

**Illustrated field guide to the *Argiope* spiders (Araneidae)
of the western Pacific islands, including a bibliography of
web-decorating behaviour in orb-weaving spiders**

Compiled by

Alexander M. Kerr

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Gef dankulu na Saina Ma'åse, todü hamyo!

SUMMARY

Argiope spp. are colourful and conspicuous spiders native worldwide, including the tropical western Pacific, where diversity is highest. They build near-vertical, planar webs, often "decorating" them with central strips or discs of bright silk whose function has long been debated. Here, I compile an illustrated and annotated guide to the *Argiope* spp. inhabiting the western Pacific Ocean. I also provide a comprehensive bibliography of web decorating by orb-weaving spiders. Of the 88 species of *Argiope* reported worldwide, there are 30 species known from the Pacific islands within the roughly triangular area framed by the Hawaiian Islands, Taiwan, and Indonesia. New Guinea is the most speciose with 15 species, while the Mariana Islands and Marshall Islands of Micronesia each possess but one, *A. appensa* (Walckenaer, 1841), which occurs throughout the region under study. This compilation is part of a project to address geographic-scale patterns in web-decorating behaviour by *Argiope*.

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INTRODUCTION

This report has been prepared as part of a feasibility study of the biogeography and ecology of the orb-weaving spider *Argiope appensa* (Walckenaer, 1841) (Araneidae). This species inhabits most islands in the tropical western Pacific Ocean. Within its geographic range are numerous co-occurring and closely allied species with likely moderately to strongly overlapping ecologies and life histories. In this report, I tally the other *Argiope* species with which *A. appensa* is known or likely to interact and thus serve as potential subjects of a geographic-scale comparative ecological study.

The spider family Araneidae Clerck, 1757 consists of 174 genera found worldwide, many of which build orb webs. One subfamily, the Argiopinae Simon, 1890, of 104 large and primarily tropical species is composed of three genera, *Argiope*, *Gea*, and *Neogea*. Key systematic reviews of the subfamily include Bjørn (1997), Jäger (2012), and Levi (1983, 2004), while the most current catalogue of species is the World Spider Catalog (2018). The argiopines are united by numerous eye and genitalic characters, as well as similar ecologies. They are mostly rather large, diurnal species that frequently include in their webs central strips or discs of white silk called 'decorations' or 'stabilimenta' whose function has long been the subject of spirited scientific debate. A bibliography of the relevant papers is provided in Appendix IV.

The largest genus *Argiope* Audouin, 1826 consists of 88 species. Of these, about 50 occur around the western Pacific rim. Most are large and colourful and build conspicuous webs in edge areas,



Figure 1. *Argiope appensa* (Walkenaer, 1841), the most widespread *Argiope* in the Pacific Ocean. (male, above, and female from Guam.) Photo: © 2012 G. Curt Fiedler.

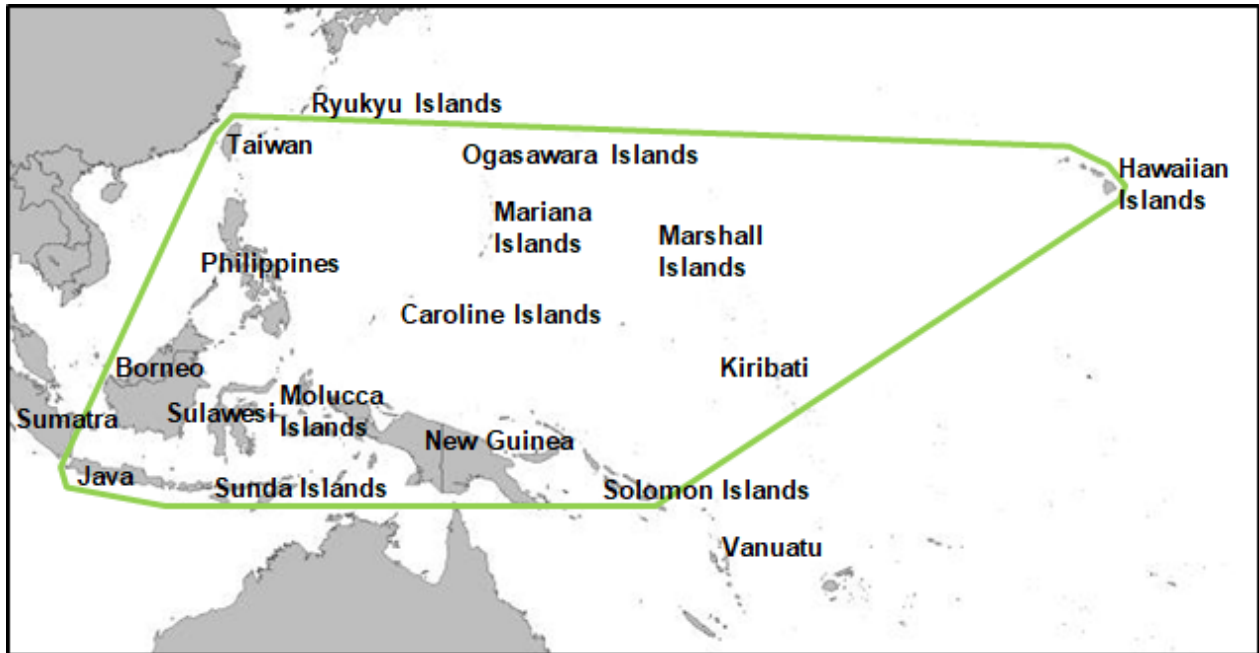


Figure 2. Regions used in this report that are within or immediately adjacent to the geographic range of *Argiope appensa*, shown as a minimum convex polygon spanning collection sites from Levi (1983).

along roadsides, in gardens, and field margins (Fig. 1). A few species, however, are fugitive, living in forest and building a web atop leaves (e.g., *A. chloreis*) or against the trunks of trees (e.g., *A. ocyaloides*). While some have quite restricted distributions, such as the single-island endemics on Pohnpei (*A. ponape*) and Chuuk (*A. truk*) in Micronesia, others are quite widespread and occasionally invasive, like *A. trifasciata* and *A. appensa*.

Argiope appensa (Fig. 1) has a broad and roughly right-triangular distribution across the western and central Pacific Ocean, from Taiwan, south to Java, Indonesia, and eastward to the Hawaiian islands (Fig. 2). On many of the larger continental islands, those in Indonesia, Melanesia, New Guinea, and the Philippines, *A. appensa* lives sympatrically with several other *Argiope* spp. Even in Oceania it co-exists with other species, such as in Micronesia with *A. catenulata* in Palau, and the aforementioned island endemics in Pohnpei and Chuuk. In the Hawaiian archipelago, *A. appensa* co-occurs with two invasive species, *A. amoena* and *A. trifasciata*, plus a likely endemic (Berry & Williams 2017), currently considered a subspecies, *A. trifasciata kauaiensis*. This broad distribution and manifold sympatry suggests that *A. appensa*

might serve as a candidate species to investigate the comparative biology of *Argiope* spiders, such as the evolutionary ecology of web-decorating behaviours.

