Gleditschia*[bc]	Fabaceae
150.	*Glycine*[bc]	Fabaceae
151.	*Glycyrrhiza*[bc]	Fabaceae
152.	*Gossypium*[bc]	Malvaceae
153.	*Guarea*[b]	Meliaceae
154.	*Guazuma*[b]	Sterculiaceae
155.	*Gymnosperma*[b]	Compositae
156.	*Haematoxylon*[c]	Fabaceae
157.	*Halimodendron*[bc]	Fabaceae
158.	*Hardwickia*[b]	Fabaceae
159.	*Hedysarum*[bc]	Fabaceae
160.	*Helianthemum*[b]	Cistaceae
161.	*Helianthus*[b]	Asteraceae
162.	*Heracleum*[c]	Umbelliferae
163.	*Heteropterys*[b]	Malpighiaceae
164.	*Hibiscus*[b]	Malvaceae
165.	*Hippocrepis*[bc]	Fabaceae
166.	*Hippomane*[b]	Euphorbiaceae
167.	*Hoffmanseggia*[b]	Fabaceae
168.	*Holcus*[c]	Poaceae
169.	*Hosackia*[b]	Fabaceae
170.	*Hymenaena*[b]	Fabaceae
171.	*Hymenoclea*[b]	Compositae
172.	*Icma*[b]	Compositae
173.	*Ichthymethia*[b]	Fabaceae
174.	*Ilex*[c]	Aquifoliaceae
175.	*Indigofera*[bc]	Fabaceae
176.	*Inodes*[b]	Palmae
177.	*Inula*[c]	Asteraceae
178.	*Impmoea*[b]	Convolvulaceae
179.	*Isatis*[c]	Brassicaceae
180.	*Juniperus*[c]	Cupressaceae
181.	*Lab lab*[b]	Fabaceae
182.	*Laburnum*[bc]	Fabaceae
183.	*Lagonychium*[b]	Fabaceae
184.	*Larix*[c]	Pinaceae
185.	*Laserpitium*[c]	Umbelliferae
186.	*Lathyrus*[bc]	Fabaceae
187.	*Lechea*[b]	Cistaceae
188.	*Lens*[bc]	Fabaceae
189.	*Lepidium*[c]	Brassicaceae
190.	*Leptoglottis*[b]	Fabaceae
191.	*Lespedeza*[bc]	Fabaceae
192.	*Leuceana*[b]	Fabaceae
193.	*Leuzea*[b]	Compositae
194.	*Lisaea*[b]	Umbelliferae
195.	*Lithraea*[b]	Anacardiaceae
196.	*Lonchocarpus*[b]	Fabaceae
197.	*Lotus*[bc]	Fabaceae
198.	*Luchia*[b]	Tiliaceae
199.	*Ludwigia*[b]	Onagraceae
200.	*Lupinus*[bc]	Fabaceae
201.	*Lysiloma*[b]	Fabaceae
202.	*Lythrum*[b]	Lythraceae
203.	*Macroptilium*[b]	Fabaceae
204.	*Malus*[c]	Rosaceae
205.	*Mangifera*[b]	Anacardiaceae
206.	*Mecadamia*[b]	Proteaceae
207.	*Medicago*[bc]	Fabaceae
208.	*Meibomia*[b]	Fabaceae
209.	*Melanoxylon*[b]	Fabaceae
210.	*Melilotus*[bc]	Fabaceae
211.	*Mentha*[bc]	Lamiaceae
212.	*Merremia*[b]	Convolvulaceae
213.	*Mimosa*[b]	Fabaceae
214.	*Mucuna*[b]	Fabaceae
215.	*Myobroma*[b]	Fabaceae
216.	*Myrcia*[b]	Myrtaceae
217.	*Nelumbo*[b]	Nelumbonaceae
218.	*Neptunia*[b]	Fabaceae
219.	*Nissolia*[b]	Fabaceae
220.	*Nitraria*[b]	Zygophyllaceae
221.	*Ochroma*[b]	Bombacaceae
222.	*Olea*[c]	Oleaceae
223.	*Olneya*[b]	Fabaceae
224.	*Onobrychis*[bc]	Fabaceae
225.	*Ononis*[bc]	Fabaceae
226.	*Orbignya*[b]	Arecaceae
227.	*Ornithopus*[bc]	Fabaceae
228.	*Oryza*[b]	Poaceae
229.	*Oxytropis*[bc]	Fabaceae
230.	*Pachyrrhizus*[b]	Fabaceae
231.	*Panax*[c]	Araliaceae
232.	*Pandanus*[b]	Pandanaceae
233.	*Panicum*[b]	Poaceae
234.	*Parkia*[b]	Fabaceae
235.	*Parkinsonia*[bc]	Fabaceae
236.	*Parryella*[b]	Fabaceae
237.	*Parthenium*[b]	Asteraceae
238.	*Parthenocissus*[c]	Vitaceae
239.	*Pavonia*[c]	Malvaceae
240.	*Pennisetum*[b]	Poaceae
241.	*Petalostemon*[b]	Fabaceae
242.	*Petit*[bc]	Verbenaceae
243.	*Pettaria*[bc]	Fabaceae
244.	*Phaseolus*[b]	Fabaceae
245.	*Phleum*[c]	Poaceae
246.	*Phoenix*[0]	Arecaceae
247.	*Physocarpus*[c]	Rosaceae
248.	*Physostigma*[b]	Fabaceae
249.	*Phytelephas*[b]	Arecaceae
250.	*Picea*[c]	Pinaceae
251.	*Piliostigma*[b]	Fabaceae
252.	*Pimpinella*[b]	Apiaceae
253.	*Pinus*[c]	Pinaceae
254.	*Piptadenia*[b]	Fabaceae
255.	*Piscidia*[b]	Fabaceae
256.	*Pistacia*[c]	Anacardiaceae
257.	*Pisum*[b]	Fabaceae
258.	*Pithecellobium*[b]	Fabaceae
