ACCOMPLISHMENTS AND FUTURE OF BIOLOGICAL CONTROL AND INTEGRATED CONTROL IN BRAZIL – PART 2

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EDITOR'S NOTE

The entomologist Kenneth Sverre Hagen, professor of the University of California at Berkeley, and that moment working in the Michigan State University, was in Brazil for a three month period in 1977 as a consultant in the Program of Superior Agricultural Education (*Programa de Educação Agrícola Superior – PEAS*) of the Ministry of Brazilian of Education and Culture. During this period (from July to September), Professor Hagen trained and changed experiences with docents (university professors) and reseachers in several fields mainly in the Biological Control of Insects and Pests using ESALQ (Superior College of Agriculture) as a basing point. He visited other Brazilian Universities and Research Institutions. All of the activities are presented in the Report Biological and Integrated Control of Insects in Brazil (*Controle Biológico e Controle Integrado de Insetos no Brasil: Realizações e Futuro*), a never published document. During his stay in Brazil, he was accompanied by a professor from the Entomology departament, responsible for rescuing this report. Of an invaluable historical nature, the report will be published in three parts in the Brazilian Journal of Agriculture (BJA), opening the "*Unpublished historical papers*" section.

HOMOPTERA

The introductions of natural enemies against Homoptera in the world have been particularly successful. Already in Brazil there have been 5 or 6 homopterous pests brought under partial to complete control by introduced natural enemies and these species are indicated by an asterisk before their names in the list, but there are nearly 90 species of Homoptera that apparently have been introduced which possess natural enemies that are not recorded to be in Brazil (see list).

Some outstanding natural enemies that should be considered for introduction against homopterous pests in Brazil are noted in the list.

Since most of the cercopid pests in Brazil are native, they were not included in the list, but perhaps it may be worth considering the introduction of the mirid *Tyttus mundulus* (Bredd.) which is an egg predator of the sugarcane leaf hopper in Hawaii. The use of the fungus *Metarrhizium anisopliae* by large sugarcane companies to help suppress the cercopid pests is to be recommended. Guagliumi *et al.* (1974) present the history, culture and use of *M. anisopliae* as well as its role in the integrated control of sugarcane pests in northeast Brazil.

The species of homopterous pests suspected to be introduced into Brazil are listed with their major plant hosts under the following families to which they belong.

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Aleyrodidae

- **Aleurodicus cocois (Curtis) - Cashew, palms*

Occurs widely in tropical Americas. It is considered native to Brazil by Carvalho *et al.* (1971) since it came to cashew from coconut and the presence of a hymenopterous parasite before any was introduced into Brazil. Four parasites and two coccinellid predators were sent to Brazil from Trinidad, and released in Pernambuco, but only one natural enemy, a predator under the name of *Clitostethus dispar* Sicard became established. This species is now known as *Nephaspis dispar* (Sicard) which according to Gordon (1972) is only known from British Guiana. Recently a new species, *Nephaspis cocois* Gordon, was described from specimens collected from cashew in Recife, Pernambuco (E. Arruda 1976). It is the only *Nephaspis* known from Brazil. Thus *N. cocois* could be originally from Trinidad and has become established in Brazil. *A. cocois* has been partially controlled in Barbados by an aphelinid, *Prospaltela* sp. introduced from Trinidad (DeBach 1964). Inconclusive results were obtained from applying a fungus *Cladosporum herbarum* (Pers.) against *A. cocois* in Brazil (Carvalho 1972).

- *Aleurothrixus floccosus (Maskell) - Citrus*

The woolly whitefly is apparently native to the Americas. Of six primary parasites recorded attacking this pest in Argentina, Chile, Mexico, Peru and Uruguay, none of these parasites have been reported to occur in Brazil on *A. floccosus* (Silva *et al*. 1968). It is necessary to determine if any of the Neotropical parasites attack *A. floccosus* in Brazil. The introduction of *Amitus spiniferus* (Brèthes) into Chile from Mexico has completely controlled the wooly whitefly (DeBach 1964).

- *Bemisia tabaci (Genn.) - Beans, cotton, tobacco*

Recently this whitefly has become a serious pest on cotton in many parts of the world and on beans in Brazil. It is widely distributed in the Mediterranean area, tropical Africa and westerly parts of tropical Asia, and recently in the New World. *Bemisia gossypiperda* Misra and Lamba is considered a synonym (Browne 1968). There are three aphelinid parasites of the pest in the Sudan (Thompson 1944).

