



## Review of the Genus *Diuncus* Hulcr & Cognato (Coleoptera, Curculionidae, Scolytinae) in Taiwan with a New Record

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### ABSTRACT

The genus *Diuncus* Hulcr & Cognato contains 18 species found in East Asian and Australasian regions in the tribe Xyleborini (Curculionidae: Scolytinae). *Diuncus* beetles are facultative or obligate associates of other ambrosia beetles. Four species are recognized: *D. ciliatoformis* (Schedl, 1953), *D. corpulentus* (Eggers, 1930), *D. haberkorni* (Eggers, 1920), and the newly recorded species, *D. adossuarius* (Schedl, 1951). The male of *D. haberkorni* is described for the first time. Observations on *Diuncus* biology in Taiwan are provided and a key to species is presented.

**Key words:** ambrosia beetles, biology, *Diuncus*, new record, Xyleborini

### Introduction

Hulcr and Cognato erected *Diuncus* based on type species *Xyleborus papatrae* Schedl (1972) in 2009. Since then, 17 species have been transferred to the genus from *Xyleborus* Eichhoff. Most species live in Southeast Asia and Melanesia, with two species in Africa (Hulcr and Cognato, 2009, 2013). *Diuncus* can be distinguished from other xyleborine genera by an obliquely truncate antennal club with margin of segment 1 elevated into circular costa on anterior face and no sutures on posterior face (type 1, Hulcr *et al.*, 2007), rounded and robust pronotum in lateral view of type 5 (Hulcr *et al.*, 2007), lateral margins of pronotum outcurved in

dorsal view with anterior margin broadly rounded (type 1, Hulcr *et al.*, 2007), with two prominent serrations on the frontal margin of the pronotum, declivity flat and broad, elytral disc short, declivital postero-lateral margins distinctly carinate, and usually with one or two pairs of denticles just posteriad to declivital summit (Hulcr and Cognato, 2009). Some species appear similar to genus *Xylosandrus* (Reitter), which can be distinguished by separate procoxae (all *Diuncus* have contiguous procoxae).

Most xyleborine ambrosia beetles are fungal farmers, and possess fungal transport organ called mycangium (Hulcr and Stelinski 2017). The beetles create tunnels called galleries in which they feed and develop on symbiotic fungi.

Table 1. Host trees of Genus *Diuncus* in Taiwan

Species			<i>Diuncus</i>	<i>Diuncus</i>
	Family	species	<i>corpulentus</i>	<i>haberkorni</i>
Host trees	Aceraceae	<i>Acer serrulatum</i>	✓	
	Anacardiaceae	<i>Mangifera indica</i>	✓	
	Elaeocarpaceae	<i>Elaeocarpus sylvestris</i>		✓
	Fagaceae	<i>Cyclobalanopsis sessilifolia</i>	✓	
		<i>Cinnamomum camphora</i>	✓	✓
	Lauraceae	<i>Cinnamomum osmophloeum</i>	✓	✓
		<i>Machilus zuihoensis</i>	✓	✓
		<i>Neolitsea konishii</i>	✓	✓
	Meliaceae	<i>Swietenia macrophylla</i>		✓
	Ulmaceae	<i>Zelkova serrata</i>	✓	✓
		<i>Trema orientalis</i>	✓	

*Diuncus* species are unusual in that they all appear to lack mycangia and do not establish galleries independently. Instead, they locate established galleries of other Xyleborini, create their own galleries adjacent to host galleries, and acquire mycelium from fungal gardens of host species (Hulcr and Cognato, 2009, 2010).

This paper provides a key to species in Taiwan, a new record, and biological notes.

