

A new species of the genus *Dicaulocephalus* Gestro (Coleoptera: Scarabaeidae: Rutelinae) from Thailand

Thitipong HONGSUWONG

Department of Entomology, Faculty of Agriculture, Kasetsart University, Nakhon Pathom, Thailand

Abstract

The genus *Dicaulocephalus* Gestro 1888 scores four species from Southeast Asia, three of them occurring in Thailand currently. A fourth species, *Dicaulocephalus intermedius* sp. nov. is described from western Thailand.

Key words: Rutelini, oriental region, taxonomy.

Introduction

Gestro (1888) erected the genus *Dicaulocephalus* with its type species *Dicaulocephalus feae* from Mount Mooleyit (Myanmar). Previously the genus was comprised of three species: *Dicaulocephalus feae* Gestro 1888 from northern Thailand and Myanmar; *Dicaulocephalus fruhstorferi* Felsche 1901 from northern Thailand to southern China, and *Dicaulocephalus antilocarpa* Bezdek et Pacholatko 2001 from southern Vietnam (Bezdek and Pacholatko, 2001; Ek-Amnuay, 2008; Qiu *et al.*, 2020).

Thus far, the records in Thailand have been limited to the North. Recently a few specimens of an undescribed species were surprisingly collected from a mountain area in western Thailand during 2020-2021. The present study aimed to describe this new species.

Materials and methods

Source of materials

This study focuses on the species occurring in Thailand, the examined specimens are deposited in the following collections:

- CWP - private collection of Wuttiapon Pathomwatananurak, Chiang Rai, Thailand;
- CTH - private collection of Thitipong Hongsuwong, Bangkok, Thailand;
- CZMZ - private collection of Ming-Zhi Zhao, Zhuhai, China;
- MNHN - Muséum National d'Histoire Naturelle, Paris, France;
- RBINS - Royal Belgian Institute of Natural Sciences, Brussels, Belgium;
- THNHM - Thailand Natural History Museum, Khlong Luang, Pathumthani, Thailand.

The following specimens were used for comparison:

Dicaulocephalus feae Gestro 1888: Syntype, MYANMAR: 1 ♂, MNHN: EC1461 (deposited in MNHN): Mooleyit, 1000-1900 m a.s.l. (examined images available on MNHN Website) (MNH, 2021). Non-type, THAILAND: 1 ♂ and ♀, Chiang Mai province, 26.III.1993, (examined images available on RBINS Website) (RBINS, 2017); THAILAND: 1 ♂, THNHM-I-09971, and 1 ♀, THNHM-I-09972 (deposited in THNHM):

Chiang Mai province, Mae Ai district, Pha Hompok national park, Tad Hmoei waterfall, 20°63'404"N 99°16'050"E, 9.III.2008, T. Jeenthong leg.; 1 ♂ and 1 ♀ (deposited in CTH): Chiang Mai province, Doi Pui, Khun Chang Khian, light trap, 31.III.2018-1.IV.2018, A. Kasempiyarom leg.

Dicaulocephalus fruhstorferi Felsche 1901: Non-type, VIETNAM: 1 ♂, 4 ♀ (deposited in CZMZ): Central Highlands Region, Kon Tum province, Dak Glei district, 1 km NW Dak Man Village, 15°13'244"N 107°43'506"E, 1080 m a.s.l., light trap, 11-26.V.2017, A.V. Korshunov leg.; THAILAND: 1 ♂ (deposited in CWP): Nan province, Bo Kluea district, 27.III.2017, N. Narin leg.; THAILAND: 1 ♂ and 1 ♀ (deposited in CTH): Nan province, Bo Kluea district, 19°11'137"N 101°10'057"E, 12-21.IV.2021, L. Khaton leg.

Morphological observation and analysis

The specimens were pinned, the male genitalia were removed, put in a 10% potassium hydroxide (KOH) solution overnight, and then mounted on triangular papers with the specimens. Newly described species are provided with a red type label. Morphological observations were made with ST6 stereomicroscope. Images were photographed by using Fuji XA5 with 60 mm f/2.8 macro lens, and multi-focused images were stacked and edited in Adobe Photoshop® CC. The following measurements are abbreviated:

- TL - total length, measured from apex of clypeus to apex of elytra;
- EW - elytral width, measured at the greatest;
- PL - pronotal length, measured at the middle;
- PW - pronotal width, measured at the greatest;
- HW - head width, measured at the greatest width of the eyes;
- IOD - interocular distance, measured interspace of eyes at the same level as HW.