COMPILATION OF DATA

The goal of this report was to compile an iconography to aid students in field identification of *Argiope* spp. whose distributions overlap geographically with *A. appensa*. For this, Levi's (1983) well-illustrated review was initially key. I assessed co-occurring species in two ways. First, I divided the islands within the range of *A. appensa* into 18 large islands or island groups (Figure 2). Three regions, the Ryukyu Islands, Sumatra, and Vanuatu lie just outside *A. appensa*'s recorded range, but are included because of their proximity to islands within the range. I then defined the range of each *Argiope* species as a minimum convex polygon encompassing all islands from which the species is known in Jäger (2012) and Levi (1983). If the polygons overlapped with the range of *A. appensa* they are included in the annotated list below.

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DISCUSSION

In this section, I discuss the findings and implications of tallying the species found within the geographic range of the focal species, *Argiope appensa*. First is outlined an updated species lists of each major island or island group. Inferred range extensions are given as are documented range extensions based on photo vouchers

Table 1. Presence/absence matrix of *Argiope* species in islands of the western Pacific Ocean. An 'S' indicates the suspected presence of the species on island groups occurring within the minimum convex polygon formed by island groups from which the species has been collected (Levi 1983) and denoted by a 'C'.

Species	Borneo	Carolines	Hawaiians	Java	Kiribati	Marianas	Marshalls	Moluccas	New Guinea	Ogasawaras	Philippines	Ryukyus	Solomons	Sulawesi	Sumatra	Sundas	Taiwan	Vanuatu
<i>A. aemula</i>	C	S		C				C	C		C	C	S	C	C	S	C	C
<i>A. aetherea</i>								C	C				C			C		C
<i>A. amoena</i>			C									S						
<i>A. appensa</i>	S	C	C	C	S	C	C	C	C	S	C	S	C	C		S	C	
<i>A. boesenbergi</i>												S					S	
<i>A. bougainvilla</i>									C				C					
<i>A. brunnescentia</i>									C				C					
<i>A. caledonia</i>																		C
<i>A. catenulata</i>	C	C		C				S	C		C				C	S		
<i>A. chloreis</i>	S			C				C	C					C	C	S		
<i>A. doboensis</i>								C	C									
<i>A. halmaherensis</i>								C	C									
<i>A. intricata</i>											C							
<i>A. lobata</i>	S			C				S	S				S	S		S		
<i>A. luzona</i>											C							
<i>A. magnifica</i>									C				C					
<i>A. manila</i>											C							
<i>A. minuta</i>												S						C
<i>A. modesta</i>	C							S						C		C		
<i>A. niasensis</i>				C											C			
<i>A. ocula</i>												S						C
<i>A. picta</i>								C	C				C			S		C
<i>A. ponape</i>		C																
<i>A. possoica</i>														C				
<i>A. reinwardti</i>	C			C				C	C					C	C	C		
<i>A. takum</i>									C									
<i>A. trifasciata</i>	S		C	S				S	C					S	C	S		
<i>A. tri. kauaiensis</i>			C															
<i>A. truk</i>		C																
<i>A. versicolor</i>	C			C											C			

found through images recovered from searching the internet. Then, I discuss the prospects for field diagnosis of the species using illustrations of adult female spiders. Finally, I sketch the background and motivation for undertaking this exercise, a proposed comparative study of the ecology of *Argiope* spiders.

Biogeography and range extensions

The geographic distribution of the focal species, *Argiope appensa* (Walckenaer, 1841) (Fig. 1), is the roughly triangular area framed by the Hawaiian Islands, Taiwan, and Indonesia (Fig. 2). Levi (1983) and more recent papers do not list *A. appensa* as occurring in Okinawa, however I have seen several photos of what appears to be this species from that region and assert its presence there (see discussion below). Its occurrence in the Hawaiian archipelago, like two other argiopines there (*A. amoena* and *A. trifasciata*), is thought to be due to a recent introduction (Suman 1964; Levi 1983).

Within the range of *A. appensa*, there are reported another 29 *Argiope* species (Table 1) out of a total of 88 species of *Argiope* described worldwide. New Guinea is the most speciose with 15 species, while the Mariana Islands and Marshall Islands of Micronesia each possess but one confirmed

species (Table 2). In Table 3 are listed the reported and suspected (in small caps) species from each island group within the range of *A. appensa*. In the case of some Oceanic island groups, there may well be no *Argiope* spp. present. For example, the Ogasawara (=Bonin) Islands have been carefully surveyed for spiders and while several large araneids are present (Ono 2011), *Argiope* is almost certainly absent.

By contrast, Kiribati, a group of atolls south of the Marshall Islands where *A. appensa* has been recorded (Levi 1983), has not been investigated for its arachnofauna as far as I am aware; hence, at least *A. appensa* may occur there.

Table 2. Estimated number of *Argiope* species in islands of the western Pacific Ocean. Estimated numbers from this study include all island groups found within the minimum convex polygon formed by collections on islands from Levi (1983). Species lists for each island are given in Table 3.

Island	Number of species	
	Levi (1983)	This study
Borneo	5	9
Caroline Islands	4	5
Hawaiian Islands	4	4
Java	8	9
Kiribati	0	1
Mariana Islands	1	1
Marshall Islands	1	1
Molucca Islands	7	11
New Guinea	14	15
Ogasawara Islands	0	1
Philippines	7	6
Ryukyu Islands	1	6
Solomon Islands	6	8
Sulawesi	6	8
Sumatra	7	7
Sunda Islands	3	10
Taiwan	4	5
Vanuatu	4	4

Table 3. List of *Argiope* species in islands of the western Pacific Ocean. Species given in small caps are predicted for island groups from which the species has not been collected, but which occur within the minimum convex polygon formed by islands from which the species has been collected and listed in Levi (1983).

