

A new population of *Dytiscus lapponicus* Gyllenhal, 1808 from Belgium with notes on the distribution and ecology of the species (Coleoptera: Dytiscidae)

Kevin SCHEERS^{1,2} & Jo PACKET²

¹Parkstraat 21 B6, B-9100 Sint-Niklaas, Belgium (e-mail: aquatic.adephaga@gmail.com)

²Research Institute for Nature and Forest (INBO): Kliniekstraat 25, B-1070 Brussels, Belgium

Abstract

During an eco-hydrological study on the aquatic habitats in the nature reserve 'Ophovenerheide' *Dytiscus lapponicus* Gyllenhal, 1808 was encountered in two small oligotrophic lakes. The species was only known from two populations in the province of Antwerpen. This new record also represents the Southernmost confirmed population of *D. lapponicus* in Europe, with exception of the population of *D. lapponicus disjunctus* in the Maritime Alps. In this article the distribution and the habitat in Belgium is discussed and the possible threats for the Belgian populations are given.

Keywords: *Dytiscus lapponicus*, Hydradephaga, Dytiscidae, Belgium, habitat type 3160.

Samenvatting

Tijdens een verkennende eco-hydrologische studie van de vennen in het natuurgebied Ophovenerheide in Limburg werd in twee vennen *Dytiscus lapponicus* Gyllenhal, 1808 aangetroffen. Deze soort was enkel gekend van twee kleine populaties in de provincie Antwerpen. Deze nieuwe vondst is de meest zuidelijke in Europa, met uitzondering van de populatie van *D. lapponicus disjunctus* in de Maritieme Alpen. In dit artikel worden de verspreiding en de habitat van de soort in België besproken en de mogelijke bedreigingen vermeld.

Résumé

Lors d'une recherche éco-hydrologique sur les étangs de la réserve naturelle 'Ophovenerheide' dans la province du Limbourg, *Dytiscus lapponicus* Gyllenhal, 1808 a été découvert dans deux lacs oligotrophes. L'espèce était connue de seulement deux populations dans la province d'Anvers. Cette nouvelle localité est également la plus méridionale de *D. lapponicus* en Europe, à l'exception de celle de *D. lapponicus disjunctus* dans les Alpes Maritimes. Dans cet article, la distribution et l'habitat en Belgique sont discutés et les menaces pour les populations belges sont évoquées.

Introduction

Dytiscus lapponicus Gyllenhal, 1808 can be easily distinguished from the nine other European species of the genus *Dytiscus* Linnaeus, 1758 by the combination of the yellow band that surrounds the eye completely and the yellow underside with characteristic black patterning (Fig. 1). Furthermore the outline is discontinuous due the presence of a definitive angle between the pronotum and elytra, the yellow margin of the pronotum is in *D. lapponicus* much broader than in other species of the genus and the elytra of the males have about 20 more or less developed narrow yellowish vitae. In Belgian specimens these last two features are only poorly developed and some specimens have thence been misidentified in the past as the more common *D. circumflexus* Fabricius, 1801. As in most species of the genus *Dytiscus*, the females of this species are dimorphic. Most females are sulcate, having elytra

with 10 deep longitudinal grooves, other females have the elytra smooth (var. *septentrionalis* Gyllenhal, 1827). The non-sulcate form seems to be restricted to northern latitudes and occurs together with the sulcate form in Scandinavia. In Central Europe only the sulcate form is known. Flight-tests have all been negative (KHEL & DETTNER, 2007) and according to ERIKSSON (1972) the flight muscles are usually degenerate. FOSTER (2010) suspects that some individuals are capable of flight. Because of the presence of the species in very isolated lakes in mountainous regions, like some lochans, it's very likely that dispersal by flight is possible. Presumably at least a portion of some populations are capable of flight, which is also the case in some other species of diving beetles. The percentage, or even the presence, of individuals with full developed wings can fluctuate considerably in time. Furthermore, oogenesis flight syndrome is to be expected in these flying individuals. The dispersal ability is possibly very limited and especially in small populations this could mean that colonisation of nearby water bodies is nearly impossible.

D. lapponicus is a North Palearctic species that occurs from Great Britain and Ireland through northern Central-Europe and Scandinavia to West Siberia (ROUGHLEY, 1990; NILSSON & HOLMEN, 1995). There is a subspecies, *Dytiscus lapponicus disjunctus* Camerano, 1880, that is restricted to the Italian Maritime Alps. The last records of this subspecies are from 1923 and it is now considered as extinct (FRANCISCOLO, 1979; ROUGHLEY, 1990).

