

## Records of Introduction of Beneficial Insects into the Hawaiian Islands.

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Apparently the first beneficial insect purposely introduced into Hawaii was the lady beetle (*Noctius cardinalis*), which is an enemy of the cottony cushion scale (*Icerya purchasi*). This was introduced from Australia in 1890 (probably via California) by Mr. Albert Koebele, who was engaged at that time in introducing beneficial insects into California to attack their orchard pests.

Since that time, there have been many species of beneficial insects successfully introduced into Hawaii, from various parts of the world, and by several institutions here. Mr. Koebele was engaged for this work in 1893. Between that time and 1904 many valuable lady beetles were introduced, also parasites of scale insects. In 1904 the Experiment Station of the Hawaiian Sugar Planters' Association began introducing parasites for the sugar-cane leafhopper, and has continued the work of introducing beneficial insects for one insect pest or another ever since. The Territorial Board of Agriculture and Forestry has also been active in this line of work; the United States Experiment Station and the Honolulu office of the United States Bureau of Entomology have also had a share in this important work.

The records of these introductions are very scattered, and in some cases very obscure, possibly entirely lacking in many cases. Herewith an attempt is made to put together for convenient reference the records of all successful introductions, so far as they could be found. They are grouped according to the various purposes for which they were introduced. The date of introduction is given, so far as known, the country from which introduced, and the particular pest on which it preys.

## LADY BEETLES PREYING ON SCALE INSECTS, MEALY-BUGS, ETC.

1890. *Novius cardinalis* Muls. From Australia via California.  
On cottony cushion scale.  $\bar{L}$
- ? <sup>1</sup> *Novius koebelei*. From Australia via California. On  
cottony cushion scale.
1894. *Cryptolaemus montrouzieri* Muls. From Australia via  
California. ? On mealy-bugs.
1894. <sup>2</sup> *Rhizobius ventralis* Erich. From Australia via Califor-  
nia. On mealy-bugs.
- ? <sup>1</sup> *Cryptogonus orbiculatus* Gyll. Japan. On mealy-bugs.
- 1895, 1906, 1914. *Nephus* sp. near *bipunctatus* Kugel. Japan,  
South China, Philippines. On mealy-bugs.
1894. *Orcus chalybaeus* (Boisd.). Australia. Diaspine scales,
1894. *Serangium maculigerum* Blkb. Australia. Diaspine scales.
- ? *Lindorus lophanthae* Blaisd. California. Diaspine scales.
1895. *Chilocorus circumdatus* Schon. South China. Diaspine  
scales.
1895. *Sticholotis punctatus* Crotch. China, Japan. Diaspine  
scales.
1895. <sup>3</sup> *Pentilia nigra* Weise. China, Japan. Diaspine scales.
1908. *Azya luteipes* Muls. Mexico. Lecaninae.
1908. *Hyperaspis jocosa* (Muls.). Mexico. *Orthozia*. {s p}
1922. *Curinus coeruleus* Muls. Mexico. *Pseudococcus nipae*.
1922. *Hyperaspis silvestrii* Weise. Mexico. *Pseudococcus nipae*.
1922. *Nephus* sp. Mexico. *Pseudococcus bromeliae*.
1922. *Diomus* sp. Mexico. Mealy-bugs.
1922. *Diomus* sp. (four-lined). Mexico. Mealy-bugs.

## COCCID PARASITES.

1894. ? *Aspidiotiphagus citrinus* Craw. China, Japan. On di-  
aspine scales.
1905. *Scutellista cyanea* Motsch. California. *Saissetia nigra*.

<sup>1</sup> Abundant in 1897, but later disappeared.

<sup>2</sup> The lady beetle introduced under this name, and for a long time con-  
sidered as such, has recently been shown by Mr. Timberlake to be a species  
of *Lindorus*.

<sup>3</sup> Recorded as introduced, but this name is used by Koebele incorrectly,  
and the species supposedly introduced, although established, is as yet unde-  
termined.

1908. <sup>4</sup> *Comperiella bifasciata* How. Japan. Diaspine scales.  
 1915. *Leptomastidea abnormis* (Gir.). Sicily via California.  
*Pseudococcus kraunhiac.*  
 1922. *Pseudaphycus utilis* Timb. Mexico. *Pseudococcus nipae.*  
 1922. *Coclaspidia osborni* Timb. Mexico. *Pseudococcus cal-*  
*ccolariae.*

It is probable that many of the other parasites established in the Hawaiian Islands on introduced Coccids are some of those that were purposely introduced, but on account of their identity not being known at the time of introduction definite records are lacking.

#### LADY BEETLES PREYING ON PLANT LICE.

1893. <sup>5</sup> *Coccinella californica* Mann. California. (Disappeared after 1896.)  
 1894. *Coclophora inaequalis* (Fab.). Australia, Ceylon, China.  
 1894. *Platyomus lividigaster* Muls. Australia.  
 1894. *Diomus notescens* (Blkb.). Australia.  
 1895. *Coclophora pupillata* (Schon.). Hongkong.  
 Before 1894. <sup>6</sup> *Callineda conformis* (Boisd.). Australia. (Disappeared after 1906.)  
 1895. *Synonyche grandis* Thun. China, Japan. (Disappeared after 1896.)  
 1895. *Verania discolor* Fab. Hongkong. (Disappeared after 1896.)  
 1895. *Coclophora biplagiata* Swartz. Hongkong. (Disappeared after 1896.)

*Scymnus*, several undetermined species introduced; details of introduction not known.

#### OTHER ENEMIES OF PLANT LICE.

Syrphid flies and Chrysopa flies were reported established by Koebele in 1897. It is not known which species, nor where from, nor when introduced.

