Dendrobaena octaedra **System:** Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Annelida	Clitellata	Haplotaxida	Lumbricidae

Common name

Synonym

Similar species

Summary

Dendrobaena octaedra is a small, litter dwelling earthworm native to Europe that has invaded areas of Canada, United States, South America and Asia. The combined impacts of this species and other exotic earthworms are having profound effects on forest ecosystems in North America, particularly in regions which lack native earthworms. Exotic earthworms rapidly consume leaf litter, thereby altering nutrient cycling and availability and other soil properties. This has cascading effects on microbial communities, invertebrates, vertebrates and seedling establishment, and may alter entire plant communities and threaten rare plant species.

view this species on IUCN Red List

Species Description

Dendrobaena octaedra is a small (2-4 cm) litter dwelling (epigeic) earthworm (Scheu & Parkinson, 1994). It has a mean biomass of 0.13 g (Wironen & Moore, 2006) and is highly pigmented, a characteristic feature of epigeic earthworms (Hendrix & Bohlen, 2002).

D. octaedra shows extensive morphological variability in its introduced North American range, and wide variability in somatic and reproductive characters in its native northern Europe range. Adults may lack or possess rudimentary male pore terminalia (Terhivuo & Saura, 2006).

Lifecycle Stages

Dendrobaena octaedra can turn to wintering at any ontogenic stage. For the whole “egg to egg” cycle to occur in one season, the soil temperatures must remain above 20 °C for four to five months. Thus the complete cycle may not occur within one season (Berman *et al*., 2001).

Uses

In agricultural systems and natural systems adapted to earthworms, they provide important ecological services including improvement of soil properties (e.g. nutrient turnover, soil structure and water flow, pH, functional biodiversity, food sources for vertebrate predators) and increasing plant production. Indeed earthworms have been deliberately introduced to pastures, landfills and reclaimed mite sites in several countries around the world to improve agricultural productivity and minimise soil degradation (Baker *et al*., 2006).

Habitat Description
Dendrobaena octaedra is common in coniferous forests in its native European and introduced North American range (Addison, 2009). It also grows and reproduces well in litter with a high content of oak (Addison & Holmes, 1996 in Addison, 2009).
It is an epigeic species, preferentially inhabiting organic layers of the soil (Dymond *et al*., 1997). It is extremely frost tolerant and can withstand freezing in all stages of development (Berman *et al*., 2001; Tiunov *et al*., 2006). *D. octaedra* is also acid tolerant, although juveniles taken from soil of pH 2.9 exhibited lower growth and survivorship than those from soil of pH 5.7 (Carcamo *et al*., 1998 in Addison, 2009).

Reproduction
Dendrobaena octaedra reproduces via apomictic parthenogenesis, in which eggs are produced by mitosis rather than meiosis. Offspring are thus genetic copies of their parent, and a single individual is capable of establishing an invasive population (Cameron *et al*., 2008).
Parthenogenic species are capable of rapid adaptation, as large numbers of offspring can be produced, some of which are likely to have beneficial mutations (Simon *et al*., 2002 in Cameron *et al*., 2008).
Eggs are produced within cocoons which are highly frost tolerant and are presumably a key factor for successful colonization of temperate regions (Dymock *et al*., 1997; Berman *et al*., 2001). *D. octaedra* can produce very high densities of cocoons; up to 3692/m2 have been recorded in Canadian Rocky Mountains, Alberta (Dymock *et al*., 1997).

Nutrition
Dendrobaena octaedra is an epigeic species. It inhabits the litter layer, feeding primarily on microorganisms associated with decaying surface litter (Hale *et al*., 2008). Epigeic species facilitate the breakdown and mineralisation of surface litter (Hendrix & Bohlen, 2002).

