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A checklist of the millipedes (Diplopoda) of Laos

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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

millipedes of that country, as well as to pinpoint the existing shortcomings, the following catalogue is provided. A complete bibliography list relevant to the Laotian fauna is also compiled.

Material and methods

The present paper is a conventional checklist restricted to the Diplopoda documented from Laos. In the catalogue sections, D stand for the original description, subsequent descriptive notes or appearance in a key, R for a subsequent record or records, N for giving a new name, and M for a mere mention. A reference to the original description is always given, regardless if this concerns the fauna of Laos or not.

The French locality names quoted in Attems (1938, 1953) can be updated in the following tabular form:

Xieng Kuang = Xiang Khouang Province, Xieng Khouang
Plateau de Boloven = Champasak Province, Bolaven Plateau
Paklay = Sainyabuli Province, Paklay
Savanna Khet = Savannakhet Province, Savannakhet
Luang Prabang = Luang Prabang Province, Luang Prabang

Systematic part

Order Glomerida

Family Glomeridae

Genus *Hyleoglomeris* Verhoeff, 1910

1. *Hyleoglomeris "electa" (Silvestri, 1917)*

Non *Apiomeris* (*Hyleoglomeris*) *electa* Silvestri, 1917: 119 (D).

Hyleoglomeris electa—Attems, 1953: 158 (R); Golovatch *et al.*, 2006: 890 (D).

Records from Laos: Champasak Province, Bolaven Plateau; Xiang Khouang Province, Xieng Khouang (Attems 1953).

Remarks. Initially, this species was described from the female holotype taken at Ghumti, Darjeeling District, India (Silvestri 1917), later redescribed from both sexes and recorded in Vietnam: Lam Dong, Dalat, Langbian Mountain, 2,300–2,400 m asl. (Attems 1938), also reported from Laos (Attems 1953). Hardly surprisingly, there are serious doubts as regards the conspecificity of material of *H. electa* from the Himalayas and Indochina (Golovatch 1987; Golovatch *et al.* 2006), the latter species in the sense of Attems (1938) likely being just a junior synonym of *H. robusta* Attems, 1938 (Golovatch *et al.* 2013). Therefore quotation marks are applied.

2. *Hyleoglomeris pulchra* Attems, 1953

Hyleoglomeris pulchra Attems, 1953: 157 (D).

Hyleoglomeris pulchra—Golovatch *et al.*, 2006: 891 (D).

Record from Laos: Sainyabuli Province, Paklay (Attems 1953). Endemic to Laos.

3. *Hyleoglomeris sulcostriata* Golovatch, Geoffroy & Mauriès, 2006

Hyleoglomeris sulcostriata Golovatch, Geoffroy & Mauriès, 2006: 902 (D).

Records from Laos: Vientiane Province, Vang Vieng, Tham Non, cave; Khammouan Province, Ban Vien, Tham Houai Sai, sink cave; same Province, Ban Nam Non, Nam Non, cave (Golovatch *et al.* 2006). Endemic to Laos, likely a troglobite.

4. *Hyleoglomeris differens* Golovatch, Geoffroy & Mauriès, 2006

Hyleoglomeris differens Golovatch, Geoffroy & Mauriès, 2006: 904 (D).

Record from Laos: Khammouan Province, Ban Thongkha, Tham Non, cave (Golovatch *et al.* 2006). Endemic to Laos, likely a troglophile.

Order **Platydesmida**

Family **Andrognathidae**

Genus ***Pseudodesmus* Pocock, 1887**

5. *Pseudodesmus camptotrichus* (Attems, 1938)

Sumatronium camptotrichum Attems, 1938: 303 (D).

Sumatronium camptotricheum—Attems, 1953: 198 (R) (lapsus).

Records from Laos: Sainyabuli Province, Paklay; Luang Prabang Province, Luang Prabang (Attems 1953).

Also known from Vietnam (Attems 1938, 1953).

6. *Pseudodesmus persimilis* (Attems, 1953).

Sumatronium persimile Attems, 1953: 197 (D).

