Indochinese Polydictya lanternflies: Two new species from Vietnam, identification key and notes on P. vietnamica...
Indoinese Polydictya lanternflies: Two new species from Vietnam, identification key and notes on P. vietnamica (Hemiptera: Fulgoromorpha: Fulgoridae)

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Abstract. Two new species of Polydictya Guérin-Méneville, 1844 from Vietnam, P. grootaerti sp. n. from Central Vietnam and P. drumonti sp. n. from North Vietnam, are described and compared with the closest species, P. chantrainei Nagai & Porion, 2004 and P. kuntzi Nagai & Porion, 2004. The male genitalia are described and illustrated for the two new species as well as for P. vietnamica Constant & Pham, 2008 for the first time. Habitus details and photographs, a distribution map and photographs of specimens in nature when available, are provided. The occurrence of P. vietnamica from Thailand and Northeast India, noted here for the first time based on photographs taken in nature, requires confirmation based on the examination of specimens. An identification key to the species of Polydictya from the Indochinese region is provided.

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INTRODUCTION

The genus Polydictya was erected by Guérin-Méneville (1844) to accommodate one species, Eurybrachys basalis Hope, 1843, described from Sylhet (Bangladesh). Species were progressively added to the genus, including Polydictya kriska Kirkaldy, 1902, the type species of Thaumastodictya Kirkaldy, 1902, when this genus was synonymized under Polydictya by Distant (1906). More recently, Lallemand (1963), Nagai & Porion (1996, 2004), Constant & Pham (2008), Constant (2009, 2010, 2015, 2016) Chew Kea Foo et al. (2010) and Bosuang et al. (2015) added new species and proposed nomenclatural changes within the genus.

The genus presently contains 28 species (Bourgoin, 2016). It is distributed in the Oriental region: from Sri Lanka to northern India, Thailand, Vietnam, southwards to Sulawesi and its adjacent islands through Indonesia, but it is not recorded from the Philippines.

Five species are currently recorded from the Indoinese Peninsula: P. basalis (Hope, 1843), P. chantrainei Nagai & Porion, 2004, P. johannae Lallemand, 1956, P. tricolor (Westwood, 1845) and P. vietnamica Constant & Pham, 2008 (Nagai & Porion, 1996; Constant & Pham, 2008). P. basalis and P. tricolor were mentioned by Distant (1918) from “Indochina” (without further details), and from Vietnam (again without a precise location) by Nagai & Porion (1996). The latter authors probably based their data on Distant’s (1918) paper but, as Indochina (i.e. former French Indochina in this case) actually includes not only Vietnam but also Laos and Cambodia, the presence of the species in Vietnam was not actually ascertained. However, the presence of P. tricolor in Vietnam was confirmed by a specimen from Cuarao (Nghe An province) in the BMNH collection (M. Webb, pers. comm. 2016).

The study of recent material in the collections of RBINS, UDCC and VNMN led to the discovery of two new species, which are here described and illustrated, and of a male specimen of P. vietnamica, allowing the description of the male genitalia of this species for the first time, for which additional material also allows an update of the distribution. An identification key to the Polydictya species from the Indochinese region is provided.
MATERIALS AND METHODS

The male genitalia were dissected as follows: The pygofer was cut from the abdomen of the softened specimen with a needle blade, then heated for about one hour in a 10% solution of potassium hydroxide (KOH). The aedeagus was dissected with a needle blade and all pieces examined in ethanol and then the whole placed in glycerine for preservation. Observations were done using a Leica MZ8 stereomicroscope. Pictures were taken with a Canon EOS 700D camera with Sigma DG Macro lens, stacked using software CombineZ and optimized with Adobe Photoshop CS3. The phallus was not inflated due to the difficulty of obtaining good and replicable results and because it is not indispensable for separating the species in the genus Polydictya.

For the transcription of the labels of the types, each single label is enclosed in square brackets.

The measurements are as in Constant (2004) and the following abbreviations are used: BF – maximum breadth of the frons; BTg – maximum breadth of the tegmen; BV – maximum breadth of the tegmen; BF – maximum breadth of the frons; BTg – maximum breadth of the tegmen; LT – total length; LV – length of the vertex in median line.


