PEST RISK ANALYSIS OF A PROPOSAL FOR THE IMPORTATION OF FEED GRAIN MAIZE (ZEA MAYS) FROM THE USA

ARTHROPOD PEST RISK ANALYSIS

March 1999

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1. ACKNOWLEDGMENTS

Mike Jefferies for assistance with research and Gina Pitsivoris for assistance with research and editing.

2. INTRODUCTION

The following pest risk initiation and assessment process of the pest risk analysis (PRA) was conducted in accordance with the relevant International Standards for Phytosanitary Measures (ISPM) (i.e. *Reference Standard, Principles of Plant Quarantine as Related to International Trade ISPM No. 1 FAO*, 1995; *Part 1-Import Regulations, Guidelines for Pest Risk Analysis ISPM No. 2 FAO*, 1996; and other standards being developed by the Secretariat of the International Plant Protection Convention (IPPC) of the Food and Agriculture Organization (FAO) of the United Nations).

The PRA covers insect, mite and mollusc pests being in the grain post harvest pathway (principally stored maize grain) in North America (Canada, USA, and Mexico). Insect, mite and mollusc pests of the plant, such as stems, leaves and roots, were not considered in the analysis due to the extremely different environments present between field and storage, and the fact that very few pests are capable of surviving in both environments. The species which do exist in both field and storage were included in the analysis. Also included in the analysis are 19 arthropod pests identified by the Disease Technical Working Group which are present in North America and are known to vector maize diseases. Due to the nature of trade in grain between Canada, USA, and Mexico, and the fact that common railcars and transport are used between all three countries, arthropod pests of stored maize grain from North America as a whole have been included in the analysis. In addition, the use of common railcars and storage facilities in North America increases the likelihood of admixture of other grain commodities. For this reason, common pests of possible admixture commodities have also been included in the analysis.

3. METHODOLOGY

The risk analysis process took into account factors such as the biology, host range, distribution, entry potential, establishment potential, spread potential and economic damage potential of pests capable of feeding and breeding on stored grains in North America and Australia. Species and genera considered, their distribution in North America and Australia, and their quarantine status in Australia are listed in Appendix 2 (Table 1: Quarantine Status of Pests Associated with Stored Maize Grain and Admixture Grain Commodities in North America (Canada, USA and Mexico)).

The risk analysis identified 14 pests of concern to Australia that have a significant risk of being associated with maize grain from the USA and are capable of breeding in stored grain (List 1A). A further 2 pests were identified that are pests of ripening plants and vegetables that have a significant risk of being associated with damp stored maize grain (List 1B). Two additional pests were identified as having a significant risk if infestable pulses were present in admixture with maize grain from the USA (List 1C). The total of 18 pests satisfy the IPPC definition of a quarantine pest and have been classified as quarantine pests for Australia.

An additional pest, *Trogoderma granarium* Everts, the khapra beetle, was identified as being of concern to Australia (List 1D). *T. granarium* is not established in North America and is a legislated pest in the USA. However, it is possible for this species to be present in ships used for grain

transport and interceptions have been recorded via this pathway. *T. granarium* is a serious pest of stored produce, is a legislated pest in Australia and has therefore been included in this analysis.

List 1: Quarantine pests for Australia with a significant risk of being associated with maize grain from the USA

a: Pests which are capable of breeding in stored grain

Cathartus quadricollis (Guérin-Méneville, 1829) [Coleoptera : Silvanidae]
Caulophilus oryzae (Gyllenhal, 1838) [Coleoptera : Curculionidae]
Cryptolestes turcicus (Grouvelle, 1876) [Coleoptera : Laemophloeidae]
Cynaeus angustus (Le Conte, 1852) [Coleoptera : Tenebrionidae]
Pharaxanotha kirschi Reitter, 1875 [Coleoptera : Languriidae]
Prostephanus truncatus (Horn, 1878) [Coleoptera : Bostrichidae]
Tribolium audax Halstead, 1969 [Coleoptera : Tenebrionidae]
Tribolium brevicornis (LeConte, 1859) [Coleoptera : Tenebrionidae]
Tribolium destructor Uyttenboogaart, 1933 [Coleoptera : Tenebrionidae]
Tribolium madens (Charpentier, 1825) [Coleoptera : Tenebrionidae]
Trogoderma glabrum (Herbst, 1783) [Coleoptera : Dermestidae]
Trogoderma inclusum LeConte, 1854 [Coleoptera : Dermestidae]
Trogoderma ornatum (Say, 1825) [Coleoptera : Dermestidae]
Trogoderma variabile Ballion 1878 [Coleoptera : Dermestidae]

b: Pests associated with damp maize grain from the USA

Glischrochilus fasciatus (Olivier, 1790) [Coleoptera : Nitidulidae]
Glischrochilus quadrisignatus (Say, 1835) [Coleoptera : Nitidulidae]

c: Pests associated with infestable pulses

Callosobruchus chinensis (Linnaeus 1758) [Coleoptera : Bruchidae]
Zabrotes subfasciatus (Boheman 1833) [Coleoptera : Bruchidae]

d: Additional pests of quarantine concern for Australia

Trogoderma granarium Everts, 1898 [Coleoptera : Dermestidae]

Data sheets for these insects detailing their biological properties, extent of host range, potential impact and difficulty of detection are given in Appendix 1 (Biological Assessment of Arthropod Pests Associated with Stored Maize Grain and Admixture Grain Commodities and Arthropod Pests Known to Vector Maize Diseases in North America).

4. RISK IDENTIFICATION

Insects

Pest species identified ranged from little known pests of limited worldwide distribution, through to pests such as *Prostephanus truncatus* and some *Trogoderma* species which are of quarantine concern generally, the presence of which requires complex management procedures. As well as being pests associated with grain, all have the potential of establishing in natural habitats. Comments have been made in the data sheets (Appendix 1: Biological Assessment of Arthropod Pests Associated with Stored Maize Grain and Admixture Grain Commodities and Arthropod Pests Known to Vector Maize Diseases in North America) as to some possible adverse consequences that introduction of these pests may have to the natural environment. Once established in natural habitats, official control and eradication is likely to be difficult.

Information on the status and distribution of important insect pests of stored grain is relatively reliable both in North America and in Australia, allowing a reasonable comparison to be made between the two faunas. However, in comparison, knowledge of many mould-feeding and minor genera is limited. Insufficient information is available to say if such species known to occur in North America are present in Australia. Some mould feeders can survive for substantial periods in clean, dry grain but are unlikely to be able to feed or reproduce in it; these species were included in the analysis.

A wide range of incidental insects can also be harvested along with grain. These form a sample of the local fauna and may include many species not found in Australia. The likely species involved are impossible to predict. Most of these incidental insects are unlikely to survive for significant periods in grain in storage, especially if it is clean with minimal admixture. No attempt was also made to assess risks associated with parasites and predators that can be associated with pest species. Nevertheless, measures that effectively control arthropod pest species can be expected to control any species associated with them.

Most major economic pests of stored grain with the exception of those identified above (List 1a, b, c & d), are common to both North America and Australia. While this may be so, genotypes of a given species may be different in either continent. Strains in one place may be more resistant to pesticides and fumigants than elsewhere. Importation of such strains could cause problems with using control treatments. Currently, there is no information regarding strains of major storage insects present in the USA and Canada that are significantly more tolerant to pest control treatments than those known to occur in Australia. However, this may be due to lack of data as survey results in USA and Canada, particularly for phosphine resistance, are rudimentary. In the absence of data and because of the widespread use of phosphine fumigation in the USA it should be assumed that some degree of phosphine resistance is likely to be present, at least in common stored product pests. Dosages will need to be targeted accordingly if phosphine is chosen as a disinfestant.

Mites

Our knowledge of the Australian mite fauna, native and exotic, associated with stored products is incomplete and there are no in-depth recent surveys. It is not possible to assert that a given mite, not currently recorded here, is not present in Australia. No mite species listed by the USDA key (Smiley, 1991) and not recorded to date in Australia is known to be significantly destructive to well-stored grain. No assessment can be made as to the potential environmental impact of mites likely to be associated with stored maize, though some are likely to become established outside of

grain stores, if not already present. Well-managed clean, dry grain is unlikely to contain significant numbers of mites.

Snails

No specific references were found concerning snails as an agronomic problem associated with trade in maize grain in the USA and Canada. No species are listed as storage pests by Godan (1983), although field slugs are mentioned as causing considerable damage to young maize plants. Snails may however be harvested as an incidental contaminant. As such they are likely to form a sample of the local fauna and may include species not found in Australia. Information does not appear to be available as to the ability of such species to survive in stored grain. Experience with the importation of maize grain from the USA in 1995 indicates that the risk of importation of molluscs is low.

5. PROPOSED PEST RISK MANAGEMENT OPTIONS

The final phase of the PRA process is the allocation of appropriate risk management options to address the pest risk identified within the pathway. Risk of importing these pests can be minimised by a combination of management methods, which include:

- Grain quality
- Selection of grain from areas free of pests (Area Freedom)
- Prevention of infestation during transportation, storage and handling
- Fumigation
- Processing

The following comments are provided for the information of the Operational Procedures Technical Working Group and the Risk Analysis Panel.

Grain quality

Risk of infestation increases with decline in grain quality, measured in terms of its physical condition (eg. % brokens, immature or mouldy grains), temperature and moisture content, and extent of admixture of trash and other material. Many insect species find it much easier to become established in grain consignments containing admixture and damaged grains. Risk of importation of species identified as of quarantine concern to Australia, with the exception of *Caulophilus oryzae* and *Prostephanus truncatus* that attack whole grains, would be reduced if only high grades, grain in good condition with minimal admixture, was imported. Grain moisture content should be less than 14%, which is independent of grade. A number of species including *C. oryzae* and *Glischrochilus* spp., are adversely affected by low moisture content. Complete removal of admixture of pulses from maize reduces the risk of species from List 1c being imported to negligible levels.

Sieving and grain cleaning will remove most snails and other incidental contaminants. It may however be difficult to remove such contaminants that are of similar size and density to maize grains, such as pulses.

Lower grades of maize are notoriously difficult to fumigate as regions of bulk cargo can be very high in trash and fines – this material tends to segregate during handling and transport of the grain and forms pockets and layers through which fumigants may have difficulty passing. This results in

non-uniform distribution of gas and an increased risk of fumigant survivors. These problems are compounded if fumigation is undertaken in-ship. Clean grain is much easier to fumigate properly.

Selection of grain from areas free of pests (Area Freedom)

Several species identified as of quarantine concern to Australia appear to have restricted distributions in the USA. *Caulophilus oryzae*, *Prostephanus truncatus* and *Cathartus quadricollis* appear to be restricted to southern states with *P. truncatus* and *C. quadricollis* at least being much more widely distributed in Mexico. If it is possible to guarantee the source of grain, obtaining it from more northerly areas will reduce the risk of importation of these species, although it will not completely eliminate the risk. Other species identified as of quarantine concern however, are appear to be widely distributed and it will not be possible to identify maize producing regions free of these pests. In general however, infestation pressure declines as one moves into more northerly grain growing areas. If maize is to be sourced using the principles of area freedom, this will require detection, monitoring and delimiting surveys for pests of quarantine to be carried out annually, also the dedication and monitoring of rail cars. This is unlikely to be commercially acceptable in the USA as this is not normal practice.

Prevention of infestation during transportation, storage and handling

A number of species identified of quarantine concern, notably *Cryptolestes turcicus*, and the *Tribolium* and *Trogoderma* species, are not host specific and can be pests infesting residues present in grain handling systems. Such species can infest maize grain when handled through contaminated facilities. Use of well managed handling and transportation systems will reduce this risk. Fumigation is a non residual treatment and will not confer protection of the grain during subsequent handling and transportation.

Ships used for the importation of maize need to be 'fit for purpose'. Vessels can become infested with insects of quarantine concern from previous cargoes and not necessarily only those associated with maize. This could include species which are not established in North America including the khapra beetle, *Trogoderma granarium*. Prior to loading grain, ships must be clean and free of infestation, at least to the standard expected of vessels which handle Australian grain exports. This includes not only the hold, but all other areas of the vessel including crew quarters and engine room and related areas from which infestation could arise.

Fumigation

There is little or no data available on the effects of fumigants, contact insecticides or other control measures on most of the pests identified as of quarantine concern. Nonetheless, most are unlikely to be more tolerant than *Tribolium castaneum* with methyl bromide (Bond, 1984), *Sitophilus oryzae* with phosphine (National Working Party on Grain Protection, 1997) or *Rhyzopetha dominica* with heat (Banks & Fields, 1995), these being the most tolerant pests that the Australian dosage rates are aimed at. Exceptions are likely to be *Trogoderma* species, as larvae in diapause, which are exceptionally tolerant of methyl bromide (Rees & Banks, 1998) and also species in the family Bruchidae, which can be exceptionally tolerant of phosphine and many contact insecticides (National Working Party on Grain Protection, 1997). Resistance status is unknown of all these pests from North America.

We also note that ship fumigation is an uncertain process and is most unlikely to be carried out to a standard required to give kill to a level expected for quarantine purposes. It is extremely difficult to ensure good gas distribution in the hold or any other part of a ship, even if the ship is stationary.

The problem is further compounded if any bulk commodity being fumigated contains a significant quantity of fines, trash and admixture; a common component even of high grades of maize.

The normal practice used by the USA for grain shipments is for grain to be treated with phosphine at US label rates as an in-ship treatment for the duration of the voyage. This methodology is not considered adequate for quarantine purposes due to difficulties in obtaining and assessing appropriate distribution of gas.

Processing

Processing maize prior to shipment can reduce risk of importing the identified pest species. Risk of importing species, eg. *Caulophilus oryzae* and *Prostephanus truncatus* that require whole grain, can be much reduced by milling and processing the grain. Other species present may be eliminated by the insecticidal nature of such processing. However, once the product has cooled, some species identified as of quarantine concern could reinfest, notably *Cryptolestes turcicus*, and the *Triboilum* and *Trogoderma* species. Therefore, if this option adopted, continued security from reinfestation must be assured.

Heat can be used for the processing or devitalisation of grain and may be insecticidal. Temperatures above 50°C are insecticidal, and becomes rapidly more insecticidal as temperature increases above this. All storage pests are killed by a few minutes actual exposure to either wet or dry heat of 65°C (Fields, 1992; Banks, in press). Time allowance needs to be made for the heat to penetrate the grain kernel to this temperature.

References

Banks, H.J. (in press) Prospects for heat disinfestation. *Proceedings of the Australian Postharvest Technical Conference*, Canberra, May 1998.

Banks, H.J. & Fields, P. (1995) Physical methods for insect control in stored-grain ecosystems, pp. 353-409 In: Jayas, D.S., White, N.D.G., Muir, W.E. (1995) *Stored-Grain Ecosystems*. Marcel Dekker: New York

Bond, E., J. (1984) Manual of fumigation for insect control. *FAO Plant Production and Protection Paper No. 54*. FAO: Rome

FAO (1995). *Reference Standard, Principles of Plant Quarantine as Related to International Trade.* ISPM Pub. No. 1, Rome.

FAO (1996). *Part 1 - Import Regulations, Guidelines for Pest Risk Analysis.* ISPM Pub. No. 2, Rome.

Fields, P. G. (1992) The control of stored-product insects and mites with extreme temperatures. *Journal of Stored Product Research* **28**: 89-118

Godan, D. (1983) *Pest Slugs and Snails, Biology and Control*. Springer-Verlag : Berlin, 445 pp.

National Working Party on Grain Protection (1997) *Appendix 1*. Draft guidelines for treatment of stored grain 1997/98, residual grain protectants for grain within or which may enter the central handling system. Brisbane: Australia

Rees, D.P. & Banks, H.J. (1998) The khapra beetle, *Trogoderma granarium* Everts (Coleoptera: Dermestidae), a quarantine pest of stored products: Review of biology, distribution, monitoring and control. A report written for AQIS, Canberra, Australia.

Smiley, R. L. (1991) Mites (Acari) in: Gorham, J. R. Ed (1991) *Insects and Mite Pests in Food, an Illustrated Key*. USDA Agriculture handbook No. 655, Washington DC, USA, Vol. 1, 3 - 44.

6. APPENDIX 1: BIOLOGICAL ASSESSMENT OF ARTHROPOD PESTS ASSOCIATED WITH STORED MAIZE GRAIN AND ADMIXTURE GRAIN COMMODITIES AND ARTHROPOD PESTS KNOWN TO VECTOR MAIZE DISEASES IN NORTH AMERICA.

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The following data sheets refer to arthropod pests known to be associated with stored maize and other stored grain commodities which are likely to be found in admixture with grain. Included are data sheets on arthropod pests known to vector maize diseases which were identified by the disease Technical Working Group for the maize from USA IRA.

Khapra beetle (*Trogoderma granarium*) is not on the list of arthropod pests of stored grain in the USA as it is not established there and is a legislated pest in the USA. However, it is possible for this species to be present in ships used for grain transport and interceptions have been recorded via this pathway. Khapra beetle is considered to be a pest of concern to Australia and has therefore been included in this analysis.

Data Sheets For Arthropods

6.1 Acanthoscelides obtectus (Say) : bean weevil

Species: *Acanthoscelides obtectus* (Say, 1831) [Coleoptera : Bruchidae]

Synonyms or changes in combination or taxonomy: *Bruchus obtectus* Say, 1831; *Buchus fabae* Riley, 1871; *Acanthoscelides varicornis* (Motshulsky)

Common name(s): bean weevil, American seed beetle, dried bean beetle

Distribution: North America, Australia

Entry potential: n/a, already present in Australia

Economic Importance: important pest of beans (*Phaseolus, Vicia, Cajanus* spp.) does not attack cereal grain, potential contaminant in maize

Quarantine Status: Non-Quarantine

References:

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

Bousquet, Y. (Ed.)(1991) *Checklist of Beetles of Canada and Alaska*. Agriculture Canada : Ottawa, 430 pp.

