

Diversity of Coleopterous Families in Phou Phanang National Biodiversity Conservation Area, Lao PDR

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ABSTRACT

Extensive surveys for coleopterans were conducted in Phu Phanang National Biodiversity Conservation Area, Vientiane Province, Laos, once in December 2017 during the dry season and once in June 2018 during the rainy season. Collections were set in two habitats, i.e. a teak plantation and a secondary mixed deciduous forest where *Lagerstroemia* sp. were the dominating trees. In total, 3,691 beetle specimens were collected with flight interception (window) traps and pitfall traps. They were identified to 194 morphospecies belonging to the following 38 families: Alleculidae, Anthribidae, Anthicidae, Bruchidae, Bostrichidae, Carabidae, Cerambycidae, Chrysomelidae, Cicindelidae, Cleridae, Coccinellidae, Curculionidae, Dytiscidae, Derodontidae, Elateridae, Endomychidae, Hispididae, Histeridae, Latridiidae, Laemophloeidae, Lymexylidae, Lycidae, Mordellidae, Monotomidae, Mycetophagidae, Nitidulidae, Phalacridae, Paussidae, Platypodidae, Salpingidae, Scarabaeidae, Scirtidae, Scolytidae, Silphidae, Silvanidae, Staphylinidae, Rhysodidae, and Tenebrionidae. For each of the families, one or a few examples of the morphospecies found are provided as illustrations.

Keywords: Coleoptera, Phou Phanang National Biodiversity Conservation Area, checklist, Laos

INTRODUCTION

Laos is a tropical country in the centre of the Indochinese Peninsula with almost 75% of the country being mountainous (Messerli *et al.* 2008). About 40% of its territory still covered with forest which makes Laos one of the global biodiversity hotspots designated by Myers *et al.*, (2000). The study of beetles in Laos is poorly known compared to neighboring countries such as Thailand, even though some coleopterans families have been previously reported from Laos, e.g. Cerambycidae (Gressitt *et al.*, 1970), Epimetopidae (Jach, 2002), Cicindelidae (Sawada and Wiesner, 2004; Wiesner, 2013; Wiesner and Geiser, 2013), Eulichadidae (Hajek, 2008), Carabidae (Nagel, 2009), Passalidae (Neumann *et al.*, 2013), Scarabaeidae (Kral *et al.*, 2015), Chrysomelidae (Sekerka and Geiser, 2016), Curculionidae (Beaver, 2016), Eucnemidae

(Otto, 2016), and Endomychidae (Yoshitomi and Sogoh, 2018). The project "Improving knowledge and understanding of the coleopteran biodiversity in Laos" was proposed to Laos in 2017 aims to increase knowledge and understanding of the coleopteran biodiversity in Laos through conducting field collections of coleopterans in selected habitats in Laos. Survey and collection of beetles were conducted at Phou Phanang National Biodiversity Conservation Area which is one of the total 20 National Biodiversity Conservation Areas in Laos. This area measures 1,525 square kilometers and is located north of Vientiane Capital. It mostly consists of degraded forest with a small area of semi-evergreen forest. Elevation ranges from 200-790 meters above sea level. This National Biodiversity Conservation Area has not been thoroughly explored for biodiversity. Therefore, the knowledge of coleopterans, the most diverse order

of insects group is clearly underexplored. This study will present the coleopteran family diversity in Phou Phanang National Biodiversity Conservation Area.

MATERIALS AND METHODS

The surveys of beetle were conducted in Phou Phanang National Biodiversity Conservation Area. Beetle specimens were collected two times in December 2017 and June 2018. The two main methods employed in this study to collect beetles were window traps and pitfall traps. Such traps have been used highly successfully for collecting coleopterans in tropical forest ecosystems (Lamarre *et al.* 2012). Both traps were set up in two habitat types of which was a teak plantation and the other one a secondary forest where numerous of *Lagerstroemia* sp. were common trees. Twelve window traps and 36 pitfall traps were established in each habitat and exposed for 48 hours during the two collections. All specimens were preserved in 80 % ethyl alcohol, then these specimens were pinned and dried in a hot air oven at 50 °C for at least 3 weeks. All relevant data (e.g. collector, date, location, habitat and family) were added to the label attached to all pinned specimens. A Cannon DSLR 5D mark II camera with 100 mm macro lens was used for taking photographs for medium to large-sized specimens and a Leica S8 APO stereomicroscope equipped with Leica MC170 HD for small-sized specimens. All specimens were sorted based on the morphospecies concept and were identified to the family level following Lawrence and Britton (1991). All specimens were deposited in the insect collection, Faculty of Agriculture, National University of Laos.

