Systematic revision of the genus *Graphelmis* (Coleoptera: Elmidae) III. *Graphelmis labralis* species group

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**Introduction**

The *G. labralis* species group designated herein includes six new species. In contrast with some other already described groups, e.g. *G. prisca* species group (ČIAMPOR 2001), *G. bandukanensis* species group (ČIAMPOR Jr. 2002) which are more or less widely distributed through the Southeast Asia, all known species of *G. labralis* group occur in a relatively small area of Borneo (Central and South Sabah, Sarawak, Brunei, North Kalimantan). Specimens prefer larger lowland streams or rivers, at least 10m wide. They live exclusively on submerged wood and they are often found in association with some other *Graphelmis* species (e.g. *G. marshalli* (HINTON, 1936), *G. punggulensis* ČIAMPOR Jr., 2001).

Species of the *G. labralis* group are likely closely related with group of species around *G. marshalli*. They differ mainly by characteristic features of males as shape of aedeagus or typically upturned anterior margin of labrum. *G. labralis* group is probably relatively young due to small number of species, high resemblance with species of *G. marshalli* group (ČIAMPOR Jr. in prep.) and small area of distribution.

Material and methods, as well as the acronyms and symbols used, follow ČIAMPOR (2001).

**Graphelmis labralis** species group

**Members:** *G. labralis* sp.nov., *G. tawauica* sp.nov., *G. kuamutensis* sp.nov., *G. brezanskae* sp.nov., *G. kodadai* sp.nov., *G. temburongensis* sp.nov.

**Diagnosis.** Within the genus the *G. labralis* species group is characterized by the following features: 1) larger body size (CL more than 3.25 mm); 2) anterior margin of male labrum mesally upturned and emarginated; 3) median longitudinal groove of pronotum very fine or absent; 4) scutellum usually with two medio-lateral tubercles; 5) metatibiae of males simple, without any characteristic structures; 6) metasternum of males with sublateral prebasal clusters of setae; 7) penis distinctly curved in lateral view with narrowed anterior half; 8) ventral lobe of penis relatively short, usually about half as long as penis; 9) spiculum gastrale with anterior median strut very short and distinctly wide.

**Graphelmis labralis** sp.nov.

(Figs 1, 7–9, 14, 22–26)

**Type locality:** Malaysia, Sabah, Crocker Range, Keningau env., Taman Bandukan

**Material examined.** Holotype ♂ (NMW): "Malaysia, SABAH, Crocker Range, Keningau env., Taman Bandukan, 13.–14. 6. 1998 I. Kodada ♀ F. Čiampor lgt.". **Paratypes** (NMW, CKB): 2 ♀♂, 10 ♀♀ with same label as holotype; 6 ♀♂, 7 ♀♀: “Malaysia, SABA, Crocker Range, Bingkor env., Taman Bandukan, 6.–7. VII. 1996, 10a, river ca. 10 m wide, flowing through degraded primary forest”; 4 ♀♂, 5 ♀♀: “Malaysia, SABA, Crocker Range, Bingkor env., Taman Bandukan, 3. VI. 1998, river ca. 10 m wide, flowing through degraded primary forest”.

**Diagnosis.** Within the *G. labralis* species group, *G. labralis* sp.nov. differs as follows: 1) surface of pronotum and elytra shining; 2) longitudinal pronotal groove short and thin; 3) lateral scutellar tubercles distinct; 4) elytral interval 7 yellowish in anterior two thirds; 5) male prebasal sublateral tufts on metasternum consist only of a few setae; 6) admedian keels of ventrite 1 reaching posterior margin of ventrite; 7) tibiae distinctly long; 8) penis long, distinctly curved in lateral view.

**Description.** Habit (Fig. 1); CL in ♀♂ (3.56 – 4.06 mm, $S = 3.74 \pm 0.16$), in ♀♀ (3.56 – 4.13 mm, $S = 3.76 \pm 0.19$); EW in ♀♂ (1.49 – 1.72 mm, $S = 1.58 \pm 0.07$), in ♀♀ (1.49 – 1.79 mm, $S = 1.64 \pm 0.10$), CL/EW in ♀♂ (2.32 – 2.44, $S = 2.37 \pm 0.04$), in ♀♀ (2.21 – 2.40, $S = 2.30 \pm 0.06$).
Colour pattern: pronotum with yellowish anterior margin and lateral margins of median groove; elytra with distinct V-shaped marking in anterior half, subtriangular marking in posterior third, interval 7 yellow in anterior two thirds.

Head (Fig. 7). HW in ♂♂ (0.71 – 0.79 mm, Ŝ = 0.74 ± 0.03), in ♀♀ (0.71 – 0.85 mm, Ŝ = 0.78 ± 0.05); ID in ♂♂ (0.40 – 0.44 mm, Ŝ = 0.41 ± 0.01), in ♀♀ (0.41 – 0.50 mm, Ŝ = 0.44 ± 0.03); ED in ♂♂ (0.32 – 0.38 mm, Ŝ = 0.34 ± 0.02), in ♀♀ (0.31 – 0.38 mm, Ŝ = 0.35 ± 0.03); HW/ID in ♂♂ (2.08 – 2.27, Ŝ = 2.17 ± 0.07), in ♀♀ (2.15 – 2.38, Ŝ = 2.24 ± 0.08). Labrum glabrous, apical half with sparse setae; anterior margin upturned along mesal third, upturned portion indistinctly emarginate (Fig. 8); clypeus as long as labrum, mesally glabrous, lateral sides rough; frons glabrous; vertex micropunctured; eyes oval in lateral view and convex in dorsal view, without distinctly raised margin.

