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The Orb-Weaver Genera *Argiope*, *Gea*, and *Neogea* from the Western Pacific Region (Araneae: Araneidae, Argiopinae)

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THE ORB-WEAVER GENERA *ARGIOPE*, *GEA*, AND *NEOGEA* FROM THE WESTERN PACIFIC REGION (ARANEAE: ARANEIDAE, ARGIOPINAE)

HERBERT W. LEVI[1]

ABSTRACT. Characters of the male, especially of the male palpus, are useful for studying the phylogeny of the Argiopinae. Members of the subfamily are relatively primitive Araneidae; they appear more advanced than the Nephilinae, Metinae, Tetragnathinae, and Cyrtophorinae, and less advanced than the Mastophorinae, Gasteracanthinae, and Araneinae.

All available types of Pacific and eastern Asian *Argiope* species names have been examined. The study was handicapped by lack of males, which are collected less often than the large, showy females.

The subfamily Argiopinae contains three genera: *Argiope*, *Gea*, and the new *Neogea*. *Neogea*, with the type *Araneus egregius*, also contains *Gea noctipicolor*. In the region, there are 49 species of *Argiope*, 7 species of *Gea*, and 2 species of *Neogea*, many of them widely distributed. The 12 new species are *Argiope dietrichae*, *A. katherina*, *A. kochi*, *A. mascordi*, *A. radon* from Australia; *A. boesenbergi* from Japan; *A. ponape* and *A. truk* from the Caroline Islands; *A. caledonia* from New Caledonia; *A. manila* from the Philippines; *A. thai* from Thailand; and *Gea eff* from New Guinea. The generic names *Austrargiope*, *Coganargiope*, *Mesargiope*, *Micrargiope*, *Chaetargiope*, and *Neargiope* of Kishida and *Brachygea* Caporiacco are subjective synonyms of *Argiope*.

Argiope aequior and *viabilior* are oxyopids; *aurea* and *sachalinensis* are *Araneus*; *lepida* is probably an *Acusilas*; *leucopicta* is a *Cyrtophora*. *Gea virginis* is a *Leucauge*. There are 57 new synonymies.

INTRODUCTION

I undertook this study in order to solve the relationship of the genera *Argiope* and *Gea* to *Araneus* and other orb-weavers. Other reasons for this revision are to make possible the identification and naming of these common, large, showy spiders from the western Pacific area, and to distinguish the related genera *Argiope* and *Gea*.

My studies of American Araneidae began with *Argiope* (1968) because these could easily be sorted from specimens of other genera. Since this was the first genus examined, analysis of the relationships was not possible. Another limiting factor was that there are only two *Argiope* species in Europe, and only seven of *Argiope* and one of *Gea* in the Americas (one additional *Argiope* from Brazil has been found since the publication of my 1968 revision). Only now that I have a fair knowledge of the temperate American and central European araneid fauna am I beginning to discern affinities.

In contrast, the western Pacific region is extremely rich in orb-weavers; 49 species of *Argiope*, 7 of *Gea*, and 2 of a new genus, *Neogea*, are illustrated here. The abundance of species is greatest in New Guinea and Australia. I hoped that by studying a great diversity of species I would develop some insight into which characters are primitive and which specialized.

Because of the increasing amount of literature and the popularity of the large diurnal *Argiope* species for ethological and ecological studies (Robinson and Robin-

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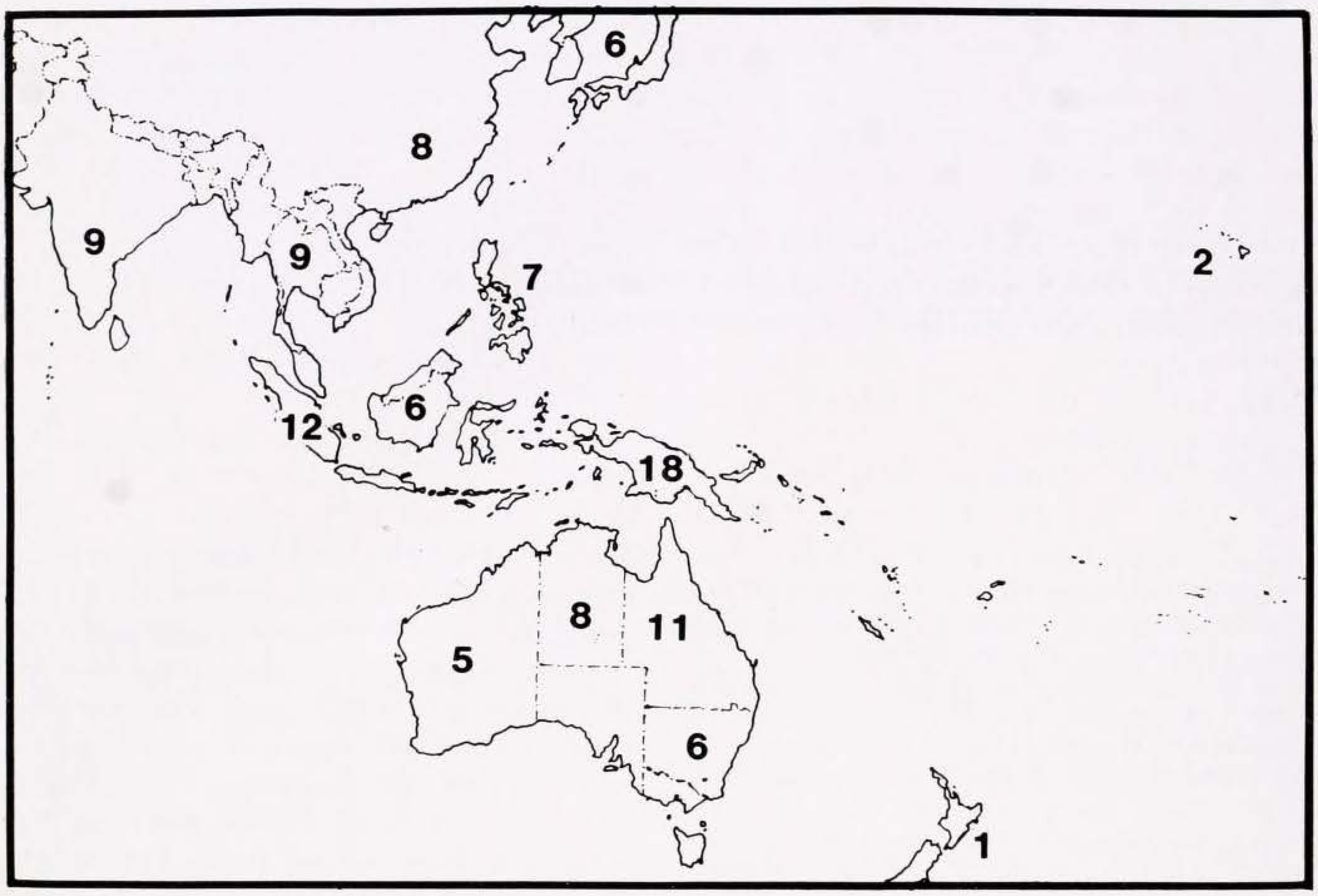

Map 1. The number of argiopine species found in different areas (see text).

son, 1980; Horton, 1981; Olive, 1980), it has become urgent to be able to determine these species, as well as to gain an understanding of their relationship.

This study began modestly as an attempt to help identify the common *Argiope* and *Gea* from New Guinea. Since only a few of the 104 species (87 *Argiope*, 17 *Gea*) and subspecies names of this region listed in Roewer's catalog (1942) [87 species in Bonnet, 1955, 72 *Argiope*, 15 *Gea*] had been illustrated and were recognizable, identification was possible only by examining the types. Most of the species names had never again been cited after the initial description. The scope of the task rapidly ballooned. It was possible only because the females of *Argiope* and *Gea* species are relatively easy to separate, having distinct, sclerotized genitalia. The abdomen, too, is usually marked and shaped distinctively.

Father Chrysanthus (1958, 1971) studied not only the New Guinea *Argiope* and *Gea*, but all species of Araneidae, and worked on various other families also. Apparently overwhelmed by the rich fauna, he unavoidably made mistakes; for instance, he compared his *Argiope* specimens to Indonesian species but not to those from nearby Australia.

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This study was made possible by the help of numerous curators and collectors, in particular, L. Capocaccia and G. Arbocco of the Museo Civico di Storia Naturale, Genova. It is impossible to work with spiders from most parts of the world without access to the Thorell collection, kept mainly in Genova, Italy. Thorell described species and genera, but never made illustrations. Even with illustrations, reference to his collection is essential. I have frequently wondered how Thorell would have fared if forced to rely solely upon his own long-winded Latin descriptions. I now know that he sometimes re-

named his own, previously described species.

Many specimens used belong to the Museum of Comparative Zoology (MCZ); some belong to the Field Museum, Chicago (FMC). Other helpful loans were made by: L. Baert and J. Kekenbosch (Institut Royal des Sciences Naturelles de Belgique, Brussels, IRSN); J. A. Beatty (BC); L. Capocaccia and G. Arbocco (Museo Civico di Storia Naturale, Genova, MCSN); Y. Coineau and M. Hubert (Muséum National d'Histoire Naturelle, Paris, MNHN); R. E. Crabill (Smithsonian Institution, Washington, D.C.); C. D. Dondale (Biosystematics Research Institute, Agriculture Canada, CNC); V. Davies (Queensland Museum, Brisbane, QMB); H. Enghoff (Zoologisk Museum, Copenhagen, ZMK); M. W. R. de V. Graham and A. Smith (Hope Entomological Collections, Oxford, HCO); M. Grasshoff (Natur-Museum Senckenberg, Frankfurt, SMF); M. R. Gray (Australian Museum, Sydney, AMS); C. Griswold (Essig Museum, University of California, Berkeley, EMB); J. Gruber (Naturhistorisches Museum, Wien, NMW); L. van der Hammen (Rijksmuseum van Natuurlijke Historie, Leiden, RNHL); S. Heimer (Staatliches Museum für Tierkunde, Dresden, SMD); L. Koch (Western Australian Museum, WAM); T. Kronestedt (Naturhistoriska Riksmuseet, Stockholm, NRS); J. Martens (JMC); M. Moritz (Zoologisches Museum der Humboldt Universität, Berlin, ZMB); J. and F. Murphy (MC); A. Riedel (Polish Academy of Science, Warsaw); J. P. O'Connor and A. B. O'Ríordáin (National Museum of Ireland, Dublin); N. Platnick (American Museum of Natural History, AMNH); W. Pulawski (California Academy of Sciences, CAS); G. Rack (Zoologisches Institut und Museum, Hamburg, ZMH); F. Radovsky and J. Tenorio (Bernice P. Bishop Museum, BPBM); W. C. Sedgwick (SC); E. Sutter (Naturhistorisches Museum, Basel, NMB); M. S. Upton (Australian National Collection, C.S.I.R.O., Canberra, CSIRO); F. Wanless and P. Hillyard (British Museum, Natural History, BMNH); J. Wunderlich (WC); T. Yaginuma (collection of the Arachnological Society of East Asia, Ohtemon-Gakuin University, Osaka, ASEA); C. M. Yang (Zoological Reference Collection, University of Singapore, formerly from Raffles Museum, ZRC); H. Yoshida (YC). After completion of the manuscript, H. M. Peters found lost types at the Universität Tübingen.

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METHODS

In a departure from my procedure with other araneid revisions, I had to look first at the type specimens. I borrowed these a few at a time, illustrated them, and returned them to the various museums before receiving the next batch. Hence, most types could not be compared. Most types

had never been illustrated before, nor had their genitalia been described. Despite the common occurrence and conspicuous appearance of many *Argiope* species, only small collections were available; these usually included only females, rarely escorted by males. The only specimens available throughout the study were collections in the Museum of Comparative Zoology (MCZ). Smaller collections of undetermined *Argiope* specimens were examined at the end of the study.

Since much of the work was done with types of names, I did not illustrate the female internal genitalia. Fortunately, *Gea* and *Argiope* species have other characters that can be used to separate the species.

The size range of individual specimens of both males and females is considerable, although most *Argiope* have similar proportions. No measurements were made. The size and proportions are recorded only for new species; the sizes of previously named species can be read from scale lines on the illustrations. Size range is usually not a good diagnostic character. Although the females of some species are always large, over 20 mm in total length, some species are intermediate in size, and small species may be only 7 to 12 mm in length.

The size range of males (those few that were available) is even broader than that of females. Specimens of any given species (not necessarily collected from the same locality) almost always display wide variability in color and marking. Males of all species were checked for leg modifications such as hook on first coxa, tooth on endite, or tooth on palpal femur. None had any of these modifications, so characteristic of the males of Araneinae.

In matching females with the very different males, it was helpful that most of the males in collections were with females. Those few that had been collected separately could be matched by considering collecting locality and the species group to which they belonged.

Another extraordinary clue expedites matching males with females of the same species. In all species (as far as we know), the tip of the male embolus breaks off and remains in the epigynum (often with a section of the duct pulled out from more proximal sclerites in *A. aemula* and *A. pulchella*). Females can be matched to males by extracting the broken tips (Figs. 250, 261, 262) from the opening of the epigynum. These broken emboli are commonly embedded in hardened exudate within the depression of the epigynum and wedged into the opening (Figs. 82, 124, 136). Just as loss of the embolus tip prevents a male from using the palpus again, having it wedged in the epigynum prevents a female from mating a second time. Although adult females of most species are commonly found with one palpal tip embedded in each side of the epigynum, males with broken palpi are uncommon. Apparently few survive mating. (One male of *A. appensa* from Palau had both palpi broken off above the tibia, as is seen in male eunuchs of *Herennia* from New Guinea [Robinson and Lubin, 1979]). Robinson and Robinson (1980) observed in several *Argiope* species that males died in copula. In the illustrations of epigyna in this monograph, the embolus tips, when present, were removed from one side and not the other (Figs. 82, 124, 136).

The similar *Argiope versicolor* (Doleschall) and *Argiope pulchella* Thorell were considered one species until it was discovered that broken tips in the epigyna differed (Figs. 250, 261, 262).

The emphasis in this paper is on the diagnostic features of the various species. The terms used to point to these differences are illustrated in Figures 12, 13.

With an abundance of species and only a limited number of specimens, decisions had to be made whether minor differences reflect geographic variation or if they represent different species (e.g., *Argiope reinwardti*, *A. caesarea*, and *A. buehleri*, Figs. 42–46, 47–55, 56–60).

Mapping the old collecting localities often proved difficult. There appear to be French, German, and several English

spellings for Chinese place names. Names changed, especially when colonial countries became independent. When the British took over from the Germans in New Guinea after the First World War, names were changed; likewise, the Indonesians changed the Dutch names and spellings.

While taxonomists are reputed to be skeptical, I believe most are too trusting about locality information and data with specimens. Of course, in the case of the well known George Marx spider collection, the specimens quite obviously did not come from the collecting sites indicated. But there are other such instances. Among the collections examined here, I believe that *Argiope carinata* L. Koch bearing a label "New Holland" [Australia] is actually from America, and is a common *A. argentata*. Another, *A. multifasciata* Thorell, allegedly from Singapore, is an Australian *A. protensa*. Such obvious errors raise the question whether other specimens may be wrongly labeled. Some old localities could not be found at all, either because indecipherable handwriting resulted in errors in copying the labels, or because the localities changed names. Some labels give precise locality data but omit the name of the island or continent. Judging by the contents, several vials marked "Plummers Island" did not come from the South Pacific at all, but from an island with this name in the Potomac River, a favorite North American collecting site. Incorrect localities in collections have been reported recently by O. Francke (1981) and von Helverson and Martens (1972).

Lectotypes were designated only when the syntype series received on loan represented several species. Only recent authors have indicated on the label that a particular vial contains types of the name; nineteenth century authors, including Thorell and Simon, did not. Worse, the original specimens may have moved to another institution, perhaps as a result of exchanges (some L. Koch determined specimens of the Godeffroy collection), or been split up, or had other specimens added (as in the Simon collection). Sometimes a syntype series has been incorrectly marked "types" by curators. It is suspected that caretakers sometimes loaned only part of the type series with a new label, failing to indicate that there were additional specimens. While I did not usually choose lectotypes, I did add labels to the vial suspected to be the type, indicating holotype or syntypes.

Roewer (1942) and Chrysanthus (1958, 1961, 1971) spelled the generic name *Argiope* with a *y*. The name *Argiope* (with *i*) has been placed on the Official List of Generic Names in Zoology; *Argyope* (with *y*) has been placed on the Official Index of Rejected and Invalid Names in Zoology (Internat. Comm. Zool. Nomencl., 1975, Opinion 1038). In the literature citations in this paper, to save space, both Chrysanthus and Roewer citations are with *i*.

RELATIONSHIPS

Argiope, *Gea*, and the new genus *Neogea* are the only genera in the subfamily Argiopinae of the family Araneidae. The subfamily is characterized by having the posterior eye row procurved; that is, the posterior lateral eyes anterior to the posterior medians (Figs. 27, 39, 52). In other Araneidae posterior lateral eyes are at the same level or slightly posterior to the posterior medians. *Gea* and *Neogea* differ from *Argiope* in having the posterior eyes equally spaced (Figs. 348, 353, 402). *Argiope* has the posterior median eyes farther from laterals than from each other.

The following are characters for the cladogram.

1. *Orientation of the Sclerites.* The sclerites of the palpus face the median, with the cymbium pushed to the side of the sclerites, left in the left palpus (Figs. 7, 8, 13) (or, the cymbium moved in a median direction, the tegulum dorsal, and the sclerites ventral). This is a synapomorphy shared by the Argiopinae, Mastophorinae, and Araneinae. In all other spiders the sclerites face ventrally with the

cymbium dorsal. (Originally I considered *A. trifasciata* intermediate in this respect, as the embolus coil faces ventrally [Fig. 119], but after examining numerous *Argiope* and *Gea* species, I find that this orientation arises from the extension of a specialized palpus with a long embolus. The long, coiled embolus has secondarily moved ventrally.) This character indicates that I can use Nephilinae, Tetragnathinae, and Metinae as outgroups for the remaining characters.

2. *Eye Position*. The procurved posterior eye row is only found in *Argiope*, *Gea*, and the new genus *Neogea*, and is a synapomorphy of these genera not otherwise found in the family (except rarely in some species of the genus *Mecynogea*). Outgroup comparison with the Tetragnathinae, Metinae, Nephilinae, and comparison with the subfamilies sharing the same orientation of the male palpal sclerites indicate the derived nature of the eye arrangement. The Argiopinae eye arrangement is accompanied by a characteristic marked reduction in the size of the anterior lateral eyes: they face down, and their diameter often is only half that of the other eyes (which are subequal in size), so small that in dorsal view they are not visible (Figs. 3, 5).

3. *Posterior Median Eye Structure*. Members of the superfamily Araneoidea have a canoe-shaped tapetum (found also in Agelenidae, Clubionidae, Anyphaenidae, and Gnaphosidae, among others). Some araneid orb-weavers have a canoe-shaped tapetum, others have the eyes more specialized. The canoe-shaped tapetum is still found in *Meta* and relatives, *Zygiella*, *Leucauge*, *Nephila* (Levi, 1980: figs. 37, 38). In the subfamily Tetragnathinae, there is a loss of the tapetum in the posterior median eyes of *Pachygnatha* (Levi, 1980: fig. 159), and in all eyes of *Tetragnatha* (Levi, 1981). In *Araneus* and most Araneidae other than Tetragnathinae, Metinae, and Nephilinae, the tapetum of the posterior median eyes shrinks to a sliver, and the rhabdom cells toward the median (of the spider) arrange themselves in rows (Fig. 10; Levi, 1978: figs. 19, 20), while the lateral eyes keep the canoe-shaped tapetum. It is a synapomorphy shared by Cyrtophorinae, Argiopinae, Mastophorinae, and various genera (most of which belong to the Araneinae).

4. *Posterior Lateral Eye Structure*. In *Argiope*, *Gea*, and *Neogea* the tapetum shrinks in the posterior lateral eyes as well as in the posterior medians (Figs. 9–11). This probably provides better daytime vision. I consider this unusual specialization of the posterior lateral eyes not otherwise found in the family Araneidae or the Araneoidea (first pointed out by Homann, 1950) to be a synapomorphy of these three genera.

5. *Carapace Shape*. The head of female is more distinctly set off from the thoracic region than in other Araneidae. In *Argiope* the head width is half that of the carapace; the sides of the head are parallel, the front edge almost straight in dorsal view, and the lateral eyes on slight tubercles (Figs. 22, 39, 45). The small anterior lateral eyes face down and are hidden in dorsal view (Figs. 3, 5); the carapace is almost circular and relatively flat, often with two comma-shaped marks in the thoracic depression. In *Gea*, which has relatively larger eyes, the head is wider and less distinctly set off (Figs. 341, 348, 353); the anterior lateral eyes are also small (Figs. 334, 336). Other genera with a narrow head are *Acusilas* of southeastern Asia and *Cyclosa* and *Mangora* (all probably Araneinae). In all of these the sides are not so parallel, and the head region is more domed. I consider the head shape and small anterior lateral eyes a synapomorphy in *Argiope*, *Neogea*, and some species of *Gea*. It has probably secondarily been lost and become more generalized in *Gea*. I assume that the distinctive procurved posterior eye row is correlated with the shape of the head.

6. *Abdomen Shape and Color*. The abdomen is usually shield-shaped, often lobed on its sides, flattened, and brightly

patterned in *Argiope*, *Gea* and *Neogea* (Figs. 27, 45, 70, 78). Silver and black are common colors. Similar abdomen shape is found in the unrelated *Herennia*. (Judging by the structure of the genitalia, especially the male palpus, *Herennia* is closely related to *Nephila*, Nephilinae.) Bright coloration is found in the predominantly diurnal American species of *Alpaida*. In some Australian *Argiope* species, the abdomen has a semblance of a dorsal folium, the dark leaf-shaped pattern (Figs. 122, 139, 191) commonly displayed by the Araneinae.

A cylindrical abdomen is found in *Nephila* (Nephilinae), *Leucauge* (Metinae), *Tetragnatha* (Tetragnathinae), *Cyrtophora* and *Mecynogea* (Cyrtophorinae); a spherical abdomen in most other Araneidae. Perhaps a cylindrical body (of *Argiope ocula* and *A. thai* is a primitive character of the family. However, color and abdomen shape probably are characters of ambiguous polarity in pinpointing phylogeny, and I use the spherical abdomen (a weak character) as a synapomorphy of Mastophorinae, and the remaining genera, most of which belong to the Araneinae.

7. *Leg Length*. *Argiope* and *Gea* have longer legs than most Araneidae. Other long-legged araneids are *Tetragnatha* species. In *Argiope* and *Gea*, legs one and two are subequal in length, the second slightly shorter than the first, the fourth leg usually slightly shorter than the second, the third by far the shortest. The first legs may be 1.3 to 1.8 carapace length; the second 1.2 to 1.6; the third, 0.6; the fourth 1.2 to 1.4. At present I am not certain of the distribution of leg length in araneid genera, and find the leg proportions confusing to use for phylogeny; they may be adapted to selection pressures of the spider's habits (Olive, 1980) which have been recurrent during phylogeny. Perhaps after studying the species of more tropical genera a phylogenetic use of leg length will emerge. I do not use this character at present.

8. *Male Size*. The small size of males is most striking compared with the large size of females in *Argiope*. Within a species, the males vary substantially in both size and coloration, making them difficult to match to females of the same species. Small males are found also in *Nephila* and other predominantly tropical genera (which have year-round reproduction, permitting the more rapidly maturing males to mate with a previous generation of females). Vollrath (1980) has recently commented on the small sizes of males. I will know more about the distribution of this character after a study of various tropical Araneidae. At present I do not use this character in phylogeny.

9. *Male First and Second Legs*. In males of most Araneinae the first or second legs are modified with extra macrosetae, bumps, and branches (e.g., *Acacesia*, *Aculepeira*, *Eriophora*, *Verrucosa*), probably to hold the females when mating. Such modifications are lacking in *Argiope*. As males of some *Gea* species have stronger setae on their legs than their females have, and in *Gea* the sexes are more nearly equal in size than in *Argiope*, I assume that in *Gea* the strong leg spines are a modification for coping with similar sized females. Leg modifications are lacking also in Nephilinae, Metinae, and Tetragnathinae, in some of which (Tetragnathinae) the sexes lock chelicerae when mating. These leg modifications are of little use for phylogeny of possible subfamilies, probably reflecting more equal size of the sexes. I do not use this character here, but may return to it in future papers.

10. *Other Modifications*. In many species of Araneidae males have a tooth on the outside of the endite, facing a tooth on the palpal femur. They also have a distal hook on the first coxa that fits into a slit on the second femur, presumably locking the two legs in mating position. Neither structure is ever found in Nephilinae, Tetragnathinae, Metinae, Cyrtophorinae, Argiopinae, or Mastophorinae. These fea-

tures are usually present but sometimes absent in the Araneinae, perhaps secondarily lost (in *Araneus gemmoides* and also some small-sized species). I take these characters to be synapomorphous among the genera belonging to the Araneinae, although they may have been lost secondarily in some species. (Male *Micrathena* may have the coxal hook; many species lack it. They never have a tooth on the endite or a tooth on the proximal end of the palpal femur, probably secondarily lost.)

11. *Epigynum.* The epigynum lacks a scape in most *Argiope* and all *Gea* and *Neogea*. A scape is present in most Araneidae, although not in Nephilinae, Metinae (except some *Zygiella*), and Tetragnathinae. The scape is also absent in those Araneidae species having a heavily sclerotized epigynum (e.g., *Gasteracantha*, *Micrathena*). But the presence of a scape in some species of *Zygiella* (a genus whose members have a canoe-shaped tapetum in the eye and a tegulum apophysis in the male palpus; Levi, 1974) and in some *Mysmena* (Mysmenidae) species, as well as in some species of *Pityohyphantes*, *Helophora*, *Lepthyphantes* (Linyphiidae), and in *Wendilgarda* (Theridiosomatidae) is convincing evidence that the scape evolved several times as a convenient coupling device. The presence or absence of the scape, therefore, is not a useful character in phylogeny. It is of interest that *Argiope ocula* has a well-developed scape (Fig. 14). This species has also several other characters that I consider primitive: the posterior eye row is only slightly procurved, and the abdomen is cylindrical. *Argiope macrochoera*, which has an indication of a scape (Fig. 19), is perhaps not closely related to *A. ocula*, judging by abdomen shape and general epigynal structure.

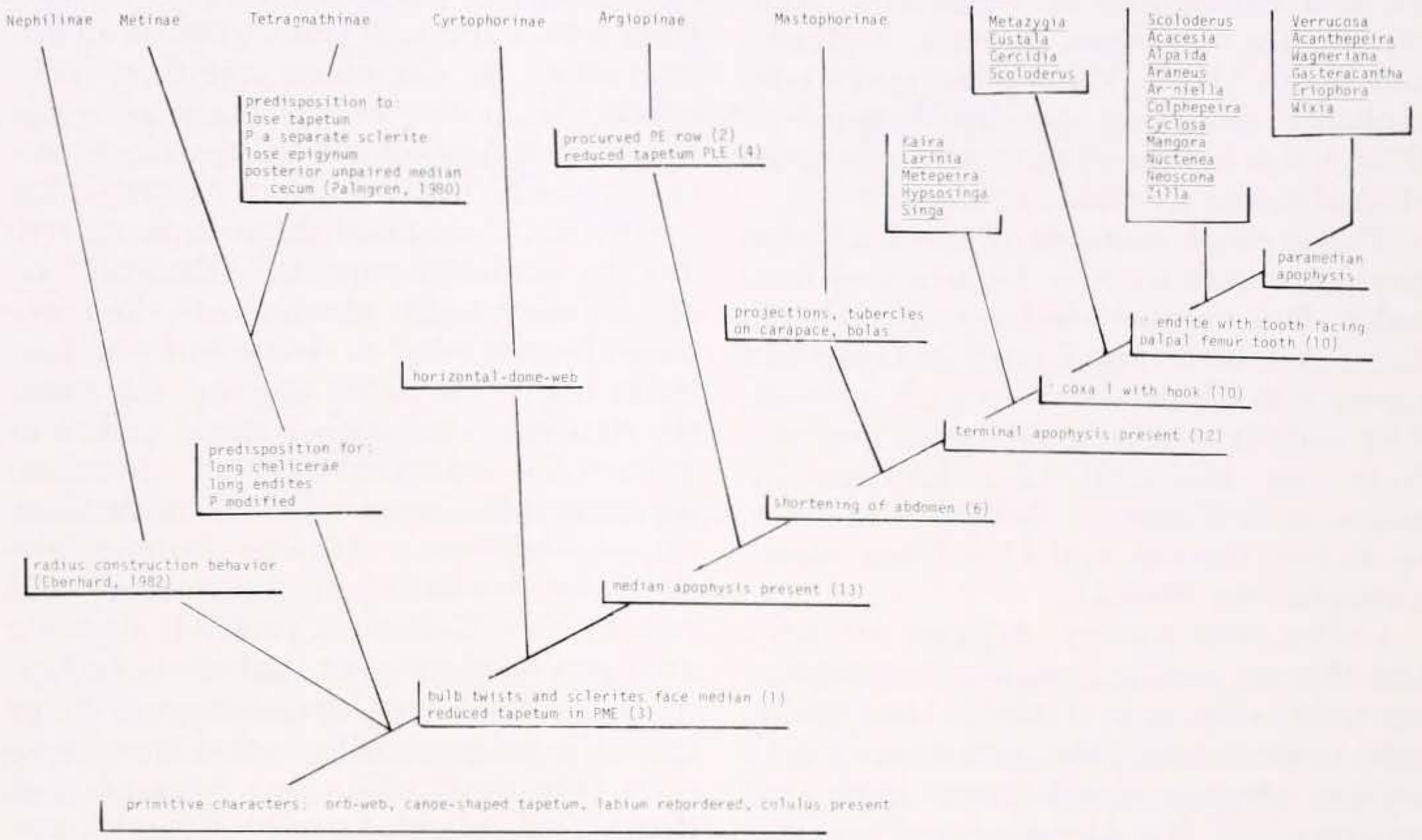
12. *Terminal Apophysis.* The Argiopinae lack a terminal apophysis in the male palpus. There is also no terminal apophysis in Nephilinae, Metinae, Tetragnathinae, Cyrtophorinae, and Mastophorinae. There is a terminal apophysis in Araneinae and related genera, a synapomorphy of the genera included. The terminal apophysis in some linyphiids and mimetids may not be homologous with that of Araneinae.

13. *Median apophysis.* The median apophysis is absent or very small in the male palpus in Nephilinae, Metinae, Tetragnathinae, and Cyrtophorinae. It is always present as a large structure on Argiopinae (Fig. 13), Mastophorinae and the various genera, most of which are placed in the Araneinae. I consider this a synapomorphy of the genera within these groups. (The lobe present in some species of Cyrtophorinae in place of the median apophysis may not be homologous with the median apophysis.)

14. *Spur of the Median Apophysis.* The spur of the median apophysis is almost always thread-shaped in *Argiope*, *Gea*, and *Neogea* (Fig. 13). Exceptions are the thorn-shaped spur in *A. ocula*, perhaps a primitive feature, and the loss of the spur in *A. trifasciata*. The spur of the median apophysis of other genera is almost never filamentous (an unusual exception is that of *Micrathena gracilis* species group). I consider the thread-shaped nature of the spur of the median apophysis a synapomorphy of the genera in Argiopinae.

15. *Embolus and Conductor.* Unlike that of other araneid genera, the embolus and conductor of the male palpus is often enlarged, frequently extending far beyond the spherical tegulum (Fig. 13). The embolus and conductor of *Nephila*, *Pachygnatha*, and *Tetragnatha* is also large. But since the bulb has not twisted (see above, no. 1), the configuration differs, and the large embolus and conductor is probably a convergence. There are *Argiope* species in which these structures are relatively small, probably a primitive condition: *A. aemula* and *A. catenulata*. The kink and pendant displayed by members of the *A. aetherea* group (Fig. 13) is a specialization, as is the coil of *A. trifasciata*. Phylogenetically, the straight em-

TABLE 1. CLADOGRAM OF SUBFAMILIES OF THE ARANEIDAE.



Abbreviations. P, paracymbium; PE, posterior eyes; PLE, posterior lateral eyes; PME, posterior median eyes. Numbers in parentheses refer to paragraphs in the text.

bolus and conductor of *A. aurantia* would place this species near the center of the *Argiope* species. The large size of embolus and conductor is an uncertain synapomorphy of the Argiopinae.

Comment. When making the simple computer cladogram (Levi, 1980: table 2) I was concerned that only slight changes in weighting of characters would result in major changes in the cladogram. Here the groups are nested according to their most unusual specializations (Table 1).

My ideas on phylogeny and relationships are changing as I study these genera a second time. For instance, *Cyrtophora* and *Mecynogea*, previously placed in the Araneinae (Levi, 1980), are here relegated to their own subfamily (Table 1). An expansion of thoughts on possible araneid-uloborid relationships is found in Coddington (in preparation) and Eberhard (1982). The Theridiidae, Nesticidae, and Linyphiidae probably had Metinae-like ancestors and branched off from the base of the branch of the Metinae and Tetragnathinae (Table 1). Shear (1981) also would place the origin of the Mimetidae in this vicinity. This would make the family Araneidae as here presented paraphyletic. But is this really objectionable in a classification?

DISCUSSION

Despite 11 new species of *Argiope* and 1 new *Gea*, the total number of species for the area is only slightly more than half the number listed (to 1938) in Roewer's catalog of spiders. The other names listed are actually synonyms, the result of inadequate descriptions. (When the synonymies revealed here could be attributed to obvious similarities in genitalia and abdomen coloration and structure, no further reason for the synonymy is given.)

Many species have enormous ranges: *A. bruennichi* from western Europe to Japan; *A. lobata* from the Mediterranean to

Java and perhaps New Caledonia, Australia, and Africa; and *A. trifasciata*, common in the Americas, Hawaii, Australia, and North Africa. Many other species are probably restricted in distribution, although this is difficult to ascertain because of inadequate available collections.

The greatest number of species of the group is found in New Guinea and Australia. The number declines towards the Asian mainland: There are 6 in Japan and Korea, 8 in China and Taiwan, 9 in India, 9 in southeastern Asia (Malayan Peninsula, Burma, Thailand), 12 in Java and Sumatra, 6 in Borneo, 7 in the Philippines, 18 in New Guinea, and 11 in Queensland, Australia (see Map 1).

Unlike most spiders, *Argiope* are large and showy, usually hanging in conspicuous webs in the open (Plate 1). Most species were named during the 19th or early 20th century. *Argiope* also has been fairly well collected. Of the 11 new species in the subfamily 6 come from Australia; 2 from the Caroline Islands; and 1 new species each from New Guinea, New Caledonia, Solomon Islands, Philippines, and Thailand. Since most museum collections available are the result of efforts by amateurs, the collections contain a preponderance of females and only very few of the small males.

Most species are very distinct and can be separated by genitalia as well as by their appearance. There are several exceptions: *Argiope versicolor* and *A. pulchella* in southwestern Asia to Indonesia are similar in appearance and also have quite similar genitalia. Also *A. taprobanica* and *A. versicolor* have a similar pattern. Their distributions overlap. Another such group (but with allopatric distribution) is *A. reinwardti* from Indonesia to New Guinea and *A. caesarea* from Burma and India; perhaps this is just a geographic variant of *A. reinwardti*.

Argiope species apparently have inherited a developmental capacity for various coloration, and similar patterns reappear in several unrelated species (Figs. 22, 45, 170, 208, 244, and 257).

Another problem is the *Argiope aetherea* group. *Argiope aetherea*, described from New Guinea, is quite variable in appearance, its abdomen ranging from banded to having only a black posterior tip (Figs. 303, 305). The sympatric *A. picta* (originally described from Australia) has a different abdominal shape and pattern. Yet the genitalia, especially the epigyna, are disconcertingly similar. Are the specimens here labeled *A. aetherea* from Australia really the same species? (In most, the sternum is not such a bright yellow as in New Guinea specimens, but Australian specimens also come with banded or black tipped abdomen.) *Argiope brunnescentia*, from the Bismarck Archipelago and eastern New Guinea, is probably distinct; its range overlaps with that of *A. aetherea*. But are *A. aetherea*-like specimens from the Solomon Islands and New Hebrides (Figs. 306, 307) and *Argiope truk* (from Truk Island, Caroline Islands) separate or just subspecies of the variable *A. aetherea*?

While a published monograph may appear to provide definite solutions, and readers infer that the author is certain of his findings, more likely the work only identifies and illuminates tantalizing problems. Especially to those with no experience with taxonomic problems, a published monograph has an unfortunate aura of authority.

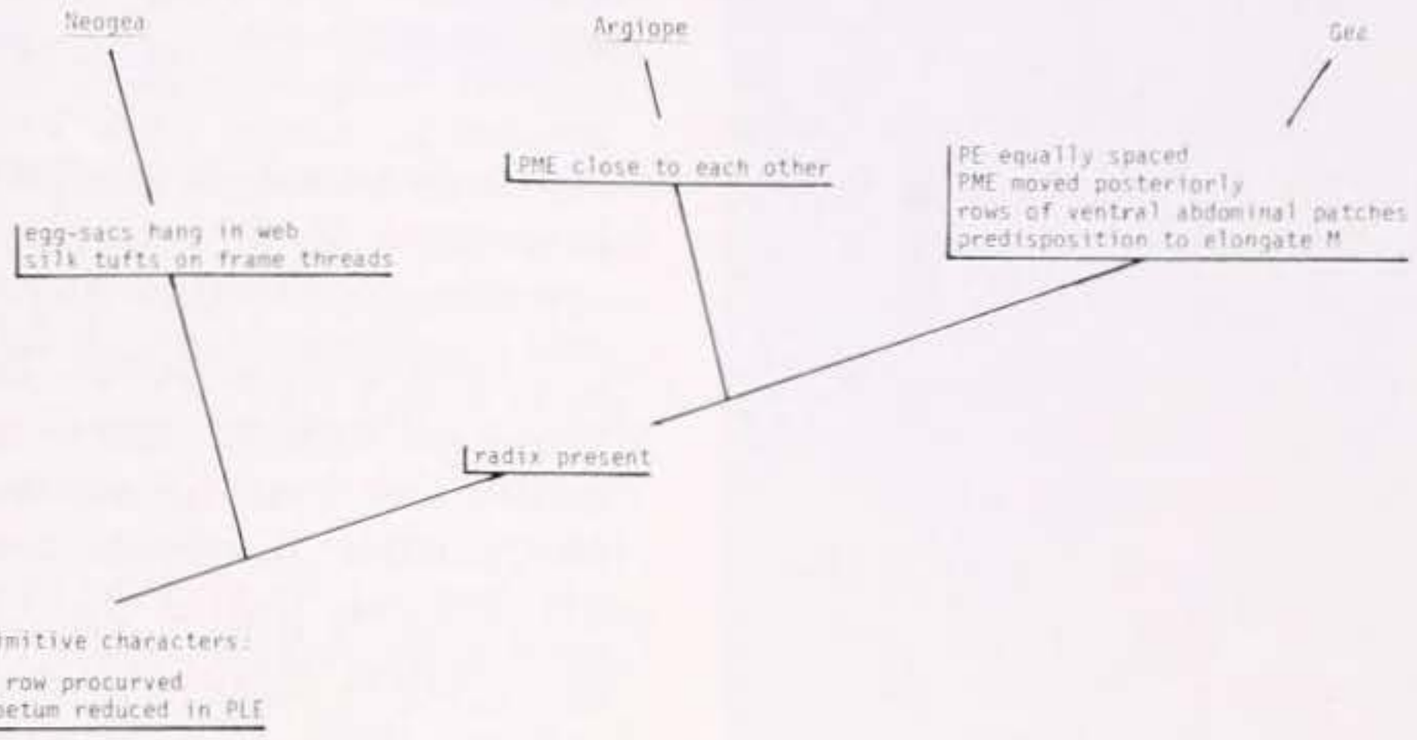
Subfamily Argiopinae Simon, 1890

Argiopidae Simon, 1890: 81. Type genus *Argiope*.
Argiopinae Simon, 1895, Histoire Naturelle des Araignées, 1: 759.

Diagnosis. Argiopinae differ from Araneinae and other subfamilies of the Araneidae by having the posterior eye row procurved when seen from above (Figs. 27, 52, 348, 402).

The posterior eyes differ structurally from those of other subfamilies of the Araneidae: both the laterals and the medians have the canoe-shaped tapetum reduced to a sliver; rows of rhabdoms lacking tapetum are arranged along the side (to-

TABLE 2. CLADOGRAM OF THE GENERA OF THE SUBFAMILY ARGIOPINAE.



Abbreviations. M, median apophysis; PE, posterior eyes; PLE, posterior lateral eyes; PME, posterior median eyes.

ward the median of the animal) (Figs. 9–11). The anterior lateral eyes are much smaller than the others and have a full canoe-shaped tapetum (Figs. 9, 11).

Structure and Color. The head is small in Argiopinae compared to the wide, almost circular thorax. The lateral eyes are on a tubercle; the small anterior laterals cannot be seen from above, as they face forward and slightly to the side (Figs. 1–6). The chelicerae are weaker than those of *Araneus*, with a smaller boss at the base. There are usually two comma-shaped depressions in the carapace. The carapace is almost always covered with white or silver down. The legs are relatively longer than in genera of the Araneinae. The first and second legs are subequal in length; the fourth is slightly shorter, the third much shorter. The abdomen is never spherical, rarely cylindrical (Fig. 16), often ovoid (Fig. 33), pentagonal (Fig. 45), sometimes lobed along the sides (Fig. 93), and often dorso-ventrally flattened. The abdomen is often brightly colored with silver or gold and black on the dorsum, and usually with two white paraxial lines on the venter (Figs. 23, 28, 79, 333). Some species can instantaneously change the color of the abdomen when dropping out of the web (Sabath, 1970; Bristowe, 1976).

The epigynum usually lacks a scape, but almost always has a septum (Fig. 12). Sometimes the openings face dorsally and are hidden below a projection from the genital area (Figs. 81, 82, 99, 100). The epigynum usually has an anterior bulge, a more or less transverse rim, and a pair of depressions separated by a septum which is usually continuous anteriorly with the rim. Posteriorly the septum widens into a posterior plate (Fig. 12). The openings are within the depression, sometimes a slit with lips or a round opening (Fig. 12).

The males are much smaller than females, and never have modified legs, except that stronger macrosetae are found occasionally in *Gea* species. Males have no hook on the first coxae, and lack a tooth on the outside of the endite and on the base of the palpal femur.

The male palpus is complex and always has a small median apophysis (larger in *Gea* species), a large embolus, sclerites between the tegulum and embolus (the stipes) in *Gea* and *Argiope*, and a large conductor. There is never a terminal apophysis (Fig. 13).

Natural History. All *Argiope* and *Gea* are diurnal spiders that rest in the center of the web, head down. Many species have a stabilimentum in the web (Plate 1). The stabilimentum may have only two lines (*A. aurantia* in America); more commonly it has four lines which may not all be present (Robinson and Robinson, 1980).

Possibly the stabilimentum functions to warn potential predators that bill and feathers are likely to be gummed up by silk threads (Horton, 1981). Olive (1980) tried to describe the niches of *Argiope* species as compared with *Araneus* species.

Genera. The subfamily has three genera: *Argiope*, *Gea*, and the new genus *Neogea*. The larger posterior median eyes of *Gea* have evolved at least twice, once in *Gea* and a second time in some of those species here placed in the new genus *Neogea*.

The genus *Argiope* has at various times been split into numerous smaller genera (Kishida, 1936). I do not find this fragmentation into monophyletic genera useful; the numerous names are confusing.

Key to Genera

1. Female abdomen black, with discrete white spots on dorsum as in Figs. 395, 402, 404; epigynum not sclerotized (Figs. 393, 399, 401); male without stipes in palpus (Figs. 397, 406) ..... *Neogea*
– Female abdomen otherwise (Figs. 27, 39, 373); male always with a stipes in palpus (Figs. 13, 387) 2
2. Posterior median eyes closer to each other than to laterals in adults (Figs. 27, 45, 64) ..... *Argiope*
– Posterior median eyes equally spaced (Figs. 348, 353, 371) ..... *Gea*

Argiope Audouin

Argiope Audouin, 1826: 121. Type species designated by Thorell, 1869: 51: *Argiope lobata*. Opinion 1038 of Int. Comm. Zool. Nomencl. (1975) validates the generic name and places the name on the Official List of Generic Names in Zoology with the name no. 2009. Various other spellings of the name have been invalidated.

Miranda C. L. Koch, 1835: 128, pl. 14. Type species *Miranda transalpina* C. L. Koch [=*Argiope bruennichi* (Scopoli)].

Metargiope F. P.—Cambridge, 1903: 451. Type species by monotypy *A. trifasciata*.

Austrargiope Kishida, 1931: 129*. Type species by original designation and monotypy *Austrargiope plana* (L. Koch) [=*A. trifasciata*]. NEW SYNONYMY.

Coganargiope Kishida, 1931: 129*. Type species by original designation and monotypy *Coganargiope amoena* (L. Koch). NEW SYNONYMY.

Mesargiope Kishida, 1931: 130*. Subgenus of *Coganargiope*. Type species by original designation and monotypy *Coganargiope* (*Mesargiope*) *aetherea* (Walckenaer) [misidentification of *A. boesenbergi* n. sp.]. NEW SYNONYMY.

Micrargiope Kishida, 1931: 130*. Subgenus of *Coganargiope*. Type species by original designation and monotypy *Coganargiope* (*Micrargiope*) *minuta* (Karsch). NEW SYNONYMY.

Chaetargiope Kishida, 1931: 130*. Type species by original designation and monotypy *Chaetargiope* (*Chaetargiope*) *picta* (L. Koch). NEW SYNONYMY.

Neargiope Kishida, 1931: 131*. Subgenus of *Chaetargiope*. Type species by original designation and monotypy *Chaetargiope* (*Neargiope*) *regalis* (L. Koch) [=*A. aetherea*]. NEW SYNONYMY.

Brachygea di Caporiacco, 1947: 24. Type species by original designation and monotypy *B. platycephala* di Caporiacco [=*Argiope trifasciata* (Forskål)]. NEW SYNONYMY.

Diagnosis. Argiope is separated from *Gea* and *Neogea* by the arrangement of eyes in females, and usually in males: the posterior median eyes are closer to each other than to the laterals in *Argiope* (Figs. 27, 45, 64). Also, the head region bearing the posterior median eyes is lower than in *Gea* and *Neogea*, and the carapace is relatively wider in the thoracic region (Figs. 1, 3, 5).

Coloration. The carapace is usually covered with white or silver down. Although females of *Argiope* species have a number of unusual patterns on the abdomen, similar patterns appear in groups unrelated to one another, judging relationship by genitalic structure (e.g., *A. trifasciata* markings are displayed also by *aemula* and *magnifica*; *reinwardti* markings by *aetherea*, *luzona*, *amoena*, and *keyserlingi*). Species with very similar genitalia often have very different color markings, which facilitate their diagnosis; thus, *Argiope aetherea* and *A. picta* of New Guinea are more easily separated by pattern than by genitalic structure (Figs. 297–307, 310–314). The venter of the abdomen is usually black with two paraxial

* Original not available; all from Kishida, 1936: 14–27.

white lines enclosing paired white spots. This ventral pattern may be diagnostic (e.g., *A. catenulata*, Fig. 40; *A. bougainvilla*, Fig. 290).

Structure. *Argiope* species have a narrow head, contrasting with a very wide thoracic region (Figs. 1–7); the chelicerae are relatively weak. Some specimens have a tubercle on the sternum opposite each coxa. The legs are long, the first longest, the second almost as long, the fourth shorter, the third very much shorter. The shape of the abdomen varies from cylindrical (Fig. 16) to oval (Fig. 289), pentagonal (Fig. 27), or shield-shaped (Fig. 313).

Behavior. *Argiope* make a characteristic orb-web, usually with a stabilimentum (Plate 1). Much of what is known of both web and mating behavior is reported in M. H. Robinson and B. Robinson (1980).

Species. There are 49 species in the Pacific area, including eastern Asia, 2 species in Europe, 7 in the Americas, and about 10 in Africa and western Asia.

Distribution. *Argiope* species are found worldwide, absent only from the coldest regions.

Species groups. There are several distinct species groups and numerous species not close to others. Characters for males, especially their palpi, are useful not only to separate the subfamilies of Araneidae, but also for understanding relationships at the species level. Unfortunately, for many species the males are not known.

1. *Argiope ocula* group: *Argiope ocula* has a characteristic triangular scape (Fig. 14), an unusual plesiomorph feature; the posterior eye row is only slightly procurved, and the abdomen is cylindrical, another primitive feature. However, as in more specialized *Argiope*, the conductor and embolus extend beyond the tegulum (Fig. 18). The presence of a scape in the epigynum of *A. macrochoera* (Fig. 19) and *A. manila* (Fig. 24) may relate them to *A. ocula*, but more likely it is a convergent structure.

2. *Argiope aemula* group: Females are characterized by the swollen rims and lateral margins of the epigynum (Figs. 29–32, 36–38). The small, short embolus of *A. aemula* and *A. catenulata* are primitive (Figs. 35, 41). To this group belong *A. aemula* and *A. catenulata*.

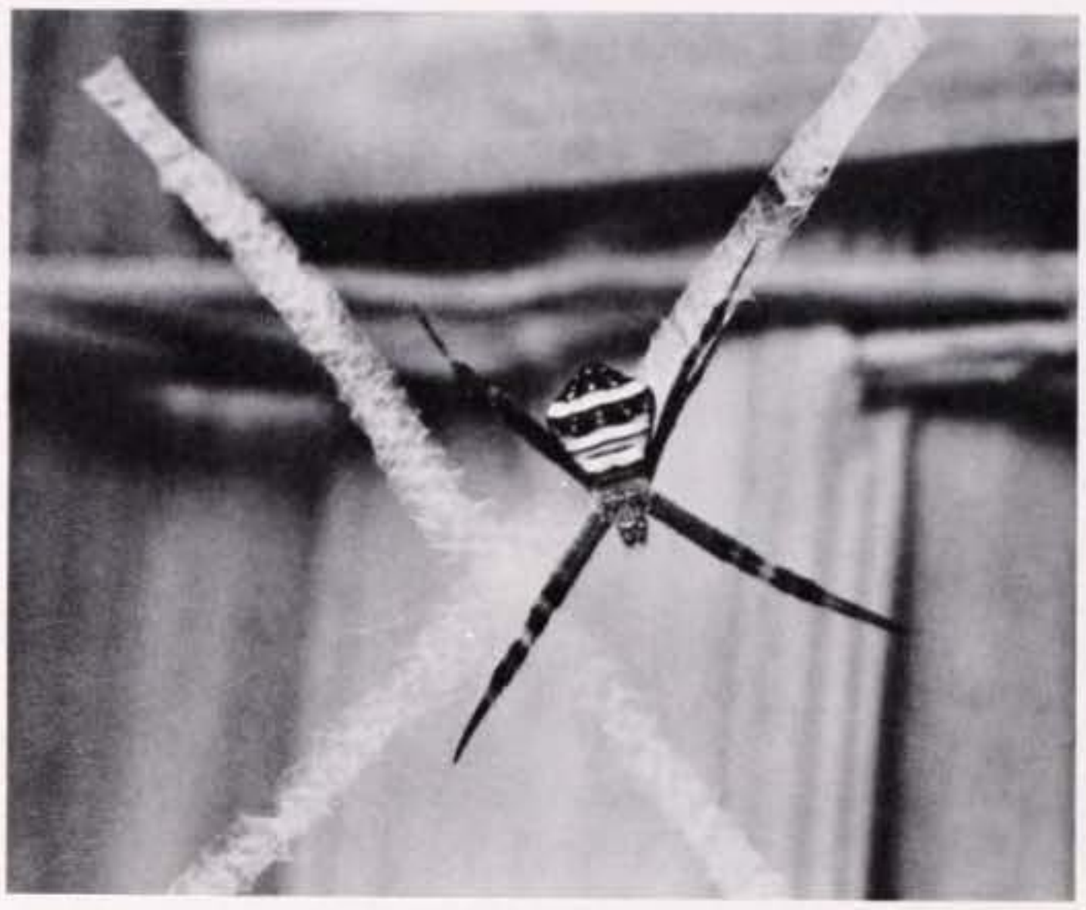


Plate 1. *Argiope versicolor* (Doleschall). Female from Sarawak with web having an unusually dense stabilimentum (photo F. Wanless).

3. *Argiope reinwardti* group: Members of this group have a wide median septum in the epigynum (Figs. 42, 47, 56). The only male known, that of *A. reinwardti*, has a relatively short embolus and conductor (Fig. 54). The group includes *A. reinwardti*, *A. buehleri* and *A. caesarea*. Since they are allopatric, they may all belong to the same species.

4. *Argiope amoena* group: Females have the epigynum modified anteriorly (Figs. 61, 67, 73). In males, the embolus is long and straight, held by a straight projecting conductor (Figs. 66, 72, 80). To this group belong *A. boesenbergi*, *A. amoena*, and *A. magnifica*. *Argiope bruennichi*'s palpus is close to this group, but the much modified epigynum has lost the septum and is pulled posteriorly (Figs. 81–83). Also, the American *A. aurantia* may belong to this group.

5. *Argiope trifasciata* group: Females of many species have a tail on the abdomen (Figs. 104, 110). The epigynum may be lightly sclerotized. In males of many

species the embolus and conductor are longer and more elaborate than in the *amoena* group (Figs. 106, 111, 119). To this seemingly specialized group belong species having a folium pattern on the abdomen (Figs. 122, 139), perhaps a primitive feature seen commonly in females of other subfamilies. *Argiope trifasciata*, *A. protensa*, *A. probata*, *A. bullocki*, *A. ocyaloides*, *A. dietrichae*, *A. doboensis*, and *A. chloreis* belong here; perhaps also *A. katherina*. The American species, *A. argentata*, *A. florida*, *A. blanda*, and *A. savignyi* also belong here.

6. The *Argiope anasuja* group includes mostly small species which tend to have a flange on the rim of the epigynum (Figs. 12, 167). The males of only a few species are known. Included in this group are *A. minuta*, *A. perforata*, *A. halmaherensis*, *A. possoica*, *A. mascordi*, *A. keyserlingi*, *A. kochi*, and *A. caledonia*.

7. *Argiope aetherea* group is the largest, the most distinct, and perhaps the most specialized. The species are often, judging by their genitalia, closely related and fairly specialized. Females of the group are characterized by a relatively narrow epigynal rim, a septum, and in most species a tubercle on the margin on each side of the posterior plate in posterior view (Fig. 12). In males the embolus is curved and describes a semicircle; in many species there is a kink between semicircle and tip (Fig. 13). Other members of the group are: *A. luzona*, *intricata*, *modesta*, *pulchella*, *versicolor*, *appensa*, *brunnescentia*, *bougainvilla*, *pentagona*, *picta*, *radon*, *ponape*, *taprobanica*, and *truk*.

Species of doubtful placement include *Argiope thai*, *takum*, and *niasensis*, in all of which the male is not known. *Argiope lobata*, with males known, is not close to any group.

M. H. Robinson and B. Robinson (1980) divide courtship and mating behavior of tropical araneid orb-weavers into three groups, with that of some *Argiope* in Group A, that of others in Group B, and that of a *Gea* in Group C. They consider Group A behavior to be primitive, Group B intermediate, and Group C the most advanced. They also believe that the behavior of Group C may have evolved several times. My findings here agree in general with this assessment. *A. reinwardti* of Group A is certainly one of the most primitive *Argiope*. *Argiope magnifica* [*A. aemula*: Robinson and Robinson] and *A. aurantia* have specialized features, although of Group A. Group B includes *A. picta*, *A. aetherea*, and *A. radon*, the most specialized *Argiope*. But the group also includes *A. aemula* ("Wau No. 5" and "Singapore No. 1"), which I would consider a species with primitive morphological features. *Gea eff* ("Wau No. 1"), placed in Group C with other species of *Gea*, I consider more specialized than any *Argiope* (Table 2).

Misplaced *Argiope*

Argiope aequior Chamberlin, 1924: 16, pl. 4, fig. 33, ♂. Male from N. Gist Gee, Soochow, China in the U.S. National Museum of Natural History, Washington, examined, is an oxyopid.

