



Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author: Agustin Zarkani
Assignment title: a8
Submission title: First Record of The Mealybug, *Rastrococcus tropicasiaticus* ...
File name: econd_of_The_Mealybug,_Rastrococcus_tropicasiaticus_Willia...
File size: 587.59K
Page count: 8
Word count: 2,418
Character count: 13,856
Submission date: 28-Feb-2023 02:49PM (UTC+0700)
Submission ID: 2025119297

Serangga 2021, 26(3): 29-36.

Agustin et al.

FIRST RECORD OF THE MEALYBUG, *Rastrococcus tropicasiaticus* WILLIAMS (HEMIPTERA: PSEUDOCOCCIDAE) IN INDONESIA

Agustin Zarkani^{1*}, Tri Sunardi¹, Nadrawati¹, Djamilah¹,
Cansu Ercan² & Mehmet Bora Kaydan²

¹Department of Plant Protection,
Faculty of Agriculture,

University of Bengkulu,

383711, Bengkulu, Indonesia

²Biotechnology Application and Research Centre,

Çukurova University,

01250, Adana, Turkey.

*Corresponding author: agustinzarkani@unib.ac.id

ABSTRACT

Rastrococcus is a spectacular genus with no close relatives of the family Pseudococcidae that have unique truncate-conical certain setae. The survey studies were conducted through random observation on some woody plants in Bengkulu province, southern Sumatra island from 2019 to 2020. The study recorded a presence of *Rastrococcus tropicasiaticus* Williams (Hemiptera: Pseudococcidae) in Indonesia for the first time. It was found on *Azadirachta excelsa* (Meliaceae), *Cerbera manghas* (Apocynaceae), *Dimocarpus longan* (Sapindaceae), *Ficus* sp. (Moraceae), and *Tectona grandis* (Lamiaceae). The highest mealybug incidence was found on *A. excelsa* and *C. manghas* with 80% and 30% of attacks, respectively.

Keywords: Biodiversity, host plant, insect pests, mealybugs, taxonomy

ABSTRAK

Rastrococcus adalah genus tanpa hubungan terdekat dari famili Pseudococcidae yang memiliki ciri serai unik yang tumpul dan pendek. Kajian tinjauan dilakukan melalui pemerhatian secara rawak terhadap beberapa tanaman berkayu di provinsi Bengkulu, wilayah selatan pulau Sumatera dari tahun 2019 hingga 2020. Kajian ini pertama kali merekodkan kehadiran spesies koya *Rastrococcus tropicasiaticus* Williams (Hemiptera: Pseudococcidae) di Indonesia. Spesies ini dijumpai hidup pada tanaman *Azadirachta excelsa* (Meliaceae), *Cerbera manghas* (Apocynaceae), *Dimocarpus longan* (Sapindaceae), *Ficus* sp. (Moraceae), dan *Tectona grandis* (Lamiaceae). Kejadian serangan koya tertinggi dijumpai pada *A. excelsa* dan *C. manghas* dengan masing-masing 80% dan 30% tingkat serangan.

Kata kunci: Kepelembagaan biologi, tumbuhan perumah, serangga perusak, koya, taksonomi

First Record of The Mealybug, *Rastrococcus tropicasiaticus* Williams

by Agustin Zarkani

Submission date: 28-Feb-2023 02:49PM (UTC+0700)

Submission ID: 2025119297

File name: econd_of_The_Mealybug,_Rastrococcus_tropicasiaticus_Williams.pdf (587.59K)

Word count: 2418

Character count: 13856

12

**FIRST RECORD OF THE MEALYBUG, *Rastrococcus tropicasiaticus* WILLIAMS
(HEMIPTERA: PSEUDOCOCCIDAE) IN INDONESIA**

**Agustin Zarkani^{1*}, Tri Sunardi¹, Nadrawati¹, Djamilah¹,
Cansu Ercan² & Mehmet Bora Kaydan²**

¹Department of Plant Protection,
Faculty of Agriculture,
University of Bengkulu,
383711, Bengkulu, Indonesia

²Biotechnology Application and Research Centre,
Çukurova University,
01250, Adana, Turkey.

