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The number of instars occurring during the development of *Argiope flavipalpis* and *Argiope trifasciata* (Araneae: Araneidae) in Ghana, West Africa

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Summary

In Ghana, females of *Argiope flavipalpis* (Lucas) mature at the tenth instar in the coastal savanna area of Legon, and at probably the tenth and eleventh instars in the forest area of Mount Atewa. It is not known how many instars are required for female *A. trifasciata* Forskål to become mature, but it is possible that the number varies between different individuals. Possible causes of variation in the number of instars in various species of araneid are discussed, variation in feeding being considered a significant cause in some cases. Neither Ghanaian species of *Argiope* increases the length of its carapace or legs after the last moult. The report by Crome & Crome (1961a, b) of this occurring in *A. bruennichi* is considered to be erroneous, probably due to faulty observation and their overlooking the possibility that araneids can displace conspecifics from their webs in some instances.

Introduction

In an earlier paper (Edmunds, 1982) on the identification of the species of *Argiope* in Ghana, it was shown that there were two species present: *A. trifasciata* Forskål and *A. flavipalpis* (Lucas) (=*A. cuspidata* Thorell and *A. pechueli* Karsch). It was noted that at Legon in the coastal savanna region all females of *A. flavipalpis* appeared to mature at the same instar, whereas at Mount Atewa, Kibi, in the forest they appeared to mature at this instar and the following one. *A. trifasciata,* which was found only at Legon, also showed variation in the size of adult females. Variation in the number of instars required to reach maturity has been reported in various Araneidae (Bonnet, 1929; Emerit, 1968; Ramousse, 1973; Robinson & Robinson, 1978; Vollrath, 1980), and in some cases variation in food supply may be a contributory factor. An additional possible cause of variation in size of mature adults is given by Crome & Crome (1961a, b) who report that *Argiope bruennichi* (Scopoli) shows significant increase in carapace and leg size after the last moult. In reaching their conclusions, they stress that *A. bruennichi* never moves web site. However, as web displacement has been observed in other Araneidae (Enders, 1974; Robinson & Robinson, 1976), it probably also occurs in this species. In order to find the cause of size variation in *A. flavipalpis* and *A. trifasciata,* several juveniles were collected and reared in captivity. Identification of instars by their size was possible in *A. flavipalpis,* but not in *A. trifasciata,* as the latter showed considerable variation in growth increments between individuals at the same instar. The results are presented below, and their relation to other aspects of spider biology assessed.

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Materials and Methods

A general description of the study area is given in Edmunds (1982). *Argiope* spp. sit at the centre of their webs and are therefore relatively easy to find. Usually, if undisturbed, they remain at the same web-site, and rebuild their webs there on successive days. However, sometimes they move web-site, without apparent outside disturbance. Nevertheless it is often possible to follow the development of an individual in the field, at least for some of its period of growth. Observations in the field were extensively augmented by observations on specimens collected in the field as juveniles, and reared in captivity. In these circumstances exuviae, which were seldom found in the field, could be collected and measured. *A. trifasciata* and *A. flavipalpis* lived satisfactorily in captivity, though the latter tended to rebuild its web less frequently than in the field.

A number of spiders were kept in cages on the Zoology Department veranda, which is a roofed passage with rooms on one side and open on the other. Except for some protection from the rain, climatic conditions were similar to those in the field. *A. flavipalpis* was kept close to the wall, where light conditions were similar to those in which it normally lived (Edmunds, 1980). *A. trifasciata* was kept on the open side of the veranda, though even this shaded it slightly more than it would be in its normal habitat (Edmunds, 1980). Cages varied in shape and size as there were insufficient identical ones. Small spiders were kept in cylindrical plastic sided cages, with netting in the lids: 0.20 m diameter, 0.39 m high. Larger specimens were kept in cages varying in size from 0.46 x 0.57 x 0.35 m to 0.60 x 0.60 x 0.90 m which were made of netting except for a wooden floor, and one 0.45 x 0.60 x 0.90 m with perspex sides, netting top and wooden floor. *A. flavipalpis* had twigs on which to build its web, and *A. trifasciata* had grass growing in a container. Spiders were fed on grasshoppers, and occasionally termites, caught nearby and thrown into the spiders' webs. Rates of feeding varied from approximately two to seven insects per week. Spiders were not all present at the same time, but were reared as they were found.