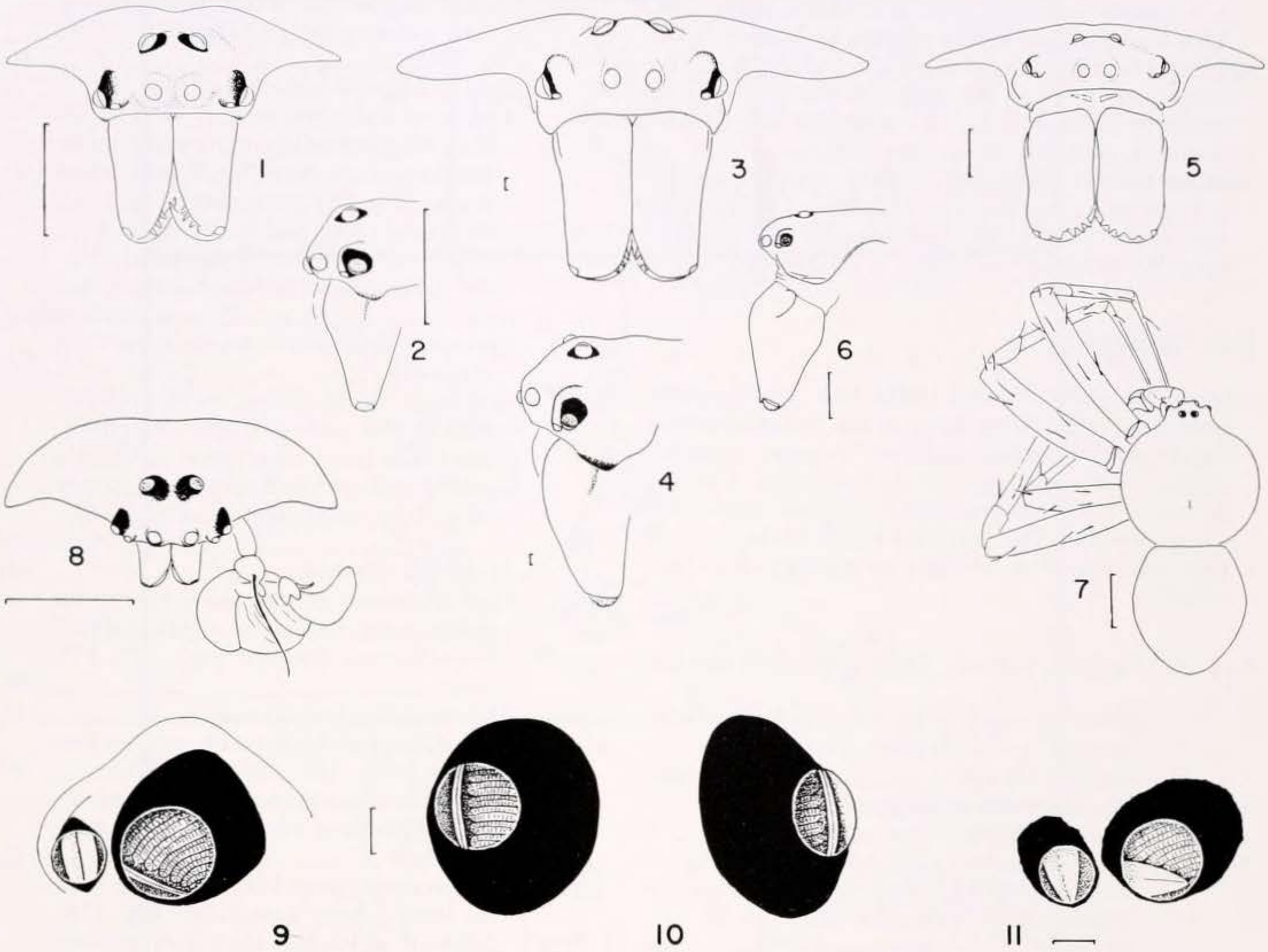
Argiope aurea Saito, 1934a: 316, pl. 13, fig. 20, pl. 15, fig. 63, ♀. The illustrations show a wide head, recurved posterior eye row, and the epigynum having the remains of a scape which has been torn off. It is a relative of *Araneus*.

Argiope carinata L. Koch, 1871: 29, pl. 2, fig. 7. Juvenile holotype and fragments of paratype in poor physical condition, broken, bleached and shrunken, from "New Holland" [Australia] in the Naturhistorisches Museum, Wien, examined. The shapes of the abdomen and ventral markings are distinct, like those of *A. argentata*. No species similar to *A. argentata* is known from Australia. There is a mistake in the locality label; it comes from America.

Argiope lepida Thorell, 1898: 337. Male holotype from Mount Carin [Karen] Chebà, Burma in the Museo Civico di Storia Naturale, Genova, examined, is probably the male of *Acusilas coccineus* Simon, 1895. It has a very narrow head and a strongly recurved eye row.

Argiope leucopicta Urquart, 1890: 234. Female holotype from Fiji Islands, lost. It is not in the Otago Museum, Dunedin, nor in the Canterbury Museum, Christchurch. The description of the recurved posterior row of eyes and color pattern of the abdomen suggest that this is a species of *Cyrtophora*.

Argiope maja Bösenberg and Strand, 1906: 201, fig.



Figures 1–13. *Argiope morphology*. 1–6. Female eye region and chelicerae, face view and lateral. 1, 2. *A. doboensis*. 3, 4. *A. versicolor*. 5, 6. *A. aetherea*. 7, 8. Male, dorsal view and eye region and chelicerae, *A. picta*. 9–11. Female secondary eyes. 9, 11. Left lateral eyes. 10. Posterior median eyes. 9, 10. *A. aemula*. 11. *A. trifasciata*. 12. Diagrammatic epigynum. 13. Left male palpus, mesal.

Scale lines. 1.0 mm, except Figures 9–11, 0.1 mm.

Abbreviations. C, conductor; E, embolus; I, stipes; M, median apophysis; P, paracymbium; R, radix; T, tegulum.

1, ♀. Female holotype from Yokohama, Japan, lost. This is probably *Nephila clavata* L. Koch.

Argiope sachalinensis Saito, 1934b: 332, fig. 6, ♀. The epigynum in Saito's illustration of this species from Sachalin [Sakhalin] has an annulate scape. The species is probably an *Araneus*.

Argiope viabilior Chamberlin, 1924: 16, pl. 4, fig. 32, ♂. Male from N. Gist Gee, Soochow, China, palpi lost, in the U.S. National Museum of Natural History, Washington, examined, is an oxyopid.

Not Recognizable

Argiope manicata Thorell, 1859: 300. Two juvenile specimens from Hong Kong in the Naturhistoriska Riksmuseet, Stockholm labeled "*Argiope tarsalis*" appear to be the types of *A. manicata*. The abdomen ovate to subpentagonal, angular anteriorly, ash gray above, the posterior black. Is this a juvenile specimen of *A. amoena* or perhaps of *A. caesarea*?

Key to Western Pacific Area *Argiope* Females

1. Abdomen oval with large lobes all around, as in Figures 93–96; widespread (Map 3) ..... *lobata*
– Abdomen various shapes, without lobes or only shallow lobes 2

2(1). Suboval abdomen with transverse dark lines on dorsum, lines narrower than intermediate light areas (Figs. 33, 78, 84, 115) 20
– Abdomen otherwise 3

3(2). Epigynum with septum constricted anteriorly forming a scape (Figs. 14, 19, 24) 24
– Epigynum without such scape 4

4(3). Abdomen with at least four narrow black and white bands of equal width, posterior on dorsum (Fig. 332); Caroline Islands (Map 5) ..... *ponape*
– Abdomen marked otherwise 5

5(4). Dorsum of abdomen with one to three wide, transverse white bands separated by black bands which on the posterior of the abdomen are about equal width or wider than white bands (Figs. 52, 70, 170, 244, 257); abdomen pentagonal or shield-shaped, widest in middle or in posterior half 26
– Abdomen marked otherwise 6

6(5). Abdomen with a post-spinneret tail (Figs. 102–104, 109, 110) or pointed behind (Figs. 105, 128, 134); New Guinea, Australia, New Zealand 43
– Abdomen rounded behind spinnerets, with at most a slight overhang 7

7(6). Epigynum with anterior edge of rim broken, lateral part of rim narrower than median or lateral part grading into anterior bulge (Figs. 263, 266, 271) 46
– Epigynum with rim entire (Fig. 12) 8

8(7). Abdomen widest posteriorly with a median longitudinal band of white scales breaking transverse black and white marks (Fig. 39); epigynum with thick V-shaped rim and septum; septum width one third that of epigynum (Fig. 36); China, India to New Guinea (Map 2) ..... *catenulata*
– Abdomen marked otherwise; epigynum otherwise 9

9(8). Abdomen shield-shaped, with anterior humps and with a median longitudinal black band constricted anteriorly and a wide white band on each side (Fig. 165); southern China (Map 4) ..... *perforata*
– Abdomen otherwise 10

10(9). Oval abdomen mostly dark except for contrasting yellow or light colored shoulders on dorsum (Figs. 117, 155, 289) 47
– Abdomen marked otherwise 11

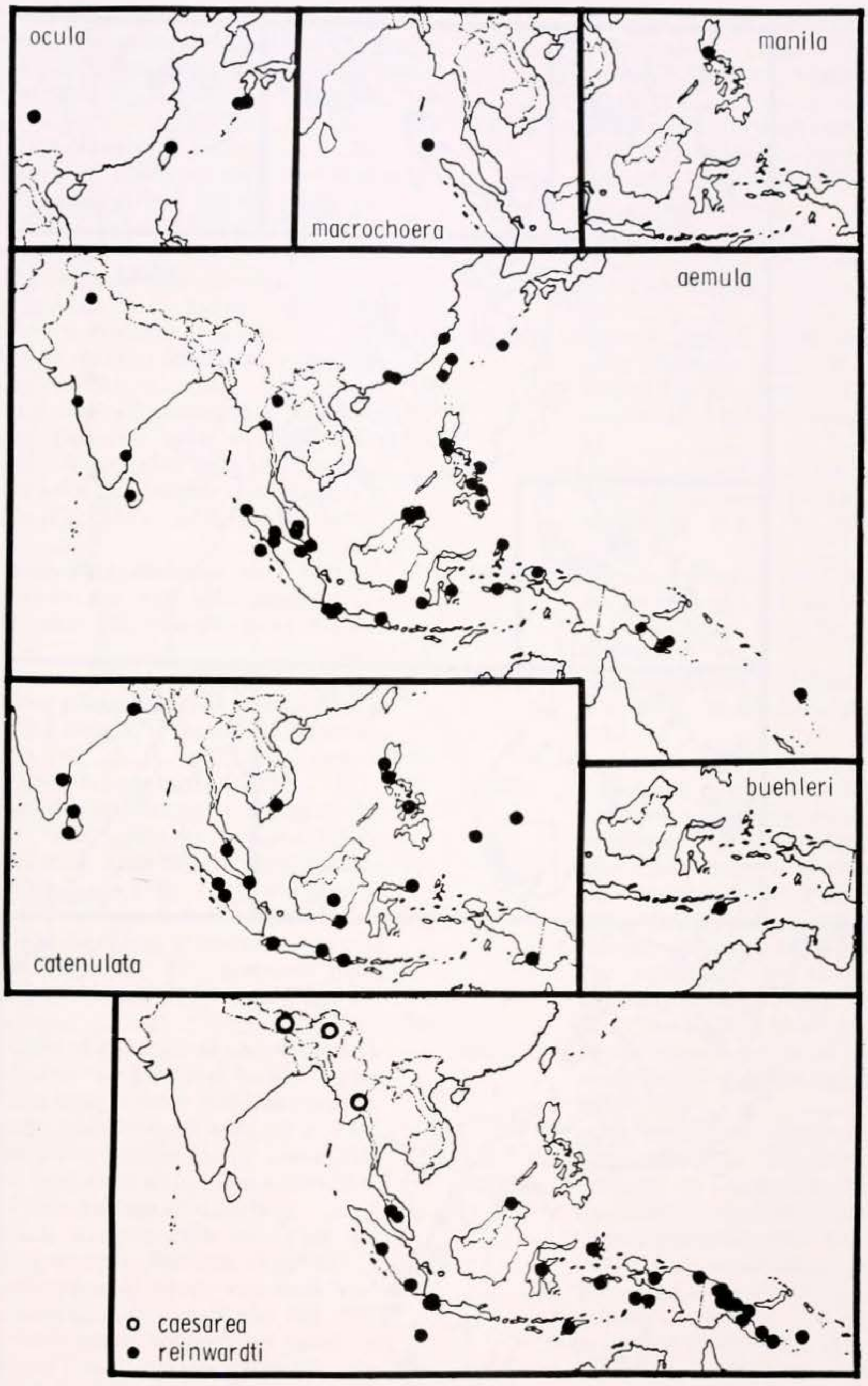
11(10). Underside of abdomen with median area white (Figs. 147, 149, 151, 296) 49
– Underside of abdomen with two parax-ial white lines enclosing white spots on black 12

12(11). Epigynum trapezoid in outline, as wide as long, widest anteriorly (Fig. 178); septum width half that of epigynum; rims are short anterior arms of septum (Fig. 178); abdomen pentagonal (Fig. 181); Indonesia (Map 4) ..... *niasensis*
– Epigynum otherwise, abdomen sometimes pentagonal 13

13(12). Abdomen shield-shaped with median dorsal light patches framed by black, as in Figure 313; epigynum with posterior lip of opening (on each side of posterior plate) swollen (Fig. 311); Moluccas, New Guinea, northern Australia to Santa Cruz Islands (Map 5) ..... *picta*
– Abdomen marked otherwise; epigynum sometimes with posterior lip of opening swollen 14

14(13). Epigynum longer than wide, rim with long flanges (Fig. 173); abdomen with three pairs of white patches (Fig. 176); Halmahera, New Guinea (Map 4) ..... *halmaherensis*
– Epigynum wider than long 15

15(14). Shield-shaped abdomen with two small anterior nipples and with paired dorsal marks (Fig. 186); venter with two white exclamation marks (Fig. 187); epigynum as in Figures 183, 184, with



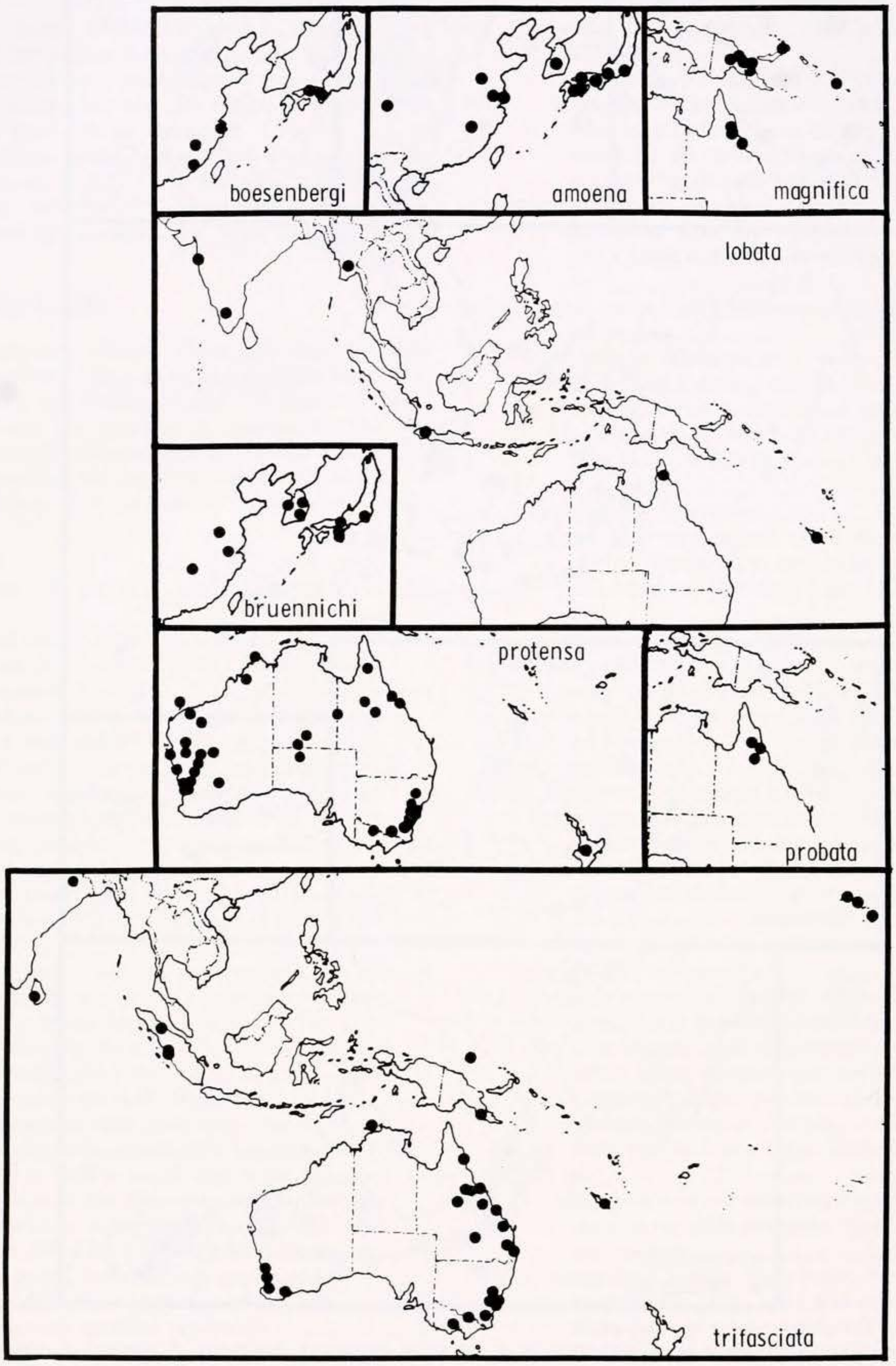
Map 2. Distribution of *Argiope ocula*, *A. macrochoera*, *A. manila*, *A. aemula*, *A. catenulata*, *A. buehleri*, *A. caesarea*, and *A. reinwardti*.

very wide septum and posterior plate; New Guinea (Map 4) ..... *takum*

Abdomen and epigynum otherwise 16

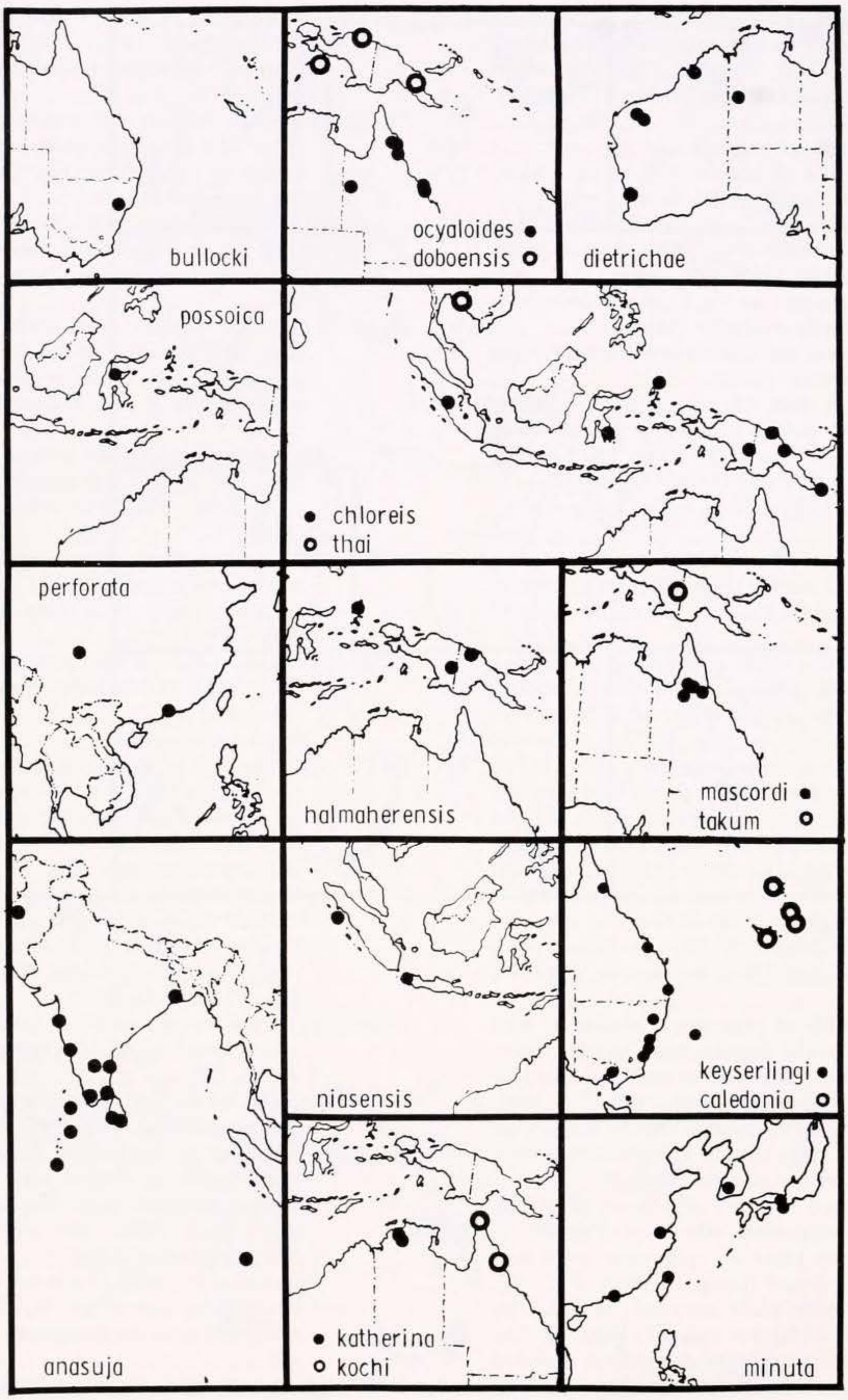
16(15). Abdomen with a dorsal dark folium, lighter on sides or with outline of folium visible in reticulate pattern (Figs. 122, 139, 191, 214) 50

Abdomen marked otherwise 17

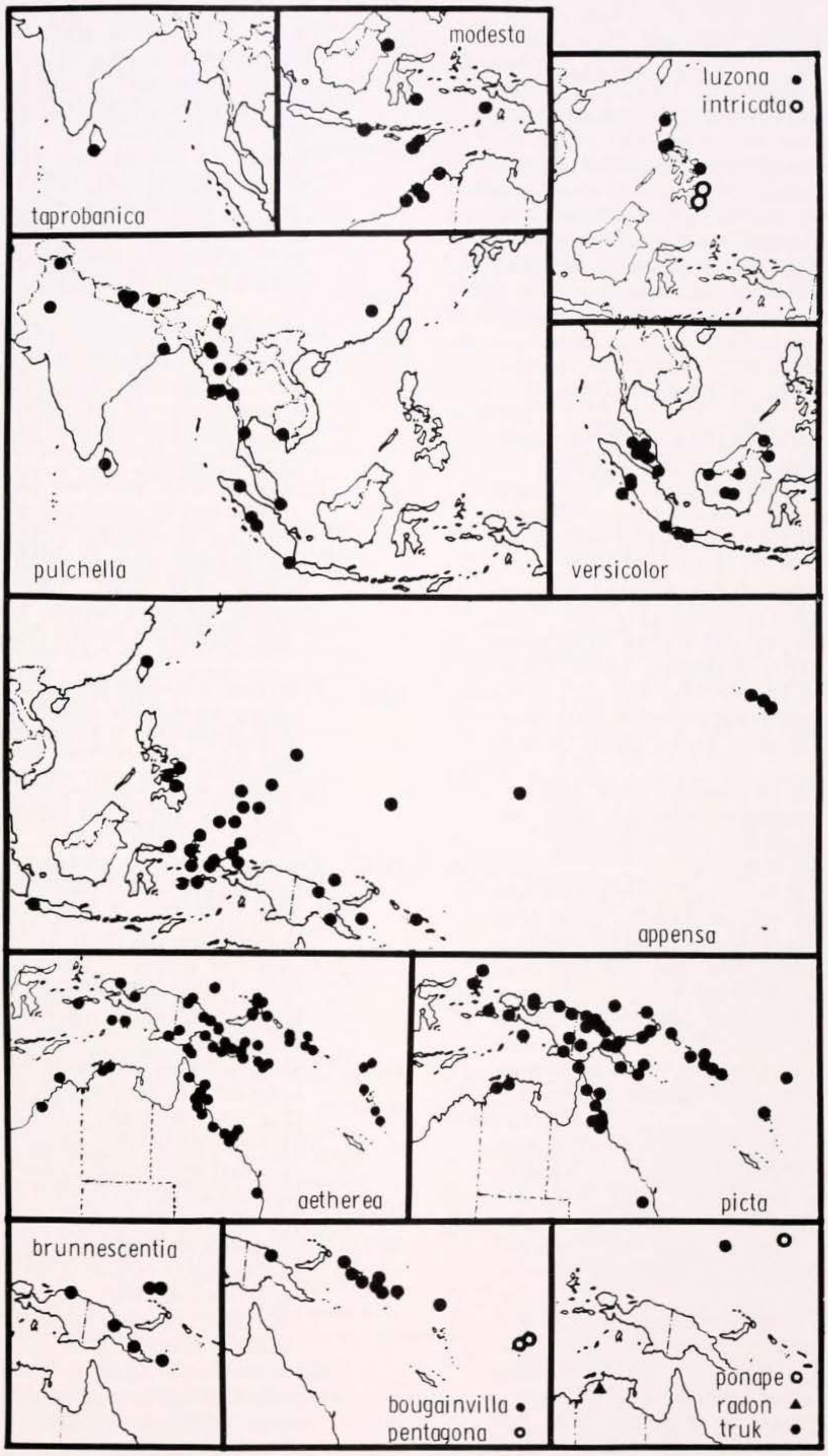


Map 3. Distribution of *Argiope boesenbergi*, *A. amoena*, *A. magnifica*, *A. protensa*, *A. probata*, and, eastern Asian and western Pacific distributions of *A. bruennichi*, *A. lobata*, and *A. trifasciata*.

17(16). Center of abdomen dorsum white, silver to yellow sometimes framed by black (Figs. 102, 303, 306, 320); posterior abdominal tip may be black (Figs. 303, 320) 53
– Markings otherwise 18
18(17). Underside of abdomen with two wide, light, longitudinal bands, wider behind than in front and separated by a black band (Fig. 204); dorsum with indistinct transverse bands (Fig. 203); epigynum as in Figures 200–202; northern Australia (Map 4) ..... *kochi*
– Abdomen marked otherwise; epigynum otherwise 19
19(18). Anterior half of pentagonal abdomen light, posterior with a large white patch on each side (Fig. 160); epigynum with rim thicker than septum is wide (Fig. 157); Celebes (Map 4) ..... *possoica*
– Abdomen subcylindrical, with anterior dorsal humps (Fig. 155); epigynum as in Figures 152, 153; Thailand (Map 4) ..... *thai*
20(2). Epigynum with a posterior lobe, containing depression that faces dorsally; lacking septum (Figs. 81–83); Eurasia (Map 3) ..... *bruennichi*
– Depression facing ventrally (Fig. 112) 21
21(20). Septum of epigynum partly bridging rim (Fig. 112); posterior plate filling depression; each side of septum plate hollowed out (Fig. 112); widespread (Map 3) ..... *trifasciata*
– Septum branching anteriorly into the rims (Figs. 29, 73); posterior plate small, not filling depression (Figs. 30, 74) 22
22(21). Underside of pentagonal abdomen with two wide longitudinal bands, wider behind than in front and separated by a black band of equal width (Fig. 204); posterior of dorsum mostly black (Fig. 203); epigynum as in Figures 200–202; northern Australia (Map 4) ..... *kochi*
– Abdomen marked otherwise (Figs. 33, 78); epigynum otherwise (Fig. 29) 23
23(22). Posterior plate of epigynum with median dorsal hump (bottom, Fig. 30); posterior plate covered on sides by lobes of lateral margin (Figs. 30, 31); lateral margins of depression rounded and black on outside (Figs. 29–31); widespread, Asia to New Hebrides (Map 2) ..... *aemula*
– Posterior plate of epigynum with median ventral hump (top, Fig. 77); posterior plate overhanging lateral margins of depression (Figs. 74, 77); lateral margins of depression flat, appearing "unfinished" (Figs. 73, 76); New Guinea, Solomon Islands, Australia (Map 3) ..... *magnifica*
24(3). Abdomen dorsum with transverse bands (Fig. 22); posterior plate with three radiating extensions (Fig. 20); Nicobar Islands (Map 2) ..... *macrochoera*
– Abdomen dorsum with white patches (Fig. 27) or with lateral chevrons (Fig. 16); posterior plate otherwise (Figs. 15, 25) 25
25(24). Abdomen dorsum with white patches (Fig. 27); depressions on each side of scape (Fig. 24); posterior plate longer than wide (Fig. 25); Philippines (Map 2) ..... *manila*
– Abdomen dorsum with lateral chevrons (Fig. 16); epigynal depressions facing posteriorly (Fig. 15); China, Japan (Map 2) ..... *ocula*
26(5). Epigynum longer than wide, rarely square in outline (Figs. 61, 67, 173) 27
– Epigynum wider than long in outline (Fig. 42) 29
27(26). Rims of epigynum with posterior flanges (Fig. 173); Halmahera, New Guinea (Map 4) ..... *halmaherensis*
– Epigynum otherwise 28
28(27). Anterior half of abdomen dorsum light; posterior with a narrow white band on black (Fig. 64); epigynal septum with small anterior groove and lacking anterior bulge (Fig. 61); Japan, China (Map 3) ..... *boesenbergi*
– Abdomen dorsum evenly banded (Fig. 70); epigynal rim U-shaped, surrounding anterior bulge (Fig. 67); Japan, China (Map 3) ..... *amoena*
29(26). Epigynal septum width at least as wide as one fourth width of epigynum (Figs. 42, 47, 56) 30
– Septum width less than one quarter of epigynum (Figs. 157, 200) 33
30(29). Depression of epigynum bordered by rim laterally in ventral view and containing posterior plate (Fig. 222); posterior plate wider than septum (Fig. 223); Sri Lanka (Map 5) ..... *taprobanica*
– Depression in ventral view not bordered laterally by rim (Figs. 42, 47); posterior plate as wide as septum (Figs. 43, 48) 31
31(30). Epigynum with septum round, appearing swollen (Fig. 42); Timor (Map 2) ..... *buehleri*
– Epigynum flattened posteroventrally (Figs. 47, 56) 32
32(31). Sternum yellowish with gray around edge (Fig. 53); rims of epigynum lat-



Map 4. Distribution of *Argiope bullocki*, *A. doboensis*, *A. ocyaloides*, *A. dietrichae*, *A. possoica*, *A. chloreis*, *A. thai*, *A. perforata*, *A. halmaherensis*, *A. mascordi*, *A. takum*, *A. anasuja*, *A. niasensis*, *A. caledonia*, *A. keyserlingi*, *A. katherina*, *A. kochi*, and *A. minuta*.



Map 5. Distribution of *Argiope taprobanica*, *A. modesta*, *A. intricata*, *A. luzona*, *A. pulchella*, *A. versicolor*, *A. appensa*, *A. aetherea*, *A. picta*, *A. brunnescentia*, *A. bougainvilla*, *A. pentagona*, *A. ponape*, *A. radon*, and *A. truk*.

erally wide (Fig. 47); Malay Peninsula, Borneo, Indonesia, New Guinea (Map 2) ..... *reinwardti*

– Sternum black with median light longitudinal band (Fig. 60); rims of epigynum narrowing laterally (Fig. 56); northeastern India, Burma (Map 2) ..... *caesarea*

33(29). Underside of abdomen with two longitudinal bands as wide as intermediate area (Fig. 204); northern Queensland (Map 4) ..... *kochi*

– Underside of abdomen with two narrow longitudinal lines 34

34(33). Epigynal rim much thicker than septum width (Fig. 157); Celebes (Map 4) ..... *possoica*

– Epigynal rim as thick as septum width or narrower (Figs. 167, 194, 205) 35

35(34). Rims of epigynum with transverse flange, posterior edge flange straight, at right angles to axis of septum (in ventral view) (Figs. 167, 205) 36

– Rims, flange if present, and epigynal depression otherwise (Fig. 194) 37

36(35). Flanges of rim with a tooth on each side (Fig. 167); Pakistan, India, Cocos Keeling Islands (Map 4) ..... *anasuja*

– Flanges enclosing posterior plate laterally (Fig. 205); Japan, China (Map 4) ..... *minuta*

37(35). Epigynum in posterior view with circular opening in depression (Figs. 195, 218); Australia, New Caledonia 38

– Epigynum otherwise 39

38(37). Epigynum in ventral view with a lobe on each side of posterior plate (Fig. 194); epigynum rectangular in outline in posterior view (Fig. 195); east coast of Australia (Map 4) ..... *keyserlingi*

– Epigynum without lobes on each side of opening (Figs. 217, 218); epigynum rounded in outline in posterior view (Fig. 218); New Caledonia (Map 4) ..... *caledonia*

39(37). Anterior bulge of epigynum very large, almost hiding posteriorly- or laterally-facing depressions (Figs. 238, 251, 254); Asia, Borneo, Indonesia 40

– Anterior bulge of usual size (Figs. 227, 233); Philippines, Moluccas to Australia 41

40(39). Anterior bulge rectangular to oval, wider than long; depressions facing posteriorly (Figs. 251, 253, 254, 256); depressions containing large piece of palpal embolus (Figs. 261, 262); Borneo, Malay Peninsula to Java (Map 5) ..... *versicolor*

– Anterior bulge subcircular, depressions facing posterolaterally (Figs. 238, 240, 241, 243); depressions containing small tip of embolus (Fig. 250); India, Malay Peninsula to Java (Map 5) ..... *pulchella*

41(39). Epigynum with narrow septum widening abruptly into posterior plate (Fig. 228); in posterior view depression framed by set-off rim (Fig. 228); northern Philippines (Map 5) ..... *luzona*

– Epigynum with septum gradually widening into posterior plate (Figs. 233, 297); in posterior view depression not framed by distinct rim (Figs. 234, 298) 42

42(41). Epigynum with posterior plate slightly lobed, its width more than one third that of epigynum (Fig. 234); lips of depression curved (Fig. 233); sternum maculated (Fig. 237); southern Philippines (Map 5) ..... *intricata*

– Epigynum with posterior plate edges straight and its width narrower (Fig. 298); lips of opening within depression straight; sternum usually bright yellow (Fig. 304); Ambon, New Guinea, Solomon Islands, New Hebrides, northern Australia (Map 5) ..... *aetherea*

43(6). Epigynum a median posterior lobe containing depressions which face dorsally (Figs. 98–101); Australia, New Zealand (Map 3) ..... *protensa*

– Epigynum with depressions facing ventrally (Fig. 107); New Guinea, northeastern Australia 44

44(43). Anterior of abdomen rounded (Fig. 109), light colored with a median dorsal abdominal dark mark (Fig. 109); northeastern Australia (Map 3) ..... *probata*

– Anterior of abdomen lobed or pointed on each side; dark colored with paired longitudinal marks or folium (Figs. 127, 133) 45

45(44). Abdomen lobed anteriorly (Fig. 127); epigynal rim and septum forming T (Fig. 124); Australia (Map 4) ..... *ocyaloides*

– Abdomen with anterior points (Fig. 133); epigynal septum and posterior plate forming an upside-down T (Fig. 130); New Guinea (Map 4) ..... *doboensis*

46(7). Abdomen with shallow lobes all around, pentagonal in outline (Figs. 269, 270); epigynum ventrally drawn out (Figs. 265, 268); Borneo to northwestern Australia (Map 5) ..... *modesta*

– Abdomen only slightly lobed behind with characteristic reticulate pattern more distinct around edge (Figs. 274–276); epigynum not ventrally drawn out (Fig. 273); Hawaii, southern Japan, Taiwan to Java, New Guinea, Solomon Islands (Map 5) ..... *appensa*

47(10). Epigynal septum bridging rim in part (Fig. 112); Kauai Island of Hawaii (Map 3) ..... *trifasciata*
– Epigynum otherwise (Fig. 286) 48
48(47). Abdomen without humps, widest anteriorly (Fig. 289); Solomon Islands (Map 5) ..... *bougainvilla*
– Abdomen with humps, widest in posterior (Fig. 155); Thailand (Map 4) ..... *thai*
49(11). Abdomen pentagonal in outline (Fig. 295); ventral white area wider than long, with eight arms (Fig. 296); Fiji (Map 5) ..... *pentagona*
– Abdomen shield-shaped (Figs. 146, 150); ventral white area longer than wide (Figs. 147, 149); Sumatra to New Guinea (Map 4) ..... *chloreis*
50(16). Epigynal depression laterally surrounded by rim; septum flaring into depression (Fig. 120); New South Wales (Map 4) ..... *bullocki*
– Epigynal depression not laterally surrounded by rim; or, if surrounded, septum a discrete structure (Fig. 136) 51
51(50). Posterior plate of epigynum only slightly wider than septum; in posterior view circular openings visible (Fig. 189); Queensland (Map 4) ..... *mascordi*
– Posterior plate of epigynum much wider than septum (Figs. 137, 212) 52
52(51). In posterior view rim surrounds depressions and circular openings are visible (Fig. 212); Northern Territory (Map 4) ..... *katherina*
– Openings on each side under a curved slit within the depression (Fig. 136); Western Australia, Northern Territory (Map 4) ..... *dietrichae*
53(17). Elongate abdomen silvery with only faint longitudinal dorsal marks (Fig. 102); epigynum a posterior lobe containing depressions that face dorsally (Figs. 98–101); New Zealand, Australia (Map 3) ..... *protensa*
– Abdomen various shapes (Figs. 303, 320), usually darker around dorsal edge (Figs. 303, 327); epigynal depressions facing ventrally (Figs. 297, 317) 54
54(53). Abdomen pentagonal, bulging, with only V-shaped marks around margin (Fig. 282); New Guinea, Bismarck Archipelago (Map 5) ..... *brunnescentia*
– Abdomen otherwise 55
55(54). Abdomen elongate, shield-shaped, slightly constricted behind humps (Fig. 320); Northern Territory (Map 5) .. *radon*
– Abdomen pentagonal or oval 56
56(55). Abdomen pentagonal, usually posterior tip black (Fig. 303); Moluccas to New Hebrides, northern Australia (Map 5) ..... *aetherea*
– Abdomen oval (Fig. 327); Caroline Islands (Map 5) ..... *truk*

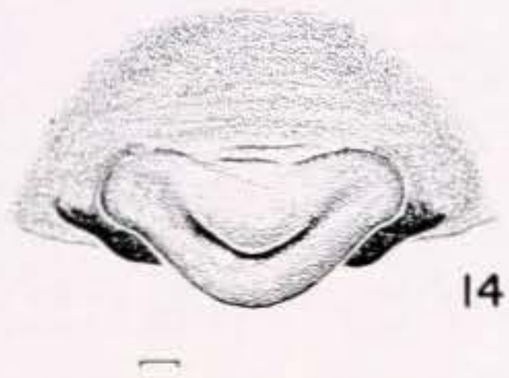
KEY TO WESTERN PACIFIC AREA MALE *ARGIOPE*

The males of a number of species are unknown: *buehleri, bullocki, caledonia, caesarea, chloreis, dietrichae, halmaherensis, intricata, macrochoera, manila, modesta, niasensis, pentagona, perforata, ponape, possoica, takum, taprobanica, thai,* and *truk.*

There is some doubt as to whether the following have been correctly matched: *brunnescentia, kochi,* and *mascordi.*

1. A distal kink on the embolus' outer ("upper") surface (Fig. 13) 19
– Upper surface of embolus without kink, at most slightly twisted (Figs. 35, 41, 80) 2
2(1). In mesal view the tegulum surrounds short embolus and conductor (Figs. 35, 41, 54, 199) 24
– Embolus and conductor extend beyond tegulum (Figs. 66, 80, 106) 3
3(2). Embolus forms a circle on ventral surface as in Figure 119; widespread (Map 3) ..... *trifasciata*
– Embolus not a coil on ventral surface (Figs. 72, 111) 4
4(3). Embolus coiled back on itself (Figs. 111, 129); Australia 27
– Embolus straight, curved, or coiled, not doubled up on itself (Figs. 54, 72) 5
5(4). Embolus curved with a slight twist in middle as in Figures 248, 259 6
– Embolus otherwise (Figs. 106, 232) 7
6(5). Pendant longer than embolus tip (Fig. 248); India to Java (Map 5) ..... *pulchella*
– Pendant shorter than embolus tip (Fig. 259); Malay Peninsula to Java, Borneo (Map 5) ..... *versicolor*
7(5). Embolus very long and conductor hanging "down" (Fig. 106); Australia, New Zealand (Map 3) ..... *protensa*
– Embolus of usual length and conductor directed straight out at 45° angle from axis of palpus (Figs. 97, 232) 8
8(7). Embolus arched, its tip held by a bowl-shaped conductor as in Figure 232; northern Philippines (Map 5) ..... *luzona*
– Embolus and conductor otherwise (Figs. 97, 210, 216) 9
9(8). Embolus with a terminal twist, its tip hidden by conductor in mesal view (Figs. 210, 216) 28
– Embolus without distal twist (Fig. 97) 10
10(9). Two barbs on base of embolus (Fig. 97); widespread (Map 3) ..... *lobata*
– Embolus without barbs (Fig. 18) 11

11(10). Embolus with a blunt spur on "upper" side; median apophysis with thorn-shaped spur (Fig. 18); Japan, China (Map 2) ..... *ocula*
– Embolus without spur (Fig. 54); median apophysis spur filamentous 12
12(11). Embolus with a much wider, set-off base (Figs. 54, 55); Malay Peninsula, Borneo, Indonesia to New Guinea (Map 2) ..... *reinwardti*
– Embolus evenly tapered (Figs. 66, 72) 13
13(12). Base of embolus near edge of tegulum (Figs. 66, 193); embolus length about equal that of previous sclerite (Figs. 66, 193) 14
– Base of embolus closer to edge of cymbium (Figs. 72, 86); embolus length much longer than previous sclerite 15
14(13). Proximal embolus sclerite butting against previous sclerite (Fig. 193); Queensland (Map 4) ..... (?) *kochi* or *mascordi*
– Proximal embolus sclerite overlapped by previous sclerite (in part hidden by edge of cymbium) (Fig. 66); Japan, China (Map 3) ..... *boesenbergi*
15(13). Base of embolus flaring, overhanging proximal sclerite; spur originating from inner corner of bend of median apophysis (Fig. 72); Japan, China (Map 3) ..... *amoena*
– Base of embolus butting against proximal sclerite without overhang; spur originating on face of median apophysis or near tip (Figs. 86, 135) 16
16(15). Embolus evenly arched as in Figure 135; spur near tip of median apophysis (Fig. 135); New Guinea (Map 4) ..... *doboensis*
– Embolus only gently curved or only distal portion bent; spur originating from face of median apophysis near bend (Fig. 86) 17
17(16). Median apophysis spur much longer than two diameters of median apophysis (Fig. 86); Eurasia (Map 3) ..... *bruennichi*
– Median apophysis spur shorter (Figs. 80, 172) 18
18(17). Embolus distally strongly curved (Fig. 172); Pakistan, India, Cocos Keeling Islands (Map 4) ..... *anasuja*
– Embolus with only slight bend (Fig. 80); New Guinea, Australia (Map 3) ..... *magnifica*
19(1). Median apophysis spur on lower edge of very tip (Fig. 315); Moluccas, New Guinea, northern Australia to Santa Cruz Islands (Map 5) ..... *picta*
– Spur attached to "upper" surface near bend (Figs. 277, 291, 308) 20
20(19). Median apophysis spur on upper surface near distal end (in mesal view) (Fig. 308); Moluccas to New Hebrides, northern Australia (Map 5) ..... *aetherea*
– Median apophysis attached to outer surface or near bend (Figs. 277, 284) 21
21(20). Median apophysis spur attached on outer surface near tip (Figs. 277, 291) 22
– Median apophysis spur attached on outer surface near bend (Figs. 284, 322) 23
22(21). Upper surface of embolus with two crests near tip (Fig. 277); Hawaii, southern Japan, Taiwan to Java, New Guinea, Solomon Islands (Map 5) ..... *appensa*
– Upper surface without such crests (Fig. 291); Solomon Islands (Map 5) ..... *bougainvilla*
23(22). Pendant overlapping embolus tip (Fig. 322); Northern Territory (Map 5) ..... *radon*
– Pendant separated from embolus tip (Fig. 284); New Guinea, Bismarck Archipelago (Map 5) ..... *brunnescentia*
24(2). Embolus a heavily sclerotized prong as in Figures 54, 55; Malay Peninsula, Borneo, Indonesia to New Guinea (Map 2) ..... *reinwardti*
– Embolus a different structure (Figs. 35, 41, 199) 25
25(24). Embolus a large curved structure with a truncate branch on its lower side from base and a notch near tip as in Figure 199; eastern coast of Australia (Map 4) ..... *keyserlingi*
– Embolus otherwise (Figs. 35, 41) 26
26(25). Conductor fan-shaped; a sclerotized truncate tip on upper branch of complex conductor (Fig. 41); China, India to New Guinea (Map 2) ..... *catenulata*
– Conductor a heavily sclerotized lobe; embolus sclerotized, with a seam across its middle and a curved tip as in Figure 35; widespread, Asia to New Hebrides (Map 2) ..... *aemula*
27(4). Embolus with pendant; one branch of median apophysis long; spur attached on upper surface (Fig. 111); Queensland (Map 3) ..... *probata*
– Embolus without pendant; two branches of median apophysis of equal length and diverging; spur attached to lower surface (Fig. 129); Queensland (Map 4) ..... *ocyaloides*
28(9). Embolus heavy and with a base; inner branch of median apophysis hidden by outer one (Fig. 216); Queensland (Map 4) ..... *katherina*
– Embolus slender without a base; inner branch of median apophysis hanging "down" (Fig. 210); Japan, China (Map 4) ..... *minuta*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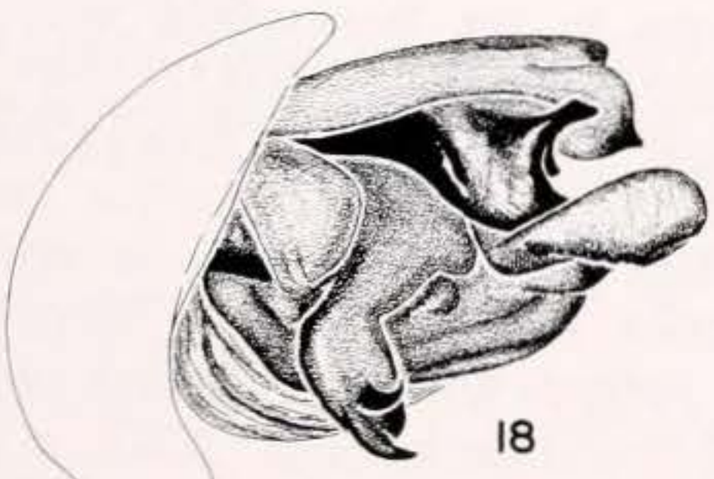
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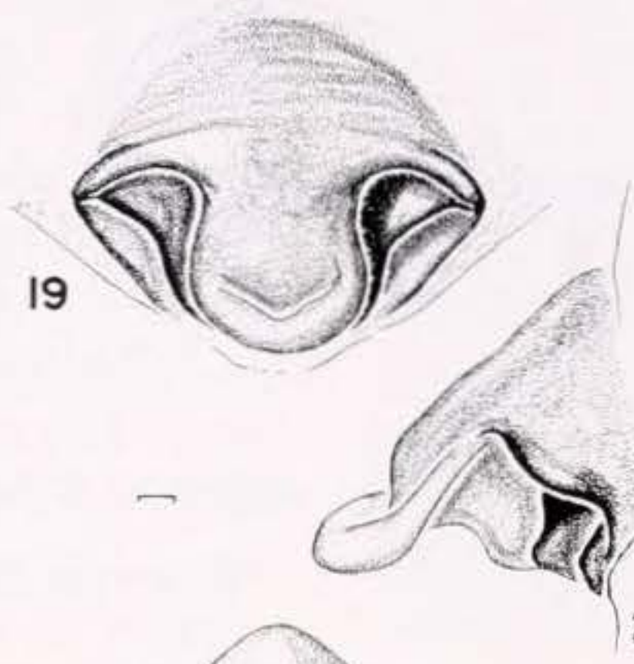
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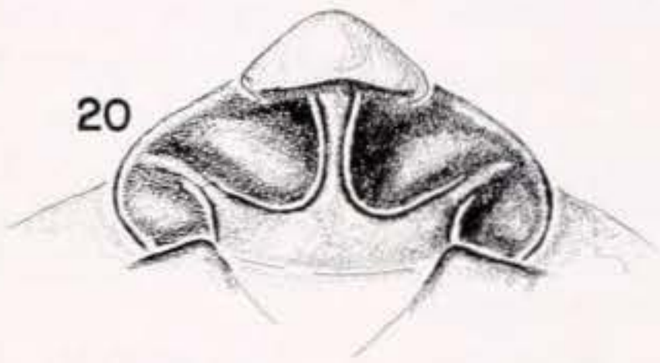
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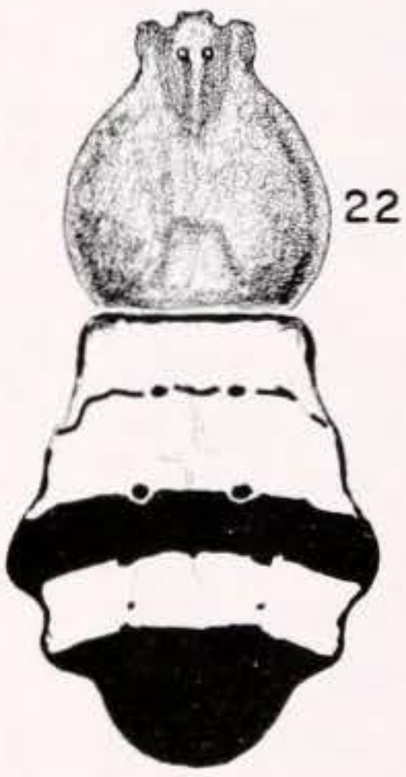
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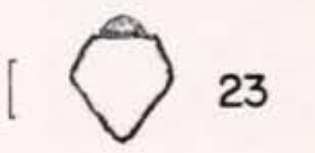
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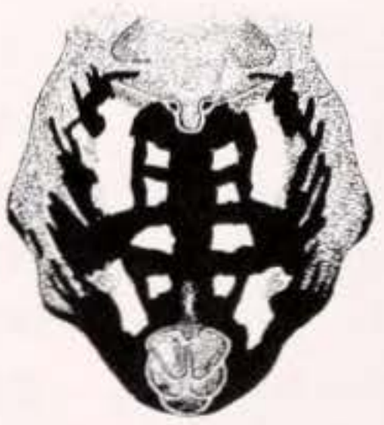

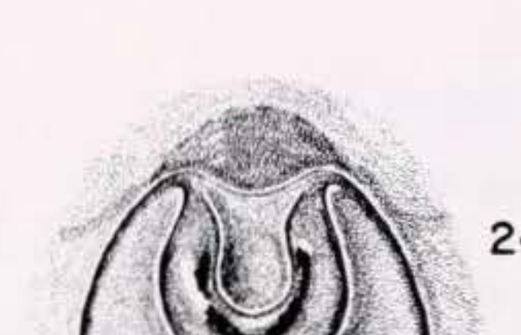
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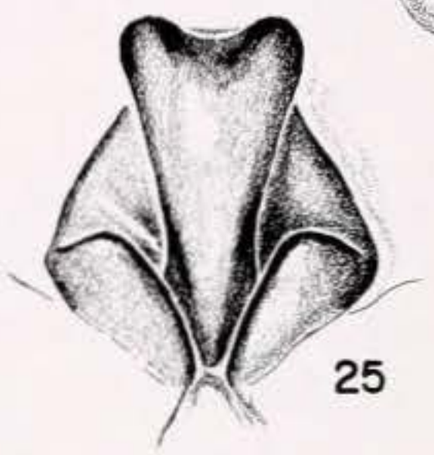
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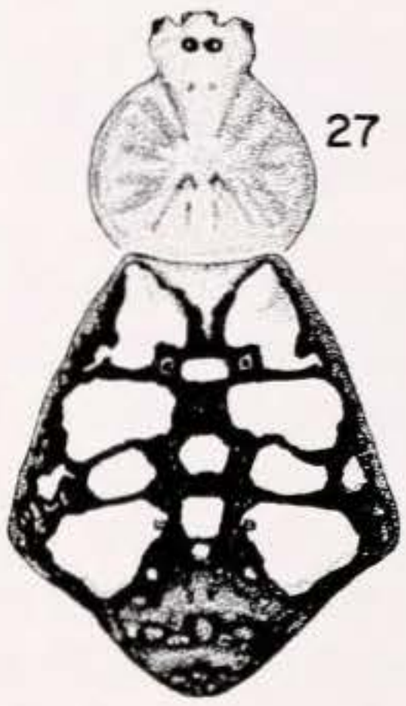
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Figures 14–18. *Argiope ocula* Fox. 14–17. Female. 14. Epigynum, ventral. 15. Epigynum, posterior. 16. Carapace and abdomen. 17. Sternum and abdomen. 18. Left male palpus, mesal.

Figures 19–23. *Argiope macrochoera* Thorell, female. 19. Epigynum, ventral. 20. Epigynum, posterior. 21. Epigynum, lateral. 22. Carapace and abdomen. 23. Sternum and abdomen.

Figures 24–28. *Argiope manila* n. sp., female. 24. Epigynum, ventral. 25. Epigynum, posterior. 26. Epigynum, lateral. 27. Carapace and abdomen. 28. Sternum and abdomen.

Scale lines. 0.1 mm, except Figures 16, 17, 22, 23, 27, 28, 1.0 mm.

Argiope ocula Fox

Figures 14–18; Map 2

Argiope ocula Fox, 1938: 364, fig. 6, ♀. Female holotype from Shin-Kai-Si, Mount Omi [O-Mei San] (1200–1500 m), Szechwan, China in the U.S. National Museum, examined.

Argiope ohsumiensis Yaginuma, 1967: 50, figs. 1–9, ♀, ♂. Female holotype from Kurio, Yaku Island [Yaku Shima], Japan, 1 Aug. 1961 in the collection of the Arachnological Society of East Asia, examined. 1971: 128, fig. 107: 12–17, ♀♂. NEW SYNONYMY.

Notes. Superficially this species does not appear to resemble an *Argiope*. But the posterior eye row is slightly procurved and the posterior lateral eyes have a narrow tapetum, as do *Argiope* (but not *Araneus*). The carapace shape is *Argiope*-like with a narrow head and a pair of comma-shaped marks behind the thoracic depressions, as found in other *Argiope* species (Fig. 16).

The male has none of the coxae modified, nor do the legs have heavier macrosetae than the female's. There is a broad, indistinct tooth lateral on the endites, but none facing it on the palpal femur. The embolus is thorn-shaped with a broad base, its pointed tip hidden by the conductor (Fig. 18). The tip breaks off when mating as in other species and is found stuck in the depression of the epigynum. The male from Taiwan has both emboli missing; it survived mating.

Diagnosis. This is the only *Argiope* with a distinct *Araneus*-like scape in the epigynum (Fig. 14). The shape and markings of the thick abdomen, with anterior dorsal humps and pointed posterior (Fig. 16), are diagnostic. The axis of the male's median apophysis is at an obtuse angle to that of the conductor, and its spur is thorn-shaped (Fig. 18).

Variation. Females differ in the shape of the opening in the depression. The Taiwan specimens are more like the type of *A. ocula* than the specimens from Japan illustrated (Figs. 14, 15).

Records. JAPAN: Nakatane-ono, Tane Isl., 22 July 1963, ♂ (H. Ohe, ASEA); Kagoshima, Tanegashima Isl., 22 July 1965, ♀ (H. Ohe, ASEA); 23 July 1971, ♀ (T. Yaginuma, ASEA). TAIWAN: *Tai Pei County.* Wulai, 6 July 1977, ♀♂ (H. Yoshida, YC); Yangmingshan, 2 Aug. 1977, ♀ (H. Yoshida, YC).

Argiope macrochoera Thorell

Figures 19–23; Map 2

Argiope macrochoera Thorell, 1891: 50. Two females, two juvenile syntypes from Nicobar Islands [Bengal Bay, Indian Ocean], in the Zoologisk Museum, Copenhagen, examined. Roewer, 1942: 738. Bonnet, 1955: 691.

Diagnosis. Like *A. manila*, the rim and septum are formed into a scape-like structure constricted anteriorly (Fig. 19). *Argiope macrochoera* differs by having the abdomen banded, and, in posterior view, the posterior plate of the epigynum is wider than long and appears to have three branches (Fig. 20), the middle one being the septum.

Argiope manila new species

Figures 24–28; Map 2

Holotype. Female and four female paratypes from Luzon, Philippines, most legs broken. Holotype and three paratypes in the Senckenberg Museum, Frankfurt, and one in the Museum of Comparative Zoology. The specific name is a noun in apposition after the type locality.