6.2 Aceria tosichella (Keifer) : grass mite

Species: *Aceria tosichella* (Keifer,1969) [Acarina: Eriophyidae]

Synonyms or changes in combination or taxonomy: *Eriophyes tosichella* Keifer, 1969; *Aceria tritici* Shevtchenko *et al.*, 1970; published records of *Aceria tulipae* (Keifer, 1938) on grasses are believed to refer to *A. tosichella*.

Common name(s): grass mite.

Distribution: no records of distribution found outside USA.

Vector Status: transmits High Plains Virus (HPV).

Entry potential - n/a, not in pathway. Mites of this family are not found on/in dry grains as they have modified piercing and sucking mouth parts and so can only feed on the liquid contents of cells. They do not have a resistant form that can sustain the species through long periods without a living host.

Establishment potential - High, suitable hosts probably widespread.

Spread potential - High.

Quarantine Status: Quarantine.

References:

Halliday, R. B (1998) *Mites of Australia: a Checklist and Bibliography*. CSIRO Publishing: Australia, 317 pp.

Jepson, L. R., Keifer, H. H., Baker, E. W. (1975) *Mites Injurious to Economic Plants*. University of California Press : Berkeley, 614pp.

Slykhuis, J. T. (1980) Mites. In Harris, K. F., Maramorosch, K. (1980) *Vectors of Plant Pathogens*. Academic Press: New York, 467 pp.

6.3 Aceria tulipae (Keifer) : wheat curl mite

Species: *Aceria tulipae* (Keifer, 1938) [Acarina: Eriophyidae]

Synonyms or changes in combination or taxonomy: *Eriophyes tulipae* Keifer, 1938; published records of *Aceria tulipae* (Keifer, 1938) on grasses are believed to refer to *A. tosichella* (Keifer,1969).

Common name(s): wheat curl mite.

Distribution: world wide, presence in Australia not confirmed**.**

Vector Status: vector of wheat streak mosaic rymovirus (WSMV)

Entry potential - n/a, not in pathway. Original records showed *A. tulipae* as a grass inhabiting species however, it is now believed that this species is confined to bulb-forming plants. Mites of this family are not found on/in dry grains as they are very small and in chambers in growing plant tissue.

Establishment potential - n/a.

Spread potential - n/a.

Quarantine Status: Quarantine.

References:

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, p185.

Halliday, R. B (1998) *Mites of Australia: a Checklist and Bibliography*. CSIRO Publishing: Australia, 317 pp.

Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p560.

Jepson L. R., Keifer, H. H., Baker, E. W. (1975) *Mites Injurious to Economic Plants*. University of California Press : Berkeley, 614pp.

6.4 Aglossa caprealis (Hübner) : murky meal moth

Species: *Aglossa caprealis* (Hübner, 1809) [Lepidoptera : Pyralidae]

Synonyms or changes in combination or taxonomy: *Pyralis caprealis* Hübner, 1809; *Pyralis aenalis* Costa, 1836; *Aglossa domalis* Guenée, 1854; *Acrobasis incultella* Walker, 1866; *Tetralopha enthealis* Hulst, 1886

Common name(s): murky meal moth

Distribution: USA, Australia

Entry potential: n/a, already present in Australia

Economic Importance: minor pest of residues

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.

6.5 Agriotes mancus (Say) : Wheat wireworm

Species: *Agriotes mancus* (Say, 1823) [Coleoptera: Elateridae]

Synonyms or changes in combination or taxonomy:

Common name(s): Wheat wireworm.

Distribution: N. America.

Vector Status: minor carrier of bacterium *Pantoea stewartii* subsp. *stewartii* (Smith) in USA.

Entry potential - n/a, not in pathway. Eggs are laid in soil, larvae live on roots only and adults are around in early spring/summer before harvest.

Establishment potential - Low, timing and point of introduction important for establishment.

Spread potential - Medium.

Quarantine Status: Quarantine.

References:

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, pp: 122-123.

Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p272.

6.6 Ahasverus advena (Waltl) : foreign grain beetle

Species: *Ahasverus advena* (Waltl, 1834) [Coleoptera : Cucujidae]

Synonyms or changes in combination or taxonomy: *Cryptophagus advena* Waltl, 1834; *Cryptophagus guerinii* Allibert, 1847; *Lathridius musaeorum* Ziegler, 1844; *Crytophagus angustatus* Lucas, 1849; *Cryptophagus striatus* Rouget, 1876

Common name(s): foreign grain beetle

Distribution: Canada, USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest mainly of damaged or milled cereal grain especially if slightly damp.

Quarantine Status: Non-Quarantine

References:

Halstead, D.G.H. (1993) Keys for the identification of beetles associated with stored products II. Laemophloediae, Passandridae and Silvanidae. *Journal of Stored Product Research* **29**: 99-197.

Greening, H.G. & Gellatley, J.G. (1987) Insect pests of stored foodstuffs. AGFACTS AE.51, NSW Department of Agriculture, Agdex 615

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

6.7 Alphitobius diaperinus (Panzer) : lesser mealworm

Species: *Alphitobius diaperinus* (Panzer, 1797) [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy:

Common name(s): lesser mealworm

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: minor pest of residues, common inhabitant of chicken houses where it feeds on faeces and other wastes

Quarantine Status: Non-Quarantine

References:

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

6.8 Alphitobius laevigatus (Fabricius) : black fungus beetle

Species: *Alphitobius laevigatus* (Fabricius,1781) [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy: *Alphitobius piceus* (Olivier); *Alphitobius picipes* (Panzer)

Common name(s): black fungus beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: minor pest of residues

Quarantine Status: Non-Quarantine

References:

Bousquet, Y. (Ed.)(1991) *Checklist of Beetles of Canada and Alaska*. Agriculture Canada : Ottawa, 430 pp.

6.9 Alphitophagus bifasciatus (Say) : twobanded fungus beetle

Species: *Alphitophagus bifasciatus* (Say, 1823) [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy: *Alphitophagus quadripustulatus* Stephens

Common name(s): twobanded fungus beetle, waste grain beetle

Distribution: Canada, USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: minor pest of residues

Quarantine Status: Non-Quarantine

References:

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.10 Anthicus spp. Paykull : ant beetles

Species: *Anthicus* spp. Paykull, 1798 [Coleoptera : Anthicidae]

Synonyms or changes in combination or taxonomy:

Common name(s): ant beetles

Distribution: North America, genus present in Australia

Entry potential: n/a, genus already present in Australia – species present in Australia likely to be imperfectly known, there may species present in North America that are not present in Australia.

Economic Importance: scavangers and mould feeders, occasional predators, which can be found in grain at harvest, populations usually decline in storage. In grain typically a minor contaminant. Present in natural ecosystems in leaf litter and debris, impact of potential new species difficult to predict.

Quarantine Status: Non-Quarantine

References:

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

6.11 Anthrenus spp. Geoffroy : museum beetle

Species: *Anthrenus* spp. Geoffroy, 1764 [Coleoptera : Dermestidae]

Synonyms or changes in combination or taxonomy:

Common name(s): museum beetle, carpet beetle

Distribution: North America, Australia

Entry potential: genus present in Australia

Economic Importance: scavangers, typically feeding on dead insects and other dried animal material, uncommon in grain in any number except when commodity contains high levels of suitable admixture

Quarantine Status: Non-Quarantine

References:
Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.12 Attagenus spp. Latrielle : fur beetle

Species: *Attagenus* spp. Latrielle [Coleoptera : Dermestidae]

Synonyms or changes in combination or taxonomy:

Common name(s): fur beetle, black carpet beetle

Distribution: North America, Australia

Entry potential: n/a, genus present in Australia

Economic Importance: scavangers, typically feeding on dead insects and other dried animal material, uncommon in grain in any number except when commodity contains high levels of suitable admixture

Quarantine Status: Non-Quarantine

References:
Voucher specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

6.13 Bruchus pisorum (Linnaeus) : pea weevil

Species: *Bruchus pisorum* (Linnaeus, 1758) [Coleoptera : Bruchidae]

Synonyms or changes in combination or taxonomy: *Bruchus salicis* Scopoli, 1763; *Bruchus crucigerus* Geoffroy; *Dermestes pisorum* Linnaeus 1758; *Bruchus pisi* Linnaeus

Common name(s): pea weevil, pea beetle, pea seed weevil

Distribution: Canada, USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: Pest of ripening peas, adults often emerge in storage but are unable to infest dry grain. A potential contaminant in cereal grains

Quarantine Status: Non-Quarantine

References:

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

Greening, H.G. & Gellatley, J.G. (1987) Insect pests of stored foodstuffs. AGFACTS AE.51, NSW Department of Agriculture, Agdex 615.

Wilcox, J.A. (1975) Family 130. Bruchidae, the pea & bean weevils In: *Checklist of the Beetles of North and Central America and the West Indies*. Flora & Fauna Pub. : Gainsville

6.14 Cadra cautella (Walker) : tropical warehouse moth

Species: *Cadra cautella* (Walker, 1863) [Lepidoptera : Pyralidae]

Synonyms or changes in combination or taxonomy: *Pempelia cautella* Walker, 1863; *Ephestia cautella* (Walker, 1863); *Cadra defectella* Walker, 1864; *Nephopteryx* (sic) *desuetella* Walker, 1866; *Ephestia passulella* Barrett, 1875; *Cryptoblabes formosella* Wileman & South, 1918; *Ephestia rotundatella* Turati, 1930; *Ephestia pelopis* Turner, 1947; *Ephestia irakella* Amsel, 1959

Common name(s): tropical warehouse moth

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: Common and important pest of mills and grain processors

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.15 Cadra figulilella (Gregson) : raisin moth

Species: *Cadra figulilella* (Gregson, 1871) [Lepidoptera : Pyralidae]

Synonyms or changes in combination or taxonomy: *Ephestia figulilella* Gregson, 1871; *Ephestia ficulella* Barrett, 1875; *Ephestia milleri* Zeller, 1876; *Ephestia gypsella* Ragonot, 1887; *Ephestia venosella* Turati, 1926

Common name(s): raisin moth

Distribution: USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: Pest of drying fruit and dried products.

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.16 Callosobruchus chinensis (Linnaeus) : southern cowpea weevil

Species: *Callosobruchus chinensis* (Linnaeus, 1758) [Coleoptera : Bruchidae]

Synonyms or changes in combination or taxonomy: *Curculio chinensis* Linnaeus, 1758; *Bruchus pecticornis* Linnaeus, 1767; *Bruchus scutullaris* Fabricius, 1792; *Bruchus barbicornis* Fabricius, 1801; *Bruchus biguttatus* Fabricius 1801; *Bruchus biguttellus* Schoenherr, 1833; *Kytorhyni scutellari* Motshoulksy 1874; *Bruchus pectinatus* Schilsky, 1904

Common name(s): southern cowpea weevil

Distribution: possible in southern USA

Entry potential: negligible if no infestable peas or beans are present.

Economic Importance: potential contaminant in maize if pulses (including soy beans, *Vigna* spp. *Lens* spp. and peas.) are present

Quarantine Status: Non-Quarantine

References:

Dobie, P., Haines, C.P., Hodges, R.J., Prevett, P.F. and Rees D.P. (Eds) (1991) Insects and Arachnids of Tropical Stored Products, Their Biology and Identification (A Training Manual). Natural resources institute, Chatham, Kent: United Kingdom, 246 pp.

Wilcox, J.A. (1975) Family 130. Bruchidae, the pea & bean weevils In: *Checklist of the Beetles of North and Central America and the West Indies*. Flora & Fauna Pub. : Gainsville

6.17 Callosobruchus maculatus (Fabricius) : cowpea weevil

Species: *Callosobruchus maculatus* (Fabricius, 1775) [Coleoptera : Bruchidae]

Synonyms or changes in combination or taxonomy: *Bruchus maculatus* Fabricius, 1775; *Bruchus quadrimaculatus* Fabricius, 1792; *Bruchus sinuatus* Fahraeus, 1839; *Bruchus ambiguus* Gyllenahl, 1839

Common name(s): cowpea weevil

Distribution: USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: potential contaminant in maize if pulses (including soy beans, *Vigna* spp. *Lens* spp. and peas.) are present

Quarantine Status: Non-Quarantine

References:

Dobie, P., Haines, C.P., Hodges, R.J., Prevett, P.F. and Rees D.P. (Eds) (1991) Insects and Arachnids of Tropical Stored Products, Their Biology and Identification (A Training Manual). Natural resources institute, Chatham, Kent, United Kingdom, 246 pp.

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.18 Carpophilus spp. Stephens : sap beetles

Species: *Carpophilus* spp. Stephens 1829 [Coleoptera : Nitidulidae]

Synonyms or changes in combination or taxonomy:

Common name(s): sap beetles, dried fruit beetles

Distribution: North America, Australia

Entry potential: n/a, genus present in Australia

Economic Importance: Minor pest of stored grain

Quarantine Status: Non-Quarantine

References: Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.19 Cathartus quadricollis (Guérin-Méneville) : square-necked flour beetle

Species: *Cathartus quadricollis* (Guérin-Méneville, 1829) [Coleoptera : Silvanidae]

Synonyms or changes in combination or taxonomy: *Silvanus quadricollis* Guérin-Méneville, 1829; Cathartus cassiae Reiche, 1854; *Silvanus gemellatus* Jaquelin du Val, 1857; *Cathartus gemellatus* (Jaqueline de Val, 1857); *Cathartus annectens* Sharp, 1899.

Common names(s): square-necked flour beetle.

Hosts: Wide range of stored commodities including maize (in field and in storage), cocoa beans, copra, groundnuts, edible tubers, rice, barley, wheat, flour, tobacco and cigars, oil-palm fruits, dried fruit and nuts.

Part of plant affected: Seeds and other dry plant material.

Distribution: Widespread in tropics, common in Mexico and southern states of USA.

Biology:

Life history:- A small active beetle which is attracted to ripening crops, it can continue to multiply in storage especially in damaged grain stored slightly damp. Adults are 2.1-3.5 mm in length, light brown in colour, parallel sided and elongate in shape. Optimum conditions for development are about 27°C and 80% R.H.. In maize, infestation begins in the field and continues to develop in storage. The adult beetles will readily fly and have been collected at heights of 70–170m above ground.

Entry potential:- High on maize sourced from areas where insect is common, small size and similarity to established species such as *Ahasverus advena* means species could easily be overlooked.

Establishment potential:- High, lives in similar environmental conditions to those found in Australia and has a wide host range. Likely to be able to thrive in summer cropping areas (eg northern NSW, south-eastern Qld) producing maize and sorghum.

Spread potential:- High, species very active and is a strong flier.

Economic importance: When it occurs in a crop this species can be numerically the most numerous storage insect present, considerable populations have been found infesting grain in storage, especially if grain is slightly damp. This species is likely to become an environmental pest owing to its ability to infest a wide range of ripening seeds.

Quarantine Status: Quarantine (High).

References:

Anon (1979) Stored Grain Insects. Agriculture Handbook No. 500, USDA, Washington DC : USA, 57pp.

Dobie, P., Haines, C.P., Hodges, R.J., Prevett, P.F. (Eds) (1984) Insects and Arachnids of Tropical Stored Products, Their Biology and Identification (A Training Manual). Tropical Development and Research Institute, Berks : United Kingdom, 273 pp.

Halstead, D.G.H. (1993) Keys for the identification of beetles associated with stored products II. Laemophloediae, Passandridae and Silvanidae. *Journal of Stored Product Research* **29**: 99-197.

6.20 Caulophilus oryzae (Gyllenhal) : broadnosed grain weevil

Species: *Caulophilus oryzae* (Gyllenhal, 1838) [Coleoptera : Curculionidae]

Synonyms or changes in combination or taxonomy: *Rhyncolus oryzae* Gyllenhal, 1898; *Rhyncolus launi* Gyllenhal, 1838; *Caulophilus sculptunatus*; *Caulophilus pinguis*; *Caulophilus latinagus*; *Caulophilus latinasus* Say, 1831

Common names(s): broadnosed grain weevil.

Hosts: maize, ginger, yams, avocado (seeds).

Part of plant affected: seeds.

Distribution: USA, (southern - Georgia, south Carolina, Florida), central America, West Indies.

Biology:

Life history:- A pest which attacks ripening crops before harvest. Can continue infesting grain in store if grain moisture content remains high. Adults are small and dark brown and can be recognised by their short rostrum and 9-segmented antennae. The species is unable to breed in dry, hard, uninjured grain but does attack soft or damaged grain or grain that is damaged by other insect. Adults are strong fliers and fly to the ripening maize crop and infest the grain before harvest. Adults live for an average of 5 months and females lay between 200-300 small white eggs usually in broken grains. In optimum conditions the life cycle can be completed in one month.

Entry potential:- Low in clean dry grain in good condition, minimal if grain is sourced from areas where insect is not found, risk increases with moisture content and quantity of admixture and damaged grains.

Establishment potential:- High, Australia has similar environmental conditions to this species' home range where crops susceptible to this pest are grown. It is most likely to be able to establish in warm humid summer cropping areas eg. northern NSW and Qld.

Spread potential:- Medium, the species can fly.

Economic importance: Can be an important pest of ripening crops in south-eastern USA and can continue in storage if grain is kept damp.

Quarantine Status: Quarantine (Medium).

