



<http://dx.doi.org/10.11646/zootaxa.3754.4.8>

<http://zoobank.org/urn:lsid:zoobank.org:pub:8565D777-8F98-46D9-AA76-206FC0658899>

A checklist of the millipedes (Diplopoda) of Laos

NATDANAI LIKHITRAKARN¹, SERGEI I. GOLOVATCH² & SOMSAK PANHA^{1,3}

¹*Animal Systematics Research Unit, Department of Biology, Faculty of Science, Chulalongkorn University, Bangkok 10330, Thailand.
E-mail: kongerrrr@hotmail.com somsak.pan@chula.ac.th*

²*Institute for Problems of Ecology and Evolution, Russian Academy of Sciences, Leninsky pr. 33, Moscow 119071, Russia.
E-mail: sgolovatch@yandex.ru*

³*Corresponding author*

Abstract

At the present, the millipede fauna of Laos comprises only 34 species from 20 genera, 13 families and 7 orders. These counts certainly represent but a minor fraction of the country's real diversity of Diplopoda even at the ordinal level, let alone at lower ones. Based on the available information from the adjacent parts of China, Thailand, Myanmar, Vietnam and/or Cambodia, the orders Polyxenida, Sphaerotheriida, Chordeumatida, Julida and Polyzoniida must occur in Laos, may be also Glomeridesmida, Siphonocryptida and Stemmiulida, but none has been recorded there yet. Moreover, even some ubiquitous "tramp" species, such as *Glyphiulus granulatus* (Gervais, 1847), *Trigoniulus corallinus* (Gervais, 1847), *Desmoxytes planata* (Pocock, 1895) or *Oxidus gracilis* (C. L. Koch, 1847), have hitherto not been found in Laos. This shows that a lot more collecting efforts, which have heretofore been rather strongly biased to caves, are required to amass a representative material of Diplopoda of Laos and make it available for study.

Key words: millipede, taxonomy, fauna, Laos

Introduction

Laos is a rather small mountainous country in Indochina, Southeast Asia, bordering on Myanmar and China in the Northwest, on Vietnam in the East, on Cambodia in the South, and on Thailand in the West. In terms of biodiversity, Laos is one of the richest countries of the region, primarily because most of the national area still remains relatively intact and supports original tropical forest (STEA 2000). Woodlands in Laos support at least 10,000 species of mammals, reptiles, amphibians, birds, freshwater fish, swallowtail butterflies, and vascular plants. Taking into account the relative size of the countries of Indochina, Laos is subordinate in terms of species richness only to Cambodia, following Thailand, Myanmar and Vietnam in the rate of endemism (ADB 2000).

Millipedes (Diplopoda) in Laos have mainly been studied by Attems (1938, 1953), based on the collections managed by staff of the Paris Museum during the 1930's in French Indochina. These two papers still remain the cornerstones of our knowledge of the Myriapoda of Indochina east of Thailand. Compared to the other parts of the ex-colony, actually quite little came from present-day Laos. Progress in collecting and especially describing the diplopod diversity of Laos has since been very modest, again mainly achieved through the support received from the Paris Museum (Golovatch *et al.* 2006, 2007a, 2007b, 2009a, 2009b). As a result, at the present the fauna contains at least 34 species, some of which still require revision (*Platyrrhacus* sp. and *Sinocallipus* sp.) or a confirmed record (*Trigoniulus variabilis ecaudatus* Attems, 1953). Moreover, two species earlier reported from Laos have been eliminated from our list: (1) *Tylopus mutilatus* (Attems, 1953), which is actually endemic to Vietnam (Enghoff *et al.* 2004), but has erroneously been recorded in Laos (Likhitrakarn *et al.* 2010); (2) *Thyropygus allevatus* (Karsch, 1881), which is said to be widespread across Thailand, Vietnam, Laos, Cambodia and continental Malaysia (Enghoff 2005), but its record in Laos is actually dubious (Hoffman 1975).