Description. Carapace yellow-white with indistinct darker marks. Sternum with bright yellow-white branched mark surrounded by black (Fig. 28). Legs brown, not banded. Dorsum of abdomen with light patches on black (Fig. 27). Venter marked as usual (Fig. 28). Anterior lateral eyes 0.5 diameter of others, which are subequal. Anterior median eyes 0.8 diameter apart, 1.2 from laterals. Posterior median eyes slightly more than their diameter apart, 1.8 from laterals. The abdomen is pentagonal. Total length, 11.5 mm. Carapace, 4.7 mm long, 4.2 mm wide. First femur, 8.2 mm; patella and

tibia, 8.6 mm; metatarsus, 8.6 mm; tarsus, 2.0 mm. Second patella and tibia, 8.6 mm; third, 4.5 mm; fourth, 7.2 mm.

Diagnosis. This species differs from all others by the distinct abdominal markings (Fig. 27) and by the unusual shape of the epigynum: the rim and the septum form a scape-like structure, constricted anteriorly (Fig. 24). The lateral margins of the depressions are rounded, dark on the outside (Fig. 24), and the posterior plate is like that of *Argiope aemula*.

Argiope aemula (Walckenaer)

Figures 29–35; Map 2

Epeira aemula Walckenaer, 1841: 118. Specimens from Celebes, lost.

Epeira striata Doleschall, 1857: 415. Name given to illustration of specimens from Java. Two original specimens here labeled syntypes in the Rijksmuseum van Natuurlijke Historie, Leiden, examined.

Argiope aemula:—Thorell, 1877: 364. Roewer, 1942: 739 (in part). Bonnet, 1955: 670 (in part). Song, 1980: 100, fig. 46, ♀.

Argiope aemula nigripes Thorell, 1877: 364. Female holotype from Kondari [Kendari], Celebes in the Museo Civico di Storia Naturale, Genova, examined.

Argiope trivittata Karsch, 1891: 280, pl. 10, fig. 6, ♀. Female holotype from Ceylon [Sri Lanka] in the Zoologisches Museum, Humboldt Universität, Berlin, examined.

Metargiope ornatus var. *lineatus* Marapao, 1965: 46, pl. 2, ♀. Female holotype from Tipolo, Mandawe, Cebu, Philippines in the Univ. San Carlos, Cebu City, not available. NEW SYNONYMY.

Argiope sp. "Wau no. 5" M. H. Robinson and B. Robinson, 1980: 10, 50, 82–85, 89, 192, figs. 37–38, ♀, ♂ (photo).

Argiope sp. "Singapore no. 1" M. H. Robinson and B. Robinson, 1980: 10, 50, 88–91, 192, fig. 42, ♂ (photo).

Note. Several specimens of this species from Celebes, the type locality, were examined. Chrysanthus (1971), B. Robinson and M. H. Robinson (1974), M. H. Robinson, Y. D. Lubin, and B. Robinson (1974), and M. H. Robinson and B. Robinson (1980) misidentified *A. aemula*. Their specimens were *A. magnifica* L. Koch, a superficially similar species. Figures 29, 30, 32–34 were made from a specimen from Bulolo, Papua New Guinea, Figure 31 from Bombay, India, and Figure 35 from Malaysia. Specimens from Bombay, India have the lateral margins of the depressions of the epigynum swollen posteriorly (Fig. 31).

Diagnosis. This is one of the largest species of *Argiope*, females often more than 20 mm total length. The oval abdomen is slightly truncate anteriorly, with indistinct shoulder humps and is dorsally marked with transverse lines (Fig. 33). The epigynum differs from that of *A. magnifica*, a similar species, by having a posterior median swelling on the posterior plate (Figs. 30, 31), also visible in ventral view. The lateral borders of the depression are smooth, rounded and seemingly polished, the outside edge black (Figs. 29, 32). In posterior view the lateral borders end in large lobes (Figs. 30, 31). The epigynum is similar to that of *A. catenulata*, which is a smaller species and has very different markings on the abdomen: dorsally a longitudinal band of white setae, and on the venter a transverse white mark connecting the longitudinal white lines.

The male palpus in mesal view has a short embolus and conductor, and a complex median apophysis surrounded by a large tegulum (unlike most *Argiope* males). The embolus has a seam where it perhaps breaks off in mating; the tip is a sclerotized hook held by a short, straight conductor (Fig. 35).

Natural History. Specimens were found in cow pastures and on roadside vegetation near Binatang Creek in the Wau Valley, Papua New Guinea, among populations of *A. magnifica*. The web has a cruciform stabilimentum. Courtship and mating are reported in M. H. Robinson and B. Robinson, 1980. Of interest are the behavioral differences reported by Robinson and Robinson between the populations from Singapore and those from New Guinea ("Wau no. 5" and "Singapore no. 1").

Distribution. Japan, India to Indonesia and New Hebrides (Map 2).

Records. JAPAN: *Nansei Islands.* Okinawa (many records, MCZ, AMNH); "Japan," (NMW). TAIWAN: Tai Pei (AMNH); Takao (NMW). CHINA: (Song, 1980); Fumni [? Funing] (ZMB); Canton (SMF). HONG KONG: (NMW, SMF). THAILAND: Doi Inthanon Natl. Park, Chieng Mai Prov., 14 Oct. 1981 (ZMK). SINGAPORE: (MCZ, BMNH). MALAYSIA: *Malay Peninsula.* Jokor Layang-Layang, jungle remnant (MC); Fraser's Hill, 1300 m (CAS); Bukit Tima (MCZ); Pahang (ZRC). *Sarawak.* Gunong Mulu Natl. Park, in grass on bank of Melinau River (BMNH). *Sabah.* Ulu Dusun, nr. Sandakan (MC); Manutek Isl., Kota Kinabalu, in grass (MC); Kudat (ZRC); Bundu Tuan (ZRC). BURMA: Mulmein (NMW). INDIA: *Punjab.* Amballa [Umballa] (MCZ). *Assam.* Chabua (AMNH). *Madras.* Vellore (ZMK). *Maharashtra.* Bombay (SMF). PHILIPPINES: *Calicoan and Lebanon Isls.* (AMNH); Santa Clara, above Gingo-og (FMC); Samar Isl. (AMNH). *Luzon.* Quezon City (AMNH); Subic (CAS); Alabang, Rizal Prov. (AMNH, ZMB); Manila (MNHN, IRSN, ZMB). *Mindanao.* Davao Prov. (MCZ); Butuan (MCZ). INDONESIA: *Sumatra.* E of Langkai Isl. (MCZ); between Taroengen [Tarutung] and Bircuen (MCZ); Nias Isl. (ZMK, BMNH); Pulau Weh Isl. (BMNH); Fort de Kock [Bukittinggi], 920 m (SMF); Bungar-Bondar [West Sumatra] (SMF); West Sumatra (BMNH); Medan (NMW). *Java.* Batavia [Djakarta] (MCZ); Buitenzorg [Bogor] (MCZ); Bantar Gebang (MCZ); Tjibodas [Cibodas] (NMW); Tengger Mts. (ZMB). *Southeast Borneo* [Kalimantan]. Tandjong (ZMH); Pagat [Pagatan] (ZMB). *Moluccas.* Celebes: Toli-Toli (MCZ); Kendari (MCSN). Halmahera: Morotai (AMNH). Ceram: Amboina [Ambon] (BMNH). WEST IRIAN: [Djaya Pura]. Manapi, Cape Vogel Penins. (AMNH). PAPUA NEW GUINEA: *Northern Distr.* Oro Bay, 1945, ♀ (S. Sandler, AMNH). *Milne Bay Distr.* Goodenough Isl., 1943, ♀ (W.B. Jones, AMNH). *Morobe Distr.* Bulolo, 17 March 1979, ♀ (M. Robinson, H. Levi, *et al.*, MCZ); Oomsis, April 1959, ♀ (J. Gunn, AMNH). NEW HEBRIDES: Aore Isl., April 1944, ♀ (W.L. Nutting, MCZ).

Argiope catenulata (Doleschall)

Figures 36–41; Map 2

Epeira catenulata Doleschall, 1859: 30, pl. 9, fig. 1, ♀. Name given to illustration of specimens from Java in the Rijksmuseum van Natuurlijke Historie, Leiden, which were examined.

Argiope opulenta Thorell, 1859: 299. Female from Java in the Naturhistoriska Riksmuseet, Stockholm, not examined.

Epeira (*Argiope*) *stellata* Stoliczka, 1869: 234, pl. 28, fig. 6, ♀. Female from Sundarbans, south of Port Canning, India, not examined.

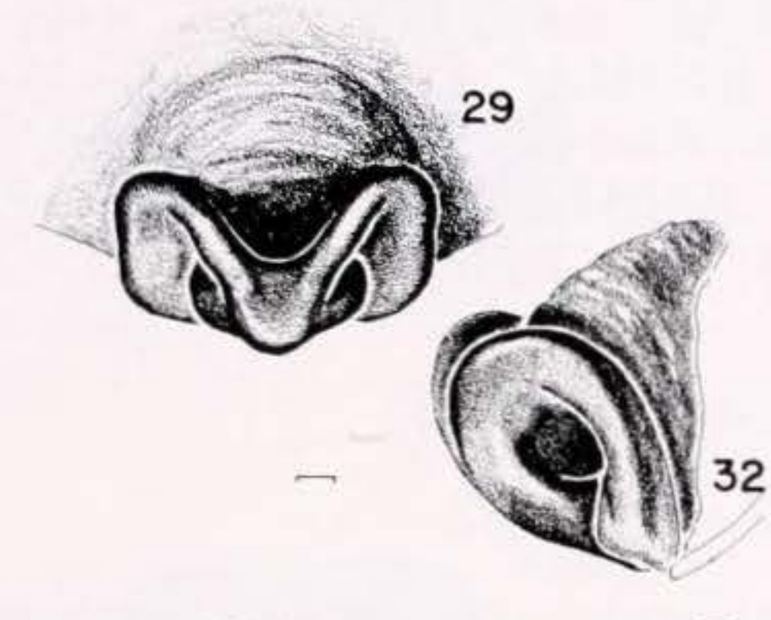
Argiope pelewensis Keyserling, 1886: 136, pl. 11, fig. 2, ♀. Female holotype from Pelew Inseln [Palau, Caroline Islands] in the Zoologisches Museum, Universität Hamburg, examined.

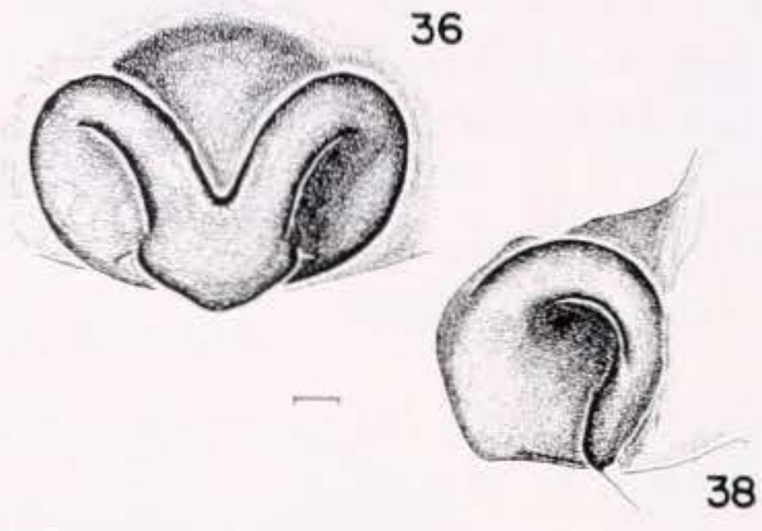
Argiope catenulata:—Roewer, 1942: 741. Bonnet, 1955: 683. Chrysanthus, 1958: 240, figs. 13–18, 22, ♀, ♂. Song, 1980: 101.

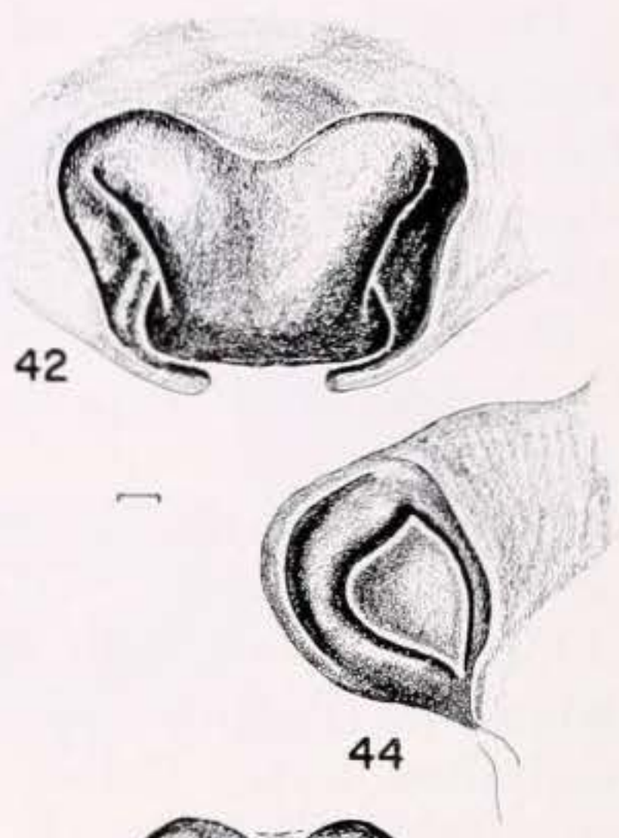
Metargiope ornatus var. *turricula* Marapao, 1965: 47, pl. 3, ♀, ♂. Female holotype from Cebu City, Philippines on tall grasses on vacant lot in the San Carlos Univ., Cebu City, unavailable. NEW SYNONYMY.

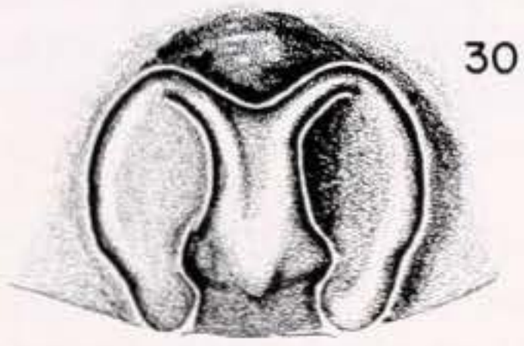
Note. Stoliczka's illustration shows the diagnostic coloration. Simon synonymized *Pronous chelifer* Hasselt (1882) with this species; this is an error; it is *Gea spinipes.* The illustrations (Figs. 36–40) of the female were made from a Philippine specimen, that of the male palp (Fig. 41) the mirror image of a right palpus of a specimen from Sumatra. Because of the setal covering of the abdomen, I expect living specimens to have a slightly different pattern from that of the one illustrated.

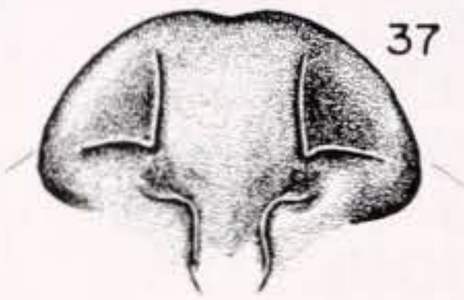
Diagnosis. Unlike other species, the abdomen is oval, widest in the posterior half, with a unique black and white dorsal pattern. The midline is covered in a longitudinal band of white setae (Fig. 39, in alcohol). The venter has a diagnostic transverse white band (Fig. 40). The epigynum is much like that of *A. aemula*, with a wide septum, the lateral border of the depression curved and dark along the outer edge (Figs. 36, 37).

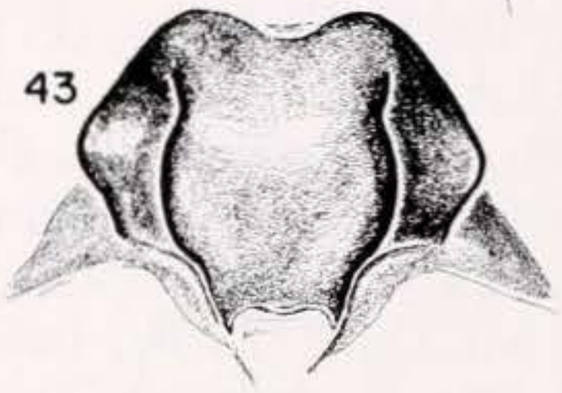


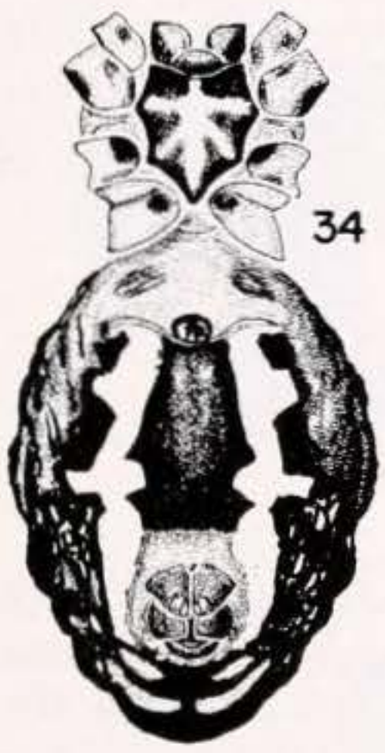


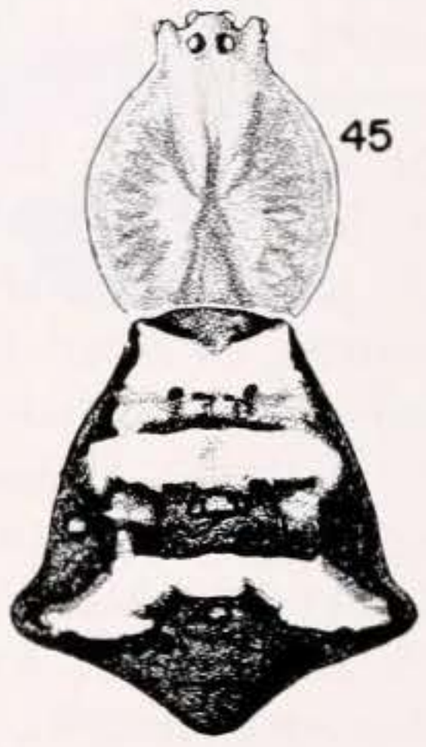


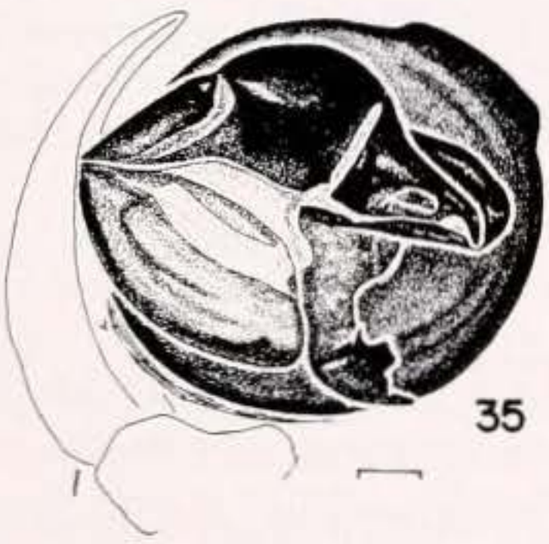


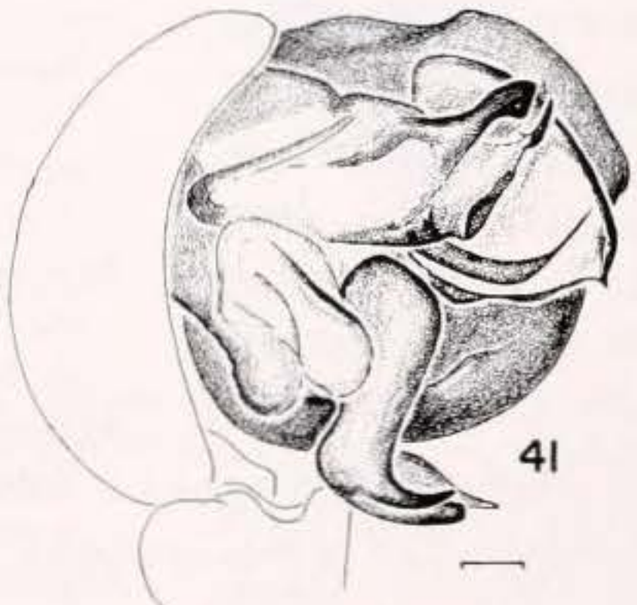


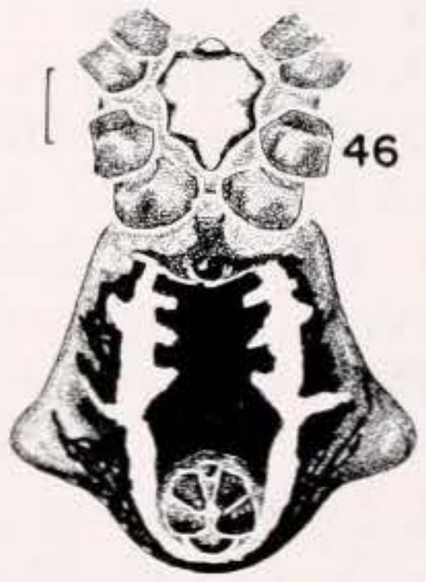












Figures 29–35. *Argiope aemula* (Walckenaer). 29–34. Female. 29. Epigynum, ventral. 30, 31. Epigynum, posterior. 29, 30, 32. (Papua New Guinea). 31. (India). 32. Epigynum, lateral. 33. Carapace and abdomen. 34. Sternum and abdomen. 35. Left male palpus, mesal.

Figures 36–41. *Argiope catenulata* (Doleschall). 36. Epigynum, ventral. 37. Epigynum, posterior. 38, Epigynum, lateral. 39. Carapace and abdomen. 40. Sternum and abdomen. 41. Left male palpus, mesal.

Figures 42–46. *Argiope buehleri* Schenkel, female. 42. Epigynum, ventral. 43, Epigynum, posterior. 44. Epigynum, lateral. 45. Carapace and abdomen. 46. Sternum and abdomen.

Scale lines. 0.1 mm, except Figures 33, 34, 39, 40, 45, 46, 1.0 mm.

The male has an evenly curved embolus containing a fine duct held by the conductor and partly hidden by an elaborate stipes (Fig. 41), quite distinct from that of other species.

Distribution. China (Song, 1980), India, Indonesia, Philippines to New Guinea (Map 2).

Records. INDIA: *Madras.* Vellore, ♀ (N. Löwenthal, ZMK). SRI LANKA (CEYLON): 1864, ♀ (Sarasin, ZMB); Kejkant ved Balangoda [Balangoda], 12 April 1957, juv. (Galathea Exp., ZMK). VIETNAM: Saigon, 1966–1967, juv. (P. Fleischer, MCZ). MALAYSIA: Perak Subur, April–July 1929, ♀ (Dalton, ZRC). INDONESIA: *Sumatra.* Si Rambé [Sirombu], sev. ♀ (Modigliani, NMW); Pedang, juv. (E. Reimoser, MCZ), ♀ (SMF); between Taroengen and Biruen, ♀♀♂ (MCZ); ? Afjeh [? Atjeh, ? Aljeh], April 1924, ♀ (S. A. R. Prince Léopold, IRSN); Harau Kloof, 24 April 1929, ♀ (S. A. R. Prince Léopold, IRSN); Fort de Kock [Bukittinggi], 900 m, 1924, 5♀ (E. Jacobsen, SMF); Bungar-Bondar (W. Sumatra), 14 April 1914, 3♀ (Schütz, SMF); Lumba Gaul [Pulau Lumba], 1500 m, 1 Sept. 1919 (O. Hagerup, ZMK). *Java.* Gebang, Bantar [? Bandjar], 1909, ♀ (Palmer and Bryant, MCZ); Pendjaloe, 31 Dec. 1928, 2♀ (S. A. R. Prince Léopold, IRSN); Buitenzorg [Bogor], 1906–1907, ♀ (T. Barbour, MCZ), Jan. 1922, ♀ (T. Mortensen, ZMK), 3♀ (NMW); Djakarta, 1957–1958, ♀ (D.M. Rees, AMNH). *Lombok Isl.* Center of island, ♀ (C. Auri-villius, NRS). *Borneo.* Pagata (Grabowski, ZMB); Moara Terveh [Muarteweh], 4♀ (Breitenstein, NMW). *Moluccas.* Celebes: Langoan Hot Springs, ♀ (MCZ); Tember Hot Springs, ♀ (MCZ); Tondano, ♀ (SMF). PHILIPPINES: *Luzon.* Manila, ♀ (W. M. Beck, AMNH); ♀ (ZMH), ♂ (MNHN); 1945, ♀ (W. R. Enns, AMNH); Alabong, 20 Jan. 1951, ♀ (J. Bergseng, FMC); Prov. Albay, ♀♂ (Jagor, ZMB); Baguio, Mtn. Prov., 3 Nov. 1945, ♀ (B. Malkin, AMNH); Umber, Cavite, 20 Dec. 1950, ♀ (J. Bergseng, FMC); Longayen, June–July 1945, ♂ (R. B. Burrows, AMNH). WEST NEW GUINEA [Djaya Pura]: Merauke, 1956, 1957, ♀ (Br. Monulph, RNHL). CAROLINE ISLANDS: *Yap.* Ruu Distr., 26 Aug. 1950, ♂ (R. J. Goss, BPBM); Colonia, July–Aug. 1950, ♂ (R. J. Goss, BPBM).

Argiope buehleri Schenkel

Figures 42–46; Map 2

Argiope bühleri Schenkel, 1944: 184, fig. 7, ♀. Female holotype from Soë, Timor, four female paratypes from Nitel-Tiki [? Nikiniki], Timor, in the Naturhistorisches Museum, Basel, examined.

Note. No others than the original specimens could be found in the collections available. It may be that these specimens belong to *A. reinwardti.*

Diagnosis. The rim of the epigynum is not as straight as that of *A. reinwardti*; the septum has an even, round curvature (Fig. 42) and is not flattened, as is that of *A. reinwardti.*

Argiope reinwardti (Doleschall)

Figures 47–55; Map 2

Epeira (*Argyropes*) *trifasciata* Doleschall, 1857: 416, pl. 1, fig. 3, ♀. One female holotype from Amboina [Ambon] in the Rijksmuseum van Natuurlijke Historie, Leiden, examined [not *A. trifasciata* (Forskål, 1775)].

Epeira reinwardti Doleschall, 1859: 31, pl. 1, fig. 3. Name given to illustrations of specimens from Java. Two syntypes, here labeled, the original specimens in the Rijksmuseum van Natuurlijke Historie, Leiden, examined.

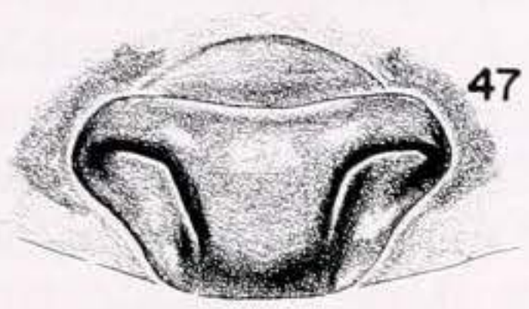
Argiope doleschalli Thorell, 1873: 520. New name for *Epeira trifasciata* Doleschall, preoccupied by *A. trifasciata* Forskål, 1775.

Argiope doleschalli sumatrana Hasselt, 1882: 18. Provisional new name for Sumatra specimens. Specimens lost in the Leiden museum.

Argiope concinna Thorell, 1881: 71. Female holotype from Aru Island [Arafura Sea] in the Museo Civico di Storia Naturale, Genova, examined. NEW SYNONYMY.

Argiope doleschalli bivittigera Strand, 1911b: 141. Last instar juvenile female holotype from Elat, Great Key [Kai Island, Banda Sea] in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

? *Argiope barbipoda* Strand, 1911: 144, pl. 5, fig. 44. Juvenile holotype from Grosz Key, Elat [Great Key,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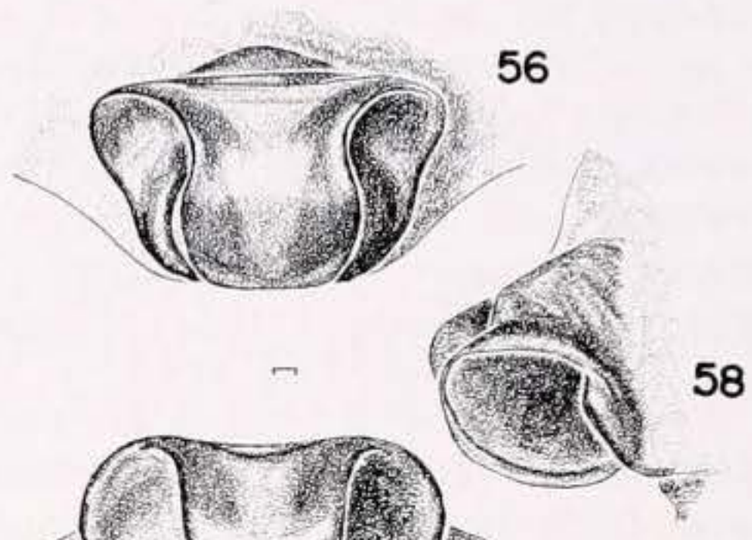
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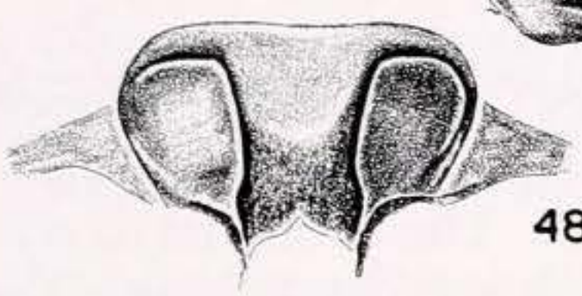
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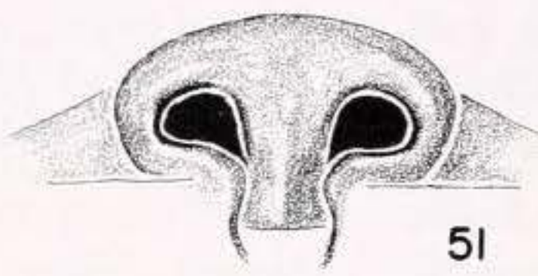
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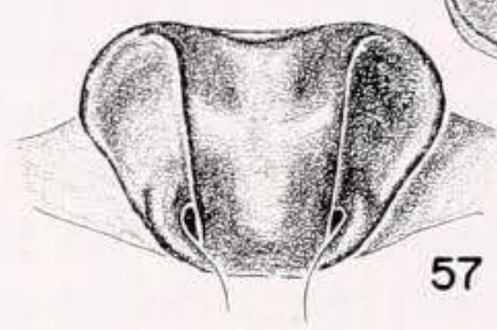
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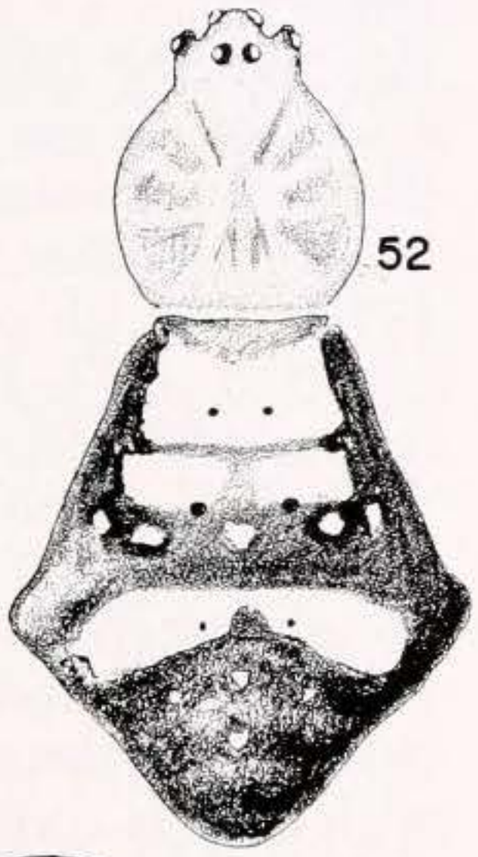
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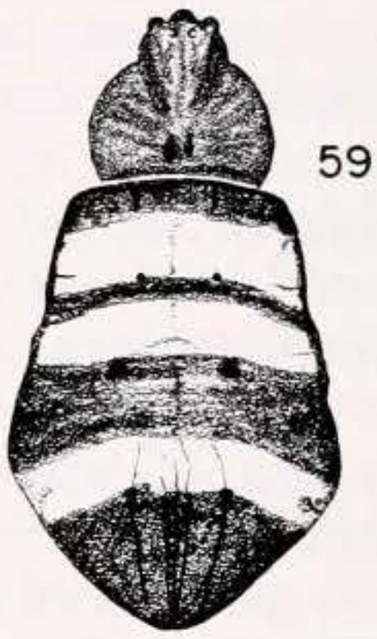
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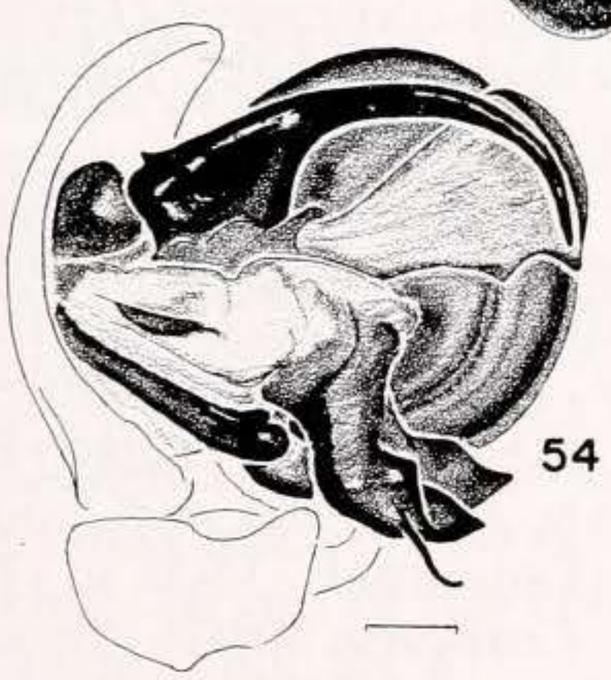
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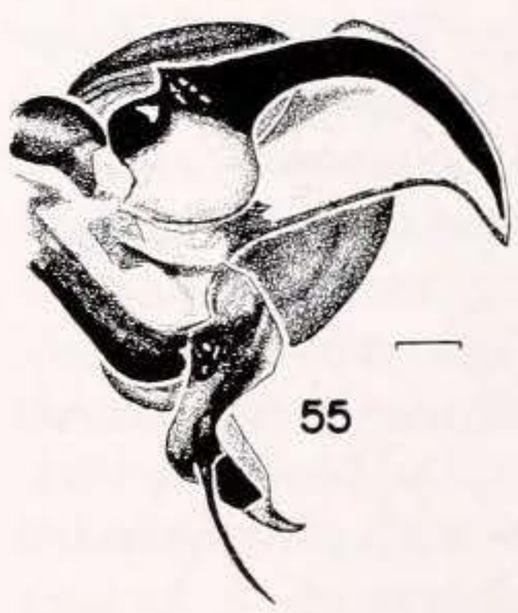
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Figures 47–55. *Argiope reinwardti* (Doleschall). 47–53. Female. 47. Epigynum, ventral. 48. Epigynum, posterior. 49. Epigynum, lateral. 50, 51. Penultimate instar, epigynal region. 50. Ventral. 51. Posterior. 52. Carapace and abdomen. 53. Sternum and abdomen. 54, 55. Left male palpus, mesal. 54 (Papua New Guinea). 55. (Western Sumatra).

Figures 56–60. *Argiope caesarea* Thorell, female. 56. Epigynum, ventral. 57. Epigynum, posterior. 58. Epigynum, lateral. 59. Carapace and abdomen. 60. Sternum and abdomen.

Scale lines. 0.1 mm, except Figures 52, 53, 59, 60, 1.0 mm.

Kai Island, Banda Sea] in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Argiope aetherea var. *confusa* Kulczynski, 1911: 475, fig. 47, ♀. One female syntype from Jenda [Jende], one female and one juvenile syntype from Manikion, New Guinea in the Polish Academy of Science, Warsaw, examined. NEW SYNONYMY.

Argiope aetherea var. *coniuncta* Kulczynski, 1911: 475, fig. 46, ♀. Female holotype from the region of upper Lake Jamur, New Guinea in the Polish

Academy of Science, Warsaw, examined. NEW SYNONYMY.

Argiope celebesiana Merian, 1911: 203, pl. 9, figs. 1–3. Female holotype from Celebes in the Naturhistorisches Museum, Basel, examined. NEW SYNONYMY.

Argiope reinwardti:—Roewer, 1942: 741. Bonnet, 1955: 693. Chrysanthus, 1971: 15, figs. 20–22, ♀, ♂. B. C. Robinson and M. H. Robinson, 1974: 145, pl. 3, ♀ (photo). M. H. Robinson, Lubin, and B. Robinson, 1974: 117–163. M. H. Robinson and B. Robinson, 1980: 10, 50, 54–60, 109, 191, figs. 22–24.

Notes. Argiope plana L. Koch from Australia, previously synonymized with *A. reinwardti*, is a synonym of *A. trifasciata*. *Argiope doleschalli bivittigera* Strand, although a last instar juvenile, has a weakly sclerotized epigynum and internal seminal receptacles (Figs. 50, 51). Other than the one from New Guinea, only one male was found in the collections available. This one from Sumatra, whose palpus has a shorter, thicker embolus (Fig. 55) and differently shaped median apophysis, indicates that specimens from Sumatra may belong to a different species. The females from Sumatra have a wider septum than the septum of the specimen from New Guinea illustrated (Figs. 47–49). Perhaps what is here considered one species consists of several; or, *A. caesarea* and *A. buehleri* may be subspecies of *A. reinwardti*.

The illustrations (Figs. 47–49, 52–53) were made from specimens from Mount Kaindi road, Wau, Papua New Guinea; Figure 55 from a male with an expanded palpus from West Sumatra.

Diagnosis. The dorsum of the pentagonal female abdomen has three transverse white bands on black (Fig. 52), similar to some specimens of *A. aetherea*. The epigynum distinguishes the two: in *A. reinwardti* it has an almost straight anterior rim, and the wide septum is dorsoventrally flattened; the posterior of the septum does not curve laterally into the depression (Figs. 47, 48). The palpus has a fan-shaped conductor, a simple clawlike embolus, and a median apophysis with a spur on the outside directed proximally (Fig. 54).

Variation. Specimens in the Berlin Museum have a different pattern, resembling that of *A. perforata*. Most are in poor condition, but they all came from the same area: coastal New Guinea between Madang and the Sepic River. Malaysian individuals have the sternum dark like the northern *A. caesarea*, and tubercles on the sides facing each coxa.

Natural History. Argiope reinwardti is found on the edge of forested slopes, sometimes rock faces, in the Wau area, Papua New Guinea. The web has a stabilimentum which is a cross, crossing the hub; but the stabilimentum is frequently absent or present only as one diagonal line (B. C. Robinson and M. H. Robinson, 1974; M. H. Robinson, Lubin, and B. Robinson, 1974). Courtship and mating behavior is reported in M. H. Robinson and B. Robinson, 1980. When the spider is disturbed while in the web, it will fall to the ground and instantaneously change the color of the abdomen; the light cells of the abdomen contract and the spider becomes earth colored. On the ground the spider lies still with its legs contracted (Bristowe, 1976).

Distribution. Malay Peninsula to New Guinea (Map 2).

Records. MALAYSIA: *Malay Peninsula*. Kuala Lumpur, Sept. 1921, ♀ (H. M. Pendlebury, ZRC); Tahan Riv., Pahang, 21 Nov. 1923, ♀ (H. M. Pendlebury, ZRC). INDONESIA: *Sabah*. Kabayau and Bundu Tuan, July 1925, ♀ (C. M. Enriquez, ZRC); Tanompek, 1500 m, July 1925, ♀ (C. M. Enriquez, ZRC). *Sumatra*. mountains above Pagaralam, 2♀ (MCZ); W Sumatra, 1974, ♀♂ (W. S. Bristowe, BMNH); Fort de Kock [Bukittinggi], 3♀ (Jacobson, NMW). *Java*. Djakarta, 1957–1958, ♀ (D. M. Rees, AMNH); Tjiboda [Ciboda], 28 Aug. 1922, ♀ (T. Mortensen, ZMK), April 1908, 2♀ (HCO); Tengger Mts., 1300 m, 16 June 1909, 3♀ (A. Berg, NRS); Buitenzorg [Bogor], 1904, ♀ (I. Jensen, ZMK); 4♀ (NMW), ♀♀ (Palmer and Bryant, MCZ). *Celebes*. Malino, ♀ (MCZ); Lokka on Pic of Bantaëng, 1150 m, ♀ (NMB); Pic of Bantaëng, 800–1000 m, ♀ (NMB). *Timor*. 2♀ (C. Auri-villius, NRS). *Moluccas*. Am-

boina [Ambon]: April 1908, ♀ (T. Barbour, MCZ); ♀ (Suykerbuyk, IRSN); ♀ (NMW). Ternate: 1906–1907, ♀ (T. Barbour, MCZ). CHRISTMAS ISLAND: numerous records (WAM, ZRC). NEW GUINEA: *West Irian* [Djaya Pura]. Hollandia [Djaya] (AMNH). *Papua New Guinea*. many records (AMNH, CNC, MCZ, BMNH, ZMB).

Argiope caesarea Thorell

Figures 56–60; Map 2

Argiope caesarea Thorell, 1897: 7. Two female specimens, probably not types, from Carin Cheba [Kareni], 1. Bia Pò, Burma in the Naturhistoriska Riksmuseet, Stockholm, examined. The types are recorded from Carin Birmaniae [Kareni] and Catun Cauri. Roewer, 1942, 1: 738. Bonnet, 1955: 683.

Argiope kalimpongensis Sinha, 1951: 77, fig. 3, ♀. Holotype from Kalimpong, Darjiling district, Bengal, India in the Zoological Survey of India, not available. NEW SYNONYMY.

Argiope sikkimensis Tikader, 1970, 64: 28, fig. 18, ♀. Female holotype from Rongli, East Sikkim, India in the Zool. Survey of India, not available. NEW SYNONYMY.

Note. It is uncertain if this is distinct from *A. reinwardti*; perhaps the male will clarify the status of *A. caesarea*. No differential characters were given to separate *A. reinwardti* or *A. caesarea* from *A. kalimpongensis* or *A. sikkimensis*, and I assume all belong to the same species.

Diagnosis. *Argiope caesarea* differs from *A. reinwardti* by the coloration of the sternum, being black on the sides (Fig. 60), and in that the rim of the epigynum narrows laterally (Figs. 56, 57).

Records. BURMA: Carin Hills [Kareni], 9000–10,000 m, 1885–1889, 3♀ paratypes of *A. caesarea* (L. Fea, ZMH). INDIA: Upper Assam, ♀ (Haberl, ZMB).

Argiope boesenbergi new species

Figures 61–66; Map 3

Argiope aetherea:—Karsch, 1878: 803. Bösenberg and Strand, 1906: 198, pl. 12, fig. 296, ♀. Yaginuma, 1960: 60, pl. 25, fig. 143, ♀. Misidentification, not *A. aetherea* (Walckenaer).

Coganargiope (*Mesargiope*) *aetherea*:—Kishida, 1936: 25.

Holotype. Female from Mt. Iwawaki, Osaka Pref., Japan, 20 Aug. 1954 (T. Yaginuma) in the collection of the Arachnological Society of East Asia in Ohtemon-Gakuin University, Osaka.

Notes. Since Karsch (1878) there are several species for which the name *A. aetherea* is used. Karsch gave the name *A. keyserlingi* to the species illustrated by Keyserling, 1865: 803, plate 19, figures 1, 2, ♀. But Keyserling specimens came from Wollongong, New South Wales, Australia; nor were they the same species as Walckenaer's *A. aetherea* from New Guinea. Bösenberg and Strand (1906), who had Japanese and northern Australian specimens, continued the confusion. *Argiope keyserlingi* has to be used for the species superficially similar to *A. aetherea* from southeastern Australia.

The illustrations of the female were made from a specimen from the Kiangsi Province, China; those of male from the mirror image of the right palpus of a Japanese paratype.

Diagnosis. The female has a diagnostic dorsal abdominal pattern (Fig. 64), yellowish silver and black in living specimens, somewhat similar to that of *A. picta*. Females differ from all other species by lacking the anterior bulge of the epigynum; in place of this structure the septum projects anteriorly into a keel with a median anterior groove (Figs. 61, 63), and the depressions on each side are not bordered anteriorly by a lip (Figs. 61–63). The palpus of the male has the embolus divided into two pieces (Fig. 66), unlike that of *A. amoena*: the distal piece is held by the conductor; both extend at a 90° angle to the axis of the palpus.

Distribution. Japan, China (Map 3).

Paratypes. JAPAN: Miyanoshita, [?*Miyagi Pref*. Miyato Shima] 1889, ♀ (B. Schmacker, SMF). *Osaka Pref*. 23 June 1946, ♀ (AMNH). *Nara Pref*. Kitayamakyo, 31 May 1951, ♂ (T. Yaginuma, MCZ); Yoshinoyama, Aug. 1980, ♀, 30 July 1981, ♀ (T. Yaginuma, ASEA); Yoshino, 14 July 1963, ♀ (T. Yaginuma, MCZ).

Records. JAPAN [?] Saga Kompira, ♀ (SMF). CHINA: *Chekiang Province*. Mokanshan, N. Gist Gee, Soochow, ♀ (MCZ).

Kiangsi Province. Hong San, 25 June 1936, ♀ (MCZ). *Fukien Province*. Changchow, ♀ (AMNH).

Argiope amoena L. Koch

Figures 67–72; Map 3

Argiope amoena L. Koch, 1878: 735, pl. 15, fig. 1, ♀. Female holotype from Japan in the British Museum, Natural History, examined. Bösenberg and Strand, 1906: 199, pl. 4, fig. 19, pl. 12, fig. 290, ♀, ♂. Strand, 1918: 95, pl. 2, fig. 37, ♀. Roewer, 1942: 740. Bonnet, 1955: 672. Yaginuma, 1960: 60, pl. 25, fig. 142, ♀. Song, 1980: 99, fig. 44, ♀.

Coganargiope amoena:—Kishida, 1936: 18.

Argiope davidi Schenkel, 1963: 137, fig. 80, ♂. Male holotype without palpi from Kiangsi in the Muséum National d'Histoire Naturelle, Paris, examined. NEW SYNONYMY.

Notes. The holotype of *A. davidi* has lost its palpi. Schenkel's illustration, however, indicates that it is a male of *A. amoena*.

The embolus with duct tears off when mating. In one female two emboli were found on the same side, one completely inserted (as illustrated) in the epigynum, and another with only the tip wedged in. The specimens illustrated came from southeastern Kiangsi Province, China.

Diagnosis. This species is close to *A. magnifica* and *A. boesenbergi*. The female differs by the contrastingly banded abdomen (Fig. 70), and by the epigynum which is longer than wide, with a U-shaped rim and sclerotized anterior bulge (Fig. 67), with the short septum widening into a very long posterior plate (Figs. 68, 69). The palpus differs by the much longer embolus flaring proximally (Fig. 72).

Distribution. Japan, China (Map 3).

Records. JAPAN: *Kyoto Pref*. Kyoto, 18 July 1980, ♀ (T. Yaginuma). *Okayama Pref*. Okayama, 10 July 1976, ♂ (Nishikawa, ASEA). *Osaka Pref*. Nishinomiya, June 1946, ♀♀ (W. Spector, AMNH). *Saitama Pref*. Tokyo, May 1931, ♀ (MCZ). [?] Kogoshima [Gogo-Shima Isl.]. [?] Kyashu, June 1958, ♀ (N. L. H. Krauss, AMNH). *Nara Pref*. Mt. Katsuragi, 13 Aug. 1951, ♀ (H. Yoneda, AMNH). *Gifu Pref*. 25 Aug. 1951, ♀ (T. Yaginuma). *Kanagawa Pref*. Misaki, July 1917, ♀ (T. Mortensen, ZMK); Yokohama, 1889, 4♀ (G. Schmacker, B. Schmacker, SMF). KOREA: Sangju, 21 Aug. 1956, ♀ (K. Paik, AMNH). CHINA: (Song, 1980). *Kiangsi Prov*. Soochow (AMNH); Hong San, June–July 1936, ♀♀♂♂ (L. Gressitt, MCZ). *Chekiang Prov*. Mokanshan [Mo-kan Shan], N. Gist Gee of Soochow, 1936, ♀♀ (L. Gressitt, MCZ); Shanghai, June 1906, ♀♀ (S. C. Thompson, CAS). *Fukien Prov*. Kuliang near Foochow [Fuchou], 750 m, July 1926, ♀♀ (C. R. Kellogg, CAS). *Hupeh Prov*. Suisapa, Lichuan Distr., 22 July 1943, ♀ (L. Gressitt, CAS), 19 Aug. 1948, ♀ (CAS). *Szechuen Prov*. Dec. 1914, ♀ (BMNH).

Argiope magnifica L. Koch

Figures 73–80; Map 3

Argiope magnifica L. Koch, 1871: 27, pl. 2, fig. 6, ♀. One female from Bowen, Queensland, and one badly damaged female from Queensland in the Godeffroy collection of the Zoologisches Museum, Universität Hamburg, examined.

Argiope aemula:—Chrysanthus, 1971: 9, figs. 1–3, ♂. M. H. Robinson and B. Robinson, 1973: 59; B. Robinson and M. H. Robinson, 1974: 145–159, pl. 1, ♀

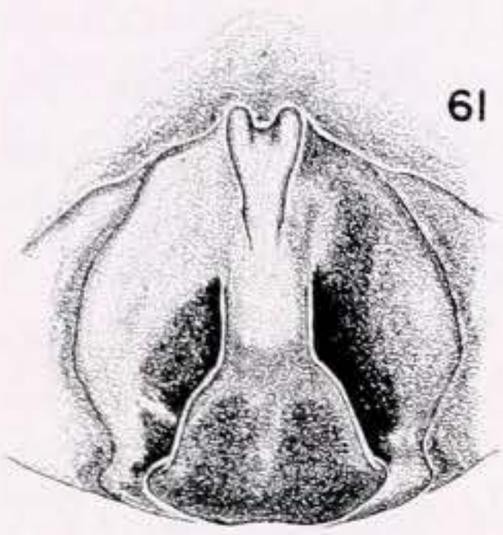
→

Figures 61–66. *Argiope boesenbergi* n. sp. 61–65. Female. 61. Epigynum, ventral. 62. Epigynum, posterior. 63. Epigynum, lateral. 64. Carapace and abdomen. 65. Sternum and abdomen. 66. Left male palpus, mesal.

Figures 67–72. *Argiope amoena* L. Koch. 67–71. Female. 67. Epigynum, ventral. 68. Epigynum, posterior. 69. Epigynum, lateral. 70. Carapace and abdomen. 71. Sternum and abdomen. 72. Left male palpus, mesal.

Figures 73–80. *Argiope magnifica* L. Koch. 73–79. Female. 73, 76. Epigynum, ventral. 74, 77. Epigynum, posterior. 75. Epigynum, lateral. 73–75. (Cairns, Queensland). 76, 77. (Wau, Papua New Guinea). 78. Carapace and abdomen. 79. Sternum and abdomen. 80. Left male palpus, mesal.

