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Quoc Toan Phan & Thi Phuong Anh Dinh

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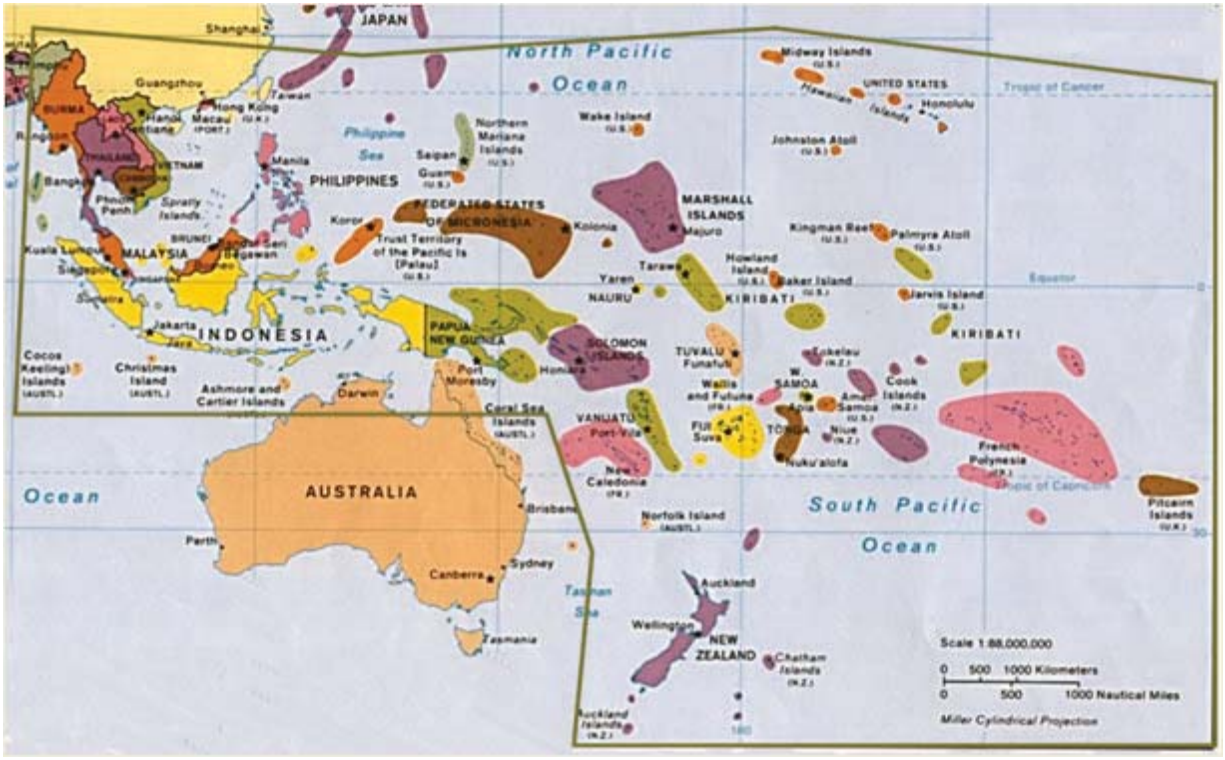

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Odonata from the Cham Islands, off central Vietnam, collected in September 2015

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Abstract

The first known Odonata records from the Cham Islands, off Quang Nam Province, central Vietnam are presented based on a brief collecting period in late September 2015. A total of 25 odonate species (8 Zygoptera and 17 Anisoptera) were recorded. Illustrations of the detailed structures of some species are provided.

Key words: Odonata, Cham Islands, Central Vietnam

Introduction

The Cham (Fig. 1) or "Cù lao Chàm" in Vietnamese, is a group of 8 islands, located about 19 kilometers off the coast of the ancient city of Hoi An, in Quang Nam Province of central Vietnam. The islands became the Cu Lao Cham Marine Reserve in March 2003, and were recognized by UNESCO as a World Biosphere Reserve (which includes Hoi An Ancient Town) in May 2009 (Cu Lao Cham MPA, 2015). The reserve is popular tourist destination because of its beautiful beaches, coral and the full primary forest cover of the biggest island (Hon Lao).

The marine fauna of the Cham Islands has been well studied by the Department of Fisheries, Department of Science, Technology and Environment of Quang Nam Province and Nha Trang Institute of Oceanography. A total of 202 species of fish, 4 species of lobsters, 84 species of molluscs and 180 species of hard corals has been recorded, but the territorial fauna has hardly been studied, only the occurrence of monkey (Macaca sp.), lizards (Varanus sp.), snake (Python sp.) or edible-nest swiftlet

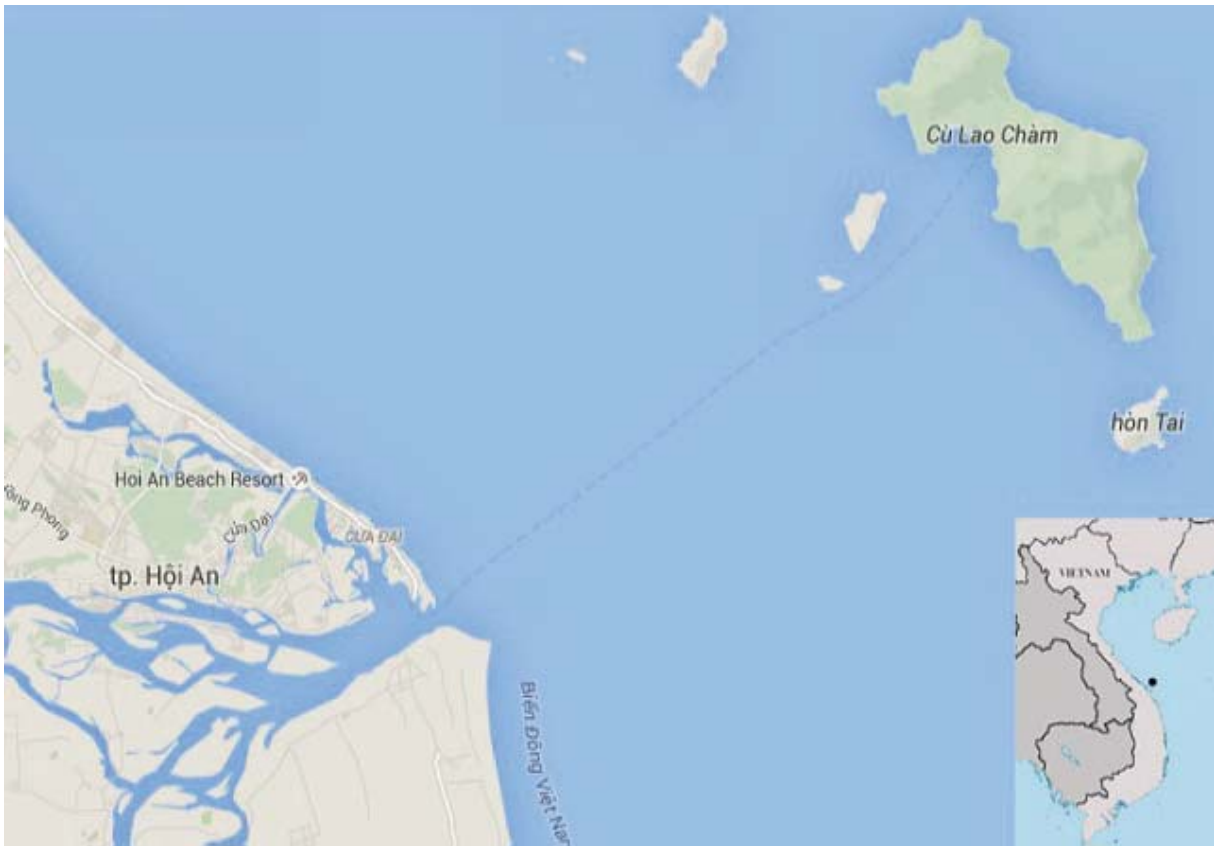

Figure 1. Location of the Cham Islands in Vietnam (rearranged from Google maps).

(*Collocallia fucifagemani*) has been documented (Cu Lao Cham MPA, 2015). Until now, no insects have been reported from the Cham Islands. In late September 2015, the first author and his students conducted a two-day survey of Odonata on Hon Lao of the Cham Islands. We also provide here new detailed illustrations of the structures of some species.

Materials and methods

The specimens were collected and preserved in triangular envelopes. After being treated for 8-12h in acetone solution, the specimens were dried and put in envelopes added with notes on date, location, and collectors. All specimens were examined in the Animal Ecology Laboratory of Tokyo Metropolitan University (Japan). Illustrations were made from sampled specimens using a microscope.

The result section includes brief comments on morphology, habitat and distribution of the taxa. The records are discussed against the background of the distribution maps published by Do & Dang (2007).

Locations

Three sites in Hon Lao, the biggest island of the Cham Islands, was visited on 24-25 September 2015:

1. Bai Ong (Fig. 2A): A small spring brooklet in secondary forest. The water from this stream creating several canals and swamps near the mountain.
2. Vung Chua (Figs. 2B, 2C): This site includes several kinds of habitats such as canals, ponds, paddies and small rocky streams.
3. Thon Cam (Fig. 2D): A rocky montane stream with very little water in this season.

Figure 2. Collecting sites in the Cham Islands. (A) Bai Ong; (B) rocky stream in Vung Chua; (C) the first author and his student in Vung Chua; (D) small rocky stream in Thon Cam.

Results

CALOPTERYGIDAE

***Vestalis gracilis* (Rambur, 1842)** (Figure 3)

Specimens collected: 1 ♂, 1 ♀ (Thon Cam)
Morphological discussion: *V. gracilis* is a large sized calopterygid species. The synthorax of the male and female is metallic green with distinct yellow stripes on the

sides. Wings are hyaline, lacking pterostigma and are pale brownish or darkened at the tip (Figs. 3A, 3B).

Distribution and habitat: This is a common and widespread species in Vietnam. Adult damselflies abound near streams in secondary and primary forests.