Island group	Species
Borneo	<i>A. aemula</i> , <i>A. APPENSA</i> , <i>A. catenulata</i> , <i>A. CHLOREIS</i> , <i>A. LOBATA</i> , <i>A. modesta</i> , <i>A. reinwardti</i> , <i>A. TRIFASCIATA</i> , <i>A. versicolor</i>
Caroline Islands	<i>A. AEMULA</i> , <i>A. appensa</i> , <i>A. catenulata</i> , <i>A. ponape</i> , <i>A. truk</i>
Hawaiian Islands	<i>A. amoena</i> , <i>A. appensa</i> , <i>A. trifasciata</i> , <i>A. trifasciata kauaiensis</i>
Java	<i>A. aemula</i> , <i>A. appensa</i> , <i>A. catenulata</i> , <i>A. chloreis</i> , <i>A. lobata</i> , <i>A. niasensis</i> , <i>A. reinwardti</i> , <i>A. TRIFASCIATA</i> , <i>A. versicolor</i>
Kiribati	<i>A. APPENSA</i>
Mariana Islands	<i>A. appensa</i>
Marshall Islands	<i>A. appensa</i>
Molucca Islands	<i>A. aemula</i> , <i>A. aetherea</i> , <i>A. appensa</i> , <i>A. CATENULATA</i> , <i>A. chloreis</i> , <i>A. halmaherensis</i> , <i>A. LOBATA</i> , <i>A. MODESTA</i> , <i>A. picta</i> , <i>A. reinwardti</i> , <i>A. TRIFASCIATA</i>
New Guinea	<i>A. aemula</i> , <i>A. aetherea</i> , <i>A. appensa</i> , <i>A. bougainvilla</i> , <i>A. brunnescentia</i> , <i>A. catenulata</i> , <i>A. chloreis</i> , <i>A. doboensis</i> , <i>A. halmaherensis</i> , <i>A. LOBATA</i> , <i>A. magnifica</i> , <i>A. picta</i> , <i>A. reinwardti</i> , <i>A. takum</i> , <i>A. trifasciata</i>
Ogasawara Is.	<i>A. APPENSA</i>
Philippines	<i>A. aemula</i> , <i>A. appensa</i> , <i>A. catenulata</i> , <i>A. manila</i> , <i>A. luzona</i> , <i>A. intricata</i>
Ryukyus	<i>A. aemula</i> , <i>A. AMOENA</i> , <i>A. APPENSA</i> , <i>A. BOESENBERGI</i> , <i>A. MINUTA</i> , <i>A. OCULA</i>
Solomon Islands	<i>A. AEMULA</i> , <i>A. aetherea</i> , <i>A. appensa</i> , <i>A. bougainvilla</i> , <i>A. brunnescentia</i> , <i>A. LOBATA</i> , <i>A. magnifica</i> , <i>A. picta</i>
Sulawesi	<i>A. aemula</i> , <i>A. appensa</i> , <i>A. chloreis</i> , <i>A. LOBATA</i> , <i>A. modesta</i> , <i>A. possoica</i> , <i>A. reinwardti</i> , <i>A. TRIFASCIATA</i>
Sumatra	<i>A. aemula</i> , <i>A. catenulata</i> , <i>A. chloreis</i> , <i>A. niasensis</i> , <i>A. reinwardti</i> , <i>A. trifasciata</i> , <i>A. versicolor</i>
Sunda Islands	<i>A. AEMULA</i> , <i>A. aetherea</i> , <i>A. APPENSA</i> , <i>A. CATENULATA</i> , <i>A. CHLOREIS</i> , <i>A. LOBATA</i> , <i>A. modesta</i> , <i>A. PICTA</i> , <i>A. reinwardti</i> , <i>A. TRIFASCIATA</i>
Taiwan	<i>A. aemula</i> , <i>A. appensa</i> , <i>A. BOESENBERGI</i> , <i>A. minuta</i> , <i>A. ocula</i>
Vanuatu	<i>A. aemula</i> , <i>A. aetherea</i> , <i>A. caledonia</i> , <i>A. picta</i>

Field diagnosis

Field identification of the congeneric species co-occurring in the range of *A. appensa* varies from easy to difficult. There are likely cryptic species in unresolved complexes, especially among forms in southeast Asia and Indonesia (Jäger 2012; Tan 2018), as well as elsewhere (Bjørn 1997; Motta & Levi 2009). The taxonomy of spiders is invariably based on laboratory examination of genital characters *via* the morphology

of the male palpus and female epigynum. However, in most *Argiope* species the adult female possesses a distinctive body shape and colour pattern. Still, there is some variation within a species. Further, to the inexperienced observer, spiders can appear quite different if gravid *versus* unfed. Colour can vary, too, even within a single small island. For example, *A. appensa* on Guam can have a yellow or white abdomen, while those in the Hawaiian islands have distinctly striped legs (AMK, unpubl.). Males of most species by contrast are generally fugitive and look more alike interspecifically than do females. The males of some species have not even been recorded or collected (Levi 1983).

The most difficult group of *Argiope* spp in the Pacific islands to diagnose in the field appear to be those belonging to Levi's (1983) *aetherea* group. All of these spiders possess three white to yellow transverse abdominal stripes bordered by spots, a roughly pentagonal abdomen, and a cruciate web decoration, at least as adults. Members of this group within the range under study here include *A. aetherea*, *A. buehleri*, *A. doleschalli*, *A. luzona*, *A. reinwardti*, and *A. versicolor*. I think *A. aetherea* is likely a complex of species given its wide variation in abdominal shape and colour patterns. *A. doleschalli* has long been a synonym of *A. reinwardti*, but was recently resurrected by Jäger (2012). As well, Levi (1983) suspects that *A. buehleri* is a variant of *A. reinwardti*, as it differs by a single and only slightly different epigynal character. Another potentially confusing, albeit smaller group are those resembling *A. appensa*, including *A. modesta*, *A. mangal*, and an unidentified species from Vanuatu with a dorsally bright yellow abdomen, yet whose colour variation suggests that it is not *A. appensa*.

Despite these challenges, the adult females of most species of *Argiope* in the study area are nevertheless identifiable using the figures and photos provided herein. Characters helpful in the field are further highlighted in the species descriptions in Appendix I. Of the 30 species confirmed or inferred in the study area, I was able to find photographs of adult females *in vivo* for 21 or 70%. I did not attempt to tally figures of male or juvenile spiders; males are not known from some species and are more similar interspecifically, while juvenile appearance for most species is poorly documented. Of the 21 photographed species of females, 15 or 72% had photos of both the dorsal and

ventral sides. While clearly incomplete, the photographs have the merit of likely being of the most abundant and often observed of the studied species. Fortunately, the remaining nine species have been drawn by Levi (1983), albeit from preserved specimens as black-and-white illustrations of their dorsal and ventral aspects. Hence, all species in the study area have been illustrated in this report.

Comparative ecology of Argiope

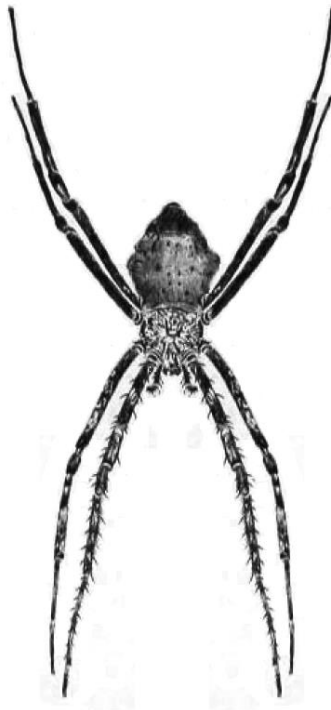
All *Argiope* build web decorations or "stabilimenta" of white aciniform silk (Levi 1983) thought to, among other things, attract prey, distract predators, or warn flying birds of the webs' location. An interesting history of the study of web decorations is found in Herberstein et al. (2000) and Bruce (2006). I surveyed variation in decoration frequency of *A. appensa* among islands in the Marianas and found that webs on Guam are the least frequently decorated webs in the archipelago and even among *Argiope* spp. worldwide (Kerr 1993). I could only speculate that the low prevalence was due to environmental factors likewise unique to the island, the most obvious candidate being the loss of its native avifauna due to an introduced snake. Work on understanding the indirect effects of these extinctions on Guam's ecosystem, including its spiders, is now underway by Rogers et al. (e.g., 2012, 2017). Also recently, Yeh et al. (2015) have performed field experiments with *Argiope* webs indicating that there exists conflicting selection for prey attraction and predator avoidance that acts to modify decoration frequency and changes in decoration patterns.