Scale lines. 0.1 mm, except Figures 64, 65, 70, 71, 78, 79, 1.0 mm.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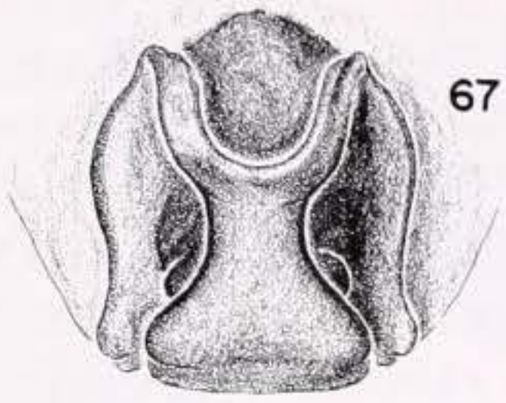
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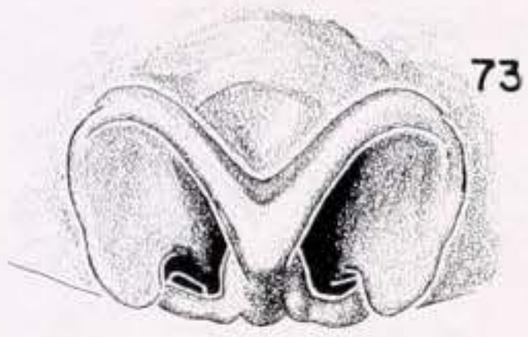
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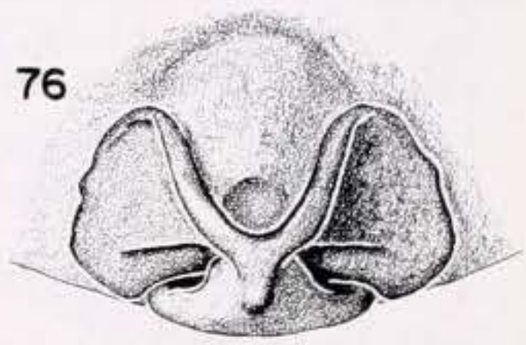
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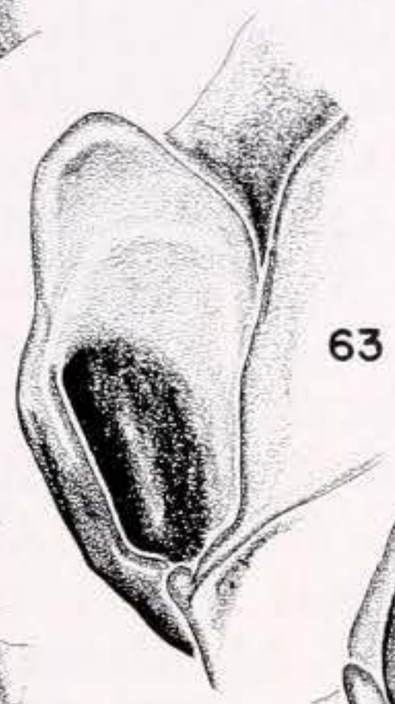
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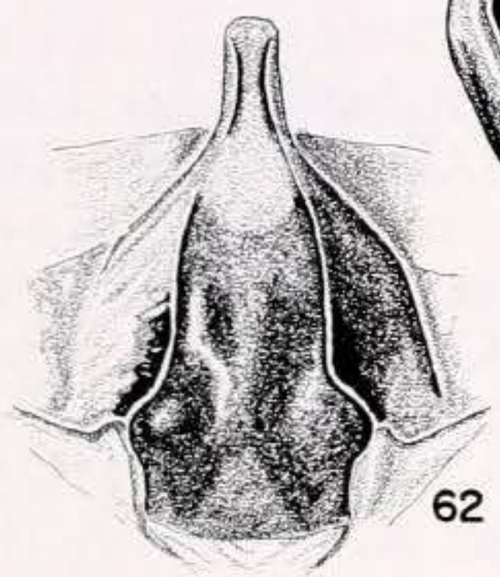
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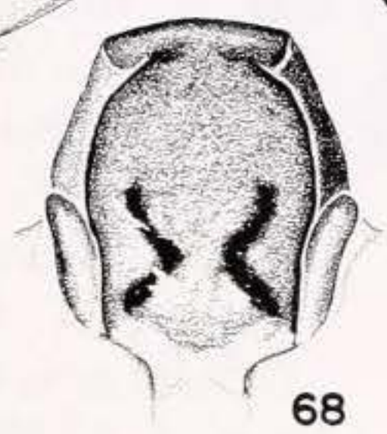
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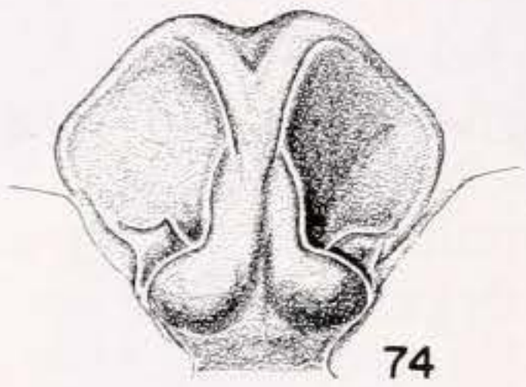
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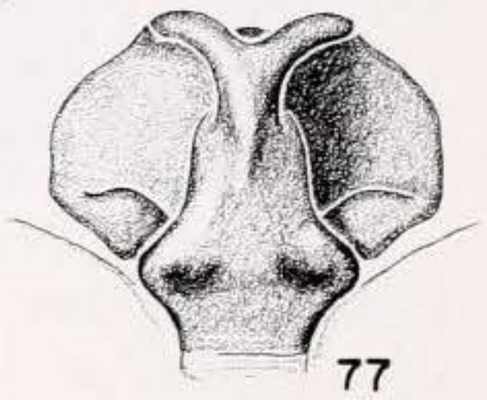
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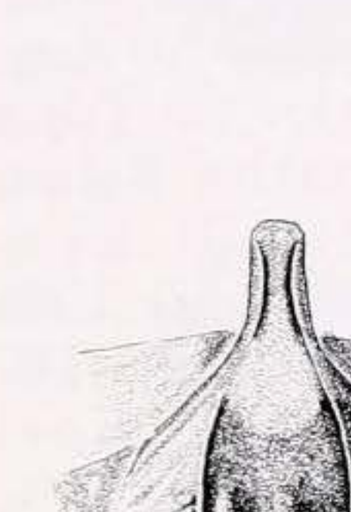
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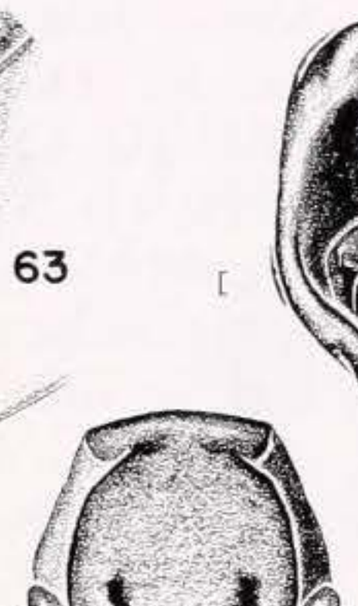
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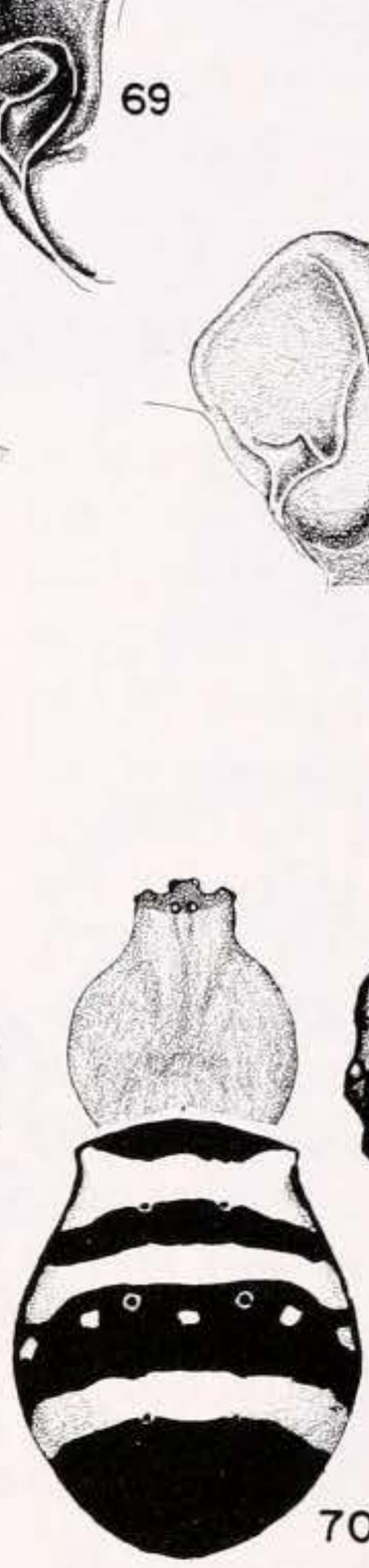
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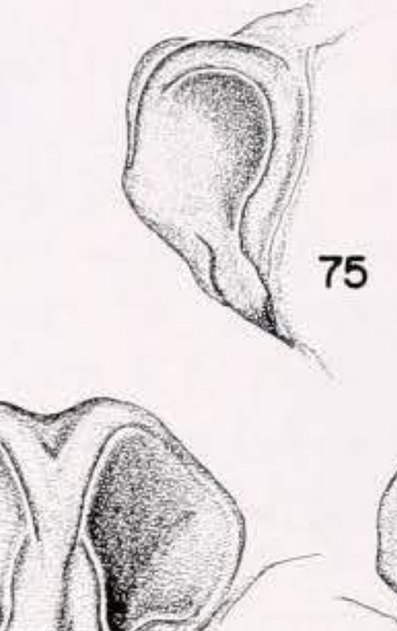
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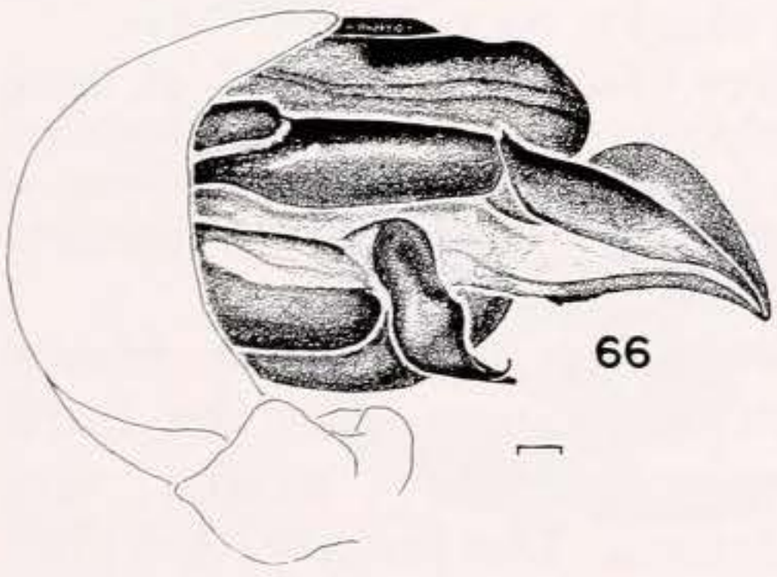
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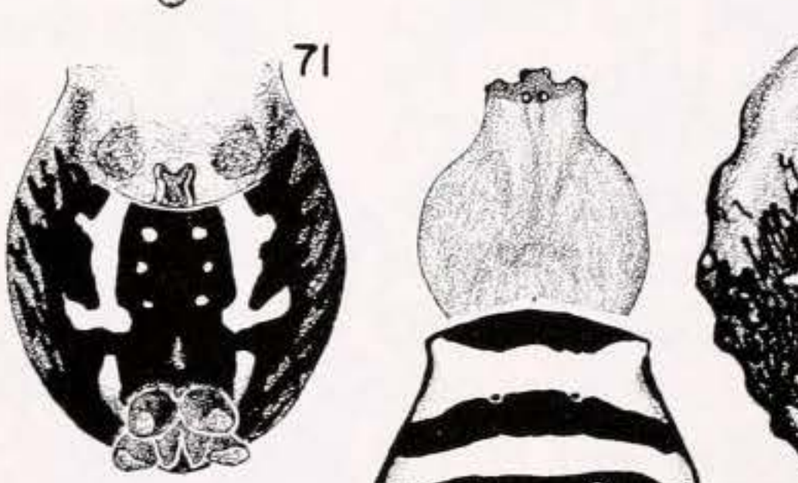
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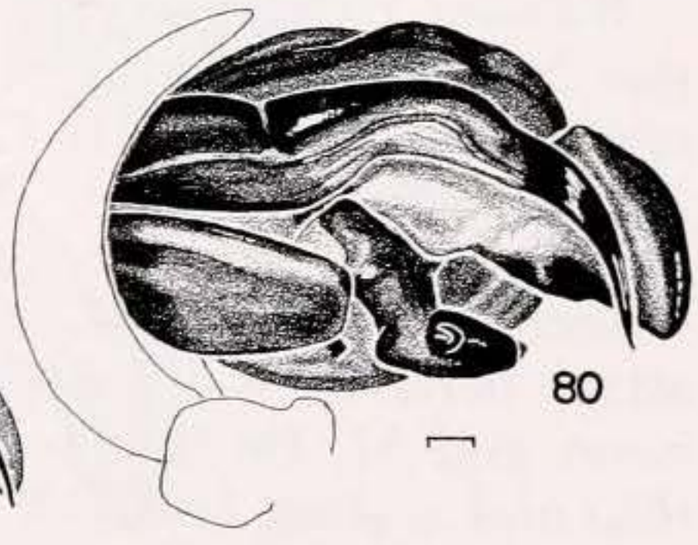
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(photo). M. H. Robinson, Lubin, and B. Robinson, 1974: 117–163. M. H. Robinson and B. Robinson, 1980: 10, 21–22, 43–58, 60, 70, 73, 82–83, 85, 89, 111, 190–192, 207, figs. 19–21, ♀♂ (photo) [misidentification, not *A. aemula* (Walckenaer)].

Notes. The specimens of *A. magnifica* from Bowen may not be the types, since the type of *A. magnifica* came from Port Mackay and Rockhampton.

The name *A. magnifica* had previously been erroneously synonymized with *A. aemula* (Roewer, 1942: 739).

Some females have fine tubes hanging out of the opening in the epigynum depression, the duct of a male embolus.

Figures 73–75 came from a specimen from Cairns, Australia; Figures 76–80 from Wau, Papua New Guinea.

Diagnosis. Females can be separated from most other *Argiope* by the uniform dorsal color of the abdomen, with fine black transverse lines (Fig. 78). Unlike the similar *aemula*, the posterior plate of the epigynum bends anteriorly and meets the scape on the venter (Figs. 73, 76); the septum continues below as a ridge in the middle of the posterior plate (Figs. 74, 77). The anterior bulge has a characteristic shallow circular posterior depression between the angle of the rim (Figs. 73, 76). The lateral edges of the depression appear unfinished and flat, unlike those of *A. aemula*.

The palpus has a long, gently curved embolus, and the median apophysis has its spur on its mesal face (Fig. 80).

Natural History. In the Wau area, Papua New Guinea this species is found in open grassy locations (B. C. Robinson and M. H. Robinson, 1974). The web usually has an X-shaped stabilimentum whose branches do not cross the hub region. The attack behavior is described in B. C. Robinson and M. H. Robinson, 1974; courtship and mating behavior in M. H. Robinson and B. Robinson, 1980.

Distribution. New Guinea, New Britain, Solomon Islands, Queensland (Map 3).

Records. PAPUA NEW GUINEA: *Eastern Highlands.* Arau, Oct. 1959, (J. Gunn, AMNH). *Morobe Distr.* Finschhafen, ♀ (NMW); Herzog Mts., Vagau, 1220 m, 17 Jan. 1965, 2♀ (M. E. Bacchus, BMNH). Mt. Kaindi, nr. Wau, May 1959, ♀♀ (Archbold Exped., AMNH); Wau, 18 March 1979, ♀♀♂ (several coll., MCZ); Kabwum [?], Huon Peninsula, Nov. 1964, ♀ (H. M. van Deusen, AMNH); Gemcheng, Huon Penins., 11–12 April 1955, ♀ (E. O. Wilson, MCZ). *Madang Distr.* Finistere Mts., Naho River Valley, Budemu, 1270 m, 25 Oct. 1964, ♀ (M. E. Bacchus, BMNH); Kundiawa near Gumine, 10 Aug. 1972, ♀ (CNC). NEW BRITAIN: 2♀ (Tring Mus., BMNH); ♀ (Finsch, ZMB); Ralum [near Rabaul], 17 May 1896, ♀ (F. Dahl, ZMB); Simpsonhafen [Rabaul], May 1909 (Schwede, ZMB). SOLOMON ISLANDS: Guadalcanal (many records); Marova Lake, ♀ (W. M. Mann, MCZ). AUSTRALIA: *Queensland.* Cairns, Aug.–Sept. 1938, ♀ (R. G. Wind, MCZ); 88 km SW Mt. Garnet, 650 m, 5 Nov. 1962, ♀ (E. S. Ross, CAS); Bellenden Ker, May, ♀ (E. Mjöberg, NRS); Bowen, 1882, ♀ (NMW).

Argiope bruennichi (Scopoli)

Figures 81–86; Map 3

Aranea bruennichi, Scopoli, 1772: 125. Original specimen from Carniolia [Carinthia].

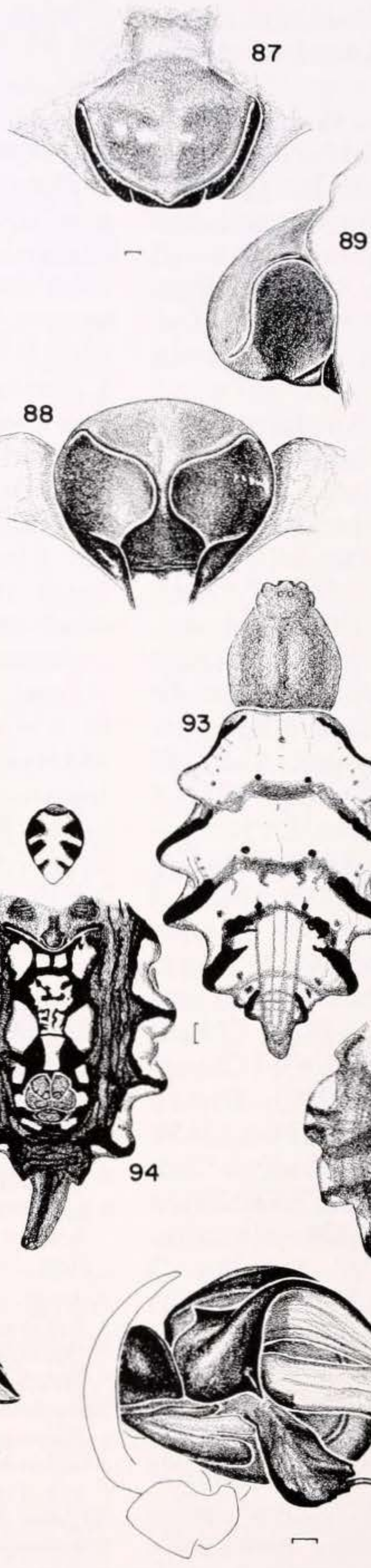
Argiope bruennichi:—Thorell, 1873: 518. Wiehle, 1931: 14, figs. 4b, 5a, 11–17. 1♀♂ Roewer, 1942: 734. Bonnet, 1955: 678. Yaginuma, 1960: 60, pl. 25, fig. 144, ♀. Song, 1980: 97, fig. 43, ♀.

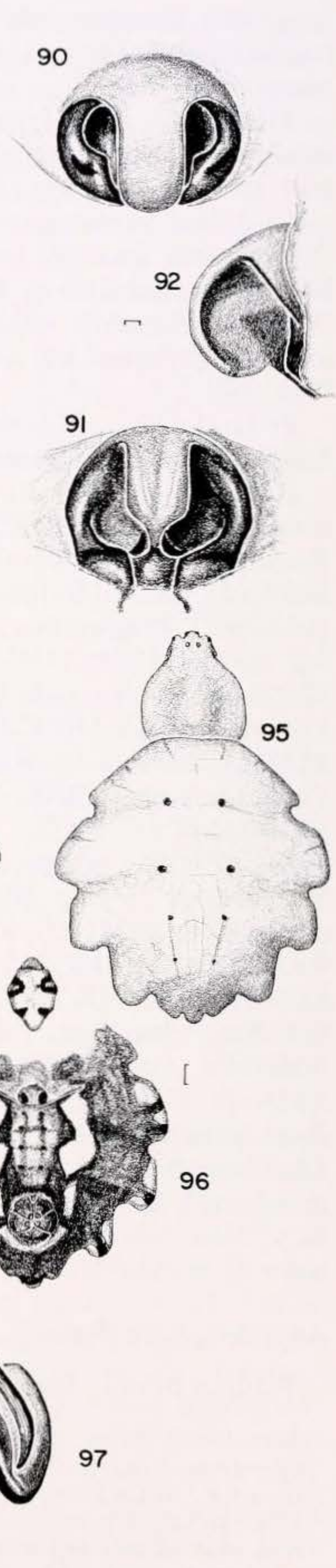
Argiope bruennichi orientalis Strand, 1907a: 416. Female holotype from Java [? erroneous locality] deposited in the Zool. Institute of the University of Tübingen, examined. Now deposited in the Senckenberg Museum. NEW SYNONYMY.

Miranda zabonica Chamberlin, 1924: 17, pl. 4, fig. 34. Male holotype from Soochow [? Hsüchou, Kiangsi Prov.], China in the National Museum of Natural History, Washington, D.C., examined. NEW SYNONYMY.

Note. According to Strand, *A. bruennichi orientalis* is larger than the European specimens but has a similar, very distinct epigynum. The female here illustrated came from China, the male from Japan.

Diagnosis. The genitalia are most similar to those of *A. aurantia* of North America (Levi, 1968: 56). As in *A. aurantia*, the epigynum is a wide scape with a median dorsal hollow, lacking a septum





Figures 81–86. *Argiope bruennichi* (Scopoli). 81–85. Female. 81. Epigynum, ventral. 82. Epigynum, dorsal. 83. Epigynum, lateral. 84. Carapace and abdomen. 85. Sternum and abdomen. 86. Left male palpus, mesal.

Figures 87–97. *Argiope lobata* (Pallas). 87–96. Female. 87, 90. Epigynum, ventral. 88, 91. Epigynum, posterior. 89, 92. Epigynum, lateral. 93, 95. Carapace and abdomen. 94, 96. Sternum and abdomen. 87–89, 93, 94. (Burma). 90–91, 95, 96. (Java). 97. Left male palpus, mesal.

Scale lines. 0.1 mm, except Figures 84, 85, 93–96, 1.0 mm.

(Fig. 82). However, the dorsal abdominal markings differ from the American *A. aurantia* (Fig. 84).

The male palpus has a long, almost straight embolus, its tip held by a conductor; the median apophysis has a long, curved filamentous spur (Fig. 86) and, like *A. aurantia*, a row of irregular large teeth laterally (not visible in Fig. 86). The stipes (base of embolus), unlike *A. aurantia* or any other species, has a soft, transverse slit (Fig. 86).

Distribution. Eurasia to Japan and China, perhaps Australia (Map 3).

Records. JAPAN: *Kanagawa Pref.* Yokohama, 1889, ♀ (Schmacker, SMF.) *Wakayama Pref.* Shiono Misaki, 29 Oct. 1973, ♀ (W. C. Sedgwick, SC). 23 Oct. 1951, ♀ (T. Yaginuma, AMNH); Shirahama, 29 Oct. 1972, ♀ (W. C. Sedgwick, SC). Negorosan, Naga-gun, 19 Aug. 1950, ♂ (H. Yoneda, MCZ); Mt. Katsuragi, Naga-gun, 13 Aug. 1951, ♀ (S. Kobayashi, AMNH); Yoshino, 6 Aug. 1980, ♀; 22 Aug. 1981, ♂ (T. Yaginuma, MCZ). *Kyoto Pref.* Kyoto, ♀ (W. C. Sedgwick, SC). KOREA: Sach'ang-ni [Sojong-ni], 16 Aug. 1953, ♀ (T. J. Cohen, AMNH); Yach'on-ni, Su-chon River, 18 Aug. 1953, ♀ (AMNH); Taegu, 28 July 1955, ♀ (K. Paik, AMNH); 24 km. SSE Kumwha, Sept. 1953, ♀ (T. J. Cohen, AMNH); Aug. 1953, ♂ (T. J. Cohen, AMNH). CHINA: (Song, 1980). *Hupeh Prov.* Suisapa, 22 Aug. 1948, ♀ (Djou, CAS). *Chekiang Prov.* Mokanshan [Mo-Kan Shan mountain], Soochow [Suchou]. AUSTRALIA: *New South Wales.* Sydney [locality error ?], ♀ (AMS).

Argiope lobata (Pallas)

Figures 87–97; Map 3

Aranea lobata Pallas, 1772: 46, pl. 3, figs 14, 15. Specimens from unknown locality [presumably from the Ukraine], lost.

Argiope arcuata Simon, 1884: 343. Female holotype from near Minnla, Irriwaddy River, Burma in the Muséum National d'Histoire Naturelle, Paris, examined. Pocock, 1900: 220, fig. 70, ♀. Roewer, 1942: 787. Bonnet, 1955: 673. NEW SYNONYMY.

Argiope lobata:—Roewer, 1942: 735. Bonnet, 1955: 687. Levi, 1968: 336, figs. 25–38, ♀♂.

Note. The illustrations for Figures 87–89, 93, 94 were made from the holotype of *A. arcuata*; Figures 90–92, 95, 96 from a specimen from Java; Figure 97 from a male from Corsica.

Diagnosis. The dorsally silvery abdomen with large lobes all around (Figs. 93, 95) is diagnostic. The epigynum is quite variable, lacking a distinct rim, and the anterior bulge continues as a more or less wide lobe which posteriorly constricts into a narrow median septum (Figs. 88, 91) (see also Levi, 1968: figs. 25–35). On each side of the base of the male's embolus is a recurved thorn (Fig. 97).

Distribution. This species is found from the Mediterranean to China (Roewer, 1942), Burma to New Caledonia and northern Australia (Map 3).

Records. INDIA: Bombay, ♀ (HCO); Nilgiri Hills, Dekan [Madras] (SMF). BURMA: 15 Oct. 1922, ♀ (B. Brown, AMNH). INDONESIA: *Java.* ♀ (coll. by Natur. Hist. Comm., early in the 19th cent., RNHL). AUSTRALIA: *Queensland.* "northern," ♀, No. KS 6182 (AMS). NEW CALEDONIA: ♀ (E. Simon, BMNH).

Argiope protensa L. Koch

Figures 98–106; Map 3

Argiope protensa L. Koch, 1872: 211, pl. 18, fig. 8, ♀. Female holotype from Bowen [Port Denisson, Queensland] in the Godeffroy collection, Zoologisches Museum, Universität Hamburg, examined. Roewer, 1942: 743. Bonnet, 1955: 693. Chrysanthus, 1971: 15, figs. 15–19, ♀.

Argiope syrmatica L. Koch, 1872: 213, pl. 18, fig. 9, ♀. Female holotype from Bowen [Port Denisson], Queensland in the Museum of the University of Hamburg, examined.

Epeira attenuata Urquhart, 1884: 33, pl. 9, fig. 1, ♀. Female holotype from New Zealand, lost.

Arachnura longicauda Urquhart, 1884: 34, pl. 9, fig. 2, ♀. Female holotype from New Zealand, lost.

Argiope multifasciata Thorell, 1892: 226. Juvenile holotype from Singapore [? locality error] in the National Museum of Ireland, Dublin, examined. NEW SYNONYMY.

Argiope extensa Rainbow, 1897: 22(3): 519, pl. 17, fig. 5, ♀. Female holotype from Guildford [? New South Wales], Australia, KS 6413 in the Australian

Museum, Sydney, examined. Roewer, 1942: 742. Bonnet, 1955: 685. Mascord, 1970, pl. 34, fig. 134, ♀ (photograph).

Argiope pallida Rainbow, 1897: 521, pl. 17, fig. 6, ♀. Female holotype from Queanbeyan, New South Wales, KS 7111 in the Australian Museum, Sydney, examined. NEW SYNONYMY.

Argiope gracilis Rainbow, 1897: 522, pl. 17, fig. 7, ♀. Female specimen from Queanbeyan, Australian Museum, Sydney, examined. Holotype allegedly from Bungendore (not *A. gracilis* Blackwall). NEW SYNONYMY.

Argiope haynesi Hogg, 1914: 73, pl. 1, fig. 3, ♀. Female syntypes from Monte Bello Islands, Western Australia, in the British Museum, Natural History, examined. NEW SYNONYMY.

Argiope gracillima Roewer, 1942: 742. New name for *A. gracilis* Rainbow, preoccupied.

Notes. Thorell's *A. multifasciata* is almost certainly this species. Thorell noticed the similarity but named it because it came from Singapore. Was it introduced to Singapore? Is there a similar uncommon native species, or is the locality in error?

A female marked *A. gracilis* by Rainbow, but from Queanbeyan, is apparently the type of *A. gracilis* since it is the specimen which Rainbow illustrated: the shape of the abdomen and the pigment distribution in the illustration and specimen examined are alike.

The female was illustrated from a specimen from New Zealand (Figs. 98–103). The male was illustrated (Fig. 106) from an individual from Swan River, Australia (MCZ). Figure 105 was prepared from the holotype of *A. pallida*; Figure 104 from a female from Fitzroy Island, northern Queensland.

Diagnosis. Argiope protensa, unlike other species except *A. probata*, has a narrow abdomen overhanging and extending beyond the spinnerets (Figs. 102–105). Unlike the epigynum of *A. probata*, the openings face dorsally toward the venter of abdomen (Figs. 98–101).

The male can be told by the long curved embolus, whose tip is held by a conductor that is directed proximally. Unlike other species, the median apophysis points proximally and has a long S-shaped spur in the same direction (Fig. 106).

Variation. The shape of the abdomen is very variable: short, with almost no tail (Fig. 105), or a post-spinneret tail of variable length (Figs. 103, 104). The sternum of many specimens has pairs of tubercles facing the coxae. At present I believe they are all one species because of the similarity of the genitalia. The size range of females is 13 to 21 mm. Mascord (1970, Australian Spiders in Colour) presented photographs under the name of *A. protensa* (fig. 130), *A. extensa* (fig. 134), and *A. syrmatica* (fig. 135).

Distribution. Australia, New Zealand (Map 3).

Records. AUSTRALIA: *Queensland.* Townsville, March 1927, ♀ (G. Dennes, AMS); Mt. Isa, 1980, ♀ (AMS); Hughenden, ♀ (AMS); Alice Riv., ♀ (E. Mjöberg, NRS). *New South Wales.* Mascot, 13 March 1968, ♀ (R. Mascord, AMS); Richmond North, 1 March 1972, ♀ (R. McDonald, AMS); Springwood, 27 Dec. 1966, ♀ (A. E. Speechley, AMS); Queanbeyan, ♀ (AMS); Colo Vale, ♀ (AMS); The Rocks, Sydney, 19 March 1967, ♀ (AMS); Maylands, 4 May 1938, ♀ (C. L. Henley, WAM); Wyangarie, ♀ (AMS); Scone, ♀ (AMS); Mittagong, 7 Nov. 1974 (B. Collins, AMS). *Victoria.* Gisborne, ♀ (AMS). *A.C.T.* Glaninderra, Canberra, apple orchard, 14 Feb. 1964, ♀ (CNC). *Northern Territory.* Alice Springs, shrubs, ♂ (J. Wunderlich, WC); 18 km N Alice Springs, 625 m, 28 Oct. 1962, ♀ (E. S. Ross, CAS); Macdonald Downs, 400 m, 30 Oct. 1962, ♀♂ (E. S. Ross, CAS); Kulgera, ♀♀ (B. Greenwood, WAM). *Western Australia.* Geraldton; 27 km N Payne's Find, 400 m; 10 km N Mandurah; Mt. Magnet, 410 m; Milly Milly; Rossmore, ♀; Sir Graham Moore Isl. nr. Anjo Penins.; Kimberley Distr.; St. George Range; Montebello Isls.; Milling, lowland flats; Kathleen Valley, wasp nest; Kalgoorlie; Newmarracarra; Wembley; Tombrey; Bedford Park; Joondana; Calbarri; Gee Gie Outcamp; Murchison; Perth; Midland Junction; Morley; Florest Park; Carrolligooda Well; Brown Bone Cave, Pinnacles Desert; City Beach,

nr. Riffle Range; Youanmi; Doodlakine; Prairie Downs. *South Australia*. Kangaroo Isl., 7 km W of Emu Bay, 6 Dec. 1977, ♀ (D. C. F. Rentz and B. G. F. Rentz, CSIRO).

Argiope probata Rainbow

Figures 107–111; Map 3

Argiope probata Rainbow, 1916: 91, pl. 21, fig. 13, ♀. Female and one juvenile male syntypes from Pentland, Queensland, Australia, KS 6157 in the Australian Museum, Sydney, examined. Roewer, 1942: 743. Bonnet, 1955: 693.

Argiope ocyaloides:—Mascord, 1978: 6 (photograph) [misidentification].

Note. The illustrations of the female (Figs. 107–110) were prepared from the type specimen. The male's first femur has long macrosetae, six on the right, five on the left, standing up and each more than three femur diameters' length. There are smaller macrosetae on all tibiae and proximal parts of metatarsi. The male (Fig. 111) is from Wolfram, Queensland, and has not been collected with the female.

Diagnosis. The female differs from *A. protensa* by the flat epigynum facing ventrally (Fig. 107); the male by the embolus having the tip doubled up over its base (Fig. 111). The median apophysis has an enormous distal projection (Fig. 111).

Variation. Some specimens have a longer tail, others a much shorter one than pictured in Figures 109 and 110.

Records. AUSTRALIA: *Queensland*. Wolfram, 11 Feb. 1972, ♂ (N. C. Coleman, AMS); 8 Aug. 1971, ♀ (R. E. Mascord, AMS); Mareeba, 8 Feb. 1970, ♀♂ (N. C. Coleman, AMS).

Argiope trifasciata (Forskål)

Figures 112–119; Map 3

Aranea trifasciata Forskål, 1775: 86. Original specimens from Cairo [Egypt], lost.

Argiope avara Thorell, 1859: 299. Female syntypes from San Francisco, California and Oahu, Honolulu, in the Naturhistoriska Riksmuseet, Stockholm, examined. Chrysanthus, 1971: 12, figs. 9–12.

Argiope plana L. Koch, 1867: 181. Four female syntypes from Peak Downs [southern Queensland] and one from Bowen, Queensland in the Godeffroy collection of the Zoologisches Museum, Universität Hamburg, examined. NEW SYNONYMY.

Argiope fasciata:—Keyserling, 1886: 133.

Argiope avara kauaiensis Simon, 1900: 477. One female syntype from Kauai Island, Hawaii in the Bishop Museum, Honolulu, not examined.

Metargiope trifasciata:—F. P.-Cambridge, 1903: 451, pl. 43, figs. 2, 3, ♀, ♂. Kishida, 1936: 17.

Austrargiope plana:—Kishida, 1936: 17.

Argiope trifasciata:—Roewer, 1942: 733. Bonnet, 1955: 694. Levi, 1968: 340, pl. 1, figs. 58–72, 74–91, ♀, ♂. M. H. Robinson, Lubin, and B. Robinson, 1974: 128.

Brachygea platycephala di Caporiacco, 1947: 24. Male holotype from British Guyana in the Zoological Museum of the University of Florence, examined. NEW SYNONYMY.

Argiope pradhani Sinha, 1951: 76, fig, 2, ♀. Female holotype from Saran, Bihar, India in the Zoological Survey of India, not available. NEW SYNONYMY.

Notes. The name of *A. plana* had previously been considered a synonym of *A. reinwardti* (Doleschall). Sinha's illustrations of *A. pradhani* appear to be those of *A. trifasciata*.

The illustrations (Figs. 112, 117, 119) were made from Hawaiian specimens; Figure 118 from a specimen from New Caledonia.

Diagnosis. The dorsum of the abdomen is oval and has transverse black lines (Figs. 115, 118). The two ventral paraxial lines

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Figures 98–106. *Argiope protensa* L. Koch. 98–105. Female. 98. Epigynum, ventral. 99. Epigynum, dorsal. 100. Epigynum, dorsal, cleared. 101. Epigynum, lateral. 102. Carapace and abdomen. 103–105. Sternum and abdomen. 103. (New Zealand). 104. (Northern Queensland). 105. (New South Wales). 106. Left male palpus, mesal.

Figures 107–111. *Argiope probata* Rainbow. 107–110. Female. 107. Epigynum, ventral. 108. Epigynum, posterior. 109. Carapace and abdomen. 110. Sternum and abdomen. 111. Left male palpus, mesal.

Figures 112–119. *Argiope trifasciata* (Forskål). 112–118. Female. 112. Epigynum, ventral. 113. Epigynum, posterior. 114. Epig-


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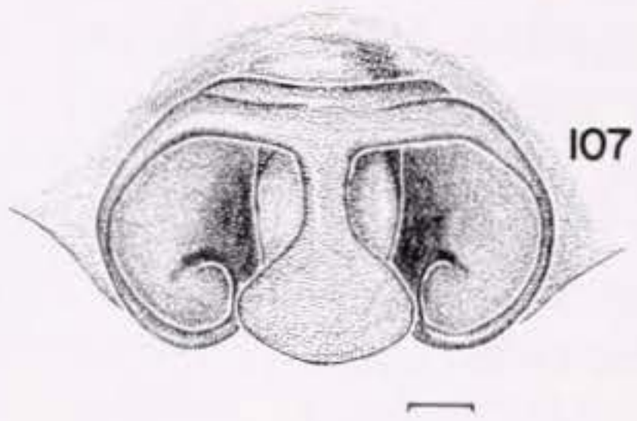
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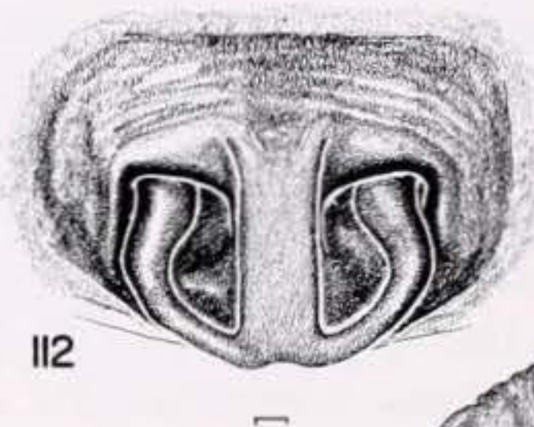
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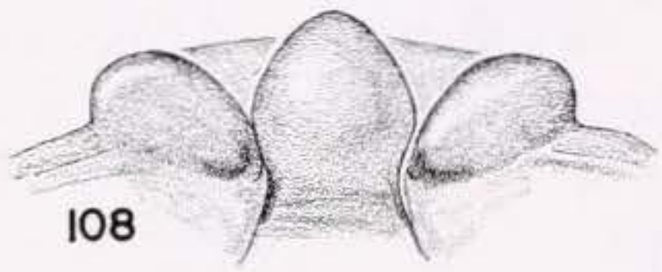
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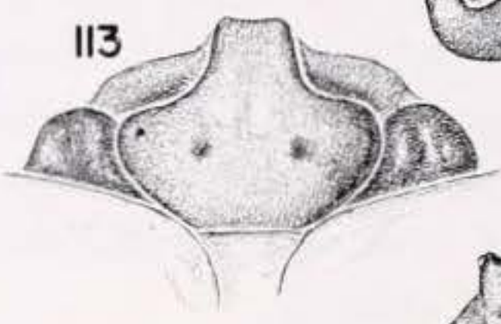
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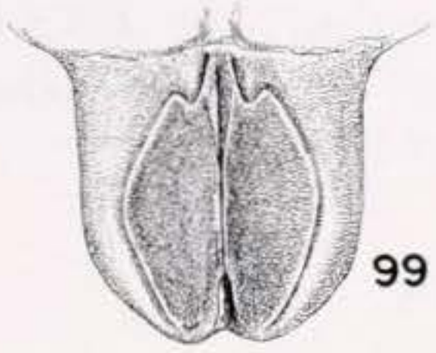
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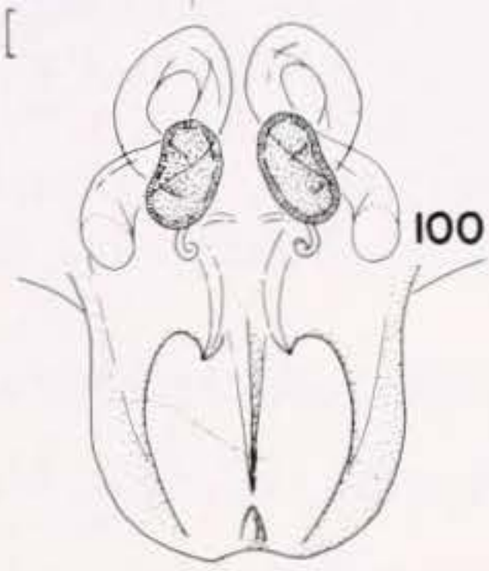
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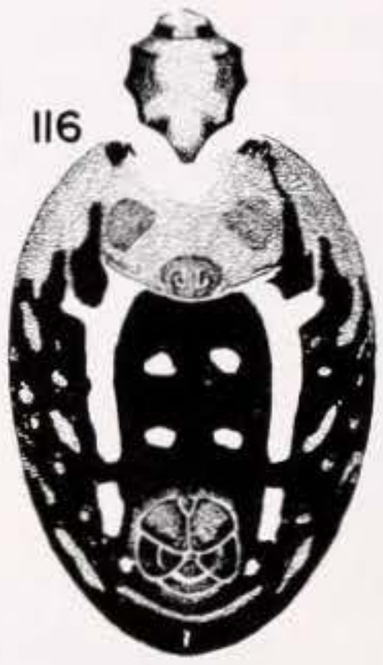
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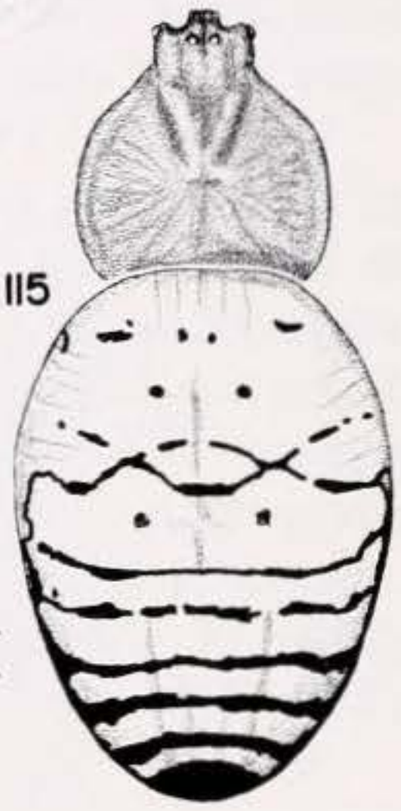
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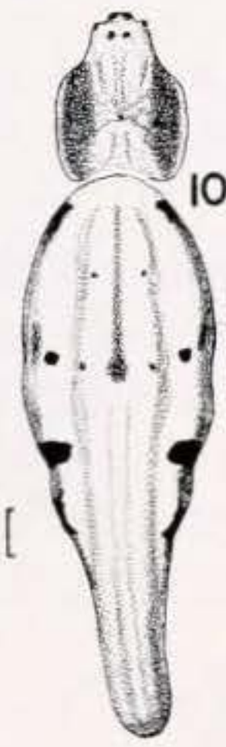
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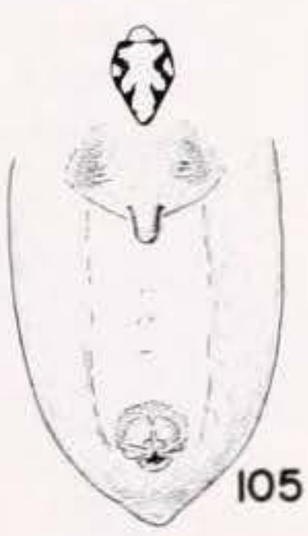
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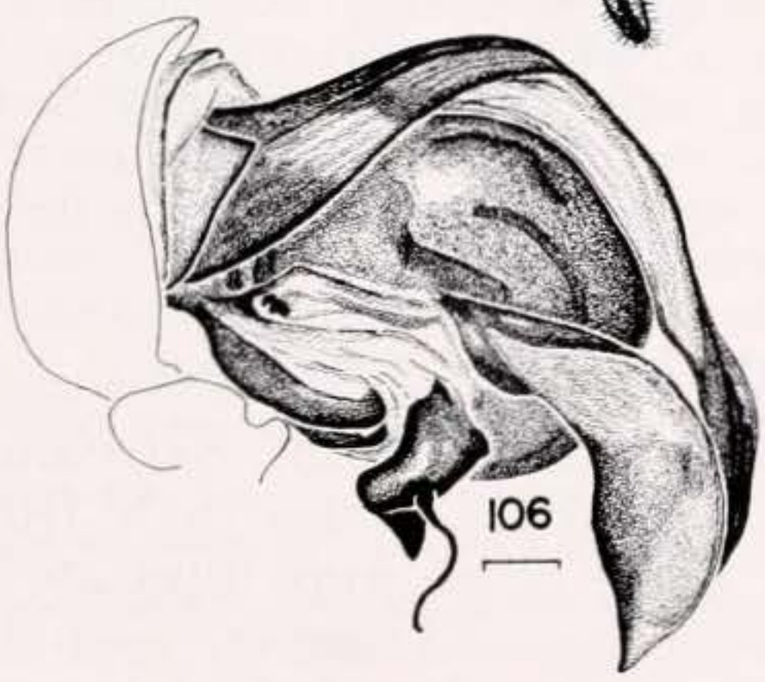
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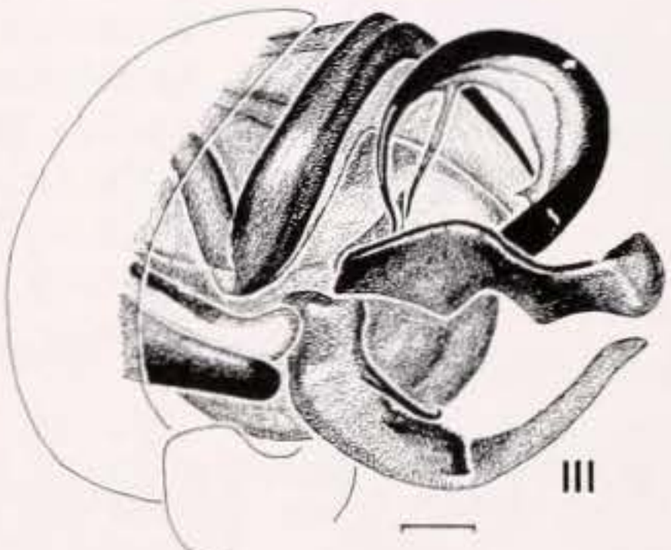
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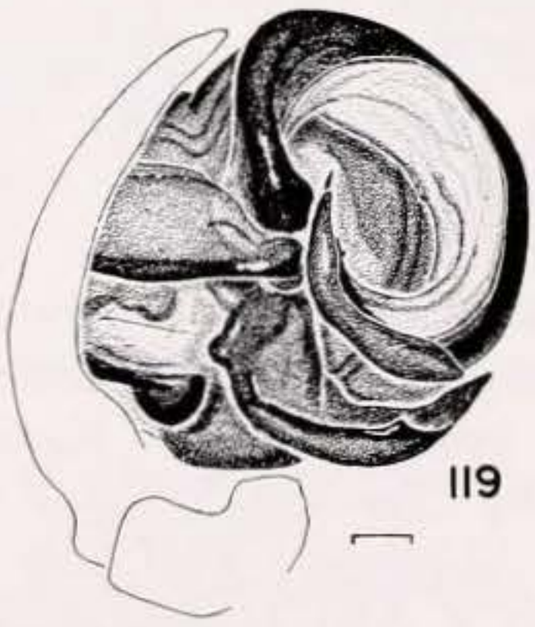
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ynum, lateral. 115. Carapace and abdomen. 116. Sternum and abdomen. 117, 118. Abdomen, dorsal. 115, 116. (Oahu, Hawaii). 117. (Kauai, Hawaii). 118. (New Caledonia). 119. Left male palpus, mesal.

Scale lines. 0.1 mm, except Figures 102–105, 109, 110, 115–118, 1.0 mm.

include a black area containing a variable number of pairs of white patches (Fig. 116). Unlike females of other species, the anterior bulge of the epigynum lacks the distinct rims which fuse into the septum, and instead the septum anteriorly overhangs the rim (Fig. 112). Posterodorsally, the septum widens into a bottle-shaped posterior plate (Fig. 113). Within the depression the posterior plate is wide and hollowed out on each side (Fig. 112).

Unlike that of other species of the region, the conductor and embolus coil and face ventrally (Fig. 119); the median apophysis has only a minute filamentous spur on its edge.

Variation. The dorsum of the abdomen of specimens from Kauai Island, Hawaii is black with a light anterior (Fig. 117), resembling *Argiope bougainvilla* from the Solomon Islands and *Cyrtophora moluccensis* (Doleschall). Simon considered this coloration a subspecies. Females from Australia and New Caledonia have the sides of the abdomen slightly scalloped (Fig. 118).

Natural History. Argiope trifasciata occurs on roadsides and in grasslands in the Wau Valley, Papua New Guinea (M. H. Robinson, Lubin, and B. C. Robinson, 1974).

Distribution. Probably worldwide in the temperate and tropical areas. Absent from Europe and Japan. Very common in Hawaii (Map 3).

Records. HAWAIIAN ISLANDS: "Sandwich Island," ca. 1864, ♀♀ (A. Garett, MCZ). *Oahu.* 28 March 1889, ♀♀ (Galathea Exped., ZMK); Koko Head; Mt. Tantalus, Waimano Ridge; Honolulu; Kauloa Point; Manoa Valley, Mokuleia; Waialua; Kailua; Wahiarra. *Kauai.* Alakai Swamp; Wailua; Kilaua; Kau Distr., volcano road. *Hawaii.* Kamulea; Lanai (?); Mauna Loa Truck Trail. NEW GUINEA: Port Moresby; McLong Island (?). BISMARCK ARCHIPELAGO: South Hermit Isl., 15 Feb. 1952, ♀ (T. C. Campbell, CSIRO). AUSTRALIA: *Queensland.* Eidsvold; Gordonvale; Bluff Down; Maylands; Bicton. *New South Wales.* Mittagong; Long Bay; Yerrinbool; Kurnell; Malabar; Sydney; Kingscliff; Jenolan State Forest; Bilpin. *Australian Capitol Territory.* Canberra, 6 April 1979, ♀, 5 March 1935 (A. L. Tonnor, CSIRO). *Victoria.* Brunswick, 20 May 1966, ♀ (E. George, WAM). *Northern Territory.* Charters Towers; Mt. Molloy. *Western Australia.* Fitzgerald River; Greenshields; Marmion; Bridgetown; Kings Park; Leederville; Maylands; Rossmorine; Subiaco; Gosnells; East Fremantle; Perth; Hellfire Bay Camp, swamp; Freemantle; Applecross. NEW CALEDONIA: Quatom Valley; Nouméa; N of Tomo. SRI LANKA: "Ceylon," 6♂ (HCO). INDONESIA: *Sumatra.* Balinghe [Balinge], ♀♀ (Modigliani, NMW).

Argiope bullocki Rainbow

Figures 120–123; Map 4

Argiope bullocki Rainbow, 1908: 46, fig. 3, ♀. Female holotype from Parkville, near Scone, New South Wales, #KS 2464 in the Australian Museum, Sydney, examined. Roewer, 1942: 741. Bonnet, 1955: 683.

Diagnosis. Argiope bullocki differs from *A. probata* by having a shield-shaped abdomen (Fig. 122), and from *A. ocyaloides* and *A. doboensis* by having the rim of the epigynum laterally completely surround the circular depressions (Fig. 120).

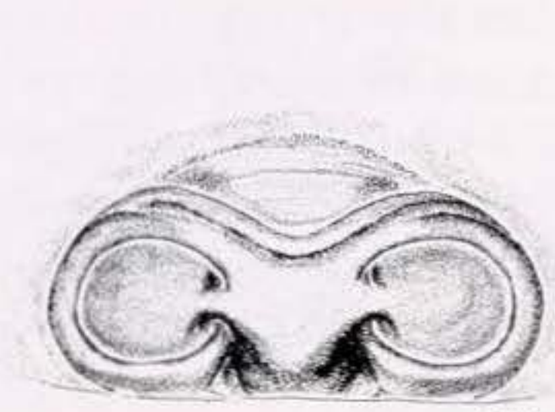
Argiope ocyaloides L. Koch

Figures 124–129; Map 4

Argiope ocyaloides L. Koch, 1871: 30, pl. 2, fig. 8, ♀. Female from Port Mackay [near Townsville, Queensland] in the Godeffroy collection, Zoologisches Museum, Universität Hamburg, lost. Female from Rockhampton, Queensland in the L. Koch collection of the British Museum, Natural History, here designated neotype, examined. Roewer, 1942: 742. Bonnet, 1955: 692.

Note. A female from Redlynch, Queensland, Australia, and a male from Proserpine, Queensland were illustrated.

Diagnosis. This small species resembles and has been confused with *A. doboensis* of New Guinea. It differs by having the septum and rims of the epigynum in the shape of a weakly sclerotized T (Fig. 124);



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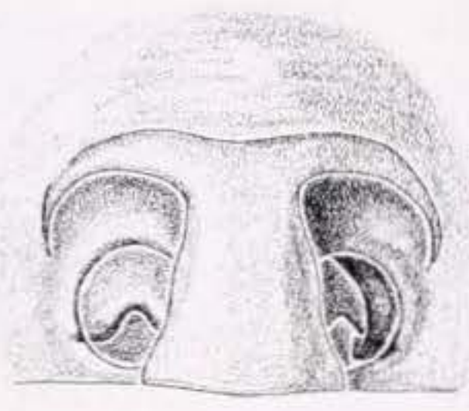

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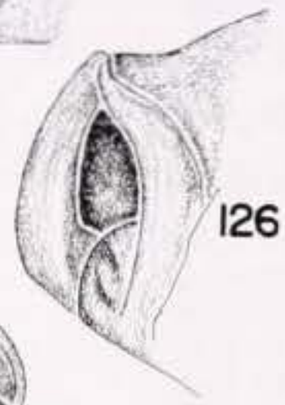

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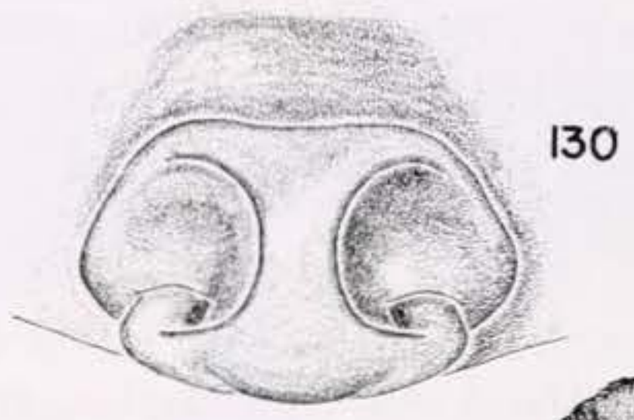

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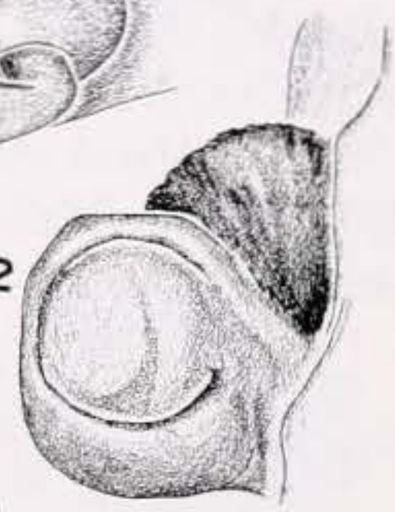

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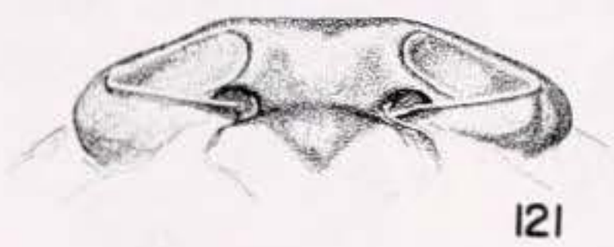

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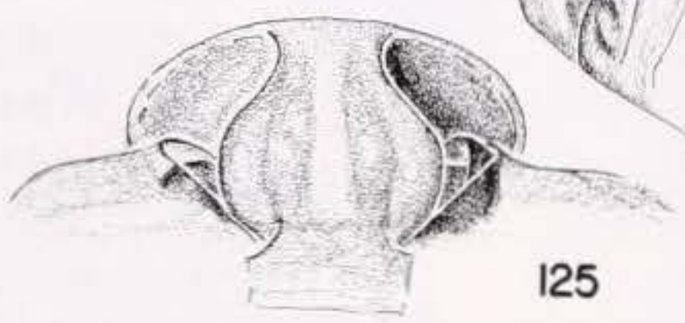

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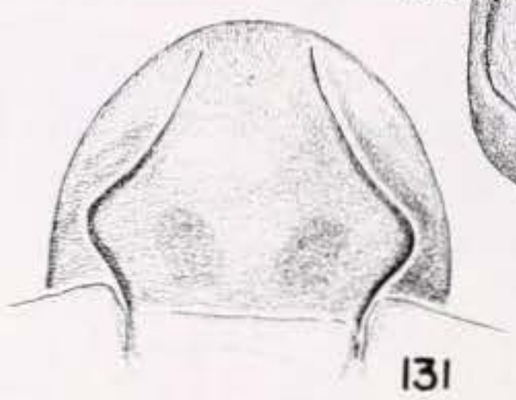

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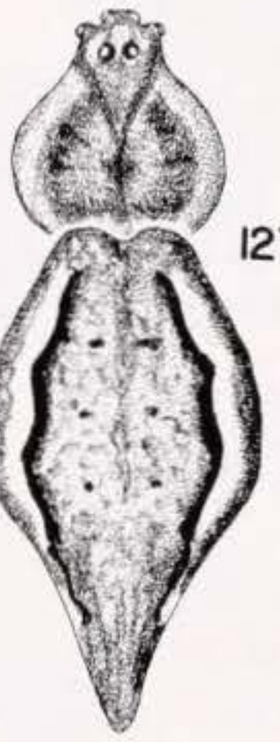

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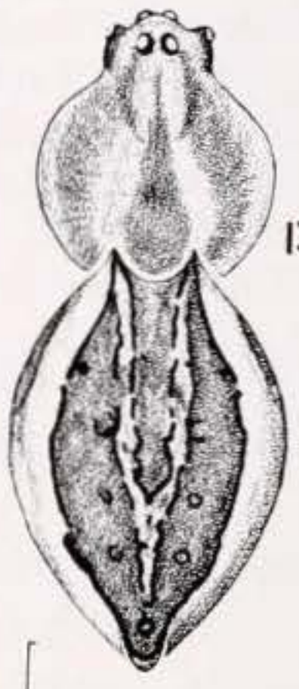

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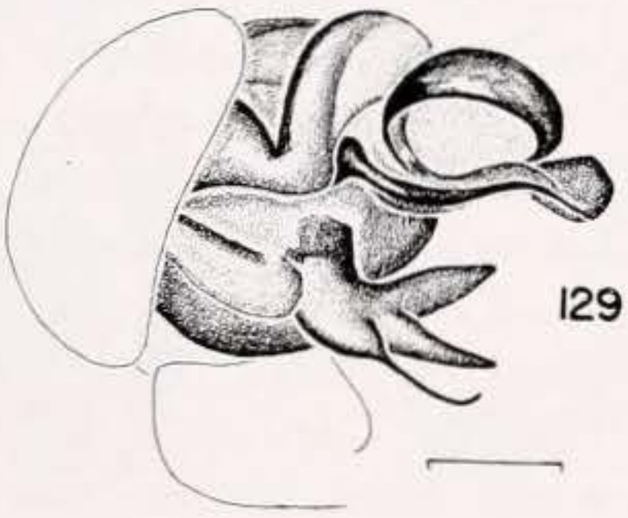

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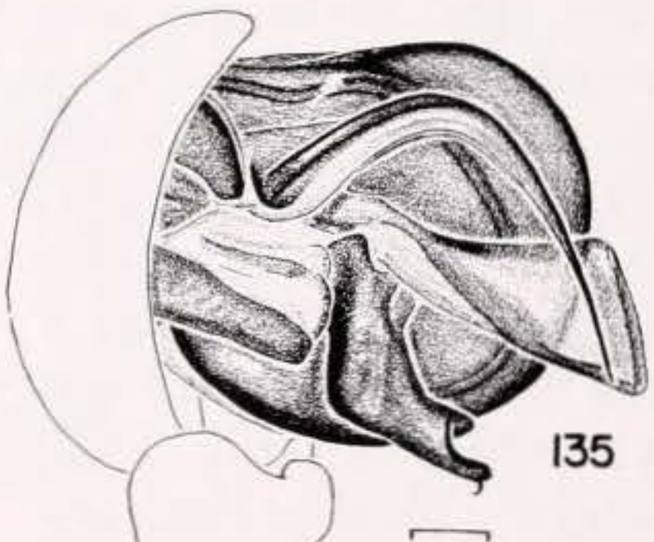

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Figures 120–123. *Argiope bullocki* Rainbow, female. 120. Epigynum, ventral. 121. Epigynum, posterior. 122. Carapace and abdomen. 123. Sternum and abdomen.

