SCALE INSECTS (HOMOPTERA: COCCOIDEA) ON COFFEE IN PAPUA NEW GUINEA

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ABSTRACT

The spread of some injurious scale insects on coffee in Papua New Guinea (P.N.G.) has coincided with an increase in coffee cultivation. Loss of yield caused mainly by the green scales Coccus celatus *De Lotto and* Coccus viridis *(Green), has stimulated interest in biological control. As a result of recent surveys to assess the extent of green scales, a list is presented of all scale insects on coffee in P.N.G.*

INTRODUCTION

Coffee has been grown in Papua New Guinea (P.N.G.) for about 70 years and Dwyer (1954) has given a short account of its earlier history in the Territory. Since 1945, coffee production has increased dramatically, but in recent years there has been concern about the spread of injurious scale insects. This spread has probably coincided with the increase of coffee cultivation. However, there is reason to believe that the most injurious scale insects on coffee were in P.N.G. before 1945.

Coffee is normally a shade-loving plant and successful cultivation depends on the use of suitable shade trees. These trees, however, often act as hosts for scale insects and injurious species may transfer from the trees to coffee.

Early accounts were given by Froggatt (1936b, 1938) of damage to coffee by the mealybug *Ferrisia virgata* (Cockerell) in the Rabaul area, but similar damage has never been reported since.

After extensive collecting in the 1950s and 1960s, Szent-Ivany & Stevens (1966) recorded severe damage to coffee roots by the mealybug *Cataenococcus leveri* (Green), but there have been no further records of similar damage, although the mealybug must still be present.

Williams (1982b) showed that *Planococcus citri* (Risso) was not yet present in P.N.G. and that all previous records of this species should refer to the related species *P. pacificus* Cox. *P. citri* has since been found in P.N.G. and although not reported on coffee, it is a potential pest. *P. pacificus* seems to be particularly common on coffee in P.N.G., although little damage has been reported. Control is effected in the Wau Valley mainly by the coccinellid *Cryptolaemus affinis* (Crotch) (Szent-Ivany and Stevens 1966). Another related species, *P. lilacinus* (Cockerell), discussed by Williams (1982b) poses a problem. It is commonly called the Coffee Mealybug throughout southern Asia, where it is probably endemic and does cause damage. Although it is fairly widespread in P.N.G., it seems to infest mainly *Theobroma cacao* and *Citrus* spp. and has never been reported on coffee, but it must remain a potential pest.

Recently the most important pests seem to be the soft scales *Coccus viridis* (Green) and *C. celatus* De Lotto (Smith and Thistleton 1984). *C. viridis* may have been present in P.N.G. for many years. It is a tropicopolitan and polyphagous species, but has been noticed

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on coffee in P.N.G. since the early surveys recorded by Froggatt (1936a) and is now widespread on coffee in P.N.G. Probably more important is *C. celatus*, discussed recently by Williams (1982a). This species may be endemic to E. Africa but has spread to parts of the Oriental Region and was first collected in P.N.G. at Kieta, Bougainville in 1938. It is now common on coffee throughout P.N.G., and the damage it causes to the young leaves and green berries is seriously affecting yield (S.T. Murphy, pers. comm.). The incidence is complicated by the presence of ants attending and protecting the scales for honeydew. Both the *Coccus* species are commonly called 'green scales' and sometimes both species are present on the same tree. When prepared on microscope slides, the differences between the two species are striking, but there is still no satisfactory method of distinguishing the species in the field. Local entomologists consider that *C. celatus* is by far the more important species and, at present, the Commonwealth Institute of Biological Control (C.I.B.C.) is engaged in controlling it. Suitable control agents may be found eventually in East Africa. Recent surveys in P.N.G. by Dr. S.T. Murphy of the C.I.B.C. have shown the extent of infestation of *C. celatus* and the localities are listed herein.

This seems a fitting time, therefore, to list all the scale insects at present known on coffee in P.N.G. The first entries under each species refer to the material examined by the author followed by certain literature records. Almost all the material has been sent, at one time or another, to the Commonwealth Institute of Entomology, London, for identification and is deposited in the collections of the British Museum (Natural History). The only species recorded, but not seen at present, is the *Pulvinaria* sp., listed by Szent-Ivany and Stevens (1966), but this may eventually prove to be *Coccus celatus*.