On the Belgian Red List of 1994 (BOSMANS, 1994) the species is considered as critically endangered. More recent it is present on the provisional Red List as endangered (SCHEERS, 2012). *D. lapponicus* is present on the Red Lists of Great Britain (near threatened; FOSTER, 2010), Ireland (near threatened; FOSTER *et al.*, 2009), Germany (near threatened; GEISER, 1998), The Netherlands (near threatened; DROST *et al.*, 1992) and Poland (vulnerable; PAWLOWSKI *et al.*, 2002).

On the ninth of June 2015 a trap, of the type 'Molchreuse', was placed in each of the five surveyed ponds in the nature reserve Ophovenerheide. These traps were baited with cat-food (14% beef and 4% liver) and left over night. In two of the traps *Dytiscus lapponicus* was caught with respectively one and six specimens. In the traps with *D. lapponicus* no other Dytiscidae were present. The other traps contained common species of water beetles: *Dytiscus marginalis* Linnaeus, 1758, *Acilius sulcatus* (Linnaeus, 1758), *Acilius canaliculatus* (Nicolai, 1822) and *Colymbetes fuscus* (Linnaeus, 1758). The trap at the Zwartven, where six specimens of *D. lapponicus* were present, was the only location where the exotic fish *Umbra pygmaea* (DeKay, 1842) was absent.



Fig. 1. *Dytiscus lapponicus* Gyllenhal, 1808. From left to right: dorsal view male, dorsal view female and ventral view male (collection K. Scheers, photos by J. Mentens, Vildaphoto).

Distribution in Belgium

The species was first recorded in Belgium in 1933 when a single female specimen was found in a farm pond at Warsage (Liège). BALFOUR-BROWNE (1950) mentions that it is “almost certainly a stray specimen from a nearby Dutch habitat”. This record is indeed very doubtful because of the absence of suitable habitat in the proximity. Furthermore, this record is not present in any examined collection (including the collection of the Royal Belgian Institute of Natural Sciences (RBINS)). Because of doubt about the record of Warsage, it is not included in the distribution map in figure 2. and in table 1. VAN DORSSELAER (1957) repeats the record of Warsage and gives a new record from specimens caught at Kalmthout (Antwerpen) in 1956. In the collection of RBINS there is one specimen from Beverlo (Limburg) caught in 1897, but this record was not known until BOSMANS (1994) included it in his Red List. In the same work, BOSMANS (1994) also included a case study on the lake ‘de Biezenkuilen’ at Kalmthout in 1994 where he mentions taking a specimen of *D. lapponicus*, which is apparently not included in this Red List. VAN DE VIJVER *et al.* (1997), apparently not aware of the record from 1994, ‘rediscovered’ the species at Brasschaat (Antwerpen). These are all the known records previous of the year 2000. Recent records confirm that the population(s) at the nature reserves ‘Kalmthoutse Heide’ (Kalmthout) and ‘Groot Schietveld’ (Brasschaat) still persist, although in low numbers. The discovery of a new population in the nature reserve ‘Ophovenerheide’ is surprising because it is the first confirmation of the species in Limburg since the specimen caught at Beverlo in 1897. A map with the distribution of *Dytiscus lapponicus* in Belgium is given in figure 2 and all known Belgian records are given in table 1.