References:

Anon (1979) Stored Grain Insects. Agriculture handbook No. 500, USDA, Washington DC : USA, 57pp.

Dobie, P., Haines, C.P., Hodges, R.J., Prevett, P.F. and Rees D.P. (Eds) (1991) Insects and Arachnids of Tropical Stored Products, Their Biology and Identification (A Training Manual). Natural Resources Institute, Chatham, Kent : United Kingdom, 246 pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.21 Chaetocnema pulicaria Melsheimer : corn flea beetle

Species: *Chaetocnema pulicaria* Melsheimer, 1806 [Coleoptera: Chrysomelidae]

Synonyms or changes in combination or taxonomy:

Common name(s): corn flea beetle.

Distribution: widespread genus; this species confined to N. America.

Vector Status: important in overwintering and spread of bacterium *Pantoea stewartii* subsp. *stewartii* (Smith) in USA; maize dwarf mosaic potyvirus.

Entry potential - n/a, not in pathway. Larvae destroy roots and adults eat growing leaf tissue, particularly seedlings, overwintering in soil and laying eggs on leaves or the ground in the spring. Adults jump when disturbed and are not present on ripened cobs.

Establishment potential - High, range of suitable hosts.

Spread potential - High.

Quarantine Status: Quarantine.

References:

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, pp: 171-172.

Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p311.

6.22 Corcyra cephalonica (Stainton) : rice moth

Species: *Corcyra cephalonica* (Stainton, 1866) [Lepdoptera : Pyralidae]

Synonyms or changes in combination or taxonomy: *Melissoblaptes cephalonica* Stainton, 1866; *Melissoblaptes oeconomellus* Mann, 1872; *Corcyra translineella* Hampson, 1901; *Tineopsis theobromae* Dyar, 1913; *Aneradtia lineata* Legrand, 1965

Common name(s): rice moth

Distribution: USA, Mexico - a tropical species, Australia

Entry potential: n/a, already in Australia

Economic Importance: a pest of mills in tropical areas

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.

6.23 Corticaria spp. : minute mould beetles

Species: *Corticaria* spp. [Coleoptera : Lathridiidae]

Synonyms or changes in combination or taxonomy:

Common name(s): minute mould beetles

Distribution: North America, Australia

Entry potential: n/a, genus present in Australia

Economic Importance: mould feeder present in damp or newly harvested grain. Not a pest of clean dry grain

Quarantine Status: Non-Quarantine

References:

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

6.24 Cryptolestes ferrugineus (Stephens) : rusty grain beetle

Species: *Cryptolestes ferrugineus* (Stephens, 1834) [Coleoptera : Cucujidae]

Synonyms or changes in combination or taxonomy: *Cucujus ferrugineus* Stephens, 1831; *Cucujus testaceus* Paykull, 1799; *Cucujus monilicornis* Stephens, 1831; *Laemophloeus concolor* Smith, 1851; *Laemophloeus obsoletus* Smith, 1851; *Laemophloeus carinulatus* Wollaston, 1877; *Laemophloeus emgei* Reitter, 1887; *Laemophloeus alluaudi* Grouvell, 1906

Common name(s): rusty grain beetle, rust-red grain beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: common important pest of stored grain and grain products

Quarantine Status: Non-Quarantine

References:

Halstead, D.G.H. (1993) Keys for the identification of beetles associated with stored products II. Laemophloediae, Passandridae and Silvanidae. *Journal of Stored Product Research* **29**: 99-197

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.25 Cryptolestes pusilloides (Steel & Howe) : flat grain beetle

Species: *Cryptolestes pusilloides* (Steel & Howe, 1952) [Coleoptera : Cucujidae]

Synonyms or changes in combination or taxonomy: *Laemophloeus pusilloides* Steel and Howe, 1952

Common name(s): flat grain beetle

Distribution: Mexico (Ref: Aitken, A. D (1975)), Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of grain and grain products

Quarantine Status: Non-Quarantine

References:

Aitken, A. D (1975) Insect Travellers, Volume I: Coleoptera, Her Majesty's Stationery Office

Halstead, D.G.H. (1993) Keys for the identification of beetles associated with stored products II. Laemophloediae, Passandridae and Silvanidae. *Journal of Stored Product Research* **29**: 99-197

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.26 Cryptolestes pusillus (Schönherr) : flat grain beetle

Species: *Cryptolestes pusillus* (Schönherr, 1817) [Coleoptera : Cucujidae]

Synonyms or changes in combination or taxonomy: *Cryptolestes minutus* Oliver, 1791; *Cucujus pusillus* Schönherr, 1817; *Cucujus testaceus* Stephens, 1831; *Cucujus ciassicornis* Waltl, 1839; *Laemophloeus longicornis* Mannerheim, 1843; *Laemophloeus brevis* Fairmaire, 1850; *Laemophloeus parallelus* Smith, 1851; *Laemophloeus pauper* Sharp, 1899; *Cryptolestes pusillus pusillus* (Schönherr) Lefkovitvh, 1967; *Cryptolestes pusillus fuscus* Lefkovitvh, 1967

Common name(s): flat grain beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of grain and grain products

Quarantine Status: Non-Quarantine

References:

Aitken, A. D (1975) Insect Travellers, Volume I: Coleoptera, Her Majesty's Stationery Office

Halstead, D.G.H. (1993) Keys for the identification of beetles associated with stored products II. Laemophloediae, Passandridae and Silvanidae. *Journal of Stored Product Research* **29**: 99-197

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

6.27 Cryptolestes turcicus (Grouvelle) : flat grain beetle

Species: *Cryptolestes turcicus* (Grouvelle, 1876) [Coleoptera : Laemophloeidae]

Synonyms or changes in combination or taxonomy: *Laemophloeus turcicus* Grouvelle, 1876; *Laemophloeus truncatus* Casey, 1884; *Laemophloeus immundus* Reitter, 1874*; Laemophloeus (Cryptolestes) turcicus* Grouvelle, 1876.

Common names(s): flat grain beetle, flour mill beetle.

Hosts: cereal grains, flour, dried vegetables, dried fruit.

Part of plant affected: seeds and other dried plant material

Distribution: Temperate regions including USA and Canada but excluding Australia and New Zealand.

Biology:

Life history:- A pest primarily of damaged grains, residues and milled produce. In North America it is most often associated with mills but is also found infesting elevators and warehouses. Adults are small in size (2mm in length), and shining reddish brown to yellowish brown in colour. Adults are winged but rarely fly. They are flat in shape and able to hide in very small crevices, making their detection difficult. Eggs are laid in holes and fractures in grains or amongst debris. The first instar larvae enter grains through minute cracks or holes in the pericarp. Development is assisted by presence of fungi in diet. Development can be completed from 17-35°C and 40-90% R.H., with optimum conditions of 27°C and 90% R.H. The life cycle can be completed in as little as 33 days.

Entry potential:- Medium in clean dry grain in good condition, risk increases with moisture content and quantity of admixture and damaged grains. *C. turcicus* can reliably only be distinguished from *Cryptolestes* species already established in Australia by microscopic examination of genitalia.

Establishment potential:- High, a pest in areas with environmental conditions very similar to those present in Australia. It is likely to be most serious a pest in temperate rather than tropical areas.

Spread potential:- High, *Cryptolestes* species are commonly found associated with traded cereal grains and products made from them.

Economic importance: An important pest of flour and feed mills in temperate regions, most commonly found in flour residues associated with mill machinery. It is likely to remain undetected for a considerable period post establishment because of its close morphological similarity to *Cryptolestes* spp. already established in Australia.

Quarantine Status: Quarantine (High).

References:

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Dobie, P., Haines, C.P., Hodges, R.J., Prevett, P.F. and Rees D.P. (Eds) (1991) Insects and Arachnids of Tropical Stored Products, Their Biology and Identification (A Training Manual). Natural Resources Institute, Chatham, Kent : United Kingdom, 246 pp.

Halstead, D.G.H. (1993) Keys for the identification of beetles associated with stored products II. Laemophloediae, Passandridae and Silvanidae. *Journal of Stored Product Research* **29**: 99-197

6.28 Cryptophagus spp. Paykull

Species: *Cryptophagus* spp. Paykull, 1800 [Coleoptera : Cryptophagidae]

Synonyms or changes in combination or taxonomy: *Kryptophagus* Herbst, 1792; *Mnionomus* Wollaston, 1864

Common name(s):

Distribution: USA, Canada, Australia

Entry potential: n/a, genus present in Australia

Economic Importance: mould feeder present in damp or newly harvested grain

Quarantine Status: Non-Quarantine

References:

Aitken, A. D (1975) Insect Travellers, Volume I: Coleoptera, Her Majesty's Stationery Office

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

Pope, R.D. (1977) Part 3 : Coleoptera and Strepsiptera In: Kloet, G.S. & Hincks, W.D. (1977) *A Check List of British Insects*. Royal Entomological Society : London

6.29 Cynaeus angustus (Le Conte) : large black flour beetle

Species: *Cynaeus angustus* (Le Conte,1852) [Coleoptera : Tenebrionidae

Synonyms or changes in combination or taxonomy:

Common names(s): large black flour beetle.

Hosts: In natural habitats it is found infesting decaying flower stems of Agave spp. It has can also infest stored cereal grains or products made from them.

Part of plant affected: Seeds and products thereof.

Distribution: Canada, Mexico, USA

Biology:

Life history:- Little known as a pest of stored produce prior to 1940. This species was previously only known from natural habitats - namely decaying parts of plants of the family Agavacae in Mexico and south-western USA. This species appears to be a recently adapted storage pest that has not spread worldwide wide in trade. The adults are 5-6 mm in length and can live for 6-12 months. The life cycle can be completed in 4 weeks under favourable conditions but usually requires 6-10 weeks. This insect prefers grain that is high in moisture.

Entry potential:- Low in clean dry grain in good condition, risk increases with moisture content and quantity of admixture and damaged grains.

Establishment potential:- High, environments suitable for this insect exist in Australia.

Spread potential:- High, adults are tough long-lived insects and would easily be capable of surviving movement in traded grain.

Economic importance: This species has been reported as a significant pest of stored shelled corn in Minnesota. It has also been reported as common in farm-stored grain in the north central states of the USA. It is also a pest in mills, retail stores and domestic situations. It is present in Canada but not regarded as a serious pest having first been seen there in the 1940s. Members of the family Agavacae are grown in Australia and are in some places weeds. These plants potentially offer a suitable habitat for this species. Its ability to establish in similar habits in native plant species is impossible to predict.

Quarantine Status: Quarantine (Medium).

References:

Anon (1979) Stored Grain Insects. Agriculture Handbook No. 500, USDA, Washington DC : USA, 57pp.

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

White, N.D.G. and Sinha, R.N. (1987) Bioenergetics of *Cyanus angustus* (Coleoptera: Tenebrionidae) feeding on stored corn. *Annals of the Entomological Society of America* **80**: 184 - 190.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.30 Dalbulus maidis (DeLong and Wolcott) : corn leafhopper

Species: *Dalbulus maidis* (DeLong and Wolcott) [Hemiptera: Cicadellidae]

Synonyms or changes in combination or taxonomy:

Common name(s): corn leafhopper.

Distribution: USA.

Vector Status: vector of maize rayado fino marafivirus.

Entry potential - n/a, not on pathway. All stages suck growing plant tissue for sap, not associated with grain or mature cobs.

Establishment potential - Medium, need suitable hosts at time of introduction.

Spread potential - High.

Quarantine Status: Quarantine.

References:

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, p. 185.

Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p166.

6.31 Deinerella spp.

Species: *Deinerella* spp. [Coleoptera : Lathridiidae]

Synonyms or changes in combination or taxonomy:

Common name(s):

Distribution: North America, Australia

Entry potential: n/a, may not be present in Australia, one introduced species established in New Zealand

Economic Importance: mould feeder, not a pest of clean dry grain

Quarantine Status: Non-Quarantine

References:

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

6.32 Delia platura (Meigen) : seed corn maggot

Species: *Delia platura* (Meigen, 1826) [Diptera: Anthomyiidae]

Synonyms or changes in combination or taxonomy: *Anthomyia platura* Meigen, 1826; *Anthomyia cana* Macquart, 1835; *Delia fusciceps* Zetterstedt, 1845; *Anthomyia rubrifrons* Macquart, 1851; *Chorthophila cilicrura* Rondani, 1866; *Anthomyia platygaster* Thomson, 1869; *Homalomyia rava* Hutton, 1901; *Phorbia novaezealandiae* Hutton, 1901.

Common name(s): seed corn maggot, bean seed fly.

Distribution: worldwide including Australia.

Vector Status: minor carrier of bacterium *Pantoea stewartii* subsp. *stewartii* (Smith) in USA.

Entry potential - n/a, not in pathway. Not found in or on dry grain, pest of roots of seedlings of wide range of mainly vegetables.

Establishment potential - Medium, many suitable hosts if introduced at right time.

Spread potential - High.

Quarantine Status: Non-Quarantine.

References:

C.I.E. (1985) Map No. A 141.

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, pp: 279-280.

Evenhuis, N.L. (Ed.) 1989 *Catalog of the Diptera of the Australasian and Oceanian Regions* Bishop Museum Press and E.J. Brill : Honolulu.

Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p.373.

6.33 Dermestes spp. Linnaeus : hide beetles

Species: *Dermestes* spp. Linnaeus [Coloptera : Dermestidae]

Synonyms or changes in combination or taxonomy:

Common name(s): hide beetles

Distribution: North America, Australia

Entry potential: n/a, genus present in Australia

Economic Importance: Pest of dried animal material, incidental in grain

Quarantine Status: Non-Quarantine

References:

Dobie, P., Haines, C.P., Hodges, R.J., Prevett, P.F. and Rees D.P. (Eds) (1991) Insects and Arachnids of Tropical Stored Products, Their Biology and Identification (A Training Manual). Natural resources institute, Chatham, Kent, United Kingdom, 246 pp.

6.34 Diabrotica sp. Chevrolat : corn rootworms

Species: *Diabrotica* sp. Chevrolat, 1835 [Coleoptera: Chrysomelidae]

Synonyms or changes in combination or taxonomy:

Common name(s): corn rootworms, cucumber beetles.

Distribution: genus worldwide. Pests in Northern Central and Southern America, otherwise world wide.

Vector Status: minor carrier of bacterium *Pantoea stewartii* subsp. *stewartii* (Smith) in USA. Also recorded as carrier of *Pseudomonas syringae* pv. *lapsa* (Ark) Young et al.

Entry potential - n/a, genus present in Australia.

Establishment potential - n/a, genus present in Australia.

Spread potential - n/a, genus present in Australia.

Quarantine Status: Non-Quarantine.

References:

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, pp: 168-171

Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p308.

6.35 Diabrotica longicornis (Say) : northern corn rootworm

Species: *Diabrotica longicornis* (Say, 1824) [Coleoptera: Chrysomelidae]

Synonyms or changes in combination or taxonomy:

Common name(s): corn rootworm, northern corn rootworm.

Distribution: Southern Canada and USA east of the Rocky Mountains.

Vector Status: minor carrier of bacterium *Pantoea stewartii* subsp. *stewartii* (Smith) in USA. Also recorded as carrier of *Pseudomonas syringae* pv. *lapsa* (Ark) Young et al.

Entry potential -n/a, not on pathway. Adults overwinter under trash on the ground and lay eggs in soil next to the host. Larvae attack roots of maize only; adults will feed on fresh corn silks reducing seed set. Not on mature cobs.

Establishment potential - Medium, may be limited by climate in N Australia.

Spread potential - High.

Quarantine Status: Quarantine.

References:

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, pp: 169-170.

6.36 Diabrotica undecimpunctata Mannerheim : southern corn rootworm

Species: *Diabrotica undecimpunctata* Mannerheim, 1843 [Coleoptera: Chrysomelidae]

Synonyms or changes in combination or taxonomy:

Common name(s): corn rootworm, southern corn rootworm, twelve-spotted cucumber beetle. Davidson & Lyon (1979) give a number of subspecies names with associated common names.

Distribution: Southern Canada and USA east of the Rocky Mountains.

Vector Status: minor carrier of bacterium *Pantoea stewartii* subsp. *stewartii* (Smith) in USA. Also recorded as carrier of *Pseudomonas syringae* pv. *lapsa* (Ark) Young et al.

Entry potential - n/a, not on pathway. Adults overwinter under trash on the ground and lay eggs in soil next to the host and atttack growing leaves. Larvae attack roots and shoots. Not found on harvested cobs.

Establishment potential - High, has range of hosts

Spread potential - High.

Quarantine Status: Quarantine.

References:

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, pp: 168-169.

6.37 Diabrotica virgifera LeConte : western corn rootworm

Species: *Diabrotica virgifera* LeConte, 1868 [Coleoptera: Chrysomelidae]

Synonyms or changes in combination or taxonomy:

Common name(s): corn rootworm, western corn rootworm.

Distribution: Nebraska, Iowa, South Dakota, Minnesota, Colorado and Kansas (south and east)

Vector Status: minor carrier of bacterium *Pantoea stewartii* subsp. *stewartii* (Smith) in USA. Also recorded as carrier of *Pseudomonas syringae* pv. *lapsa* (Ark) Young et al.

Entry potential - n/a, not in pathway. Overwinter as eggs in soil. Larvae attack roots of maize only; adults feed voraciously on fresh corn leaves and silks reducing seed set. Not on mature cobs.

Establishment potential - Medium, may be limited by climate.

Spread potential - High.

Quarantine Status: Quarantine.

References:

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, p. 170.

6.38 Dinoderus minutus (Fabricius) : bamboo powderpost beetle

Species: *Dinoderus minutus* (Fabricius, 1775) [Coleoptera : Bostrichidae]

Synonyms or changes in combination or taxonomy:

Common name(s): bamboo powderpost beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest mainly of bamboo and bamboo products, occasional pest of maize under tropical subsistence conditions.

