

An Updated Checklist of the Scale Insects from Réunion Island (Indian Ocean)

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Abstract: An updated checklist of the scale insects recorded from Réunion Island (French overseas department) is given. This list has been collated from data from 5 different sources: ScaleNet, WILLIAMS, WILLIAMS (1988), MNHN in Paris, LSV in Montpellier and a recent survey made by FDGDON-REUNION. Previously, 70 species were recorded from Réunion Island but our present list includes 90 species. The 20 species added are in 6 families: 4 Coccidae, 6 Diaspididae, 1 Monophlebidae, 1 Ortheziidae, 7 Pseudococcidae and 1 Rhizoecidae.

Key words: Scale insects, inventory, Réunion Island

Introduction

A monitoring of the mealybugs on Réunion Island, conducted by the local FDGDON (Fédération Départementale des Groupements de Défense contre les Organismes Nuisibles) in recent years, has provided an opportunity to update the checklist of scale insects from this French overseas department. Réunion Island is the westernmost island of the Mascarene archipelago in the Indian Ocean, in the Madagasian sub-region. It is a small territory (2512 km²) located 700 km east of Madagascar. The island has a tropical climate and is very mountainous (highest point at 3071 meters). The fauna and flora have been enriched by many species introduced by man. However, the island has a high number of endemic species.

Materials and Methods

The ScaleNet database (BEN-DOV *et al.* 2013) served as a starting point for listing species data for the island as well as the 'Annotated Catalogue of the Homoptera of the Mascarene Islands' by WILLIAMS, WILLIAMS (1988). This information was supplemented with data collected during the monitoring and further data from the collections of MNHN (Muséum National d'Histoire Naturelle) Paris, CIRAD Réunion (French agricultural research centre for international development) and LSV (Laboratoire de la Santé des Végétaux) Montpellier.

Results and Discussion

Seventy species were listed in ScaleNet and WILLIAMS, WILLIAMS (1988), mainly taken from the

Table 1. Updated checklist of the scale insects from Réunion Island with validation source and comments on the newly recorded species

| Family | Species | Validation source and comments |
|-------------------------|--|--|
| Acleridae | <i>Aclerda takahashii</i> Kuwana, 1930 | MAMET, 1952 |
| Asterolecaniidae | <i>Bambusaspis bambusae</i> (Boisduval, 1869) | MAMET, 1943 |
| | <i>Bambusaspis miliaris</i> (Boisduval, 1869) | MAMET, 1957 |
| | <i>Palmaspis palmicola</i> (Mamet, 1957) | MAMET, 1957 |
| Coccidae | <i>Ceroplastes floridensis</i> Comstock, 1881 | MAMET, 1943 |
| | <i>Ceroplastes reunionensis</i> Ben-Dov & Matile-Ferrero, 2000 | BEN-DOV <i>et al.</i> , 2000 |
| | <i>Ceroplastes rubens</i> Maskell, 1893 | <i>Cycas</i> sp. (Cycadaceae), La Saline-les-Bains, Nativel rec., 25 XI 1983, identification (id.) F. Kozar (Collection CIRAD) |
| | <i>Ceroplastes stellifer</i> (Westwood, 1871) | MAMET, 1943 |
| | <i>Coccus hesperidum</i> Linnaeus, 1758 | MAMET, 1952 |
| | <i>Coccus viridis</i> (Green, 1889) | MAMET, 1957 |
| | <i>Eucalymnatus tessellatus</i> (Signoret, 1873) | MAMET, 1952 |
| | <i>Kilifia deltoides</i> De Lotto, 1965 | <i>Mangifera indica</i> (Anacardiaceae), Saint-Denis, Quilici rec., 20 II 1986, id. D. Matile-Ferrero (DMF) (Collection MNHN, 10929) |
| | <i>Milviscutulus mangiferae</i> (green, 1889) | MAMET, 1943 |
| | <i>Parasaissetia nigra</i> (Nietner, 1861) | MAMET, 1957 |
| | <i>Parasaissetia tsaratananae</i> (Mamet, 1951) | MAMET, 1957 |
| | <i>Protopulvinaria longivalvata</i> Green, 1909 | MAMET, 1959 |
| | <i>Protopulvinaria pyriformis</i> (Cockerell, 1894) | <i>Litsea glutinosa</i> (Lauraceae), Ilet Latanier, Quilici rec., 25 IV 1988, id. DMF (Collection MNHN, 12302) |
| | <i>Pulvinaria iceryi</i> (Signoret, 1869) | MAMET, 1943 |
| | <i>Pulvinaria psidii</i> Maskell, 1893 | MAMET, 1943 |
| | <i>Pulvinaria urbicola</i> Cockerell, 1893 | <i>Capsicum annum</i> (roots) (Solanaceae), La Possession, Quilici rec., 4 XII 1988, id. DMF (Collection MNHN, 13507) |
| | <i>Saissetia coffeae</i> (Walker, 1852) | MAMET, 1943 |
| | <i>Trijuba oculata</i> (Brain, 1920) | MAMET, 1954 |
| Conchaspidae | <i>Conchaspis angraeci</i> Cockerell, 1893 | RICHARD <i>et al.</i> 2003 |
| Dactylopiidae | <i>Dactylopius opuntiae</i> (Cockerell, 1896) | PÉREZ-GUERRA and KOSZTARAB, 1992 |
| | <i>Dactylopius tomentosus</i> (Lamarck, 1801) | MAMET, 1952 |
| Diaspididae | <i>Abgrallaspis cyanophylli</i> (Signoret, 1869) | MAMET, 1952 |
| | <i>Aonidiella aurantii</i> (Maskell, 1879) | MAMET, 1957 |
| | <i>Aspidiella sacchari</i> (Cocckerell, 1893) | MAMET, 1957 |
| | <i>Aspidiotus destructor</i> Signoret, 1869 | MAMET, 1943 |