RESULTS

The study resulted in the collection of 3,691 beetle specimens which were grouped into 38 families and 192 morphospecies (Table 1). In total, 2,716 beetle specimens were found in the rainy season while in the dry season only 972 specimens were found. The largest number of specimens were found from the Staphylinidae (40.8% of the total), with 96.7% of them captured in the rainy season. Staphylinidae were found more from pitfall traps but still a large number was also found from window traps (31.6%). The second largest family found was the Scolytidae, accounting for 29.0% of the total. In terms of beetle families, seven families were found only in the rainy season, 10 families in the dry season and 21 families were found in both seasons. Similar number of specimens were found in the two different trap types,

i.e. 1,821 in the 12 window traps and 1,880 in the 36 pitfall traps. In terms of beetle families, 12 families were captured only in the window traps while only three families were exclusively found in the pitfall traps and 23 families were captured in both kind of traps. Regarding the two habitat types sampled, six families were found only in the teak plantation but 14 families in the secondary forest and 18 families were found in both habitats (Table 1).

DISCUSSION

During a preliminary assessment, mostly done to establish suitable trapping methods, Chouangthavy *et al.* (in press) already reported 22 coleopteran families from Phou Phanang National Biodiversity Conservation Area. In the present study, 38 beetle families are reported from the same area. Six families recorded by Chouangthavy *et al.* (2018) are not found in this study: F. Brentidae, F. Gyrinidae, F. Haliplidae, F. Lucanidae, F. Meloidae, and F. Passandridae. On the other hand, the following 21 families were not reported in the previous report: F. Anthribidae, F. Bruchidae, F. Scolytidae, F. Cerambycidae, F. Cicindelidae, F. Coccinellidae, F. Derodontidae, F. Hispididae, F. Latridiidae, F. Laemophloeidae, F. Lymexylidae, F. Monotomidae, F. Mycetophagidae, F. Phalacridae, F. Paussidae, F. Platypodidae, F. Salpingidae, F. Scirtidae, F. Silphidae, F. Silvanidae, and F. Rhysodidae. Up to date, a total of 44 coleopterous families were recorded in Phou Phanang National Biodiversity Conservation Area. These numbers are closer to the 64 coleopterous families that Hutacharern *et al.* (2007) and Ek-Amnuay (2008) have been reported from Thailand. This study identifies the found specimen only up to family level, so more in-depth efforts and assistance from taxonomists are needed for correct identification to genus and species level in the future. This will be an important starting point for a database of beetle diversity in Laos.

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Table 1. List of Coleopterous families in Phou Phanang National Biodiversity Conservation Area and number of morphospecies in each family based on seasons, habitats, and kind of traps.

Family	Dry season				Rainy season			
	Teak plantation		Disturbed natural forest		Teak plantation		Disturbed natural forest	
	Window	Pitfall	Window	Pitfall	Window	Pitfall	Window	Pitfall
Alleculidae	0	0	0	0	0	0	3	0
Anthribidae	0	2	0	3	1	0	1	0
Anthicidae	2	0	0	0	0	0	0	0
Bruchidae	0	0	3	2	0	0	0	0
Bostrichidae	10	7	25	8	9	3	13	5
Carabidae	2	0	1	0	27	0	31	0
Cerambycidae	2	2	0	0	3	0	0	0
Chysomelidae	0	2	3	5	11	5	0	0
Cicindelidae	0	0	0	0	10	4	12	3
Cleridae	0	0	6	1	0	0	2	0
Coccinellidae	0	0	0	0	0	0	3	0
Curculionidae	2	0	4	0	11	11	17	31
Dytiscidae	0	0	6	0	7	0	0	0
Derodontidae	1	0	0	0	0	0	0	0
Elateridae	0	2	3	4	15	1	2	1
Endomychidae	2	0	0	0	0	0	0	0
Hispidae	0	0	0	0	0	0	1	0
Histeridae	1	1	11	27	7	0	115	7
Latridiidae	2	33	2	22	0	1	0	1
Laemophloeidae	0	0	1	1	0	0	0	0
Lymexylidae	0	1	0	0	1	0	0	0
Lycidae	0	0	0	0	1	0	0	0
Mordellidae	0	0	0	0	0	0	0	4
Monotomidae	0	1	0	0	1	0	0	0
Mycetophagidae	0	0	0	2	0	0	0	0
Nitidulidae	8	4	5	7	2	10	8	13
Phalacridae	0	0	2	0	0	0	0	0
Paussidae	0	0	0	0	0	0	2	2
Platypodidae	8	25	32	33	29	3	40	15
Rhysodidae	0	0	0	0	0	0	3	0
Salpingidae	0	0	0	10	0	0	0	0
Scarabaeidae	0	0	1	3	52	30	54	50
Scirtidae	0	1	0	0	0	0	1	1
Scolytidae	57	46	261	158	150	109	210	81
Silphidae	0	1	11	0	5	2	4	4
Silvanidae	0	0	1	0	0	0	0	0
Staphylinidae	16	10	16	9	166	303	279	708
Tenebrionidae	3	3	2	36	0	0	0	0
Total = 38 Families	3,691 individuals							