The interesting work of Yeh et al. (2015), among others, suggest several hypotheses to test their ideas that might be approached *via* large-scale mensurative and experimental comparative studies of co-occurring *Argiope* species. For example, one predicts that similar species that co-occur in the same habitat and therefore are potentially catching the same prey and avoiding the same predators, may respond similarly in decorating behaviour. No previous studies have been geographic in scope and broadly comparative. I suggest using the high diversity of *Argiope* in the western Pacific to compare decorating behaviour among closely allied species.

However, the first step in any ecological field study is *in situ* diagnosis of the species. Hence, this report. Proximate next steps include 1) expanding the database of

species sympatric with *A. appensa* by investigating distributional records in more recent literature, 2) compiling decoration prevalence from other argiopinine species worldwide via the literature, and 3) tallying decoration prevalence in *A. appensa* in islands beyond the Mariana archipelago. These pursuits have begun.

Alexander M. Kerr
uogmarinelab@gmail.com
Marine Laboratory
University of Guam
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APPENDIX I: ARGIOPE OF THE PACIFIC ISLANDS

Islands in italics below are part of a spider's range implied by being located inside the minimum convex polygon framing collection sites listed in Levi (1983) for that species and given below in regular text. The only island groups with which I have any familiarity are from Micronesia and the Philippines. Hence, when the spider is well known from only a portion of these archipelagos, those islands follow enparenthetically.

***Argiope aemula* (Walckenaer, 1841)**

Description: One of the largest species of *Argiope*. Oval abdomen, truncate anteriorly and marked with transverse lines. Builds a partial to complete cruciate stabilimentum (do for all spp; i think most are listed in a review).

Range: Borneo, *Carolines*, Java, Moluccas, New Guinea, Philippines, Ryukyus, *Solomons*, Sulawesi, Sumatra, *Sundas*, Taiwan, Vanuatu.

***Argiope aetherea* (Walckenaer, 1841)**

Description: Pentagonal abdomen the posterior margin wavy, usually with three transverse light bands with irregular edges on a dark background, the posterior-most two bands separated by an irregular row of small light spots.

Range: Moluccas, New Guinea, Solomons, *Sundas*, Vanuatu.

***Argiope amoena* L. Koch, 1878**

Description: Dorsal abdomen with three transverse light bands on a dark background, the posteriormost two bands separated by an irregular row of small light spots.

Range: Hawaiians, *Ryukyus*.

***Argiope appensa* (Walckenaer, 1841)**

Description: A large species, the only *Argiope* with a yellow to white abdomen with fine black reticulation covering the dorsum. Differs from *A. modesta*, which has the abdomen is lobed all around, in *A. appensa*, only the posterior is lobed.

Range: *Borneo*, Carolines (Palau, Yap), Hawaiians, Java, *Kiribati*, Marianas, Marshalls, Moluccas, New Guinea, *Ogasawaras*, Philippines, Pohnpei, *Ryukyus*, Solomons, Sulawesi, *Sundas*, Taiwan.

***Argiope boesenbergi* Levi, 1983**

Description: Dorsal abdominal pattern is diagnostic, yellowish silver and black.

Range: *Ryukyus*, *Taiwan*.

***Argiope bougainvilla* (Walckenaer, 1847)**

Description: Distinct elongate oval abdomen nearly all black with scattering of small light spots and commas and a white anterior-most margin.

Range: New Guinea, Solomons.

***Argiope brunnescentia* Strand, 1911**

Description: Elongate oval abdomen in outline, bluntly pointed posteriorly, with dorsolateral flammulate markings on a light dorsum.

Range: New Guinea, Solomons.

***Argiope caledonia* Levi, 1983**

Description: The dorsal abdomen has three transverse light bands, the posterior most two each bordered posteriorly by a row of light spots.

Range: Vanuatu.

***Argiope catenulata* (Doleschall, 1859)**

Description: Only *Argiope* with a completely oval abdomen, wider posteriorly, displaying a unique black-and-white dorsal pattern and a mid-ventral white band.

Range: Borneo, Carolines (Palau, Yap), Java, *Moluccas*, New Guinea, Philippines, Sumatra, *Sundas*.

***Argiope chloreis* Thorell, 1877**

Description: The abdomen in outline oval and truncate anteriorly, while dorsally is either entirely green or there are green transverse rectangular patches with white borders, while ventrally there is a median rectangular white area, bordered on each side by a narrow, broken longitudinal dark line.

Range: *Borneo, Java, Moluccas, New Guinea, Sulawesi, Sumatra, Sundas.*

***Argiope doboensis* Strand, 1911**

Description: A quite small species of *Argiope*. Easily diagnosed by three pointed lobes on the abdomen, two positioned anteriorly and nearly axially with a more blunt one posteriorly with white bands on each side of the dorsal side and a pair of light exclamation marks ventrally.

Range: New Guinea.

***Argiope halmaherensis* Strand, 1907**

Description: A small species distinct in having three pairs of dorsal white abdominal patches.

Range: Moluccas, New Guinea.

***Argiope intricata* Simon, 1877**

Description: Abdomen pentagonal in outline, the posterior two margins irregularly lobed. Dorsally the abdomen with irregular light transverse bands the posterior two separated by a dark band with light spots and rounded patches.

Range: Philippines (Mindanao).

***Argiope lobata* (Pallas, 1772)**

Description: Abdomen with nine large lateral lobes, four on either side and one posteriorly. Dorsally either all silvery or with thick short dark stripes on each lateral lobe.

Range: *Borneo, Java, Moluccas, New Guinea, Solomons, Sulawesi, Sundas.*

***Argiope luzona* (Walckenaer, 1841)**

Description: A large species with a pentagonal abdomen, the posterior portion lobed laterally, and with wide black and silver transverse bands dorsally.

Range: Philippines (Luzon, Visayas).

***Argiope magnifica* L. Koch, 1871**

Description: Differs from most *Argiope* by the almost uniform light abdominal colour having numerous fine transverse lines. Builds a partial to complete cruciate stabilimentum.

Range: New Guinea, Solomons.

***Argiope manila* Levi, 1983**

Description: Only *Argiope* with two longitudinal rows of large irregular light patches and a central row of smaller light patches, all with distinct margins on a black background.

Range: Philippines (Luzon).

***Argiope minuta* Karsch, 1879**

Description: A small species, the anterior half of the dorsal abdomen light with fine transverse lines and the posterior half dark with a single wide transverse band bordered on both sides by rows of light spots.

Range: *Ryukyus*, Taiwan.

***Argiope modesta* Thorell, 1881**

Description: The abdomen has lobed to wavy margins in outline, anterior-most light and two pairs of large light off axial and irregular patches more posteriorly with small light spots posteriorly. In some specimens the posterior abdomen is unpatterend and black. Differs from *A. appensa* in the abdomen is lobed all around, in *A. appensa*, only the posterior is lobed.

Range: Borneo, *Moluccas*, Sulawesi, Sundas.

***Argiope niasensis* Strand, 1907**

Description: Abdomen is pentagonal in outline with two small lumps anterior-most. Diagnosed by epigynal and palpal characters. The colour pattern in living specimens is not known. Possibly similar in living appearance to *A. reinwardti* (Levi 1983).

