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INSECTS AND MITES ASSOCIATED WITH STORED PRODUCTS IN QUEENSLAND

3. HYMENOPTERA

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SUMMARY

Forty-one species of Hymenoptera of the families Braconidae, Ichneumonidae, Mymaridae, Trichogrammatidae, Encyrtidae, Pteromalidae, Eurytomidae, Chalcididae, Evaniidae, Bethylidae and Formicidae are recorded from stored products in Queensland.

Most are recognized parasites and hyperparasites of stored product pests. Their contribution to suppression of pest populations is slight and they rarely become prevalent until high populations of hosts are present and severe damage has taken place.

INTRODUCTION

Some of the earliest records of Hymenoptera associated with stored products in Queensland were made by A. A. Girault in his series on Australian Hymenoptera, Chalcidoidea in *Memoirs of the Queensland Museum* from 1913 to 1915. About the same time, E. Jarvis, of the Department of Agriculture and Stock, made numerous collections and prepared demonstration show-cases of major pest species, illustrating the insects and their life-history stages, together with their parasites. Jarvis and the Government Entomologist (H. Tryon) referred the common Hymenoptera to names used by Girault and W. W. Froggatt of the New South Wales Department of Agriculture, and these names remained in use for some 40 years until identifications by the Commonwealth Institute of Entomology were adopted. The first detailed survey of stored product fauna was by N. E. H. Caldwell during the 1939-1945 war (Caldwell 1947). That survey resulted from concern over wartime food supplies and was essentially a listing of pest status, particularly in North Queensland. Though numerous Hymenoptera were collected, this group was not examined in detail.

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This report is the third of a series (see Champ and Smithers 1965; Champ 1966) covering a survey of the arthropod fauna of stored products in Queensland and carried out during 1960–1964. The data gathered have been supplemented by relevant literature, unpublished Queensland Department of Primary Industries reports, and arthropod material held in the Department of Primary Industries Collection.

Hymenoptera recorded from stored products in Queensland are, with the exception of Eurytomidae, reported elsewhere as parasites and hyperparasites of pest species. There are few authenticated specific host records; conclusions as to associations are made from factual data only.

Formicidae, with the exception of *Pheidole megacephala* F., have not been included. Undoubtedly species of this group attack stored foodstuffs and prey on storage pests (*cf.* Myers 1929).

Data are presented under headings of "Distribution" and "Recorded Hosts and Habitats". *Distributions* are given as follows: a statement of world distribution; published records from elsewhere in Australia if these precede the first Queensland record; and Queensland records giving general references first, then specific localities and the year of the first records from these localities together with references or with actual insect material, the authorities who have determined the material and in parenthesis the collection in which the material is held, and finally the months of the year in which occurrence has been recorded. Where references or authorities are not given, material has been determined by the author. *Recorded hosts and habitats* are given as follows: statements, if any, from references to the Queensland scene; and specific records giving host or habitat, locality, year of record, authority who determined the material and collection where held. Again, where references or authorities are not given, this author holds responsibility.

The author is indebted to the Commonwealth Institute of Entomology for many of the determinations, and where the authority involved is known, this is listed. The following abbreviations have been used together with the years in which the determinations were made—CIE, Commonwealth Institute of Entomology; RDE, R. D. Eady 1961–1965 (CIE); AAG, A. A. Girault; GJK, G. J. Kerrich 1954, 1960–1965 (CIE); GEJN, G. E. J. Nixon, 1953, 1961–1964 (CIE); EFR, E. F. Riek 1955, 1964. The abbreviation DPI is used to denote the Department of Primary Industries Collection.

SPECIES RECORDED

Alaptus globosicornis Girault 1908
Anisopteromalus calandrae (Howard 1881)
Antrocephalus sp.
Apanteles carpatus (Say 1836)
Apanteles galleriae Wilkinson
Apanteles spp.

Brachymeria sp.
Bracon gelechiae Ashmead 1889 (1888)
Bracon hebetor Say 1836
Bruchophagus gibbus (Boheman 1836 (1835))
Campyloneurus sp.
Cephalonomia tarsalis (Ashmead 1893)
Cephalonomia waterstoni (Gahan 1931)
Cerocephala dinoderi Gahan 1925
Chelonus phthorimaeae Gahan 1917
Choetospila elegans (Westwood 1874)
Chremylus elaphus Haliday 1833
Cremastus (*Trathala*) sp.
Devorgilla canescens (Gravenhorst 1829)
Dibrachys cavus (Walker 1835)
Evania appendigaster (Linnaeus 1758)
Goniozus antipodum Westwood 1874
Habrocytus cerealellae (Ashmead 1902)
Holepyris sylvanidis (Brèther 1913)
Ipobracon sp.
Lariophagus distinguendus (Foerster 1840)
Microchelonus spp.
Microplitis demolitor Wilkinson
Nasonia vitripennis (Walker 1836)
Paralitomastix koehleri (Blanchard 1940)
Phanerotoma sp.
Pheidole megacephala (Fabricius 1793)
Plastanoxus westwoodi (Kieffer 1914)
Pristomerus sp.
Pseudomicromelus australia (Girault 1917)
Spalangia sp.
Stomatoceras pomonellae Cameron
Stomatocerus stomesi
Systole sp.
Trichogramma australicum Girault 1912
Trichogramma minutum Riley 1871
Zeteticontus sp.

Braconidae

Apanteles carpatus

Distribution.—Cosmopolitan (Cotton and Good 1937). SOUTH QUEENSLAND: *Brisbane* 1941, Jan. to Dec. (Key and Common 1959).