Results

Taxonomy

Dicaulocephalus Gestro 1888

Dicaulocephalus Gestro 1888: 623. Type species: *Dicaulocephalus feae* Gestro 1888.

Dicaulocephalus: Nonfried, 1891: 354; Kolbe, 1894: 4; Ohaus, 1900: 266; Arrow, 1917: 34; Ohaus, 1918: 31; 1934: 93; Paulian, 1959: 78; Machatschke, 1972: 35; Bezděk and Pacholátko, 2001: 138; Zorn, 2006: 276; Zorn and Bezděk, 2016: 357.

Remark. The genus has been reviewed by Bezděk and Pacholátko (2001). These authors described *Dicaulocephalus antilocapra* Bezdek et Pacholatko 2001 which is only known from its type locality in southern Vietnam.

Dicaulocephalus intermedius sp. nov.

(Figures 1, 4, 7, 10, 13, 16)

Type series

Holotype, ♂ (deposited in THNHM): THAILAND: Ratchaburi province, Suan Phueng district, Suan Phueng subdistrict, 13°53'846"N 99°20'071"E, 980 m a.s.l., 22-23.II.2020, light trap, T. Hongsuwong et al. leg., THNHM-I-26218, HOLOTYPE, *Dicaulocephalus intermedius* Hongsuwong.

Paratype, ♀ (deposited in THNHM): THAILAND: Ratchaburi province, Suan Phueng district, Suan Phueng subdistrict, 13°53'846"N 99°20'071"E, 980 m a.s.l., 9.II.2021, light trap, K. Jaranaisakul leg., THNHM-I-26219, PARATYPE, *D. intermedius*.