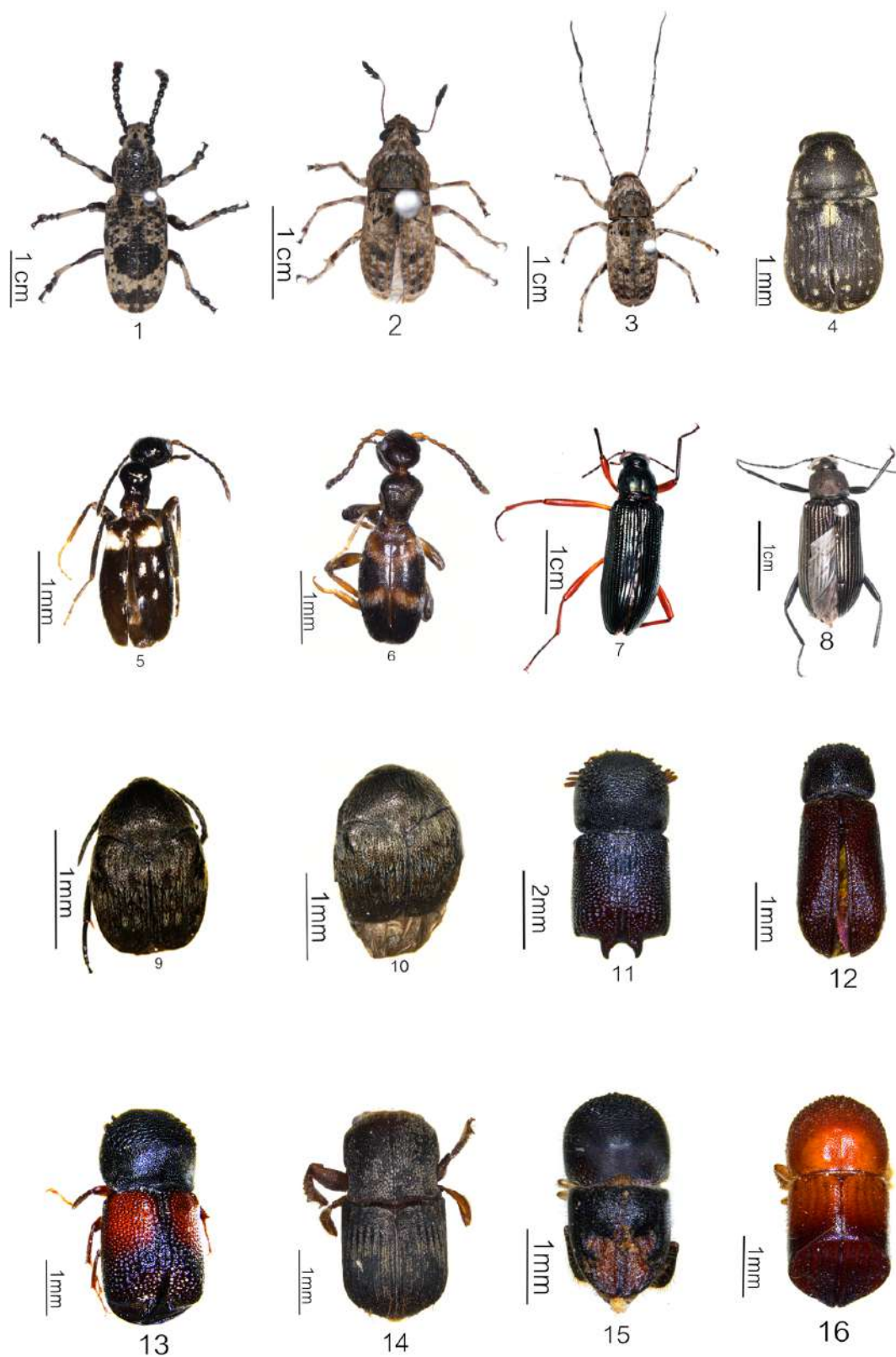


Figure 1-16. Adult of beetle families. 1–4 Anthribidae, 5–6 Anthicidae, 7–8 Alleculidae, 9–10 Bruchidae, 11–14 Bostrichidae and 15–16 Scolytidae.