Recorded host and habitats.—Bred from cocoons of *Tineola bisselliella* (Hummel) ex wool store also infested with *Tinea pellionella* Linnaeus (Key and Common *op. cit.*); these authors described the seasonal occurrence of *A. carpatus* in a wool store in Brisbane during 1941-1944.

Apanteles galleriae

Distribution.—SOUTH QUEENSLAND: *Mt. Tamborine* 1965, Dec.

Recorded host and habitat.—Ex wax moth complex, Mt. Tamborine 1965.

Apanteles sp.

Apanteles sp. (*ater* group)

Records.—Host millet moth, Indooroopilly, 11.vi.12, coll. E. Jarvis, det. CIE; parasite *Sitotroga cerealella* (Oliver), Aug. 1945, det. CIE; bred from sorghum head, Mooloolah, 22.vi.62, det. CIE; ex Galeriidae in old beehive.

Apanteles sp. (ultor group)

Record.—Bred from sorghum heads in the field infested with *Homeosoma vagella* Zellar and *Sathrobrota badia* Hodges, and the parasite *Brachymeria* sp., Kalbar, 2.iv.64, det. CIE: in DPI Collection.

Apanteles sp.

Record.—Ex *Phthorimaea operculella* (Zeller) from potato (*Solanum tuberosum* L.) foliage, Gatton, Aug. 1952, coll. A. May, det. GEJN 1953; in DPI Collection. Nixon placed this single male near *plutellae* Kurdj.

Microplitis demolitor

Distribution.—SOUTH QUEENSLAND (Smith 1945): *Brisbane* 1919 det. CIE, May.

Recorded hosts.—Heliothis armigera Hübner, *Prodenia litura* Fabricius (Smith *op. cit.*); this author outlined the life-history of *M. demolitor.* Fur moth, Brisbane 1919 det. CIE.

Notes.—M. demolitor was introduced to Egypt from Queensland in 1939-1941 to control *Prodenia litura* (F.): it did not become established (Wilson 1963). This species is not generally regarded as a parasite of stored product species.

Microchelonus spp.

R. D. Eady, Commonwealth Institute of Entomology, recognizes two species of *Microchelonus* in collections of parasites of *Phthorimaea operculella* (Zeller) from Queensland.

Microchelonus sp. A

Females only were available for examination: this species is parthenogenetic (based on laboratory breeding tests). Eady (personal communication) placed species A near *M. malayanus* (Wilkinson 1932) and distinguished females as follows:

M. malayanus—Antennae with flagellum more slender, all segments at least a little longer than broad, rufo-fuscous.

M. sp. A—Antennae with flagellum stouter in middle and proportionally shorter, distal segments quadrate; flagellum rufo-fuscous proximally, fuscous distally.

Distribution.—NORTH QUEENSLAND: *Bowen* 1931 (DPI); *Dimbulah* 1934 (DPI); *Mareeba* 1935 (DPI); *Hot Springs* 1961 (DPI): SOUTH QUEENSLAND: *Lockyer Valley* (including Gatton) 1944 (DPI); *Toogoolawah* 1963 (DPI); *Rochedale* 1964.

Recorded hosts.—Ex *Phthorimaea operculella* (Zeller) infesting potato (*Solanum tuberosum* L.): foliage—Mareeba 1935 (DPI) Mar.; Glenore Grove 1948 (DPI) Oct.; Gatton 1952 (DPI) Aug.; Hot Springs 1961 (DPI) July; Millaroo 1962 (DPI) Oct., Nov.; Toogoolawah 1963 Jan.; Ayr 1963 (DPI) Feb.; Rochedale 1964 Mar.: Tubers—Lockyer Valley 1944 (DPI) Nov., Dec.; Gatton 1964 (DPI) Aug. Ex *Scrobipalpa heliopa* (Lower): infesting tobacco (*Nicotiana tabacum* L.) foliage—Dimbulah, 1934 (DPI) Apr., 1935 (DPI) Mar. Ex unknown host: Bowen 1931 (DPI) Oct.

Microchelonus sp. B

Males and females appeared in collections in approximately equal numbers. Eady regarded this species as distinct from anything he had seen from this region; the male appeared to have some characters in common with *Chelonella curvimaculata* Cameron but in both sexes the marking on the gaster was distinctive.

The two species of *Microchelonus* listed here are separated readily by the marking of the gaster.

M. sp. A—Gaster completely encircled by anterior unpigmented area two-fifths length of whole, generally showing subcuticular yellow colour.

M. sp. B—Gaster with blunt triangular unpigmented area on anterior third of dorsal surface and not extending to anterior or lateral edges, subcuticular colour varying from orange to off-white.

Distribution.—NORTH QUEENSLAND (*Atherton* 1936, *vide infra*): *Bowen* 1931; *Dimbulah* 1935 (DPI); *Millaroo* 1962 (DPI).

Recorded hosts.—Associated with *Phthorimaea operculella* (Zeller) infesting tobacco foliage, Millaroo 1962 (DPI) Oct. Ex *Scrobipalpa heliopa* (Zeller) infesting tobacco: Bowen 1932 (DPI) Sept.; Dimbulah 1935 (DPI) Jan.; Mareeba 1935 (DPI) Mar. Ex unknown host: "in sweepings", Bowen 1931 June; "tobacco", Bowen 1931 Oct.