The following abbreviations in the text are used for provinces:

C.P., Central Province
Chimbu P., Chimbu Province
E.N.B.P., East New Britain Province
E.H.P., Eastern Highlands Province
E.S.P., East Sepik Province
Madang P., Madang Province
Manus P., Manus Province
Milne B.P., Milne Bay Province
Morobe P., Morobe Province
N.P., Northern Province
N.S.P., North Solomons Province
W.H.P., Western Highlands Province

Abbreviations for collectors' names are as follows:

F.A., F. Arndt
G.B., G. Baker
J.H.B., J.H. Barrett
A.C., A. Catley
K.S.C., K.S. Cole
G.S.D., G.S. Dun
J.L.F., J.L. Froggatt
J.H., J. Healy
W.T.B.H., W.T.B. Heath
J.W.I., J.W. Ismay
B.J.K., B.J. Kebby
J.H.M., J.H. Martin
R.M., R. Montgomery
S.T.M., S.T. Murphy
D.S., D. Shaw
B.M.T., B.M. Thistleton
J.J.H.S.I., J.J.H. Szent-Ivany
G.Y., G. Young

FAMILY PSEUDOCOCCIDAE

Cataenococcus leveri (Green) (*Pseudococcus leveri*, *Paraputo leveri*)

Morobe P., Mumeng, Sum Suum Plantation, on *C. arabica*, 12.vii.19060 (A.C.). Snake River Valley, Sunshinne Plantation, on roots of *C. arabicca*, 2.vii.1963, attended by *Pheidole meggacephala* (Fabricius) (J.J.H.S.I. & B.J.KK.)

Milne B.P., Inanianene Village, on roots of *C. canephora*, ix.1959 (K.S.C.).

Szent-Ivany and Stevens (1966) discussed these records in greater detail. Apparently the mealybugs were killing trees by damaging the roots. On *C. canephora* mealybugs were protected under a layer of the symbiotic fungus *Diacanthodes philippinensis* and were attended by the ants *Paratrechina* (*Nylanderia*) sp., *Monomorium* sp. and *Odontomachus simillimus* (Smith).

This mealybug species is known also from the Solomon Islands, Vanuatu, Fiji and Tonga on various host-plants and Beardsley (1966) has recorded it from the Caroline Islands.

Dysmicoccus brevipes (Cockerell)

C.P., Goilala, Tapini, on *C. arabica*, 13.vi.1960 (J.J.H.S.I.).

This widespread and polyphagous species may be found on coffee in other parts of P.N.G., but it is doubtful if it is injurious.

Ferrisia virgata (Cockerell)

E.S.P., Maprik, Tamaui Plantation, on *C. robusta*, 13.x.1957; Kimbangua, on *C. robusta*, 29.ii.1959 (J.J.H.S.I.).

Milne B.P., Dogura, Anglican Mission, on *C. robusta*, 29.vi.1959 (J.H.).

This species was first mentioned on coffee from P.N.G. by Froggatt (1936a) as 'Mealy Bug' without locality, and by Froggatt (1936b) as *Pseudococcus* sp. on coffee in E.N.B.P., Rabaul area, where it was the worst infestation to date. Froggatt observed it also on *Erythrina* sp., introduced for the development of permanent shade of coffee, and *Cryptolaemus* sp. gave a good measure of control. Froggatt (1938) stated that the mealybug was *F. virgata*. Specimens are at hand, sent by Froggatt, on *Erythrina* sp., and these are identical with specimens, discussed by Williams (1985) as the biparental strain of *F. virgata*.

Szent-Ivany (1956) recorded the species from E.S.P., Maprik, on *C. robusta*, when the leaves and branches of *C. robusta* were heavily attacked.

The mealybug is known from other localities in P.N.G. on various host-plants and it is one of the most widespread of the tropicopolitan mealybugs.