## Materials and Methods

Specimens of *D. ciliatiformis* (Schedl) were collected in 12-unit Lindgren funnel traps baited with 95% ethanol, and 95%  $\alpha$ -pinene (Merck, Germany). Specimens of *D. corpulentus* (Eggers) and *D. haberkorni* (Eggers) were collected using the same 12-unit Lindgren funnel traps as well as excised from unhealthy trees (Table 1). Specimens of *D. adossuarius* (Schedl) were collected from *Macaranga sinensis* (Euphorbiaceae) on Orchid Island (Taitung, Lanyu Township, Taiwan). Beetles were identified to the species level using available taxonomic keys (Maiti and Saha, 2004; Hulcr and Cognato, 2013). Measurements were taken using a Leica stereomicroscope (Wild MZ 8) equipped with eyepiece micrometer in a Pl 10x/22 eyepiece. Beetle length was measured from the pronotal apex to the elytral apex.

## Taxonomy

### Key to Female Taiwan *Diuncus* Species (modified from Hulcr and Cognato, 2013)

1. Summit of elytral declivity with no denticles, smooth ..... 2
- Summit of elytral declivity with two pairs of

- denticles of equal size ..... 3
2. (1) Elytral declivity with moderately impressed striae 1. Declivital striae and interstriae covered by recumbent long hair-like setae ..... *D. ciliatiformis*
- Elytral declivity plano-convex, declivital interstriae 2 and 3 with distinct granules; declivital setae minute ..... *D. corpulentus*
3. (1) Denticles on elytral declivity pointed, sharp, denticle-like ..... *D. adossuarius*
- Denticles on elytral declivity oblique, tubercle-like ..... *D. haberkorni*

### *Diuncus adossuarius* (Schedl)

*Xyleborus adossuarius* Schedl, 1951: 367.

#### Diagnosis:

Female (Fig. 1A-B): Length 2.7 mm (N = 1); stout, 2.16 times as long as wide; body shining, reddish brown in color; pronotum 0.8 times as long as wide, anterior margin with four distinct asperities, anterior half finely asperate, posterior half finely reticulate with minute punctures; elytra 1.7 times longer than pronotum, elytral disc shining up to one third then opaque and slightly concave, two small recurved spines on each elytron, declivity obliquely convex, surface opaque with appressed setae, interstriae often slightly elevated, each with row of minute granules.

Male: Unknown.

**Material examined:** TAIWAN. TAITUNG: Lanyu Township (22°0.9533'N; 121°33.7833'E), 1♀, 03.IV.2016, Y. T. Lin leg. from *Macaranga sinensis* (Euphorbiaceae).

**Distribution:** New Guinea, Philippines (Wood and Bright, 1992; Hulcr and Cognato, 2013). Newly recorded from Taiwan.



Fig. 1. *Diuncus adossuarius* (Schedl), female: A. Dorsal view, B. Lateral view.

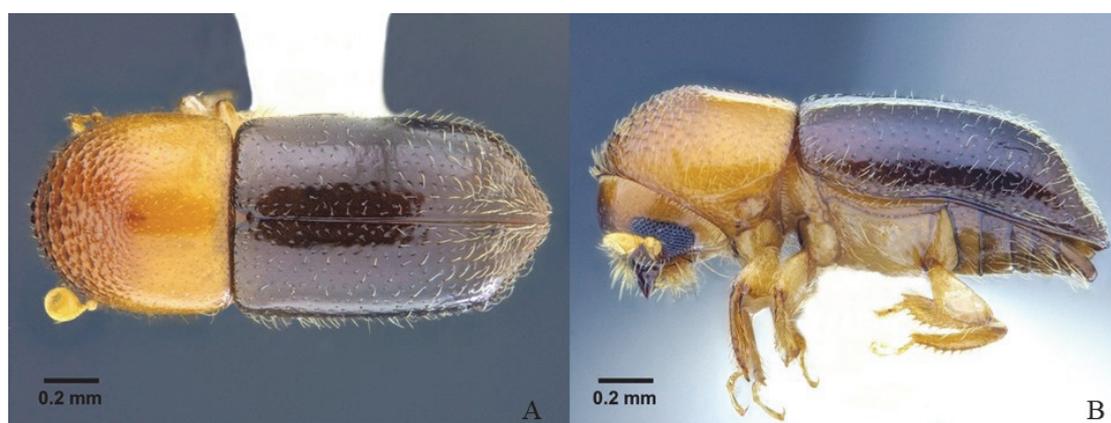


Fig. 2. *Diuncus ciliatoformis* (Schedl), female: A. Dorsal view, B. Lateral view.

