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# Taxonomic revision of *Anacaena* THOMSON, 1859
# VIII. Taiwan
## (Coleoptera: Hydrophilidae)

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**Abstract**

Two new species of *Anacaena* THOMSON, 1859, *A. jengi* and *A. smetanai*, are described. This is the first record of the genus *Anacaena* in Taiwan. The male genitalia and other morphological details are illustrated. Both species are endemic to Taiwan, but morphologically very similar to other species, especially from the mainland of China. Both occur in a very wide variety of different aquatic or moist terrestrial habitats.

**Key words**: Coleoptera, Hydrophilidae, *Anacaena*, taxonomy, revision, key to species, new species, Oriental Region, Taiwan.

## Introduction

Covering an area of 35.801 km², Taiwan belongs to the Oriental Region and is located on the northern border of the Tropics. Representatives of *Anacaena* THOMSON, 1859 have not yet been recorded from this island. The rich beetle material collected by A. Smetana and M.-L. Jeng in the last decades yielded two new species of this genus, which are described herein.

## Material and methods

About 270 specimens of *Anacaena* from Taiwan deposited in the collections of the FMNH, the NMP and the NMW were examined and compared with type material and hundreds of additional specimens from China, Thailand, Laos, Vietnam, Cambodia, Malaysia, and Indonesia (see e.g., KOMAREK 2009, 2010). Mouth parts, thoracic structures and male genitalia were dissected, placed in concentrated lactic acid. The specimens were examined using a binocular Leica MZ 12.5 with diffuse and focused light sources, and a light microscope (Olympus BX 41). Measurements were taken with a micrometric eyepiece, drawings were made using CorelDRAW X5. The morphological terminology is based on KOMAREK (2004).

Within the precisely cited label data, "/ " indicates the change of line, "\" the change of label.

### Abbreviations

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| EI | elytral index = ratio of greatest elytral length to greatest elytral width |
| FMNH | Field Museum of Natural History, Chicago (USA) |
| NMP | National Museum Praha (Czech Republic) |
| NMW | Naturhistorisches Museum Wien (Austria) |

### *Anacaena jengi* sp.n.

TYPE LOCALITY: Taiwan, Nantou County, Tzuchung, road side ditch with rotting leaves.

TYPE MATERIAL: **Holotype** ♂ (NMW): "TAIWAN: Nantou / Tzuchung / 17.VIII. 1992 / leg. M.L. Jeng". **Paratypes**: **Nantou County**: 6 ♂♂, 3 ♀♀ (NMW): same data as holotype; 2 ♂♂, 3 ♀♀ (NMW): Tungpu, 18.IX.1992, M.-L. Jeng; 1 ♂ (FMNH): Shanlinchi, 1650 m a.s.l., mixed broadleaved and coniferous forest, sifting of leaf litter and other debris along large fallen trees, 16.V.1990, A. Smetana "T160"; **Hsinchu County**: 2 ♂♂, 5 ♀♀ (NMW): Jianshi, Mashi, 1500 m a.s.l., in a small mountain creek, 1.VI. 2000, M.-L. Jeng; **Hualien County**: 1 ♂ (FMNH): Taroko N.P., Nanhushi Hut, 2220 m a.s.l., same creek as "T153" [Yilan County], strictly by sifting wet moss on large rocks directly in the creek, 12.V.1990, A. Smetana "T154"; **Kaohsiung County**: 2 ♂♂, 6 ♀♀ (NMW): Nanheng road km 132, collected in a small mountain creek or in a roadside ditch, 15.V.1993, M.-L. Jeng; 1 ♂ (NMW): Tenchi, 23.VI.2000, C.-F. Lee; 1 ♀ (NMP): rd. 20, km 117, Yushan N.P., >1800 m a.s.l., road side slopes litter, 13.IV.2009, S. Vít "TW2/2009-9"; **Miaoli County**: 1 ♂ (NMW): Magdala Stream, mountain creek with very clean water, 5.X.1991, M.-L. Jeng; **Taichung County**: 1 ♀ (FMNH): Anmashan, 2150 m a.s.l., 13.V.1992, mixed coniferous and broadleaved forest, sifting of piles of leaves mixed with parts of leaf-buds, accumulated after hard rain along the edges of a road (the parts of leaf-buds were obviously fermenting, attracting enormous numbers of beetles), A. Smetana "T129"; **Taoyuan County**: 2 ♂♂ (NMW): Lalashan, in a small mountain creek with seepage environment, 10.III.1988, C.-F. Lee "82"; **Yilan County**: 3 ♀♀ (NMW): Shen Mi Lake, 24°22'43"N 121°44'12"E, 1110 m a.s.l., 10.V.1995, A. Smetana "T177"; 1 ♀ (FMNH): Taipingshan, 1820 m a.s.l., secondary, mostly coniferous forest, sifting of leaf litter and other debris accumulated among large rocks at the above creek, 15.VII.1993, A. Smetana "T153".

