



The Whirligig Beetles of Taiwan (Coleoptera: Gyrinidae): Taxonomy, Distribution and Current Status

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Received: 14 October 2024

Accepted: 16 December 2024

Available online: 3 January 2025

ABSTRACT

The fauna of whirligig beetles (Coleoptera: Adepaga: Gyrinidae) in Taiwan is reviewed. Five species are recognized, including *Dineutus (Cyclous) australis* (Fabricius, 1775), *D. (Dineutus) mellyi mellyi* Régimbart, 1882, *D. (Spinodineutes) orientalis* Modder, 1776, *Gyrinus (Gyrinus) convexiusculus* Macleay, 1871 and *Orectochilus (Orectochilus) formosanus* Takizawa, 1931. The species information is supplemented with illustrations of the habitus, salient structures and habitats, a distribution map, and an identification key to all species. In addition, this study discusses the conservation of species in Taiwanese whirligig beetles.

Key words: Adepaga, aquatic beetle, aquatic insect, conservation, freshwater

Introduction

The family Gyrinidae, also known as whirligig beetles, comprises a group of aquatic beetles that dwell on the water surface (Hayashi, 2023). These beetles utilize their short and flattened mid and hind legs as swimming legs, seamlessly adapting to both streams and ponds. Distinguished by their unique lifestyle, whirligig beetles have even inspired the development of water robots (Jia *et al.*, 2015). Except for the pupal stage, they spend the majority of their life cycle submerged or resting on the water's surface. Approximately 900 extant species in 13 extant genera have been described worldwide (Miller and Bergsten, 2012; Gustafson and Miller, 2017; Liang *et al.*, 2021), with occurrences

on all continents except Antarctica. In Taiwan, five species have been documented, including *Dineutus (Cyclous) australis* (Fabricius, 1775), *Dineutus (Dineutus) mellyi mellyi* Régimbart, 1882, *Dineutus (Spinodineutes) orientalis* Modder, 1776, *Gyrinus (Gyrinus) convexiusculus* Macleay, 1871, and *Orectochilus (Orectochilus) formosanus* Takizawa, 1931 (Takizawa, 1931; Mazzoldi, 1995).

The conservation of Gyrinidae is significant, as they are highly sensitive to the environment and can serve as bioindicators. In Japan, several species are experiencing population decline, with approximately 67% of species listed on the Red List (Hayashi *et al.*, 2020; Nakajima *et al.*, 2020; Ministry of the Environment of Japan, 2020), indicating a critical situation. It serves as a

cautionary signal for Taiwan, highlighting the necessity for a comprehensive understanding of Gyrinidae to prevent potential biodiversity loss.

However, faunistic studies of Gyrinidae in Taiwan are scarce, with occurrence data of these species scattered across various literature sources. Consequently, our understanding of the ecology of Taiwanese Gyrinidae remains limited, especially regarding their current occurrence. This knowledge gap is crucial for conservation efforts. Therefore, the objective of this study is to conduct a comprehensive review of the distribution of whirligig beetles in Taiwan based on literature records and specimen examinations, along with insights from our recent surveys. Additionally, we provide taxonomic keys for all species to enhance the efficiency of future conservation research.

Material and Methods

The materials used in this study were derived from museum specimens, donations from colleagues, and our fieldwork (2018–2023). In fieldwork, water nets were used. Photographs were taken by Sony $\alpha 7$ II camera with Laowa 25 mm F2.8 Ultra Macro 2.5-5X. Specimens examined for this study were deposited in the following collections: NMNS (National Museum of Natural Science, Taichung Taiwan), NMW (Naturhistorisches Museum Wien, Vienna, Austria), RMNH (Rijksmuseum van Natuurlijke Historie, Leiden Netherlands), HCLC (H.-C. Liu collection, Hsinchu County, Taiwan) and TARI (Taiwan Agricultural Research Institute, Taichung Taiwan).

Results

Genus *Dineutus* Macleay, 1825

Dineutus (Cyclous) australis (Fabricius, 1775)

Taiwanese common name: 南方圓鼓甲
(Figures 1A, 2A, F, 3A)

Gyrinus australis Fabricius, 1775: 235.

Gyrinus rufipes Fabricius, 1801: 276.

Synonymized by Schonherr (1808).

Gyrinus dentipennis W.S. Macleay, 1825: 30.

Synonymized by Régimbart (1892).

Gyrinus limbatus W.S. Macleay, 1825: 30.

Synonymized by Ochs (1949).

Gyrinus iridis Hope, 1842: 428. Synonymized by Ochs (1926).

Dineutus dentatus Suffrian, 1842: 256.

Synonymized by Ochs (1949).

Dineutes janthinus Blanchard, 1843: pl. 4.

Synonymized by Ochs (1926).

Dineutus leucopoda Montrouzier, 1860: 245.

Synonymized by Ochs (1949).

Dineutus (Cyclous) australis: Gustafson and Miller (2017).