Records from Laos: Sainyabuli Province, Paklay; Luang Prabang Province, Luang Prabang (Attems 1953)

Endemic to Laos.

7. *Pseudodesmus variegatus* (Attems, 1938)

Sumatronium variegatum Attems, 1938: 308 (D).

Sumatronium variegatum—Attems, 1953: 198 (R).

Record from Laos: Xiang Khouang Province, Xiang Khouang (Attems 1953).

Also known from Vietnam (Attems 1938, 1953).

Order **Siphonophorida**

Family **Siphonophoridae**

Genus ***Siphonacme* Cook & Loomis, 1928**

8. *Siphonacme dawydoffi* (Attems, 1938)

Siphonophora dawydoffi Attems, 1938: 311 (D).

Siphonacme dawydoffi—Attems, 1953: 198 (R); Jeekel, 2001a: 53 (R).

Records from Laos: Xiang Khouang Province, Xieng Khouang; Luang Prabang Province, Luang Prabang (Attems 1953).

Also known from Vietnam and Cambodia (Attems 1938, 1953).

Family **Siphonorhinidae**

Genus ***Siphonorhinus* Pocock, 1894**

9. *Siphonorhinus robustus* (Attems, 1938)

Teratognathus robustus Attems, 1938: 299 (D).

Teratognathus robusta—Attems, 1953: 198 (R) (lapsus).

Siphonorhinus robustus—Jeekel, 2001a: 47 (R).

Record from Laos: Xiang Khouang Province, Xieng Khouang (Attems 1953).

Also known from Vietnam (Attems 1938, 1953).

Order **Spirobolida**

Family **Pseudospirobolellidae**

Genus ***Pseudospirobolellus* Carl, 1912**

10. *Pseudospirobolellus avernus* (Butler, 1876)

Spirostreptus averus Butler, 1876: 498 (D).

Pseudospirobolellus bulbiferus—Attems, 1953: 184 (R).

Pseudospirobolellus avernus—Jeekel, 2001b: 45 (R).

Record from Laos: Xiang Khouang Province, Xieng Khouang (Attems 1953).
A pantropical anthropochore (Jeekel 2001b).

Family **Trigoniulidae**

Genus ***Trigoniulus* Pocock, 1894**

11a. ***Trigoniulus variabilis variabilis* Attems, 1953**

Trigoniulus variabilis Attems, 1953: 190 (D).

Trigoniulus variabilis—Jeekel, 2001b: 80 (R).

Record from Laos: Xiang Khouang Province, Xieng Khouang (Attems 1953). Endemic to Laos.

11b. ***Trigoniulus variabilis ecaudatus* Attems, 1953**

Trigoniulus variabilis ecaudatus Attems, 1953: 191 (D).

Trigoniulus variabilis ecaudatus—Jeekel, 2001b: 80 (R).

?Laos (Attems 1953). No type locality has been mentioned.

Order **Spirostreptida**

Family **Harpagophoridae**

Genus ***Anurostreptus* Attems, 1914**

12. ***Anurostreptus longisipinus* Demange, 1961**

Anurostreptus longisipinus Demange, 1961: 252 (D).

Anurostreptus longisipinus—Jeekel, 2006: 45 (R); Pimvichai *et al.*, 2010: 62 (M).

Recorded from “Laos” without any further information (Demange 1961).

Also found in Thailand (Demange 1961).

Genus ***Thyropygus* Pocock, 1894**

13. ***Thyropygus resimus* Attems, 1938**

Thyropygus resimus Attems, 1938: 283 (D).

Thyropygus allevatus resimus—Jeekel, 2006: 13 (R).

Thyropygus resimus—Pimvichai *et al.*, 2011: 53 (D).

Records from Laos: Savannakhet Province, Savannakhet (Attems, 1938); Vientiane Province, Houayang National Park; Champasak Province, Bolaven Plateau, Muang Paxong, Ban Thongvay; Salavan Province, 20 km east of Ban Nong Bua (Pimvichai *et al.* 2011).