Planococcus pacificus Cox

C.P., Sogeri, Koitaki Estate, on *C. arabica*, 13.iv.1962 (J.J.H.S.I.), 25.ix.1962 (G.S.D. & J.J.H.S.I.); Tapini, on *C. arabica*, 12.v.1960, 13.vi.1960 (J.J.H.S.I.).

E.N.B.P., New Britain, Keravat, on *C. canephora*, v.1960, vii, 1961, 3.x.1961 (G.S.D.).

E.H.P., Goroka, on *Coffea* sp., 12.v.1963 (J.H.B.).

E.S.P., Maprik, Bainyik, on *C. robusta*, 2.iii.1960 (J.J.H.S.I.), on *C. canephora*, xii.1962 (F.A.); Tamani, on *C. robusta*, 25.x.1957 (J.J.H.S.I.).

Madang P., Madang Agricultural Sta., on *C. robusta*, 9.x.1959 (J.H.).

Milne B.P., Naura, on *C. robusta*, v.1960 (W.T.B.H.).

Morobe P., Wau, on *C. arabica*, 30.v.1957, 1.vi.1957, 24.ix.1957 (J.J.H.S.I.), 2.vii.1963 (J.J.H.S.I. & B.J.K.).

N.S.P., Bougainville, Kieta, on *Coffea* sp., 19.ix.1937, 11.x.1937, 17.viii.1938 (J.L.F.).

The distribution of this species in the southern tropical Pacific area has been discussed by Williams (1982b) who stated that *Planococcus citri* did not occur in P.N.G., and that all previous records of *P. citri* in P.N.G. should refer to *P. pacificus*. Since the paper was published, *P. citri* has been found in the W.H.P., but not on coffee. *P. pacificus* is widespread in many parts of the world

and probably has a similar host-plant range to that of *P. citri*.

Szent-Ivany (1956) recorded it as damaging flower clusters in the Wau area in 1956–1957 but it was kept under control by *Cryptolaemus affinis*. On *C. robusta*, damage was not so severe. Later Szent-Ivany & Stevens (1966) stated that this mealybug represented 90–95% of the scale insect populations.

Barrett (1966) discussed the mealybug from the Highlands area, giving notes on the life history and control.

Pseudococcus longispinus (Targioni Tozzetti) (*P. adonidum* (L.))

E.H.P., Aiyura, on *Coffea* sp., 25.ix.1959 (J.H.B.).

Szent-Ivany and Stevens (1966) have recorded this mealybug from Morobe P., Wau area, on coffee, and from E.H.P., Okapa, Etesena Coffee Block, on *C. arabica*. The insect does not appear to cause damage. It is one of the most widespread of mealybugs and has been reported on numerous host-plants.

FAMILY COCCIDAE

Ceroplastes destructor Newstead (*Gascardia destructor*)

Morobe P., Wau, on *C. robusta*, 24.xi.1979 (J.H.M.).

W.H.P., nr Banz, on *Coffea* sp., 3.iii.1980 (B.M.T.).

Szent-Ivany and Stevens (1966) reported this species from Morobe P., Wau Valley on *C. arabica*, where the damage was insignificant. However, at the Sunshine Plantation, Snake River Valley, almost every bush was infested in 1965. The species is fairly widespread in P.N.G. on numerous host-plants but it is now effectively controlled by the encyrtid wasp *Paraceraptrocerus nyasicus* (Compere) introduced from Australia in 1982.

Chloropulvinaria psidii (Maskell) (*Pulvinaria psidii*)

C.P., Goilala District, Tapini, on *C. arabica*, 12.v.1960 (*J.J.H.S.I.*).

E.H.P., Kainantu District, Norikori Plantation, on *C. arabica*, 18.ix.1984 (S.T.M.); Aiyura, on *Coffea* sp., 13.i.1959 (J.H.B.).

E.N.B.P., Keravat, on *Coffea* sp., 30.xi.1961 (G.S.D.), on *C. canephora*, v.1959.

This is a tropicopolitan and polyphagous species, but it is often found on coffee where it sometimes causes concern. Szent-Ivany (1958) recorded it from the Western Highlands P. on *C. arabica* where it was controlled by *Callineda* sp., and from the Eastern Highlands P., Asaro Valley, Lunapieve Plantation, where outbreaks were also controlled by *Callineda* sp. collected in the Bena Valley.

