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RECORDS OF CALOPTERYGOIDEA FROM VIETNAM, WITH DESCRIPTIONS OF TWO NEW SPECIES (ZYGOPTERA: AMPHIPTERYGIDAE, CALOPTERYGIDAE, CHLOROCYPHIDAE, EUPHAEIDAE)

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Based on the recently collected material from the formerly unexplored areas of Vietnam, spp. new to Vietnam are enumerated. *Rhinocypha watsoni* sp.n. (holotype ♂: Nghe Tinh prov., W of Rao Qua, tributary of An Bun R., 1-VII-1990; deposited at RMNH, Leiden) appears closely related to *R. drusilla* Needham, which is here redescribed. *Bayadera vietnamensis* sp.n. (holotype ♂: Nghe Tinh prov., Doi Khe Lao, 11/12-VII-1990; deposited at RMNH, Leiden) is intermediate between *B. kali* Cowley and *Schmidtiphaea schmidi* Asahina. Some biogeographic considerations are provided.

INTRODUCTION

The fauna of Vietnam is still poorly known, as is duly demonstrated by the recent discovery of the Vu Quang bovid *Pseudoryx nghetinhensis* (see VAN DUNG et al., 1993), and the dragonfly fauna is no exception to the general picture. The number of publications dealing with the Odonata of this region is limited. Approximately one hundred years ago the area was investigated rather thoroughly by H. Fruhstorfer, and descriptions of new species were published by MARTIN (1904), RIS (1912), FÖRSTER (1905) and FRASER (1919). TSUDA (1991: 299-315) provided a valuable checklist based on published as well as unpublished records, mentioning 144 species in total for Vietnam.

Recent investigations in Vietnam have yielded an interesting, although still preliminary, insight into the huge richness of this area, and it is absolutely certain that the total number of odonate species of Vietnam will exceed 200, or perhaps even 250 species. These impressions are, among others, based upon two collections made by the junior author. During a predominantly ornithological survey in

Vietnam (ROZENDAAL, 1993), Rozendaal also paid due attention to the dragonfly fauna. These explorations did include various, hitherto hardly investigated areas, e.g. close to the borders of China and Laos. It appears from these collections, that the fauna of the northern provinces differs in many respects from that of the central and southern parts. In this collection, still only partly identified, several novelties have turned up, and also many species previously unknown from Vietnam, are represented. We summarize here the new records of Calopterygoidea (sensu DAVIES & TOBIN 1984), and add descriptions of two new species.

Nomenclature of morphology follows WATSON & O'FARRELL (1991). Material collected by Rozendaal is preserved in the National Museum of Natural History (Leiden) (RMNH).

In the systematic list only those species are mentioned that are represented in the present collection, or unpublished records from the collection of RMNH Leiden. For Rozendaal's sampling stations, we give the localities in abbreviated form.

The following species of Calopterygoidea have previously been mentioned from Vietnam, but are not represented here:

Amphipterygidae: *Devadatta argyoides* (Selys) (MARTIN, 1904: 220, as *Tetraneura argyroides*, Indo-Chine française); *D. ducatrix* Lieftinck (LIEFTINCK, 1969: 205-207, described as new species, Than-Moi, Tonkin; TSUDA, 1991: 304).

Calopterygidae: *Calopteryx atrata* Selys (MARTIN, 1904: 218, Tonkin [possibly a misidentification of *C. grandaeva* Selys]; TSUDA, 1991: 305, Vietnam, with question mark); *C. (orientalis) atrocyana* Fraser (FRASER, 1935, original description; TSUDA, 1991: 305, Vietnam [a possible synonymy of this nominal taxon with *C. grandaeva* should be investigated, see below]); *C. coomani* (Fraser) (ASAHINA, 1969: 9; Tonkin; Saigon); *Echo maxima* Martin (MARTIN, 1904: 219, as new species, one female Than-Moi, Tonkin; TSUDA, 1991: 305, Vietnam); *Mnais andersoni* McLachlan (ASAHINA, 1975: 255; TSUDA, 1991: 305, Vietnam; *M. gregoryi* Fraser (TSUDA, 1991: 305, Vietnam).

Chlorocyphidae: *Aristocypha quadrimaculata* Selys (MARTIN, 1904: 220, Tonkin; TSUDA, 1991: 304, Vietnam, with question mark); *Cyrano unicolor* Hagen (MARTIN, 1904: 220, as *Libellago asiatica*, certainly a misidentification); *Indocypha (? vittata) svenhedini* (Sjöstedt) (TSUDA, 1991: 304); *Libellago aurantiaca* (TSUDA, 1991: 304); *L. hyalina* (Selys) (ASAHINA, 1969: 7, record Vietnam); *Rhinocypha biseriata biforata* Selys (ASAHINA, 1969: 6, records South Vietnam); *R. fulgipennis* (Guérin) (MARTIN, 1904: 220, Cochinchine, Annam; ASAHINA, 1969: 6, records South Vietnam; TSUDA 1991: 304, Vietnam).

Euphaeidae: *Anisopleura lestoides* Selys (MARTIN, 1904: 218, Tonkin; TSUDA, 1991: 305, Vietnam); *Bayadera indica* (Selys) (MARTIN, 1904: 218, Tonkin, Annam; TSUDA, 1991: 305, Vietnam, with question mark); *Dysphaea basitincta* Martin (MARTIN, 1904: 218, as new species, 'seems common in Tonkin'; TSUDA, 1991: 305, Vietnam); *D. dimidiata* Selys (MARTIN, 1904: 218, also as *D. limbata*, 'commune au Tonkin'; TSUDA, 1991: 305, Vietnam); *D. gloriosa* Fraser (ASAHINA, 1969: 7, first record for Vietnam); *Euphaea bocki* McLachlan (MARTIN, 1904: 218, Tonkin; TSUDA, 1991: Vietnam); *E. guerini inouei* Asahina (ASAHINA, 1977, described as new subspecies from South Vietnam; TSUDA, 1991: 305, Vietnam).

LIST OF LOCALITIES

All localities in Vietnam and collected by F.G. Rozendaal (De Bilt, The Netherlands).

E331 Vinh Phu province. Tam Dao. Stony rivulets in primary forest. 900 m. 21°28'N 105°38'E. 25-26 July 1990.

E332 25 km S of Lai Chau. Small stream through secondary forest. 850 m. 14 June 1990.

