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GROUND BEETLES OF GENUS *NOTIOPHILUS* DUMERIL, 1806 (COLEOPTERA: CARABIDAE) IN THE WORLD ENTOMOLOGICAL COLLECTIONS

2. UNIVERSITY OF COLORADO MUSEUM

Arvīds Barševskis

Barševskis A. 2009. Ground beetles of genus *Notiophilus* Dumeril, 1806 (Coleoptera: Carabidae) in the world entomological collections. 2. University of Colorado Museum. *Acta Biol. Univ. Daugavp., 9 (2): 137 – 138.*

The article contains the information about the ground beetles of the genus *Notiophilus* Dum. in the collection of the University of Colorado Museum. Altogether 13 specimens from 6 species of this genus were revised. *N. novemstriatus* LeC. is presented for the first time in the State of Colorado.

Key words: *Notiophilus*, Carabidae, University of Colorado Museum, entomological collection

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INTRODUCTION

The article continues the publications series about the ground beetles of genus *Notiophilus* Dum. (Coleoptera: Carabidae) in the world entomological collections, which the author has revised.

The first article of this publications series was devoted to Illinois Natural History Survey and Eastern Illinois University (USA, Illinois) available species of the genus *Notiophilus* Dum. (Barševskis 2009).

The second article contains the information about the ground beetles of the genus *Notiophilus* Dum. in the collection of the University of Colorado Museum.

Altogether 13 specimens of the genus *Notiophilus* Dum. which belong to 6 species were revised in the University of Colorado Museum. Among the available in the museum collection species of the genus *Notiophilus* Dum. *N. biguttatus* (F.) is collect in Europe – in Iceland and United Kingdom. The other five are collect in North-America. *N. aquaticus* (L.) is holarctic species, which can be found in Nearctic´s as well as in Palearctic. *N. semistriatus* Say can be found as in Nearctic as in Palearctics Eastern part (Siberia, Far East, Japan) (Bousquet, Barsevskis 2003). The last three species are spread only in Nearctic Region. *N. novemstriatus* LeC. until this time was not mentioned in Colorado State in main works about North-American fauna (Lindroth, 1961; Larochelle, Lariviere 2003).

Table 1. Species of *Notiophilus* Dum. genus in the beetles collection of University of Colorado Museum

Species	UCMC	
	Number of specimens	Regions
N. aeneus Herbst, 1806	1	NAR: NC
N. aquaticus (Linnaeus, 1758)	5	NAR: CO
N. biguttatus (Fabricius, 1779)	3	EUR: IC, UK
N. novemstriatus LeConte, 1849	2	NAR: CO
N. semistriatus Say, 1823	1	NAR: CO
N. simulator Fall, 1906	1	NAR: CO
TOTAL	13	

In the species list after the species name there are mentioned the revised specimens label data: region (country or state), where the specimen collected, in brackets the information about the collecting place, the date, the collector's name and the numbers of revised specimens. In the label data of the revised representatives the following abbreviations are used: NAR – Nearctic: CO – Colorado, NC – North Carolina ; EUR – Europe: IC – Iceland, UK – United Kingdom.

SPECIES LIST

1. *Notiophilus aeneus* Herbst 1806 – NAR: NC (Black Mountains, 30.05.1904., 1).

2. *Notiophilus aquaticus* (Linnaeus, 1758) – NAR: CO (W Boulder Co., Science Lodge, 10.06.1940., U.N.Lanham leg., 1; Elwood Pass., 26.07.1967., B.Rotger C.R. leg., 1; Mineral Co., Wolf Creek Pass., 13.06.1961. B.Rotger C.R. leg., 2; San Jua, 12.05.1971., B.Rotger C.R. leg., 1).

3. *Notiophilus biguttatus* Fabricius 1779 – EUR: IC (L.P.Gratacap leg., 1); UK (England, Edgbaston, Birmingham, 30.04.1978., 2).

4. *Notiophilus novemstriatus* LeConte 1849 – NAR: CO (W Boulder Co., W of Science Lodge, 10300 ft., 20.06.1939., U.N.Lanham leg., 1; Boulder Co., 08.1939., H.G.Rodeck leg., 1). The species is mentioned in the Colorado state fauna for the first time.

5. *Notiophilus semistriatus* Say 1823 – NAR: CO (Lump Gulch near Gilpin, 27.07.1934., N. Dondelinger leg., 1).

6. *Notiophilus simulator* Fall 1906 – NAR: CO (Vallecitos, 20.04.1963., B.Rotger leg., 1).

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Larochelle A., Lariviere M.C. 2003. A natural History of the Ground Beetles (Coleoptera: Carabidae) of America north of Mexico. Pensoft., Sofia – Moscow, 584 pp.

Lindroth C.H. 1961. The ground-beetles (Carabidae, excl. Cicindelinae) of Canada and Alasca. Part.2. Opuscula Entomiologica Suplementum, 20: 1-200.

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FAUNISTIC RECORDS OF THE BEETLES (HEXAPODA: COLEOPTERA) IN LATVIA. 3.

Arvīds Barševskis, Marina Janovska, Kristīna Aksjuta, Raimonds Cibuļskis

Barševskis A., Janovska M., Aksjuta K., Cibuļskis R., 2009. Faunistic records of the beetles (Hexapoda: Coleoptera) in Latvia. 3. *Acta Biol. Univ. Daugavp., 9(2): 139 – 159.*

The article conteint new information about distribution data of 219 species of the beetles (Hexapoda: Coleoptera) in Latvia mainly collected in 2008 - 2009. One species *Lomechusoides strumosus* (Fabricius, 1792) (Staphylinidae) is indicated for the first time in the fauna of Latvia.

Key words: Beetles, Coleoptera, fauna, Latvia.

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INTRODUCTION

The article is continuation of previous series of the publications about Latvian beetles' fauna (Barševskis et al. 2004, 2008) devoted to the study study of the beetles (Hexapoda: Coleoptera) fauna and distribution in Latvia.

The article contains information on 219 beetle species, from which one species *Lomechusoides strumosus* (Fabricius, 1792) (Staphylinidae) is indicated for the first time in the Latvian fauna, 10 species are officially protected in Latvia and 21 species are included in the list of special and indicator species of natural forest key habitats. Beetles collected in the way of separate expeditions with entomological net, in window traps, pitfall traps and pheromone traps.

The material is stored in the collection of the Institute of Systematic Biology, Daugavpils University (DAUC) (Daugavpils, Latvia). The records published in the article will complete the information about beetle species distribution in Latvia.

The nomenclature, which is applied in H. Silfverberg's (2004) catalogue, is used as the basis in the species list of this article.

In the species list after species name is indicated place where it was found, collecting date, in the brackets is indicated the number of collected specimens, short information about biotope and collectors name abbreviation:

A.A. – A. Anichtchenko, A.B. – A. Barševskis, A.Be. – A. Berziņš, A.Bu. – A. Bukejs, A.Č. – A. Čukliņa, A.G.-G. – A. Grenciņa-Grencione, A.H. – A. Harlevskis, A.L. – A. Lukaševiča, A.P. – A. Pankjāns, A.Pa. – A. Pavlova, A.S. – A. Soldāns, A.So. – A. Soklāns, A.T. – A. Titovs, A.Z. – A. Zdanoka, A.Zd. – A. Zdankovska, D.P. – D. Pilāte,

E.B. – E. Bolšteine, E.R. – E. Rudāns, E.T. – E. Tamanis, G.J. – G. Jurševska, G.L. – G. Lociks, I.K. – I. Kampāne, I.L. – I. Leiskina, J.A. – J. Aksjuta, J.D. – J. Donis, J.Da. – J. Daņilova, J.I. – J. Ivanova, J.J. – J. Jasinskis, J.K. – J. Kundziņš, J.Ku. – J. Kupce, J.L – J. Lučina, J.La. – J. Laizāns, J.P. – J. Prokopčika, J.S. – J. Stasķeviča, K.A. – K. Aksjuta, K.B. – K. Barševska, L.R. – L. Rancāna, M.B. – M. Balalaikins, M.J. – M. Janovska, M.N. – M. Nicis, M.P. – M. Pilāts, M.V. – M. Verdenfelde, M.Z. – M. Zolovs, N.M. – N. Mihailova, N.V. – N. Vaciļa, O.D. – O. Drošina, O.K. – O. Kuzmina, O.Ko. – O. Koškina, O.V. – O. Vasiļjeva, R.C. – R. Cibuļskis, R.M. – R. Miznikova, R.O. – R. Orlovskis, S.P. – S. Pipiņa, T.V. – T. Vasiļjeva, U.V. - U. Valainis, V.A. – V. Aleksejevs, V.D. – V. Dementjeva, V.K. – V. Krone, V.Ko. – V. Kokina, V.F. – V. Ferbere.