- *Dialeurodes citrifolli (Morgan) - Citrus*

This is the most abundant whitefly on *citrus* in the State of São Paulo, and it has been confused with other whiteflies on *citrus* in Brazil (Cassino 1977). Apparently it originated in the Orient (Peracchi 1971). In Florida, only general predators and some diseases have been recorded attacking it (Muma *et al.* 1961).

- *Paraleyrodes bondari Peracchi - Citrus*

Since this species has only been found on *citrus* in N.E. Brazil and only several predators observed attacking it (Peracchi 1971), it may be an introduced pest in Brazil.

Aphididae (sens lat.)

Of the 66 aphid species recorded to occur in Brazil (Silva *et al.* 1968) of which 40 species alone occur in Rio Grande do Sul (Bertels 1973), most of these aphids either invaded or were accidentally introduced into Brazil. Listed below are some 40 aphid pest species present in Brazil that possess parasites in other parts of world but which evidently did not accompany their aphid hosts when the aphids invaded Brazil. Therefore, these introduced aphids are candidates for attempting classical

biological control. Thus far in Brazil apparently only one aphid species, *Eriosoma lanigerum*, has a parasite been intentionally introduced. Mackauer and Stary (1967) list aphid hosts of the world Aphidiidae. There are also *Aphelinus* spp. that could be introduced into Brazil.

If it were not for the few parasites and predators that occur in Brazil that attack aphids, the introduced aphids would even cause greater damage than they do today. Besides considering introducing parasites of aphids into Brazil, there are some general aphid predators and possibly some *Entomophthora* fungi that may be worth the effort of introducing.

One of the most important coccinellids attacking a wide variety aphids in California is *Hippodamia quinquesignata punctulata* LeConte. This species may adapt to southern Brazil environment. It is particularly suited for alfalfa and grain aphids. Also a tropical lady beetle *Coelophora inequalis* (F.) which controls several aphids in Hawaii should be tried in Brazil.

The impact of pathogens, parasites and predators on aphids is discussed by Hagen and Van den Bosch (1968).

The following list of aphid pests are believed to be introduced into Brazil. Their Aphidiidae parasites are listed in Mackauer and Stary (1967).

- *Acyrthosiphon dirhodum (Walker) now Metopolophium dirhodum - Wheat*
- *Acyrthosiphon kondoi Shinji - Alfalfa*

The blue alfalfa aphid has recently invaded Argentina and may occur already in southern Brazil.

- *Acyrthosiphon pisum (Harris) - Alfalfa, peas*

The pea aphid may already occur in Brazil. It occurs in Argentina and Peru and has been substantially controlled by the introduction of *Aphidius smithi* Sharma and Rau from California, originally from India (Hagen *et al.* 1976). This parasite and *A. ervi* Haliday also attacks *A. kondoi.*

- *Amphorophora lactucae (Kalt.) - Lettuce*
- *Anuraphis helichrysi (Kalt.) - Peach*
- *Anuraphis persicae-niger (Smith) - Peach*
- *Anuraphis prunicola (Kalt.) - Peach, prune*
- *Anuraphis schvartzi (Borner) - Peach*
- *Aphis fabae scopoli - Beans*
- *Aphis gossypii Glover - Cotton*
- *Aphis maidis (Fitch) - Corn, milo, sorghum, sugar cane*
- *Aphis nerii (Boyer de Fons.) - Aleander*
- *Aphis pomi De Geer - Apple*
- *Aphis rumicis I. - Beans*
- *Aphis sambuci I. - Sambucus*
- *Aphis spiraecola Path - Potato*
- *Brevicoryne brassicae (L.) - Crucifers*
- *Capitophorus braggi (Gillete) - Artichoke*
- *Capitophorus fragaefolii (Cock.) - Strawberries*
- *Capitophorus rosarum (Kalt.) - Roses*
- *Cavariella aegopodii (Scopoli) - Carrot*
- *Cerataphia lataniae (Boisd.) - Orchids, palms*
- *Cerosipha forbesi (Weed) - Strawberry*
- *Dastynotus sonchi (L.) - Compositae (Sonchus)*
- **Eriosoma Lanigerum (Hausmann) - Apple, pear*

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This pest was one of the first in Brazil to have imported natural enemies released against it. In 1923, *Aphelinus mali* Howard was introduced into Brazil (DeBach 1964). Silva *et al.* (1968) report that the encyrtid *Neonisotylus bimaculatus* DeSantis is an important parasite of the wooly apple aphids in Brazil.