In order to find the size range of the different instars, measurements were taken of carapace length and width, leg length, total body length and abdomen length on live and preserved specimens in captivity and from the field. In addition the carapace length and width and leg length were measured on exuviae. Live captive spiders were weighed just after they had moulted, and weights were taken of mature females at various times after their last moult. No mature males are included in these results. An unsuccessful attempt was made to rear *A. trifasciata* and *A. flavipalpis* from spiderlings.

Results

The number and size of instars

Argiope trifasciata

Measurements of adults collected at Legon, Ghana are given in Edmunds (1982). The weights of four

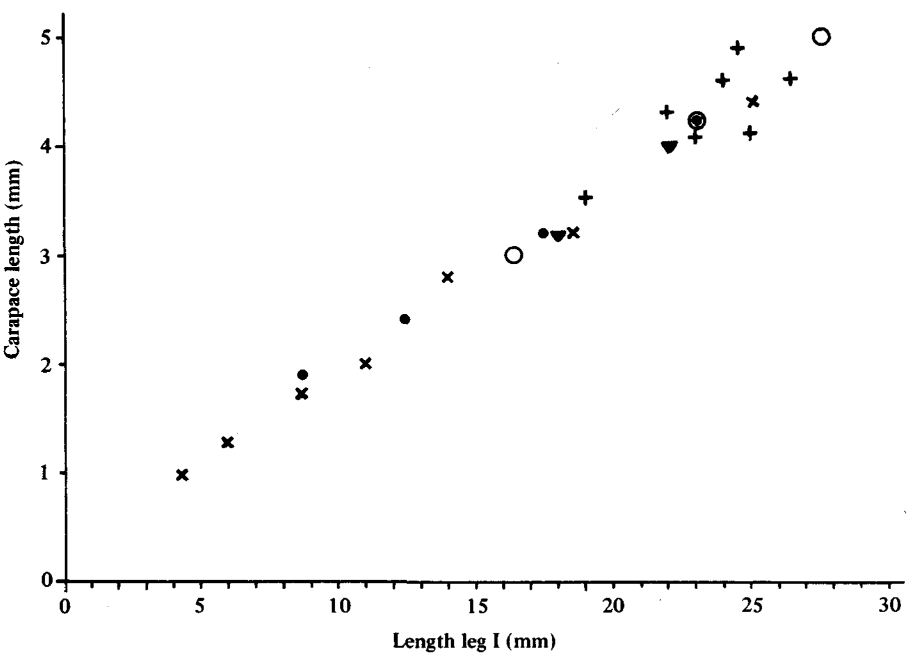

Fig. 1: Carapace length plotted against length of leg I for *A. trifasciata.*
+ 7 mature females collected in the field
▼ spider 141
○ spider 143
× spider 146
● spider 148
kept in captivity for 1-6 moults

spiders just after their last moult were 102-150 mg, with an abdomen length of 8.0-9.6 mm; for 11 spiders at least two weeks after their last moult (therefore with ripe ovaries) the weights were 334-444 mg and the abdomen lengths 10.0-13.7 mm. There is considerable variation in the measurements of the carapaces and legs of mature females. Fig. 1 plots the length of the carapace against the length of the first leg for a number of instars of four cage-reared spiders and for seven adults collected in the field. No spider was reared from the egg but one was reared through six moults. In Fig. 1 it is not possible to group the points into discrete instars. Most spiders matured between leg length 22-28 mm and carapace length 4.0-5.0 mm. However this size range spanned two moults for spider 143, whose penultimate instar was the same size as the mature 148 (leg I 23 mm, carapace 4.2 mm). Further anomalies occur. Though spiders 148 and 146 matured at similar sizes (146: leg I 25 mm, carapace 4.4 mm; 148: leg I 23 mm, carapace 4.2 mm), 146 had undergone four moults and 148 three since their legs I were 8.5 mm (the exuviae of 146 had a damaged carapace). One mature spider was collected from the field with a leg length of 19 mm and a carapace length of 3.5 mm, and so was similar to the penultimate instar for most spiders; another similar sized spider was seen, but not measured. Therefore it seems that the size ranges of the different instars overlap, so that for the population of *A. trifasciata* at Legon one cannot ascribe a juvenile to an instar on the basis of its measurements. An attempt to rear spiderlings was not successful, as all died before the first free moult. Therefore it is not possible to state at which instars *A. trifasciata* matures in Ghana, though from the measurements of adults it would appear to do so at two or three different instars. Nor is it possible to give the size range of a given instar for this population.