**Host tree:** *M. sinensis* (Euphorbiaceae).

**Biology:** This beetle was collected from a gallery adjacent to that of *Hadrodemius globus* (Blandford). It is unclear whether the two species were involved in any association with each other.

***Diuncus ciliatoformis* (Schedl)**

*Xyleborus ciliatoformis* Schedl, 1953: 81.

**Diagnosis:**

Female (Fig. 2C-D): Length 1.95-2.05 mm (N = 3); slender, 2.23-2.67 times as long as wide; body shining, pronotum yellowish brown, elytra dark brown; pronotum 0.8-1.0 times as long as wide, anterior margin with distinct row 4-6 asperities, anterior half finely asperate, posterior half shiny and with very fine punctures and pubescence; elytra 1.67-1.79 times longer than pronotum, discal striae with fairly regular rows of very fine punctures, interstriae smooth and wide, declivity with a moderate longitudinal depression along suture 1 on upper half of declivity, pubescence longer and distinctly

directed toward suture on lateral convexities of declivity.

Male: Unknown.

**Material examined:** TAIWAN. NANTOU: Yuchi Township (23°50.6083'N; 120°55.1983'E), 3♀, 18.IX.2013, C. S. Lin leg. in ethanol-baited traps.

**Distribution:** Indonesia, Malaysia, New Guinea, Taiwan (Wood and Bright, 1992; Beaver and Liu, 2010)

**Host tree:** *Pasania sundaica* (Fagaceae); *Shorea balanocarpoides*, *Vatica* sp. (Dipterocarpaceae) (Wood and Bright, 1992; Bright and Skidmore, 1997). Browne (1961) surmised that the beetle prefers Dipterocarpaceae.

**Biology:** Tree hosts and ambrosia beetle hosts of this species in Taiwan are unknown.

***Diuncus corpulentus* (Eggers)**

*Xyleborus corpulentus* Eggers, 1930: 198.

**Diagnosis:**

Female (Fig. 3A-B): Length 2.65-2.95 mm (N = 7); stout, 2.12-2.36 times as long as wide; body