- *Hylopterus pruni (Geoffrey) - Peach*
- *Longiunguis (=Aphis) sacchari (Zhnt.) - Milo, sorghum, sugar cane*
- *Macrosiphum avenae (Fabr.) - Wheat*
- *Macrosiphum euphorbiae (Thomas) - Potato, tobacco*
- *Macrosiphum rosae (L.) - Rose*
- *Macrosiphum luteum (Buck.) - Orchids*
- *Mysus persicae (Sulzer) - Crucifers, peach, potato, tomato*

Aphidius matricariae Haliday has recently become a dominant parasite of *M. persicae* in California (Schlinger and Mackauer 1963). This parasite might well adapt to Brazil's environment.

- *Pentalonia nigronervosa Coquerel - Banana*
- *Rhopalosiphum maidis (Fitch) - Sugar cane, wheat.*
- *Rhopalosiphum padi (L.) - Sorghum, wheat*
- *Rhopalosiphum rufiabdominalis (Sasaki) - wheat*
- *Sipha flava Forbes - Milo, sorghum, sugar cane*
- *Smynthurodes betae (Westwood) - Beans, hibiscus*
- *Toxoptera aurantii (Boyer de Fons.) - Banana, Coffee, Eucalyptus*
- *Toxoptera citricidus (Kirkaldy) - Citrus, coffee*
- *Toxoptera graminum (Rondani) - Milo, rice, wheat*

Asterolecaniidae

- *Asterolecanium bambusae Boisduval - Bamboo*

A widely distributed species in the tropics of the eastern hemisphere. Substantial control in Puerto Rico was achieved by the introduction of *Chilocorus cacti* (L.).

- *Asterolecanium pustulans (Cockerell) - Cassia, fig.*

This pest of a wide variety of shrubs and broad-leaved trees throughout the tropical and subtropical world was brought under control in Puerto Rico by the coccinellid *Chilocorus cacti* (L.). This coccinellid is not reported to occur in Brazil. It is a general predator of many coccids and diaspine scales. I did not see *C. cacti* in any of the collections I surveyed.

Coccidae

- *Ceroplastes floridensis Comstock - Citrus, ficus*

In Trinidad, *Coccidoxenus mexicanus* Girault has been reared from the above coccid, and was sent to Hawaii to control *Ceroplastes cirripediformis* Comstock a pest which may occur in Brazil (Bennett *et al.* 1976).

- *Chloropulvinaria psidii (Maskell) - Citrus, coffee, guava, ficus*

The encyrtids *Micriterys kotinski* (Fullaway) and *Aneristus ceroplastae* Howard were introduced into Bermuda from Hawaii and is considered

an important factor in the control of *C. psidii* (Bennett *et al.* 1976)

- *Coccus hesperidium L. - Citrus*

This polyphagous, cosmopolitan species, is usually kept under substantial control in most areas by a complex of natural enimies. There are over 30 parasites known to attack this coccid (Thompson 1944). However, in South America only seven primary parasites and one predator are recorded (Silva et al. 1968).

- *Coccus viridis (Green) - Citrus, coffee, guava*

Very widely distributed in the tropics. About 30 parasites of this coccid were recorded by Thompson (1944). In South America nine have been reported (Silva *et al.* 1968). *Microterys flavus.* Howard which parasitizes both *Coccus* spp. should be considered for introduction into Brazil.

- *Saissetia coffeae (Walker) - Fig, citrus*

Very widely distributed in the tropics and subtropics. Thompson (1955) recorded 23 parasites of this pest in th world. Silva *et al.* (1968) recorded ten primary parasites, two predators and a fungus *Metaphycus helvolus* (Compere) gave complete control of the coccid when introduced into Peru (Bennett *et al.* 1976).

- *Saissetia nigra (Nietner) - Avocado, citrus, coffee, cotton, etc.*

Very widely distributed species in the tropics and subtropics. The encyritid *M. helvolus* completely controlled this scale in California (DeBach 1964).

- *Saissetia oleae (Oliver) - Citrus, cotton, olive, etc.*

A subcosmopolitan species. *Metaphycus* helvolus and *M. lounsburyi* introduced into California and Peru has given substantial control of the black scale (DeBach 1964). The introduction of *M. helvolus* into Brazil is highly recommended.