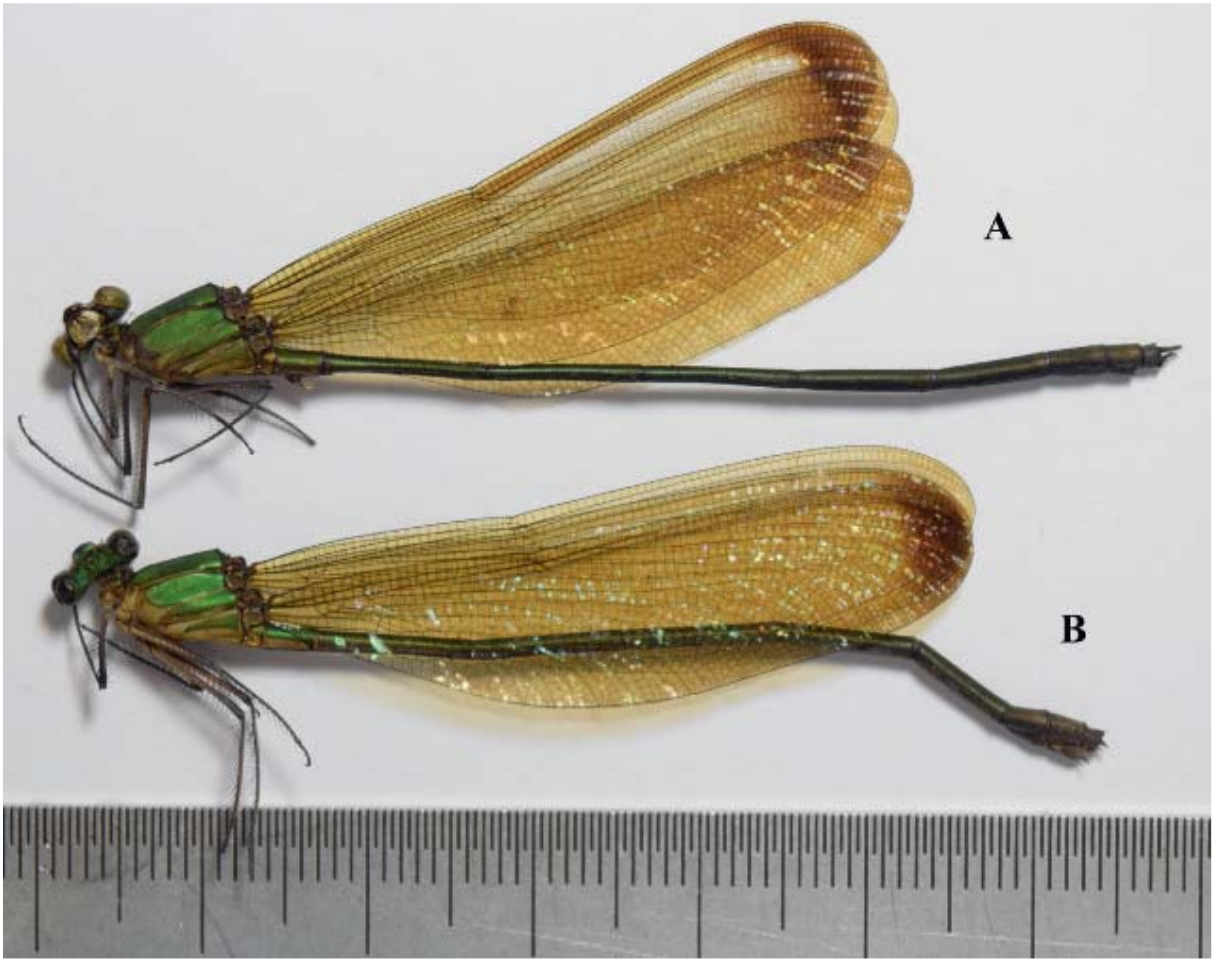

Figure 3. *Vestalis gracilis*. (A) ♂ & (B) ♀.

COENAGRIONIDAE

***Agriocnemis femina* (Brauer, 1868)** (Figure 4)

Specimens collected: 4 ♂♂, 2 ♀♀ (Vung Chua)

Morphological discussion: This is a tiny-sized damselfly, characterized by the superiors anal appendages having a semicircular shape in lateral view, with a large internal spine, and inferiors being longer than the length of the superiors and apically covered with dense long hairs (Fig. 4C). Body colour pattern of the male is black-bluish (Fig. 4A) with antehumeral stripe and abdominal segments 8th to 10th olivacious, but the female differs from the male by pinkish or pale-orange head, thorax and abdomen (Figs. 4B, 4F). Penile organ structure as in Figs. 4D, 4E.

Distribution and habitat: *A. femina* is a very common species in paddies, ponds, bogs or grassy swamps all over Vietnam (Do & Dang, 2007, von Ellenrieder et al., 2015; Kompier, 2015).

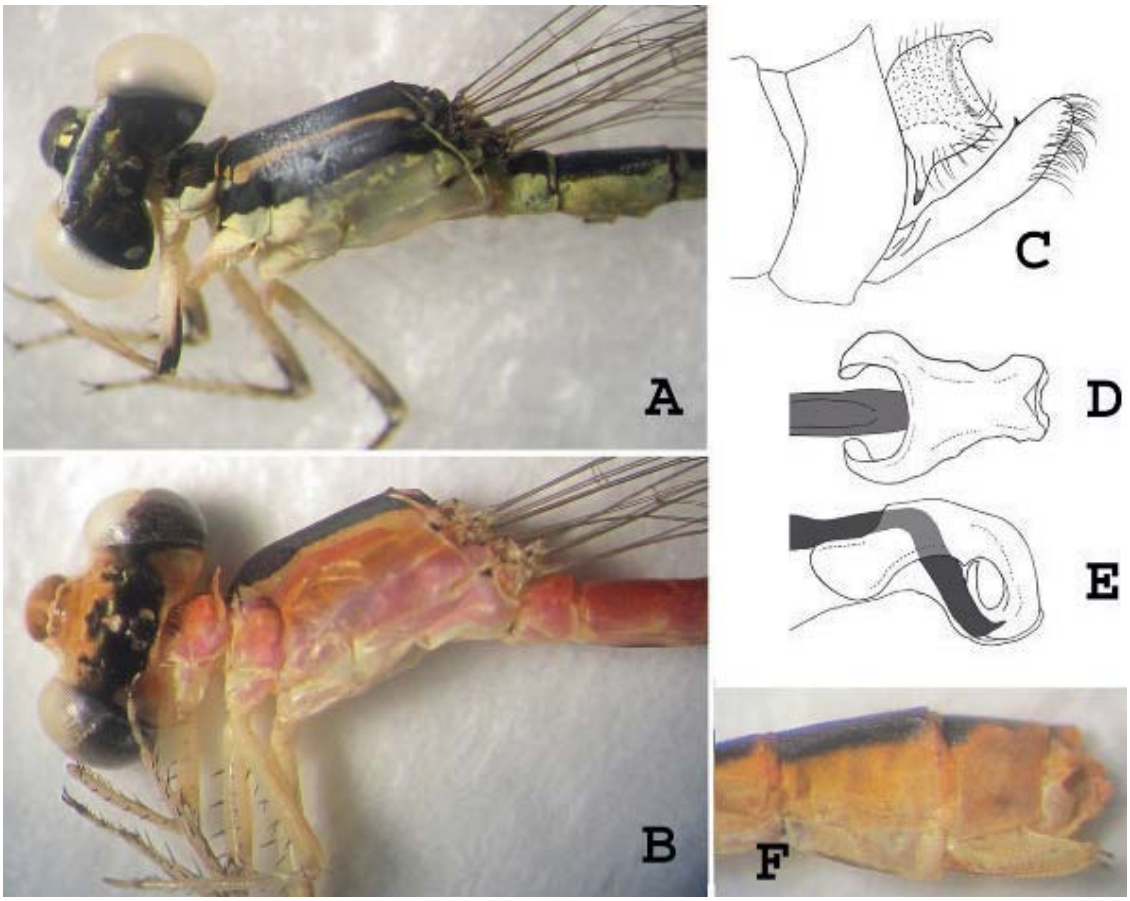

Figure 4. *Agriocnemis femina*. (A) ♂; (B) ♀; (C) anal appendages in lateral view; penile organ in (D) dorsal & (E) lateral view; (F) ♀ tip of abdomen.

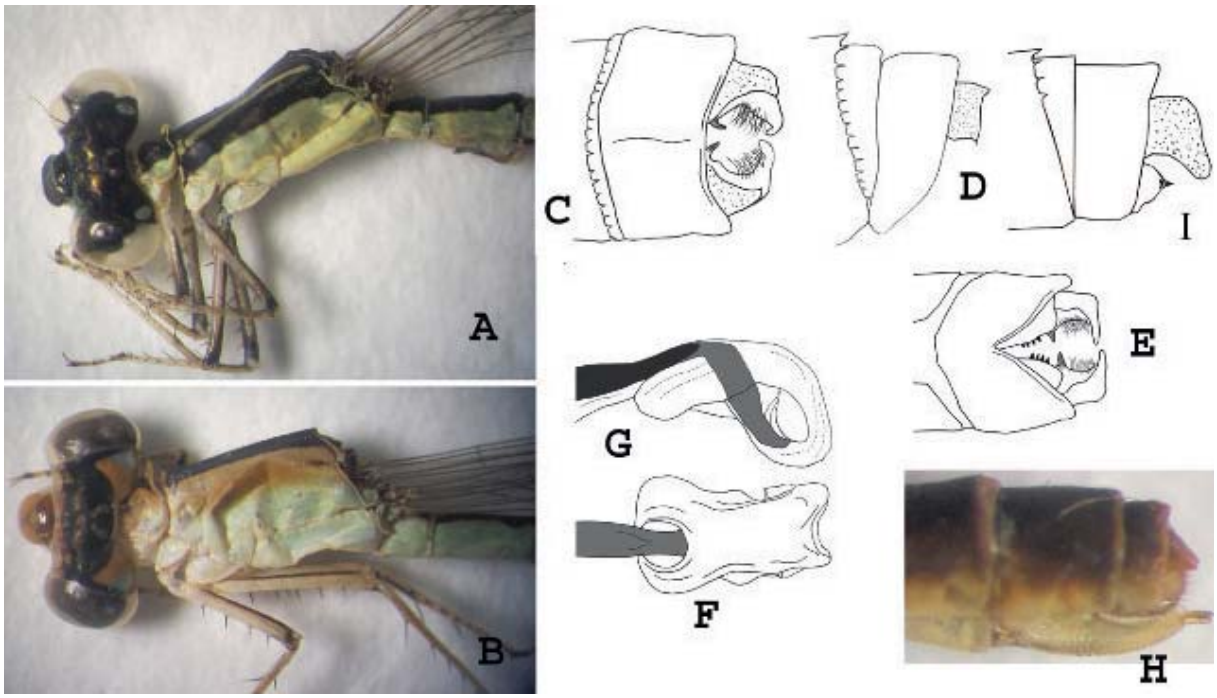

Figure 5. *Agriocnemis* spp. [A-H] *Agriocnemis* sp. (A) ♂; (B) ♀; anal appendages in (C) dorsal, (D) lateral & (E) ventral view; penile organ in (F) dorsal & (G) lateral view; (H) ♀ tip of abdomen. (I) *Agriocnemis pygmaea* ♂ (Nam Bung, Yen Bai Province), anal appendages in lateral view.