Specimens examined. TAIWAN: 4 ex. (TARI): Chelongpu (車籠埔), Taichung, 11.X.1955, COL. S. C. CHIU; 3 ex. (TARI): Penghu Island, 10.XI.1943, Col. Omoteichi Horie (堀江表一); 32 ex. (TARI): Peng Hwu [=Penghu], 4-13.VI.1948, Col. C.-W. Chen and L.-T. Chen; 2 ex. (TARI): Chiayi, 30.IV.1951; 2 ex. Lanyu, Taitung Hsien, 13-18.IV.1981, K.S.Lin, L.Y.Chou, T.Lin & S.C.Lin leg.; 1 ex. (NMNS): Lanyu I. (Botel Tobago), 4-8.III.1991, C. K. Starr & H. Y. Wang; 8 ex. (NMNS): Yonghsingnung Cnuang, Lanyu, Taitung, 30.IV.1997, M. L. Chan & M. M. Yang, Sweeping Net. NMNS ENT 2667-2289, 2667-2250, 2667-2346, 2667-2270, 2667-2292, 2667-2335, 2667-2300, 2667-2351; 1 ex. (HCLC): Tainan City, 10.IX.2023, H.-C. Liu leg.; 1 ex. (NTU): Kenting (墾丁), 10.X.1987, Chi-Feng Lee leg.

Diagnosis. Body length 6.5–9.0 mm. Body oval, maximum width ca. 1.4× width of head, flat in lateral view. Dorsal surface black, some specimens with metallic green (Figure 1A); male elytral apices obliquely truncate with epipleural spines and serrations present (Figure 2A), but female elytral apices without epipleural spines. Male genitals slender, median lobe almost as long as or slightly shorter than paramere (Figure 2F). *Dineutus australis* can be distinguished from similar species by body length 6.5–9.0 mm, dorsal side dull, and male elytral apices obliquely truncated with epipleural spines.

Distribution in Taiwan. Taiwan Main Island (Taichung, Chiayi, Tainan; Pingtung), Kinmen Islands (Kinmen Island, Lieyu Island, Dadan Island), Penghu Islands and Lanyu Island (Zimmermann, 1916; Ochs, 1949; Miwa, 1931; Miwa *et al.*, 1932; Chang, 2017; Liu *et al.*, 2020; this study).