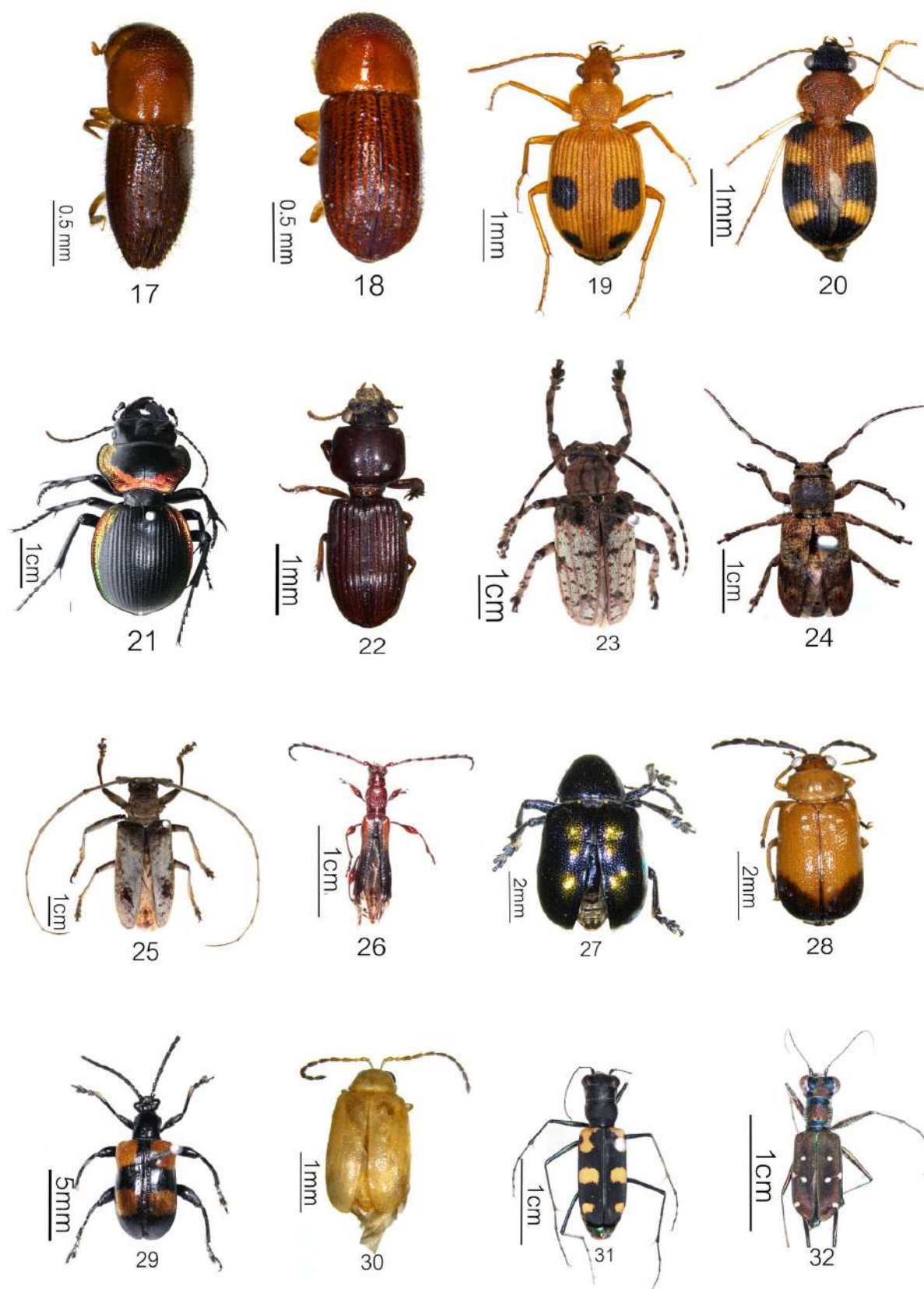


Figure 17-32. Adult of beetle families. 17–18 Scolytidae, 19–22 Carabidae, 23–26 Cerambycidae, 27–30 Chysomelidae and 31–32 Cicindelidae.