Quarantine Status: Non-Quarantine

References:
Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

6.39 Endrosis sarcitrella (Linnaeus) : whiteshouldered house moth

Species: *Endrosis sarcitrella* (Linnaeus, 1758) [Lepidoptera : Oecophoridae]

Synonyms or changes in combination or taxonomy: *Phalaena* (*Tinea*) *sarcitrella* Linnaeus, 1758; *Tinea lactella* Denis & Schiffermüller, 1775

Common name(s): whiteshouldered house moth

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: minor pest of residues

Quarantine Status: Non-Quarantine

References:
Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.40 Enicumus minutus (Linnaeus)

Species: *Enicumus minutus* (Linnaeus, 1767) [Coleoptera : Lathridiidae]

Synonyms or changes in combination or taxonomy: *Lathridius minutus* (Linnaeus, 1767)

Common name(s):

Distribution: USA, Canada, Australia

Entry potential: n/a, present in Australia

Economic Importance: mould feeder present on newly harvested or damp grain

Quarantine Status: Non-Quarantine

References:

Aitken, A. D (1975) Insect Travellers, Volume I: Coleoptera, Her Majesty's Stationery Office

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.41 Ephestia elutella (Hübner) : tobacco moth

Species: *Ephestia elutella* (Hübner, 1796) [Lepidoptera : Pyralidae]

Synonyms or changes in combination or taxonomy: *Tinea elutella* Hübner, 1796; *Phycis semirufa* Haworth, 1811; *Phycis rufa* Haworth, 1811; *Hyphantidium sericarium* Scott, 1859; *Ephestia roxburghi* Gregson, 1873; *Ephestia infumatella* Ragonot, 1887; *Homoeosoma affusella* Ragonot, 1888; *Ephestia icosiella* Ragonot, 1888; *Ephestia amarella* Dyar, 1904

Common name(s): tobacco moth, warehouse moth, cocoa moth, chocolate moth

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: Common and important pest of mills and grain processors

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.,

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.42 Ephestia kuehniella (Zeller) : Mediterranean flour moth

Species: *Ephestia kuehniella* (Zeller, 1879) [Lepidoptera : Phycitinae]

Synonyms or changes in combination or taxonomy: *Ephestia keuhniella* Zeller, 1879; *Ephestia fuscofasciella* Ragonot, 1887; *Ephestia gitonella* Druce, 1896; *Homoeosoma ischnomorpha* Meyrick, 1931

Common name(s): Mediterranean flour moth

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: Common and important pest of mills and grain processors

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.43 Exitianus exitosus Uhler : leafhopper

Species: *Exitianus exitosus* Uhler [Hemiptera: Cicadellidae]

Synonyms or changes in combination or taxonomy:

Common name(s): leafhopper.

Distribution: apart from USA no mention of distribution found.

Vector Status: vector of maize chlorotic mottle machlomovirus and maize chlorotic dwarf waikavirus.

Entry potential - n/a, not in pathway. By analogy with other leafhoppers, on growing cereals and grasses where they suck sap, not associated with grain.

Establishment potential - Medium.

Spread potential - High.

Quarantine Status: Quarantine.

References:

Brunt, A.A., Crabtree, K., Dallwitz, M.J., Gibbs, A.J., and Watson, L. (1996). *Viruses of Plants.* CABI, University Press : Cambridge, p748.

6.44 Gibbium aequinoctiale Boieldieu : spider beetle

Species: *Gibbium aequinoctiale* Boieldieu, 1854 [Coleoptera : Ptinidae]

Synonyms or changes in combination or taxonomy:

Common name(s): spider beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: scavenger and minor pest of residues

Quarantine Status: Non-Quarantine

References: Aitken, A. D (1975) Insect Travellers, Volume I: Coleoptera, Her Majesty's Stationery Office

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.45 Gibbium psylloides (Czenpinski) : spider beetle

Species: *Gibbium psylloides* (Czenpinski, 1778) [Coleoptera : Ptinidae]

Synonyms or changes in combination or taxonomy: *Scotias psylloides* Czempinski, 1778; *Ptinus scotias* Fabricius, 1781; *Gibbium apterus* Fourcroy, 1785; *Gibbium scotias* (Fabricius, 1781)

Common name(s): spider beetle

Distribution: USA, Mexico, Australia

Entry potential: n/a, present in Australia

Economic Importance: scavenger and minor pest of residues

Quarantine Status: Non-Quarantine

References:
Aitken, A. D (1975) Insect Travellers, Volume I: Coleoptera, Her Majesty's Stationery Office

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.46 Glischrochilus fasciatus (Olivier) : picnic beetle

Species: *Glischrochilus fasciatus* (Olivier, 1790) [Coleoptera : Nitidulidae]

Synonyms or changes in combination or taxonomy: *Nitidula fasciata* Olivier, 1790; *Ips quadrisignatus* Say, 1835; *Ips bipustulatus* Mesheimer, 1846; *Ips sexpustulata* Reitter, 1873; *Ips quadriguttatus* Blatchley, 1910.

Common names(s): picnic beetle, redspotted sap beetle.

Hosts: ripening grain, fruit and vegetables.

Part of plant affected: seeds and ripening plant material.

Distribution: Canada, USA.

Biology:

Life history:- This species attacks ripening crops. It is unlikely to survive and breed in dry clean grain. The species is usually found in the field on fruit and vegetables already injured by other insects or birds, and occasionally in stored products. Adults hibernate in large numbers under bark or underneath logs. Can be a facultative predator on other insects present.

Entry potential:- Low in clean dry grain in good condition, risk increases with moisture content and quantity of admixture and damaged grains.

Establishment potential:- High, wide variety of suitable hosts present in Australia.

Spread potential:- High, adults are very active and fly well.

Economic importance: In North America can be a serious pest of ripening fruit and vegetable crops and a nuisance at picnic areas. It appears capable of spreading a number of fungal plant diseases. It is a pest of ripening grain but appears incapable of surviving in dry grain in good condition.

Quarantine Status: Quarantine (High), damp grain in poor condition may be a way this potentially important pest of fruit, vegetables and ripening grain may enter the country.

References:

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Hinton, H. (1945) A Monograph of the Beetles Associated with Stored Products. Vol. 1. British Museum : London, 443 pp.

6.47 Glischrochilus quadrisignatus (Say) : picnic beetle

Species: *Glischrochilus quadrisignatus* (Say, 1835) [Coleoptera : Nitidulidae]

Synonyms or changes in combination or taxonomy:

Common names(s): picnic beetle, fourspotted sap beetle.

Hosts: ripening grain, fruit and vegetables.

Part of plant affected: seeds and ripening plant material

Distribution: North America, (Canada , USA), Europe, (Czechoslovakia, Britain, Croatia, Italy, Yugoslavia, Central Europe, Germany, Netherlands), former USSR.

Biology:

Life history:- This species attacks ripening crops. It is unlikely to survive and breed in dry clean grain. Development time from egg to adult takes between 40 to 60 days depending on the food source. Can survive for long periods (up to 62 days) without food if moisture is available. Peak populations occur in late summer and throughout autumn. Adults overwinter under the bark of trees. Can be a facultative predator on other insects present.

Entry potential:- Low in clean dry grain in good condition, risk increases with moisture content and quantity of admixture and damaged grains.

Establishment potential:- High, wide variety of suitable hosts present in Australia.

Spread potential:- High, adults are very active and fly well.

Economic importance: In North America can be a serious pest of ripening fruit and vegetable crops and a nuisance at picnic areas. It appears capable of spreading a number of fungal plant diseases. It is a pest of ripening grain but appears incapable of surviving in dry grain in good condition.

Quarantine Status: Quarantine (High), damp grain in poor condition may be a way this potentially important pest of fruit, vegetables and ripening grain may enter the country.

References:

Blackmer, J.L. & Phelan, P.L. (1995). Ecological analysis of Nitidulidae: seasonal occurrence, host choice and habitat preference. *Journal of Applied Entomology* **119**: 321-329.

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Foott, W.H. & Timmins, P.R. (1979) The rearing and biology of *Glischrochilus quadrisignatus* (Coleoptera: Nitidulidae) in the laboratory. *Canadian Entomologist* **111**: 1337-1344.

6.48 Gnatocerus cornutus (Fabricius) : broadhorned flour beetle

Species: *Gnatocerus cornutus* (Fabricius, 1798) [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy: *Trogosita cornuta* Fabricius, 1798

Common name(s): broadhorned flour beetle, horned flour beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: minor pest of stored grain

Quarantine Status: Non-Quarantine

References:

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.49 Graminella nigrifrons (Forbes) : grass leafhopper

Species: *Graminella nigrifrons* (Forbes, 1885) [Hemiptera: Cicadellidae]

Synonyms or changes in combination or taxonomy:

Common name(s): grass leafhopper.

Distribution: USA.

Vector Status: vector of maize chlorotic mottle machlomovirus and maize chlorotic dwarf waikavirus.

Entry potential - n/a, not in pathway. On growing cereals and grasses where they suck sap, not associated with grain.

Establishment potential - High, many potential hosts.

Spread potential - High.

Quarantine Status: Quarantine.

References:

Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p.166.

6.50 Graminella sonora (Ball): grass leafhopper

Species: *Graminella sonora* (Ball) [Hemiptera: Cicadellidae]

Synonyms or changes in combination or taxonomy:

Common name(s): grass leafhopper.

Distribution: USA.

Vector Status: vector of maize chlorotic mottle machlomovirus and maize chlorotic dwarf waikavirus.

Entry potential - very low, not in pathway. On growing cereals and grasses where they suck sap, not associated with grain.

Establishment potential - High, many potential hosts

Spread potential - High.

Quarantine Status: Quarantine.

References:
Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p.166.

6.51 Henoticus spp.

Species: *Henoticus* spp. [Coleoptera : Cryptophagidae]

Synonyms or changes in combination or taxonomy:

Common name(s):

Distribution: North America, Australia

Entry potential: n/a, genus probably present in Australia

Economic Importance: mould feeder, not a pest of clean dry grain

Quarantine Status: Non-Quarantine

References:
Aitken, A. D (1975) Insect Travellers, Volume I: Coleoptera, Her Majesty's Stationery Office

6.52 Hofmannophila pseudospretella (Stainton) : brown house moth

Species: *Hofmannophila pseudospretella* (Stainton, 1849) [Lepidoptera : Oecophoridae]

Synonyms or changes in combination or taxonomy: *Oecophora pseudospretella* Stainton, 1849; *Litoides punctipinguinella* Bruand, 1856; *Gelechia improbella* Walker, 1869

Common name(s): brown house moth

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: occasional inhabitant of crop residues

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.

6.53 Lachesilla pedicularia (Linnaeus) : booklouse

Species: *Lachesilla pedicularia* (Linnaeus, 1758) [Psocoptera : Lachesillidae]

Synonyms or changes in combination or taxonomy: *Hemerobius pedicularia* Linnaeus, 1758; *Termes fatidicum* Linnaeus, 1758; *Hemerobius abdominalis* Fabricius, 1775; *Hemerobius pusillus* Müller, 1776; *Psocus nigricans* Stephens, 1836; *Psocus dubius* Stephens, 1836; *Psocus domesticus* Burmeister, 1839; *Psocus binotatus* Rambur, 1842; *Psocus salicus* Hagen, 1861; *Psocus geologus* Walsh, 1862; *Leptopsocus exiguus* Reuter, 1899; *Lachesilla limbata* Enderlein, 1924; *Caecilius nigrotuberculatus* Curran, 1925; *Lachesilla stigmalis* Navás, 1932

Common name(s): booklouse

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of storage structures in coastal areas

Quarantine Status: Non-Quarantine

References:

Smithers, C.N. (1996). Psocoptera. Pp. 1-79, 333-361 (App. I-IV), 363-372 (Index) In Wells, A. (Ed.) Zoological Catalogue of Australia. Vol. 26. Psocoptera, Phthiraptera, Thysanoptera. Melbourne : CSIRO Publishing, Australia 418pp.

Rees, D.P. & Wright, E.J. (1995). Lachesilla quercus (Kolbe) (Psocoptera: Lachesillidae): First record in Australia and a new pest of grain stores. J. Aust. Ent. Soc. 34: 355-357

6.54 Lachesilla quercus (Kolbe) : booklouse

Species: *Lachesilla quercus* (Kolbe, 1880) [Psocoptera : Lachesillidae]

Synonyms or changes in combination or taxonomy:

Common name(s): booklouse

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: known only from natural habitats in Australia

Quarantine Status: Non-Quarantine

References:

Rees, D.P. & Wright, E.J. (1995). Lachesilla quercus (Kolbe) (Psocoptera: Lachesillidae): First record in Australia and a new pest of grain stores. J. Aust. Ent. Soc. 34: 355-357

6.55 Lasioderma serricorne (Fabricius) : cigarette beetle

Species: *Lasioderma serricorne* (Fabricius, 1792) [Coleoptera : Anobiidae]

Synonyms or changes in combination or taxonomy: *Hypora serricorne* Fabricius, 1792; *Xyletinus brevis* Wollaston, 1861; *Lasioderma rufescens* Sturm, 1826; *Lasioderma testacea* Duftschmidt, 1825.

Common name(s): cigarette beetle

Distribution: North America, Australia

Entry potential: n/a, already present in Australia

Economic Importance: minor pest of stored grains, more important as pest of processed foods and tabacco products.

Quarantine Status: Non-Quarantine

References:

Arnett, R.H. (1983) Checklist of the Beetles of North and Central America and the West Indies. Vol. 4. The Click Beetles, Fireflies, Checkered Beetles, and Related Groups. Gainesville, Florida : Fauna and Fauna Publications

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.56 Latheticus oryzae Waterhouse : longheaded flour beetle

Species: *Latheticus oryzae* Waterhouse, 1880 [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy:

Common name(s): longheaded flour beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: minor pest of stored grain

Quarantine Status: Non-Quarantine

References:

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

6.57 Lathridius spp. : plaster beetle

Species: *Lathridius* spp. [Coleoptera : Lathridiidae]

Synonyms or changes in combination or taxonomy: *Conithassa* Thomson, 1859

Common name(s): plaster beetle

Distribution: North America , Australia

Entry potential: n/a, genus probably present in Australia

Economic Importance: mould feeder – not a pest of clean dry grain

Quarantine Status: Non-Quarantine

References:

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.58 Lema melanopa Linnaeus : cereal beetle

Species: *Lema melanopa* Linnaeus [Coleoptera: Chrysomelidae]

Synonyms or changes in combination or taxonomy: *Oulema melanopus* (Linnaeus)

Common name(s): cereal beetle, cereal leaf beetle, oat leaf beetle.

Hosts: Growing plants of oats, wheat, barley, rye, maize, and grasses especially timothy and quack grass; prefers oats.

Distribution: Europe, Iran, Israel, Turkey, Cyprus, Morocco, Tunisia, Mongolia, China, USA, Canada.

Parts of plant affected: Shoots and leaves, particularly of young plants.

Vector Status: Vector of maize dwarf mosaic potyvirus, maize chlorotic mottle virus (MCMV).

Biology:

Life History - Adults are slender, about 4mm in length, head and elytra metallic blue-black, prothorax and legs red. Overwintering beetles appear in the spring, females lay tiny cylindrical eggs on upper surfaces of leaves, yellow darkening to almost black before hatching. Larvae are pale yellow with brown-black legs and head but are encased in fecal matter. They browse on the leaf surfaces between veins. Pupation is in earthen cells in the top two inches of soil, adults emerging after 20-25 days. Life cycle can be as short as 46 days; the emerging adults feed for a while and then go into summer diapause followed by hibernation for the winter under crop remnants.

Entry potential - n/a, recorded as being carried in grain at harvest stage, however, no records of species as a storage pest or in grain itself.

Establishment potential - High, suitable hosts widespread.

Spread potential - High, said to be spread in grain, straw, fodder and machinery in USA.

Economic Importance: Medium, infestations have caused loss of some oat crops at seedling stage and spread MCMV in corn crops.

Estimated Risk: Quarantine.

References:

C.I.E. (1969) Map No. A 260.

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, pp: 167-168.

Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p304.

6.59 Lepinotus inquilinus Heyden : booklouse

Species: *Lepinotus inquilinus* Heyden, 1850 [Psocoptera : Trogiidae]

Synonyms or changes in combination or taxonomy: :Scopoli, 1763; *Pradoxides psocoides* Motschulsky, 1851; *Clothilla picea* Hagen 1861; *Atropos sericea* Kolbe, 1883; *Atropos distincta* Kolbe, 1888; *Cuixa canaria* Navás, 1927

Common name(s): booklouse

Distribution: USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of stored grain and grain storage structures

Quarantine Status: Non-Quarantine

References:

Smithers, C.N. (1996). Psocoptera. Pp. 1-79, 333-361 (App. I-IV), 363-372 (Index) In Wells, A. (Ed.) Zoological Catalogue of Australia. Vol. 26. Psocoptera, Phthiraptera, Thysanoptera. Melbourne : CSIRO Publishing, Australia 418pp.

