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OUTBREAK OF AULACASPIS YASUMATSUI IN JAPAN (STERNORRHYNCHA: COCCOIDEA: DIASPIDIDAE)

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Abstract

TAKAGI, S., 2023. Outbreak of *Aulacaspis yasumatsui* in Japan (Sternorrhyncha: Coccoidea: Diaspididae). *Ins. matsum. n.s.* 79: 81–84, 2 tables.

Serious damage caused by *Aulacaspis yasumatsui* Takagi was found on *Cycas revoluta* in the island of Amami-Ôsima, Japan, in 2022. This scale insect was originally described from Bangkok, Thailand, a locality possibly included in the range of natural distribution of the species; in recent years it has invaded many other areas of the world and is now known as a world-wide catastrophic pest of cycads under the name Cycad Aulacaspis Scale or CAS. In this article, the material of CAS forwarded to the author from various areas for identification has been re-examined for tracing the invasion into Amami-Ôsima.

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In October and November, 2022, serious damage caused by *Aulacaspis yasumatsui* Takagi on *Cycas revoluta* was found in the island of Amami-Ôsima [Amami-Ôshima], Japan. In this country this is the first record of the scale insect, which is now known as a catastrophic pest of cycads under the name Cycad Aulacaspis Scale or CAS in many areas of the world where it invaded in the past decades—undoubtedly through commercial transmission of cycads for ornamental use, no other situations being supposable. According to a news account on Amami-Shimbun dated December 7, 2022, many hundreds of cycads, 711 in estimation, were found to have been infested with CAS, especially heavily in the District of Naze, Amami City. By this account, nothing has been heard from inhabitants in the district about possible recent introduction of cycads from the outside. However, in my understanding, it is broadly known among the inhabitants that the outbreak began in and around Yagi-Zima, an islet, which is a tourist area in Naze Bay.

So far as I am aware, no solid information is available as to when, from where, and how CAS was introduced into Japan except for the report made by Tokihiro (2006), who recorded the importation of CAS as follows: 'Taiwan→Moji Port, 21 Apr. 2005, on Bulb of *Cycas revoluta*, leg. T. Sakai & S. Sumi'. I examined six adult females mounted from the material collected from the bulb checked at that time and identified them with *Aulacaspis yasumatsui*; the specimens examined at that time are those of 'Taiwan 3' in Table 1 in the present paper. However, I have failed to get information about the whereabouts of the cycads imported into Japan at that time.

I have had further opportunities to examine material of CAS from Taiwan, 'Taiwan 1' and 'Taiwan 2' in Table 1 (but I have no knowledge about the detailed localities in Taiwan where the cycads concerned were bred). 'Taiwan 2' and 'Taiwan 3' show the total numbers of the dorsal macroducts and the perivulvar disc pores largely overlapping, so that they are united together to form 'Taiwan 2+3' for making comparisons with 'Bangkok, 1972' and 'Amami-Ôsima, 2022', all in the same sample size.

CAS feeds not only on the aerial parts but also on the roots of the host plants, and this habit 'may be an important adaptation to surviving bush fires' in the monsoon tropics (Howard et al., 1999). The native land of CAS is unknown, but in the present state of our knowledge, there may be no good reason for excluding Bangkok, the type locality, from the possible native distribution range of CAS.

In Takagi and De Faveri (2009, Fig. 1), the adult female samples of CAS from Bangkok, Hong Kong, and Taiwan are compared by means of polygons drawn on the basis of the interrelation between the total perivulvar disc pores and the total submedian and submarginal dorsal macroducts. In the present paper, I have made comparisons among these samples and the newly added sample from Amami-Ôsima by means of numerals (Table 1), which, in my expectation, should show expanded variations in the populations occurring now in the invaded areas. Numbers of the wax organs in a few individuals available from some other localities of the world are given supplementarily (Table 2).

Aulacaspis yasumatsui or CAS should be native to somewhere in monsoon tropical Asia. In recent years it has spread broadly in the world probably through commercial transmission of cycads, making outbreaks undoubtedly under the absence of effective natural enemies in new localities, thus increasing genetic and phenotypic diversities in the growing populations and changing some ecological—physiological and morphological—characters in adaptation to the natural conditions of the new localities.