General distribution. Widely distributed in

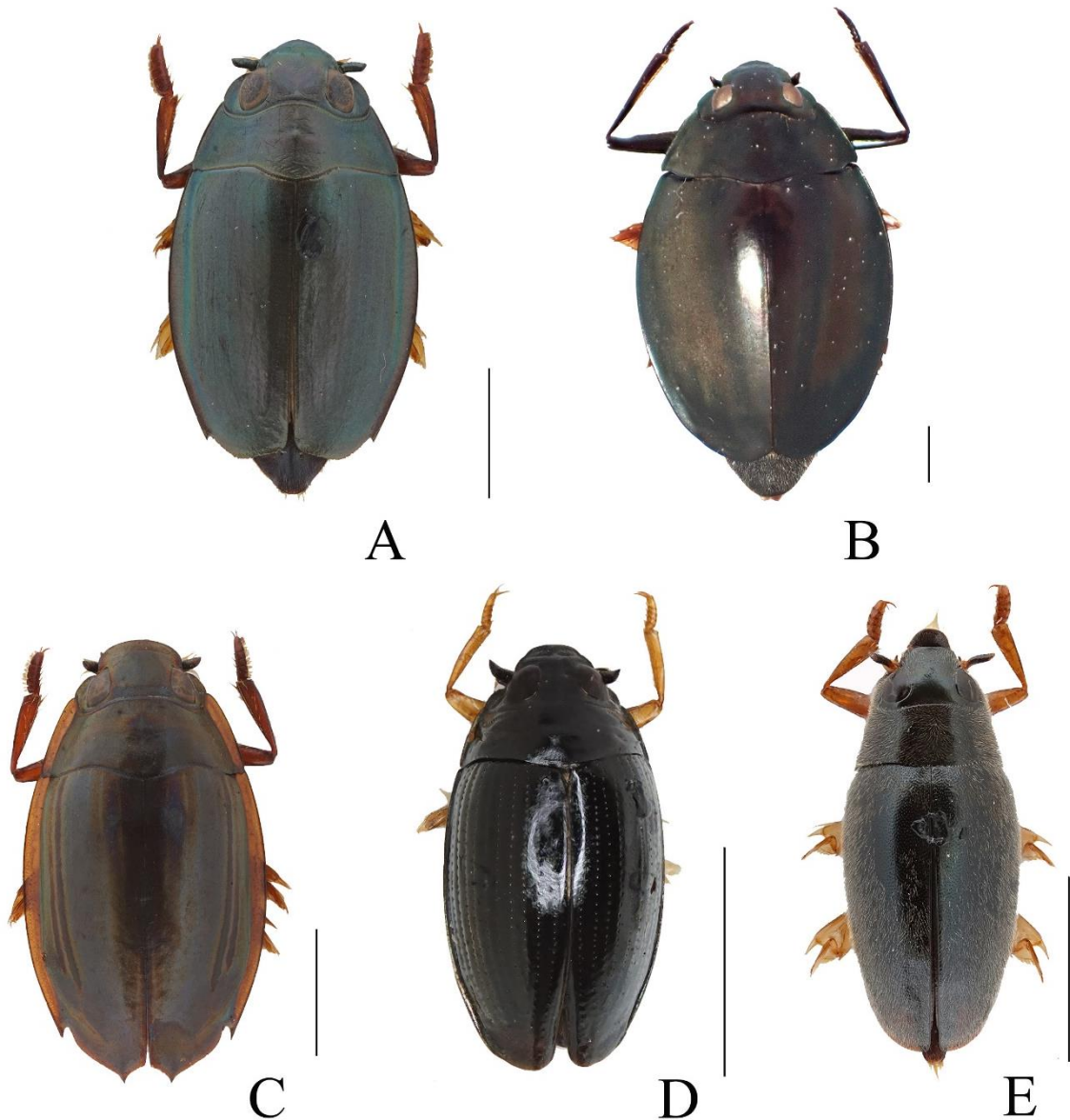


Fig. 1. Dorsal habitus of Taiwanese Gyrinidae. (A) *Dineutus australis*; (B) *D. mellyi mellyi*; (C) *D. orientalis*; (D) *Gyrinus convexiusculus*; (E) *Orectochilus formosanus*. Scale size: 2 mm.

East Asia to Oceania: Australia, China (Fujian, Guangdong, Guangxi, Hong Kong, Hainan, Jiangxi), Japan (Yonaguni Island to Nakanoshima), New Caledonia, New Guinea, Taiwan, Southeast Asia and the Pacific Islands (Ochs, 1949; Timms *et al.*, 2006; Mazzoldi 2010; Freitag *et al.*, 2016; Nakajima *et al.*, 2020; Liang *et al.*, 2021; Suksai *et al.*, 2021).

Bionomics. This species inhabits stagnant water in low-altitude areas (Figure 3A).

***Dineutus (Dineutus) mellyi mellyi*
Régimbart, 1882**

Taiwanese common name: 梅氏圓豉甲
(Figures 1B, 2B, G, 3B)

Dineutus mellyi mellyi Régimbart, 1882: 399.

Dineutes sauteri Uyttenboogaart, 1915:140.

Synonymized by Mazzoldi (1995).

Dineutes indicus: misidentification from Taiwan by Takizawa (1931).

Dineutus (Dineutus) mellyi mellyi: Gustafson and Miller (2017).

Type material examined. "H. Sauter Lake Candidius Formosa/1.10.09//*Dineutes sauteri* Uyttenboogaart/♂//Mauseum Leiden sauteri/Det Uyttenboogaart//Type [white but slightly yellow label]//Type [blue label]//Type [red label]//Sauter //", deposited in the RMNH.

Other specimens examined. TAIWAN: 2 ex.

(TARI): Tsaoshan [=Yangmingshan], 5.X.1957, K. S. Lin leg.; 1 ex. (TARI): Taihoku?, 17.II.1924, N. Tateda leg.; 1 ex. (TARI): Shinten [in New Taipei], Formosa, 10.X.1948, Col. C. T. Lin; 1 ex. (TARI): Anko [in New Taipei], Taihoku, Formosa, 16.II.1941, Col. S. Miyamoto; 1 ex. (TARI): Lienhuachih, Nantou, 9.I.2008, C.-F. Lee leg; 1 ex. (NMNS): Lienhuachih, Nantou, 25.IV.2010, Y.L.Chen, Sweeping Net. NMNS ENT 6399-78; 2 males, 1 female (HCLC): Lienhuachih (蓮華池), Nantou county, 30.XI.2018, Hsing-Che Liu leg.; 1 ex. (NTU): Manyueyuan (滿月圓), 23.VII.1992, the collector's label is blurry and cannot be identified.; 1 ex. (NTU): Songluo (松羅), 18.V.1981, W. J. Wu leg.; 1 ex. (NTU): Cilán (棲蘭), 26.I.1991, Lin Qihui leg.; 1 ex. (NTU): Fuxing (復興), 10.VIII.1990, Shi-Zhen Zhang leg.

Diagnosis. Body length 15.0–20.0 mm. Body oval, maximum width ca. 2.0× width of head, flat in lateral view. Dorsal black, surface glabrous (Figure 1B); both male and female elytral apices without obliquely truncate and epipleural spines (Figure 2B). Median lobe of male genitals slightly shorter than paramere, paramere of male genitals slight widening apically (Figure 2G). *Dineutus mellyi* can be distinguished from similar species by body more regularly rounded, elytral apices almost without apicolateral sinuation and median lobe of aedeagus narrow, regularly attenuated to broadly pointed apex (Gustafson *et al.*, 2016).

Distribution in Taiwan. Taiwan Main Island (New Taipei, Taipei; Hsinchu, Nantou, Yilan, Hualien, Tainan, Kaohsiung) (Uyttenboogaart, 1915; Zimmermann, 1916; Mazzoldi, 1995; Miwa, 1931; Takizawa, 1931; this study).