Instar	Weight (g)	Abdomen length	Total length (mm)	Carapace: length	Carapace: width (mm)	Length in mm of leg number: I	II	III	IV	N*
Adult	120.2	6.4	9.8	4.0	4.4	21.8	21.9	13.3	21.2	6 + 4
	63–140	5.0–7.0	8.0–10.5	3.4–5.0	3.0–4.5	18.5–25.0	18.5–25.5	11.5–15.0	18.0–24.0	
9th	44.4	4.3	6.8	3.6	2.8	15.4	15.1	9.4	14.6	8
	29–61	3.5–4.5	5.5–8.0	3.0–4.0	2.4–3.2	13.0–18.0	13.0–17.5	8.0–12.0	13.0–17.0	
8th	29.0	4.3	6.3	2.8	2.2	11.3	11.2	7.0	10.6	7
	18–40	3.5–5.0	5.5–7.0	2.5–3.0	2.0–2.5	10.5–12.0	10.0–12.0	6.0–8.0	9.5–11.0	
7th	9.0	2.6	3.7	2.1	1.7	8.1	8.1	5.0	7.7	4
		2.2–3.0	3.7–4.0	2.0–2.2	1.5–2.0	8.0–8.5	8.0–8.5	5.0	7.5–8.5	
6th		1.9	3.1	1.6	1.3	6.7	6.3	3.3	5.8	3
		1.3–2.5	2.3–4.0	1.5–1.8	1.2–1.5	6.5–7.1	5.5–7.1	3.0–3.8	5.0–6.9	
5th				1.2	1.1	4.3	4.3	2.5	3.8	5
				1.0–1.4	1.0–1.2	4.0–4.5	4.0–4.5	2.0–3.0	3.0–5.0	
4th				0.83	0.74	3.45	3.42	1.96	3.09	4
				0.69–0.94	0.53–0.88	3.23–3.53	3.23–3.53	1.89–2.06	2.94–3.23	
3rd				0.60	0.67	2.13	2.04	1.34	1.91	4
				0.59–0.60	0.62–0.71	2.13	1.98–2.06	1.32–1.40	1.84–1.98	
2nd				0.39	0.48	1.38	1.34	0.94	1.23	4
				0.37–0.44	0.46–0.51	1.32–1.47	1.32–1.40	0.88–0.96	1.18–1.25	

Table 1: Size of captive *Argiope flavipalpis* from Legon at different instars (the first instar moults in the cocoon and was not measured). Weight, length of abdomen and total length measured on live specimens just after moulting. Size of carapace and leg lengths measured on exuviae except for adults. Upper figure is the mean, lower figures are the range.

*In adults the weight, abdomen length and total length were taken on six captive specimens immediately after moulting; carapace and leg measurements include those of four individuals that were collected as adults. In some cases, especially in early instars, parts of exuviae were damaged, so measurements in some columns may be on fewer individuals than N.

Argiope flavipalpis

Apart from Edmunds (1982), some measurements have been made on only a few mature females of *Argiope flavipalpis* by Lucas (1858) and as *A. cuspidata* or *A. pechueli* by Thorell (1868), Strand (1906) and de Lessert (1930). Four spiderlings of *A. flavipalpis* were reared in captivity from the cocoon, before dying at the third or fourth moult through faulty ecdyses. Nevertheless their later instars were the same size as the smallest spiders collected in the field. Slightly larger spiders that were collected also fall into discrete size classes that are likely to correspond to separate instars. However spiders collected at a late stage in development were grouped into instar classes from maturity backwards. These classes are given in Table 1. Allowing for a moult in the cocoon, there are nine moults, and the females mature at the tenth instar. There is no overlap between instars in the length of the legs, but a slight overlap in the size of the carapace between instars eight and nine and between nine and ten (adult). There is also an overlap in the length of the abdomen and in the weight at the time of moulting between the seventh and eighth and between the eighth and ninth (last) moults. In Fig. 2 the length of the carapace is plotted against the length of leg I for ten captive spiders which were reared through more than one moult. It can be seen that the points representing the earlier instars form fairly discrete clusters, but that those representing the penultimate instar and adults are more scattered. However, unlike *A. trifasciata*, there is no complete overlap.

