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Two new species of *Gaeolaelaps* (Acari: Mesostigmata: Laelapidae) from Iran, with a revised generic concept and notes on significant morphological characters in the genus

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Abstract

Two new species of laelapid mites of the genus *Gaeolaelaps* Evans & Till are described based on adult females collected from soil and litter in Kerman Province, southeastern Iran, and Mazandaran Province, northern Iran. *Gaeolaelaps jondishapouri* Nemati & Kavianpour is redescribed based on the holotype and additional specimens collected in southeastern Iran. The concept of the genus is revised to incorporate some atypical characters of recently described species. Finally, some morphological attributes with potential to define natural species groupings as well as hypoaspidine genera are discussed, particularly idiosomal gland pores and poroids.

Key words: Soil mites, Parasitiformes, Iran, gland pores, poroids

Introduction

At present, Laelapidae is the most morphologically and ecologically diverse family of mesostigmatic mites, including obligate and facultative ectoparasites of mammals, soil-dwelling predators, and arthropod symbionts, for many of which the feeding biology is unknown (Evans & Till, 1966; Klimov & OConnor, 2004; Beaulieu, 2009; Lindquist *et al*., 2009). Since its erection by Berlese (1892), the family has increased dramatically in size with currently *ca*. 90 known genera and over 1300 known species (Beaulieu *et al*., 2011), and has benefited from several studies that variously tackled its classification (e.g. Berlese, 1903, 1916; Vitzthum, 1940–1943; Evans, 1957; Tipton, 1960; Karg, 1965, 1979; Evans & Till, 1966, 1979; Casanueva, 1993; Radovsky & Gettinger, 1999; Dowling & OConnor, 2010). However, it remains quite unstable overall, with the family being possibly paraphyletic or polyphyletic (Dowling & OConnor, 2010) and many of its inclusive subfamilies and genera have uncertain, tentatively defined boundaries. Radovsky & Gettinger (1999) and Shaw (2012) commented on the difficulty of placing genera in appropriate subfamilies. This incomplete understanding of the family is the result of a dearth of comprehensive systematic studies, as well as the large number of undescribed species from all over the world (Evans & Till, 1966). The limited quality of species descriptions, which often largely ignore key characters such as leg chaetotaxy and gnathosomal attributes, is also a strong impediment to systematic progress, including the elucidation of both taxonomic relationships and species delineation.

Gaeolaelaps, or *Hypoaspis* (*Gaeolaelaps*), is poorly known worldwide, except possibly in some parts of Europe (e.g. Karg, 1993). *Gaeolaelaps* species are typically known from soil and litter, living as opportunistic predators of small invertebrates. The type species of the genus—*Gaeolaelaps aculeifer* (G. Canestrini)—is well known as a predator, and its voracity has been exploited in the biological control of crop pests (Prischmann-Voldseth & Dashiell, 2013). *Gaeolaelaps gillespiei* Beaulieu is another species used in greenhouses, mostly for the control of fungus gnats and thrips (Gillespie & Quiring, 1990; Beaulieu, 2009). On the other hand, an increasing

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only be gained with experience, through careful comparison of poroids and pores between conspecific specimens and species, and with some literature at hand to guide where to look.

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References

Alberti, G. & Coons, L.B. (1999) Acari. *In*: Harrison, F.W. & Foelix, R.F. (Eds.), *Microscopic Anatomy of Invertebrates*: *Chelicerate Arthropoda*. *Vol*. *8C*. Wiley-Liss, New York, pp. 515–1215.

Arutunian, E.S. (1993) New species of the genus *Hypoaspis* Can., 1884 s. l. of the family Laelaptidae Berlese, 1892 (Parasitiformes). *Doklady Akademii Nauk Armenii*, 94, 115–122. [in Russian]

Athias-Henriot, C. (1969a) Gamasides chiliens (Acariens Anactinotriches). 1. Genre *Anephiasca* n. g. (Ascidae). *Revista Brasileira de Biologia*, 7, 123–149.

Athias-Henriot, C. (1969b) Les organes cuticulaires sensoriels et glandulaires des Gamasides. Poroïdotaxie et adénotaxie. *Bulletin de la Société Zoologique de France*, 94, 458–492.

Athias-Henriot, C. (1969c) Note on the external morphology of the gamasid mites (anactinotrichous Acari) (in French). *Acarologia*, 11, 609–629.

Athias-Henriot, C. (1970) Un progrès dans la connaissance de la composition métamérique des gamasides: leur sigillotaxie idiosomale (Arachnida). *Bulletin de la Société Zoologique de France*, 96, 73–85.

Athias-Henriot, C. (1971) La divergence néotaxique des Gamasides (Arachnides). *Bulletin Scientifique de Bourgogne*, 28, 93–106.

Athias-Henriot, C. (1973) Observations sur le genres *Neojordensia* Evans et *Orthadenella* N. G. en Europe occidentale (Gamasides, Dermanyssina, Ascidae). *Acarologia*, 15, 18–32.

Athias-Henriot, C. (1975) Nouvelles notes sur les Amblyseiini. 2. Le relevé organotaxique de la face dorsale adulte (gamasides, protoadéniques, Phytoseiidae). *Acarologia*, 17, 20–29.