Notes.—It is possible that the record of *M.* sp. B (1 ♂, 1 ♀) associated with *P. operculella* may have been attributable to inclusion of odd individuals of *S. heliopa* in field-collected samples of *P. operculella.* Other than this doubtful record, *M.* sp. B has not been collected in the field ex *P. operculella.* Atherton (1936) recorded one parasite of *P. operculella* from large numbers of field-collected larvae during the course of an extensive survey of *P. operculella* and *S. heliopa* in North Queensland. This parasite, not identified, was recorded as the major parasite of *S. heliopa,* and *S. heliopa* was parasitized also by two further unidentified species. Localities given were Bowen, Harvey's Range,

Mareeba and Mount Garnet. Atherton's illustration of *S. heliopa* (Atherton *op. cit.,* Plate 8) included two unidentified parasites, probably *Iphiaulax* sp. (Fig. 9) and *Microchelonus* sp. B (Fig. 10). Among Atherton's material in the Department of Primary Industries Collection were two specimens of *Iphiaulax* sp. from *S. heliopa* at Dimbulah but there were no specimens from *P. operculella.* The other specimens in this collection were *Microchelonus* spp. A and B labelled "Host: *P. heliopa*" or with no host given. As *M.* sp. A is the only species subsequently recorded from *P. operculella,* it seems that *M.* sp. A was the major parasite of *S. heliopa* and the only parasite Atherton recorded from *P. operculella.* As the illustration for *S. heliopa,* however, includes *M.* sp. B, and it is probable that Atherton would illustrate the major parasite, the major parasite is not definite.

S. heliopa was established in Queensland as a tobacco pest before *P. operculella,* which was not known in Queensland until 1890-1900; Lamb (1890, 1892) referred to a "boring worm" in tobacco which was undoubtedly *S. heliopa.* The distribution of this species includs the African, Indo-Malayan and Australian regions, whereas *P. operculella* apparently originated in the New World. Both species of *Microchelonus* in Queensland appear closer to Braconidae, viz. *M. cereris* (Wilkinson) and *M. curvimaculata* (Cameron) found in the areas of occurrence of *S. heliopa;* it seems that the primary association or the less specialized *M.* sp. A was with *S. heliopa,* and that adaptation to *P. operculella* has come through *S. heliopa.* The bulk of Atherton's material was from *S. heliopa,* which was more prevalent at the time of his survey than now, when it is seen rarely in numbers; the low incidence of *M.* sp. A in the present survey indicated that *P. operculella* is a less suitable host than *S. heliopa. M.* sp. A has been recorded from most potato and tobacco growing areas but its contribution to checking *P. operculella* numbers would be negligible, if any—field parasitism percentages are usually less than 1%.

Microchelonus phthorimaea

Chelonus phthorimaea was introduced, as a parasite of *Phthorimaea operculella* (Zeller), to Queensland in 1945 from material collected in California by the Council for Scientific and Industrial Research. Liberations were made as follows—2 batches of 500 each at Home Hill in July 1945, one batch of 1,340 at Ayr on September 25, 1945, and one batch of 500 at Bowen on October 9, 1945 (unpublished Departmental records). No subsequent recoveries were made which would indicate establishment of the species (Anon. 1954).

Bracon gelechiae

Bracon gelechiae was introduced, as a parasite of *Phthorimaea operculella* (Zeller), to Queensland in 1943-1947 from material collected in California by the Council for Scientific and Industrial Research. Liberations were made as follows—7,603 parasites were released (Anon. 1945), 2 batches in October 1943 on a farm near Gatton on relatively late planted potato crops, another batch on an adjacent farm in November 1943, 2 batches at Ayr on August 18,

1944, and further releases at Gatton College in December, 1947 (Unpublished Departmental records). No subsequent recoveries were made which would indicate establishment of the species (Anon. 1954).

Bracon hebetor

Distribution.—Cosmopolitan (Richards and Herford 1930). New South Wales (Froggatt 1912). SOUTH QUEENSLAND (Jarvis 1913): *Brisbane* 1910, 1962 det. RDE (DPI), Jan., Apr., Oct., Nov.; *Toowoomba* 1942 (DPI) Jan.; *Macalister* 1960 det. RDE (DPI), Sept.; *Kingaroy* 1962 det. RDE, (DPI) Jan. to Apr. (Champ 1965); *Bowenville, Norwin* 1963 det. RDE, Jan., Feb.: NORTH QUEENSLAND: *Cairns* 1932 det. RDE (DPI), Feb., Nov., Dec.

Recorded hosts and habitats.—Jarvis (*op. cit.*) illustrated *Hadrobracon hebetor* as a parasite of *Sitotroga cerealella* (Olivier) and *Anagasta kuhniella* (Zeller). Parasite of *Cadra cautella* (Walker) and *Plodia interpunctella* (Hübner) in peanuts (Champ *op. cit.*).

Records include: *S. cerealella,* Brisbane 1910 det. RDE (DPI), 1913; *A. kuhniella,* Brisbane 1911 (DPI), 1913, 1956; ex maize with *S. cerealella* and *A. kuhniella,* 1932 det. RDE (DPI); *P. interpunctella* 1958 det. CIE; *Ephestia* sp., Toowoomba 1942 (DPI); from oatmeal infested with *Corcyra cephalonica* (Stainton); ex oatmeal, Cairns 1942 (DPI); ex wheat, Macalister 1960 det. RDE; ex barley, Norwin 1963 det. CIE; ex grain, Brisbane 1962 det. RDE (DPI); ex larva *Plutella maculipennis* Curt. 1939.

Note.—B. hebetor is present in most established infestations of stored product Phycitidae in Queensland.

