

***Rhithrogeniella tonkinensis* sp.n. (Ephemeroptera,
Heptageniidae) from Vietnam, with descriptions
of the nymphal stages and biology of the genus**

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**Taxonomy, nymph, subimago, generic relationship, phylogeny, habitats,
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Abstract. *Rhithrogeniella tonkinensis* sp. n. (nymph, subimago, imago female) is described from Vietnam and assigned to the monotypic genus *Rhithrogeniella* ULMER otherwise known only from the Sunda Islands in the adult stage. Based on nymphal characters of the Vietnamese species, critical distinguishing characters and generic relationships of the genus within the family Heptageniidae are discussed. Observation of living nymphs at the type locality provides basic data on their bionomy.

The subfamily Heptageniinae of the Heptageniidae is known to include 2 fossil and 28 extant genera. Of these recent genera, the nymph of six mostly Oriental genera (i.e. *Afghanurus* DEMOULIN, *Atopopus* EATON, *Epeorella* ULMER, *Rhithrogeniella* ULMER and *Sigmoneuria* DEMOULIN) have not so far been described. When studying extensive material of mayflies from the Sunda Islands, ULMER (1939) erected the monotypic genus *Rhithrogeniella*, characterized chiefly by the widely separated and narrow *Rhithrogena*-like penis lobes and the absence of titillators. This genus was established to accommodate a single species, *R. ornata* ULMER, known only in the subimaginal and imaginal stage from West Java and Central Sumatra. Since then the genus has been mentioned several times in the literature (e.g. EDMUNDS et al., 1963) without additional records.

The recent finding of a further apparently new species of *Rhithrogeniella* in the Hong Song (Red River) basin in Vietnam now enables us to describe the previously unknown nymphal stage of the genus and to give an outline of the biology of the new species.

Genus *Rhithrogeniella* ULMER, 1939

Rhithrogeniella ULMER, 1939: *Arch. Hydrobiol.*, Suppl., 16 : 575.

Rhithrogeniella: EDMUNDS et al., 1963 : 13; HUBBARD, 1979 : 7; LANDA & SOLDÁN, 1985 : 96.

Adult male: Medium sized mayflies, body length 4.0—7.0 mm, cerci longer than body. Eyes nearly contiguous; thorax and abdomen light yellow with dark red brownish markings. Tibia of fore leg 1.25 times as long as femur, tarsus slightly shorter; basal tarsal segment shorter than segment 2 (Fig. 21). Femur of hind leg 1.5 longer than tibia, tarsus shorter by 1/2 than tibia; segment 1 of hind tarsus 1.2—1.3 times longer than segment 2 (Fig. 22).

Fore wings oval, transparent, pterostigma with 7—10 cross veins; cross veins straight, unforked; hind wings oval or triangular with bluntly pointed or rounded apex and distinct, sharply pointed costal angulation; cross veins in cubital membrane well developed, cross veins in posterior wing portion reduced. Forceps base with slight rounded projection in middle and a pair of projections near the bases of segment 1 of forceps; forceps 4-segmented; segment 3 slightly longer than segment 4. Penis lobes (see ULMER, 1939: 572, Fig. 169) widely separated, parallel, rounded at apex; rounded median titillators with sclerotized apical parts present (see discussion below).

Adult female: Length of body and cerci as in male. Eyes not contiguous, distance between them as wide as eye width or longer; thorax and abdomen with colour patterns similar to males. Tibia of fore leg about as long as femur, tarsus as long as 2/3 of tibia; segment 1 and 2 equal in length; segment 3 longer than segment 4, segment 5 as long as segment 3. Wings as in male. Posterior margin of sternum VII straight, not enlarged; posterior margin of sternum IX convex or straight in the middle, without medial emargination.

Subimago: Body paler, general colour pattern as in adults. Tarsal segment relationships approximately the same as in adults. Wings greyish, translucent, marginal ciliae paler. Forceps straight, penis lobes oval, contiguous, with well apparent medial titillators (Fig. 20). For further details of adult and subimaginal characters see ULMER (1939: 575—578, Figs. 165—174).

Nymph: Body only moderately dorsolaterally flattened. Body length approximately as in adults, cerci as long as 2/3 of body. Head regularly oval, margins convex, posterolateral and posterior margin slightly convex or straight (ratio length : width 6 : 9). Anterior margin convex, without distinct median U-shaped emargination; head margin smooth, without setae (Fig. 16). Labrum moderately produced laterally as broad as 1/2 of head width, ratio length : width 2 : 1. Mandibles triangular with large molar part; outer incisors with numerous blunt teeth, 2—3 setae near the basis of inner incisors (Figs. 11, 12). Armature on crown of galea-lacinia of maxillae consisting of pectinate spines, plumose setae on inner surface of maxilla; maxillary palpus three-segmented, terminal segment imperfectly separated, without pectinate spines (Fig. 10). Glossae with wide U-shaped separation, paraglossae narrow, produced laterally (Fig. 9).

Pronotum as broad as head or head very slightly broader, with moderately expanded lateral margins (Fig. 17); lateral margins not produced posteriorly; metanotum distinctly broader than head capsule and pronotum (Fig. 17). Posterolateral angles of meso- and metathoracic nota above bases of coxae produced into obtuse or rounded projections. Hind legs distinctly longer than fore and middle ones, femora with marginal row of bristles and scales on dorsal surface (Fig. 8). Claws bent and pointed, not hooked, with bluntly pointed or rounded teeth situated on apical half of claws (Fig. 13).