Also known from Thailand, Cambodia and Myanmar (Demange 1961; Pimvichai *et al.* 2011).

Genus ***Balustreptus* Hoffman, 1980**

14. ***Balustreptus falcatus* (Attems, 1938)**

Rhynchoproctus falcatus Attems, 1938: 290 (D).

Balustreptus falcatus—Jeekel, 2006: 43 (R); Pimvichai *et al.*, 2010: 64 (R).

Record from Laos: Savannakhet Province, Savannakhet (Attems 1938). Endemic to Laos.

Family **Cambalopsidae**

Genus ***Glyphiulus* Gervais, 1847**

15. ***Glyphiulus bedosae* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2007**

Glyphiulus bedosae Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2007a: 30 (D).

Record from Laos: Luang Prabang Province, Nong Kiaw (Muang Ngoy), Tham Pha Kouang Cave (Golovatch *et al.* 2007a). Endemic to Laos, a troglophile at most.

16. *Glyphiulus costulifer* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2007

Glyphiulus costulifer Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2007b: 436 (D).

Record from Laos: Luang Prabang Province, Nong Kiaw (Muang Ngoy), Tham Pha Kouang Cave (Golovatch *et al.* 2007b). Endemic to Laos, a troglophile at most.

17. *Glyphiulus subcostulifer* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2007

Glyphiulus subcostulifer Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2007b: 439 (D).

Record from Laos: Vientiane Province, Vang Vieng, Tham None, cave (Golovatch *et al.* 2007b). Endemic to Laos, a troglophile at most.

18. *Glyphiulus percostulifer* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2007

Glyphiulus percostulifer Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2007b: 441 (D).

Record from Laos: Khammouan Province, Ban Nakok (Nakhok), Tham Thê, cave (Golovatch *et al.* 2007b). Endemic to Laos, probably troglobitic.

Genus ***Plusioglyphiulus* Silvestri, 1923**

19. *Plusioglyphiulus foveatus* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009

Plusioglyphiulus foveatus Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009a: 83 (D).

Plusioglyphiulus foveatus—Golovatch *et al.*, 2011: 4 (D).

Record from Laos: Luang Prabang Province, west of Tham, 19.88°N, 102.14°E (Golovatch *et al.* 2009a). Endemic to Laos.

20. *Plusioglyphiulus steineri* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009

Plusioglyphiulus steineri Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009a: 88 (D).

Plusioglyphiulus steineri—Golovatch *et al.*, 2011: 4 (D).

Record from Laos: Khammouan Province, Gnommalat, Cave Tham Kamuk (Golovatch *et al.* 2009a). Endemic to Laos, a troglophile at most.

21. *Plusioglyphiulus deharvengi* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009

Plusioglyphiulus deharvengi Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009a: 93 (D).

Plusioglyphiulus deharvengi—Golovatch *et al.*, 2011: 4 (D).

Record from Laos: Luang Prabang Province, Xieng Maen, Cave Vat Tham (Golovatch *et al.* 2009a). Endemic to Laos, a troglophile at most.

Order **Callipodida**

Family **Sinocallipodidae**

Genus ***Sinocallipus* Zhang, 1993**

22. *Sinocallipus jaegeri* Stoev & Enghoff, 2011

Sinocallipus jaegeri Stoev & Enghoff, 2011: 20 (D).

Records from Laos: Khammouan Province, 9.5 km northeast of Thakek; Thakek area, inside and near Cave Ban Tham (Stoev & Enghoff 2011). Endemic to Laos, a troglophile at most.

23. *Sinocallipus steineri* Stoev & Enghoff, 2011

Sinocallipus steineri Stoev & Enghoff, 2011: 24 (D).

Records from Laos: Luang Prabang Province, Ponsai District, Ben Nambo (Thapo) Village, Cave Tham Gia (Bat cave) (Stoev & Enghoff 2011). Endemic to Laos, a troglophile at most.

24. *Sinocallipus* sp.

Non *Sinocallipus simplipodicus* Zhang, 1993: 129 (D).

Sinocallipus simplipodicus—Shear *et al.*, 2003: 5 (D) (wrong identification).