The measurements for adults from Legon (both captive specimens and those collected as adults) and spiders collected at Mount Atewa are given in

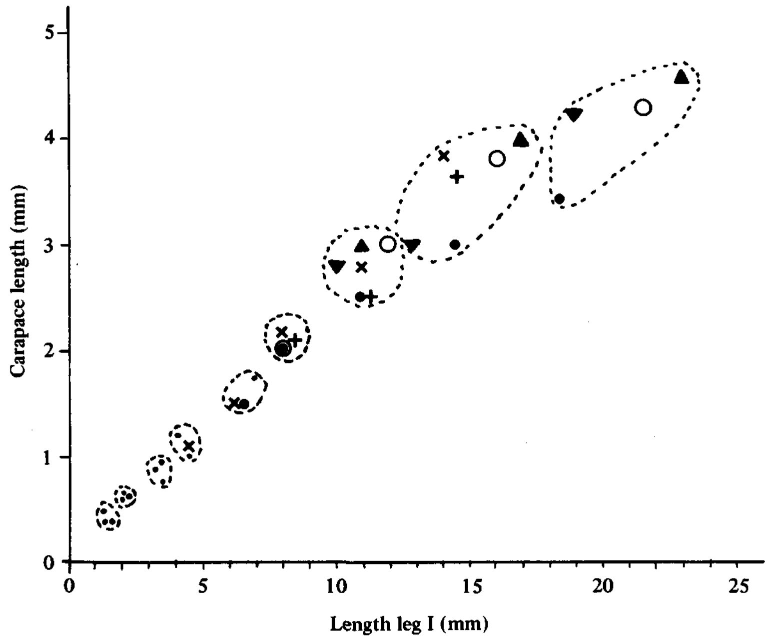

Fig. 2: Carapace length plotted against length of leg I for 10 *A. flavipalpis* kept in captivity for 2-4 moults.

▲ spider 90
▼ spider 94
○ spider 95
● spider 105
× spider 111 } did not reach maturity
+ spider 112 }
• four spiderlings reared from cocoon through three or four moults (at each moult at least one of their exuviae was incomplete and therefore could not be plotted).

Table 2. Spiders from Legon are subdivided into those that had just moulted and those in which at least two weeks had elapsed since the last moult, and which therefore had ripe ovaries. Measurements are given of those spiders from Mount Atewa that appeared to have ripe ovaries, and these apparently fall into two categories, distinguishable on the size of the carapace and length of the legs. The differences are shown in Fig. 3. Most large spiders had dark legs, though on a few, banding was distinguishable. Only a few of the smaller adults from Mount Atewa had dark legs, and none from Legon did. Spiders from Mount Atewa were not reared in captivity. However, from Fig. 3 it appears that the population at Mount Atewa had specimens maturing at both instars ten and eleven. The male from Mount Atewa, described in Edmunds (1982), would, by comparing its measurements with those given in Table 1, probably have matured at the seventh instar. The length of time taken to complete each instar varied with the rate of food intake (Edmunds, 1980).

Table 2 also gives the dimensions of the following: the type specimen of *A. cuspidata* from the Cape of Good Hope Province, South Africa, as measured by Thorell (1868) and myself (e and f); the type specimen of *A. pechueli* Karsch from West Africa, as measured by myself (h), and another specimen of *A. pechueli* from South Cameroun measured by Strand (1906) (g); and a specimen collected at Ibadan, Nigeria by M. H. Robinson and measured by myself (i). Karsch gives the length of his specimen as 16 mm, but it may have shrunk in alcohol between his measurements and mine. Lucas gives measurements of *A. flavipalpis* as length 22 mm and width 13 mm, and de Lessert (1930) gives the length of *A. cuspidata* from the Congo as 13-19 mm. It would appear that Karsch's specimen and that from Nigeria