Table 1. Continued

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|--|---|---|
| | <i>Aulacaspis tegalensis</i> (Zehntner, 1898) | MAMET, 1943 |
| | <i>Aulacaspis tubercularis</i> Newstead, 1906 | MAMET, 1957 |
| | <i>Chrysomphalus aonidum</i> (Linnaeus, 1758) | MAMET, 1952 |
| | <i>Chrysomphalus dictyospermi</i> (Morgan, 1889) | MAMET, 1952 |
| | <i>Chrysomphalus pinnulifer</i> (Maskell, 1891) | MAMET, 1957 |
| | <i>Diaspis echinocacti</i> (Bouché, 1833) | MAMET, 1952 |
| | <i>Duplachionaspis cymbopogoni</i> Mamet 1959 | MAMET, 1959 |
| | <i>Fiorinia coronata</i> Williams & Watson, 1988 | <i>Dypsis lutescens</i> (Palmae), Etang-salé, Cirad rec., 04 IX 2006, id. J.-F. Germain (JFG) (Collection LSV, 0701462) |
| | <i>Fiorinia fioriniae</i> (Targioni Tozzetti, 1867) | <i>Dictyospermum album</i> (Commelinaceae), Le Moufia, Girard rec., 24 IV 1986, id. DMF (Collection MNHN, 10927) |
| | <i>Furcaspis rufa</i> Lindinger 1913 | MAMET, 1957 |
| | <i>Hemiberlesia lataniae</i> (Signoret, 1863) | MAMET, 1952 |
| | <i>Hemiberlesia palmae</i> (Cockerell, 1892) | <i>Litchi chinensis</i> (Sapindaceae), Saint-Martin, Quilici rec., 24 I 1985, id. DMF (Collection MNHN, 10117) |
| | <i>Hemiberlesia rapax</i> (Comstock, 1881) | MAMET, 1957 |
| | <i>Ischnaspis longirostris</i> (Signoret, 1882) | MAMET, 1952 |
| | <i>Lepidosaphes beekii</i> (Newman, 1869) | WILLIAMS and WILLIAMS, 1988 |
| | <i>Lepidosaphes gloverii</i> (Packard, 1869) | WILLIAMS and WILLIAMS, 1988 |
| | <i>Lepidosaphes tokionis</i> (Kuwana, 1902) | MAMET, 1952 |
| | <i>Lepidosaphes vermiculus</i> Mamet, 1937 | <i>Cocos nucifera</i> (Palmae), Saint-Pierre, GERDAT rec., 20 VI 1984, id. DMF (Collection MNHN, 9868) |
| | <i>Lindingaspis rossi</i> (Maskell, 1892) | MAMET, 1952 |
| | <i>Mimusaspis mimusopis</i> (Mamet, 1939) | MAMET, 1959 |
| | <i>Odonaspis ruthae</i> Kotinsky, 1910 | MAMET, 1957 |
| | <i>Parapandaspis reunioniensis</i> Mamet, 1967 | MAMET, 1967 |
| | <i>Parlatoria proteus</i> (Curtis, 1843) | <i>Vanilla</i> (Orchidaceae), unknown locality, Vercambre rec., 15/11/1979, id. DMF (Collection MNHN, 10930) |
| | <i>Pinnaspis buxi</i> (Bouché, 1851) | MAMET, 1959 |
| | <i>Pinnaspis strachani</i> (Cooley, 1899) | MAMET, 1954 |
| | <i>Poliaspoides formosana</i> (Takahashi, 1930) | MAMET, 1957 |
| | <i>Pseudaonidia trilobitiformis</i> (Green, 1896) | MAMET, 1952 |
| | <i>Pseudaulacaspis cockerelli</i> (Cooley, 1897) | MAMET, 1952 |
| | <i>Pseudaulacaspis pentagona</i> (Targioni Tozzetti, 1886) | MAMET, 1952 |
| | <i>Pseudaulacaspis subcorticalis</i> (Green, 1905) | MATILE-FERRERO, 1978 |