E335 Nghe Tinh province. Huong Son district. West of Rao Qua. Rivulet, tributary of the Khe Da Ban R. (Nam Chat). Logging road and secondary growth. 100-150 m. 18°26'N 105°13'E. 30 June 1990.

E336 Nghe Tinh province. Huong Son district. W of Rao Qua. Logging road along tributary of the An Bun R. Rivulets through grass and rocky stream, edge of logged forest. 100-150 m. 18°24'N 105°15'E. 1 July 1990.

E338 Nghe Tinh province. Anh Son district: ca 15 km S of Anh Son. Song Giang R. near Cao Veu village. Wide, shallow, stony river through cultivations. 50 m. 18°50'N 105°00'E. 5 July 1990.

E340 Nghe Tinh province. Ky Son district. Hillside just SW of Muong Xen village. Rocky stream throuegh disturbed primary forest and along forest edge. 700 m. 19°24'N 104°08'E. 7 July 1990.

E341 NgheTinh province. Ky Son district. Khe Thuong forest stream, tributary of the Song Car. Primary forest. 500 m. 19°15'N 104°23'E. 8 July 1990.

E342 Nghe Tinh province. Thang Chuong district. Doi Khe Lao. Several streams through logged forest. 100 m. 18°40'N 105°15'E. 11-12 July 1990.

E343 Nghe Tinh province. Thang Chuong district. Border station SW of Thang Chuong. Wide, shallow, stony river near forest edge, marshy pools in river bed. 50 m. 18°48'N 105°20'E. 11 July 1990.

E368 Nghe Tinh province. Ky Anh district. Ky Son. Mosaic of cultivated area and moderately dense secondary growth with small remnants of disturbed primary forest along watercourses. 100 m. 17°59'N 106°10'E. 21-28 June 1988.

E369 Binh Tri Thien province. A Shau valley. Lang Ka Kou. Stream through cultivated area near forest edge. 600 m. 16°22'N 107°07'E. 9 June 1988.

E370 Binh Tri Thien province. A Shau valley. 4 km NW of Lang Ka Kou. Fast flowing clear mountain stream through primary forest. 490 m. 16°22'N 107°07'E. 10 June 1988.

E371 Binh Tri Thien province. A Shau valley: 4 km NW of Lang Ka Kou. Small stream along secondary forest edge. 600 m. 16°22'N 107°07'E. 10 June 1988.

AMPHIPTERYGIDAE

DEVADATTA SP. INDET.

Material. – E336, 1 ♀ (JvT 1070); E370, 1 ♀ (JvT 1069).

Three species of *Devadatta* are known from mainland Asia (see FRASER 1933, 1938, LIEFTINCK, 1969), viz. *D. argyoides* (Selys), *D. multinervosa* Fraser and *D. ducatrix* Lieftinck. The last species is only known from the type specimen collected near Tonkin (Than Moi) by Fruhstorfer. *D. a. argyoides* is rather widespread (Thailand to Sumatra) and was recorded from 'Indo-Chine française' by MARTIN (1904) and from Tonkin by LAIDLAW (1934).

The present specimens differ in various respects from the described taxa. Specimen JvT 1069 has hind wing of 35 mm, fore wing with 8 Ax, 34-36 Px, hind wing 8 Ax, 30-32 Px and 3-4 subcostal Ax in line with Ax in costal area; JvT 1070 has hind wing 35 mm, fore wing with 9-10 Ax, 36-37 Px, hind wing with 8-9 Ax, 30--31 Px and also 3-4 Ax in line; the pterostigma is unicolorous brown; all wings have a brown tip of ca 2 mm. Especially hind wings are clearly petiolate, longitudinal veins not abruptly bent towards hind margin of wing.

The present specimens, which we consider conspecific, differ in wing characters from all known species. Males of *ducatrix* and *multinervosa* have 12-15 Ax and 44-53 Px in the fore wing, and as many as 6 or 7 antenodal nervures of which the costal and subcostal halves coincide (LIEFTINCK, 1969: 206-207). If it is true that male and female wing characters are similar, as is the case in *D. argyoides*, then the present specimens evidently belong to an as yet undescribed taxon. Since no males are available, we refrain from naming it.

CALOPTERYGIDAE

CALIPHAEA THAILANDICA ASAHINA, 1976

Figure 23

Selected references. – ASAHINA, 1976: 387-388, 395-397, figs 1, 4-5, 16 (orig. descr.); TSUDA, 1991: 305 (distr. Thailand).

Material. – E311, 3 ♀ (JvT 1001-1003).

New to Vietnam. These specimens were compared with material of *C. confusa* Hagen from Yunnan, Mekong valley, 1 ♂ 2 ♀ (ex Morton collection, in RMNH) (see MORTON, 1928), and with the holotype of *C. thailandica*.

C. thailandica was so far only known from northern Thailand, where it was described from Doi Suthep (1000 m). Both records are possibly indicating a much larger distribution of this species in the mountainous areas of Thailand, Laos and Vietnam along the border with China. ASAHINA (1976: 402) expressed the view that the Caliphaeinae are primitive Calopterygidae, which have survived in the mountains of the Himalaya-W China during the course of evolution of the modern Calopteryginae. In this context two points are of interest. First, it is not clear whether the Calopterygidae are really primitive Zygoptera, as argued by e.g. TILLYARD & FRASER (1939: 211-212). Second, the moutainous area along the southern border of China is tectonically very complex, and was subject to enormous changes during at least the last 60 My. It is, therefore, potentially also an area for rapid evolution of forms adapted to higher altitudes.

CALOPTERYX GRANDAEVA SELYS, 1853

Selected references. – SELYS, 1853: sep. 16 (♀ orig. descr., ♂ unknown, China); NEEDHAM, 1930: 197 (records Szechuan, Chekiang and Formosa); LIEFTINCK et al., 1984: 64 (considers record Taiwan lapsus, distr., Vietnam incl.). Also ? FRASER, 1935: 330 (*Agrion atrocyana*, orig. descr.).

Material. – Not represented in collection Rozendaal. – Other material in RMNH: Than Moi, Tonkin (H. Fruhstorfer) 1 ♂ (ex coll. Lieftinck).

There is much confusion on this rather enigmatic species. Its range appears to include southern China and northern Vietnam. The record from Vietnam (LIEFTINCK et al., 1984) is presumably based on the specimen in RMNH.