Figures 124–129. *Argiope ocyaloides* L. Koch. 124–128. Female. 124. Epigynum, ventral. 125. Epigynum, posterior. 126. Epigynum, lateral. 127. Carapace and abdomen. 128. Sternum and abdomen. 129. Left male palpus, mesal.

Figures 130–135. *Argiope doboensis* Strand. 130–134. Female. 130. Epigynum, ventral. 131. Epigynum, posterior. 132. Epigynum, lateral. 133. Carapace and abdomen. 134. Sternum and abdomen. 135. Left male palpus, mesal.

Scale lines. 0.1 mm, except Figures 122, 123, 127, 128, 133, 134, 1.0 mm.

that of *A. doboensis* is an upside-down T. The male differs by having the embolus of the palpus coiled back on itself (Fig. 129), as is that of *A. probata*.

Records. AUSTRALIA: *Queensland.* ♀ (NMW); Cairns, 14 Oct. 1914, ♀ (W. M. Wheeler, MCZ); Redlynch, 18 Oct. 1938, ♀ (R. G. Wind, MCZ); Rochedale, 15 Dec. 1973, ♀♀ (R. Raven, QMB); Proserpine, 17 Aug. 1971, ♀, ♂ (N. C. Coleman, QMB).

Argiope doboensis Strand

Figures 1, 2, 130–135; Map 4

Argiope doboensis Strand, 1911b: 144, pl. 4, fig. 6, ♀ juv. Juvenile holotype from Wamar Island in forest between Dobo and Vezagil, Indonesia [Aru Isls.] in the Senckenberg Museum, Frankfurt, examined.

Argiope ocyaloides:—Chrysanthus, 1971: 14, figs. 13–16. M. H. Robinson and Lubin, 1979: 116, fig. 7 (web photo). M. H. Robinson and B. Robinson, 1980: 10, 51, 104–109, 192–193, figs. 52–54, ♀♂. Misidentification; not *A. ocyaloides* L. Koch.

Note. The female illustrated came from Madang, the male from Wau, Papua New Guinea.

Diagnosis. Argiope doboensis, like *A. ocyaloides*, is much smaller than most *Argiope* species, only about 7 mm total length. The female is readily recognized by the three pointed extensions on the abdomen, two anteriorly and one blunt one posteriorly (Fig. 133). The abdomen also has white bands on each side of the dorsum; the venter a pair of exclamation marks (Fig. 134). Unlike the Australian *A. ocyaloides*, the septum and posterior plate of the epigynum form an upside-down T in ventral view, and the openings are under a transverse slit on each side (Fig. 130).

The male, only slightly smaller than the female, has similar coloration on the abdomen, and is armed with strong macrosetae on the first and second patella and tibia. The abdomen is shield-shaped with points indistinct. Unlike *A. ocyaloides*, the embolus is evenly tapered to the tip and not coiled; the median apophysis has two prongs with the spur near the tip of the mesal one (Fig. 135).

Natural History. The web, like that of *Herennia*, is found on the trunks of trees, most common on *Araucaria*. Trunk projections support the web. Unlike the web of *Herennia*, it is not curved; at its closest it is 2 to 3 cm from the trunk (M. H. Robinson and Lubin, 1979). Courtship and mating is described in M. H. Robinson and B. Robinson, 1980.

Records. NEW GUINEA: *West Irian* [Djaya Pura]. Maffin Bay, Sept. 1944, ♀ (E. S. Ross, CAS). *Papua New Guinea.* Morobe Distr.: Wau, ♀♂ (MCZ); Bulolo, 18 Aug. 1970, ♀ (M. Gray, AMS).

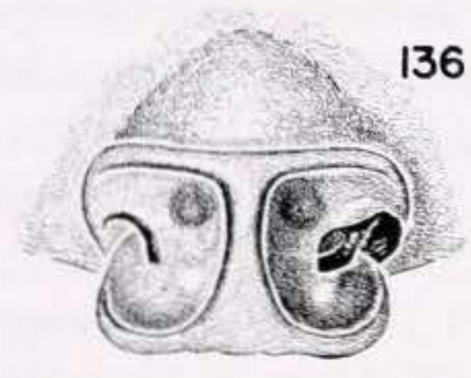
Argiope dietrichae new species

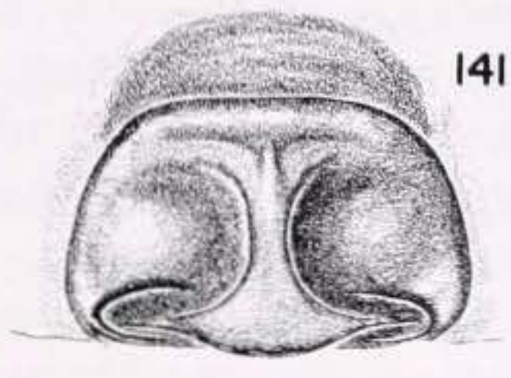
Figures 136–140; Map 4

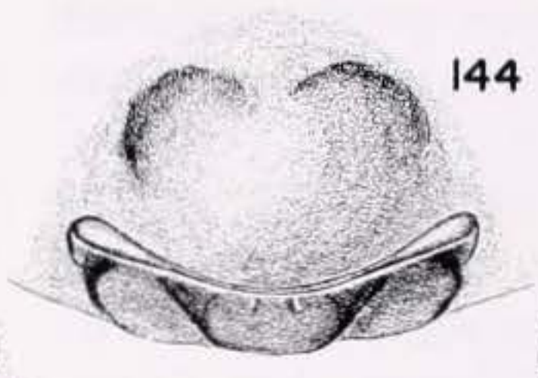
Holotype. Female from Pyramid Pool Cave, Western Australia, 30′ [10 m] above water, 5 June 1970 [22°17′S 118°19′W] in the Western Australian Museum, Perth. The species is named after Amalie Dietrich, 19th century collector of spiders for Godeffroy.

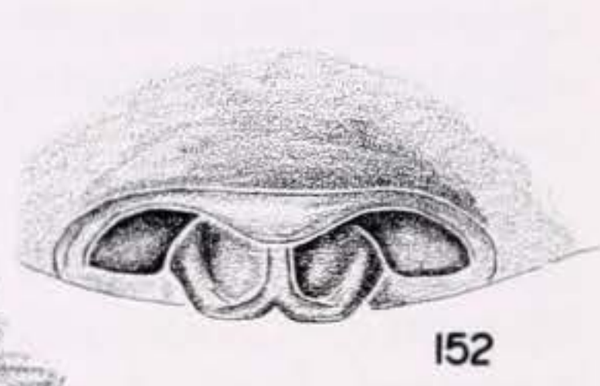
Description. Female paratype from Dales Gorge. Carapace brown streaked with light colored down. Sternum with a median posterior white mark. Legs light brown with darker spots and bands. Dorsum of abdomen with a folium surrounded by light dots. Folium enclosing transverse bands, spotted. Venter with usual *Argiope* pattern. Anterior lateral eyes 0.8 diameter of anterior medians. Posteriors subequal to anterior medians. Anterior median eyes 1.3 diameters apart, 1.5 from laterals. Posterior median eyes 1.5 diameters apart, 2.5 from laterals. Abdomen slightly lobed on sides (Fig. 139). Total length, 13.5 mm. Carapace, 5.3 mm long, 4.5 mm wide. First femur, 9.4 mm; patella and tibia, 10.2 mm; metatarsus, 9.8 mm; tarsus, 2.3 mm. Second patella and tibia, 10.1 mm; third, 5.2 mm; fourth, 8.8 mm.

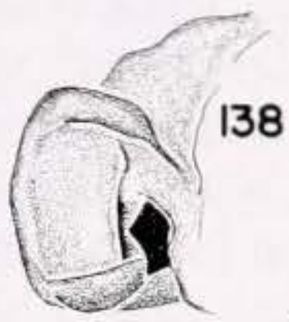
Diagnosis. Argiope dietrichae differs from *A. ocyaloides*, *A. doboensis*, and *A. katherina* by having a narrower rim and septum of the epigynum (Fig. 136), and in having the posterior plate much wider than long in posterior view (Fig. 137). The

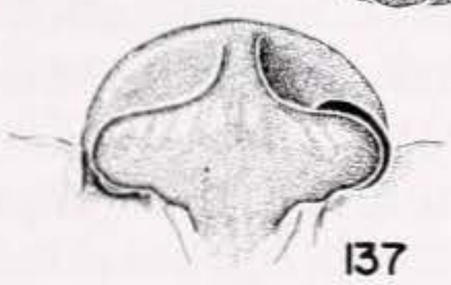


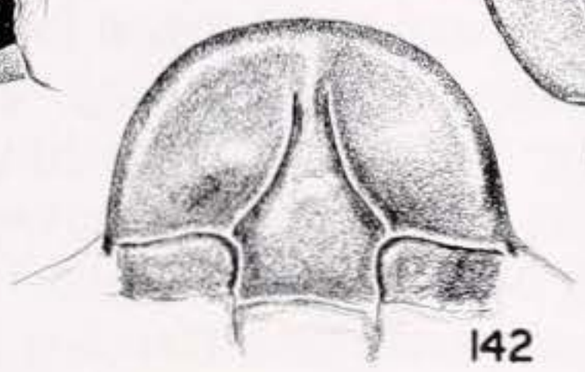


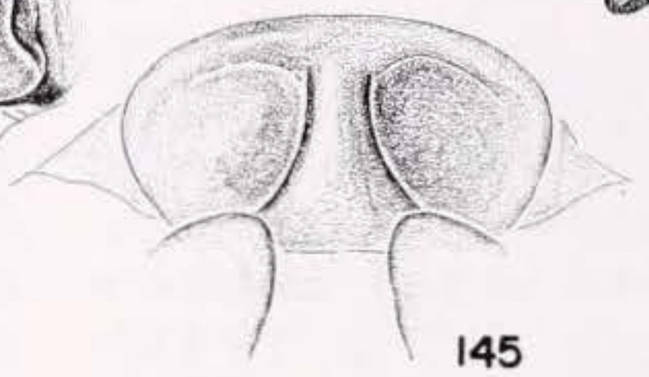


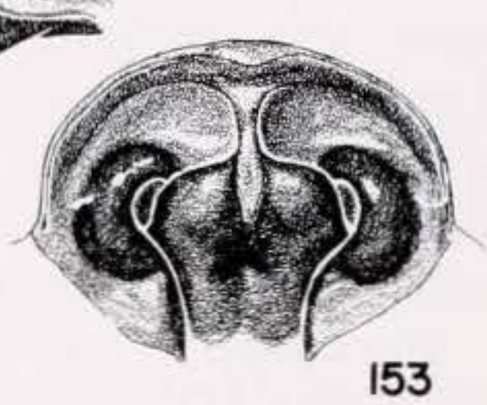


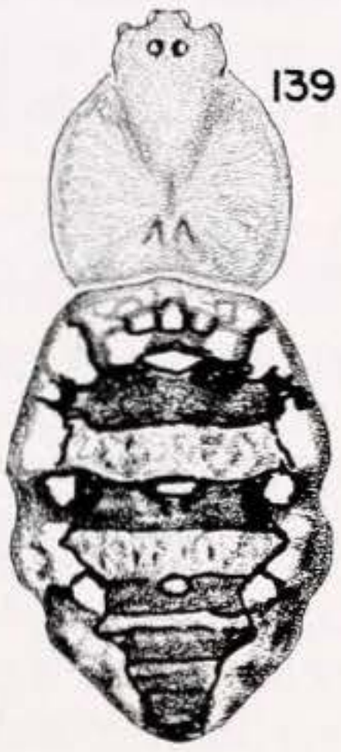


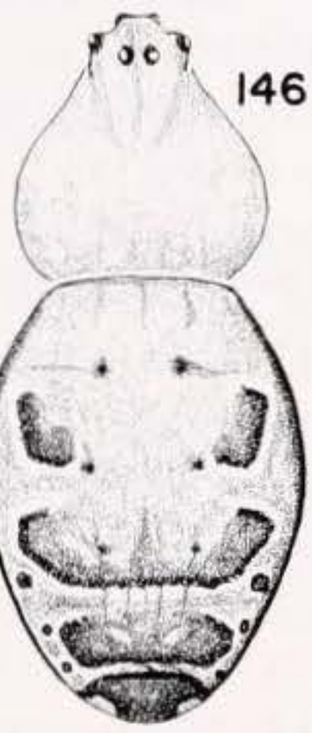


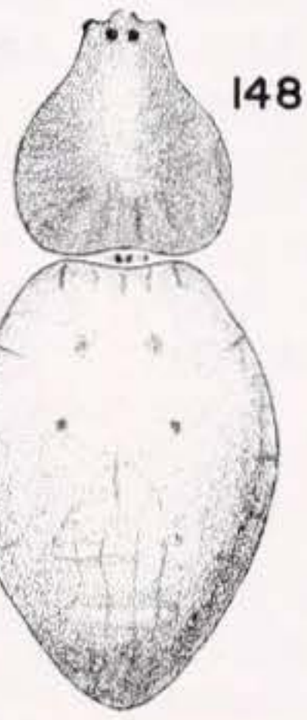


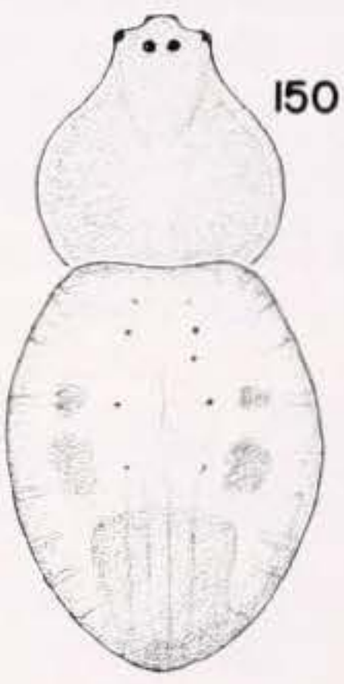


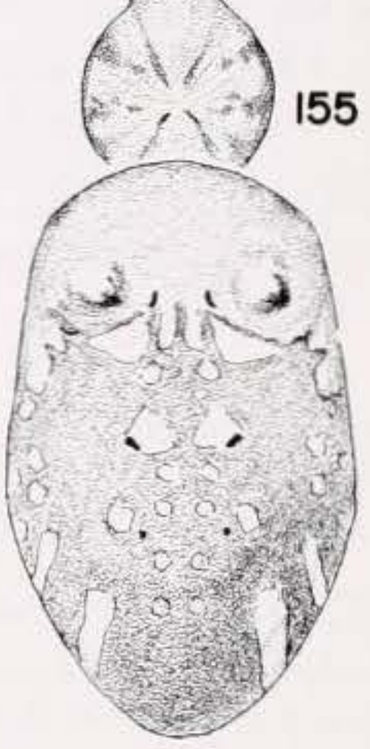


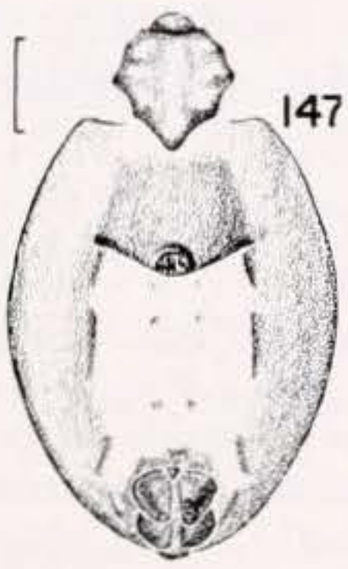


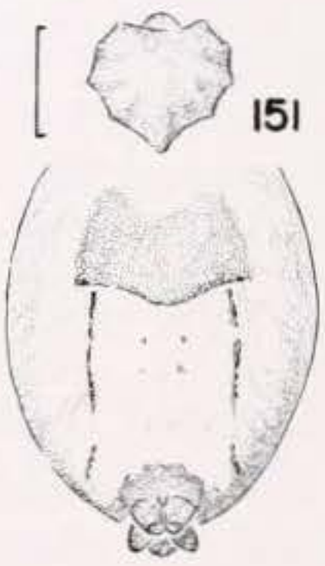


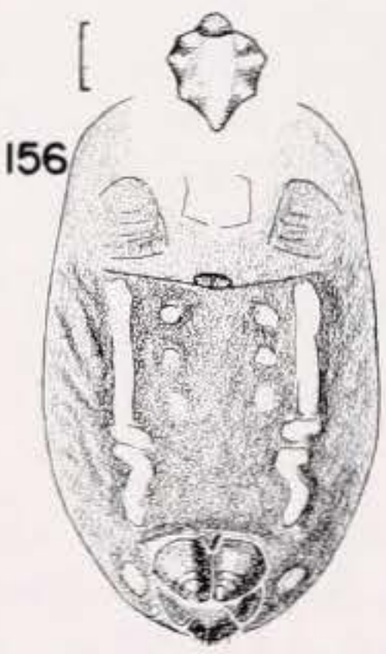












Figures 136–140. *Argiope dietrichae* n. sp., female. 136. Epigynum, ventral. 137. Epigynum, posterior. 138. Epigynum, lateral. 139. Carapace and abdomen. 140. Sternum and abdomen.

Figures 141–151. *Argiope chloreis* Thorell, female. 141. Epigynum, ventral. 142, 145. Epigynum, posterior. 143. Epigynum, lateral. 144. Epigynum, anteroventral. 141–143. (Western New Guinea). 144, 145. (Sumatra). 146, 148, 150. Carapace and abdomen. 147, 149, 151. Sternum and abdomen. 146, 147. (Western New Guinea). 148, 149. (Sumatra). 150, 151. (Celebes).

Figures 152–156. *Argiope thai* n. sp., female. 152. Epigynum, ventral. 153. Epigynum, posterior. 154. Epigynum, lateral. 155. Carapace and abdomen. 156. Sternum and abdomen.

Scale lines. 0.1 mm, except Figures 139, 140, 146–151, 155, 156, 1.0 mm.

abdomen lacks an anterior projection and a posterior extension behind the spinnerets (Fig. 139).

Variation. The septum of the epigynum of one specimen from Wotjulum Mission is considerably wider than that illustrated from Dales Gorge. Specimen from Tanami Bone Hole, N.T. has the abdomen entire and the openings in ventral view are circles. Four specimens from Kimberley Distr. differ by having the posterior plate of the epigynum triangular and the lips of the openings circular. The abdomen is less lobed.

Paratypes. AUSTRALIA: *Western Australia.* Dales Gorge, 625 m, 10 Oct. 1962, ♀, juv. (E. S. Ross and D. Q. Cavagnaro, CAS); Wotjulum Mission via Derby, Oct. 1955, 2♀ (A. Douglas, WAM); 4♀ (WAM). *Northern Territory.* Tanami Govt. Borehole, July 1971, ♀ doubtful determ. (J. Hodgson, CSIRO).

Argiope chloreis Thorell

Figures 141–151; Map 4

Argiope chloreis Thorell, 1877: 368. Juvenile female holotype from Kendari, Celebes in the Museo Civico di Storia Naturale, Genova, examined. Roewer, 1942: 738. Bonnet, 1955: 684.

Argiope pumila Thorell, 1890: 99. Female syntype from Sungeibulu, Sumatra in the Museo Civico di Storia Naturale, Genova, examined. Roewer, 1942: 738. Bonnet, 1955: 693. NEW SYNONYMY.

Argiope chloreides Chrysanthus, 1961: 197, figs. 5–8, ♀. Female holotype from Mindiptana, West New Guinea in the Rijksmuseum van Natuurlijke Historie, Leiden, examined. NEW SYNONYMY.

Notes. The penultimate female of *A. chloreis* (Figs. 150, 151) probably belongs to the same species as *A. pumila* (Figs. 148, 149). They have similar white venter of the abdomen. The dorsal markings of *A. pumila* have disappeared (Fig. 148). The sternum of *A. chloreis* is noticeably larger (Fig. 151) than that of *A. pumila* (Fig. 149); that of the type specimen of *A. chloreides* is intermediate in size (Fig. 147). Figures 141–143, 146, 147 were prepared from the holotype of *A. chloreides*, the best preserved of these specimens. Chrysanthus indicated that *A. chloreides* differed by lacking macrosetae on the ventral side of the tibia I and II. But examination of the holotype showed that they had broken off.

Diagnosis. Argiope chloreis has very distinct coloration: the dorsum of the abdomen has light bordered dark patches (Fig. 146); the venter a median rectangular white area, bordered on each side by a narrow, broken longitudinal dark line (Figs. 147, 149, 151). The abdomen lacks the anterior projection of *A. doboensis.* Circling the abdomen on the sides is a distinct line bordering a much lighter area on the dorsum, and a much darker area ventrally than on the dorsum. The epigynum is small and relatively flat (Figs. 141–145).

Distribution. Sumatra, Moluccas to New Guinea (Map 4).

Records. INDONESIA: *Moluccas.* Morotai Isl., Jan.–April 1945, ♀ (G. Banner, AMNH). *Sumatra.* Perdagangan [?], ♀ (E. Mjöberg, NRS). PAPUA NEW GUINEA: *East Sepik Distr.* Töpferfluss [Keram River], 21 April 1913, ♀ (Bürgers, ZMB). *Milne Bay Distr.* Modewa Bay, 32–40 km W of Samarai, 1956, ♀ (Archbold Exped., AMNH). *Madang Distr.* Finisterre Mts., Naho River Valley, Damanti, 1100 m, 2–7 Oct. 1964, imm. doubtful determ. (M. E. Bacchus, BMNH).

Argiope thai new species

Figures 152–156; Map 4

Holotype. Female in poor condition from Preuw, Chantaburi [Chathaburi], Thailand, 4 Jan. 1958 (N. Meinkoth) in the Museum of Comparative Zoology. The specific name is a noun in apposition, derived from the country of the type locality.

Description. Carapace light brown with dark brown irregular patches, covered with white setae. Sternum with median longitudinal white pigment band, dark on sides. Legs light brown with dark brown speckles. Dorsum of abdomen with indistinct white patches. Venter dark brown with two longitudinal lines and white

spots. Anterior lateral eyes 0.6 diameter of anterior medians; posterior median eyes 1.4 diameters; posterior laterals 1.2 diameters. Anterior median eyes their diameter apart, 1.5 from laterals. Posterior median eyes 1.2 diameters apart, 2 from laterals. Total length, 13.0 mm. Carapace, 3.7 mm long, 3.2 mm wide. First femur, 5.0 mm; patella and tibia, 5.2 mm; metatarsus, 5.0 mm; tarsus, 1.7 mm. Second patella and tibia, 6.3 mm.

Diagnosis. This species differs from other *Argiope* by having the second leg considerably longer than the first. The epigynum differs from all other *Argiope* by having the flange of the rim forming a lobe on each side of the depression (Fig. 152). The wide posterior plate fills the depression, and is hollowed out on each side of the septum (Fig. 153).

Argiope possoica Merian, new status

Figures 157–161; Map 4

Argiope celebesiana possoica Merian, 1911: 205. Female holotype from Posso Sea [Teluk Poso Bay], Celebes in the Naturhistorisches Museum, Basel, examined. Roewer, 1942: 738. Bonnet, 1955: 684.

Note. This species was described as a subspecies of *A. reinwardti.*

Diagnosis. Argiope possoica superficially resembles *A. modesta* in abdominal markings (Figs. 160, 161). The thick rim of the epigynum (Fig. 157) distinguishes *A. possoica* from *A. minuta. Argiope possoica* has "bottle brushes" on the ends of the tibiae, especially on the fourth legs.

Argiope perforata Schenkel

Figures 162–166; Map 4

Argiope perforata Schenkel, 1963: 135, fig. 79, ♀. Female holotype from Lunan fu city [Lung-ngan fu], Szetchuan, China in the Muséum National d'Histoire Naturelle, Paris, examined.

Note. The holotype is in poor condition. The illustrations were made from a specimen from Kwantung Province.

Diagnosis. The color pattern of the abdomen (Fig. 165) and the narrower septum in the epigynum (Fig. 162) separate *Argiope perforata* from *A. anasuja.*

Record. CHINA: *Kwantung Prov.* Kwantung City, Paiyunshan, 25 Aug. 1978, ♀ (T. Terada, ASEA).

Argiope anasuja Thorell

Figures 167–172, Map 4

Argiope ornata:—Simon, 1885: 34. Misidentification; not *A. ornata* Blackwall [=*Nephila antipodiana* (Walckenaer)].

Argiope anasuja Thorell, 1887: 162. New name for *A. ornata*:—Simon. One female lectotype, one female and one male paralectotype, and juveniles, all in poor physical condition, from Kulachee, British India [Kulachi, Pakistan] in the Muséum National d'Histoire Naturelle, Paris, here designated. Gravely, 1921: 412, fig. 3a, ♀. Roewer, 1942: 737. Bonnet, 1955: 672.

Argiope plagiata Karsch, 1891: 279, pl. 10, fig. 5, ♀. Three female syntypes from Minicoy Islands, Indian Ocean in the Zoologisches Museum, Humboldt Universität, Berlin, examined. NEW SYNONYMY.

Note. The illustrations were made from a specimen from Karnatake, India.

Diagnosis. The genitalia of this small species resemble those of *A. minuta, A. doboensis,* and *A. perforata.* The species, however, is larger than these three. The female has a pair of anterolateral tubercles and transverse bands on the dorsum of the abdomen (Fig. 170). The rims of the epigynum have a flange with a lateral tooth providing an anterior lip to the openings (Fig. 167); the openings are posterior, within the posteriorly extended septum (Figs. 167, 168).

The male has the embolus strongly curved distally, and longer than that of *A. minuta* and *A. doboensis.* The median apophysis has the filamentous spur attached near the middle (Fig. 172).

Distribution. Pakistan, India, Sri Lanka Maldives and Cocos-Keeling Islands (Map 4).

Records. INDIA: *West Bengal.* Tarkhola, Kalimpong Distr., 325 m, Aug. 1958, juv., ♀ (M. L. Bristol, MCZ); Kanchrafara [Kanchrapara ?], July 1944, ♀♀ (M. Cazier,

AMNH). *Karnatake*. Bangalore, 300 m, Nov. 1979, ♀, ♂ (W. Eberhard, MCZ); Dandeli, 530 m, Nov. 1979, ♀ (W. Eberhard, MCZ). *Tamil Nadu*. 5 km W Rajapalayam, Ayyanar Falls, 350 m, Nov. 1979, ♀, ♂ (W. Eberhard, MCZ). *Madras*. Madras, 27 Dec. 1969, ♀ (M. Gray, AMS); Sept. 1948, ♀ (N. Haarler, ZMK); Vellore, ♀, ♂ (M. Löwenthal, ZMK); Mandapam Camp, 3 Oct. 1951 (H. Lemche, ZMK). *Maharashtra*. Bombay, ♀♀ (HCO). SRI LANKA: "Ceylon," ♀ (Reimoser, NMW); ♀ (Bedemann, NMW); Colombo, 23 Jan. 1927, ♀ (J. G. Myers, MCZ); Yala, Oct. 1979, ♂ (W. C. Sedgwick, SC); Kagalu Beach Hotel, Galle, Oct. 1979, ♀ (W. C. Sedgwick, SC). INDIAN OCEAN: *Cocos-Keeling Islands*. West Isl., 11 Nov. 1964, ♀; June 1952, ♀; scrub near Tanjong Klirkil, May 1952, 2♀, ♂; south end West Isl., 12 Nov. 1964, 2♀ (all T. G. Campbell, CSIRO). MALDIVES: *Ari Atoll*. Insel Fusdu, 18 April 1958, ♀ (Klausewitz, SMF). *Addu Atoll*. 23 Jan. 1958, ♀ (SMF); Wadewaru Isl., 7 April 1958, ♀ (S. Gerlach, SMF). *Maté Atoll*. 3♀ (SMF). *Rastú Atoll*. Insel Weligandu, 8 March 1958, ♀♀♂ (Klausewitz, SMF).

Argiope halmaherensis Strand

Figures 173–177; Map 4

Argiope halmaherensis Strand, 1907b: 65, pl. 171, fig. 4, ♀. Female holotype from Halmahera Isl., Moluccas, in the Staatliches Museum für Naturkunde, Stuttgart, destroyed in the last war. No specimens in Görlitz. Roewer, 1942: 738. Bonnet, 1955: 686.

Argiope mindiptanensis Chrysanthus, 1961: 195, figs. 1–4, ♀. Female holotype from Mindiptana, West Irian [New Guinea] in the Rijksmuseum van Natuurlijke Historie, Leiden, examined. NEW SYNONYMY.

Note. Strand provided three primitive sketches of the epigynum which show the unusual proportions. Strand's specimen had three equally wide yellow-white transverse bands on the abdomen dorsum, separated by thin lines, and was dark brown posteriorly. While Strand's description fits, I believe his figure 4a to be on its side, figure 4b to be the epigynum from posterior view, 4c the epigynum from ventral view with the posterior part of the epigynum hidden by the abdomen. The illustrations (Figs. 173–177) were made from the holotype of *A. mindiptanensis*.

Diagnosis. The female of this small sized *Argiope* can be separated from others by the three pairs of dorsal white patches on the abdomen (Fig. 176), and by the epigynum. The epigynum is trapezoidal, longer than wide, widest anteriorly (Fig. 173). Like *A. anasuja*, the posterior plate forms a bowl, and the rim has a flange.

Variation. The only other specimen in collections from the Sepic River had the epigynum more square.

Records. PAPUA NEW GUINEA: Kaiserin Augustafluss Exped. [Sepic River], July 1912, ♀ (Bürger, ZMB).

Argiope niasensis Strand

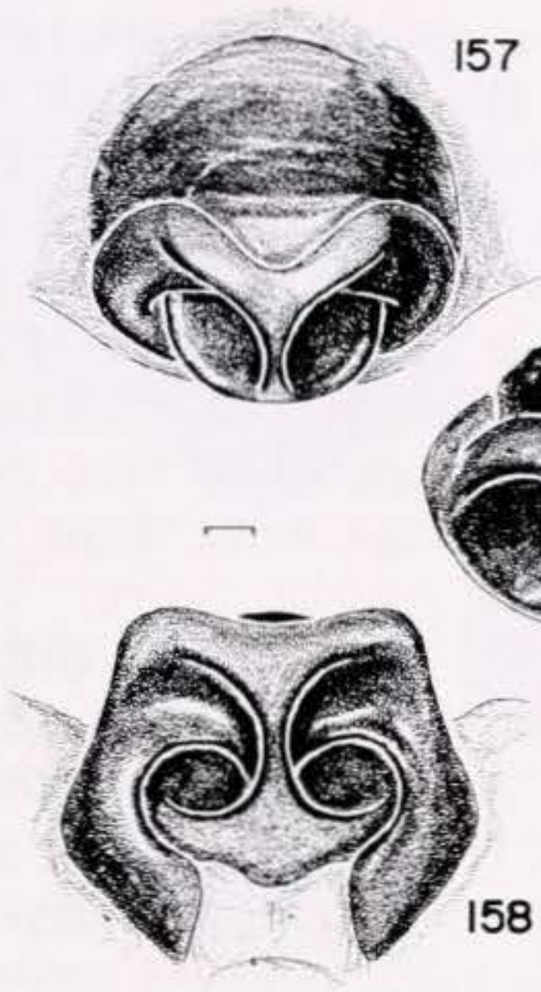
Figures 178–182; Map 4

Gea spinipes:—Simon, 1905: 62. Misidentification; not *G. spinipes* (L. Koch).

Argiope niasensis Strand, 1907b: 56, figs. 1–3, ♀. Female holotype from Joenoeng-Sitoli, Nias Island (west of Sumatra) in the Staatliches Museum für Naturkunde, Stuttgart, destroyed during the last war. No specimens in Görlitz Museum. Female neotype here designated from Bogor in the Museum of Comparative Zoology, Harvard University.

Note. The small sketch of the epigynum provided by Strand is diagnostic. Strand's size fits. However, Strand's specimen had three transverse white bands on the abdomen like *A. reinwardti* (Strand, 1907: fig. 3). The neotype from Bogor was illustrated.

Diagnosis. The abdomen of the female is pentagonal, widest posteriorly with small anterior humps (Fig. 181). The dorsal abdominal markings have unfortunately washed out. The epigynum, unlike others, has a large septum, trapezoidal in ventral view, widest posteriorly (Fig. 178). The rim borders a short, wide bulge. Posteriorly the septum continues into the pos-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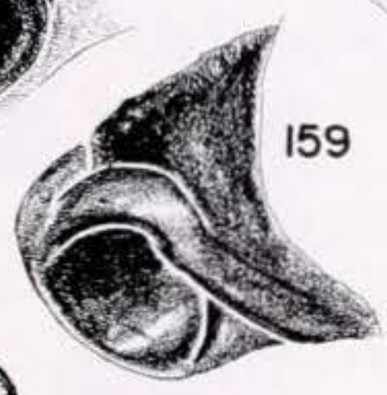
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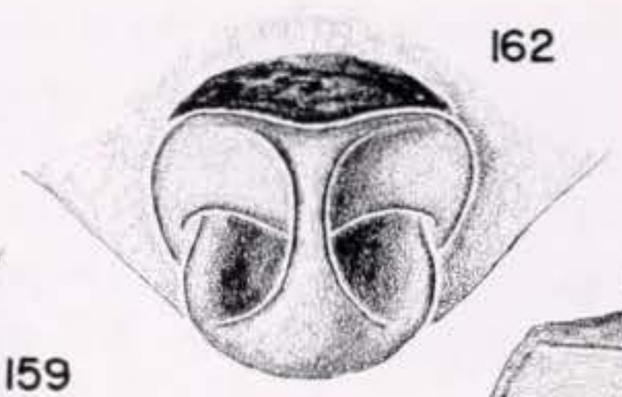
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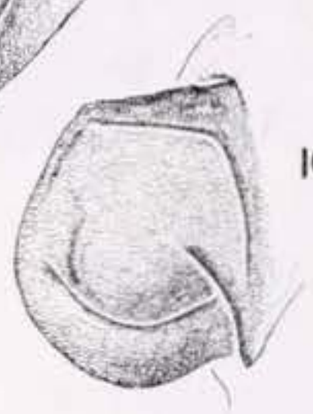
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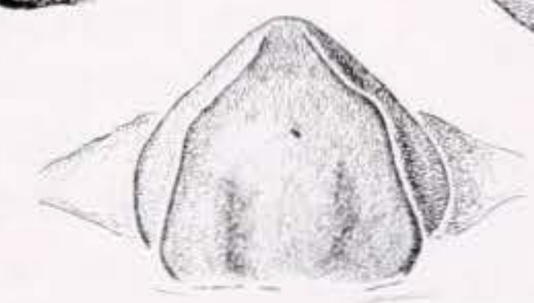
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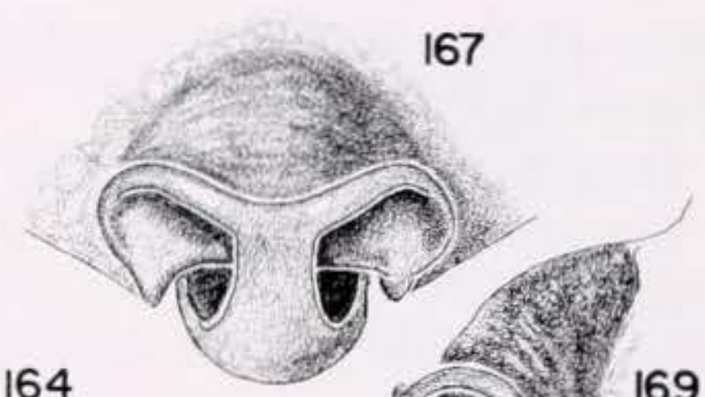
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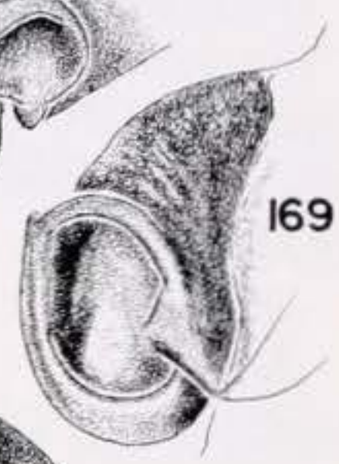
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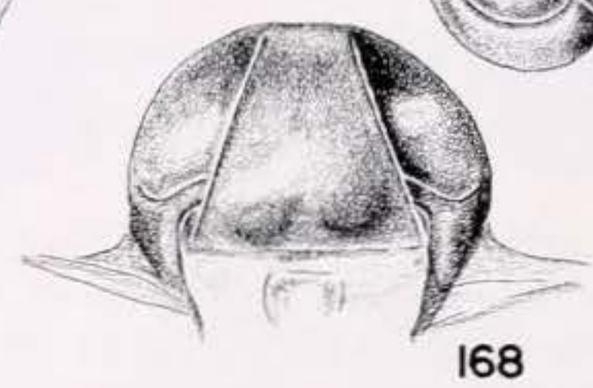
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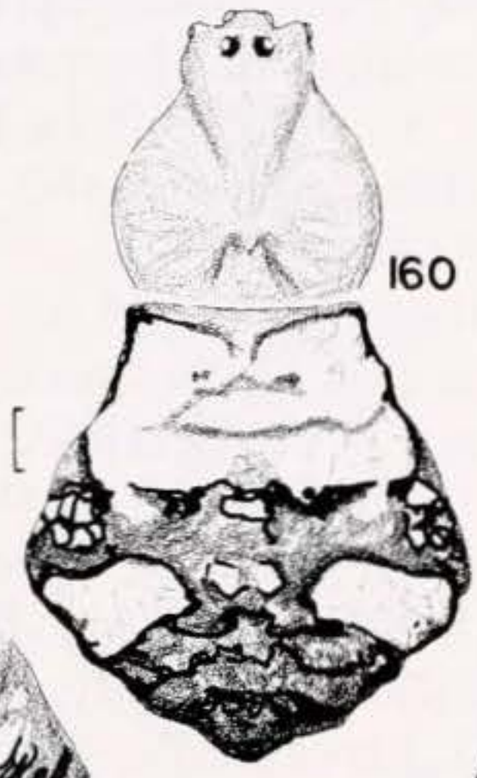
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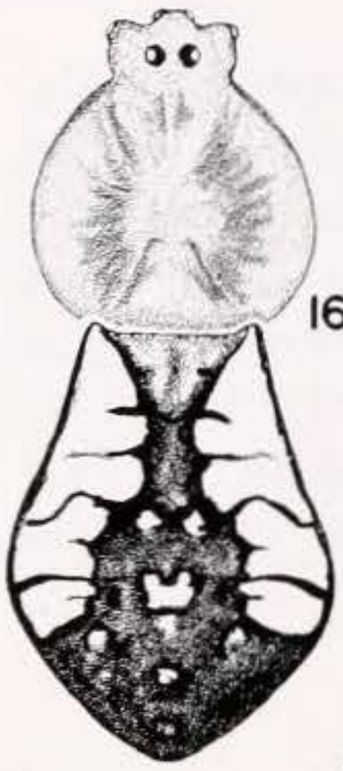
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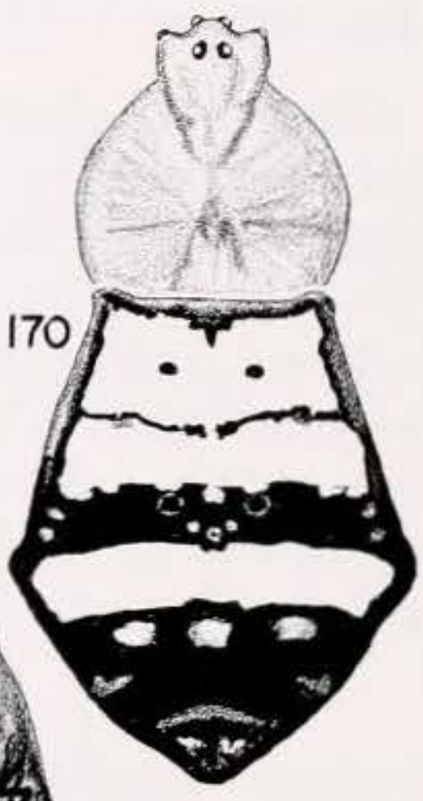
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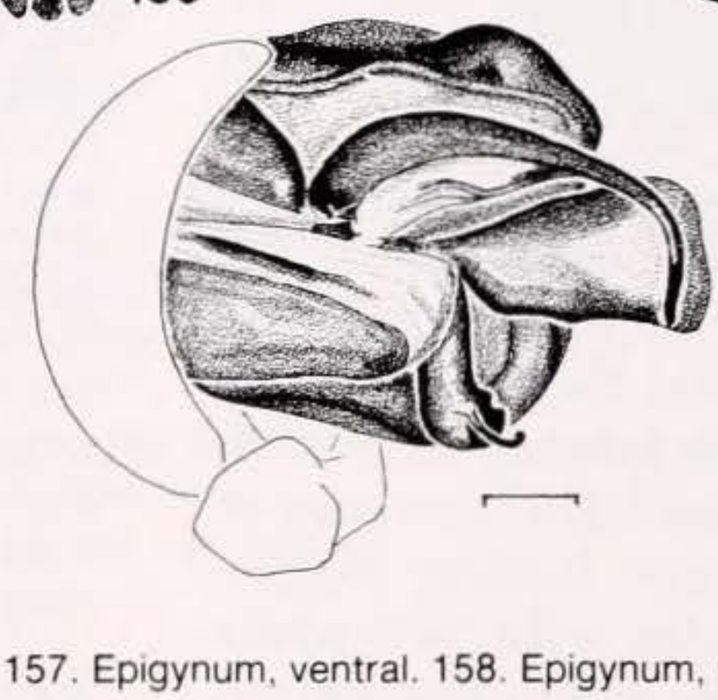
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Figures 157–161. *Argiope possoica* Merian, female. 157. Epigynum, ventral. 158. Epigynum, posterior. 159. Epigynum, lateral. 160. Carapace and abdomen. 161. Sternum and abdomen.

Figures 162–166. *Argiope perforata* Schenkel, female. 162. Epigynum, ventral. 163. Epigynum, posterior. 164. Epigynum, lateral. 165. Carapace and abdomen. 166. Sternum and abdomen.

Figures 167–172. *Argiope anasuja* Thorell. 167–171. Female. 167. Epigynum, ventral. 168. Epigynum, posterior. 169. Epigynum, lateral. 170. Carapace and abdomen. 171. Sternum and abdomen. 172. Left male palpus, mesal.

Scale lines. 0.1 mm, except Figures 160, 161, 165, 166, 170, 171, 1.0 mm.

terior plate which has nearly parallel sides (Fig. 179).

Distribution. Sumatra, Java (Map 4).

Records. INDONESIA: *Java*. Buitenzorg [Bogor], 1904, ♀ (H. Jenson, ZMK); ♀ (MCZ); Tjibodas [Cibodas], 25–28 March 1904, ♀ (K. Kraepelin, ZMK).

Argiope takum Chrysanthus

Figures 183–187; Map 4

Argiope takum Chrysanthus, 1971: 17, figs. 23–25, ♀. Female holotype from Kamp Wifob, Takum, West New Guinea [Djaya Pura], 10 Aug. 1959 (Star Mts. Expedition) in the Rijksmuseum van Natuurlijke Historie, Leiden, examined.

Diagnosis. *Argiope takum* differs from other *Argiope* species by the shape of the epigynum and the shape of the abdomen. The septum of the epigynum hangs and widens posteriorly into a bowl-shaped posterior plate (Figs. 183–185); the dorsum of the abdomen has indistinct paired patches (Fig. 186), the venter two white exclamation marks (Fig. 187).

Argiope mascordi new species

Figures 188–192; Map 4

Holotype. Female from Mt. Garnet, Queensland, 25 Feb. 1972 (N. C. Coleman), #KS 101 in the Australian Museum, Sydney. This species is named after Ramon Mascord, collector and author of books on Australian spiders.

Description. Carapace yellow-brown with dark brown marks and covered by white down. Sternum very dark on sides, a light longitudinal band through middle (Fig. 192). Legs contrastingly banded, darker bands wider than light. Dorsum of abdomen with a folium having jagged outline (Fig. 191). Venter with two white lines, black in between, enclosing paired white spots (Fig. 192). Anterior lateral eyes 0.5 diameter from anterior medians. Posterior median eyes 1.1 diameters; posterior laterals subequal to anterior median eyes. Anterior median eyes their diameter apart, 1.2 from laterals. Posterior median eyes their diameter apart, 2.0 from laterals. The height of the clypeus equals the diameter of the anterior median eyes. The abdomen is oval with indistinct dorsal anterior humps. Total length, 9.5 mm. Carapace, 3.7 mm long, 3.2 mm wide. First femur, 5.2 mm; patella and tibia, 5.8 mm; metatarsus, 5.3 mm; tarsus, 1.5 mm. Second patella and tibia, 5.6 mm; third, 3.2 mm; fourth, 5.1 mm.

Diagnosis. *Argiope mascordi* differs from *A. keyserlingi*, *A. caledonia*, and *A. kochi* by the oval shape of the abdomen, by having a dorsal folium (Fig. 191), and by being smaller in size. The epigynum in posterior view is more pointed ventrally (Fig. 189) than the squarish epigynum of *A. keyserlingi* or the round one of *A. caledonia*. *A. mascordi* lacks the lateral lobes on either side of the epigynum as found in *A. keyserlingi*.

The palpus illustrated by Fig. 193 may be of the male of this species or *A. kochi*.

Paratypes. AUSTRALIA: *Queensland*. Almaden, March 1929, ♀ (W. D. Campbell, AMS); Chillagoe Caves area, 18 July 1978, ♀ (R. Mascord, AMS); 21 km E Croydon, 150 m, 4 Nov. 1962, ♀ (E. S. Ross, D. Q. Cavagnaro, CAS).

Argiope keyserlingi Karsch

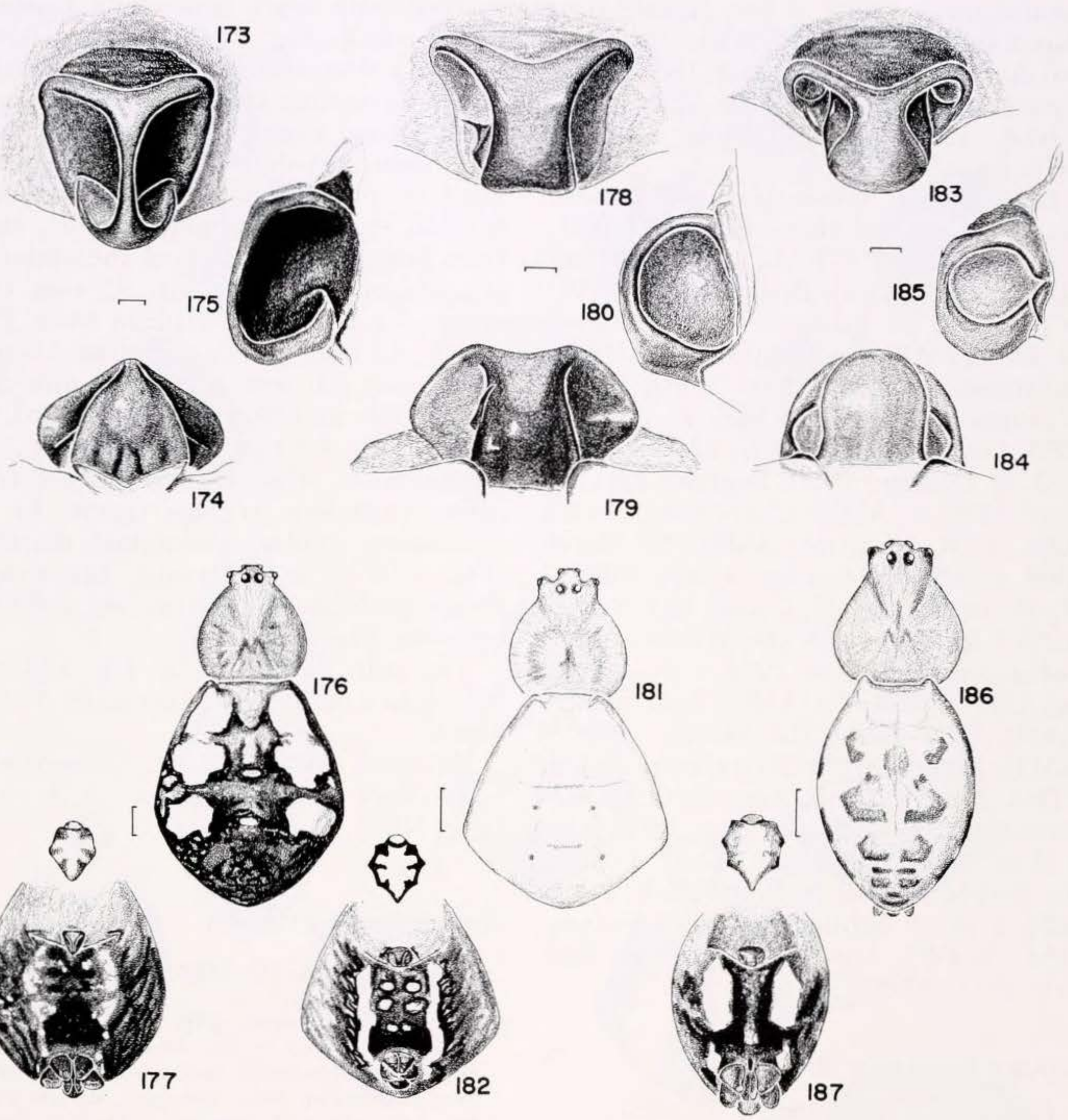
Figures 194–199; Map 4

Argiope aetherea:—Keyserling, 1865: 803, pl. 19, figs. 1, 2, ♀. Female specimen from Woollongong [New South Wales], lost. Misidentification; not *A. aetherea* (Walckenaer).

Argiope keyserlingi Karsch, 1878: 789. New name for *A. aetherea*:—Keyserling, 1865, misidentification.

Neotype. Female from Canterbury near Sydney, New South Wales, labeled "*Argiope aetherea*, K57683, 1 April 1928" by Rainbow, in the Australian Museum, Sydney.

Diagnosis. The female differs from other species, particularly *Argiope aetherea*, by the epigynum having a flat flange on the rim, with a lobe on each side posteriorly (in ventral view) (Fig. 194). In posterior view the epigynum shows the wide, flat flange and a nearly circular opening



Figures 173–177. *Argiope halmaherensis* Strand, female. 173. Epigynum, ventral. 174. Epigynum, posterior. 175. Epigynum, lateral. 176. Carapace and abdomen. 177. Sternum and abdomen.

Figures 178–182. *Argiope niasensis* Strand, female. 178. Epigynum, ventral. 179. Epigynum, posterior. 180. Epigynum, lateral. 181. Carapace and abdomen. 182. Sternum and abdomen.

Figures 183–187. *Argiope takum* Chrysanthus, female. 183. Epigynum, ventral. 184. Epigynum, posterior. 185. Epigynum, lateral. 186. Carapace and abdomen. 187. Sternum and abdomen.

Scale lines. 0.1 mm, except Figures 176, 177, 181, 182, 186, 187, 1.0 mm.

quite far dorsally (Fig. 195). The abdomen is more rounded than the pentagonal one of *A. aetherea* (Figs. 197, 198).

The male differs from *A. aetherea* by the much smaller embolus: the base of the embolus has a prong with parallel sides; the tip has a neck and a distal expansion. The median apophysis has the spur originating from near its bend (Fig. 199).

Variation. Females vary 9 to 16 mm total length.

Natural History. The only record with

natural history data is one female from Careel Bay, New South Wales, from a salt marsh. Most illustrations of the St. Andrew's spider seem to be this species (Clyne, 1969: figs. 153–159; Mascord, 1970: fig. 132).

Distribution. Queensland, New South Wales coast, Lord Howe Island (Map 4).

Paratypes. AUSTRALIA: *Queensland.* Atherton, 3♀ (NRS); Brisbane, ♀ (NMW), ♀♀ (HCO); East Brisbane, 1 June 1911, ♀ (H. Buch, ZMK); Rockhampton, ♀♀ (HCO); Molangool, ♀ (AMS). *New South Wales.* Wyangarie, ♀♂ (AMS); Mascot, 24 Nov. 1966, ♂ (AMS); North Ryde, 22 Nov. 1966, ♂ (D. A. Doolan, AMS); Regent's Park, 26 April 1978, ♀ (AMS); Currawong, 2 Oct. 1966, ♀ (R. Mascord, AMS); 12 March 1966, ♀ (AMS); Roseville, 3 Nov. 1929, ♀ (F. W. Rodda, AMS); Careel Bay, 4 Dec. 1972, ♀ in salt marsh (D. Wilson, AMS); Darlinghurst, 19 Dec. 1973, ♀ (R. Banuelos, AMS); Sydney, ♀ (AMS); Tamworth, ♀ (AMS); The Basin, 12 March 1966, ♀ (AMS); Elanora, near Narrabeen, 100 m, 3 Dec. 1962, ♀♂ (E. S. Ross, D. G. Cavagnaro, CAS); Sylvania, 20 Dec. 1962, ♀ (E. S. Ross, D. G. Cavagnaro, CAS); S of Aroca Beach, Bouddi National Park, 9 Jan. 1978, ♀ (E. I. Schlinger, EMB); Sydney, 1884 (NMW). *Lord Howe Island.* ♀♀♂♂, Feb. 1971 (AMS).

Argiope kochi new species

Figures 200–204; Map 4

Argiope aemula:—Mascord, 1980, pl. 24, fig. 2 (photograph). Misidentification; not *A. aemula* (Walckenaer).

Holotype. Female from Edmonton, northern Queensland, 13 June 1969 (N. C. Coleman), KS 6193 in the Australian Museum, Sydney. The species is named after Ludwig Koch, who described many *Gea* and *Argiope* species from Australia 100 years ago.

Description. Carapace beige, covered by white down. Sternum with sides dark, median area light (Fig. 204). Legs brown, not banded; some darker patches on underside. Dorsum of abdomen white with thin black transverse lines; posterior black, reticulated (Fig. 203). Venter strikingly marked with black and white bands of equal width (Fig. 204). Anterior lateral eyes 0.5 diameter of anterior medians. Posterior median eyes 1.2 diameters, posterior lateral eyes 1.2 diameters of anterior medians. Anterior median eyes 1.2 diameters apart, two from laterals. Posterior median eyes 1.5 diameters apart, three from laterals. The shape of the abdomen is pentagonal. Total length, 8.2 mm. Carapace, 3.7 mm long, 3.3 mm wide. First femur, 5.2 mm; patella and tibia, 5.6 mm; metatarsus, 5.0 mm; tarsus, 1.4 mm. Second patella and tibia, 5.4 mm; third, 3.0 mm; fourth, 4.6 mm.

Diagnosis. This species differs from other Australian *Argiope* species by the contrasting ventral abdominal markings (Fig. 204). The epigynum has a wide flange posterior to the rim and a slit-like opening (Figs. 200, 201).

The palp illustrated by Fig. 193 may belong to a male of this species or *A. mascordi.*

Records. AUSTRALIA: *Queensland.* Cape York Peninsula, Sept., ♀ (E. Mjöberg, NRS).

