A journal of world insect systematics

INSECTA MUNDI

0995

The records of *Nipaecoccus viridis* (Newstead) (Hemiptera: Pseudococcidae) deposited in the Florida State Collection of Arthropods

Lily A. Deeter

Florida Department of Agriculture and Consumer Services
Division of Plant Industry
Gainesville, FL

Muhammad Z. Ahmed

Subtropical Insects and Horticulture Research Unit
Agricultural Research Service
United States Department of Agriculture
Fort Pierce, FL

Date of issue: June 30, 2023

Center for Systematic Entomology, Inc., Gainesville, FL

Deeter LA, Ahmed MZ. 2023. The records of *Nipaecoccus viridis* (Newstead) (Hemiptera: Pseudococcidae) deposited in the Florida State Collection of Arthropods. Insecta Mundi 0995: 1–8.

Published on June 30, 2023 by
Center for Systematic Entomology, Inc.
P.O. Box 141874
Gainesville, FL 32614-1874 USA
http://centerforsystematicentomology.org/

Insecta Mundi is a journal primarily devoted to insect systematics, but articles can be published on any non-marine arthropod. Topics considered for publication include systematics, taxonomy, nomenclature, checklists, faunal works, and natural history. Insecta Mundi will not consider works in the applied sciences (i.e. medical entomology, pest control research, etc.), and no longer publishes book reviews or editorials. Insecta Mundi publishes original research or discoveries in an inexpensive and timely manner, distributing them free via open access on the internet on the date of publication.

Insecta Mundi is referenced or abstracted by several sources, including the Zoological Record and CAB Abstracts. Insecta Mundi is published irregularly throughout the year, with completed manuscripts assigned an individual number. Manuscripts must be peer reviewed prior to submission, after which they are reviewed by the editorial board to ensure quality. One author of each submitted manuscript must be a current member of the Center for Systematic Entomology.

Guidelines and requirements for the preparation of manuscripts are available on the Insecta Mundi website at http://centerforsystematicentomology.org/insectamundi/

Printed copies (ISSN 0749-6737) annually deposited in libraries

Florida Department of Agriculture and Consumer Services, Gainesville, FL, USA
The Natural History Museum, London, UK
National Museum of Natural History, Smithsonian Institution, Washington, DC, USA
Zoological Institute of Russian Academy of Sciences, Saint-Petersburg, Russia

Electronic copies (online ISSN 1942-1354) in PDF format

Archived digitally by Portico.
Florida Virtual Campus: http://purl.fcla.edu/fcla/insectamundi
University of Nebraska-Lincoln, Digital Commons: http://digitalcommons.unl.edu/insectamundi/
Goethe-Universität, Frankfurt am Main: http://nbn-resolving.de/urn/resolver.pl?urn:nbn:de:hebis:30:3-135240

0995: 1–8 **INSECTA MUNDI** 2023

The records of *Nipaecoccus viridis* (Newstead) (Hemiptera: Pseudococcidae) deposited in the Florida State Collection of Arthropods

Lily A. Deeter
Florida Department of Agriculture and Consumer Services
Division of Plant Industry
Gainesville, FL
Lily.Deeter@fdacs.gov
https://orcid.org/0000-0002-7716-3831

Muhammad Z. Ahmed
Subtropical Insects and Horticulture Research Unit
Agricultural Research Service
United States Department of Agriculture
Fort Pierce, FL
Muhammad.Ahmed@usda.gov
https://orcid.org/0000-0003-2486-157X

Abstract. We studied the slides of *Nipaecoccus viridis* (Newstead) (Hemiptera: Pseudococcidae) deposited in the Florida State Collection of Arthropods and provided specimen label data, including geographical location, global positioning system coordinates when available, host plant, collector name, adult females/immature stages, sex of specimens on respective slides, number of slides, and collection date. In addition, we discuss its first record from Florida ornamental landscape and two most recent new host records of the species on commercial crops, including blueberries and hemp. These data will help regulatory agencies slow the spread of this pest inside and outside of Florida.

Key words. Citrus pest, geographical location, hibiscus mealybug, host plants, lebbeck mealybug.

ZooBank registration. urn:lsid:zoobank.org:pub:EEB2767C-9B59-4BA9-A5B5-D5B14FF7B38F

Introduction

Hibiscus or lebbeck mealybug, *Nipaecoccus viridis* (Newstead) (Hemiptera: Pseudococcidae), is a pest of limited distribution in Florida found on citrus and other commercial crops (Ahmed et al. 2019; Diepenbrock and Ahmed 2020; Olabiyi et al. 2023). It is widespread in at least 60 countries on four continents, including Asia, Africa, Australia, and North America (García Morales et al. 2016). It was reported for the first time in North America from Florida in late 2009 from a natural area on dodder vine, *Cuscuta exaltata* Engelm. (Sonales: Convolvulaceae), in Palm Beach County, Florida (Stocks and Hodges 2010). However, it was not until 2019 that outbreaks were found on commercial citrus for the first time in the USA, at a grove in Highlands County, Florida (Ahmed et al. 2019). Recently, this pest was discovered in a hemp production greenhouse and in an organic U-pick blueberry farm (FDACS-DPI Database, 2021).