Athias-Henriot, C. (1976) *Syskenozercon kosiri* n. g., Zerconidae dorsonéotriche des Alpes et de l'Himalaya (arachnides, gamasides). *Bulletin de la Société Zoologique de France*, 101, 433–444.

Athias-Henriot, C. (1980) Terrestrial Parasitiformes Gamasida I. The families Phytoseiidae, Pergamasidae, Eviphididae and Zerconidae. *The Zoology of Iceland*, III (Part 57d), 1–38.

Baker, E.W., Delfinado-Baker, M. & Reyes, O.F. (1983) Some laelapid mites (Laelapidae: Mesostigmata) found in nests of wasps and stingless bees. *International Journal of Acarology*, 9, 3–10.

Barilo, A.B. (1991) New species of the soil laelapid mites (Parasitiformes, Laelapidae) from Middle Asia. *Vestnik Zoologii*, 1991, 13–17. [in Russian]

Beard, J.J. (1999) Taxonomy and biological control: *Neoseiulus cucumeris* (Acari: Phytoseiidae), a case study. *Australian Journal of Entomology*, 38, 51–59.
http://dx.doi.org/10.1046/j.1440-6055.1999.00096.x

Beard, J.J. (2001) A review of Australian *Neoseiulus* Hughes and *Typhlodromips* de Leon (Acari: Phytoseiidae: Amblyseiinae). *Invertebrate Taxonomy*, 15, 73–158.
http://dx.doi.org/10.1071/IT99017

Beaulieu, F. (2009) Review of the mite genus *Gaeolaelaps* Evans &Till (Acari: Laelapidae) and description of a new species from North America, *G. gillespiei*. *Zootaxa*, 2158, 33–49.

Beaulieu, F., Dechene, A.D. & Walter, D.E. (2008) Phase morphs and phoresy: new species of *Antennoseius* (*Vitzthumia*) mites (Acari: Mesostigmata: Ascidae) associated with pyrophilous carabids (Carabidae: *Sericoda* spp.) in Alberta, Canada. *Zootaxa*, 1961, 37–57.

Beaulieu, F., Dowling, A.P.G., Klompen, H., de Moraes, G.J. & Walter, D.E. (2011) Superorder Parasitiformes Reuter, 1909. *In*: Zhang, Z.-Q. (Ed.), Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. *Zootaxa*, 3148, 1–237. [pp. 13–128]

Berlese, A. (1892) *Acari Myriapoda et Scorpiones hucusque in Italia reperta. Ordo Mesostigmata (Gamasidae).* Patavii, Sumptibus Auctoris, 143 pp. + 11 pls.

Berlese, A. (1903) Diagnosi di alcune nuove specie di Acari italiani, mirmecofili e liberi. *Zoologischen Anzeiger*, 27 (1), 12–28.