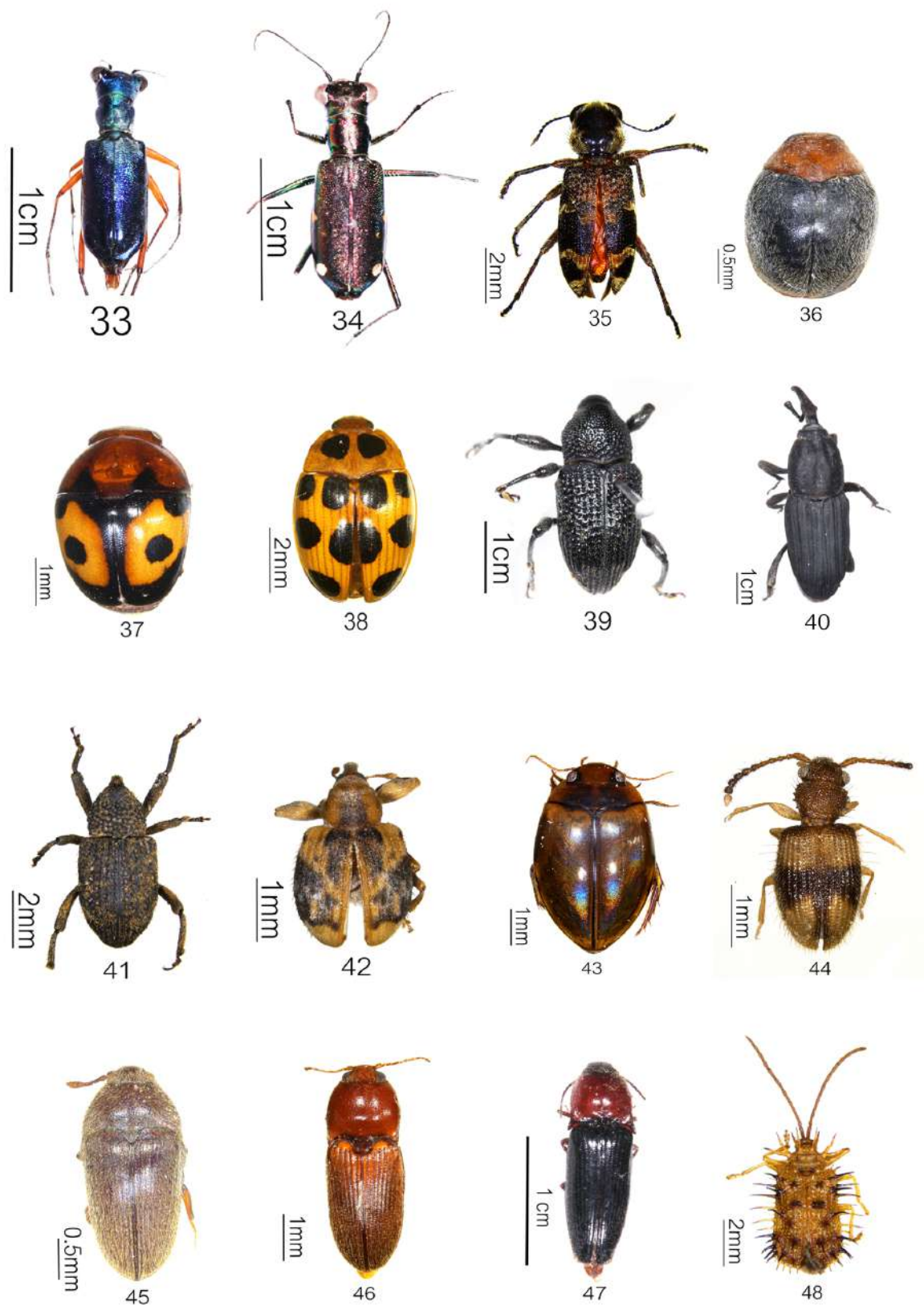


Figure 33-48. Adult of beetle families. 33-34 Cicindelidae, 35 Clelidae, 36-38 Coccinellidae, 39-42 Curculionidae, 43 Dytiscidae, 44 Derodontidae, 45-47 Elateridae and 48 Hispidae.