Table 1. Continued

| | | |
|-----------------------|--|---|
| | <i>Rutherfordia major</i> (Cockerell, 1894) | <i>Litchi chinensis</i> (Sapindaceae), La Montagne, GERDAT rec., 13X 1982, id. DMF (Collection MNHN, 9271) |
| | <i>Selenaspidus articulatus</i> (Morgan, 1889) | MAMET, 1952 |
| | <i>Triraphaspis hymenophylli</i> Mamet, 1959 | MAMET, 1959 |
| | <i>Triraphaspis trilobis</i> Mamet, 1957 | MAMET, 1957 |
| Monophlebidae | <i>Icerya seychellarum</i> (Westwood, 1855) | MAMET, 1952 |
| | <i>Pseudaspidoproctus fulleri</i> (Cockerell, 1901) | <i>Cynodon dactylon</i> (Poaceae), La Saline-les-Bains, Pierre rec., 12 III 2001, id. DMF (Collection MNHN, 14114) |
| Ortheziidae | <i>Insignorthezia insignis</i> (Brown, 1887) | BORDAGE, 1914 |
| | <i>Praelongorthezia praelonga</i> (Douglas, 1891) | <i>Bougainvillea</i> sp. (Nyctaginaceae), Saint-Paul, Méron rec., 23 VII 2012, id. JFG (in GERMAIN, 2013) |
| | <i>Newsteadia gomyi</i> Richard, 1979 | RICHARD, 1979 |
| | <i>Nipponorthezinella guadalcanalia</i> (Morrison, 1952) | RICHARD, 1979 |
| Pseudococcidae | <i>Dysmicoccus boninsis</i> (Kuwana, 1909) | MAMET, 1943 |
| | <i>Dysmicoccus brevipes</i> (Cockerell, 1893) | MAMET, 1957 |
| | <i>Ferrisia virgata</i> (Cockerell, 1893) | unknown hostplant and locality, Hoffmann rec., 14 XII 1950, id. A.S. Balachowsky (Collection MNHN, 170) |
| | <i>Formicococcus anaboranae</i> (Mamet, 1959) | <i>Cocos</i> sp. (Palmae), Sainte-Suzanne, Quilici rec., 20 XII 1982, id. DMF (MNHN, 9218) |
| | <i>Maconellicoccus hirsutus</i> Green, 1908 | DELPoux <i>et al.</i> 2013 |
| | <i>Nipaecoccus cacuminis</i> Mamet, 1957 | MAMET, 1957 |
| | <i>Nipaecoccus viridis</i> (Newstead, 1894) | <i>Citrus</i> sp. (tangelo Orlando) (Rutaceae), Bassin Martin, Quilici rec., 7 V 1990, id. DMF (Collection MNHN, 12334) |
| | <i>Paracoccus burnerae</i> (Brain, 1915) | <i>Psidium guajava</i> (Myrtaceae), Saint-Leu, Minatchy rec., 6 IV 2011, id. JFG (Collection LSV, 1100531) |
| | <i>Paracoccus marginatus</i> Williams & Granara de Willink, 1992 | GERMAIN <i>et al.</i> , 2010 |
| | <i>Phenacoccus madeirensis</i> Green, 1923 | <i>Capsicum</i> (Solanaceae), Etang Salé, Quilici rec., 20 VI 1991, id. DMF (Collection MNHN, 12346) |
| | <i>Phenacoccus parvus</i> Morrison, 1924 | <i>Lycopersicon esculentum</i> (Solanaceae), Saint-Pierre, Minatchy rec., 14 I 2011, id. JFG (collection LSV, 1100225) |
| | <i>Phenacoccus solenopsis</i> Tinsley, 1898 | DELPoux <i>et al.</i> 2013 |
| | <i>Pedrococcus longisetosus</i> Mamet, 1942 | MAMET, 1957 |
| | <i>Planococcus citri</i> Risso, 1813 | MAMET, 1957 |
| | <i>Planococcus lilacinus</i> (Cockerell, 1905) | WILLIAMS <i>et al.</i> , 2001 |
| | <i>Pseudococcus jackbeardleyi</i> Gimpel & Miller, 1996 | <i>Lycopersicon esculentum</i> Mill. (Solanaceae), Saint-Pierre, Dupuis rec., 22 IX 2010, id. JFG (in GERMAIN, 2013) |