Thorax. Pronotum (Fig. 9) nearly as long as wide, widest about in the middle; PL in ♂♂ (0.94 – 1.13 mm, Ŝ = 1.03 ± 0.06), in ♀♀ (1.06 – 1.38 mm, Ŝ = 1.18 ± 0.09); PW in ♂♂ (1.13 – 1.23 mm, Ŝ = 1.17 ± 0.05), in ♀♀ (1.13 – 1.33 mm, Ŝ = 1.22 ± 0.07); AP in ♂♂ (0.79 – 0.87 mm, Ŝ = 0.82 ± 0.03), in ♀♀ (0.82 – 0.97 mm, Ŝ = 0.88 ± 0.05); lateral margins finely explanate; anterior margin glabrous, as well as mesal portion along groove paler; anterior angles produced; sublateral tubercles visible; finely paler; median groove about in the middle third of pronotum, thin; prebasal admedian pits fine; surface irregularly punctured, interstices shiny. Prosternum: prosternal process about as long as wide, slightly widened apically; lateral margins raised around coxae, micoreticulate, posterior margin with distinct median protuberance; apical portion of disc glabrous, rest of disc and process plicate. Scutellum subpentagonal to rounded, surface shiny, lateral tubercles distinct. Mesosternum with moderately raised oblique
microreticulate carinae. Metasternum (Fig. 14) about twice as long as mesosternum; disc almost flat, only slightly raised in anterior half; surface shiny; longitudinal suture thin, finely depressed in posterior half; admedian prebasal punctures distinct; sublateral carinae absent; admedian prebasal tufts of setae in males with few setae only (Fig. 14a). Elytra with sides parallel in about anterior two thirds, then continuously converging toward apices; EL in $\delta$ $\delta$ $(2.56 – 2.94$ mm, $S = 2.71 \pm 0.11$), in $\varphi \varphi$ $(2.50 – 2.75$ mm, $S = 2.58 \pm 0.10$); EW in $\delta \delta$ $(1.49 – 1.72$ mm, $S = 1.58 \pm 0.07$), in $\varphi \varphi$ $(1.49 – 1.79$ mm, $S = 1.64 \pm 0.10$); lateral margins sparsely serrate; apices rounded; strial punctures $\approx 0.07$, in

Habitus (Fig. 2); CL in $\delta \delta$ $(3.56 – 4.31$ mm, $S = 3.83 \pm 0.23$), in $\varphi \varphi$ $(3.63 – 4.13$ mm, $S = 0.39 \pm 0.18$); EW in $\delta \delta$ $(1.62 – 1.82$ mm, $S = 1.69 \pm 0.07$), in $\varphi \varphi$ $(1.59 – 1.90$ mm, $S = 1.71 \pm 0.09$), CL/EW in $\delta \delta$ $(2.17 – 2.37, S = 2.26 \pm 0.07$), in $\varphi \varphi$ $(2.17 – 2.39, S = 2.29 \pm 0.06$).

Colour pattern: pronotum with yellowish anterior margin and lateral margins of median groove; elytra with V-shaped marking in anterior half and subtriangular marking in posterior third (elytral marking often darkened).

Head. HW in $\delta \delta$ $(0.74 – 0.85$ mm, $S = 0.78 \pm 0.04$), in $\varphi \varphi$ $(0.76 – 0.88$ mm, $S = 0.80 \pm 0.04$); ID in $\delta \delta$ $(0.38 – 0.47$ mm, $S = 0.43 \pm 0.03$), in $\varphi \varphi$ $(0.38 – 0.50$ mm, $S = 0.44 \pm 0.03$); ED in $\delta \delta$ $(0.32 – 0.38$ mm, $S = 0.35 \pm 0.02$), in $\varphi \varphi$ $(0.32 – 0.41$ mm, $S = 0.36 \pm 0.02$); HW/ID in $\delta \delta$ $(2.08 – 2.32, S = 2.21 \pm 0.08$), in $\varphi \varphi$ $(2.08 – 2.36, S = 2.23 \pm 0.11$). Labrum glabrous, anterior two thirds with yellow setae; anterior margin upturned along mesal third, upturned portion shallowly emarginate; clypeus slightly shorter than labrum; posterior half of clypeus, as well as frons and vertex rough; eyes oval in lateral view and convex in dorsal view, without distinctly raised margin.