RESULTS

Taxonomy

Family Fulgoridae Latreille, 1807
Genus Polydictya Guérin-Méneville, 1844


Diagnosis. The characters defining this genus are given by Lallemand (1963), i.e., head broad, slightly narrower than the pronotum; frons as long as broad, not carinate, largely rounded dorsally, broadened above clypeus and much broader than the latter; vertex at least 4 times broader than long, excavate; tegmina at least 2.5 times longer than broad, densely reticulate; clavus closed with vein A1+2 extending up to sutural margin; hind wings almost entirely reticulate; anterior tibiae as long as femora, sometimes slightly foliaceous; hind tibiae with 4–6 lateral spines.

Polydictya drumonti sp. n.
(Figs 1, 2, 9)

ZooBank taxon LSID: 63549734-1129-49F0-83F5-1549747607BE

Diagnosis. This species can be separated from all other Polydictya species by the following combination of characters: (1) tegmina pale rosy-brown densely covered with irregular black-brown marking; black spots better defined and more spaced on basal 1/3 (Fig. 1A); (2) hind wings red with apical 1/3 and sutural margins brown and some small black spots inside the red area (Fig. 1A); (3) frons regularly rounded in dorsal view, not projecting anteriorly (Fig. 1B), yellow-brown (Fig. 1D); (4) anterior tibiae not laminate, black (Fig. 1A, C); (5) abdomen mostly black dorsally (Fig. 1A); (6) genital segments red.

The closest species are P. chantrainei (Thailand, Malaysia), P. grootaerti sp. n. (Vietnam) and P. kuntzi (Borneo), from which P. drumonti can be separated by characters (2) (the three other species do not have black spots inside the coloured area on the posterior wings) and (5) (the abdomen of the three other species is largely or entirely red dorsally).

Description. Measurements and ratios: LT: $\varphi$ (n = 5): 28.7 mm (27.2–30.0); LTg/BTg = 3.0; BV/LV = 4.4; LF/BF = 0.71.

Head. Pale yellow-brown with apex of clypeus brown and infraocular tubercle red (Fig. 1B, D, F); vertex curved and deeply grooved transversely with lowest point in middle, and with all 4 margins carinate (Fig. 1B); frons slightly visible from above (Fig. 1B), convex, smooth, subquadrate with impressed, S-shaped longitudinal groove along lateral margin, starting in front of eye (Fig. 1D); clypeus slightly narrower and shorter than frons (Fig. 1D); labium elongate, dark brown, surpassing metacoxae (Fig. 1C); antennae yellow-brown with scape cylindrical, elongate; pedicel bulbous (Fig. 1D, F).

Thorax. Yellow-brown; mesonotum darker than pronotum with a pair of paler, yellowish markings on each side of median line (Fig. 1B, F); pro-, meso- and metasternites brown (Fig. 1C, D); pronotum with transverse wrinkles, longitudinal carina and pair of impressed points on disc; mesonotum smooth with disc wrinkled and obsolete peridiscal carinae; scutellum slightly impressed on disc (Fig. 1B, F); tegulae yellow-brown (Fig. 1B, F).

Tegmina (Fig. 1A, C, E). Pale yellow-brown with basocostal angle whitish, basal 1/4 tinged with rosy, large black markings on basal 1/3 often merging together, 3 large black to dark-brown markings and groups of smaller spots on costal cell sometimes merging together; apical half with veins yellowish and cells dark brown, paler towards apex,
and with some irregular yellow-brown markings; costal and sutural margins subparallel, apex obliquely rounded. Hind wings (Fig. 1A, C). Broader than tegmina. Brown on apical half and along sutural margin; basal half bright
red with small irregular black markings; transverse yellowish-orange area between red and brown parts.

Legs (Fig. 1A, C). Elongate and slender with pro- and mesotibiae not foliaceous. Anterior and middle legs black-brown with protibiae and pro- and mesotarsi black, and mesotibiae with 2 obsolete paler rings. Metafemora yellow-brown dorsally and brown ventrally; metatibiae yellow-brown with apex brown; metatarsi dark brown. Metatibiae with 6 lateral and 7 apical spines.

Abdomen (Fig. 1A, C). Black with lateral pleura and intersegmental membranes bright red. Posterior margin of tergites and sternites very narrowly bordered with red.

**Male genitalia.** Pygofer, anal tube and gonostyli red; pygofer higher than long, with posterior margin strongly...
sinuate in lateral view and with strong posterodorsal process directed dorso-posteriorly and slightly hooked internally towards apex (Fig. 2A–B). Anal tube rather massive and short, 1.25 times longer than broad in dorsal view, broader at about half of total length, at level of ventrolateral processes, strongly curved ventrally near base (Fig.