Abdominal segments with bluntly pointed; short posterolateral spines, segments 8—10 without spines (Fig. 18). Posterior margins of abdominal terga with a row of irregular pointed spines and minute submarginal spines (Fig. 7). Seven pairs of gills; gills progressively larger anteriorly, triangular or oval, asymmetrical (Figs. 3—6). Gill 1 tongue-shaped bent, with bundle of filaments as long as 1/2 of plate; gills 2—6 with bundles of about 10—15 filaments, gill 7 without filaments, consisting of oval, *Baetis*-like plate. Three caudal filaments well developed, paracercus as long as cerci. Cerci

with long setae in medial and posterior portion; segments with large blunt spines and bristles on anterior margin regularly alternate with those with very fine bristles and individual scales on posterior margin (Figs. 14, 15). These differences not so pronounced but well apparent also in posterior portion of cerci and paracercus.

Type-species: *Rhithrogeniella ornata* ULMER, 1939, by original designation.

Species included: *R. ornata* ULMER, 1939 (Sunda Islands), *R. tonkinensis* sp.n. (Vietnam).

Distribution: This genus seems to be restricted and endemic to the Oriental region.

Differential diagnosis and discussion

The genus *Rhithrogeniella* ULMER undoubtedly belongs to the subfamily Heptageniinae of the Heptageniidae, and there are no apparent relationships to the subfamilies Arthropleinae, Anepeorinae, Pseudironinae and Spinadinae.

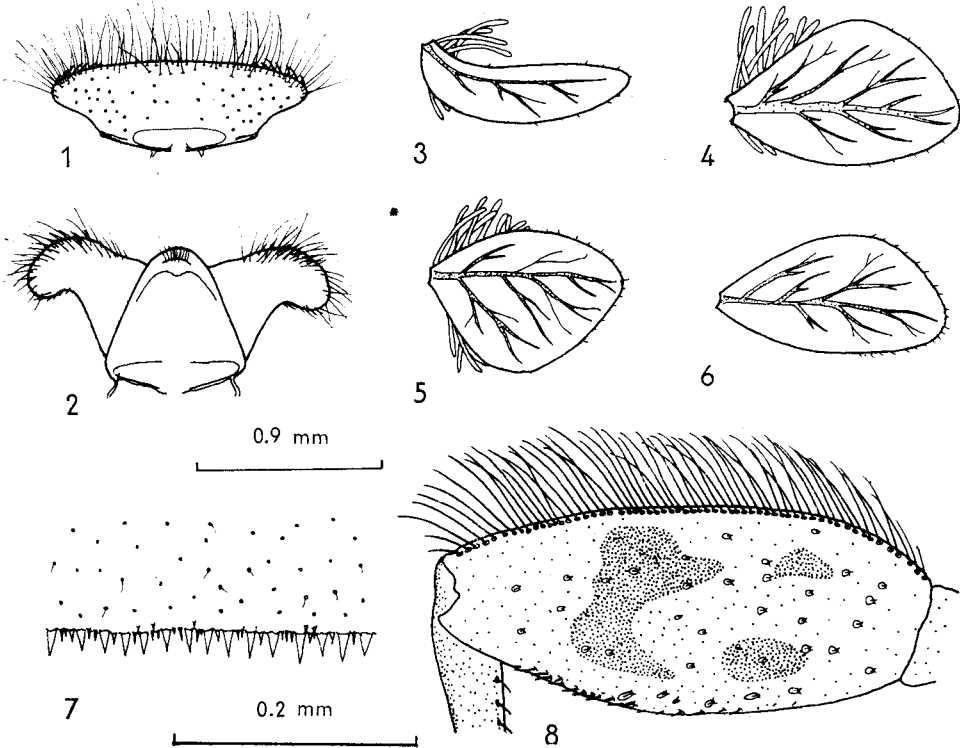
As regards the adult stage, *Rhithrogeniella* occupies a quite independent position within the Heptageniinae. Adults can be easily distinguished by the widely separated, narrow and rounded penis lobes from adults of other known genera. Other critical distinguishing characters are as follows: (1) head not expanded and produced ventrally; (2) eyes of males nearly contiguous on vertex; (3) fore tarsus of male subequal or slightly shorter than tibiae; (4) claws of all leg pairs dissimilar; (5) cross veins of fore wing well developed; (6) hind wing with conspicuous and sharply pointed costal angulation, cubital region with intercalaries; (7) subgenital plate without medial emargination. Adults differ in non-sigmoidal, straight basal costal cross veins in fore wing from the genus *Sigmoneuria* DEMOULIN (known only from female adults). The arrangement of penis lobes approach those of the genera *Rhithrogena* EATON and *Epeiron* DEMOULIN. Males of *Rhithrogeniella* can be distinguished by absence of stout spines projecting from bases of penis lobes posterolaterally (lateral titillators). These structures are absent also in some species of *Rhithrogena* (e. g. *R. kimminsi* THOMAS and some Asiatic species) and in *Epeiron*, contrary to *Rhithrogeniella*. In those cases stout chitinous spines are present on the apex of penis lobes, and in males of *Epeiron* there are relatively short and much less separated rounded lobes (DEMOULIN, 1964; BRAASCH & SOLDÁN, 1982). Neither *Rhithrogena* nor *Epeiron* (these genera seem to be closely related or even congeneric — see THOMAS & DIA, 1982) possess a median titillator. In the subimago of *Rhithrogeniella tonkinensis* sp.n. well developed, cylindrical medial titillators with sclerotized apices were found. Similar structures occur in subimagos of *R. ornata* (material in the Zoological Museum, Hamburg). On the other hand, ULMER (1939: 575) states that there are no titillators in *R. ornata* („Titillatoren anscheinend fehlend“). Our opinion agrees with that of Jensen (pers. comm.) who supposes the existence of medial titillators as well.

Nymphs of *Rhithrogeniella* ULMER can be distinguished from other genera of Heptageniidae by the following combination of critical distinguishing characters: (1) head approximately as broad as pronotum, without median emargination and marginal bristles; (2) labrum as broad as 1/2 of head width; (3) no pectinate spines on maxillary palps, these spines present on maxilla;

(4) pronotum with moderately expanded lateral margins; (5) projections above bases of coxae obtuse or rounded; (6) claws with rounded teeth situated subapically; (7) abdominal segments with short bluntly pointed posterolateral spines; (8) gill 1 with relatively long and well developed plates, not expanded beneath venter of abdomen; (9) gills 2—7 oval or triangular, progressively larger caudally, gill 7 without filaments; (10) segments of cerci bearing stout spines regularly alternate with those without spines; (11) cerci with lateral bristles; and (12) three caudal filaments well developed.