LIST OF SPECIES

Carabidae Latreille, 1802

1. *Leistus terminatus* (Panzer, 1793) - Jēkabpils distr., Dignāja, bank of Daugava river, 14. VIII 2009. (1, M.B.); Krāslava distr., ~1.3 km NW Skaista, Zakulišķi, Nature park „Dridža ezers", 14. VII 2008. (1, R.C.); Talsi distr., Kaļķi, protected area „Kaļķupes ieleja", 13. VII 2009. (1, J.I.).

2. *Leistus ferrugineus* (Linnaeus, 1758) - Liepāja distr., Upmaļi, sea-cost, 12. VIII 2008. (1, A.B.).

3. *Nebria rufescens* (Ström, 1768) - Cēsis distr., Gauja National park, near Rauna river, 15. VII 2008. (1, D.P.); Talsi distr., Laidze, „Zaļmeži", 13.-14. VI 2009. (2, M.J.).

4. *Nebria brevicollis* (Fabricius, 1792) - Daugavpils distr., Nature park „Silene", 09. VI 2008. (1, A.S.), Šedere, „Straumēni', 28.-30. VIII 2009. (1, M.J.); Dobele distr., near Liepāja road and Ķemeri National park, 02. X 2008. (2, R.O.); Jēkabpils distr., Dunava, 01.-07. VI 2009. (1, K.B.), 11.-22. VI 2009. (1, K.B.); Preiļi distr., Jersika, „Kurpnieki", 18.-20. VII 2009. (1, A.B.), 28. X 2009. (2, A.B.); Rīga distr., Jūrmala, Dzintari, 24. VI 2009. (2, R.C.); Talsi distr., Laidze, „Zaļmeži", 13.-14. VI 2009. (14, M.J.), Slītere National park, „Zilie kalni", 16. X 2008. (3, A.B.), 13. VII 2009. (2, A.B.), Kaļķi, protected area „Kaļķupes ieleja", 13. VII 2009. (1, A.B., R.C.; 3, J.I.), protected area „Kaļķupes ieleja", window trap, VI – 13. VII 2009. (18, A.B.), protected area „Kaļķupes ieleja", „Puiškalns", (1, R.C.); Ventspils distr., Moricsala Nature reserve, 03. IX 2004. (1, U.V.), 15. X 2008. (1, A.A.), 14. VII 2009. (3, R.C.).

5. *Calosoma inquisitor* (Linnaeus, 1758) - Ventspils distr., Moricsala Nature reserve, window trap, 13. VI 2008. (1, M.N.), Moricsala Nature reserve, window trap, *Sorbus aucuparia,* 04. VI – 14. VII 2009. (1, A.B.).

6. *Carabus glabratus* Paykull, 1790 - Daugavpils distr., Nature park „Silene", 17.-20. VI 2008. (2, V.K., J.S.), 01.-03. VII 2008. (1, J.K.), Nature park „Silene", protected area „Ilgas", 19.-22. VI (1), VI 2006. (1, R.M.), 05. VI – 06. VII 2006. (1, O.K.; 1, N.N.), 27. VI – 03. VII 2007. (1, L.R., A.Be.; 1, J.Da., A.Č.; 1, N.V., O.K.).

7. *Carabus convexus* Fabricius, 1775 - Daugavpils distr., Bebrene, Nature park „Dvietes paliene", 19. XI 2006. (1, E.R.), 18. IV 2009. (1, K.A.); Krāslava distr., Šķeltova, „Barševski", 18. X 2009. (1, A.B.); Limbaži distr., Lāni, VIII 2008. (5); Preiļi distr., Jersika, „Kurpnieki", 01.-10. V 2009. (1, A.B., K.B.); Ogre distr., Jumprava, „Velna dobe", 10. VII 2008. (1, A.B.).

8. *Carabus coriaceus* Linnaeus, 1758 – Daugavpils distr., Nature park „Daugavas loki", pine forest near Daugava river, 55°54'39"N, 026Ś53'25"E, 13. VIII – 17. IX 2008. (4, A.P., A.Bu.); Kuldīga distr., Padure, protected area „Ventas ieleja", mixed forest near Venta river valley, 30. VII 2009. (1, R.C.).

9. *Cychrus caraboides* (Linnaeus, 1758) - Aizkraukles distr., Ērberģe, 04. IX 2006. (4, J.D.), Taurkalne, 16. VI 2006. (1, J.D.), 03. VII 2006. (3, J.D.); Daugavpils distr., Nature park „Silene", protected area „Ilgas", 02. XI 1994. (1, A.H.), 28.-29. VI 2007. (1, A.B.), 01. VIII 2007. (1, A.B., U.V.),

Šedere, „Straumēni", 26. VIII 2008. (1, M.J.), 24. VII 2009. (1, M.J.); Jēkabpils distr., Dunava, 01 XI 2009. (1, A.B.); Jelgava distr., Nature park „Vilce", 23°32'31"N, 56°25'13"E, 03. V 2008. (1, A.S., U.V., A.P., E.T.); Rīga distr., Biķernieki forest, 04. XI 2008. (1, V.F.), Olaine, 01. VIII 2006. (1, J.D.), 14. VIII 2006. (1, J.D.), Salaspils, 14. VIII 2006. (3, J.D.); Talsi distr., Slītere National park, „Zilie kalni", 17. VII 2007. (1, A.B.), Stende, pine forest clearing, 57°07'19"N, 022°32'26"E, 19. VII 2007. (1, A.B., U.V., A.P., A.S.); Tukums distr., Ķemeri National park, 27. X 2009. (4, J.P.); Valka distr., Mežole, 26. VI 2006. (1, J.D.), 05. IX 2006. (1, J.D.), 18. IX 2006. (1, J.D.); Ventspils distr., Moricsala Nature reserve, 26. VI 2004. (1, A.B.), VIII 2008. (2, A.B.).

10. *Cicindela sylvatica* Linnaeus, 1758 - Daugavpils distr., near Daugavpils beltway behind Mežciems, 05. VII 2009. (1, A.B.), Nature park „Silene", protected area „Ilgas", 12. VIII 2009. (1, A.B.), Rīga – Krāslava beltway, near Ļubesti, 02. VI 2007. (1, A.B.); Rēzekne distr., Puša, 25. II 2002. (1, A.B.).

11. *Cicindela hybrida* Linnaeus, 1758 - Cēsis distr., Gauja National park, 07. VI 2005. (1, E.R.); Daugavpils distr., Nature park „Silene", 28.-30. VI 2004. (1, A.B.), 01.-03. VII 2008. (1, S.P.), Nature park „Silene", protected area „Ilgas", 27. VI 2009. (2, A.B.), 02. VIII 2009. (9, A.B.), Medumi, Kurcums, 18. V 2009. (1, A.B., A.A.), near Kurcums lake, 06. VI 2008. (1, A.B.), Rīga – Krāslava beltway, near Ļubesti, 02.VI 2007. (2, A.B.), Višķi lake bank, 20. V 2007. (1, M.J.); Krāslava distr., Nature park „Daugavas loki", Skerškānu loks, 55°52'44"N, 027°05'35"E, 28. IV 2009. (4, M.N., A.A., U.V.), Ūdrīši, „Zapoļniki", 08.-10. V 2009. (2, M.J.); Limbaži distr., country territ. of Salacgriva, „Veczemju klintis", 17. VII 2008. (7, A.B.); Preiļi distr., Jersika, „Kurpnieki", 22.-25. IX 2008. (1, A.B.); Talsi distr., Mazirbe, 21. VI 2004. (2, A.B.), Mazirbe, dune, 10. VII 2004. (1, A.B.).