Coccus celatus De Lotto

N.S.P., Bougainville, Kieta, on *Coffea* sp., 17.viii.1938.

Morobe P., Bulolo, on *Coffea* sp., 29.vii.1980 (G.Y.), on *C. arabica* 23.xi.1980 (G.Y.); Bubia, on *C. canephora*, 18.xi.1980 (G.Y.); Eurakor, on *C. arabica*, 22.xi.1980 (G.Y.); Wau, on *C. robusta*, 24.xi.1979 (J.H.M.), on *C. arabica*, 22.xi.1980 (G.Y.), 21.ix.1984 on *C. arabica* (S.T.M.), Blue Mountain Estate, on *C. arabica*, 21.ix.1984 (S.T.M.); Lae, Bumayong High School, on *C. robusta*, 22.ix.1984 (S.T.M.).

W.H.P., (all on *C. arabica*, S.T.M.), Baiyer District, Lapramba village, 8.ix.1984, Kainwa Estate, 8.ix.1984, Mants Farmers Plantation, 8.ix.1984; N. Wahgi District, Koban Plantation, 10.ix.1984, Kimil Estate, 10.ix.1984, Mintal Estate, 10.ix.1984; S. Wahgi

District, Kurumul Plantation, 11.ix.1984; Hagen District, Raglamp Estate, 11.ix.1984.

Chimbu P., (all on *C. arabica*, S.T.M.), Kerowagi District, D.P.I., Kumgi, 13.ix.1984, Siure, 13.ix.1984; Kundiawa District, Mirane, 15.ix.1984; Gumine District, Munma, 15.ix.1984, Kup, 15.ix.1984.

E.H.P., (all on *C. arabica*, S.T.M.), Kainantu District, Mamaa Estate, 18.ix.1984, Norikori Plantation, 18.ix.1984, Mareya Plantation, 19.ix.1984; Goroka District, Asaro Estate, 24.ix.1984, Samoyufa Estate, 24.ix.1984, Bena Bena, 24.ix.1984.

E.N.B.P., Keravat, on *C. canephora*, v.1959 (G.S.D.).

This was discussed recently by Williams (1982a), and is now regarded as one of the most important insects on coffee in P.N.G. It is associated with the ant species *Technomyrmex albipes* (Smith), *Iridomyrmex* sp., *Iridomyrmex* (*anceps* group), *Pheidole* sp., *Anoplolepis longipes* (Jerdan) *Polyrachis* (*rostella* group), *Crematogaster* sp., *Paratrechina* sp. and *Oecophylla smaragdina* (Fabricius).

Coccus viridis (Green)

C.P., Laloki, on *C. robusta*, 17.ix.1958 (R.M. & D.S.)

E.H.P., (all on *C. arabica*), Kainantu District, Norikori, 17.ix.1984, Korona, 18.ix.1984, NPMA Plantation, 19.ix.1984 (all S.T.M.); Goroka District, 21.i.1981 (G.Y.), Samoyufa Estate, 24.ix.1984 (S.T.M.).

E.S.P., Maprik, Bainyik, on *C. robusta*, 2.ii.1960, 3.iii.1960 (J.J.H.S.I.).

Madang P., Madang, on *C. robusta*, 9.x.1959 (J.H.).

Manus P., Manus, Lorengau, on *C. canephora*, 20.i.1963 (J.J.H.S.I.).

Milne B.P., East Cape, on *C. robusta*, 20.vii.1959 (W.T.B.H.).

Morobe P., Bubia, on *C. canephora*, 18.xi.1980 (G.Y.); Bulolo, on *C. arabica*, 23.xi.1980 (G.Y.); Wau, Kosali Plantation, on *C. arabica*, 3.vii.1965 (J.J.H.S.I. & B.J.K.), on *C. arabica*, 22.xi.1980 (G.Y.); Lae, Bumayong High School, on *C. robusta*, 22.ix.1984 (S.T.M.).

N.S.P., Bougainville, Kieta, on *Coffea* sp., 17.vii.1938 (J.L.F.).

N.P., Mamba Plantation, on *C. robusta*, 1.iii.1983 (J.W.I.).

