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TREUBIA

*A JOURNAL ON ZOOLOGY
OF THE INDO-AUSTRALIAN ARCHIPELAGO*

Vol. 47, no. 1, pp. 1-75

June 2020



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Vol. 47, no. 1, pp. 1–75, June 2020

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UDC: 595.78(594.73)

David J. Lohman

Syntopic *Elymnias agondas aruana* female forms mimic different *Taenaris* model species (Papilionoidea: Nymphalidae: Satyrinae) on Aru, Indonesia

TREUBIA, June 2020, Vol. 47, No. 1, pp. 1–12.

Wing patterns of female *Elymnias agondas* (Boisduval, 1832) butterflies are highly variable, presumably to mimic different *Taenaris* species throughout New Guinea and surrounding islands. Labels on most *E. agondas* museum specimens lack precise locality information, complicating efforts to match *E. agondas* female wing patterns with presumed *Taenaris* model species. This paucity of data also makes it impossible to determine where different forms occur and whether they are strictly allopatric. During fieldwork on the Aru Archipelago, we found two distinct forms of *E. agondas* females occurring syntopically. The “light form” resembles *T. catops*, while the “dark form” seems to mimic *T. myops* and *T. artemis*. We discuss the significance of this finding and illustrate species in the *Taenaris* mimicry ring encountered on Aru.

(David J. Lohman, Sarino, and Djunijanti Peggie)

Keywords: adaptation, Batesian mimicry, butterfly, mimicry ring, polymorphism

UDC: 598.2:910.4(594.4)

Tri Haryoko

Recent ornithological expeditions to Siberut Island, Mt. Talamau and Rimbo Panti Nature Reserve, Sumatra, Indonesia

TREUBIA, June 2020, Vol. 47, No. 1, pp. 13–38.

Siberut Island, Mt. Talamau, Rimbo Panti Nature Reserve, and intervening locations in West Sumatra Province were visited during two expeditions in 2018-2019 by ornithologists from the Museum Zoologicum Bogoriense-Indonesian Institute of Sciences (LIPI), Louisiana State University Museum of Natural Science, and Andalas University. The main objective of these expeditions was to obtain data and tissue-subsample rich museum specimens for morphological and genetic studies of phylogeny and population genetics of Southeast Asian birds aimed at understanding the causes of avian diversification in the region. We also observed, photographed, and audio-recorded numerous bird species during the expeditions and archived these data. In total, 285 species were identified, and specimen material was collected from 13 species and 26 subspecies not previously represented in tissue resource collections. Here, we provide complete lists of birds found at each location, highlight distributional discoveries, and note cases of potential taxonomic, ecological, and conservation interest.

(Tri Haryoko, Oscar Johnson, Matthew L. Brady, Subir B. Shakya, M. Irham, Yohanna, Rusdian P. Ritonga, Dewi M. Prawiradilaga, and Frederick H. Sheldon)

Keywords: birds, distribution, diversity, conservation, West Sumatra

UDC: 598.813.063(59)

Elize Y. X. Ng

Integrative taxonomy reveals cryptic robin lineage in the Greater Sunda Islands

TREUBIA, June 2020, Vol. 47, No. 1, pp. 39–52.

Southeast Asian avifauna is under threat from both habitat loss and illegal poaching, yet the region's rich biodiversity remains understudied. Here, we uncover cryptic species-level diversity in the Sunda Blue Robin (*Myiomela diana*), a songbird complex endemic to Javan (subspecies *diana*) and Sumatran (subspecies *sumatrana*) mountains. Taxonomic inquiry into these populations has previously been hampered by a lack of DNA material and the birds' general scarcity, especially *sumatrana* which is only known from few localities. We demonstrate fundamental bioacoustic differences in courtship song paired with important distinctions in plumage saturation and tail length that combine to suggest species-level treatment for the two taxa. Treated separately, both taxa are independently threatened by illegal poaching and habitat loss, and demand conservation action. Our study highlights a case of underestimated avifaunal diversity that is in urgent need of revision in the face of imminent threats to species survival.

(Elize Y. X. Ng, Arya Y. Yue, James A. Eaton, Chyi Yin Gwee, Bas van Balen, and Frank E. Rheindt)

Keywords: bioacoustics, bird trade, passerines, songbird crisis, taxonomic neglect

UDC: 595.76:591.46(594.53)

Arif Maulana

A contribution to the taxonomy and ecology of little-known Indonesian *Afissa* ladybird beetles (Coccinellidae, Epilachnini)

TREUBIA, June 2020, Vol. 47, No. 1, pp. 53–62.