259.	*Plantago*[0]	Plantaginaceae
260.	*Poinciana*[b]	Fabaceae
261.	*Podocytisus*[bc]	Fabaceae
262.	*Prangos*[bc]	Umbelliferae
263.	*Primula*[c]	Primulaceae
264.	*Prosopis*[bc]	Fabaceae
265.	*Prunus*[c]	Rosaceae
266.	*Pseudabutilon*[b]	Malvaceae
267.	*Pseudosamanea*[b]	Fabaceae
268.	*Pseudotsuga*[c]	Pinaceae
269.	*Psidium*[c]	Myrtaceae
270.	*Psophocarpus*[b]	Fabaceae
271.	*Pterocarpus*[b]	Fabaceae
272.	*Pueraria*[b]	Fabaceae
273.	*Pyrus*[c]	Rosaceae
274.	*Quercus*[c]	Fagaceae
275.	*Reseda*[c]	Resedaceae
276.	*Rhamnus*[b]	Rhamnaceae
277.	*Rhus*[c]	Anacardiaceae
278.	*Rhynchosia*[b]	Fabaceae
279.	*Ricinus*[b]	Euphorbiaceae
280.	*Rbinia*[bc]	Fabaceae
281.	*Rosa*[bc]	Rosaceae
282.	*Rosmarinus*[c]	Lamiaceae
283.	*Ruellia*[b]	Acanthaceae
284.	*Sabal*[b]	Arecaceae
285.	*Salvia*[bc]	Lamiaceae
286.	*Samanea*[bc]	Fabaceae
287.	*Sarothamnus*[b]	Fabaceae
288.	*Sauvagesia*[b]	Ochnaceae
289.	*Scheelea*[b]	Plamae
290.	*Schinus*[b]	Anacardiaceae
291.	*Schrankia*[b]	Fabaceae
292.	*Scorpiurus*[bc]	Fabaceae
293.	*Senna*[b]	Febacea
294.	*Sesamum*[c]	Pedaliaceae
295.	*Sesbania*[bc]	Fabaceae
296.	*Sesbastiana*[b]	Euphorbiaceae
297.	*Sideroxylon*[b]	Sapotaceae
298.	*Silybum*[c]	Asteraceae
299.	*Smilax*[c]	Smilacaceae
300.	*Smirnowia*[c]	Fabaceae
301.	*Soja*[b]	Fabaceae
302.	*Sophora*[bc]	Fabaceae
303.	*Sorbus*[c]	Rosaceae
304.	*Spartium*[bc]	Fabaceae
305.	*Sphaerophysa*[b]	Fabaceae
306.	*Spiraea*[c]	Rosaceae
307.	*Spondias*[bc]	Anacardiaceae
308.	*Strombocarpus*[b]	Fabaceae
309.	*Strophostyles*[b]	Fabaceae
310.	*Stylosanthes*[b]	Fabaceae
311.	*Tachigalia*[b]	Fabaceae
312.	*Tamarindus*[b]	Fabaceae
313.	*Tamarix*[c]	Tamaricaceae
314.	*Taverniera*[b]	Fabaceae
315.	*Tectona*[b]	Verbenaceae
316.	*Tephrosia*[bc]	Fabaceae
317.	*Termindalia*[b]	Combretaceae
318.	*Tetragonolobus*[b]	Fabaceae
319.	*Theobroma*[b]	Sterculiaceae
320.	*Thermopsis*[bc]	Fabaceae
321.	*Thusyopsis*[b]	Coniferaceae
322.	*Tillandsia*[b]	Bromeliaceae
323.	*Trifolium*[bc]	Fabaceae
324.	*Trigonella*[bc]	Fabaceae
325.	*Triumfetta*[b]	Tiliaceae
326.	*Tsuga*[c]	Pinacceae
327.	*Ulex*[bc]	Fabaceae
328.	*Ulmus*[c]	Ulmaceae
329.	*Urena*[b]	Malvaceae
330.	*Urginea*[b]	Liliaceae
331.	*Vachellia*[b]	Mimosaseae
332.	*Verbascum*[c]	Scrophylariaceae
333.	*Veronica*[bc]	Scrophylariaceae
334.	*Viburnum*[c]	Caprifoliaceae
335.	*Vicia*[b]	Fabaceae
336.	*Vigna*[b]	Fabaceae
337.	*Vitis*[bc]	Vitaceae
338.	*Voandzeia*[b]	Fabaceae
339.	*Zea*[b]	Poaceae
340.	*Zizyphus*[b]	Rhamnaceae

b = Plant genera known to carry hidden infestation of Bruchids

c = Plant genera known to carry hidden infestation of Chalcids

bc = Plant genera known to carry hidden infestation of Bruchids and Chalcids

0 = Plant genera known to carry hidden infestation of other (Curculionids/ Scolytids etc.)

Several interceptions of exotic bruchids, chalcids etc. of quarantine significance have been made in the Plant Quarantine Division as a result of X-ray screening of the listed plant genera (Verma, 1980; Chandel and Singh, 1987; Mathur and Lal, 1996). This information is of paramount importance for the exchange of seeds including transgenics among different countries. Therefore, it is suggested to expose the listed plant genera to X-ray radiography at all the ports of entry.

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