Chremylus elaphus

Distribution.—U.S.A., Europe, Japan (Muesebeck *et al.* 1951). SOUTH QUEENSLAND: *Brisbane* 1941, as *Chremylus rubiginosus* Hal. (Key and Common 1959).

Recorded habitat.—Taken on tanglefoot traps in wool store infested with *Tinea pellionella* Linnaeus and *Tineola bisselliella* (Hummel), Brisbane 1941-1944 (Key and Common *op. cit.*).

Notes.—C. elaphus has been recorded as a parasite of *Tinea pellionella* (Mason 1948) and *Tineola bisselliella* (Muesebeck *et al., op. cit.*). It does not appear to be a common species.

Campyloneurus sp.

Record.—Bred from larva of *Etiella zinckenella* Treitschke in pods of *Crotalaria* sp., Nambour, 20.vi.62, coll. H.G.G., det CIE.

Ipobracon sp.

Records.—Bred from larva of *Etiella zinckenella* Treitschke in pods of *Crotalaria* sp., Nambour, 20.vi.62, coll. H.G.G., det CIE, Palmwoods and Coes Creek, 1962, coll. D.A.I., det CIE.

Phanerotoma sp.

Record.—Ex pods of *Crotalaria incana glabrescens,* Millaroo, 27.ii.62, coll. J. J. Davis, det. CIE.

Ichneumonidae

Devorgilla canescens

Distribution.—Cosmopolitan (Muesebeck *et al.* 1951). Victoria, New South Wales as *Amorphota ephestiae* (Cameron 1912, Froggatt 1912, Morley 1914, Townes *et al.* 1961). SOUTH QUEENSLAND (as *A. ephestiae,* Jarvis 1913): *Brisbane* 1896 (as *Mesochorus australicus* Girault, Girault 1925*b,* Townes *et al.* 1961), Jan., Mar., Apr., May, Aug.; *Toowoomba* 1942, Jan.; *Kingaroy* 1942 (Champ 1965): NORTH QUEENSLAND (as *A. ephestiae,* Caldwell, unpublished Department report 1942).

Recorded hosts and habitats.—Ex window, Brisbane 1896; dried apples infested with *Plodia interpunctella* (Hübner), Brisbane 1897; (Girault *op. cit.*). Parasite of *Anagasta kuhniella* (Zeller) (Jarvis *op. cit.*). Associated with *Corcyra cephalonica* (Stainton) and *Cadra cautella* (Walker), North Queensland (Caldwell *op. cit.*). Associated with *C. cautella* in peanut silos, Kingaroy 1942 (Champ *op. cit.*). Records include: at window, Brisbane 1931; *Ephestia* larvae in peanuts, Toowoomba 1942; produce store, Ravenshoe 1942; *Ephestia larvae,* 1942; bred from *Anagasta kuhniella,* Brisbane 1956; ex sorghum heads, parasite of *A. kuhniella,* Brisbane 1963 det. CIE (DPI); *C. cautella* no data; ex grain silo infested with *A. kuhniella,* Brisbane 1966 det. CJK.

Note.—D. canescens is common but not to the extent that records indicate it has been in the past.

Pristomerus sp.

Record.—Ex pods of *Crotalaria incana glabrescens,* Millaroo, 27.ii.62, coll. J. J. Davies, det. CIE.

Cremastus (*Trathala*) sp.

Record.—Bred from larva of *Etiella zinckenella* Treitschke in pods of *Crotalaria* sp., Palmwoods and Coes Creek, 1962, coll. D.A.I., det CIE.

Mymaridae

Alaptus globosicornis

Distribution.—NORTH QUEENSLAND: *Nelson,* via Cairns 1911: SOUTH QUEENSLAND: *Roma* 1911 (Girault 1912*b*).

Notes.—Timberlake (1924) records *A. globosicornis* as an egg-parasite of *Atropos divinitoria*—see Champ and Smithers (1965) re Queensland records of *A. divinitorius.*

Trichogrammatidae

Trichogramma australicum

Distribution.—NORTH QUEENSLAND: *Mackay* 1911, Oct., *Mareeba* 1911, Dec., *Herberton* 1911, Dec., *Nelson* 1911, Nov., *Cairns* 1912, Jan., *Cooktown* 1912, Feb., *Innisfail* 1912, Jan. (Girault 1912*a*); *Gordonvale* 1914, May, June (Girault 1915*a*).

Recorded hosts.—Ex mass of Noctuidae eggs on *Melaleuca* forest, Gordonvale 1914 (Girault 1915*a*); eggs of *Heliothis obsoleta* Fabricius (= *H. armigera* Hübner) (Veitch 1927).

Notes.—*T. australicum* has been reared in the laboratory on eggs of *Sitotroga cerealella* (Olivier) and *Cadra cautella* (Walker) (Takano 1933), *Plutella cruciferarum* Zell. (= *P. maculipennis* Curt.), *Hellula undalis* F. and *Heliothis obsoleta* (Veitch 1929). *T. australicum* is taken commonly on windows of buildings. It is reported by Allman (1927) and Wilson (1963) as the most important parasite of *Cydia pomonella* (L.) in Australia.

Trichogramma minutum

Distribution.—New South Wales (Girault 1912*a*). NORTH QUEENSLAND: *Rossville* (Girault *op. cit.*). Veitch and Simmonds (1929) referred to *T. minutum* as an established species in Queensland.

Notes.—In 1927, a strain of *T. minutum* from California was introduced to Queensland and liberated at Stanthorpe, in North Queensland and near Brisbane for control of *Cydia pomonella* (L.) (Veitch 1928, 1929; Veitch and Simmonds *op. cit.*). This strain did not appear to become established.