To better understand the history and pest potential of this mealybug, we reexamined the holdings of the Florida State Collection of Arthropods (FSCA) slide collection, Gainesville, Florida, and collated specimen-level data from the slide labels. During our reexamination, we found a slide containing a single specimen of *N. viridis* collected in 1987 in Cedar Key, Florida, on *Portulaca oleracea* L. (Caryophyllales: Portulacaceae) that was determined as *Nipaecoccus* sp. This record coincides with the global invasions of *N. viridis* across Africa, Asia, and the Middle East (Sharaf and Meyerdirk 1987). There were no subsequent reports of the species in Florida for almost two and a half decades since this collection (Stocks and Hodges 2010).

Materials and Methods

We studied all the records of *N. viridis* in the DPI database and recorded verbatim label data of *N. viridis* from the FSCA slide collection. At the same time, we examined all specimens to verify the identifications and life stages using the taxonomic key and species diagnosis from von Ellenrieder et al. (2018) and Ghosh and Ghose (1989). Species verification involved confirmation of the following features: (i) dorsal setae lanceolate; (ii) ventral margins of head, thorax, and anterior abdominal segments with multilocular disc pores; (iii) presence of oral collar tubular ducts on dorsum and medial and submedial areas of venter (von Ellenrieder et al. 2018).

A survey for *N. viridis* was conducted in response to the record in 1987 from Cedar Key. We visited Cedar Key on December 3rd, 2020, to survey the mealybug. Both known hosts of the mealybug and potential new hosts were inspected, as well as *Portulaca oleracea*, the host of the specimen found in 1987. Areas inspected included a cemetery, community gardens, nature trails, and public parks.

Results

Family Pseudococcidae
Pseudococcinae

Nipaecoccus viridis (Newstead, 1894)