Thorax. Pronotum (Fig. 10) nearly as long as wide, widest near base; PL in $\delta \delta$ $(1.06 – 1.31$ mm, $S = 1.16 \pm 0.07$), in $\varphi \varphi$ $(1.13 – 1.31$ mm, $S = 1.21 \pm 0.07$); PW in $\delta \delta$ $(1.18 – 1.38$ mm, $S = 1.23 \pm 0.07$), in $\varphi \varphi$ $(1.18 – 1.38$ mm, $S = 1.24 \pm 0.07$); AP in $\delta \delta$ $(0.79 – 0.92$ mm, $S = 0.85 \pm 0.04$), in $\varphi \varphi$ $(0.85 – 0.97$ mm, $S = 0.89 \pm 0.05$); lateral margins finely explanate; anterior angles produced; sublateral tubercles flat, black, glabrous or sparsely punctured; median groove about in the middle third of pronotum, thin; prebasal admedian pits small; surface densely punctured. Prosternum glabrous; prosternal protuberance about as long as wide; lateral margins raised around coxae, microreticulate; posterior margin with wide median protuberance; surface finely plicate. Scutellum subpentagonal, surface shiny, lateral tubercles less distinct. Mesosternum with moderately raised oblique microreticulate carinae. Metasternum (Fig. 15) about twice as long as mesosternum; disc almost flat; surface shiny; longitudinal suture thin, finely depressed in posterior half; admedian prebasal punctures shallow; sublateral carinae absent; prebasal, setal tufts of males dense (Fig. 15a). Elytra with sides parallel in anterior half to two thirds, then continuously converging toward apices; EL in $\delta \delta$ $(2.44 – 3.00$ mm, $S = 2.67 \pm 0.17$), in $\varphi \varphi$ $(2.50 – 2.88$ mm, $S = 2.70 \pm 0.06$)
0.12); EW in ♂ (1.62 – 1.82 mm, $\bar{S} = 1.69 \pm 0.07$), in ♀ (1.59 – 1.90 mm, $\bar{S} = 1.71 \pm 0.09$); lateral margins sparsely serrate; apices rounded; strial punctures distinct, moderately deeply depressed (deeper on disc); interval 3 finely raised prebasally. Legs glabrous; protibiae very finely grooved on outer side; mesotibiae with fine spines on inner side; FT in ♂ (1.18 – 1.38 mm, $\bar{S} = 1.26 \pm 0.06$), in ♀ (1.15 – 1.29 mm, $\bar{S} = 1.21 \pm 0.05$); MT in ♂ (1.15 – 1.41 mm, $\bar{S} = 1.23 \pm 0.08$), in ♀ (1.06 – 1.24 mm, $\bar{S} = 1.16 \pm 0.07$); HT in ♂ (1.24 – 1.44 mm, $\bar{S} = 1.31 \pm 0.07$), in ♀ (1.21 – 1.32 mm, $\bar{S} = 1.26 \pm 0.04$); length of metatarsomere 5 equal to combined length of segments 1–4.

Abdomen. Admedian keels of ventrite 1 straight, not reaching posterior margin of ventrite; abdominal intercoxal process as well as mesal portion of remaining ventrites shiny; sides of ventrites covered by plastron structures; ventrite 5 with sides of apical emargination only slightly produced posteriad. Sternite 9 and spiculum gastrale (Fig. 29).

Aedeagus (Figs 27, 28). Penis elongate, with numerous small spines; in lateral view curved at most subapically and in the middle; apical half thin, only slightly widened, basal half distinctly wider; in ventral view narrow along apical third, then gradually widened to middle, subparallel along basal half; ventral lobe with apex distinctly acuminate, about half as long as penis; phallobasis shorter than half of penis.

Ovipositor (Fig. 30) with terminal segment straight, widened apically; preterminal segment ca. 3.3× as long as terminal, outer side concave; distal sclerite produced mesally; basal segment as long as terminal, preterminal and distal sclerites combined; ventral fulcrum finely sinuate.

Sexual dimorphism. Males are distinguished by mesally upturned and emarginated anterior labral margin and admedian prebasal tufts of setae on metasternum.

Distribution. So far known only from southeast Sabah (Malaysia).

Etymology. Named in reference to the type locality.

Figs 7–13: 7) Graphelmis labralis sp.nov., male head; 8) Graphelmis labralis sp.nov., upturned mesal portion of labrum; Figs 9–13 Pronotum of: 9) Graphelmis labralis sp.nov.; 10) Graphelmis tawauica sp.nov.; 11) Graphelmis kuamutensis sp.nov.; 12) Graphelmis brezanskae sp.nov.; 13) Graphelmis kodadai sp.nov.
**Graphelmis kuamutensis** sp.nov.
(Figs 3, 11, 16, 19–21, 31–34)

**Type locality**: Malaysia, Sabah, Kuamut river environment, near Kampung Pisang Pisang, ca. 10m wide tributary of Kuamut river in primary forest.

**Material examined.** Holotype ♂ (NMW): “Malaysia, SABAH, Kuamut river env., near Kampung Pisang Pisang, 3. 4. VII. 1996, 14b: ca. 10 m wide tributary of Kuamut river in primary forest”.