General distribution. China (Fujian, Guangdong, Guangxi, Guizhou, Henan, Hong Kong, Hubei, Hunan, Jiangxi, Shandong, Sichuan, Xizang, Yunnan, Zhejiang), Japan (Yonaguni Island), northern Laos and Taiwan (Gustafson *et al.*, 2016; Nakajima *et al.*, 2020; Liang *et al.*, 2021; Hájek and Fery, 2022).

Bionomics. This species inhabits forest streams and small ponds (Figure 3B). The larvae of *Dineutus mellyi* have three instars, with development under 25 ± 1°C, RH, 12L:12D conditions. The egg stage lasted 11.75 days, larval stages 12.20, 10.43, and 19.34 days, and the pupal stage 18.17 days. Both pupae and adults can overwinter, and adults live over a

year (Wu *et al.*, 2002).

Notes. Uyttenboogaart (1915) described *Dineutes sauteri* Uyttenboogaart, 1915 based on specimens collected from Taiwan. Subsequently, it was synonymized with *D. mellyi mellyi* Régimbart, 1882 (Mazzoldi, 1995).

Matsumura (1906) first recorded *D. indicus* from Taiwan, and later Miwa (1931) also included this species in his catalogue of Coleoptera in Taiwan. Takizawa (1931) reviewed the Gyrinidae in Japan (including Taiwan) and examined all specimens from Taiwan. No specimens of *D. indicus* were found. Since *D. indicus* is similar to *D. mellyi mellyi*, Takizawa (1931) doubted Matsumura's (1916) record of *D. indicus*, suggesting it was a misidentification. Consequently, *D. indicus* was removed from the list of Taiwanese species. During my collection surveys, I also found no *D. indicus* from Taiwan, consistent with Takizawa's (1931) opinion.

D. mellyi Régimbart, 1882 has 3 subspecies in the world, and the distribution of each subspecies is geographically separated. The subspecies are distributed as follows: *D. m. annamensis* Mouchamps, 1949 (southern Laos and Vietnam), *D. m. mellyi* Régimbart, 1882 (China, Japan (Yonaguni Island), northern Laos and Taiwan) and *D. m. insularis* Régimbart, 1907 (Japan (Tokunoshima, Okinaraabu Island, Okinawa Island)) (Gustafson *et al.*, 2016; Nakajima *et al.*, 2020).

Dineutus (Spinosodineutes) orientalis (Modder, 1776)

Taiwanese common name: 東方圓鼓甲
(Figures 1C, 2C, H)

Gyrinus orientalis Modeer, 1776: 160.

Dineutus marginatus Sharp, 1873: 56.

Synonymized by Ochs (1926: 136).

Dineutus quadrispina Fairmaire, 1878

(Deyrolle and Fairmaire, 1878: 88).

Synonymized by Ahlwarth (1910: 6).

Dineutus (Spinosodineutes) orientalis: Ochs
(1930: 9).

Specimens examined. TAIWAN: 12 ex. (TARI): Taoyuan (桃園), 17.X.1915, Col. M. Maki; 1 ex. (TARI): Musha [in Nantou], Formosa, 18.V.-15.VI.1919, T. Okuni.; 1 ex. (TARI): Heito [=Pingtung], 20.X.1921, M. Yoshino; 2 ex. (TARI): Hori [in Nantou], 5.VII.1947, Coll. Maa, Chen