General Impacts
In many ecosystems and in agricultural systems earthworms are highly beneficial to soil processes (Hendrix & Bohlen, 2002). However in forest ecosystems with few or no native earthworms, introduced species can have negative effects. Earthworms are keystone detritivores that can act as “ecosystem engineers” and have the potential to change fundamental soil properties, with cascading effects on ecosystem functioning and biodiversity (Frelich *et al*., 2006; Eisenhauer *et al*., 2007; Addison, 2009)
Exotic earthworms are a particular problem in previously earthworm-free temperate and boreal forests of North America dominated by *Acer*, *Quercus*, *Betula*, *Pinus* and *Populus* (Frelich *et al*., 2006).
Earthworms are often classified based on their activity and feeding type, which affects their impacts on the soil (Bouché, 1977 in Addison, 2009). *Dendrobaena octaedra* and *Dendrodrilus rubidus* are epigeic species, which inhabit and feed at the soil surface. Epigeics physically disrupt the organic layer of the soil by consuming and mixing the F and H layers, producing a homogenous and granular form of organic forest floor (Addison, 2009). *Lumbricus rubellus* operates in two categories, 1) epigeic which inhabit and feed at the soil surface and 2) endogeic which live and feed in the mineral horizons below the organic (LFH) layer. Thus it is considered epi-endogeic in its habits, feeding on organic matter in the forest floor, but also mixing the organic material into the upper layer of mineral soil (Addison, 2009). *L. terrestris* is a deep-burrowing anecic earthworm, which create permanent vertical burrows in the mineral layer. They come to the surface to feed on litter and pull it down to their burrows, depositing casts of mixed organic and mineral material on the soil surface (Addison, 2009).
Thus earthworms in different functional groups have different impacts on the soil (Frelich *et al*., 2006; Hale *et al*., 2008). Often multiple earthworm species inhabit areas of forest, and studies suggest that impacts are greater when earthworms from more than one functional group occur together (Hale *et al*., 2005; Hale *et al*., 2008). Earthworm invasions typically occur in waves (e.g. Hendrix & Bohlen, 2002; Eisenhauer *et al*., 2007), with epigeic (e.g. *D. octaedra*, *D. rubidus*) or epi-endogeic (e.g. *L. rubellus*) species arriving first as they are able to utilise undisturbed forest floors. The first noticeable impacts tend to be physical disruption of the stratified humus layers on the forest floor. Endogeics generally only invade after the organic layer has been modified by epigeic or epi-endogeic species. Anecic species (e.g. *L. terrestris*) are usually last to arrive (James & Hendrix, 2004 in Addison, 2009).
The purported impacts of invasive earthworms are often varied between publications, and different soil types and soil layers may be affected differently by earthworm invasion. However the main effect of earthworms is to consume litter, and incorporate it into deeper soil layers, thus causing mixing of the A and O soil horizons. This causes extreme reduction of the litter layer and changes in nutrient concentrations and cycling in the soil. Other soil characteristics such as pH, porosity and decomposition rates may also be affected. Physical disruption of plant roots and mycorrhizal associations is also a common impact. These changes to fundamental soil properties have cascading effects on plant communities, microorganisms, micro and mesofauna, birds and mammals (Hale *et al*., 2008; Addison, 2009).
For a detailed account of the impacts of invasive earthworms please read Earthworms Impacts Information.

Management Info
There are currently no effective methods to eradicate established earthworm populations without unacceptable non-target effects. Thus the main technique for managing invasions is prevention of introductions, via various pathways (Cameron *et al*., 2007; Keller *et al*., 2007).
Preventative measures: One of the major pathways for earthworm introductions is believed to from release by anglers discarding unwanted live bait. Keller *et al*. (2007) suggest two alternatives to reduce the likelihood of further establishments while preserving the economically important live trade of earthworms. These are: 1) Replace the species currently sold with earthworm species that are unlikely to establish populations, e.g. *Eudrilus eugeniae* which has an extremely low invasion risk in the U.S. Midwest, and 2) Strengthen efforts to educate anglers to dispose of live earthworms responsibly, i.e. in the trash where landfill conditions are likely to kill them (Keller *et al*., 2007) or to prohibit the abandonment of live bait (Cameron *et al*., 2007).
Similarly, transport of cocoons and earthworms via vehicular transport is a major pathway for introduction to new locations. Thus construction of fewer roads, restricting the amount of traffic on roads or reclaiming roads where possible would minimize spread of earthworms (Cameron & Bayne, 2009).
Management and regulatory strategies should also take into account the fact that some earthworm species, such as *Lumbricus rubellus* have larger impacts than others. This species is less widely distributed than other exotic species. Thus preventing its introduction to new areas is important, even if those areas are already infested with other species (Hale *et al*., 2006). Similarly, some forests will be more susceptible to invasion than others. Litter calcium content is likely to be an important predictor of litter decomposition rates by exotic earthworms (Holdsworth, 2008).
Callaham *et al*. (2006) suggest various policy measures that could be adapted to prevent the spread of exotic earthworms. The authors suggest restrictions on transportation of soils from infested areas to non-infested areas, unless a special permit certifying that the material is free from earthworm propagules has been granted. Formalized earthworm introduction decision making tools are also recommended as an alternative to the *ad hoc* decisions made by regulating agencies at present. This decision-making process allows for the quarantine of materials containing propagules of earthworms that have not been identified or widely introduced previously. These quarantines would provide time to determine the ecological risk posed by the introduction of a given earthworm species into particular systems. Suggested types of information needed to determine ecological risk include mode of reproduction, number of embryos per cocoon, ecological “strategy”, and temperature, pH and moisture requirements (Callaham *et al*., 2006).
Cultural measures: Successful establishment of earthworm populations is influenced by management of the site. For example, synergistic effects of the invasive weed buckthorn and exotic earthworms could be minimized by early control measures to limit the weed (Heneghan *et al*, 2006).
Chemical control: Where non-native earthworms are not well established or are found in discrete populations, the use of chemical treatments to eradicate undesirable worms may be successful. Chemical control have been used in the management of golf courses. While these treatments are highly effective, the non-target effects of chemicals should be examined before large-scale utilization (Callaham *et al*., 2006).