*Corresponding author: agustinzarkani@unib.ac.id

ABSTRACT

Rastrococcus is a spectacular genus with no close relatives of the family Pseudococcidae that have unique truncate-conical cerarian setae. The survey studies were conducted through random observation on some woody plants in Bengkulu province, southern Sumatra island from 2019 to 2020. The study recorded a presence of *Rastrococcus tropicasiaticus* Williams (Hemiptera: Pseudococcidae) in Indonesia for the first time. It was found on *Azadirachta excelsa* (Meliaceae), *Cerbera manghas* (Apocynaceae), *Dimocarpus longan* (Sapindaceae), *Ficus* sp. (Moraceae), and *Tectona grandis* (Lamiaceae). The highest mealybug incidence was found on *A. excelsa* and *C. manghas* with 80% and 30% of attacks, respectively.

1

Keywords: Biodiversity, host plant, insect pests, mealybugs, taxonomy

ABSTRAK

Rastrococcus adalah genus tanpa hubungan terdekat dari famili Pseudococcidae yang memiliki duri serari unik yang tumpul dan pendek. Kajian tinjauan dilakukan melalui pemerhatian secara rawak terhadap beberapa tanaman berkayu di provinsi Bengkulu, wilayah selatan pulau Sumatera dari tahun 2019 hingga 2020. Kajian ini pertama kali merekodkan kehadiran spesies koya *Rastrococcus tropicasiaticus* Williams (Hemiptera: Pseudococcidae) di Indonesia. Spesies ini dijumpai hidup pada tanaman *Azadirachta excelsa* (Meliaceae), *Cerbera manghas* (Apocynaceae), *Dimocarpus longan* (Sapindaceae), *Ficus* sp. (Moraceae), dan *Tectona grandis* (Lamiaceae). Kejadian serangan koya tertinggi dijumpai pada *A. excelsa* dan *C. manghas* dengan masing-masing 80% dan 30% tingkat serangan.

Kata kunci: Kepelbagaian biologi, tumbuhan perumah, serangga perosak, koya, taksonomi

INTRODUCTION

Pseudococcidae is the second species-rich family of Coccoidea after Diaspididae (García et al. 2016). This family includes many polyphagous species that are common invaders of new geographical areas and potential to become pests in many cropping systems (Hodgson 1994; Nurkomar et al. 2021). They feed on plant juices and many are found on greenhouse plants, house plants and trees in almost all parts of the plants from roots to fruits (Williams 2004). It is sometimes not possible to save a badly damaged plant since the mealybugs promote sooty mold and transmit plant viruses (Daane et al. 2012; Franco et al. 2009). To date, two subfamilies and 256 genera within about 2,032 species have been described in this family (García et al. 2016). In Indonesia about 103 species of Pseudococcidae have been recorded, of which *Pseudococcus* Westwood, *Paraputo* Laing, and *Rastrococcus* Ferris are the most species-rich and harmful genera (García et al. 2016).

The genus *Rastrococcus* was first described by Ferris (1954). It is a spectacular genus of Pseudococcidae that appears to have no close relatives because it is the only genus with unique truncate-conical cerarian setae (García et al. 2016). At present, the natural distribution of the genus is southern Asia, China and the tropical Pacific region through Australia and New Zealand. In total, there are 31 species of *Rastrococcus* over the world (García et al. 2016). In Indonesia, the genus *Rastrococcus* is composed of 14 species, namely *R. balinensis* Buchner (Buchner 1957), *R. biggeri* Williams & Watson (Williams & Watson 1988), *R. chinensis* Williams (Williams 1989), *R. expeditionis* Williams (Gavrilov-Zimin 2013), *R. franssenii* Buchner (Buchner, 1957), *R. invadens* Williams (Ben-Dov 1994), *R. jabadiu* Williams (Williams 1989), *R. kendariensis* Gavrilov (Gavrilov-Zimin 2013), *R. neoguineensis* Williams & Watson (Williams 1989), *R. pseudospinosus* Buchner (Buchner, 1957), *R. rubellus* Williams (Williams 2004), *R. spinosus* (Robinson) (Williams 2004), *R. vicorum* Williams & Watson (Williams 1989), and *R. wilsoni* Williams (Williams 2004).