***Agriocnemis* sp.** (Figure 5)

Specimens collected: 1 ♂, 1 ♀ (Vung Chua)
Morphological discussion: This resembles *A. femina* (Brauer, 1868) and *A. pygmaea* Rambur, 1842 both in body colour pattern (Figs. 4A, 4B, 4F, 5A, 5B, 5H) and penile organ (Figs. 4D, 4E, 5G, 5H). The specimens resemble *A. pygmaea*, but they can be distinguished by different shape of anal appendages. In *A. pygmaea*, the superiors are hook-shaped in lateral view and the inferiors are prominent in lateral view (Fig. 5I); but in *Agriocnemis* sp. the superiors are blunt, not hook-shaped, and the inferiors are placed inside the posterior end of 10th abdominal segment and cannot be seen in lateral view (Figs. 5C, 5D, 5E). In the female *A. pygmaea*, the black pattern at dorsal abdominal segments 8th to 10th is less extensive, extending covering only to the top 1/4 part of the segment, but in *Agriocnemis* sp., the blackish dorsum extends much further down laterally (Fig. 5H). Additionally, *Agriocnemis* sp. has a distinct posterior lobe on the prothorax, which is virtually absent in *A. pygmaea*. The taxonomic status of this species of *Agriocnemis* from the Cham Islands remains open until we have more complete access to literature and specimens. Its status will be clarified in the future when we have access to more material.
Distribution and habitat: Specimens of this species were collected from a wet grassy swamp in the Cham Islands.

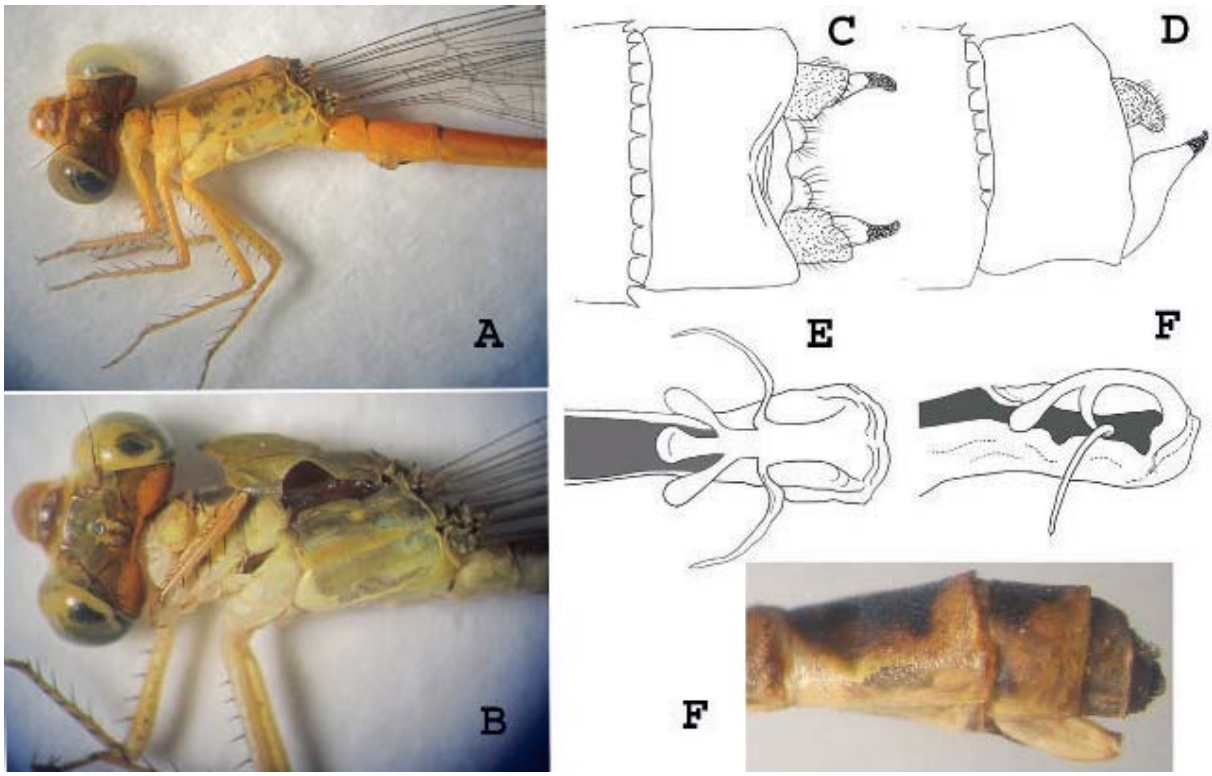

Figure 6. *Ceriagrion auranticum*. (A) ♂; (B) ♀ (synthorax broken); anal appendages in (C) dorsal & (D) lateral view; penile organ in (E) dorsal & (F) lateral view; (G) ♀ tip of abdomen.

***Ceriagrion auranticum* Fraser, 1922** (Figure 6)

Specimens collected: 1 ♂, 1 ♀ (Bai Ong)
Morphological discussion: A small-sized damselfly. Male with orange body, female pale bluish-yellow, the apical segments of abdomen with black dorsal markings. (Figs. 6A, 6B, 6F).
Distribution and habitat: In Vietnam, *C. auranticum* is a common species, widespread from the North to the South (Do & Dang, 2007; Ellenrider et al., 2015, Kompier, 2015).

***Ischnura senegalensis* (Rambur, 1842)** (Figure 7)

Specimens collected: 12 ♂♂, 3 ♀♀ (Bai Ong, Vung Chua)
Morphological discussion: Male and female resembleeach other in their colour pattern. (Figs. 7A, 7B, 7C, 7F). In male, the 10th abdominal segment has prominent posterior-dorsal ridge that is typical for the genus Ischnura (Fig. 7C). *I. senegalensis* can be found in paddy fields, ditches, wet grassland.
Three other *Ischnura* taxa have been recorded in Vietnam (Do & Dang, 2007 and Kompier, 2015): *I. carpentieri* Fraser, 1946, *I. rufostigma* Selys, 1876, and *I. aurora* (Brauer, 1865). According to Kompier (2015) and Kompier (pers. comm.) *I. aurora* is widespread, and it occurs at least from Lai Chau in the north to Cat Tien National Park in the south, whereas *I. rufostigma* and *I. carpentieri* are most probably infrasubspecific morphs of the same species, so *I. carpentieri* may be a junior synonym of *I. rufostigma*.
Distribution and habitat: This is common species in Vietnam.

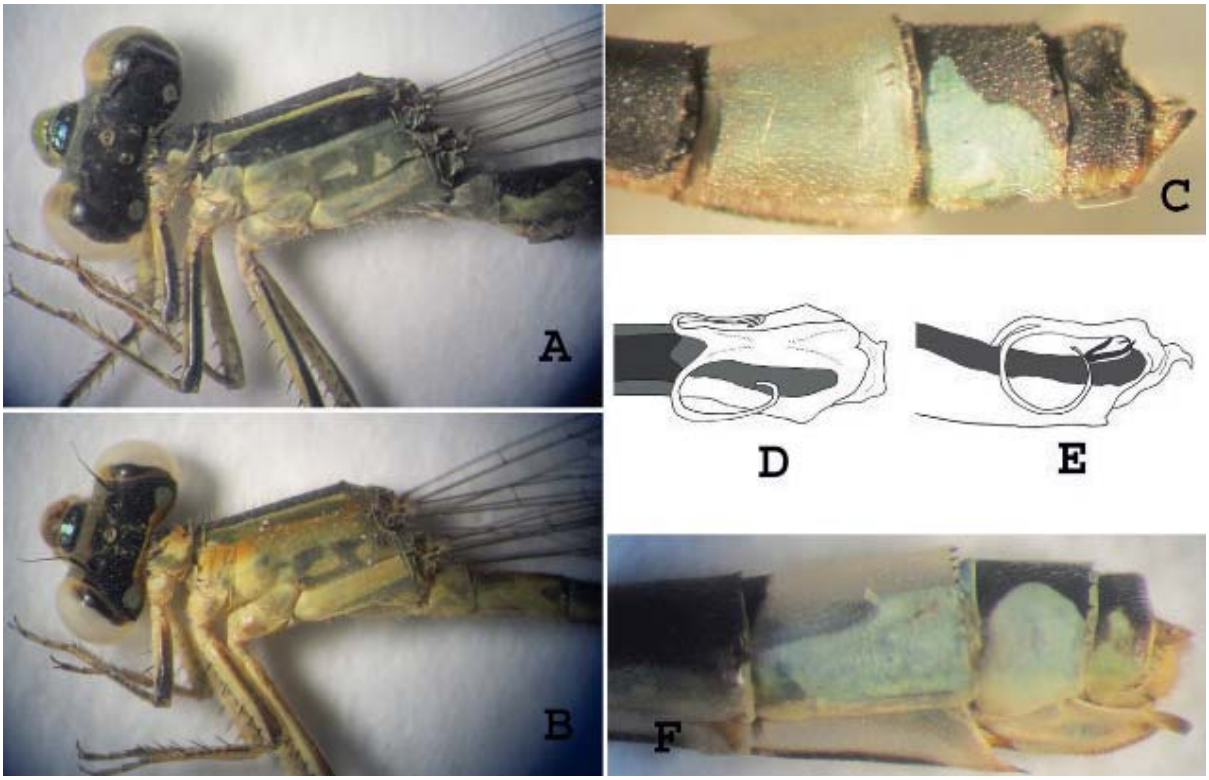

Figure 7. *Ischnura senegalensis*. (A) ♂; (B) ♀; (C) anal appendages in lateral view; penile organ in (D) dorsal & (E) lateral view; (F) ♀ tip of abdomen.

***Paracercion melanotum* (Selys, 1876)** (Figure 8)

Specimens collected: 1 ♂ (Bai Ong)
Morphological discussion: The structure of anal appendages of the male from the Cham Islands (Figs. 8B, 8C, 8D) matches that of *P. melanotum* from China as given by Dumont, 2004 (Figs. 13-15, p. 363).
Distribution and habitat: *P. melanotum* is known from China, Hong Kong, Maucau, Taiwan, South Korea, Japan and Vietnam (Dumont, 2004). In Vietnam, this species has been recorded from several locations in the north: Ninh Binh, Lang Son and Cao Bang Provinces (von Ellenrieder et al., 2015; Kompier, 2015). This is the first time *P. melanotum* is recorded from central Vietnam.

