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Host Records for Erotylinae (Coleoptera: Erotylidae) of Taiwan: Part I

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ABSTRACT

Erotylinae is a mycophagous subfamily of Erotylidae, with the majority of erotyline species feeding on Agaricomycetes fungi. According to some studies, mycophagous beetles may have coevolved with their fungal hosts. However, the host records for Erotylinae in most regions are understudied. A comprehensive list of host records offering a deeper understanding of the beetle-fungus relationship would be helpful for taxonomic studies. Thus, this study provides host records for some Taiwanese erotyline beetles. Additional studies are warranted to investigate the evolution of specialized and generalized host preferences among these beetles.

Key words: mycophagous beetles, host preference, Agaricomycetes

Introduction

Erotylidae, a family of beetles, consists of 6 subfamilies, 11 tribes, and approximately 3500 species worldwide (Leschen *et al.*, 2010). These beetles have various feeding preferences, with some being phytophagous, some mycophagous, and others saprophagous (Leschen and Buckley, 2007). Erotylinae is the most diverse mycophagous subfamily of Erotylidae. Erotyline species feed on the fruiting bodies of Agaricomycetes, such as Agaricales, Polyporales, and Hymenochaetales (Chûjô, 1969, Skelley, 1988, Leschen 2003, Robertson *et al.*, 2004, Jung, 2018). Numerous adults of different species are found on these fruiting bodies; however, their larvae are more host-specific, with usually one species found in or on the host (Goodrich and Skelley, 1994).

The Erotylinae beetle-fungal host association is understudied. Recent host records are mostly from the Neotropical region (Skelley *et al.*, 1991, Goodrich and Skelley, 1994, 1995), whereas those from the rest of the world, including Korea (Jung and Park, 2017, Jung, 2018), Japan (Chûjô, 1969), Australia (Hawkeswood *et al.*, 1997, Maynard *et al.*, 2018), and Taiwan, are scarce. Mycophagous insects are

Table 1. Fungal host records and observed behaviors of Erotylinae species. A = more than one adult beetle was observed. a = one adult beetle was observed. L = more than one beetle larvae was observed. (m) = adult beetles were mating during the observation.

Beetle tribes	Beetle species	Host Fungi	
		Feeding	Resting
Dacnini Crotch, 1876	*Microsternus tricolor* Lewis, 1887 Figure 1(A)		*Hydnochaete* sp.[A]
Encaustini Crotch, 1876	*Aulacocheilus* (*Aulacocheilus*) *issikii* Chûjô, 1936 Figure 1(B)	*Trametes versicolor* (L.) Lloyd[A]	
	Aulacocheilus (*Aulacocheilus*) *luniferus helleri* Deelder, 1942 Figure 1(C,D)	*Trametes* sp.[A(m)]	
	Aulacocheilus (*Aulacocheilus*) *sibiricus bedeli* Harold, 1880 Figure 1(E,F), 2(A,B)	*Trametes elegans* (Spreng.) Fr.[A] *Trametes orientalis* (Yasuda) Imazeki[A(m),L] *Trametes* sp.[A]	
	Encaustes cruenta formosana Chûjô, 1964 Figure 2(C-F), 3(A)	*Favolus tenuiculus* P. Beauv.[A(m)] *Polyporus arcularius* (Batsc) Fr.[a] *Polyporus* sp.[A] *Ganoderma* sp.[a]	*Lentinus squarrosulus* Mont.[a]
	Hornerotylus abdominalis (Csiki, 1910) Figure 3(B)	*Pleurotus* sp.[A]	
	Micrencaustes taiwana Araki, 1941 Figure 3(C)	*Microporus affinis* (Blume & T. Nees) Kuntze[A]	*Panus* sp.[a]
Megalodacnini Sengupta, 1969	*Episcapha* (*Ephicaspa*) *asahinai asahinai* (Chûjô, 1936) Figure 3(D)		*Pleurotus* sp.[a]
	Episcapha (*Episcapha*) *septentrionis* Heller, 1920 Figure 3(E)	*Schizophyllum commune* Fr.[A,L]	
	Episcapha (*Psiloscapha*) *morawitzi magna* Araki, 1949 Figure 3(F)		*Irpex lacteus* (Fr.) Fr.[A]
	Episcapha (*Psiloscapha*) *takasagona* Chûjô, 1941 Figure 4(A-C)	*Trametes versicolor* (L.) Lloyd[A,L] *Trichaptum* sp.[L]	
Tritomini Curtis, 1834	*Amblyopus interruptus* Miwa, 1929 Figure 4(D,E)	*Termitomyces* spp.[A,L]	
	Cyrtomorphus liui Chûjô, 1967 Figure 4(F)	*Microporus affinis* (Blume & T. Nees) Kuntze[A]	
	Rhodotritoma albofasciata Nakane, 1982 Figure 5(A)	*Pleurotus* sp.[A(m)]	
	Spondotriplax flavofasciata Chûjô, 1941 Figure 5(B)	*Pleurotus* sp.[A,L]	
	Spondotriplax flavomaculata Chûjô, 1941 Figure 5(C)	*Pleurotus* sp.[A]	
	Triplax horni (Chûjô, 1941) Figure 5(A)	*Pleurotus* sp.[A(m)]	
	Triplax hurusyoi (Chûjô, 1941) Figure 5(D)	*Favolus tenuiculus* P. Beauv.[A,L]	
	Tritoma (*Tritoma*) *fasciata* (Chûjô, 1941) Figure 5(E)		*Favolus tenuiculus* P. Beauv.[a]
	Tritoma (*Tritoma*) *taiwana* Chûjô, 1936 Figure 5(F)	*Pleurotus* sp.[A(m)]	