We collected the little-known ladybird beetle *Afissa incauta* in the mountainous region of Bandung, West Java. The beetle occurred sympatrically with the very similar species *A. gedeensis*. Here, we provide an update to the current knowledge for these two species. The *A. incauta* we collected have a slightly smaller and duller body compared to the previously known specimens of *Afissa incauta*, with convergent elytral maculation similar to *A. gedeensis*.

(Arif Maulana, Tri Atmowidi, and Sih Kahono)

Keywords: *Afissa gedeensis*, *Afissa incauta*, Coleoptera, Epilachnini, ladybird beetle

UDC: 595.733:574.2(594.57)

Ainun Rubi Faradilla

The life history and microhabitat ecology of a phytotelm-breeding damselfly *Pericnemis stictica* in Jatimulyo forest, Yogyakarta

TREUBIA, June 2020, Vol. 47, No. 1, pp. 63–75.

This study aims to understand the life history and microhabitat ecology of a phytotelmata-breeding species, *Pericnemis stictica*. Data was collected at 46 breeding sites in the Jatimulyo Forest, Kulonprogo. Several parameters were recorded from each breeding site, i.e. plant species, diameters, depth, water depth, water volume, water pH, and water turbidity. Naiads and imagoes of *P. stictica* were measured morphometrically. The data taken was analyzed descriptively using Minitab 19. The results showed that 17 naiads of *P. stictica* were found in 13 bamboo stumps. The bamboo species most commonly used by *P. stictica* as a breeding site was *Dendrocalamus asper*. Naiads of *P. stictica* were found in the same habitat as mosquito larva from genera *Toxorhynchites*, *Aedes*, *Armigeres*, and *Culex*. During the rearing process, it was recorded that *P. stictica* naiads can eat more than ten mosquito larvae a day. Four males and one female imagoes of *P. stictica* were found. The imagoes were mostly found in a secondary forest with shady ravine areas. Imago's average total length was 7.19 cm. Naiad's final instar average size was 16.7 mm. Water depth, water temperature, bamboo depth, bamboo volume, and humidity were all positively correlated to *P. stictica*'s phytotelmata-breeding behavior.

(Ainun Rubi Faradilla, Mariza Uthami, Bella Andini, and Hening Triandika Rachman)

Keywords: breeding, *Pericnemis*, phytotelm, Yogyakarta

THE LIFE HISTORY AND MICROHABITAT ECOLOGY OF A PHYTOTELM-BREEDING DAMSELFLY *PERICNEMIS STICTICA* IN JATIMULYO FOREST, YOGYAKARTA

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ABSTRACT

This study aims to understand the life history and microhabitat ecology of a phytotelmata-breeding species, *Pericnemis stictica*. Data was collected at 46 breeding sites in the Jatimulyo Forest, Kulonprogo. Several parameters were recorded from each breeding site, i.e. plant species, diameters, depth, water depth, water volume, water pH, and water turbidity. Naiads and imagoes of *P. stictica* were measured morphometrically. The data taken was analyzed descriptively using Minitab 19. The results showed that 17 naiads of *P. stictica* were found in 13 bamboo stumps. The bamboo species most commonly used by *P. stictica* as a breeding site was *Dendrocalamus asper*. Naiads of *P. stictica* were found in the same habitat as mosquito larva from genera *Toxorhynchites*, *Aedes*, *Armigeres*, and *Culex*. During the rearing process, it was recorded that *P. stictica* naiads can eat more than ten mosquito larvae a day. Four males and one female imagoes of *P. stictica* were found. The imagoes were mostly found in a secondary forest with shady ravine areas. Imago's average total length was 7.19 cm. Naiad's final instar average size was 16.7 mm. Water depth, water temperature, bamboo depth, bamboo volume, and humidity were all positively correlated to *P. stictica*'s phytotelmata-breeding behavior.

Keywords: breeding, *Pericnemis*, phytotelm, Yogyakarta

ABSTRAK

Penelitian ini bertujuan untuk mempelajari perikehidupan dan ekologi mikrohabitat spesies capung yang berkembang biak pada phytotelmata, *Pericnemis stictica*. Data diperoleh dari 46 titik berkembang biak di Hutan Jatimulyo, Kulonprogo. Dilakukan pencatatan beberapa parameter dari tiap tempat berkembang biak, yaitu spesies tumbuhan, diameter, kedalaman, kedalaman air, volume air, pH air, dan tingkat kekeruhan air. Naiad dan imago dari *P. stictica* diukur secara morfometrik. Data yang sudah diperoleh dianalisis secara deskriptif menggunakan Minitab 19. Hasil penelitian menunjukkan bahwa 17 naiad *P. stictica* hidup di 13 tunggul bambu. Spesies bambu yang banyak digunakan oleh *P. stictica* sebagai tempat berkembang biak adalah *Dendrocalamus asper*. Naiad *P. stictica* ditemukan di habitat yang sama dengan larva nyamuk dari marga *Toxorhynchites*, *Aedes*, *Armigeres*, dan *Culex*. Selama proses pemeliharaan, tercatat bahwa naiad *P. stictica* dapat memakan lebih dari 10 larva nyamuk dalam satu hari. Dijumpai empat jantan dan satu betina imago *P. stictica*. Sebagian besar imago dijumpai di hutan sekunder dengan kawasan tebing yang teduh. Panjang tubuh imago rata-rata 7,19 cm. Panjang naiad tahap instar terakhir 16,7 mm. Kedalaman air, suhu air, kedalaman bambu, volume air, dan kelembapan berkorelasi positif terhadap perilaku berkembang biak *P. stictica* pada phytotelmata.