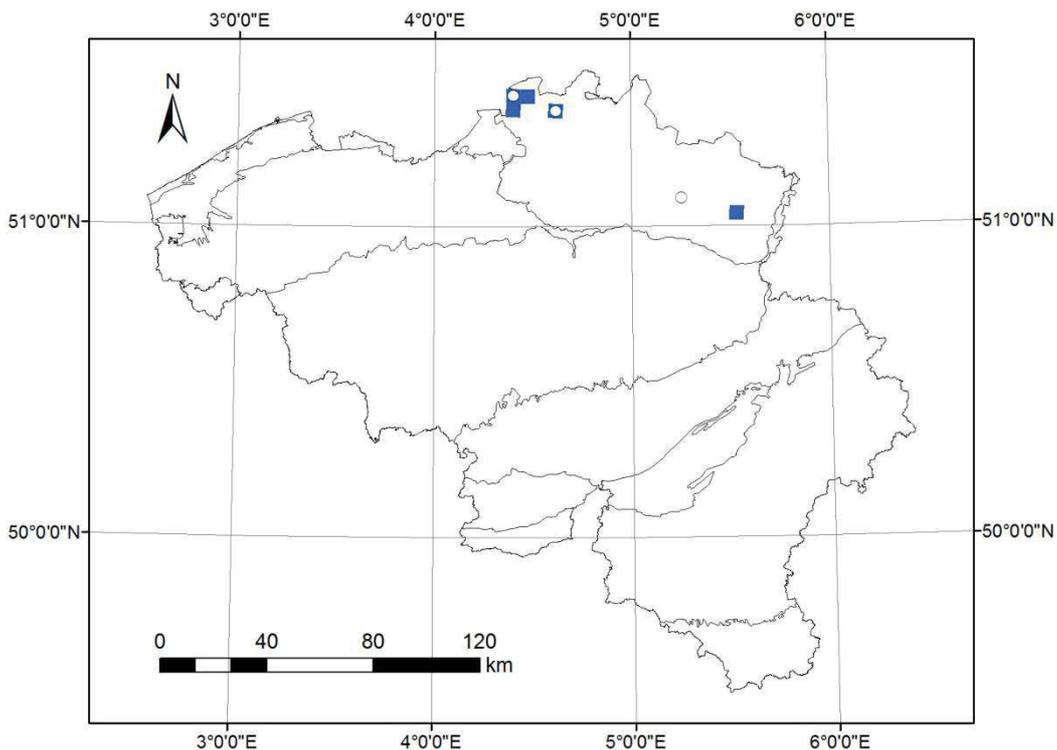


Fig. 2. Distribution of *Dytiscus lapponicus* Gyllenhal, 1808 in Belgium on UTM5km grid. White dots indicate records up to 2000 and blue squares indicate records from 2000 onwards.

Table 1. Belgian records of *Dytiscus lapponicus* Gyllenhal, 1808 ordered by date.

Locality	Province	Date	Number	Reference
Beverlo	Limburg	1897	1	Collection RBINS
Kalmthout	Antwerpen	08.VII.1956	1	Collection RBINS
Kalmthout	Antwerpen	23.VIII.1956	3	Collection RBINS
Kalmthout	Antwerpen	23.IX.1956	1	Collection RBINS
Kalmthout	Antwerpen	06.VII.1957	1	Collection RBINS
Kalmthout	Antwerpen	03.VII.1959	2	Collection RBINS
Brasschaat, Groot Schietveld	Antwerpen	1993	1	Van De Vijver et al., 1997
Kalmthout, Biezenkuilen	Antwerpen	29.IX.1994	1	Bosmans, 1994
Kalmthout, Biezenkuilen	Antwerpen	08.VII.2002	1	Collection K. Scheers
Kalmthout, Verbindingsven	Antwerpen	24.V.2008	1	Collection K. Scheers
Kalmthout, Stappersven	Antwerpen	03.V.2011	5	Collection K. Scheers
Brasschaat, Groot Schietveld	Antwerpen	03.IX.2011	1	Collection K. Scheers
Kalmthout, Stappersven	Antwerpen	30.VI.2015	2	Observation J. Kooijman & K. Scheers
Kalmthout, Putse Moer	Antwerpen	02.VII.2015	2	Observation J. Kooijman
Ophoven, Zwartven	Limburg	10.VII.2015	6	Collection K. Scheers
Ophoven, Turfven II	Limburg	10.VII.2015	1	Observation K. Scheers & Jo Packet

Habitat

According to NILSSON & HOLMEN (1995) the main habitat are sparsely vegetated shallow lakes and ponds above the tree-line and at lower altitudes the species seems to be confined to small dystrophic lakes devoid of fish. In Britain the habitat is mostly described as permanent, exposed lochans with a peat substratum and with no outlets from which the sites can be colonized by fish. The sites are mainly situated in mountainous regions but in the north the species occurs also at lower altitudes (FOSTER, 2010).

All Belgian localities where the species is present are permanent oligotrophic, moorland ponds where the water is brown in colour due to a high content of humic acids. The water is acidic (pH <5.5) and the conductivity is very low (< 100µS/cm). All seven ponds are between 0,6 ha and 41,8 ha and the maximum depth ranges from 60 to 150 cm. These ponds are all located on sandy or peaty soil and the bottom is covered by a layer of peaty detritus. There is very limited contact with local groundwater (perched water table) and the water level is mainly rainwater dependent. These ponds are of natural origin, laying in depressions that were formed by aeolian erosion which were filled up with rain water. From which period these ponds originate is difficult to ascertain but they are considered to be at least a few hundred if not a few thousand years old. The riparian vegetation is dominated by *Juncus effusus*, or *Molinia caerulea* sometimes with patches of *Carex rostrata* and *Sphagnum* species. Most of the lakes are in contact with oligotrophic bog vegetation dominated with *Sphagnum* spec. and *Eriophorum angustifolium*. The submerge vegetation is absent or consists of some patches *Sphagnum cuspidatum* and *Juncus bulbosus*. Most of the sites are located in heath- and moorland and/or pine-forest. Most of the locations are known as ‘Natural dystrophic lakes and ponds (3160)’, according to the Habitat Directive. None of the localities where *D. lapponicus* occurs are in good status mainly due to eutrophication. According to LOUETTE *et al.* (2013) this habitat type is considered to be in a bad condition in Flanders.