Unlike the faunas of the adjacent Thailand (Enghoff 2005) and Vietnam (Enghoff *et al.* 2004), no comprehensive checklist of the Diplopoda of Laos has been attempted. To promote further studies on the

All this shows that a lot more collecting efforts, which have heretofore been rather strongly biased to caves, are required to amass a truly representative material of the Diplopoda of Laos and to make it available for study. At the moment we may roughly estimate the Laotian millipede richness at least at 130 species, i.e. quite comparable to what has hitherto been documented from Thailand or Vietnam (Enghoff *et al.* 2004; Enghoff 2005). The degree of endemism is therefore expected to be very high, as in Vietnam reaching at least 90% at the species level, as opposed to only about 80% recorded in Thailand.

Acknowledgements

This project was partly funded by Chulalongkorn University Graduate School Postdoctoral Project to NL, while most of the financial support was received from The Thailand Research Fund, The TRF Senior Research Scholar RTA 5580001 (2012–2015) to SP. We thank the members of Animal Systematics Research Unit for the assistance in the field.

References

- ADB (2000) *Environments in transition: Cambodia, Lao PDR, Thailand, Vietnam*. Asian Development Bank, Manila, 144 pp.
- Attems, C. (1937) Myriapoda 3. Polydesmoidea I. Fam. Strongylosomidae. *Das Tierreich*, 68, i–xxii + 1–300.
- Attems, C. (1938) Die von Dr. C. Dawydoff in Französisch Indochina gesammelten Myriopoden. *Mémoires du Muséum national d'Histoire naturelle*, N. S., 6 (2), 187–353.
- Attems, C. (1953) Myriopoden von Indochina. Expedition von Dr. C. Dawydoff (1938–1939). *Mémoires du Muséum national d'Histoire naturelle*, N. S., série A, 5 (3), 133–230.
- Butler, A.G. (1876) Preliminary notice of new species of Arachnida and Myriapod from Rodriguez. *Annals and Magazine of Natural History*, ser. 4, 17, 497–509.
- Demange, J.-M. (1961) Matériaux pour servir à une révision des Harpagophoridae (Myriapodes-Diplopedes). *Mémoires du Muséum nationale d'histoire naturelle*, N. S., série A, 24, 1–274.
- De Saussure, H. (1860) Essai d'une faune de Myriapodes du Mexique, avec la description de quelques espèces des autres parties de l'Amérique. *Mémoires de la Société de Physique et d'Histoire Naturelle de Genève*, 15, 259–394.
- Enghoff, H. (2005) The millipedes of Thailand (Diplopoda). *Steenstrupia*, 29(1), 87–103.
- Enghoff, H., Golovatch, S.I. & Nguyen Duc, A. (2004) A review of the millipede fauna of Vietnam (Diplopoda). *Arthropoda Selecta*, 13 (1–2), 29–43.
- Golovatch, S.I. (1984) Contributions to the millipede fauna of Vietnam (Diplopoda) II. *Acta Zoologica Hungarica*, 30 (1–2), 53–77.
- Golovatch, S.I. (1987) Diplopoda from the Nepal Himalayas: Glomeridae, additional Opisetretidae. *Courier Forschungsinstitut Senckenberg*, 93, 219–228.
- Golovatch, S.I. (1998) On several new or poorly-known Oriental Paradoxosomatidae (Diplopoda Polydesmida), VI. *Arthropoda Selecta*, 6 (3–4), 35–46. [for 1997]
- Golovatch, S.I. & Enghoff, H. (1993) Review of the millipede genus *Tylopus*, with descriptions of new species from Thailand (Diplopoda, Polydesmida, Paradoxosomatidae). *Steenstrupia*, 19 (3), 85–125.
- Golovatch, S.I. & Nguyen Duc, A. (2007) Two new species of the millipede genus *Platyrhacus* C. L. Koch, 1847 from Vietnam (Diplopoda: Polydesmida: Platyrhacidae). *Arthropoda Selecta*, 15 (3), 215–224. [for 2006]
- Golovatch, S.I., Geoffroy, J.-J. & Mauriès, J.-P. (2006) Review of the millipede genus *Hyleoglomeris* Verhoeff, 1910 (Diplopoda, Glomerida, Glomeridae), with descriptions of new species from caves in Southeast Asia. *Zoosystema*, 28 (4), 887–915.
<http://dx.doi.org/10.3897/bdj.1.e1000>
- Golovatch, S.I., Geoffroy J.-J. & VandenSpiegel, D. (2013) On several new species of the millipede family Glomeridae from Vietnam (Diplopoda: Glomerida). *Arthropoda Selecta*, 22 (3), 201–206.
- Golovatch, S.I., Geoffroy, J.J., Mauriès, J.P. & VandenSpiegel, D. (2007a) Review of the millipede genus *Glyphiulus* Gervais, 1847, with descriptions of new species from Southeast Asia (Diplopoda, Spirostreptida, Cambalopsidae). Part 1: the *granulatus*-group. *Zoosystema*, 29 (1), 7–49.
<http://dx.doi.org/10.5252/z2009n1a5>
- Golovatch, S.I., Geoffroy, J.-J., Mauriès, J.-P. & VandenSpiegel, D. (2007b) Review of the millipede genus *Glyphiulus* Gervais, 1847, with descriptions of new species from Southeast Asia (Diplopoda, Spirostreptida, Cambalopsidae). Part 2: the *javanicus*-group. *Zoosystema*, 29 (3), 417–456.
<http://dx.doi.org/10.5252/z2009n1a5>