Berlese, A. (1914) Acari nuovi. *Redia*, 10, 113–150.
Berlese, A. (1916) Centuria prima di Acari nuovi. *Redia*, 12, 19–67.
Berlese, A. (1917) Centuria seconda di Acari nuovi. *Redia*, 12, 125–177.
Berlese, A. (1918) Centuria quarta di Acari nuovi. *Redia*, 13, 115–192.
Berlese, A. (1924) Centuria sesta di Acari nuovi. *Redia*, 15, 237–262.
Bregetova, N.G. (1977) Family Laelaptidae Berlese, 1882. *In*: Ghilyarov, M.S. & Bregetova, N.G. (Eds.), *Key to the Soil Inhabiting Mites*. *Mesostigmata*, Nauka, Leningrad, pp. 486–556. [in Russian]
Bhattacharyya, S.K. (1968) Studies on Indian mites (Acarina: Mesostigmata). 6. Six records and descriptions of nine new species. *Acarologia*, 10, 527–549.
Britto, E.P.J., Lindquist, E.E. & de Moraes, G.J. (2011) Redescription of *Lasioseius floridensis* Berlese, 1916 (Acari: Mesostigmata: Blattisociidae), with notes on closely related species. *Zootaxa*, 2905, 1–15.
Cargnus, E., Girolami, V. & Zandigiacomo, P. (2012) Re-examination of specimens of three species of *Kampimodromus* Nesbitt (Acari: Phytoseiidae) from north-eastern Italy, with first report on *Kampimodromus corylosus* Kolodochka in Italy. *International Journal of Acarology*, 38, 583–594.
http://dx.doi.org/10.1080/01647954.2012.710247
Casanueva, M.E. (1993) Phylogenetic studies of the free-living and arthropod associated Laelapidae (Acari: Mesostigmata). *Gayana Zoologia*, 57, 21–46.
Chant, D.A. (1958) Description of six new species of *Garmania* Nesbitt and *Lasioseius* Berlese (Acarina, Aceosejidae). *Canadian Journal of Zoology*, 36, 383–390.
http://dx.doi.org/10.1139/z58-032
Chant, D.A. & Yoshida-Shaul, E. (1987) A world review of the *pyri* species group in the genus *Typhlodromus* Scheuten (Acari: Phytoseiidae). *Canadian Journal of Zoology*, 65, 1770–1804.
http://dx.doi.org/10.1139/z87-272
Chant, D.A., Hansell, R.I.C. & Yoshida, E. (1974) The genus *Typhlodromus* Scheuten (Acarina: Phytoseiidae) in Canada and Alaska. *Canadian Journal of Zoology*, 52, 1265–1291.
http://dx.doi.org/10.1139/z74-168
Clark, J.M. & Hawke, D.J. (2012) A new epizoic laelapid mite from the New Zealand sand scarab *Pericoptus truncatus* larvae and its isotopic ecology. *New Zealand Journal of Zoology*, 39, 187–199.
http://dx.doi.org/10.1080/03014223.2011.628997
Costa, M. (1966) A redescription of *Hypoaspis queenslandicus* Womersley, 1956, comb. nov. Acari Mesostigmata with notes on the genus *Hypoaspis* Canestrini. *Israel Journal of Zoology*, 15, 141–147.
Costa, M. (1968) Little known and new litter-inhabiting laelapine mites (Acari, Mesostigmata) from Israel. *Israel Journal of Zoology*, 17, 1–30.
Costa, M. (1969) New dermanyssid mites (Acari: Mesostigmata) from nests of *Spalax ehrenbergi* Nehring. *Acarologia*, 11, 163–174.
Costa, M. (1971) Mites of the genus *Hypoaspis* Canestrini, 1884, s. str. and related forms (Acari: Mesostigmata) associated with beetles. *Bulletin of the British Museum* (*Natural History*), *Zoology*, 21, 69–98.
Costa, M. (1974) Mesostigmatic mites (Acari: Mesostigmata) from the Mediterranean shores of Israel. 1. The genus *Hypoaspis* Canestrini 1884. *Israel Journal of Entomology*, 9, 219–227.
Costa, M. & Hunter, P.E. (1970) The genus *Coleolaelaps* Berlese, 1914 (Acarina: Mesostigmata). *Redia*, 52, 323–360.
Denmark, H.A. & Evans, G.A. (2011) *Phytoseiidae of North America and Hawaii* (*Acari*: *Mesostigmata*). Indira Publishing House, West Bloomfield, Michigan, USA, 451 pp.
Díaz-Aguilar, I. & Ujvári, Z. (2010) New zerconid mites (Acari: Mesostigmata: Zerconidae) from Canada, with a review of the genus *Mixozercon* Halašková, 1963. *Zootaxa*, 2555, 1–29.
Domrow, R. (1957) Some acarina Mesostigmata from the Great Barrier Reef. *Proceedings of the Linnean Society of New South Wales*, 81, 197–216.
Domrow, R. (1978) Two new species of *Andreacarus* Radford from Tasmania (Acari: Dermanyssidae). *Journal of the Australian Entomological Society*, 17, 271–274.
Dowling, A.P.G. & OConnor, B.M. (2010) Phylogeny of Dermanyssoidea (Acari: Parasitiformes) suggests multiple origins of parasites. *Acarologia*, 50, 113–129.
http://dx.doi.org/10.1051/acarologia/20101957
Dowling, A.P.G., Bochkov, A.V. & OConnor, B.M. (2007) Revision of the genus *Andreacarus* (Acari: Laelapidae) with description of seven new species and a new genus for Australian species formerly placed in *Andreacarus*. *Journal of Medical Entomology*, 44, 405–421.
Evans, G.O. (1957) An introduction to the British Mesostigmata (Acarina) with keys to families and genera. *Journal of the Linnean Society of London*, *Zoology*, 43, 203–259.
http://dx.doi.org/10.1111/j.1096-3642.1957.tb01552.x
Evans, G.O. (1963a) Observation on the chaetotaxy of the legs in the free-living Gamasina (Acari: Mesostigmata). *Bulletin of British Museum* (*Natural History*), Series Zoology, 10, 277–303.
Evans, G.O. (1963b) Some observations on the chaetotaxy of the pedipalps in the Mesostigmata (Acari). *Annals and Magazine of Natural History*, Series 13, 6, 513–527.
Evans, G.O. & Till, W.M. (1965) Studies on the British Dermanyssidae (Acari: Mesostigmata). Part 1. External morphology. *Bulletin of the British Museum* (*Natural History*), *Zoology*, 13, 247–294.
Evans, G.O. & Till, W.M. (1966) Studies on the British Dermanyssidae. Part II. Classification. *Bulletin of the British Museum*