Range: Java, Sumatra.

***Argiope ocula* Fox, 1938**

Description: Only *Argiope* with elongate abdomen with dorsal, anterior, and lateral humps and a pointed end. The pattern on the abdomen, though variable, is also diagnostic.

Range: Ryukyus, Taiwan.

***Argiope picta* L. Koch, 1871**

Description: Abdomen oval, truncate anteriorly with intricate and diagnostic transverse light patterns on a dark background.

Range: Moluccas, New Guinea, Solomons, *Sundas*, Vanuatu.

***Argiope ponape* Levi, 1983**

Description: Oval abdomen the posterior half wavy; dorsum light with posterior half showing darker narrow transverse bands.

Range: Carolines (Pohnpei).

***Argiope possoica* Merian, 1911**

Description: Abdomen outline rounded pentagonal, dorsally with a light anterior half, posterior dark with two large light patches on either side. The species has 'bottlebrushes' on the distal ends of the tibiae, particularly developed on the fourth legs (Levi 1983).

Range: Sulawesi.

***Argiope reinwardti* (Doleschall, 1859)**

Description: Pentagonal abdomen, its dorsum with three transverse white bands on a black background, rather similar to some specimens of *A. aetherea*., in which case

diagnosis requires epigynal characters. Builds a partial to complete cruciate stabilimentum.

Remarks: Levi (1983) suspects that *Argiope buehleri* Schenkel, 1944 is a variant of *A. reinwardti*, as it differs by a single and only slightly different epigynal character. *Argiope buehleri* Schenkel, 1944 from the Sundas is distinguished from *A. reinwardti* by a single epigynal character (Levi 1983).

Range: Borneo, Java, Moluccas, New Guinea, Sulawesi, Sumatra, Sundas.

***Argiope takum* Chrysanthus, 1971**

Description: Abdomen in outline is elongate oval with two small anterior lumps. Dorsally the abdomen has axially aligned row of indistinct paired light patches and ventrally a pair of light exclamation marks.

Range: New Guinea.

***Argiope trifasciata* (Forsskål, 1775)**

Description: Abdomen is oval and dorsally silvery with transverse black lines, more crowded posteriorly. Specimens in Kauai have an abdomen that is silvery at the anterior end and the rest mostly black with a few white patches.

Range: Borneo, Carolines, Hawaiians, Java, Kiribati, Marianas, Marshalls, Moluccas, New Guinea, Philippines, Solomons, Sulawesi, Sumatra, Sundas, Vanuatu.

***Argiope trifasciata kauaiensis* Simon, 1900**

Description: Abdomen is oval and silvery at the anterior end and the rest mostly black with a few white patches.

Remarks: While currently considered a subspecies (World Spider Catalog 2018), this form may warrant species status (Berry & Williams 2017).

Range: Hawaiians.

***Argiope truk* Levi, 1983**

Description: Oval to elongate pentagonal abdomen in outline, dorsal colour light with fine irregular lines dorsolaterally.

Range: Carolines (Chuuk).

***Argiope versicolor* (Doleschall, 1859)**

Description: Abdomen pentagonal in outline with wavy margins, anterior half white with thin transverse black lines, the posterior half with a central transverse light band bordered on both sides by small light spots on a black background.

Remarks: Quite similar in appearance to and once considered conspecific with *A. pulchella* Thorell, 1881, which apparently differs only in genitalic characters and which is distributed east of *A. versicolor*'s range, from Sumatra to India.

Range: Borneo, Java, Sumatra.



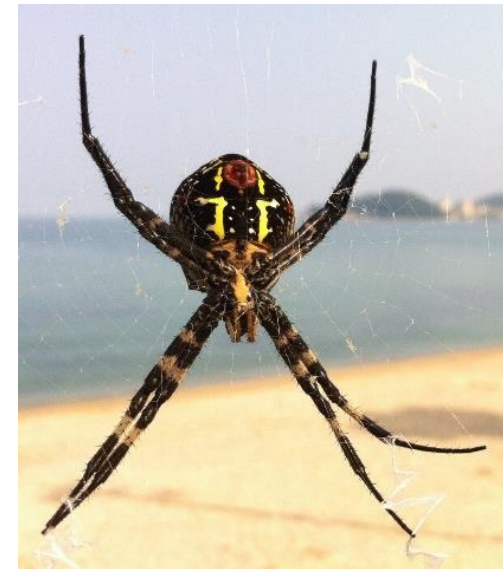
APPENDIX II: COLOUR PLATES

Figures 3–8

Figs. 3–4. *A. aemula*, Dorsal: Okinawa, Japan, Ventral: Suluwesi, Indonesia.

Figs. 5–6. *A. aetherea*, Dorsal: Queensland, Australia, Ventral: Queensland, Australia.

Figs. 7–8. *A. amoena*, Dorsal: Kobe, Japan, Ventral: Fukui, Japan.



Figures 9–14

Figs. 9–10. *A. appensa*, Dorsal: Hawaii, Hawaii, Ventral: Hawaii, Hawaii.

Figs. 11–12. *A. boesenbergi*, Dorsal: Shishitsuka, Japan, Ventral: Jiangxi, China.

Figs. 13–14. *A. caledonia*, Dorsal: Païta, New Caledonia, Ventral: Noumea, New Caledonia.



Figures 15–20

Figs. 15–16. *A. catenulata*, Dorsal: Kerala, India, Ventral: Philippines.

Figs. 17–18. *A. chloreis*, Dorsal: Sarawak, Malaysia, Ventral: No locality.

Figs. 19–20. *A. doleschalli*, Dorsal: Pahang, Malaysia, Ventral: Ambon, Indonesia.



Figures 21–26

Figs. 21–22. *A. lobata*, Dorsal: Pomarico, Italy, Ventral: Hérault, France.

Figs. 23–24. *A. luzona*, Dorsal: Mindanao, Philippines, Ventral: Luzon, Philippines.

Figs. 25–26. *A. magnifica*, Dorsal: Queensland, Australia, Ventral: Queensland, Australia.

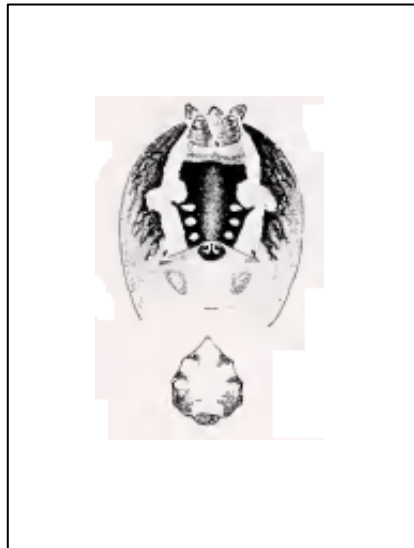


Figures 27–32

Figs. 27–28. *A. mangal*, Dorsal: Singapore, Ventral: Singapore.

Figs. 29–30. *A. minuta*, Dorsal: Okinawa, Japan, Ventral: Xinjiang, China.