Rastrococcus tropicasiatricus Williams (Hemiptera: Pseudococcidae) is known from southern Asia and hitherto recorded from Malaysia (Kedah, Pahang, Sabah, Sarawak, Selangor), Philippines, Thailand, and Vietnam (William 2004). Known host plants are mostly woody plant trees of the Anacardiaceae (*Mangifera indica*), Meliaceae (*Azadirachta indica*), Moraceae (*Ficus* sp., *Ficus grossularioides*), Rutaceae (*Citrus* sp.), and Sapindaceae (*Nephelium lappaceum*), but has also been reported associated with a wild grass (Poaceae) (Williams 2004).

MATERIALS AND METHODS

The survey studies were conducted in Bengkulu province from 2019 to 2020. Specimens were collected through random observation on some woody plants such as *Azadirachta excelsa* (Meliaceae), *Cerbera manghas* (Apocynaceae), *Dimocarpus longan* (Sapindaceae), *Ficus* sp. (Moraceae), and *Tectona grandis* (Lamiaceae) spreading in Bengkulu city, Bengkulu Tengah district, Kepahiang district and Seluma district, a part of southern Sumatra.

The specimens were preserved in 70% ethyl alcohol and slide-mounts were prepared following the method of Kosztarab and Kozár (1988). Species identification was made using light microscopy and identified according to the keys in Williams (2004). The slide-mounted specimens of *R. tropicasiatricus* females and nymphs were deposited in the mini Insects Museum, Plant Protection Department, Faculty of Agriculture, University of Bengkulu (Sumatra-Indonesia) with slide number series: AZ330-342. The incidence of *R.*

tropicasiaticus was calculated by counting total infested plants divided by the total number of plants in the size of a quadrant.

RESULTS AND DISCUSSION

Rastrococcus tropicasiaticus Williams, 2004

Materials examined

Bengkulu province: 21 ♀, Muara Bangkahulu, campus park of University of Bengkulu, Bengkulu city, *A. excelsa*, *C. manghas*, *D. longan*, *Ficus* sp. and *T. grandis*, 20 m a.s.l., 03°45'33"S, 102°16'10"E, 10.ii.2019 & 15.iii.2020, Coll. A. Zarkani, Djamilah, E. Depari, Nadrawati, Priyatiningsih, S. Ginting & T. Sunardi (AZ224; AZ330-335); 3 ♀, Air Periukan, Seluma district, *A. excelsa*, 10 m a.s.l., 3°59'07"S, 102°25'37"E, 10.iv.2020, Coll. A. Zarkani, (AZ336); 9 ♀, Kabawetan, Kepahiang district, *A. excelsa*, *D. longan*, and *Ficus* sp., 800 m a.s.l., 03°34'54.4"S, 102°38'33"E, 12.vi.2020, Coll. A. Zarkani (AZ337-339); 9 ♀, Taba Penanjung, Bengkulu Tengah district, *A. excelsa*, *C. manghas* and *D. longan*, 550 m a.s.l., 03°42'22"S, 102°30'11"E, 12.vi.2020 Coll. A. Zarkani (AZ340-342).