DIFFERENTIAL DIAGNOSIS (Figs. 1, 2, 5, 7, 9): This species is very similar to *Anacaena atriflava* JIA, 1997, including features of the aedeagus. It can be distinguished from this species by characters of the clypeus (shorter, angles between lateral and anterior edges absent), maxillary palpi (palpomere 4 shorter and stouter, apical infuscation less distinct), labial palpi (palpomere 3 stouter), and pronotal coloration (without paramesal yellowish spots on posterior margin). Distinguished from *A. smetanai* by the following features: maxillary palpomeres slightly more slender, palpomere 4 infuscated apically; clypeus slightly longer; preocular patches smaller, distinctly demarcated; punctures on head slightly denser; pronotum slightly longer in relation to length of elytra; median patch of pronotum smaller; metafemoral pubescence distinctly more expanded, with rounded hairline; parameres with slight lateral indentation, parameres wider than phallobase, manubrium tapering; parameres with ventral portion of bases fused, dorsal portion of bases slightly curved.

DESCRIPTION: Total length 2.3−2.7 mm; maximum width 1.4–1.7 mm; EI 1.06–1.09. Habitus: oblong oval, with greatest width in midlength; elytra about 3.5 to 4.0 × as long as pronotum in dorsal view.

Head: Labrum dark brown; clypeus and frons black, with rather sharply demarcated, yellow, approximately triangular preocular patches of about the size of eyes, reaching to lateral edge of labrum. Irregular punctures fine and deep, interspaces 1−2 × as large as punctures, denser towards clypeal margins, without setae; one series of very fine, densely arranged punctures present along inner margin of eyes; microsculpture absent. Clypeus comparatively short in longitudinal diameter, not excised anteriorly, without discernible angles between lateral and anterior portion. Eyes very slightly constricted anteriorly by clypeal extension; dorsal portion not distinctly larger than ventral portion. Frontoclypeal suture visible as a dark line laterally, mesal portion very indistinct or obsolete. Antennae composed of nine antennomeres; pedicellus distinctly longer than wide; antennomere 3 slightly elongate, about as long as segments 4 and 5 combined; antennomere 4 small but distinct; antennal club more than 2 × as long as wide; apical segment slightly longer than wide. Maxillary palpomere 2 distinctly inflated; palpomere 4 widest distal to midlength, with convex inner margin, broadly rounded apically, with weak terminal infuscation. Mentum ca. 1.7 × as wide as long, rather flat, anteriorly slightly impressed, lateral margins with dense fringes of long soft setae, convex, with distinct anterior angles; anterior

margin almost semicircularly projecting, with distinct, deep mesal impression; ventral face rather sparsely set with widely spaced fine setiferous punctures, irregularly distributed; microsculpture absent. Labial palpi weakly pigmented, stout, with convex margins; slightly longer than lateral edge of mentum; palpomere 3 not distinctly longer than palpomere 2.