Argiope minuta Karsch

Figures 205–210; Map 4

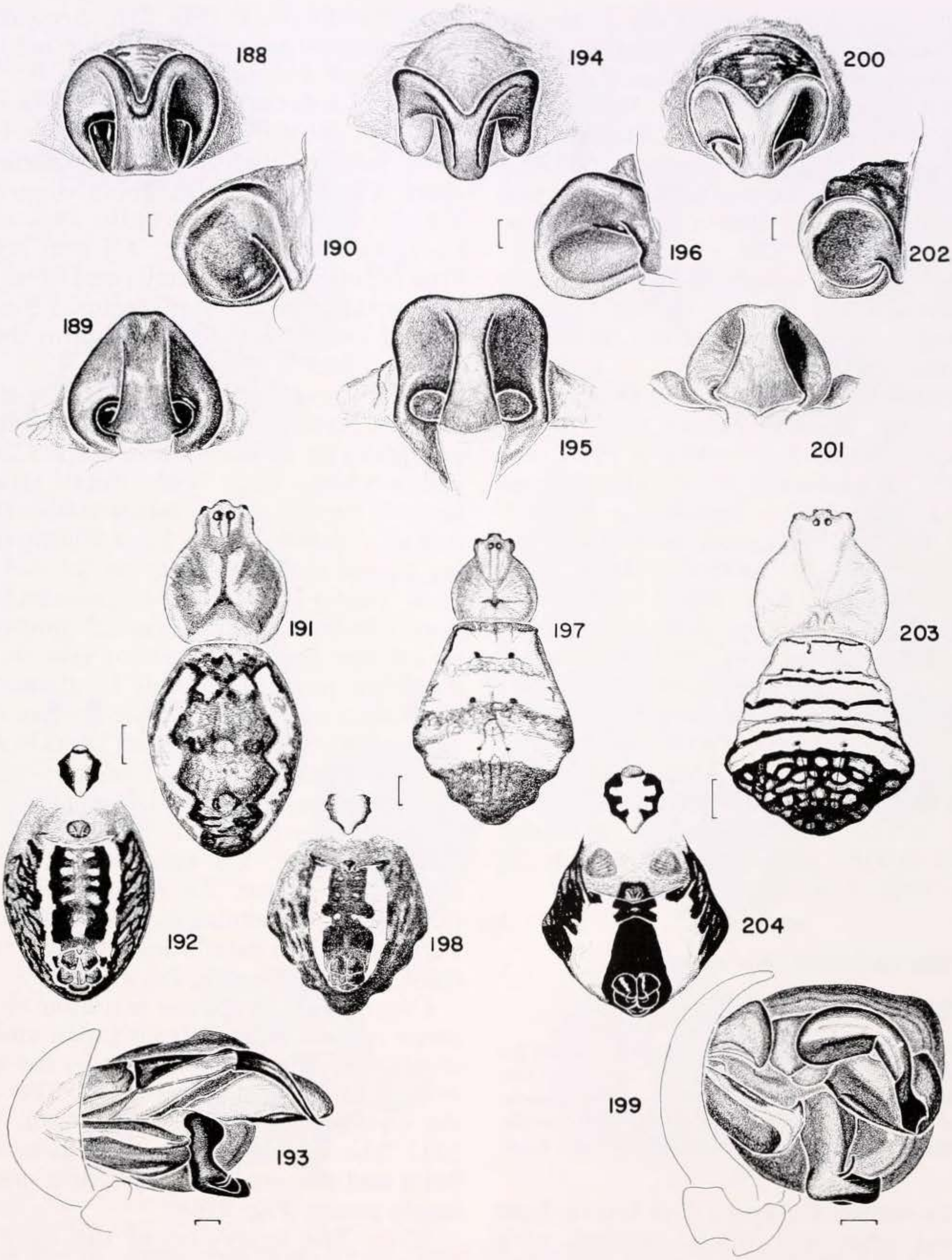
Argiope minuta Karsch, 1879: 67. Juvenile specimens from Japan in the Zoologisches Museum, Humboldt Universität, Berlin, examined. Bösenberg and Strand, 1906: 194, pl. 1, fig. 16, pl. 11, figs. 218, 222, ♀, ♂. Roewer, 1942: 736. Bonnet, 1955: 69. Yaginuma, 1960: 145, pl. 25, fig. 145, ♀. Song, 1980: 99, fig. 45, ♀.

Coganargiope (Micrargiope) minuta:—Kishida, 1936: 19.

? *Argiope shillongensis* Sinha, 1951: 75, fig. 1, ♀. Female holotype from Shillong, Assam, India in the Zoological Survey of India collection, unavailable. DOUBTFUL NEW SYNONYMY.

Note. The illustrations were made from specimens from Checkiang Prov., China. The illustration of Sinha's *A. shillongensis* appears to be that of *A. minuta.* If it is, it would extend the range of the species to Assam.

Diagnosis. The female of this small species has two transverse, wide dark



Figures 188–192. *Argiope mascordi* n. sp., female. 188. Epigynum, ventral. 189. Epigynum, posterior. 190. Epigynum, lateral. 191. Carapace and abdomen. 192. Sternum and abdomen.

Figure 193. *Argiope mascordi* n. sp. or *A. kochi* n. sp., left male palpus, mesal.

Figures 194–199. *Argiope keyserlingi* Karsch. 194–198. Female. 194. Epigynum, ventral. 195. Epigynum, posterior. 196. Epigynum, lateral. 197. Carapace and abdomen. 198. Sternum and abdomen. 199. Left male palpus, mesal.

Figures 200–204. *Argiope kochi* n. sp., female. 200. Epigynum, ventral. 201. Epigynum, posterior. 202. Epigynum, lateral. 203. Carapace and abdomen. 204. Sternum and abdomen.

Scale lines. 0.1 mm, except Figures 191, 192, 197, 198, 203, 204, 1.0 mm.

bands across the dorsum of the abdomen, each enclosing some white spots (Fig. 208). Anteriorly the abdomen has small anterior lateral humps. The rim of the anterior bulge of the epigynum has a flange which encloses the openings (Figs. 205, 206). Unlike *A. anasuja*, the septum is narrow and widens posteriorly into a transverse posterior plate (Fig. 206).

The median apophysis has its inside branch hanging "down"; the conductor is partially wrapped around the tip of the embolus (Fig. 210).

Distribution. Japan, China (Map 4).

Records. JAPAN: *Hyogo Pref*. Siyodenyama, Setsu, Sept. 1895, ♀ (T. Lenz, ZMH). *Wakayama Pref*., Hatakejima [Hatake-Yama Mt.], Shirahama, 31 Oct. 1973, ♀ (W. C. Sedgwick, SC); *Mie Pref*., 23 Oct. 1951, ♀♀ (AMNH). *Osaka Pref*. Osaka, Tennoji, Aug. 1895, ♀ (T. Lenz, ZMH); Osaka, 18 Aug. 1956, ♂ (T. Yaginuam, MCZ). *Nara Pref*. Yoshino, 29 Aug. 1976, ♀ (T. Yaginuma, MCZ). SOUTH KOREA: Mt. Chiri [Chi-San], 8 Aug. 1959, ♀ (K. Paik, AMNH). TAIWAN: Tai Pei, Aug. 1957, ♀ (Wang, AMNH). CHINA: Chekiang Prov., Mokanshan [Mo-Kan Shan Mt.], N Gist Gee of Soochow, ♀♂ (Song, 1980) (MCZ). HONG KONG: Peak, 22 Sept. 1931, ♀ (R. Sherriffs, ZMK).

Argiope katherina new species

Figures 211–216; Map 4

Holotype. Female and juvenile and male paratypes from Katherine Gorge, Northern Territory, Australia, Dec. 1980 (R. R. Jackson), in the Queensland Museum, Brisbane, no. S904. The specific name is a noun in apposition after the type locality.

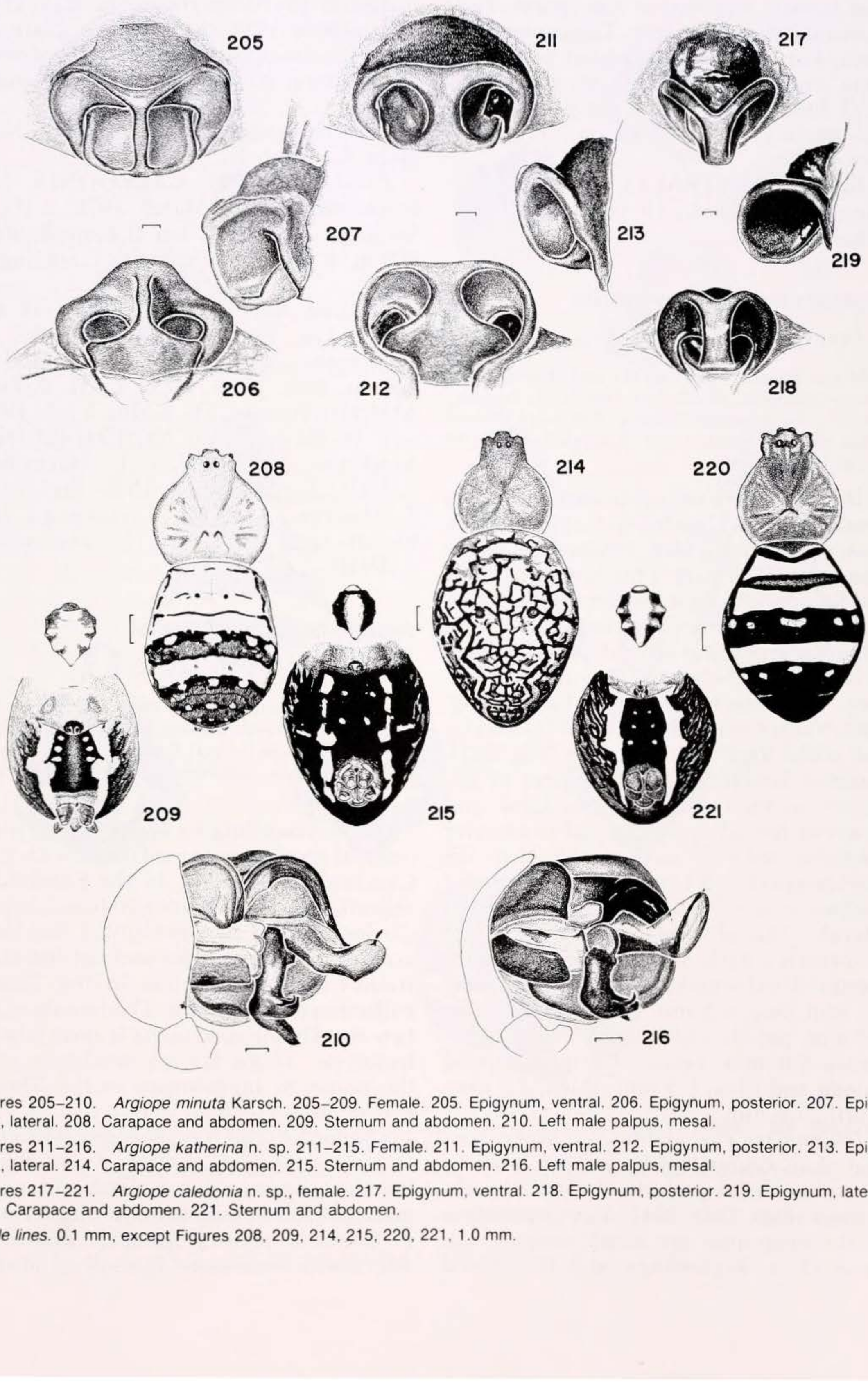
Description. Carapace dark brown, light around edge and thinly covered with white down. Sternum black with a median longitudinal mark (Fig. 215). Coxae black, each with a small white spot. Palpi white. Legs dark brown; distal end of tibiae and metatarsi black; tarsi black. Dorsum of abdomen with diagnostic reticulate pattern (Fig. 214). Venter black with slender white marks (Fig. 215). Secondary eyes subequal in size to anterior median eyes except for anterior laterals, 0.7 diameter of anterior medians. Anterior median eyes about their diameter apart. Posterior median eyes about their diameter apart, 1.5 from laterals. The abdomen is oval in outline. Total length, 14.5 mm. Carapace, 5.0 mm long, 4.2 mm wide. First femur, 7.4 mm; patella and tibia, 8.2 mm; metatarsus, 7.6 mm; tarsus, 1.9 mm. Second patella and tibia, 8.0 mm; third, 4.6 mm; fourth, 7.7 mm.

Male. Carapace light olive-brown, dark on sides. Sternum black with median light and posterior median white mark. Coxae yellow-white. Legs with distal articles banded. Proximal ones yellow-white. Dorsum of abdomen with a black folium having jagged outline; lighter on sides of folium. Venter black with two paraxial light lines. Posterior median eyes 1.2 diameters of anterior medians; anterior laterals 0.5 diameter; posterior laterals 1.2 diameters of anterior medians. Anterior median eyes 1.5 diameters apart, 0.8 from laterals. Posterior median eyes 1.7 diameters apart, 1.8 from laterals. The abdomen is oval, dorsoventrally flattened. Total length, 3.6 mm. Carapace, 2.2 mm long, 2.0 mm wide. First femur, 2.6 mm; patella and tibia, 2.8 mm; metatarsus, 2.7 mm; tarsus, 1.2 mm. Second patella and tibia, 2.7 mm; third, 1.4 mm; fourth, 2.2 mm.

Diagnosis. The species is similar to *Argiope minuta* Karsch from Japan and *A. dietrichae*. The female differs by the very distinct abdominal pattern (Fig. 214) and the wider septum in the epigynum (Fig. 211). The male has a much heavier embolus and the median apophysis a shorter inside prong (Fig. 216).

Note. The epigynum of the holotype had one embolus tip stuck to it on the left side (Fig. 211) and had two on the right side (which were removed).

Natural History. The spiders were in webs at the mouth of sandstone caves on the walls of the Katherine Gorge, 10 to 100 m from Katherine River, in precipi-



Figures 205–210. *Argiope minuta* Karsch. 205–209. Female. 205. Epigynum, ventral. 206. Epigynum, posterior. 207. Epigynum, lateral. 208. Carapace and abdomen. 209. Sternum and abdomen. 210. Left male palpus, mesal.

Figures 211–216. *Argiope katherina* n. sp. 211–215. Female. 211. Epigynum, ventral. 212. Epigynum, posterior. 213. Epigynum, lateral. 214. Carapace and abdomen. 215. Sternum and abdomen. 216. Left male palpus, mesal.

Figures 217–221. *Argiope caledonia* n. sp., female. 217. Epigynum, ventral. 218. Epigynum, posterior. 219. Epigynum, lateral. 220. Carapace and abdomen. 221. Sternum and abdomen.

Scale lines. 0.1 mm, except Figures 208, 209, 214, 215, 220, 221, 1.0 mm.

tous terrain. Vegetation was sparse, *Pandanus* the dominant tree. The canopy was open, but the caves provided protection from sunlight; temperature was about 37°C, humidity 90% (the rainy season was just starting) (R. R. Jackson, correspondence).

Records. AUSTRALIA: *Northern Territory*. Pine Creek, 15 Oct. 1975, ♀ (P. Whelan, AMS).

Argiope caledonia new species

Figures 217–221; Map 4

Holotype. Female from 7 mi [11 km] SE of La Foa, New Caledonia, 16–22 April 1945 (C. L. Remington) in the American Museum of Natural History. The specific name is a noun in apposition after the type locality.

Description. Female from Mt. Koghi, Noumea, New Caledonia. Carapace dark brown, middle lighter, covered by white down. Sternum with a median light band and lighter spots on sides facing coxae (Fig. 221). Palpi yellow-white. Legs black with a light narrow ring around proximal part of tibiae and metatarsi. Dorsum of abdomen with black transverse bands (Fig. 220). Venter with a black band framed by two white longitudinal stripes (Fig. 221). Anterior lateral eyes 0.5 diameter of anterior medians. Posterior medians and posterior lateral eyes subequal to anterior medians. Anterior median eyes their diameter apart, 1.5 from laterals. Posterior median eyes 1.5 diameters apart, 2 from laterals. The abdomen is oval, truncate anteriorly, with small anterior lateral humps. Total length, 12.5 mm. Carapace, 5.2 mm long, 4.5 mm wide. First femur, 7.9 mm; patella and tibia, 8.6 mm; metatarsus, 8.0 mm; tarsus, 2.0 mm. Second patella and tibia, 8.5 mm; third, 4.3 mm; fourth, 7.6 mm.

Diagnosis. The abdomen differs from that of *A. keyserlingi* by lacking lobes on the sides of the posterior half of the abdomen (Figs. 220, 221). The depressions of the epigynum are much deeper than those of *A. keyserlingi*, and the lateral margin is curved convexly (Figs. 217, 218). In posterior view the posterior plate on each side disappears into a round opening; the opening is not bordered posteriorly (Fig. 218).

Distribution. New Caledonia, New Hebrides (Map 4).

Paratypes. NEW CALEDONIA: Mt. Koghi, 400 m, 12 March 1978, ♀ (E. I. Schlinger, EMB); 22 km E Bourall, 460–600 m, 6 March 1978, 2♀ (E. I. Schlinger, EMB).

Records. NEW CALEDONIA. 11 km SE La Foa, Feb.–April 1945, 2♀ (C. L. Remington, AMNH); Mt. Koghi, 400 to 500 m, Feb. 1973, ♀ (N. L. H. Krauss, AMNH); Noumea, Mt. Koghi, 5 July 1970, ♀ (T. W. Davies, CAS). NEW HEBRIDES: Anietyum, Aug. 1937, ♀ (L. Macmillan, AMNH); Espiritu Santo, 1943–1944, 3♀ (J. S. Haeger, AMNH); Erromanga Isl., March–April 1937, 2♀ (L. Macmillan, AMNH).

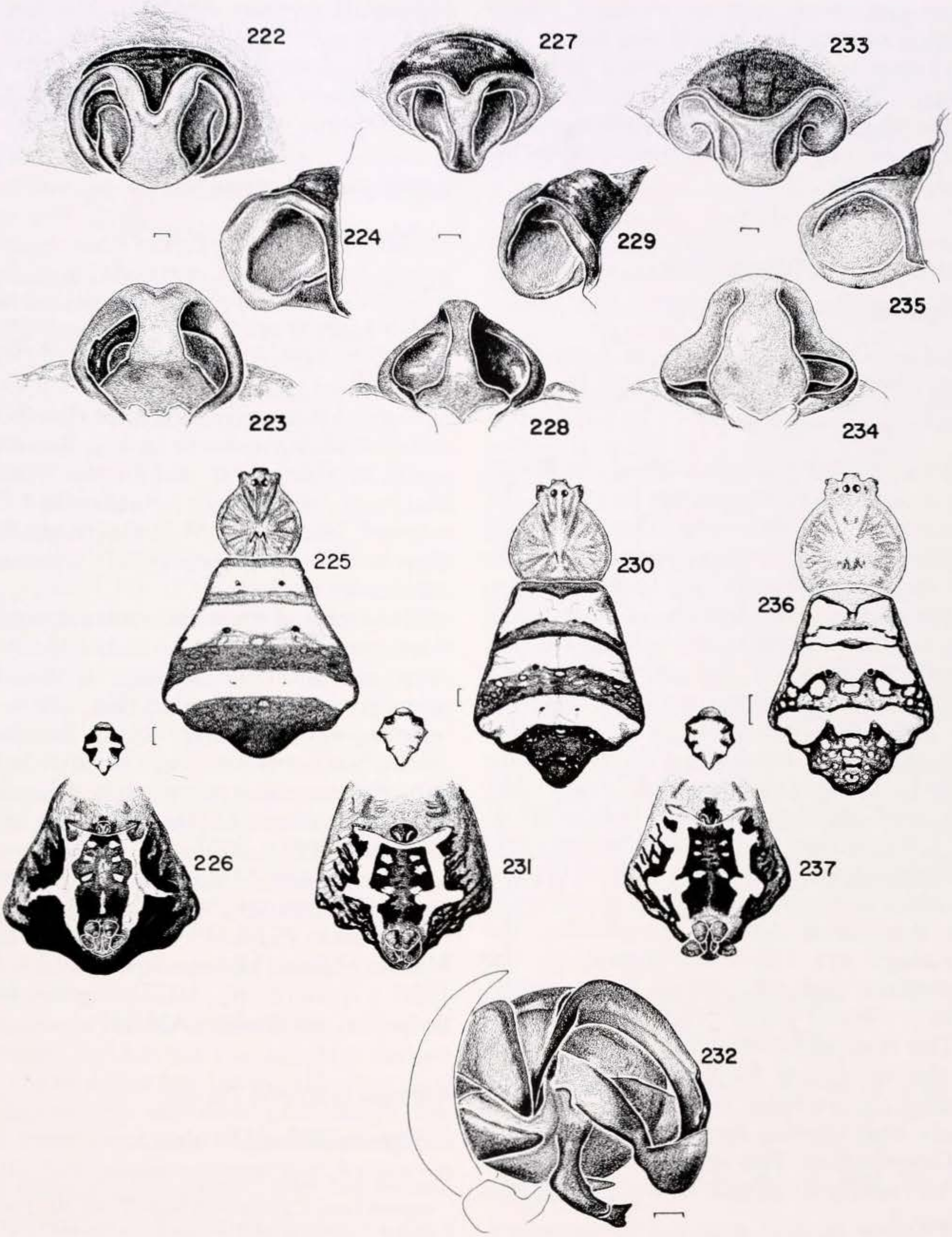
Argiope taprobanica Thorell

Figures 222–226; Map 5

Argiope taprobanica Thorell, 1887: 164. Female lectotype and juvenile paralectotype here designated from Taprobane [Island], Ceylon [Sri Lanka] in the Naturhistoriska Riksmuseet, Stockholm. Roewer, 1942: 739.

Note. According to Thorell (1887), the original specimens came from the O. P.—Cambridge collection. In the Cambridge collections in Oxford are two females from Ceylon marked *A. taprobanica*. But these are in fact *A. pulchella* and not the same species as the specimens in the Thorell collection in Stockholm. The female of the two Stockholm specimens is now labeled lectotype. There are no specimens with the name *A. taprobanica* in the Thorell collection in Genova, Italy.

Diagnosis. This species is probably close to *A. luzona* and perhaps *A. pulchella*, but the epigynum has a much wider septum and continues posteriorly into a wider posterior plate (Figs. 222, 223). The depression faces more ventrally; the rims



Figures 222–226. *Arigope taprobanica* Thorell, female. 222. Epigynum, ventral. 223. Epigynum, posterior. 224. Epigynum, lateral. 225. Carapace and abdomen. 226. Sternum and abdomen.

Figures 227–232. *Argiope luzona* (Walckenaer). 227–231. Female. 227. Epigynum, ventral. 228. Epigynum, posterior. 229. Epigynum, lateral. 230. Carapace and abdomen. 231. Sternum and abdomen. 232. Left male palpus, mesal.

Figures 233–237. *Argiope intricata* Simon, female. 233. Epigynum, ventral. 234. Epigynum, posterior. 235. Epigynum, lateral. 236. Carapace and abdomen. 237. Sternum and abdomen.

Scale lines. 0.1 mm, except Figures 225, 226, 230, 231, 236, 237, 1.0 mm.

curve posteriorly and are strongly sclerotized, forming the lateral margin of the depression. The rims appear polished (Figs. 222, 223). The embolus tip found in the epigynum (right depression, on left of Fig. 222) is a large bow resembling that of *A. luzona*.

Argiope luzona (Walckenaer)

Figures 227–232; Map 5

Epeira luzona Walckenaer, 1841: 109. Female specimens from Luzon, Philippine Islands, lost.
Argiope luzona:—Simon, 1877: 74. Roewer, 1942: 738. Bonnet, 1955: 690.

Note. Walckenaer described the broad black and silver transverse bands of the dorsum of the abdomen. The male and female have not been collected together, but are believed to belong together.

Diagnosis. The female of this large species has a pentagonal abdomen, the posterior lobed on the sides, and with broad black and silver transverse bands on the dorsum (Fig. 230). Unlike similar species and *A. intricata*, the septum anteriorly partly overlaps and bridges the rim, and the rim appears twisted (Fig. 227); the septum broadens posteriorly into a short posterior plate (Fig. 228). The continuation of the posterior plate dorsally fills the depression almost completely; the openings are anterior, lateral in the depression and only visible if the epigynum is viewed partly from the side.

The male differs from others by the tip of the conductor forming a basket containing the embolus tip, and by the relatively long median apophysis (Fig. 232).

Distribution. This species is only found on the northern islands of the Philippines (Map 5).

Records. PHILIPPINES: *Luzon*. Mt. Makiling [? Mt. Makelkelan], ♀♀ (Baker, SMF); Columba, Laguna Prov., 1 Sept. 1945, ♀ (S. G. Jewett, Jr., AMNH); Pasay City, Rizal Prov., ♀ (S. Wonechek, MCZ); Alabang, Rizal Prov., 20 Jan. 1957, ♀ (AMNH); Lucena, Tayabas Prov., 7 Oct. 1945, ♀ (B. Malkin, AMNH); Alabang, Rizal Prov., 20–30 July 1945, ♀ (W. Spector, AMNH); Los Baños, Laguna Prov., 16 Dec. 1945, ♂ (B. Malkin, AMNH). *Calicoan Island*. ♀ (F. F. Bibby, AMNH).

Argiope intricata Simon

Figures 233–237; Map 5

Argiope intricata Simon, 1877: 75. Original specimens from Malamoy [? Malamaui Isl.] and Basilan Isl., Philippines in the Muséum National d'Histoire Naturelle, Paris, lost. Roewer, 1942: 738. Bonnet, 1955: 687.

Note. Apparently at a later date Simon considered *A. intricata* and *A. luzona* the same, as there is a vial in the Muséum National d'Histoire Naturelle, Paris marked "*A. luzona* W. (=*intricata* E. S.) Manila det. Simon no. 9891" containing specimens of both.

Diagnosis. *Argiope intricata* is medium sized, smaller than *A. luzona*; the transverse bands on the dorsum of the abdomen have a jagged edge (Fig. 236). The opening of the epigynum, unlike that of *A. luzona*, can be seen surrounded by strongly curved lips on each side of the posterior plate in the middle of the depression (Fig. 236).

Distribution. Mindanao and Basilan Islands, Philippines (Map 5).

Records. PHILIPPINES: *Mindanao*. Mother Lode Mines, Surigao, 17 May 1950, ♀ (J. Bergseng, MCZ); Agusan River, Bunawan, 2♀ (Baker, AMNH).

Argiope pulchella Thorell

Figures 238–250; Map 5

Argiope pulchella Thorell, 1881: 74. Females reported from Celebes and near Tcibodas, Java [Cibodas, near Bogor]. Female syntypes [?] from "Mulmein" [Moulmein, Burma] in the Museo Civico di Storia Naturale, Genova, examined. Roewer, 1942: 738. Bonnet, 1955: 693.
Argiope undulata Thorell, 1887: 154. Female holotype from Schwego Mayo [Schwegu, near Bhamo], Burma in the Museo Civico di Storia Naturale, Genova, examined. Roewer, 1942: 739. NEW SYNONYMY.

Note. Bonnet (1955: 690) lists *undulata* as a synonym of *A. luzona*. This is a mistake. Figures 238–240 were made from the syntype of *A. pulchella*; Figures 241–243, 246, 247 from the syntypes of *A. undulata*; Figures 244, 245 from a specimen from Singapore and the male from Nepal (Figs. 248, 249).

Diagnosis. This species has an abdomen shape and coloration similar to *A. versicolor* but is much more variable in size, usually larger. Females vary in total length from 11.5 to 18.0 mm, carapace length, 4.0 to 6.1 mm; from Nepal, total length 10.7 mm, carapace length 3.9 mm. The epigynum has a smaller anterior bulge with a thicker V- or U-shaped rim (Figs. 244, 245) than *A. versicolor*, and the depressions face posterolaterally. In posterior view the epigynum is not as wide (Figs. 239, 242) as that of *A. versicolor*. Within the depression of mated females can be seen the torn-off duct from a male palpus (Fig. 239); usually only the very tip of the embolus (Fig. 250) becomes embedded in the opening (unlike *A. versicolor*, where a larger piece breaks off). Only rarely is a longer piece present; if it is, the pendant is as long as the tip, as in some Sumatra specimens. The internal genitalia of only a single female from Padang, Sumatra were examined and the seminal receptacles were found to be longer and narrower than those of *A. versicolor*.

The male palpus differs from that of *A. versicolor* by having the pendant longer than the embolus tip, having the duct near the tip of the embolus proximally approaching the margin of the embolus, and having the median apophysis longer in ventral view (Fig. 248).

Distribution. Thailand, India to Java (Map 5).

Records. CHINA: *Kiangsi Prov.* Hong San, 16 July 1936, ♀ (L. Gressitt, MCZ). THAILAND: Fang Hortic. Exp. Sta., Chieng Mai Prov., 19 Oct. 1981, ♀ (ZMK); Doi Inthanon Nat. Park, Chieng Mai Prov., 14 Oct. 1981, ♀ (ZMK); Chieng Mai, ♀ (L. Abra, AMS); Doi Suthep, Chieng Mai Prov., 800 m, 14 May 1958, ♂ (B. Degenbøl, ZMK); Choomporn [Chumphon], 15–20 Nov. 1957, ♀ (N. Meinkoth, MCZ). CAMBODIA: Stonkeve [Stŏeng Kêv], 1961, 2♀ (P. Skafte, ZMK). BURMA: Pegu, 3♀ (C. H. Carpenter, MCZ); Myitkyina, 1945, ♀ (D. N. Marks, AMNH); Mt. Popa, 4♀ (SMF). SINGAPORE: ♀ (H. N. Ridley, BMNH); Kalaw, 11 Nov. 1978, 2♀ (E. S. Ross, CAS). NEPAL: Tanhu Distr., Marsyandi, 400–500 m, Dumre-Turture, 7 April 1980, 3♀, 3♂ (J. Martens, Ausobsky, JMC); Kathmandu Valley, western part, 1300–1400 m, 17 Sept. 1964, ♀ (J. Martens, JMC); 1956–1958, ♀ (MCZ). INDIA: *Assam*. 13 km N of Silchar [? Sikar], 1–5 April 1969, ♀ (H. Hill, MCZ). "*North India*." Kooloo Valley [Kulu], Himalaya, 1871, ♀ (M. Carlton, MCZ). *Dargiling* [Darjeeling]. ♀ (E. Reimoser, MCZ); ♀ (Gravely, NMW). *Bengal*. Calcutta, 1906–1907, house, ♀ (T. Barbour, MCZ). SRI LANKA: 2♀ (HCO), ♀ (NMW). INDONESIA: *Sumatra*. Deli [Labuhandeli], ♀ (BMNH), 24 April 1894, ♀ (W. Burchard, ZMH); Pulau Sertung [Verlaten Eiland], Dec. 1919, ♀ (Damm, AMNH); Medan, ♀ (E. Mjöberg, NRS); Kota Tajne [? Kotatinggi], ♀ (E. Mjöberg, NRS); Padang, ♀♀ (SMF); Fort de Kock [Bukittinggi], 900 m, 1924, ♀♀ (E. Jacobson, SMF).

Argiope versicolor (Doleschall)

Figures 3, 4, 251–262; Map 5

Epeira versicolor Doleschall, 1859: 31, pl. 9, fig. 10, ♀. Name given to illustration of specimens from Java. Two original Java specimens now labeled syntypes in the Rijksmuseum van Natuurlijke Historie, Leiden, examined. Roewer, 1942: 739. Bonnet, 1955: 698.

Argiope succincta L. Koch, 1871: 35. Female holotype from Borneo, lost; not in Zoologisches Museum, Universität Hamburg nor in British Museum.

Note. The type of *A. succincta* is lost. There is no doubt on the synonymy, since Koch described the diagnostic swollen anterior bulge of the epigynum; also, the

species is common in Borneo. Figures 254–258, 261, 262 were made from a female from Siberit, Sumatra; Figures 251–253 from Kepong, Selangor, Malaysia. The male Figures 259, 260 were made from a specimen from Kuala Lumpur, Malaysia.

Diagnosis. This species has the abdomen shape and epigynum similar to that of *A. pulchella*. All specimens are medium sized, none large. Total length of females, 8.6 to 12.0 mm; carapace length, 3.5 to 4.4 mm. *Argiope pulchella* may be much larger, but also sometimes is smaller. The epigynum in *A. versicolor* has a larger anterior bulge, the rim is thin and almost straight (Figs. 251, 254); in *A. pulchella* the thick rim describes a U-shape, and the depressions face posterolaterally. In posterior view the epigynum is wider in proportion (Figs. 252, 255) than that of *A. pulchella*. The broken-off parts of the palpal embolus in *A. versicolor* are large (Figs. 261, 262) and fit snugly inside the margins of the depression. They only become apparent as a separate structure if pushed in. Only the very tip is found in the epigynum of *A. pulchella*, and a torn-off duct hangs inside the depression. The internal genitalia of only one female from Panang, Malaysia were examined; the seminal receptacles were found wider and shorter than those of *A. pulchella*.

The embolus of the palpus lacks the dorsal kink of the *A. aetherea* group. An embolus tip from Java had the distal curved part above the duct (but not the pendant) more sclerotized and more distinct, similar to the tips found in *A. pulchella* epigyna. The palpus (Fig. 259) differs from that of *A. pulchella* in having the pendant shorter than the embolus, the duct almost through the middle of the embolus, and the median apophysis shorter in ventral view.

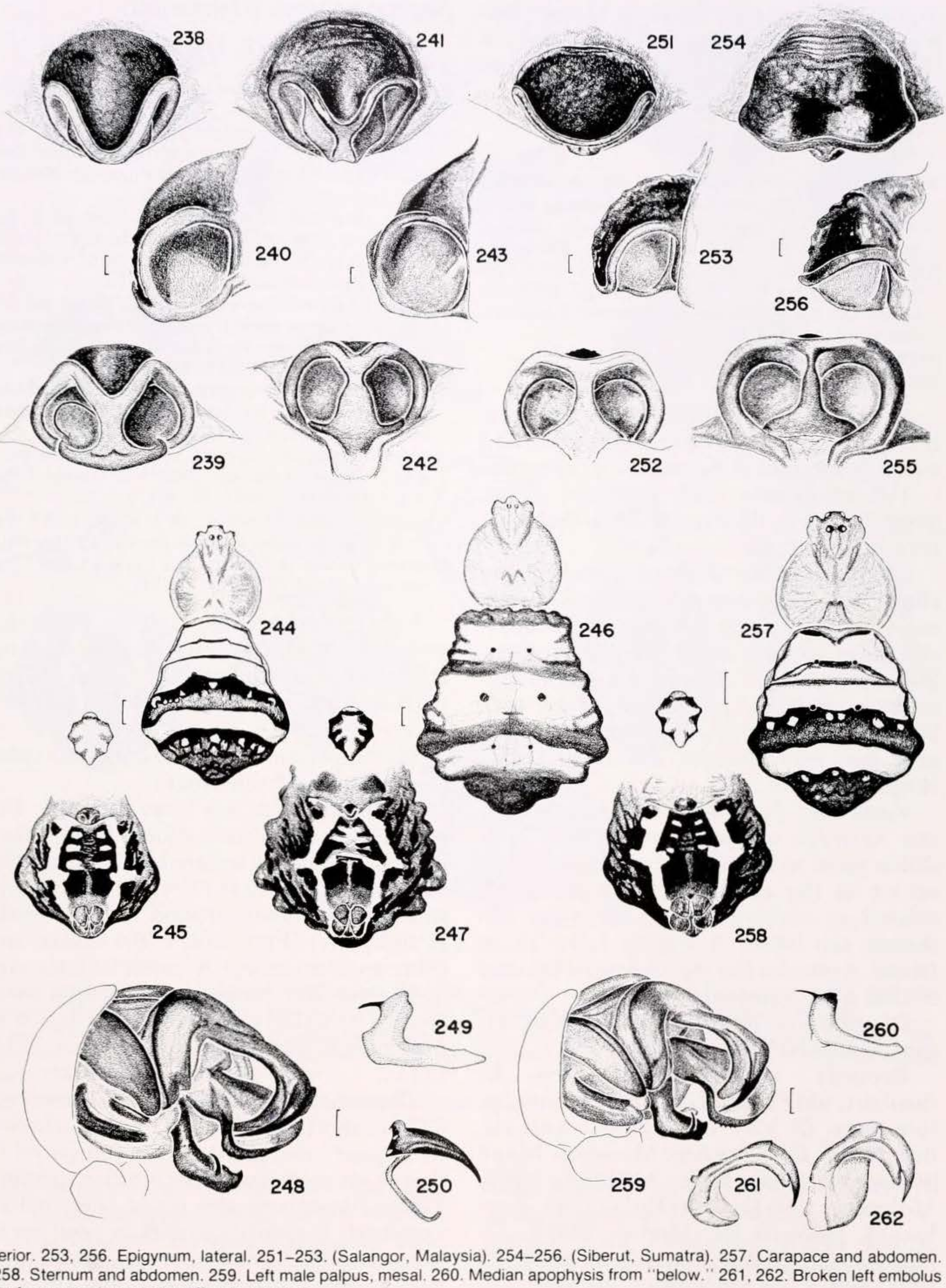
Distribution. Malaysia, Borneo, Sumatra, Java (Map 5).

Records. MALAYSIA: *Malay Peninsula.* Kedah Peak, 1000–1200 m, 28 April 1962 (E. S. Ross, CAS); 24 km N Kuala Lumpur, March 1949, ♀ (R. Traub, AMNH), bldgs., 30 April 1980, ♀♂ (J. A. Beatty, BC); Kepong, Sept. 1979, ♀♂ (P. Hillyard, BMNH); between Kuala Lumpur and Fraser's Hill, 14 Feb. 1974, ♀♂ (W. C. Sedgwick, MCZ); Fraser's Hill, 5 Feb. 1973, ♀, 8 April 1976, ♀ (W. C. Sedgwick, SC); Genting, 18–22 Aug. 1979, ♀, ♂ (F. & J. Murphy, MC). *Sarawak.* Ng. Ngungun, Sg. Ngemah, 24 Nov. 1974, ♂ (CNC); Sadong, Dec., ♀ (Smith, MCZ); Feb. 1976, ♀ (E. W. Classey, MC); Gunong, Mulu Natl. Park, May 1978, ♀ (F. Wanless, BMNH). *Sabah.* Gaya Island, 26 Jan. 1976, ♀ (E. W. Classey, MC); Porung [? Poring], 900 m, 19 Jan. 1976, ♀ (E. W. Classey, MC); 550 m, 22 Jan. 1976, ♀ (E. W. Classey, MC); Ulu Dusun, Sandakan, 29–31 Jan. 1976, 2♀ (E. W. Classey, MC). SINGAPORE: ♀ (H. N. Ridley, BMNH). INDONESIA: *Sumatra.* between Kotabaroe [Kotabaru] and Pajacombe [Pajakumbuh], June 1937, ♀ (C. T. Brues, MCZ); Fort de Kock [Bukittinggi], 1926, 5♀ (Jacobson, NMW), roadside farm, 14 July 1981, 7♀ (W. C. Sedgwick, SC); Harau Kloof, 23 April 1929, ♀ (S. A. R. Prince Léopold, IRSN); Panti, 26 April 1929, ♀ (S. A. R. Prince Léopold, IRSN); Pulau Sertung [Verlaten Eiland], Dec. 1919, ♀ (Damm, AMNH); Siberut [Isl.], 7 Feb. 1917, ♀ (O. Hagerup, ZMK); ♀♂ (Doria, NRS). *Java.* Buitenzorg [Bogor], March 1909, ♀ (O. Bryant, MCZ), ♀ (NMW); Tasikmalaja, in house, ♀ (Gornsten, NMW). *East Borneo*

→

Figures 238–250. *Argiope pulchella* Thorell. 238–247. Female. 238, 241. Epigynum, ventral. 239, 242. Epigynum, posterior. 240, 243. Epigynum, lateral. 238–240. (Moulmein, Burma). 241–243. (northeastern Burma). 244, 246. Carapace and abdomen. 245, 247. Sternum and abdomen. 244, 245. (Singapore). 246, 247. (northeastern Burma). 248. Left male palpus, mesal. 249. Median apophysis from "below." 250. Broken left embolus tip from an epigynum.

Figures 251–262. *Argiope versicolor* (Doleschall). 251–258. Female. 251, 254. Epigynum, ventral. 252, 255. Epigynum, pos-



terior. 253, 256. Epigynum, lateral. 251–253. (Salangor, Malaysia). 254–256. (Siberut, Sumatra). 257. Carapace and abdomen. 258. Sternum and abdomen. 259. Left male palpus, mesal. 260. Median apophysis from "below." 261, 262. Broken left embolus tip from an epigynum (at different angles).

Scale lines. 0.1 mm, except Figures 244–247, 257, 258, 1.0 mm.

[Kalimantan]. Long Navang [Long Nawan], ♀ (E. Mjöberg, NRS); Tewah, ♀ (Breitenstein, NMW).

Argiope modesta Thorell

Figures 263–270; Map 5

Argiope modesta Thorell, 1881: 75. Female holotype in poor condition from Kunang [? Kupang], Timor in the Museo Civico di Storia Naturale, Genova, examined. Roewer, 1942: 738. Bonnet, 1955: 691.

Argiope crenulata pictula Strand, 1911a: 203. Two female syntypes from Boeton [Butung], southeast Celebes in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Argiope appensa pictula:—Roewer, 1942: 740.

Argiope appensa:—Bonnet, 1955: 672 (in part).

Note. The type specimen of *A. modesta* is in poor condition (Figs. 263–265) and was first thought to belong to *A. appensa*.

The epigynum and abdomen (Figs. 266–270) were illustrated from the holotype of *A. pictula*.

Diagnosis. Like *Argiope appensa*, the rim of the epigynum appears broken, the anterior lateral part is a part of the anterior bulge without an intervening lip (Figs. 263, 266). Unlike *A. appensa*, the epigynum is ventrally pulled out (Figs. 265, 268). Also, the abdomen is lobed all around and has very distinct dorsal markings (Figs. 269, 270).

Variation. Two collections from Western Australia of specimens in poor condition seem to have just the posterior dorsal tip of the abdomen black, as in the related *A. aetherea*; the sides of the abdomen are lobed. A female from Taam Island, Australia has the abdomen banded as that of *A. rainbowi*.

Distribution. Borneo, Java, Celebes, Timor, Australia (Map 5).

Records. INDONESIA: *Java*, 2♀ (Seubort, SMF) *Lombok*. from hymenoptera nests, 29 May 1899, 2♀ (C. Auri-villius, NRS). *East Borneo*. Maratoea Island [Pulau Maratua], ♀ (E. Mjöberg, NRS). *Moluccas*. Key Duelah [Dula, Tual, Kep. Ewab], 1908, 6♀ (H. Merton, SMF). *Timor*. 5♀ (NHMW); Roti Isl. in grass, 23 July 1899, ♀ (C. Auri-villius, NRS).

Argiope appensa (Walckenaer)

Figures 271–278; Map 5

Epeira appensa Walckenaer, 1841: 111. Female without locality, lost.

Epeira (Argyopes) crenulata Doleschall, 1857: 414; 1859, pl. 3, fig. 7, ♀. Female specimens from Amboina [Ambon] in the Rijksmuseum van Natuurlijke Historie, Leiden, examined.

Argiope chrysorrhoea L. Koch, 1871: 38, pl. 3, fig. 5, ♀. Three female syntypes from the Pelew Inseln [Palau Isl.] in the Zoologisches Museum, Universität Hamburg, examined.

Argiope boetonica Strand, 1915: 215, pl. 16, fig. 53, ♂. Male holotype from Bau-Bau, Boeton, southeast Celebes in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Coganargiope (Micrargiope) reticulata Kishida, ?1931: 130; 1936: 22, figs. 6–11, ♀♂. ?Type specimens? NEW SYNONYMY.

Argiope crenulata:—Roewer, 1938: 33, fig. 23, ♀.

Argiope appensa:—Roewer, 1942: 740. Bonnet, 1955: 672. Chrysanthus, 1971: 10, figs. 4–8, ♀, ♂.

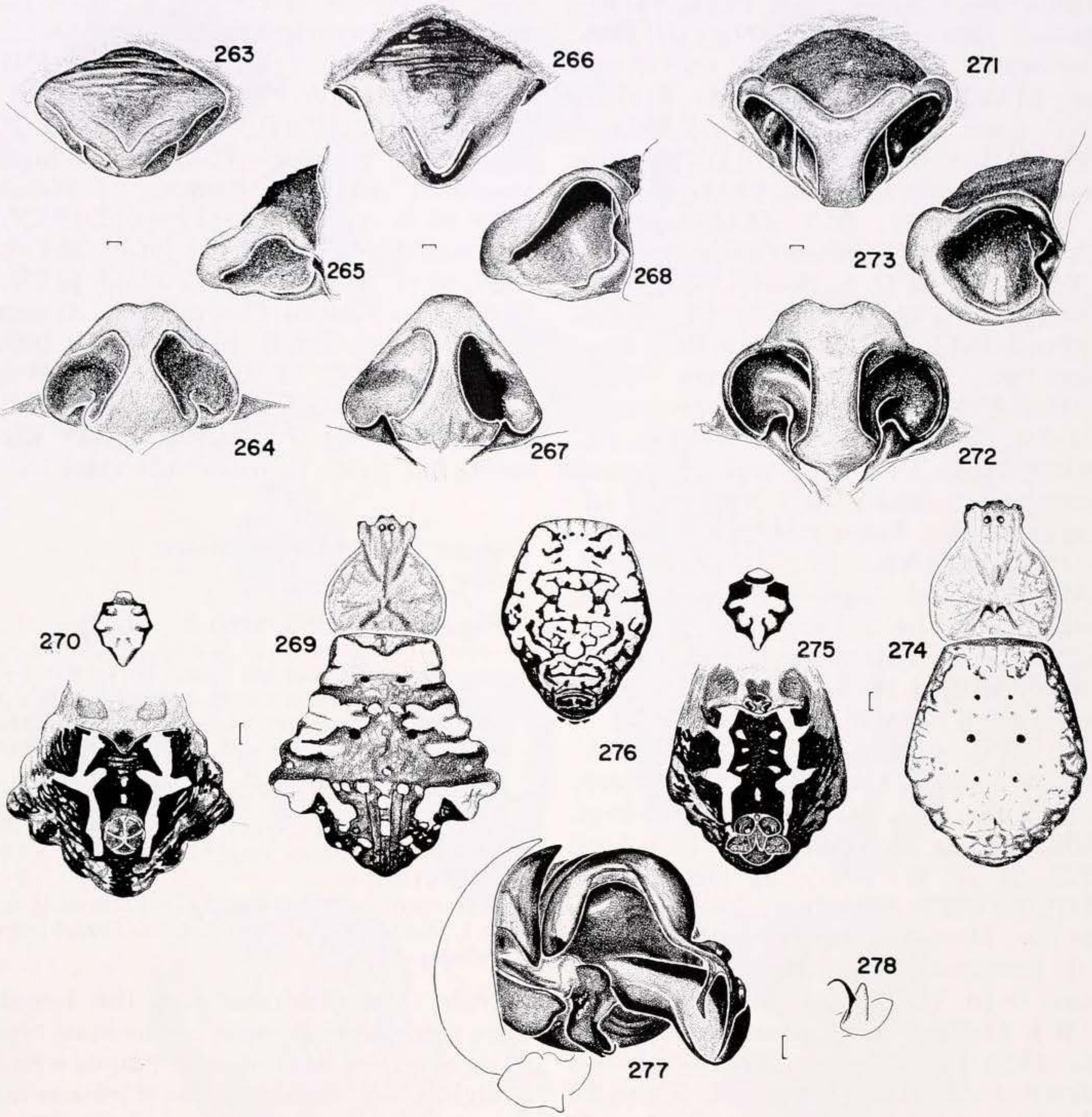
Argiope schoenigi Marapao, 1965: 45, pl. 1, ♀, ♂. Female holotype from Guadalupe, Cebu City, Philippines in the University San Carlos, Cebu City, not available. NEW SYNONYMY.

Notes. Walckenaer gave a good description of the unusual dorsal pattern. *Argiope boetonica* had been synonymized with *A. aetherea* by Chrysanthus (1971), an error.

The illustrations were made from specimens coming from Guam.

Diagnosis. This is a large *Argiope*. Females can be distinguished from other species by the reticulated pattern on the abdomen covering the dorsum completely in dark specimens, around the edge only in light ones (Figs. 274, 276). Unlike any other species (except *A. modesta*), the rim of the anterior bulge of the epigynum is broken anteriorly on each side; the median part is wide, the lateral narrow (Fig. 271).

The conductor of the male palpus (Fig. 277) is shorter than that of *A. aetherea*, its "upper" margin straight (compared to that of *A. picta* and other similar species). While the axis of the tip of the median apophysis is nearly parallel in position to the axis of the conductor in *A. aetherea* and *A. picta*, it is on angle, and the me-



Figures 263–270. *Argiope modesta* Thorell, female. 263, 266. Epigynum, ventral. 264, 267. Epigynum, posterior. 265, 268. Epigynum, lateral. 263–265. (Timor). 266–268. (Celebes). 269. Carapace and abdomen. 270. Sternum and abdomen.

Figures 271–278. *Argiope appensa* (Walckenaer). 271–276. Female. 271. Epigynum, ventral. 272. Epigynum, posterior. 273. Epigynum, lateral. 274. Carapace and abdomen. 275. Sternum and abdomen. 276. Abdomen, dorsal. 277. Left male palpus, mesal. 278. Median apophysis from "below."

Scale lines. 0.1 mm, except Figures 269, 270, 274–276, 1.0 mm.

dian apophysis is a shorter structure (Fig. 277), with the spur coming off the middle.

Distribution. Hawaii, Taiwan to New Guinea (Map 5).

Records. TAIWAN: Taipei, 11 Oct. 1955, ♀ (M. Walsh, AMNH). HAWAII: *Oahu.* Lualuale; Diamond Head Crater; Waipio; Ewa Plantation; Kunia Camp; Waialua, Mokuleia Beach, house and garden; Honolulu, McCully; Kaneohe. *Maui.*

Haiku; Seven Sacred Pools; 13 km S Hana. *Hawaii*. Hawaii Volcanoes National Park, Kamoamoa, bldgs.; Wahaula; trail to crater. MARSHALL ISLANDS: *Majuro Atoll*. grass, herbs, and shrubs, 22 March 1980, ♀♂ (J. A. Beatty, BC); 10 km E Laura, Long Isl., shrubs and trees, 24 March 1980, ♀ (J. A. Beatty, BC). MARIANA ISLANDS: *Guam*. bamboo-Pandanus forest, 4 April 1980, 2♀ (J. A. Beatty, BC); bldgs., 4 March 1973, ♀♂ (J. A. Beatty, BC); beach, 3 March 1973, ♀♂ (J. A. Beatty, BC); Mangilao, Nov. 1969, ♀♂ (E. Sabath, MCZ). CAROLINE ISLANDS: *Ponape Island*. Kolonia, bldgs., [numerous collections, BC, BPBM, MCZ), Uh Distr., shrubs, 27 March 1980, ♀ (J. A. Beatty, BC). *Ngajangel Isl., Kayangel Isl., Palau Isl.* (numerous collections, AMNH, BC, BPBM, MCZ, NMW). *Yap Isl.* (many collections, MCZ, BPBM). *Fais Isl.* 5 Dec. 1952, 2♀ (N. L. H. Krauss, BPBM). *Tobi Island*. trees in forest, 21 April 1973, ♀♂ (J. A. Beatty, E. Berry, BC); ♀ (SMF). *Sonsorol Island*. 13 Sept. 1952, ♀ (N. L. H. Krauss, BPBM); tropical forest, 6 April 1973, ♀ (J. W. Berry & E. Berry, BC). *Pulo Anna Isl*. 13 Sept. 1952, ♀ (N. L. H. Krauss, BPBM); 7 April 1973, ♀♂ (J. W. Berry, E. Berry, BC). PHILIPPINES: *Mindanao*. Anakan Lumber Co., Misamis Oriental, 12 May 1950, ♀ (J. Bergseng, FMC); Balingasag coastal road, 9–10 May 1950, ♀♂ (J. Bergseng, FMC); Mother Lode Mines, Surigao, 17 May 1950, ♂ (J. Bergseng, FMC). *Calicoan Island*. (AMNH). *Leboon Isl*. [Calicoan Isl.], 1945, ♀ (F. Bibby, AMNH). *Mactan Island*. Mactan, Dec. 1958, ♂ (N. L. H. Krauss, AMNH). INDONESIA: *Java*. ?Buitenzorg [Bogor], ♀ (SMD). *Celebes*. Menado, 13 Feb. 1929, ♀ (S. A. R. Prince Léopold, IRSN). *Molucca Islands. Morotai*: 10 July 1945, ♀ (B. Malkin, AMNH); *Ambon*: April 1908, ♀ (T. Barbour, MCZ), ♀♀ (Suyberbuyk, IRSN), 8♀ (Challenger Exped., BMNH); *Ternate*: 14 Feb. 1929, ♀ (S. A. R. Prince Léopold, IRSN), 1906–1907, ♀ (T. Barbour, MCZ). *Obi Island*: ♀ (T. Barbour, MCZ). *Bouron Island* [Buru Isl.]: Tifoe [Tifu], 1906–1907, ♀ (T. Barbour, MCZ). NEW GUINEA: ?Île Mansinam [Mausinam?], Manokwan, 8 March 1929, 3♀ (S. A. R. Prince Léopold, IRSN). *West Irian* [Djaya Pura]. Middleburg Isl., 3 July 1952, ♀ (RNHL); Purdy Islands, 19 June 1944, ♀ (C. B. Phillips); Archipel Manfield, "au N de Batanta," 1 March 1929, 3♀ (S. A. R. Prince Léopold, IRSN); Archipel Misool [Misoöl Isl.], Jef-bi, 26 Feb. 1929, 3♀ (S. A. R. Prince Léopold, IRSN). *Papua New Guinea*. Central Distr. Areana Estate, Galley Reach, 19–25 March 1966 (G. Bush, MCZ). Madang Distr. Fr. Wilhelmshafen [Madang], May 1909 (G. Duncker, ZMH). *Trobriand Islands*. Kiriwinia Isl., ♂ (W. B. Jones, AMNH).

Argiope brunnescentia Strand, new status

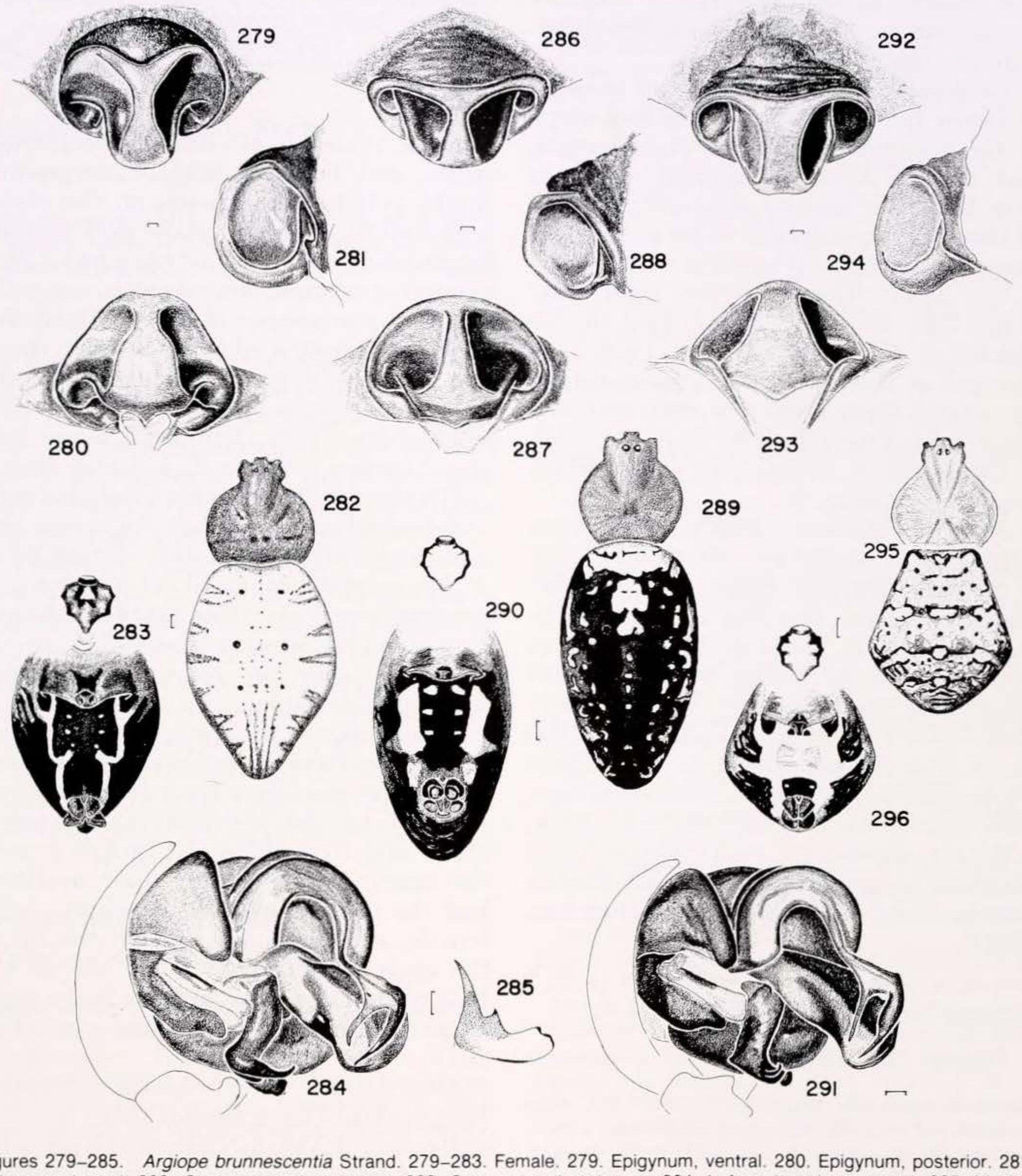
Figures 279–285; Map 5

Argiope avara brunnescentia Strand, 1911a: 203. Two female syntypes from Squally Insel [Tench Island, Bismarck Archipelago] in the Senckenberg Museum, Frankfurt, examined. Roewer, 1942: 740. Bonnet, 1955: 677.