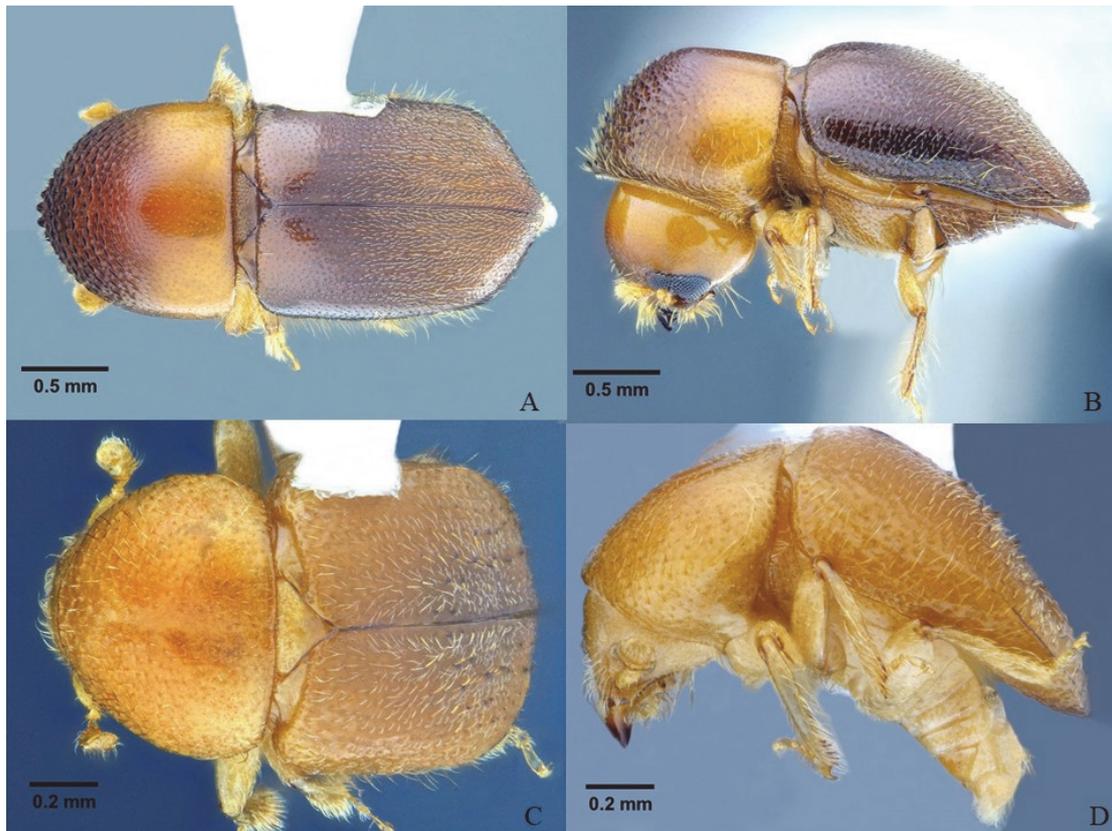


Fig. 3. *Diuncus corpulentus* (Eggers), female: A. Dorsal view, B. Lateral view; male: C. Dorsal view, D. Lateral view.

shiny, pronotum bicolored, yellowish brown to reddish brown, elytra reddish brown; pronotum globose, 0.73-0.92 times as long as wide, anterior margin with distinct row of 5-6 asperities, anterior half with distinct concentric rows of triangular asperities, posterior half shiny with finely reticula and punctures; elytra 1.5-2.0 times longer than pronotum, discal striae marked by close fine punctures, interstriae wide and flat with irregular minute punctures and inconspicuous setae, declivity surface opaque, striae with irregular small punctures; interstriae 3, 5, and 6 with uniseriate row of granules.

Male (Fig. 3C-D): Length 1.40-1.65 mm (N = 7); small and stout, 1.94-2.03 times as long as wide; body moderately setose, yellowish brown; eyes small and narrow; pronotum 0.59-0.73 times as long as wide, anterior margin broadly rounded and unarmed, with comparatively long hairs, anterior half with indistinct asperities, posterior shiny with finely reticulate and scattered shallow punctures; elytra 1.77-2.30 times longer than pronotum, elytra opaque, elytral striae punctures shallow and small, interstriae with fine punctures, declivity surface

opaque, interstriae 3 with a row of small granulates.

**Material examined:** TAIWAN. NANTOU: Yuchi Township (23°51.4733'N; 120°56.6733'E), 8♂14♀, 11.VI.2015, C. S. Lin leg. from *Machilus zuihoensis*. TAICHUNG: Heping Dist. (24°19.9810'N; 120°56.3550'E), 1♂9♀, 06.VIII.2019, C. S. Lin leg. from *Zelkova serrata*.

**Distribution:** China, India, Nepal, Taiwan, Thailand (Wood and Bright, 1992; Maiti and Saha 2004; Beaver and Liu, 2010).

**Host tree:** *Acrocarpus fraxinifollius* (Leguminosae); *Albizia lebbek* (Fabaceae); *Artocarpus chaplasha* (Moraceae); *Canarium euphyllum* (Burseraceae); *Cryptocarya wightiana* (Lauraceae); *Sterculia villosa* (Sterculiaceae); *Vatica lanceaefolia* (Dipterocarpaceae) (Wood and Bright, 1992; Maiti and Saha 2004). Taiwanese hosts are reported in Table 1.