W.H.P., Hagen District, Kara Estate, on *C. arabica*, 7.ix.1984 (S.T.M.), Koma Estate, 7.ix.1984 (S.T.M.), Mt Hagen, on *Coffea* sp., 1.xi.1981 (B.M.T.), on *C. arabica*, 25.ii.1973 (G.B.); Minj, on *Coffea* sp., 11.xii.1975 (B.M.T.); N. Wahgi District, Koban Plantation, 10.ix.1984 (S.T.M.); Nebilyer Valley, Mala Plantation, 12.ix.1984 (S.T.M.).

This species was first recorded on coffee from P.N.G. by Froggatt (1936a) and it has since been found in many localities. Froggatt (1936b) recorded copious honeydew production on which sooty moulds developed over much of the foliage. The species was later recorded by Szent-Ivany (1958) from the Highlands area where nearly every coffee plantation was infested, but the scale was controlled by the coccinellids *Menochilus sexmaculatus* (Fabricius) and *Callineda* sp. The scale insect was later discussed by Szent-Ivany and Stevens (1966) from the Wau Valley on *C. arabica* but many insects were killed by entomophagous fungi.

Further information on the life history and control in the Highlands area were given by Barrett (1966).

Ant species attending this scale have been reported as *Iridomyrmex nitidus* Mayr, *Iridomyrmex* (*anceps* group), *Polyrhachis wagneri* Wiehmeyer, *Technomyrmex albipes*, *Rhoptromyrmex melleus* Emery and *Oecophylla smaragdina*.

Parasaissetia nigra (Nietner) (*Saissetia nigra*)

Morobe P., Wau, on *C. robusta*, 24.xi.1979 (J.H.M.)

W.H.P., Hagen District, Kara Estate, on *C. robusta*, 7.ix.1984 (S.T.M.).
E.H.P., Henganofi, on *Coffea* sp., 2.xi.1961 (J.H.B.).

This species is widespread in P.N.G., on numerous host-plants. Large populations were reported by Szent-Ivany (1958) in E.H.P. on virus disease-infested *Crotalaria anagyroides* planted as shade trees to coffee.

Saissetia coffeae (Walker)

Chimbu P., D.P.I. Kumgi, on *C. arabica*, 13.ix.1984 (S.T.M.).
E.H.P., Norikori, on *C. arabica*, 17.ix.1984 (S.T.M.).
Morobe P., Wau, on *C. arabica*, 22.x.1980 (G.Y.); Bulolo, on *C. arabica*, 23.x.1980 (G.Y.).
W.H.P., Hagen District, Kara Estate, on *C. arabica*, 7.ix.1984 (S.T.M.).

This species was recorded by Szent-Ivany (1958) from the Highlands area where it was controlled by *Callineda* sp. and two species of *Orcus*.

Szent-Ivany and Stevens (1966) recorded it from Morobe P., in the Wau Valley and Bulolo-Snake River area in almost every plantation of *C. arabica*, but there were low population densities. The species is one of the most widespread and polyphagous of all scale insects.

Barrett (1966) has given useful information on the life history and control in the Highlands area.

FAMILY DIASPIDIDAE

Hemiberlesia lataniae (Signoret)

C.P., Port Moresby, on *C. robusta*, 5.ii.1960 (A.C.).

This is a cosmopolitan and polyphagous species, known in many parts of P.N.G., on other host-plants. It has been recorded by Szent-Ivany & Catley (1960).

Hemiberlesia palmae (Cockerell)

C.P., Port Moresby, on *C. robusta*, 5.ii.1960 (A.C.).

This cosmopolitan species is known throughout P.N.G. on numerous host-plants. The record on coffee by Szent-Ivany & Catley (1960) is the only one so far.

Ischnaspis longirostris (Signoret)

C.P., Port Moresby, on *C. robusta*, 5.ii.1960 (A.C.).

This is known in many parts of the world as the 'black thread scale', and although polyphagous it is often found on coffee. It is known from a few localities in P.N.G. on different host-plants and will probably be widespread on coffee. It was recorded on coffee by Szent-Ivany & Catley (1960).

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