Fig. 3. Polydictya grootaerti sp. n., female paratype. A – habitus, dorsal view; B – head, pro- and mesonotum, dorsal view; C – habitus, ventral view; D – frons, normal view; E – habitus, lateral view; F – head and prothorax, lateral view.
2A–B); lateral margins strongly projecting ventrally into a large lobe with posterior margin concave; posterior margin rounded in dorsal view (Fig. 2B) and slightly notched ventrally in posterodorsal view (Fig. 2C). Aedeagus (Fig. 2D–E) with endosomal processes with a strong, dorsal, hooked tooth projecting dorso-posteriorly. Apex of endosomal process membranous.


**Etymology.** The species epithet refers to our colleague Alain Drumont (RBINS), who kindly donated the first known specimen of this new species.

**Distribution.** Known from North Vietnam: Sa Pa and Ha Giang (Fig. 9A).

**Polydictya grootaerti sp. n.**

(Figs 3, 4, 5, 9)

ZooBank taxon LSID: B7CBBEAB-2D49-4BFC-B322-A206CCF378F7

**Diagnosis.** This species can be separated from all other species of *Polydictya* by the following combination of

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**Fig. 4.** *Polydictya grootaerti* sp. n., male holotype, genitalia. A – pygofer, anal tube and gonostylus, left lateral view; B – anal tube and pygofer, dorsal view; C – apex of anal tube, postero-dorsal view; D – aedeagus, lateral view; E – aedeagus, dorsal view. An – anal tube; EP – endosomal process of aedeagus; G – gonostylus; Py – pygofer.
characters: (1) tegmina pale yellow-brown largely covered with irregular brown-black markings (Fig. 3A); (2) hind wings bright orange with apical 1/3 and large sutural band dark brown; basal angle bright red (Fig. 3A); (3) frons regularly rounded in dorsal view, slightly projecting anteriorly (Fig. 3B), yellow-brown (Fig. 3D); (4) anterior tibiae not laminate, with obsolete paler ring (Fig. 3A, C); (5) abdomen red with middle black dorsally (Fig. 3A); (6) genital segments orange.

The closest species are *P. chantrainei* (Thailand, Malaysia), *P. drumonti* sp. n. (Vietnam) and *P. kuntzi* (Borneo), from which *P. grootaerti* can be separated by character (2) (the three other species do not have a bright red patch at the base of a bright orange coloured area on the posterior wings) and (5) (in *P. chantrainei* the dorsum of the abdomen is entirely red, in *P. drumonti* it is entirely black). It can also be separated from *P. kuntzi* by the black abdominal sternites (red in *P. kuntzi*).

**Description.** Measurements and ratios: LT: ♂ (n = 1): 23.4 mm; ♀ (n = 4): 27.6 mm (26.0–28.8); LTg/BTg = 3.0; BV/LV = 3.56; LF/BF = 0.82.

Head. Pale yellow-brown with apex of clypeus brown (Fig. 3B, D, F); vertex curved and deeply grooved transversely with lowest point in middle, and with all 4 margins carinate (Fig. 3B); frons very slightly visible from above (Fig. 3B), convex, smooth, subquadrate with impressed, S-shaped longitudinal groove along lateral margin, starting in front of eye (Fig. 3D); clypeus slightly narrower and shorter than frons (Fig. 3D); labium elongate, dark brown, surpassing metacoxae (Fig. 3C); antennae brown with scape cylindrical, elongate; pedicel bulbous (Fig. 3D, F).

Thorax. Pronotum pale yellow-brown with 4 paler spots; mesonotum black-brown with a pair of paler, yellowish markings on each side of median line, at base of scutellum (Fig. 3B, F); pro-, meso- and metasternites black-brown (Fig. 3C); pronotum with transverse wrinkles, obsolete longitudinal carina on basal half and 4 impressed points on disc; mesonotum smooth with disc longitudinally wrinkled and obsolete peridiscal carinae; scutellum slightly impressed on disc (Fig. 3B, F); tegulae yellow-brown (Fig. 3B, F).

Tegmina (Fig. 3A, C, E). Pale yellow-brown largely covered with irregular black markings formed by black cells; 5 black markings on costal cell; all veins yellowish; pale yellow marking at apex of clavus; costal and sutural margins subparallel, apex obliquely rounded.