Thorax: pronotum with a dark brown median patch, usually reaching to mesal margin of eyes, and wide yellowish lateral margins; narrow yellow rim often present along anterior border; some individuals with enlarged dark brown patch almost reaching lateral edge of pronotum; yellowish spots absent. Punctation very fine, weakly impressed, finer than that of head, interspaces 2–4 × as wide as one puncture, very slightly denser towards lateral margins; microsculpture absent. Prosternum bulging, mesally projecting towards gula. Elytra dark brown; intensity of coloration decreasing towards lateral and posterior portion in most individuals; some specimens with brighter areas anteromesally; dark brown, serially arranged spots present on lateral and posterior areas with lighter coloration; scutellar shield dark brown. Lateral borders of pronotum and elytra without setae. Elytra with indistinctly accentuated shoulder regions, with distinct anterior and lateral bead; demarcated anterior declivity present; punctures as fine as on head but distinctly coarser than that of pronotum; irregular, with very indistinct short lateral series of coarser punctures in some indivudals; interspaces as wide as one puncture; microsculpture absent. Sutural stria in posterior 2/3 of elytra, continued anteriorly by a series of very small dark brown patches in individuals with lighter coloration. Mesoventrite distinctly elevated mesally, with a sharply pointed protuberance. Legs unicolored, brown. Procoxa and protrochanter pubescent, without spine-like setae. Femoral hairlines distinct; profemur pubescent on proximal 3/4, with oblique hairline; meso- and metafemur almost entirely pubescent except on apical portion; metafemur with convex hairline. Metatarsus shorter than metatibia.

Abdominal ventrites dark brown to black; entirely covered with dense hydrofuge pubescence.

Aedeagus: Main piece of phallobase about as long as parameres, as wide as long or sligthly longer than wide; manubrium smoothly converging proximad, extended into conical lobe, broadly rounded apically or smoothly tapering; borderline between unpigmented and narrow pigmented part of ventral face of phallobase very deep, almost reaching proximal edge, very indistinct, not recognisable in some specimens. Lateral and mesal margins of parameres curved, slightly sigmoidal; distance between lateral margins of parameres slightly larger than distance between lateral margins of phallobase; apex wide, not inflated, slightly asymmetrical, very slightly pointing mesad; basal portion wider than apical part; ventral portion of bases fused, very slightly reaching into phallobase; dorsal portion of bases slightly curved. Length ratio median lobe/parameres 0.9. Median lobe converging towards pointed apex in straight lines; corona in subapical position of median lobe. Basal apophyses about as long as main piece of median lobe or slightly longer, attaining less than midlength of phallobase. Base of median lobe distinctly connected with parameres by small tooth.

ETYMOLOGY: The name of the epithet refers to M.-L. Jeng who collected most of the specimens.

ECOLOGY: This species was collected in different kinds of small water bodies and also among wet or rotting material in forests.

DISTRIBUTION: Taiwan.

### *Anacaena smetanai* sp.n.

TYPE LOCALITY: Taiwan, Taichung County, Anmashan, broadleaved evergreen forest, sifting of deep layers of fallen leaves accumulated in a depression of the forest floor.