**Biology:** Galleries of *D. corpulentus* and *H. globus* (Blandford) were densely interlaced in Thailand. (Hulcr and Cognato, 2009). We found that its galleries were interlaced with *Cnestus mutilatus* (Blandford) and *H. comans* (Sampson) in Taiwan (Fig. 4A-D).



Fig. 4. *Diuncus corpulentus* (Eggers), *Cnestus mutilatus*, and *Hadrodemius comans* (Sampson): A. Female *D. corpulentus* (right) bored entrance next to *H. comans* (left). B. *D. corpulentus* and *H. comans* galleries are interlaced. C. Two *D. corpulentus* females (blue arrow) and three *D. haberkorni* females (red arrow) bored entrance hole adjacent to *C. mutilatus*. D. Galleries of *D. haberkorni* (left), *C. mutilatus* (middle), and *D. corpulentus* (right).

#### ***Diuncus haberkorni* (Eggers)**

*Xyleborus haberkorni* Eggers, 1920: 43.

*Xyleborus taichuensis* Schedl, 1952: 64.

#### **Diagnosis:**

Female (Fig. 5A-B): Length 1.78-2.03 mm (N = 7); slender, 2.23-2.45 times as long as wide; body shining, pronotum yellowish brown, elytra brown; pronotum 0.82-0.97 times as long as wide, anterior margin with 4-6 distinct asperities, anterior half with dense asperities in concentric rows, posterior half finely reticulate with minute punctures; elytra 1.53-1.86 times longer than pronotum, discal striae with distinct and shallow punctures, interstriae with uniseriate fine punctures, declivity surface opaque, interstriae 2 with a tubercle at commencement of declivity, interstriae 3 with a tubercle near commencement of declivity.

**Material examined:** TAIWAN. NANTOU: Yuchi Township (23°51.4733'N; 120°56.6733'E), 3♀, 11.IX.2013, 1♀, 08.V.2014, 1♀, 28.V.2014, 1♀, 26.VI.2014, C. S. Lin leg. in ethanol-baited traps, 23♀, 11.VI.2015, from *Neolitsea konishii*.

TAICHUNG: Heping Dist. (24°19.9810'N; 120°56.3550'E), 20♀, 06.VIII.2019, C. S. Lin leg. from *Z. serrata*. Voucher male specimen ♂, TAIWAN. NANTOU: Yuchi Township 824 m (24°19.9810'N 120°56.355'E), 11.VI. 2015, C. S. Lin leg. from *N. konishii*. Additional specimens: 2♂, same data as for voucher male specimen, from *M. zuihoensis* (1) and *N. konishii* (1). Voucher male specimen was deposited in the National Museum of Natural Science (NMNS), Taichung, Taiwan. Additional specimens are in the first author's collection.

**Male** (Fig. 5C-F): Length 1.13-1.50 mm (mean = 1.28 ± 0.19 mm; N = 3; 1.50 mm in the voucher male specimen); 2.05-2.23 times as long as wide (2.14 in the voucher male specimen); body small and slender, yellowish brown. **Head.** Frons plano-convex, surface finely reticula with shallow punctures, epistomal margin with fringe of distinctly long hairs, eyes small and narrow. **Pronotum** 0.75-0.86 times as long as wide (0.75 in Voucher male specimen); lateral sides moderately outcurved with anterior margin



Fig. 5. *Diuncus haberkorni* (Eggers): Female: A. Dorsal view, B. Lateral view; male: C. Dorsal view, D. Lateral view, E. Frontal view head, F. Declivital view.

broadly rounded, anterior margin unarmed, with comparatively long hairs; no distinct summit; pronotal surface shiny with finely reticulate and scattered shallow punctures. **Elytra** 1.37-1.88 times longer than pronotum (1.86 in Voucher male specimen) and 1.18-1.45 times as long as wide (1.39 in Voucher male specimen); elytra as in female, opaque, but strial and interstitial punctures small and shallow; declivital striae 1 and 2 depressed as in female, interstriae 2 and 3 with minute tubercles, declivital striae and interstriae with setae, postero-lateral margins acute, distinctly carinate.