Kata kunci: berkembang biak, *Pericnemis*, phytotelm, Yogyakarta

INTRODUCTION

Indonesian rainforest is rich in biodiversity. More than 600 species of Odonata occur in Indonesia (Caldecott & Janzen, 1996), each species with its characteristics. *Pericnemis stictica* Selys, 1863 is a damselfly with unique breeding behavior. *P. stictica* breeds in

'phytotelmata' (Murphy, 1997), which are small water bodies contained within plants (ancient Greek: 'phytos' = plant; 'telma' = pond) (Wen et al., 2012). There are several species that are known to breed in phytotelmata in Indonesia, e.g., *Indaeschna grubaueri*, *Lyriothemis cleis*, and *Pericnemis stictica* (Orr, 2015).

Recent records of *P. stictica* in Java show partially distributed populations. Some populations were reported to exist in Jatimulyo, Yogyakarta (Setiyono et al., 2017), Ungaran, Central Java (Baskoro et al., 2018), and Cirinten, Banten (Rachman & Rohman, 2016). Records of *P. stictica* life history and microhabitat ecology in Indonesia are still limited and have primarily been recorded by Lieftinck (1954). This rare species is known as the largest Zygopteran in the Malay Archipelago (Lieftinck, 1954). The naiad of this species is positively affected by season and climate change. *P. stictica* also plays essential roles in the ecosystem, including as a predator of mosquitoes, flies, and other small insects. This background information has driven our interest to study the life history and ecology of *P. stictica*.

MATERIALS AND METHODS

The research was conducted at Jatimulyo Forest, Kulonprogo, Yogyakarta. A preliminary survey was held during the dry season in July-August 2018. The survey continued during the rainy season in January-June 2019. The data was taken using the point count method. The survey was divided into two prominent locations. The first sampling location is a calcareous river with many bamboo trees, and the second sampling location was around Gunung Kelir Hill. Adults and imagoes of *Pericnemis stictica* were caught using an insect net. Imagoes were examined morphometrically using a vernier caliper. Each imago was documented using digital cameras and then released in the same habitat as soon as possible. *P. stictica* breeding sites were observed by checking all water-filled plants such as bamboo stumps, root cavities, and leaf axils using a small net, pincher, and headlamp. We examined at least 46 breeding sites. The parameters of breeding sites such as plant species, diameter, depth, water depth, water volume, water pH, and water turbidity were recorded using a tally sheet. Additional data, such as coordinates, were collected using GPS (Fig. 1). Phytotelm data were then analyzed statistically using Minitab 19. Final instar naiads were collected for subsequent ex-situ behavioral studies.

RESULTS

Morphometric measurement

There were five individuals of *Pericnemis stictica*, four males and one female. The average measurements for the total length were 7.17 cm, forewing 4.08 cm, hindwing 4.03 cm, thorax 0.92 cm, abdomen 6.15 cm (Table 1).