TYPE MATERIAL: **Holotype** ♂ (NMW): "TAIWAN, Taichung / Hsien, Anmashan, / 2230 m a.s.l., 12.V.1992 / A. Smetana [T127]". **Paratypes**: **Taichung County**: 15 ♂♂, 27 ♀♀ (FMNH, NMW): same data as holotype; 1 ♂, 3 ♀♀ (FMNH, NMW): Anmashan, 2225 m a.s.l., 11.V.1992, original untouched mixed forest with many large dead standing and fallen trees, sifting moist to wet forest floor debris (mainly layers of accumulated leaves), A. Smetana "T123"; 2 ♂♂, 3 ♀♀ (FMNH, NMW): Anmashan, Creek, 2185 m a.s.l., 12.V.1992, mature evergreen forest, sifting of wet moss on large rocks in a brook, A. Smetana "T126"; 6 ♂♂, 14 ♀♀ (FMNH, NMW): Anmashan, 2150 m a.s.l., mixed coniferous and broadleaved forest, sifting of piles of leaves mixed with parts of leaf-buds, accumulated after hard rain along the edges of a road (the parts of leaf-buds were obviously fermenting, attracting enormous numbers of beetles), 13.V.1992, A. Smetana "T129"; 3 ♂♂, 9 ♀♀ (FMNH, NMW): Anmashan, 2225 m a.s.l., original, untouched mixed forest with huge trees, including fallen trees, sifting of layers of moist to wet fallen leaves under a huge tree, 14.V.1992, A. Smetana "T130"; 6 ♂♂, 2 ♀♀ (FMNH, NMW): Anmashan, 2220 m a.s.l., same forest as "T130", sifting of rotten wet wood on the ground in a wet depression of the forest floor 14.V.1992, A. Smetana "T131"; **Chiayi County**: 2 ♂♂ (NMP, NMW): National Scenic Area Alishan, road to Youth Activity Center (Rd. 18), 2000 m a.s.l., fern litter, 8.I.2009, S. Vít; **Kaoshiung County**: 13 ♂♂, 13 ♀♀ (FMNH, NMW): Peinantashan trail, 2500 m a.s.l., abandoned forest road with dense growth of the giant grass *Miscanthus sinensis*, groups of broadleaved bushes near the vertical wall along the road, sifting of wet leaf litter and other debris under the bushes, 4.VII.1993, A. Smetana "T136"; 4 ♀♀ (FMNH, NMW): Peinantashan trail, 2250 m a.s.l., secondary broadleaved forest, sifting moist leaf litter and various debris around trees and in forest floor depressions, 4.VII.1993, A. Smetana "T137"; 25 ♂♂, 19 ♀♀ (FMNH, NMW): Peinantashan trail, 2390−2490 m a.s.l., same as "T136", collected the same way, 5.VII.1993, A. Smetana "T138"; 2 ♂♂ (FMNH): Peinantashan trail, 2080 m a.s.l., 6.VII.1993, abandoned forest road, sifting of wet accumulated leaves and other debris along the vertical wall of the road, A. Smetana "T141"; 2 ♀♀ (FMNH): Peinantashan trail, 2020 m a.s.l., 7.VII.1993, mature broadleaved forest, sifting moist leaf litter and other debris along a large fallen tree A. Smetana "T143"; 1 ♀ (FMNH): Peinantashan trail, 1950 m a.s.l., large fallen tree