These waters are from origin devoid of fish and this is the case in all sites except one. The aversion of *D. lapponicus* for fish was already stated by FRANCISCOLO (1979), FOSTER (2010) and FOSTER & FRIDAY (2011).



Fig. 3. Turfven II in the nature reserve Ophovenerheide. In this rather small oligotrophic lake with *Sphagnum cuspidatum* and *Juncus bulbosus* one specimen of *Dytiscus lapponicus* Gyllenhal, 1808 was caught in a baited trap (photo by Jo Packet).

Threats

There are multiple threats for the populations of this species in Belgium. First of all there is the rapid spread of invasive fish species like the Pumpkinseed (*Lepomis gibbosus* (Linnaeus, 1758)), Eastern mudminnow (*Umbra pygmaea* (DeKay, 1842)) and the Catfish species *Ameiurus nebulosus* Lesueur, 1819 and *A. melas* Rafinesque, 1820. At all sites there are similar lakes in the direct vicinity where *Lepomis gibbosus* is present in very high densities. In the lakes at ‘Ophovenerheide’ also *Umbra pygmaea* is present in nearly all lakes and pools in great numbers, including one site with *D. lapponicus* (here only one male of *D. lapponicus* could be caught). In Britain *D. lapponicus* has already been lost from many sites by introduction of fish (FOSTER, 2010). Also restoration of the degraded oligotrophic lakes could be a major threat if the presence of this species is not taken into account in the restoration works. This is because the lakes are normally pumped dry before restoration and after which they are normally naturally filled up with rain water which can take several months. After this restoration recolonization, as mentioned in the introduction, will be very improbable. When restoring a pond where this species is present, the temporary relocation of the specimens during restoration works and reintroduction afterwards could be a solution. FOSTER (2010) mentions the rising summer temperatures as the main threat for the species in Great Britain. And last but not least, there is a risk of genetic impoverishment because of the high level of isolation of small populations.

Conclusion

The discovery of a new population of *Dytiscus lapponicus* in Belgium comes somewhat unexpected because, with exception of the record from Beverlo in 1897, all known records are from the northwestern part of the province of Antwerp. These new records represent the Southernmost confirmed population of *Dytiscus lapponicus* in Europe, with exception of the population of *D. lapponicus disjunctus* in the Alps (which at the moment is considered to be extinct).

The population at the nature reserve ‘Ophovenerheide’ is most probably a relict population that has been overlooked in the past rather than the result of a new colonization. This conclusion is based on

the nearby presence of the species in 1897 and on the fact that this species has a very limited dispersal ability.

In Belgium the species seems to be restricted to ponds of the habitat type 3160 of the Habitat Directive (natural dystrophic lakes and ponds). However, most of the sites are more or less degraded. According to the conservation status assessment of the Habitat Directive, the habitat type 3160 is in a bad status of conservation in Flanders (LOUETTE *et al.*, 2013). This bad conditions are mainly due to eutrophication and acidification. There is still hope for the species in anticipation of an action plan to restore the habitat type 3160, assuming that this species tolerates a certain level of eutrophication and the presence of this species is taken into account when preparing the restoration plans.

In Belgium the distribution of the bigger species of Dytiscidae, (i.e. the genera *Dytiscus*, *Cybister* but also *Graphoderus*) is only partly known. These species are easier caught with traps than with the commonly used net and in Belgium traps are only very sporadically used to catch water beetles (SCHEERS, 2015). Therefore it is possible that there are other populations of *D. lapponicus* at sites where the habitat is present. There are some sites with high potential for this species like the ponds in heathland on the military domain at Leopoldsburg, the 'Klein Schietveld' near Kalmthout, the oligotrophic ponds near Dilsen-Stokkem.

Acknowledgements

Both authors wish to acknowledge Karel Flipkens (Agentschap voor Natuur en Bos, ANB) for the permission to conduct research in the nature reserve Ophovenerheide and for his hospitality. The first author would also like to thank Jurriën Kooijman for the permission to include his records of the species from Kalmthout and Jeroen Mentens (Vildaphoto) for the use of the habitus photos of *D. lapponicus*.