Contrary to certain relationships of male genitalia to the genus *Rhithrogena*, nymphal characters show absolutely no relationship to the plesiomorphic *Cinygma-Rhithrogena-Cinygmula* phyletic lineages of the Heptageniinae (cf. JENSEN & EDMUNDS, 1973: 83, Fig. 1, lineage IA). The nymph of *Rhithrogeniella* differs in nearly all the above critical distinguishing characters, namely in (1, 2, 3, 4, 6, 8, 9, 10).

Also *Rhithrogeniella*'s relationships to the apomorphic lineage (II of JENSEN & EDMUNDS, 1973) of *Bleptus-Ironodes-Epeorus-Iron* are very distant. This lineage is represented by specialized rheophilous nymphal forms with two caudal filaments and mostly highly specialized gills and mouthparts (characters 1, 2, 4, 6, 7—10, 12).



Figs. 1—8: *Rhithrogeniella tonkinensis* sp. n., nymph: 1 — labrum, dorsal view. 2 — hypopharynx. 3 — gill 1. 4 — gill 6. 5 — gill 3. 6 — gill 7. 7 — posterior margin of abdominal tergum 3. 8 — fore femur, dorsal view.

According to nymphal characters the genus *Rhithrogeniella* apparently belongs to the apomorphic phyletic lineage of the Heptageniinae, consisting of *Thalerosphyrus*, *Afronurus*, *Cinygmmina*, *Stenonema*, *Stenacron*, *Ecdyonurus* and *Heptagenia* (cf. lineage IB of JENSEN & EDMUNDS, 1973), and probably of *Compsooneuria* and *Compsooneuriella* as well. The genera *Thalerosphyrus*, *Cinygmmina* and *Afronurus* show more derived nymphal characters than *Rhithrogeniella*, such as pointed notal projections above coxae, specialized or truncate (*Cinygmmina*) gills, etc. (for details see BRAASCH & SOLDÁN, 1984a, 1984b). *Rhithrogeniella* seems to belong to the *Ecdyonurus-Heptagenia* phyletic lineage, e.g. to the more primitive types of the IB apomorphic group (cf. JENSEN & EDMUNDS, 1973). It shows close relationship to the *Ecdyonurus lateralis* species-group (which probably represents a separate genus from "true" *Ecdyonurus*).

Rhithrogeniella shares with these species moderately expanded pronotum, arrangement of gill 1 and some characters of mouthparts, and a similar general colour pattern (characters 1—4, 8, 11, 12). It is distinguished from all these genera (lineage IB) mainly by the unique arrangement of segments of cerci (9, 10) and claws (6) and by progressively posteriorly larger gills.

On the other hand, the arrangement of eggs of *Rhithrogeniella* is quite different from that of *Ecdyonurus* including the *E. lateralis* species-group. The hexagonal or polygonal structures encircling adhesive coils (Plate II)* closely resemble those of the Nearctic genus *Nixe* FLOWERS.

Rhithrogeniella tonkinensis sp.n.

(Figs. 1—21; Plates I—II)*

Adult female (paratype No. 1): Body length 4.3 mm, length of cerci 7.2 mm, length of fore wing 5.2 mm. Body whitish yellow with reddish brown markings on head, thorax and anterior abdominal segments. Head with dark stippling near occipital margin; eyes blackish grey, the distance between eyes as much as 1.25 of the eye width; antennae unicolorous, slightly darker than head. Pronotum with wide dark medial longitudinal band expanded posteriorly; a pair of conspicuous dark elongated spots near the anterior margin of mesonotum. Legs damaged. Wings nearly colourless and transparent, basal portion slightly brownish; longitudinal as well as transversal veins slightly darker; 9—10 straight unforked cross veins in pterostigma. Abdominal tergum I stippled with reddish brown in middle; tergum II with a pair of pale spots in dark stippling near the anterior margin; terga III—X as well as sterna I—IX pale and without markings. Posterior margin of sternum VII straight, similar in shape to other sterna; posterior margin of sternum IX convex, straight in middle, sternum IX about twice longer than abdominal segment VIII. Cerci whitish, unicolorous.

Subimago male (paratype No. 2): Body length 3.1 mm, length of cerci 7.3 mm, length of fore wing 4.7 mm. Head and thorax whitish yellow, abdomen slightly paler. Eyes very large, covering nearly whole dorsum of head, nearly contiguous, blackish brown. Antennal scape brownish yellow, flagellum dark brown.

