REDIA, XCIX, 2016: 229-231 http://dx.doi.org/10.19263/REDIA-99.16.31

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THE ARMORED SCALE INSECTS (HEMIPTERA DIASPIDIDAE) OF ALABAMA, USA ([1])

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Waltman K.G., Ray C.H. Jr., Wıllıams M.L. – The armored scale insects (Hemiptera Diaspididae) of Alabama, USA.

A continuing survey of the armored scale insects of Alabama has resulted in recording 113 species in 47 genera, among the tribes Aspidiotini, Diaspidini, and Odonaspidini. Alabama now ranks second among states in the southeastern United States in number of species of armored scales, trailing only Florida with its 150+ species. Comments on some of the more notable diaspidids, not previously collected in Alabama, are made along with notes on their hosts and distribution in the State.

KEY WORDS: biodiversity, Aspidiotini, Diaspidini, Odonaspidini

INTRODUCTION

The family Diaspididae (armored scale insects), is a large and diverse family, which is widely distributed across the state of Alabama. Yet, there is no published literature available cataloging the occurrence of armored scale insects in Alabama. OWEN (1925), BOYD (1932), TIPPINS (1953), and WALTMAN (2008) all did Master's theses pertaining to scale insects in general, or select scale insects that included Diaspididae in Alabama. WALTMAN (2008) was the most inclusive of the four and she listed 107 species in 42 genera as occurring in Alabama. Two studies on the biology of tea scale and obscure scale were completed by CHIU (1974) and HENDRICKS & WILLIAMS (1992) respectively.

Although there is a lack of published information for Alabama distributions and records, work with this family in several other sister-states has been published. Comprehensive coverage of host plant relationships, distribution, and morphology was recorded for the armored scales of Florida by DEKLE (1965). In Georgia, Beshear, Tippins, and Howell published a short listing in 1973, in which they cited 100 species in 46 genera (BESHEAR *et al*., 1973). There are also publications available for Mississippi & Louisiana including HERRICK (1911) listing certain scale insects in the Mississippi region and HOWARD & OLIVER (1985) listing the armored scales of Louisiana.

The purpose of this paper is to document the current results of a continuing survey on the scale insects of Alabama, begun in 1973, by publishing a listing of the species of armored scale insects recorded in Alabama to date.

MATERIALS AND METHODS

Upon joining the faculty at Auburn University in March of 1973, the third author began a research project to survey the scale insects of Alabama.

All the known literature pertaining to the family Diaspididae and its occurrence in Alabama was reviewed and any pertinent information was integrated into a research database. Literature on Diaspididae from surrounding states was also reviewed for comparison purposes. All generic and species names recorded from Alabama during this survey were compared to the diaspidid information listed on the scale insect database ScaleNet (http://scalenet.info) (GARCIA *et. al.* 2015) to insure that all of the records being generated used the most current terminology.

The slide collection and records of the U. S. National Museum and the U. S. Department of Agriculture in Beltsville, Maryland were examined for Alabama records and all information pertaining to Alabama records were incorporated in our survey database

Dried pre-collected material was gathered from around the state from different institutions and individuals to identify any species not already recorded in the state. They were then slide mounted, examined, identified, and pertinent collection information was recorded in the Auburn University scale card catalogue.

Throughout the survey fresh material was collected from different regions of Alabama. Special attempts were made to collect armored scales that had been recorded from neighboring states but had not yet been collected in Alabama. Samples of all collected material were slide mounted, assigned a slide number, identified, and the slide number and collection information including host, locality, date of collection and collector were recorded in both a slide mounting record book and a survey database. All slide-mounted specimens collected during the survey are deposited in the Auburn University Coccoidea Collection (AUCC).

Additional information was recorded for each identified species that included: biology, distribution across Alabama, a listing of host plant species, a photograph of the specimens (before slide mounting), and a short description of morphological characters of the cover, for aid in simplification of field identification. This information will be used to publish a manual of the Diaspididae of Alabama for use by extension personnel, regulatory officials, and the general public at a later date.