Diaspididae

- *Aulacaspis rosae (Bouché) - Mango, raspberry, rose*

Widely distributed. Thompson (1944) lists eight parasites. Silva *et al.* (1968) list six parasites and one predator attacking the rose scale in South America.

- *Aonidiella auranti (Maskell) - Citrus*

Very widely distributed polyphagous species in tropics and subtropics of Oriental origin. *Aphytis lingnanensis* Compere, *A. melinus* and *Comperiella bifasciata* Howard have given substantial control in southern California (DeBach 1962) and in other countries where introduced (Bennett 1976). None of these parasites appear to have been introduced into Brazil.

- *Aonidiella orientalis (Newstead) - Citrus, cassia*

Widely distributed in the tropics of the eastern hemisphere.

- *Aulacaspis destructor Signoret - Bananas, citrus, coconut*

Very widely distributed in tropics. The coconut scale has been completely controlled in

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Fiji and Principe by the introduction of the coccinellid *Crytognatha nodiceps* Marshall and in Vaté Island in New Hebrides by *Rhizobius pulchellus* Mont. (Hagen 1974). If considered for introduction into Brazil, both coccinellids should be imported since the former species is apparently more effective in warmer areas while the latter is more effective in cooler subtropical regions. *Chilocorus politus* Muls. from Java and *C. nigritus* from Ceylon gave complete control of the pest in Mauritius (DeBach 1964),

- *Aspidiotus hederae (Vallot) - Eucalyptus*

Nearly a cosmopolitan pest. Thompson (1944) records 12 parasites.

- *Chrysomphalus dictyospermi (Morgan) - Citrus, mango, palms*

Widely distributed in tropics and subtropics. *Aphytis melinus* introduced from India into California, Greece and Sicily produced complete control of the pest (Bennett *et al.* 1976).

- **Chrysomphalus ficus Ashmead - Avocado, citrus*

The introduction of *Aphytis holoxanthus* DeBach from California into Brazil has reduced the pest to a non-economic status (DeBach 1971). Carvalho *et al.* (1967) proposed a biological control campaign against this diaspine scale in Brazil.

- *Heniberlesia lataniae (Signoret) - Citrus, Ficus, Vitis*

Tropical Africa and Asia but spreading into other regions. There are nine parasites listed by Thompson (1944). No parasites have been recorded in Brazil (Silva *et al.* 1968).

- *Hemiberlesia repax (Comstock) - Banana, citrus, camelia*

Widely distributed in tropics and subtropics. Thompson (1944) lists 10 parasitic species, and Silva et al. (1968) list 13 as occurring in South America; however none have been recorded in Brazil.

- *Morganella longispina (Morgan) - Citrus*

Perhaps of Oriental origin. There are only three parasites listed by Thompson (1944) and none have been reported in Brazil (Silva *et al.* 1968).

- **Mytilococcus (=Lepidosaphes) beckii (Newman) - Citrus*

Of Oriental origin. The introduction of *Aphytis lepidosaphes*, Compere from China into California and Brazil is responsible for substantial to complete biological control of the purple scale (DeBach 1971).

- *Mytilococcus (=Lepidosaphes) ulmi (L.) - Apple, citrus, peas*

Widely distributed in the temperate areas of the world. *Aphytis mytilaspidis* (LeBaron) and the mite *Hemisarcoptes malus* Shimer are effective natural enemies (MacPhee *et al.* 1976).

- *Parlatoria blanchardii (Targ and Tozz.) - Date, palm*

Widely distributed particularly in the Middle East. *Aphytis mytilaspidis* a parasite of many diaspine scales also attacks the date scale. This parasite in South America has been reported to

occur in Argentina and Chile (Silva *et al.* 1968). The coccinellid *Chilocorus bipustilatus* (L.) is an effective predator of the scale in Mauritania (Iperti *et al.* 1970).

- *Parlatoria cinerea Done and Haddon - Citrus, mango, pear*

Probably of Oriental origin.

- *Parlatoria oleae (Colvée) - Mango, olive*

Old world origin. The introduction of *Aphytis maculicornis* (Masi) from Iran and *Coccophagoides utilis* Doutt from Pakistan into California completely controlled the olive scale (Huffaker and Kennett 1966),

- *Parlatoria pergandii (Comstock) - Citrus, mango*

Widely distributed in the tropics and subtropics. Thompson (1944) records four parasites, and Silva *et al.* (1968) notes that *Aphytis maculicornis argentinus* (Brèthes) is an important parasite of the chaff scale in Brazil. *Aphytis chilensig* Howard also is a reported parasite (Delucchi 1961).