Diagnosis

Alive specimen (after Williams 2004), the body of the adult female is covered in the copious secretion of white wax and resembling a species of *Icerya* (Monophlebidae). In slide-mounted specimens, the body of the adult female is broadly oval, about 4.25 mm long and 2.75 mm wide. Antennae with 9 segments, legs well developed, long and slender. Claw about 45 µm long, stout, with a denticle. Circulus wide with a wrinkled surface, lying on borders of abdominal segment III. Ostiole represented by posterior pair only, with inner edges of lips sclerotized, each lip with a few trilocular pores. Dorsal surface with short and almost conical setae whilst ventral surface with normal flagellate setae. Cerarii always conspicuous, each bearing numerous truncate-conical setae, each cerarian seta flat at the apex. Cerarii numbering 17 pairs, each situated on a weak sclerotized base, mostly each smaller in area than the anal ring. All cerarii containing trilocular pores with rim and loculi well defined on each pore.

Comments

Rastrococcus tropicasiaticus is a new record for the mealybug fauna of Indonesia. In mid-February 2019, the mealybug infestation firstly became apparent when the female insects were found producing copious amounts of white powdery wax secretion which covered the leaves, tree trunk and branches hanging from small trees (Figure 1). In the sapling stages, leaves of plants curl, turn yellow and die due to high infestation of the scales.

The presence of *R. tropicasiaticus* was first observed on the trunk and branches of *Cerbera manghas* and *Azadirachta excelsa*, respectively. These woody plants grow close to each other in one of the main campus parks of the University of Bengkulu. *Cerbera manghas* is an interesting fruit plant with aromatic flower used in gardening displays, whereas *D. molissimum* is an aromatic woody plant species that is most commonly used for the construction of wood and furniture in Indonesia (Dewi et al. 2017; Gan et al. 1999). Furthermore, the species is also found growing as a woody plant in different latitudes and sites in Bengkulu province.



Figure 1. Nymphs and adults of *Rastrococcus tropiciaticus* Williams on a tree of *Azadirachta excelsa* (Meliaceae)

The morphology of *R. tropiciaticus* is very close to *R. biggeri*, described from the Solomon Islands, in possessing marginal multilocular disc pores on the venter of the head, thorax and abdomen, and dorsal large-type quinquelocular pores (Williams 2004). However, in *R. biggeri* the multilocular disc pores are numerous on the head and thorax, and extend in a zone to the margins whilst in *R. tropiciaticus* the marginal multilocular disc pores are few. The species is also similar to *R. jabadiu* by having large-type quinquelocular pores on the dorsum but they can be easily differentiated by the presence of multilocular disc pores on the ventral margin of the thorax (Figures 2a-c).