Encyrtidae

Zeteticontus sp.

Record.—Ex nut-in-shell peanuts in bag stacks heavily infested with insects, Kingaroy, 29.iii.62 (det. RDE): in DPI Collection.

Paralitomastix koehleri

Paralitomastix koehleri (Blanchard) = *Copidosoma koehleri* Blanchard (E. F. Riek 1964, personal communication).

Paralitomastix koehleri was introduced to Australia from Chile in 1945 as a parasite of *Phthorimaea operculella* (Zeller) and 2,000,000 were liberated in the potato-growing district at Lowood on January 7, 1947, and 100,000 at Stanthorpe, where tomato crops were being severely damaged, on January 17, 1947 (Anon. 1947). During 1947-1949 further mass-rearings and liberations were made. Field surveys showed that *P. koehleri* was established over a wide area of southern Queensland potato-growing areas and it was considered this species exerted a higher level of control in Queensland than elsewhere (Anon. 1954).

Distribution.—SOUTH QUEENSLAND: *Gatton* 1952; *Brisbane* 1961; *Flaxton* 1962; *Palmwoods* 1962; *Toogoolawah* 1962; *Kingaroy* 1963; *Beerwah* 1963; *Rochedale* 1964; *Elimbah* 1964; *Beerburrum* 1964; *Glasshouse* 1964: NORTH QUEENSLAND: *Millaroo* 1962; *Ayr* 1963.

Recorded hosts.—All ex *Phthorimaea operculella.* Infesting potato (*Solanum tuberosum* L.): foliage—Gatton, Aug. 1952 (DPI); Brisbane, Aug. 1961 (DPI); Palmwoods, Oct. 1962 (DPI) light*; Flaxton, Nov. 1962; Toogoolawah, Dec. 1962, Jan. 1963 light; Rochedale, Mar. 1964 moderate, July (DPI) heavy: tubers —Kingaroy, Jan. 1963 (DPI) very light; Gatton, Dec. 1962, Aug. 1964 (DPI), Sept. 1965 heavy. Infesting tobacco (*Nicotiana tabacum* L.) foliage: Millaroo, Oct., Nov. 1962 (DPI) very light; Beerwah, Jan. 1963 very light, Feb. 1963 (DPI) light; Ayr, Feb. 1963 (DPI) light; Elimbah, Apr. 1964 very light; Beerburrum, July 1964 (DPI) moderate; Glasshouse, Nov. 1964 light, Jan., Feb. 1965 (DPI) very light.

Notes.—P. koehleri is established throughout the tobacco and potato growing areas of southern Queensland and has appeared in North Queensland at Millaroo, a tobacco and potato growing centre at the time concerned. It appears likely from numerous observations that infested potato tubers are responsible for the spread of the species as has occurred in the distribution of resistant strains of *P. operculella* throughout Queensland (Champ and Shepherd 1965). High parasitism rates are recorded but from a consideration of the applied control programme deemed necessary for adequate suppression of *P. operculella* in the areas concerned, the economic significance of this natural control is at best slight.

Pteromalidae

Spalangia sp.

Record.—Ex infested grain, Bongeen, 27.ix.60, det. GJK: in DPI Collection.

Choetospila elegans

Distribution.—Tropicopolitan (G. J. Kerrich, personal communication). New South Wales (Westwood 1874). NORTH QUEENSLAND: *Port Douglas,* Oct., *Nelson, Cooktown, Halifax,* 1913, Feb., as *Spalangiomorpha fasciatipennis*

* Parasitism has been classified as follows: very light, < 1% of larvae; light, 1–10%; moderate, 10–25%; heavy, 25–50%.

Girault (Girault 1913, 1915*b*); *Innisfail* 1942 det. GJK, Jan.; *Atherton* 1942 det. GJK, May; *Mareeba* 1942 det. GJK, May: SOUTH QUEENSLAND: *Brisbane* 1911 det. AAG, 1936 det. GJK, Jan., Apr., June, Dec.; *Dalby* 1960 det. GJK, Sept. (DPI); *Jondaryan, Kaimkillenbun, Mt. Tyson, Mywybilla* 1962 det. GJK (DPI), Nov.; *Brookstead* 1962 det. GJK (DPI), Dec.

Recorded hosts and habitats.—Rather common on windows of grocery stores (Girault 1913, 1915*a*).

Records include: *Sitophilus oryzae* (Linnaeus), stored wheat, Brisbane 1911 det. AAG; ex grain pests, ex corn weevil (presumably *Sitophilus zeamais* Motschulsky, "from *Calandra oryzae*", Brisbane 1936 det. GJK; ex pearl barley infested with insects, Innisfail 1942 det. GJK; ex wheat infested by *Calandra* sp., Atherton 1942 det. GJK; wheatmeal, Mareeba 1942 det. GJK; ex maize residues infested with *S. oryzae* and *S. zeamais,* Brisbane 1960 det. GJK (DPI); wheat infested with *S. oryzae,* Brisbane 1960, Dalby 1960, Jondaryan 1962, Kaimkillenbun 1962, Mywybilla 1962, Mt. Tyson 1962, Brookstead, 1962, det. GJK (DPI).