Florida Collection Records

Broward Co.: Ft. Lauderdale, (26.10916, −80.144), June 23, 2011, on *Uncarina grandidieri*, (1 slide), K. Griffiths (2011-4050) 3 ad. F; Ft. Lauderdale, July 19, 2011, on *Portulaca oleracea*, (1 slide), N. Marrone (2011-4736) 4 ad. F; Ft. Lauderdale, February 21, 2012, on *Citrus* sp., (2 slides), W. Thiel (2012-1235) 2 ad. F; Pembroke Pines, August 7, 2018, on *Citrus x paradisi*, (1 slide) K. Williams (2018-4236) 1 ad. F. **Charlotte Co.**: Punta Gorda, June 2, 2020, on *Citrus* sp., (3 slides), L. Diepenbrock (2020-2132) 3 ad. F. **Collier Co.**: Naples, (26.208539, −81.800483), September 20, 2019, on *Citrus* sp., (3 slides), S. Kreuger (2019-5249) 3 ad. F. **De Soto Co.**: Arcadia, (27.23746, −81.61575), September 5, 2019, on *Citrus sinensis*, (1 slide), H. Lemay (2019-4959) 1 ad. F; Arcadia, March 6, 2020, on *Citrus sinensis*, (1 slide), K. Buice & T. Joseph (2020-940) 1 ad. F; Arcadia, March 22, 2021, on *Citrus* sp., (2 slides), A. Nolen (2021-1142) 2 ad. F; Fort Meade, (27.7077778, −81.888333), June 2019, on *Citrus sinensis*, (1 slide), L. Diepenbrock (2019-3827) 1 ad. F. **Glades Co.**: Okeechobee, (27.159590, −81.162480), June 10, 2022, on *Citrus reticulata,* (2 slides), S. Valdez (2022-5448) 2 ad. F; **Hardee Co.**: Zolfo Springs, (27.5366667, −81.5897222), June 2019 on *Citrus* sp., (2 slides), L. Diepenbrock (2019-3826) 2 ad. F; Zolfo Springs, (27. 414556, −81.714274), June 2, 2020, on *Citrus sinensis*, (7 slides), T. Joseph (2020-2085) 7 ad. F; Zolfo Springs, July 1, 2021, on *Citrus* sp., (1 slide), G. Harris, J. Nobles (2021-3362) 1 ad. F. **Highlands Co.**: Spring Lake, November 14, 2018, on *Citrus* sp., (1 slide), Payne (2018-5980) 1 ad F.; Avon Park, June 14, 2019, on *Citrus sinensis*, (6 slides), L. Diepenbrock (2019-3408) 6 ad. F; Lake Placid, (27.53211, −81.50835), July 5, 2019, on *Citrus* sp., (1 slide), K. Buice (2019-3814) 1 ad. F; Lorida, (27.4143, −81.2382), July 26, 2019, on *Citrus sinensis*, (3 slides), T. Joseph (2019-4226) 3 ad. F; Sebring, (27.5278, −81.459063), April 17, 2020, on *Citrus sinensis*, (3 slides), T. Joseph (2020-1567) 3 ad. F. **Indian River Co.**: Fellsmere, January 30, 2020, on *Citrus* ×*tangelo*, (5 slides), W. Tallacagua (2020-437) 5 ad. F. **Lake Co.**: Groveland, (26.61241, −81.80532), April 1, 2021, on *Vaccinium* sp., (2 slides) L. Osborne (2021-1340) 2 ad. F; Groveland, (26.612542, −81.80532), April 7, 2021, on *Vaccinium* sp., (3 slides), A. Bartlett (2021-1495) 3 ad. F; Minneola, (28.575683, −81.748215), July 16, 2019, on *Gardenia jasminoides*, (2 slides), A. Bartlett (2019-3982) 2 ad. F. **Lee Co.**: Sanibel, March 6, 2020, on *Citrus* sp., (3 slides), R. Blaney (2020-935) 3 ad. F. **Levy Co.**: Cedar Key, October 4, 1987, on *Portulaca oleracea*, (1 slide), F; Bennett (1987-001) 1 ad. F. **Martin Co.**: Stuart, June 12, 2013, on *Nerium oleander*, (2 slides), J. Gomes (2013-4095) 1 ad. F; Stuart, April 18, 2021, on *Clerodendrum paniculatum*, (1 slide), L. West (2019-2091) 1 ad. F; Stuart, April 23, 2021, on *Dodonaea viscosa,* (1 slide), L. West (2021-1876) 1 ad. F.; Stuart, 23 April 2021, on *Acalypha wilkesiana,* (3 slides), L. West (2021-1877) 3 ad. F; Stuart, June 11, 2021, on *Odontonema* sp., (1 slide), L. West (2021-2957) 1 ad F.; Stuart, June 11, 2021, on *Tecoma capensis*, (3 slides), L. West (2021-2958) 3 ad. F. **Miami-Dade Co.**: Coral