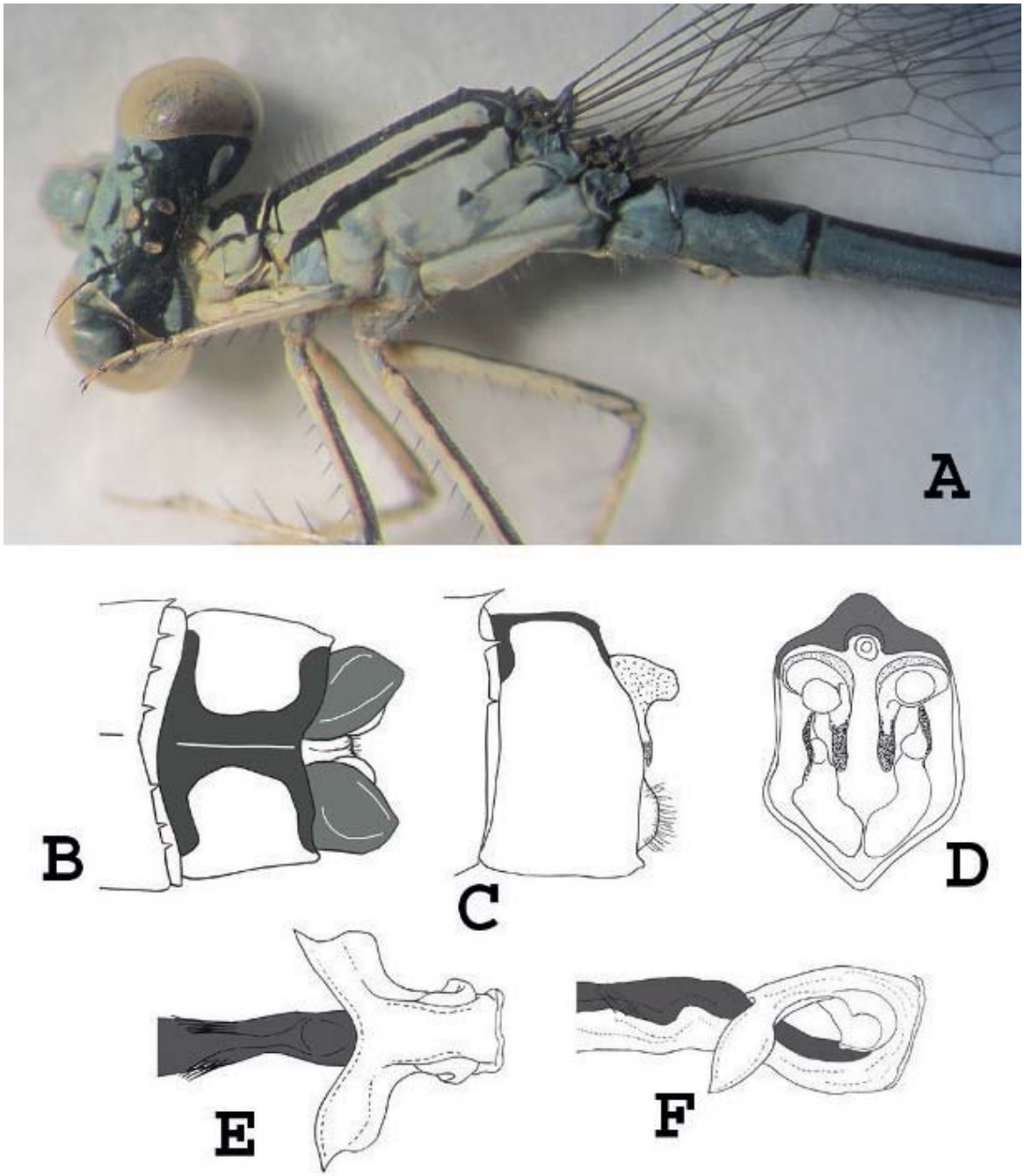

Figure 8. *Paracercion melanotum* ♂. (A) habitus; anal appendages in (B) dorsal, (C) lateral & (D) posterior view; penile organ in (E) dorsal & (F) lateral view.

PLATYCNEMIDAE

***Copera marginipes* (Rambur, 1842)** (Figure 9)

Specimens collected: 3 ♂♂, 1 ♀ (Vung Chua)
Morphological discussion: This is a common damselfly, characterized by a thorax marked with bright yellow and yellowish legs with flattened tibia. In *C. marginipes* the superiors are very short, like a protuberance at the dorsal base of the inferiors (Figs. 9C, 9D) while the superiors are half the length of the inferiors in *C. vitatta* (Asahina, 1984: Figs. 20-22, p.10). The female of *C. marginipes* (Fig. 9B) differs from *C. vittata* by the median lobe of prothorax, which lacks the horned protuberance as in *C. vittata* (Asahina, 1984: Figs. 24, 25, p.10).
Distribution and habitat: *C. marginipes* has a wide distribution in Vietnam, from the north to the far south (Do & Dang, 2007). *C. marginipes* and *C. vittata* often occur together at streams in secondary or primary forests.

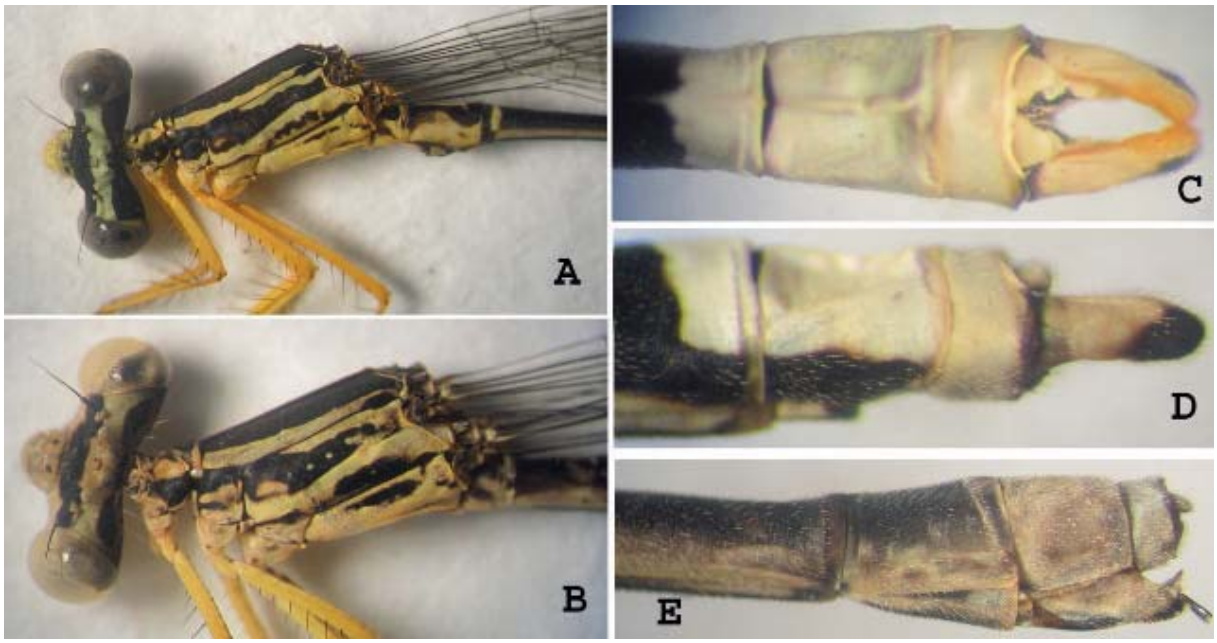

Figure 9. *Copera marginipes*. (A) ♂; (B) ♀; anal appendages in (C) dorsal & (D) lateral view; (E) ♀ tip of abdomen.

***Prodasineura croconota* (Ris, 1916)** (Figure 10)

Specimens collected: 1 ♂, 2 ♀♀ (Vung Chua)
Morphological discussion: *P. croconota* is a slender built damselfly. The male can be easily recognized from other *Prodasineura* species by having two distinct large orange spots on the dorsum of the thorax and the distinct pale yellow lateral stripe (Fig. 10A). Abdomen is black with indistinct whitish spots at the nodes, anal appendages milky whitish marked with black at superiors and inferiors as Fig. 10C. Female differs markedly from the male in body colour pattern and the head has a pale yellow transverse streak, whereas postclypeus and labrum are orange, anteclypeus black; prothorax and synthorax black with pale yellow stripes marked as Fig. 10B; abdomen entirely

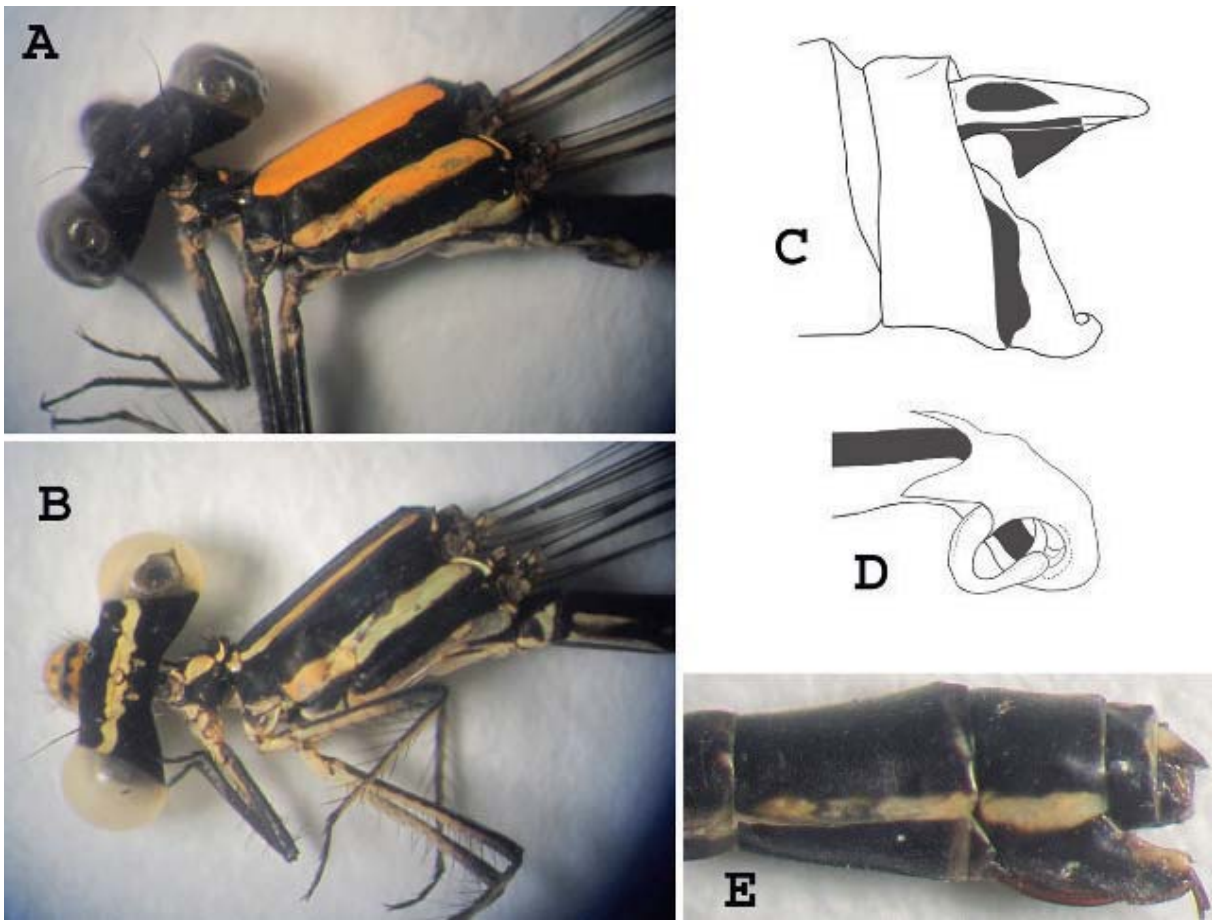

Figure 10. *Prodasineura croconota*. (A) ♂; (B) ♀; (C) anal appendages in lateral view; (D) penile organ in oblique-dorsal view; (E) ♀ tip of abdomen.

black apart from a tiny pale yellow stripe running along the posterior suture of each segment (Fig. 10E).
Distribution and habitat: *P. croconota* is widespread from the north (Me Linh, Vinh Phuc Province, Huu Lien, Lang Son Province, Xuan Son National Park) to central Vietnam (Ha Tinh, Quang Binh, Quang Nam Provinces and Da Nang city) (Kompier, 2015; Phan, personal data). It is usually found along open streams in secondary forests in lowlands.