on a forest clearing, sifting of wet moss and various vegetation growing on it, 8.VII.1993, A. Smetana "T145"; 1 ♀ (NMW): Peinantashan trail, 2080 m a.s.l., sifting of fallen leaves and other debris in a small seepage, 2.V.1995, A. Smetana "T169"; 8 ♂♂, 5 ♀♀ (FMNH, NMW): Kuanshan trail above Kaunshanchi River, 2550 m a.s.l., mixed broadleaved and coniferous forest, sifting of leaf litter and other debris along large fallen trees, 22.VII.1993, A. Smetana "T160"; 2 ♂♂, 3 ♀♀ (FMNH, NMW): road above Tona Forest station, km 16–17, 1700–1800 m a.s.l., 28.IV.1998, A. Smetana "T190"; 3 ♂♂, 3 ♀♀ (FMNH, NMW): road above Tona Forest station (fork), 1850 m a.s.l., 29.IV.1998, A. Smetana „T191"; **Nantou County**: 2 ♂♂ (FMNH, ex coll. H.G. Nelson): Meifeng, 2130 m a.s.l., 2. and 4.V.1998, A. Smetana "T196" and "T199"; **Pintung County**: 1 ♂ (FMNH): Peitawushan, Kuai-Ku Hut, 2325 m a.s.l., 21.V.1991, A. Smetana "T88"; **Taitung County**: 1 ♀ (FMNH): Foothills of Hsikangshan near Chengkung, 400−450 m a.s.l., broadleaved evergreen forest, sifting of wet layers of leaves in a deep, shady canyon of a river, 20.VII.1993, A. Smetana "T157"; 1 ♀ (NMW): Hsinkangshan above Chengkung, 850 m a.s.l., original cloud forest with big tree ferns, sifting of fallen leaves and other debris along large fallen trees, 26.IV.1995, A. Smetana "T166"; 1 ♂ (NMW): Hsinkangshan above Chengkang, 800 m a.s.l., similar forest as "T166", sifting of wet leaf litter and other debris at the base of a vertical rockwall over which a thin layer of water was running down; 17.IV.1998, A. Smetana & Lise Robillard "T180"; 3 ♂♂ (FMNH, NMW): Hsinkangshan above Chengkang, 900 m a.s.l., sifting of accumulated leaf litter and other debris in a dried out creek bed, 19.IV.1998, A. Smetana "T184"; **Yilan County**: 11 ♂♂, 7 ♀♀ (FMNH, NMW): Taipingshan, 1895 m a.s.l., secondary mixed forest with rhododendron bushes, sifting of moss and layers of rhododendron leaves, 13.VII.1993, A. Smetana "T149"; 6 ♂♂, 6 ♀♀ (FMNH, NMW): Taipingshan, 1950 m a.s.l., coniferous forest (mainly *Chamaecyparis* sp.), sifting thick layers of moss on fallen trees, 13.VII.1993, A. Smetana "T150"; 1 ♀ (FMNH): Taipingshan, 1880 m a.s.l., secondary, mostly coniferous forest, sifting of wet moss along edges of a small creek, 14.VII.1993, A. Smetana "T152"; 5 ♂♂, 4 ♀♀ (FMNH, NMW): Taipingshan, 1820 m a.s.l., sifting of leaf litter and other debris accumulated among large rocks at the above creek, 15.VII.1993, A. Smetana "T153"; 7 exs. (NMW): Shen Mi Lake, 24°22'43"N 121°44'12"E, 1110 m a.s.l., 10.V.1995, A. Smetana "T177".