Gables, February 18, 2019, (1 slide), P. Perez (2019-647) 1 ad. F; Miami, September 5, 2014, on *Gardenia jasminoides*, (2 slides), J. G. Lopez (2014-6369) 1 ad. F; Miami, July 23, 2015, on *Tamarindus indica*, (2 slides), D. Hanna (2015-4179) 1 ad. F; Miami, August 10, 2015, on *Vitis rotundifolia*, (1 slide), D. Hannah (2015-4649) 1 ad. F; Miami, October 13, 2015, on *Ficus carica*, (2 slides), D. Hanna (2015-5818) 1 ad. F; Miami, August 3, 2016, on *Citrus* sp., (2 slides), B. Rodriguez (2016-3746) 1 ad. F; Miami, April 11, 2016, on *Citrus* sp., (1 slide), M. Justiz (2016-1571) 1 ad. F; Miami, October 18, 2018, on *Citrus* sp., (1 slide), R.M. Quinones (2018-5547) 1 ad. F; Miami, April 3, 2019, on *Mimusops elengi*, (1 slide), C. Millan (2019-1652) 1 ad. F; North Miami, (25.899553. -80.1685), July 24, 2019, on *Citrus* sp., (2 slides), O. Garcia (2019-4133) 2 ad. F. **Monroe Co.**: Key West, (24.552082, −81.780918), January 24, 2023, on *Citrus* sp., (2 slides), L. Deeter, K. Burnette, R. Krueger (2023-00647) 2 ad. F; Key West, (24.554638, −81.780918), January 25, 2023, on *Citrus aurantifolia*, (2 slides), L. Deeter, K. Burnette, R. Krueger (2023-00648) 1 first instar F, 1 ad. F. **Orange Co.**: Apopka, nursery interception, (28.770029, −81.593328), December 5, 2018, on *Ziziphus jujuba*, (1 slide), K. Gonzales (2018-6317) 1 ad. F; Apopka, April 20, 2021, on *Cannabis sativa,* (2 slides), L. Osborne (2021-1837) 1 second instar F, 1 pharate ad. F; Apopka, April 26, 2021, on *Cannabis sativa*, (3 slides), L Osborne (2021-1852) 3 ad. F. **Osceola Co.**: Kissimmee, June 24, 2021, on *Tamarindus indica*, (2 slides), S. Restrepo (2021-3261) 2 ad. F. **Palm Beach Co.**: Boynton Beach, (26.55791, −80.06815), November 13, 2009, on *Cuscuta exaltata*, (3 slides), K. Griffiths (2009-8598) 3 ad. F; Boynton Beach, (26.55805, −80.06786), December 9, 2009, on *Cuscuta exaltata*, (8 slides), K. Griffiths (2009-9052) 15 ad. F; Boynton Beach, (26.55828, −80.06789), March 4, 2010, on *Quercus myrtifolia*, (1 slide), K. Griffiths & M. McGovern (2010-1126) 4 ad. F; Boynton Beach, (26.55823, −80.06791), September 21, 2010, on *Bidens alba*, (1 slide), K. Griffiths (2010-5876) 6 ad. F; Boynton Beach, (26.55831, −80.06786), October 1, 2010, *Bidens alba*, (1 slide), P. Perez, L. Bradshaw, A. Derksen, K. Griffith, D. Amalin (2010-6095, 2010-6098) 4 ad. F; Boynton Beach, (26.55832, −80.06787), October 1, 2010, on *Croton glandulosus*, (1 slide), A. Derksen, K. Griffiths, A. Divina, P. Perez, L. Bradshaw (2010-6100) 5 ad. F; Boynton Beach, October 15, 2010, on *Ambrosia artemisiifolia*, (1 slide), K. Griffiths (2010-6345) 4 ad. F; Boynton Beach, (26.55816, −80.06788), October 21, 2010, on *Cuscuta exaltata*, (1 slide), S. Romero, K. Griffiths, A. Derksen, L. Bradshaw, P. Perez (2010-6610) 5 ad. F; Boynton Beach, July 2, 2011, on *Ximenia americana*, (1 slide), S. Romero, A. Roda (2011-5185) 1 ad. F; Boynton Beach, April 2, 2012, on *Ximenia americana*, (1 slide), I. Stocks (2012-2319) 1 ad. F; Boynton Beach, September 3, 2013, on *Persea americana*, (2 slides), E. Solis (2013-6529) 1 ad. F; Boynton Beach, (26.55277, −80.205826), September 30, 2015, on *Schefflera arboricola*, (2 slides), S. Simmons (2015-5634) 1 ad. F; Boynton Beach, April 10, 2018, on *Ficus microcarpa*, (1 slide), S. Simmons (2018-1697) 1 ad. F; Boynton Beach, April 20, 2018, on *Citrus* sp., (2 slides), S. Simmons (2018-2051) 1 ad. F; Delray Beach, June 11, 2012, on *Citrus* sp., (1 slide), E. Tannehill (2012-4514) 1 ad. F; Lake Worth, September 21, 2010, on *Fortunella japonica*, (1 slide), L. Buss, A. Derksen, K. Griffiths (2010-6093) 6 ad. F; Lake Worth, (26.59966, −80.15898), June 29, 2011, on *Citrus limettioides*, (1 slide), A. Derksen, K. Griffiths (2011-4260) 3 ad. F; Lake Worth, (26.60133, −80.16045), June 29, 2011, on *Punica granatum*, (1 slide), A. Derksen, K. Griffiths (2011-4261) 1 ad. F; Lake Worth, (26.60074, −80.15963), June 29, 2011, on *Nycanthes arbortristis*, (1 slide), A. Derksen, K. Griffiths (2011-4262) 2 ad. F; Lake Worth, (26.59885, −80.15948), June 29, 2011, on *Artocarpus heterophyllous*, (1 slide), A. Derksen, K. Griffiths (2011-4264) 1 ad. F; Lake Worth, (26.59965, −80.1592), June 29, 2011, on *Fortunella japonica*, (1 slide), A. Derksen, K. Griffiths (2011-4265) 4 ad. F; Lake Worth, (26.60073, −80.16055), June 29, 2011, on *Citrus sinensis*, (1 slide), A. Derksen, K. Griffiths (2011-4266) 3 ad. F; Lake Worth, (26.6008, −80.16052), June 29, 2011, on *Citrus* sp., (1 slide), A. Derksen, K. Griffiths (2011-4267) 2 ad. F.; Lake Worth, July 14, 2011, on *Citrus* sp., (2 slides), I. Stocks, A. Derksen, K. Griffiths (2011-4590) 4 ad. F; Lake Worth, July 14, 2011, on *Punica granatum*, (1 slide), I. Stocks, A. Derksen, K. Griffiths (2011-4591) 2 ad. F; Lake Worth, (26.59972, −80.15813), July 14, 2011, on *Artocarpus heterophyllus*, (2 slides), I. Stocks, A. Derksen, K. Griffiths (2011-4592) 4 ad. F; Lake Worth, (26.59954, −80.15835), July 14, 2011, on *Citrus* sp., (1 slide), A. Derksen, K. Griffiths (2011-4593, 2011-4595) 4 ad. F; Lake Worth, July 14, 2011, (1 slide), I. Stocks, A. Derksen, K. Griffiths (2011-4602) 1 ad. F; Lake Worth, (26.599281, −80.158719), July 21, 2011, (2 slides), L. Lodyga, O. Garcia (2011-4772) 3 ad. F; Lake Worth, (26.599281, −80.158719), July 21, 2011, on *Annona squamosa*, (1 slide), H. Cruz-Escoto, S. Beidler (2011-4776) 3 ad. F; Lake Worth, (26.59853, −80.15874), April 2012, on *Citrus aurantifolia*, (2 slides), A. Derksen (2012-2349) 2 ad. F; Lake Worth, September 1, 2015, on *Portulacaria afra*, (2 slides), L. Buss (2015-5238) 2 ad. F; Delray Beach, (26.48014, −80.12578), September 9, 2016, on *Citrus* sp., (2 slides), J. Williamson (2016-4327) 2 ad. F; Delray