AESHNIDAE

***Anax guttatus* (Burmeister, 1839)** (Figures 11A-D)

Specimens collected: 1 ♂ (Vung Chua)
Morphological discussion: A large-sized species, widely distributed from north to south of Vietnam (Do & Dang, 2007). Body of male and female is bright green; it is characterized by the two blue dorsal half-rings on 2nd abdominal segment; 3-9th segments are mat black with several silver-colored oval spots laterally; 10th segment and anal appendages black (Fig. 11A).

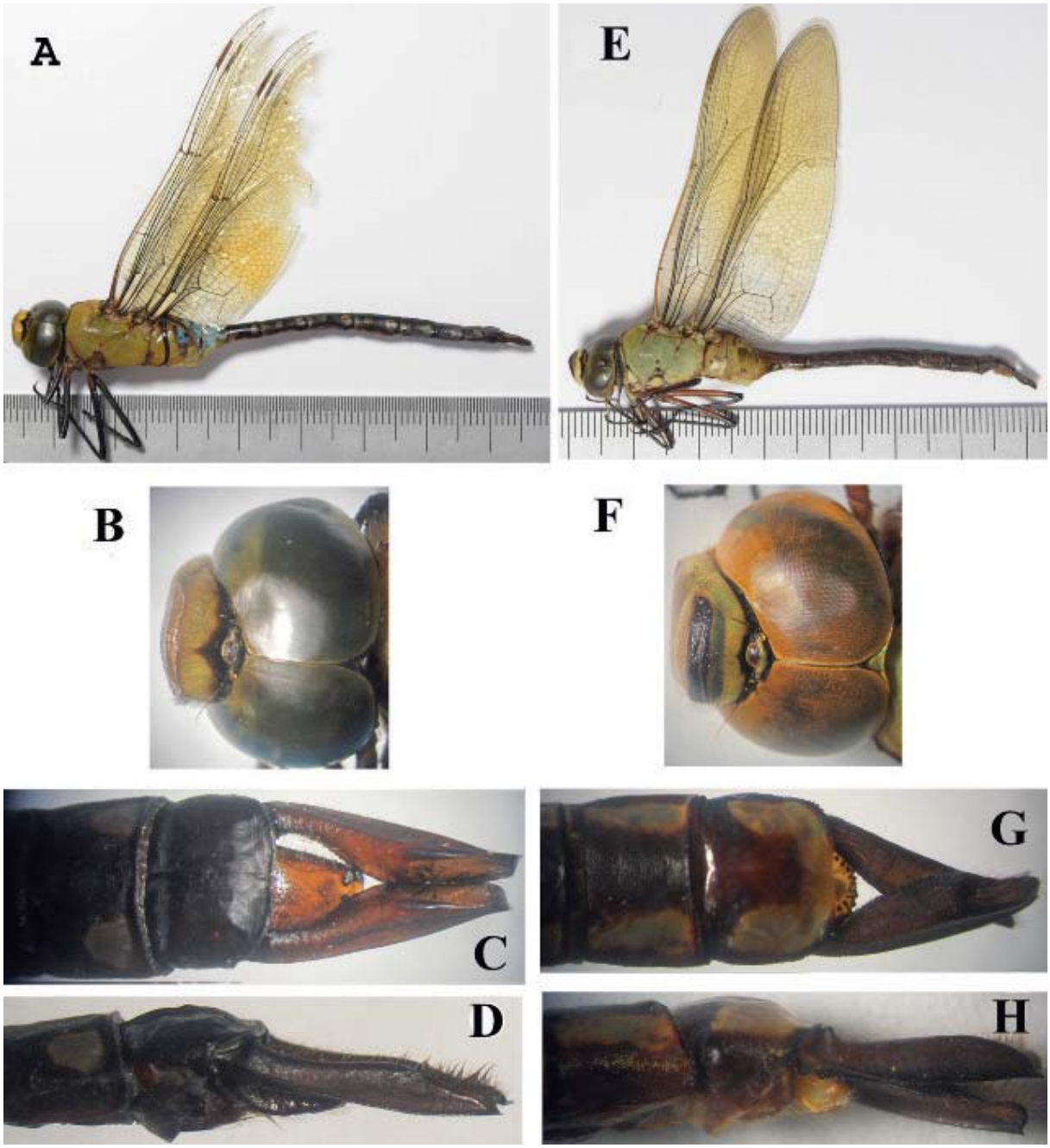

Figure 11. Structural features of *Anax* spp. ♂ [A-D], *A. guttatus* & [E-H], *A. parthenope julius* (A) & (E) habitus; (B) & (F) front of head in dorsal view; (C) & (G) anal appendages in dorsal view; (D) & (H) anal appendages in lateral view.

Distribution and habitat: Four species of the genus *Anax* have been recorded in Vietnam: *A. g. guttatus* (Burmeister, 1839), *A. immaculifrons* Rambur, 1842; *A. nigrofasciatus* Oguma, 1915 and *A. parthenope julius* Brauer, 1865. They are easily separated by body colour pattern and especially by the structure of the anal appendages (see below). Of these *A. nigrofasciatus* is more restricted to mountainous areas, whereas the other species have a wider altitudinal range (Kompier, 2015).

***Anax parthenope julius* Brauer, 1865** (Figures 11E-H)

Specimens collected: 2 ♂♂ (Bai Ong)

Morphological discussion: *A. parthenope julius* resembles *A. g. guttatus* in body colour pattern, but differs in the structure of the anal appendages: in *A. parthenope julius*, the epiproct is very short (about 1/4 of the length of superiors) adorned with black spines distally (Figs. 11G, 11H), but in *A. g. guttatus*, the epiproct is half the length of the superiors with only two apical spines (Figs. 11C, 11D). They can also be identified by the pattern of the postfrons (*A. parthenope julius* has a black line (Fig. 11F), but it is uniform yellowish in *A. g. guttatus* (Fig. 11B).

Distribution and habitat: Karube (2004) recorded a female of this species from Tam Dao National Park in northern Vietnam. Recently Delonglée (2014) and Kompier (2015) also recorded it from several locations in the north: Xuan Son National Park, Phu Tho Province, Huu Lien Nature Reserve, Lang Son Province and Cat Ba Island, Hai Phong Province, respectively. This is the first record *A. parthenope julius* from central Vietnam, expanding the known range of the taxon in Vietnam to the south.

Figure 12. *Ictinogomphus pertinax* ♂. (A) habitus; (B) Head in front view; (C) anal appendages in lateral view.

GOMPHIDAE

***Ictinogomphus pertinax* (Hagen in Selys, 1854)** (Figure 12)

Specimens collected: 1 ♂ (Vung Chua)
Morphological discussion: Body colour pattern of male is black with yellowish or bluish-yellow markings; 8th segment of the the abdomen has characteristic leaf-shaped expansions (Fig. 12A, 12C). *I. pertinax* was synonymised with *I. rapax* Rambur, 1842 by Chao (1990).
Distribution and habitat: Of this species there are only a few old records (Tam Dao, Vinh Phuc Province and Da Ban, Ninh Thuan Province) (Do & Dang, 2007). *I. pertinax* occurs in Laos, southern China, Taiwan, Japan, and probably eastern India and Myanmar. This is a very common species occurring all through Vietnam at lower altitudes (Do & Dang, 2007, Kompier pers. comm.), both from the far north and the Mekong Delta. However this is the first published record of *I. pertinax* from central Vietnam.

LIBELLULIDAE

***Acisoma panorpoides* (Rambur, 1842)** (Figure 13)

Specimens collected: 3 ♂♂ (Vung Chua)
Morphological discussion: This is small dragonfly, characterized by its peculiarly shaped abdomen, of which the basal half is dilated, but of which the apical half is much narrower, with distal segments black and appendages white. Body colour pattern of male and female is similar, although males are blue and females yellowish brown (Figs. 13A, 13B).
Distribution and habitat: *A. panorpoides* is widespread in Vietnam. These dragonflies mainly fly among dense vegetation, especially in montane streams, marshes or paddies.

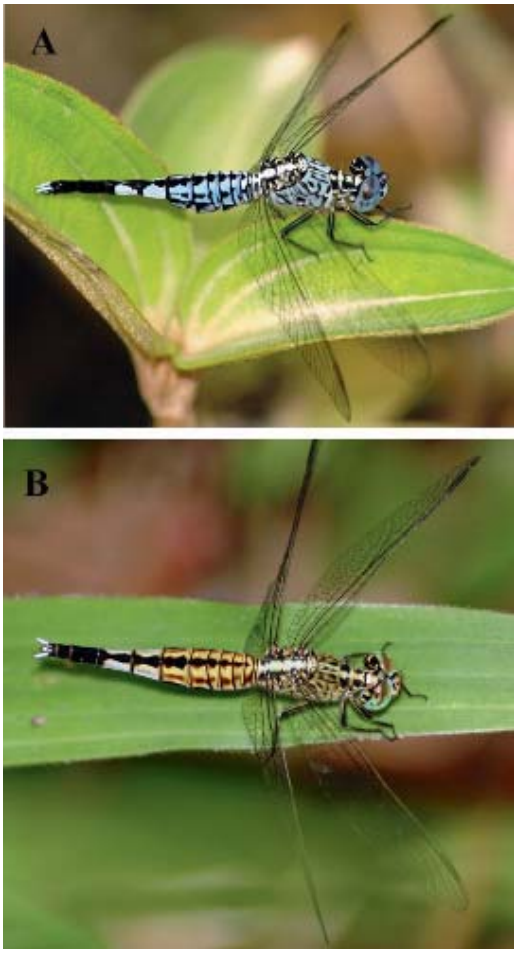

Figure 13. *Acisoma panorpoides*. (A) ♂ & (B) ♀, KaNak, K'Bang, Gia Lai Province, 27.IV.2010, Q.T. Phan.