DIFFERENTIAL DIAGNOSIS (Figs. 3, 4, 6, 8, 10): See *Anacaena jengi*.

DESCRIPTION: Total length 2.4–2.7 mm; maximum width 1.5–1.8 mm (dwarfish exs. with total length 2.1 mm and maximum width 2.3 mm observed in location "T 184"); EI 1.11−1.33. Habitus: oblong oval, with greatest width in midlength; elytra about 3.1−3.6 × as long as pronotum in dorsal view.

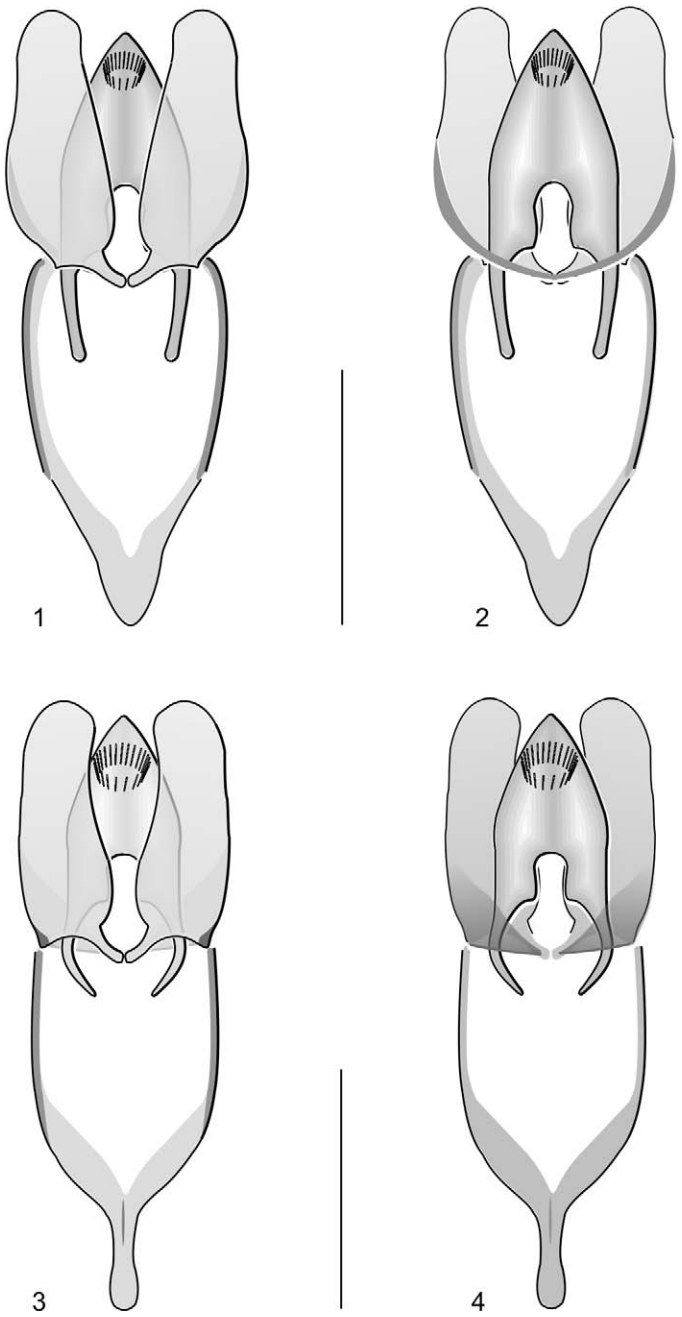
Head: Labrum light brown (like preocular patches); clypeus and frons dark brown; indistinctly demarcated, yellowish brown, preocular patches larger than eyes, mesally confluent in some individuals. Irregular punctures fine and deep, interspaces 1–3 × as wide as one puncture, indistinctly denser towards clypeal margins, without setae; one series of very fine, densely arranged punctures present along inner margin of eyes. Microsculpture absent. Clypeus comparatively short, not excised anteriorly, without discernible angles between lateral and anterior portion. Eyes very slightly constricted anteriorly by clypeal extension; dorsal portion distinctly larger than ventral portion. Frontoclypeal suture visible as dark line laterally; mesal portion very indistinct or not recognisable. Antennae composed of nine antennomeres; pedicellus distinctly longer than wide; antennomere 3 slightly elongate, as long as antennomere 4 and 5 combined; antennomere 4 minute, indistinct in some individuals. Antennal club about 2 × as long as wide, with almost spherical apical segment. Maxillary palpomere 2 distinctly inflated; palpomere 4 with strongly convex outer margin and slightly convex inner margin; widest at midlength or slightly proximad; not infuscated. Mentum ca. 1.5 × as wide as long, rather flat, slightly impressed anteriorly; lateral margins with dense fringes of long soft setae, convex, with distinct anterior angles; anterior margin almost semicircularly projecting, with distinct, deep mesal impression; ventral face sparsely set with widely spaced fine setiferous punctures, with irregular distribution on entire ventral surface; microsculpture absent. Labial palpi moderately slender, outer margin strongly convex, inner margin slightly convex; slightly longer than lateral edge of mentum; palpomere 2 and 3 almost equally long.