(*Natural History*), *Zoology*, 14, 107–370.
Evans, G.O. & Till, W.M. (1979) Mesostigmatic mites of Britain and Ireland (Chelicerata: Acari-Parasitiformes) An Introduction to their external morphology and classification. *Transactions of the Zoological Society of London*, 35, 145–270.
http://dx.doi.org/10.1111/j.1096-3642.1979.tb00059.x
Faraji, F. & Halliday, B. (2009) Five new species of mites (Acari: Laelapidae) associated with large Australian cockroaches (Blattodea: Blaberidae). *International Journal of Acarology*, 35, 245–265.
http://dx.doi.org/10.1080/01647950903059445
Fouly, A.H. & Al-Rehiayani, S.M. (2011) Predaceous mites in Al-Qassim Region, Saudi Arabia, with description of two new laelapid species (Acari: Gamasida: Laelapidae). *Journal of Entomology*, 8, 139–151.
http://dx.doi.org/10.3923/je.2011.139.151
Gillespie, D.R. & Quiring, D.M.J. (1990) Biological control of fungus gnats *Bradysia* spp. (Diptera: Sciaridae) and western flower thrips *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae) in greenhouses using a soil-dwelling predatory mite *Geolaelaps* sp. nr. *aculeifer* (Canestrini) (Acari: Laelapidae). *Canadian Entomologist*, 122, 975–985.
http://dx.doi.org/10.4039/Ent122975-9
Gu, Y. & Bai, X. (1991) Two new species of Laelapidae from Yunnan, China (Acari: Gamasina). *Acta Zootaxonomica Sinica*, 16, 181–185.
Gu, Y.-M. & Wang, J.-S. (1996) A new genus and two new species of Laelapidae from China (Acari: Gamasina). *Acta Zootaxonomica Sinica*, 21, 406–411.
Hafez, S.M., Elbadry, E.A. & Nasr, A.K. (1982) Soil Mites of the Family Laelapidae from Egypt (Acari: Mesostigmata). *Research Bulletin of the Ain Shams University*, *Faculty of Agriculture*, 1759, 1–14.
Hirschmann, W. (1960) Acarologie. Gangsystematik der Parasitiformes. Teil 3 – Die Gattung *Dendrolaelaps* Halbert 1915. *Acarologie Schriftenreihe für Vergleichende Milbenkunde*, 3, 1–27 + plates 21–28.
Hirschmann, W. (1966) Gangsystematik der Parasitiformes, Teile 15. Gänge von Litoralmilben und neue Litoralmilbenarten. *Acarologie*. *Schriftenreihe für Vergleichende Milbenkunde*, 9, 25–44 + plates 1–14.
Hirschmann, W., Bernhard, F., Greim, E. & Götz, H. (1969) Zwanzig neue *Hypoaspis*-Arten. *Acarologie Schriftenreihe für Vergleichende Milbenkunde*, 12, 133–141.
Hirschmann, W. & Wiśniewski, J. (1982) Weltweite Revision der Gattungen *Dendrolaelaps* Halbert 1915 und *Longoseius* Chant 1961 (Parasitiformes). Band 1. Beschreibung der Untergattungen und Arten, Bestimmungstabellen, Chätotaxie, Porotaxie. *Acarologie Schriftenreihe für Vergleichende Milbenkunde*, 29, 1–190.
Hunter, P.E. (1961) The genus *Laelaspis*, with descriptions of three new species (Acarina: Laelaptidae). *Annals of the Entomological Society of America*, 45, 672–683.
Hunter, P.E. (1963) Two new genera of mites associated with stingless bees (Acarina, Laelaptidae). *Acarologia*, 5, 1–12.