	Weight (g)	Abdomen length	Abdomen width	Total length	Carapace length	Carapace width	Leg I	Leg II	Leg III	Leg IV
a)	106	6.2	4.8	9.9	4.3	3.8	21.8	22.2	13.5	21.2
	63–140	5.0–7.5	3.8–5.5	8.2–11.0	3.4–5.0	3.0–4.5	18.5–25.0	18.5–25.5	11.5–15.0	18.0–24.0
b)	369	9.2	7.6	12.5	4.4	4.1	21.8	21.8	13.4	21.2
	353–393	7.6–10.4	5.8–9.0	11.0–14.4	4.0–4.8	4.0–4.4	19.0–24.0	19.0–24.0	11.5–14.5	19.0–23.0
c)	329	10.0	8.6	13.3	4.6	4.3	23.3	23.3	14.4	22.4
	297–356	9.7–10.3	8.0–9.8	12.5–14.1	4.3–5.0	4.0–4.8	21.5–26.0	21.5–26.0	13.5–15.0	20.5–24.5
d)	568	10.7	9.8	16.8	6.5	6.1	31.5	31.6	19.6	30.6
	475–687	10.0–11.6	9.0–10.5	15.4–18.2	6.0–7.2	5.5–6.8	28.0–34.0	28.0–34.0	18.0–21.0	27.5–33.0
e)				25			38	38	24	35
f)		16.0	13.0	broken	8.5	7.5	39.3*		23.2	?
g)		10.8	10.5	15.2	6.5	5.5	30	29.5	20.5	30.0
h)				19			20.0	16.3	14.3	8.5
i)		10.0	7.0	broken	6.4	5.8	28.0	29.0	14.5	26.0

Table 2: Weights of live and measurements of preserved *Argiope flavipalpis*. a-d give mean, minima and maxima of:

a) three spiders from Legon just after their last moult;
b) seven spiders from Legon at least two weeks after their last moult;
c) four smaller spiders from Mount Atewa with ripe ovaries;
d) four larger spiders from Mount Atewa with ripe ovaries.
e) data given by Thorell (1868) for type specimen of *A. cuspidata* from Cape of Good Hope Province, South Africa.
f) my own measurements for e.
g) my measurements for type specimen of *A. pechueli* from West Africa.
h) measurements given by Strand for *A. pechueli* from South Cameroun (it appears that leg IV had broken and was regenerating).
i) my measurements of *A. flavipalpis* collected by M. H. Robinson from Ibadan, Nigeria.

Measurements in mm; * = leg broken, could be leg I or II.

matured at the same size as the larger spiders at Mount Atewa, i.e. 11th instar, and that Strand's specimen probably matured at the previous instar, like the spiders at Legon and the smaller ones from the forest. However, both Lucas' measurements of his type specimen and Thorell's specimen of *A. cuspidata* are larger than those that I have seen or than those described elsewhere in the literature, and may have matured at a yet later instar, possibly the 12th.

Growth after the last moult

In both species there is a considerable increase in the length of the abdomen and in the spiders' weight after the last moult, presumably as the ovaries mature. However, Crome & Crome (1961a, b) report that *A. bruennichi* (Scopoli) increases in leg size from 10.2 mm just after the last moult to 24.9 mm when it lays a cocoon, and in carapace size from 2.52 mm to 5.22 mm. They also imply that the last moult occurs at the same instar in both males and females. In both *A. flavipalpis* and *A. trifasciata* females undergo further moults after they reach the size at which males mature. Both species moult at least three times after the carapace is *ca* 2 mm long. Fig. 4 gives the differences in size of the carapace and legs between the last exuviae and the adult female. It can be seen that those individuals that lived for some time after moulting before being killed showed no greater increase than those that were killed just after moulting. In *A. trifasciata* the spider with the longest legs (leg I: 27.5 mm) was preserved just after it had moulted, while that with the shortest legs (leg I: 19.0 mm) was preserved two months after its last moult, in which time it had laid three cocoons. Therefore *A. trifasciata* and *A. flavipalpis* do not increase the size of their legs or carapace after the last moult.

Discussion

Some species of spider have a variable number of instars before maturity and some do not: the literature on this has been reviewed by Levy (1970). A variable number of moults has been found in some species of Araneidae: *Nephila madagascariensis* Vinson (Bonnet, 1929), males of *Gasteracantha versicolor* Walckenaer (Emerit, 1968), *Araneus diadematus* Clerck (Ramousse, 1973) and both sexes of *Argiope argentata* (Fabricius) and *A. aemula* (Walckenaer) (Robinson & Robinson, 1978).