***Brachydiplax chalybea flavovittata* Ris, 1911** (Figure 14)

Specimens collected: 1 ♂ (Vung Chua)
Morphological discussion: The male is characterized by light blue pruinescence on the dorsum of the thorax, between the wings and on S1-6 and amber basal spots to the wings; synthorax laterally has distinct yellowish stripes; the four last abdominal segments and anal appendages are entire black (Figs. 14A, 14D). The female differs markedly from the male by being striped yellow-and-black (Fig. 14E).
Distribution and habitat: According to Kompier (2015, and pers. comm.), *B. chalybea flavovittata* is widespread in the northern part of Vietnam and it occurs commonly at least as far south as Quang Nam Province. In Cham Island it was found along a canal with dense weedy vegetation. It was found from a rocky montane stream in

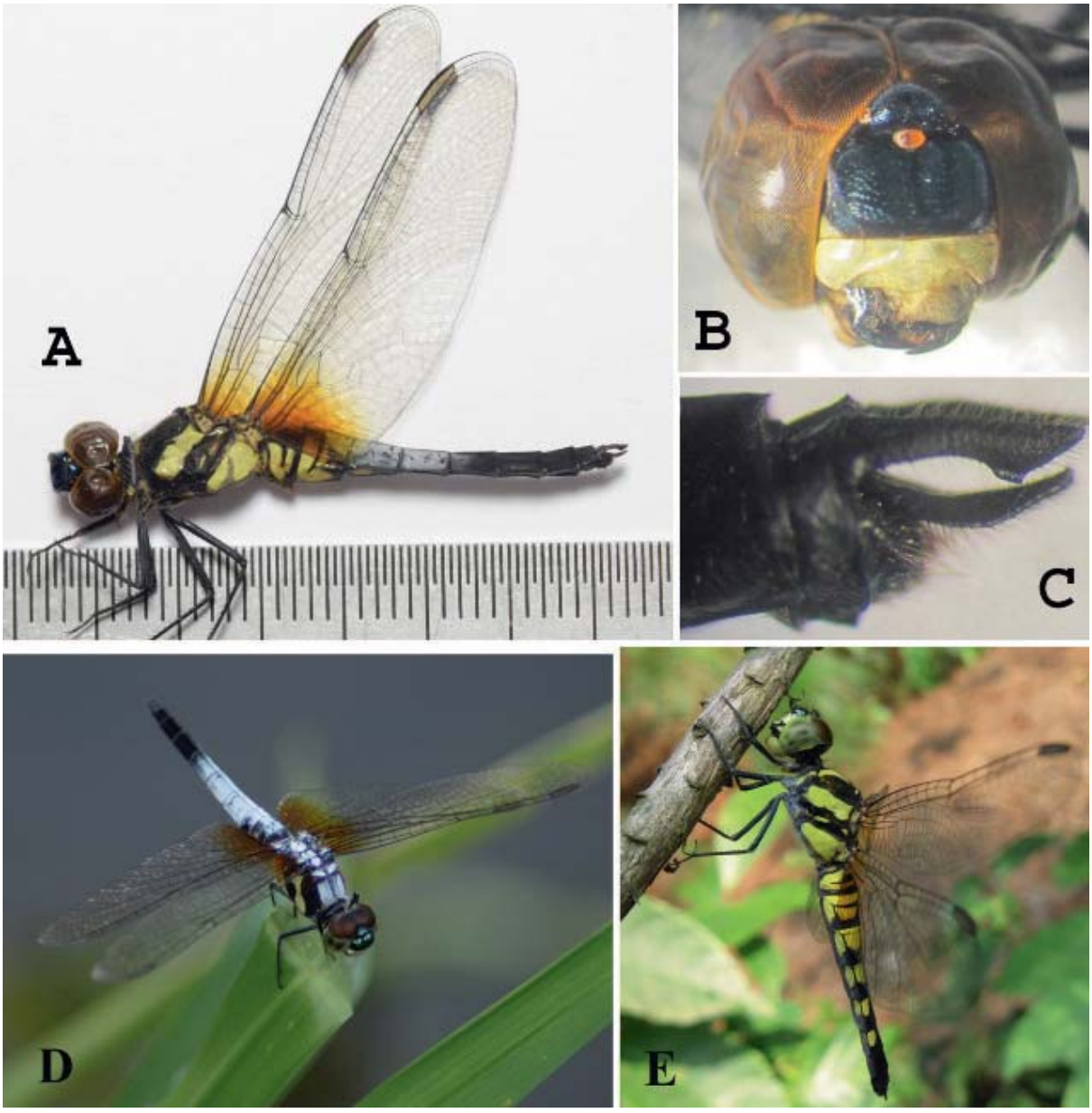

Figure 14. *Brachydiplax chalybea flavovittata*. (A) ♂; (B) head in front view; (C) anal appendages in lateral view; (D) & (E) ♂ & ♀, Suoi Tien, Hong Linh Town, Ha Tinh Province at 15.VI.2008, Q.T. Phan.

Hong Linh town of Ha Tinh Province by the first author. Asahina (1969) reported a single female specimen of the nominate subspecies *B. c. chalybea* from Dong Nai province in southern Vietnam. However, it should be confirmed whether the female was correctly identified.

***Crocothemis servilia* (Drury, 1773)** (Figure 15A)

Specimens collected: 1 ♂, 3 ♀♀ (Bai Ong, Vung Chua)
Morphological discussion: The male is largely red, with a thin black dorsal line along the abdomen; the wings are hyaline with a large amber basal patch; the anal appendages are red (Fig. 15A). The female is pale olivaceous brown with a similar black dorsal line; the marking at the wing bases is much paler with bright yellow venation.
Distribution and habitat: This is very common species, found on ponds, canals and paddy fields.

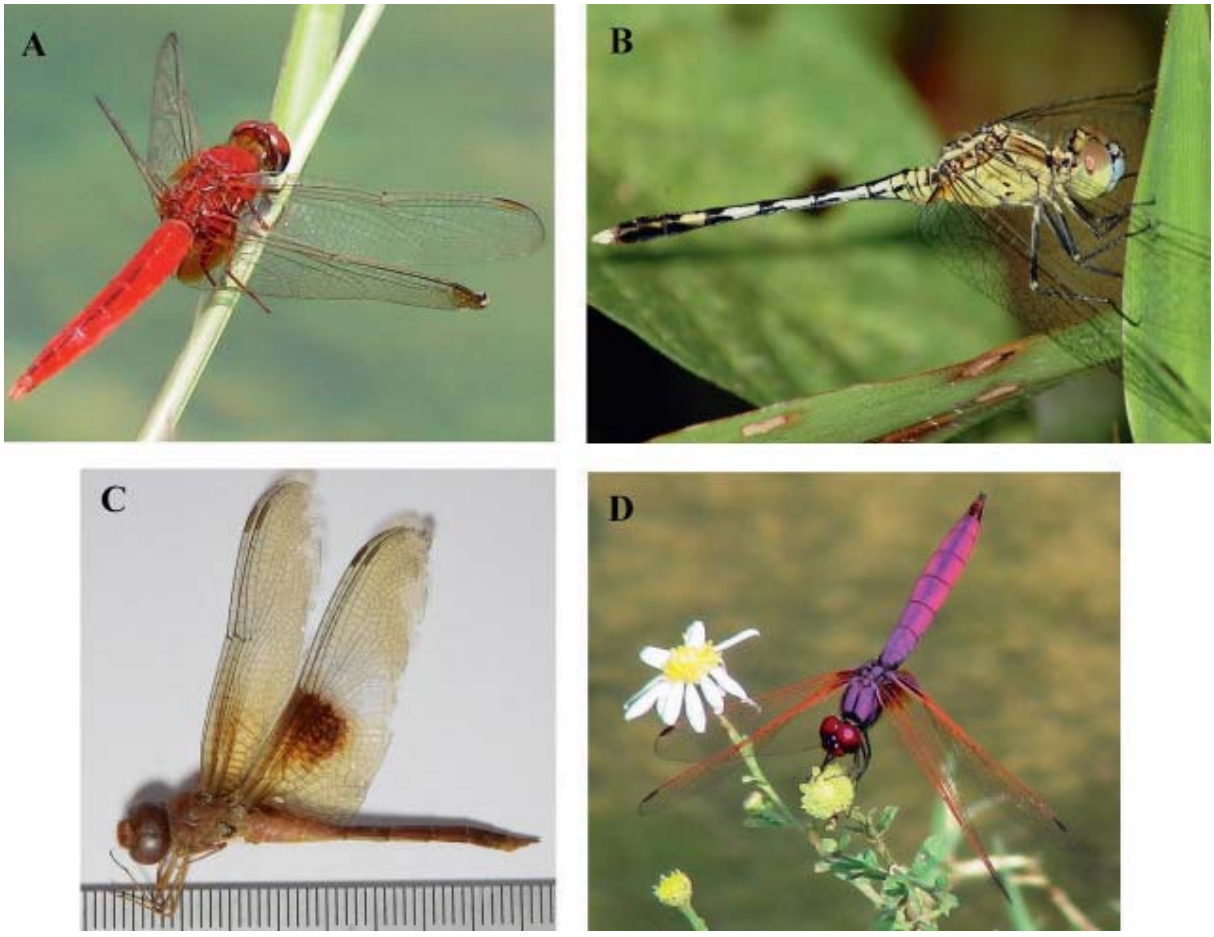

Figure 15. ♂ (A) *Crocothemis servilia*, Trung Khanh, Cao Bang, 6.IX.2008, Q.T. Phan; (B) *Diplacodes trivialis*, Tuyen Hoa, Quang Binh, 25.VI.2010, Q.T. Phan; (C) *Tholymis tillarga*, Cham Islands (wings broken); (D) *Trithemis aurora*, Trung Khanh, Cao Bang, 6.IX.2008, Q.T. Phan.

***Diplacodes trivialis* (Rambur, 1842)** (Figure 15B)

Specimens collected: 2 ♂♂ (Bai Ong, Vung Chua)
Morphological discussion: The adult male is almost completely pruinosed blue, with apex of abdomen black, whitish anal appendages, and hyaline wings. The female and immature male are quite similar with yellowish thorax and black and yellowish white abdomen.
Distribution and habitat: This is a very common species that inhabits ponds, canals and paddy fields.