Argiope squallica Strand, 1915: 216, pl. 16, fig. 54. Male holotype from Squally [Tench Island] in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Argiope avara:—Chrysanthus, 1971: 12 (in part), fig. 10, ♀. Misidentification; not *A. avara* Thorell [=*trifasciata*].

Note. The illustrations of the female were made from a syntype. The male type of *A. squallica* has only one palpus which is slightly expanded and therefore was not illustrated. The base of the embolus forms a much smaller semicircle than that of *A. aetherea*, *A. appensa*, and *A. picta*. It is like the palpus illustrated (Fig. 284) and like that of *A. bougainvilla*. However, the median apophysis is much more like that of *A. picta* (Fig. 315) than that illustrated by Figure 284. A second specimen labeled *A. squallica* by Strand from New Guinea is a male of *A. picta*. Only the syntype female illustrated (Figs. 279–283) had the ventral paraxial lines farther apart anteriorly than posteriorly. I have some doubt about every specimen examined, whether



Figures 279–285. *Argiope brunnescentia* Strand. 279–283. Female. 279. Epigynum, ventral. 280. Epigynum, posterior. 281. Epigynum, lateral. 282. Carapace and abdomen. 283. Sternum and abdomen. 284. Left male palpus, mesal. 285. Median apophysis from "below."

Figures 286–291. *Argiope bougainvilla* (Walckenaer). 286–290. Female. 286. Epigynum, ventral. 287. Epigynum, posterior. 288. Epigynum, lateral. 289. Carapace and abdomen. 290. Sternum and abdomen. 291. Left male palpus, mesal.

Figures 292–296. *Argiope pentagona* L. Koch, female. 292. Epigynum, ventral. 293. Epigynum, posterior. 294. Epigynum, lateral. 295. Carapace and abdomen. 296. Sternum and abdomen.

Scale lines. 0.1 mm, except Figures 282, 283, 289, 290, 295, 296, 1.0 mm.

it is conspecific with the type. A large series of females and males is needed to adequately diagnose this species.

Diagnosis. This species differs from *A. aetherea* by the laterally rounded shape of the abdomen, round in cross section, and by the dorsal abdominal markings (Fig. 282). The septum and posterior plate of the epigynum appear to be pulled in a posterior direction (Fig. 279).

The male from Oro Bay illustrated (Figs. 284, 285) may not belong to this species; it differs from others by having the spur of the median apophysis shaped like a large thorn (Figs. 284, 285) and having a pointed tooth near its base (Fig. 285).

Distribution. New Guinea, Bismarck Archipelago (Map 5).

Records. NEW GUINEA: *West Irian* [Djaya Pura]. Maffin Bay, Dec. 1944, ♀ (G. B. Sirotiak, AMNH): *Papua New Guinea.* Northern Distr. Oro Bay, ?1944, ♂ (B. Struck, AMNH). Madang Distr. Finisterre Mts., Naho River Valley, Budemu, 1270 m, 30 Oct.–23 Nov. 1964, ♀ (M. E. Bacchus, BMNH); Naho Riv. Vall., Moro, 1700 m, 30 Oct.–23 Nov. 1964, ♀ (M. E. Bacchus, BMNH). *Louisiade Archipelago.* Misima Isl., Mt. Sisa, 350 m, ♀ (L. Brass, AMNH). *Bismarck Archipelago.* Saint Matthias Group, south coast of Ebolin, Aturini Falls, Sept. 1908, ♀ (G. Duncker, ZMH).

Argiope bougainvilla (Walckenaer)

Figures 286–291; Map 5

Epeira bougainvilla Walckenaer, 1847: 473. Two specimens from the Solomon Islands, lost.

Argiope bougainvilla:—L. Koch, 1871: 42. Roewer, 1942: 741. Bonnet, 1955: 677.

Argiope vanicoriensis Simon, 1897: 272. Female holotype from Vanikora Island, Santa Cruz Islands, in the Muséum National d'Histoire Naturelle, examined. NEW SYNONYMY.

Argiope leopardina Pocock, 1898: 461, pl. 19, fig. 2, ♀. Two female syntypes from Solomon Islands, probably Shortland Island, in the British Museum, Natural History, examined. Roewer, 1942: 742. Bonnet, 1955: 687. NEW SYNONYMY.

Argiope leopardina clavifemur Strand, 1914: 216. Five syntypes from interior of Buka, Solomon Islands in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Argiope avara:—Chrysanthus, 1971: 12 (in part: figs. 9, 11, 12, ♀). Misidentification; *A. avara* = *A. trifasciata.*

Note. Walckenaer's description is enigmatic, but he describes the diagnostic, bright yellow dorsal patch on the abdomen and the smaller yellow dots behind, toward the sides. He must have had a light colored specimen, and dwelled on individual characteristics of his specimen. Pocock's description also has similar shortcomings, but his good illustrations and the presence of types removes all doubt. The illustrations (Figs. 286–290) were prepared from a syntype of *A. leopardina.*

Diagnosis. The elongate, oval abdomen of females bearing an anterior dorsal yellow patch (Fig. 289) readily distinguishes *A. bougainvilla* from all other species of *Argiope* except *A. trifasciata* from Kauai, Hawaii. The ventral abdominal marks (Fig. 290) may also be distinct, but are sometimes variable.

The shape of the epigynum separates this species from Hawaiian *A. trifasciata.*

The species differs from the related *A. appensa* by the abdomen shape, coloration, and by lacking the broken rim of the epigynum. The only male available had the distinct ventral markings of the female, and a smooth back of the tip of the embolus (Fig. 291). The axis of the base of the median apophysis is at a right angle to the axis of the conductor (Fig. 291).

Distribution. New Guinea?; Solomon Islands, Santa Cruz Islands (Map 5).

Records. PAPUA NEW GUINEA: *Madang Distr.* Finel Siar, near Friedrich Wilhelmshafen [Madang], 1906, 10♀ (error in locality?) (Schauinsland, SMF). SOLOMON ISLANDS: *Guadalcanal.* (many coll., AMNH). *Florida Island.* (AMNH). *New Georgia.* Munda (N. L. H. Krauss, AMNH). *Bougainville Isl.* (AMNH). *Russell Islands.* (R. B. Eads, AMNH; AMS). *Auki.* (W. M. Mann, MCZ). *Ugi.* (MCZ, AMS). *North Howla.* (AMS). *Isabel Isl.* ♀

(Albatross Exped., NMW). *Shortland Isl.* ♀ (Rechingen, NMW). SANTA CRUZ ISLANDS: Vanikora, ♀♀ (AMS).

Argiope pentagona L. Koch

Figures 292–296; Map 5

Argiope pentagona L. Koch, 1871: 39, pl. 3, fig. 6. Female holotype from Ovalau, Fiji in the Godeffroy Collection, Zoologisches Museum, Universität Hamburg, examined. Roewer, 1942: 742. Bonnet, 1955: 692.

Note. The dorsum of the abdomen of the type is white, the pattern washed out. The dorsal abdominal pattern in Figure 295 has been illustrated from a juvenile specimen having similar distinctive ventral markings (Fig. 296). The epigynum was illustrated from the type specimen.

Diagnosis. Like the epigynum of *A. bougainvilla*, the rim of the epigynum is almost straight (Fig. 292). It differs by having a wider septum (Fig. 292), a pentagonal-shaped abdomen (Figs. 295, 296), with a diagnostic square ventral white mark bearing eight arms (Fig. 296).

Records. FIJI ISLANDS: juv. (AMS); Mango Isl., 18 Sept. 1924, ♀ (E. H. Bryant, AMNH); Lami, Vit. Levu Isl., March 1955, ♀ (N. L. H. Krauss, BPBM).

Argiope aetherea (Walckenaer)

Figures 5, 6, 297–309; Map 5

Epeira aetherea Walckenaer, 1841: 112. Specimens from Port de Dorey, New Guinea [Dorei, Vogelkop Peninsula, West Irian], lost.

? *Argiope gorgonea* L. Koch, 1871: 35. Female specimen from Rockhampton, Queensland, L. Koch collection in the British Museum, Natural History, examined. The original description has the species coming from Boeroe [Buru Island, Moluccas].

Argiope regalis L. Koch, 1871: 36, pl. 3, fig. 4, ♀. Female holotype from Port Mackay, Queensland in the Godeffroy collection of the Zoologisches Museum, Universität Hamburg, examined.

Argiope variabilis Bradley, 1876: 141, pl. 1, fig. 3, ♀. Female lectotype and paralectotype here designated from Darnley Island, Torres Strait, in the Australian Museum, Sydney. examined.

Argiope lunata Bradley, 1876: 143, pl. 1, fig. 4, ♀. Female lectotype from Cocoanut Island, paralectotype from Sue Island, Torres Strait here designated in the Australian Museum, Sydney, examined. NEW SYNONYMY.

Argiope brownii O. P.-Cambridge, 1877: 284. Three female syntypes from Duke of York Island, New Britain in the Hope Entom. Collections, Oxford Univ., examined. NEW SYNONYMY.

Argiope keyserlingi:—Bösenberg and Strand, 1906: 199, pl. 11, fig. 230, ♀. Misidentification; not *A. keyserlingi* Karsch.

Argiope verecunda Thorell, 1878: 35. Female holotype in very poor condition from Amboina [Ambon], Moluccas in the Museo Civico di Storia Naturale, Genova, examined. NEW SYNONYMY.

Argiope aetherea annulipes Thorell, 1881: 68. Female holotype from Yule Isl. [nr. Port Moresby, New Guinea] in the Museo Civico di Storia Naturale, Genova, examined. According to Thorell the specimen came from "New Guinea."

Argiope aetherea deusta Thorell, 1881: 68. Two female syntypes in poor condition from Fly River, New Guinea in the Museo Civico di Storia Naturale, Genova, examined. According to Thorell (1881) the specimens came from Yule Island [nr. Port Moresby, New Guinea].

Argiope maerens, Kulczynski, 1911: 473, pl. 20, fig. 45, ♀. Female holotype from New Guinea in the Polish Academy of Sciences, Warsaw, examined. NEW SYNONYMY.

Argiope avara ocelligera Strand, 1911a: 203. Two female syntypes from Keule Insel [Koil], New Guinea in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

? *Argiope avara tristipes* Strand, 1911a, 77: 203. Female type from Squally Island [Tench Island, Bismarck Archipelago], lost. DOUBTFUL NEW SYNONYMY.

Argiope avara angulicosta Strand, 1911a: 203. A female holotype from Keule Insel [Koil], New Guinea in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Argiope friedericii Strand, 1911a: 204; 1915: 214, pl. 17, fig. 62, ♀. Female holotype, two paratypes from Eitape, German New Guinea [Aitape, Papua New Guinea] in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Argiope wolfi Strand, 1911a: 204; 1915: 212, pl. 16, fig. 55, ♀. Three female syntypes from Auer near Neu Mecklenburg [New Ireland] in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Argiope aetherea tangana Strand, 1911a: 204; 1915: 211. Juvenile female from Tanga Islands near Neu Mecklenburg [New Ireland] in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Argiope aetherea melanopalpis Strand, 1911a: 204. One juvenile, two female syntypes from Lamassa [Lamassong], Neu Mecklenburg [New Ireland] in the Senckenberg Museum, Frankfurt, examined. Strand, 1914: 211. NEW SYNONYMY.

Argiope udjirica Strand, 1911b: 142, pl. 5, fig. 43, ♀.

Female holotype from Aru Island in the Senckenberg Museum, Frankfurt, examined. Roewer, 1938: 33, fig. 22, ♀. Roewer, 1942: 743. NEW SYNONYMY.

Argiope aetherea keyensis Strand, 1911b: 145. Female holotype from Gross Key, Elat [Great Key, Banda Sea] in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Argiope lihirica Strand, 1913: 116; 1915: 215, pl. 13, fig. 14, pl. 16, fig. 52, ♀. Female holotype from Lihir near Neu Mecklenburg [New Ireland] in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Argiope wogeonicola Strand, 1913: 116; 1914: 213, pl. 16, fig. 56, pl. 17, fig. 58, ♀. Female holotype from Wogeo, Schouten Isl. [Vokeo Isl., Papua New Guinea] in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Argiope novaepommeraniae Strand, 1915: 212, pl. 16, fig. 51, ♀. Female holotype from Toma, Neu Pommern [New Britain] in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Gea rotunda Hogg, 1915: 244, fig. 24, ♂. Male holotype from Dutch New Guinea [West Irian] in the British Museum, Natural History, examined. NEW SYNONYMY.

Chaetargiope (*Neargiope*) *regalis*:—Kishida, 1936: 21.

Argiope aetherea:—Chrysanthus, 1958: 237, figs. 7–12, 24, ♀, ♂. M. H. Robinson, Lubin, and B. Robinson, 1974: 128. M. H. Robinson and B. Robinson, 1980: 10, 50, 79–83, 85, figs. 34–36 (photo).

Notes. Karsch wrote (1878: 788) that what Keyserling (1865) considered *A. aetherea* from New South Wales, Australia is probably a misidentification. Karsch continued to say that he had specimens from Japan that better fitted Walckenaer's description, but they had different epigyna from the specimens from Australia. He went on to say that these specimens from Japan may not be the right *aetherea*, since no specimens of the real *aetherea* from Australia were available for comparison. He then proceeded to give the name *A. keyserlingi* to Keyserling's specimens from Sydney, Australia and started a chain of confusion. The Asian species is here called *A. boesenbergi*, and the southern Australian species *A. keyserlingi*.

The type of *A. verecunda* Thorell is in poor physical condition, and the pattern of the abdomen has disappeared (the color had been lost when Thorell described it). The yellow sternum and shape of the epigynum indicate that it is *A. aetherea*.

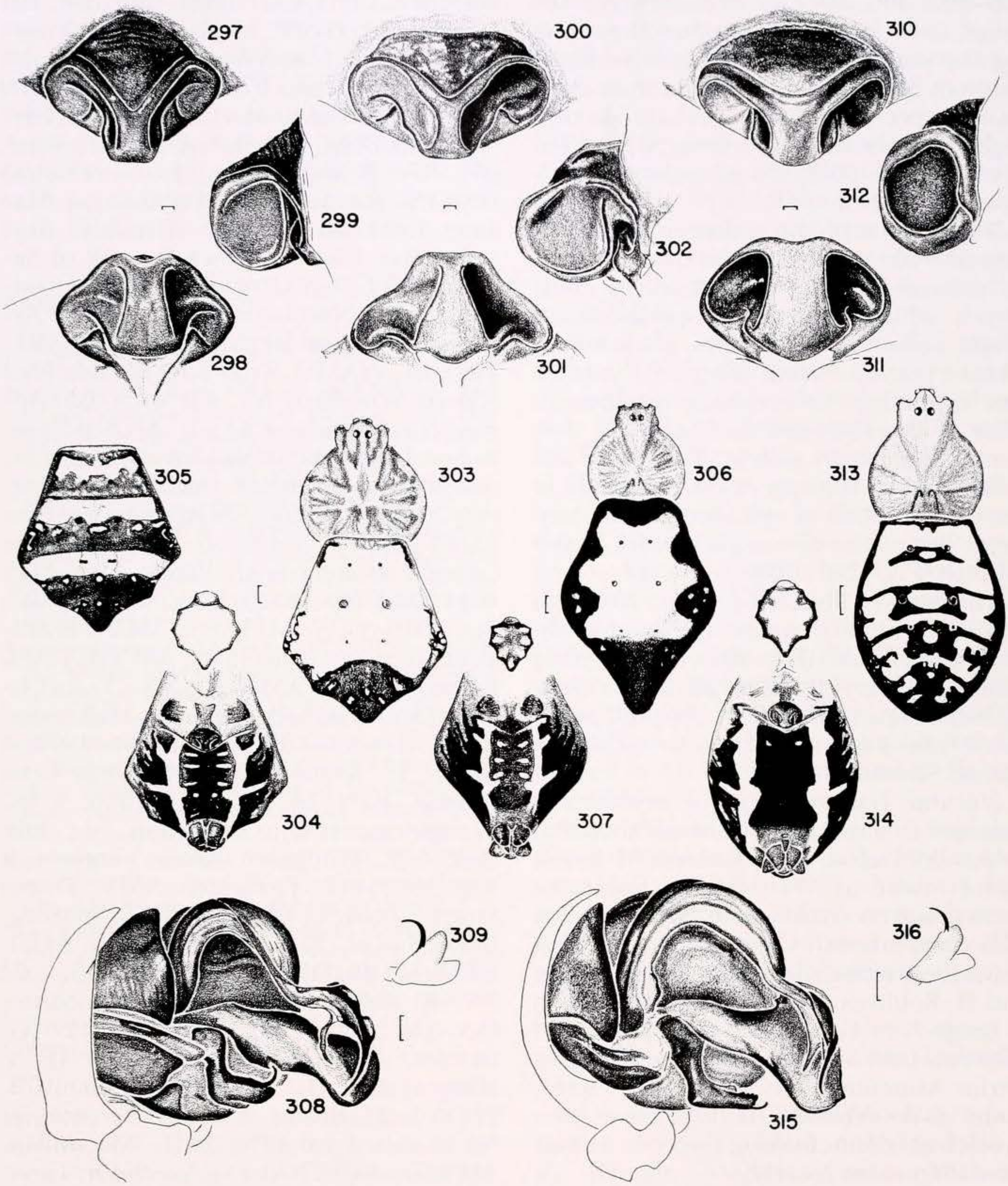
Roewer (1942) has synonymized *A. gorgonea* with *A. picta*. This may be an error. The pattern of the specimen available and named by Karsch resembles that of *A. aetherea* except for the sternum, which is like that of *A. picta*. The epigynum is perhaps closer to *A. picta*. The vial label has the specimen coming from Rockhampton, Queensland; the original description is of a specimen from Boeroe [Buru Island, Moluccas].

The specimens of *A. avara ocelligera* Strand and *A. avara angulicosta* Strand are melanistic (the dorsum of the abdomen is all black). All the other types examined and newly synonymized had genitalia and abdominal pattern within the variation of *A. aetherea*.

Diagnosis. Argiope aetherea differs from other similar species by the pentagonal shape of the abdomen (Fig. 303); from *A. picta* also by the dorsal abdominal markings (Figs. 303–305) and the anterior lip of the opening in the depression of the epigynum (Figs. 297, 300) which flares to each side (unlike *A. picta*); and by the yellow-to-orange color of the sternum (Fig. 304) (compared to the white markings on the venter). The anterior white branch of the paraxial white line on the venter of the abdomen is long in *A. aetherea*, short in *A. picta*.

The palpus of the male differs from that of *A. picta* in several ways: in lacking an "upper" lobe on the conductor behind the embolus; in the pendant of the embolus occurring at a greater distance from the tip; and in the orientation of the spur toward the embolus on the "upper" surface of the median apophysis (Figs. 308, 309) (on the "lower" edge of the tip in *A. picta*).

Variation. The species of this group, close to *A. aetherea*, hardly differ in genitalia. It is clear, however, that the sympatric *A. picta* is distinct. But are *A. truk* and *A. brunnescentia* forms of *A. aetherea*? The Solomon Island specimens (Figs.



Figures 297–309. *Argiope aetherea* (Walckenaer). 297–307. Female. 297, 300. Epigynum, ventral. 298, 301. Epigynum, posterior. 299, 302. Epigynum, lateral. 297–299. (Lae, Papua New Guinea). 300–302. (New Georgia, Solomon Islds.). 303, 306. Carapace and abdomen. 304, 307. Sternum and abdomen. 305. Abdomen, dorsal. 303–304. (Lae, Papua New Guinea). 305. (Buso, Papua New Guinea). 306–307. (New Georgia, Solomon Islds.). 308. Left male palpus, mesal. 309. Median apophysis from "below."

Figures 310–316. *Argiope picta* L. Koch. 310–314. Female. 310. Epigynum, ventral. 311. Epigynum, posterior. 312. Epigynum, lateral. 313. Carapace and abdomen. 314. Sternum and abdomen. 315. Left male palpus, mesal. 316. Median apophysis from "below."

Scale lines. 0.1 mm, except Figures 303–307, 313–314, 1.0 mm.

300–302, 306, 307) for a while were believed to be distinct. But other than having the sternum infused with some black pigment from the sides (also in some Australian specimens) and perhaps having slightly different proportions of the abdomen (Fig. 306), no consistent differences could be found.

The dorsum of the abdomen may have several wide transverse black bands, as in *A. reinwardti* (Fig. 305); may be completely white in preserved specimens; or bright yellow in living ones, always with a black posterior mark (Fig. 303). Australian specimens have similar variation in color of the abdomen but have the sternum a less bright yellow. There are also differences in the epigynum, especially in the configuration of the median and posterior lips of the openings; the rim is also thinner (Figs. 297, 300).

The female illustrated (Figs. 297–299, 303, 304) came from Lae, the banded abdomen from Buso (Fig. 303), and the male from Madang (Fig. 308), all Papua New Guinea. Figures 300–302, 306, 307 were made from a specimen from New Georgia Island, Solomon Islands.

Natural History. Argiope aetherea is common in gardens and disturbed coastal forests in Papua New Guinea; it is not found inland at Wau (M. H. Robinson, Lubin, and B. Robinson, 1974, and my own observations). Courtship and mating behavior are described in M. H. Robinson and B. Robinson, 1980.

Large New Guinea collections obtained between 1880 and 1914 and housed in the Berlin Museum have only a few specimens of *A. aetherea*. It must have been much less common along the coast at that time than more recently.

Distribution. Ambon, New Guinea to Solomon Islands, New Hebrides, northern Australia (Map 5).

Records. INDONESIA: *Kepulauan Aru.* Pulai Workai, Gomogomo, 2♀ (SMF); Poloe Enoe, ♀♀ (S. A. R. Prince Léopold Exped., IRSN). NEW GUINEA: *West Irian* [Djaya Pura]. Geelvink Baai, Legare; Merauke, 2♀ (SMF), 1956–1957, 3♀ (Br. Momelphus, IRSN); Menapi, Cape Vogel Peninsula. *Papua New Guinea.* Morobe Distr. Buso River; Finschhafen. Western Distr. Lake Daviumbu, Middle Fly Riv. Northern Distr. Oro Bay; Peria Cr., Kwagira Riv. [Kwagila Riv.]; Buna. Central Distr. St. Joseph's Riv. [Angabunga]. Madang Distr. Stephansort, Astrolabe Bay. Milne Bay Distr. Modewa Bay, W of Samarai. *D'Entrecasteaux Islands.* Goodenough Isl.; Normanby Isl. *Louisiade Archipelago.* Rossel Isl.; Mt. Sisa, Misima Isl.; Teste Isl., ♀ (AMS). *Trobriand Islands.* Hall Sound; Woodlark Isl.; Kiriwina Isl. *Admiralty Islands. Chagos Archipelago.* Sudest Island, Iamelele. *Bismarck Archipelago.* Maroon Isl., ♀ (AMS). *New Britain.* Matupi; Ralum, Simpsonhafen [Rabaul] (ZMB). *Solomon Islands.* New Georgia Island: Segi Point, Feb.–May 1944, 2♀, 5 juv. (C. O. Berg, MCZ, AMS); Bio, 1916, ♀ (W. M. Mann, MCZ). Guadalcanal: (many collections, AMNH, CAS). Russell Islands: (AMNH, AMS). Ysabel Island [Santa Isabel]: ♀ (N. S. Heffernan, AMS). Rendova: Hopongo, Nov. 1972, ♀ (N. L. H. Krauss, AMNH). *Santa Cruz Islands.* Reef Isl., 21 July 1926, ♀ (E. Troughton, AMS); Trevanton Isl., July 1926, ♀ (E. Troughton, AMS); Vanikoro, 9 Aug. 1926, ♀ (E. Troughton, AMS). *Torres Strait.* Cocoanut Isl., ♀ (H. H. B. Bradley, AMS); Sue Isl., 2♀ (H. H. B. Bradley, AMS). NEW HEBRIDES: Nov.–Dec. 1943, ♀, 2♂ (W. R. Enns, AMNH). *Espirito Santo.* Oct.–Dec. 1943, 3♀, May 1944, 12♀ (G. Banner, AMNH); 1943–1944, 3♀ (J. S. Haeger, AMNH). *Efate.* Jan.–Feb. 1973, 2♀ (N. L. H. Krauss, AMNH). *Erromagna Isl.* March–April 1973, 2♀ (L. Macmillan, AMNH). AUSTRALIA: *Northern Territory.* Barnard Isl.; Howard Springs Reserve [SE of Darwin]; Darwin; W. Alligator Mouth. *Queensland.* 27 km E Mount Garnet; Bellenden Ker; Palm Park [SE Byfield]; Rockhampton; Iron Range; Cairns; Wenlock; Portland Roads; Ravenshoe; Townsville; Fitzroy Isl.; Rainbow Beach; Whitsunday Isl. Gp.; Edmonton; Hayman

Isl.; Almaden; Helenvale, S of Cooktown; Mt. Dryander, N of Proserpine. *Great Barrier Reef*. Penrith Island, 2 Aug. 1969, ♀ (H. Heatwole, AMS); Lizard Isl., 25 Oct. 1967, ♀ (H. Heatwole, AMS). *Western Australia*. Derby Narth, ♀ (AMS); Sir Graham Moore Isl., 16–26 Feb. 1945, ♀ (B. Malkin, AMNH); Anjo Peninsula, 14–15 Feb. 1945, ♀ (B. Malkin, AMNH).

Argiope picta L. Koch

Figures 7, 8, 310–316; Map 5

Argiope picta L. Koch, 1871: 33, pl. 3, fig. 3, ♀. Two female syntypes from Port Mackay, 19°S, near Townsville, Queensland, Australia in the Godeffroy collection, Zoologisches Museum, Universität Hamburg, examined. Roewer, 1942: 743. Bonnet, 1955: 692. Chrysanthus, 1958: 237, figs. 1–6, 21, 23, ♀, ♂; 1971: 14. B. C. Robinson and M. H. Robinson, 1974: 145, pl. 2 (photo). M. H. Robinson, Lubin, and B. Robinson, 1974: 118. M. H. Robinson and B. Robinson, 1980: 10, 46, 50, 55, 71, 73–81, 85, 88–89, figs. 30–33.

Argiope principalis L. Koch, 1872: 207, pl. 18, fig. 5, ♀. Female holotype from Bowen [Fort Denisson], Queensland in the British Museum, Natural History, examined. Roewer, 1942: 743.

Argiope lugubris L. Koch, 1872: 209, pl. 18, figs. 6, 7. Male and juvenile female syntypes from Bowen [Fort Denisson], Queensland in the British Museum, Natural History, examined. Roewer, 1942: 742. Bonnet, 1955: 690. NEW SYNONYMY.

Argiope picta faorensis Thorell, 1881: 65. Female type from Pheo Faor, New Guinea in the Naturhistoriska Riksmuseet, Stockholm, examined.

?*Gea dubiosa* Strand, 1911b: 146, pl. 4, fig. 11, juv. Parts of juvenile holotype in very poor condition from between Gueramaguarin and Eresin, Teranga [Aru Island] in the Senckenberg Museum, Frankfurt, examined. NEW SYNONYMY.

Chaetargiope picta:—Kishida, 1936: 20.

Notes. Gea dubiosa is an early instar *Argiope* or *Gea* with a white spot in the middle posteriorly on the abdomen. It belongs to this species or perhaps to *Gea spinipes*, but it appears to come from a locality outside the range of *Gea spinipes*.

The specimens illustrated (Figs. 311–313) came from teak forest, Madang; Figure 310 from Wau, Papua New Guinea. Mascord (1978: 6) presents color photograph with the name *A. principalis*.

Diagnosis. This species can be confused with *A. aetherea*. Females differ by the distinct dorsal markings and the shield-shaped abdomen (Fig. 313). The sternum is not as bright orange as that of *A. aetherea*.

The epigynum is very similar to that of *A. aetherea* and quite difficult to separate consistently. Within the depression, the lateral edges of the posterior plate which form the anterior lip of the opening end closer to the midline (Fig. 310), and the rim is thicker than in *A. aetherea*.

The male differs from that of *A. aetherea* in having the spur at the very tip of the median apophysis in mesal view (Figs. 315, 316); in *A. aetherea* the spur is on the "upper" margin in mesal view.

Natural History. *Argiope picta* is found in shaded forest edge in the Wau area of Papua New Guinea. The web may have an X-shaped stabilimentum with the branches crossing the hub; most often the stabilimentum is absent (B. C. Robinson and M. H. Robinson, 1974). Females are common throughout the year (M. H. Robinson, Lubin, and B. Robinson, 1974). Courtship and mating behavior is described in M. H. Robinson and B. Robinson, 1980.

New Guinea collections obtained between 1880's and 1914 in the Berlin Museum are mostly *A. picta*, with very few *A. aetherea*. It must have been much more common at that time than it now is. The specimens had been misidentified as *A. aetherea* by F. Dahl.

Distribution. Moluccas, New Guinea to northern Australia and New Hebrides (Map 5).

Records. MOLUCCAS: *Morotai*. 6 Jan. 1945, ♀ (E. Reimschlisel, AMNH); 1944, ♂ (G. Banner, AMNH). *Ceram*. Wahaari [? Wahai], 1906–1907, ♀ (T. Barbour, MCZ). *Halmahera*. Djailolo, 16 Feb. 1929, ♀ doubtful det. (S. A. R. Prince Léopold, IRSN). *Aru*. Soengi Manoembaai, 26 March 1929, ♀♀ (S. A. R. Prince Léopold, IRSN). NEW GUINEA: *West Irian* [Djaya Pura]. Hollandia [Djaya]; Merauke, 1956–1957, ♀, ♂ (Br. Monulf, MCZ); Fakfak, 6

July 1939, ♀ (R. G. Wind, MCZ); Maffin Bay, Sept. 1944, (E. S. Ross, CAS); Dec. 1944, ♂ (G. B. Sirotiak, Tana [? Tanamerah] Aug. 1910, ♀ (Moszkowski, ZMB); Teba, May 1910, ♀ (Moszkowski, ZMB). Seroel, Japen 6 March 1929, ♂ (S. A. R. Prince Léopold, IRSN). Mindiptana, 1959, ♂ (Br. Monulf, IRSN). *Papua New Guinea*. Many collections. *New Britain*. Herbertshöhe [? Kokopo], March 1903, ♀ (Dempwolff, ZMB); Ralum [Gazelle Penins.], June 1896, ♀ (F. Dahl, ZMB). SOLOMON ISLANDS: *Isabel Island*. 1 June 1925, ♀ (N. S. Heffernan, AMS); 3♀ (Albatross Exped., NMW). *Russell Islands*. Dec. 1944, ♀♂ (R. B. Eads, AMNH). *New Georgia*. Ugi, ♀ (AMS). Malaita, Auki, Dec. 1972, ♀ (N. L. H. Krauss, AMNH). Gizo, Nov. 1972, ♀ (N. L. H. Krauss, AMNH). *Guadalcanal*. (several collections, AMNH, CAS, MCZ). *Santa Cruz*. ♀ (W. M. Mann, MCZ); Pamira, ♀ (W. M. Mann, MCZ); Trevanion Isl. off Santa Cruz Isl., 10:30 S, 166:00 E, ♀ (Troughton and Livingston, AMS). AUSTRALIA: *Queensland*. Townsville; Cooktown; Edmonton; Iron Range; Mossman Riv. Gorge; Telegraph Crossing; Koak; Cairns; Redlynch; Kuranda; 10 km W Gordonvale; 5 km S Cardwell; Aloomba; Innisfail; Fitzroy Island; Edmonton; Bellenden Ker. *Northern Territory*. Howard Springs Reserve, 24 km SE Darwin, shrubs, 23 June 1923, ♀ (J. A. Beatty, BC); Darwin, March 1945, ♀ (B. Malkin, AMNH); E Alligator Riv., May 1979, ♂♂ (P. Davie, QMB). *Great Barrier Reef*. Lizard Isl., 27 Sept. 1967, ♂ (AMS); 8 km W Ravenshoe, 780 m, 6 Nov. 1962 (E. S. Ross, CAS); Thursday Isl., ♂ (AMS). NEW HEBRIDES: Aore Island, April 1944, ♀ (W. L. Nutting, MCZ).

Argiope radon new species

Figures 317–323; Map 5

Argiope sp. "N.T. riverine," M. H. Robinson and B. Robinson, 1980: 10, 50, 85–88, figs. 39–41, ♀ (web photo).

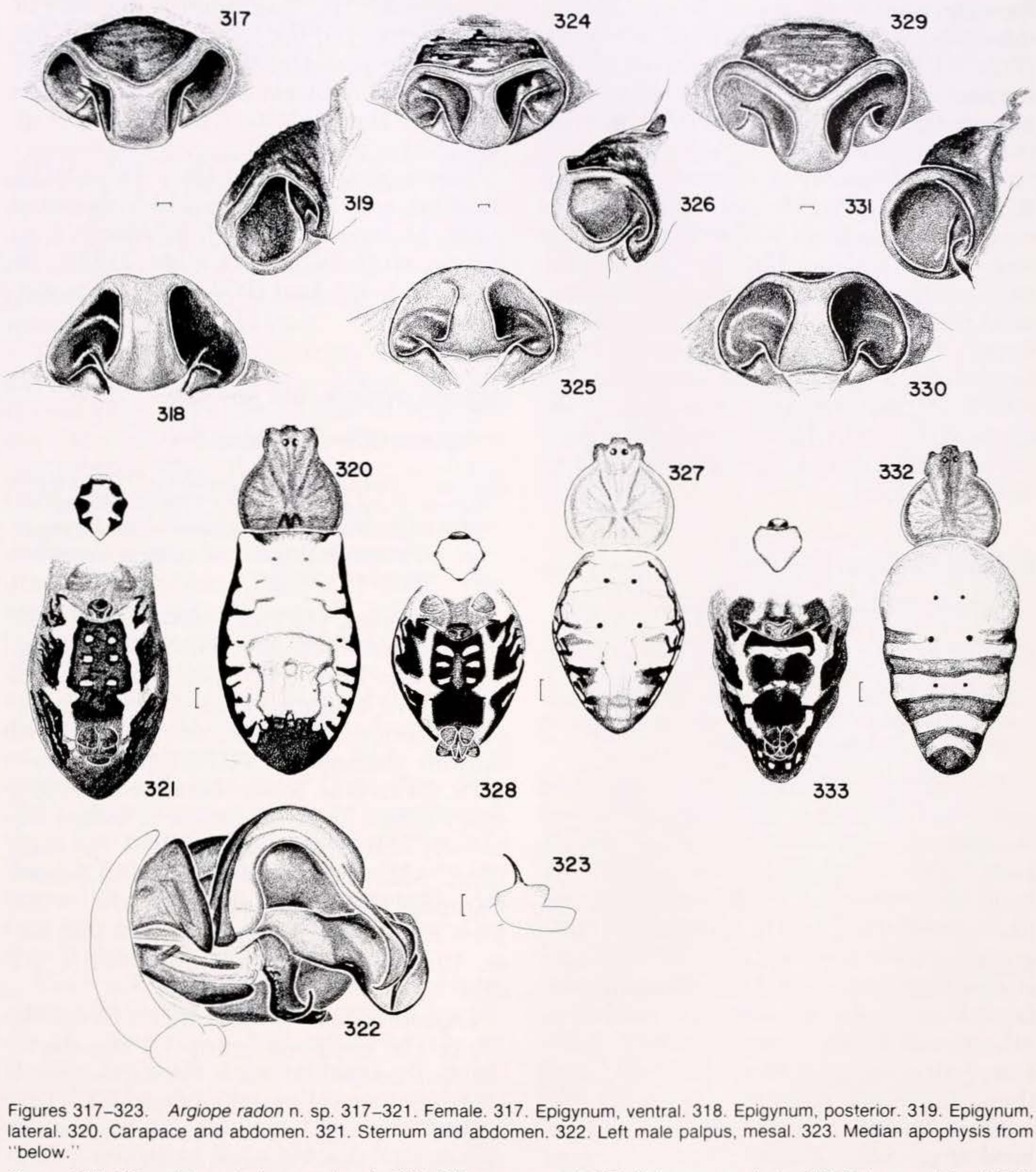
Holotype. Female; two males, one female, two juvenile paratypes from Radon Creek [12.45°S, 132.53°E], rainforest, Northern Territory, Australia, Nov. 1979, in the Queensland Museum, Brisbane, No. S906. The specific name is a noun in apposition after the type locality.

Description. Female. Carapace streaked dark brown, covered by white down. Sternum black, middle white (Fig. 321). Dorsum of abdomen mottled white, covered by white setae, framed by black, and posterior tip black (Fig. 320). Venter with two white lines enclosing three pairs of black spots in black area (Fig. 321). Anterior lateral eyes 0.5 diameter of anterior median eyes; posterior median and posterior lateral eyes subequal to anterior median eyes. Anterior median eyes their diameter apart, two diameters from laterals. Posterior median eyes slightly more than their diameter apart, three diameters from laterals. The abdomen is elongate, with anterior lateral humps. Total length, 18.0 mm. Carapace, 6.3 mm long, 5.1 mm wide. First femur, 10.5 mm; patella and tibia, 11.3 mm; metatarsus, 11.3 mm; tarsus, 2.3 mm. Second patella and tibia, 10.8 mm; third, 6.0 mm; fourth, 9.9 mm.

Male. Carapace yellow-brown. Legs yellow-brown, not banded. Dorsum of abdomen white; second specimen with a dark folium. Venter with two white longitudinal lines, gray in between. Carapace nearly circular. Anterior lateral eyes 0.5 diameter of anterior median eyes; posterior median eyes subequal to anterior medians; posterior laterals 0.9 diameter. Anterior median eyes 0.7 diameter apart, 0.7 from laterals. Posterior median eyes 1.2 diameters apart, more than two diameters from laterals. The chelicerae are small and reduced. Total length, 6.0 mm. Carapace, 3.2 mm long, 3.2 mm wide. First femur, 4.2 mm; patella and tibia, 4.7 mm; metatarsus, 4.7 mm; tarsus, 1.4 mm. Second patella and tibia, 4.5 mm; third, 2.3 mm; fourth, 3.5 mm.

Note. The palpal embolus of one male is broken off and missing.

Diagnosis. The female can be separated from *Argiope aetherea* by the frame-like black marks and shield-shaped abdomen (Fig. 320). The anterior bulge of



Figures 317–323. *Argiope radon* n. sp. 317–321. Female. 317. Epigynum, ventral. 318. Epigynum, posterior. 319. Epigynum, lateral. 320. Carapace and abdomen. 321. Sternum and abdomen. 322. Left male palpus, mesal. 323. Median apophysis from "below."

Figures 324–328. *Arigope truk* n. sp., female. 324. Epigynum, ventral. 325. Epigynum, posterior. 326. Epigynum, lateral. 327. Carapace and abdomen. 328. Sternum and abdomen.

Figures 329–333. *Argiope ponape* n. sp, female. 329. Epigynum, ventral. 330. Epigynum, posterior. 331. Epigynum, lateral. 332. Carapace and abdomen. 333. Sternum and abdomen.

Scale lines. 0.1 mm, except Figures 320, 321, 327, 328, 332, 333, 1.0 mm.

the epigynum is wider and the rim on each side more curved than that of *A. aetherea*. (Figs. 317–319). The males differ by the median apophysis of *Argiope radon* having a large spur attached to near its bend (Figs. 322, 323).

Natural History. M. H. Robinson and B. Robinson (1980) report threads spanning from riverbank to riverbank above a river nowhere more than 5 m wide. The webs were aggregated and shared structural lines. The stabilimentum was present in only 3 of 32 webs, and one vertical line was broken at the hub; the webs are large (100 × 75 cm), with eccentric hubs in the upper half. Courtship and mating behavior is reported in M. H. Robinson and B. Robinson (1980).

Argiope truk new species

Figures 324–328; Map 5

Holotype. Female from Moen, Truk Island, Caroline Islands, in man-made cave, 12 June 1973, ♀ (J. A. Beatty and J. W. Berry) in the B. P. Bishop Museum, Honolulu. The specific name is a noun in apposition after the type locality.

Description. Carapace light, streaked and covered with white down. Sternum completely yellow-white. Coxae black. Legs light and dark brown, indistinctly banded. Dorsum of abdomen with irregular symmetrical marks forming a frame around light anterior (Fig. 327). Venter contrastingly banded (Fig. 328). Anterior lateral eye diameter equal to radius of others, which are subequal in size. Anterior median eyes 1.8 diameters apart, more than 2.5 from laterals. Abdomen oval without humps or lobes and pointed behind (Fig. 327). Total length, 14.5 mm. Carapace, 5.6 mm long, 4.5 mm wide. First femur, 9.0 mm; patella and tibia, 9.3 mm; metatarsus, 8.9 mm; tarsus, 2.0 mm. Second patella and tibia, 9.0 mm; third, 4.9 mm; fourth, 7.9 mm.

Diagnosis. Argiope truk differs from the sympatric *A. appensa* by the nearly straight rim of the epigynum (Fig. 324), lacking the broken appearance of that in *A. appensa*. The epigynum is like that of *A. aetherea*, but the species differs by not having the posterior tip on the dorsum of the abdomen black, and by having the shape of the abdomen more oval (Fig. 327).

Paratypes. CAROLINE ISLANDS: *Truk Islands.* Moen, on roadside shrubs at night, 11 June 1973, 2♀ (J. W. Berry, J. A. Beatty, MCZ, BC). Mt. Uniböt, Tol Isl., 30 Dec. 1952, ♀, 1 Jan. 1953, ♀ (J. L. Gressitt, BPBM).

Argiope ponape new species

Figures 329–333; Map 5

Holotype. Female from Agricultural Experiment Station, Colonia, Ponape, Caroline Islands, no. BPBM 12513 in the B. P. Bishop Museum, Honolulu. The specific name is a noun in apposition after the type locality.

Description. Carapace dark brown with white down. Sternum yellow-white (Fig. 333). Legs brownish black, not banded. Dorsum of abdomen transversely banded on posterior (Fig. 332; anterior part of dorsum damaged). Venter of abdomen with transverse white bands connecting longitudinal lines. Abdomen is widest anteriorly and lobed posteriorly on the sides (Figs. 332, 333). Total length, 15.8 mm. Carapace, 5.8 mm long, 5.0 mm wide. First leg (missing); second patella and tibia, 10.1 mm; third, 5.6 mm; fourth, 9.2 mm.

Diagnosis. The species differs from others of the *aetherea* group by the dorsal banding on the abdomen, the narrow black and white stripes being of almost equal width (Fig. 332), and by the two white transverse lines connecting the two paraxial ventral lines (Fig. 333). Unfortunately, only one specimen is available, which has the anterior of the abdomen damaged.

Gea C. L. Koch, 1843

Gea C. L. Koch, 1843: 101. Type species by monotypy *Gea spinipes* C. L. Koch from "Puloloz, Os-

tindien" [? Pulo Lozin, southern Burma, now southern tip of Thailand, Gulf of Siam].

Ebaea L. Koch, 1872: 130. Type species *E. praecincta* L. Koch [=*Gea heptagon* (Hentz)] designated by Bonnet, 1956: 1641.

Note. Unfortunately, C. L. Koch's specimen was a juvenile in shrivelled condition, with uncertain locality. Since the generic name *Gea* is in use, it is best to make the neotype for the name of the type species a specimen belonging to a widespread species (see below).

Diagnosis. Gea differs from *Argiope* by having the posterior eyes about equally spaced (Figs. 348, 353); those of *Argiope* have the posterior medians farther from the laterals than the posterior medians from each other. *Gea* differs from both *Argiope* and *Neogea* by having the anterior head region bearing the posterior median eyes swollen (Figs. 334–337). The epigynum is usually weakly sclerotized, the openings sometimes hidden (Figs. 338, 376, 381) and appearing more elaborate and specialized than those of most *Argiope* species. The male palpus has a longer median apophysis (Figs. 375, 388), a more elaborate conductor (Figs. 344, 361, 388), again appearing more specialized than the palpus of *Argiope* species, although I expect that some species are intermediate between the two genera. All *Gea* species are relatively small, females 5 to 9 mm total length.

Coloration. While many *Argiope* species have the carapace covered by silver or white down, this is not usually so in *Gea* (or does it get rubbed off more easily?). The abdomen is less contrastingly marked on the dorsum than in *Argiope* species and often has a black folium at the posterior end (Figs. 348, 353, 358). In place of the two ventral paraxial white lines in *Argiope*, *Gea* species have a series of white splotches (Figs. 342, 354, 372).

Structure. The chelicerae are relatively weak (Figs. 334–337). The abdomen of most species is shield-shaped (rarely oval), widest anteriorly and often with a pair of small anterolateral humps (Figs. 348, 353).

Behavior. We have most knowledge of *Gea heptagon* and *Gea eff*. *Gea eff* has a stabilimentum (M. H. Robinson and B. Robinson, 1980); *G. heptagon* makes a vertical web low in grass, the orb usually lacking a stabilimentum (Levi, 1968). When disturbed, *Gea heptagon* drops out of the web and rapidly changes color once on the ground (E. Sabath, 1970).

Species and Distribution. There are seven species in the Pacific region (Map 6); one of these species, *G. heptagon*, is also known from the Americas (Levi, 1968), the only *Gea* species occurring in America. Roewer (1942) lists four species from Africa; but these may be misplaced or be synonyms of the widespread *Gea heptagon*.

Misplaced species:

Gea virginis Strand, 1911b: 147. Female holotype from Aru Island in the Senckenberg Museum, Frankfurt, examined, is a *Leucauge*.

KEY TO PACIFIC AREA *GEA* FEMALES

1. Epigynum with a distinct septum visible in ventral view separating two depressions (Figs. 345, 350, 355, 362, 368) 2
– Epigynum without septum visible in ventral view (Figs. 338, 376, 381) 5

2(1). Septum continuing anteriorly into a rim which frames depressions completely as in Figure 350; overhang of depressions transparent (Figs. 350, 351); Burma to New Guinea, Borneo, Philippines (Map 6) ..... *subarmata*
– Septum continuing posteriorly to surround openings as posterior plate (Figs. 345, 355, 362, 365) or not surrounding opening 3

3(2). Septum thick, disappearing anteriorly and transforming posteriorly into hemispherical posterior plate (Figs. 345, 346); New Guinea (Map 6) ..... *argiopides*
– Septum narrow and continuing anteriorly into a transverse rim and posteriorly into the posterior plate (Figs. 355, 362, 365) 4

4(3). Posterior plate wider than long in posterior view (Figs. 363, 366, 369); India, Malay Peninsula, Sumatra, Borneo (Map 6) ..... *spinipes*
– Posterior plate longer than wide with rim visible on each side in posterior view (Fig. 356); New Guinea (Map 6) ..... *eff*

5(1). Epigynum with a transverse anterior lip (Fig. 338); septum visible in posterior view (Fig. 339); widespread (Map 6) ..... *heptagon*

– Epigynum a knob without transverse anterior lip (Figs. 376, 381) 6

6(5). Septum visible in anterior or lateral view only (Figs. 381, 383); eastern Australia (Map 6) ..... *theridioides*

– No septum visible in anterior or lateral view (Figs. 376, 378); New Guinea (Map 6) ..... *bituberculata*

KEY TO PACIFIC AREA *GEA* MALES

(The males of *Gea argiopides*, *G. bituberculata*, and *G. subarmata* are unknown.)

1. Embolus coiling on distal surface of palpus; conductor enclosing and surrounding bulb (Figs. 343, 344); widespread (Map 6) ..... *heptagon*

– Embolus coiling on mesal side of bulb; conductor projecting (Figs. 360, 375, 387) 2

2. Conductor tuberculate (Figs. 387, 388); long median apophysis without spur (Figs. 387, 388); eastern Australia (Map 6) ..... *theridioides*

– Conductor smooth (Figs. 360, 375); median an apophysis with spur 3

3. Conductor hiding most of embolus in mesal view (Figs. 360, 375); spur almost as long as median apophysis (Fig. 360); New Guinea (Map 6) ..... *eff*

– Conductor only partly hiding embolus in mesal view (Fig. 375); spur on small thorn on long median apophysis (Fig. 375); India, southeastern Asia, Sumatra, Borneo (Map 6) ..... *spinipes*

Gea heptagon (Hentz)

Figures 334, 335, 338–344; Map 6

Epeira heptagon Hentz, 1850: 20, pl. 3, figs. 5, 6, ♀♂. Type specimen from North Carolina and Alabama, United States, destroyed.

Ebaea praecincta L. Koch, 1872: 130, pl. 10, figs. 2, 3, ♀, ♂. Two female syntypes from Upolu, Samoa in the Zoologisches Museum, Universität Hamburg, examined. NEW SYNONYMY.

Gea praecincta:—Simon, 1895: 765, fig. 844. Roewer, 1942: 746. Bonnet, 1957: 1983. NEW SYNONYMY.

Gea heptagon:—Levi, 1968: 324, figs. 1–24, map 1.

Diagnosis. The female can be separated from other *Gea* species by the shape of the epigynum: a prominent straight rim with a transverse anterior pocket and openings facing posterodorsally (Figs. 338–340).

The male can be separated from other *Gea* species by the apical position of the embolus whose tip is held by a gently curved conductor which surrounds the bulb (Figs. 343, 344).

Variation. Some specimens from Australia have anterior humps on the abdomen, others do not (Fig. 341).

Note. This is the first time that the species has been recorded outside of the Americas. Since it is the only American *Gea*, with several other Australian *Gea* species, I suspect it originally came from Australia. The illustrations were made from a specimen from Darwin, Northwest Territory.

Distribution. Southeastern United States, West Indies (Levi, 1968), South Pacific, Australia (Map 6).

Records. MARIANA ISLANDS: *Saipan.* Sugar King Monument, 30 June 1969, ♀ (E. Sabath, MCZ). CAROLINE ISLANDS: *Truk Isl.* Moen, on abandoned building, 12 June 1973, ♀ (J. A. Beatty, J. W. Berry, BC). AUSTRALIA: *Northern Territory.* Darwin, 3–13 Feb. 1945, ♀, ♂ (B. Malkin, AMNH). *Queensland.* Gordonvale, ♂ (AMS); Rockhampton, 2♀ (ZMH). *New South Wales.* Sydney, ♂ (ZMH).

Gea argiopides Strand

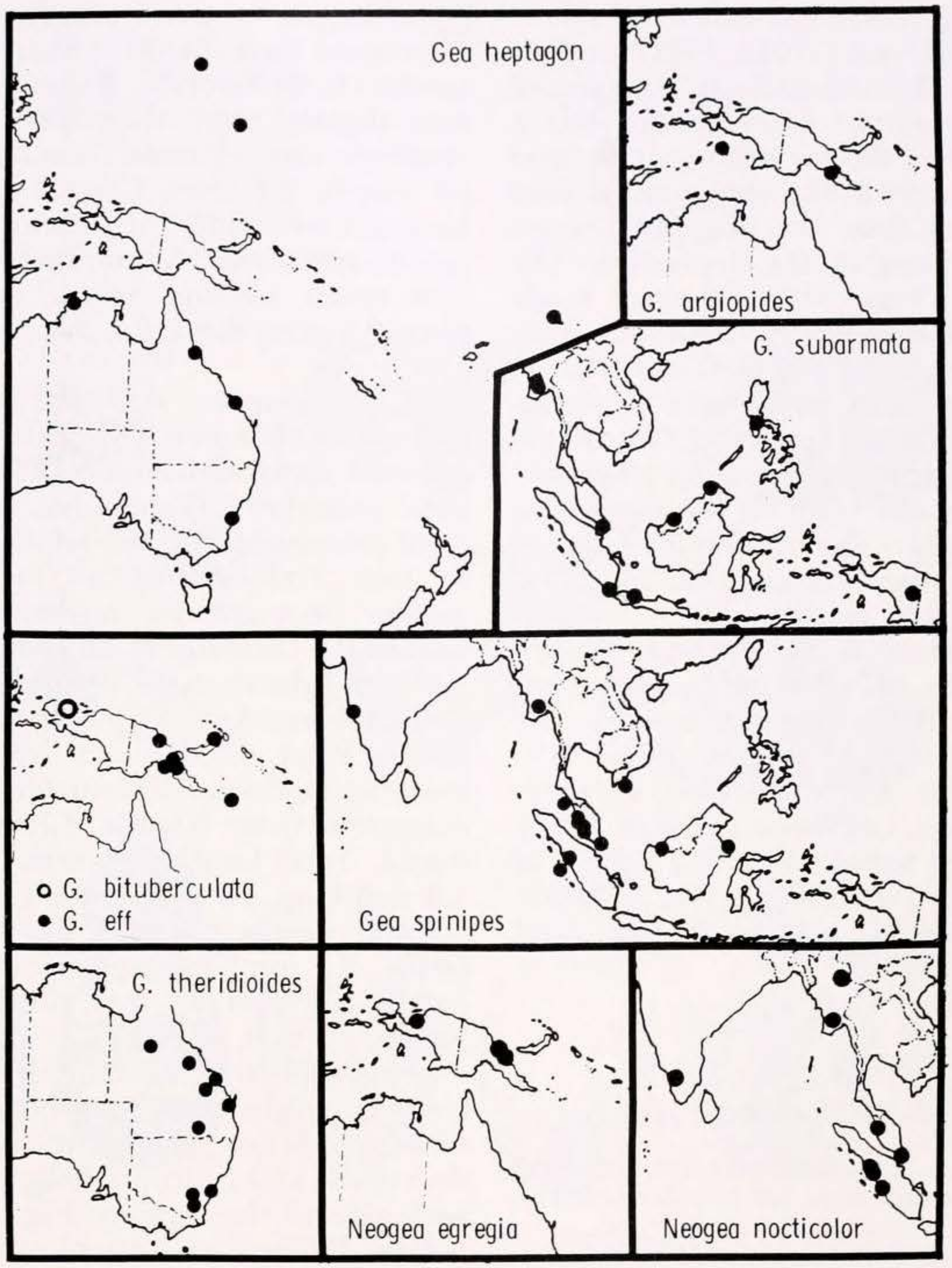
Figures 345–349; Map 6

Gea argiopides Strand, 1911b: 146, pl. 4, fig. 10, pl. 5, fig. 51, ♀. Female holotype from Seltoeti Kobroor, Aru Island in the Senckenberg Museum, Frankfurt, examined. Roewer, 1942: 746. Bonnet, 1957: 1982.

Note. The illustrations were made from specimens from the Central Province, Papua New Guinea.

Diagnosis. Gea argiopides differs from other *Gea* species by the distinct epigynum: a straight anterior edge of the rim, lacking a posterior edge, and a septum continuing posteriorly into a large hemispherical posterior plate (Figs. 345, 346).

Record. PAPUA NEW GUINEA: *Cen-*



Map 6. Distribution of *Gea* and *Neogea* species, and the Pacific distribution of *G. heptagon*.

tral Prov. Sogeri Plateau, near Sogeri, 1000 m, 1 May 1980, ♀ (Y. Lubin, MCZ).

Gea subarmata Thorell

Figures 350–354; Map 6

Gea subarmata Thorell, 1890: 101. Female syntype from Sarawak in the Museo Civico di Storia Naturale, Genova, and two female syntypes from Singapore and two from Java in the Naturhistoriska Riksmuseet, Stockholm, examined. Roewer, 1942: 746. Bonnet, 1957: 1984.

Gea catenulata Thorell, 1898: 339. Female holotype from Teinzo [? Teinsan], Burma in the Museo Civico di Storia Naturale, Genova examined. Roewer, 1942: 745. Bonnet, 1957: 1982. NEW SYNONYMY.

Gea brongersmai Chrysanthus, 1971: 18, figs. 26–29, ♀. Female paratype from Tanah Merah, Star Mountains Exped., West New Guinea in the Rijksmuseum van Natuurlijke Historie, Leiden, examined. NEW SYNONYMY.

Gea corbetti Tikader, 1982: 109, figs. 205–210, ♀. Female holotype from Corbett National Park, Dhikala, Dist. Pauri, Uttar Prades State, India in the Zoological Survey of India, Calcutta, unavailable. NEW SYNONYMY.

Note. The specimens called *G. subarmata* by Kulczyński (1910, 1911) are *Gea eff*; they were misidentified. The type of *Gea brongersmai* Chrysanthus has a slightly wider, shorter septum. Chrysanthus' illustration of the epigynum is poor and does not show the diagnostic transparent overhang of the depression. The illustrations (Figs. 351–354) were made from the holotype of *Gea catenulata*, Figure 350 from a syntype of *G. subarmata*.

Diagnosis. *Gea subarmata* is distinguished from other species of *Gea* by the rim of the circular epigynum completely surrounding and framing the depression (Figs. 350, 351). The overhanging part of the rim is transparent and thus its edge is quite difficult to see.

Distribution. India, Burma, Philippines, Borneo, to New Guinea (Map 6).