[1] Original scientific contribution presented and discussed at XIV International Symposium on Scale Insect Studies, Catania-Italy, 13-16 June 2016.

– Received 20 September 2016 Accepted 24 October 2016

RESULTS AND DISCUSSION

Prior to this survey, begun in 1973, only 48 species belonging to 17 genera of Diaspididae were recorded in Alabama. As a result of this survey, Alabama now has recorded 113 species in 47 genera. A breakdown of the armored scale insects of Alabama listed by tribe, genus, and number of species (in parentheses) is presented in Table 1, and an alphabetical listing of the 113 species currently recorded in Alabama is presented in Table 2. This study has added 65 previously unrecorded species of Diaspididae in Alabama. Not included in the list of species recorded in Alabama are an undescribed species of *Clavaspis* and an undescribed species of *Lindingaspis* which were collected in Alabama and are currently being described.

Table 1 – Alabama armored scale insects.
(Reported by tribe, genera, and number of species in parentheses)

Odonaspidini - 2 genera	**Diaspidini - 24 genera**
Odonaspis (3)	*Aonidomytilus* (4)
Froggattiella (1)	*Aulacaspis* (2)
	Carulaspis (2)
Aspidiotini - 21 genera	*Chionaspis* (13)
Abgrallaspis (3)	*Diaspis* (4)
Acutaspis (2)	*Duplachionaspis* (1)
Aonidia (1)	*Fiorinia* (2)
Aonidiella (2)	*Fissuraspis* (1)
Aspidiella (1)	*Gymnaspis* (1)
Aspidiotus (3)	*Haliaspis* (1)
Chortinaspis (1)	*Kuwanaspis* (3)
Chrysomphalus (4)	*Lepidosaphes* (7)
Clavaspis (2 + 1 undescribed))	*Lopholeucaspis* (1)
Comstockaspis (1)	*Neopinnaspis* (1)
Comstockiella (1)	*Niveaspis* (1)
Diaspidiotus (11)	*Parlatoria* (3)
Dynaspidiotus (1)	*Pinnaspis* (2)
Hemiberlesia (5)	*Pseudaulacaspis* (3)
Lindingaspis (1 undescribed)	*Pseudoparlatoria* (1)
Melanaspis (7)	*Quernaspis* (1)
Morganella (1)	*Thysanofiorinia* (1)
Oceanaspidiotus (1)	*Unachionaspis* (1)
Pseudaonidia (2)	*Unaspis* (1)
Rhizaspidiotus (1)	*Velataspis* (1)
Selenaspidus (1)	

The following two species, previously recorded in Alabama, could not be verified by us as actually occurring in the State as they were not recollected by us and there were no slide-mounted specimens from Alabama in any of the collections we examined: *Chrysomphalus diversicolor* (Green) – A single USDA record listed this species as being collected from Jefferson County, Alabama on palms. The Birmingham Botanical Gardens is in Jefferson County and they have a palm collection so this is possibly a valid record; and *Lepidosaphes lasianthi* (Green) – Another USDA record listed this species as occurring in Alabama, but according to TAKAGI (1970) all records of *Lepidosaphes lasianthi* in Hawaii, the Philippines and North America are all misidentifications of *Lepidosaphes tokionis* (Kuwana). We have not collected *L. tokionis* in Alabama and the listing of this species in Table 2 is based on the reference by TAKAGI (1970).

Alabama now ranks number two in terms of number of species of diaspidids in the southeastern United States. Alabama is second only to Florida with 150+ species. The only other state in our region that has recorded anywhere near as many species as Alabama is our neighboring state of Georgia with 105 diaspidids recorded. Although our other neighbors like Mississippi, Tennessee, Louisiana and Kentucky have recorded much lower numbers of species (all below 70), we have no doubt that this is largely due to a lack of collecting with this particular group of insects in those states.

