A summary of stored product Coleoptera in New Zealand and neighbouring Pacific countries

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ABSTRACT

The distribution of 71 species of stored product Coleoptera is listed from 14 countries or island groups of the Pacific. These include Australia, Cook Islands, Fiji, French Polynesia, Hawaii, Micronesia, New Caledonia, New Zealand, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga and Vanuatu. The distribution of the species has been compiled from previously published lists. Three species, *Alphitobius laevigatus*, *Cryptolestes capensis*, and *Dermestes ater*, not previously recorded as established in New Zealand, are reported and the current status of *Callosobruchus maculatus* is discussed. The distribution of a stored product beetle within the region appears to depend on climate and the food preferences of the human inhabitants of the various countries.

Keywords: Coleoptera, stored product pests, distribution, New Zealand, Pacific, summary.

INTRODUCTION

The use of good quarantine methods to prevent the establishment of a pest is much cheaper than controlling or eradicating a pest once it has become established. To this end quarantine services aim to keep all immigrant species out. It is, nevertheless, a considerable aid to quarantine to have a knowledge of the distribution of pests both within a country and through the surrounding region. This allows quarantine authorities to concentrate on pests not already established and to assess the possibility of a pest being imported, and then becoming established from other countries in the region.

This paper provides a summary list of the cosmopolitan stored product Coleoptera known to be established in the Pacific up until the end of 1983, and discusses their distribution in the region.

MATERIAL STUDIED

The list of stored product beetles found in the Pacific has been summarised from: Archibald & Chalmers (1983) for New Zealand, Loschiavo & Okumura (1979) for Hawaii, Maddison (in press) for Australia and the south Pacific islands, and interception records originating from the New Zealand Quarantine Service (Keall 1981; Manson & Ward 1968; Richardson 1979). Recent data for New Zealand have come from the literature, specimens in collections, and personal communications.

Species are listed as established, recorded, or intercepted. A pest is regarded as established if it is listed as such in any previous publication, if it appears in entomological literature of a particular country, or if it is recorded in collections on 5 different occasions at different places and on different dates. If fewer records than this exist, or if there is some doubt in the literature that the pest is established in that country then the species is listed as "recorded" from the country concerned.

Pests intercepted entering New Zealand from Pacific countries generally come from

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those countries in which they are established. However, where a pest is intercepted on produce from a country where it is not known to occur, then the interception records may indicate that the pest is in fact established there. Where records compiled from interceptions by the New Zealand Quarantine Service (Keall 1981; Manson & Ward 1968; Richardson 1979) do not correspond with the known distribution of the pest then the species is listed as intercepted.

Although interception data have some value in indicating the presence of a pest in a country there are several problems in extrapolating from such records. The country of origin may be inaccurate; either because the boat or plane has passed through several countries or because the infested commodities have been transhipped. Such known cases have been ignored. There can also be infestations of products from reservoirs of stored product pests on vessels. In some cases, infestations on tropical islands may only last for 1-2 generations; so that although the record of a pest may represent a genuine interception from that country it may be found that the pest has subsequently died out. Although a useful indicator that a pest is established, an interception record must be used with caution.

RESULTS

The distribution of stored product Coleoptera in the Pacific is given in Table 1. The reasons for the distribution of these pests will vary between species but will depend on: A species having had at some time an opportunity to invade the country; the availability of suitable products to attack; and the availability of suitable habitats in which to live.

Table 1: The distribution of stored product Coleoptera in the countries or island groups of the Pacific.

	Australia	Cook Islands	Fiji	French Polynesia	Hawaii	Micronesia	New Caledonia	New Zealand	Niue	Papua New Guinea	Samoa	Solomon Islands	Tonga	Vanuatu
Acanthoscelides obtectus	E		I		E		E	E		E				
Ahasverus advena	E	I	I		E	E	E	E		E	E		E	
Alphitobius diaperinus	E		E	I	E	E		E		E	E		E	
A. laevigatus	E	I	E		E	E	E	E	E	E		I	I	
Anthrenocerus australis	E							E						
Anthrenus flavipes	E				E									
A. verbasci	E	I						E	E					
Araecerus fasciculatus	E	I	E		E	I	E		E	E	E		E	
Attagenus fasciatus	I		I		E					I				
A. unicolor	E							R						
Bruchus pisorum	E				E									
B. rufimanus	E													
Callosobruchus chinensis	I		E		E					E				I
C. maculatus			E		E				I	E				
C. phaseoli					E									
Carpophilus dimidiatus	E	E	E	E	E	E	E	E	E	E	E	E	E	
C. hemipterus	E	I	E		E	E	E	E		E	E		I	
C. maculatus	E	E	E		E	E		R			E		E	
C. marginellus					I	E		E						
C. mutabilis			E										I	
C. mutilatus	E					E		E		E				
C. obsoletus		I	I		I	E					E	E	I	
C. pilosellus						E	E							
Cartodere constricta					E									
Caryedon serratus			E		E					E				