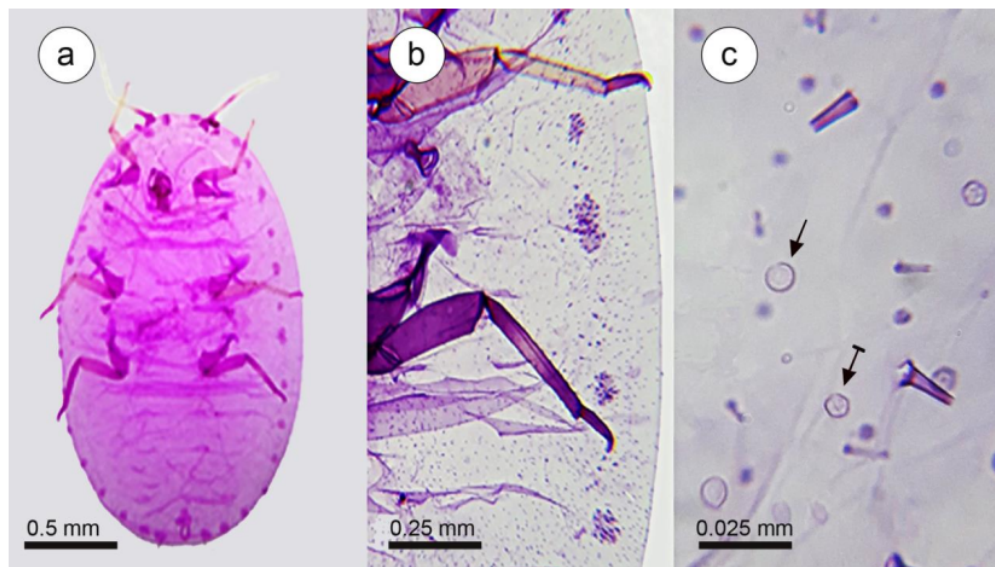


Figure 2. A stained slide-mounted specimen of *Rastrococcus tropicasiaticus* Williams: a. Female specimen with 17 pairs of cerarii; b. Ventral margin of thorax; c. Multilocular disc pores (↓) on ventral margin of thorax with quinquelocular pores (↓) present on dorsum

The incidence of *R. tropicasiaticus* on some woody plants varied. Throughout the year 2020, simultaneous outbreaks of *R. tropicasiaticus* were found on *A. excelsa* and *C. manghas* reaching the highest point of 80% and 30%, respectively. Furthermore, other plants such as *D. longan*, *Ficus* sp. and *T. grandis* were also found attacked by *R. tropicasiaticus* with about 1% to 5% incident. An outbreak of *Rastrococcus* sp. was reported by Ginting et al. (2020) attacking *Dysoxylum mollissimum* Blume (Meliaceae) which is probably the same species as *R. tropicasiaticus*. This species is a polyphagous insect widespread in southern Asia and it must be regarded as a potentially invasive species (García et al. 2016; Williams 2004).

The exact time of arrival of *R. tropicasiaticus* in Indonesia is not precise. Hitherto it was recorded on woody plants and wild grass in southern Asia: Malaysia (Selangor; Kedah; Sabah; Sarawak), Philippines (Luzon; Manila), Thailand (Rayong; Chanthaburi), and Vietnam (Hanoi) (García et al. 2016). In this study, the distribution of the species is updated to include Bengkulu, Sumatra Island (Figure 3). It may have been introduced unintentionally through the international transportation and trade from its known range to Indonesia. It is also possible that winds and storms may have carried it from Malaysia to Indonesia. The presence of *R. tropicasiaticus* on various host plants in Bengkulu and its high prevalence levels of the mealybug indicate that the species was very probably introduced some years before this report. This mealybug incidence is quite similar to the presence of *Ferrisa dasyllirii* (Cockerell) (Hemiptera: Pseudococcidae) reported a year before (Zarkani et al. 2020). Further studies are needed to clarify the phenology, female fecundity, search for the presence of males as well as identify predators and parasitoids on this newly established mealybug. It would be interesting to determine its distribution, dynamics in its colonization phase, reproductive biology and host plants in Indonesia.



Figure 3. Updated distribution of *Rastrococcus tropiciasiaticus* Williams in Southeast Asia (after García et al. 2016).

CONCLUSION

A newly recorded mealybug species, *R. tropiciasiaticus* has been reported from Indonesia. It was found on woody plants such as *A. excelsa*, *C. manghas*, *D. longan*, *Ficus* sp., and *T. grandis* in Bengkulu province, southern Sumatra. Of these, all plants except *Ficus* sp. are the new hosts of *R. tropiciasiaticus*.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. Takumasa Kondo (Corporación Colombiana de Investigación Agropecuaria - Agrosavia, Colombia), for critical reading of the manuscript. This project was made possible by the Faculty of Agriculture, University of Bengkulu. Cooperative Agreement No. 12/5/2020.