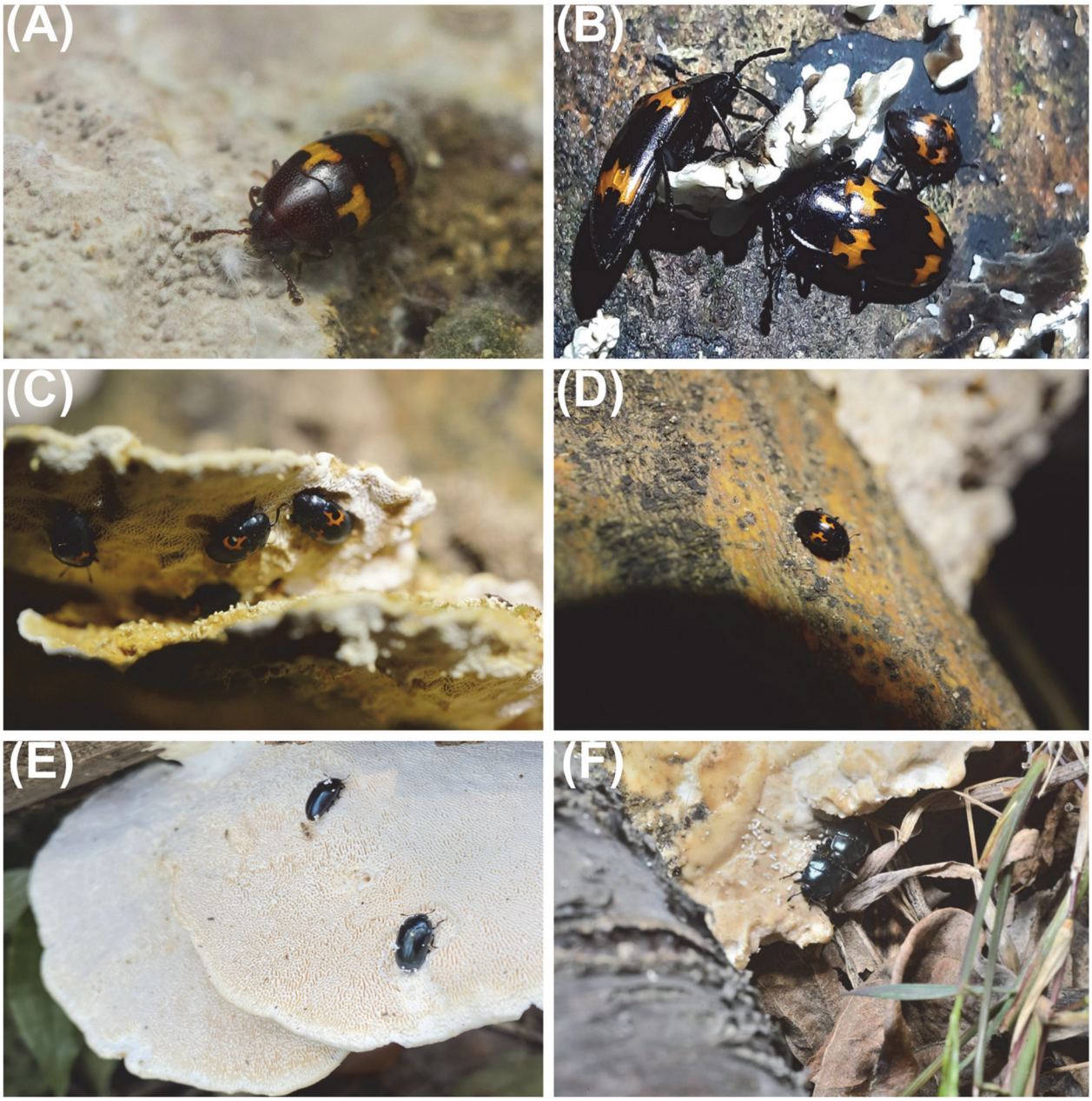

Fig. 1. Field photographs of the observed behaviors of Erotylinae species. (A) *Microsternus tricolor* Lewis, 1887 resting on *Hydnochaete* sp. in Nangangshan (南港山), Taipei City, in July 2021, photographed by Janus Olajuan Boediman. (B) *Aulacocheilus* (*Aulacocheilus*) *issikii* Chûjô, 1936 feeding on *Trametes versicolor* (L.) Lloyd at Daxueshan Forest Road (大雪山林道), Taichung City, photographed by Ming-Hsun Wu in September 2021. (C) *A.* (*Aulacocheilus*) *luniferus helleri* Deelder, 1942 feeding on *Trametes* sp. and (D) mating beside the host in Erbazi Botanical Garden (二叭子植物園), New Taipei City, photographed by the author in August 2021. (E) *A.* (*Aulacocheilus*) *sibiricus bedeli* Harold, 1880 feeding on *T. elegans* (Spreng.) Fr. at Bulau Trail (不老步道), Yilan County, photographed by Jing-Fu Chen in March 2021. (F) *A.* (*Aulacocheilus*) *sibiricus bedeli* Harold, 1880 feeding and mating on *T. orientalis* (Yasuda) Imazeki at Beiyuan Road (北原路), Nantou County, photographed by Chi-Wei Chiang in February 2021.

speculated to have coevolved with their fungal host (Robertson *et al.*, 2004, Birkemoe *et al.*, 2018, Mayers *et al.*, 2020, Kobayashi and Sota, 2021). However, this hypothesis remains untested for Erotylinae and their fungal hosts (Robertson *et al.*, 2004, Birkemoe *et al.*, 2018). A host record list is thus necessary for future investigations.

Materials and Methods

Records were drawn from observation records on online citizen scientist platforms, such as iNaturalist (https://www.inaturalist.org/