Paratypes (NMW, CKB): 8 ♂, 2 ♀ with the same label as holotype; 36 ♂, 21 ♀: “Malaysia, Sabah, Kuamut river env., river Kampung Pisang Pisang, 3.–4. VII. 1996, 14a, shaded stream in primary forest with submerged wood”; 1 ♂, 1 ♀: “Malaysia, Sabah, Gn. Antulai, ca. 5 km S Sapulut, 2. VII. 1996, 13a, river about 7 m wide, flowing through secondary forest”; 1 ♂, 1 ♀: “Malaysia, SABAH, Kuamut river env., near Kampung Pisang Pisang (ca. 106 km of SAPULUT) 3.–4. VII. 1996, 14a”; 1 ♂, 2 ♀: “Malaysia, Sabah, Kampung Pisang Pisang env., tributary of Kuamut river, 29. 6. 1998, J. Kodada ♀ F. Čiampor Lgt.”.

**Diagnosis.** Within the *G. labralis* species group, *G. kuamutensis* sp.nov. differs as follows: 1) entire pronotum except of indistinctly paler anterior margin black; 2) longitudinal pronotal groove absent; 3) sublateral pronotal tubercles very fine or absent; 4) elytral anterior V-shaped marking not reaching middle of elytra; 5) penis long, distinctly curved in lateral view.

**Description.** Habitus (Fig. 3): CL ♂ (3.38 – 3.69 mm, $\bar{x} = 3.56 \pm 0.10$), in ♀ (3.44 – 3.88 mm, $\bar{x} = 3.63 \pm 0.14$); EW ♂ (1.59 – 1.79 mm, $\bar{x} = 1.68 \pm 0.05$), in ♀ (1.64 – 1.79 mm, $\bar{x} = 1.71 \pm 0.05$), CL/EW ♂ (1.99 – 2.21, $\bar{x} = 2.12 \pm 0.07$), in ♀ (2.07 – 2.25 mm, $\bar{x} = 2.12 \pm 0.06$).

Colour pattern: pronotum black with indistinctly paler anterior margin; elytra with short V-shaped marking in about anterior third and irregular marking in posterior third.

Head. HW in ♂ (0.74 – 0.83 mm, $\bar{x} = 0.78 \pm 0.03$), in ♀ (0.76 – 0.83 mm, $\bar{x} = 0.78 \pm 0.02$); ID in ♂.
(0.41 – 0.45 mm, -uppercase \( \bar{S} = 0.43 \pm 0.02 \)), in \( \varphi \varphi \) (0.43 – 0.47 mm, -uppercase \( \bar{S} = 0.45 \pm 0.01 \)); ED in \( \delta \delta \) (0.31 – 0.34 mm, -uppercase \( \bar{S} = 0.33 \pm 0.02 \)), in \( \varphi \varphi \) (0.31 – 0.38 mm, -uppercase \( \bar{S} = 0.35 \pm 0.02 \)); -uppercase \( S \) of HW/ID in \( \delta \delta \) (2.15 – 2.56, -uppercase \( \bar{S} = 2.36 \pm 0.13 \)), in \( \varphi \varphi \) (2.18 – 2.44, -uppercase \( \bar{S} = 2.26 \pm 0.09 \)). Labrum glabrous, with fine, sparse setae; anterior margin upturned along mesal third, upturned portion indistinctly emarginate; clypeus slightly shorter than labrum; surfaces of clypeus, frons and vertex rough; eyes oval in lateral view, convex in dorsal view, without distinctly raised margin.

Thorax. Pronotum (Fig. 11) slightly wider than long, widest at base; PL in \( \delta \delta \) (1.06 – 1.19 mm, -uppercase \( \bar{S} = 1.11 \pm 0.04 \)), in \( \varphi \varphi \) (1.06 – 1.25 mm, -uppercase \( \bar{S} = 1.15 \pm 0.06 \)); PW in \( \delta \delta \) (1.18 – 1.28 mm, -uppercase \( \bar{S} = 1.24 \pm 0.03 \)), in \( \varphi \varphi \) (1.18 – 1.38 mm, -uppercase \( \bar{S} = 1.25 \pm 0.06 \)); AP in \( \delta \delta \) (0.82 – 0.87 mm, -uppercase \( \bar{S} = 0.85 \pm 0.02 \)), in \( \varphi \varphi \) (0.82 – 0.92 mm, -uppercase \( \bar{S} = 0.87 \pm 0.03 \)); lateral margins finely explanate; anterior margin paler, almost glabrous; anterior angles produced; sublateral tubercles very fine, absent or black; median groove absent; prebasal admedian pits absent; surface densely punctured, interstices shiny. Prosternum: prosternal process about as long as wide, with lateral margins widely raised, median protuberance of posterior margin flat; anterior half of disc glabrous, posterior half of disc and process plicate. Scutellum subpentagonal; surface shiny, lateral tubercles more or less distinct. Mesosternum with microreticulate carinae. Metasternum (Fig. 16) about twice as long as mesosternum; disc almost flat, with lateral sides slightly}