Pathway
When Europeans first colonized the United States midwest they probably brought earthworms as adults or cocoons in dry ship ballast (Hendrix & Bohlen, 2002).Road vehicles are thought to be a major vector for the spread of earthworm cocoons (Cameron *et al*., 2008). Epigeic species are more easily transported in this manner as they are present close the litter surface (Cameron *et al*., 2007). In fac

Principal source:

Compiler: National Biological Information Infrastructure (NBII) & IUCN/SSC Invasive Species Specialist Group (ISSG)

Review:

Pubblication date: 2011-03-09

ALIEN RANGE

[1] ASIA
[1] CHILE
[1] FINLAND
[1] GREAT LAKES
[1] JAPAN
[4] RUSSIAN FEDERATION
[11] CANADA
[1] COLOMBIA
[1] GEORGIA
[1] INDIA
[1] MEXICO
[15] UNITED STATES

BIBLIOGRAPHY

76 references found for **Dendrobaena octaedra**

Managment information

Callaham, Mac A. Jr., Grizelle Gonza&#65533;lez, Cynthia M. Hale, Liam Heneghan, Sharon L. Lachnicht & Xiaoming Zou, In Press. Policy and management responses to earthworm invasions in North America. Biol Invasions DOI 10.1007/s10530-006-9016-6
Summary: Available from: http://www.fs.fed.us/global/iitf/pubs/ja_iitf_2006_Callaham001.pdf [Accessed 28 August 2010]

Cameron, Erin K.; Bayne, Erin M.; Clapperton, M. Jill, 2007. Human-facilitated invasion of exotic earthworms into northern boreal forests. Ecoscience. 14(4). 2007. 482-490.

Cameron, Erin K. & Erin M. Bayne, 2009. Road age and its importance in earthworm invasion of northern boreal forests. Journal of Applied Ecology Volume 46, Issue 1, pages 28&#65533;36, February 2009

Hendrix F. Paul (Ed). 2006. Biological invasions belowground earthworms as invasive species. SpringerLink Dordrecht, Netherlands: Springer.

Hendrix, F. Paul & Patrick J. Bohlen, 2002. Exotic Earthworm Invasions in North America: Ecological and Policy Implications. BioScience September 2002 : Vol. 52, Issue 9, pg(s) 801-809

Keller, Reuben P.; Cox, Annie N.; Van Loon, Christine; Lodge, David M.; Herborg, Leif-Matthias; Rothlisberger, John, 2007. From bait shops to the forest floor: Earthworm use and disposal by anglers. American Midland Naturalist. 158(2). OCT 2007. 321-328.

General information

Addison, J. A., 2009. Distribution and impacts of invasive earthworms in Canadian forest ecosystems. Biological Invasions Volume 11, Number 1, 59-79, DOI: 10.1007/s10530-008-9320-4

Al-Yousuf S. & Hagras A E W , 1986. On the Earthworm Fauna and Distribution in the State of Qatar. Qatar University Science Bulletin. 6 1986. 247-254.