Hind wings (Fig. 3A, C). Broader than tegmina. Apical half and broad band along sutural margin brown; basal half bright orange with basal angle red.

Legs (Fig. 3A, C). Elongate and slender with pro- and mesotibiae not foliaceous. Anterior and middle legs black-brown, with pro- and mesotibiae with one yellowish ring. Metafemora yellow-brown dorsally and brown ventrally; metatibiae yellow-brown with base brown; metatarsi yellow-brown. Metatibiae with 5–6 lateral and 7 apical spines.

Abdomen (Fig. 3A, C). Black ventrally; dorsum bright red with large black marking on middle.

**Male genitalia.** Pygofer, anal tube and gonostyli orange; pygofer higher than long, with posterior margin slightly curved in lateral view and showing spatulate dorsolateral process directed dorsally (Fig. 4A, B). Anal tube elongate, 1.55 times longer than broad in dorsal view, broader at 3/5 of total length; dorsal margin nearly straight in lateral view and strongly curved ventrally near apex (Fig. 4A, B); lateral margins sinuate in dorsal view (Fig. 4B); apical margin nearly straight in dorsal view (Fig. 4B); apical margin curved in posterior view (Fig. 4C); ventral margin reflexed near apex (Fig. 4A). Gonostyli (Fig. 4A) elongate with posterior half broader and strong subbasal constriction in lateral view; strong lateral tooth at about half length.
directed antero-ventrally; apical margin nearly straight medially. Aedeagus (Fig. 4D, E) with endosomal process curved internally, laterally laminate and narrowing towards apex in dorsal view; dorsal margin with 6 teeth directed laterodorsally and a strong tooth directed dorsolaterally on mediодorsal margin.
Type material. VIETNAM. Holotype ♂: [Coll. I.R.Sc.N.B., Vietnam, Da Nang prov., Ba Na Mt, 15°59´44˝ N 107°59´39˝E, ix.2015, 1450 m, local collector] (RBINS). Paratypes (5♀): 1♀: [VNMN.E.000000013, Bach Ma NP. Thua Thien Hue Prov., VIETNAM, 9/10/2015. Leg. Pham H.T.] (VNMN); 1♀ same data except: VNMN.E.000000010 (RBINS); 1♀: VNMN.E.000000011 (RBINS); 1♀: VNMN.E.000000012 (VNMN); 1♀: VNMN.E.000000131 (VNMN). Coordinates of Bach Ma National Park: 16°12´N 107°52´E.

Etymology. The species is dedicated to Dr Patrick Grootaert, the head of Entomology at RBINS in acknowledgment for his long-standing support and help with our projects in Vietnam.

Distribution. Known from Central Vietnam, Bach Ma National Park and Ba Na Hills (Fig. 9A).

Biology. The specimens collected in Bach Ma National Park were sitting close to one another on the trunk of an unidentified species of tree (Fig. 5). At rest, they are very well camouflaged and difficult to spot.

Polydictya vietnamica Constant & Pham, 2008 (Figs 6–8, 9B)

Polydictya vietnamica Constant & Pham, 2008: 27 (type in RBINS) [described, illustrated, distribution map].
**Polydictya vietnamica** Constant 2009: 294 [key to *Polydictya* species with posterior wings red basally]; Constant et al., 2016 [to be searched for in Cambodia].

**Male genitalia.** Pygofer, anal tube and gonostyli red. Pygofer higher than long, with posterior margin showing a broad, elongate, laminate process at mid-height, directed medioposteriorly, posterior margin of process rounded; anterior margin of pygofer strongly concave in lateral view (Fig. 7A, B). Anal tube in dorsal view elongate, 1.54 times longer than broad, broader at 3/4 of total length (Fig. 7B); strongly curved ventrally in lateral view and broader apically (Fig. 7A); apical margin slightly concave in posterior view (Fig. 7C); lateral margins diverging from base to apex in dorsal view (Fig. 7B). Gonostyli (Fig. 7A) elongate, 1.70 times longer than high in lateral view with posterior half broader in lateral view; strong lateral tooth directed posteroventrally at about half of length, under dorsal margin; apical margin oblique with dorsal and ventral angles rounded; dorsal margin slightly curved and ventral margin broadly rounded in lateral view; basal dorsal field of small spines directed dorsally. Aedeagus (Fig. 7D–E) with endosomal processes elongate with apex slightly clavate and curved internally; dorsolateral lamina on median 1/3, broader near base and with lateral margin irregular; lamina sinuate in lateral view.