Figs 22–26 *Graphelmis labralis* sp.nov.: 22) aedeagus lateral view; 23) aedeagus ventral view; 24) male sternite 8; 25) female sternite 8; 26) ovipositor. Scale bars: 0.1 mm.
raised; surface shiny; longitudinal suture thin, finely depressed in posterior half; admedian prebasal punctures shallow, plicate, more distinct in males; sublateral carinae short; setal tufts of males dense, setae erect. Elytra with sides subparallel in anterior two thirds, then continuously converging toward apices; EL in $\delta\delta$ (2.25 – 2.50 mm, $\bar{x} = 2.45 \pm 0.09$), in $\delta\delta$ (2.38 – 2.63 mm, $\bar{x} = 2.48 \pm 0.10$); EW in $\delta\delta$ (1.59 – 1.79 mm, $\bar{x} = 1.68 \pm 0.05$), in $\delta\delta$ (1.64 – 1.79 mm, $\bar{x} = 1.71 \pm 0.05$); lateral margins sparsely serrate; apices rounded; strial punctures finely impressed, shallowest in anterior 0.15; interval 3 feebly raised anteriorly. Legs glabrous; protibiae very finely

Figs 27–30 *Graphelmis tawauica* sp.nov.: 27) aedeagus lateral view; 28) aedeagus ventral view; 29) spiculum gastrale and sternite 9; 30) ovipositor. Scale bars: 0.1 mm.
grooved on outer side; mesotibiae with fine spines on inner side; FT in ♂ (1.14 – 1.31 mm, $\bar{S} = 1.22 \pm 0.05$), in ♀ (1.03 – 1.21 mm, $\bar{S} = 1.12 \pm 0.06$); MT in ♂ (1.17 – 1.34 mm, $\bar{S} = 1.25 \pm 0.05$), in ♀ (1.00 – 1.10 mm, $\bar{S} = 1.06 \pm 0.04$); HT in ♂ (1.17 – 1.34 mm, $\bar{S} = 1.25 \pm 0.05$), in ♀ (1.10 – 1.24 mm, $\bar{S} = 1.18 \pm 0.05$); length of metatarsomere 5 equal to combined length of segments 1–4.

Abdomen. Admedian keels of ventrite 1 slightly curved, reaching posterior margin of ventrite; abdominal intercoxal process as well as mesal portion of remaining ventrites shiny; lateral portions of ventrites covered by plastron structures; ventrite 5 with sides of apical emargination produced posteriad. Sternite 9 and spiculum gastrale (Fig. 33).

Aedeagus (Figs 19, 31, 32). Penis elongate, with numerous small spines especially in apical half (Fig. 21); in lateral view continuously curved and widened toward base;

Figs 31–34 Graphelmis kuamutensis sp.nov.: 31) aedeagus lateral view; 32) aedeagus ventral view; 33) spiculum gastrale and sternite 9; 34) ovipositor. Scale bars: 0.1 mm.
in ventral view narrow in apical half then gradually widened; ventral lobe with apex pointed (Fig. 20), about half as long as penis; phallobasis about half as long as penis.

Ovipositor (Fig. 34) with terminal segment straight, widened apically; preterminal segment ca. 3.4× as long as terminal, outer side concave; distal sclerite subquadrate; basal segment finely longer than terminal, preterminal and distal sclerites combined; ventral fulcrum almost straight.

**Sexual dimorphism.** Males differ from females in mesally upturned anterior labral margin and admedian prebasal tufts of setae on metasternum.

**Distribution.** So far known only from southern Sabah (Malaysia).

**Etymology.** Named for the river Kuanum where the type material was collected.

**Graphelmis brezanskae** sp. nov.
(Figs 4, 12, 17, 35–38)

**Type locality:** Malaysia, Sarawak, ca. 40 km SE Kapit.

**Material examined.** *Holotype* ♂ (NMW) “SARAWAK (Borneo), ca. 40 km SE KAPIT. 03. 1994, J. Kodada leg.”:

**Paratypes** (NMW, CKB): 4 ♂♂, 6 ♀♀ with the same label as holotype; 1 ♂: “SARAWAK (Borneo), ca. 40 km SE KAPIT. 3. 1994, leg. J. Kodada”; 1 ♂: “MALAYSIA: Sarawak Baan Gong Sikog, 40 km S Kuching. 17. 2. 1993, leg. H. Zettel (3)”.

**Diagnosis.** Within the *G. labralis* species group, *G. brezanskae* sp. nov. differs as follows: 1) body slightly flattened; 2) mesal portion of labrum and clypeus yellow; 3) longitudinal pronotal groove indicated only by yellowish lateral margins; 4) pronotum very densely punctured, matt; 5) elytral intervals yellowish; 6) penis short, continuously curved in lateral view.

**Description.** Habitus (Fig. 4), about 2.1× as long as wide; CL in ♂ 3.25 – 3.63 mm, $\bar{S} = 3.40 \pm 0.13$), in ♀♀ (3.25 – 3.63 mm, $\bar{S} = 3.41 \pm 0.15$); CL/EW in ♂ 2.02 – 2.21, $\bar{S} = 2.13 \pm 0.07$), in ♀♀ (1.92 – 2.21, $\bar{S} = 2.07 \pm 0.10$).

Colour pattern: pronotum with yellowish anterior margin, sublateral tubercles and lateral margins of median groove; elytra with yellowish intervals and three indistinct black spots.