REFERENCES

- Ben-Dov, Y. 1994. *A Systematic Catalogue of the Mealybugs of the World (Insecta: Homoptera: Coccoidea: Pseudococcidae and Putoidae) with Data on Geographical Distribution, Host Plants, Biology and Economic Importance*. Andover, UK: Intercept Limited.
- Buchner, P. 1957. Endosymbiosestudien an schildläusen. 5. Die gattung *Rastrococcus* Ferris (Ceroputo Sulc). *Zeitschrift für Morphologie und Ökologie der Tiere* 46: 111-148.
- Dewi, N., Wijayanto, N. & Gusmaini. 2017. Dimension growth of *Azadirachta excelsa* and *Phyllanthus* spp. in agroforestry system. *Biodiversitas* 18(2): 494-499.
- Daane, K.M., Almeida, R.P.P., Bell, V.A., Walker, J.T.S., Botton, M., Fallahzadeh, M., Mani, M., Miano, J.L., Sforza, R., Walton, V.M. & Zaviezo, T. 2012. Biology and management of mealybugs in vineyards. In Bostanian, N.J., Vincent, C. & Isaacs, R. (eds.). *Arthropod Management in Vineyards*, pp. 271–307. Dordrecht: Springer Netherlands Press.
- Ferris, G.F. 1954. Report upon scale insects collected in China (Homoptera: Coccoidea). Part V. (Contribution No. 89). *Microentomology* 19: 51-66.
- Franco, J.C., Zada, A. & Mendel, Z. 2009. Novel approaches for the management of mealybug pests. In Ishaaya, I. & Horowitz, A.R. (eds.). *Biorational Control of Arthropod Pests*, pp. 233–278. New York: Springer Science + Business Media.
- Gan, K.S., Choo, K.T. & Lim, S.C. 1999. *Timber Notes - Light Hardwoods VII (Sentang Sepetir, Sesendok, Terap, Terentang)*. Kuala Lumpur: Timber Technology Centre, FRIM.
- García, M., Denno, B., Miller, D.R., Miller, G.L., Ben-Dov, Y. & Hardy, N.B. 2016. ScaleNet: A literature-based model of scale insect biology and systematics. <http://scalenet.info> [05 January 2021].
- Gavrilov-Zimin, I.A. 2013. New scale insects (Homoptera: Coccinea) from Sulawesi and New Guinea, with some other additions to the Indonesian fauna. *Tropical Zoology* 26(2): 64-86.
- Ginting, S., Depari, E.K., Nadrawati & Zarkani, A. 2020. The attack of *Rastrococcus* sp. (Homoptera: Pseudococcidae) on *Dysoxylum mollissimum* Blume in campus forest of Bengkulu University. *Jurnal Hama dan Penyakit Tumbuhan Tropika* 20(1): 54-60.
- Hodgson, C.J. 1994. *The Scale Insect Family Coccidae: An Identification Manual to Genera*. Oxon, UK: CAB International Wallingford.
- Kosztarab, M. & Kozár, F. 1988. *Scale Insects of Central Europe*. Budapest: Akadémiai Kiadó.
- Nurkomar, I., Trisnawati, D.W. & Aisyah, S.N. 2021. Pest insects in cassava plantations intercrop with different plants at Gunungkidul, Yogyakarta, Indonesia. *Serangga* 26(1):1-12.
- Williams, D.J. & Watson, G.W. 1988. *The Scale Insects of the Tropical South Pacific Region. Pt. 2: The Mealybugs (Pseudococcidae)*. London: CAB International Institute of Entomology.

- Williams, D.J. 1989. The mealybug genus *Rastrococcus* Ferris (Hemiptera: Pseudococcidae). *Systematic Entomology* 14(4): 433-486.
- Williams, D.J. 2004. *Mealybugs of Southern Asia*. Kuala Lumpur: The Natural History Museum jointly with Southdene.
- Zarkani A., Apriyanto D., Turanli F. & Kaydan M.B. 2020. New record of *Ferrisa dasyliirii* (Cockerell) (Hemiptera: Coccothorax: Pseudococcidae) in Indonesia. *Serangga* 25(3) 93-100.