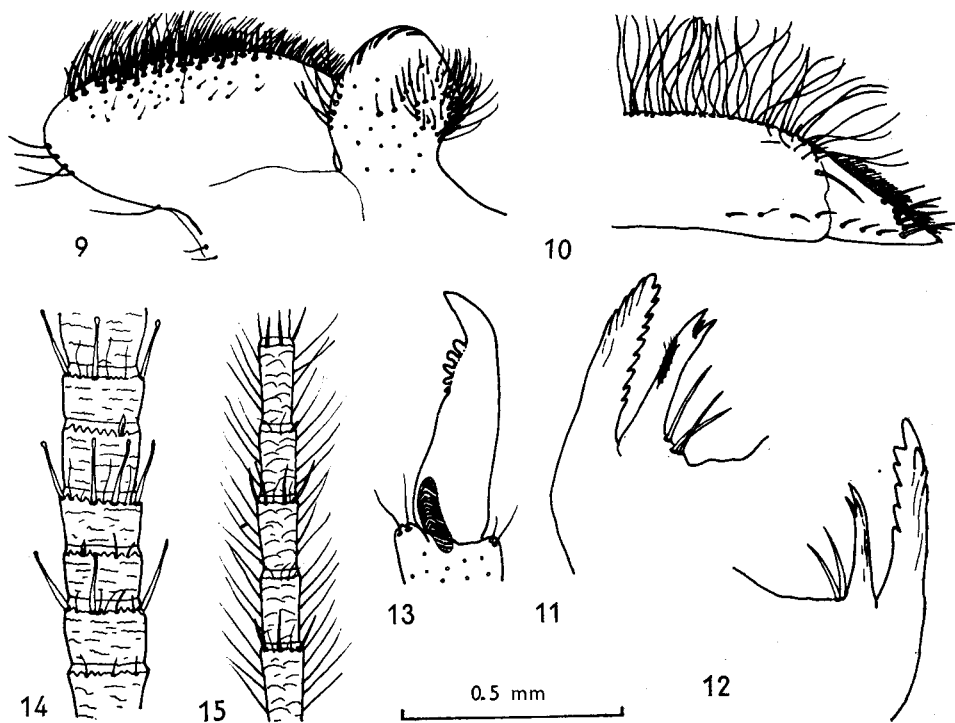
Pronotum with similar colour pattern as female, narrow pale stripe in the middle; mesonotal colour pattern also same as in female, but much darker and

* Plates I—II will be found at the end of this issue.

more pronounced; a pair of conspicuous dark brown spots near the bases of fore wings. Ventral side of thorax pale yellowish; unicolorous. Fore legs dark, evenly stippled with dark brown, unicolorous, apical portion of tibia blackish. Middle and hind legs light brownish yellow, inconspicuously dark stippled. Ratio femur : tibia : tarsus 26 : 24 : 17 (fore leg); 26 : 20 : 12 (middle leg); 29 : 26 : 12 (hind leg). Ratio of tarsal segment 1—5: 18 : 24 : 22 : 22 : 2 (fore leg) (Fig. 21); 20 : 15 : 12 : 7 : 23 (middle leg); 20 : 14 : 10 : 7 : 26 (hind leg) (Fig. 22); tarsal segments of middle and hind legs with an apical spine. Wings greyish, transparent, veins of the same colour as wing, about 8 simple cross veins in pterostigma; cilia pale whitish, transparent.

Colour pattern of abdominal terga as in Fig. 19; terga VI—X almost without markings, unicolorous, in some species also terga IV and V without any markings. Abdominal sterna pale, anterior sterna with inconspicuous dark stippling in some specimens. Genitalia as in Fig. 20; subgenital plate with a pair of rounded projections, straight in middle; penis lobes rounded, contiguous, twice as long as wide at basis; median titillators cylindrical, about 4 times as long as wide, rounded at apex with terminal sclerotized structures. Cerci whitish, unicolorous.

Nymph (holotype): Body length 4.6 (4.3—5.2) mm, length of cerci 2.9 (2.3—3.8) mm. Head (Fig. 16) oval (ratio width : length 23 : 38); eyes greyish black, ocelli lighter; antennal scape pale, flagellum much darker, brownish;



Figs. 9—12: *Rhithrogeniella tonkinensis* sp. n., nymph: 9 — glossa and paraglossa. 10 — apical part of maxillary palpus. 11, 12 — left and right mandibular incisors. 13 — claw of middle leg. 14 — segments of cerci, proximal portion. 15 — segment of cerci, distal portion.

distance between eyes in male nymphs as great as half eye width. Colour pattern of head, pro- and mesonotum as in Figs. 16, 17, very variable in both intensity and ornamental patterning. Head usually dark brown or greenish brown with two pairs of submarginal or marginal anterior pale spots, unpaired rounded spots on frons and roughly triangular spot on occiput; eyes usually pale bordered anteriorly.

Labrum three times as broad as long (ratio length : width 91 : 29) moderately produced laterally, posterolateral margin only slightly concave, ventrally with a pair of oblique 5—6 stout spines and groups of 10—15 strong bristles on lateral lobes; ventrally with fine bristles as long as $1/2$ — $2/3$ of labrum length (Fig. 1). Outer incisors of mandibles with numerous bluntly pointed or rounded teeth on inner and outer margin (Figs. 11—12); inner incisors stout, subequal to outer ones in length, distally serrated into three or four pointed projections; right mandible with inner incisors as long as $2/3$ of outer ones and two bristles near its basis; inner incisor of left mandible nearly as long as outer one, with three fine plumose bristles near basis. Three stout bristles situated below molar part of mandibles. Maxilla relatively wide with marginal inner row of bristles as long as $1/2$ of galea-lacinia width and about 7 twice longer submarginal bristles near its basis; apical part of galea-lacinia with a row of 10—11 combs consisting of about 6—8 teeth; inner surface of maxilla with numerous plumose bristles. Segment 3 of maxillary palps (Fig. 10) triangular, as long as $1/6$ of segment 2 length, with a group of 5—6 transversally situated subapical bristles; segment 2 longer by $1/3$ than segment 1. Hypopharyngeal superlinguae moderately produced laterally and bent anteriorly, lingua triangular, bluntly pointed (Fig. 2). Segment 1 of labial palps approximately as long as segment 2; glossae longer than broad with apical chitinous ridges; paraglossae produced laterally, more than twice broader than long (Fig. 9).

Pronotum more than 4 times as broad as long (ratio length : width 25 : 114) produced laterally into lobes with convex margins. Femora oval, more than twice as long as broad evenly covered with wide rounded scales. Submarginal bristles as long as $2/3$ — $3/4$ of femur width, longer on middle and hind femora; irregular row of spines on inner margin of femur (Fig. 8). Ratio femur : tibia : tarsus 32 : 30 : 12 (fore leg), 38 : 35 : 15 (middle leg) and 43 : 35 : 17. Claws (Fig. 13) with 3—6 rounded or bluntly pointed teeth situated subapically. Femora pale with two pairs of dark spots; distal pair of spots usually fused (Fig. 8); coxae and apex of femora with dark stippling; tibiae and tarsi darker than femora, light brownish or greenish brown.