We suppose that Martin's record of *C. atrata* pertains to a misidentified specimen of *C. grandaeva*. Another mysterious *Calopteryx* is *C. atrocyana* (Fraser). Judged from the description, *atrocyana* seems a synonym of *C. grandaeva*, but KIMMINS (1966), who designated the lectotype, did not comment upon this.

MATRONA BASILARIS SELYS, 1853

Selected references. – MARTIN, 1904: 218 (Tonkin); WILLIAMSON, 1905: 187 (no new records); RIS, 1916: 5-8 (synonymy, geographical variation, status of *nigripectus* unsettled); ASAHINA, 1985b: 7-9, figs (extensive references); TSUDA, 1991: 84, 305 (distr., incl. Vietnam).

Material. – E331, 1 ♀ (JvT 1004).

Both the nominotypical subspecies and ssp. *nigripectus* Selys have been recorded from Vietnam. Our understanding of the geographical variation is still insufficient and we refrain from assigning the present specimen to one of the subspecies.

MNAIS MNEME RIS, 1916

Selected references. – RIS, 1916 (orig. descr., type locality Atchong, southern China; key to SE Asian *Mnais* spp.); ASAHINA, 1969: 8-9 (as *andersoni* MacLachlan: records Vietnam); ASAHINA, 1974 (reidentification *M. andersoni* sensu ASAHINA, 1969); TSUDA, 1991: 85, 305 (distr., incl. Vietnam).

Material. – E371, 2 ♂ (JvT 1005, 1066). Uncertain identification: E368, 1 ♀ (JvT 1006).

Our knowledge of this poorly known taxon was summarized by ASAHINA (1974). Although species recognition in *Mnais* is reputedly difficult, *M. mneme* is relatively distinct because of clearly defined penile characters. In Vietnam it has been recorded from Phuc Son (three localities with this name, viz. 18°02'N 106°25'E, 18°58'N 105°03'E, 19°49'N 105°48'E), Dran near Dalat (11°51'N 108°35'E) and Djiring (= Di Linh, 11°35'N 108°04'E) (ASAHINA, 1974). This is generally a species of higher altitudes and has been reliably recorded outside Vietnam from southern China, Hongkong and Hainan. In view of the present records (close to the western border of Vietnam) the uncertain evidence from Laos can now be considered of more significance.

The occurrence in Vietnam of specimens assigned to *M. andersoni* still causes

problems (see ASAHINA, 1975). At least, *M. earnshawi* has to be considered a synonym of *M. andersoni.*

NEUROBASIS C. CHINENSIS (L., 1758)

Selected references. – KIRBY, 1894: 113 (Upper Burma); MARTIN, 1904: 218 (implicitly from Vietnam); ASAHINA, 1969: 7 (records Vietnam); ASAHINA, 1985b: 17-20; TSUDA, 1991: 86, 306 (distr., incl. Vietnam).

Material. – E335, 1 ♂ 1 ♀; E336, 1 ♂; E340, 2 ♂; E343, 1 ♂; E369, 1 ♂ 4 ♀.

A common species in southeastern Asia. HÄMÄLÄINEN (1993) removed the taxon *longipes* Hagen from Borneo from the synonymy of *N. chinensis.*

VESTALIS G. GRACILIS (RAMBUR, 1842)

Selected references. – MARTIN, 1904: 218 (Annam, Tonkin); WILLIAMSON, 1905: 183-184 (records Burma and Thailand; fig. wings ♂); ASAHINA, 1967: 211 (records Cambodia); ASAHINA, 1969: 7 (records South Vietnam); ASAHINA, 1985b: 14-17; TSUDA, 1991: 87, 306 (distr. incl. Vietnam).

Material. – E340, 1 ♂ (JvT 1007). – Other material from Vietnam in RMNH collection: Blao, alt. 600 m, 16-X-1960 (Yoshimoto) 1 ♂ (ex BPBM); – 35 km S of Dalat, dry forest, broad leave, some pine, bamboo, 10-XI-1960 (Gressitt) 1 ♂; – Dah Song, 76 km SW Ban Me Thuot, 20-V-1960 (L. Quate) 3 ♀; – Danang, alt. 200 m, Monkey Mt., 4-VI-1970 (A.R. Gillogly) 1 ♂.

Ranges from Thailand through Laos and Vietnam to Malaysia.

CHLOROCYPHIDAE

ARISTOCYPHA F. FENESTRELLA (RAMBUR, 1842)

Selected references. – MARTIN, 1904: 220 (Tonkin); WILLIAMSON, 1905: 178-179, figs 9-10 (records Thailand, Burma; figs wings ♂ from Burma and Perak); ASAHINA, 1969: 6 (records South Vietnam); TSUDA, 1991: 76, 304 (as *Rhinocypha*, distr. incl. Vietnam).

Material. – E332, 3 ♂; E335, 1 ♂ 1 ♀; E340, 3 ♂ 1 ♀; E341, 2 ♂ 1 ♀; E342, 2♂; E370, 2♂; E371, 2♂ 1 ♀. – Other material from Vietnam in RMNH collection: E of Danang, Monkey Mts, 1000 ft, various dates 1970-1971 (A. R. Gillogly) 4 ♂ 1 ♀.

A common and widespread species.

HELIOCYPHA P. PERFORATA (PERCHERON, 1835)

Selected references. – MARTIN, 1904: 220 (as *Rhinocypha perforata* and *R. whiteheadi*, Cochinchine, Annam, Tonkin); RIS, 1916: 4-5, pl. 1 (1-2) (synonymy, geographical variation, record Tonkin); ASAHINA, 1969: 6 (records South Vietnam); TSUDA, 1991: 77, 304 (as *Rhinocypha*, distr., incl. Vietnam).

Material. – E335, 1 ♀; E336, 4 ♂ 2 ♀; E342, 1 ♂; E368, 1 ♂; E369, 4 ♂ 4 ♀. – Other material in RMNH: Tonkin, Than Moi (H. Fruhstorfer) 1 ♂; Tonkin, Mt Mau Son, 3000 ft (H. Fruhstorfer) 1 ♂ 1 ♀ (ex coll. Förster).