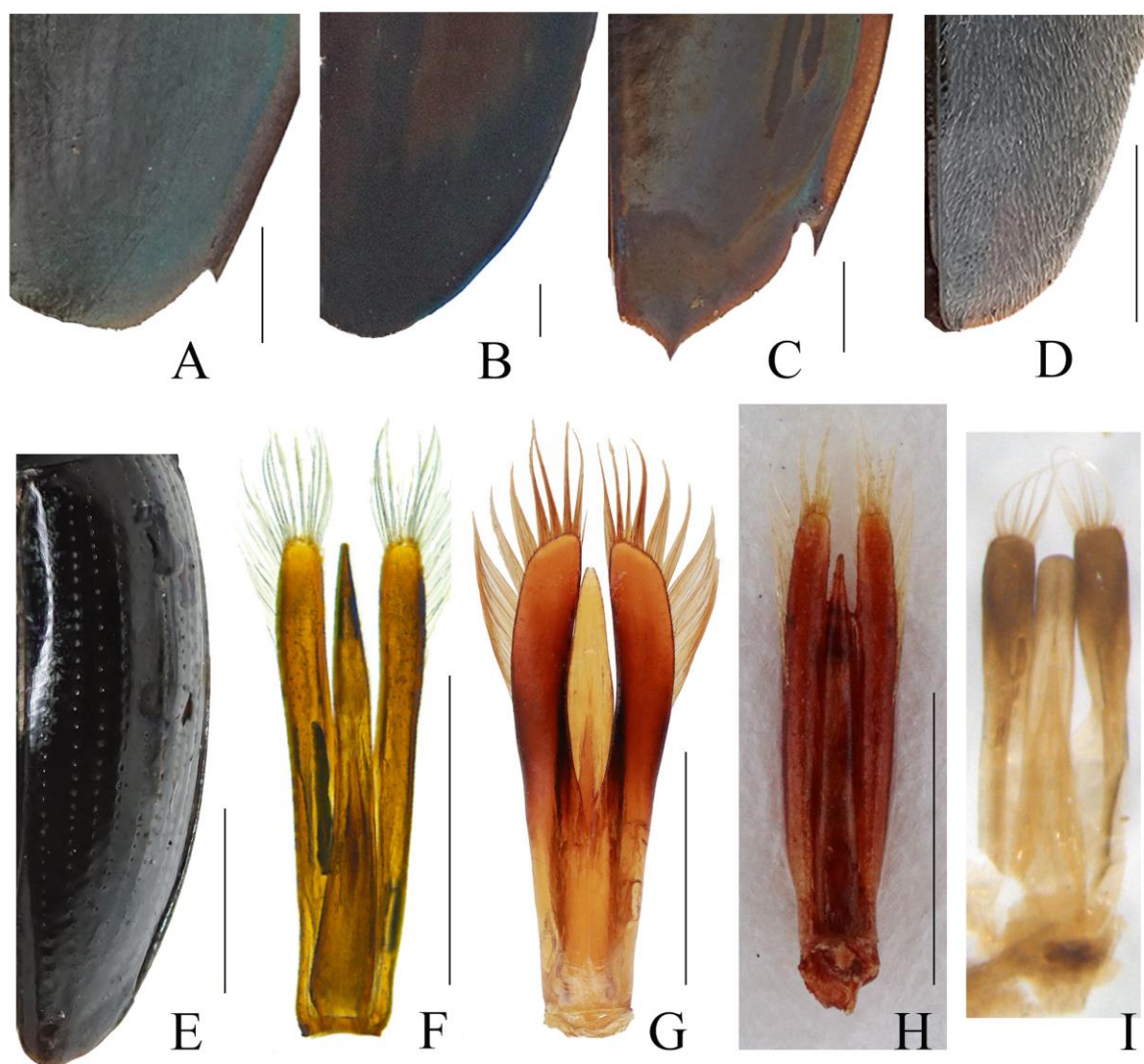


Fig. 2. The apical part of elytron (dorsal view) (A–D), entire right elytra (dorsal view) (E), and male genitalia (F–I). (A, F) *Dineutus australis*; (B, G) *D. mellyi mellyi*; (C, H) *D. orientalis*; (D) *Orectochilus formosanus*; (E, I) *Gyrinus convexiusculus*. Scale size: 1 mm.

and Lin; 1 ex. (NMNS): Yangmei (楊梅), 23.V.1972, B.-S. Chang. NMNS ENT 1282-34258.

Diagnosis. Body length 9.0–10.0 mm. Body oval, maximum width ca. 1.5× width of head, flat. Dorsal surface black with metallic green, but part of margin yellow (Figure 1C); elytra and pronotum without pubescent and punctures; postero-lateral and apical parts of elytron sharply pointed (Figure 2C). Male genitals slender, the front part of the paramere with long setae, median lobe shorter than paramere, apical sharply pointed (Figure 2H). *Dineutus orientalis* has no similar species and can be easily distinguished from other species by the dorsal surface black with yellow edge.

Distribution in Taiwan. Taiwan Main Island (Taipei, New Taipei, Taoyuan, Nantou, Pingtung, Taitung), Matsu Islands and Lanyu Island (Takizawa, 1931; Miwa, 1931; Miwa *et al.*, 1932; Wu, 2003; Liu *et al.*, 2023; this study).

Distribution. China (Beijing, Fujian, Guandong, Guizhou, Guangxi, Hainan, Hebei, Hong Kong, Hubei, Jiangsu, Liaoning, Sichuan, Shaanxi, Shanghai, Shandong, Tianjin, Yunnan, Zhejiang), Korea, Japan, Taiwan, Russia (Far East), Vietnam and Laos (Mazzoldi 1995; Lee and Ahn, 2015, 2019; Liang *et al.*, 2021; Hájek and Fery, 2022; this study).

Bionomics. The habitat of *D. orientalis* in Taiwan is unknown. This species in Japan and Korea inhabits stagnant water and mountain

streams (Lee and Ahn, 2015; Nakajima *et al.*, 2020).

Notes. Liu *et al.* (2023) stated that the record of Gyrinidae by Wu (2003) may be *Dineutus orientalis*, and distributed in Nangan Island (personal communication, August 15, 2023). The record from Lanyu Island comes from Miwa *et al.* (1932). So, we are trying to find specimens from Lanyu Island and Matsu Islands again from 2021 to 2023. Unfortunately, the original habitat may be destroyed, making it impossible to reconfirm the occurrence.

Genus *Gyrinus* Geoffroy, 1762

Gyrinus (Gyrinus) convexiusculus Macleay, 1871

Taiwanese common name: 隆條豉甲
(Figures 1D, 2E, I, 3C)

Gyrinus convexiusculus Macleay, 1871: 128.

Gyrinus huttoni Pascoe, 1877: 141.

Synonymized by Régimbart (1907).

Gyrinus simoni Régimbart, 1883: 163.