Table 1 shows that the sample from Amami City largely overlap with ‘Taiwan 2+3’ in the ranges of the total submedian and submarginal macrducts and the total perivulvar disc pores. So far as based on this fact, the possibility may not be excluded that the population in Amami City has its origin in the breeder of the cycads ‘Taiwan 3’. In another possible interpretation, the Amami population, introduced from any other area of the world, should have made a variation similar to that in the Taiwan population.

Because the islands of Amami-Ôsima and Tawian are separated from each other not very distantly and enjoy similar subtropical climates, the invasion and inhabitation of CAS in Amami-Ôsima may have been easier from Taiwan than from any other area, for example, Thailand, especially in view of acclimatization of the invading population. So far as based on the limited information and knowledge now available, it may be plausible and reasonable to suppose that the population of CAS in the island of Amami-Ôsima has its immediate origin in Taiwan and that the invasion was made at least once, in 2005. All this may be no more than supposition, but I would like to venture to say that, in retrospect, there should have been a chance in 2005 to prevent the invasion of CAS into Japan by banning import of cycads especially from Taiwan and also inhibiting domestic transportation of the cycads imported into Japan at that time. Now that rapid establishment of effective biological control is not expectable, temporary counter-plan may be limited to promoting chemical control. Recently, Takanashi (2023) revised outbreaks of CAS and countermeasures adopted, mainly chemical, in some areas including Amami-Ôsima, and advanced some proposals for improving the chemical control of CAS.

Acknowledgements

I got from Mr. Hiroyuki Takanashi, a cycadophilist in Ôsaka, the first information about the outbreak of CAS in the island of Amami-Ôsima. He also informed me about Mr. Daisuke Uchiyama, an inhabitant of the island; he and his mother, Mrs Hatsumi Uchiyama, have been in action in the island against the disaster. Mr. Uchiyama collected material of CAS in the island for my present study. Mr. Jui Tse Chang, a student in Taiwan, read at my request a draft of this manuscript and posed many questions, which apparently require for settlement further and fuller information. Mr. Takanashi also read the manuscript at my request.

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Table 1. Total numbers of submedian and submarginal dorsal macroducts and perivulvar disc pores in some local samples (collected in or imported from the areas concerned) of *Aulacaspis yasumatsui*. Range and mean; [ ]: number of individuals examined; s: standard deviation.

Sample from:	Macroducts	Perivulvar disc pores
Bangkok, 1972	27—35.7—46 [30], s=4.7	77—91.2—101 [30], s=6.1
Hong Kong, 1992	58—70,0—90 [18]	89—95.7—113 [18]
Taiwan 1, 2006	32—58.2—66 [20]	70—92.2—110 [20]
Taiwan 2, 2006	59—80.0—98 [24]	103—117.4—132 [24]
Taiwan 3, 2005	70—73.8—82 [6]	111—126.0—138 [6]
Taiwan 2+3	59—78.7—98 [30], s=9.6	103—119.1—138 [30], s=9.9
Amami-Ôsima, 2022	60—81.2—99 [30], s=11.0	99—118.0—135 [30], s=9.5

‘Hong Kong 1992’: Sun Chui Estate. ‘Taiwan 1’ & ‘Taiwan 2’: R. Bailey leg. ‘Taiwan 3’: intercepted in quarantine in Japan. ‘Taiwan 1’ includes two individuals apparently abnormal in having much fewer macroducts and disc pores; they, however, are not excluded from the sample. ‘Taiwan 2’ and ‘Taiwan 3’, largely overlapping in their ranges, are united into ‘Taiwan 2+3’.‘Amami-Ôsima, 2022’: Nov. 21, Naze, Amami City, D. Uchiyama leg.

Table 2. Total numbers of submedian and submarginal dorsal macroducts and perivulvar disc pores in slide-mounted specimens accepted for confirming the identification.

Specimens from:	Macroducts	Perivulvar disc pores
Vietnam, 1995	47, 53, 79	82, 100,150
Guam, 2005	37, 37, 64	69, 88, 91
Puerto Rico, 1999	58	92
Florida, 1996, 2001	54, 56	77, 94

‘Vietnam, 1995’: collected in quarantine in the Netherlands.‘Guam, 2005’: collected at Mangilao. ‘Puerto Rico, 1999’: collected at Dorado. ‘Florida, 1996, 2001’: collected at Miami and Palm Harbor.