Figs. 31–32. *A. modesta*, Dorsal: Sulawesi, Indonesia, Ventral: Sulawesi, Indonesia.



Figures 33–38

Figs. 33–34. *A. ocula*, Dorsal: Yangmingshan, Taiwan, Ventral: Taiwan.

Figs. 35–36. *A. picta*, Dorsal: Queensland, Australia, Ventral: Queensland, Australia.

Figs. 37–38. *A. reinwardti*, Dorsal: Pahang, Malaysia, Ventral: Pahang, Malaysia.



Figures 39–44

Figs. 39–40. *A. trifasciata*, Dorsal: Iowa, USA, Ventral: Iowa, USA.

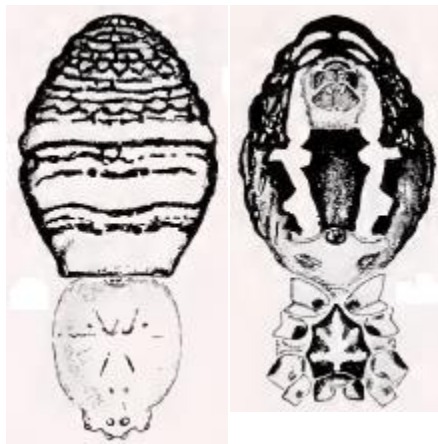
Figs. 41–42. *A. trifasciata kauaiensis*, Dorsal: Kauai, Hawaii, Ventral: Kauai, Hawaii.

Figs. 43–44. *A. versicolor*, Dorsal: Chaiyaphum, Thailand, Ventral: Phuket, Thailand.

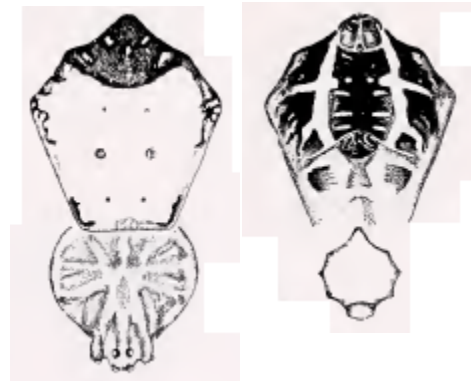


APPENDIX III: FIGURES FROM LEVI (1983)

Figures 45–66. Pacific island *Argiope* spp. Dorsal and ventral views shown in life position of adult female preserved specimens *from* Levi, H. W. 1983. The Orb-weaver genera *Argiope*, *Gea*, and *Neogea* from the Western Pacific region (Araneae: Araneidae, Argiopinae). *Bulletin of the Museum of Comparative Zoology* 150: 247–338.