- Golovatch, S.I., Geoffroy, J.-J., Mauriès, J.-P. & VandenSpiegel, D. (2009a) Review of the millipede genus *Plusioglyphiulus* Silvestri, 1923, with descriptions of new species from Southeast Asia (Diplopoda, Spirostreptida, Cambalopsidae). *Zoosystema*, 31 (1), 71–116.
<http://dx.doi.org/10.5252/z2009n1a5>
- Golovatch, S. I., Geoffroy, J.-J., Mauriès, J.-P. & VandenSpiegel, D. (2009b) Review of the millipede genus *Eutrichodesmus* Silvestri, 1910 (Diplopoda, Polydesmida, Haplodesmidae), with descriptions of new species. In: Golovatch, S. I. & Mesibov, R. (Eds.), *Advances in the systematics of Diplopoda II*. *ZooKeys*, 12, 1–46.
<http://dx.doi.org/10.3897/zookeys.12.167>
- Golovatch, S.I., Geoffroy, J.-J., Mauriès, J.-P. & VandenSpiegel, D. (2011) The millipede genus *Plusioglyphiulus* Silvestri, 1923 in Thailand (Diplopoda, Spirostreptida, Cambalopsidae). *Zootaxa*, 2940, 1–63.
- Hoffman, R.L. (1975) Studies on spirostreptoid millipedes. XI. A review of some Indonesian genera of the family Harpagophoridae. *Journal of Natural History*, 9, 121–152.
<http://dx.doi.org/10.1080/00222937500770101>
- Jeekel, C.A.W. (1964) A new species of *Orthomorpha* Bollman from Thailand observed in migration, with taxonomic notes on the genus (Diplopoda). *Tijdschrift voor Entomologie*, 107, 355–364.
- Jeekel, C.A.W. (1965) A revision of the Burmese Paradoxosomatidae (Diplopoda, Polydesmida) in the Museo Civico di Storia Naturale at Genoa (Part I). *Tijdschrift voor Entomologie*, 108, 95–144.
- Jeekel, C.A.W. (1968) *On the classification and geographical distribution of the family Paradoxosomatidae (Diplopoda, Polydesmida)*. Academisch Proefschrift, Rotterdam, 162 pp.
- Jeekel, C.A.W. (2001a) A bibliographic catalogue of the Siphonophorida (Diplopoda). *Myriapod. Memoranda*, 3, 44–71.
- Jeekel, C.A.W. (2001b) A bibliographic catalogue of the Spirobolida of the Oriental and Australian regions (Diplopoda). *Myriapod Memoranda*, 4, 5–104.
- Jeekel, C.A.W. (2006) A bibliographic catalogue of the Oriental Harpagophoridae (Diplopoda, Spirostreptida). *Myriapod Memoranda*, 9, 5–58.
- Likhitrakarn, N., Golovatch, S.I., Prateepasen, R. & Panha, S. (2010) Review of the genus *Tylopus* Jeekel, 1968, with descriptions of five new species from Thailand (Diplopoda, Polydesmida, Paradoxosomatidae). *ZooKeys*, 72, 23–68.
<http://dx.doi.org/10.3897/zookeys.72.744>
- Likhitrakarn, N., Golovatch, S.I. & Panha, S. (2011) Revision of the Southeast Asian millipede genus *Orthomorpha* Bollman, 1893, with the proposal of a new genus (Diplopoda, Polydesmida, Paradoxosomatidae). *ZooKeys*, 131, 1–161.
<http://dx.doi.org/10.3897/zookeys.131.1921>