Abdominal tergum I pale, yellowish with inconspicuous brownish stippling; terga II—VII usually dark brown or greenish brown, with paler posterior margins; outer spots large, rounded, diffuse, inner spot pair small, spots sometimes (especially on terga IV—V) fused, forming a single medial U-shaped spot. Terga VIII and IX predominantly pale yellowish, sometimes with slight brownish stippling; sternum X pale, with elongated medial dark spot. Sterna II—IX stippled with brown, with diffuse light spot or without spot. Abdominal colour pattern generally strongly variable. Posterolateral spines of abdominal segments I—VII (Fig. 18) as long as $1/6$ — $1/5$ of segment length, bluntly pointed or rounded (segment I) and slightly bent medially to the body axis. Posterior margins of abdominal terga with a row of unequal, irregularly alternating triangular sharply pointed spines (Fig. 7); submarginal

spines much less abundant and very small. Surface of terga with minute hairs.

Gills (Figs. 3—6) pale, plates sometimes slightly dark brown dusted with moderately distinct reddish brown pigmented tracheations and minute marginal hairs; bundles of filaments usually not pigmented, as long as 1/2 of plate length or slightly longer. Posterior gills longer, gill 1 (Fig. 3) as long as gill 3; gill 1 tongue-shaped, moderately bent, 3.5—4.5 times as long as wide; gill 2—6 (Fig. 4—5) triangular, asymmetrical, longer by 1/3 than broad, with tufts of filaments consisting of 10—20 filaments; gill 7 (Fig. 6) rounded, asymmetrical, without bundle of filaments, nearly twice longer than broad, resembling that of the genus *Baetis*. Cerci (Figs. 14, 15) dark yellowish or pale brownish, unicolorous, not ringed; segments alternating as in Figs. 14, 15, in basal portion long spines rounded at apex as long as or slightly longer than segment length, in apical portion spines short and smaller, as long as about half length of segment.

Egg (dissected from subimago female, critical point dried, gold-coated): Egg ovoid, about 1/3 longer than broad, with 1—2 micropyle in the equatorial area. Chorion (Plate II, Figs. 5—10) with hexagonal structures and evenly covered with knob-terminated coiled threads. Polar caps not developed. Micropyle circular or slightly oval with inconspicuous marginal rim.

Material examined: Mature nymph ♂ (holotype), adult female (paratype No. 1), subimago male (paratype No. 2); 1 ♂, 3 ♀♀ subimagos, 95 ♂♂, 133 ♀♀ nymphs (further paratypes): Vietnam, Ha Son Binh Prov., Suoi Xui Riv., Hoa Binh, November 15—17, 1984, leg. T. Soldán; 2 nymph (further paratype): Vietnam, Vinh Phu Prov., Song Dan near Tam-Dao, May 26, 1982, leg. T. Soldán. Parts of paratypes on slides, holotype and paratypes in alcohol; deposited in the Institute of Entomology, ČSAV, České Budějovice, some paratypes in the collection of junior author.

Etymology: Named after Tonkin, an old name for parts of northern Vietnam and north-eastern Laos.

Distribution: Oriental, so far known only from the basin of the Red River (2 localities).

Differential diagnosis and discussion

Since the adult male of *Rhithrogeniella tonkinensis* sp.n. and nymphs of *R. ornata* ULMER are unknown only subimagos of these two species can be compared. The subimago of *R. tonkinensis* can be distinguished by the following critical distinguishing characters: (1) Body length 4.1—4.7 mm; (2) fore leg tibia approximately as long as femur (ratio 13 : 12); hind leg tarsus as long as about 1/2 of tibiae; (3) basal tarsal segment of fore leg as long as 3/4 of segment 2; (4) colour patterns of abdomen similar to those of *R. ornata* but on segments I—V (male) or I—III (female) respectively. Adult female without tergal markings; (5) apices of penis lobes more rounded, posterior margin of subgenital plate straight.

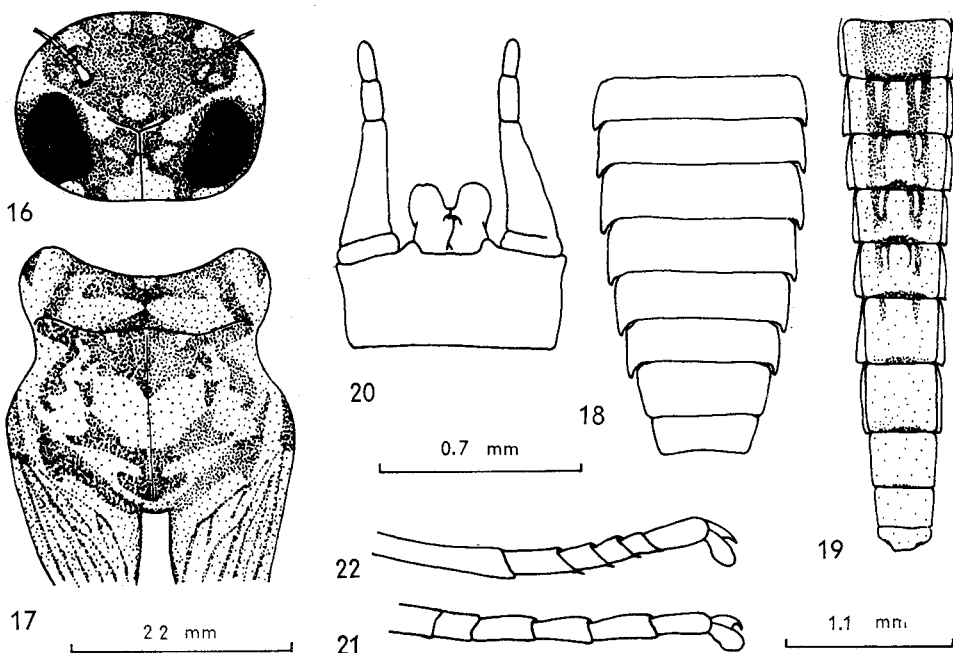
On the other hand, subimagos of *R. ornata* shows different combination of characters as seen from ULMER's (1939) original description and drawing (p. 576 : Fig. 173, 174) and from the examination of paratypes in the Zoological Museum in Hamburg. Head and thoracic dark marking are identical but abdominal colour patterns are quite different in both sexes (coloration not fully preserved in the paratypes, see ULMER's (1939) illustrations, Figs 170 and 171 — dark brown colour patterns occupy terga I—VIII or I—VII in females respectively). Contrary to *Rhithrogeniella tonkinensis* sp.n.,