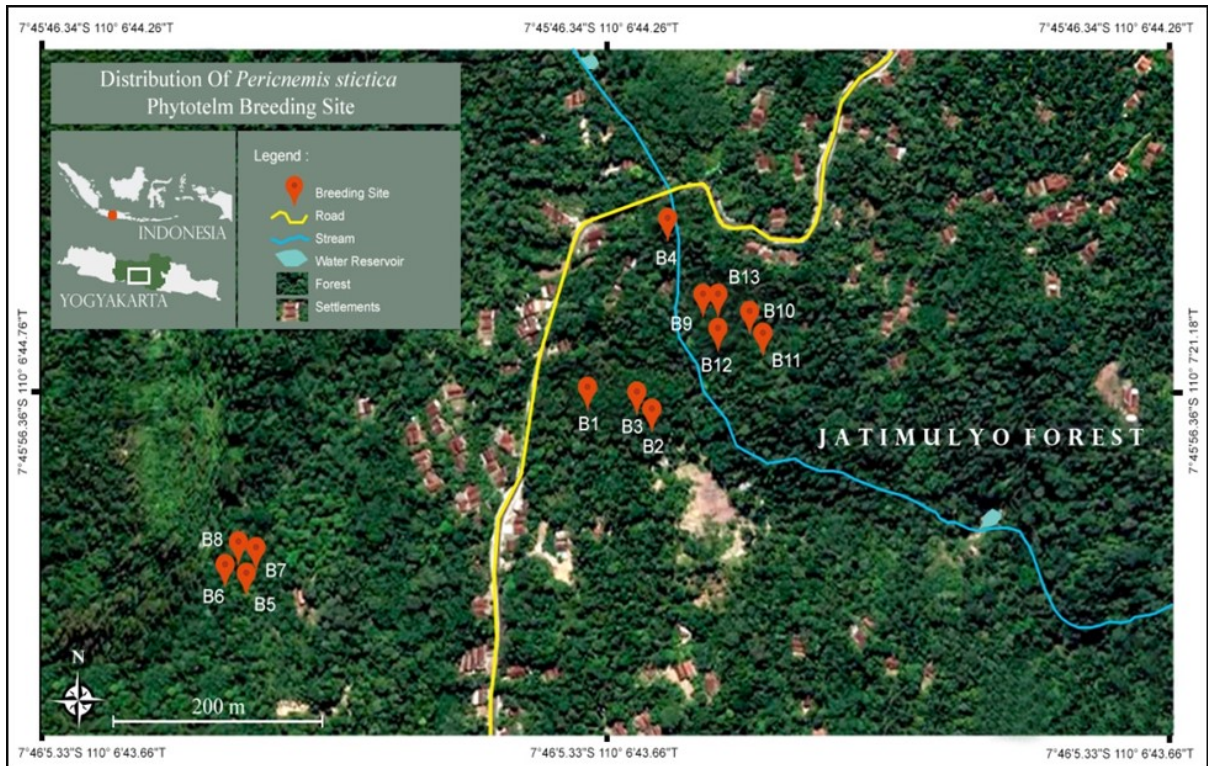


Figure 1. Distribution of *Pericnemis stictica* phytotelm breeding sites.

Table 1. Morphometric measurements of adult (imago) *Pericnemis stictica*

Label	Sex	Total length (cm)	Forewing (cm)	Hindwing (cm)	Thorax (cm)	Abdomen (cm)
C1	Male	7.34	4.16	4.08	0.93	6.24
C2	Male	6.76	3.81	3.57	0.91	5.79
C3	Male	7.23	4.12	3.98	0.94	6.22
C4	Male	7.33	3.99	3.83	0.94	6.29
C5	Female	7.20	4.34	4.70	0.90	6.24
Mean		7.17	4.08	4.03	0.92	6.15

Plant species at *P. stictica* breeding sites

There were three species of plants found as breeding sites for *Pericnemis stictica*, namely *Dendrocalamus asper*, *Gigantochloa atroviolaceae*, and *Gigantochloa apus*. The percentage of each plant species to the presence of *Pericnemis stictica* naiad are *Dendrocalamus asper* (61.53%), *Gigantochloa atroviolaceae* (23.07%), *Gigantochloa apus* (15.40%) (Table 2).

Environmental parameters of *P. stictica* (Phytotelmata) breeding sites

The environmental parameters measured are water depth, water pH, water temperature, water turbidity, bamboo diameter, bamboo depth, and water volume. There were 13 breeding sites with the average as follows: water depth 5.6 cm, water pH 5.3, water temperature 25.2°C, water turbidity 226.4 ppm, bamboo diameter 8.8 cm, bamboo depth 15.8 cm, water volume 387.52 cm³ (Table 3).

Table 2. Plant species at *P. stictica* (Phytotelmata) breeding sites

Label	Bamboo species	Naiad number
B1	<i>Dendrocalamus asper</i>	2
B2	<i>Dendrocalamus asper</i>	1
B3	<i>Dendrocalamus asper</i>	3
B4	<i>Gigantochloa apus</i>	1
B5	<i>Dendrocalamus asper</i>	1
B6	<i>Dendrocalamus asper</i>	1
B7	<i>Gigantochloa atroviolaceae</i>	1
B8	<i>Gigantochloa atroviolaceae</i>	2
B9	<i>Dendrocalamus asper</i>	1
B10	<i>Dendrocalamus asper</i>	1
B11	<i>Dendrocalamus asper</i>	1
B12	<i>Dendrocalamus asper</i>	1
B13	<i>Gigantochloa atroviolaceae</i>	1