First Record of The Mealybug, *Rastrococcus tropicasiaticus* Williams

ORIGINALITY REPORT

12%
SIMILARITY INDEX

8%
INTERNET SOURCES

10%
PUBLICATIONS

%
STUDENT PAPERS

PRIMARY SOURCES

- | | | |
|---|--|----|
| 1 | Agustin Zarkani, Cansu Ercan, Dwinardi Apriyanto, M. Bora Kaydan. "Studies on Mealybug Species (Hemiptera: Coccoomorpha: Pseudococcidae) with Description of Two New Species and Three Newly Recorded Species from Indonesia", Pensoft Publishers, 2021
Publication | 2% |
| 2 | www.acarindex.com
Internet Source | 1% |
| 3 | Hiroataka Tanaka, Kenji Suetsugu, Satoshi Kamitani. "A parasitic insect on a parasitic plant: a new species of the genus Formicoccus Takahashi (Hemiptera, Coccoomorpha, Pseudococcidae) from Ishigaki Island, Japan", ZooKeys, 2021
Publication | 1% |
| 4 | pinpdf.com
Internet Source | 1% |
| 5 | D. J. Williams. " Two new species of (Hemiptera: Pseudococcidae) on from | 1% |

6

Soo - Jung Suh. "Interception of mealybugs (Hemiptera: Pseudococcidae) at import during phytosanitary inspections in South Korea from 1996 to 2018", EPPO Bulletin, 2020

Publication

1 %

7

Imre Foldi. " Ground pearls: a generic revision of the Margarodidae (Hemiptera: Sternorrhyncha: Coccoidea) ", Annales de la Société entomologique de France (N.S.), 2013

Publication

1 %

8

D. J. Williams. "An account of the mealybug genus Paraputo Laing (Hemiptera: Coccoidea: Pseudococcidae) in the Pacific region", Journal of Natural History, 1/1/2005

Publication

<1 %

9

D.J. Williams. " Four related species of root mealybugs of the genus from east and southeast Asia of importance at quarantine inspection (Hemiptera: Coccoidea: Pseudococcidae) ", Journal of Natural History, 1996

Publication

<1 %

10

actazool.nhmus.hu

Internet Source

<1 %

- | | | |
|----|--|------|
| 11 | www.heighpubs.org
Internet Source | <1 % |
| 12 | www.sel.barc.usda.gov
Internet Source | <1 % |
| 13 | "Grapevine Viruses: Molecular Biology, Diagnostics and Management", Springer Science and Business Media LLC, 2017
Publication | <1 % |
| 14 | D. J. Williams, P. J. Gullan. " A revision of the Neotropical scale insect genus Townsend (Hemiptera: Coccoidea: Monophlebidae: Llaveiini) ", Journal of Natural History, 2008
Publication | <1 % |
| 15 | D. J. Williams. " sp. n. (Hemiptera: Pseudococcidae) introduced from the Oriental Region to West Africa and causing damage to mango, citrus and other trees ", Bulletin of Entomological Research, 2009
Publication | <1 % |
| 16 | www.agriculturejournals.cz
Internet Source | <1 % |
| 17 | www.mapress.com
Internet Source | <1 % |
| 18 | D. J. Williams. "Phenacoccus gossypii Townsend & Cockerell, P. madeirensis Green and some related mealybug species | <1 % |

(Hemiptera: Pseudococcidae)", Bulletin of
Entomological Research, 06/1987

Publication

19

M. Kosztarab, F. Kozár. "Scale Insects of
Central Europe", Springer Nature, 1987

Publication

<1 %

20

Ramzi Mansour, Luc P. Belzunces, Pompeo
Suma, Lucia Zappalà et al. "Vine and citrus
mealybug pest control based on synthetic
chemicals. A review", Agronomy for
Sustainable Development, 2018

Publication

<1 %

Exclude quotes Off

Exclude matches Off

Exclude bibliography On

First Record of The Mealybug, Rastrococcus tropicasiaticus Williams

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8