**Remarks:** Male of this species is described for

the first time.

**Distribution:** Bangladesh, Burma, China, India, Indonesia, Japan, Malaysia, Myanmar, New Guinea, Sri Lanka, Taiwan, Thailand, Tanzania, Vietnam (Wood and Bright, 1992; Maiti and Saha 2004; Bright, 2014).

**Host tree:** *Mangifera indica*, *Melanorrhoea curtisii* (Anacardiaceae); *Terminalia myriocarpa* (Combretaceae); *Dryobalanops oblongifolia*, *Shorea bracteolata*, *S. leprosula*, *S. maxwelliana*, *S. ovata*, *S. robusta*, *S. sumatrana* (Dipterocarpaceae); *Adenantha pavonina*, *Albizia mohiccana*, *Dalbergia latifolia*, *Parkia speciosa* (Fabaceae); *Tectona grandis*, *Vitex*

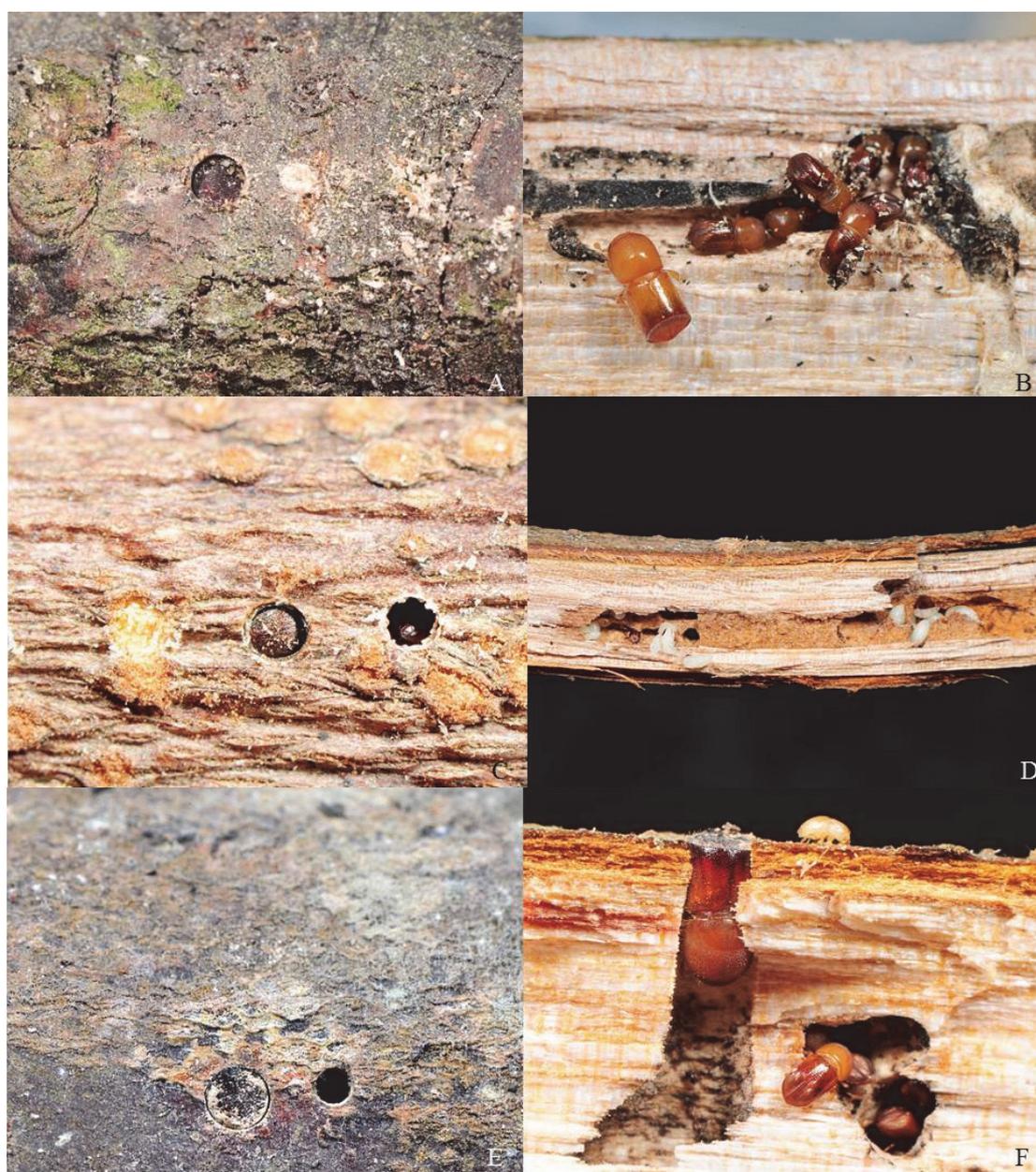


Fig. 6. *Diuncus haberkorni* (Eggers) (small) and its host beetles in the genus *Xylosandrus* (big one): A. Entrance hole of *D. haberkorni* and *X. amputatus*. B. *D. haberkorni* gallery separated from *X. amputatus* gallery. C. Entrance hole of *D. haberkorni* and *X. discolor*. D. *D. haberkorni* gallery (left) separate from *X. discolor* gallery (right) for a long distance. E. Entrance hole of *D. haberkorni* and *X. mancus*. F. *D. haberkorni* gallery next to *X. mancus* gallery.