Notes.—*C. elegans* is a common parasite of *Sitophilus oryzae* and *S. zeamais* throughout Queensland. *Cerocephala dinoderi* is frequently recorded with *C. elegans.*

Cerocephala dinoderi

Distribution—Philippine Islands (Gahan 1925), tropicopolitan (G. J. Kerrich, personal communication). SOUTH QUEENSLAND: *Brisbane* 1935 det. GJK, Apr., June, Dec.; *Mywybilla* 1962 det. GJK (DPI), Nov.; *Brookstead* 1962 det. GJK, Dec.; NORTH QUEENSLAND: *Atherton* 1942 det. GJK, May.

Recorded hosts and habitats.—Ex pests, stored grain, Brisbane 1935 det. GJK; ex corn weevil (presumably *Sitophilus zeamais* (Motschulsky)), Brisbane 1936 det. GJK; associated with *Calandra* sp. in wheat (presumably *S. oryzae* (Linnaeus)), 1942 det. GJK; ex wheat infested with *S. oryzae,* Atherton 1942, Brisbane 1960 (DPI), Mywybilla 1962 (DPI), Brookstead 1962, det. GJK; ex maize infested with *S. oryzae* and *S. zeamais,* Brisbane 1960 det. GJK (DPI); ex flour infested by *Tribolium confusum* (Jacq. du Val) det. GJK.

Notes.—Gahan (*op. cit.*) described *C. dinoderi* from *Dinoderus minutus* (Fabricius), which since 1916 (Tryon 1916) has been intercepted at Queensland ports in bamboo and similar products but has not been recorded as established. Most Queensland records refer to associations with *Sitophilus oryzae* and *S. zeamais. C. dinoderi* usually occurs with the more common *Choetospila elegans.*

Dibrachys cavus

Distribution.—QUEENSLAND (as *D. clisiocampae* (Fitch) Girault, *in lit.*).

Recorded hosts.—*Cydia pomonella* (Linneaus), *Phthorimaea operculella* (Zeller) (Girault *op. cit.*).

Pseudomicromelus australia

Distribution.—QUEENSLAND as *Dibrachys australia* (Girault *in lit.*).

Recorded host.—Cydia pomonella (Linneaus) (Girault *op cit.*).

Lariophagus distinguendus

Distribution.—Probably cosmopolitan (Muesebeck *et al.* 1951). NORTH QUEENSLAND: *Atherton* 1942, May: SOUTH QUEENSLAND: *Brisbane* 1960 det. GJK (DPI), Apr.; *Bongeen* 1960 det. GJK (DPI) Sept., Nov.; *Oakey* 1960 det. GJK (DPI), Sept.; *Jondaryan, Kaimkillenbun, Mywybilla, Yargullen,* 1962 det. GJK (DPI), Nov.; *Bowenville, Brookstead* 1962 det. GJK (DPI), Dec.; *Kingaroy* 1963 det. GJK (DPI), Nov.

Recorded hosts and habitats.—Sitophilus oryzae (Linnaeus) larva, Atherton 1942 (this may refer to either *S. oryzae* or *S. zeamais* (Motschulsky)); maize residues, Brisbane 1960 det. GJK (DPI); wheat and barley infested with *S. oryzae,* Bongeen 1960, Oakey 1960, Bowenville 1962, Brookstead 1962, Jondaryan 1962, Kaimkillenbun 1962, Mywybilla 1962, Yargullen 1962, det. GJK (DPI); sorghum infested with *S. oryzae,* Kingaroy 1963 det. GJK (DPI); associated with *Stegobium paniceum* Fabricius in dog biscuits, Brisbane 1962 det. GJK (DPI).

Notes.—L. distinguendus is common throughout Queensland. Voinoskaya-Kriger (1927) reported this species as hyperparasitic on *Nemeritis canescens* Gravenhorst (= *Devorgilla canescens*); the records given for Queensland indicate a wider host range. The early record (1942) of *L. distinguendus* referred to *Pteromalus oryzae* Cameron.

Nasonia vitripennis

Distribution.—Cosmopolitan (Muesebeck (*et al.* 1951). SOUTH QUEENSLAND: *Brisbane* (Girault 1913); 1911, Oct., *Aramac* and *Longreach,* 1913, Oct., (Girault 1915*b*): as *Nasonia brevicornis* Girault and Sanders.

Recorded hosts and habitats.—Window of wool-house, 1911; dipterous pupae, Aramac, Longreach 1913; (Girault 1915*b*).

Notes.—N. vitripennis is a common parasite of sheep blowflies in Australia; its status was discussed by Froggatt (1919), Hardy (1924, 1925) and others. Muesebeck *et al.* (1951) recorded *Piophila casei* (Linnaeus) as a host.

Habrocytus cerealellae

Distribution.—Cosmopolitan (Muesebeck *et al.* 1951). QUEENSLAND: 1945 det. CIE, Aug.

Recorded hosts.—Sitotroga cerealella (Olivier) 1945 det. CIE; *Earias huegeli* Rog. 1963 det. CIE.

Anisopteromalus calandrae

Distribution.—Cosmopolitan (Cotton and Good 1937). New South Wales (Frogatt 1891, 1903). NORTH QUEENSLAND: *Nelson,* via Cairns 1911, Nov., Dec., as *Neocatolaccus australiensis* Girault (Girault 1913) = *Aplastomorpha australiensis* (Girault 1915*b*) = *A. vandinei* (Tucker) (Girault 1917, Waterston 1921); *Innisfail* 1912, Jan., *Gordonvale* (Girault 1915*b*); *Cairns* 1932, Feb.; *Atherton*: SOUTH QUEENSLAND: *Brisbane* 1938 det. GJK, Jan., Mar., Apr., Aug., Sept., Dec.; *Bongeen, Dalby* 1960 det. GJK (DPI), Sept.; *Kingaroy* 1962 det. GJK (DPI), Mar. (Champ 1965); *Booie* 1963 det. GJK (DPI), Dec.