12. *Cicindela campestris* Linnaeus, 1758 - Daugavpils distr., Bebrene, 27. VI 2005. (1, E.R.), clearing, forest near Daugavpils beltway behind Mežciems, 11. V 2006. (1, K.B.), 05. VII 2009. (1, A.B.), Nature park „Silene", protected area „Ilgas", 14.-20. VI 2002. (3, A.B.), VII 2005. (1, A.B.), protected area „Ilgas", meadow, pit fall trap, VI 2006. (1, A.B.), Šedere, „Straumēni", 01.-03. V 2008. (1, M.J.), 18. V 2008. (1, M.J.), 10.-26. IV 2009. (2, M.J.); Jēkabpils distr., Dunava, Dviete forest, 18. V 2008. (1, A.B.), Tadenava, forest clearing, 01. VI 2006. (1, A.B.); Krāslava distr., near Čertoks lake, 27. IV 2007. (1, M.J., K.A.), Ūdrīši, „Zapoļniki", VII 2009. (1, M.J.); Madona distr., Teiči Nature reserve, 06. VI 2005. (1, E.R.); Rēzekne distr., Stalerova, Šortu lake env., clearing, 29. VII 2009. (1, M.B.).

13. *Miscodera arctica* (Paykull, 1790) - Daugavpils distr, near Daugavpils beltway, behind Mežciems, 08. VI 2008. (1, A.B., K.B.).

14. *Blemus discus* (Fabricius, 1792) - Daugavpils distr., Nature park „Svente", 09. VII 2008. (1, K.A.).

15. *Stomis pumicatus* (Panzer, 1796) – Aizkraukle distr., Taurkalne, 04. IX 2006. (1, J.D.); Preiļi distr., Jersika, „Kurpnieki", 07. IX 2008. (1, A.B., K.B.); Rēzekne distr., Teirumnieki, clearing, 15. VII 2009. (1, A.Bu., M.B.).

16. *Pterostichus quadrifoveolatus* Letzner, 1852 - Daugavpils distr., near Daugavpils beltway, behind Mežciems, 05. VII 2009. (3, A.B.).

17. *Sericoda quadripunctata* (DeGeer, 1774) - Daugavpils distr., near Daugavpils beltway behind Mežciems, 05. VII 2009. (5, A.B.).

18. *Platynus livens* (Gyllenhal, 1810) - Valka distr., Mežole, 26. VI 2006. (1, J.D.); Ventspils distr., Moricsala Nature reserve, 15. X 2008. (2, A.A.), 23. VIII 2008. (1, A.B.).

19. *Agonum sexpunctatum* (Linnaeus, 1758) – Daugavpils distr., Dviete, Dviete – Tadenava forest, clearing, 10. VIII 2008. (1, A.B.).

20. *Panagaeus cruxmajor* (Linnaeus, 1758) - Jēkabpils distr., Dunava, 01. XI. 2009. (4, A.B.); Preiļi distr., Jersika, „Kurpnieki", 01. X 2006. (1, A.B.); Ventspils distr., Moricsala Nature reserve, 15. X 2008. (1, A.B.).

21. Chlaenius nitidulus (Schrank, 1781) – Preiļi distr., Jersika, "Kurpnieki", 26.-28. V 2006. (1, K.B.).

22. Badister unipustulatus Bonelli, 1813 - Daugavpils distr., Nature park „Silene", protected area „Ilgas", 18. VI 2008. (1, R.C.); Talsi distr., Mazirbe, VI 2002. (1, A.B.).

23. Badister bullatus (Schrank, 1798) - Daugavpils distr., Bebrene, 28. X 2006. (1, E.R.), Stropi, 11. VI 2009. (1, A.Bu.); Šedere, „Straumēni", 12.-13. VI 2007. (1, M.J.); Krāslava distr., Šķeltova, „Barsevski", 10. IV 2009. (1, A.B.), Ūdrīši, „Zapoļniki", 08.-10. V 2009. (1, M.J.).

24. Badister meridionalis Puel, 1925 - Preiļi distr., Jersika, „Kurpnieki", 07. VIII 2009. (1, A.B., K.B.).

25. Badister lacertosus Sturm, 1815 - Daugavpils distr., Bebrene, 28. X 2006. (1, E.R.), Elerne, Muravki, 24. V 2007. (1, A.P.), Šedere, Šarlote, 04. V 2009. (1, K.A.); Jēkabpils distr., Dunava, 23.-30. VI 2007. (1, K.B.), 01.-08. VI 2009. (1, K.B.); Krāslava distr., Šķeltova, „Barševski", VI 2002. (1, A.B.); Preiļi distr., Jersika, „Kurpnieki", 28. VI 2009. (1, A.B.); Talsi distr., Slītere National park, 13. VI 2007. (1, K.A.); Ventspils distr., Moricsala Nature reserve, 14. VIII 2009. (1, A.B.), Moricsala Nature reserve, pit-fall trap, 29. VI 2006. (1, A.B.).

26. Badister (Trimorphus) sodalis (Duftschmid, 1812) - Preiļi distr., Jersika, „Kurpnieki", 07. VI 2009. (1, A.B., K.B.).

27. Diachromus germanus (Linnaeus, 1758) - Krāslava distr., Ūdrīši, Tartaks, 55Ś54'15"N, 026Ś48'54"E, 30. V 2008. (1, A.P.).

28. Lebia chlorocephala (J.J.Hoffmann, 1803) - Daugavpils distr., Bebrene, 27. V 2006. (1, E.R.), Nature park „Silene", 27. VI 2006. (1, A.B., U.V., A.P.), Šedere, „Straumēni", 25. III 2007. (1, M.J.), 10.-26. IV 2009. (1, M.J.); Jēkabpils distr., Dunava, 16. IV 2006. (1, A.B.), 01. XI 2009. (2, A.B.); Preiļi distr., Jersika, „Kurpnieki", 07. VI 2006. (1, A.B., K.B.); Rēzekne distr., Rēzekne, wood, 08. XI 2008. (1, J.Ku.).

29. Lebia cruxminor (Linnaeus, 1758) - Daugavpils distr., Butišķi, valley of Daugava river, 01. VII 2009. (1, A.Bu., M.B.); Svente meadow, 13. VII 2008. (1, A.Bu.); Dobele distr., near Liepāja road and Ķemeri National park, 02. X 2008. (1, R.O.).

30. Paradromius linearis (Olivier, 1795) - Liepāja distr., Upmaļi, sea-cost, 12. VIII 2008. (1, A.B.).

31. Dromius agilis (Fabricius, 1787) - Daugavpils distr., Bebrene, 02.-03. III 2007. (5, E.R.), 03. VII 2007. (14, E.R.), 04. VII 2007. (1, E.R.), Naujene, Daugava river valley, 21. I 2008. (2, A.B.), Svente, protected area "Sasaļu mežs", 20. I 2008. (2, A.B.); Jēkabpils distr., Dunava, 24. III 2007. (6, A.B.), 01. XI. 2009. (3, A.B.); Preiļi distr., Jersika, forest clearing, 17. IV 2008. (1, A.B.); Rīga distr., Pļaviņas, 07. XI 2009. (2, A.B.); Talsi distr., Slītere National park, „Zilie kalni", 04. X 2007. (1, A.P.); Ventspils distr., Moricsala Nature reserve, 14. VII 2009. (1, A.B.).