Some of the more notable diaspidids that were not previously collected in Alabama include *Melanaspis arundinariae* Deitz & Davidson, which had previously only been collected in South Carolina as far as U.S. records are concerned. They also include *Quernaspis quercicola* Tippins & Beshear, which worldwide had only been collected in Georgia and is quite a rare find. Lastly, *Diaspidiotus crystallinus* Ferris has also been found in Alabama in multiple locations and had only been recorded worldwide from Texas.

The discovery of these and several other newly recorded diaspidids have great implications for Alabama and the surrounding states. Species that were previously thought to be primarily of western distribution, like *D. crystallinus* and *Clavaspis texana* Ferris, may actually be distributed across the nation. Species that are considered serious pests in other states, like the newly recorded *Aspidiella sacchari* (Cockerell), may be newly introduced or may simply be inhibited by some unseen factor keeping it from reaching pest status in Alabama. More research and additional surveys in other states would greatly contribute to helping answer these questions and many more for the better of state-wide integrated pest management programs.

ACKNOWLEDGEMENTS

The third author thanks all his former graduate students who spent many hours collecting and mounting scale insects during the many years of this survey, but especially Krystal Waltman, Charles H. Ray, Jr., Gary L. Miller, Harlan Hendricks and Takumasa (Demian) Kondo.

Thanks to Dr. Dug Miller (retired) and Dr. Gary L. Miller, Systematic Entomology Laboratory, USNM Coccoidea Collection, Beltsville, Maryland, for allowing us access to the collection and associated records of the USNM.

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Table 2 – Alphabetical listing of the Diaspididae recorded in Alabama.