- *Parlatoria proteus (Curtis) - Citrus, orchids*

Thompson (1944) lists one species of parasite of the scale in Australia.

- *Pinnaspis aspidistrae (Sign.) - Acacia, banana, citrus, coffee*

Widely distributed in the warmer regions of the world. It is not a pest in India. *Aphytis gytilaspidis* in Japan and *Aspidiotiphagous citrinus* in Holland are recorded as parasites (Thompson 1944). Silva *et al.* (1968) record one predator in Brazil.

- *Pinnaspis buxi (Bouché) - Bamboo, palms*

Widely distributed in the warmer regions of the world. The introduction of two coccinellids *Telsimia nitida* Chapin and *Chilocorus nigzitua* (F.) into the Seychelles resulted in substantial control (DeBach 1964).

- *Pinnaspis minor (Maskell) - Citrus, cotton*

A complex of two parasites and a predator introduced into Peru from Barbados, Italy, Japan and USA has resulted in partial control of the cotton white scale (DeBach 1964). Two predators are recorded in Brazil by Silva *et al.* (1968).

- **Pseudaulacaspis pentagona (Targ. and Tozz.) - Mulberry, papaya*

Very widely distributed in the tropics and warmer parts of the temperate zone. Substantial control of the white peach scale was obtained on mulberry in Italy and USSR by the introduction of *Prospaltella berlesei* (Howard), in Puerto Rico by *Chilocorus cacti*, and in Bermuda by Aphytis *diaspidis* (DeBach 1964). Since *P. berlesei* has already been introduced into Brazil and if this scale is still a pest on crops not treated by pesticides, other natural enemies should be sought. *Chilocorus cacti* is one natural enemy that should be introduced, for it feeds on a variety of diaspine scales.

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- *Unaspis citri (Comstock) - Citrus*

Its origin is unknown to me. Recently. in Florida the snow scale has been substantially reduced by introducing an *Aphytis* sp. from California. I cannot recall what *Aphytis* species is involved.

Margarodidae

- **Pericerya (=Icerya) purchasi Maskell - Acacia, citrus*

An Australian species originally, now worldwide in tropics, subtropics and warm temperate regions. Under substantial to complete control by *Rodolia cardinalis* (Mulsant) which was introduced into Brazil in 1923. If *P. purchasi* occurs as a pest in cooler parts of Brazil, the introduction of the fly *Cryptochaetum iceryae* Will. should be considered for introduction.

Ortheziidae

According to Kogan (1964) there are four species of *Orthezia* in Brazil but only the following two species are considered of economic importance. Kogan explored the systematics of the genus to bring additional support for exploration of natural enemies in an attempt to biologically control *O. praelonga* on *citrus*.

- *Orthezia insignis Browne - Coffee, lantana, tomato*

Very widely distributed in the tropics, subtropics and warmer temperate regions. Substantial control of this pest on coffee in Kenya resulted by introducing the coccinellid *Hyperaspis jocosa* Mulsant from California (DeBach 1964).

- *Orthezia praelonga Douglas - Capsicum, citrus*

Perhaps a neotropical species. Gonçalves (1964) traced the history of outbreaks of this coccid. Cassino *et al.* 1975) discuss an integrated control program against this pest on *citrus*. These authors list the parasite *Cales noacki* Howard, six predators and three fungi that attack *O. praelonga*. Gonçalves (1962) outlined the biological control prospects of this pest, and Robbs (1962) mentions the importance of fungi of this coccid as well as other Homoptera.

Pseudoccidae

- **Antonina graminis (Maskel) - Forage grasses*

The Rhodes grass scale has been substantially controlled in Texas and Florida by the introduction of the encyrtid *Neodusmetia sangwani* (Rao) from India (DeBach 1974) and completely controlled in Bermuda (Simmonds 1974). This parasite was introduced from Texas into Brazil in 1967, and distributed in the first six months to the following states: Bahia, Ceará, Minas Gerais, Pernambuco, Rio de Janeiro, São Paulo and Sergipe (Costa *et al.* 1970). By 1972 *N. sangwani* was established in Pernambuco and was considered the best method of controlling the pest (Arruda 1973). Dr. Elio Corseuil told me that in Rio Grande do Sul *N. sangwani* was released from 1970 to 1973 and recovered in the field two years after the final releases. The parasite is probably today established from Pernambuco do Rio Grande do Sul. Several Brazilian parasites have been found parasitizing *A. graminis* including a hyperparasite *Marietta graminicola* Timberlake (Arruda, G.P. 1971; Carvalho *et al.* 1969).