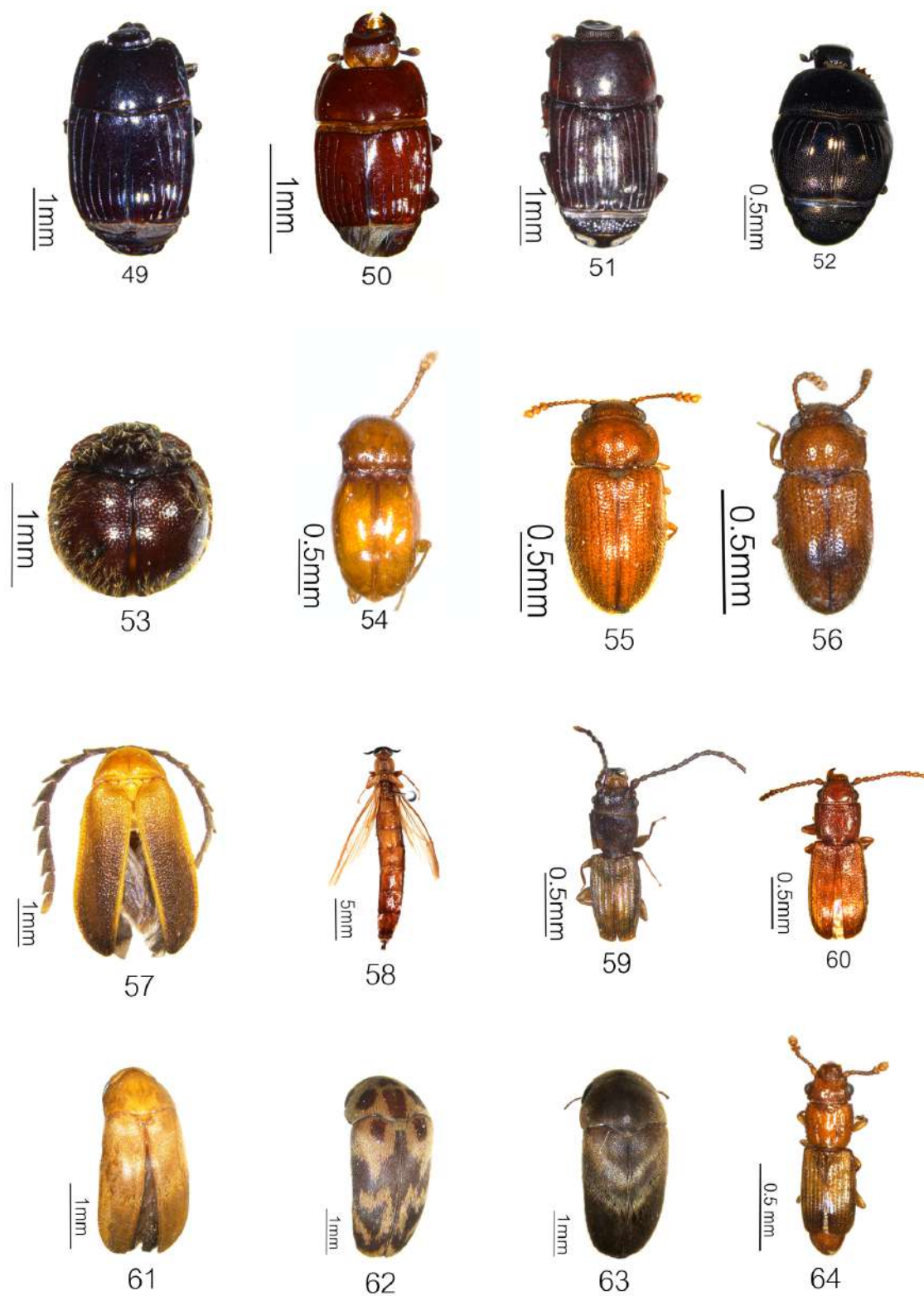


Figure 49-64. Adult of beetle families. 49–52 Histeridae, 53–54 Endomychidae, 55–56 Lathridiidae, 57 Lycidae, 58 Lymexylodidae, 59–60 Laemophloeidae, 61–63 Mordellidae and 64 Monotomidae.