Hunter, P.E. (1964) Laelaptid mites from Auckland and Macquarie Islands (Acarina: Laelaptidae). *Pacific Insects Monograph* (*Supplement*), 7, 630–641.
Hunter, P.E. & Yeh, S. (1969) *Hypoaspis* (*Geolaelaps*) *disjuncta* (Acarina: Laelapidae) associated with the horned passalus beetles. *Journal of the Georgia Entomological Society*, 4, 97–102.
Hyatt, K.H. (1964) A collection of Mesostigmata (Acari) associated with Coleoptera and Hemiptera in Venezuela. *Bulletin of the British Museum* (*Natural History*), *Zoology*, 11, 465–509.
Ishikawa, K. (1982) Gamasid mites (Acarina) found in the subterranean domain of southwest Japan. *Journal of the Speleological Society of Japan*, 7, 88–100.
Joharchi, O. & Babaeian, E. (2014) A new species of *Gaeolaelaps* Evans and Till (Acari: Laelapidae) on *Acinopus* sp. (Coleoptera: Carabidae) from Iran. *Acarologia*, 54, 89–95.
http://dx.doi.org/10.1051/acarologia/20142119
Joharchi, O. & Halliday, B. (2011) New species and new records of mites of the family Laelapidae (Acari: Mesostigmata) associated with Coleoptera in Iran. *Zootaxa*, 2883, 23–38.
Joharchi, O., Halliday, B. & Saboori, A. (2012) Three new species of *Laelaspis* Berlese from Iran (Acari: Laelapidae), with a review of the species occurring in the Western Palaearctic Region. *Journal of Natural History*, 46, 1999–2018.
http://dx.doi.org/10.1080/00222933.2012.707240
Joharchi, O., Halliday, B., Saboori, A. & Kamali, K. (2011) New species and new records of mites of the family Laelapidae (Acari: Mesostigmata) associated with ants in Iran. *Zootaxa*, 2972, 22–36.
Johnston, D.E. & Moraza, M.L. (1991) The idiosomal adenotaxy and poroidotaxy of Zerconidae (Mesostigmata: Zerconina). *In*: Dusbábek, F. & Bukva, V. (Eds.), *Modern Acarology. Vol. 2*. Academia, Prague, pp. 349–356.
Karg, W. (1962) Zur Systematik und Postembryonalen Entwicklung der Gamasiden (Acarina, Parasitiformes) landwirtschaftlich genutzter Boden. *Mitteilungen aus dem Zoologischen Museum in Berlin*, 38, 23–119.
Karg, W. (1964) Systematische Untersuchungen zwei eigenartiger neuer Gamasides-Arten (Acari, Parasitiformes) aus der Bodenkrume. *Opuscula Zoologica*, 5 (1), 69–75.
Karg, W. (1965) Larvalsystematische und phylogenetische Untersuchung sowie Revision des Systems der Gamasina Leach, 1915 (Acarina, Parasitiformes). *Mitteilungen aus dem Zoologischen Museum in Berlin*, 41, 193–340.
Karg, W. (1978) Zur Kenntnis der Milbengattung *Hypoaspis*, *Androlaelaps* und *Reticulaelaps* (Acarina, Parasitiformes, Dermanyssidae). *Zoologische Jahrbüch der Systematik*, 105, 1–32.
Karg, W. (1979) Die Gattung *Hypoaspis* Canestrini 1884 (Acarina, Parasitiformes). *Zoologische Jahrbücher Abteilung für Systematik Ökologie und Geographie der Tiere*, 106, 65–104.
Karg, W. (1982) Zur Kenntnis der Raubmilbeng *Hypoaspis* Canestrini, 1884 (Acarina, Parasitiformes). *Mitteilungen aus dem*