Records. BURMA: Tharrawaddy, 4♀ (Oates, BMNH); 2♀ (Oates, NRS). SINGAPORE: 2♀ (Kinberg, NRS). PHILIPPINES: *Luzon.* Los Baños, ♀ (Baker, MCZ). MALAYSIA: *Sabah.* Manuluk Isl., Kota Kinabalu, 29 July 1979, ♀ (MC). INDONESIA: *Sebesi Isl.*, 1921, ♀ (AMNH). *Java.* 2♀ (Kinberg, NRS).

Gea eff new species

Figures 336–337, 355–361; Map 6

Gea subarmata:—Kulczyński, 1911: 476, pl. 20, figs. 48, 49. Misidentification; not *G. subarmata* Thorell.

Argiope "F":—B. C. Robinson and M. H. Robinson, 1974: 146. M. H. Robinson, Lubin, and B. Robinson, 1974: 126. M. H. Robinson and B. Robinson, 1980: 71, 111, figs. 55–57, ♀.

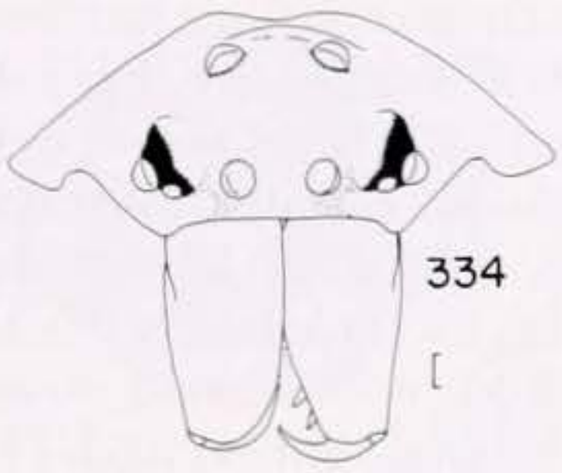
Holotype. Female and three female paratypes and fragments of male from McAdam Park, near Wau, Morobe Province, Papua New Guinea, 12 June 1974 (M. Robinson) in the Museum of Comparative Zoology. The specific name is an arbitrary combination of letters.

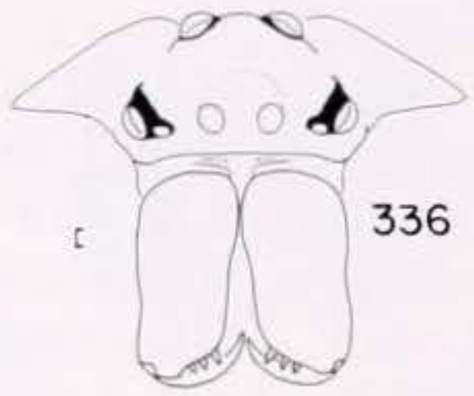
Description. Female. Carapace brown, head light. Sternum with longitudinal white stripe on black (Fig. 359). Legs banded. Dorsum of abdomen with transverse bands, posterior with black folium (Fig. 358). Anterior lateral eyes 0.5 diameter of anterior medians; others subequal in size. Anterior medians slightly more than their diameter apart, their diameter from laterals. Posterior median eyes slightly more than their diameter apart, the same distance from laterals. Total length, 6.6 mm. Carapace, 3.2 mm long, 2.5 mm wide. First femur, 3.3 mm; patella and tibia, 3.8 mm; metatarsus, 2.9 mm; tarsus, 1.3 mm. Second patella and tibia, 3.8 mm; third, 2.2 mm; fourth, 3.2 mm.

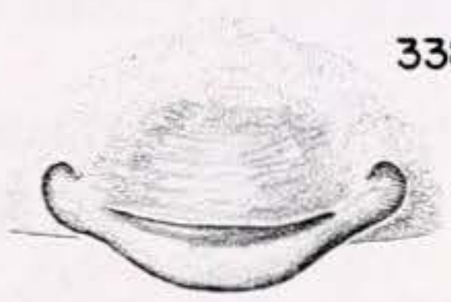
Male. Carapace, sternum, legs beige. Dorsum of abdomen with scattered white pigment spots; indications of a dark folium posteriorly. Venter has white pigment concentrated in two white spots, side by side. Posterior median eyes slightly smaller than anterior medians; anterior laterals 0.5 diameter of anterior medians; posterior laterals same diameter as anterior medians. Anterior medians their diameter apart, 0.5 diameter from laterals. Posterior medians 1.5 diameters apart, 1.5 diameters from laterals. Chelicerae reduced. Total length, 3.0 mm. Carapace, 1.9 mm long, 1.7 mm wide. First femur, 2.2 mm; patella and tibia, 2.5 mm; metatarsus, 2.2 mm; tarsus, 0.9 mm. Second patella and tibia, 2.3 mm; third, 1.3 mm; fourth, 1.8 mm.

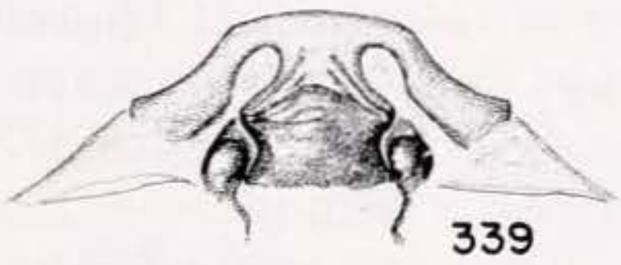
Diagnosis. *Gea eff* can be separated from the other species by the epigynum, whose posterior plate curves into the depression and is deeply hollowed out on each side of the septum (Fig. 355). The palpus differs from that of other species by having a relatively short median apophysis with a long straight side spur from the mesal end (Figs. 360, 361). The conductor tip is large and smooth (Figs. 360, 361).

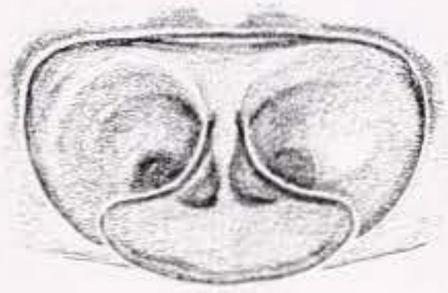
Natural History. This species has been collected sweeping in coconut plantations and forest. B. C. Robinson and M. H. Robinson (1974) report that *G. eff* builds its web below the upper margins of herb patches in tall grass (M. H. Robinson, Lubin, and B. Robinson, 1974). It has a cruciform stabilimentum whose branches do not cross the hub (M. H. Robinson and B. Robinson, 1980). Courtship and mating are

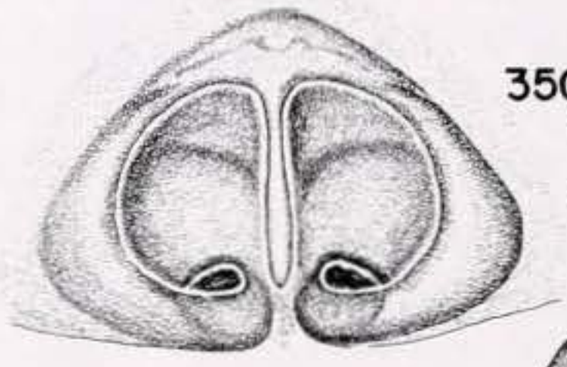


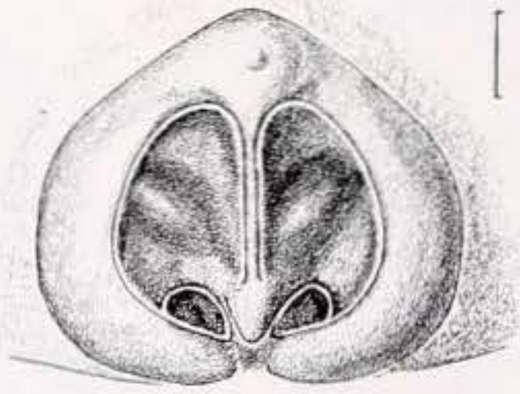


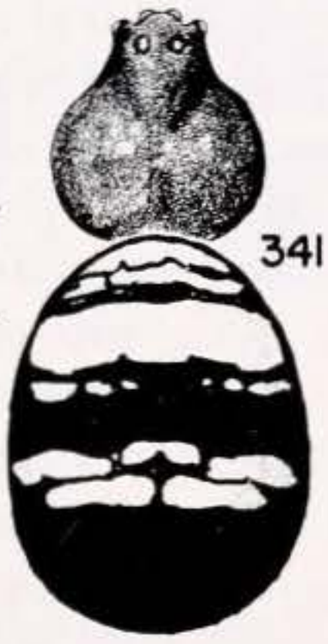


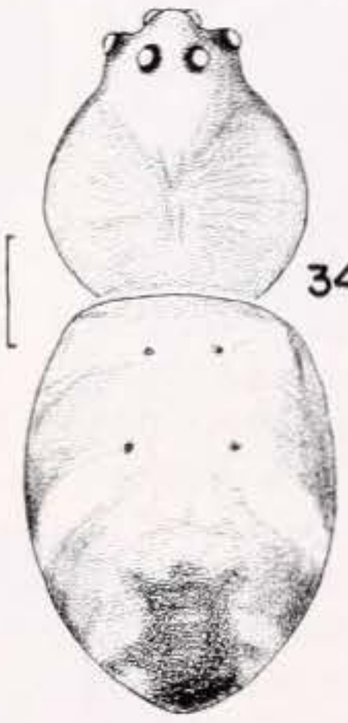


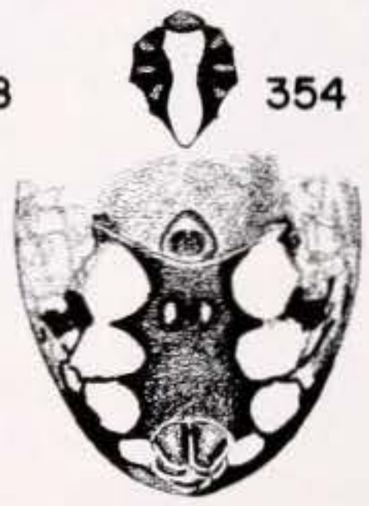


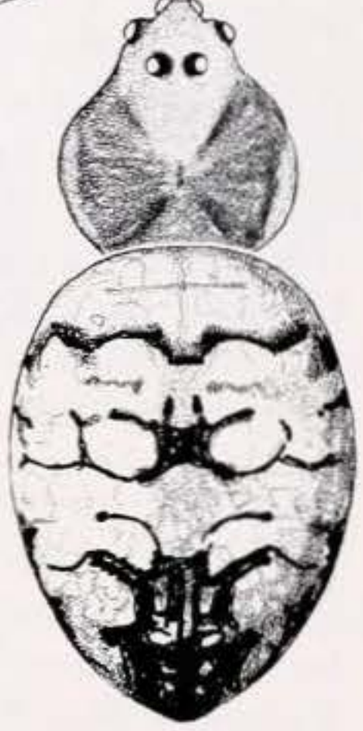












Figures 334–337. *Gea*, female eye region and chelicerae, face view and lateral. 334, 335. *G. heptagon*. 336, 337. *G. eff.*

Figures 338–344. *Gea heptagon* (Hentz). 338–342. Female. 338. Epigynum, ventral. 339. Epigynum, posterior. 340. Epigynum, lateral. 341. Carapace and abdomen. 342. Sternum and abdomen. 343, 344. Left male palpus. 343. Mesal. 344. Ventral.

Figures 345–349. *Gea argiopides* Strand, female. 345. Epigynum, ventral. 346. Epigynum, posterior. 347. Epigynum, lateral. 348. Carapace and abdomen. 349. Sternum and abdomen.

Figures 350–354. *Gea subarmata* Thorell, female. 350, 351. Epigynum, ventral. 352. Epigynum, lateral. 350. (Sarawak). 351, 352. (Burma). 353. Carapace and abdomen. 354. Sternum and abdomen.

Scale lines. 0.1 mm, except Figures 341, 342, 348, 349, 353, 354, 1.0 mm.

described in M. H. Robinson and B. Robinson, 1980.

Paratypes. PAPUA NEW GUINEA: *Madang Distr.* 10 km N Madang, 20 March 1979, ♀ (H. Levi, Y. Lubin, B. Robinson, MCZ); 40 km S Madang, 21 March 1979, ♀ (H. Levi, Y. Lubin, AMS); near Alexishafen, 23 March 1979, ♂ (H. Levi, B. Robinson, MCZ). *Morobe Distr.* Oomsis, 35 km W Lae-Bulolo road, 26–28 April 1959, ♀ (Archbold Exped., AMNH); Wau, 1200 m, July 1974, ♀ (E. W. Classey, MC). *Central Distr.* Galley Reach. Aroana Estate, 19–25 March 1966, ♀ (G. Bush, MCZ). *Louisiade Archipelago.* Sudest Isl., Sept. 1956, ♀ (Archbold Exped., AMNH). *New Britain.* ♀ (NMW).

Gea spinipes C. L. Koch

Figures 362–375; Map 6

Gea spinipes C. L. Koch, 1843: 101, pl. 823. Shrivelled juvenile from "Puloloz, Ostindien,"* lost, probably destroyed.

Pronous chelifer Hasselt, 1882: 24, pl. 2, fig. 3, pl. 4, figs. 7–10, ♂. Male holotype (without abdomen) from Sumatra in the Rijksmuseum van Natuurlijke Historie, Leiden, examined. NEW SYNONYMY.

Gea decorata Thorell, 1890: 104. Female syntype from Singeibulu, Sumatra in the Museo Civico di Storia Naturale, Genova, examined. Workman, 1896: 23, pl. 23, ♂. Roewer, 1942: 745. Bonnet, 1957: 1982. NEW SYNONYMY.

Gea festiva Thorell, 1895: 166. Two female syntypes from Tharawaddy, Burma in the British Museum, Natural History, and one female from same locality in Naturhistoriska Riksmuseet, Stockholm, examined, one female syntype from Singapore in the National Museum of Ireland, not examined. Roewer, 1942: 745. Bonnet, 1957: 1982. NEW SYNONYMY.

Gea festiva nigrifrons Simon, 1901: 59. Female type from Yala, near Battani, Thailand and Bukit Bekit, Jalor, lost; not in Paris or London collections.

Neotype. Female from Fraser's Hill, Malaysia, 1 June 1981 (W. C. Sedgwick) in the Museum of Comparative Zoology.

Notes. The generic name *Gea* has been used since the 1890's, although Koch's description of *G. spinipes*, the type species of the generic name, is not recognizable. For stability's sake, a neotype is here designated from Malaysia belonging to the commonest and most widespread southeast Asian species of *Gea*. Simon and Thorell cite the name *Gea spinipes*, but had apparently no determined specimens of this species.

Pronous chelifer had previously been synonymized with *Argiope catenulata* (Roewer, 1942).

The illustrations (Figs. 362–364, 371, 372) were made from specimens from Karnatake, India; Figures 365–367, 373, 374 from a syntype of *Gea festiva* Thorell from Burma; Figures 368–370 from a syntype of *Gea decorata* Thorell, Figure 375 from a specimen from Vietnam.

Diagnosis. Gea decorata can be separated from other *Gea* species by the dorsal abdominal pattern having a median row of black-framed white patches, and smaller white patches to the sides (Figs. 371, 373). It differs from *G. eff* by having the posterior plate of the epigynum wider than long (Figs. 363, 366, 369); its sides often completely fill the depression and curl within it (Fig. 365). The epigynum of *Gea decorata* could be confused with that of *Argiope doboensis* and *A. dietrichae*, but the larger posterior median eyes and abdomen pattern separate the species.

The male palpus, unlike that of other *Gea* species but like *G. theridioides*, has an enormous median apophysis projecting under the conductor (Fig. 375). It differs from that of *G. theridioides* by having a smaller conductor (Fig. 375).

Distribution. Indochina to India, Indonesia, Borneo (Map 6).

Records. VIETNAM: Con Son Isl., Nov. 1966, ♂ (MCZ). BURMA: Tharrawaddy, ♀ (Oates, NRS). MALAYSIA: *Malay Peninsula. Perak*, Maxwell's Hill, 17 Feb. 1974, ♀ (W. C. Sedgwick, MCZ); Fraser's Hill, 8 June 1976, ♀ (W. C. Sedgwick, SC); Johor [Johore], Layang-Layang, remnant jungle, 25 July 1979, ♀ (J. and F. Murphy,

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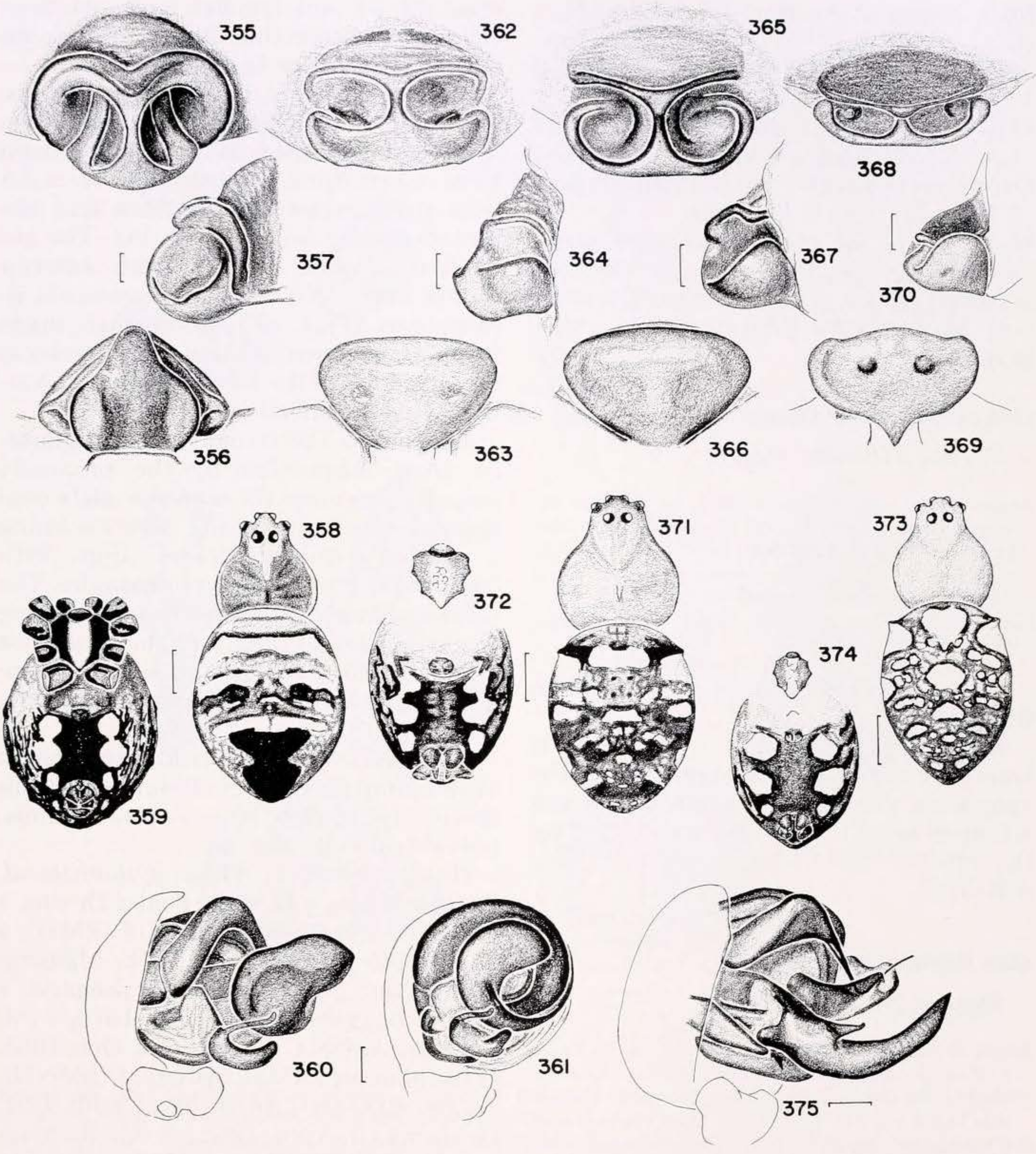
* Ostindien—Name für Vorder-u. Hinterindien und den Malaiischen Archipel [Name for India, Indochina, and Indonesia] (Knaurs Lexikon, 1978 edit.). The locality is most likely in Malaysia or Indonesia because "Pulo" = island; it may have been Pulo Lozin (southern Burma, now southern Thailand), the "in" (German "In." = Island) having been dropped.



Figures 355–361. *Gea eff* n. sp. 355–359. Female. 355. Epigynum, ventral. 356. Epigynum, posterior. 357. Epigynum, lateral. 358. Carapace and abdomen. 359. Sternum and abdomen. 360, 361. Left male palpus. 360. Mesal. 361. Ventral.

Figures 362–375. *Gea spinipes* C. L. Koch. 362–374. Female. 362, 365, 368. Epigynum, ventral. 363, 366, 369. Epigynum, posterior. 364, 367, 370. Epigynum, lateral. 362–364. (India). 365–367. (Burma). 368–370. (Sumatra). 371, 373. Carapace and abdomen. 372, 374. Sternum and abdomen. 371, 372. (India). 373, 374. (Burma). 375. Left male palpus, mesal.

Scale lines. 0.1 mm, except Figures 358, 359, 371–374, 1.0 mm.

MC). *Selangor*. Kepong, 22 April 1921, ♀ (H. C. Abraham, ZRC); Port Dickson, Dec. 1924, ♀ (ZRC). *Sarawak*. Kuching, 4 April 1978, ♀ (K. Krishna, AMNH). SINGAPORE: ♀ (Workman, NRS); mangroves, 21 May 1922, ♀ (H. C. Abraham, ZRC). INDIA: Karnstaka, Dandeli [railroad station, 15°15′N, 74°37′E], 530 m, Nov. 1979, ♀ (W. Eberhard, MCZ). INDONESIA: *Sumatra*. Siberut Isl., Sept. 1924, ♀ (C. B. Kloss, N. Smedley, ZRC). *East Borneo* [Kalimantan]. Maratoea Isl. [Maratua], ♂ (E. Mjöberg, NRS).

Gea bituberculata (Thorell)

Figures 376–380; Map 6

Ebaea bituberculata Thorell, 1881: 60. Female holotype from Hatam, Arfak Mountains, southwest of Dorei, New Guinea [Dore Baai, Vogelkop Peninsula, West Irian] in the Museo Civico di Storia Naturale, Genova, examined.

Gea bituberculata:—Roewer, 1942: 746. Bonnet, 1957: 1982.

Note. The illustrations were made from the holotype.

Diagnosis. This small species differs from *Gea theridioides* by the shape of the epigynum: the septum has expanded and wrapped around other features, including the anterior face of the epigynum (Figs. 376–378).

Gea theridioides (L. Koch)

Figures 381–388; Map 6

Ebaea theridioides L. Koch, 1872: 132, pl. 10, fig. 4, ♀. Female holotype from Port Mackay, Queensland, Australia in Zoologisches Museum, Universität Hamburg, lost. One female from Peake Downs [Queensland, Australia] in the Godeffroy collection here designated lectotype in the Naturhistorisches Museum, Wien, examined.

Argiope curvipes Keyserling, 1886: 135, pl. 11, fig. 1, ♂. Male holotype from Gayndah, Peake Downs [southeastern Queensland] in the British Museum, Natural History, examined. NEW SYNONYMY.

Gea theridioides:—Roewer, 1942: 746. Bonnet, 1957: 1984. Mascord, 1970: 78, pl. 35, fig. 137, ♀.

Notes. The specimen marked lectotype had been registered as a type in the catalog of the Naturhistorisches Museum, Vienna. Males and females have not been collected together, thus there is some doubt as to whether they belong together.

The female genitalia illustrations (Figs. 381–383) were made from a specimen from Sydney; Figure 384 from a specimen from Currawong. Three other females with the Currawong specimen had the posterior plate as in Figure 382. The abdomen may be oval or with anterior humps (Fig. 385). The male genitalia illustrations (Figs. 387, 388) were made from a specimen labeled *E. praecincta* from Sydney in the British Museum, Natural History collection.

Diagnosis. The female can be separated from other *Gea* by the unusually shaped epigynum: the posterior plate continues ventrally into a flat plate enclosing a median wrinkled septum (Figs. 381–384), visible from anterior or the sides. The male, unlike other species, has sculpturing on the outside of the tip of the conductor and the median apophysis is a long, worm-shaped structure without a spur (Figs. 387, 388).

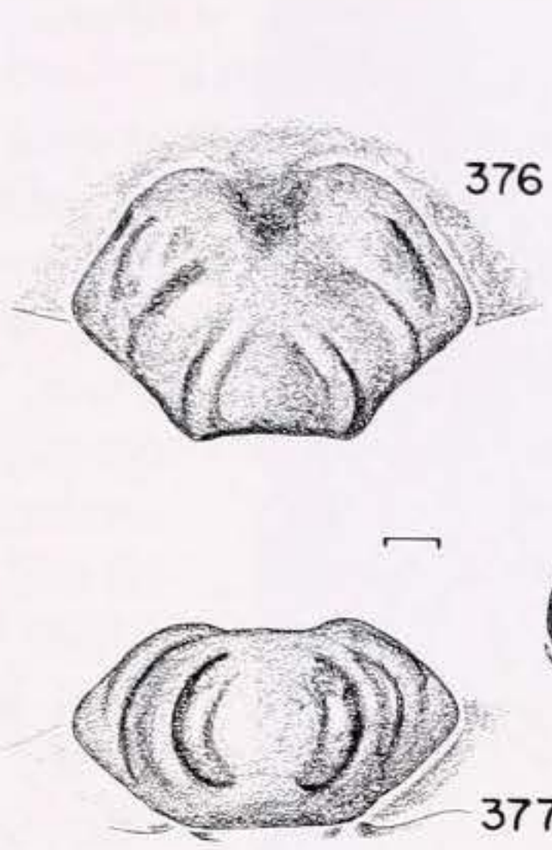
Distribution. Queensland, New South Wales (Map 6). Roewer (1942) reports this species from New Guinea and Samoa, probably an error.

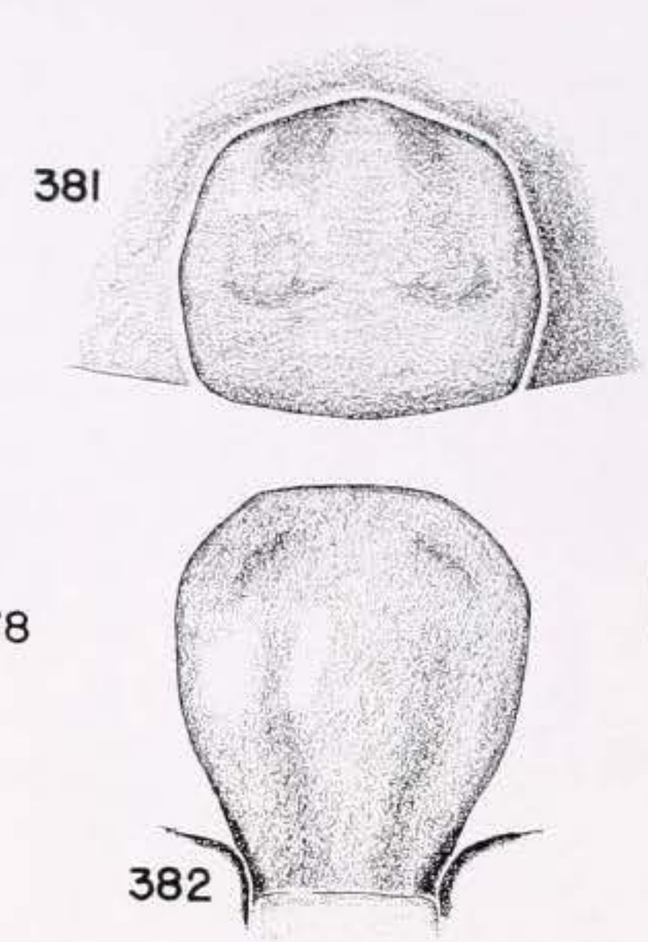
Records. AUSTRALIA: *Queensland*. Rockhampton, ♀ (ZMH); Peake Downs, ♀ (ZMH); ♀ (NMW); Gayndah, ♀ (ZMH); ♀ (NMW); Colosseum, Nov., ♀ (E. Mjöberg, NRS). *New South Wales*. Wyangarie, ♀ (AMS); Boggabilla, 10 March 1970, ♀ (M. J. Cann, AMS); Currawong, 2 Oct. 1965, ♀♀ (R. Mascord, AMS); Sydney, ♂ (BMNH); ♀♀, juv. ♂ (ZMH). *Australian Capit. Terr.* Canberra, 6 April 1963, ♀ (C. R. MacLellan, CSIRO), 7 March 1970, ♀♀ (H. Evans, AMS).

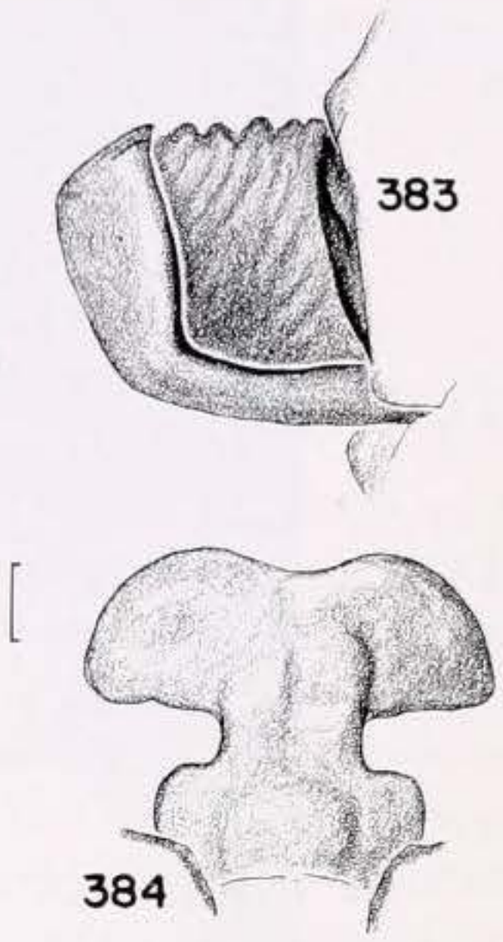
Neogea new genus

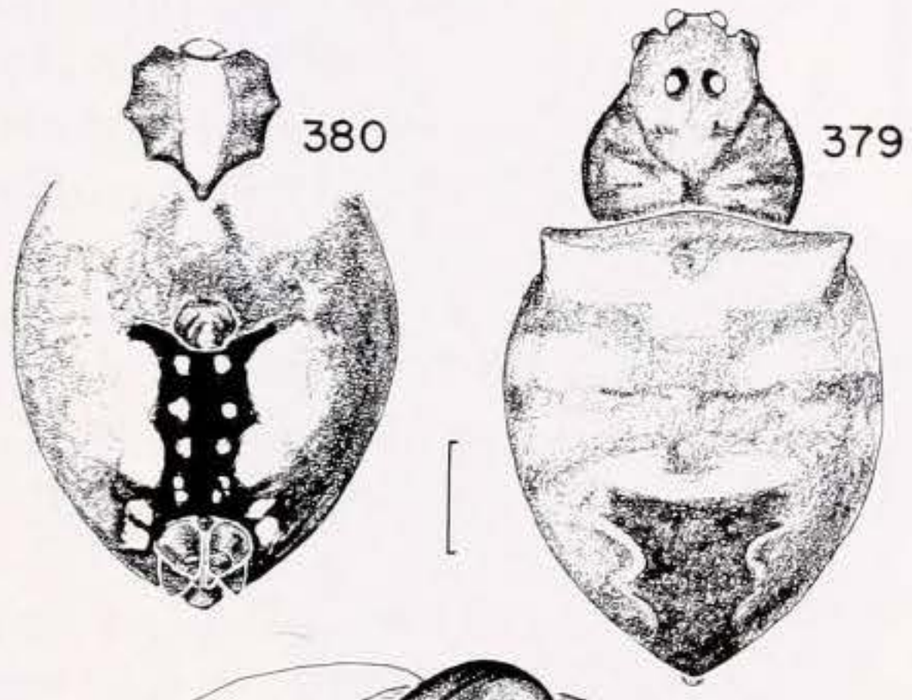
Type species. *Araneus egregius* Kulczynski. The gender is feminine.

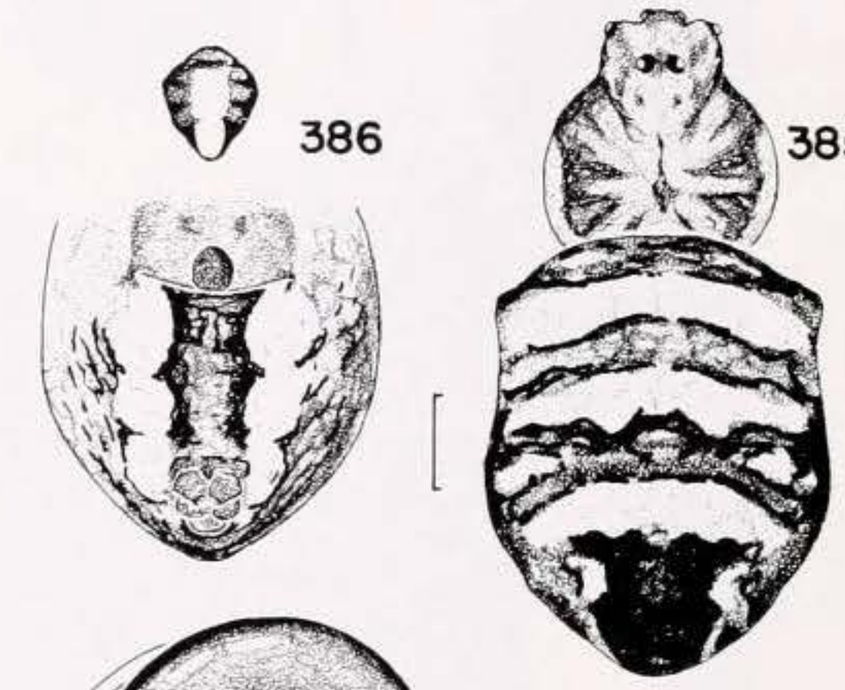
Diagnosis. *Neogea* differs from *Argiope* by having the posterior eyes about equally spaced, the medians the same dis-

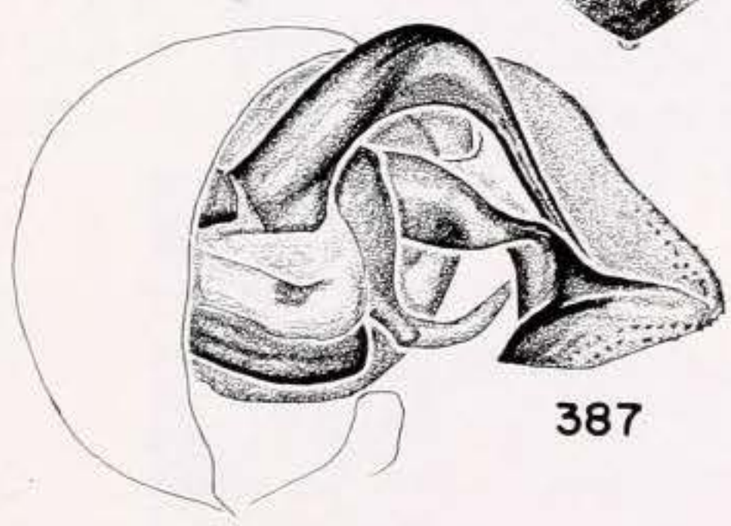


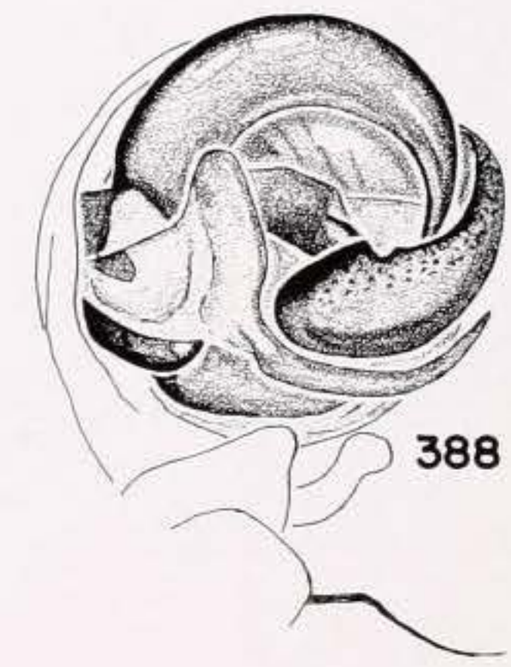










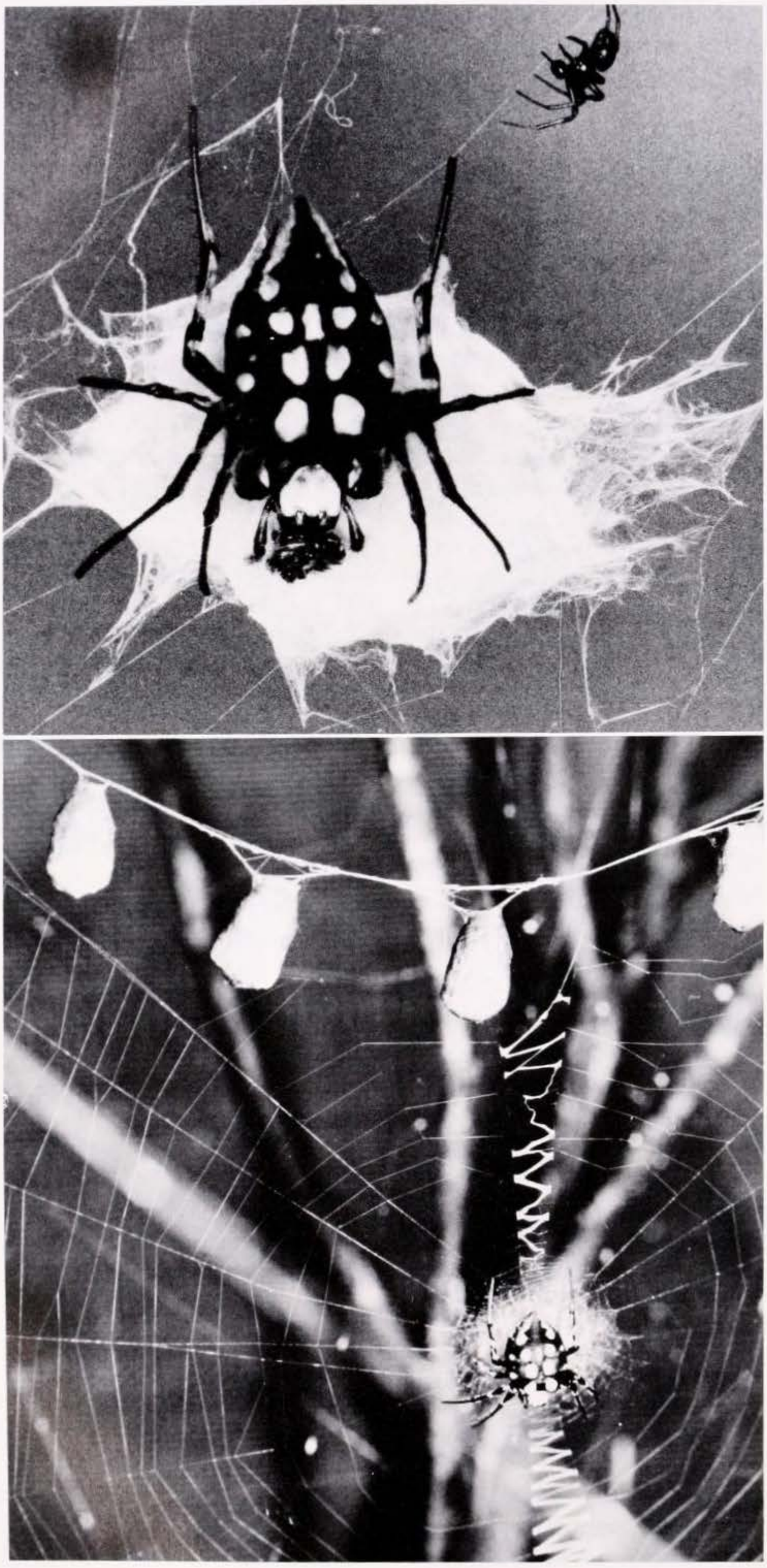


Figures 376–380. *Gea bituberculata* (Thorell), female. 376. Epigynum, ventral. 377. Epigynum, posterior. 378. Epigynum, lateral. 379. Carapace and abdomen. 380. Sternum and abdomen.

Figures 381–388. *Gea theridioides* (L. Koch). 381–386. Female. 381. Epigynum, ventral. 382, 384. Epigynum, posterior. 383. Epigynum, lateral. 381–383. (Sydney, Australia). 384. (Currawong, Australia). 385. Carapace and abdomen. 386. Sternum and abdomen. 387, 388. Male left palpus. 387. Mesal. 388. Ventral.

Scale lines. 0.1 mm, except Figures 379, 380, 385, 386, 1.0 mm.

tance from each other as from the posterior laterals. *Neogea* differs from both *Gea* and *Argiope* by having the head region of the carapace behind the eyes swollen (Figs. 390, 392), the epigynum weakly sclerotized (Figs. 393, 394, 398, 399, 400, 401), and the palpal embolus one piece sitting on the tegulum (Figs. 397, 406) rather than being attached to an intermediate sclerite, the stipes.



Coloration. All species have the carapace black with white setae covering the head and sometimes the sides of the thorax. The abdomen is black with paired and median white or silver patches (Figs. 395, 402, 404). The venter has paraxial white marks (Figs. 396, 403, 405) as in *Argiope*, not like the splotches of *Gea*.

Structure. The chelicerae are quite strong, with a distinct proximal condyle (Figs. 389–392). The abdomen of both species is drawn out posteriorly and overhangs the spinnerets (Figs. 396, 403, 405). The palpus of *N. egregia* has a twisted flap at the base of the embolus (Fig. 397). Perhaps this breaks off when mating and plugs the epigynum. If this is the case, the palpus of *N. nocticolor* examined might be of a mated male and that of *N. egregia* of a virgin male.

Behavior. Neogea females are known to decorate their webs with egg-sacs (Sherriffs, 1928) (Plate 2). Also, as in *Gasteracantha*, the frame lines have tufts of silk (M. H. Robinson, personal communication).

Species. There are only two species: *N. nocticolor* and *N. egregia*.

Distribution. India to New Guinea.

KEY TO SPECIES OF *NEOGEA*

1. Males 2
– Females 3
2(1). Conductor curved and with pointed tip (Fig. 406); India, Burma to Sumatra (Map 6) ..... *nocticolor*
– Conductor straight with a distal notch (Fig. 397); New Guinea (Map 6) ..... *egregia*
3(1). Posterior median eyes appearing large, separated by a distance equal to 1.5 times their diameter (Figs. 391, 392, 402, 404); India, Burma to Indonesia (Map 6) ..... *nocticolor*
– Posterior median eyes small, separated by a distance equal to two diameters (Figs. 389, 390, 395); New Guinea (Map 6) ..... *egregia*

Neogea egregia (Kulczynski) new combination

Figures 389, 390, 393–397; Map 6

Araneus egregius Kulczynski, 1911: 479, pl. 20, fig. 51, ♀. Female holotype from Napan, West Irian in the Polish Academy of Sciences, Warsaw, examined. Roewer, 1942: 827. Bonnet, 1955: 499.

Diagnosis. This species is black except for the head and the white patches on the abdomen (Figs. 395, 396). The female differs from *N. nocticolor* by being larger in size and by having relatively smaller eyes (Fig. 395).

The male has a heavier embolus (Fig. 397) than the male of *N. nocticolor*, a twisted sclerite near the base of the embolus, and the spur of the median apophysis curved up toward the tip of the embolus (Fig. 397).

Records. PAPUA NEW GUINEA: *Morobe Distr.* Oomsis, near Lae, 7 Dec 1979, ♀ (M. Robinson, MCZ); Buso, 4 May 1979, ♂ (M. Robinson, MCZ).

Neogea nocticolor (Thorell) new combination

Figures 391, 392, 398–406; Map 6

Gea nocticolor Thorell, 1887: 170. Two female syntypes from Bhamo, Burma in the Zoologisches Museum, Universität Hamburg, examined.

Gea guttata Thorell, 1890: 107. Juvenile holotype from Sungeibulu [Sungaibulu], Sumatra in the Museo Civico di Storia Naturale, Genova, examined. NEW SYNONYMY.

Gea lugens O. P.—Cambridge, 1899: 520, pl. 29, fig. 3, ♀. Female holotype from Singapore in the Hope Entomological Collections, Oxford University, examined. NEW SYNONYMY.

Gea diadema Hogg, 1920: 92, pl. 9, fig. 6. Female holotype in poor condition from Sungei Kumbang [Kambang], Korinchi Peak [Kerintji], 1400 m, West

←

Plate 2. *Neogea egregia* (Kulczyński). Above, female and male. Below, female from New Guinea in web having a stabilimentum and four egg-sacs on a line above (photo M. Robinson).

Sumatra in the British Museum, Natural History, examined. NEW SYNONYMY.

Argiope lalita Sherriffs, 1928: 186, figs. 3–7, ♀♂. Male holotype without palpi, two female paratypes from Charlotte Estate, Sidapur, S. Coorg [West of Mysore, Mysore State], India in the British Museum, Natural History, examined. Roewer, 1942: 738. Bonnet, 1955: 687. NEW SYNONYMY.

Notes. The type of *Gea guttata* is a juvenile, 4.3 mm total length, with the same diagnostic coloration, white head setae and posterior median eyes as in *G. nocticolor* Thorell.

The illustrations (Figs. 398, 399, 402, 403) were made from the paratype of *A. lalita*; Figures 400, 401, 404, 405 from the holotype of *Gea lugens*.

The male was not collected with a female; it is all black, except for the proximal ends of the femora (which are also light in females). None of the legs of the male are modified.

The male holotype of *A. lalita* has the distal article of both palpi missing, and Sherriffs' illustration shows only the palpal tibia. The abdomen shape of the syntypes of *G. nocticolor* is more like that of *A. lalita*: drawn out behind and with two small anterior humps on the dorsum, and three posterior white wedge-shaped patches on the abdomen.

Diagnosis. Neogea nocticolor differs from *N. egregia* in having larger, more closely spaced eyes (Figs. 402, 404). The male differs from that of *N. egregia* by the longer, more slender embolus and conductor, and by the shape of the median apophysis, which has a filiform spur extending in a proximal direction (Fig. 406).

Distribution. India, Burma to Sumatra (Map 6).

Records. BURMA: Tharrawaddy, ♀ (Oates, BMNH); Bhamo, 3♀ (NRS). MALAYSIA: *Malay Peninsula*. Genting, 18–22 Aug. 1979, ♂ (F. Murphy and J. Murphy, MC). INDONESIA: *Sumatra*. Fort de Kock [Bukittinggi], ♀♀ (Jacobson, NMW).

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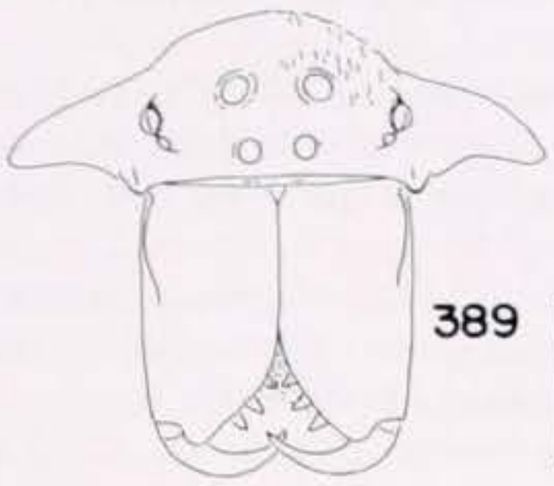
Figures 389–392. *Neogea* female eye region and chelicerae, face view and lateral. 389, 390. *N. egregia*. 391, 392. *N. nocticolor*.

Figures 393–397. *Neogea egregia* (Kulczyński). 393–396. Female. 393. Epigynum, ventral. 394. Epigynum, posterior. 395. Carapace and abdomen. 396. Abdomen, ventral. 397. Male left palpus, mesal.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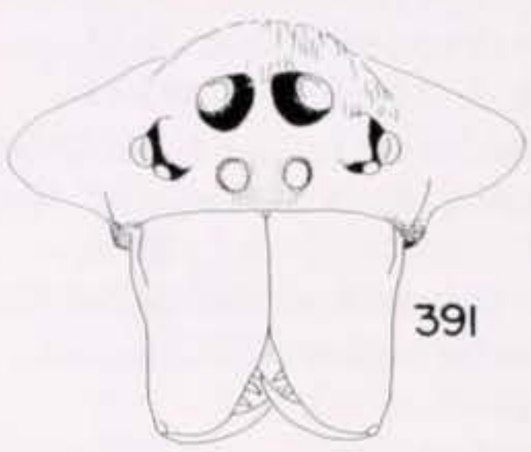
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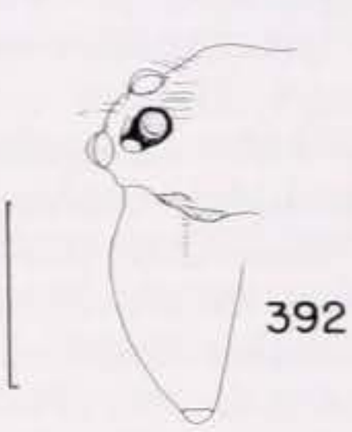
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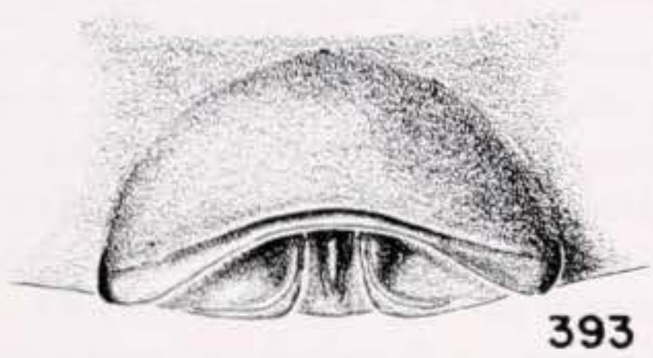
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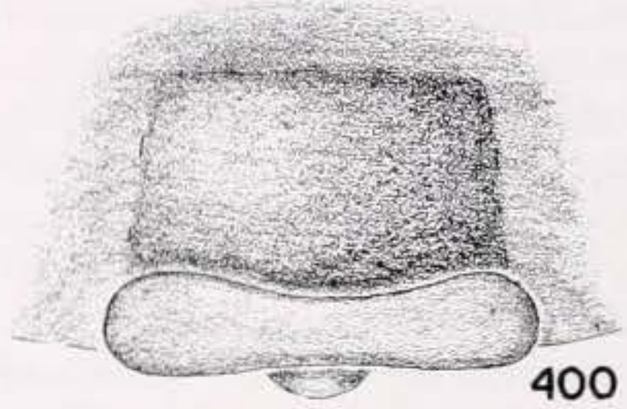
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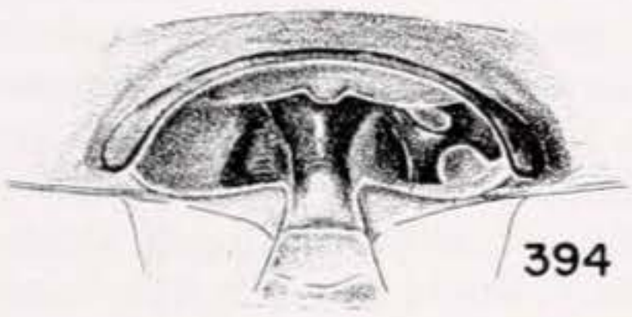
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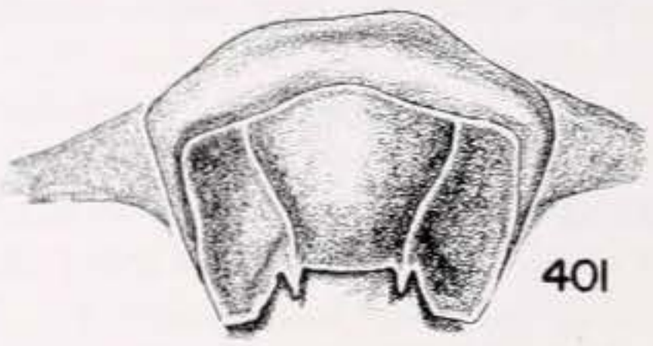
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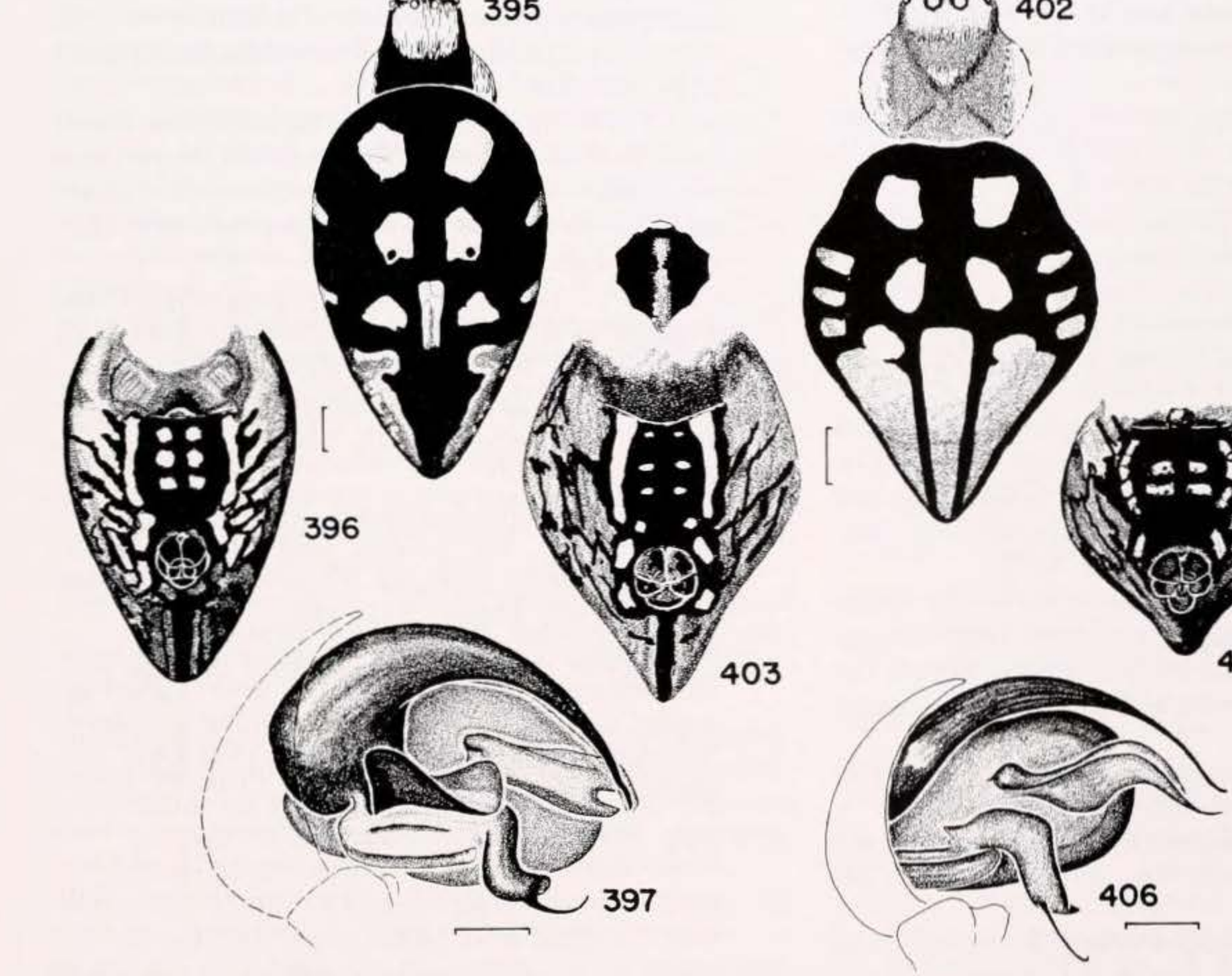
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Figures 398–406. *Neogea nocticolor* (Thorell). 398–405. Female. 398, 400. Epigynum, ventral. 399, 401. Epigynum, posterior. 402, 404. Carapace and abdomen. 403, 405. Sternum and abdomen, ventral. 398, 399, 402, 403. (India). 400, 401, 404, 405. (Singapore). 406. Male left palpus, mesal.

Scale lines. 0.1 mm, except Figures 389–392, 395, 396, 402–405, 1.0 mm.

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