Beach, August 24, 2018, on *Ziziphus mauritiana*, (2 slides), K. Harris (2018-4591) 1 ad. F; Delray Beach, September 27, 2018, on *Ximenia americana*, (2 slides), L. Smith (2018-5187) 1 ad. F; Delray Beach, June 11, 2012, on Poaceae, (1 slide), E. Tennehill (2012-4514) 1 ad. F; Lake Worth, (26.586966, −80.205872), September 18, 2014, on *Radermacher* sp., (2 slides), S. Simmons (2014-6721) 1 ad. F; Lake Worth, (26.598096, −80.158702), October 7, 2014, on *Murraya koenigii*, (2 slides), S. McCarthy (2014-7024) 1 ad. F; Lake Worth, September 24, 2018, on *Nerium oleander*, (2 slides), W. Churchill (2018-5171) 1 ad. F; Lantana, March 26, 2022, on *Jatropha integerrima,* (2 slides) L. Deeter (2022-2469) 2 ad. F; West Palm Beach, (27.161363, −81.336491), August 26, 2014, on *Citrus* sp., (3 slides), S. McCarthy (2014-6136) 1 ad. F; West Palm Beach, August 6, 2015, on *Murraya koenigii*, (2 slides), L. Buss (2015-4820) 1 ad. F; West Palm Beach, (26.672014, −80.073015), March 5, 2018, on *Citrus aurantifolia*, (3 slides), J. Lee (2018-869) 1 ad. F; West Palm Beach, (26.74168, −80.05003), November 10, 2010, on *Mangifera indica*, (1 slide), K. Griffiths (2010-7015) 5 ad. F; West Palm Beach, June 1, 2010, on *Citrus* sp., (1 slide), B. Clark (2010-3207) 1 ad. F; West Palm Beach, June 1, 2010, on *Citrus* sp., (1 slide), B. Clark (2010-3644) 1 third instar F., 2 ad. F; West Palm Beach, (26.74126, −80.05019), June 23, 2010, on *Citrus limon*, (1 slide), A. Derksen, K. Griffiths (2010-3965) 6 ad. F; West Palm Beach, (26.67881, −80.05206), August 3, 2010, on *Jatropha integerrima*, (1 slide), P. Perez, L. Bradshaw, A. Derksen, K. Griffith, D. Amalin (2010-4640) 4 ad. F; Palm Beach, (26.67881, −80.05206), August 3, 2010, on *Cupaniopsis anacardioides*, (1 slide), P. Perez, L. Bradshaw, A. Derksen, K. Griffith, D. Amalin (2010-4644) 9 ad. F; West Palm Beach, (26.74168, −80.05003), December 22, 2010, on *Syzygium paniculatum*, (1 slide), A. Derkensen, K. Griffiths, S. Romero, (2010-7849) 2 ad. F; West Palm Beach, September 5, 2011, on *Citrus* sp., (2 slides), O. Garcia (2011-6537) 4 ad. F; West Palm Beach, August 18, 2011, on *Citrus* sp., (1 slide), A. Roda, S. Romero (2011-5904); Palm Beach, May 17, 2010, on *Citrus sinensis*, (1 slide), B. Clark (2010-2880) 1 third instar F., 9 ad. F; Palm Beach, (26.76277, −80.03976), May 26, 2010, on *Gardenia jasminoides*, (2 slides), A. Derksen, K. Griffiths (2010-3171) 6 ad. F; Palm Beach, June 8, 2010, on *Gardenia jasminoides*, (2 slides), B. Clark (2010-3466) 8 ad. F; Palm Beach, June 8, 2010, on *Citrus* sp., (1 slide), B. Clark (2010-3467) 2 ad. F; Palm Beach, October 18, 2010, on *Fortunella japonica*, (1 slide), B. Pages, B. Schall (2010-6381) 6 ad. F; Palm Beach, October 18, 2010, on *Gardenia jasminoides*, (1 slide), B. Pages, B. Schall (2010-6384) 8 ad. F; Palm Beach, (26.68389, −80.03793), October 20, 2010, on *Fortunella japonica*, (1 slide), K Griffiths, A Derksen, B. Page (2010-6470) 2 ad. F; Palm Beach, April 16, 2012, on *Citrus limon*, (3 slides), B. Pages, L. Buss (2012-2952) 3 ad. F; **Pinellas Co.**: St. Petersburg, (27.778960, −82.732440), August 19, 2022, on *Gossypium* sp., (2 slides), D. Restom-Gaskill (2022-7722) 2 ad. F. **Polk Co.**: Babson Park, January 6, 2020, on *Citrus* sp., (3 slides), L. Diepenbrock (2020-35) 3 ad. F; Dundee, (28.02902, −81.640375) December 6, 2019, on *Citrus* sp., (2 slides), A. Lebron-Rivera (2019-6702) 2 ad. F; Frostproof, January 16, 2020, on *Citrus* sp., (1 slide), P. Alderman (2020-274) 1 ad. F; Lake Wales, February 7, 2020, on *Citrus sinensis*, (1 slide), L. Daily, L. Arbthnot (2020-508) 1 ad. F. **Sarasota Co.**: North Port, (27.060000, −82.260000), October 19, 2021, on *Citrus* sp., (3 slides), P. Kumar (2021-9260) 3 ad. F; **St. Lucie Co.**: Port Saint Lucie, (27.50389, −80.596669), July 8, 2020, on *Citrus sinensis*, (4 slides), W. Mackey (2020-2680) 4 ad. F.