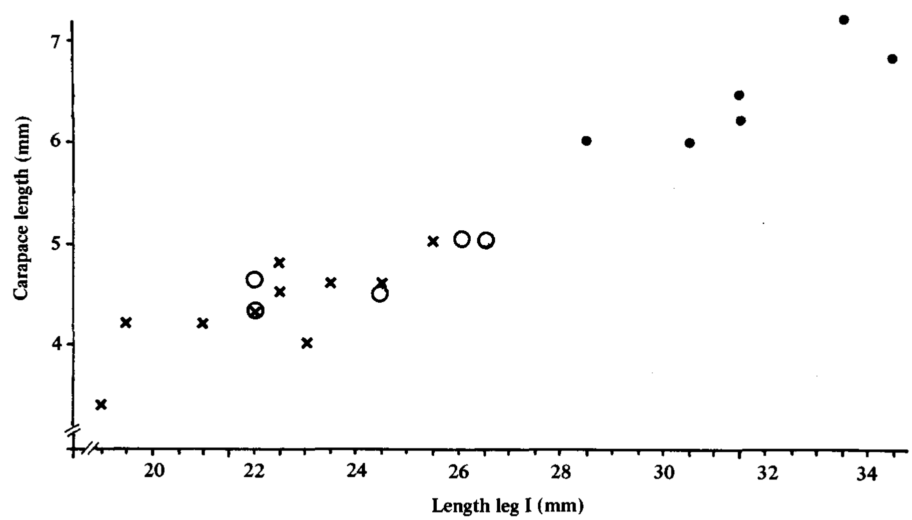

Fig. 3: Carapace length plotted against length of leg I for 21 adult females of *A. flavipalpis*.
× spiders from Legon
○ spiders from Mount Atewa, small specimens
● spiders from Mount Atewa, large specimens

Robinson & Robinson (1976) found no evidence that there is a variable number of instars in *Nephila maculata* (Fabricius), although more recently (1978) they imply that this species does mature over a range of instars. Males of *Nephila clavipes* L. mature at moults 4-9 (Vollrath, 1980, and pers. comm.) and this may be correlated with food supply, males with more food having more instars. However in some species of spider, e.g. *Latrodectus mactans* (Fabricius) (Deevey, 1949), *Heteropoda venatoria* (L.) (Ždárek & Ždárková, 1969) and *Araneus diadematus* (Ramousse, 1973), those individuals that eat at a faster rate undergo on average fewer moults before maturity. As well as this effect, in *L. mactans* individuals within a given feeding regime vary the number of moults. In *Thomisus onustus* despite all being fed at the same rate, males have fewer moults if they emerge from the cocoon in the spring than if they emerge later in the year (Levy, 1970). A fixed number of moults before maturity is found in *Linyphia triangularis* Clerck (Turnbull, 1962) and *Agelenopsis potteri* (Blackwall) (Turnbull, 1965) no matter how variable the rate of feeding.

Robinson & Robinson (1978) and Vollrath (1980) have suggested that if there is competition between males, those that mature early have an advantage in being able to reach the females first, though if there is fighting in the competition then a larger size would be an advantage. Robinson & Robinson (1978) consider that females with larger abdomens may produce more eggs, though in the species that they studied females maturing at later instars had longer legs, but overall size did not differ much. However, in *Argiope flavipalpis,* those specimens with longer legs also had larger abdomens and were heavier. Ewer (1972) records an *A. cuspidata* (=large *A. flavipalpis*) as laying 11 cocoons in captivity, though the last three were infertile since it did not mate whilst in captivity. No spider from Legon produced more than four cocoons, and one to three were commoner (Edmunds, 1980). Therefore there is some evidence that in this species, large spiders lay more cocoons than smaller ones. The instar at which *A. flavipalpis* matures may be dependent on the rate of feeding; it is likely that food is more plentiful in the forest area of Mount Atewa, with its shorter, moister dry season, than in the savanna area of Legon. It is possible that there is a genetic effect as well, for not even well fed captive specimens from Legon reached the larger size indicative of an extra instar. However a specimen that received less food in early instars, showed smaller increments in later ecdyses, though its legs when adult were not as short as those of any penultimate instar. If a higher rate of feeding is the cause of some individuals from Mount Atewa maturing at a later instar, the situation would be similar to that possibly occurring in *Nephila clavipes* (F. Vollrath, pers. comm.), and the reverse of the situation in *Araneus diadematus* (Ramousse, 1973), *Latrodectus mactans* (Deevey, 1949) and *Heteropoda venatoria* (Ždárek & Ždárková, 1969). More work needs to be done on the possible correlations between rate of feeding and number of instars, and the instar at which the female becomes mature and the number of eggs or cocoons it produces. In the field at Legon, the food intake of *A. trifasciata* was greater than that of *A. flavipalpis* (Edmunds, 1980). It is possible that one *A. trifasciata,* which matured at a larger size than average, had a higher rate of feeding than normal in the early stages, but the data are inconclusive. *A. trifasciata* at Legon were able to produce up to six cocoons, and the interval between cocoon production in captivity was inversely proportional to the rate of feeding during cocoon production (Edmunds, 1980). Tolbert (1975) found that in North America *A. trifasciata* reached maturity at the tenth instar in females and the eighth in males; there is no suggestion of variability. It is not known at which instar the species reaches maturity in Ghana, and there is the possibility that this may vary between individuals, which, if so, might affect cocoon production.