Synonymized by Ochs (1949)

Specimens examined. TAIWAN: 1 ex. (TARD): Joyen?, 14.X.1930, Col. Y. Miwa; 2 ex. (TARD): Chih (汐止), Taipei, 20.IV.2008, H.-J. Chen leg.; 3 females (NMW): Taipei city, 15.V.1991, leg. C. F. Lee.

Diagnosis. Body length 3.5–4.7 mm. Body oval, slightly convex. Dorsal black, with strong luster. Pronotum with transverse depression on median part (Figure 1D). Elytra with rows of serial punctures (Figure 2E), apex somewhat obliquely truncate, surface without pubescent. Median lobe of male genitals gradually narrowing from the base towards the middle, distal half nearly parallel, apex rounded. *Gyrinus convexiusculus* and *G. gestroi* Régimbart, 1883 are very similar, with limited morphological differences. However, *G. convexiusculus* can be distinguished from *G. gestroi* by its more rounded and convex body shape, and the median lobe of the male genitalia truncate apex (Figure 2I).

Distribution in Taiwan. Only distributed in Taipei and New Taipei City (Ochs, 1949; Mazzoldi, 1995; this study).

General distribution. China (Jiangxi, Xizang and Yunnan), Taiwan, Oriental and Australian Regions (Liang *et al.*, 2021).

Bionomics. This species inhabits ponds in low-altitude areas (Figure 3C).

Notes. The genus *Gyrinus* in Taiwan is recorded in the TaiCOL (Catalogue of Life in Taiwan) as containing two species: *G. convexiusculus* and *G. gestroi* Régimbart, 1883, with both records coming from northern Taiwan. The former species is cited from Mazzoldi (1995), while the latter is referenced from a non-peer review report by Yang and Jeng (1993), which has not undergone peer review. Based on my examination, there appears to be only one species of the genus *Gyrinus* in Taiwan. Therefore, this study maintains the identification proposed by Mazzoldi (1995) and Satô (1977), recognizing the species in Taiwan as *G. convexiusculus*.

Genus *Orectochilus* Dejean, 1833

Orectochilus (Orectochilus) formosanus Takizawa, 1931

Taiwanese common name: 蓬萊梭豉甲
(Figures 1E, 2D, 3D)

Orectochilus (s.str.) *formosanus* Takizawa, 1931: 19.

Specimens examined. TAIWAN: 2 ex. (TARI): Joyen?, 14.X.1930, Col. Y. Miwa; 1 ex. (TARI): Sinten [in New Taipei], Formosa, 22.II.1940, Col. S. Miyamoto; 4 ex. (TARI): Hsitou (溪頭), Nantou, 17.III.2004, H.-Y. Lee leg; 1 ex. (HCLC): Jiaoxi Township [礁溪鄉], Yilan County, 7.VII.2019; 1 ex. (HCLC): Beipu Township, Hsinchu County, 12.VI.2021, Hsing-Che Liu; 3 ex. (HCLC): Hsitou (溪頭), Nantou County, 5.VII.2021, Guan-Yu Chen leg.; 1 ex. (NTU): Zhinan Temple (指南宮) [in Taipei City], 27.V.1989, S. M. Li leg.

Diagnosis. Body length 4.0–4.6 mm. Body elongate, with length ca. 2.4× as long as wide, strongly convex. Dorsal face black, with densely pubescent and punctures, except without pubescence on vertex part (Figure 1E). Male genitals slender, median lobe slightly shorter than paramere, paramere apex with long setae. This species is very similar to *Orectochilus punctipennis* Sharp 1884 and can be distinguished by the following characters: *O. formosanus* by its lack of pubescence on the head, larger and more distinct punctures on the



Fig. 3. Habitat of Taiwanese Gyrinidae species. (A) Tainan: habitat of *Dineutus australis*, photo by Yung-Chun Chou; (B) Nantou: habitat of *D. mellyi mellyi*; (C) New Taipei: habitat of *Gyrinus convexiusculus*; (D) Yilan: habitat of *Orectochilus formosanus*.

pronotum, and jet-black coloration, while *O. punctipennis* shows pubescence on the head (except at the vertex), finer punctures, and reddish-brown ventral coloration.

Distribution in Taiwan. Taiwan Main Island (New Taipei, Taipei, Hsinchu, Nantou, Chiayi, Yilan) (Takizawa, 1931; this study).

General distribution. Endemic to Taiwan (Takizawa, 1931; this study).

Bionomics. This species inhabits clear stream edges at low to mid-altitude areas, usually living in the shadow of grass (Figure 3D).

Notes. Takizawa (1931) reported the type specimen of this species is based on specimens from northern Taiwan, and indicates that the closely related species *Orectochilus (Orectochilus) punctipennis* Sharp 1884 is distributed in the central Taiwan, but Ocus (1950) questioned this, and he believed that *O. (Orectochilus) punctipennis* Sharp 1884 is a species from northern East Asia (Korea, Japan (Honshu, Shikoku, Kyushu) and Russia (Far East)), and the identity of the specimen from Taiwan needs to be confirmed again. Based on the specimens

from New Taipei (close to the type location of *O. formosanus*), Yilan, Hsinchu, and Nantou (central Taiwan), I reconfirmed that Taiwanese should only include *O. formosanus*.