Hendry Co., Florida Records

There are four records in the FDACS-DPI Database (FDACS-DPI Database 2021) from Hendry Co., but their specimens were either insufficient or not at the life stages needed to slide-mount for deposition in the FSCA.

Maryland Collection Record

USA, Maryland, Washington Co.: Rorersville, November 3, 2021, on *Portulacaria afra,* (1 slide) G. Williams (2021-4272) 1 ad. F.

North Carolina Collection Record

USA, North Carolina, Wake Co.: Raleigh, June 21, 2020, on *Gardenia* sp., (4 slides), M. Bertone (2020-2653) 4 ad. F.

Texas Collection Record

USA, Texas, Hidalgo Co.: Hidalgo, (26.10945, −98.22594), November 2, 2022, on *Citrus aurantifolia*, (1 slide), A. Derksen (2023-02107) 1 ad. F.

Discussion

During the survey of Cedar Key, no specimens of *N. viridis* or signs of infestation were found. Considering that there have been no reports of this pest at this location since 1987, we postulate that the original sample could have been an interception, and the pest was never established. In addition, a one-day survey might not be sufficient, even though the geographical area of Cedar Key is small (5.4 km^2), and plant diversity is distributed in small areas. It seems the likely reason it would be reported from Cedar Key is in the case of an interception rather than an established infestation. Speculations aside, we conclude that there is insufficient evidence of *N. viridis* establishment in Cedar Key.

The recent 2021 discoveries of *N. viridis* in a hemp production greenhouse and an organic U-pick blueberry, *Vaccinium* sp. L. (Ericales: Ericaceae) farm are new host records for this species in Florida, the USA, and worldwide (García Morales et al. 2016). The ability of *N. viridis* to infest and reproduce on these crops cautions growers that scouting for *N. viridis* is critical to prevent its future outbreaks. Blueberries are considered one of Florida's major fruit crops, and severe infestations could render fruits unsellable if *N. viridis* infestation symptoms are like those seen on citrus, such as fruit distortion and premature fruit drop (FDACS 2019). Moreover, crawlers

Figure 1. Infestation of *Nipaecoccus viridis* on blueberries, *Vaccinium* sp. L., in Florida (FDACS-DPI # E2021-1340-1). **a)** Adult female. **b)** Adult female with ovisac. **c)** Adult females with ovisacs stacked on top of one another. **d)** Close-up (10×) view of an adult female.