Table 1: —*(continued)*

	Australia	Cook Islands	Fiji	French Polynesia	Hawaii	Micronesia	New Caledonia	New Zealand	Niue	Papua New Guinea	Samoa	Solomon Islands	Tonga	Vanuatu
Caulophilus oryzae					E									
Coccotrypes dactyliperda	E				E									
Cryptamorpha desjardinsi	E	I	I		E		E	E	E	I	I		I	
Cryptolestes capensis								E					I	
C. ferrugineus	E				E			E						
C. pusilloides	E		I											
C. pusillus			E		E		E	R		E	E			
Dermestes ater	E	I	I		E	E	E	E	I	E	E	E	I	
D. carnivorus			I		E		E							
D. frischi			E											
D. haemorrhoidalis								R						
D. maculatus	E		I				E	E					I	
Gibbium psylloides	E				E					E				
Gnatocerus cornutus	E				E		E	E		I			E	
Hypothenemus hampei	I		E	E		E	E							
Lasioderma serricorne	E	I	E		E	E	E	E		E	E			
Latheticus oryzae	E				E					E				
Lophocateres pusillus	E		I							E				
Mezium affine	E							E						
M. americanum	E							E						
Necrobia ruficollis	E	I			E		E	E						
N. rufipes	E	E	E	I	E	E	E	E	E	E	E	E	E	
Niptus hololeucus								R						
Oryzaephilus mercator	E	I	E	I	E	E	I	E	E	E	E	E	I	
O. surinamenis	E		E		E	E	E	E		E	E			
Palorus ratzeburgi	E				E									
P. subdepressus	E		E	E	E		E	E			E			
Ptinus clavipes	E				E		E	E		I	I			
P. fur	E							E						
P. tectus	E		I					E				I		
Rhizopertha dominica	E		E		E	E	E	E		E	E		E	
Sitophilus granarius	E		I		E		E	E						
S. linearis			I		E									
S. oryzae	E		E		E	E	E	E		E	E		E	I
S. zeamais	E		E			E		E		E	E		E	
Stegobium paniceum	E		E		E	E	E	E		E				
Tenebrio molitor	E		I		E		E	E						
T. obscurus	E				E			E						
Tenebroides mauritanicus	E		E		E	E	E	E		E	E		E	
Tribolium castaneum	E	E	E	E	E	E	E	E	E	E	E	E	E	
T. confusum	E		I		E	E		E						
Trigonogenius globulus	E							E						
Trogoderma anthrenoides					E	E								
T. variabile	E				E									
Typhaea stercorea	E	I			E	E	E	E		I		I		
Urophorus humeralis	E	E	E	E	E	E		E		E	I			

The lack of a record of a species in a country may indicate a genuine gap in the distribution of that species, or it may indicate that knowledge of stored product insects is poor in that country.

The type of product available for an insect to attack will depend on the food preferences of the local human inhabitants or the type of products produced for export.

A species which thrives in the tropics may not be found or may rarely be found in temperate New Zealand because such species must be able to overwinter and have a minimum temperature limit low enough to allow development to proceed. A species with a high minimum temperature for development will only be successful in a temperate country if it is in a heated or sheltered environment. The ability of a species to overwinter is indicated by categories of cold hardiness, which are based on a species' ability to survive a British winter. A cold-hardy species always survives a British winter, a moderately-hardy species sometimes survives, and cold-susceptible species will normally only survive a winter in heated buildings in Britain.

Those factors which influence the distribution of some of the stored product beetles in the Pacific are detailed below along with some new records of species being established in New Zealand. The data on the minimum temperature for development and cold hardiness are taken from Howe (1965).

Alphitobius laevigatus(F.), black fungus beetle, (Tenebrionidae) has recently been found in Canterbury, New Zealand (K. G. Somerfield pers. comm).

Araecerus fasciculatus(Degeer) the coffee bean weevil, (Anthribidae), is a pest of spices, seeds, and seed products such as coffee and nutmeg. It is gradually spreading in the Pacific region but it is cold-susceptible with a minimum temperature for development of 22°C and hence is unlikely to spread into temperate areas.

Callosobruchus chinensis(L.), southern cowpea weevil; *C. maculatus*(F.), cowpea weevil; and *C. phaseoli*(Gyllenhal), (Bruchidae) are species associated with legume seeds. Their distribution seems to reflect human demography. They are found in countries with a significant Asian population where dried beans constitute a major part of the diet. *Callosobruchus maculatus* was recently recorded as being established in New Zealand (Wightman & Southgate 1981), however K. G. Somerfield (pers. comm.) states that these records refer to specimens found alive in imported cowpeas in retail and domestic situations and there is no evidence that it established in the field in either Auckland or Canterbury. It is cold-susceptible with a minimum temperature for development of 22°C.

Caulophilus oryzae(Gyllenhal) the broad-nosed grain weevil, (Curculionidae), is principally a cereal pest. It is apparently absent from most of the Pacific Islands and this is probably associated with the relatively restricted importance of cereals in the Islanders' diet.