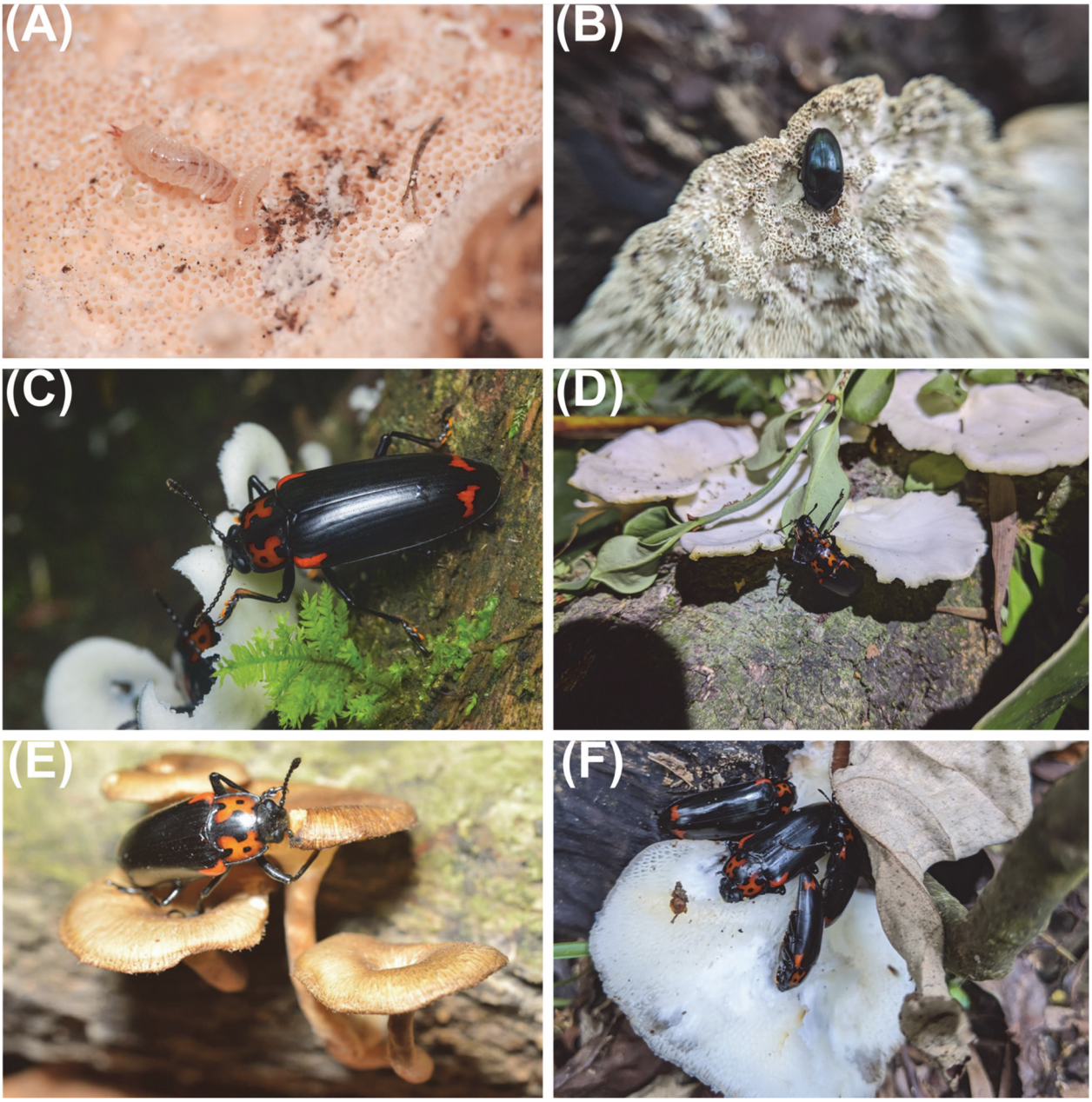

Fig. 2. Field photographs of the observed behaviors of Erotylinae species. (A) *A.* (*Aulacocheilus*) *sibiricus bedeli* Harold, 1880 larvae feeding on *T. orientalis* (Yasuda) Imazeki at Beiyuan Road (北原路), Nantou County, photographed by Ming-Hsun Chou in February 2021. (B) *A.* (*Aulacocheilus*) *sibiricus bedeli* Harold, 1880 feeding on *Trametes* sp. at Yuemeikeng Waterfall Trail (月眉坑瀑布步道), Yilan County, photographed by the author in May 2021. (C) *Encaustes cruenta formosana* Chûjô, 1964 feeding on *Favolus tenuiculus* P. Beauv. at Dingshan Shitiling Trail (頂山石梯嶺步道), Taipei City, photographed by Janus Olajuan Boediman in September 2020. (D) *E. cruenta formosana* Chûjô, 1964 mating on *F. tenuiculus* P. Beauv. in Nangangshan (南港山), Taipei City, photographed by the author in August 2021. (E) *E. cruenta formosana* Chûjô, 1964 feeding on *Polyporus arcularius* (Batsc) Fr. in Puli Township (埔里鄉), Nantou County, photographed by Chi-Wei Chiang in March 2021. (F) *E. cruenta formosana* Chûjô, 1964 feeding on *Polyporus* sp. at Yuemeikeng Waterfall Trail (月眉坑瀑布步道), Yilan County, photographed by the author in October 2020.

projects/mycoleopterans-of-taiwan) and a Facebook group (https://www.facebook.com/groups/2468666720094053/). Additional records were from the author's personal observation. The erotyline beetles were listed on the basis of the latest taxonomic works (Leschen *et al.*, 2010, Skelley *et al.*, 2021). The host fungi were recorded according to the latest scientific names from the MYCOBANK (https://www.mycobank.org/) and Index Fungorum (http://www.indexfungorum.org/names/names.asp). Host records were reported for each beetle species