Table 3. Environmental parameters of *P. stictica* (Phytotelmata) breeding sites

Label	Water depth (cm)	Water pH	Water temperature (°C)	Water turbidity (ppm)	Bamboo diameter (cm)	Bamboo depth (cm)	Water volume (cm ³)
B1	4.0	5.2	24.2	77	9.5	8.5	283.64
B2	6.0	5.0	24.1	109	16	11.5	1206.85
B3	8.5	5.7	25	90	16	23.0	1709.71
B4	3.9	6.2	24.9	254	4	16.2	49.27
B5	2.6	5.8	26.8	98	8.9	19.0	161.81
B6	8.9	3.6	26.6	70	4.4	22.4	135.38
B7	3.9	5.0	26.1	103	5.1	15.2	79.70
B8	6.4	5.3	25.7	24	5.5	18.1	152.11
B9	17.5	5.3	26.4	656	5.1	25.5	357.63
B10	1.5	7.2	26.4	564	15.7	7.0	290.50
B11	2.7	5.4	24	236	10.3	4.3	222.88
B12	3.0	4.3	24	106	9.2	11.2	199.50
B13	4.5	5.2	23.6	557	5.8	24.7	188.66
Mean	5.6	5.3	25.2	226.4	8.8	15.8	387.52
StDev	4.21	0.862	1.163	218.9	4.51	7.00	493

Principal components axis values with *P. stictica* phytotelm breeding behavior

The parameter that significantly affect *P. stictica* phytotelm breeding behavior are water depth 0.469, water temperature 0.348, bamboo diameter -0.353, bamboo depth 0.483 (Table 4).

Principal component analysis of *P. stictica* phytotelm breeding behavior

Water depth, water temperature, bamboo depth, bamboo volume, and humidity are positively correlated with *P. stictica* phytotelm breeding behavior, while water pH is negatively correlated (Fig. 2).

Table 4. Principal components axis values with *P. stictica* phytotelm breeding behavior

Variable	PC1	PC2
Water depth	0.469	0.275
Water pH	-0.139	-0.250
Water temperature	0.348	-0.158
Water turbidity	0.223	-0.207
Bamboo diameter	-0.353	0.333
Bamboo depth	0.483	0.230
Bamboo volume	-0.116	0.619
Air temperature	0.314	-0.347
Humidity	0.347	0.356

Values written in bold indicate parameters that significantly affect *P. stictica* phytotelm breeding behavior

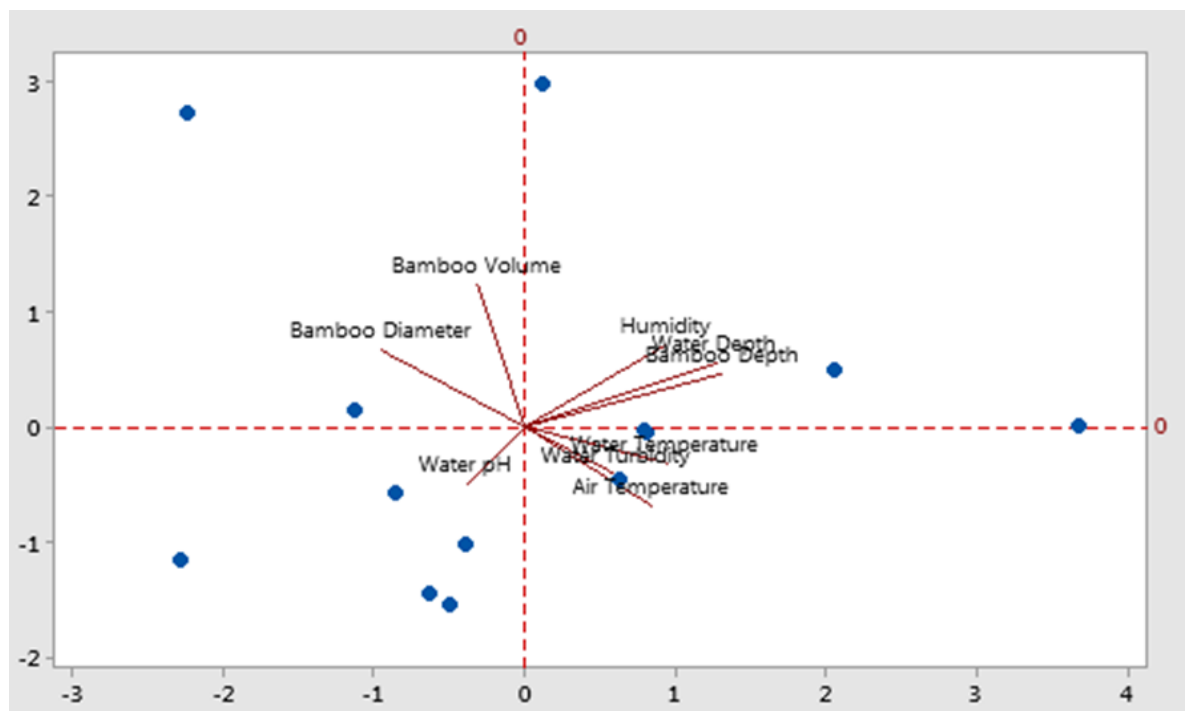


Figure 2. Biplot of principal component analysis of *P. stictica* phytotelm breeding behavior.