Zoologischen Museum in Berlin, 58, 233–256.
Karg, W. (1987) Neue Raubmilbenarten der Gattung *Hypoaspis* Canestrini, 1884 (Acarina, Parasitiformes). *Zoologische Jahrbücher Abteilung für Systematik Ökologie und Geographie der Tiere*, 114, 289–302.
Karg, W. (1989a) Zur Kenntnis der Untergattungen *Geolaelaps*, *Alloparasitus* und *Laelaspis* der Raubmilbengattung *Hypoaspis* Canestrini, 1884 (Acarina, Parasitiformes). *Mitteilungen aus dem Zoologischen Museum in Berlin*, 65, 115–126. http://dx.doi.org/10.1002/mmnz.19890650103
Karg, W. (1989b) Zwei neue Raubmilben arten der Gattung *Hypoaspis* Canestrini, 1884 (Acarina, Parasitiformes) aus dem Leutratalbei Jena. *Abhandlungen und Berichte des Naturkunde Museums Görlitz*, 63, 1–6.
Karg, W. (1993) Acari (Acarina), Milben. Parasitiformes (Anactinochaeta). Cohors Gamasina Leach, Raubmilben. *Die Tierwelt Deutschlands*, 59, 1–523.
Karg, W. (2006) The systematics of Parasitiformes, especially of Gamasina leach (Acarina), with new species from Ecuador. *Mitteilungen aus dem Museum für Naturkunde in Berlin*, *Zoologische Reihe*, 82, 140–169. http://dx.doi.org/10.1002/mmnz.200600002
Kavianpour, M. & Nemati, A. (2013) A new species of the genus *Gaeolaelaps* (Acari, Mesostigmata, Laelapidae) from Iran. *Zookeys*, 277, 1–11. http://dx.doi.org/10.3897/zookeys.277.4741
Kavianpour, M. & Nemati, A. (2014) *Gaeolaelaps* (Acari: Laelapidae) mites from Iran with description of a new species. *Journal of Crop Protection*, 3, 315–325.
Kavianpour, M., Nemati, A., Gwiazdowicz, D.J. & Kocheili, F. (2013) A new species of the genus *Gaeolaelaps* (Acari, Mesostigmata, Laelapidae) from Iran. *Zookeys*, 277, 1–11. http://dx.doi.org/10.3897/zookeys.277.4741
Kazemi, Sh. & Rajaei, A. (2013) An annotated checklist of Iranian Mesostigmata (Acari), excluding the family Phytoseiidae. *Persian Journal of Acarology*, 2 (1), 63–158.
Klimov, P.B. & OConnor, B.M. (2004) North American bee-associated mites: potential threats to native and introduced pollinators. Available from: http://insects.ummz.lsa.umich.edu/beemites/ (accessed 1 February 2013)
Krantz, G.W & Redmond, B.L. (1987) Identification of glandular and poroidal idionotal systems in *Macrocheles perglaber* F. & P. (Acari: Macrochelidae). *Experimental and Applied Acarology*, 3, 243–253. http://dx.doi.org/10.1007/bf01270460
Lindquist, E.E. (1971) New species of Ascidae (Acarina: Mesostigmata) associated with forest insect pests. *The Canadian Entomologist*, 103, 919–942. http://dx.doi.org/10.4039/Ent103919-7
Lindquist, E.E. (1994) Some observations on the chaetotaxy of the caudal body region of gamasine mites (Acari: Mesostigmata), with a modified notation for some ventrolateral body setae. *Acarologia*, 35, 323–326.
Lindquist, E.E. (1995) Remarkable convergence between two taxa of ascid mites (Acari: Mesostigmata) adapted to living in pore tubes of bracket fungi in North America, with description of *Mycolaelaps* new genus. *Canadian Journal of Zoology*, 73 (1), 104–128. http://dx.doi.org/10.1139/z95-013
Lindquist, E.E. & Evans, G.O. (1965) Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: Mesostigmata). *Memoirs of the Entomological Society of Canada*, 47, 1–64. http://dx.doi.org/10.4039/entm9747fv
Lindquist, E.E. & Makarova, O.L. (2012) Review of the mite subfamily Arctoseiinae Evans with a key to its genera and description of a new genus and species from Siberia (Parasitiformes, Mesostigmata, Ascidae). *Zookeys*, 233, 1–20. http://dx.doi.org/10.3897/zookeys.233.3862
Lindquist, E.E. & Moraza, M.L. (1998) Observations on homologies of idiosomal setae in Zerconidae (Acari: Mesostigmata), with modified notation for some posterior body setae. *Acarologia*, 39, 203–226.
Lindquist, E.E. & Moraza, M.L. (2008) A new genus of flower-dwelling melicharid mites (Acar: Mesostigmata: Ascoidea) phoretic on bats and insects in Costa Rica and Brazil. *Zootaxa*, 1685, 1–37.
Lindquist, E.E. & Moraza, M.L. (2010) Revised diagnosis of the family Blattisociidae (Acari: Mesostigmata: Phytoseioidea), with a key to its genera and description of a new fungus-inhabiting genus from Costa Rica. *Zootaxa*, 2479, 1–21.
Lindquist, E.E. & Moraza, M. (2014) Mites coexistent with neotropical hispine beetle in unfurled leaves of *Heliconia*: a new genus and family of the Ascoidea (Acari: Mesostigmata: Gamasina). *Journal of Natural History*, 48, 1611–1651. http://dx.doi.org/10.1080/00222933.2014.915469
Lindquist, E.E., Krantz, G.W. & Walter, D.E. (2009) Order Mesostigmata. *In*: Krantz, G.W. & Walter, D.E. (Eds.), *A Manual of Acarology. 3rd Edition*. Texas Tech University Press, Lubbock, pp. 124–232.
Liu, J. & Ma, L. (2003) Three new species of Gamasina from Western Hubei Province, China (Acari, Mesostigmata). *Acta Zootaxonomica Sinica*, 28, 651–656.
Ma, L. (1996) Three new species of the genus *Hypoaspis* from Jilin Province, China (Acari: Laelapidae). *Acta Zootaxonomica Sinica*, 21, 48–54.
Ma, L. (1997) Three new species of Gamasina in soll [soil] (Acari: Laelapidae, Parasitidae, Pachylaelaptidae). *Acta Arachnologica Sinica*, 6, 31–36.
Ma, L. (2000) Description of a new species of Gamasid mite (Acari: Laelapidae). *Entomotaxonomica*, 22 (2), 150–152.
Ma, L.-M. & Lin, J.-Z. (2009) On five new species of the genera *Hypoaspis* and *Cosmolaelaps*, with supplementary descriptions of *Cosmolaelaps xiajiangensis* and *Haemolaelaps cordatus* (Acari: Mesostigmata: Laelapidae). *Acta Arachnologica Sinica*, 18, 28–39.
Ma, L. &Yin, X. (1998) Two new species of the genus *Hypoaspis* (Acari: Gamasina: Laelapidae) from Heilongjiang Province,