32. Dromius quadraticollis Morawitz, 1862 - Cēsis distr., „Cīrulīšu klintis", 24. VII 2007. (1, E.R.); Daugavpils distr., Bebrene, 02.-03. VII 2007. (1, E.R.); Preiļi distr., Jersika, forest clearing, 17. IV 2008. (1, A.B.).

33. Dromius schneideri Crotch, 1871 - Daugavpils distr., near Daugavpils beltway behind Mežciems, 29. III 2009. (1, K.B., A.B.).

34. Dromius quadrimaculatus (Linnaeus, 1758) - Daugavpils distr., Bebrene, 02.-03. III 2007. (10, E.R.), 03. VII 2007. (11, E.R.), 04. III 2007. (6, E.R.), Naujene, Daugava river valley, 21. I 2008. (1, A.B.), Nature park „Silene", protected area „Ilgas", 12. XI 2002. (1, A.B.), Svente, protected area "Sasaļu mežs", 20. I 2008. (2, A.B.), Šedere, „Straumēni", (1, M.J.); Jēkabpils distr., Dunava, 24. III 2007. (10, A.B.), 22. III 2009. (4, A.B.), 01. XI. 2009. (13, A.B.); Preiļi distr, Jersika, forest clearing, 17. IV 2009. (1, K.B.), Jersika, „Kurpnieki", 28. X 2008. (1, A.B.); Rīga distr.,

protected area „Daugavgrīva", 03. XI- 06. XII 2008. (3, J.L.), Pļaviņas, 07. XI 2009. (6, A.B.); Talsi distr., Slītere National park, 13. IX 2005. (1, A.B.).

35. *Calodromius spilotus* (Illiger, 1798) - Daugavpils distr., Bebrene, 04. III 2007. (2, E.R.); Rīga distr., Kalngale, 24. II 2007. (16, E.R.).

36. *Philorhizus sigma* (Rossi, 1790) - Daugavpils distr., Bebrene, 03. III 2007. (6, E.R.); Jēkabpils distr., Dunava, 22. III 2009. (1, A. B.), 01. XI 2009. (11, A.B.); Krāslava, Ūdrīši, „Zapoļniki", 18.-19. IV 2009. (2, M.J.); Rīga distr., protected area „Daugavgrīva", 03. XI – 06. XII. 2008. (1, J.L.).

37. *Cymindis humeralis* (Fourcroy, 1785) - Daugavpils distr., near Daugavpils beltway behind Mežciems, 29. III 2009. (1, A.B.).

Histeridae Gyllenhal, 1808

38. *Hololepta plana* (Sulzer, 1776) - Ventspils distr., Moricsala Nature reserve, window trap, VIII 2009. (1, A.P.).

Silphidae Latreille, 1807

39. *Silpha obscura* Linnaeus, 1758 - Tukums distr., Kandava, bank of Abava river, 16. V 2009. (1, A.B.).

40. *Silpha tristis* Illiger, 1798 - Krāslava distr., Šķeltova, „Barševski", 17. VII 2008. (1, A.B.), VII 2009. (1, A.B.); Preiļi, 17. XI 2008. (1, O.V.).

Staphylinidae Latreille, 1802

41. *Hydrosmecta longula* (Heer, 1839) - Daugavpils distr., Saliena, Faltopi, Poguļanka river valley, Nature park „Daugavas loki", 17. VII 2006. (1, R.C.).

42. *Atheta paracrassicornis* Brundin, 1954 - Ventspils distr., Usma, Moricsala Nature reserve, V 2002. (1, U.V.).

43. *Alianta incana* (Erichson, 1837) - Daugavpils distr., Vabole, Zascenku Vaikulīši, meadow, under dead leaf of *Typhaea latifolia* on bank of pond, 14. II 1998. (4, R.C.), 28. III 1998. (4, R.C.); Jēkabpils distr., Rubene, Rubeņi, 10. IV 1998. (1, I.L.), 12. IV 1998. (2, I.L.), 25. IV 1998. (1, I.L.), 06. I 1999. (4, I.L.).

44. *Lomechusoides strumosus* (Fabricius, 1792) - Daugavpils distr., Līksna, VII 2001. (1, A.B.); Rīga distr., Salaspils, 15. V 1973. (2, M.S.). New species for the fauna of Latvia.

45. *Scaphidium quadrimaculatum* Olivier, 1790 - Daugavpils distr., 1.3 km S Naujene, Jezupova, Nature park "Daugavas loki", 55°55'53.9"N, 026°42'72,6"E, 09. V 2008. (1, R.C.), Nature park „Silene", 01.-03. VII 2008. (1, N.M.); Rēzekne distr., Staļerova, lake Šortu env., clearing, 29. VII 2009. (1, M.B.); Talsi distr., Kaļķi, protected area „Kaļķupes ieleja", 02. VI 2009. (1, R.C.); Tukums distr., 56°56'04"N, 023°10'50"E, 16. VII 2007. (1, A.B., U.V., A.P., A.S.).

46. *Oxyporus mannerheimi* Gyllenhal, 1827 - Krāslava distr., Nature park „Daugavas loki", Tartaks, mixed forest, on *Phallus impudicus*, VII 2008. (3, U.V.).

47. *Atrecus affinis* (Paykull, 1789) - Talsi distr., protected area „Kaļķupes ieleja", window trap, VI – 13. VII 2009. (1, A.B., U.V., R.C.).

48. *Emus hirtus* (Linnaeus, 1758) - Daugavpils distr., clearing, forest near Daugavpils beltway behind Mežciems, 11. V 2006. (1, K.B.); Jēkabpils distr., Dunava, 31. V 2009. (1, A.B.); Krāslava distr., Šķeltova, „Barševski", VII 2009. (1, A.B.).

49. *Ocypus ophthalmicus* (Scopoli, 1763) - Ventspils distr., Moricsala Nature reserve, window trap, *Quercus robur,* VIII 2009. (1, A.P.).

50. *Ocypus brunnipes* (Fabricius, 1781) – Aizkraukle distr., protected area „Aizkraukles purvs un meži", „Liepu sala", 06. VIII 2008. (1, A.Bu.); Jēkabpils distr., Dunava, 01. XI 2009. (2, A.B.); Preiļi distr., Jersika, „Kurpnieki", 28. X 2009. (1, A.B.); Rīga distr., Olaine, 05. IX 2006. (1, J.D.), Pļaviņas, 07. XI 2009. (2, A.B.), Salaspils, 02. X 2006. (2, J.D.).

51. Tasgius melanarius Heer, 1839 - Talsi distr., protected area „Kaļķupes ieleja", window trap, 13. VII 2009. (1, A.B., U.V.).

Lucanidae Latreille, 1806

52. Ceruchus chrysomelinus (Hochenwarth, 1785) - Kuldīga distr., Padure, protected area „Ventas ieleja", mixed forest near Venta river valley, 30. VII 2009. (1, R.C.); Talsi distr., Slītere National park, „Zilie kalni", 13. VII 2009. (1, R.C.); Ventspils distr., Moricsala Nature reserve, VI (2, A.B).

