

Colour variation and polymorphism in the Giant orb-weaving spider *Nephila vitiana* (Araneae: Nephilidae) from Lombok, Indonesia

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Abstract The Giant orb-weaving spider *Nephila vitiana* occurred in large number in a patch of mangrove vegetation in Gili Meno, Lombok, Indonesia. Two abdominal (opisthosomal) colour morphs – yellow and greenish-yellow – were present in adult female spiders. They were equally abundant. A single female of the yellow morph was found in Sekotong on the main Lombok Island. The dorsum of the abdomen in the yellow morph was decorated with five pairs of sigillae. In the greenish morph, the dorsum was marked with five pairs of white-spotted sigillae or yellow spots. The present observation does not show unequivocally the association of colouration with habitat usage. Whether yellow colour in *N. vitiana* confers a selective advantage remains to be verified. The juvenile female spiders have different colour pattern from the adults.

Keywords *Nephila vitiana* – colour polymorphism – spider – colour variation – new record – West Nusa Tenggara

INTRODUCTION

The Giant orb-weaving spider *Nephila vitiana* (Walckenaer, 1847) has been recorded to occur in Indonesia, Sulawesi, to Fiji, Tonga [1]. It has been suggested that this spider is not present in the Australasian region, including Fiji and Tonga [2]. In the collections of 30 museums in Europe, USA, Australia and New Zealand, specimens clearly referable to *N. vitiana* were from Bali (in Western Australian Museum, Perth, Australia) and Sulawesi and Timor (in Zoologisches Museum, Berlin, Germany) [2]. Excepting Bali with 8 specimens, the number was very small for Sulawesi (2 specimens) and Timor (1 specimen).

Nephila vitiana was originally described as *Epeira vitiana* Walckenaer, 1847. It now includes as synonyms the taxa *Nephila pipersii* Thorell, 1877 and *Nephila wallacei* Thorell, 1877 [1]. It is noteworthy that there appear very little published records of this spider. We report here the finding of *N. vitiana*, and

the occurrence of abdominal colour variation, in Lombok, West Nusa Tenggara, Indonesia.

MATERIALS AND METHODS

During the occasion of the signing of Memorandum of Understanding (June 2010) between Mataram University and University of Malaya in Mataram, Lombok, Indonesia, the Malaysian delegates were accompanied by some Indonesian counterparts for three field excursions – to Kerandangan, Gili Meno and Sekotong. Kerandangan is a forested area, Gili Meno is a small island, and Sekotong is a coastal area with mangrove vegetation.

On Gili Meno (9 June 2010), we witnessed a large number (over 20) of *N. vitiana* in a patch of mangrove vegetation (a study site of I. Wayan Suana). The general appearance and the abdominal (opisthosomal) colour of the female spiders were noted and photographed. In addition to the female spiders, other life stages (egg cocoon, spiderlings,

juveniles, and males) were also noted. Due to limited time, quantitative study was not carried out. I. Wayan Suana made a follow-up trip (26-27 June 2010) to make numerical record of the colour morphs as well as the other life stages.

RESULTS AND DISCUSSION

Female *N. vitiana* can be readily distinguished from other *Nephila* species in the region (e.g. *N. antipodiana*, *N. pilipes* and *N. plumipes*) by the presence of a reddish sternum (Fig. 1) [2, 3]. There are also prominent yellow marks near the joints on the ventral side of all the legs (Fig. 1). A fairly large population of this spider was found confined to a small stretch of mangrove vegetation on Gili Meno. The spiders appeared to prefer this habitat near the water edge than the nearby area with coconut palms. We did not observe any *N. vitiana* in other parts of the island.

Two abdominal colour morphs – yellow (Figs. 2, 3) and greenish-yellow (Figs. 4, 5) – of female *N. vitiana* were present in Gili Meno. A cursory count during our first visit indicated that these two colour morphs occurred in about 1:1 ratio in some 20 individuals observed. On the second visit, the yellow morph accounted for 29 individuals and the greenish-yellow morph 22 individuals. The number of yellow and greenish-yellow females was not significantly different ($\chi^2 = 0.96$; $0.50 > P > 0.30$).

During the first visit, there were few adult male (Fig. 5) and juvenile female (Fig. 6) spiders. Several egg cocoons were present on the branches nearby the web. The silk appeared more orange than yellow in colour. The numerical count on the second visit resulted in six males and 19 juveniles associated with the yellow females; and one male and 13 juveniles associated with the greenish-yellow females. It is noteworthy that there appeared to be significantly more adult males associated with the yellow females. The significance remains to be determined.

The dorsum of the yellow morph was decorated with dark streaks and spots. It possessed five pairs of sigillae/spots arranged longitudinally along the middle part, with the two anterior pairs more prominent and larger in size (Fig. 2). The sigillae had a dark outline and a dark spot at the posterior part.