Recorded hosts and habitats.—At window, Nelson 1911, miscellaneous tree galls, 1912 (Girault 1913). Foliage of tea plants, 1911; at window, Cairns 1911, Innisfail 1912; abundant in seed corn infested by common grain weevil *Calandra* (probably *Sitophilus zeamais* (Motschulsky)), 1914; common on windows, Gordonvale: Girault (1915*b*). Ex nut-in-shell peanuts in bag-stacks (Champ *op. cit.*).

Records include: Ex *Sitrotoga cerealella* in dried wheat heads, 1912 (DPI); *Callosobruchus maculatus* (Fabricius) on poona pea, Brisbane, 1938 det. GJK (DPI); on bags of wheat, maize and cornflour, Brisbane 1955 det. GJK (DPI); infestation complexes in grain with *Sitophilus oryzae* (Linnaeus) and *S. zeamais* as primary species, Brisbane 1960, 1962 det. GJK (DPI), Bongeen, Dalby 1960 det. GJK (DPI), Booie 1963 det. GJK (DPI).

Notes.—*A. calandrae* is common and appears in most established infestations of *Sitophilus oryzae* and *S. zeamais.* There are specimens of *A. calandrae* recorded as *Aplastomorpha vandinei* (Tucker), "ex maize with *Sitotroga cerealella* (Oliver) and *Anagasta kuhniella* (Zeller), Cairns, 14.ii.1932", and "host *A. kuhniella,* Atherton"; it is not clear whether these were bred from the hosts and the records need confirmation. A record of *Neocatolaccus* sp. from *Tribolium* sp. larva, Collinsville, 23.iv.1932, may refer to *A. calandrae.*

Eurytomidae

Systole sp.

Record.—Ex warehouse, Brisbane, 25.x.61, det. GJK; ex bulk wheat in storage, Warra, Nov. 1963, det. CIE: in DPI Collection.

Notes.—Krombein *et al.* (1958) recorded *S. geniculata* Foerster from seeds of umbellifers. R. D. Eady (personal communication) records the present species ex coriander seed (Umbelliferae) from Aden—coriander seed was stored in the warehouse reported above.

Bruchophagus gibbus

Distribution.—Cosmopolitan (Muesebeck *et al.* 1951). Australia (Froggatt 1919). SOUTH QUEENSLAND (Sept. 1922, Tryon 1925, Girault 1925*a,* as *Bruchophagus funebris* Howard; Smith 1945, Jarvis and Smith 1946, Hooper 1958): *Brisbane,* 1946; *Killarney,* 1954 det. EFR, Nov.

Recorded hosts and habitats.—Lucerne and clover seeds (Jarvis and Smith *op. cit.*); these authors discuss occurrence, life history, habits and control in Queensland.

Records include: ex lucerne seed, Brisbane 1946; ex lucerne, Killarney 1954 det. EFR.

Note.—Tryon (*op. cit.*) reported an unidentified chalcid of metallic blue green colour accompanying *B. gibbus* "evidently one of its parasites".

Chalcididae

Stomatocerus pomonellae

Distribution.—New South Wales (Allman 1927). SOUTH QUEENSLAND: (Smith 1945).

Recorded Hosts.—Often bred from pupae of *Cydia pomonellae* (Smith *op. cit.*). *Aglossa pinguinalis* (Linnaeus).

Stomatocerus stomesi

Distribution.—SOUTH QUEENSLAND: Stanthorpe 1935, Jan.

Recorded host.—*Cydia pomonella* (Linnaeus), Stanthorpe 1935, record only.

Brachymeria sp.

Records.—Bred from *S. cerealella* (Olivier), 22.viii.1945, det. CIE; bred from sorghum heads in the field infested with *Homeosoma vagella* Zeller and *Sathrobrota badia* Hodges, Kalbar, 2.iv.64, det. GJK: in DPI Collection.

Antrocephalus sp.

Record.—Ex maize silo infested with *Cadra cautella* (Walker), Strathpine, 7.i.65, det. GJK in DPI Collection.

Evaniidae

Evania appendigaster

Distribution.—Tropicopolitan (Muesebeck *et al.* 1951). QUEENSLAND (Smith 1945).

Recorded hosts and habitats.—Cockroaches (Smith *op. cit.*).

Note.—*E. appendigaster* is common in south Queensland.

Bethylidae

Cephalonomia waterstoni

Distribution.—Australia (Durrant 1921, Gahan 1931, Richards 1939).

Cephalonomia tarsalis

Distribution.—Probably cosmopolitan (Richards and Herford 1930). Western Australia, New South Wales, Victoria, South Australia (Waterston 1921, Myers 1928, 1929 as *Cephalonomia* sp., Richards and Herford 1930 as *C. carinata* Kieffer, Gahan 1931). SOUTH QUEENSLAND: *Brisbane* 1936 det. CIE (DPI), Apr.; *Toowoomba* 1942 det. CIE, Jan. (Champ 1965); *Kingaroy* 1962 det. GEJN (DPI), Mar. (Champ *op. cit.*); *Bowenville* 1962 det. GEJN (DPI), Dec.; *Norwin* 1963 det. GEJN (DPI), Feb.: NORTH QUEENSLAND: *Charters Towers* 1942 det. CIE, Apr.; *Mt. Garnet* 1960 det. CIE, Jan.