Naiad feeding behavior

Naiads that reared are fed with mosquito larvae, they eat 5–7 mosquito larvae each day, naiads will stop eating about 2–3 days before they metamorph (Fig. 3).

The final instar stage of *P. stictica* was found in a nearly dried *Dendrocalamus asper* stump. We found three cases with similar conditions. All naiads were in the final stage and were ready to molt. Some stumps were rehydrated by adding mineral water to prevent naiad from dying. Water at large and shallow stump is likely to evaporate faster.

DISCUSSION

In-situ habitat description

Jatimulyo Forest is a secondary forest located at Girimulyo, Kulonprogo, Yogyakarta, 7.76594°S 110.11730°E. On the west side, the forest is bordered by Gunung Kelir Hill, a cliff-like hill which stands 200 meters vertically. The topography of the area is very contoured with lots of ravines. The altitude of the forest is 550 meters above sea level on average. Air temperature can drop to 11°C in August, but on average, the temperature is around 20°- 25°C. The weather is mostly cloudy and cold. The forest has two waterfalls called Kembang Soka and Banyu Mudal. Both waterfalls are tourist destinations managed by local people. The water comes from nearby springs, which flows throughout the year and makes the whole forest wet. Local people also use water springs for daily activity. The flow rate of the water springs decreases during the dry season.

The forest vegetation is mixed between local plantations such as *Theobroma cacao*, *Cocos nucifera*, *Syzygium aromaticum*, *Paraserianthes falcataria*, and wild plants such as *Ficus septica*, *Pterospermum diversifolium*, *Microcos tomentosa*, and *Semecarpus longifolius*. *Colocasia esculenta*, *Bromelia sp.*, and *Cucurliigo latifolia* dominate the forest floor. This forest provides a suitable habitat for dragonflies. In 2015, 16 species of dragonflies were recorded in Menoreh (Lupiyaningdyah, 2015), including Javan endemic species *Drepanosticta sundana*. Another survey in 2016 focused on waterfalls around Jatimulyo recorded 11 species, including *Drepanosticta sundana* and *Drepanosticta gazella* (Rachman & Rohman, 2016). Both research surveys were conducted in open areas such as streams, waterfalls, and ponds. Species like *P. stictica* prefer to stay in shaded areas, explaining why *P. stictica* was not recorded during previous surveys.

P. stictica naiads were found inside bamboo stumps. Local people usually chop down the bamboo trees for gardening, building, and other purposes. Bamboo stumps are then filled by accumulated rainwater. The water contained inside the bamboo stump creates a specific habitat that contains organic substrates from dead leaves, bamboo grain, and twigs. The material trapped inside the bamboo stump then rots, becoming a brownish turbid water. The rotten material is used by insect larvae such as mosquitoes and Tipulidae as food sources. The