In the greenish-yellow morph, the dorsum was streaked with yellow base colour (Figs. 4, 5). It was decorated with five main pairs of white-spotted

sigillae (Fig. 4) or yellow spots (Fig. 5) arranged longitudinally as in the yellow morph, but without dark outline. Most of the greenish-yellow morph had white-spotted sigillae. In individuals with sigillae, the white colour was marked with a dark spot at the posterior part in the anterior pairs (Fig. 4). In individuals with yellow spots, the two anterior pairs were larger and the posterior spots were irregular in shape.

Colour polymorphism and pattern variation have been recently reported for female *N. antipodiana* in Peninsular Malaysia [4]. Several colour morphs appear to be present. The yellow abdominal colour morph appears to be the common form. In a particular locality, the population appears to be represented by only two colour morphs – yellow and non-yellow (greenish-yellow or reddish brown). In the present Gili Meno population, only two colour morphs (yellow and greenish-yellow) were observed. On the main Lombok Island, a single yellow-morph female spider was found in an inland area of Sekotong among the fruit trees. On Bali Island, over 15 *N. vitiana* adult females in Kedongan all belonged to the greenish morph – the spiders occurred among mango trees and on electric cables (I. Wayan Suana, unpublished data). It has been suggested that yellow colour is most cryptic in the below-leaf environment and hence selected for [5]. However, as in *N. antipodiana*, the association of colouration and habitat use in *N. vitiana* remains to be elucidated.

The juvenile female *N. vitiana* (Fig. 6), like *N. antipodiana* [4], is very different in colouration and pattern from the adult. These two taxa could provide useful models for the study of the ontogeny of colour and pattern development.

During the three earlier brief field excursions in early June 2010, we did not encounter any *N. antipodiana* and *N. pilipes*. We also did not come across any *Nephila* spider in Kerandangan. More intensive field study will be needed.

As in the case of *N. antipodiana* and *N. pilipes* [6, 7], two species of comb-footed spider (Theridiidae) – *Argyrodes argentatus* Pickard-Cambridge 1880 and *Argyrodes flavescens* (Pickard-Cambridge 1880 – are associated with *N. vitiana*. In Gili Meno, there were significantly more *Argyrodes* spiders associated with the yellow females than the greenish-yellow females – 42 versus 6. The reason and significance need verification.

In sum, it is reasonable to conclude that the dorsal



Figure 1. Ventral view of female *Nephila vitiana* in Gili Meno. (photo: H. S. Yong)

Figure 2. Yellow morph of female *N. vitiana* in Gili Meno. (photo: H. S. Yong)

Figure 3. Ventral view of yellow morph of female *N. vitiana* in Gili Meno. (photo: H. S. Yong)

Figure 4. Greenish-yellow morph of female *N. vitiana* with white-spotted sigillae in Gili Meno. (photo: H. S. Yong)

Figure 5. Greenish-yellow morph of female *Nephila vitiana* with yellow spots and a male on its back in Gili Meno. The dorsal view looks very much like *Nephila antipodiana*. (photo: H. S. Yong)

Figure 6. Juvenile *Nephila vitiana* at Gili Meno, Lombok, Indonesia. (photo: H. S. Yong)



abdominal colour in female *N. vitiana* is polymorphic in nature. Whether the yellow morph confers a selective advantage remains to be confirmed. Extensive studies are needed to determine the occurrence of abdominal colour polymorphism in *N. vitiana* in West Nusa Tenggara and other parts of Indonesia.

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REFERENCES

1. Platnick N.I. (2010) *The world spider catalog, version 11.0*. American Museum of Natural History, online at <http://research.amnh.org/entomology/spiders/catalog/index.html>.
2. Harvey M.S., Austin A.D. and Adams M. (2007) The systematic and biology of the spider genus *Nephila* (Araneae: Nephilidae) in the Australasian region. *Invertebrate Systematics* **21**: 407-451.
3. Dahl H. (1912) Seidenspinne und Spinnenseide. Mitteilung aus dem Zoologischen Museum in Berlin **6**: 1-90.
4. Yong H.S., Hashim R., Belabut D. and Lim P.E. (2010) Abdominal colour polymorphism in female Asian Golden Web Spider *Nephila antipodiana* (Araneae: Nephilidae). *Journal of Science and Technology in the Tropics* **6**: 39-42.
5. Oxford G.S. (2009) An exuberant, undescribed colour polymorphism in *Theridion californicum* (Araneae, Theridiidae): implications for a theridiid pattern ground plan and the convergent evolution of visible morphs. *Biological Journal of the Linnean Society* **96**: 23-34. With 2 figures.
6. Koh J.K.H. (1989) *A guide to common Singapore spiders*. Singapore Science Centre, Singapore.
7. Yong H.S. (2009) *Nephila antipodiana* (Araneae: Nephilidae) from Pahang: a new record for Peninsular Malaysia. *Journal of Science and Technology in the Tropics* **5**: 19-21.