Head. HW ♂ 0.72 – 0.78 mm, $\bar{S} = 0.75 \pm 0.02$), in ♀♀ (0.76 – 0.79 mm, $\bar{S} = 0.77 \pm 0.02$); ID in ♂ 0.34 – 0.41 mm, $\bar{S} = 0.38 \pm 0.03$), in ♀♀ (0.38 – 0.43 mm, $\bar{S} = 0.40 \pm 0.02$); ED ♂ 0.34 – 0.38 mm, $\bar{S} = 0.36 \pm 0.02$), in ♀♀ (0.34 – 0.38 mm, $\bar{S} = 0.35 \pm 0.01$); HW/ID in ♂ 2.00 – 2.20, $\bar{S} = 2.09 \pm 0.07$), in ♀♀ (2.09 – 2.30, $\bar{S} = 2.21 \pm 0.07$). Labrum glabrous, with sparse long setae. Elytra with sides slightly diverging in anterior half to two thirds, then continuously converging toward apices; EL in ♂ 2.19 – 2.50 mm, $\bar{S} = 2.33 \pm 0.10$), in ♀♀ (2.13 – 2.50 mm, $\bar{S} = 2.30 \pm 0.13$); EW ♂ 1.49 – 1.64 mm, $\bar{S} = 1.60 \pm 0.05$), in ♀♀ (1.62 – 1.69 mm, $\bar{S} = 1.65 \pm 0.03$); lateral margins serrate, finely explanate; striae punctures moderately deeply impressed; surface rough. Legs, except of finely grooved protibiae, glabrous; FT in ♂ 1.03 – 1.14 mm, $\bar{S} = 1.09 \pm 0.04$), in ♀♀ (1.03 – 1.14 mm, $\bar{S} = 1.09 \pm 0.06$), in ♀♀ (1.03 – 1.10 mm, $\bar{S} = 1.06 \pm 0.04$); HT in ♂ 1.10 – 1.24 mm, $\bar{S} = 1.17 \pm 0.05$), in ♀♀ (1.10 – 1.17 mm, $\bar{S} = 1.14 \pm 0.03$); mesotibiae with fine spines on inner surface; metasternum of males simple; length of tarsomere 5 subequal to combined length of segments 1–4.

Abdomen. Admedian keels of ventrite 1 visible, not reaching posterior margin of ventrite; abdominal intercoxal process as well as mesal portion of remaining ventrites shiny; lateral portions of ventrites covered by plastron structure; ventrite 5 with sides of apical emargination produced posteriori. Sternite 9 and spiculum gastrale (Fig. 37).

Aedeagus (Figs 35, 36). Penis elongate, with numerous small spines; in lateral view continuously curved and widened toward base; in ventral view continuously widened toward base; ventral lobe with apex rounded, slightly longer than half of penis; phallobasis about half as long as penis.

Ovipositor (Fig. 38) with terminal segment straight, finely widened apically; preterminal segment ca. 3.5× as long as terminal, outer side concave; distal sclerite about half as long as preterminal; basal segment finely longer than terminal, preterminal and distal sclerites combined; ventral fulcrum sinuate.

**Sexual dimorphism.** Males are easily distinguished by mesally upturned anterior margin of labrum and admedian prebasal setal tufts on metasternum.

**Distribution.** So far known only from Sarawak (Malaysia).

**Etymology.** Named in honour of Ms. Mária Brezanská, good friend and altruistic supporter of several entomological field trips focused on water beetle fauna of Southeast Asia.
Graphelmis kodadai sp.nov.
(Figs 5, 13, 18, 39–42)

Type locality: Malaysia, Sabah, Crocker Range, Keningau env., Taman Bandukan, river about 10–15 m wide flowing through secondary forest, partly shaded with rocks, gravel and submerged wood.


Diagnosis. Within the G. labralis species group, G. kodadai sp.nov. differs as follows: 1) longitudinal pronotal groove fine, with lateral margins yellowish; 2) anterior V-shaped marking of elytra extending middle, reaching posterior marking; 3) male metasternal tufts of setae on tubercles; 4) penis short, in lateral view distinctly curved sub-apically; 5) ventral lobe longer than half of the penis.

Description. Habitus (Fig. 5), about 2.3× as long as wide; CL in ♀♂ (3.63 – 4.00 mm, $\bar{s} = 3.78 \pm 0.16$), in ♀♀ (3.63 – 3.88 mm, $\bar{s} = 3.74 \pm 0.09$); CL/EW in ♀♂ (2.25 – 2.44, $\bar{s} = 2.33 \pm 0.08$), in ♀♀ (2.18 – 2.36, $\bar{s} = 2.29 \pm 0.07$). Colour reddish-brown to dark brown.

Colour pattern: pronotum with feebly paler anterior margin, lateral margins of median groove and sublateral tubercles almost as dark as whole pronotum; elytra with long V-shaped anterior marking reaching posterior third.