Rees, D.P. (1994) Studies of distribution and control of Psocoptera (psocids or booklice) associated with the grain industry in Australia. CSIRO Australia, Division of Entomology Report No. 57

Mockford, E.L (1993). North American Psocoptera (Insecta), Sandhill Crane Press, Inc., Florida

6.60 Lepinotus patruelis Pearman : booklouse

Species: *Lepinotus patruelis* Pearman, 1931 [Psocoptera : Trogiidae]

Synonyms or changes in combination or taxonomy: *Lepinotus quadrispinosus* Obr, 1948

Common name(s): booklouse

Distribution: USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of stored grain and grain storage structures

Quarantine Status: Non-Quarantine

References:

Smithers, C.N. (1996). Psocoptera. Pp. 1-79, 333-361 (App. I-IV), 363-372 (Index) In Wells, A. (Ed.) Zoological Catalogue of Australia. Vol. 26. Psocoptera, Phthiraptera, Thysanoptera. Melbourne : CSIRO Publishing, Australia 418pp.

Rees, D.P. (1994) Studies of distribution and control of Psocoptera (psocids or booklice) associated with the grain industry in Australia. CSIRO Australia, Division of Entomology Report No. 57

Mockford, E.L (1993). North American Psocoptera (Insecta), Sandhill Crane Press, Inc., Florida

6.61 Liposcelis bostrychophila Badonnel : booklouse

Species: *Liposcelis bostrychophila* Badonnel, 1931 [Psocoptera : Liposcelididae]

Synonyms or changes in combination or taxonomy: *Liposcelis bostrychophilus* Badonnel, 1931; *Liposcelis divergens* Badonnel, 1943; *Liposcelis granicola* Broadhead & Hobby, 1944

Common name(s): booklouse

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of stored grain and grain storage structures

Quarantine Status: Non-Quarantine

References:

Smithers, C.N. (1996). Psocoptera. Pp. 1-79, 333-361 (App. I-IV), 363-372 (Index) In Wells, A. (Ed.) Zoological Catalogue of Australia. Vol. 26. Psocoptera, Phthiraptera, Thysanoptera. Melbourne : CSIRO Publishing, Australia 418pp.

Rees, D.P. (1994) Studies of distribution and control of Psocoptera (psocids or booklice) associated with the grain industry in Australia. CSIRO Australia, Division of Entomology Report No. 57

Mockford, E.L (1993). North American Psocoptera (Insecta), Sandhill Crane Press, Inc., Florida

6.62 Liposcelis brunnea Motschulsky : booklouse

Species: *Liposcelis brunnea* Motschulsky, 1852 [Psocoptera : Liposcelididae]

Synonyms or changes in combination or taxonomy: *Liposcelis brunneus* Motschulsky, 1852; *Liposcelis liparus* Broadhead, 1947

Common name(s): booklouse

Distribution: USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of stored grain and grain storage structures

Quarantine Status: Non-Quarantine

References:

Rees, D.P. (1994) Studies of distribution and control of Psocoptera (psocids or booklice) associated with the grain industry in Australia. CSIRO Australia, Division of Entomology Report No. 57

Mockford, E.L (1993). North American Psocoptera (Insecta), Sandhill Crane Press, Inc., Florida

6.63 Liposcelis corrodens (Heymans) : booklouse

Species: *Liposcelis corrodens* (Heymans, 1909) [Psocoptera : Liposcelididae]

Synonyms or changes in combination or taxonomy: *Liposcelis liparus* Broadhead, 1947; *Troctes corrodens* Heymons, 1909; *Liposcelis subfuscus* Broadhead, 1947

Common name(s): booklouse

Distribution: USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of stored grain and grain storage structures

Quarantine Status: Non-Quarantine

References:

Smithers, C.N. (1996). Psocoptera. Pp. 1-79, 333-361 (App. I-IV), 363-372 (Index) In Wells, A. (Ed.) Zoological Catalogue of Australia. Vol. 26. Psocoptera, Phthiraptera, Thysanoptera. Melbourne : CSIRO Publishing, Australia 418pp.

Rees, D.P. (1994) Studies of distribution and control of Psocoptera (psocids or booklice) associated with the grain industry in Australia. CSIRO Australia, Division of Entomology Report No. 57

Mockford, E.L (1993). North American Psocoptera (Insecta), Sandhill Crane Press, Inc., Florida

6.64 Liposcelis decolor (Pearman) : booklouse

Species: *Liposcelis decolor* (Pearman, 1925) [Psocoptera : Liposcelididae]

Synonyms or changes in combination or taxonomy: *Troctes bicolor* var. *decolor* Pearman, 1925; *Liposcelis terricolis* Badonnel, 1945; *Liposcelis luridus* Broadhead, 1947*; Lisposcelis simulans* race B Broadhead, 1950; *Liposcelis silvarum palpalis* Badonnel, 1971; *Liposcelis terricolis monniotae* Badonnel, 1971; *Lisposcelis macedonicus* Gunther, 1980

Common name(s): booklouse

Distribution: USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of stored grain and grain storage structures

Quarantine Status: Non-Quarantine

References:

Rees, D.P. (1994) Studies of distribution and control of Psocoptera (psocids or booklice) associated with the grain industry in Australia. CSIRO Australia, Division of Entomology Report No. 57

Mockford, E.L (1993). North American Psocoptera (Insecta), Sandhill Crane Press, Inc., Florida

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.65 Liposcelis entomolphila (Enderlein) : booklouse

Species: *Liposcelis entomolphila* (Enderlein, 1907) [Psocoptera : Liposcelididae]

Synonyms or changes in combination or taxonomy: *Troctes entomophilus* Enderlein, 1907; *Liposcelis bakeri* Pearman, 1928; *Liposcelis virgulatus* Pearman, 1929

Common name(s): booklouse

Distribution: North America, Australia

Entry potential: n/a, already present in Australia

Economic Importance: Nil

Quarantine Status: Non-Quarantine

References:

Smithers, C.N. (1996). Psocoptera. Pp. 1-79, 333-361 (App. I-IV), 363-372 (Index) In Wells, A. (Ed.) Zoological Catalogue of Australia. Vol. 26. Psocoptera, Phthiraptera, Thysanoptera. Melbourne : CSIRO Publishing, Australia 418pp.

Rees, D.P. (1994) Studies of distribution and control of Psocoptera (psocids or booklice) associated with the grain industry in Australia. CSIRO Australia, Division of Entomology Report No. 57

Mockford, E.L (1993). North American Psocoptera (Insecta), Sandhill Crane Press, Inc., Florida

6.66 Liposcelis paeta (Pearman) : booklouse

Species: *Liposcelis paeta* (Pearman, 1942) [Psocoptera : Liposcelididae]

Synonyms or changes in combination or taxonomy: *Liposcelis paetus* Pearman, 1942

Common name(s): booklouse

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of stored grain and grain storage structures

Quarantine Status: Non-Quarantine

References:

Rees, D.P. (1994) Studies of distribution and control of Psocoptera (psocids or booklice) associated with the grain industry in Australia. CSIRO Australia, Division of Entomology Report No. 57

Mockford, E.L (1993). North American Psocoptera (Insecta), Sandhill Crane Press, Inc., Florida

6.67 Liposcelis rufa (Broadhead) : booklouse

Species: *Liposcelis rufa* (Broadhead, 1950) [Psocoptera : Liposcelididae]

Synonyms or changes in combination or taxonomy: *Liposcelis rufus* Broadhead, 1950

Common name(s): booklouse

Distribution: USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of stored grain and grain storage structures

Quarantine Status: Non-Quarantine

References:

Rees, D.P. (1994) Studies of distribution and control of Psocoptera (psocids or booklice) associated with the grain industry in Australia. CSIRO Australia, Division of Entomology Report No. 57

Mockford, E.L (1993). North American Psocoptera (Insecta), Sandhill Crane Press, Inc., Florida

6.68 Litargus balteatus LeConte

Species: *Litargus balteatus* LeConte, 1856 [Coleoptera : Mycetophagidae]

Synonyms or changes in combination or taxonomy: *Litargus inflatus* LeConte, 1856

Common name(s):

Distribution: Canada, USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: mould feeder, not a pest of clean dry grain

Quarantine Status: Non-Quarantine

References:

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

6.69 Mezium affine Boieldieu : spiny spider beetle

Species: *Mezium affine* Boieldieu, 1856 [Coleoptera : Ptinidae]

Synonyms or changes in combination or taxonomy:

Common name(s): spiny spider beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: scavenger and minor pest of residues

Quarantine Status: Non-Quarantine

References:

Greening, H.G. & Gellatley, J.G. (1987) Insect pests of stored foodstuffs. AGFACTS AE.51, NSW Department of Agriculture, Agdex 615

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

6.70 Mezium americanum Laporte : American spider beetle

Species: *Mezium americanum* Laporte, 1840 [Coleoptera : Ptinidae]

Synonyms or changes in combination or taxonomy: *Gibbium americanum* Laporte, 1840

Common name(s): American spider beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: scavenger and minor pest of residues

Quarantine Status: Non-Quarantine

References:

Greening, H.G. & Gellatley, J.G. (1987) Insect pests of stored foodstuffs. AGFACTS AE.51, NSW Department of Agriculture, Agdex 615

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

6.71 Murmidius ovalis (Beck) : murmidius beetle

Species: *Murmidius ovalis* (Beck, 1814) [Coleoptera : Cerylonidae]

Synonyms or changes in combination or taxonomy: *Hister ovalis*; *Murmidius ferrugineus* Leach; *Ceutocerus advena* Schueppel

Common name(s): murmidius beetle

Distribution: Canada, USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: mould feeder

Quarantine Status: Non-Quarantine

References:

Aitken, A. D (1975) Insect Travellers, Volume I: Coleoptera, Her Majesty's Stationery Office

6.72 Mycetophagus quadriguttatus Müller : spotted hairy fungus beetle

Species: *Mycetophagus quadriguttatus* Müller, 1821 [Coleoptera : Mycetophagidae]

Synonyms or changes in combination or taxonomy: *Mycetophagus bipustulatus* Melsheimer; *Mycetophagus bisignatus* Melsheimer

Common name(s): spotted hairy fungus beetle

Distribution: Canada, USA, Australia

Entry potential: low, except in damp grain in poor condition

Economic Importance: possibly not present in Australia, a mould feeder – known from damp residues and grain kept in poor condition. Not a pest of clean dry grain.

Quarantine Status: Non-Quarantine

References:

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

6.73 Nemapogon granella (Linnaeus) : European grain moth

Species: *Nemapogon granella* (Linnaeus, 1758) [Lepidoptera : Tineidae]

Synonyms or changes in combination or taxonomy: *Tinea granella* Linnaeus, 1758; *Phalaena fenestrella* Scopoli, 1763; *Phalaena domesticella* Scopoli, 1763; *Tinea nebulosella* Geoffroy, 1785; *Tinea tesserella* Linnaeus, 1794; *Tinea costotristigella* Chambers, 1873; *Tinea fuscomaculella* Chambers, 1895; *Tinea marmorella* Chambers, 1873; *Tinea mancuniella* Hodgkinson, 1880; *Tinea nigroatomella* Dietz, 1905; *Tinea fuscicornella* Wöz, 1958

Common name(s): European grain moth, corn moth, mottled corn clothes moth

Distribution: USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: minor pest of residues

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.74 Niptus hololeucus (Faldermann) : golden spider beetle

Species: *Niptus hololeucus* (Faldermann, 1836) [Coleoptera : Ptinidae]

Synonyms or changes in combination or taxonomy:

Common name(s): golden spider beetle

Distribution: Canada, USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: scavenger and minor pest of residues

Quarantine Status: Non-Quarantine

References:

Aitken, A. D (1975) Insect Travellers, Volume I: Coleoptera, Her Majesty's Stationery Office

6.75 Oryzaephilus mercator (Fauvel) : merchant grain beetle

Species: *Oryzaephilus mercator* (Fauvel, 1889) [Coleoptera : Silvanidae]

Synonyms or changes in combination or taxonomy:*Silvanus mercator* Fauvel, 1889; *Silvanus gossypii* Chittenden, 1897

Common name(s): merchant grain beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: major pest of dried fruit, occasional on stored grain

Quarantine Status: Non-Quarantine

References:

Halstead, D.G.H. (1993) Keys for the identification of beetles associated with stored products II. Laemophloediae, Passandridae and Silvanidae. *Journal of Stored Product Research* **29**: 99-197.

Greening, H.G. & Gellatley, J.G. (1987) Insect pests of stored foodstuffs. AGFACTS AE.51, NSW Department of Agriculture, Agdex 615

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.76 Oryzaephilus surinamensis (Linnaeus) : sawtoothed grain beetle

Species: *Oryzaephilus surinamensis* (Linnaeus, 1758) [Coleoptera : Cucujidae]

Synonyms or changes in combination or taxonomy: *Dermestes surinamensis* Linnaeus, 1758; *Tenebrio cursor* Linnaeus, 1758; *Anobium frumentarium* Fabricius, 1775; *Ips sexdentata* Herbst, 1783; *Dermestes sexdentatus* Fabricius, 1792; *Colydium frumentarium Fabricius* 1792; *Silvanus bicornis* Erichson, 1846

Common name(s): sawtoothed grain beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: major pest of stored grain and grain products

Quarantine Status: Non-Quarantine

References:

Halstead, D.G.H. (1993) Keys for the identification of beetles associated with stored products II. Laemophloediae, Passandridae and Silvanidae. *Journal of Stored Product Research* **29**: 99-197.

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.77 Palorus ratzeburgii Wissman : broadhorned flour beetle

Species: *Palorus ratzeburgii* Wissman, 1848 [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy: *Hypophloeus ratzeburgii* Wissmann, 1848; *Hypophloeus depressus* Stephens, 1832; *Hypophloeus ambiguus* Wollaston, 1857; *Palorus floricola* Marseul, 1876; *Palorus galilaea* Sahleberg, 1913

Common name(s): broadhorned flour beetle, small-eyed flour beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: minor pest of stored grain

Quarantine Status: Non-Quarantine

References:

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Greening, H.G. & Gellatley, J.G. (1987) Insect pests of stored foodstuffs. AGFACTS AE.51, NSW Department of Agriculture, Agdex 615

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6.78 Palorus subdepressus (Wallaston) : depressed flour beetle

Species: *Palorus subdepressus* (Wallaston, 1864) [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy: *Hypophloeus subdepressus* Wallaston, 1864; *Palorus bifoveolatus* Baudi, 1896

Common name(s): depressed flour beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: minor pest of stored grain

Quarantine Status: Non-Quarantine

References:

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Greening, H.G. & Gellatley, J.G. (1987) Insect pests of stored foodstuffs. AGFACTS AE.51, NSW Department of Agriculture, Agdex 615

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

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6.79 Peregrinus maidis (Ashmead) : corn planthopper

Species: *Peregrinus maidis* (Ashmead, 1890) [Hemiptera: Delphacidae]

Synonyms or changes in combination or taxonomy:

Common name(s): corn planthopper

Distribution: circumtropical, including coastal eastern Australia.

Vector Status: maize stripe tenuivirus and maize mosaic nucleorhabdovirus.

Entry potential - n/a, not on pathway. On growing cereals and grasses where suck sap, not associated with grain.

Establishment potential - n/a, already present in Australia.

Spread potential - High, in suitable areas.

Quarantine Status: Non-Quarantine.

References:

C.I.E. (1973) Map No. A 317.

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, p. 184.

Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p155.

6.80 Pharaxanotha kirschi Reitter : Mexican grain beetle

Species: *Pharaxanotha kirschi* Reitter, 1875 [Coleoptera : Languriidae]

Synonyms or changes in combination or taxonomy: *Thallisella conradti* Gorham, 1898.

Common names(s): Mexican grain beetle.

Hosts: maize and maize meal, cotton bolls, edible tubers, wheat, flour, beans, stored products.

Part of plant affected: seeds.

Distribution: North and South America, intercepted in Germany from Guatemala.

Biology:

Life history:- A general feeder scavenger insect probably of tropical origin. Adults are 4-4.5 mm long with shining dark brown to reddish cuticle and a sparse covering of fine and short recumbent setae. The adults tend to remain on the surface of grain meal, forming small pits which 2 or 3 beetles will occupy. Adults can live for up to three months and deposit eggs on the surface of the food source. The larvae prefer to feed on broken grains as opposed to whole grains. Larvae move to the surface to pupate and pupation takes from 5-10 days. Life cycle from egg to adult takes 32 days to 5 months depending on temperature and humidity.

Entry potential:- Low in clean dry grain in good condition, risk increases with moisture content and quantity of admixture and damaged grains

Establishment potential:- High, suitable hosts present in Australia.

Spread potential:- Low, spread would depend on passive movement in commodity.

Economic importance: Likely to be only a minor pest, likely to be best able to feed and breed successfully on grain in poor condition.

Quarantine Status: Quarantine (Low-Medium).

References:

Hinton, H. (1945) A Monograph of the Beetles Associated with Stored Products. Vol. 1. British Museum : London, 443 pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.81 Phyllophaga spp. Harris : may beetle

Species: *Phyllophaga* spp. Harris, 1826 [Coleoptera: Scarabaeidae]

Synonyms or changes in combination or taxonomy:

Common name(s): may beetle, white grub, grubworm, june beetles.

Distribution: 20 species widespread in Northern, Central and Southern America.

Vector Status: minor carrier of bacterium *Pantoea stewartii* subsp. *stewartii* (Smith) in USA.

Entry potential - n/a, not in pathway. Larvae are exclusively general root feeders on grasses and cereals. Adults emerge and fly for relatively short periods in late spring to mid summer, not likely to be present at harvest or in stored grain.

Establishment potential - possibly high, other family members native to Australia.

Spread potential - Medium.

Quarantine Status: Quarantine.

References:

Davidson, R.H. & Lyon, W.F. (1979) *Insect Pests of Farm, Garden and Orchard*. 7th Edition. John Wiley & Sons : New York, pp: 126-128.

Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p265.