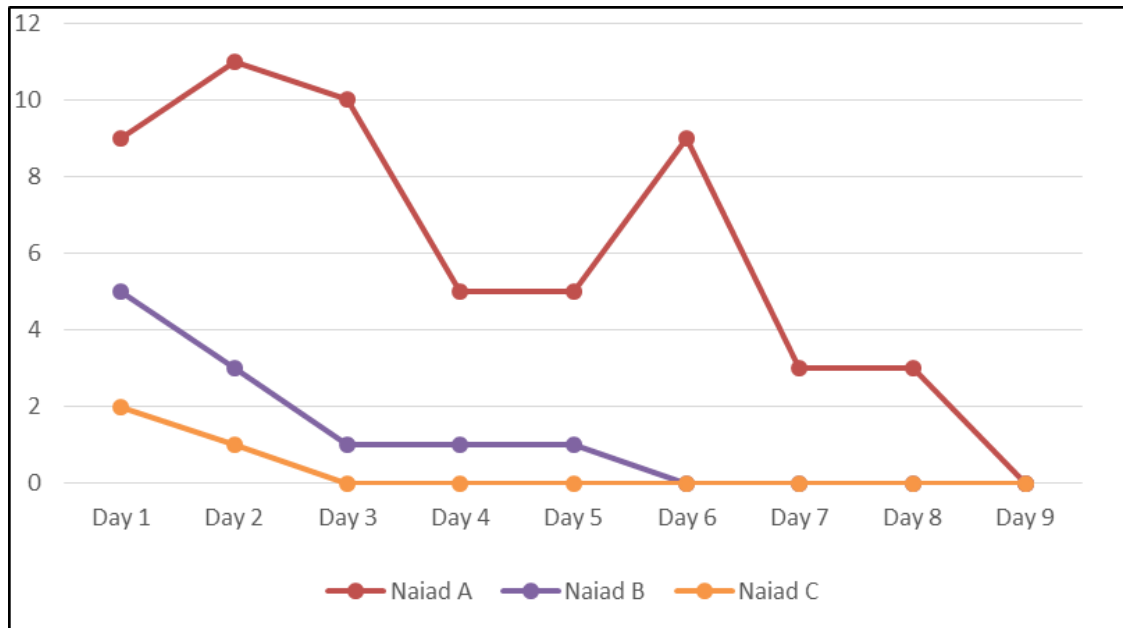


Figure 3. Naiad feeding behavior, as observed during the research

existence of small insect larvae attracts predators such as *P. stictica* to lay eggs there. During the survey, all the bamboo stumps that were used by *P. stictica* naiads also contained mosquito larvae from genera *Aedes*, *Armigeres*, *Culex*, and *Toxorhynchites* (Fig. S1). Based on data analysis, water depth, water temperature, bamboo depth, bamboo volume, and humidity are all positively correlated with *P. stictica* phytotelm breeding behavior. This suggests that *P. stictica* considers these parameters when laying eggs. Water depth, bamboo depth, and bamboo volume were also determining factors as to whether the naiads will remain in a bamboo stump and be able to complete the whole instar stage before the water totally evaporates. Temperature and humidity are two related factors that affect water evaporation: higher temperature and lower humidity will increase water evaporation. On the other hand, water pH was negatively correlated to *P. stictica*'s breeding behavior. Data in Table 3 shows that *P. stictica* is able to live at very diverse pH levels, from 3.6 to 7.2.

Naiad rearing in ex-situ habitat

Three final instar naiads were collected from bamboo stumps using a small hand net and reared in captivity in a small aquarium (15 cm × 15 cm). The aquarium was filled with bamboo water mixed with mineral water at 10 cm depth. Sand substrate and bamboo sticks were provided inside the aquarium. Naiads were fed with mosquito larva daily. During the return from the extraction site, one larva appeared to be dying. We later realized that the naiad was not dying but beginning the molting process. The newly molting larva turned white and became darker for an hour. Three naiads were reared together without showing any aggression toward each other. Naiad coloring is reddish-brown, which is very well camouflaged against the natural substrate.

The size of the final instar stage of *P. stictica* was 16.7 mm on average. The eyes are large and well separated. The antenna is thin and long, used to detect prey. The abdomen is slender and extended with a thin white line along the segment. The thin white line along the segment is a part of the abdomen that elongated after molting. The most interesting part of the naiad is the gill shape. It has three broad gills with a spoon-like shape (Fig. S4. B). The average gill size was 3.7 mm. The gills were constantly flapping. Usually, naiads stay at the bamboo stick with the gills facing the water's surface and the head facing down. These large-sized gills and this behavior are used to increase oxygen intake. Naiads can absorb more oxygen directly from the air by placing their gills at the water's surface. The naiad waits for the mosquito larvae calmly and moves slowly toward its prey. The naiad grabs the mosquito larva using its extended labium and chews the prey using its mandible (Fig. S5. B). The last instar stage of *P. stictica* eats 5-7 mosquito larvae in a day, but the most incredible amount recorded was 11 larvae. In nature, *P. stictica* is very important for controlling small insect populations such as mosquitoes and flies. Besides, Jatimulyo and some neighboring villages are locations where malaria is endemic, although the number of cases decreases every year. Dragonflies and damselflies seem very effective at controlling mosquito populations because they consume mosquito larvae and imagoes. Naiads stop eating around 2-3 days before metamorphosis. Their eye color becomes dull grey, and the gap at the dorsal side of its thorax is seen. The wing structure turns reddish-brown. Two days after the signs of metamorphosis appear, the naiad crawls up bamboo twigs, hangs outside the bamboo, and begins emerging. Metamorphosis was recorded at around 7-9 AM, and it took 2 hours until the body structure was well developed. The naiad's body length increased four times the length following metamorphosis.