Table 1. Continued

| | | |
|--------------------|---|--|
| | <i>Pseudococcus longispinus</i> (Targioni Tozzetti, 1867) | MAMET, 1952 |
| | <i>Pseudococcus mascarensis</i> Mamet, 1957 | MAMET, 1957 |
| | <i>Saccharicoccus sacchari</i> (Cockerell, 1895) | MAMET, 1952 |
| | <i>Spilococcus bourbonicus</i> Mamet, 1957 | MAMET, 1957 |
| Rhizoecidae | <i>Rhizoecus americanus</i> (Hambleton, 1946) | <i>Lycopersicon esculentum</i> Mill. (Solanaceae), Sainte-Rose, Minatchy rec., 15 XII 2012, id. JFG (in GERMAIN, (2013)) |

works of MAMET between 1943 to 1967. The oldest records date from the late 19th century (COCKERELL 1894) and the early 20th century (LINDINGER 1913, BORDAGE 1914), and the most recent are from the early 2000s (BEN-DOV *et al.* 2000, GERMAIN *et al.* 2010, DELPOUX *et al.* 2013, GERMAIN 2013). The information gathered through the work of FDGDON and MNHN, CIRAD and LSV collections has increased the known species to 90. The 20 additional species belong to the following 6 families: **Coccidae**, with *Ceroplastes rubens* MASKELL, 1893, *Kilifa deltoides* DE LOTTO, 1965, *Protopulvinaria pyriformis* (COCKERELL, 1894), *Pulvinaria urbicola* COCKERELL, 1893; **Diaspididae**, with *Fiorinia coronata* WILLIAMS & WATSON, 1988, *Fiorinia fioriniae* (TARGIONI TOZZETTI, 1867), *Hemiberlesia palmarum* (COCKERELL, 1892), *Lepidosaphes vermiculus* MAMET, 1937, *Parlatoria proteus* (CURTIS, 1843), *Rutherfordia major* (COCKERELL, 1894); **Monophlebidae**, with *Pseudaspidopectus fulleri* (COCKERELL, 1901); **Ortheziidae**, with *Praelongorthezia praelonga* (DOUGLAS, 1891); **Pseudococcidae**, with *Ferrisia virgata* (COCKERELL, 1893), *Formicococcus anaboranae* (MAMET, 1959), *Paracoccus burnerae* (BRAIN, 1915), *Phenacoccus madeirensis* GREEN, 1923, *Phenacoccus parvus* MORRISON, 1924, *Pseudococcus jackbeardsleyi* GIMPEL & MILLER, 1996, *Nipaecoccus viridis* (NEWSTEAD, 1894), and **Rhizoecidae**, with *Rhizoecus americanus* (HAMBLETON, 1946).

The 90 species present in Réunion Island are listed in Table 1.

Of these, ten species are endemic, namely *Palmaspis palmicola* (MAMET, 1957) (**Asterolecaniidae**); *Ceroplastes reunionensis* BEN-DOV & MATILE-FERRERO, 2000 (**Coccidae**); *Duplacionaspis cymbopogoni* MAMET, 1959,

Furcaspis rufa LINDINGER, 1913, *Parapandaspis reunioniensis* MAMET, 1967, *Triraphaspis hymenophylli* MAMET, 1959, *Triraphaspis trilobis* MAMET, 1957 (**Diaspididae**); *Newsteadia gomyi* RICHARD, 1979 (**Ortheziidae**); *Pseudococcus mascarensis* MAMET, 1957, and *Spilococcus bourbonicus* MAMET, 1957 (**Pseudococcidae**).