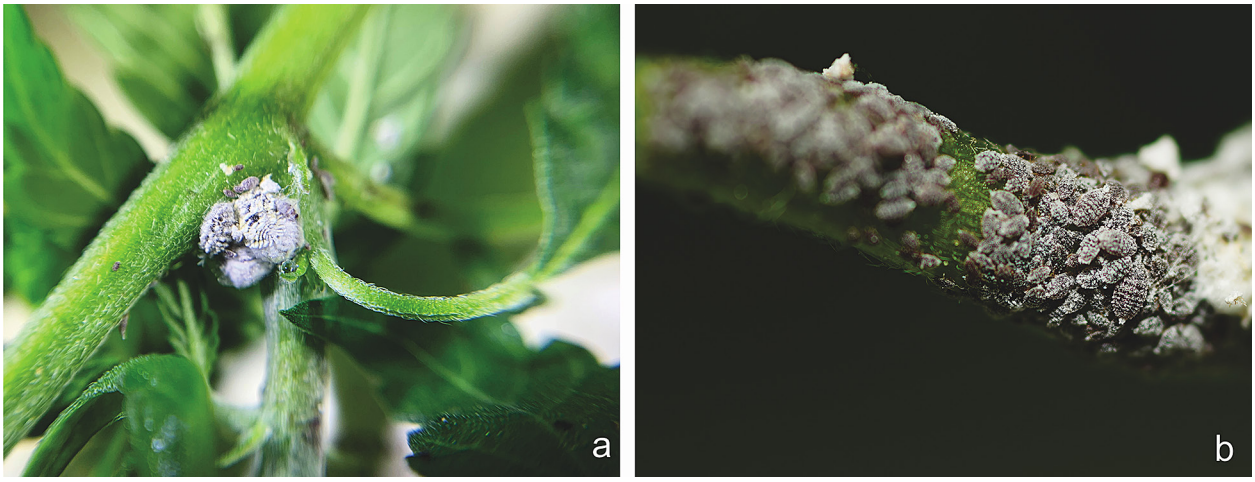

Figure 2. Infestation of *Nipaecoccus viridis* on hemp, *Cannabis sativa* L., in Florida (FDACS-DPI # E2021-1852-1). **a)** Settled 3rd instar and young adult females. **b)** 1st and 2nd instar (10 ×).

could move easily with both fruit and pickers, especially at a U-pick operation. Infested plant material and fruit are subject to quarantine nationally and internationally due to the status of *N. viridis* as a pest of concern in the USA and Europe (EPPO Global Database 2019; FDACS-DPI Database 2021). In the case of the organic U-pick farm, the crop may become unmarketable as infested plants become unsightly with wax and sooty mold (Figure 1). If chemical controls are applied at these farms, the growers may lose their organic status, negatively affecting the crop's marketability and sale value. Early detection of this pest at immature stages or low populations will be vital for organic U-pick farms as the sooty mold and waxy mess associated with severe infestations of adult females would harm these operations significantly.

The infestation of *N. viridis* is also of concern to hemp, *Cannabis sativa* L. (Rosales: Cannabaceae). Florida's budding hemp industry boasts a $370 million economic impact, with over $17 million in tax revenue in the first year Florida's hemp program allowed cultivation of the crop within the state (WTXL 2021). The discovery of this destructive invasive pest on this crop for the state of Florida warrants further observation, and growers should be aware not only of the pest but should also be prepared to detect it in their crops before infestations reach severity (Figure 2).

The discovery of *N. viridis* on two new hosts is a problem not limited to growers of blueberries and hemp in Florida. This polyphagous pest has demonstrated its ability to feed on a diverse range of hosts from 29 different plant families (García Morales et al. 2016). We recently found heavy infestations of *N. viridis* for the first time from the residential landscape in Palm Beach County (Figure 3) on two ornamental plant species, *Nerium oleander* L. (Gentianales: Apocynaceae) and *Jatropha* sp. L. (Malpighiales: Euphorbiaceae). This proliferation of *N. viridis* outside of the agricultural setting further underscores the pest's ability to cause economic damage in a variety of environments.

Although *N. viridis* infestations in the USA are currently limited to Florida, it may eventually spread to other states. For example, *N. viridis* has been reported outside of Florida thrice: A nursery in North Carolina intercepted *N. viridis* on *Gardenia* sp. J. Ellis (Gentianales: Rubiaceae) (FDACS-DPI # 2020-2653-1), a nursery in Maryland on *Portulacaria afra* Jacq. (Caryophyllales: Didiereaceae) (FDACS-DPI # 2021-4272-1), and a residential area in Texas on *Citrus aurantifolia* (Christm.) Swingle (Sapindales: Rutaceae) (FDACS-DPI # 2023-02107).

Nipaecoccus viridis hides and feeds in cryptic locations such as plant nodes and under the fruit calyx, and it is likely to be shipped to other states and countries in produce and nursery stock exported by Florida. The prevention of *N. viridis*' spread to more hosts and locations will be dependent on rigorous inspection, which will be aided by the application of the host and location data provided in this study.