Thorax: Pronotum dark brown, with intensity of coloration decreasing towards lateral margins; brighter areas on posterior margin present in some individuals; irregular punctures distinctly finer than that of head, interspaces 3–4 × as wide as one puncture, sligthly denser towards lateral margins, microsculpture absent; lateral margins with a distinct fine bead. Prosternum bulging, projecting towards gula mesally. Elytra dark brown; indistinct brighter areas present posterolaterally and/or anteromesally, the latter adjacent to scutellar shield in many individuals. Lateral borders of pronotum and elytra without setae. Elytra with accentuated shoulder regions, with distinct anterior and lateral bead; demarcated anterior declivity present; punctures distincly coarser than that of pronotum; finer anteriorly, irregular with short series of coarser punctures along lateral margins; interspaces 1−2 × as wide as one puncture; microsculpture absent. Sutural stria in posterior 2/3–3/4 of elytra. Mesoventrite distinctly elevated mesally, with bluntly pointed protuberance. Legs unicolored, brown. Procoxa and protrochanter pubescent, without spine-like setae. Pro- and mesofemur pubescent on proximal 3/4, metafemur on proximal 2/3; hairlines distinct, straight on profemur, convex on mesofemur, concave on metafemur. Metatarsus shorter than metatibia.

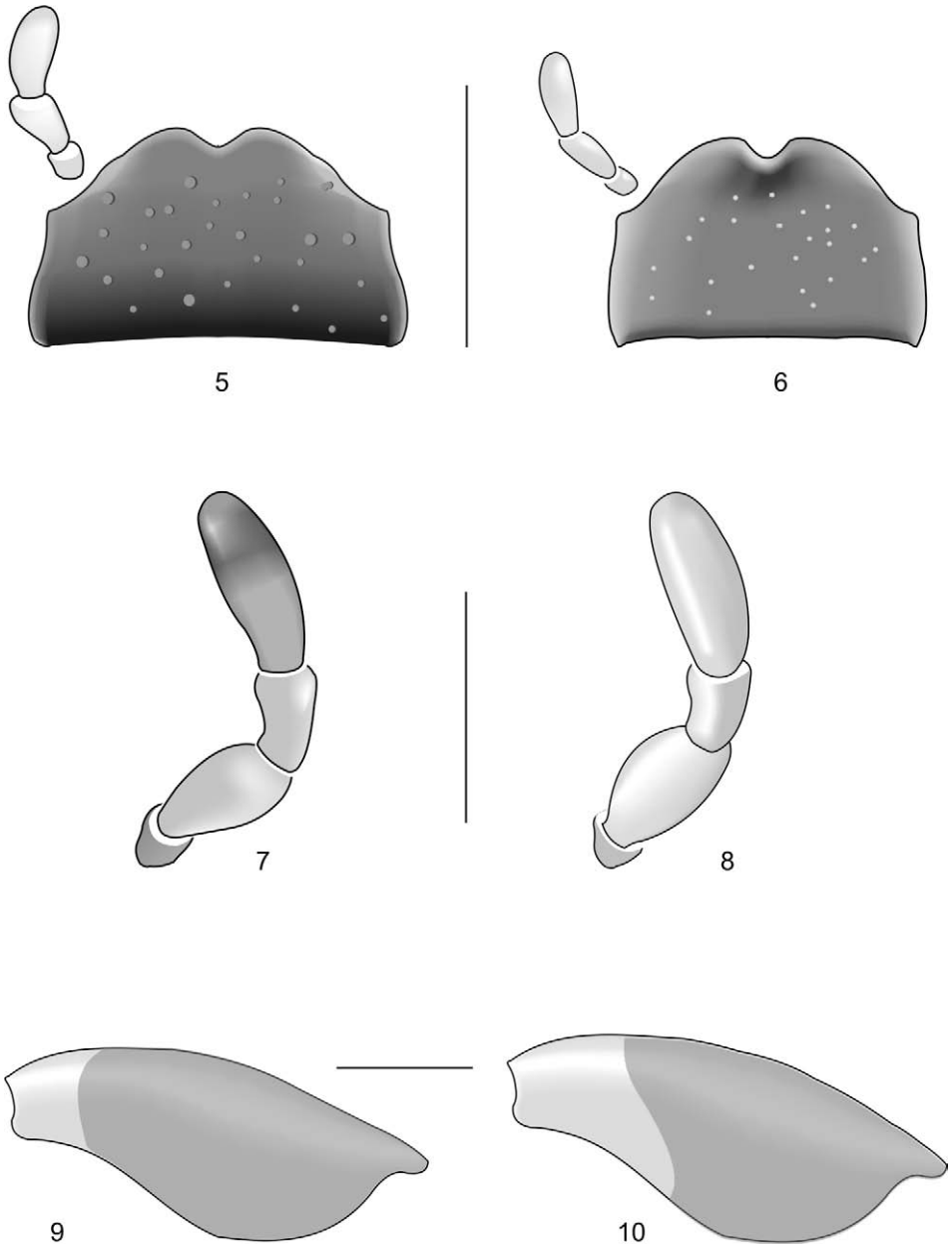
Abdominal ventrites dark brown, entirely covered with dense hydrofuge pubescence.