Adult (imago) stage

Five *P. stictica* imago were found during the survey, four males and one female. The immature form displays yellow coloring on the lateral side of the eyes, thorax, and abdomen. The yellow colour turns light blue and a little bit green at the front of the eyes when becoming mature. The dorsal side of the thorax and abdomen is black (Fig. S2). The immature form also has a white pterostigma shaped like a diamond; it turns black when mature (Fig. S3). Orr & Hamalainen (2013) stated that *P. stictica*'s pterostigma shape is pentagonal. The femur and tibia are short, with short black setae along with them. The abdomen is long and slender; the longest abdomen record is 6.24 cm, with the longest total body length is 7.34 cm. The long stick-shaped abdomen is probably the etymological background for this species. This long abdomen helps the female when laying eggs, minimizing the risk of drowning when laying eggs inside the bamboo. Forewings are 4.08 cm, and hindwings 4.03 cm on average. Adult *P. stictica* were found around breeding sites, like bamboo grooves. They like to stay in ravines or under the cliff area, which has dense

vegetation, low light intensity, and high humidity. Locations like Jatimulyo Forest's conditions support the imagoes to live and breed. Also, Lieftinck (1932) recorded that *P. stictica* was found at 0 – 900 meters above sea level. It means that *P. stictica* is well adapted to the air temperature condition. *P. stictica* usually perches in a vertical position on low-level branches or leaves and remains motionless. Its color is well camouflaged with the forest's shades. When disturbed, the imago will fly to a higher branch or move into the bushes. Observers should focus on the imago when it flies because it is hard to see. Other dragonfly species that were recorded being present alongside *P. stictica* are *Gynacantha musa*, *Gynacantha subinterrupta*, *Agrionoptera insignis*, *Drepanosticta gazella*, *Drepanosticta sundana*, *Nosoticta insignis*, and *Coeliccia membranipes*. During the survey, we never found imagoes in tandem, copulation, or ovipositing.

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SUPPLEMENTARY FIGURES:



Figure S1. *D. asper* stump used by a *P. stictica* naiad (A); *P. stictica* naiad and *Toxorhynchites* were found in the same habitat (B).



Figure S2. Head and thorax details of male *P. stictica* (A); head and thorax details of female *P. stictica* (B); lateral details of male *P. stictica* and anal appendages (C); dorsal details of male *P. stictica* anal appendages (D).

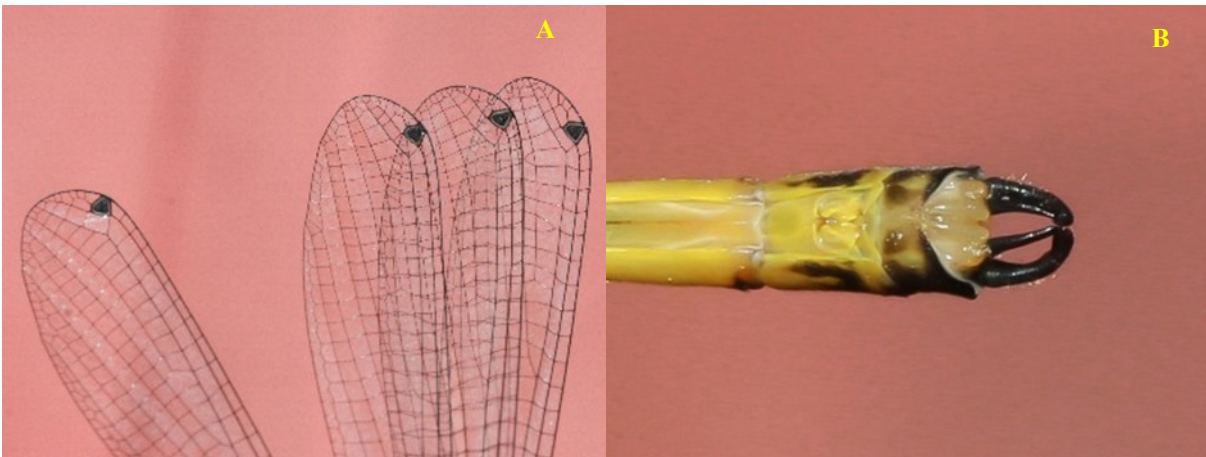


Figure S3. Detail of diamond shaped pterostigma of male *P. stictica* (A); ventral view detail of male *P. stictica* anal appendages (B).



Figure S4. *P. stictica* naiad dorsal view (A); *P. stictica* naiad lateral view (B).



Figure S5. Teneral form of *P.stictica* that has just finished molting in Cirinten forest, Banten Province. The body color is totally white and almost transparent. The picture was taken at a bamboo stump around 7.30 AM. The naiad was observed crawling outside and hanging outside of the bamboo (A); *P. stictica* eating *Armigeres* larva (B); immature male *P. stictica* (yellow form) (C); mature female (blue form) (D).

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