6.82 Plodia interpunctella (Hübner) : Indian meal moth

Species: *Plodia interpunctella* (Hübner, 1813) [Ledidoptera : Pyralidae]

Synonyms or changes in combination or taxonomy: *Tinea interpunctella* Hübner, 1813; *Tinea zeae* Fitch, 1856; *Unadilla latercula* Hampson, 1901; *Ephestia glycinivana* Matsumura, 1917; *Ephestia glycinivorella* Matsumura, 1932

Common name(s): Indian meal moth

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: major pest of mills, food processors, shops and homes

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.83 Prostephanus truncatus (Horn) : larger grain borer

Species: *Prostephanus truncatus* (Horn, 1878) [Coleoptera : Bostrichidae]

Synonyms or changes in combination or taxonomy: *Dinoderus truncatus* Horn, 1878.

Common names(s): larger grain borer, greater grain borer.

Hosts: maize and dried cassava, also in young woody shoots of a wide range of tree species. In the laboratory it can be made to breed slowly on other grains, eg. wheat, however it is not been found to be a pest of grains other than maize.

Part of plant affected: seeds, roots and woody twigs.

Distribution: Natural range - northern South America, Central America, Mexico and far south of USA. In Mexico it is widely distributed in a wide range of climatic conditions from montane to seasonally arid tropics. In the USA it is an occasional pest of maize in southern states, especially those bordering Mexico. No information appears to be publicly available as to its presence in natural habitats in the USA. It may be occasionally intercepted further north in the USA or in Canada as a result of grain movements but is unlikely to persist in such areas. From the late 1970's onwards it was introduced by accident into Africa, initially into Togo and Tanzania. It has since become widely spread in surrounding countries and is still spreading rapidly in sub-Saharan Africa.

Biology:

Life history:- This species is primarily a wood-borer feeding on young shoots of a wide range of tree species in natural bush habitats. Such populations act as a major reservoir for invasion of the storage environment. Its appearance in storage structures in affected areas is unpredictable. When populations do become established in stored maize or cassava they can cause very severe damage. Typically it is a pest of farm stored grain stored on the cob, especially under conditions of subsistence agriculture. While it is not regarded as an important pest of bulk stored grain, it can survive in such grain and in it capable of being moved great distances. Adults are 3-4 mm in length, cylindrical and dark brown to black in colour The adult is a strong flier and infestation can occur in the field or after the crop is harvested. The beetle can breed rapidly in maize and dried cassava. Huge quantities of dust and frass are produced as adults tunnel from grain to grain. Females lay between 30-600 eggs on the grain or in damaged parts of the plant. Larval development takes place inside grains and shoots. Development is completed between 18-37°C and and 30-70% R.H., with optimum conditions being at 32°C and 70% R.H at which eggs can compete development to adults in 25 days. It is very tolerant of dry grain and can breed in maize of moisture contents of less than 10%.

Entry potential:- Negligible on grain sourced / moved from and through areas where insect is not established. Risk increases if grain is sourced from areas where insect is found.

Establishment potential:- High, in areas which grow maize. This insect is very likely capable of becoming an environmental pest in Australia. Native genera of woody shrubs and trees eg *Acacia* spp. appear at risk of being attacked. Official attempts at eradication and control of spread have not been very successful.

Spread potential:- Very high. They are long lived and are good fliers. They can also conceal themselves by boring into wooden structures. Native vegetation potentially offers a reservoir for this species. They are also strong fliers. Attempts to control this insect in Africa have at best only slowed its spread.

Economic importance: Damage to maize stored on cob can be severe with weight losses as high as 34% observed after only 3-6 months storage. Losses in dried cassava after six months storage average between 19% to 30%. Should this insect become established here, trade in commodities at risk could become difficult or badly disrupted as this pest is subject to official quarantine control in most countries.

Quarantine Status: Quarantine (High).

References:

Anon (1979) Stored Grain Insects. Agriculture Handbook No. 500, USDA, Washington DC : USA, 57pp.

GASGA (1993) Larger Grain Borer. Technical Leaflet No. 1, 2nd Ed. CTA : Netherlands.

Hodges, R.J. (1986) The biology and control of *Prostephanus truncatus* (Horn) (Coleroptera:Bostrichidae) – a distructive pest with an increasing range. *Journal of Stored Product Research* **22:** 1-14.

Nang'ayo, F.L.O., Hill, M.G., Chandi, E.A., Chiro, C.T., Nzeve, D.N., & Obiero, L.W. (1993) The natural environment as a reservoir for the *Prostephanus truncatus* (Horn) (Coleoptera: Bostrichidae) in Kenya. *African Crop Science Journal* **1**: 39-47.

6.84 Pseudeurostus hilleri (Reitter)

Species: *Pseudeurostus hilleri* (Reitter, 1877) [Coleoptera : Ptinidae]

Synonyms or changes in combination or taxonomy: *Niptus hilleri* Reitter 1877; *Eurostus hilleri* (Reitter, 1877); *Pseudeurostus hilleri* (Reitter, 1877); *Eurostus aligenus* Brown, 1840

Common name(s):

Distribution: Canada, USA, Australia

Entry potential: n/a, may not be present in Australia

Economic Importance: likely scavenger and inhabitant of residues, potential minor pest of feed mills and warehouses

Quarantine Status: Non-Quarantine

References:

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.85 Psocatropos microps (Enderlein) : booklouse

Species: *Psocatropos microps* (Enderlein, 1903) [Psocoptera : Psyllipsocidae]

Synonyms or changes in combination or taxonomy: *Axinopsocus microps* Enderlein, 1903; *Psocatropos lesnei* Badonnel, 1931; *Psocinella slossonae* Banks, 1900; *Vulturops floriadanus* Corbett & Hargeaves, 1915

Common name(s): booklouse

Distribution: USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: structural pest of grain storage in tropical coastal areas

Quarantine Status: Non-Quarantine

References:

Smithers, C.N. (1996). Psocoptera. Pp. 1-79, 333-361 (App. I-IV), 363-372 (Index) In Wells, A. (Ed.) Zoological Catalogue of Australia. Vol. 26. Psocoptera, Phthiraptera, Thysanoptera. Melbourne : CSIRO Publishing, Australia 418pp.

Mockford, E.L (1993). North American Psocoptera (Insecta), Sandhill Crane Press, Inc., Florida

6.86 Ptinus spp. Linnaeus : spider beetles

Species: *Ptinus* spp. Linnaeus, 1766 [Coleoptera : Ptinidae]

Synonyms or changes in combination or taxonomy:

Common name(s): spider beetles

Distribution: North America, especially temperate areas, Australia

Entry potential: n/a, genus present in Australia

Economic Importance: minor pest of residues and grain kept under conditions of poor hygiene

Quarantine Status: Non-Quarantine

References:

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Dobie, P., Haines, C.P., Hodges, R.J., Prevett, P.F. and Rees D.P. (Eds) (1991) Insects and Arachnids of Tropical Stored Products, Their Biology and Identification (A Training Manual). Natural resources institute, Chatham, Kent, United Kingdom, 246 pp.

Hinton, H. (1945) A Monograph of the Beetles Associated with Stored Products. Vol. 1. British Museum : London, 443 pp.

6.87 Pyralis farinalis Linnaeus : meal moth

Species: *Pyralis farinalis* Linnaeus, 1758 [Lepidoptera : Pyralidae]

Synonyms or changes in combination or taxonomy: *Asopia domesticalis* Zeller, 1847; *Pyralis fraterna* Butler, 1879; *Pyralis meridionalis* Schmidt, 1934; *Pyralis orientalis* Amsel, 1961

Common name(s): meal moth

Distribution: Canada, USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: pest of residues in mills and grain handling facilities

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.

Greening, H.G. & Gellatley, J.G. (1987) Insect pests of stored foodstuffs. AGFACTS AE.51, NSW Department of Agriculture, Agdex 615

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.88 Rhopalosiphum maidis (Fitch) : corn leaf aphid

Species: *Rhopalosiphum maidis* (Fitch,1856) [Hemiptera: Aphididae]

Synonyms or changes in combination or taxonomy: *Aphis maidis* Fitch

Common name(s): corn leaf aphid.

Distribution: worldwide including Australia.

Vector Status: barley yellow dwarf luteovirus, maize dwarf mosaic potyvirus.

Entry potential - n/a, not on pathway. On growing cereals and grasses where suck sap, not associated with grain.

Establishment potential - n/a, already present in Australia.

Spread potential - High.

Quarantine Status: Non-Quarantine.

References:

C.I.E. (1971) Map No. A 67.

6.89 Rhopalosiphum padi (Linnaeus) : bird cherry-oat aphid

Species: *Rhopalosiphum padi* (Linnaeus, 1758) [Hemiptera: Aphididae]

Synonyms or changes in combination or taxonomy: *Rhopalosiphum prunifoliae* (Fitch)

Common name(s): bird cherry-oat aphid.

Distribution: worldwide including Australia.

Vector Status: barley yellow dwarf luteovirus, maize dwarf mosaic potyvirus.

Entry potential - n/a, not in pathway. On growing cereals and grasses where they suck sap, not associated with grain.

Establishment potential - n/a, already present in Australia.

Spread potential - High.

Quarantine Status: Non-Quarantine.

References:
C.I.E Map No. A 288

6.90 Rhyzopertha dominica (Fabricius) : lesser grain borer

Species: *Rhyzopertha dominica* (Fabricius, 1792) [Coleoptera : Bostrichidae]

Synonyms or changes in combination or taxonomy: *Rhizopertha dominica* Agassiz, 1846; *Synodendron dominicum* Lesne, 1898

Common name(s): lesser grain borer

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: major pest of stored cereal grain

Quarantine Status: Non-Quarantine

References:
Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.91 Sitophilus granarius (Linnaeus) : granary weevil

Species: *Sitophilus granarius* (Linnaeus, 1758) [Coleoptera : Curculionidae]

Synonyms or changes in combination or taxonomy: *Calandra granaria* Linnaeus, 1758; *Curculio granarius* Linnaeus 1758

Common name(s): granary weevil, grain weevil

Distribution: Canada, USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: major pest of stored cereal grain

Quarantine Status: Non-Quarantine

References:

Zimmerman, E.C. (1994). Australian Weevils. Vol. 2. Melbourne: CSIRO publishing, Australia 755pp.

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.92 Sitophilus oryzae (Linnaeus) : rice weevil

Species: *Sitophilus oryzae* (Linnaeus, 1763) [Coleoptera : Curculionidae]

Synonyms or changes in combination or taxonomy: *Curculio oryzae* Linnaeus 1763; *Curculio sasakii* Takahashi, 1928p

Common name(s): rice weevil

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: major pest of stored cereal grain

Quarantine Status: Non-Quarantine

References:

Zimmerman, E.C. (1994). Australian Weevils. Vol. 2. Melbourne: CSIRO Publishing, Australia 755pp.

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.93 Sitophilus zeamais Motschulsky : maize weevil

Species: *Sitophilus zeamais* Motschulsky, 1855 [Coleoptera : Curculionidae]

Synonyms or changes in combination or taxonomy: *Cossonus quadrimacula* Walker 1859

Common name(s): maize weevil

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: major pest of stored cereal grain

Quarantine Status: Non-Quarantine

References:

Zimmerman, E.C. (1994). Australian Weevils. Vol. 2. Melbourne: CSIRO Publishing, Australia 755pp.

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.94 Sitotroga cerealella (Olivier) : angoumois grain moth

Species: *Sitotroga cerealella* (Olivier, 1789) [Lepidoptera : Gelechiidae]

Synonyms or changes in combination or taxonomy: *Alucita cerealella* Olivier, 1789; *Tinea hordei* Kirby, 1815; *Gelechia arctella* Walker, 1864; *Gelechia methanarthra* Lower, 1900;

Epithectis pelearis Meyrick, 1913; *Syngenomictis aenictopa* Meyrick, 1927; *Aristitelia ochrescens* Meyrick, 1938

Common name(s): angoumois grain moth

Distribution: USA, Mexico, Australia

Entry potential: n/a, present in Australia

Economic Importance: occasional pest of stored grain in Australia, especially in summer crops such as maize and sorghum

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.95 Stegobium paniceum (Linnaeus) : drugstore beetle

Species: *Stegobium paniceum* (Linnaeus,1758) [Coleoptera : Anobiidae]

Synonyms or changes in combination or taxonomy:

Common name(s): drugstore beetle, biscuit beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: common pest of wide range of dried products of plant origin

Quarantine Status: Non-Quarantine

References:

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

6.96 Tenebrio molitor (Linnaeus) : yellow mealworm

Species: *Tenebrio molitor* (Linnaeus, 1758) [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy:

Common name(s): yellow mealworm

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: scavenger and inhabitant of residues

Quarantine Status: Non-Quarantine

References:

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

6.97 Tenebrio obscurus Fabricius : dark mealworm

Species: *Tenebrio obscurus* Fabricius [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy:

Common name(s): dark mealworm

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: scavenger and inhabitant of residues

Quarantine Status: Non-Quarantine

References:

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

6.98 Tenebroides mauritanicus (Linnaeus) : cadelle

Species: *Tenebroides mauritanicus* (Linnaeus, 1870) [Coleoptera : Trogositidae]

Synonyms or changes in combination or taxonomy:

Common name(s): cadelle

Distribution: Canada, USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: scavenger and inhabitant of residues

Quarantine Status: Non-Quarantine

References:

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

6.99 Tineola bisselliella (Hummel) : common clothes moth

Species: *Tineola bisselliella* (Hummel, 1823) [Lepidoptera : Tineidae]

Synonyms or changes in combination or taxonomy: *Tinea bisselliella* Hummel 1823; *Tinea destructor* Stephens 1825; *Tinea crinella* Sodoffsky, 1830; *Tinea lanariella* Clemens, 1859; *Tinea furciferella* Zagulajev, 1954

Common name(s): common clothes moth

Distribution: USA, Australia

Entry potential: n/a, present in Australia

Economic Importance: scavanger which feeds on wool, feathers, bird nests, incidental in grain

Quarantine Status: Non-Quarantine

References:

Nielsen, E.D., Edwards, E.D., Rangsi, T.V. (Eds)(1996). Checklist of the Lepidoptera of Australia. Melbourne : CSIRO Publishing, Australia 529pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.100 Tortricidae spp. : budworms

Species: Tortricidae spp. [Lepidoptera]

Synonyms or changes in combination or taxonomy:

Common name(s): budworms.

Distribution: worldwide including Australia.

Vector Status: recorded as vector of *Erwinia herbicola* (Lohnis) Dye 1964.

Entry potential - n/a, not on pathway. Budworms are pests of growing plants where they get the name because they eat buds and/or growing tips. The tortricids are a family containing many species whose larvae bore in a variety of plant parts such as shoots, stems, fruit or which eat leaves. Not found on or in dry grains.

Establishment potential - High, similar species native to Australia.

Spread potential - High.

Quarantine Status: Non-Quarantine.

References:
Hill, D.S. (1994). *Agricultural Entomology*. Timber Press, Portland : Oregon, p409, pp: 440-445.

6.101 Tribolium audax Halstead : American black flour beetle

Species: *Tribolium audax* Halstead, 1969 [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy:

Common names(s): American black flour beetle.

Hosts: stored cereals and cereal products, granaries, flour and feed mills, retail stores, warehouses, rail cars also under bark, and in bees nests.

Part of plant affected: Seeds and products therefrom.

Distribution: Canada, USA. In USA said to occur in greatest numbers in Rocky Mountain states.

Biology:

Life history:- A widespread minor pest of stored cereals. This species is not often found in injurious numbers in stored grain. Eggs are laid at random in the commodity. Larvae are active and move through the food. Pupation occurs amongst the food. Both adults and larvae feed on cereals and their products, they are also cannibalistic and predatory. Heavy infestation can leave persistent disagreeable odours in the commodity due to the secretion of benzoquinones from abdominal glands of the adult. The species is very cold tolerant, recorded to survive up to 15 days at -15°C. In natural conditions the species lives under the bark of pine trees and has been found in the nests of a bee *Megachile rotundata* (Fabricius). This bee is being imported in Australia.

Entry potential:- Low in clean dry grain in good condition, risk increases with moisture content and quantity of admixture and damaged grains.

Establishment potential:- High, has a wide range of hosts and is able to colonise natural habitats.

Spread potential:- Low, spread is mainly dependent on transport in grain.

Economic importance: In Canada and the USA this species is generally less important a pest than *Tribolium castaneum* and *T. confusum*.

Quarantine Status: Quarantine (Medium).

References:

Anon (1979) Stored Grain Insects. Agriculture Handbook No. 500, USDA, Washington DC : USA, 57pp.

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Sokoloff, A .(1974) The biology of *Tribolium* – with special emphasis on genetic aspects. Vol 2, Clarendon press, Oxford : UK, 610pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.102 Tribolium brevicornis (LeConte) : flour beetle

Species: *Tribolium brevicornis* (LeConte, 1859) [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy: *Aphanotus brevicornis* LeConte, 1859

Common names(s): flour beetle

Hosts: grains, animal feeds, also found from nests of leaf cutting bees.

Part of plant affected: seeds and products therefrom.

Distribution: In North America, known from Western Canada and USA.

Biology:

Life history:- Likely natural habitat for this species is under bark of trees. Eggs are laid at random in the commodity. Larvae are active and move through the food. Pupation occurs amongst the food. Both adults and larvae feed on cereals and their products, they are also cannibalistic and predatory. Heavy infestation can leave persistent disagreeable odours in the commodity due to the secretion of benzoquinones from abdominal glands of the adult.

Entry potential:- Low in clean dry grain in good condition, risk increases with moisture content and quantity of admixture and damaged grains.

Establishment potential:- High, has a wide range of hosts and able to colonise natural habitats.