Sinocallipus incertae sedis—Stoev & Enghoff, 2011: 27 (R).

Record from Laos: Champasak Province, Bolaven Plateau (Shear *et al.* 2003). According to Stoev & Enghoff (2011), this species from Laos requires revision, being based on a single female.

Order **Polydesmida**

Family **Paradoxosomatidae**

Genus ***Orthomorpha* Bollman, 1893**

25. *Orthomorpha coarctata* (De Saussure, 1860)

Polydesmus coarctatus De Saussure, 1860: 297 (D).

Orthomorpha coarctata—Attems, 1953: 179 (R).

Record from Laos: Sainyabuli Province, Paklay (Attems 1953).

A pantropical anthropochore (e.g. Likhitrakarn *et al.* 2011).

26. *Orthomorpha scabra* Jeekel, 1964

Pratinus granosus Attems, 1953: 166 (D).

Orthomorpha scabra Jeekel, 1964: 361 (N, D).

Orthomorpha scabra—Jeekel, 1968: 56 (M); Golovatch, 1998: 42 (M, D); Likhitrakarn *et al.* 2011: 58 (D).

Records from Laos: Luang Prabang Province, Luang Prabang; Xiang Khouang Province, Xieng Khouang (Attems 1953).

Also known from Vietnam (Attems 1953).

27. *Orthomorpha rotundicollis* (Attems, 1937)

Pratinus rotundicollis Attems, 1937: 118 (D).

Pratinus tuberculatus Attems, 1937: 119 (D).

Pratinus rotundicollis—Attems, 1953: 179 (R).

Orthomorpha rotundicollis—Jeekel, 1964: 361 (M, D); 1968: 56 (M); Golovatch, 1998: 42 (M, D); Likhitrakarn *et al.*, 2011: 61 (D).

Orthomorpha tuberculata—Jeekel, 1964: 361 (M, D); 1968: 56 (M); Golovatch, 1998: 42 (M, D).

Record from Laos: Xiang Khouang Province, Xieng Khouang (Attems 1953).

Also known from Vietnam (Attems 1937, 1938, 1953).

Genus ***Piccola* Attems, 1953**

28. *Piccola corrugata* (Attems, 1953)

Orthomorpha (Orthomorpha) corrugata Attems, 1953: 161 (D).

Piccola corrugata—Jeekel, 1968: 56 (M).

Record from Laos: Champasak Province, Bolaven Plateau (Attems 1953). Endemic to Laos.

Genus ***Orthomorphoides* Likhitrakarn, Golovatch & Panha, 2011**

29. *Orthomorphoides exaratus* (Attems, 1953)

Pratinus exaratus Attems, 1953: 167 (D).

Orthomorphoides exaratus—Likhitrakarn *et al.*, 2011: 144 (M).

Record from Laos: Xiang Khouang Province, Xieng Khouang (Attems 1953). Endemic to Laos.

Genus ***Simplogonomorpha* Nguyen Duc & Korsós, 2011**

30. *Simplogonomorpha falcata* (Attems, 1953)

Haplogonosoma falcatum Attems, 1953: 177 (D).

Riukiupeltis falcatus—Jeekel, 1968: 62 (M).

Simplogonomorpha falcata—Nguyen Duc & Korsós, 2011: 33 (D).

Record from Laos: Xiang Khouang Province, Xieng Khouang, 1,500 m (Attems 1953).
Also known from Vietnam (Nguyen Duc & Korsós 2011).

Genus *Tylopus* Jeekel, 1968

31. *Tylopus nodulipes* (Attems, 1953)

Agnesia nodulipes Attems, 1953: 174 (D).

Agnesia nodulipes—Jeekel, 1965: 98 (M, D).

Tylopus nodulipes—Jeekel, 1968: 60 (M); Golovatch, 1984: 69 (D); Golovatch & Enghoff, 1993: 92 (D);

Likhitrakarn *et al.*, 2010: 25 (R, D).

Record from Laos: Luang Prabang Province, Luang Prabang (Attems 1953).