It would seem likely that, unless related to seasonal factors as in *Thomisus onustus,* variation in the instar at which maturation occurs is related to rate of feeding, at least in some Araneidae. If food supply is poor, growth rate is slower in some species (Turnbull, 1962, 1965; Edmunds, 1980). Under these conditions it may be an advantage for some species to mature early and at least produce some eggs, especially if delayed maturity would considerably reduce chances of survival. On the other hand, if food is plentiful, growth rate is more rapid and a larger size may allow a greater number of cocoons, or in some cases possibly more eggs per cocoon, to be produced.

Crome & Crome (1961a, b) claim that *Argiope bruennichi* in the field near Berlin increased both in leg and carapace size after the last moult. Levi (1968) thinks that there might be some error in the observations, and says that there was no evidence of growth after the last moult in *A. argentata* in an unpublished experiment carried out by W. Eberhard. There is no growth after the last moult in *A. flavipalpis* and *A. trifasciata.* The increase in size of the carapace and legs of mature specimens compared with their last exuviae is similar for those killed on the day of moulting to those killed some time after the last moult, including some spiders which had produced cocoons. Further, D. S. Bunn (pers. comm.) reports that in captive and free living *A. bruennichi* there is no increase in leg and carapace size after the last moult. Therefore it is likely that there were more moults in *A. bruennichi* after the one that Crome & Crome designated the last. Exuviae may easily be overlooked in the field; I seldom found them in wild *Argiope* spp., though in captivity they were found on the floor of the cage. In the field the occurrence of moulting could be judged with experience, but it was not easy.

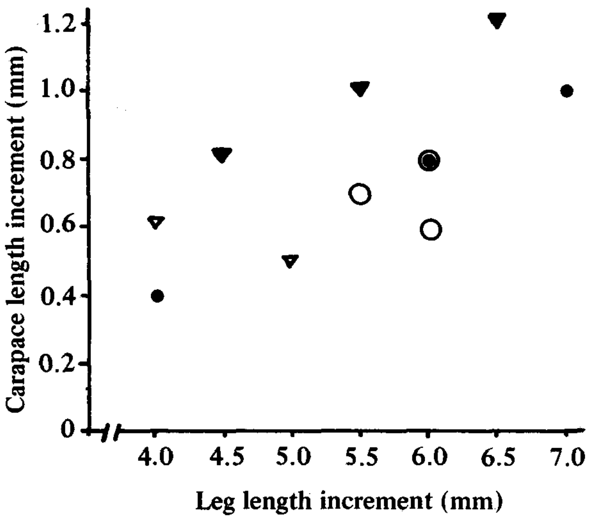

Fig. 4: Growth increment of carapace plotted against that of leg I for last moult of *A. trifasciata* and *A. flavipalpis.*
- ▼ *A. trifasciata* killed immediately after last moult
- ▽ *A. trifasciata* killed 2 months after last moult
- ● *A. flavipalpis* killed immediately after last moult
- ○ *A. flavipalpis* killed 2-5 months after last moult