Spread potential:- Low, spread is dependent on passive transport in grain as the species does not appear to fly.

Economic importance: a minor pest of stored grain.

Quarantine Status: Quarantine (Low - Medium).

References:

Spilmann, T.J. (1991) Darkling beetles (Tenebrionidae, Coleoptera) in: Gorham, J. R. Ed (1991) Insects and mite pests in food, an illustrated key, USDA Agriculture Handbook no. 655. Washington DC : USA.

Sokoloff, A .(1974) The biology of *Tribolium* – with special emphasis on genetic aspects. Vol 2, Clarendon press, Oxford : UK, 610pp.

6.103 Tribolium castaneum (Herbst) : red flour beetle

Species: *Tribolium castaneum* (Herbst,1797) [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy: *Colydium castaneum* Herbst, 1797; *Tenebrio castaneus* Schonhegr, 1806; *Phaleria castanea* Gyllenhal, 1810; *Uloma ferruginea* Dejann, 1821; *Tribolium castaneum* MacLeay, 1825*; Margus castaneus* Dejean, 1833; *Stene ferruginea* Westwood, 1839; *Tribolium ferrugineum* Wollaston, 1854

Common name(s): red flour beetle, rust red flour beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: important pest of cereal grain and their products

Quarantine Status: Non-Quarantine

References:

Rees, D.P. (1994) Insects of Stored Grain - a Pocket Reference. Stored Grain Research Laboratory, CSIRO Entomology : Canberra.

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.104 Tribolium confusum Jacquelin duVal : confused flour beetle

Species: *Tribolium confusum* Jacquelin duVal, 1868 [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy: *Tribolium ferrugineum* Mulsant; *T.* (*Stene*) *confusum* Seidlitz, 1891

Common name(s): confused flour beetle

Distribution: North America, Australia

Entry potential: n/a, present in Australia

Economic Importance: important pest of cereal grain and their products

Quarantine Status: Non-Quarantine

References:

Greening, H.G. (1985) Insect pests of stored grain. AGFACTS P1.AE.1, NSW Department of Agriculture, Agdex 100/615

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.105 Tribolium destructor Uyttenboogaart : Large flour beetle

Species: *Tribolium destructor* Uyttenboogaart, 1933 [Coleoptera : Tenebrionidae]

Synonyms or changes in combination or taxonomy:

Common names(s): Large flour beetle.

Hosts: milled cereals, oilseeds, pulses, dried fruit, poultry feed.

Part of plant affected: seeds.

Distribution: Canada, USA, Asia, Europe, subtropical regions, cool areas in the tropics (Afghanistan, Ethiopia, Kenya). In Canada it is found 'coast to coast'.

Biology:

Life history:- A secondary pest of cereal grains. This species tends to be associated with poor storage conditions, especially inadequate hygiene and high commodity moisture content. It does not multiply rapidly on whole undamaged grain. Can be found living under bark of trees. Adults are 5-6 mm long and black to very dark brown in colour. The optimum temperature for development is 25°C and eggs do not hatch above 30°C. Recorded breeding at very low humidities of 10% R.H. The species does not tolerate very cold conditions of 5°C or less. Larvae and adults are general feeders being also cannibalistic and predatory. Eggs are laid at random, are sticky, and become coated with flour and other particles. Larvae are active and move through the food. Pupae are naked and found amongst the food. The adults

and larvae feed on cereals and their products. Infestation leads to persistent disagreeable odours in the commodity due to the secretion of benzoquinones from a pair of abdominal defence glands..

Entry potential:- Low in clean dry grain in good condition, risk increases with moisture content and quantity of admixture and damaged grains.

Establishment potential:- High, has a wide range of hosts and is able to colonise natural habitats.

Spread potential:- Low, spread is dependent on passive transport in grain as the species does not appear to fly.

Economic importance: This species is usually seen in mills and places where milled products are used. In Canada it is sometimes as important as *Tribolium castaneum* and *T. confusum*.

Quarantine Status: Quarantine (Medium).

References:

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Dobie, P., Haines, C.P., Hodges, R.J., Prevett, P.F. and Rees D.P. (Eds) (1991) Insects and Arachnids of Tropical Stored Products, Their Biology and Identification (A Training Manual). Natural Resources Institute, Chatham, Kent : United Kingdom, 246 pp.

Mound, L. (Ed.) (1989) Common Insect Pests of Stored Food Products - A Guide to Their Identification, 7th Edition. British Museum (Natural History) : London, 68 pp.

Sokoloff, A .(1974) The biology of *Tribolium* – with special emphasis on genetic aspects. Vol 2, Clarendon press, Oxford : UK, 610pp.

6.106 Tribolium madens (Charpentier) : black flour beetle

Species: *Tribolium madens* (Charpentier, 1825) [Coleoptera: Tenebrionidae]

Synonyms or changes in combination or taxonomy: *Tenebrio madens*; *Uloma madens* Krynicki, 1832; *Margus obscurus*

Common names(s): black flour beetle.

Hosts: grain, flour, pollen.

Part of plant affected: seeds, stored products.

Distribution: Canada, USA, Europe. This species appears to have recently become established in North America, first being recorded in about 1981.

Biology:

Life history:- A secondary pest of cereal grains. Previously confused with *T. audax*. Eggs are laid at random, are sticky, and become coated with flour and other particles. Larvae are active and move through the food. Pupae are naked and found amongst the food. The adults and larvae feed on cereals and their products. Larvae and adults are general feeders being also cannibalistic and predatory. Heavy infestation can leave persistent disagreeable odours in the commodity due to the secretion of benzoquinones from abdominal glands of the adult.

Entry potential:- Low in clean dry grain in good condition even from areas where insect is present, risk increases with moisture content and quantity of admixture and damaged grains.

Establishment potential:- High, especially in mills, its recent establishment in North America demonstrates the ability of this insect to establish itself in new environments.

Spread potential:- Low, spread is dependent on passive transport in grain as the species does not appear to fly.

Economic importance: In North America it is thought that this species could become a significant pest of flour mills.

Quarantine Status: Quarantine (Medium).

References:

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Becker, E.C. (1982) The European *Tribolium madens* (Charpentier) in North America (Tenebrionidae). *Coleopterists Bulletin* **36:** 166–169.

Sokoloff, A .(1974) The biology of *Tribolium* – with special emphasis on genetic aspects. Vol 2, Clarendon press, Oxford : UK, 610pp.

References: Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.107 Trigonogenius globulus Solier : globular spider beetle

Species: *Trigonogenius globulus* Solier, 1849 [Coleoptera : Ptinidae]

Synonyms or changes in combination or taxonomy:

Common name(s): globular spider beetle

Distribution: Canada, USA, Australia

Entry potential: n/a, already present in Australia

Economic Importance: scavenger and inhabitant of residues and bird nests.

Quarantine Status: Non-Quarantine

References:
Aitken, A. D (1975) Insect Travellers, Volume I: Coleoptera, Her Majesty's Stationery Office

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

6.108 Trogoderma glabrum (Herbst) : glaberous cabinet beetle

Species: *Trogoderma glabrum* (Herbst, 1783) [Coleoptera: Dermestidae]

Synonyms or changes in combination or taxonomy: *Anthrenus glaber* Herbst, 1783; *Trogoderma boron* Beal, 1954.

Common names(s): glaberous cabinet beetle.

Hosts: Wide range of stored products, including raw grains and processed foods, under bark, dead insects, bird and insect nests.

Part of plant affected: seeds and other dried plant and animal material.

Distribution: USA, Mexico, Canada, Europe, Caucasus, Kazakhstan, S. Siberia.

Biology:

Life history:- *T. glabrum* often lives in natural habitats such as bird and insect nests and these can act as a source of infestation. This species is however capable of developing on grain alone. Adults are to 24 mm in length, with shining black cuticle and a moderate clothing of fine hairs on the dorsal surface. Larvae are hairy and light brown in colour. The adults are short lived and the females lay between 60-80 eggs. Under favourable conditions the entire life cycle may take as little as 28–32 days at 32°C and 70% R.H. *T. glabrum* is very tolerant of low relative humidities.

Entry potential:- High, larvae in particular often conceal themselves in cracks and crevices and can be difficult to detect. Risk of entry highest in mixed feeds, processed commodities or in grain in poor condition with significant admixture of other material.

Establishment potential:- High, can breed on a variety of stored foodstuffs and also capable of establishing in the natural environment.

Spread potential:- Low, would be mostly dependant on movement of infested material in trade.

Economic importance: In Canada it regarded as a minor pest. In the USA it is sometimes found infesting stored whole grains. It is best known as a pest of mixed animal feeds. Larval skins are highly allergenic. Presence of any *Trogoderma* species can lead to trade difficulties in its own right or due to its close similarity to the khapra beetle *Trogoderma granarium.* It is a quarantineable pest in Australia under existing legislation. Similar in appearance to native non-pest *Trogoderma* species.

Quarantine Status: Quarantine (High).

References:

Anon (1979) Stored Grain Insects. Agriculture Handbook No. 500, USDA, Washington DC : USA, 57pp.

Arbogast, R.T. (1991) Beetles: Coleoptera In: Gorham, J.R. (Ed.) (1991) Ecology and management of food-industry pests. FDA Technical Bulletin 4, AOAC, Arlington, Virginia : USA.

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Hinton, H. (1945) A Monograph of the Beetles Associated with Stored Products. Vol. 1. British Museum : London, 443 pp.

Kingsolver J.M. (1991) Dermestid beetles (Dermestidae, Coleoptera) In: Gorham, J. R. Ed (1991) Insects and mite pests in food, an illustrated key, USDA Agriculture Handbook no. 655. Washington DC : USA.

6.109 Trogoderma granarium Everts : khapra beetle

Species: *Trogoderma granarium* Everts, 1898 [Coleoptera : Dermestidae]

Synonyms or changes in combination or taxonomy: *Trogoderma khapra* Arrow, 1917

Common names(s): khapra beetle.

Hosts: It will infest almost any dried material of plant origin, including raw grains, herbs, spices and processed foods. This species has a lower requirement for proteinacous food than other pest *Trogoderma* and will thrive on cereal grain. Because of its habit as a larvae of seeking refuges under adverse conditions it can be found in a wide range of situations where there is no obvious food source. This includes packing materials and almost any dry cargo.

Part of plant affected: seeds and other dried plant material.

Distribution: Established as pest in north and west Africa, eastern Mediterranean, SE Turkey, Middle East, SW Asia, northern areas of Indian subcontinent and Myanmar. Recently become established or introduced into parts of the Philippines, peninsular Malaysia, Irian Jaya, Taiwan, southern Russia, and central Asian republics. Intercepted and possibly also established in areas bordering these regions. In Japan, Korea and parts of western and northern Europe is has been recorded in the past as a specialised pest of hot dry grains, in particular in maltings. In these areas it has either been eradicated or has largely disappeared as an important pest due to changes in commodity management. Formerly established in SW USA and nearby parts of Mexico. These populations appear to have been officially eradicated. Recorded from Venezuela but status there is unclear. Formerly present in South Africa, where population appears to have died out, however status in other countries of southern Africa is currently unclear.

Intercepted in the above mentioned countries and others infesting traded materials or vessels transporting them. Vessels trading between countries where *T. granarium* is absent may nevertheless be carriers of active infestations of this pest in locations such as ship's stores and grain cargo residues. Diapausing larvae may seek a multitude of locations.

Biology:

Life history:- *T. granarium* is typically a pest of hot dry climates or of commodities stored elsewhere in hot dry conditions. Under such conditions it can become the dominant pest. While it breeds more rapidly under hot humid conditions it is rarely found under such conditions. *T. granarium* is thought not to compete well with faster breeding pests such as *Sitophilus* spp. (Coleoptera : Curculionidae) and *Rhyzopertha dominica* (Coleoptera : Bostrichidae). In conditions where these pests are a major problem *T. granarium* is either absent or a minor component of the pest complex.

Adults are 1.8 - 3 mm in length, with brown cuticle and a moderate clothing of fine hairs on the dorsal surface. Females are bigger than males. Larvae are hairy and light brown in colour. The adults are short lived and the females lay about 100+ eggs. Development can take place between 22-41°C. Under favourable conditions the entire life cycle may take as little as 5 weeks at 33-37°C, 45-75% r.h. *T. granarium* is very tolerant of low relative humidities.

If conditions are unfavourable, larvae can enter diapause during which they can survive several years without food. In such a state larvae are very hard to kill with pesticides and fumigants.

Entry potential:- High, larvae in particular often conceal themselves in cracks and crevices and can be difficult to detect. Can occur in almost any stored commodity. Can be very persistent as pest of storage structures, handling machinery and transport vessels. Larvae can wander into and be transported in diapause in almost any dry cargo.

Establishment potential:- High, can breed on a variety of stored foodstuffs. Climatic conditions in much of Australia appear suitable for this insect.

Spread potential:- High, *T. granarium* is largely dependent on being spread by movement of infested material or transport. Larvae can be wind blown or carried on clothing, tarps and sacking. Unlike other storage *Trogoderma* species, adults of *T. granarium* do not fly.

Economic importance: One of the most feared pests of stored products - an important pest of a wide range of stored produce, especially if stored under hot dry conditions. It is very persistent pest of structures and transport vessels. Establishment of this pest in Australia would likely lead to loss of market for Australian produce as this insect is a regulated quarantine pest in many countries.

Quarantine status: Quarantine (High).

References:

Rees, D.P. and Banks, H.J. (1998) The khapra beetle, *Trogoderma granarium* Everts (Coleoptera: Dermestidae), a quarantine pest of stored products: review of biology, distribution, monitoring and control. A report prepared for the Australian Quarantine and Inspection Service (AQIS). CSIRO Entomology, Canberra, Australia, 48pp.

6.110 Trogoderma inclusum LeConte : large cabinet beetle

Species: *Trogoderma inclusum* LeConte, 1854 [Coleoptera : Dermestidae]

Synonyms or changes in combination or taxonomy: *Trogoderma versicolor* sensu auct. Brit not (Creutzer, 1799); sometimes confused with *Trogoderma versicolor* (Creutzer).

Common names(s): large cabinet beetle, mottled dermestid.

Hosts: Wide range of stored products, including raw grains and processed foods, under bark, dead insects, bird and insect nests

Part of plant affected: seeds and other dried plant and animal material.

Distribution: Canada, USA, Europe, Mediterranean region, former USSR, India.

Biology:

Life history:- *T. inclusum* can live in natural habitats such as bird and insect nests and these can act as a source of infestation. Adults are to 2-4 mm in length, with shining black cuticle and a moderate clothing of fine hairs on the dorsal surface. Larvae are hairy and light brown in colour. The adults are short lived and the females lay about 100 eggs. Development can take place between 20-40°C. Under favourable conditions the entire life cycle may take as little as 50 days at 30°C and 70% R.H. *T. inclusum* is very tolerant of low relative humidities. If conditions are unfavourable larvae can enter diapause during which they can survive more than a year without food.

Entry potential:- High, larvae in particular often conceal themselves in cracks and crevices and can be difficult to detect. Risk of entry highest in mixed feeds, processed commodities or in grain in poor condition with significant admixture of other material.

Establishment potential:- High, can breed on a variety of stored foodstuffs and also capable of establishing in the natural environment.

Spread potential:- High, easily spread by movement of infested material in trade. Adults can fly.

Economic importance: In Canada this species is the most frequently encountered species of *Trogoderma* infesting stored produce. Larval skins are highly allergenic. Presence of any *Trogoderma* species can lead to trade difficulties in its own right or due to its close similarity to the khapra beetle *Trogoderma granarium.* It is a quarantine pest in Australia under existing legislation. Similar in appearance to some native non-pest *Trogoderma* species.

Quarantine Status: Quarantine (High).

References:

Anon (1979) Stored Grain Insects. Agriculture handbook No. 500, USDA, Washington DC : USA, 57pp.

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Hinton, H. (1945) A Monograph of the Beetles Associated with Stored Products. Vol. 1. British Museum : London, 443 pp.

Kingsolver J.M. (1991) Dermestid beetles (Dermestidae, Coleoptera) in: Gorham, J. R. Ed (1991) Insects and mite pests in food, an illustrated key, USDA Agriculture handbook no. 655. Washington DC : USA

6.111 Trogoderma ornatum (Say) : ornate cabinet beetle

Species: *Trogoderma ornatum* (Say, 1825) [Coleoptera : Dermestidae]

Synonyms or changes in combination or taxonomy: *Megatoma ornata* Say, 1825; *Trogoderma tarsale* Melsheimer, 1844; *Trogoderma pallipes* Ziegler, 1845; *Trogoderma pusilla* Leconte, 1854; *Eucnocerus anthrenoides* Sharp, 1902.

Common names(s): ornate cabinet beetle.

Hosts: Wide range of stored products, including raw grains and processed foods, under bark, dead insects, bird and insect nests.

Part of plant affected: seeds and other dried plant and animal material.

Distribution: North and central America, Hawaii.

Biology:

Life history:- *T. ornatum* can live in natural habitats such as dead animals, bird and insect nests and these can act as a source of infestation. Adults are 1.6-4 mm in length with shining black cuticle which has large red-brown markings on the pronotum and elytra. The dorsal surface is densely clothed with dark brown, golden and white setae which are arranged in patterns. Adults are short lived. Larvae are hairy and light brown in colour.

Entry potential:- High, larvae in particular often conceal themselves in cracks and crevices and can be difficult to detect. Risk of entry highest in mixed feeds, processed commodities or in grain in poor condition with significant admixture of other material.

Establishment potential:- High, can breed on a variety of stored foodstuffs and also capable of establishing in the natural environment.