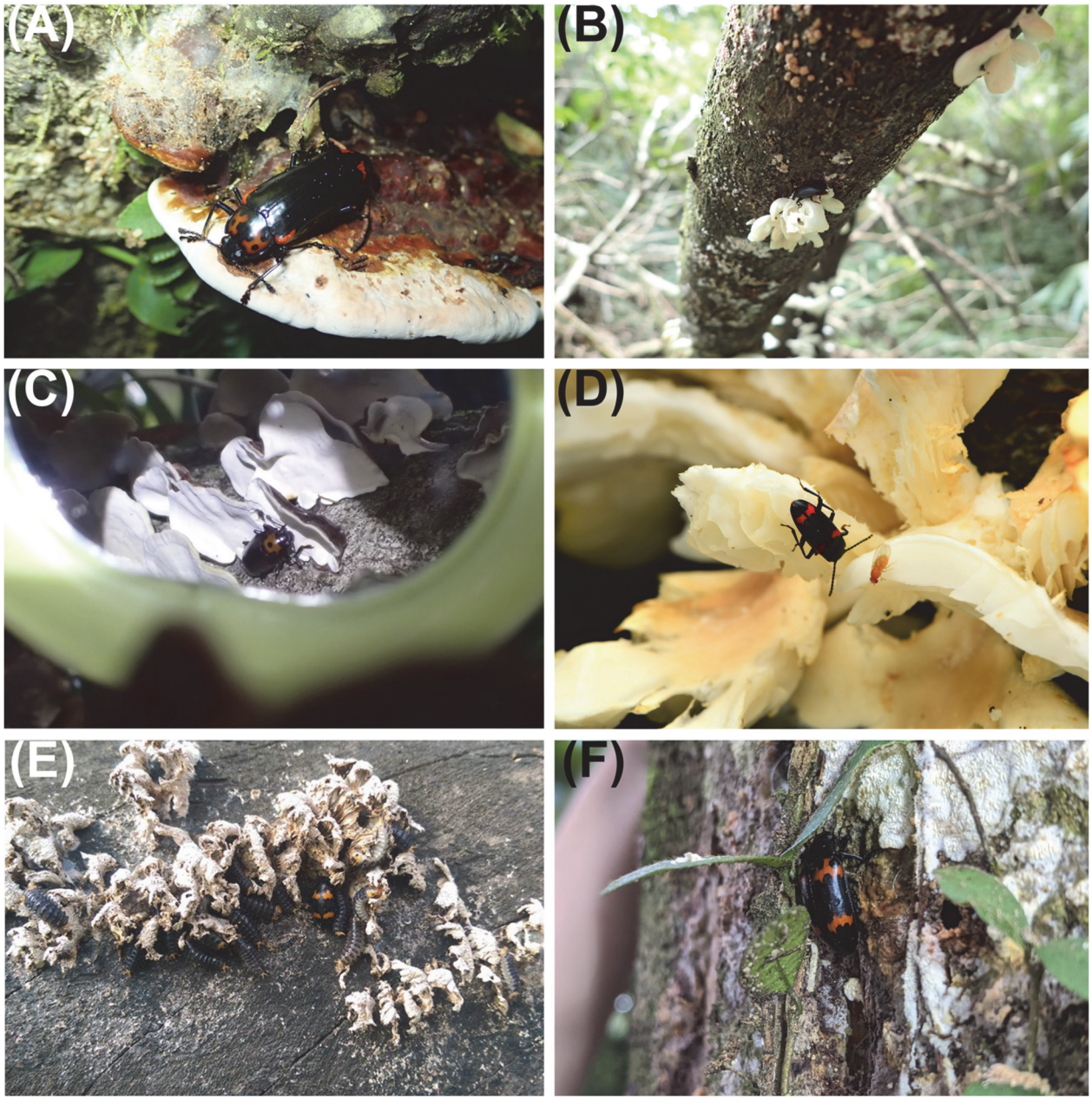

Fig. 3. Field photographs of the observed behaviors of Erotylinae species. (A) *E. cruenta formosana* Chûjô, 1964 feeding on *Ganoderma* sp. at Fushan Botanical Garden (福山植物園), Yilan County, photographed by Kai-Wei Chan in May 2021. (B) *Hornerotylus abdominalis* (Csiki, 1910) feeding on *Pleurotus* sp. at Dulanshan (都蘭山), Taitung County, photographed by Wei-Yun Chen in November 2021. (C) *Micrencaustes taiwana* Araki, 1941 feeding on *Microporus affinis* (Blume & T. Nees) Kuntze at Jinshuiying Historic Trail (浸水營古道), Pingtung County, photographed by the author in November 2020. (D) *Episcapha* (*Ephicaspa*) *asahinai asahinai* (Chûjô, 1936) resting on *Pleurotus* sp. at Daxueshan Forest Road (大雪山林道), Taichung City, photographed by Pei-Yuan Liang in October 2021. (E) *E.* (*Episcapha*) *septentrionis* Heller, 1920 adults and larvae feeding on *Schizophyllum commune* Fr. in Pingtung County, photographed by Yi-Ting Chung in October 2021. (F) *E.* (*Psiloscapha*) *morawitzi magna* Araki, 1949 resting on *Irpex lacteus* (Fr.) Fr. in Dongyanshan National Forest Recreation Area (東眼山森林遊樂區), New Taipei City, photographed by the author in December 2020.

(Table 1). Only taxonomically well-defined erotyline species were selected because future taxonomic revisions will be necessary for the remaining species.

Results and Discussion

This study tabulated the fungal host records for selected Erotylinae species, their observed behaviors, and life history stages (Table 1). Figures 1-5 present field photographs of the