LIBELLAGO L. LINEATA (BURMEISTER, 1839)

Selected references. – WILLIAMSON, 1905: 171, figs 5-6 (records Thailand, Burma; range); ASAHINA, 1969: 6-7, as *L. limbata* (typographical error, records South Vietnam); TSUDA, 1991: 74, 304 (as *L. limbata* apparently copied from ASAHINA, 1969, distr., incl. Vietnam).

Material. – E338, 1 ♂ 1 ♀.

A widespread species in the Oriental region.

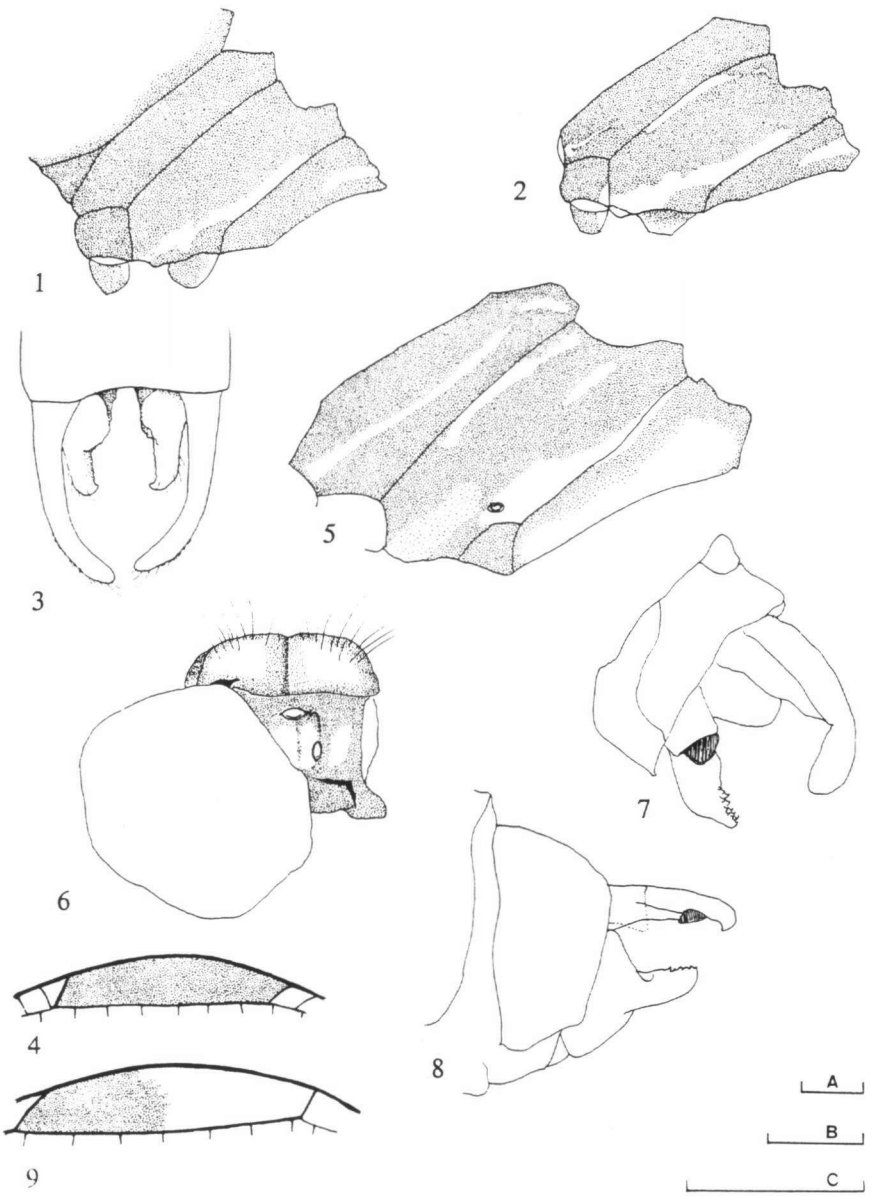
RHINOCYPHA WATSONI SP. NOV.
Figures 1-4, 11, 23

Material (5). – **Holotype** ♂ (JvT 1051): Nghe Tinh prov., Huong Son Distr., W of Rao Qua: logging road along tributary of An Bun R., rivulets through grass and rocky stream, edge of logged forest, alt. 100-150 m, 18°24'N 105°15'E, 1-VII-1990 (F.G. Rozendaal). – **Paratypes** (4 ♂ 1 ♀): Vietnam (Binh Tri Thien prov.) A Shau valley: 4 km NW of Lang Ka Kou: ca 600 m, small stream along secondary forest edge, 16°22'N 107°07'E, 10-VI-1988 (F.G. Rozendaal), 2 ♂ (JvT 1047-1048); – Nghe Tinh prov., Huong Son distr., W of Rao Qua: logging road along tributary of An Bun R., rivulets through grass and rocky stream, edge of logged forest, alt. 100-150 m, 18°24'N 105°15'E, 1-VII-1990 (F.G. Rozendaal), 2 ♂ (JvT 1049-1050), 1 ♀ (JvT 1061) (all in RMNH).

Etymology. – Named after Dr J.A.L. Watson (1935-1993), eminent odonatologist and specialist on the Australian fauna.

MALE (**holotype**). – A very dark *Rhinocypha*, without blue or red coloration on head, thorax or abdomen, but with a broken narrow stripe over synthorax; fore wing without markings, hind wing with distal part of wing beyond ca Px5 opaque dark brownish black with blue metallic shine.

Head. – Black or very dark castaneous; labium shining, labrum very finely punctuate, shining brownish black; anterior side of rhinarium (mostly anteclypeus) shining, dorsal side velvet black, gena below antenna with a subquadrangular yellowish white shining marking; frons and dorsal side of head velvet black with three pairs of small pale spots, one pair between antennae against frontal suture, one pair laterally of lateral ocelli and one pair on postocular lobes; size of spots



Figs 1-4. *Rhinocypha watsoni* sp.n.: (1) synthorax, ♂, left lateral view; – (2) idem, ♀; – (3) anal appendages ♂; – (4) pterostigma. – Figs 5-9. *Rhinocypha drusilla* Needham, holotype ♂: (5) synthorax, left lateral view; – (6) head, dorsal view; – (7) anal appendages, oblique view; – (8) same, left lateral view; – (9) pterostigma. – [Scale line A-C 1 mm; – scale (A) for Figs 1, 2, 5; (B) for 4, 9 and (C) for 3, 7 and 8].

approximately the size of ocelli.