Also known from Vietnam (Attems 1953).

Family **Cryptodesmidae**

Genus *Niponia* Verhoeff, 1931

32. *Niponia kometis* (Attems, 1938)

Niponielle kometis Attems, 1938: 244 (D).

Onomatoplanus kometis—Attems, 1953: 179 (R).

Niponia kometis—Enghoff *et al.*, 2004: 41 (R).

Records from Laos: Xiang Khouang Province, Xieng Khouang; Luang Prabang Province, Luang Prabang;

Sainyabuli Province, Paklay; Champasak Province, Bolaven Plateau (Attems 1953).

Also known from Vietnam (Attems 1953; Enghoff *et al.* 2004).

Family **Platyrhacidae**

Genus *Platyrhacus* C. L. Koch, 1847

33. *Platyrhacus* sp.

Non *Platyrhacus marginellus* Silvestri, 1895: 31 (D).

Nec *Platyrhacus marginellus*—Attems, 1938: 241 (D); Attems, 1953: 179 (R).

Platyrhacus sp.—Golovatch & Nguyen Duc, 2007: 221 (D).

Record from Laos: Xiang Khouang Province, Xieng Khouang (Attems 1953). According to Golovatch & Nguyen Duc (2007), on geographical grounds alone, this species may prove to be *P. borealis* Golovatch & Nguyen Duc, 2007, which currently is known only from Vietnam. However, its identity still remains to be verified, based on pertinent material. Probably this species occurs also in Vietnam (Attems, 1938, 1953; Golovatch & Nguyen Duc 2007).

Family **Haplodesmidae**

Genus *Eutrichodesmus* Silvestri, 1910

34. *Eutrichodesmus multilobatus* Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009

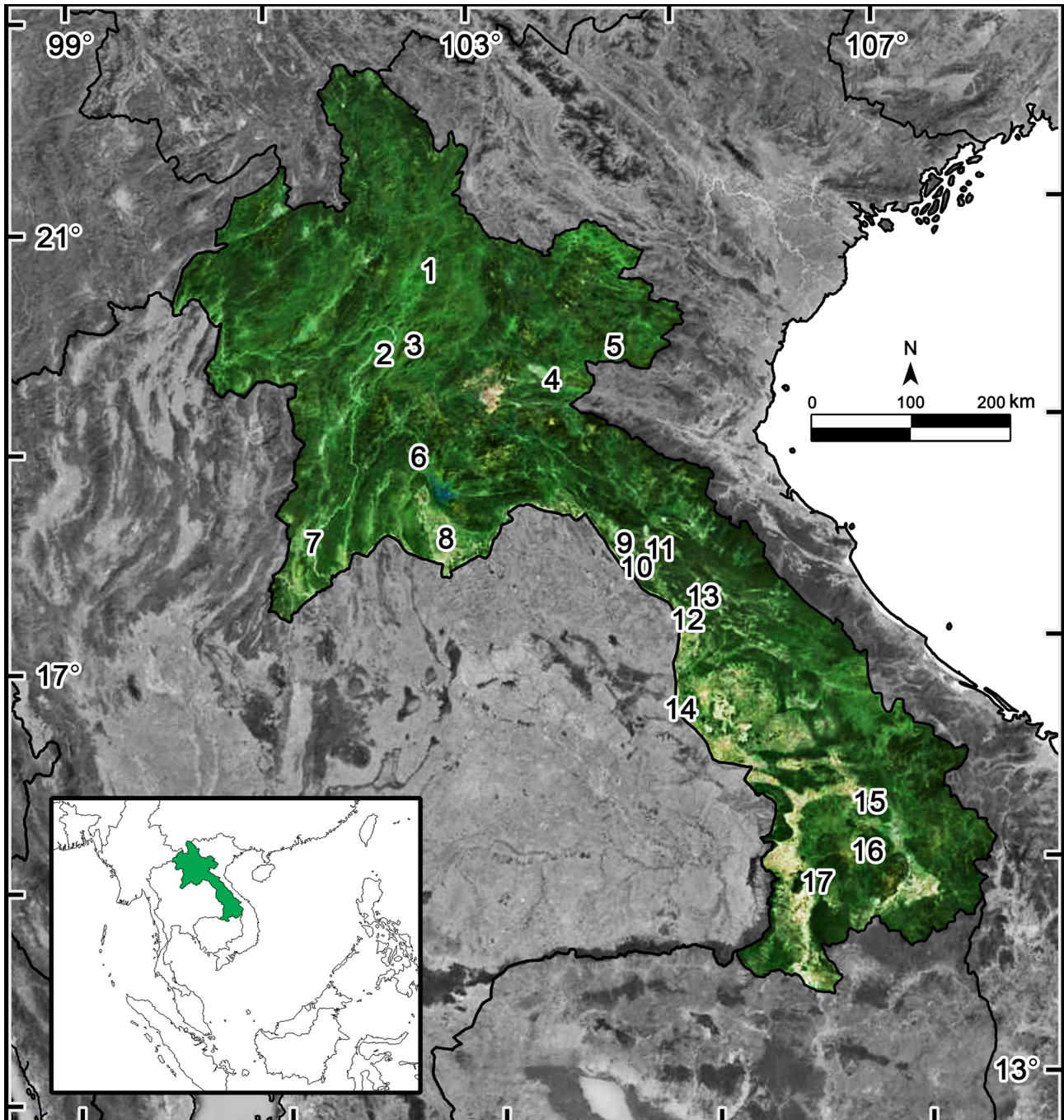
Eutrichodesmus multilobatus Golovatch, Geoffroy, Mauriès & VandenSpiegel, 2009b: 33 (D).