53. Sinodendron cylindricum (Linnaeus, 1758) – Aizkraukle distr., protected area „Aizkraukles purvs un meži", 01. VII 2008. (1, A.Bu.), 06. VIII 2008. (1, A.Bu.); Daugavpils distr., Bebrene, 56°03'13"N, 26°07'02"E, 07. V 2006. (15, E.R.), Eglaine, „Saliņas", 12. VII 2008. (1, M.J.), Nature park „Silene", protected area „Ilgas", VI 2006. (2, R.M.), 27. V – 01. VI 2009. (1, R.C.), protected area „Ilgas", clearing, near maple, VI 2005. (8, A.B.), Šedere, Šarlote, 16. IV 2008. (1, K.A.); Jēkabpils distr., Dunava, 10.-18. VI 2006. (1, K.B.), 18.-22. VI 2006. (1, K.B.), 06.-09. VI 2007. (1, K.B.), 10.-19. VI 2007. (2, K.B.), 04.-20. VI 2008. (1, K.B.), 02. VII 2008. (1, A.B.), 31. V 2009. (1, A.B.), 01.-07. VI 2009. (1, K.B.), 01.-08. VI 2009. (1, K.B.), 11.-22. VI 2009. (1, K.B.), 08.-09. VIII 2009. (1, A.B.), Dviete, Dviete – Tadenava forest, clearing, 10. VIII 2008. (1, A.B.), Tadenava, Dviete – Tadenava forest, pheromone trap, VII 2009. (1,A.B.); Krāslava distr., ~1.3 km NNW Skaista, Zukulišķi, Nature park „Dridža ezers", 14. VII 2008. (1, R.C.), Šķeltova, „Barševski", 03. VI 2008. (1, A.B.), 28. VI 2008. (1, A.B.), VII 2009. (1, A.B.); Preiļi distr., Jersika, „Kurpnieki", 22.-24. VI 2009. (1, A.B.), Preiļi, 17. XI 2008. (1, O.V.); Ogre distr., Jumprava, „Velna dobe", 10. VII 2008. (1, A.B.); Talsi distr., protected area „Kaļķupes ieleja", window trap, VI – 13. VII 2009. (6, A.B.; 2, A.B., U.V.), Slītere National park, VII 2002. (1, A.B.), Slītere National park, „Zilie kalni", 21. IX 2009. (1, A.P.); Ventspils distr., Moricsala Nature reserve, VI (4, A.B.), 09. VII 2004. (1, A.B.), 23. VIII 2008. (2, A.B.), Moricsala Nature reserve, 57°11'31"N, 022°08'03"E, 11. VII 2005. (1, U.V.), Moricsala Nature reserve, 55°11'40"N, 022°08'10"E, 11. VII 2005. (2, U.V.); Moricsala Nature reserve, window trap, 23. VIII 2008. (3, A.B., A.S.), Moricsala Nature reserve, window trap, *Sorbus aucuparia,* 04. VI – 14. VII 2009. (2, A.B.).

54. Dorcus parallelipipedus (Linnaeus, 1758) - Daugavpils distr., Nature park „Silene", protected area „Ilgas", 27. V – 01. VI 2009. (1, J.I.), Červonka, 29. VI 2008. (1, N.M.); Jēkabpils distr., Dunava, 31. V 2009. (2, A.B.), 01.-07.VI 2009. (1, K.B.), 01. XI 2009. (1, A.B.).

Trogidae Macleay, 1819

55. Trox sabulosus (Linnaeus, 1758) - Krāslava distr., Ūdrīši, „Zapoļniki", 08.-10. V 2009. (1, M.J.).

Geotrupidae Latreille, 1806

56. Trypocopris (Geotrupes) vernalis (Linnaeus, 1758) - Daugavpils distr., Nature park „Silene", 17.-20. VI 2008. (1, J.S., V.K.), Nature park „Silene", protected area „Ilgas", 26.-30. VI 2009. (1, M.Z.).

Scarabaeidae Latreille, 1802

57. Psammodius sulcicollis (Illiger, 1802) - Ventspils distr., Moricsala Nature reserve, window trap, 04. VI – 14. VII 2009. (1, A.B.).

58. Maladera holosericea (Scopoli, 1772) - Daugavpils distr., Nature park „Silene", protected area „Ilgas", IV 2002. (1, A.B.).

59. Omaloplia ruricola (auct. nec Fabricius, 1775) - Daugavpils distr., Butišķi, velley of Daugava river, 01. VII 2009. (2, A.Bu., M.B.), 1.5 km N Daugavpils, edge of pine forest, 29. VI 2009. (1, A.Bu.).

60. Amphimallon solstitiale (Linnaeus, 1758) - Bauska distr., Skaistkalne, 19. VI 2009. (1, A.B.); Daugavpils distr., Līksna, 3 km N Daugavpils, 55°56'01"N, 026°33'36"E, 28. VII 2009. (1, A.Bu.).

61. Hoplia graminicola (Fabricius, 1792) - Daugavpils distr., Šedere, Šarlote, 23.-24. VI 2009. (1, K.A.).

62. Anomala dubia (Scopoli, 1763) - Daugavpils distr., 1.5 km N, edge of pine forest, 29. VI 2009. (1, A.Bu.), near Daugavpils beltway behind Mežciems, 05. VII 2009. (1, A.B.); Preiļi distr., Aglona, 14. VIII 2009. (1, A.B.); Rēzekne distr., Rēzekne, 14. VII 2009 (2, M.B.); Talsi distr., Kolka dunes, 06. VIII 2009. (1, A.B.).

63. Oxythyrea funesta (Poda, 1761) - Daugavpils distr., ~1.5 km N Daugavpils, edge of pine forest, 29. VI 2009. (1, A.Bu.), near Daugavpils beltway, behind Mežciems, 05. VI 2009. (1, A.B.), Dviete, Dviete – Tadenava forest, 31. VII 2008. (1, A.B.), Dviete, Nature park „Dvietes paliene", 56°03'04"N, 026°20'41"E, 12. V 2009. (1, A.P., M.N.), Līksna, 4 km N Daugavpils, old cutting area, 29. VI 2008. (1, A.Bu.), Nature park „Silene", protected area „Ilgas", 05. VI – 03. VII 2006. (1, A.L.), 27. VI 2009. (6, A.B.), Vabole, 56°01'35"N, 026°27'35"E, 11. VII 2009. (2, R.C.); Jēkabpils distr., Dunava, 01.-07. VI 2009. (1, K.B.), 11.-22. VI 2009. (3, K.B.), 12.-18. VII 2009. (3, K.B.), 15.-18. VII 2009. (2, A.B.), 01.-13. VIII 2009. (1, K.B.), 08.-09. VIII 2009. (2, A.B.), Vandāni, bank of Daugava river, on Salix, 14. VI 2009. (1, M.B.); Preiļi distr., Jersika, „Kurpnieki", 22.-24. VI 2009. (1, A.B.).

64. Liocola (Protaetia) marmorata (Fabricius, 1792) - Jēkabpils distr., Dunava, Dviete – Tadenava forest, 31. V 2009 (1, A.B.); Ventspils distr., Moricsala Nature reserve, 14. VII 2009. (1, A.B.).

65. Gnorimus nobilis (Linnaeus, 1758) - Talsi distr., Slītere National park, VII 2002. (2, A.B.), Slītere National park, „Zilie kalni", 13. VII 2009. (1, R.C., 5, A.B.).

Byrrhidae Latreille, 1806

66. Lamprobyrrhylus nitidus (Schaller, 1783) - Daugavpils distr., Elerne, valley of Daugava river, V 2002. (9, A.B.), Elerne, dry meadow, IV 2002. (1, A.B.), Stropi, 23. VI 2009. (1, A.Bu.); Jēkabpils distr., Dunava, V 2002. (1, A.B.).

67. Cytilus sericeus (Forster, 1771) - Daugavpils distr., 3 km from Daugavpils, inland dunes, 27. V 2009. (1, A.Bu.), Elerne, dry meadow, IV 2002. (1, A.B.), Elerne, Daugava river valley, V 2002. (4, A.B.), Nature park „Silene", protected area „Ilgas", 14.-.20. VI 2002. (1, A.B.); Dobele distr., Jaunbērze, "Mežiniece", 12. VIII 2008. (1, A.B.); Gulbene distr., Lejasciems, V 2005. (1, A.B.), Ušūrs, pit-fall trap, VI 2004. (3, A.B.); Jelgava distr., Nature park "Vilce", 23°32'31"N, 56°25'13"E, 03. V 2008. (1, A.S., U.V., A.P., E.T.); Jēkabpils distr., Dunava, V 2002. (2, A.B.), 01. VI 2002. (1, A.B.), Dunava, dry meadow, IV 2002. (4, A.B.), Dunava, Dviete forest, 18. V 2008. (2, A.B.); Krāslava distr., Šķeltova, "Barševski", V 2002. (1, A.B.), Ūrdīši, „Zapoļniki", 09. VI 2007. (1, M.J.), 18.-19. IV 2009. (1, M.J.), 08.-10. V 2009. (7, M.J.); Madona distr., Bērzaune, 07. VII 2006. (1, A.B., A.P., E.R.); Preiļi distr., Jersika, „Kurpnieki", 15. v 2007. (1, A.B.); Rīga distr., Jūrmala, Kūdra, 13. VI 2006. (1, A.T.); Ventspils distr., Moricsala Nature reserve, window trap, *Quercus robur*, VIII 2009. (1, A.P.).