T h o r a x. – Prothorax black without pale markings. Synthorax (Fig. 1) black with coppery red shine; mesothoracic triangle rather large; sides with a broken pale coloured, yellowish white fascia, starting anteriorly on ventralmost part of mesokatepisternum with a triangular marking, hind margin of coxa of middle leg with longitudinal stripe, stripe over mesepimeron covering stigma, curving to metapleural suture, and running for ca half its length anteriorly to this suture ending shortly before dorsum of thorax; another pale fascia over distal third of metepimeron.

Legs black, not dilated, a pale stripe running over anterior side of trochanter and femur, that of fore femur very short, on middle femur ending just before tibia and on hind femur running for approximately two-thirds of length of femur; innerside of fore tibia with some white pruinescence, innerside of middle leg pure 'mouldy' white; no trace of white on hind tibiae.

Wings distinctly pleated; rather broad (Fig. 11); R3 arising more than one cell distal from subnodus; fore wing with 13 Ax, 26-27 Px; hind wing 13-14 Ax, ca 26 Px; one additional Ax between primaries; arculus at or just anterior to Ax2; pterostigma in both fore and hind wing, covering 6-7 cells; arculus divided at base; pterostigma unicolorous (Fig. 4).

A b d o m e n. – Dorsum black with bluish shine, without any indication of pale coloration on any of the segments; anal appendages with superiors remarkably slender (Fig. 3).

M e a s u r e m e n t s (in mm). – Hind wing 24, abdomen 20. – (Paratypes hind wing 23.5-24.0, abdomen 20-21).

FEMALE. – Generally as the male, but head with pale coloration much more extensive and more yellowish. Mandibles mainly yellow except for area against labrum; gena pale; anteclypeus shining black; base of postclypeus with a small elongate pale spot at outer corner against frons; frons with extensive pale coloration with oblique running marking from upper inner to lower outer corner, dorsally broad and tapering towards lower end, where just connected with pale marking on gena; scapus bluish yellow; vertex with a crescent shaped marking between antennae below the median ocellus; small paired spots laterally of lateral ocelli and on occiput.

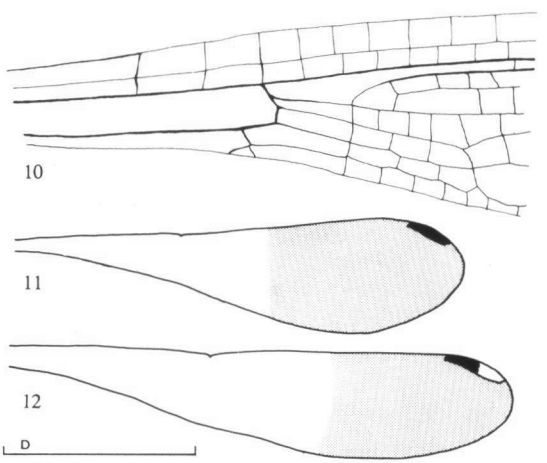
Thorax. – Prothorax with subquadrangular spot on median lobe, and a very small marking on lateral lobe; synthorax (Fig. 2) with dorsal carina indicated by yellow line, a narrow and short line on inner corner of mesepisternum above mesokatepisternum; narrow pale line against mesopleural (humeral) suture over mesepimeron, distally ending in a hook-shaped marking, remaining pale marking as in male. Legs without pruinosity. Wings with fore wings hyaline, dark markings on hind wings less sharply defined than in male, suffusion starting lightly at level of nodus, distally gradually becoming darker till nearly brownish black at level of Px 10, distally of pterostigma opaque white; pterostigma in fore wing

elongate, covering four cells, greyish brown with distal third more greyish; in hind wing shape as in fore wing, but coloration pale yellow with inner one-fifth brownish black and other corners with brownish black suffusion.

Abdomen nearly black.

Measurements (in mm). – Hind wing 25, abdomen 19.

DIFFERENTIAL DIAGNOSIS. – *R. watsoni* is considered most closely related to *R. drusilla* Needham. Possessing a short, uncoloured mesothoracic triangle, dark coloration only in the hind wings, absence of vitreous spots and hind wings broader than fore wings, both species do not belong to any of the groups distinguished by FRASER (1934). *R. drusilla* was originally rather poorly described and illustrated, while a translation of text by SUI & SUN (1984) is not available to us. From the bicoloured pterostigma in the plate in the latter publication, it seems that these authors indeed had before them a specimen of *drusilla* in the present sense.



Figs 10, 12. *Rhinocypha drusilla* Needham, holotype ♂: (10) venation at base of wing; – (12) shape of hind wing. – Fig. 11. *R. watsoni* sp.n.: shape of hind wing of ♂. – [Scale D: 10 mm for 11-12]

The coloration of the wing is also reminescent of the group of *sanguinolenta / dorsosanguinea / turconii*, a species group confined to the Philippines.

DISTRIBUTION. – Two sites in the Nghe Tinh and Binh Thien provinces, close to the western border (Fig. 23).

[*RHINOCYPHA DRUSILLA* NEEDHAM, 1930]
Figures 5-10, 12

References. – NEEDHAM, 1930: 221-222, pl. 16(9); SUI & SUN, 1984: 228-229, figs 148A-C, pl. 18(5).

Type material. – Bur. Ent. 113 / 13 Oct. 1924 / Ching Yuan Chikiang / *Rhinocypha drusilla* sp.n. ♂ [Locality possibly ca 27°27'N 109°41'E] (Cornell University).

Not recorded from Vietnam; a description is presented here to facilitate the comparison with *R. watsoni*.

MALE (**holotype**) Cornell Univ. Holotype No. 976, kept in alcohol, but one wing pair as slide; in poor condition. – Colours hardly recognizable, head and thorax badly broken, but recognizable; abdomen in several pieces, last abdominal

segment with anal appendages presumably treated with potassium hydroxid. Characters in square brackets from NEEDHAM (1930).

H e a d (only partly in recognizable form) (Fig. 6). – Colour dark [black]. Postclypeus, frons, vertex and left eye still extant as one part; all parts except eyes with long setae; dorsal side of postclypeus with large pale marking, frons next to lateral ocelli with elongate pale marking, vertex possibly paler than frons.