Recorded hosts and habitats.—Peanuts, Toowoomba 1942 det. CIE, Kingaroy 1962 det. GEJN (DPI) (Champ *op. cit.*).

Records include: With *Oryzaephilus surinamensis* (Linnaeus) in currants, Charters Towers 1942; wheat, Bowenville 1962 det. GEJN (DPI); barley, Norwin 1963 det. GEJN (DPI).

Notes.—*C. tarsalis* in Queensland probably parasitized *Oryzaephilus surinamensis* and *Sitophilus oryzae* (Linnaeus) (*cf.* Gahan 1931), *Cryptolestes* spp. (*cf.* Muesebeck *et al.* 1951), and *Oryzaephilus mercator* Fauvel. There are two slides of a *Cephalonomia* sp. in the DPI collection labelled "from stored maize pests, Brisbane, 12.v.36" and "Parasites among larvae feeding on debris of walnuts destroyed by *Plodia interpunctella* Ag. Dept. Jan. 1912, possibly species of *Silvanus* or *Tribolium.*"

Plastanoxus westwoodi

Distribution.—Africa, Australia, North America (Gahan 1931). New South Wales, Western Australia (Waterston 1921, Gahan *op. cit.*). SOUTH QUEENSLAND: *Brisbane* 1936, 1961 det. GEJN (DPI), May, Dec.; *Yarranlea* 1960 det. GEJN (DPI), Aug.; *Allora* 1960 det. GEJN (DPI), Dec.

Recorded habitats.—From stored maize pests, Brisbane 1936 (DPI); ex grain residues in silo, Yarranlea 1960 det. GEJN (DPI); infested wheat spillage, Allora 1960 det. GEJN (DPI); infested sunflower seed, Brisbane 1960 det. GEJN (DPI).

Notes.—Gahan (*op. cit.*) recorded *P. westwoodi* from *Cryptolestes pusillus* (Schonherr). All Queensland records listed here were from infestation complexes containing *Cryptolestes pusilloides* (Steele and Howe) only.

Goniozus antipodum

Distribution.—South Australia (Westwood 1874), New South Wales (Froggatt 1906). SOUTH QUEENSLAND: *Stanthorpe,* no date.

Recorded host.—*Cydia pomonella* (Linnaeus), Stanthorpe.

Holepyris sylvanidis

Distribution.—Cosmopolitan (Muesebeck *et al.* 1951). Western Australia as *Rhabdepyris zeae* Turner and Waterston (Richards 1939) *H. sylvanidis* (Evans 1964). SOUTH QUEENSLAND: *Brisbane* 1960 det. GEJN (DPI), Apr.; *Kingaroy* 1962 det. GEJN (DPI), Mar. (Champ 1965).

Recorded habitats.—Infested nut-in-shell peanuts in silos, Kingaroy 1962 det. GEJN (DPI) as *R. zeae* (Champ *op. cit.*). Infested maize residues, Brisbane 1960 det. GEJN (DPI).

Note.—Hosts of *H. sylvanidis* recorded elsewhere (Muesebeck *et al.* 1951) and associated with *H. sylvanidis* in the above records were *Sitophilus oryzae* (Linnaeus) and *Tribolium casteneum* Herbst.

Formicidae

Pheidole megacephala

Distribution.—QUEENSLAND (Tryon 1912): *Cairns* 1901, Aug. (Gurney 1905); *Brisbane* (Tryon 1915), 1960 det. GEJN (DPI), Jan. to Dec.; *Innisfail* 1937, June; *Mackay* 1952, Dec.; *Maryborough* 1953, Jan.; *Kingaroy* 1953, Nov.; *Bundaberg* 1954, May; *Toowoomba* 1956, Apr., Sept.; *Roma* 1957, June; *Collinsville* 1957, Sept.; *Goondiwindi* 1958, Apr.; *Westgate, Western Queensland* 1959, Jan.; *Jandowae* 1959, Mar.; *Barron* 1959, June; *East Palmerston* 1959, July, Sept.; *Upper Barron, Warwick* 1960, Mar.; *Monto, Victoria Island* 1962, Apr.; *Kalunga* 1962, Aug.; *Eudlo* 1963, Feb.; *Nambour* 1963, Mar.

Recorded foods and habitats.—Attacking plants, e.g. boring channels in base of banana stems, pineapple, citrus, wheat, grass, chrysanthemum; attacking small grains, foodstuffs in houses, including bread, meat, butter, cheese, milk; destroying soiled clothing and plastic electrical cables.

Notes.—*P. megacephala* is common throughout Queensland. It is essentially a scavenger and is most important as a pest in houses.

COMMENTS

Veitch (1934), discussing the rice weevil (*Sitophilus oryzae* (L.)) in maize in Queensland, noted that small wasp parasites were not infrequently bred from infested grain but general experience was that parasites did not become common until grain was heavily infested and damage nearly at its peak. A similar association of parasites and pea and bean weevils was reported also but that author concluded it was practically certain that control by parasites offered no prospect of success. This situation has not changed, at least with respect to the Coleoptera.

The position appears similar but less clear with Lepidoptera and particularly the major pest species, *Cadra cautella* (Walk.). Populations are seasonal, and though commodities become heavily infested by late summer, outbreaks are followed by spectacular decreases in numbers. Infestations in which Hymenoptera operate usually are attended by numerous predaceous species and frequently protozoan disease: no evidence has been found to attribute anything more than an incidental role to Hymenoptera, specifically *Bracon hebetor,* the most abundant species—removal of the *B. hebetor* component with the somewhat specific insecticide, malathion, does not change the picture.

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