Coccotrypes dactyliperda(Gyllenhal), date stone beetle, (Scolytidae), is frequently intercepted in the region on dates from California, the Middle East, and North Africa. Its distribution is affected by the presence of suitable hosts; date palms and related palm species.

Cryptolestes spp., (Cucujidae) like *Sitophilus* spp. are associated with cereal products and seem to be restricted in their distribution, possibly as a result of the small volume of cereals used by some countries. Archibald & Chalmers (1983) report only 1 record of *C. capensis*, but further records indicate that this species is established in the Nelson area of New Zealand (C. Watt pers. comm.)

Dermestes spp., (Dermestidae) are primarily associated with animal products. With the exception of *D. ater, Dermestes* spp. are not widely distributed in the tropical Pacific. This is not surprising as the drying of fish and meat is not widely practised and there is little trade in such commodities. *Dermestes ater* is widespread and this may be because of its association with copra which Aitken (1975) suggests forms an important part of its diet. The Plant Health Diagnostic Station, Auckland, has 7 records of *D. ater* from Auckland and Tauranga which indicates that it is now established in those parts of New Zealand.

Hypothenemus hampei(Ferrari), the coffee berry borer, (Scolytidae), is spreading in the Pacific region and has recently become established in Fiji. Its establishment depends partly on the availability of coffee trees.

Necrobia rufipes(Degeer), the copra beetle, (Cleridae) is one of the most abundant stored product pests in the Pacific. It is usually possible to tell when copra is being loaded as the beetle abounds in the wharf area. Although not a pest of well-cured copra it is abundant if the copra is at all mouldy. It is a predator on the larvae of other stored product pests. In New Zealand it is found on animal products and is found outside on animal carcases.

Necrobia rufipes is moderately hardy and requires a minimum temperature for development of 22°C.

Oryzaephilus mercator(Fauvel), the merchant grain beetle, (Silvanidae), is almost cosmopolitan in distribution, but in New Zealand most records are from Hamilton northwards. In the Pacific it attacks a wide range of products, particularly those of an oily nature such as copra. It is cold-susceptible and requires a minimum temperature for development of 20°C.

Rhizopertha dominica(F.), the lesser grain borer, (Bostrichidae), infests a wide range of products and is well distributed in the Pacific region. There are very few records of it in New Zealand. It is moderately hardy and requires a minimum temperature for development of 18°C.

Sitophilus granarius(L.), granary weevil, (Curculionidae) is a pest of temperate regions and is absent from most of the Pacific Islands. It is common on grain in New Zealand.

Tenebriodes mauritanicus(L.), cadelle, (Trogossitidae), attacks a wide range of products and is of widespread occurrence in the Pacific. It occurs irregularly in New Zealand, sometimes in large numbers (K. G. Somerfield pers. comm.)

Tribolium castaneum(Herbst), the rust-red flour beetle, (Tenebrionidae), is almost cosmopolitan in distribution. It is associated with rice, grains, peanuts, dried fruit, etc. and seems to be adaptable to both temperate and tropical climes. Commonly recorded in New Zealand and widespread throughout the country, it has been taken at lights in Auckland in summer. It is cold-susceptible and requires a minimum temperature for development of 22°C.

Tribolium confusum Jacquelin du Val, the confused flour beetle, (Tenebrionidae), is more temperate in distribution and is rarely found in the Pacific islands. It occurs widely in New Zealand.

DISCUSSION

The distribution of stored product pests in the Pacific region seems to result from the type of products traded and the climate. Beetles that feed on oily products such as copra are of widespread occurrence, possibly reflecting the importance of trade in this commodity. On the other hand those beetles associated with cereal products seem to have a restricted distribution which may result from the relative lack of importance of cereals in the diets of Islanders compared with Europeans. A further example of the spread of a group of beetles associated with a dietary habit is provided by the bruchids, the larvae of which feed internally in legume seeds. This group seems to be established in those countries where there is a significant Asian population—a people who use various dried beans and peas in their cookery.

Species which are cold-susceptible are almost entirely restricted to the tropical and sub-tropical areas of the Pacific. The only exceptions are, *T. castaneum, G. cornutus* and *O. mercator* which can be found in New Zealand. Within New Zealand the distribution of 2 species, *G. cornutus* and *O. mercator* appears to be restricted to areas north of Hamilton, but *T. castaneum* is more widespread. It has been found outside in the Auckland area although most of the southern records appear to be from indoors. Species which are successful in New Zealand are therefore those that are cold-hardy or moderately hardy and which do not require a minimum temperature for development in excess of 22°C. These do not do well in New Zealand, unless they are in a heated environment. For example, *A. diaperinus* has only become a pest of broiler houses in New Zealand since they have become heated.

The knowledge of stored product pests in the region is fragmentary and the situation in certain countries needs to be investigated. A good knowledge of the distribution of the pests would be a valuable aid for the quarantine services of the region. Any pest prevented from becoming established will save the country concerned the cost of its control or eradication.

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