T h o r a x. – Prothorax dark [black] with a pale stripe along anterior margin, pale marking on each side of middle lobe; possibly also a small, triangular marking in the centre of the hind lobe [not mentioned by Needham]. Synthorax (Fig. 5) somewhat longer than wide, height approximately half the length of dorsal carina, which is bordered with a narrow, pale line; sides dark [metallic blackish] with pale stripes; a narrow pale stripe over mesepisternum tapering posteriorly and widening against hind margin; a somewhat wider line over mesepimeron, running along middle part of humeral suture, posteriorly leaving the suture, ending towards hind margin of mesepisternum; a narrow stripe posteriorly just under interpleural suture; a wide stripe from lower part of mesepimeron over stigma, crossing the metapleural suture, tapering posteriorly and ending towards hind margin of metapleural suture; infraepisternum ? dark; metepimeron pale bordered dorsally with a dark stripe. Legs discoloured [brown, becoming darker on the tarsi].

Wings (Figs 10, 12). Fore wing hyaline without any marking; hind wing distally from Px11 middle brown with the extreme tip subhyaline, no fenestrate areas, extreme base of hind wing ochreous hyaline. Wings distinctly pleated, rather narrow; R3 arising more than one cell distal from subnodus; fore wing with 13 Ax, 23 Px, hind wing with 14 Ax, 21 Px, one additional Ax between primaries; arculus at Ax2; pterostigma in both fore and hind wing, covering 6-7 cells, pale brown, but distal third in fore wing and distal half in hind wing creamish. Arculus distinctly divided at base.

A b d o m e n. – Broken and discoloured [brown, the middorsal half paler on segments 1-9; sides and narrowed cross lines on the sutures darker; 10 and appendages darker]; appendages (Figs 7-8) also severely damaged, left superior broken off, as was presumably already the case when Needham studied the specimen, see his figure; superior more slender than in *watsoni*; inferiors more robust, innerside of tip with more than ten conspicuous denticles.

M e a s u r e m e n t s (in mm). – [hind wing 26, abdomen 16].

EUPHAEIDAE

ALLOPHAEA O. OCHRACEA (SELYS, 1859)

Selected references. – MARTIN, 1904: 218 (as *ochracea* and *brunnea*, Tonkin, Annam); WILLIAMSON, 1905: 181-182 (records Burma and Thailand; wings of ♂ from Thai-

land); FRASER, 1934: 96-98; ASAHINA, 1985a: 22-25, figs 15-20, 54-58 (synonymy, references, records Thailand, descr.); TSUDA, 1991: 81, 305 (as *Euphaea o. ochracea*, Vietnam).

Material. – E332, 5 ♂ 2 ♀; E336, 2 ♂ 1 ♀; E340, 2 ♂; E341, 2 ♂; E342, 1 ♂ 1 ♀.

A common species in Southeast Asia from Thailand and Assam to Malaya. According to LIEFTINCK (1954) in the Malay states of Pehang, Perak and Selangor between 100 and 400 m altitude, but mentioned by ASAHINA (1985a) as high as 1200 m (Doi Inthanon, Thailand). Here recorded from a maximum altitude of 850 m (locality E332).

EUPHAEA DECORATA SELYS, 1853

Selected references. – MARTIN, 1904: 218 ('seems very common in Tonkin'); TSUDA 1991: 81, 305 (Vietnam).

Material. – E331, 2 ♂ (JvT 1067/8). – Other material in RMNH: W Tonkin Mts Mau Son, alt. 3000' (H. Fruhstorfer) 1 ♂ (ex coll. Förster). – In RMNH is also material from Hong Kong NT, Tai-Po--Kan, 31-VII-1964 (Voss) 3 ♂ 1 ♀ (ex coll. BPBM).

There is considerable variation in the size and shape of the wing, even to such an extent that at least one specimen from locality E331 was thought to belong to *E. ornata* (CAMPION, 1924) (see also KIRBY, 1900: 536, pl. 12). The hind wing of both specimens measures 27 and 29 mm, respectively. The dark marking in the hind wing is, however, distinct and without any fading towards the base and the apex. The shape of the dark marking seems to be the only reliable character to distinguish both taxa [examined in RMNH: Hainan Is, Nai-suen, 1-2 Sep. 1932 (F.K. To) 1 ♂ 1 ♀].

EUPHAEA SUPERBA KIMMINS, 1936

Selected references. – KIMMINS, 1936: 147 (Tonkin); TSUDA, 1991: 305 (Vietnam).

Material. – Not represented in collection Rozendaal. – Other material in RMNH collection from Vietnam: W Tonkin (H. Fruhstorfer) 1 ♂ (ex coll. Förster).

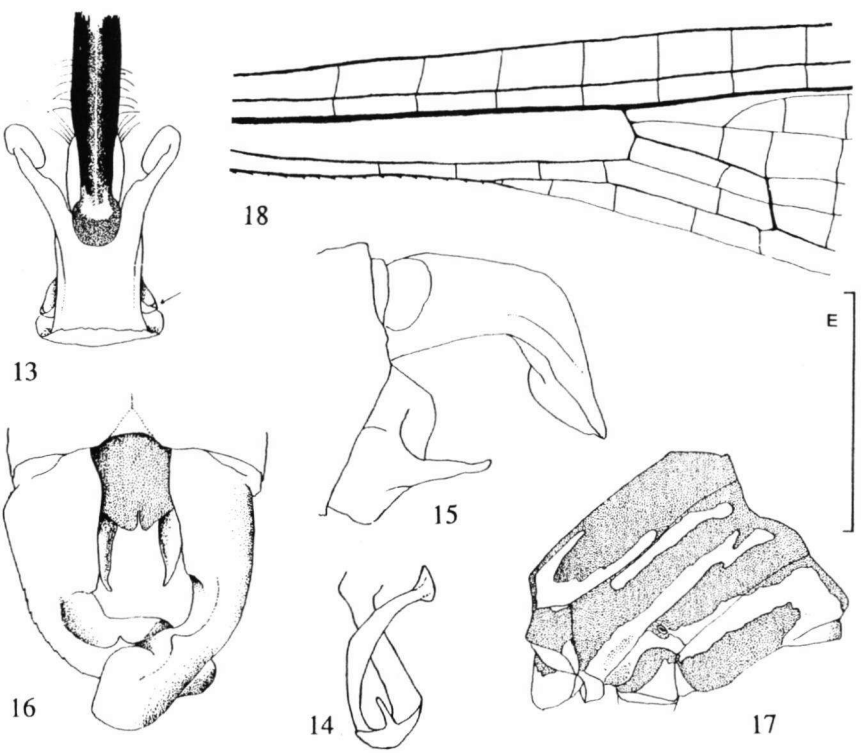
BAYADERA VIETNAMENSIS SP. NOV.
Figures 13-19, 23

Material. – **Holotype** ♂: Vietnam, Nghe Tinh prov., Thang Chuong distr., Doi Khe Lao, several streams through logged forest, alt. ca 100 m, 18°40'N 105°15'E, 11/12-VII-1990 (F.G. Rozendaal) in RMNH (JvT 1072). – **Paratypes** (2): same data as holotype, 2 ♂ (in RMNH) (JvT 1071, 1073).