Aedeagus: Main piece of phallobase about as long as parameres, as wide as long; manubrium smoothly converging proximad, forming long, narrow lobe, parallel-sided or very slightly extended apically; borderline between unpigmented and narrow pigmented part of ventral face of phallobase very deep, almost reaching proximal edge. Lateral margins of parameres curved, not or very indistinctly sigmoidal; mesal margins slightly sigmoidal; apex not inflated, slightly pointing mesad; basal portion slightly wider than apical part; ventral portion of bases not fused, not reaching into phallobase; dorsal portion of bases strongly curved. Median lobe distinctly shorter than parameres. Length ratio median lobe/parameres 0.9. Corona in subapical position of median lobe. Basal apophyses about as long as main piece of median lobe, attaining less than midlength of phallobase. Base of median lobe distinctly connected with parameres by small tooth.

ETYMOLOGY: The name of the epithet refers to Aleš Smetana (Canada), who collected most of the specimens.




Figs. 1–4: Aedeagus: 1, 3: dorsal view, 2, 4: ventral view. 1–2) *Anacaena jengi*, 3–4) *A. smetanai*. Scale bar = 0.2 mm.




Figs. 5–10: 5–6: Mentum (setae omitted); 7–8: maxillary palpus; 9–10: metafemur. 5, 7, 9: *Anacaena jengi*; 6, 8, 10: *A. smetanai*. Scale bar = 0.2 mm.

ECOLOGY: This species was collected in wet or moist plant material in forests, like fallen leaves, moss, debris, rotten wood, among the vegetation in different kinds of very small water

retentions, and in hygropetric habitats. Absent from larger water bodies. The fact that the ventral eye-portion is very small suggests that the species avoids fully submerged habitats.

DISTRIBUTION: Taiwan.

## Discussion

Specimens of *A. jengi* and *A. smetanai* were compared to hundreds of specimens of *Anacaena* spp. from China and other Southeast Asian countries. This clearly showed that the two species described herein are endemic to Taiwan. Island endemism of *Anacaena* is not uncommon. Other species are restricted to Madagascar (KOMAREK 2004), New Guinea (KOMAREK 2009) and New Caledonia (KOMAREK 2010), respectively. Both new species are very similar to species from China. Whether they form a clade is unclear at present. Potential morphological synapomorphies are not apparent. An unusual ecological feature shared by both is that they occur in a broad variety of different wet habitats. *Anacaena smetanai* seems to avoid fully submerged habitats. Both species were collected from rotting plant material, in very small stagnant water bodies, and in hygropetric localities, specimens of *A. jengi* also in small creeks. This is surprising as all hitherto described species of *Anacaena* are either strictly aquatic (most species) or only found in terrestrial habitats (some species from Madagascar and New Caledonia).

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## Zusammenfassung

Zwei endemische Arten der Gattung *Anacena* von Taiwan werden erstmals beschrieben und durch differentialdiagnostisch relevante, morphologische Details illustriert. Beide Arten sind endemisch für Taiwan, aber morphologisch Arten vom chinesischen Festland sehr ähnlich. Ungewöhnlich ist, dass beide sowohl in sehr unterschiedlichen aquatischen, als auch feuchten terrestrischen Habitaten vorkommen.

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