68. Byrrhus fasciatus Forster, 1771 - Aizkraukle distr., Taurkalne, 16. VI 2006. (1, J.D.), 03. VII 2006. (2, J.D.); Cēsis distr., Katrīnkalns, 26. VII 2007. (1, A.B.), Daugavpils distr., Elerne, Daugava river valley, V 2002. (2, A.B.), near Daugavpils beltway, behind Mežciems, 08. VI 2008. (1, A.B., K.B.), Rīga – Krāslava beltway, near Ļubesti, 17. V 2007. (1, A.B., K.B.), Nature park „Silene", 17.-20. VI 2008. (1, J.S., V.K.), Nature park „Silene", protected area „Ilgas", IV 2002. (1, A.B.), Šedere, „Straumēni", 10.-26. IV 2009. (1, M.J.), 01.-04. V 2009. (4, M.J.); Jēkabpils distr., Dunava, 01. V 2006. (1, A.B.), 11.-22. VII 2009. (1, K.B.); Krāslava distr., Izvalta, V (1, A.B.), Ūrdīši, „Zapoļniki", 09. VI 2007. (2, M.J.), 14.-15. VI 2008. (1, M.J.), IX 2009. (2, M.J.), 08.-10. V 2009. (3, M.J.), 27.-.28. VI 2009. (1, M.J.), 04.-06. IX 2009. (1, M.J.); Preiļi distr., Jersika, „Kurpnieki", 14. IV 2009. (1, A.B., K.B.), 01.-10. V 2009. (1, A.B., K.B.); Talsi distr., Mazirbe, dunes, 10. VII 2004. (1, A.B.).

69. Byrrhus pustulatus Forster, 1771 - Bauska distr., Skaistkalne, 19. VI 2009. (1, A.B.);

Daugavpils distr., near Daugavpils beltway, behind Mežciems, 08. VI 2008. (2, A.B., K.B.), Nature park „Silene", 17.-20. VI 2008. (1, J.Da., A.Zd.), Nature park 'Silene", resrtricted area „Ilgas", VI 2006. (1, R.M.), Krāslava distr., Ūdrīši, „Zapoļniki", 04.-06. IX 2009. (1, M.J.); Rēzekne distr., near Galdacis lake, 12. VII 2008. (1, A.Bu.).

70. *Byrrhus pilula* (Linnaeus, 1758) - Jēkabpils distr., Dunava, 10.-19. VI 2007. (1, K.B.); Krāslava distr., Ūdrīši, „Zapoļniki", 08.-10. V 2009. (3, M.J.); Preiļi distr., Jersika, „Kurpnieki", 19. IV 2009. (1, K.B.); Rēzekne distr., Nagļi, Lubāns lake bank, near Rēzekne river, 08. IX 2007. (1, A.Bu. M.B.).

Eucnemidae Eschscholtz, 1829

71. *Xylophilus corticalis* (Paykull, 1800) - Talsi distr., Kaļķi, protected area „Kaļķupes ieleja", window trap, 05. VIII 2008. (2, A.P.); Ventspils distr., Moricsala Nature reserve, window trap, *Quercus robur,* VII 2009. (1, A.P.).

Elateridae Leach, 1815

72. *Athous vittatus* (Fabricius, 1792) - Daugavpils distr., Šedere, „Straumēni", 10.-11. V 2008. (1, M.J.); Talsi distr., Kaļķupe, „Puiškalns", protected area „Kaļķupes ieleja", 02. VI 2009. (2, A.B.), Kaļķi, protected area „Kaļķupes ieleja", 57°32'31"N, 022°30'45"E, 12. V 2009. (1, A.B.), Slītere National park, window trap, 14. VI 2008. (2, A.P.), Slītere National park, „Dāvida pļavas", 02. VI 2009. (1, A.B.); Ventspils distr., Moricsala Nature reserve, window trap, 13. VI 2008. (1, M.N.).

73. *Athous haeromorhoidalis* (Fabricius, 1801) - Aizkraukle distr., Rīteri, 08. VI 2009. (2, A.B., R.O.); Bauska distr., Skaistkalne, 09. VI 2009. (1, A.B., R.O.); Daugavpils distr., Nature park „Silene", protected area „Ilgas", 05. VI – 03. VII 2006. (2, A.L.); Jelgava distr., Peterlauki, 27. V 2008. (1); Talsi distr., Slītere National park, window trap, 14. VI 2008. (2, A.P.), Slītere National park, „Dāvida pļavas", 02. VI 2009. (3, A.P., R.C.).

74. *Diacanthous undulatus* (De Geer, 1774) – Bauska distr., Skaistkalne, 09. VI 2009. (1, A.B., R.O.); Talsi distr., protected area „Kaļķupes ieleja", window trap, VI – 13. VII 2009. (3, A.B.).

75. *Denticollis rubens* Piller & Mitterpacher, 1783 - Talsi distr., Slītere National park, window trap, 14. VI 2008. (1, A.P.).

76. *Denticollis borealis* (Paykull, 1800) - Jēkabpils distr., Dunava, Tadenava forest, 17. V 2009. (1, A.B.); Talsi distr., protected area „Kaļķupes ieleja", window trap, VI – 13. VII 2009. (1, A.B., U.V.).

77. *Anostirus castaneus* (Linnaeus, 1758) - Preiļi distr., Jersika, „Kurpnieki", 01.-10. V 2009. (1, A.B., K.B.).

78. *Selatosomus cruciatus* (Linnaeus, 1758) - Daugavpils distr., clearing, forest near Daugavpils beltway, behind Mežciems, 11. V 2008. (1, K.B.), Lielborone, near Borne river, entry in Daugava river, 21. V 2008. (1, A.P.), Stropi, 04. V 2009. (1, A.B.), Šedere, Šarlote, 23.-24. VI 2009. (1, K.A.); Talsi distr., protected area „Kaļķupes ieleja", window trap, VI – 13. VII 2009. (1, A.B.), Kaļķi, protected area „Kaļķupes ieleja", window trap, 05. VIII 2009. (1, A.P.).

79. *Oedostethus quadripustulatus* (Fabricius, 1792) - Daugavpils distr., Dubna, „Lielie Stradišķi", 08. VII 2006. (1, A.P.).

80. *Sericus brunneus* (Linnaeus, 1758) - Bauska distr., Skaistkalne, 09. VI 2009. (1, A.B., R.O.); Daugavpils distr., Daugavpils, near Mežciems, edge of pine forest, 01. VI 2008. (1, A.Bu.), 3 km from Daugavpils, inland dunes, 27. V 2009. (1, A.Bu.), Līksna, Daugavpils beltway, 2.5 km from Rīga road, forest on continenthal dunes, 16. VI 2008. (1, A.B.); Dobele distr., near Liepāja road and Ķemeri National park, 02. X 2008. (1, R.O.); Jēkabpils distr., Dunava, Dviete - Tadenava forest, 15. VII 2009. (1, A.B.).

81. *Ectinus aterrimus* (Linnaeus, 1761) - Bauska distr., Skaistkalne, 19. VI 2009. (1, A.B.); Preiļi distr., Jersika, „Kurpnieki", 22.-24. VI 2009.