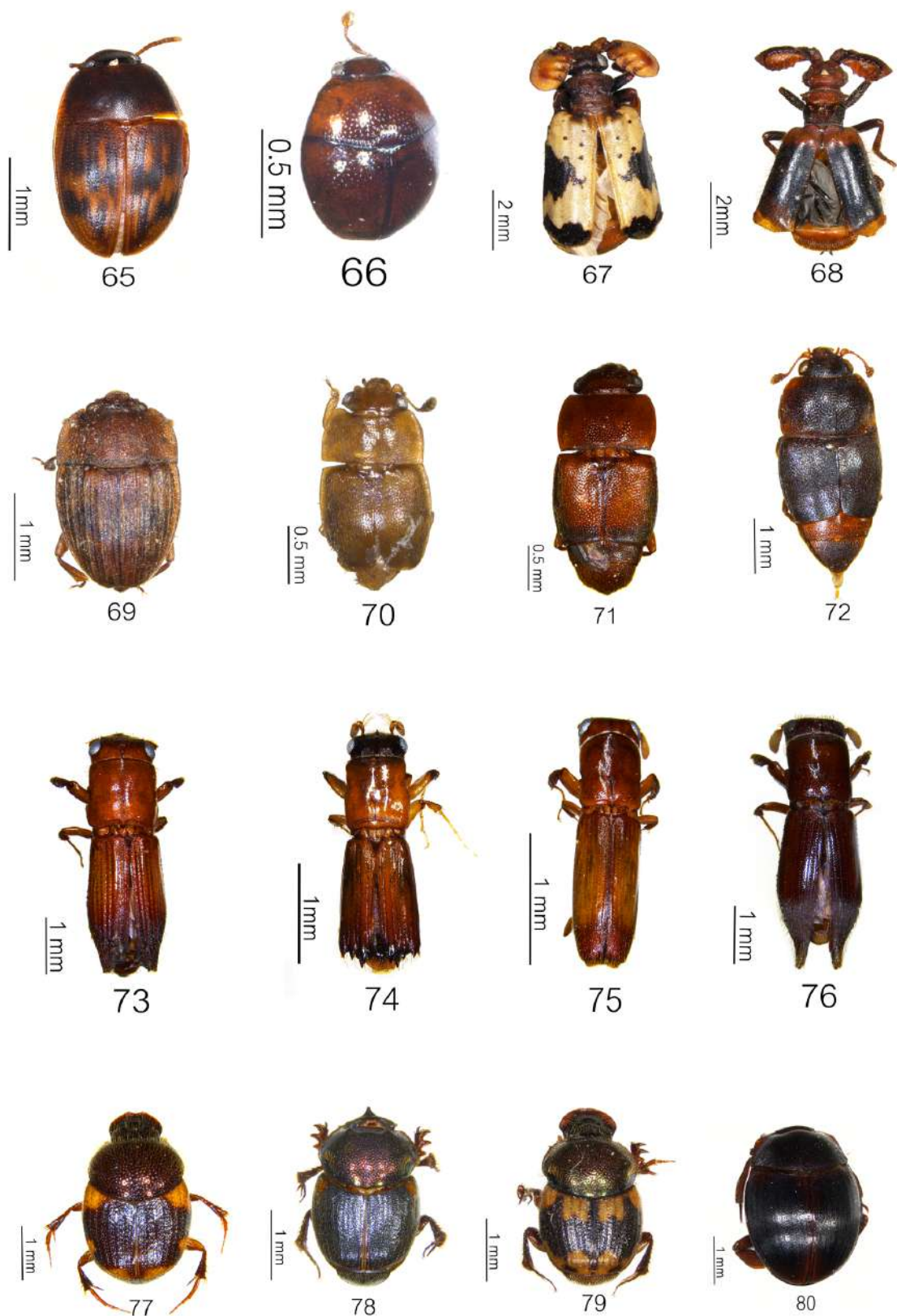


Figure 65-80. Adult of beetle families. 65 Mycetophagidae, 66 Phalaelidae, 67-68 Paussidae, 69-72 Nitidulidae, 73-76 Platypodidae and 77-80 Scarabaeidae.

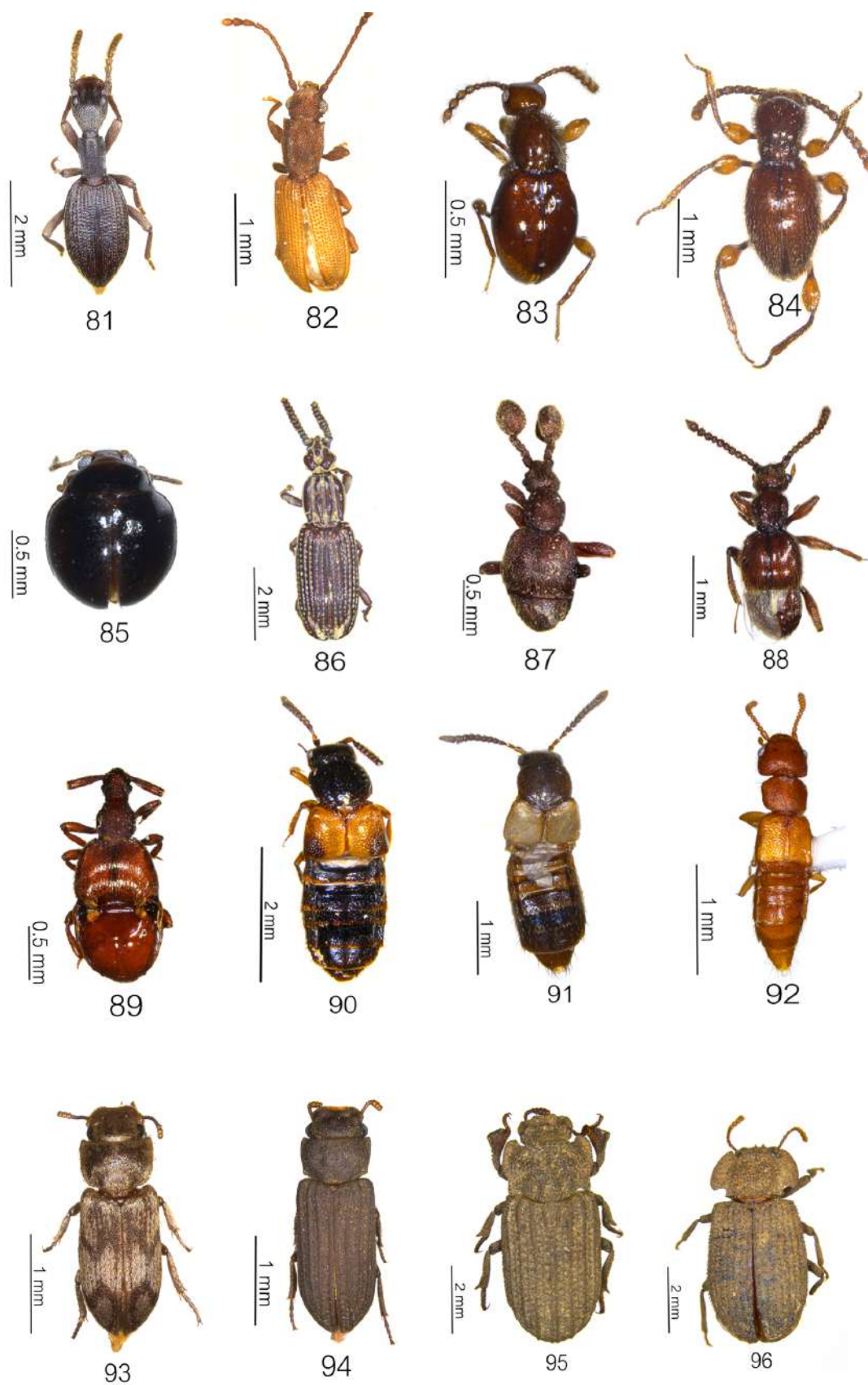


Figure 81-96. Adult of beetle families. 81 Salpingidae, 82 Silvanidae, 83–84 Silphidae, 85 Scirtidae, 86 Rhysodidae, 87–92 Staphylinidae and 93–96 Tenebrionidae.