Key to Taiwanese species of the family Gyrinidae

1. Body oval, with length 1.7-2.0× as long as wide (Figure 1A–D); elytra without compact setae (Figures 2A–C, E) 2
 - Body elongate, with length ca. 2.4× as long as wide (Figure 1E); elytra with compact setae, except the apex (Figures 1E, 2D) *Orectochilus formosanus* Takizawa, 1931
2. Pronotum without transverse depression; elytra without rows of serial punctures (Figures 2A–C)..... 3
 - Pronotum with transverse depression on median part; elytra with rows of serial punctures (Figure 2E) *Gyrinus convexiusculus* Macleay, 1871
3. Body small (7–12 mm); body strongly arcuate (Figures 1A, C); apical part of male elytral with spine (Figures 2A, C); male genitalia elongate and straight (Figures 2F, H) 4
 - Body larger (15–20 mm); body weakly arcuate (Figure 1B); apical part of male elytral flatly rounded, with apicolateral sides slightly sinuate (Figure 2B); male genitalia slightly widening apically, broader in the front half (Figure 2G)..... *Dineutus mellyi mellyi* Régimbart, 1882
4. Pronotum and elytra uniformly black, with greenish sheen (Figure 1A); elytra with apex broadly rounded (Figure 2A); median lobe almost as long as parameres (Figure 2F) *Dineutus australis* (Fabricius, 1775)
 - Pronotum and elytra with yellow lateral margins (Figure 1C); elytra with apex sharply pointed (Figure 2C); median lobe shorter than parameres (Figure 2H)..... *Dineutus orientalis* (Modder, 1776)

Discussion

Biogeographic analysis

Based on specimens and literature records from this study, the occurrences of Taiwanese Gyrinidae have been summarized (Figure 4). The results revealed that *Gyrinus convexiusculus* is

highly localized, predominantly inhabiting a few ponds in Taipei City and New Taipei City; I also have not found this species in similar habitats in Hsinchu and Taoyuan (near New Taipei). Other species exhibit broader distributions found in more than three counties or cities. *Dineutus australis* is distributed from Taichung City to Hengchun Township in Pingtung County, with no specimens found in the eastern region, indicating that its distribution in eastern Taiwan remains unclear. *Orectochilus formosanus* is distributed from Nantou County to the northernmost (Yangmingshan). *D. mellyi mellyi* and *D. orientalis* are widely distributed on the main Island of Taiwan.

Current status

Since all major island groups in Taiwan have been surveyed, the number of five species in Taiwan may be very close to the number of existing species. A brief assessment of the current status of each species was conducted based on these results. *D. australis* sporadically appeared in ponds near Tainan farmland and ponds in the Kinmen Islands, which have a stable population. However, no specimens have been recorded in the Penghu Islands since 1951, and our survey did not rediscover them. Additionally, there has been no record of this species on Lanyu Island since 1997. *D. mellyi mellyi* is considered endangered in Japan, where conservation efforts, including artificial breeding and habitat protection, are underway (Watanabe *et al.*, 2022). This species is abundant at the Lienhuachih Research Center (蓮華池研究中心) in Taiwan, where it is protected within the conservation area of low-altitude regions in Nantou. However, the population status outside the conservation area remains unclear. Therefore, it is strongly recommended that the Lienhuachih Research Center enhances conservation efforts and monitors the population size of this species to prevent biodiversity loss. The current status of *D. orientalis* is the most concerning; the latest identified specimen information dates back to 1972 in Taoyuan. Despite surveys in Taoyuan, Nantou, Tainan, Matsu Islands, and Lanyu Island, no rediscovery was made. Future collection efforts will be necessary to expand collection localities and confirm the current status of this species. *G.*