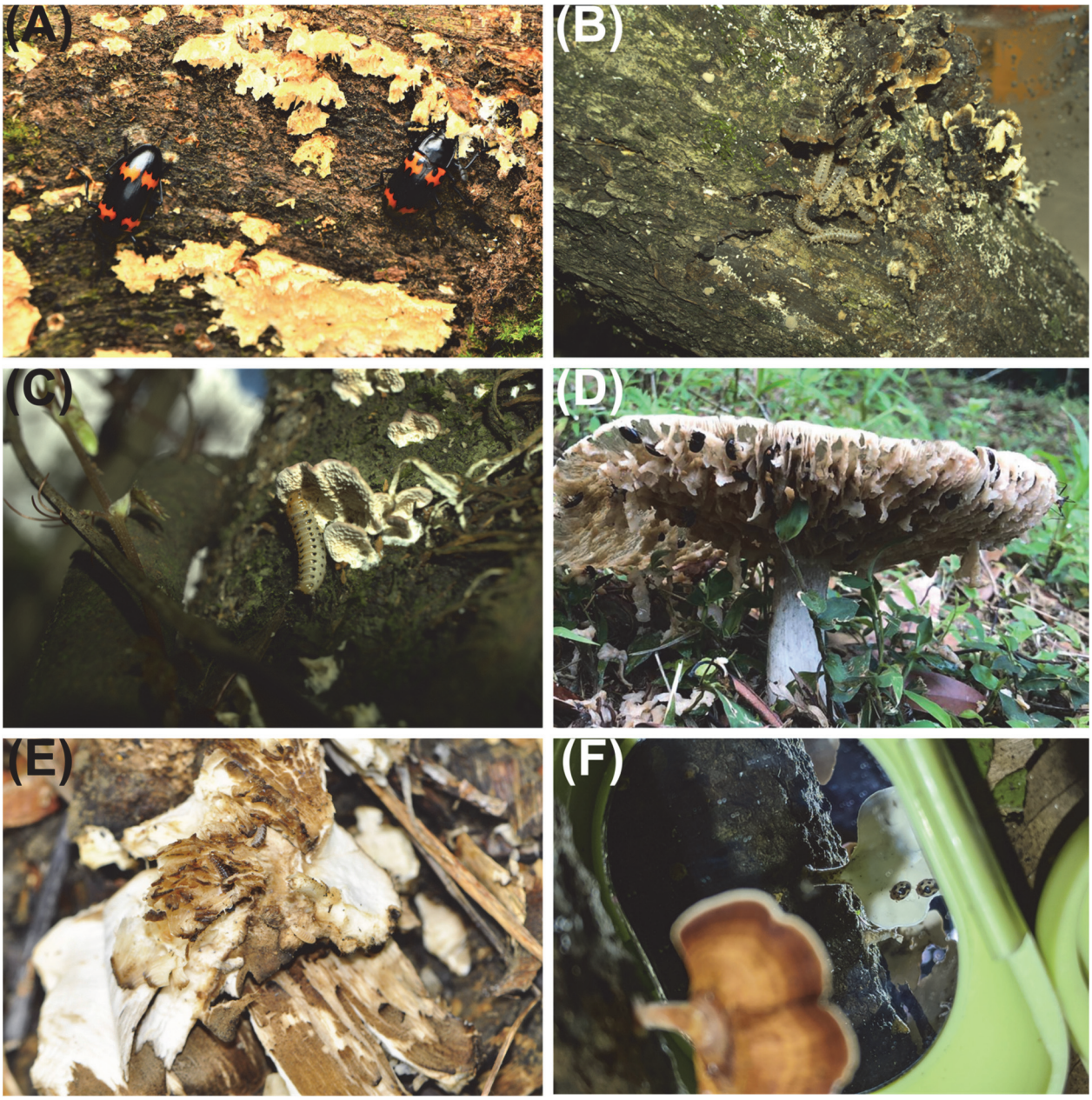

Fig. 4. Field photographs of the observed behaviors of Erotylinae species. (A) *E.* (*Psiloscapha*) *takasagona* Chûjô, 1941 feeding on *T. versicolor* (L.) Lloyd at Daxueshan Forest Road (大雪山林道), Taichung City, photographed by Pei-Yuan Liang in October 2021. (B) *E.* (*Psiloscapha*) *takasagona* Chûjô, 1941 larvae feeding on *T. versicolor* (L.) Lloyd in Tunyuan (屯原), Nantou County, photographed by the author in August 2021. (C) *E.* (*Psiloscapha*) *takasagona* Chûjô, 1941 larva feeding on *Trichaptum* sp. in Tunyuan (屯原), Nantou County, photographed by the author in August 2021. (D) *Amblyopus interruptus* Miwa, 1929 feeding on *Termitomyces* spp. in Neichajiao (內插角), New Taipei City, photographed by Yuan-Siang Wang in June 2021. (E) *Am. interruptus* Miwa, 1929 larvae feeding on *Termitomyces* spp. in Wuri (烏日), Taichung City, photographed by Pei-Yuan Liang in June 2021. (F) *Cyrtomorphus liui* Chûjô, 1967 feeding on *M. affinis* (Blume & T. Nees) Kuntze in Sikanshui (四崁水), New Taipei City, photographed by the author in July 2021.

observation records. Beetles having a broader host range might have adapted to the host structural characteristics, specifically the complexity of the hyphal structure rather than the fungal chemistry (Hanski, 1989). Monophagy or specificity to a single host might have resulted from insufficient sampling (Hanski, 1989). However, further taxonomic revisions are required for a better understanding of beetle host preferences.