Record from Laos: Luang Prabang Province, Nong Kiaw: Tham Pha Kouang, Cave B (Golovatch *et al.* 2009b). Endemic to Laos, possibly a troglobite.

Conclusions

The number of collecting localities for the Diplopoda of Laos is quite limited (Map). Hardly surprisingly, at the present the millipede fauna of Laos comprises only 34 species from 20 genera, 13 families and seven orders. These counts certainly represent very little of the real diversity of Diplopoda in Laos even at the ordinal level, let alone at lower ones. The Oriental realm is the globe's sole biogeographic region that harbours all 16 orders of Diplopoda (Shelley & Golovatch 2011). Thus, based on the available information from the adjacent parts of China, Myanmar,

Thailand, Vietnam and/or Cambodia (e.g. Attems 1938, 1953; Enghoff *et al.* 2004; Enghoff 2005, Shelley 2011), the orders Polyxenida, Sphaerotheriida, Chordeumatida, Julida and Polyzoniida are certain to occur in Laos, maybe also Stemmiulida, Siphoniulida, Siphonocryptida and Glomeridesmida, but none has been recorded there yet. Similarly, several families from the orders confirmed as being present in Laos are also missing, e.g. Polydesmidae, Trichopolydesmidae, Opisotretidae (Polydesmida) or Spirobolellidae (Spirobolida). Moreover, so far even some ubiquitous “tramp” species, such as *Glyphiulus granulatus* (Gervais, 1847), *Trigoniulus corallinus* (Gervais, 1847), *Desmoxytes planata* (Pocock, 1895), *Oxidus gracilis* (C. L. Koch, 1847) and some others, have not been found in Laos.



MAP. Distribution of millipedes in Laos (34 species): 1 Cave Tham Pha Kouang. 2 Luang Prabang; west of Tham; Nong Kiaw: Tham Pha Kouang. 3 Cave Tham Gia (Bat cave). 4 Xiang Khouang. 5 Cave Vat Tham. 6 Cave Tham Non. 7 Paklay. 8 Houayang National Park. 9 Cave Tham Kamuk. 10 Cave Tham Thê. 11 Nam Non, cave. 12 inside and near Cave Ban; 9.5 km northeast of Thakek. 13 Cave Tham Houai Sai. 14 Savannakhet. 15 Ban Nong Bua. 16 Ban Thongvay. 17 Bolaven Plateau.

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.

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