(1, A.B.); Ventspils distr., Moricsala Nature reserve, 14. V 2004. (2, A.B.), 29. V 2006. (4, E.R.), 13. VI 2008. (3, M.N.), Moricsala Nature reserve, window trap, *Sorbus aucuparia,* 04. VI – 14. VII 2009. (4, A.B.), VII 2009. (1, A.P.).

82. *Cardiophorus ruficollis* (Linnaeus, 1758) - Daugavpils distr., 3 km N Līksna, inland dunes, pine forest, 24. VI 2008. (1, A.Bu.); Gulbene distr., Lejasciems, 09. VI 2009. (1, A.B,. R.O.); Jēkabpils distr., Dunava, 03. VI 2007. (1, A.B.), Dviete, clearing near Dviete - Tadenava road, 23. VII 2008. (1, A.B.), Tadenava, Dviete – Tadenava forest, pheromone trap, VII 2009. (1, A.B.).

83. *Cardiophorus asellus* Erichson, 1840 - Daugavpils distr., 3 km N Līksna, inland dunes, pine forest, 24. IV 2008. (2, A.Bu.).

84. *Dicronychus equiseti* (Herbst, 1784) - Daugavpils distr., Līksna, 1,5 km N Daugavpils, inland dunes, 27. V 2009. (1, A.Bu.); Rīga distr., Jūrmala, Kūdra, 17. V 2008. (1, A.T.).

Lampyridae Fleming, 1821

85. *Lampyris noctiluca* (Linnaeus, 1758) - Daugavpils distr., Nature park „Silene", 01.-03. VII 2008. (2, R.C.), Nature park „Silene", protected area „Ilgas", 55°41'47,2"N, 026°47'01,8"E, 10. VI 2008. (1, R.C.); Ventspils distr., protected area „Kaļķupes ieleja", window trap, VI – 13. VII 2009. (1, A.B., U.V., R.C.), Moricsala Nature reserve, window trap, *Sorbus aucuparia,* 04. VI – 14. VII 2009. (1, A.B.).

Dermestidae Latreille, 1807

86. *Dermestes lardarius* Linnaeus, 1758 - Krāslava distr., Ūdrīši, „Zapoļniki", 14.-15. VI 2008. (1, M.J.), 08.-10. V 2009. (1, M.J.), Šķeltova, „Barševski", 10. IV 2009. (1, A.B.), VII 2009. (1, A.B.); Preiļi distr., Jersika, „Kurpnieki", 31. V 2008. (1, A.B.), 01.-10. V 2009. (4, A.B., K.B.).

87. *Dermestes murinus* Linnaeus, 1758 - Aizkraukle distr., Ērberģe, 18. IX 2006. (1, J.D.); Daugavpils distr., Nature park „Silene", protected area „Ilgas", 19.-22. VI (1), 26.-30. VI 2009. (1, M.Z.), 28. VIII 2009. (1, R.C.); Jēkabpils distr., Dunava, Tadenava forest, 07. VI 2009. (4, A.B.), Dunava, Dviete – Tadenava forest, 31. V 2009. (18, A.B.); Madona distr., Kalsnava, 14. VIII 2006. (3, J.D.); Rīga distr., Olaine, 05. IX 2006. (6, J.D.), Salaspils, 14. VIII 2006. (1, J.D.), 05. IX 2006. (2, J.D.).

Anobiidae Kirby, 1837

88. *Ptilinus fuscus* Geoffroy, 1785 – Jēkabpils distr., Dunava, 11.-22. VI 2009. (1, K.B.).

Lymexylidae Fleming, 1821

89. *Hylecoetus dermestoides* (Linnaeus, 1761) - Daugavpils distr., clearing, forest near Daugavpils beltway, behind Mežciems, 11. V 2008. (4, K.B.), Nature park „Silene", 26. V 2009. (1, A.P., M.N.); Jēkabpils distr., Dunava, Tadenava forest, 17. V 2009. (2, A.B.); Talsi distr., Slītere National park, 30. V 2006. (1, A.B.), Slītere National park, window trap, 14. VI 2008. (7, A.P.), Slītere National park, „Zilie kalni", 14. VI 2008. (1, M.N.); Ventspils distr., Moricsala Nature reserve, window trap, 13. VI 2008. (4, M.N.).

Trogossitidae Latreille, 1802

90. *Peltis grossa* (Linnaeus, 1758) - Daugavpils distr., Nature park „Silene", protected area „Ilgas", 27. VI 2009. (1, A.B.), 27. V – 01. VI 2009. (1, R.C.); Jēkabpils distr., Dunava, 01.-08. VI 2009. (2, K.B.), Mežāre, near Jēkabpils – Rēzekne road, 04. IX 2009. (1, M.B.), Tadenava, Dviete – Tadenava forest, pheromone trap, VII 2009. (1, A.B.); Kuldīga distr., Padure, protected area „Ventas ieleja", declivity of Venta river valley, 29. VII 2009. (1, R.C.), protected area „Ventas ieleja", mixed forest, 19. VIII 2009. (1, R.C.).

91. *Ostoma ferruginea* (Linnaeus, 1758) - Daugavpils distr., near Daugavpils beltway, behind Mežciems, 05. VII 2009. (1, K.B.); Jēkabpils distr., Dunava, 22. III 2009. (4, A.B.), 01.-07. VI 2009. (1, K.B.), Dunava, Tadenava forest, 07. VI 2009. (1, A.B.), Dunava, Dviete - Tadenava forest, 15. VII 2009. (1, A.B.), 31. V 2009. (4, A.B.).

92. *Thymalus limbatus* (Fabricius, 1787) - Ventspils distr., Moricsala Nature reserve, 14. VII 2009. (1, R.C.).

93. *Grynocharis oblonga* (Linnaeus, 1758) - Daugavpils distr., Šedere, „Straumēni", 16.-17. V 2009. (1, M.J.); Ventspils distr., Moricsala Nature reserve, 14. VII 2009. (1, A.B.), Moricsala Nature reserve, window trap, *Quercus robur*, VII 2009. (1, A.P.).

Cleridae Latreille, 1802

94. *Tillus elongatus* (Linnaeus, 1758) - Preiļi distr., Jersika, „Kurpnieki", 09.-12. VII 2009. (1, A.B.); Ventspils distr., Moricsala Nature reserve, *Sorbus aucuparia*, VI – 14. VII 2009. (1, A.B).

95. *Thanasimus formicarius* (Linnaeus, 1758) - Bauska distr., Bārbele, 08. V 2009. (6, A.B., R.O.), 28. V 2009. (1, A.B.), Skaistkalne, 09. VI 2009. (1, A.B., R.O.), 19. VI 2009. (4, A.B.); Daugavpils distr., clearing, forest near Daugavpils beltway, behind Mežciems, 11. V 2008. (9, K.B.), clearing near Rīga – Krāslava beltway, behind Mežciems, 11. V 2008. (9, A.B.), Līksna, forest near Rīga – Krāslava beltway, 22. III 2007. (1, A.B., U.V., A.S.); Gulbene distr., Lejasciems, burning, VI 2004. (1, A.B.), Ušūrs, window trap, 20. VIII 2004. (2, A.B., U.V.), VI 2005. (1, A.B., J.L.); Jēkabpils distr., Dunava, 01. VIII 2004. (1, K.B.), 25. IV 2009. (2, A.B.), Dunava, Dviete – Tadenava forest, 20. VII 2009. (1, A.B.), Viesīte, 15. IV 2008. (6, A.B.); Talsi distr., protected area „Kaļķupes ieleja", window trap, VI – 13. VII 2009. (1, A.B.), Slītere National park, window trap, 14. VI 2008. (2, M.N.); Tukums distr., Ķemeri National park, Lielaisciems, 17. VII 2007. (2, A.B., U.V., A.P., A.S.).