A. aemula



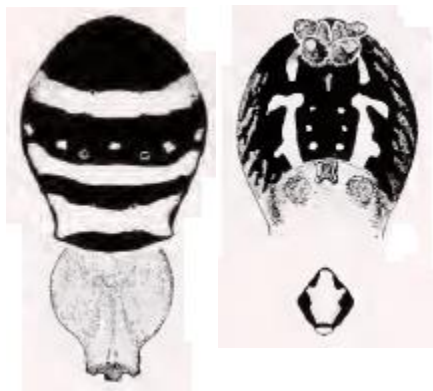
A. aetherea New Guinea



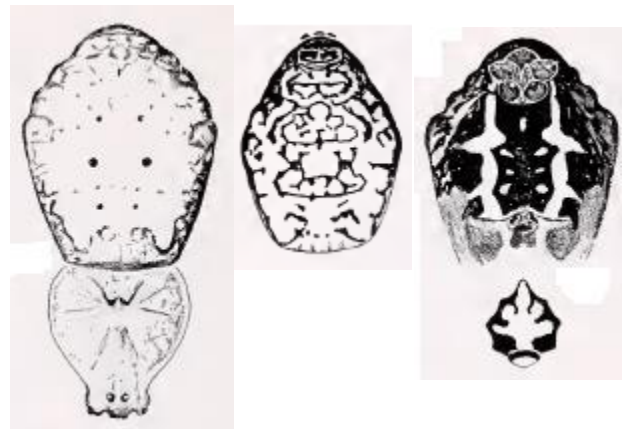
A. aetherea Solomons



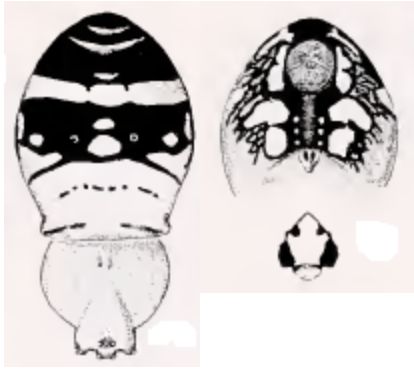
A. aetherea New Guinea



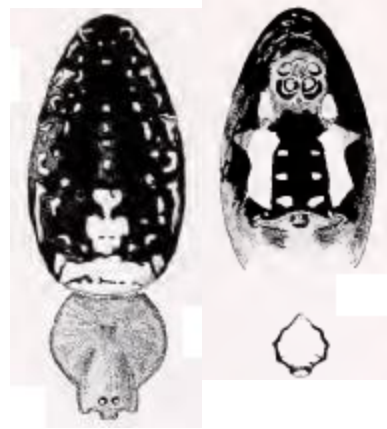
A. amoena



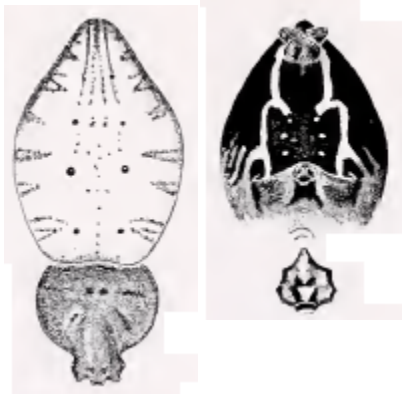
A. appensa



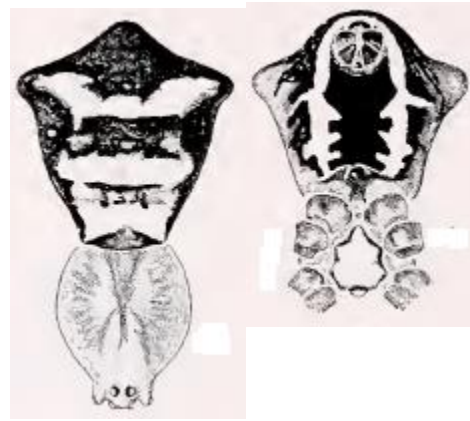
A. boesenbergi



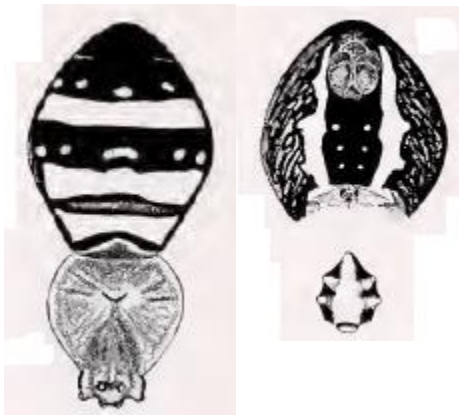
A. bouganvilla



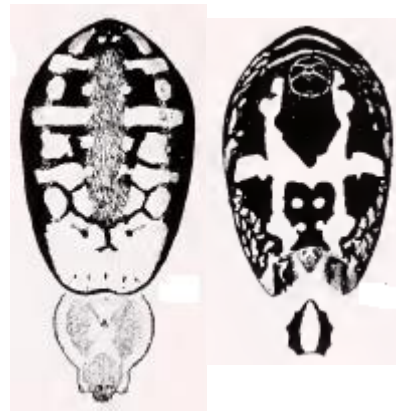
A. brunnescentia



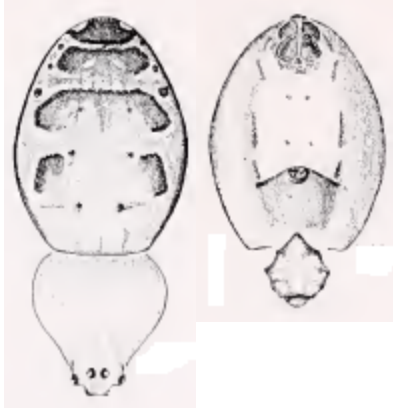
A. buehleri



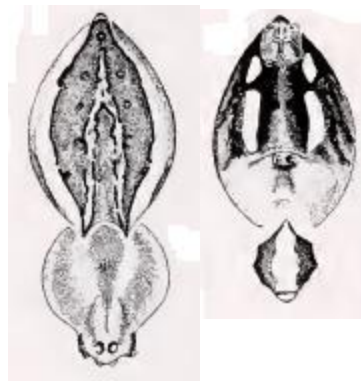
A. caledonia



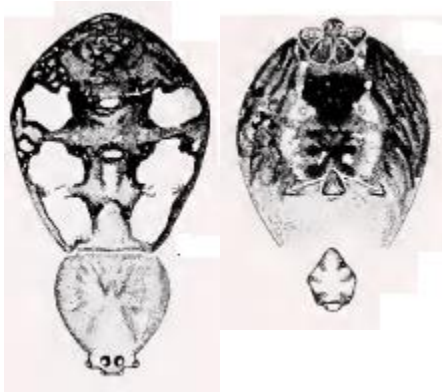
A. catenulata



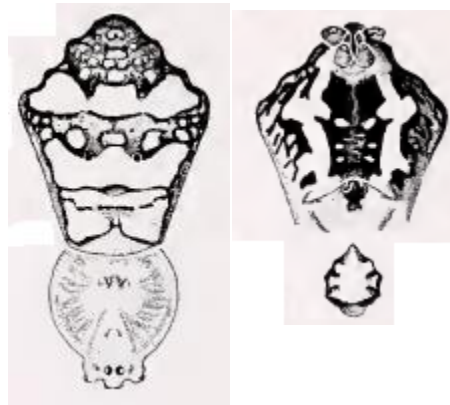
A. chloreis



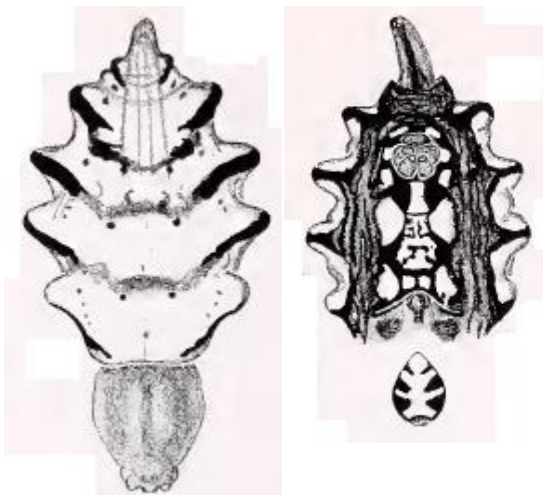
A. doboensis



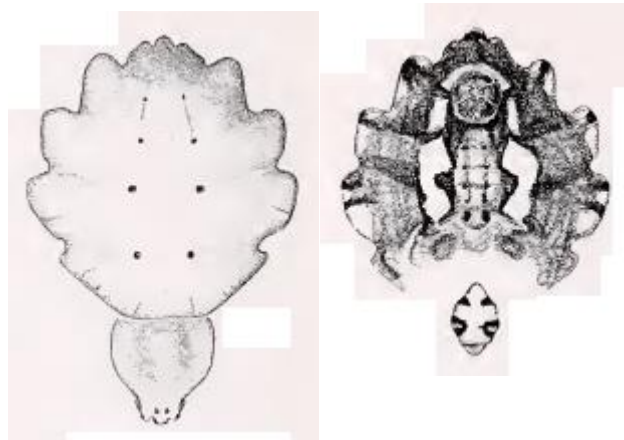
A. halmaherensis



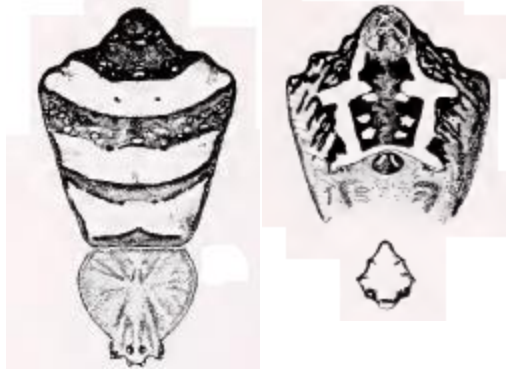
A. intricata



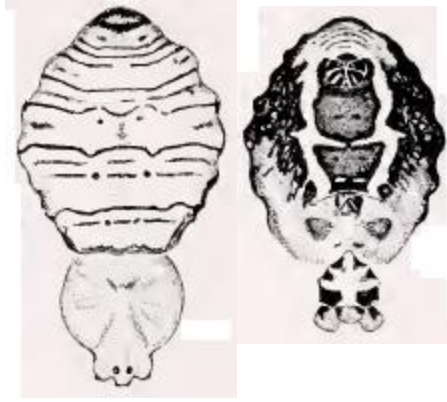
A. lobata Myanmar



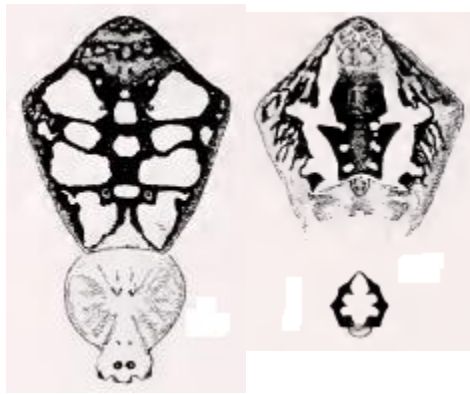
A. lobata Java



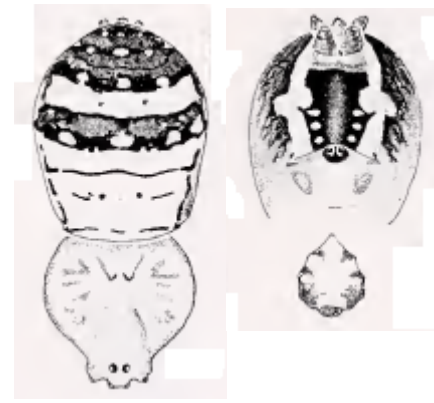
A. luzona



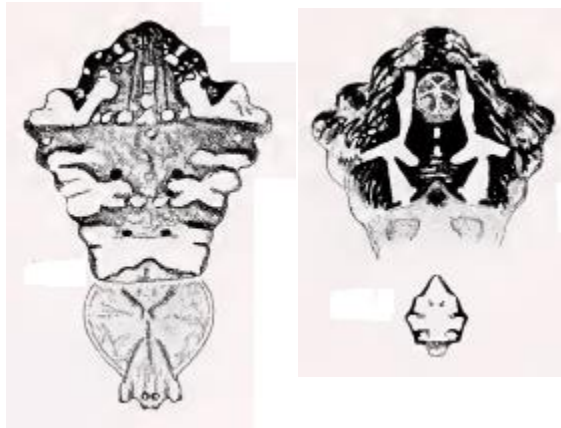
A. magnifica



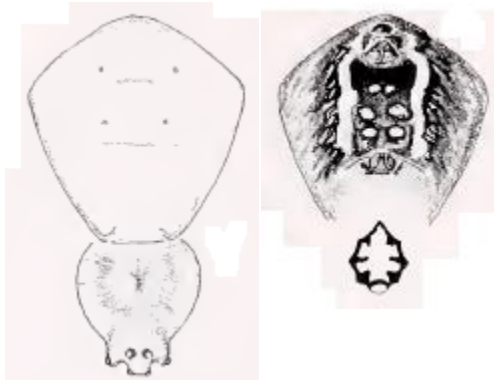
A. manila



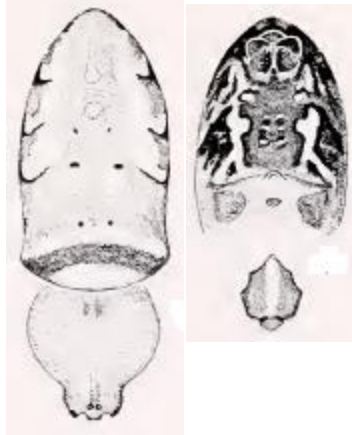
A. minuta



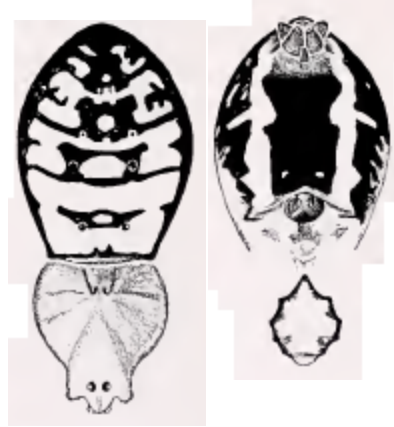
A. modesta



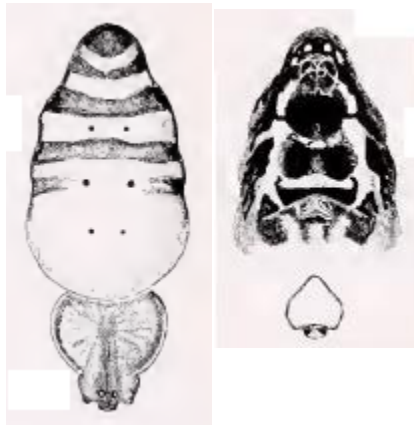
A. niasensis



A. ocula



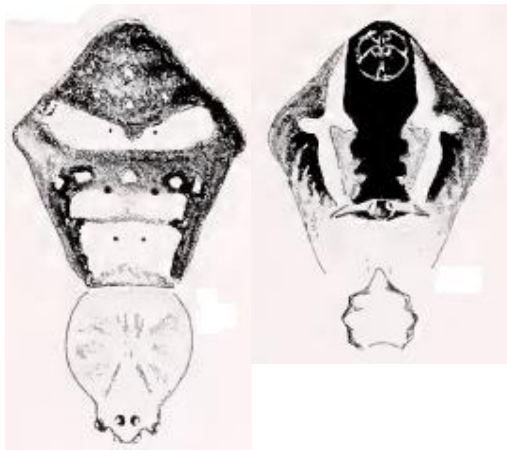
A. picta



A. ponape



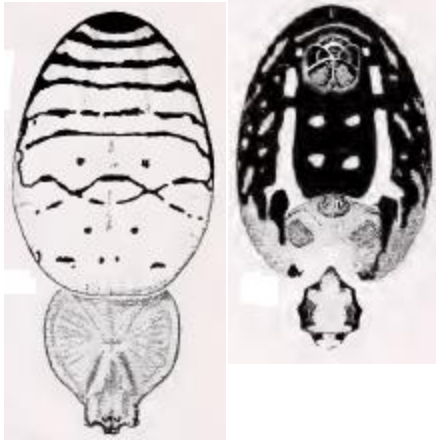