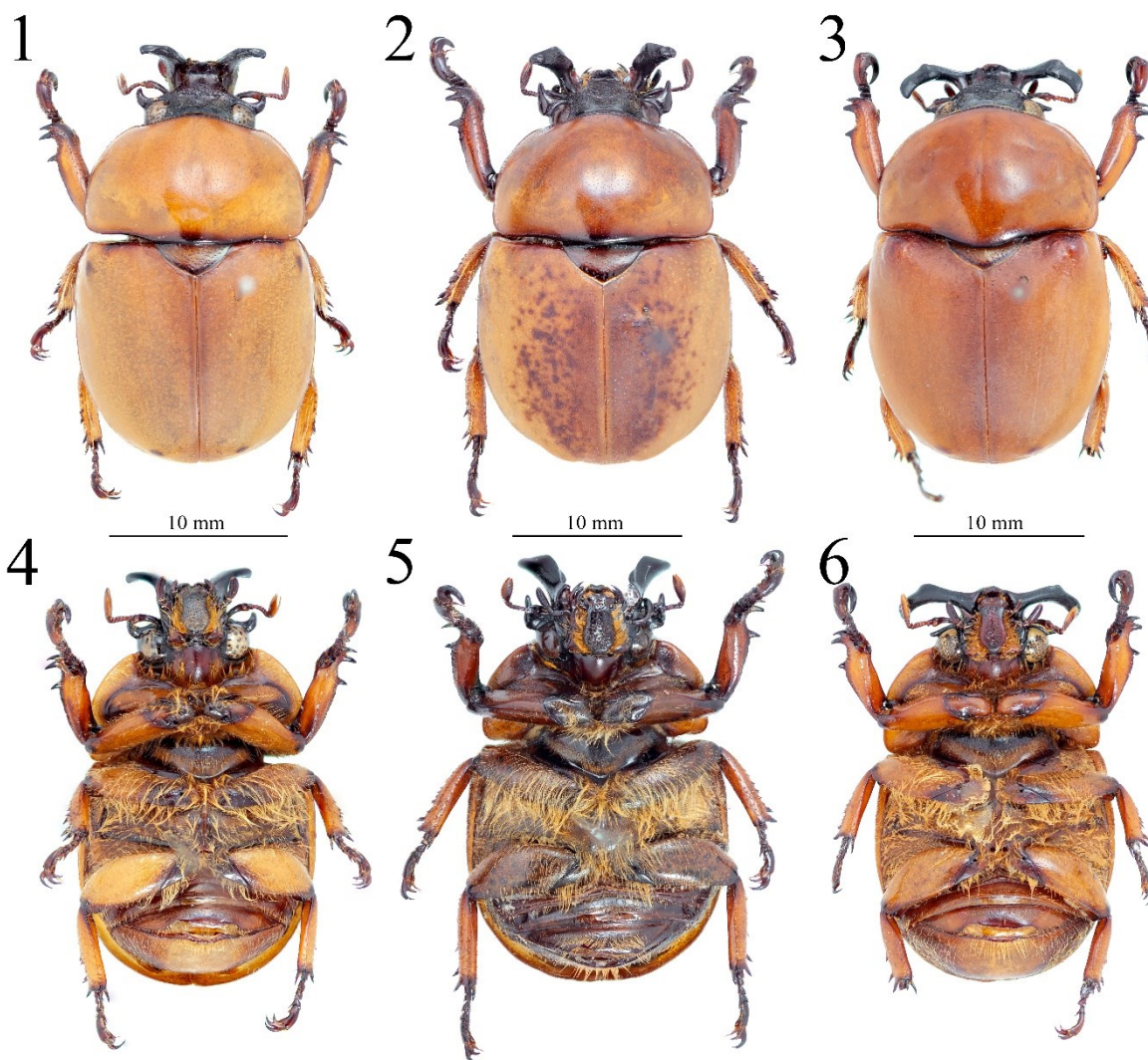
Measurements

♂, holotype: TL 22.4 mm; EW 13.0 mm; PL 8.2 mm; PW 12.1 mm; ♀, paratype: TL 20.1 mm; EW 11.7 mm; PL 6.9 mm; PW 10.2 mm.