Etymology. – *Vietnamensis*, after Vietnam, genitive case.

MALE (**holotype**). – H e a d. – Labium with median lobe dark brown, the outer margin with pale border, the tips beyond the cleft shining black, lateral lobes bluish white, but end hooks and movable hooks shining black; labrum glossy bluish white, mandibles bluish yellow, very finely bordered with black; clypeus shining, anteclypeus very narrow, black, postclypeus protruding, finely transversely wrinckled, brownish black with basal third in outer corners with elongate pale stripe; frons and vertex matt-black, but area under antenna along eyes shining; frons between antennae black, below antennae and against eyes yellowish white; vertex black; antenna brownish black except anterior side of first and second segment, which are pale; underside of head black, somewhat pruinose.

T h o r a x. – Prothorax with anterior lobe black, middle lobe basically black, with a large diamond-shaped bluish yellow spot; side lobe mainly pale yellowish white, anteriorly with a triangular marking; the sutures with dark fasciae; synthorax (Fig. 17) shining black with pale markings as follows: mesepisternum with cres-



Figs 13-18. *Bayadera vietnamensis* sp.n.: (13) penis, ventral view; – (14) idem, lateral view; – (15) anal appendages, left lateral view; – (16) idem, dorsal view; – (17) synthorax, left lateral view; – (18) base of wing.

cent-shaped marking starting close to dorsal carina approximately halfway, running anteriorly along mesostigmal lamina and posteriorly along humeral suture to approximately three-fifth of length of humeral suture; mesokatepisternum black with a triangular pale marking in ventralmost part against mesepimeron; mesepimeron anteriorly with narrow pale stripe along humeral suture from ca one-quarter of length ending just before dorsum; a somewhat wider fascia from lower anterior side of mesepimeron over metapleural suture, running distad above metathoracic spiracle, dividing shortly before dorsal side of thorax and especially extending over upperside of metepisternum; ventral side of metepisternum with pale fascia against metakatepisternum under spiracle, somewhat widening and running posteriorly over metepimeron, bending downwards along hind margin, finally bending anteriorly, tapering and ending approximately at two-thirds of lower margin of metepimeron.

Legs brownish black, but anterior side of trochanters and femora bluish white.

Wings (Figs 18-19) hyaline, yellowish enfumed; venation brownish black. Costa straight, pterostigma castaneous, covering 4-5 cells in fore wing, and ca 4 cells in hind wing; fore wing with 15-16 Ax, 21-22 Px; hind wing 12-13 Ax, 21 Px; nodal sector arising ca 3 cells distal to nodus; no basal incomplete Ax in subcostal space; 5 cubital cross-veins; quadrangle (discoidal cell) in some specimens with (asymmetrical) crossvein(s).

A b d o m e n. – Brownish black, segment 2-5 especially in centre dark castaneous; segment 10 middorsally with shallow emargination; last abdominal segments somewhat pruinose in some specimens.

Anal appendages brownish black (Figs 15-16), distal half of superiors strongly bent inwards and downwards; inferiors somewhat curved upwards; superiors in dorsal view with solid, straight base, from approximately one-third from base to three-quarters a rather deep incurvation at innerside, causing dorsally a sharp ridge, provided halfway with a sharp inwardly directed triangular tubercle; distal quarter of superior dorso-ventrally compressed, ventral side somewhat hollow as a continuation of a more or less hollow underside start-

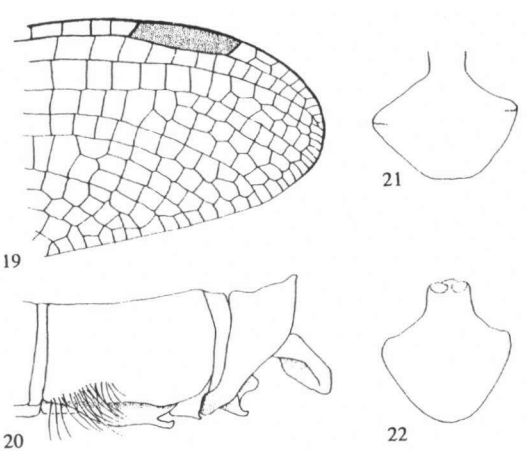


Fig. 19. *Bayadera vietnamensis* sp.n.: tip of wing. – Figs 20-21. *Euphaea guerini*, ♂: (20) last abdominal segments, left lateral view; – (21) visicle, ventral view. – Fig. 22. *Euphaea masoni*, ♂: vesicle, ventral view.

ing at base; inferiors in ventral view triangular, with acute top.

Penis as in other species of *Bayadera*, with distinct internal fold (Figs 13-14).

Measurements (in mm). – Abdomen (incl. appendages) 44, hind wing 29. – (Paratypes: abdomen 44-46, hind wing 30-31).

FEMALE unknown.

DIFFERENTIAL DIAGNOSIS. – Apparently closely related to *Bayadera kali* Cowley (see COWLEY, 1936) (type locality Khasia Hills) (cf. also FRASER, 1934: 78--84 for other species of this genus), as is apparent from the hyaline wings and the shape of the anal appendages, which is round and falt in both species. The internal fold of the penis is visible on both sides. The present species is, however, remarkable in having 4-6 cross-veins in the cubital space. Also, they have 1-2 cross-veins in the discoidal cell. Other species assigned to *Bayadera* have at most one cross-vein in both the cubital space and the discoidal cell. In some respects *B. vietnamensis* seems to approach the monotypic genus *Schmidtiphaea* Asahina (see ASAHINA, 1978, 1987), which also has cross-veins in the cubital space. *S. schmidi* Asahina is, however, very aberrant in the position of the pterostigma; it also has another type of penis. Awaiting a phylogenetic study of the genus, the present attribution of *vietnamensis* to *Bayadera* should be considered preliminary.