1. *Abgrallaspis cyanophylli* (Signoret)
2. *Abgrallaspis ithacae* (Ferris)
3. *Abgrallaspis liriodendri* Miller and Howard
4. *Acutaspis morrisonorum* Kosztarab
5. *Acutaspis perseae* (Comstock)
6. *Aonidia atlantica* Ferris
7. *Aonidiella aurantii* (Maskell)
8. *Aonidiella taxus* Leonardi
9. *Aonidomytilus crookiae* (Ferris)
10. *Aonidomytilus hyperici* Ferris
11. *Aonidomytilus sabatius* Tippins
12. *Aonidomytilus solidaginis* (Hoke)
13. *Aspidiella sacchari* (Cockerell)
14. *Aspidiotus cryptomeriae* Kuwana
15. *Aspidiotus marisci* Tippins & Beshear
16. *Aspidiotus nerii* Bouché
17. *Aulacaspis rosae* (Bouché)
18. *Aulacaspis yasumatsui* Takagi
19. *Carulaspis juniperi* (Bouché)
20. *Carulaspis minima* (Signoret)
21. *Chionaspis americana* Johnson
22. *Chionaspis caryae* (Cooley)
23. *Chionaspis furfura* (Fitch)
24. *Chionaspis gleditsiae* Sanders
25. *Chionaspis heterophyllae* Cooley
26. *Chionaspis kosztarabi* Takagi & Kuwana
27. *Chionaspis longiloba* Cooley
28. *Chionaspis nyssae* Comstock
29. *Chionaspis pinifoliae* (Fitch)
30. *Chionaspis platani* (Cooley)
31. *Chionaspis salicis* (Linnaeus)
32. *Chionaspis styracis* Liu & Kosztarab
33. *Chionaspis triformis* Tippins & Beshear
34. *Chortinaspis subchortina* (Laing)
35. *Chrysomphalus aonidum* (Linnaeus)
36. *Chrysomphalus bifasciculatus* Ferris
37. *Chrysomphalus dictyospermi* (Morgan)
38. *Chrysomphalus diversicolor* (Green)
39. *Clavaspis crypta* Howell & Tippins
40. *Clavaspis texana* Ferris
41. *Comstockaspis perniciosis* (Comstock)
42. *Comstockiella sabalis* (Comstock)
43. *Diaspidiotus ancylus* (Putnam)
44. *Diaspidiotus bumeliae* Ferris
45. *Diaspidiotus coniferarum* (Cockerell)
46. *Diaspidiotus crystallinus* Ferris
47. *Diaspidiotus forbesi* (Johnson)
48. *Diaspidiotus juglansregiae* (Comstock)
49. *Diaspidiotus liquidambaris* (Kotinsky)
50. *Diaspidiotus mccombi* McKenzie
51. *Diaspidiotus osborni* (Newell & Cockerell)
52. *Diaspidiotus taxodii* (Ferris)
53. *Diaspidiotus uvae* (Comstock)
54. *Diaspis boisduvalii* Signoret
55. *Diaspis bromeliae* (Kerner)
56. *Diaspis echinocacti* (Bouché)
57. *Diaspis townsendi* Cockerell
58. *Duplachionaspis divergens* (Green)
59. *Dynaspidiotus californicus* (Coleman)
60. *Fiorinia fioriniae* (Targioni-Tozzeti)
61. *Fiorinia theae* Green
62. *Fissuraspis ulmi* (Hoke)
63. *Froggattiella penicillata* (Green)
64. *Gymnaspis aechmeae* Newstead
65. *Haliaspis spartinae* (Comstock)
66. *Hemiberlesia diffinis* (Newstead)
67. *Hemiberlesia lataniae* (Signoret)
68. *Hemiberlesia neodiffinis* Miller & Davidson
69. *Hemiberlesia palmae* (Cockerell)
70. *Hemiberlesia rapax* (Comstock)
71. *Kuwanaspis hikosani* (Kuwana)
72. *Kuwanaspis howardi* (Cooley)
73. *Kuwanaspis pseudoleucaspis* (Kuwana)
74. *Lepidosaphes beckii* (Newman)
75. *Lepidosaphes camelliae* Hoke
76. *Lepidosaphes gloverii* (Packard)
77. *Lepidosaphes lasianthi* (Green)
78. *Lepidosaphes newsteadi* (Sulc)
79. *Lepidosaphes pallida* (Maskell)
80. *Lepidosaphes ulmi* (Linnaeus)
81. *Lopholeucaspis japonica* (Cockerell)
82. *Melanaspis arundinariae* Deitz & Davidson
83. *Melanaspis bromeliae* (Leonardi)
84. *Melanaspis deklei* Dietz & Davidson
85. *Melanaspis nigropunctata* (Cockerell)
86. *Melanaspis obscura* (Comstock)
87. *Melanaspis smilacis* (Comstock)
88. *Melanaspis tenebricosa* (Comstock)
89. *Morganella cueroensis* (Cockerell)
90. *Neopinnaspis harperi* McKenzie
91. *Niveaspis ilicis* (Hoke)
92. *Oceanaspidiotus spinosus* (Comstock)
93. *Odonaspis benardi* Balachowsky
94. *Odonaspis ruthae* Kotinsky
95. *Odonaspis saccharicaulis* (Zehntner)
96 *Parlatoria camelliae* Comstock
97. *Parlatoria pergandii* Comstock
98. *Parlatoria theae* (Cockerell)
99. *Pinnaspis aspidistrae* (Signoret)
100. *Pinnaspis strachani* (Cooley)
101. *Pseudaonidia duplex* (Cockerell)
102. *Pseudaonidia paeoniae* (Cockerell)
103. *Pseudaulacaspis cockerelli* (Cooley)
104. *Pseudaulacaspis pentagona* (Targioni-Tozzetti)
105. *Pseudaulacaspis prunicola* (Maskell)
106. *Pseudoparlatoria parlatorioides* (Comstock)
107. *Quernaspis quercicola* Tippins & Beshear
108. *Rhizaspidiotus dearnessi* (Cockerell)
109. *Selenaspidis articulatus* (Morgan)
110. *Thysanofiorinia nephelii* (Maskell)
111. *Unachionaspis tenuis* (Maskell)
112. *Unaspis euonymi* (Comstock)
113. *Veletaspis dentata* (Hoke)

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