REFERENCES

- Beaver, R.A. 2016. The Platypodine ambrosia beetles of Laos (Coleoptera: Curculionidae: Platypodinae). *Entomologica Basiliensia et Collectionis Frey* 35: 487–504.
- Chouangthavy, B., S. Souksavath, P. Phewphanh, S. Lathtanalasy, P. Sibounnavong and D. Babendreier. (in press). Preliminary assessment of beetle diversity in Phou Pha Nang National Biodiversity Conservation Area in Center of Lao PDR. *NUOL* 14(133) (in Laos).
- Ek-Amnuay, P. (2008). *Beetles of Thailand 2nd Edition*. Amarin Book Center Co. Ltd. Bangkok.
- Gressitt, J.L., J.A. Rondon and S. Breuning. 1970. *Pacific Insects Monograph 24: Cerambycid-beetles of Laos*. Entomology Department, Bernice P. Bishop Museum, Honolulu, Hawaii, USA.
- Hajek, J. 2008. A new species of Eulichas (Coleoptera: Eulichadidae) from Laos. *Acta Entomologica Musei Nationalis Pragae* 48(1): 67–72.
- Hutacharern, C., N. Tubtim and C. Dokmai. 2007. *Checklists of Insect and Mites in Thailand*. The Agricultural Co-operative Federation of Thailand, Ltd., Bangkok.
- Jach, M.A. 2002. First record of Epimetopidae in Laos (Coleoptera: Epimetopidae). *Koleopterogische Rundschau* 72: 161–164.
- Kral, D., M. Rakovic and L. Mencl. 2015. *Odontoxyomus denticypeatus*, a new genus and new species of Aphodiini from Laos (Coleoptera: Scarabaeidae: Aphodiinae). *Taxonomical Series* 11(1): 159–166.
- Lawrence, J.F. and E.B. Britton. 1991. *Coleoptera (Beetles)*. The Insect of Australia. Cornell University Press, New York.
- Messerli P., M. Heinimann, M. Epprecht, S. Phonesaly, C. Thiraka, N. Minot. (eds.) 2008. *Socio-Economic Atlas of the Lao PDR, an Analysis based on the 2005 Population and Housing Census*. Swiss National Center of Competence in Research (NCCR) North-South, University of Bern, Bern and Vientiane: Geographica Bernensia <http://www.laoatlas.net/links/PDF%20download.html>
- Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. Fonseca and J. Kent. 2000. *Biodiversity hot spots for conservation priority*. *Nature* 403: 853–858.
- Nagel, P. 2009. Flanged bombardier beetles from Laos (Carabidae, Paussinae). *Entomologica Basiliensia et Collectionis Frey* 31: 101–113.
- Neumann, C., M. Kon and K. Araya. 2013. Checklist of Passalidae Leach, 1815 (Coleoptera, Scarabaeoidea) of Laos with a key to their identification and a description of *Leptaulax pacholatkoii mutonistus* ssp. nov. *Entomologica Basiliensia et Collectionis Frey* 34: 207–235.
- Otto, R.L. 2016. The false click beetles (Coleoptera: Eucnemidae) of Laos. *Entomologica Basiliensia et Collectionis Frey* 35: 181–427.
- Sawada, H. and J. Wiesner. 2004. Enumeration of tiger beetles from Laos with description of three new species (Coleoptera: Cicindelidae). *Entomological Review of Japan* 59(2): 255–274.
- Sekerka, L. and M. Geiser. 2016. Sagrinae of Laos (Coleoptera: Chrysomelidae). *Entomologica Basiliensia et Collectionis Frey* 35: 443–453.
- Wiesner, J. 2013. Checklist of the tiger beetle genus *Calochroa* Hope, 1838 from Laos and a description of a new species (Coleoptera: Cicindelidae). *Entomologica Basiliensia et Collectionis Frey* 35: 47–51.
- Wiesner, J. and M. Geiser. 2013. Faunistic survey of the Tiger Beetles (Coleoptera, Carabidae, Cicindellidae) of Laos. *Entomologica Basiliensia et Collectionis Frey*: 35, 61–117.
- Yoshitomi, H. and K. Sogoh. 2018. A new record of *Stoheckeria quadrimaculata* (Coleoptera, Endomychidae, Lycoperdininae) from Laos. *Elytra, Tokyo, New Series* 8(2): 325–326.

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