**Material examined.** Type material. VIETNAM. Holotype ♀: [Coll. I.R.Sc.N.B., Vietnam, Quang Tri prov., Dakrong district, Hue Nghii commune, 6/V/2005, 265 m, Ho. 1472, leg. H.T. Pham] (RBINS).


**Note.** We have not been able to find a place named “Nui Hong Kong”, but near Pleiku, there is “Nui Ham Rong” (Gia Lai province), a mountain close to Camp Enari, an American military base camp established in September 1966 and closed in April 1970 (Wikipedia, 2016). The wrong name on the specimen’s label is probably a transcriptional error.

**Material examined only on photographs taken in nature.** THAILAND: 1 ex. (Fig. 8A), Thailand, Khao Yai National Park, 13.vii.2015, Ruangyot Hongsaeng; 1 ex. (Fig. 8B), Thailand, Khoa Soi Dao Wildlife Sanctuary, ix.2008, Bullung Siriphiphat.

INDIA: 1 ex. (Fig. 8C), India, Meghalaya, Balpakram National Park, 3.vi.2015, Sachin Ranade.

**Distribution.** This species is recorded from Vietnam, Thailand (new country record to be confirmed) and northern India (new country record to be confirmed) (Fig. 9B).

**Note.** The data from Thailand and India are based on photographs as no collection specimens from these countries are available. Confirmation of the presence of this species based on the examination of specimens is still pending (see Discussion).

**Identification key to the species of Polydictya from the Indochinese region**

**Note.** The couplet 2 concerning *P. basalis* and *P. johannae* is based on the key given by Lallemand (1963). The latter species was described based on a female specimen and still requires a study of the male genitalia in order to assess its relation to *P. basalis*.

1. Hind wings with a rectangular basicostal bluish-white marking.................................................................2
2. Hind wings without rectangular basicostal bluish-white marking..........................................................3
3. Hind wings red basally .................................*P. basalis* (Hope, 1843)
4. Hind wings brown basally .........*P. johannae* Lallemand, 1956
3 Anterior and middle legs red ................................................ 4
  – Anterior and middle legs brown to black, often with a paler
    ring on tibia ...................................................................... 5
4 Basal half of tegmina with large black markings, posterior
  half mostly black; tegmina narrow, about three times as long
  as broad................................. P. tricolor (Westwood, 1845)
  – Basal 2/3 of tegmina without large black markings, apical 1/3
    brown; tegmina rather broad, less than 2.5 times as long as
    broad ............................... P. vietnamica Constant & Pham, 2008

5 Hind wings largely bright red basally with some small black
  spots in the red area; abdomen mostly black dorsally ............
  ................................................................. P. drumonti sp. n.
  – Hind wings largely bright red or orange basally without small
    black spots; abdomen red or red with middle black dorsally.
    ........................................................................... P. grootaerti sp. n.
6 Hind wings largely bright orange with basal bright red marking;
  abdomen red with middle black dorsally ............................
  ........................................................................... P. grootaerti sp. n.
  – Hind wings largely, uniformly, bright red or bright orange;
    abdomen entirely red dorsally ................................. P. chantrainei Nagai & Porion, 2004

**DISCUSSION**

Seven species of *Polydictya* are currently recorded from the Indochinese Peninsula, with three of them described from Vietnam within the last 8 years.

Recent research and additional data based on photographs have also greatly extended the recorded distribution of *P. vietnamica*. The species was described based on a single female from Central Vietnam but is apparently widespread in continental Southeast Asia, with a range extending westwards to Thailand and India. All photographic data of this species were obtained through social media on the internet, on Facebook pages dedicated to insects and nature (see also Constant et al., 2016 for another example of the improvement of Lanternflies knowledge through the use of social networks).

However, the identification of *Polydictya* species requires confirmation based on the colouration of the hind wing and dorsum of the abdomen as well as the male genitalia, especially when data is recorded for areas far away from the previous distribution. For example, based on photographs of living specimens, *P. grootaerti* sp. n. could be easily confused with *P. chantrainei* (see also Constant, 2009 for an illustration of *P. chantrainei*). In conclusion, collecting specimens to accurately document the species (males and females whenever possible) is highly recommended, and authorities should encourage this practice by citizen-scientists providing they collaborate in scientific projects. This is of great importance in order to build scientifically based faunistic lists and databases, e.g., for protected areas.

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