China. *Entomotaxonomia*, 20, 223–229.
Makarova, O.L. (2003) A new genus and three new species of the family Arctacaridae (Parasitiformes, Mesostigmata) from North America. *Entomological Reviews*, 83, 868–886.
Makarova, O.L. & Lindquist, E.E. (2013) New species of the gamasid mite genus *Arctoseius* Thor, 1930 (Parasitiformes, Mesostigmata, Ascidae) from Russia with a key to the multidentatus species-group. *Zookeys*, 313, 9–24. http://dx.doi.org/10.3897/zookeys.313.5317
Meledzhaeva, M.A. (1963) New species of mites of the familiy Laelaptidae from the southeastern Kara-Kum (Gamasoidea, Parasitiformes). *Izvestiya Akademii Nauk Turkmenskoi SSR*, *Seriya Biologicheskikh nauk*, 4, 49–55.
Menzies, G.C. & Strandtmann, R.W. (1952) A new species of mite taken from nest of armadillo (Acarina, Laelaptidae, Hypoaspinae). *Proceedings of the Entomological Society of Washington*, 54, 265–269.
Michael, A.D. (1891) On the association of gamasids with ants. *Proceeding of the Zoological Society of London*, 4, 638–654.
Moraza, M.L. (2005) A new genus and species of Epicriidae (Acari, Mesostigmata) from eastern North America. *Canadian Entomologist*, 137, 539–550. http://dx.doi.org/10.4039/N04-101
Moraza, M.L. & Lindquist, E.E. (1998) Coprozerconidae, a new family of zerconoid mites from North America (Acari: Mesostigmata: Zerconoidea). *Acarologia*, 39, 291–313.
Moraza, M.L. & Kazemi, Sh. (2009) A new species of *Antennoseius* (*Vitzthumia*) Thor (Acari: Mesostigmata: Ascidae), associated with carabid beetles in Iran and a key to species. *International Journal of Acarology*, 35, 59–65. http://dx.doi.org/10.1080/01647950902884538
Moraza, M.L. & Lindquist, E.E. (2011) A new genus of fungus-inhabiting blattisociid mite (Acari: Mesostigmata: Phytoseoidea) from Middle America, with a key to genera and subgenera of the subfamily Blattisociinae. *Zootaxa*, 2758, 1–25.
Moraza, M.L, Arroyo, J. & Bolger, T. (2009) Three new species of mites (Acari: Zerconidae) from canopy habitats in Irish forests. *Zootaxa*, 2019, 29–39.
Moriera, F.G., Klompen, H. & de Moraes, G.J. (2014) Redefinition of *Cosmolaelps* Berlese (Acari: Laelapidae) and description of five new species from Brazil. *Zootaxa*, 3764 (3), 317–346. http://dx.doi.org/10.11646/zootaxa.3764.3.4
Nasr, A.K. & Nawar, M.S. (1989) *Hypoaspis cucumerus*, a new species of laelapid mites from Egypt (Acari, Mesostigmata: Laelapidae). *Bulletin de la Société entomologique d'Égypte*, 68, 69–74.
Nawar, M.S., Shereef, G.M. & Ahmed, M.A. (1993) Influence of food on development and reproduction of *Hypoaspis solimani* (Acari: Laelapidae). *Insect Science and its Application*, 14, 343–349. http://dx.doi.org/10.1017/S1742758400014831
Nemati, A. & Kavianpour, M. (2013) A new species of Laelapidae (Acari: Mesostigmata) from Iran. *Journal of Crop Protection*, 2 (1), 63–73.
Nemati, A. & Mohseni, M. (2013) Two new species of *Gaeolaelaps* (Acari: Laelapidae) from Iran. *Zootaxa*, 3750 (1), 71–82. http://dx.doi.org/10.11646/zootaxa.3750.1.5
Özbek, H.H & Bal, D.A. (2013) Three new species of the genus *Nothrholaspis* (Acari: Macrochelidae) from the Kelkit Valley, Turkey. *Zootaxa*, 3635, 40–50. http://dx.doi.org/10.11646/zootaxa.3635.1.4
Prischmann-Voldseth, D.A. & Dashiell, K.E. (2013) Effects of releasing a generalist predator (Acari: *Gaeolaelaps aculeifer*) on a subterranean insect herbivore (Coleoptera: *Diabrotica virgiferavirgifera*). *Biological Control*, 65, 190–199. http://dx.doi.org/10.1016/j.biocontrol.2013.03.002
Radovsky, F.J. & Gettinger, D. (1999) Acanthochelinae, a new subfamily (Acari: Parasitiformes: Laelapidae), with redescription of *Acanthochela chilensis* Ewing and description of a new genus and species from Argentina. *International Journal of Acarology*, 25, 77–90.
Ragusa, S. & Athias-Henriot, C. (1983) Observations on the genus *Neoseiulus* Hughes (Parasitiformes, Phytoseiidae). Redefinition. Composition. Geography. Description of two new species. *Revue suisse de Zoologie*, 90, 657–678.
Rosario, R.M.T. (1981) Philippine Hypoaspidinae (Acari: Mesostigmata: Laelapidae). *Philippine Entomologist*, 5, 23–82.
Ruf, A. & Koehler, H. (1993) *Hypoaspis fishtowni* sp. nov. (Acari, Mesostigmata, Laelapidae): a new predatory mite. *Acarologia*, 34, 193–198.
Sellnick, M. (1958) Die Familie Zerconidae Berlese. *Acta Zoologica Academiae Scientiarum Hungaricae*, 3, 313–368.
Shaw, D.M. (2011) Laelapidae (Acari: Mesostigmata) on megachiropteran bats: new records and a new species of *Neolaelaps* Hirst. *Zootaxa*, 2807, 41–56.
Shaw, D.M. (2012) Re-evaluation of *Pseudoparasitus* (*Gymnolaelaps*) *annectans* (Womersley): a new genus and two new species (Acari: Mesostigmata: Laelapidae). *Zootaxa*, 3453, 25–42.
Shereef, G.M. & Afifi, A.M. (1980) Five new species of mesostigmatid mites, inhabiting organic manures (Acari: Laelapidae). *Proceedings of the First conference of the Plant Protection Research Institut*e, 3, 121–134.
Strong, K.L. (1995) A new species of *Hypoaspis* (Acarina: Laelapidae) associated with funnel-web spiders (Araneae: Hexathelidae). *Records of the Western Australian Museum Supplement*, 52, 219–223.
Strong, K.L. & Halliday, R.B. (1994) Three new species of *Hypoaspis* Canestrini (Acarina: Laelapidae) associated with large Australian cockroaches. *Journal of the Australian Entomological Society*, 33, 87–96. http://dx.doi.org/10.1111/j.1440-6055.1994.tb00927.x
Teng, K.F. (1982) On some new species and new records of laelapid mites from China (Acarina: Gamasina). *Acta Zootaxonomica Sinica*, 7, 160–165.