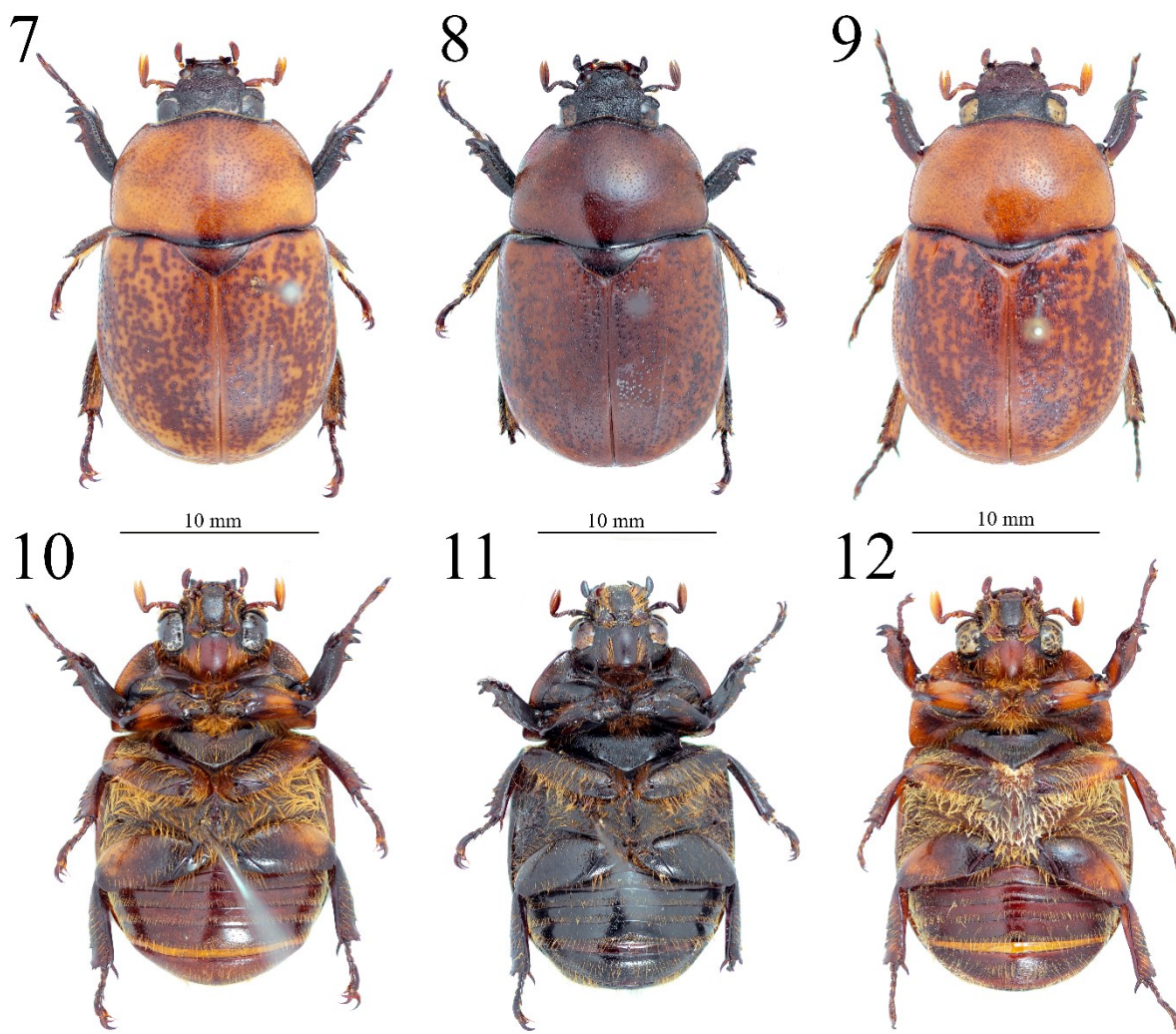
Description of holotype

♂: body in dorsal view roundly convex; surface pale testaceous, except head, antennae, posterior margin of pronotum, and tarsi dark reddish-brown; humeral and apical calli with a tiny dark spot.

Head: clypeus elongate subtriangular, anterior half strongly curved upward, apex with two small and obtuse denticles medially; lateral margin of clypeus slightly concave; frontoclypeal suture incomplete, median obsolete.



Figures 1-6. Habitus of *Dicaulocephalus* spp., ♂: (1) (4) *Dicaulocephalus intermedius* sp. nov., holotype, Ratchaburi province (THNHM-I-26218); (2) (5) *D. fruhstorferi*, non-type, Nan province (CTH); (3) (6) *D. feae*, non-type, Chiang Mai province (THNHM-I-09971); (1-3) dorsal view; (4-6) ventral view.



Figures 7-12. Habitus of *Dicaulocephalus* spp., ♀: (7) (10) *Dicaulocephalus intermedius* sp. nov., paratype, Ratchaburi province (THNHM-I-26219); (8) (11) *D. fruhstorferi*, non-type, Nan province (CTH); (9) (12) *D. feae*, non-type, Chiang Mai province (THNHM-I-09972); (7-9) dorsal view; (10-12) ventral view.

Eyes rounded, ratio of IOD and HW approximately 0.60; ocular canthus hornlike developed, apex produced forward, anteriorly beyond frontoclypeal suture, but less than one-fourth from the suture to apex of clypeus; external margin of ocular canthus convex, while internal margin concave. Antennomere 1 elongate and swollen apically, antennal clubs much shorter than antennomeres 1-7 combined. Mandibles enlarged, apically protruding upwards, dorsal outline bluntly tridentate. Mentum longer than width, anterior margin bilobed.

Pronotum: clearly shorter than width, 0.67 as long as width; lateral margins convex and rimmed; median of posterior margin truncate, margin with incomplete rim; anterolateral corners weakly protruding, posterolateral corners round.

Scutellum: very short subtriangular, 0.42 as long as width, lateral margins convex.