References

- BALFOUR-BROWNE F., 1950. - *British Water Beetles, Volume II*. Ray Society, London, 394 pp.
- BOSMANS R., 1994. - *Een gedocumenteerde rode lijst van de water- en oppervlaktewantsen en waterkevers van Vlaanderen, met inbegrip van enkele case studies*. Universiteit Gent (RUG), Laboratorium voor Ecologie, Zoögeografie en Natuurbehoud, Gent. 175 pp.
- DROST M.B.P., CUPPEN H.P.J.J., VAN NIEUKERKEN E.J. & SCHREIJER M. 1992. - *De waterkevers van Nederland*. Stichting Uitgeverij van de Koninklijke Nederlandse Natuurhistorische Vereniging, Utrecht, 280 pp.
- ERIKSSON U., 1972. - The invertebrate fauna of the Kilpisjärvi area, Finnish Lapland. *Acta Societatis pro Fauna Flora Fennica* 80: 121-160.
- FOSTER G.N., 2010. - *A review of the scarce and threatened Coleoptera of Great Britain Part (3): Water beetles of Great Britain. Species Status I*. Joint Nature Conservation Committee, Peterborough, 143 pp.
- FOSTER G.N. & FRIDAY L.E., 2011. - *Keys to the water beetles of Britain and Ireland (part 1)*. Field Studies Council, Shrewsbury, 144 pp.
- FOSTER G.N., NELSON B.H. & O CONNOR Á., 2009. - *Ireland Red List No. 1. Water Beetles*. Dublin: National Parks & Wildlife, Department of Environment, Heritage & Local Government. 64 pp.
- FRANCISCOLO M.E., 1979. - *Coleoptera Haliplidae, Hygrobiidae, Gyrinidae, Dytiscidae*. Fauna d'Italia, Bologna, 804 pp.
- GEISER R., 1998. - Rote Liste der Käfer (Coleoptera). in: BINOT M., BLESS R., BOYE P., GRUTTKE H. & PRETSCHER, P., 1998. *Rote Liste gefährdeter Tiere Deutschlands*. Schriftenreihe für Landschaftspflege und Naturschutz 55: 168-230.
- KHEL S. & DETTNER K., 2007. - Flugfähigkeit der in Deutschland vorkommenden adepagen Wasserkäfer (Coleoptera, Hydradephaga). *Entomologie heute*, 19: 141-161.
- LOUETTE G., ADRIAENS D., DE KNIJF G. & PAELINCKX D., 2013. - *Staat van instandhouding (status en trends) habitattypen en soorten van de Habitatrichtlijn (rapportageperiode 2007-2012)*. Rapporten van het Instituut voor Natuur- en Bosonderzoek 2013 (INBO.R.2013.23). Instituut voor Natuur- en Bosonderzoek, Brussel. 46 pp.
- NILSSON A.N., & HOLMEN, M., 1995. - *The aquatic Adephaga (Coleoptera) of Fennoscandia and Denmark*. II. Dytiscidae, Leiden: E.J. Brill. (Fauna Entomologica Scandinavica, No. 32.), 192pp.
- PAWLOWSKI J., KUBISZ D. & MAZUR M., 2002. - Coleoptera Chrzaszcze. in: GLOWACINSKI Z., 2002. *Red List of Threatened Animals in Poland*. Polish Academy of Sciences, institute of Nature Conservation, Krakov, 88-110.
- ROUGHLEY R.E., 1990. - A systematic revision of the species of *Dytiscus* Linnaeus (Coleoptera: Dytiscidae). Part 1. Classification based on adult stage. *Quaestiones entomologicae* 26: 383-557.

- SCHEERS K., 2012. - *Rode lijst en verspreidingsonderzoek van de waterroofkevers (Coleoptera: Dytiscidae) van Vlaanderen*. unpublished manuscript, Van Hall Larenstein, 39 pp.
- SCHEERS K., 2015. - *Dytiscus latissimus* Linnaeus, 1758 and *Graphoderus bilineatus* (Degeer, 1774) in Belgium: a detailed account of the known records (Coleoptera: Dytiscidae). *Bulletin S.R.B.E./K.B.V.E.*, 151 (2015): 34-39.
- VAN DE VIJVER B., STOKS R., SANTENS M. & DE VOCHT S., 1997. - The rediscovery for Flanders of *Dytiscus dimidiatus* Bergsträsser, 1778 and *Dytiscus lapponicus* Gyllenhal, 1808 (Coleoptera, Dytiscidae) at the Groot Schietveld (Brasschaat). *Bulletin & Annales de la Société royale belge d'Entomologie*, 133: 317-322.
- VAN DORSSELAER R., 1957. - *Catalogue des Coléoptères de Belgique III, 4 Dytiscidae (Adephaga, Caraboidea)*. Société Royale d'Entomologie de Belgique, Bruxelles, 3-31.