1904. *Chrysopa* sp. Australia.  
 1907. *Trioxyis* sp. ? California. Parasite on orange Aphis.  
 1919. *Micromus tinaceus* Gerst. Queensland.

<sup>4</sup> Doubtfully established.

<sup>5</sup> Again introduced in 1905, but failed.

<sup>6</sup> Again introduced in 1904, but failed.

## ENEMIES OF THE SUGAR-CANE LEAFHOPPER.

1904. *Paranagrus optabilis* Perkins. Queensland. Egg-parasite.  
 1904. *Paranagrus perforator* Perkins. Queensland. Egg-parasite.  
 1904. *Anagrus frequens* Perkins. Queensland. Egg-parasite.  
 1905. *Ootetrastichus beatus* Perkins. Fiji. Egg-parasite.  
 1906. *Haplogonatopus vitiensis* Perkins. Fiji. Parasite on nymph.  
 1907. *Pseudogonatopus hospes* Perkins. China. Parasite on adult.  
 1916. *Ootetrastichus formosanus* Timb. Formosa. Egg-parasite.  
 1920. *Cyrtorhinus mundulus* (Bredd.). Queensland and Fiji. Predacious on eggs.

## BRUCHID PARASITES.

1910. *Uscana semifumipennis* Gir. Texas. Egg-parasite.  
 1910. *Heterospilus prosopidis* Vier. Texas. Parasite on larva.  
 1921. *Lariophagus texanus* Cwfd. Texas. Parasite on larva.  
 1921. *Urosigalphus bruchi* Cwfd. Texas. Parasite on larva.  
 1921. *Glyptocolastes bruchivorus* Cwfd. Texas. Parasite on larva.  
 1921. *Horismenus* sp. Texas. Parasite on larva.

## FRUIT-FLY PARASITES.

1913. *Opius humilis* Silv. South Africa. On larva of *Ceratitis capitata*.  
 1913. *Diachasma tryoni* Cam. Australia. On larva of *Ceratitis capitata*.  
 1914. *Diachasma fullawayi* Silv. Africa. On larva of *Ceratitis capitata*.  
 1914. *Tetrastichus giffardianus* Silv. West Africa. On larva of *Ceratitis capitata*.  
 1913. *Dirhinus giffardii* Silv. West Africa. On pupa of *Ceratitis capitata*.  
 1913. <sup>7</sup> *Galesus silvestrii* Kieffer. West Africa. On pupa of *Ceratitis capitata*.  
 1916. *Opius fletcheri* Silv. India. On larva of *Bactrocera cucurbitae*.

<sup>7</sup> Doubtfully established.

## OTHER ENEMIES OF DIPTERA.

1906. *Eucoila impatiens* Say. Arizona. On larva of *Sarcophaga*.  
 1909. <sup>7</sup> *Bathymetis* sp. Germany. On puparium of horn-fly.  
 1909. *Hister bimaculatus* L. Germany. Predacious on maggots.  
 1913. *Muscidifurax raptor* Gir. & Sand. South Africa. Parasite on puparia.  
 1914. *Pachycrepoides dubius* Ashm. Philippines. Parasite on puparia.  
 1914. *Spalangia philippinensis* Ful. Philippines. Parasite on puparia.  
 1914. *Spalangia* sp. Africa. Parasite on puparia.  
 1921. *Creophilus erythrocephalus* Fab. Australia. Predacious on maggots.

## PARASITES OF LEAF-ROLLERS AND ARMY WORMS.

1895. *Microbracon omiodivorum* (Terry). Japan. On larva of leaf-rollers.  
 1895. *Chalcis obscurata* Walker. Japan. On pupa of leaf-rollers, etc.  
 ? *Amblyteles kobelei* (Sw.). California. Army-worm parasite.  
 ? *Amblyteles purpuripennis* (Cress.). California. Army-worm parasite.  
 ? *Frontina archippivora* Will. North America. Army-worm parasite.

## MISCELLANEOUS.

1904. *Aphanomerus pusillus* Perk. Queensland. Egg-parasite of *Siphanta acuta*.  
 1909. *Blastophaga psenes* (Linn.). California. Caprifier of edible fig.  
 1910. *Ceromasia sphenophori* Vill. New Guinea. Parasite of larva of *Rhabdoctenemis obscura*.  
 1916. *Paranagrus osborni* Ful. Philippines. Egg-parasite of corn leafhopper.  
 1916. *Scolia manilae* Ashm. Philippines. Parasite of larva of *Anomala* and *Adoretus*.

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<sup>7</sup> Doubtfully established.

1917. *Dolichurus stantoni* Ashm. Philippines. Parasite on nymph of roach.
1921. *Ischiogonus syagrii* Ful. Australia. Parasite of larva of Australian fern weevil.
1921. *Pleistodontes froggatti* Mayr. Australia. Caprifier of *Ficus macrophylla*.
1922. *Pleistodontes imperialis* Saund. Australia. Caprifier of *Ficus rubiginosa*.
1922. *Notogonidca luzonensis* Rohwer. Philippines. Parasite of field cricket.
- ? *Stethorus vagans* Blackburn. Predacious on leaf-mites.

## LANTANA INSECTS.

1902. *Agromyza lantanae* Frogg. Mexico. Larvae in seeds.
1902. *Thecla echion* Linn. Mexico. Larvae on flowers.
1902. *Thecla agra* Hew. Mexico. Larvae on flowers.
1902. *Crocidosema lantana* Busck. Mexico. Larvae in flower clusters.
1902. *Platyptilia pusillidactyla* Walk. Mexico. Larvae in flower clusters.
1902. *Cremastobombycia lantanella* Busck. Mexico. Leaf-miner.
1902. *Teleonemia lantanae* Distant. Mexico. Leaf-bug.
1902. *Eutrecta xanthochaeta* Aldrich. Mexico. Stem gall-fly.