- *Dysmicoccus boninsis (Kuwana) - Sugar cane*

Widely distributed in tropics and subtropics. No natural enemies reported in Brazil (Silva *et al.* 1968) This pest was completely controlled in Hawaii by introducing the encyrtid *Aphycus terryi* (Full.) (Sweetman 1958).

- *Dysmicoccus brevipes (Ck11.) - Banana, palms, pineapple*

Even though this species is considered native to Brazil, it is widely distributed in the Americas and there are parasites present in other countries which have not been recorded in Brazil. Nakano (1972) reviewed the literature of *D. brevipes* and includesd names of parasites and predators recorded on the pest in the world.

- *Ferrisiana virgata Cockerell - Cacao, cotton*

Very widely distributed in the tropics and extending into the subtropics. Thompson (1944) lists 13 parasites, none of which are the three parasites listed by Silva *et al.* (1968).

- *Geococcus coffee Green - Citrus, coffee*

Probably introduced into Brazil. Reported in Africa (Entwistle 1972).

- *Neorhizoeous coffee (Laing) - Coffee*

Probably introduced into Brazil.

- *Nipaecoccus nipae (Mask.) - Avocado, citrus, fig, palm*

Substantial control of this mealybug in Hawaii resulted from introducing the encyrtid *Pseudaphycus utilis* Timberlake from Mexico (DeBach 1964).

- *Phenacoccus gossypii (Towns and Ckll.) - Cotton, tomato, etc.*

Apparently a New World species which may not be native to Brazil. Silva *et al.* (1968) only list predators of *P. gossypii*. Thompson (1944) lists four parasites.

- *Planococcus citri (Risso) - Citrus, cacao, coffee*

Very widely spread in the tropics and subtropics. Silva *et al.* (1968) list five primary parasites in Brazil. There are 30 species of parasites of the *citrus* mealy bug listed by Thompson 1944). An important predator of many mealy bugs including *P. citri* is the coccinellid *Cryptolaemus montrouzieri* Mulsant which originally was imported from Australia into California and is mass cultured for periodic releases (Hagen 1974), and has become established in several other countries (Bennett 1976). It is highly recommended that continuing effort be made to introduce *C. montrouzieri* into Brazil.

- *Pseudococcus adonidum (L.) - Avocado, citrus*

Very widely spread in the tropics and subtropics. It is partially to substantially controlled in Califoria by the encyrtid *Anarhopous sydneyensis* Timberlake which was introduced from Australia and *Hungariella peregrina* (Timb.) from Argentina (DeBach 1964). Silva *et al.* (1968) record three parasites of the longtailed mealybug in Brazil.

- *Pseudococcus comstocki (Kuwana) - Apple, cacao, coffee, citrus, etc.*

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Of widely scattered occurrence in both tropics and temperate regions, but apparently absent from Africa (Browne 1968). The introduction of *Allotropa burelli* Muls. from Japan to USA resulted in complete control of the mealybug on apple, and in USSR by the introduction of *Pseudaphycus malinus* Gah. from the USA (DeBach 1964).

- *Pseudococcus maritimus (Erhorn) - Grapevines*

Very widely distributed in the subtropics and warmer parts of the temperate zones. Substantial control occurs in California by the encyrtid *Acerophagas notativentris* (Gir.). Silva *et al.* (1968) record one parasite and eight predators associated with *P. maritimus* in Brazil.

- *Sacharicoccus sacchari (Ckll.) - Sugar cane*

Very widely spread in the tropics and subtropics. Silva *et al.* (1968) do not record any natural enemies under this species, but Guagliumi (1973) believes that many of natural enemies reported by Silva *et al.* (1968) under *Pseudococcus* sp. (s.1.) may be associated with *S. sacchari*. The fungus *Aspergillus* possibly *flavus* is at times an important natural enemy (Guagliumi 1973). In Hawaii substantial control was obtained from the encyrtid *Anagyrus saccharicola* Timberlake imported from the Philippines (DeBach 1964).

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