Tenorio, J.M. & Radovsky, F.J. (1974) The genus *Mesolaelaps* (Laelapidae: Mesolaelapinae n. subfam.) with descriptions of two new species from New Guinea. *Journal of Medical Entomology*, 11, 211–222.
Till, W.M. (1963) Ethiopian mites of the genus *Androlaelaps* Berlese s. lat. (Acari: Mesostigmata). *Bulletin of the British Museum* (*Natural History*) *Zoology*, 10, 1–104.
Tipton, V.J. (1960) The genus *Laelaps*, with a review of the Laelaptinae and a new subfamily Alphalaelaptinae (Acarina: Laelaptidae). *University of California Publications in Entomology*, 16 (6), 233–356.
Tixier, M.-S., Tsolakis, H., Ragusa, S., Poinso, A., Ferrero, M., Okassa, M. & Kreiter, S. (2011) Integrative taxonomy demonstrates the unexpected synonymy between two predatory mite species: *Cydnodromus idaeus* and *C. picanus* (Acari: Phytoseiidae). *Invertebrate Systematics*, 25, 273–281.
http://dx.doi.org/10.1071/IS11025
Trach, V.A. (2012) *Gaeolaelaps carabidophilus* n. sp., a new mite species (Acari: Mesostigmata: Laelapidae) from carabid beetles (Coleoptera: Carabidae) from southern Ukraine. *Acarologia*, 52 (2), 157–163.
http://dx.doi.org/10.1051/acarologia/20122045
Van Aswegen, P.I.M. & Loots, G.C. (1970) A taxonomic study of the genus *Hypoaspis* Canestrini sens. lat. (Acari: Laelapinae) in the Ethiopian region. *Publicações Culturais da Companhia de Diamantes de Angola*, 82, 167–213.
Van Driel, C.D., Loots, G.C. & Marais, J.F. (1977) Freeliving Mesostigmata. La faune terrestre de l'île Sainte-Hélène. *Annales du Musée Royal de l'Afrique Centrale*, 220, 305–335.
Vitzthum, G.H. (1940–1943) *Acarina. Klassen und Ordnung des Tierreichs, 5 (4), Bd. 5*. H.G. Braun, Leipzig, 1011 pp.
Walter, D.E. & Oliver, J.H. (1989) *Geolaelaps oreithyiae*, n. sp. (Acari: Laelapidae), a thelytokous predator of arthropods and nematodes, and a discussion of clonal reproduction in the Mesostigmata. *Acarologia*, 30, 293–303.
Walter, D.E. & Campbell, N.J.H. (2003) Exotic vs endemic biocontrol agents: Would the real *Stratiolaelaps miles* (Berlese) (Acari: Mesostigmata: Laelapidae), please stand up? *Biological Control*, 26, 253–269.
http://dx.doi.org/10.1016/S1049-9644(02)00171-8
Walter, D.E. & Moser, J.C. (2010) *Gaeolaelaps invictianus*, a new and unusual species of hypoaspidine mite (Acari: Mesostigmata: Laelapidae) phoretic on the red imported fire ant *Solenopsis invicta* Buren (Hymenoptera: Formicidae) in Louisiana, USA. *International Journal of Acarology*, 36, 399–407.
http://dx.doi.org/10.1080/01647954.2010.481263
Wang, D.C., & Li, K.C. (1965) On some new species of Gamasoidea. *Acta Zootaxonomica Sinica*, 2, 233–242.
Willmann, C. (1949) Beiträge zur Kenntnis des Salzgebietes von Ciechocinek. 1. Milben aus den Salzwiesen und Salzmooren von Ciechocinek an der Weichsel. *Voröffentlichungen aus dem Museum fur Natur-, Völker- und Handelskande in Bremen, Reihe A*, 1, 106–142.
Willmann, C. (1951) Untersuchungen über die terrestrische Milbenfauna im pannonischen Klimagebiet Österreichs. *Sitzungsberichte der Österreichischen Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Abteilung I*, 160, 91–176.
Womersley, H. (1956) On some new Acarina–Mesostigmata from Australia, New Zealand and New Guinea. *Journal of the Linnean Society of London* (*Zoology*), 42, 505–599.
http://dx.doi.org/10.1111/j.1096-3642.1956.tb02218.x
Xu, X. & Liang, L. (1996) Four new species of the Hypoaspidinae (Acari: Laelapidae) from moss in China. *Systematic and Applied Acarology*, 1, 189–197.
Xu, X., Wang, B., Wang, E. & Zhang, Z.-Q. (2013) Comments on the identity of *Neoseiulus californicus* sensu lato (Acari: Phytoseiidae) with a redescription of this species from southern China. *Systematic & Applied Acarology*, 18, 329–344.
http://dx.doi.org/10.11158/saa.18.4.3
Zeman, P. (1982) Two new species of Hypoaspidinae (Acari: Mesostigmata: Dermanyssidae) associated with ants. *Vestnik Ceskoslovenske Spolecnosti Zoologicke*, 46, 231–237.