Seven species are from the Madagascan sub-region: *Parasaissetia tsaratananae* (MAMET, 1951), *Trijuba oculata* (BRAIN, 1920) (**Coccidae**), *Mimusaspis mimusopsis* (MAMET, 1939) (**Diaspididae**); *Pseudaspidopectus fulleri* (COCKERELL, 1901) (**Monophlebidae**); and *Formicococcus anaboranae* (MAMET, 1959), *Pedrococcus longisetosus* MAMET, 1942 and *Nipaecoccus cacuminis* MAMET, 1957 (**Pseudococcidae**).

The endemic species and those present in the Madagascan sub-region thus represent 20% of the total species.

Thirty seven species can be considered as cosmopolitan and 22 as pantropical. This (59) is about two-thirds of the total, and includes species of recent introduction in connection with the development of international trade, such as the mealybugs *Maconellicoccus hirsutus* (GREEN, 1908), *Paracoccus marginatus* WILLIAMS & GRANARA DE WILLINK, 1992, *Phenacoccus solenopsis* TINSLEY, 1898, and *Pseudococcus jackbeardsleyi* GIMPEL & MILLER, 1996.

The remaining 14 species originated either in the Old or New World.

Of these ninety species, 3 families represent 84% of the total: e.g. Diaspididae 42%, Pseudococcidae 22% and Coccidae 20%. The seven other families make up the remainder (fig. 1).

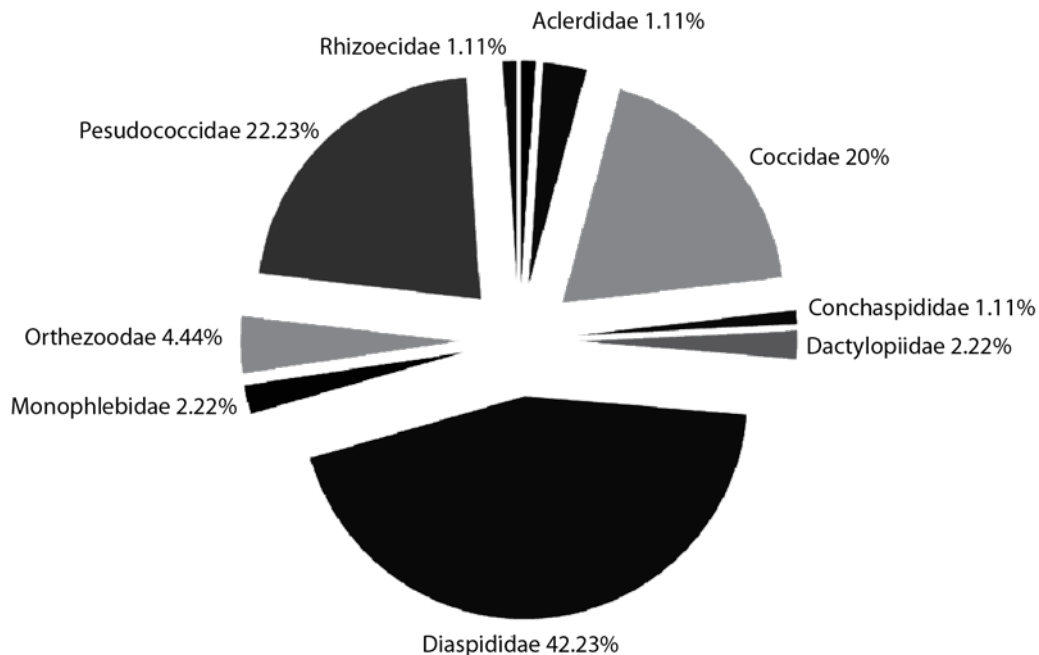


Fig 1. Distribution of the ten families of scale insects from Réunion Island

Conclusion

Ninety scale insect species are now recorded from Réunion. Despite some endemism, most species are invasive, a result of human activities, and this is not without consequences on the environment. From an agronomic point of view, some armored scale insects have been considered the most damaging pests for a long time, particularly on fruit trees such as Citrus (e.g., *Aonidiella aurantii*, *Lepidosaphes beckii*, *Pseudaonidia trilobitiformis*) or mango (e.g.,

Aulacaspis tubercularis, *Pseudaonidia trilobitiformis*) (QUILICI *et al.* 2003). However, in recent years, important damage has also been caused by mealybugs, due to the arrival of the exotic invasive species *Paracoccus marginatus* on papaya (GERMAIN *et al.* 2010) and by the disruption of biological control of species such as *Icerya seychellarum* on mango (DELPOUX *et al.* 2013). The latter group of scale insects should receive increased attention in future research programs.

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