Head. HW ♀♂ (0.74 – 0.79 mm, $\bar{s} = 0.78 \pm 0.03$), in ♀♀ (0.75 – 0.82 mm, $\bar{s} = 0.78 \pm 0.03$); ID in ♀♂ (0.38 – 0.44 mm, $\bar{s} = 0.42 \pm 0.03$), in ♀♀ (0.41 – 0.44 mm, $\bar{s} = 0.43 \pm 0.03$); ED ♀♂ (0.32 – 0.35 mm, $\bar{s} = 0.33 \pm$...
Labrum glabrous, with sparse long setae; anterior margin upturned, emarginate in the middle; anterior half and mesal portion of clypeus almost glabrous, posterolateral portions irregularly micropunctured; frontoclypeal suture straight; frons and vertex irregularly micropunctured except of glabrous portion between antennae; eyes oval in lateral view and convex in dorsal view.

Thorax. Pronotum (Fig. 13) about as long as wide, widest in posterior half; PL in ♂ ♀ (1.06 – 1.25 mm, $\bar{S} = 1.14 \pm 0.08$), in ♀ (1.13 – 1.25 mm, $\bar{S} = 1.18 \pm 0.05$); PW in ♂ ♀ (1.13 – 1.23 mm, $\bar{S} = 1.19 \pm 0.04$), in ♀ (1.13 – 1.23 mm, $\bar{S} = 1.16 \pm 0.05$); AP ♀ (0.82 – 0.87 mm, $\bar{S} = 0.75 \pm 0.02$), in ♀ (0.82 – 0.90 mm, $\bar{S} = 0.86 \pm 0.03$); lateral margins finely explanate; anterior angles produced; sublateral tubercles indistinct, flat (anterior tubercles almost invisible, posterior glabrous); median groove very fine, with denser punctures; prebasal admedian pits small and fine; surface except of glabrous anterior margin densely, irregularly punctured. Prosternum: prosternal process slightly longer than wide, with lateral margins raised; posterior margin with distinct median protuberance; anterior half of disc glabrous, posterior half of disc and process plicate. Scutellum subpentagonal with angles rounded, surface shiny, lateral tubercles fine. Mesosternum microreticulate with oblique carinae and sublateral depressions, postero-medially with small pit. Metasternum (Fig. 18) about twice as long as mesosternum; disc shiny, finely depressed in posterior half; longitudinal suture thin; admedian prebasal punctures and sublateral carinae present; setal tufts of males on tubercles (Fig. 18a). Elytra with sides parallel in anterior half to two thirds, then continuously converging toward apices; EL in

Figs 39 – 42 Graphelmis kodadai sp.nov.: 39) aedeagus lateral view; 40) aedeagus ventral view; 41) spiculum gastrale and sternite 9; 42) ovipositor. Scale bars: 0.1 mm.
♂ ♀ (2.56 – 2.75 mm, $\overline{S} = 2.64 \pm 0.08$), in ♀ ♀ (2.50 – 2.63 mm, $\overline{S} = 2.56 \pm 0.06$); EW ♀ ♀ (1.54 – 1.67 mm, $\overline{S} = 1.62 \pm 0.06$), in ♀ ♀ (1.54 – 1.69 mm, $\overline{S} = 1.63 \pm 0.07$); lateral margins sparsely serrate, finely explanate; strial punctures shallowly impressed; intervals and interstices glabrous. Legs glabrous; FT in ♀ ♀ (1.21 – 1.35 mm, $\overline{S} = 1.29 \pm 0.06$), in ♀ ♀ (1.24 – 1.32 mm, $\overline{S} = 1.28 \pm 0.04$); MT in ♀ ♀ (1.21 – 1.35 mm, $\overline{S} = 1.29 \pm 0.06$), in ♀ ♀ (1.21 – 1.29 mm, $\overline{S} = 1.25 \pm 0.03$); HT in ♀ ♀ (1.24 – 1.44 mm, $\overline{S} = 1.35 \pm 0.08$), in ♀ ♀ (1.29 – 1.35 mm, $\overline{S} = 1.32 \pm 0.03$); mesotibiae with fine spines on inner surface; metatibiae of males simple; length of tarsomere 5 subequal to combined length of segments 1 – 4.

Abdomen. Admedian keels of ventrite 1 visible, almost reaching posterior margin of ventrite; abdominal intercoxal process as well as mesal portion of remaining ventrites shiny; lateral portions of ventrites covered by pilastron structures; ventrite 5 with sides of apical emargination produced posteriad. Sternite 9 and spiculum gastrale (Fig. 41).

Aedeagus (Figs 39, 40). Penis elongate, with numerous small spines concentrated especially along apical por-

Figs 43–46 Graphelmis temburongensis sp.nov.: 43) aedeagus lateral view; 44) aedeagus ventral view; 45) spiculum gastrale and sternite 9; 46) ovipositor. Scale bars: 0.1 mm.
tion; in lateral view curved, more distinctly apically; slightly widened toward base; in ventral view continuously widened toward base; ventral lobe about half as long as penis; phallobasis about half as long as penis.

Ovipositor (Fig. 42) with terminal segment straight, finely widened apically; preterminal segment ca. 2.6x as long as terminal, outer side concave; distal sclerite mesally rounded; basal segment about as long as terminal, preterminal and distal sclerites combined; ventral fulcrum almost straight.

Sexual dimorphism. Males are distinguished by mesally upturned anterior margin of labrum and admedian prebasal tubercles with setal tufts on metasternum.