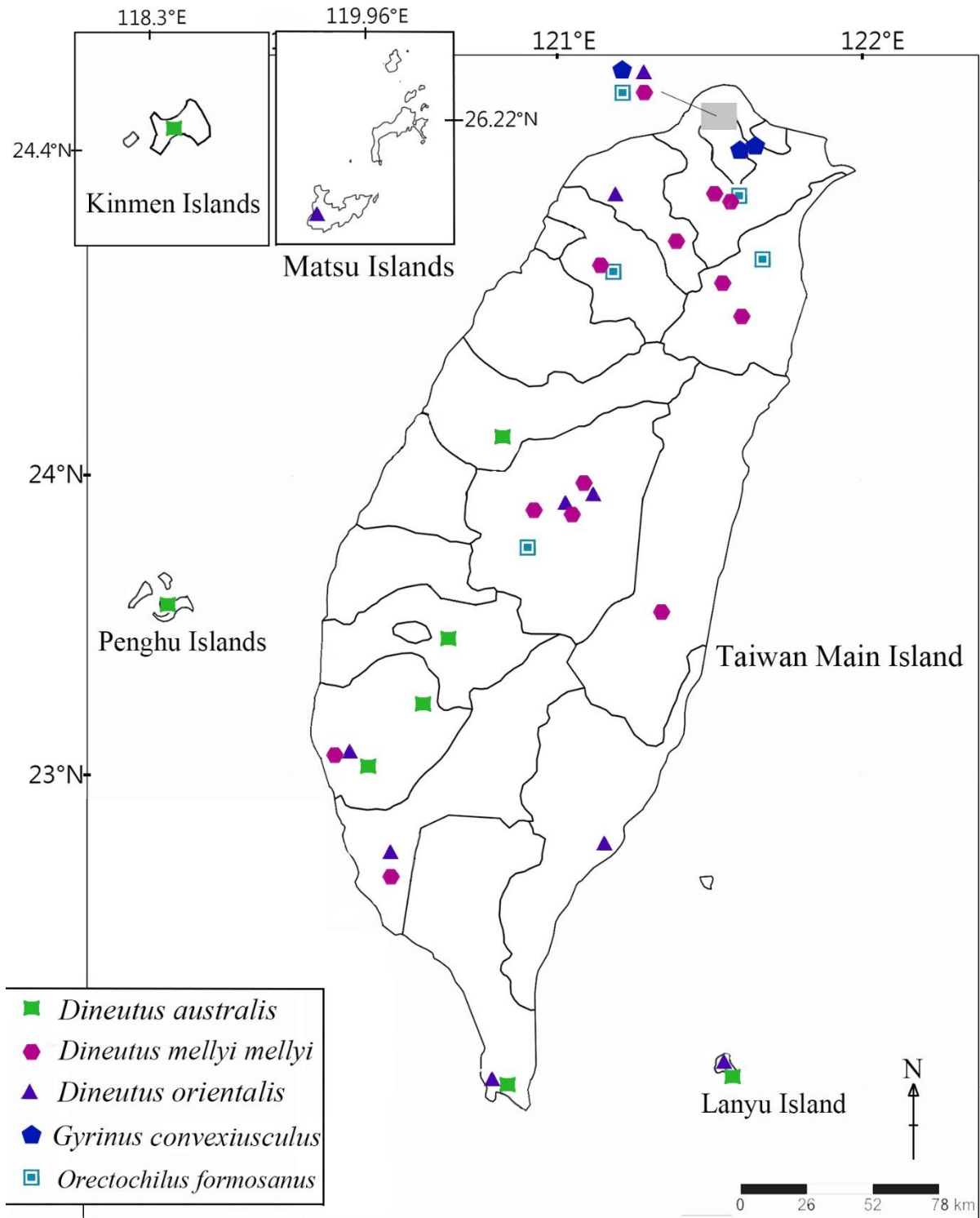


Fig. 4. Map of Taiwan showing the distribution of species of the family Gyrinidae.

convexiusculus has recent specimen records, and the habitats at these locations do not appear to be significantly disturbed. *O. formosanus* is found only in clean forest streams, and stable populations were observed in the northern and central regions.

Acknowledgments

I thank Dr. Jing-Fu Tsai, Dr. Chi-Feng Lee, and Mr. Bao-Cheng Lai for helping me examine the museum specimens in NMNS and TARI. I also thank Dr. Toshimasa Mitamura, Mr. Kei Hirasawa, Mr. Sigeyuki Yoshii, Mr. Fang-Shuo Hu, Mr. Bin-Hong Ho, Mr. Tyus Ma, and Mr.

Guan-Yu Chen for their important contributions to specimen collection. I thank Dr. Gray T Gustafson and Dr. Manfred Jäch for providing important information and Mr. Yung-Chun Chou for providing the habitat photos of *Dineutus australis*. I thank Professor Wen-Jer Wu, Mr. Dan Lu, and Dr. Masakazu Hayashi for providing me with useful information. I am grateful to the Lienhuachih Research Center for allowing us to survey aquatic insects in the reserve. I thank the Integrated Insect Types Database of Taiwanese Species project for providing the type specimens for this study. This project was sponsored by the NMNS (Project team includes Dr. Mei-Ling Chan, Dr. Jen-Yuan Yeh, Dr. Ming-Luen Jeng, Dr. Jing-Fu Tsai, Mr. Yen-Ling Chen, Ms. Ling-Hua Chen and Ms. Shao-Ru Lin). Finally, I would like to thank the two anonymous reviewers for their helpful suggestions.

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臺灣的豉甲（鞘翅目：豉甲科）：分類學、分布與現況

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收件日期：2023 年 10 月 14 日 接受日期：2024 年 12 月 16 日 線上刊登日期：2025 年 1 月 3 日

摘 要

本文回顧台灣已知 5 物種，包含南方圓豉甲 (*Dineutus (Cyclous) australis* (Fabricius, 1775))、梅氏圓豉甲 (*Dineutus (Dineutus) mellyi mellyi* Régimbart, 1882)、東方圓豉甲 (*Dineutus (Spinodineutes) orientalis* (Modder, 1776))、隆條豉甲 (*Gyrinus (Gyrinus) convexusculus* Macleay, 1871) 和蓬萊梭豉甲 (*Orectochilus (Orectochilus) formosanus* Takizawa, 1931)，並提供他們在台灣的分布地、棲息地資訊和所有物種的檢索表。此外，本研究討論台灣物種的分布和棲息地現況。

關鍵詞：肉食亞目、水棲甲蟲、水生昆蟲、保護、淡水