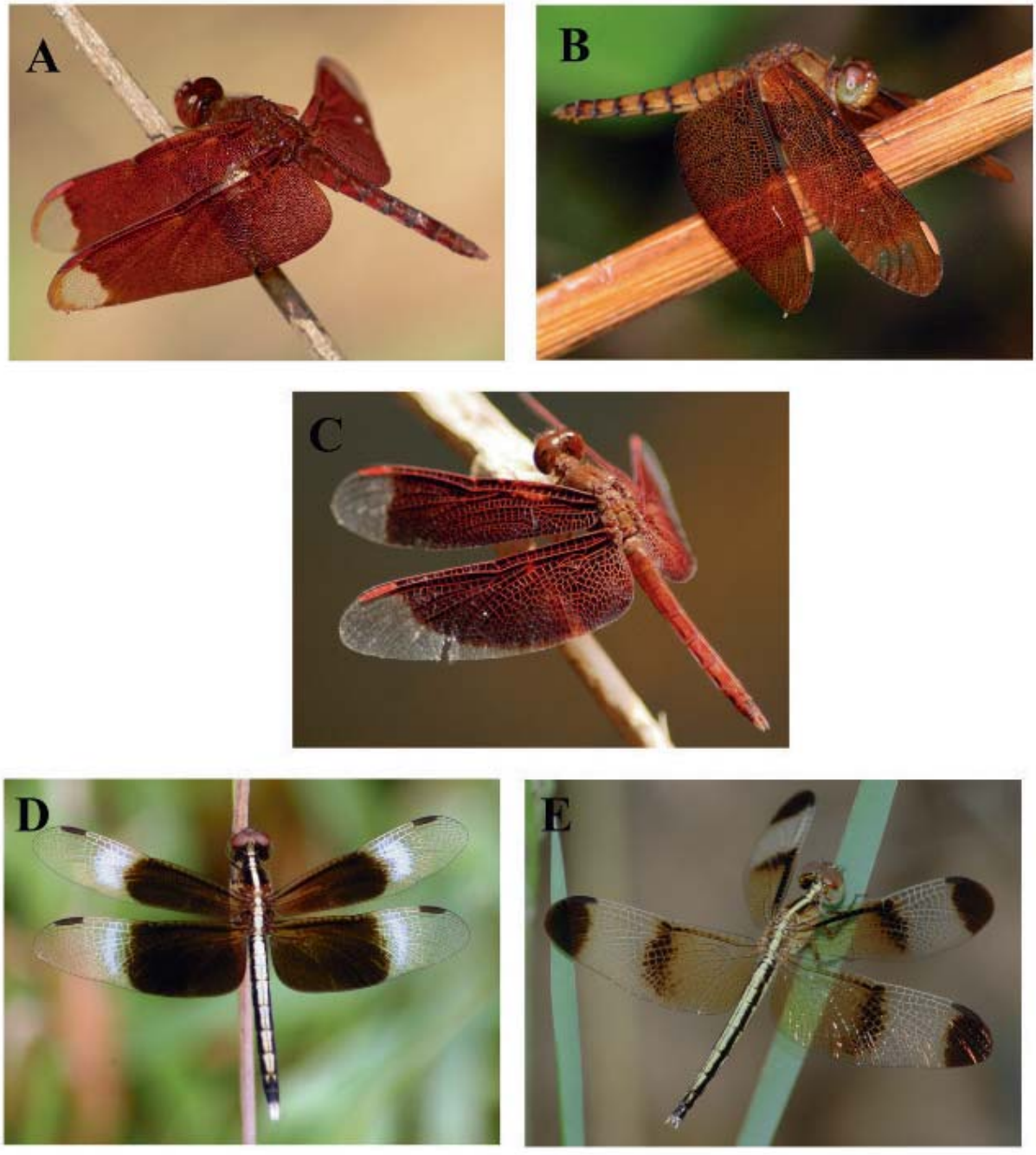

Figure 16. *Neurothemis* spp. (A & B) ♂♀ *N. fulvia*, Tuyen Hoa, Quang Binh, 25.VI.2010, Q.T. Phan; (C) ♂ *N. fluctuans*, Cao Bang city, 31.V.2009, Q.T. Phan; (D & E) ♂♀ *N. tullia*, Vu Quang National Park, Ha Tinh Province, 09.IX.2015, Q.T. Phan.

Neurothemis fulvia (**Drury, 1773)** (Figures 16A, 16B)

Specimens collected: 6 ♂♂, 4 ♀♀ (Bai Ong, Vung Chua, Thon Cam)
Morphological discussion: The male has a reddish body, the female yellowish brown. The wings of the male are blood-red with red veins, but with hyaline tips. The hyaline pattern of the hind wings separates *N. fulvia* from the smaller *N. fluctuans* (Fabricius, 1793) (Figs. 16A-C).
Distribution and habitat: This is very common species, widespread from the north to the south of Vietnam. It can be found at marshes, canals, weedy tanks, ponds, paddy fields.

Neurothemis tullia **(Drury, 1773)** (Figures 16D, 16E)

Specimens collected: 3 ♂♂, 2 ♀♀ (Bai Ong, Vung Chua)
Morphological discussion: Male is easy recognized by its black basal part of wings bordered by a white band along the distal edge. Immature individuals are light brown, but turn darker with age; abdomen black with pale yellow markings dorsally, anal appendages pale yellow (Fig. 16D). Female differs from the male by having the basal half of the wings amber, with a large dark spot in the middle of the wing and dark brown tips, the abdomen is yellowish with a lateral black lines; the cerci are pale yellow (Fig. 16E).
Distribution and habitat: *N. tullia* is very common species, widespread in many parts of Vietnam, although scarce in the north. *N. tullia* is often abundant around ponds, marshes, channels, and paddy fields from lowlands to the hills.

Orthetrum pruinosum neglectum **(Rambur, 1842)**

Specimens collected: 3 ♂♂, 2 ♀♀ (Thon Cam)
Morphological discussion: The male has a dark brown-coloured thorax, red-violet abdomen, and hyaline wing hyaline with black venation and a reddish-brown basal spot on the hind wings. The female differs from the male by having a dull olive-brown or yellowish body and paler markings at the wing bases.
Distribution and habitat: *O. pruinosum neglectum* is a very common dragonfly, found on ponds or streams at montane areas.

Orthetrum sabina **(Drury, 1773)**

Specimens collected: 1 ♂, 1 ♀ (Bai Ong, Vung Chua, Thon Cam)
Morphological discussion: The male and female have the same body colour pattern, characterized by black-blue stripes (like tiger's skin) on the thorax and first three abdominal segments; S1-3 strongly inflated, S4-6 narrow with alternating black-green pattern, S7-10 expanded again and dull black with white anal appendages.
Distribution and habitat: This is very common species with a very extensive distribution. It can be found on every water-source from lowlands to the hills.

***Pantala flavescens* (Fabricius, 1798)**

Specimens collected: 7 ♂♂, 5 ♀♀ (Bai Ong, Vung Chua, Thon Cam)
Morphological discussion: Male and female are very similar in colour pattern with thorax and abdomen orange or yellowish brown; the long abdomen has a black mid-dorsal line; wings long, hyaline with an amber basal mark in immature individuals, and becoming clear when maturing.
Distribution and habitat: A very common species, with a wide distribution from lowlands to montane areas.

***Rhyothemis variegata* (Linnaeus, 1763)** (Figure 17)

Specimens collected: 5 ♂♂ (Bai Ong, Vung Chua, Thon Cam)
Morphological discussion: Male and female have richly marked wings like a butterfly species, wings patterned in yellow and black; head, thorax, abdomen and anal appendages are shiny black or brown (Fig. 17).
In Vietnam, seven species of the genus *Rhyothemis* have been recorded: *R. aterrima* Selys, 1891, *R. obsolescens* Kirby, 1889, *R. phyllis* (Sulzer, 1776), *R. plutonia* Selys, 1883, *R. triangularis* Kirby, 1889, *R. variegata* (Do & Dang, 2007, Do et al., 2011) and *R. severini* Ris, 1913. From these *R. severini* has not been recorded in Vietnam since its description. It is easy to distinguish these species on the basis of the colour of their wings.
Distribution and habitat: *R. variegata* can be found on paddies, ponds, weedy tanks, marshes, and streams, sometimes in substantial numbers.

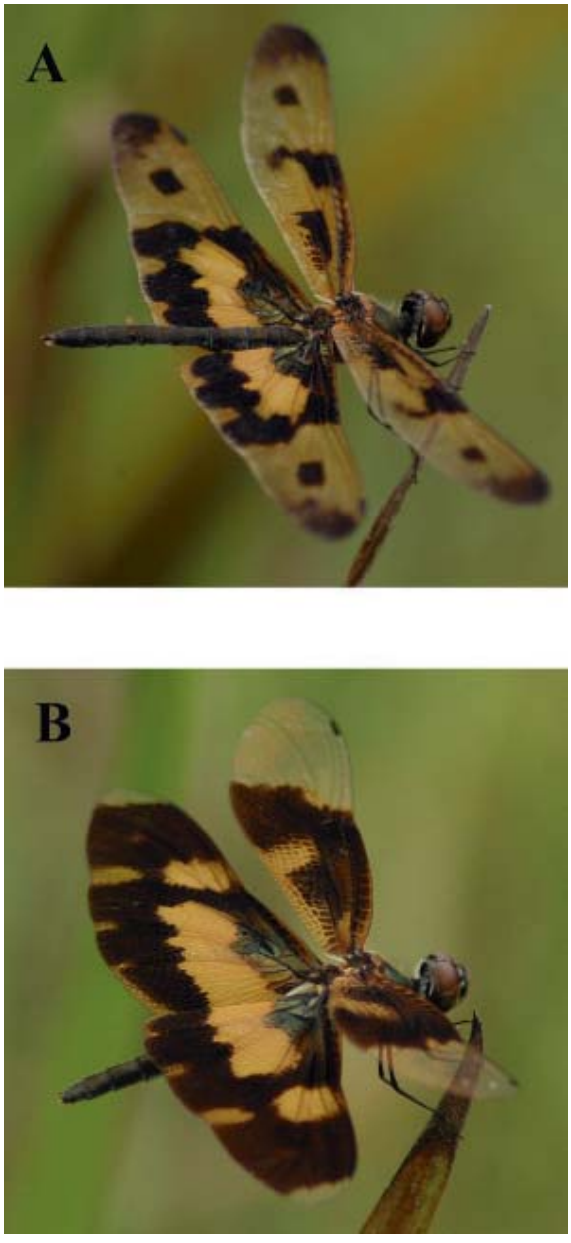

Figure 17. *Rhyothemis variegata* ♂ ♀, Da Nang city, 20.VII.2011, Q.T. Phan.

***Tholymis tillarga* (Fabricius, 1798)** (Figure 15C)

Specimens collected: 1 ♂ (Bai Ong)
Morphological discussion: The male has a dark-red body and is easy recognized by its conspicuous opalescent whitish spot besides the amber mark on its hind wings, although this whitish spot disappears with age (Fig. 15C). The female of this species is less commonly seen. Females have a straw-coloured thorax and abdomen, with wings similar to the male with an orange mark, but lacking the whitish spot.
Distribution and habitat: *T. tillarga* is a common and widespread species. It can be found in rocky montane streams or canals, marshes.