R. ornata subimagos possess fore tibiae apparently shorter than femora and hind tarsi as long as 2/3 of tibiae. Basal segment of fore tarsus as long as about 2/5 of the length of segment 2. Subimagos of *R. ornata* are longer, length of body is 5.5–7.0 mm. Apices of penis lobes seem to be bluntly pointed in *R. ornata*, medial portion of posterior margin of subgenital plate is slightly convex.

Notes to biology

The Suoi Xui (Plate I; Figs. 1–4) is a moderately small river or large stream (about 4–8 m across at the locality studied), with regular permanent water 5–80 cm in mean depth during the dry season and about 1 m water level fluctuation in the wet season. It is a tributary of the Brown River (Song-Da) in the Red River (Hong Song) basin; the locality studied lies about 15–20 km upstera from the mouth. During the period studied the water temperatures were from 23.8–25.3 °C by day and pH was 7.5–8.0, water level fluctuation \pm 5 cm. The river has a large number of rapids and backwaters possessing mostly stony or sandy bottom on limestone substratum.

The river bed offers a large scale of different microhabitats. Larvae of *Rhithrogeniella* occur at nearly all of them, except for rapids with very fast current. They clearly prefer relatively deep (mean depth about 30–40 cm) places with relatively slow current and smaller stones or coarse



Figs. 16–22: *Rhithrogeniella tonkinensis* sp. n., nymph (16–18), subimago male (19–22): 16 — colour patterns and shape of head capsula, dorsal view. 17 — colour patterns of pro- and mesonotum. 18 — shape of abdominal segments, dorsal view. 19 — colour patterns of pro- and mesonotum. 20 — forceps and penis lobes. 21 — tarsus of fore leg. 22 — tarsus of hind leg.

sand on the bottom. Their quantitative presentation in these microhabitats with 5–25, 25–50, and more than 50 cm. s⁻¹ current speed was 45–58 %, 19–28 % and less than 10 % of the total mayfly standing crop respectively. Current speed seems to be the main factor controlling the distribution of nymphs within microhabitats. Nymphs were found mostly together with those of *Habrophleboides*, *Choroterpes* (subgenus *Euthraulius*), *Centroptilum*, *Cloeon*, *Ephemera*, *Caenis* and *Mesoplocia*. They were found only exceptionally at plant roots and amongst debris or at clayey microhabitats. Generally, nymphal habitat preference is similar to that of nymphs of *Compsoeuriella*, though the latter prefer submerged vascular plants or roots, and is quite different from that of the genera *Cinygmina*, *Paegniodes*, and *Thalerosphyrus* of the Heptageniidae living at similar localities.

Nymphs are good swimmers, but they prefer remaining attached to the stone surface to swimming. The oxygen demands are not so pronounced as in rheophilous forms, they can survive in transporting jars for several day. Gill 2–6 are, similarly to those of *Ecdyonurus*, movable. Subimagos emerge late in the afternoon; the subimago stage lasts one day. Adults fly probably in the evening at dusk, but otherwise their habits are unknown. Fecundity of the female is about 350–500 eggs. During the period of collection, predominantly mature and older nymphs were found, half-grown nymphs reached only 10 % of the total number of nymphs collected in the beginning of November, 1984. The nymphs caught at the end of May, 1982 were also older ones. There is no doubt that this species has at least two generations a year.

Acknowledgements

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REFERENCES

- BRAASCH D. & SOLDÁN T. 1982: Neue Heptageniidae (Ephemeroptera) aus Asien III. *Ent. Nachr. Berich.*, **26** : 25–28.
- BRAASCH D. & SOLDÁN T. 1984a: Zwei neue Arten der Gattung *Cinygmina* Kimmins, 1937 aus Vietnam (Ephemeroptera, Heptageniidae). *Reichenbachia*, **22** : 196–200.
- BRAASCH D. & SOLDÁN T. 1984b: Beitrag zur Kenntnis der Gattung *Thalerosphyrus* Eaton, 1881 im Hinblick auf die Gattung *Ecdyonuroides* Thanh, 1967 (Ephemeroptera, Heptageniidae). *Reichenbachia*, **22** : 202–206.
- DEMOULIN G. 1964: Mission H. G. Amsel en Afghanistan 1956. *Bull. Ann. Soc. Ent. Belg.*, **100** : 351–363.
- EDMUNDS G. F., ALLEN R. K. & PETERS W. L. 1963: An annotated key to the nymphs of the families and subfamilies of mayflies (Ephemeroptera). *Univ. Utah Biol. Ser.*, **13** : 1–55.
- HUBBARD M. D. 1979: Genera and subgenera of recent Ephemeroptera. *Eatonia*, Suppl., **2** : 1–8.
- JENSEN S. L. & EDMUNDS G. F. 1973: Some phylogenetic relationships within the family Heptageniidae. Proc. 1st Inter. Conf. Ephemeroptera, Tallahassee 1970, pp. 82–87.
- LANDA V. & SOLDÁN T. 1985: Phylogeny and higher classification of the order Ephemeroptera: a discussion from the comparative anatomical point of view. *Studie ČSAV*, **4**, 124 pp., Academia, Praha.
- THOMAS A. G. B. & DIA A. 1982: *Ecdyonurus* (?) znojkoï Tshernova 1938: Redescription et appartenance générique réelle (Ephemeroptera, Heptageniidae). *Bull. Soc. Hist. Nat. Toulouse*, **118** : 297–303.
- ULMER G. 1939: Eintagsfliegen (Ephemeropteren) von den Sunda-Inseln. *Arch. Hydrobiol.*, Suppl., **16** : 1–691.