Distribution. So far known only from two localities on Sabah (Malaysia).

Etymology. Named for my friend and supervisor, water beetle expert Ján Kodada from Bratislava (Slovakia).

**Graphelmis temburongensis** sp. nov. (Figs 6, 43–46)

**Type locality:** Brunei, Temburong Kuala Belalong.


**Paratypes** (NMW, CKB): 5♂♂, 8♀♀: “BRUNEI: Temburong, July 2000, Belalong Forest, S Temburong, nr. S. Apan 500 m, on logs, lg. A. Foggio”.

**Diagnosis.** Within the *G. labralis* species group, *G. temburongensis* sp. nov. differs as follows: 1) largest body size (CL around 4.4 mm); 2) anterior V-shaped marking of elytra reaching posterior third; 3) male metasternal setae very short, lying on distinct tubercles; 4) elytral apices produced; 5) penis relatively short, extremely curved and narrow apically.

**Description.** Habitus (Fig. 6), about 2.3x as long as wide; CL in ♂ 4.45 mm, in ♀ 4.44 mm; CL/EW in ♂ 2.29, in ♀ 2.23.

Colour pattern: pronotum with anterior margin, lateral margins of median groove and sublateral tubercles yellowish; elytra with V-shaped marking extending midlength, reaching irregular yellowish marking in posterior third.

Head. HW ♂ 0.88 mm, in ♀ 0.89 mm; ID in ♂ 0.46 mm, in ♀ 0.47 mm; ED ♂ 0.38 mm, in ♀ 0.36 mm; HW/ID in ♂ 1.94, in ♀ 1.89. Labrum glabrous, with sparse long setae, anterior margin upturned, emarginate in the middle; anterior half and mesal portion of clypeus almost glabrous, posterolateral portions shallowly irregularly micropunctured; frontoclypeal suture straight; frons and vertex irregularly shallowly micropunctured except of glabrous portion between antennae; eyes oval in lateral view and convex in dorsal view.

Thorax. Pronotum wider than long, widest about in middle; PL in ♂ 1.24 mm, in ♀ 1.28 mm; PW in ♂ 1.44 mm, in ♀ 1.47 mm; AP ♂ 1.00 mm, in ♀ 1.06 mm; lateral margins finely explanate; anterior angles produced; sublateral tubercles flat, anterior tubercles vestigial, posterior ones elongate, nearly reaching posterior margin; median groove narrow, shallowly impressed; prebasal admedian pits inconspicuous; surface except of glabrous anterior margin densely, irregularly punctured. Prosternum almost glabrous; prosternal process widened posteriad, with lateral margins distinctly raised, posterior margin wide, microreticulate, with distinct median protuberance. Scutellum subpentagon with angles rounded, surface glabrous, lateral tubercles fine. Mesosternum glabrous, with oblique, microreticulate carinae. Metasternum about twice as long as mesosternum; disc shiny, widely and shallowly depressed in posterior half; longitudinal suture thin; admedian prebasal punctures transverse, shallow; sublateral carinae short, behind mid coxae; lateral margins of disc raised; posterior sublateral setae very short, clustered in dense tufts, lying on distinct tubercles. Elytra with sides parallel in ca. 0.6, then continuously converging toward produced apices; EL in ♂ 3.21 mm, in ♀ 3.30 mm; EW ♂ 1.94 mm, in ♀ 1.99 mm; lateral margins sparsely serrate, finely explanate; strial punctures moderately deeply impressed; intervals and interstices glabrous. Legs glabrous; tibiae finely grooved; FT in ♂ 1.56 mm, in ♀ 1.58 mm; MT in ♂ 1.49 mm, in ♀ 1.53 mm; HT in ♂ 1.62 mm, in ♀ 1.66 mm; length of tarsomere 5 subequal to combined length of segments 1–4.

Abdomen. Admedian keels of ventrite 1 visible, extending middle of ventrite; abdominal intercoxal process as well as mesal portion of remaining ventrites glabrous; lateral portions of ventrites covered by plastron structures; ventrite 5 with sides of apical emargination produced posteriad. Sternite 9 and scutipal gastrale (Fig. 45).

Aedeagus (Figs 43, 44). Penis elongate, with numerous small spines; in lateral view widened toward base, distinctly curved apically; in ventral view widened toward base; ventral lobe slightly longer than half of penis, apex narrowed, rounded with small spines and thin setae; phallobasis about 0.6 times as long as penis; endophallus membranous with numerous irregular small spines in apical part and ring-like formation of fine longitudinal sclerotizations.

Ovipositor (Fig. 46) with terminal segment straight, finely widened apically; preterminal segment ca. 3.4x as long as terminal, outer side concave; distal sclerite ca. 0.7x as long as preterminal, produced ventrally; basal segment about 1.4x as long as preterminal and distal sclerites combined; ventral fulcrum finely sinuate.

Sexual dimorphism. Males are easily distinguished by mesally upturned anterior margin of labrum and admedian prebasal tubercles with setal tufts on metasternum.

**Distribution.** So far known only from the type locality in Brunei.

**Etymology.** Named in reference to the type locality.

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References


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