Figure 3. Infestation of *Nipaecoccus viridis* on *Nerium oleander* L. (FDACS-DPI # E2027-01-04292022-03815) and *Jatropha* sp. L. (FDACS-DPI # E2028-01-04292022-03816) in Florida. **a)** Adult females with ovisacs co-infested with *Fiorinia phantasma* Cockerell and Robinson on jatropha (naked eye view). **b)** Clusters of adult females on oleander (naked eye view).

Acknowledgments

The authors thank the Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville, Florida, for providing facilities and space to perform this work, and the Florida State Collection of Arthropods, Gainesville, Florida, for granting permission to use the slide collection. Special thanks to Douglass Miller (Florida State Collection of Arthropods and retired Research Entomologist, Systematic Entomology Laboratory, USDA) for providing constructive advice during this study. Thanks to Erin Powell, Gareth Powell, Susan Halbert, and Trudi Deuel, Florida Department of Agriculture and Consumer Services, Division of Plant Industry (FDACS-DPI), for constructive reviews. We thank Gabi Ouwinga (FDACS-DPI) for mounting and curating slides and for her involvement in the survey of Cedar Key. We also thank Lance Osborne (University of Florida) for sending us samples and images and Greg Hodges, Leroy Whilby, and Paul Skelley (FDACS-DPI) for providing administrative support during this study.

Literature Cited

Ahmed MZ, Hodges G, Diepenbrock LM. 2019. *Nipaecoccus viridis* (Newstead), Lebbeck Mealybug, (Coccoidea: Pseudococcidae). Pest Alert. FDACS-P-02116. Available at https://www.fdacs.gov/content/download/84014/file/pest-alert-nipaecoccus-viridis.pdf (Last accessed May 15, 2023.)

Diepenbrock LM, Ahmed MZ. 2020. First report of *Nipaecoccus viridis* (Hemiptera: Pseudococcidae) associated with citrus production in the United States. Journal of Integrated Pest Management 11(1): 7.

EPPO Global Database. 2019. Mini data sheet on *Nipaecoccus viridis*. Available at https://gd.eppo.int/taxon/NIPAVI/documents (Last accessed October 26, 2021.)

FDACS (Florida Department of Agriculture and Consumer Services). 2019. Florida Agriculture Overview and Statistics. Available at https://www.fdacs.gov/Agriculture-Industry/Florida-Agriculture-Overview-and-Statistics. (Last accessed May 15, 2022.)

FDACS-DPI Entomology Database. 2021. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville, FL. Available via Public Records Request (Last accessed January 20, 2021.)

García Morales M, Denno BD, Miller DR, Miller GL, Ben-Dov Y, Hardy NB. 2016. ScaleNet: a literature-based model of scale insect biology and systematics. Database 2016: 1–5.

Ghosh AB, Ghose SK. 1989. Descriptions of all instars of the mealybug *Nipaecoccus viridis* (Newstead) (Homoptera, Pseudococcidae). Environment and Ecology 7(3): 564–570.

Olabiyi, D, Middleton E, Ahmed MZ, Osborne, LS, McKenzie CL, Diepenbrock L. 2023. Hibiscus mealybug (Hemiptera: Pseudococcidae) – biology, host plants, current management practices, and a field guide for North America. Journal of Integrated Pest Management 14(1): 3.

Sharaf NS, Meyerdirk DE. 1987. A review on the biology, ecology and control of *Nipaecoccus viridis* (Homoptera: Pseudococcidae). Miscellaneous Publications of the Entomological Society of America 66: 1–18.

Stocks IC, Hodges G. 2010. *Nipaecoccus viridis* (Newstead), a New Exotic Mealybug in South Florida (Coccoidea: Pseudococcidae). Pest Alert. DACS-P-01716. Available at https://www.fdacs.gov/content/download/66447/file/Pest_Alert_-_Nipaecoccus_viridis,_a_New_Exotic_Mealybug.pdf (Last accessed May 15, 2023.)

von Ellenrieder N, Watson GW, Kinnee SA. 2018. Identification of *Nipaecoccus* (Hemiptera: Coccomorpha: Pseudococcidae) species in the United States, with descriptions of *Nipaecoccus bromelicola* sp. n. and the male of *N. floridensis* Beardsley. Zootaxa 4444(2): 163–178.

WTXL. 2021. WTXL Tallahassee**.** FDACS Celebrates One Year of Florida's State Hemp Program, $370 Million in Economic Impact. Available at https://www.wtxl.com/news/local-news/fdacs-marks-1-year-of-floridas-state-hemp-program-370m-economic-impact (Last accessed May 19, 2023.)

Received March 30, 2023; accepted May 18, 2023.
Review editor David Plotkin.