*pubescens* (Lamiaceae); *Theobroma cacao* (Malvaceae); *Swietenia macrophylla*, *S. mahagoni*, *Toona sinensis* (Meliaceae); *Artocarpus dadah* (Moraceae); *Eugenia jambolana*, *Tristania whiteana* (Myrtaceae); *Piper* sp. (Piperaceae); *Coffea liberica* (Rubiaceae); *Salix tetrasperma* (Salicaceae); *Palaquium maingayi* (Sapotaceae); *Turpinia pomifera* (Staphyleaceae); *Styrax benzoin* (Styracaceae) (Browne, 1961; Wood and Bright, 1992; Maiti and Saha 2004). Taiwanese hosts are listed in Table 1.

**Biology:** Beaver and Browne (1978) noted its galleries were started next to *Xylosandrus mancus* (Blandford). Kalshoven (1959) found that its brood chamber was fused with *X. morigerus*. We found that they created their galleries adjacent to *C. mutilatus* (Blandford) (Fig. 4C-D), *X. amputatus* (Blandford) and *X. discolor* (Blandford) in Taiwan (Fig. 6). It probably has a marked preference for fungi farmed by genus *Xylosandrus*. However, galleries of *D. haberkorni* were also observed farther from other ambrosia beetles, and its

fungal parasitic habit may be facultative (Hulcr and Cognato, 2009).

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## 檢閱臺灣雙棘小蠹屬及一新紀錄種 *Diuncus adossuarius* (Coleoptera, Curculionidae, Scolytinae)

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### 摘 要

臺灣目前已知的雙棘小蠹屬 (*Diuncus*) 有 3 種，微粒雙棘小蠹 *Diuncus adossuarius* (Schedl) 首次記錄於臺灣，本文提供臺灣雙棘小蠹屬之檢索表、雙棘小蠹在臺灣的寄主植物及生物學研究。

**關鍵詞：**菌蠹蟲、生物學、雙棘小蠹屬、新記錄、材小蠹族