**Rhithrogeniella tonkinensis sp. n. (Ephemeroptera, Heptageniidae)
из Вьетнама с описанием нимфальных стадий и биологии рода**

Таксономия, нимфы, родовые реляции, филогенез, габитаты, абундация, Восточная область

Резюме. *Rhithrogeniella tonkinensis* sp. n. (нимфа, субимаго, имаго самки) описана из Вьетнама; принадлежит к монотипичному роду *Rhithrogeniella* Ulmer известному только из Суидских островов по стадии имаго. На основе нимфальных признаков вьетнамского вида обсуждаются критические различительные признаки рода и его положение в рамках семейства Heptageniidae. Наблюдение живых нимф на типовом местонахождении позволяет обобщить основные данные, касающиеся их биологии.

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REVIEW

Steinmann H. & Zombori L.: AN ATLAS OF INSECT MORPHOLOGY. 2nd revised edition, 254 pp., 756 figs., Akadémiai Kiadó, Publishing House of the Hungarian Academy of Sciences, Budapest, 1985.

This volume is a second, revised of Steinmann and Zombori's annotated illustrations of morphological characters of an insect body first published in 1981. The arrangement of chapters following three main insect body parts (head, thorax and abdomen) and the number of illustrations remain unchanged. However, some entirely new figures with some new terminological expressions have been introduced and some earlier figures have been replaced by more meaningful ones. Besides these changes, the list of selected references at the end of this atlas has been enlarged to cover basic sources of both illustrations and nomenclature.

We would like to emphasize once again (see *Acta ent. bohemoslov.*, 79 : 340, 1982) how useful this volume is to entomologists in general, filling a gap in existing literature on insect morphology. The figures are mostly line drawings and show an extremely wide diversity of the arrangement of the insect integument, using up-to-date terminology. The authors have used Latin for the descriptions of all the figures and English for the captions. Registers are arranged in alphabetic order in Latin-

English and English-Latin in an appendix. The authors attempt to unify insect morphological terms on the basis of Latin and English, which is very useful for beginners in insect morphology or students of general entomology or zoology. This gives more strength to the idea of unifying Russian, German and French insect morphological terminology as well. The extensive homology of individual structures used here should make this task easier.

There are only two things we miss: 1) a really up-to-date review of basic insect morphological literature and 2) critical evaluation of some earlier illustrations. Of the 66 references, used as a basic source of illustration, 18 are devoted to Tuxen's glossary of insect genitalia published in 1956, while only a simple citation is given to the outstanding very extensive Matsuda's morphological monograph on the insect abdomen published in 1975.

Some obvious mistakes occur in the illustrations which could have been eliminated in this edition, e.g. Figs. 331-332 definitely do not belong to the Oligoneuriidae of Ephemeroptera; basal segment of gonostylus is presented as "tergum deciduum" on p. 111. Also some illustrations appear too schematic and fail to show adequately characteristic features of the respective order, e.g. those on p. 103.

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SOLDÁN T. & BRAASCH D. 1986: *Rhithrogeniella tonkinensis* sp.n. (Ephemeroptera, Heptageniidae) from Vietnam, with descriptions of the nymphal stages and biology of the genus