Elytra: dorsum roundly convex, two-fifths from anterior widest; external margin rimmed, maximum thickness at one-third from anterior; posterior margin round with

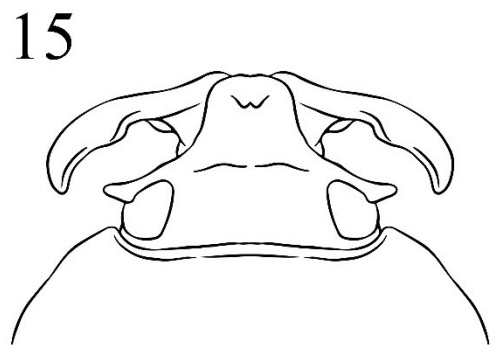
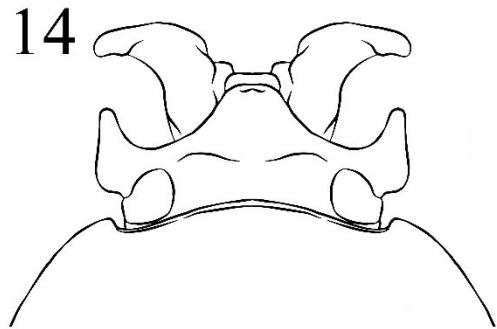
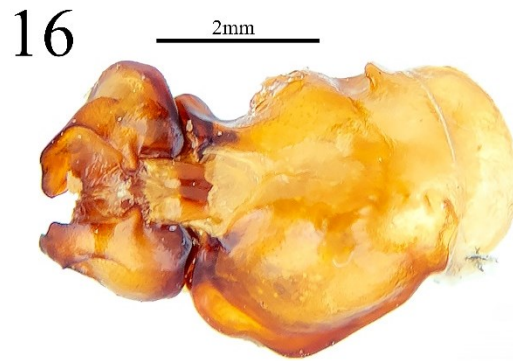
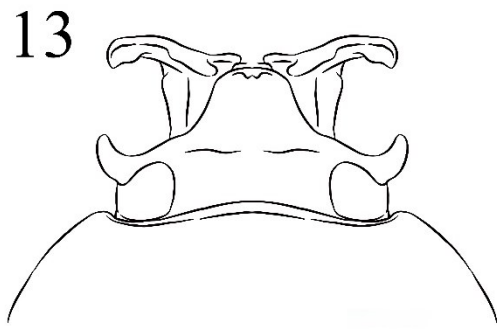
almost complete rim; humeral and apical calli weakly pronounced.

Pygidium: broad subtrapezoidal, 0.55 as long as width; anterior margin convex, lateral margins almost straight, apex of pygidium truncate; lateral margins and apex of pygidium thickly rimmed.

Ventral thoracic surfaces: ventral prothoracic surface flat with prosternal process distinctly produced downward; metasternite much shorter than width, metasternal process indistinct, median portion with a longitudinal groove.

Abdominal ventrites: ventrites 1-5 abbreviated; posterior margin of ventrite 6 with a long transverse concavity medially.

Legs: external margin of protibia tridentate, basal tooth smaller and separated from prebasal and apical teeth, internal margin with a deep and round concavity basally; apex of external margin of meso- and metatibiae tridentate. Tarsi somewhat short and enlarged, tarsomere 5 clearly longer than tarsomeres 1-4 combined; tarsomere 4



Figures 13-18. Characteristics of *Dicaulocephalus* spp., ♂: (13) (16) *Dicaulocephalus intermedius* sp. nov., holotype, Ratchaburi province (THNHM-I-26218); (14) (17) *D. fruhstorferi*, non-type, Nan province (CTH); (15) (18) *D. feae*, non-type, Chiang Mai province (THNHM-I-09971); (13-15) head morphological drawing in dorsal view; (16-18) aedeagus in dorsal view.

with a sharp spinose process ventroapically, tarsomere 5 with a small spinose process ventrobasally; both claws of protarsus simple sickle-shaped, internal claw distinctly larger than external claw; internal claw of meso- and metatarsi simple, while external claw widely bifurcate.

Sculpturing: interspaces of sculptures with distinctly micro-shagreened. Anterior half of clypeus with sparse minute punctures, while posterior half superficially foveate; frons and vertex densely foveate, larger and denser laterally. Pronotum minutely punctate, lateral portions with denser and larger punctures, posterior portion sparser and smaller punctate. Scutellum punctate. Elytral surface almost smooth, whole surface with irregularly minute punctures, punctures near median suture larger, punctures near external margin smaller. Anterior portion

of pygidium densely punctate, remaining smooth and shiny with sparse micro-punctures. Median portion of metasternite punctate, lateral portions rugopunctate. Posterior half of each abdominal ventrites sparsely punctate to slightly shagreened.