Baker, G. H., G. Brown, K. Butt, J. P. Curry and J. Scullion, 2006. Introduced earthworms in agricultural and reclaimed land: their ecology and influences on soil properties, plant production and other soil biota. Biol Invasions (2006) 8:1301&#65533;1316

Baker, G. H.; Thumlert, T. A.; Meisel, L. S.; Carter, P. J.; Kilpin, G. P., 1997. Earthworms downunder : A survey of the earthworm fauna of urban and agricultural soils in Australia. Soil Biology & Biochemistry. 29(3-4). 1997. 589-597.

Berman, D. I., E. N. Meshcheryakova, A. N. Leirikh. 2010. Egg Cocoons of the Earthworm *Dendrodrilus rubidus tenuis* (Lumbricidae, Oligochaeta) Withstand the Temperature of Liquid Nitrogen.Doklady Biological Sciences. 434. MAY 2010. 347-350.

Berman, D. I., E. N. Meshcheryakova, A. V. Alfimov and A. N. Leirikh, 2001. Spread of the Earthworm *Dendrobaena octaedra* (Lumbricidae: Oligochaeta) from Europe to Northern Asia Is Restricted by Its Insufficient Frost Resistance. Doklady Biological Sciences. Volume 377, Numbers 1-6, 145-148, DOI: 10.1023/A:1019222127107

Blakemore, R. J. 2003. Japanese earthworms (Annelida: Oligochaeta): a review and checklist of species. Org. Divers. Evol. 3, Electr. Suppl. 11: 1 - 43.
Summary: Available from: http://www.senckenberg.uni-frankfurt.de/odes/03-11.pdf [Accessed 3 March, 2011]

Blakemore, R. J., 2006. Chilean earthworms -a checklist of species updated from Seilfield (2002) and Zicsi (2004)
Summary: Available from: http://bio-eco.eis.ynu.ac.jp/eng/database/earthworm/Chile.pdf [Accessed 28 August 2010]

Blakemore, R.J. 2008b. British and Irish earthworms - a checklist of species updated from Sims & Gerard (1999).
Summary: Available from: http://www.annelida.net/earthworm/Britain%20&%20Ireland.pdf

Blakemore, R. J., 2008. Review of Southern Ocean, South Atlantic and Subantarctic Island earthworms updated from Lee (1994)
Summary: Available from: http://www.annelida.net/earthworm/Subantarctic/Subantarctic%20Species.pdf [Accessed 28 August 2010]

Bohlen, Patrick. J., Stefan Scheu, Cindy M Hale, Mary Ann McLean, Sonja Migge, Peter M Groffman, and Dennis Parkinson, 2004. Non-native invasive earthworms as agents of change in northern temperate forests. Front Ecol Environ 2004; 2(8): 427&#65533;435

Cameron, K. Erin, Erin M. Bayne & David W. Coltman, 2008. Genetic structure of invasive earthworms *Dendrobaena octaedra* in the boreal forest of Alberta: insights into introduction mechanisms. Molecular Ecology Volume 17, Issue 5, pages 1189&#65533;1197, March 2008

Costello, David M.; Lamberti, Gary A., 2008. Non-native earthworms in riparian soils increase nitrogen flux into adjacent aquatic ecosystems. Oecologia (Berlin). 158(3). DEC 2008. 499-510.

Damoff, George Alan; Reynolds, John Warren, 2009. The Earthworms (Oligochaeta: Acanthodrilidae, Eudrilidae, Lumbricidae, Megascolecidae, Ocenerodrilidae, and Sparganophilidae) of East Texas, USA. Megadrilogica. 13(8). OCT 2009. 113-140.

de Mischis, Catalina C.; Gleiser, Raquel M., 1999. First record of oligochaete fauna (Annelida, Oligochaeta) from the Province of La Rioja, Argentina. Megadrilogica. 7(9). July, 1999. 61-64.

Dymond, P., S. Scheu, and D. Parkinson. 1997. Density and distribution of *Dendrobaena octaedra* (Lumbricidae) in aspen and pine forests in the Canadian Rocky Mountains (Alberta). Soil Biology and Biochemistry 29:265&#65533;273.