A. poissonica



A. reinwardti



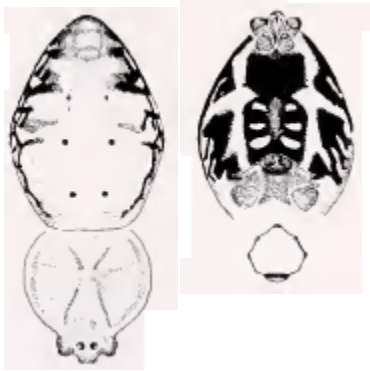
A. takum



A. trifasciata Oahu



A. trifasciata kauaiensis Hawaii



A. truk



A. versicolor

APPENDIX IV: BIBLIOGRAPHY OF WEB DECORATIONS IN ORB-WEAVING SPIDERS

Below are all the refereed published scientific articles I could find on decorating papers in *Argiope*. Ive tried to fill it out with papers on decorating in other orb-weaving spiders, but they are not as complete.

- Abrenica-Adamat, L. R. 2015. Intraspecific and interspecific variation of stabilimenta in orb webs of *Argiope* spiders (Araneae: Araneidae). *Electronic Journal of Biology* 11: 74–79.
- Abrenica-Adamat, L. R., E. E. Bermudo, M. A. J. Torres, A. L. B. Dupo, C. G. Demayo. 2013. Describing frequency of occurrence, size and stabilimentum-building behavior of four species of orb-web building *Argiope* spiders. *ELBA Bioflux* 5: 28–37.
- Abrenica-Adamat, L. R., M. A. J. Torres, A. A. Barrion, A. L. B. Dupo and C. G. Demayo. 2009. Salient features of the orb-web of the garden spider, *Argiope luzona* (Walckenaer, 1841) (Araneae: Araneidae). *Egyptian Academic Journal of Biological Sciences: Zoology* 1: 73–83.
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- Arnold A 1986. Die Wespenspinne *Argyope bruennichi* (Scopoli) im Stadtgebiet von Leipzig (Arachnida, Araneae). *Entomologische Nachrichten und Berichte* 30: 268-269.
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