Setation: pronotum and scutellum glabrous without distinct setae. Head covered with erect setae; surface of mandibles covered with suberect to erect setae. External portion of elytra with sparsely minute suberect setae. Pygidium covered with decumbent setae, longer and denser in anterolateral portions. Metasternite superficially yellowish lanuginous. Abdominal ventrites 2-6 covered with decumbent setae, posterior margin of ventrite 6 with a row of long decumbent setae medially.

Aedeagus: flattened with asymmetric parameres (figure 16).

Key to species of *Dicaulocephalus* Gestro in Thailand

(adapted from Bezděk and Pacholátko, 2001)

- | | | |
|----|--|--------------------------------|
| 1 | - Mandibles enlarged, distinctly protruding beyond clypeus | Male 2 |
| -- | - Mandibles not enlarged, not protruding beyond clypeus | Female 4 |
| 2 | - Ocular canthus hornlike developed with apex laterally pointed, apex not reached the level of frontoclypeal suture; mandibles laterally produced with apex slightly curve backward (figure 15); median of posterior margin of pronotum slightly produced backward, overlapped anterior half of scutellum; anterior portion along scutellum impressed with humeral callus swollen (figure 3) | <i>D. feae</i> |
| -- | - Ocular canthus hornlike developed with apex pointed forward, apex beyond frontoclypeal suture; mandibles produced upward anteriorly (figures 13-14); posterior margin of pronotum indistinctly producing with scutellum completely visible; elytral surface plain without distinct impression (figures 1-2) | 3 |
| 3 | - Apex of ocular canthi anteriorly beyond one-third from frontoclypeal suture to clypeal apex, external margin angulated in dorsal view (figure 14); elytral punctures often with enclosed brownish brands; parameres as figure 17 | <i>D. fruhstorferi</i> |
| -- | - Apex of ocular canthus anteriorly protruding, but less than one-fourth from frontoclypeal suture to clypeal apex, external margin convex in dorsal view (figure 13); elytral surface mostly testaceous, humeral and apical calli with a tiny dark spot; parameres as figure 16 | <i>D. intermedius</i> sp. nov. |
| 4 | - Posterior margin of pronotum slightly produced backward medially and overlapped anterior half of scutellum (figure 9); anterior portion of elytra with 2-3 short but deep furrows medially | <i>D. feae</i> |
| -- | - Pronotal posterior margin indistinctly produced, clearly visible scutellum (figures 7-8); elytra smooth without distinct impression | 5 |
| 5 | - Frons rugose; pronotum relatively long, 0.7 as long as width; whole ventral surface and legs dark brown to black (figure 8); abdominal ventrite 6 greatly swollen, anterior portion of surface foveate | <i>D. fruhstorferi</i> |
| -- | - Frons foveate, denser laterally; pronotum slightly short, 0.65 as long as width; ventral surface mostly testaceous to reddish-brown (figure 7); abdominal ventrite 6 feebly swollen, surface almost reticulately rugulose | <i>D. intermedius</i> sp. nov. |

Description of paratype

♀: pronotum and elytra testaceous, ventral surface darker as reddish-brown, base of femora and tibiae dark brown; elytral sculptures with enclosed brownish area.

Head: clypeus short subtrapezoidal, lateral margins strongly concave two-fifths from base, apex weakly curved with two upward sharp denticles medially. Ocular canthus simply developed backward with stout apex. Antennae lamellate, clearly shorter than male. Mandibles simply developed, apex not much beyond clypeus; external margin of mandibles greatly sinuate, anterior margin truncate. Mentum clearly shorter than male.

Pygidium: short suboval, 0.34 as long as width; lateral margins almost straight with apex round.

Abdominal ventrites: short but ventrites 2-5 without abbreviation; each of ventrites 2-4 subequal in length, ventrite 5 distinctly longer; posterior margin of abdominal ventrite 6 convex.

Legs: all tarsi slender and fairly elongate subcylindrical, tarsomere 5 shorter than tarsomeres 1-4 combined; internal claw of protarsus with a small sharp denticle basally.