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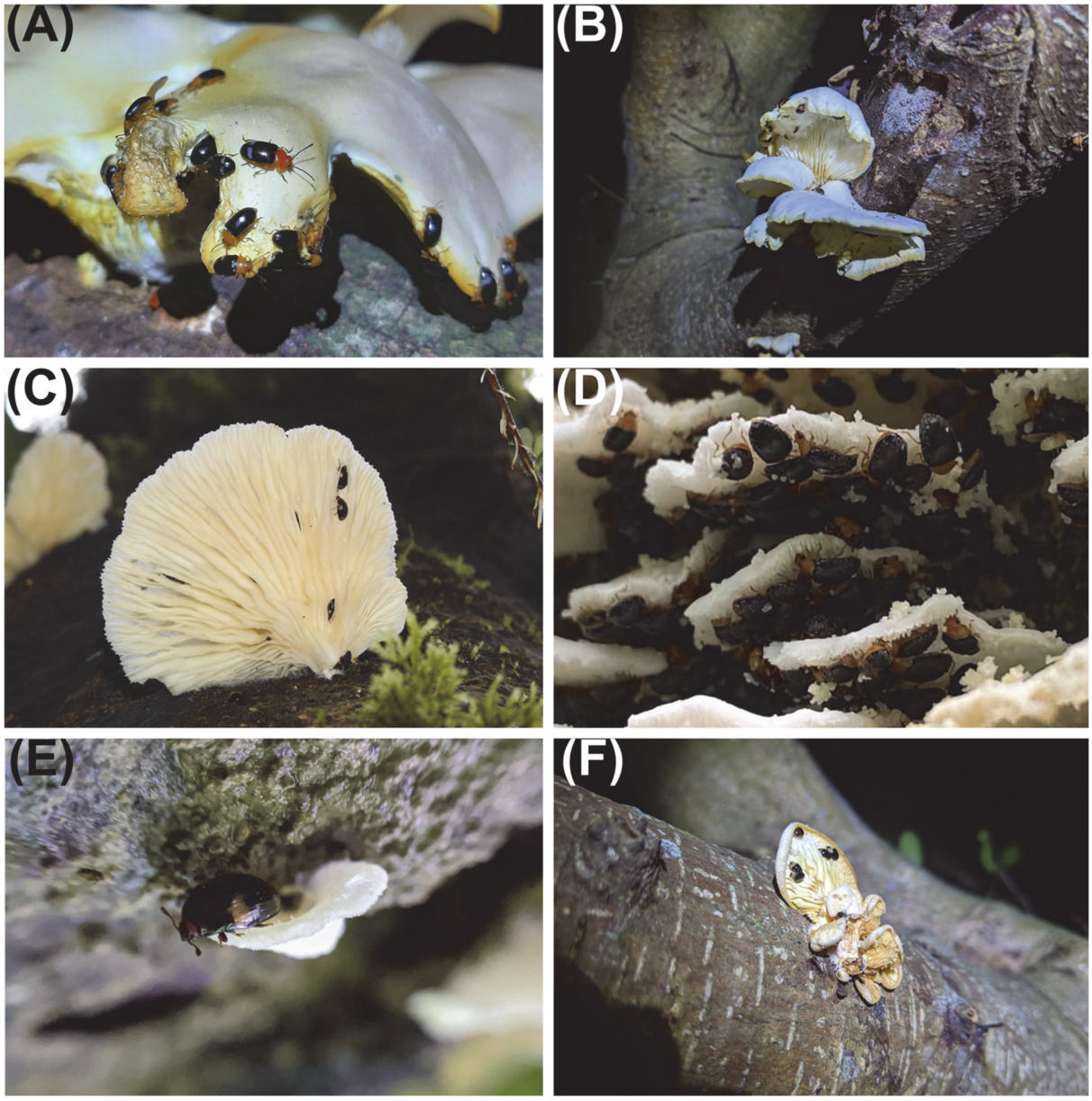

Fig. 5. Field photographs of the observed behaviors of Erotylinae species. (A) *Rhodotritoma albofasciata* Nakane, 1982 [reddish orange pronotum] and *Triplax horni* (Chûjô, 1941) [yellowish pronotum] feeding on *Pleurotus* sp. at Daxueshan Forest Road (大雪山林道), Taichung City, photographed by Ming-Hsun Wu in April 2021. (B) *Spondotriplax flavofasciata* Chûjô, 1941 [in the middle of the figure] feeding on *Pleurotus* sp. in Erbazi Botanical Garden (二叭子植物園), New Taipei City, photographed by the author in November 2021. (C) *S. flavomaculata* Chûjô, 1941 feeding on *Pleurotus* sp. in Kabaoshan (卡保山), New Taipei City, photographed by Jun-Xiong Liu in November 2021. (D) *T. hurusyoi* (Chûjô, 1941) feeding on *F. tenuiculus* P. Beauv. in Yuemeikeng Waterfall Trail (月眉坑瀑布步道), Yilan County, photographed by Jing-Fu Chen in March 2021. (E) *Tritoma* (*Tritoma*) *fasciata* (Chûjô, 1941) resting on *F. tenuiculus* P. Beauv. in Erbazi Botanical Garden (二叭子植物園), New Taipei City, photographed by the author in November 2021. (F) *Tr.* (*Tritoma*) *taiwana* Chûjô, 1936 feeding on *Pleurotus* sp. in Erbazi Botanical Garden (二叭子植物園), New Taipei City, photographed by the author in November 2021.

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臺灣大蕈蟲亞科的寄主紀錄 I

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摘　要

大蕈蟲亞科為蕈食性甲蟲，大部分種類的幼蟲和成蟲以傘菌綱子實體為食。此外，多項研究認為蕈食性甲蟲與其真菌寄主有共演化關係。然而，大部分大蕈蟲的寄主紀錄不齊全，使大蕈蟲和真菌寄主共演化的了解有限。較完整的寄主紀錄有助於了解上述演化關係以及大蕈蟲的系統分類。此研究提供臺灣大蕈蟲亞科的寄主紀錄，顯示大蕈蟲有廣食者也有專食者，需要更完整的採樣以及更多的研究以解釋這些現象。

關鍵詞：蕈食性甲蟲、寄主偏好、傘菌綱