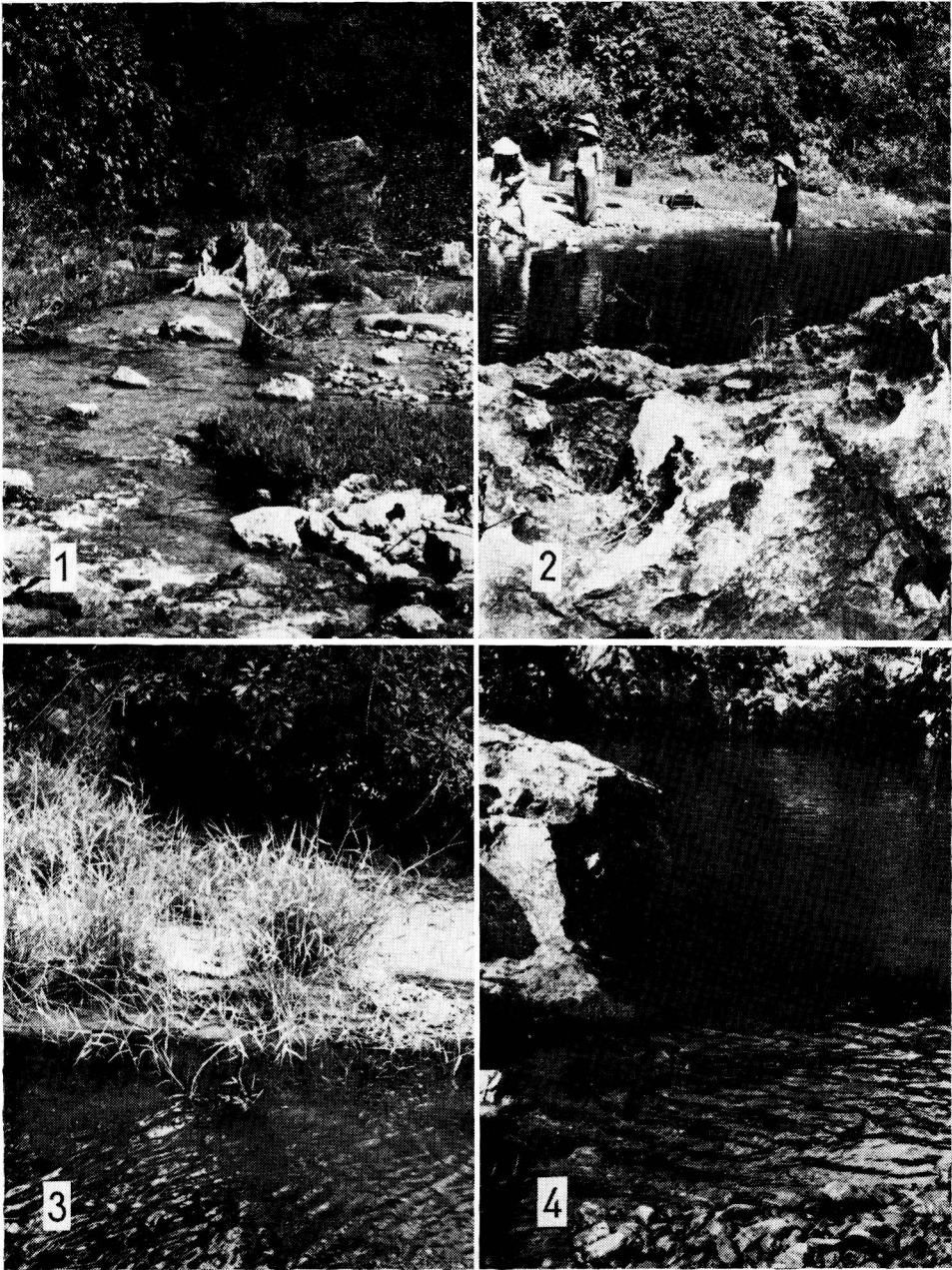


PLATE I, Figs. 1—4: Type locality of *Rhithrogeniella tonkinensis* sp. n., Suoix Xui River near Hoa Binh. 1, 2 — general view of rapids and river pools. 3, 4 — microhabitat preferred by nymphs.

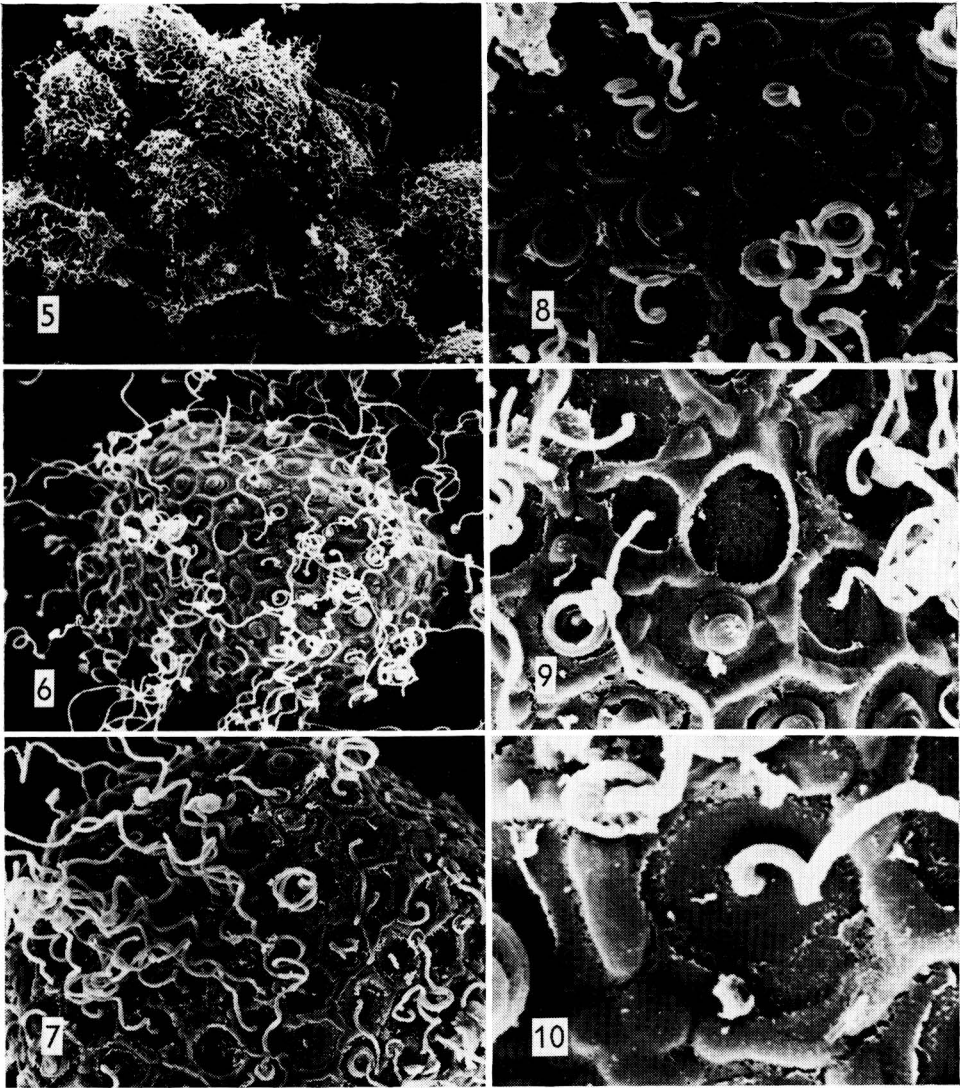


PLATE II, Figs. 5–10: Eggs of *Rhithrogeniella tonkinensis* sp. n. (critical point dried, gold coated, Tesla BS 300 at 15 kV). 5 – eggs, general view ($\times 370$). 6 – egg with uncoiled threads and micropyle ($\times 960$). 7 – detail of chorionic surface ($\times 1600$). 8 – uncoiled knob-terminated structures ($\times 2700$). 9 – micropyle ($\times 3500$). 10 – chorionic hexagonal structure ($\times 7100$).