Sculptures: posterior portion of clypeus and lateral portion of frons moderately dense foveate; pronotum with coarse punctures; elytra roundly foveate; pygidium somewhat reticulate; anterior half of abdominal ventrites 2-5 sparsely punctate, posterior half with dense foveae; abdominal ventrite 6 reticulately rugulose.

Setation: rather shorter than male, except setae of abdominal sternites distinctly longer.

Diagnosis

This species was compared with *D. feae* and *D. fruhstorferi*, the other two Thai species known thus far. The external characters of the new species are similar to the

external morphology of *D. fruhstorferi*, but aedeagal morphology is similar to *D. feae* (figures 16-18). The new species is defined by the following combination of characters: ocular canthus hornlike developed, apex anteriorly produced less than one-fourth from frontoclypeal suture to clypeal apex, external margin of ocular canthus convex, internal margin concave in male; male mandibles produced anteriorly upward; posterior margin of pronotum not overlapped scutellum; elytral surface almost plain without distinct impression or elevation in both sexes; abdominal ventrite 6 short and weakly swollen, surface reticulately rugulose in female; right paramere of male aedeagus short and strongly twisted, apex weakly and bluntly bisinuate; left paramere swollen at base, apex stout but angulate.

Distribution

Known only from the type locality in western Thailand. The type locality is characterized by the presence of hill evergreen forest.

Remark

Both specimens were collected with a light trap (UV fluorescence light), between 23:00-02:00 hours in February. Compared to the known bionomics of the other species (Bezděk and Pacholátko, 2001; Qiu *et al.*, 2020), it could be hypothesized that the new species has an annual life cycle, with adults active during summer.

Etyymology

The name of this species is a Latin adjective that means “intermediate” due to its similarities with *D. feae* and *D. fruhstorferi*.

Discussion

Since *Dicaulocephalus* individuals are only found in high mountain areas in Thailand, most localities belong to national parks. Thus, specimen collecting is hardly ever performed without permission. Additionally, the specimens deposited in the institutions and private collections in the country are often acquired via commercial trading, lacking labels and source localities. They are, therefore, unreliable for studying. According to the localities information of the specimens and the observation by citizen scientists (iNaturalist user cheryl394, 2022a; 2022b), *D. feae* can be found in north-western Thailand, whereas *D. fruhstorferi* is unknown in the country. Ek-Amnuay (2008) noted that *D. fruhstorferi* (= *Dicaulocephalus tet-suoi*) is confined to Chiang Mai province, northern Thailand. But since then, there have been no precise reports from Chiang Mai, and the labels of the specimens from that locality needed to be more precise. All the Thai specimens of *D. fruhstorferi* used in this examination were provided by residents of Nan province. Consequently, the issues of unusable specimens or missing distribution data may be solved if intensive data from the collaboration of citizen scientists or government authorities are used.

Acknowledgements

I sincerely regard Kawin Jiaranaisakul (Rabbit in the Moon Foundation, Suan Phueng, Ratchaburi, Thailand) who assists in gathering the type specimens. To compare specimens of *Dicaulocephalus* from Thailand, I would like to thank Akkharadech Kasempiyarom (Sansai, Chiang Mai, Thailand), Wutipon Pathomwattananurak (Mueang, Chiang Rai, Thailand), Lek Khaton (Bo Kluea, Nan, Thailand), and the staff of the THNHM who enabled them in this work. Special thanks to Ming-Zhi Zhao (South China Agricultural University, Guangzhou, China) for enabling foreign specimens, insightful commentary, and discussion. Additionally, the paper's improvement is credited to the anonymous reviewers.

References

- ARROW G. J., 1917.- Coleoptera Lamellicornia part II (Rutelinae, Desmonycinae, and Euchirinae), pp. 1-387. In: *The Fauna of British India, Including Ceylon and Burma*.- Taylor and Francis, London, UK.
- BEZDĚK A., PACHOLÁTKO P., 2001.- A review of the genus *Dicaulocephalus*.- *Folia Heyrovskyana*, 9 (2): 137-146.
- EK-AMNUAY P., 2008.- *Beetles of Thailand (2nd edition). Fascinating insects*. Vol. 1.- Amarin, Bangkok, Thailand.
- GESTRO R., 1888.- Descrizione un di nuovo genere di Lamellicorni.- *Annali del Museo Civico di Storia Naturale di Genova*, 5: 623-628.