Crome & Crome emphasise that *A. bruennichi* never move their web sites, and Witt (discussion of Rawlings & Witt, 1973) also says that this is true of araneids in general. However there are records of araneids moving their web sites and invading the webs of other spiders. Witt (1975) records araneids escaping from laboratory cages, and Turnbull (1964) records *Araneus sericatus* Clerck doing so. *Nephila maculata* shows a fairly high frequency of moving its web site in the field (Robinson & Robinson, 1976). At Legon, Ghana, change of web site was seen in *Araneus cereolus* (Simon), *A. rufipalpis* (Lucas) *A. legonensis* Grasshoff & Edmunds, *Gasteracantha curvispina* (Guérin), *Argiope flavipalpis* and *A. trifasciata.* Spiders may also enter the webs of conspecifics and of other species, and cannibalism indicates that either the victim or the eater invaded the other's web. Cannibalism has been recorded in the field in *Argiope trifasciata* (Bilsing, 1920), *A. aurantia* Lucas (Enders, 1974), *Nephila maculata* (Robinson & Robinson, 1976), and has been seen in captive *A. flavipalpis* (R. F. Ewer, pers. comm.). Invasion of the webs of conspecifics has been reported in *A. aurantia,* and occupation of empty webs of conspecifics in *A. aurantia* and *Araneus cornutus* Clerck (Enders, 1974). I have seen *Nephilengys cruentata* (Fabricius) both successfully invade occupied webs and occupy empty webs of conspecifics. When *Argiope trifasciata* formed a particularly dense population (Edmunds, 1980), sudden changes of size of spiders at a web site on several occasions indicated that webs had been invaded, or that empty webs had been occupied. Spiders may also invade the webs of other species in the field: e.g. Enders (1974) reports *Argiope aurantia* invading the web of *A. trifasciata,* and *Araneus cornutus* invading the web of *Neoscona arabesca* (Walckenaer); in Ghana *A. trifasciata* invaded the web of *A. flavipalpis* on one occasion (R. F. Ewer, pers. comm.). In all accounts the larger spider displaced the smaller (Enders, 1974; R. F. Ewer, pers. comm.; pers. obs.) and this is also true in colonial *Cyrtophora* spp. (Blanke, 1972; Lubin, 1974). Enders considers that web displacement occurred in 0.6% of his observations. It is quite likely that invasions of webs occurred in the population of *Argiope bruennichi* that Crome & Crome were studying, with possible subsequent occupation of empty webs by displaced spiders.

It is not known if *A. bruennichi* matures at more than one instar, as has been reported here for *A. flavipalpis,* but this could possibly have occurred in the population that Crome & Crome were studying. Therefore their deduction that *A. bruennichi* grows after its last moult could have been based on faulty observation, due to their not finding exuviae, and possibly complicated by web invasion and spiders maturing at different instars. In any case it seems unlikely that *A. bruennichi* does increase in leg and carapace size after its last moult.

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Spiders (Araneae) from Papua New Guinea III. Mysmenidae (Symphytognathoidea)*

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Introduction

This paper is the third contribution of a series of papers on spiders from Papua New Guinea. The material collected by Dr J. Van Goethem during his expeditions of 1977 and 1978 contained a few small spiders belonging to the Mysmenidae.

Family Mysmenidae

From the literature (Wunderlich, 1980; Brignoli, 1980) it seems clear that there is still considerable controversy among araneologists about the taxonomic validity of the various families of the Symphytognathoidea as split up by Forster & Platnick (1977). Without taking provisionally any position in this matter, two new symphytognathoid spiders are here described from Papua New Guinea. It seems justified to erect a new genus for them.

*Léopold III Biological Station, Laing Island. Contribution No. 35.

Kekenboschiella new genus

Type species: *Kekenboschiella marijkeae* sp. n.

Diagnosis of genus

Small spiders; prosoma high, in ♂ elevated in ocular area and about as long as wide, in ♀ longer than wide; ocular area broad, eight eyes with AME and PME > LE, AMs wide apart and directed forwards, LEs touching or nearly touching each other, anterior row recurved, posterior row almost straight; chelicerae long and slender, with strong frontal spine near base, pro- and retromargin with three teeth (♂) (in ♀ with two retromarginal teeth?); opisthosoma globular; legs: I > II > IV > III, clasping spur on ♂ Mt I, femoral organ on ♀ Fe I and II, Ta > Mt; ♂ palp twisted, tibia cup-like fringed with a row of long strong hairs, cymbium with curious outgrowth (trifid in *K. marijkeae* and horseshoe-like in *K. vangoethemi*).

Derivatio nominis: Dedicated to Mr J. Kekenbosch for his valuable work on Belgian spiders.

Kekenboschiella marijkeae new species (Figs. 1-11)

Material

Type locality: Papua New Guinea, Madang province.

♂ holotype (I.G. 25848/1, microscopic prepar-