Edwards, C.A. & Arancon, N.Q. 2004. The Use of Earthworms in the Breakdown of Organic Wastes to Produce Vermicomposts and Animal Feed Protein. In. C.A. Edwards (Ed). Earthworm Ecology (pp. 45–379). CRC Press.
Summary: Available from: http://www.crcnetbase.com/doi/pdf/10.1201/9781420039719.pt9 [Accessed 24 January, 20011]
Eisenhauer, Nico; Partsch, Stephan; Parkinson, Dennis; Scheu, Stefan, 2007. Invasion of a deciduous forest by earthworms: Changes in soil chemistry, microflora, microarthropods and vegetation. Soil Biology & Biochemistry. 39(5). MAY 2007. 1099-1110.
European Environment Agency. Undated B. *Dendrobaena octaedra*
Summary: Available from: http://eunis.eea.europa.eu/species/223813/general [Accessed 24 February, 2011]
Frelich, Lee E., Cindy M. Hale, Stefan Scheu, Andrew R. Holdsworth, Liam Heneghan, Patrick J. Bohlen and Peter B. Reich, 2006. Earthworm invasion into previously earthworm-free temperate and boreal forests. Biol Invasions (2006) 8:1235–1245
Frenot, Yves, 1992. Introduced populations of *Dendrodrilus rubidus* ssp. (oligochaeta:lumbricidae) at Crozet, Kerguelen and Amsterdam islands: effects of temperature on growth patterns during the juvenile stages. Soil Biology and Biochemistry Volume 24, Issue 12, December 1992, Pages 1433-1439
Global Biodiversity Information Facility (GBIF), 2010. Species: *Dendrobaena octaedra*
Summary: Available from: http://data.gbif.org/species/14843550/ [Accessed 28 August 2010]
Global Biodiversity Information Facility (GBIF), 2010. Species: *Dendrodrilus rubidus*
Summary: Available from: http://data.gbif.org/species/16502231/ [Accessed 28 August 2010]
Global Biodiversity Information Facility (GBIF), 2010. Species: *Lumbricus rubellus*
Summary: Available from: http://data.gbif.org/species/14850239/ [Accessed 28 August 2010]
Gonzalez, Grizelle; Seastedt, Timothy R.; Donato, Zugeily, 2003. Earthworms, arthropods and plant litter decomposition in aspen (*Populus tremuloides*) and lodgepole pine (*Pinus contorta*) forests in Colorado, USA. Pedobiologia. 47(5-6). 2003. 863-869.
Greiner, Holly G.; Costello, David M.; Tiegs, Scott D., 2010. Allometric estimation of earthworm ash-free dry mass from diameters and lengths of select megascolecid and lumbricid species. Pedobiologia. 53(4). 2010. 247-252.
Gundale J. Michael, William M. Jolly and Thomas H. Deluca, 2005. Susceptibility of a Northern Hardwood Forest to Exotic Earthworm Invasion. Conservation Biology Volume 19, No. 4, August 2005
Gundale, Michael J., 2002. Influence of exotic earthworms on the soil organic horizon and the rare fern *Botrychium mormo*. Conservation Biology. 16(6). December 2002. 1555-1561.
Hale, Cindy M.; Frelich, Lee E.; Reich, Peter B., 2005. Exotic European earthworm invasion dynamics in northern hardwood forests of Minnesota, USA. Ecological Applications. 15(3). JUN 05. 848-860.
Hale, Cindy M.; Frelich, Lee E.; Reich, Peter B., 2006. Changes in hardwood forest understory plant communities in response to European earthworm invasions. Ecology (Washington D C). 87(7). JUL 2006. 1637-1649.
Hale, Cindy M.; Frelich, Lee E.; Reich, Peter B.; Pastor, John, 2008. Exotic earthworm effects on hardwood forest floor, nutrient availability and native plants: a mesocosm study. Oecologia (Berlin). 155(3). MAR 2008. 509-518.
Heneghan, Liam; Steffen, James; Fagen, Kristen, 2006. Interactions of an introduced shrub and introduced earthworms in an Illinois urban woodland: Impact on leaf litter decomposition. Pedobiologia. 50(6). 2006. 543-551.