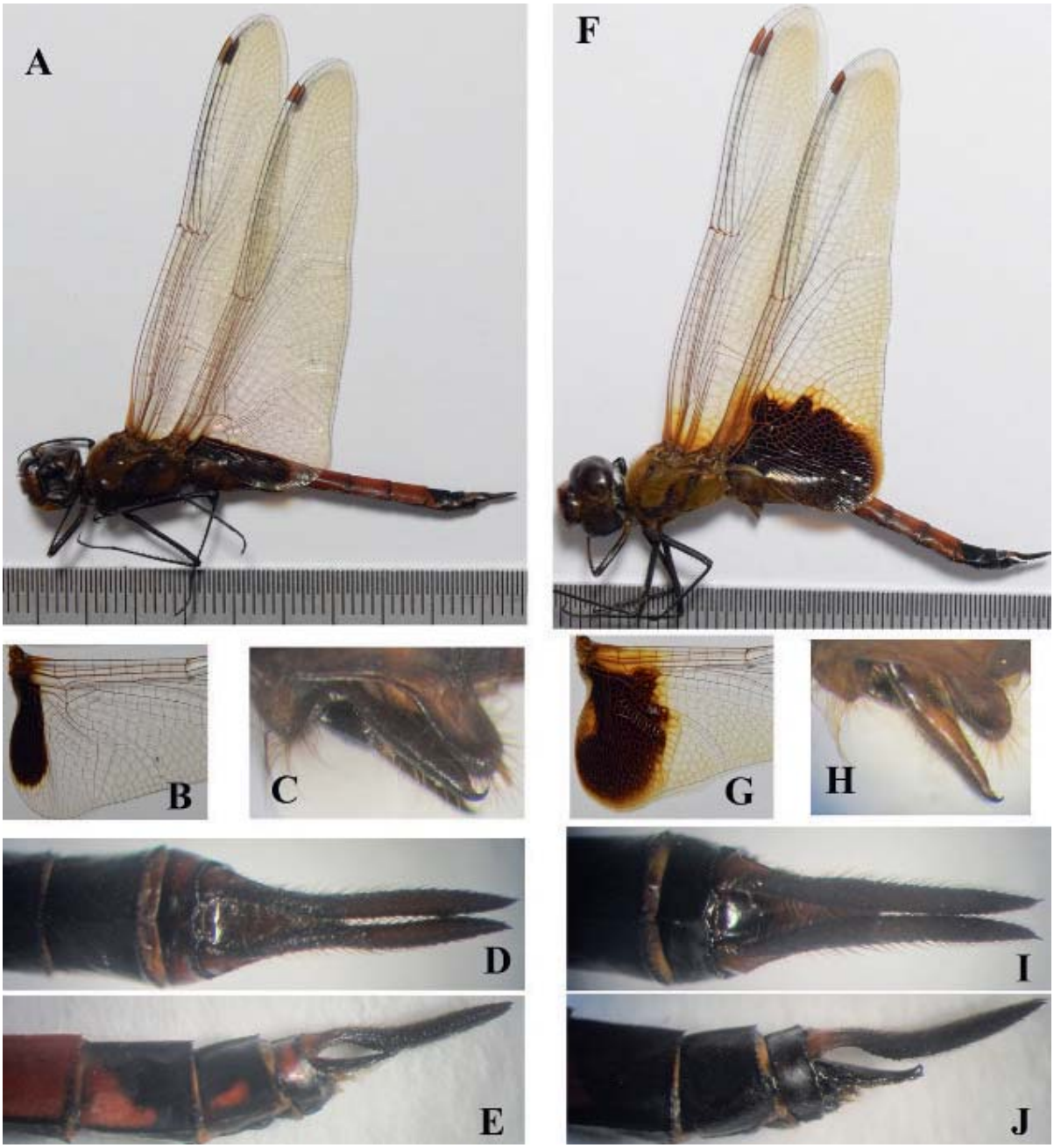

Figure 18. Structural features of *Tramea* spp. ♂, [A-E] *T. transmarina euryale* & [F-J] *T. virginia*. (A) & (F) habitus; (B) & (G) base of hind wing; (C) & (H) genitalia organ; (D) & (I) anal appendages in dorsal view; (E) & (J) anal appendages in lateral view.

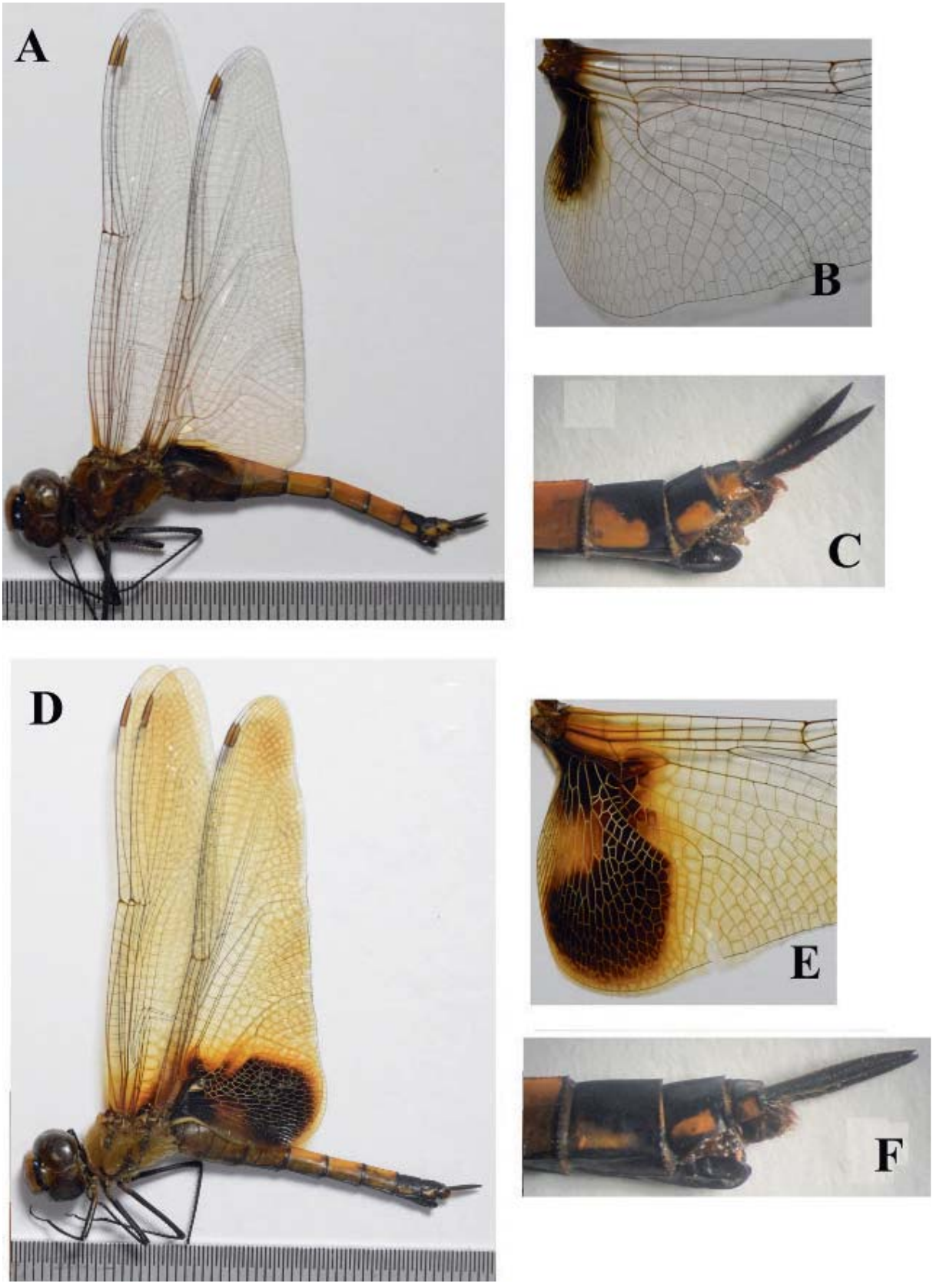

Figure 19. Structural features of *Tramea* spp. ♀, [A-C] *T. transmarina euryale* & [D-F] *T. virginia*. (A) & (D) habitus; (B) & (E) base of hind wing; (C) & (F) tip of abdomen.

***Tramea transmarina euryale* Selys, 1878** (Figures 18A-E, 19A-C)

Specimens collected: 3 ♂♂, 1 ♀ (Bai Ong, Vung Chua, Thon Cam)
Morphological discussion: This species is characterized by a relatively small, elongated dark-red mark with orange veins at the base of hind wing (Figs. 18A, B); the male has a dark reddish-brown thorax, with a red abdomen with black dorsal markings to S8-10 and long black anal appendages (Figs. 18A, E). The female is similar to the male in body colour pattern and wing base markings (Figs. 19A, B), but its excluded abdomen is pale brown (Figs. 18A, 19A).
Distribution and habitat: This is the first published record of this species from central Vietnam. Kompier (2015) recorded *T. transmarina euryale* from Van Long (Ninh Binh Province), Ba Vi National Park (Ha Noi) and Cat Tien National Park (Dong Nai Province). Furthermore Kompier (pers. comm.) has recorded it also from Lai Chau Province in the north to Can Tho Province in the south. This species flies over weedy marshes, tank, paddies or ponds in lowland and montane areas.

***Tramea virginia* (Rambur, 1842)** (Figures 18F-J, 19D-F)

Specimens collected: 2 ♂♂, 2 ♀♀ (Bai Ong, Vung Chua, Thon Cam)
Morphological discussion: Like in *T. transmarina euryale*, the male and female *T. virginia* are quite similar in body colour pattern, although the female's abdomen is paler brown (Figs. 18F, 19D). It is easily separated from *T. transmarina euryale* by the following characteristics: (1) the basal patches in the hind wings are much more extensive in *T. virginia*, covering almost the complete anal loop (Figs. 18B, 18G, 19B, 19E); (2) the hamules only slightly overlap the genital lobe in *T. transmarina euryale* (Fig. 18C), but are clearly longer than the lobe in *T. virginia* (Fig. 18H). The anal appendages are similar in structure, but the colour pattern of S8-10 is slightly different: entirely black in *T. virginia* (Figs. 18I, 18J), but red with black spotsin *T. transmarina euryale* (Figs. 18D, 18E). Females are similar in body colour pattern, but S8-10 are not as dark in T. virginia (Fig. 19F) as in *T. transmarina euryale* (Fig. 19C).
Distribution and habitat: *T. virginia* was found first from Ninh Thuan Province of southern Vietnam (Fraser, 1919), and later from several locations in the north (Hoa Binh, Ninh Binh Provinces) and the south (Dong Nai, Binh Duong Provinces and Ho Chi Minh city) (Pritykina, 1992; Asahina, 1969, Kompier, 2015).

***Trithemis aurora* (Burmeister, 1839)** (Figures 15D)

Specimens collected: 1 ♂ (Bai Ong)
Morphological discussion: The male has a bright pinkish-red body, with hyaline wings with red veins and a dark reddish mark at the base. The female differs from the male by its olivaceous thorax and orange abdomen with paler golden spot at the wing base.
Distribution and habitat: In Vietnam this pecies is very common in montane streams.

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