Spread potential:- High, easily spread by movement of infested material in trade. Adults can fly.

Economic importance: *T. ornatum* is an occasional inhabitant of stored produce. Larval skins are highly allergenic. It is most able to thrive under conditions of poor hygiene. It is unlikely to be a major pest of clean dry grain in good condition. While adult beetles can be distinguished from *Trogoderma granarium*, larvae are very similar in appearance to some native non-pest *Trogoderma* species.

Quarantine Status: Quarantine (Medium).

References:

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Hinton, H. (1945) A Monograph of the Beetles Associated with Stored Products. Vol. 1. British Museum : London, 443 pp.

Kingsolver J.M. (1991) Dermestid beetles (Dermestidae, Coleoptera) in: Gorham, J. R. Ed (1991) Insects and mite pests in food, an illustrated key, USDA Agriculture handbook no. 655. Washington DC : USA.

6.112 Trogoderma variabile Ballion : warehouse beetle

Species: *Trogoderma variabile* Ballion, 1878 [Coleoptera : Dermestidae]

Synonyms or changes in combination or taxonomy: *Trogoderma parabile* Beal, 1954

Common names(s): warehouse beetle.

Hosts: Wide range of stored products, including raw grains and processed foods, under bark, dead insects, bird and insect nests.

Part of plant affected: seeds and other dried plant and animal material.

Distribution: Northern Hemisphere (holarctic), Australia (wheat belt areas, under official control in WA).

Biology:

Life history:- *T. variabile* can live in natural habitats such as bird and insect nests and these can act as a source of infestation. Adults are 2-4 mm in length, with weakly patterned brown cuticle and a moderate clothing of fine hairs on the dorsal surface. Larvae are hairy and light brown in colour. The adults are short lived and the females lay about 100+ eggs. Development can take place between 17-37°C. Under favourable conditions the entire life cycle may take as little as 30 days at 30°C. *T. varibile* is very tolerant of low relative humidities. If conditions are unfavourable larvae can enter diapause during which they can survive more than a year without food.

Entry potential:- High, larvae in particular often conceal themselves in cracks and crevices and can be difficult to detect. Risk of entry highest in mixed feeds, processed commodities or in grain in poor condition with significant admixture of other material.

Establishment potential:- High, can breed on a variety of stored foodstuffs and also capable of establishing in the natural environment.

Spread potential:- High, easily spread by movement of infested material in trade. Adults can fly.

Economic importance: A minor to important pest of a wide range of stored produce. A very persistent pest of storage structures once infested. It appears capable of breeding on clean well managed commodities and in eastern Australia is becoming a pest of bulk stored canola. Presence of any *Trogoderma* species can lead to trade difficulties in its own right or due to its close similarity to the khapra beetle *Trogoderma granarium*.

Quarantine Status: Quarantine (High).

References:

Anon (1979) Stored Grain Insects. Agriculture Handbook No. 500, USDA, Washington DC : USA, 57pp.

Bousquet, Y. (1990) Beetles Associated with Stored Grain Products in Canada : An Identification Guide. Agriculture Canada : Ottawa, 220 pp.

Hinton, H. (1945) A Monograph of the Beetles Associated with Stored Products. Vol. 1. British Museum : London, 443 pp.

Kingsolver J.M. (1991) Dermestid beetles (Dermestidae, Coleoptera) in: Gorham, J. R. Ed (1991) Insects and mite pests in food, an illustrated key, USDA Agriculture Handbook no. 655. Washington DC : USA.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

6.113 Typhaea stercorea (Linnaeus) : hairy fungus beetle

Species: *Typhaea stercorea* (Linnaeus, 1758) [Coleoptera : Mycetophagidae]

Synonyms or changes in combination or taxonomy: *Dermestes stercoreus* Linnaeus; *Dermestes fumatus* Linnaeus

Common name(s): hairy fungus beetle

Distribution: North America, Australia

Entry potential: n/a, already present in Australia

Economic Importance: minor pest of stored grain, often present at harvest, will only persist in storage if grain remains slightly damp

Quarantine Status: Non-Quarantine

References:

Voucher Specimens in Australian National Insect Collection, CSIRO Entomology, Canberra

6.114 Zabrotes subfasciatus (Boheman) : Mexican bean beetle

Species: *Zabrotes subfasciatus* (Boheman, 1833) (Coleoptera: Bruchidae)

Synonyms or changes in combination or taxonomy: many, see Bottimer (1968)

Common name(s): Mexican bean beetle

Distribution: southern USA, Mexico

Entry potential: n/a, negligible unless maize is source with beans as admixture from areas where this pest is present

Economic Importance: pest of stored beans – *Phaseolus* spp (only in Americas), potential contaminant in maize if beans are present as admixture

Quarantine Status: Non-Quarantine

References: Bottimer, L.J. (1968) Notes on Bruchidae of America north of Mexico with a world list of genera, *Canadian Entomologist* **100**: 1009-1049.

Dobie, P., Haines, C.P., Hodges, R.J., Prevett, P.F. and Rees D.P. (Eds) (1991) Insects and Arachnids of Tropical Stored Products, Their Biology and Identification (A Training Manual). Natural Resources Institute, Chatham, Kent, United Kingdom, 246 pp.

Pest Infestation Control Laboratory Library Index, Slough: UK, now known as Central Science Laboratory, York, Ministry of Agriculture, Fisheries & Food: UK. Copy held in Stored Grain Research Laboratories, CSIRO Entomology, Canberra, Australia

7. APPENDIX 2: TABLE 1: QUARANTINE STATUS OF PESTS ASSOCIATED WITH STORED MAIZE GRAIN AND ADMIXTURE GRAIN COMMODITIES AND ARTHROPOD PESTS KNOWN TO VECTOR MAIZE DISEASES IN NORTH AMERICA.

In Table 1 the economic pests that either do not occur on stored maize grain in Australia or are under official control are quarantine pests in accordance with the FAO definition of a quarantine pest. However, specific phytosanitary measures are only needed if the pest is associated with the part of the plant proposed to be imported, in this case the seeds. Taking account of this, the final column in the table identifies those pests which require quarantine management. Action, however, will be taken against any of the quarantine pests if found with the commodity on arrival in Australia.

Pest	Common name/s	Present in North America, Canada, USA or Mexico	Present in Australia	Australian Quarantine Status	Present on Pathway (seeds)	Quarantine Management Required[1]
Acanthoscelides obtectus	bean weevil	North America	yes	Non-quarantine	yes	
Aceria tosichella	grass mite	USA	no	Quarantine	no	
Aceria tulipae	wheat curl mite	North America	unconfirmed	Quarantine	no	
Aglossa caprealis	murky meal moth	USA	yes	Non-quarantine	yes	
Agriotes mancus	wheat wireworm	North America	no	Quarantine	no	
Ahasverus advena	foreign grain beetle	Canada, USA	yes	Non-quarantine	yes	
Alphitobius diaperinus	lesser mealworm	North America	yes	Non-quarantine	yes	
Alphitobius laevigatus	black fungus beetle	North America	yes	Non-quarantine	yes	
Alphitophagus bifasciatus	twobanded fungus beetle	Canada, USA	yes	Non-quarantine	yes	
Anthicus spp.	ant beetles	North America	yes	Non-quarantine	yes	
Anthrenus spp.	museum beetle, carpet beetle	North America	yes	Non-Quarantine	yes	
Attagenus spp.	black carpet beetle, fur beetle	North America	yes	Non-quarantine	yes	
Bruchus pisorum	pea weevil	Canada, USA	yes	Non-quarantine	yes	
Cadra cautella	tropical warehouse moth	North America	yes	Non-quarantine	yes	
Cadra figulilella	raisin moth	USA	yes	Non-quarantine	yes	
Callosobruchus chinensis	southern cowpea weevil	possible in southern USA	no	Quarantine	yes	yes
Callosobruchus maculatus	cowpea weevil	USA	yes	Non-quarantine	yes	
Carpophilus spp.	sap beetles, dried fruit beetles	North America	yes	Non-quarantine	yes	
Cathartus quadricollis	square-necked flour beetle	USA-south, Mexico	no	Quarantine	yes	yes

[1] Pests assessed as quarantine pests present in the pathway will be addressed by routine inspection procedures. The risks posed by these pests are reduced to negligibly low levels with a combination of inspection and management strategies which are outlined in other parts of this document.

Pest	Common name/s	Present in North America, Canada, USA or Mexico	Present in Australia	Australian Quarantine Status	Present on Pathway (seeds)	Quarantine Management Required[1]
Caulophilus oryzae	broadnosed grain weevil	SE USA, Mexico	no	Quarantine	yes	yes
Chaetocnema pulicaria	corn flea beetle	North America	no	Quarantine	no	
Corcyra cephalonica	rice moth	USA, Mexico	yes	Non-quarantine	yes	
Corticaria spp.	minute mould beetle	North America	yes	Non-quarantine	yes	
Cryptolestes ferrugineus	rusty grain beetle	North America	yes	Non-quarantine	yes	
Cryptolestes pusilloides	flat grain beetle	Mexico	yes	Non-quarantine	yes	
Cryptolestes pusillus	flat grain beetle	North America	yes	Non-quarantine	yes	
Cryptolestes turcicus	flat grain beetle, flour mill beetle	Canada, USA	no	Quarantine	yes	yes
Cryptophagus spp.		USA, Canada	yes	Non-quarantine	yes	
Cynaeus angustus	large black flour beetle	Canada, Mexico, USA	no	Quarantine	yes	yes
Dalbulus maidis	corn leafhopper	USA	no	Quarantine	no	
Deinerella spp.		North America	yes	Non-quarantine	yes	
Delia platura	seed corn maggot	North America	yes	Non-quarantine	no	
Dermestes spp.	hide beetles	North America	yes	Non-quarantine	yes	
Diabrotica sp.	corn rootworm	North America	yes	Non-quarantine	no	
Diabrotica longicornis	northern corn rootworm	Canada, USA	no	Quarantine	no	
Diabrotica undecimpunctata	southern corn rootworm	Canada, USA	no	Quarantine	no	
Diabrotica virgifera	western corn rootworm	USA	no	Quarantine	no	
Dinoderus minutus	bamboo powderpost beetle	North America	yes	Non-quarantine	yes	
Endrosis sarcitrella	whiteshouldered house moth	North America	yes	Non-quarantine	yes	
Enicumus minutus		USA, Canada	yes	Non-quarantine	yes	
Ephestia elutella	tobacco moth	North America	yes	Non-quarantine	yes	
Ephestia kuehniella	Mediterranean flour moth	North America	yes	Non-quarantine	yes	
Exitianus exitosus	leafhopper	USA	no	Quarantine	no	
Gibbium aequinoctiale	spider beetle	North America	yes	Non-quarantine	yes	
Gibbium psylloides	spider beetle	USA, Mexico	yes	Non-quarantine	yes	
Glischrochilus fasciatus	redspotted sap beetle, picnic beetle	Canada, USA	no	Quarantine	yes	yes
Glischrochilus quadrisignatus	fourspotted sap beetle, picnic beetle	Canada, USA	no	Quarantine	yes	yes

Pest	Common name/s	Present in North America, Canada, USA or Mexico	Present in Australia	Australian Quarantine Status	Present on Pathway (seeds)	Quarantine Management Required[1]
Gnatocerus cornutus	broadhorned flour beetle	North America	yes	Non-quarantine	yes	
Graminella nigrifrons	grass leafhopper	USA	no	Quarantine	no	
Graminella sonora	grass leafhopper	USA	no	Quarantine	no	
Henoticus spp.		North America	yes	Non-quarantine	yes	
Hofmannophila pseudospretella	brown house moth	North America	yes	Non-quarantine	yes	
Lachesilla pedicularia	booklouse	North America	yes	Non-quarantine	yes	
Lachesilla quercus	booklouse	North America	yes	Non-quarantine	yes	
Lasioderma serricorne	cigarette beetle	North America	yes	Non-quarantine	yes	
Latheticus oryzae	longheaded flour beetle	North America	yes	Non-quarantine	yes	
Lathridius spp.	plaster beetle	North America	yes	Non-quarantine	yes	
Lema melanopa	cereal beetle	Canada, USA	no	Quarantine	no	
Lepinotus inquilinus	booklouse	USA	yes	Non-quarantine	yes	
Lepinotus patruelis	booklouse	USA	yes	Non-quarantine	yes	
Liposcelis bostrychophila	booklouse	North America	yes	Non-quarantine	yes	
Liposcelis brunnea	booklouse	USA	yes	Non-quarantine	yes	
Liposcelis corrodens	booklouse	USA	yes	Non-quarantine	yes	
Liposcelis decolor	booklouse	USA	yes	Non-quarantine	yes	
Liposcelis entomolphila	booklouse	North America	yes	Non-quarantine	yes	
Liposcelis paeta	booklouse	North America	yes	Non-quarantine	yes	
Liposcelis rufa	booklouse	USA	yes	Non-quarantine	yes	
Litargus balteatus		Canada, USA	yes	Non-quarantine	yes	
Mezium affine	spiny spider beetle	North America	yes	Non-quarantine	yes	
Mezium americanum	American spider beetle	North America	yes	Non-quarantine	yes	
Murmidius ovalis	murmidius beetle	Canada, USA	yes	Non-quarantine	yes	
Mycetophagus quadriguttatus	spotted hairy fungus beetle	Canada, USA	yes	Non-quarantine	yes	
Nemapogon granella	European grain moth	USA	yes	Non-quarantine	yes	
Niptus hololeucus	golden spider beetle	Canada, USA	yes	Non-quarantine	yes	
Oryzaephilus mercator	merchant grain beetle	North America	yes	Non-quarantine	yes	

Pest	Common name/s	Present in North America, Canada, USA or Mexico	Present in Australia	Australian Quarantine Status	Present on Pathway (seeds)	Quarantine Management Required[1]
Oryzaephilus surinamensis	sawtoothed grain beetle	North America	yes	Non-quarantine	yes	
Palorus ratzeburgii	broadhorned flour beetle	North America	yes	Non-quarantine	yes	
Palorus subdepressus	depressed flour beetle	North America	yes	Non-quarantine	yes	
Peregrinus maidis	corn planthopper	USA	yes	Non-quarantine	no	
Pharaxanotha kirschi	Mexican grain beetle	USA, Mexico	no	Quarantine	yes	yes
Phyllophaga spp.	May beetle	North America	no	Quarantine	no	
Plodia interpunctella	Indian meal moth	North America	yes	Non-quarantine	yes	
Prostephanus truncatus	larger grain borer, greater grain borer	USA-south, Mexico	no	Quarantine	yes	yes
Pseudeurostus hilleri		Canada, USA	yes	Non-quarantine	yes	
Psocathropos microps		USA	yes	Non-quarantine	yes	
Ptinus spp.	spider beetles	North America (temperate regions)	yes	Non-quarantine	yes	
Pyralis farinalis	meal moth	Canada, USA	yes	Non-quarantine	yes	
Rhopalosiphum maidis	corn leaf aphid	North America	yes	Non-quarantine	no	
Rhopalosiphum padi	bird cherry-oat aphid	North America	yes	Non-quarantine	no	
Rhyzopertha dominica	lesser grain borer	North America	yes	Non-quarantine	yes	
Sitophilus granarius	granary weevil	Canada, USA	yes	Non-quarantine	yes	
Sitophilus oryzae	rice weevil	North America	yes	Non-quarantine	yes	
Sitophilus zeamais	maize weevil	North America	yes	Non-quarantine	yes	
Sitotroga cerealella	angoumois grain moth	USA, Mexico	yes	Non-quarantine	yes	
Stegobium paniceum	drugstore beetle	North America	yes	Non-quarantine	yes	
Tenebrio molitor	yellow mealworm	North America	yes	Non-quarantine	yes	
Tenebrio obscurus	dark mealworm	North America	yes	Non-quarantine	yes	
Tenebroides mauritanicus	cadelle	Canada, USA	yes	Non-quarantine	yes	
Tineola bisselliella	common clothes moth	USA	yes	Non-quarantine	yes	
Tortricidae spp.	budworm	North America	yes	Non-quarantine	no	
Tribolium audax	American black flour beetle	Canada, USA	no	Quarantine	yes	yes
Tribolium brevicorne	flour beetle	Canada, USA	no	Quarantine	yes	yes
Tribolium castaneum	red flour beetle	North America	yes	Non-quarantine	yes	

Pest	Common name/s	Present in North America, Canada, USA or Mexico	Present in Australia	Australian Quarantine Status	Present on Pathway (seeds)	Quarantine Management Required[1]
Tribolium confusum	confused flour beetle	North America	yes	Non-quarantine	yes	
Tribolium destructor	large flour beetle	Canada, USA	no	Quarantine	yes	yes
Tribolium madens	black flour beetle	Canada, USA	no	Quarantine	yes	yes
Trigonogenius globulus	globular spider beetle	Canada, USA	yes	Non-quarantine	yes	
Trogoderma glabrum	glaberous cabinet beetle	Canada, Mexico, USA	no	Quarantine	yes	yes
Trogoderma granarium	khapra beetle	not present but interceptions recorded	no	Quarantine	yes	yes
Trogoderma inclusum	large cabinet beetle, mottled dermestid	Canada, USA	no	Quarantine	yes	yes
Trogoderma ornatum	ornate cabinet beetle	USA	no	Quarantine	yes	yes
Trogoderma variabile	warehouse beetle	USA	yes (under official control in WA)	Quarantine	yes	yes
Typhaea stercorea	hairy fungus beetle	North America	yes	Non-quarantine	yes	
Zabrotes subfasciatus	Mexican bean beetle	southern USA, Mexico	no	Non-quarantine	yes	yes