Holdsworth, Andrew R.; Frelich, Lee E.; Reich, Peter B., 2008. Litter decomposition in earthworm-invaded northern hardwood forests: Role of invasion degree and litter chemistry. Ecoscience. 15(4). 2008. 536-544.
Marshall, Valin G.; Fender, William M., 2007. Native and introduced earthworms (Oligochaeta) of British Columbia, Canada. Megadrilogica. 11(4). AUG 2007. 29-52.
McAlpine D. F. Reynolds J. W., 1977. Terrestrial Oligochaeta of some New Brunswick Cana Caves with remarks on their ecology. Canadian Field-Naturalist. 91(4). 1977. 360-366.
McLean, M. A., and D. Parkinson. 1997a. Changes in structure, organic matter and microbial activity in pine forest soil following the introduction of *Dendrobaena octaedra* (Oligochaeta, Lumbricidae). Soil Biology and Biochemistry 29:537–540.
McLean, M. A., and D. Parkinson. 2000a. Field evidence of the effect of the epigeic earthworm *Dendrobaena octaedra* on the microfungal community in pine forest floor. Soil Biology and Biochemistry 32:351–360.
McLean, M. A., and D. Parkinson. 2000b. Introduction of the epigeic earthworm *Dendrobaena octaedra* changes the orabatid community and microarthropod abundances in a pine forest. Soil Biology & Biochemistry 32:1671–1681.
McLean, M. A.; Parkinson, D., 1997b. Soil impacts of the epigeic earthworm *Dendrobaena octaedra* on organic matter and microbial activity in lodgepole pine forest. Canadian Journal of Forest Research. 27(12). Dec., 1997. 1907-1913.
McLean, M. A., S. Migge-Kleian, D. Parkinson, 2006. Earthworm invasions of ecosystems devoid of earthworms: effects on soil microbes. Biol Invasions (2006) 8:1257–1273
Migge-Kleian, Sonja; Mary Ann McLean; John C. Maerz & Liam Heneghan, 2006. The influence of invasive earthworms on indigenous fauna in ecosystems previously uninhabited by earthworms. Biol Invasions (2006) 8:1275–1285
Nuzzo, A. Victoria, John C. Maerz, Bernd Blossey, 2009. Earthworm Invasion as the Driving Force Behind Plant Invasion and Community Change in Northeastern North American Forests. Conservation Biology. Volume 23, Issue 4, pages 966–974, August 2009
Pop, Victor V. & Adriana Antonia Pop, 2006. Lumbricid earthworm invasion in the Carpathian Mountains and some other sites in Romania. Biol Invasions (2006) 8:1219–1222
Prat, Pascale; Charrier, Marryvonne; Deleporte, Simone; Frenot, Yves, 2002. Digestive carbohydrases in two epigeic earthworm species of the Kerguelen Islands (Subantarctic) Pedobiologia. 46(5). 2002. 417-427.
Reeves, Will Karlisle; Reynolds, John Warren, 1999. New records of cave-dwelling earthworms (Oligochaeta: Lumbricidae, Megascolecidae and Naididae) and other annelids (Aeolosomatida, Branchiobdellida and Hirudinea) in the Southeastern United States, with notes on their ecology. Megadrilogica. 7(10). Sept., 1999. 65-71.
Reynolds, John Warren, 2000. A contribution to our knowledge of the earthworm fauna of Manitoba, Canada (Oligochaeta, Lumbricidae). Megadrilogica. 8(3). June, 2000. 9-12.
Reynolds, John Warren, 2001a. The earthworms of New Brunswick (Oligochaeta: Lumbricidae) Megadrilogica. 8(8). June, 2001. 37-47.
Reynolds, John Warren, 2001b. The earthworms of South Carolina (Oligochaeta: Acanthodrilidae, Lumbricidae, Megascolecidae, Ocnerodrilidae and Sparganophilidae) Megadrilogica. 8(7). May, 2001. 25-36.
Reynolds, John Warren, 2003. The earthworms (Oligochaeta: Lumbricidae) of Wyoming, USA. Megadrilogica. 9(6). January 2003. 33-39.