- Nguyen Duc, A. & Korsós, Z. (2011) A revision of the millipede genus *Riukiupeltis* Verhoeff, 1939 (Diplopoda, Polydesmida, Paradoxosomatidae), with comments on the status of related species. In: Mesibov, R. & Short, M. (Eds.), *Proceedings of the 15th International Congress of Myriapodology*, 18–22 July 2011, Brisbane, Australia. *ZooKeys* 156, 25–40.
<http://dx.doi.org/10.3897/zookeys.156.2009>
- Pimvichai, P., Enghoff, H. & Panha, S. (2010) The Rhynchoproctinae, a southeast Asiatic subfamily of giant millipedes: cladistic analysis, classification, four new genera and a deviating new species from NW Thailand (Diplopoda: Spirostreptida: Harpagophoridae). *Invertebrate Systematics*, 24, 51–80.
<http://dx.doi.org/10.1071/is09052>
- Pimvichai, P., Enghoff, H. & Panha, S. (2011) A revision of the *Thyropygus allevatus* group. Part 3: the *T. induratus* subgroup (Diplopoda: Spirostreptida: Harpagophoridae). *Zootaxa*, 2941, 47–68.
- Shear, W.A., Shelley, R.M. & Heatwole, H. (2003) Occurrence of the millipede *Sinocallipus simplipodicus* Zhang, 1993 in Laos, with reviews of the Southeast Asian and global callipodidan faunas, and remarks on the phylogenetic position of the order (Callipodida: Sinocallipodidae: Sinocallipodidae). *Zootaxa*, 365, 1–20.
- Shelley, R.M. (2011) The millipede order Glomeridesmida (Diplopoda: Pentazonia: Limacomorpha) in Oceania, the East Indies, and southeastern Asia; first records from Palau, the Philippines, Vanuatu, New Britain, the Island of New Guinea, Cambodia, Thailand, and Borneo and Sulawesi, Indonesia. *Insecta Mundi*, 0196, 1–11.
- Shelley, R.M. & Golovatch, S.I. (2011) Atlas of myriapod biogeography. I. Indigenous ordinal and supra-ordinal distributions in the Diplopoda: Perspectives on taxon origins and ages, and a hypothesis on the origin and early evolution of the class. *Insecta Mundi*, 0158, 1–134.
- Silvestri, F. (1917) Contributions to a knowledge of the Oriental Diplopoda Oniscomorpha. 1. The family Glomeridae. *Records of the Indian Museum*, 13, 103–151.
- STEA (2000) *National Environmental Action Plan 2000*, Science Technology and Environment Agency, Lao PDR.
- Stoev, P. & Enghoff, H. (2011) A review of the millipede genus *Sinocallipus* Zhang, 1993 (Diplopoda, Callipodida, Sinocallipodidae), with notes on gonopods monotony vs. peripheral diversity in millipedes. *ZooKeys*, 90, 13–34.
<http://dx.doi.org/10.3897/zookeys.90.1291>
- Zhang, C. (1993) Diplopoda from Yunnan caves II. Contribution to the study of a new cavernous taxon of the nematophoran millipedes (Diplopoda: Coelocheta: Callipodida). *Proceedings of the XI International Congress of Speleology*, 1993, 128–130.