- iNATURALIST USER CHERYL394, 2022a.- *Dicaulocephalus feae*.- [online] URL: <https://inaturalist.ca/observations/108419098> (accessed 26 June 2022).
- iNATURALIST USER CHERYL394, 2022b.- *Dicaulocephalus feae*.- [online] URL: <https://inaturalist.ca/observations/108724295> (accessed 26 June 2022).
- KOLBE H. J., 1894.- Ueber einige neue, von Herrn J. Fruhstorfer auf Java entdeckte Coleopteren.- *Entomologische Zeitung*, 55: 3-11.
- MACHATSCHKE J. W., 1972.- Superfamilie Scarabaeoidea, Familie Melolonthidae, Subfamilie Rutelinae, pp. 1-361. In: *Coleopterorum catalogus supplementa pars 66, fascicle 1*, (WILCOX J. A., Ed.).- Junk's -Gravenhage, Berlin, Germany.
- MNHN, 2021.- *Collection: insects – Coleoptera (EC), specimen MNHN-EC-EC1461*.- Muséum National d'Histoire Naturelle, Paris, France. [online] URL: <http://coldb.mnhn.fr/catalognumber/mnhn/ec/ec1461> (accessed 14 January 2022).
- NONFRIED A. F., 1891.- Verzeichniss der Rutelidae beschrieben nach der Herausgabe des Münchener Kataloges.- *Berliner Entomologische Zeitschrift*, 36: 347-358.
- OHAUS F., 1900.- Revision der Parastasiiden.- *Deutsche Entomologische Zeitschrift*, 1900 (2): 225-266.
- OHAUS F., 1918.- Phaenomerinae Euchirinae Rutelinae. pp. 1-241. In: *Coleopterorum catalogus auspiciis et auxilio Pars 66*, (SCHENKLING S., Ed.).- Junk's -Gravenhage, Berlin, Germany.
- OHAUS F., 1934.- Coleoptera Lamellicornia, Fam. Scarabaeidae, Subfam. Rutelinae. Erster Teil. pp. 1-172. In: *Genera Insectorum. Coleoptera. Fascicule 199A*, (WYTSMAN P., Ed.).- Louis Desmet-Verteneuil, Brussels, Belgium.
- PAULIAN R., 1959.- Coléoptères Scarabéides de l'Indochine (Rutélinae et Cétonines).- *Annales de la Société Entomologique de France*, 127: 73-105.
- QIU J. Y., XU H., ZHAO M. Z., 2020.- On the distribution of *Dicaulocephalus fruhstorferi* in China (Coleoptera: Scarabaeidae: Rutelinae).- *Saikaku Tsūshin*, 41: 41-44.
- RBINS, 2017.- *Dicaulocephalus feae Gestro, 1888*.- Royal Belgian Institute of Natural Sciences, Brussels, Belgium. [online] URL: <https://virtualcollections.naturalsciences.be/virtual-collections/entomology/coleoptera/scarabaeidae/rutelinae/dicaulocephalus-feae-gestro-1888> (accessed 26 June 2022).
- ZORN C., 2006.- Subfamily Rutelinae, tribe Rutelini, pp. 276-277. In: *Catalogue of Palaearctic Coleoptera, Volume 3, Scarabaeoidea- Scirtoidea- Dascilloidea- Buprestoidea- Byrrhoidea*, (LOBL I., SMETANA A., Eds).- Apollo Books, Stenstrup, Denmark.
- ZORN C., BEZDĚK A., 2016.- Subfamily Rutelinae, pp. 317-358. In: *Catalogue of Palaearctic Coleoptera. Vol. 3. Scarabaeoidea, Scirtoidea, Dascilloidea, Buprestoidea, Byrrhoidea. Revised and updated edition*, (LÖBL I., LÖBL D., Eds).- Brill, Leiden, The Netherlands.

Author's addresses: Thitipong HONGSUWONG, Kasetsart University, Faculty of Agriculture, Department of Entomology, Kamphaeng Saen Campus Nakhon Pathom, 73140, Thailand, (thitipong.ho@ku.th).

Received January 7, 2022. Accepted November 22, 2022.