Reynolds, John Warren, 2007a. First earthworm (Annelida : Clitellata : lumbricidae) records from Wentworth township, Argenteuil county, Quebec, Canada. Megadrilogica. 11(5). SEP 2007. 58-62.
Reynolds, John Warren, 2007b. The earthworms (Oligochaeta : Lumbricidae) of South Dakota, USA. Megadrilogica. 10(12). FEB 2007. 95-105.
Reynolds, John Warren, 2008. The Earthworms (Oligochaeta: Acanthodrilidae, Lumbricidae and Ocnerodrilidae) of Arizona, USA. Megadrilogica. 12(11). NOV 2008. 155-166.
Reynolds, John Warren; Damoff, George Alan, 2010. The Earthworms (Oligochaeta: Acanthodrilidae, Lumbricidae, Megascolecidae and Sparganophilidae) of Oklahoma USA. Megadrilogica. 13(12). MAY 2010. 173-193.
Reynolds, John Warren; Hanel, Christine, 2005. The earthworms (Oligochaeta: Lumbricidae) of Tristan da Cunha and Nightingale Islands, south Atlantic Ocean. Megadrilogica. 10(7). SEP 2005. 47-56
Reynolds, John Warren; Jones, Alexander G.; Gaston, Kevin J.; Chown, Steven L., 2002. The earthworms (Oligochaeta: Lumbricidae) of Gough Island, South Atlantic Ocean. Megadrilogica. 9(2). May, 2002. 5-15.
Reynolds, John W.; Mayville, Philip N., 1994. New earthworm records from Rainy River District in North Western Ontario (Oligochaeta: Lumbricidae) Megadrilogica. 6(2). 1994. 13-17.
Reynolds, J. W., 1976. Catalog and Identification Key to Lumbricidae in Quebec Canada. Naturaliste Canadien (Quebec). 103(1). 1976. 21-27.
Reynolds, J.W. 2004. The Status of Earthworm Biogeography, Diversity, and Taxonomy in North America Revisited with Glimpses into the Future.In. C.A. Edwards (Ed). Earthworm Ecology (pp. 63-74). CRC Press.
Summary: Available from: http://www.crcnetbase.com/doi/pdf/10.1201/9781420039719.ch4 [Accessed 24 February, 2011]
Righi, G., 1989. Addition to the knowledge of Venezuelan Oligochaeta. Revista Brasileira de Biologia. 49(4). 1989. 1065-1084.
Summary:
Roubickova, Alena; Mudrak, Ondrej; Frouz, Jan, 2009. Effect of earthworm on growth of late succession plant species in postmining sites under laboratory and field conditions. Biology & Fertility of Soils. 45(7). AUG 2009. 769-774.
Scheu, Stefan; Parkinson, Dennis, 1994. Effects of invasion of an aspen forest (Canada) by *Dendrobaena octaedra* (Lumbricidae) on plant growth. Ecology (Tempe). 75(8). 1994. 2348-2361.
Straube, Daniela; Johnson, Edward A.; Parkinson, Dennis; Scheu, Stefan; Eisenhauer, Nico, 2009. Nonlinearity of effects of invasive ecosystem engineers on abiotic soil properties and soil biota. Oikos. 118(6). JUN 2009. 885-896.
Suarez, Esteban R.; Fahey, Timothy J.; Groffman, Peter M.; Yavitt, Joseph B.; Bohlen, Patrick J., 2006a. Spatial and temporal dynamics of exotic earthworm communities along invasion fronts in a temperate hardwood forest in south-central New York (USA). Biological Invasions. 8(4). JUN 2006. 553-564.
Suarez, Esteban R.; Fahey, Timothy J.; Yavitt, Joseph B.; Groffman, Peter M.; Bohlen, Patrick J., 2006b. Patterns of litter disappearance in a northern hardwood forest invaded by exotic earthworms. Ecological Applications. 16(1). FEB 2006. 154-165.
Szlavecz, Katalin; Csuzdi, Csaba, 2007. Land use change affects earthworm communities in Eastern Maryland, USA. European Journal of Soil Biology. 43(Suppl. 1). NOV 2007. S79-S85.
Teale, Chelsea L, 2007. A preliminary survey of the Oligochaete fauna of the Yukon Territory, Canada. Megadrilogica. 11(1). MAR 2007. 3-7.
Tiunov, Alexei V., Cindy M. Hale, Andrew R. Holdsworth, Tamara S. Vsevolodova-Perel, 2006. Invasion patterns of Lumbricidae into the previously earthworm-free areas of northeastern Europe and the western Great Lakes region of North America. Biol Invasions (2006) 8:1223 1234
Uvarov, Alexei V., 2009. Inter- and intraspecific interactions in lumbricid earthworms: Their role for earthworm performance and ecosystem functioning. Pedobiologia. 53(1). 2009. 1-27
Wironen, M. and T. R. Moore, 2006. Exotic earthworm invasion increases soil carbon and nitrogen in an old-growth forest in southern Quebec. Can. J. For. Res. 36(4): 845 854 (2006)
Zhang, Weixin; Hendrix, Paul F.; Snyder, Bruce A.; Molina, Marirosa; Li, Jianxiong; Rao, Xingquan; Siemann, Evan; Fu, Shenglei, 2010. Ecology (Washington D C). 91(7). JUL 2010. 2070-2079. Dietary flexibility aids Asian earthworm invasion in North American forests