DISTRIBUTION. – Only known from the type locality.

EUPHAEA GUERINI RAMBUR, 1842
Figures 21-21, 23

Selected references. – MARTIN, 1904: 218 (Cochinchine, Annam, Tonkin); ASAHINA, 1969: 7 (records South Vietnam, no subspecific status); ASAHINA, 1977: 173-174, figs 30-33, 52 (synonymy, references, diagnosis, distr., figs); ASAHINA, 1985a: 27 (key to sspp., range of *E. g. guerini* is 'Cochin China'); TSUDA, 1991: 305 (Vietnam).

Material. – E335, 2 ♂; 336, 4 ♂ 1 ♀; E342, 3 ♂; E368, 2 ♂; E369, 3 ♂; E370, 1 ♂; E371, 2 ♂. Specimen JvT 1096 very small, hind wing 24 mm.

For some notes see below under *E. masoni*.

EUPHAEA MASONI SELYS, 1879
Figures 22-23

Selected references. – KIRBY, 1894: 113 (record Upper Burma); MARTIN, 1904: 218 (Tonkin, Annam); WILLIAMSON, 1905: 182 (records Burma and Tonkin); ASAHINA, 1977: 174-178, figs 34-39, 43-44, 46-49 (synonymy, references, diagnosis ♂ and ♀, distr.); ASAHINA, 1985a: 24-27, figs 21-24, 60-61 (synonymy, records Thailand, key to sspp. of *guerini*, range Burma, Tenasserim, N Thailand, Assam; figs diagn. characters).

Material. – E335, 1 ♂; E340, 2 ♂; E341, 1 ♂; E368, 2♂. – Other material from Vietnam in RMNH collection: W Tonkin (H. Fruhstorfer) 2 ♂ 1 ♀ (ex UMMZ); Tonkin, Than Moi (VI/VII) (H. Fruhstorfer) 3 ♂ (ex UMMZ); Annam, Phuc Son (XI/XII) (H. Fruhstorfer), 1 ♂ (ex UMMZ); S Vietnam, Da Nang, Monkey Mts, 4-VI-1970 (A.R. Gillogly) 1 ♂ 2 ♀; Vietnam, 35 km E Dilinh [= Diring], 25-IV--1960 (Leech) 1 ♂.

ASAHINA (1969: 7) considers *masoni* the northern subspecies of *guerini*. ASAHINA (1977, 1985a) also distinguishes *E. guerini inouei*, ranging from SE Thailand to S Vietnam.

E. guerini and *E. masoni* are parapatric, at least in Vietnam. Subspecies *inouei* seems to approach *E. masoni* in most respects. We consider *E. guerini* and *masoni* as distinct species, based on well-defined structural characters which seem to hold for most of their range. Both species possibly hybridize to a small extent in the contact zone of their distribution. Whether *inouei* can be considered a distinct taxon, or only the extreme end of a clinal variation within *masoni*, should be investigated further.

E. guerini is characterized by a tuft of setae at the ventral side of tergite 9 (not 8 as in ASAHINA, 1985a: 27), and the shape of the vesicle (Fig. 21). The most distinct character for the vesicle of *E. guerini* is the sharp edge of the outermost corners; the dorso-ventral line is absent in *E. masoni*. Generally, the shape of the vesicle of *guerini* also looks wider than that in *masoni*, but this is much depending on the view angle.

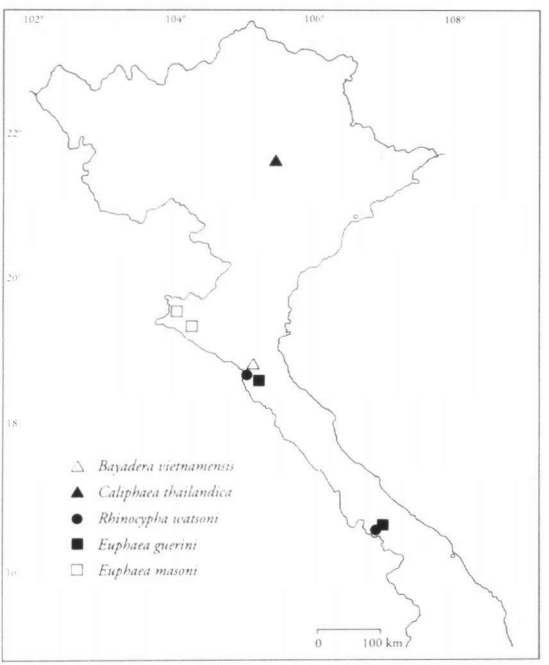


Fig. 23. Localities for several species of Vietnamese Odonata.

DISCUSSION

The present material comes partly from an area which was not, or so far very insufficiently investigated, as apparent also from the map in BIBBY et al. (1992, fig. 34) giving the restricted-range bird records. No such records from the central border area were available at that time, while it seems very unlikely that such species do not occur there. The recent discovery of the Vu Quang bovid *Pseudoryx nghetinhensis* VAN DUNG et al. (1993), in the (former)

province of Nghe Tinh is the best illustration of the underestimated value of this region. Both *Rhinocypha watsoni* sp. n. and *Bayadera vietnamiensis* sp. n. were collected in the very area where the Vu Quang bovid occurs, although at least *R. watsoni* appears to have a wider distribution. A further study of this area would be of high scientific interest. It is worthwhile to mention that the discovery of the new mammal has already resulted in the extension by the Vietnamese government, of the Vu Quang nature reserve from 16,000 to 60,000 ha. However, because of the rapid economic development of the country, all natural areas of Vietnam are under pressure.

Finally, we wish to venture some ideas on the biogeographical relationships of northern and central Vietnam. A biogeographical subregion seems to be discernible for Odonata, extending from the northernmost part of Thailand to northern and central Vietnam, and reaching northwards up to the southern Chinese provinces, possibly also including Hainan. For example, locality E 331, located at 900 m not far from Hanoi, not only revealed *Caliphaea thailandica* Asahina (type locality Doi Suthep), but also the synlestid *Megalestes kurahashii* Asahina (type locality Doi Inthanon) (new to Vietnam).

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