96. *Thanasimus femoralis* (Zetterstedt, 1828) – Daugavpils distr., Bebrene, 23.-28. I 2007. (1, E.R.), Dviete, forest, clearing near Dviete – Tadenava road, 23. VII 2008. (5, A.B.), Dviete, Dviete – Tadenava forest, 10. VIII 2008. (1, A.B.), Dviete, Dviete – Tadenava forest, clearing, 20. VII 2008. (1, A.B.); Gulbene distr., Lejasciems, burning, 20. VII 2004. (1, A.B.); Jēkabpils distr., Tadenava, Dviete – Tadenava forest, pheromone trap, VII 2009. (3, A.B.); Madona distr., Krustkalni Nature reserve, forest, VI 2005. (1, A.B., J.L.), 56°45'37"N, 026°07'29"E, VI 2005. (1, A.B., J.L.); Talsi distr., Slītere National park, "Zilie kalni", 30. V 2006. (1, A.B.); Tukums distr., Lielaisciems, window trap, 56°56'09"N, 023°10'75"E, 10. VIII 2006. (1, A.B.); Ventspils distr., Moricsala Nature reserve, VI (1, A.B.).

97. *Trichodes apiarius* (Linnaeus, 1758) - Daugavpils distr., Eglaine, 27. VI 2008. (1, T.V.), Ilūkste, 28.-29. VI 2008. (2, S.P.), Līksna, 3 km N Daugavpils, 55°56'01"N, 026°33'36"E, 28. VII 2009. (1, A.Bu.), Nature park „Silene", 01.-03. VII 2008. (1, N.M.); Jēkabpils distr., Dunava, 10.-19. VI 2007. (11, K.B.), 23.-30. VI 2007. (4, K.B.), 04.-20. VI 2008. (2, K.B.), 22. VI 2008. (3, A.B.), 11.-22. VI 2009. (2, K.B.), 12.-18. VII 2009. (3, K.B.), 01.-13. VIII 2009. (2, K.B.), 14.-16. VIII 2009. (4, K.B.), Dunava, Dviete - Tadenava forest, 15. VII 2009., (1, A.B.); Krāslava distr., Šķeltova, „Barševski", VII 2009. (1, A.B.), 11. VIII 2009. (1, A.B.); Preiļi distr., Aglonas stacija, 02. VIII 2008. (2, J.S.); Talsi distr., Kaļķi, protected area „Kaļķupes ieleja", 13. VII 2009. (1, A.B., R.C.).

98. *Korynetes caeruleus* (De Geer, 1775) - Daugavpils distr., Šedere, „Straumēni", 21. VI 2008. (1, M.J.), 05. VII 2008. (1, M.J.).

99. *Necrobia violacea* (Linnaeus, 1758) - Daugavpils distr., Šedere, „Straumēni", 05. VII 2008. (1, M.J.).

Melyridae Leach, 1815

100. *Cordylepherus viridis* (Fabricius, 1792) - Daugavpils distr, 1,5 km N Daugavpils, edge of pine forest, 29. VI 2009. (1, A.Bu.), near Daugavpils beltway, behind Mežciems, 05. VII 2009. (7, A.B.).

101. *Malachius bipustulatus* (Linnaeus, 1758) – Preiļi distr., Jersika „Kurpnieki", 31. V 2008. (1, A.B.); Ventspils distr., Moricsala Nature reserve, window trap, *Sorbus aucuparia*, 04. VI – 14. VII 2009. (1, A.B.).

102. *Anthocomus rufus* (Herbst, 1784) - Daugavpils distr., Daugavpils city, A.Pumpura

str.55, VI 2009. (1, M.J.), Arhitektu str.-1, 05. IX 2008. (1, M.J.), Šedere, „Straumēni", 07. IX 2008. (1, M.J.), 28. – 30. VIII 2009. (1, M.J.); Krāslava distr., Šķeltova, „Barševski', 18. X 2009. (5, A.B.); Liepāja distr., Upmaļi, sea-cost, 12. VIII 2008. (6, A.B.).

103. Anthocomus fasciatus (Linnaeus, 1758) - Jēkabpils distr., Dunava, 11.-22. VI 2009. (1, K.B.); Preiļi distr., Jersika, „Kurpnieki", 31. V 2008. (2, A.B.).

104. Anthocomus equestris (Fabricius, 1781) - Daugavpils distr., Daugavpils city, A.Pumpura str.-55, 01. VII 2009. (1, M.J.).

Nitidulidae Latreille, 1802

105. Nitidula bipunctata (Linnaeus, 1758) - Krāslava distr., Ūdrīši, „Zapoļniki", 26.-27. IV 2008. (1, M.J.).

106. Amphotis marginata (Fabricius, 1781) - Aizkraukle distr., Rīteri, 20. VI 2006. (1, A.B.), Skriveri, 21. VI 2006. (1, A.B.).

107. Soronia grisea (Linnaeus, 1758) - Aizkraukle distr., Pļaviņas, 07. XI 2009. (1, A.B.); Daugavpils distr., Bebrene, 56°03'40"N, 26°06'44"E, 04. V 2006. (2, E.R.), 56°03'51"N, 26°07'02"E, 07. V 2007. (4, E.R.), Nature park „Silene", protected area „Ilgas", 16. VIII 2002. (1, A.B.); Jēkabpils distr., Dunava, 15. VI 2006. (7, A.B.), VIII 2008. (1, K.B.), Dunava, Dviete forest, 18. V 2008. (1, A.B.); Ogre distr., 4 km NW Dīriķupīte river connection with Daugava river, 03. V 2006. (1, A.B., U.V., E.R.); Preiļi distr., Jersika, „Kurpnieki", 04.-05. VIII 2008. (1, A.B.), 28. IV 2009. (1, A.B., K.B.), 10. V 2009. (1, A.B.; 1, K.B.); Sutri, „Znotiņi", 26. V 2007. (1, A.So.); Rīga distr., Ķemeri, 2002. (1, A.B.); Talsi distr., Slītere National park, 17. VII 2007. (1, A.B., U.V., A.P., A.S.).

108. Ipidia binotata Reitter, 1875 – Aizkraukle distr., Taurkalne, 16. VI 2006. (1, J.D.); Gulbene distr., Lejasciems, VII 2006. (5, A.B.), Ušūrs, VI 2005. (1, A.B., J.L.), 05. VIII 2008. (1, A.B.); Daugavpils distr., Nature park „Silene" 17.-20. VI 2008. (1, J.S, V.K.); Tukums distr., window trap, 56°56'09"N, 023°10'75"E, 10. VIII 2006. (1, A.B.).

109. Cyllodes ater (Herbst, 1792) - Aizkraukle distr., protected area „Aizkraukles purvs un meži", 15. IX 2008. (1, A.Bu.); Daugavpils distr., Dviete, Dviete – Tadenava forest, 56°12'50,3"N, 26°26'16,2"E, 25. VI 2008. (1, A.B.); Nature park „Silene", protected area „Ilgas", 09. VI 2009. (6, A.B., A.S.); Talsi distr., protected area „Kaļķupes ieleja", window trap, VI – 13. VII 2009. (6, A.B.; 3, A.B., U.V.), Slītere National park, „Zilie kalni", „Dāvida pļavas", 16. VII 2008. (V.A., A.Pa.); Ventspils distr., Moricsala Nature reserve, 15. VII 2008. (2, V.A.), window trap, 13. VI 2008. (2, M.N.), 23. VIII 2008. (1, A.B., A.S.), Moricsala Nature reserve, window trap, *Sorbus aucuparia*, 04. VI – 14. VII 2009. (28, A.B.), VII 2009. (4, A.P.), *Quercus robur*, VII 2009. (1, A.P.), VIII 2009. (1, A.P.).

110. Pityophagus ferrugineus (Linnaeus, 1761) - Aizkraukle distr., Taurkalne, 16. VI 2006. (3, J.D.); Madona distr., Kalsnava, 14. VIII 2006. (1, J.D.); Valka distr., Mežole, 01. VIII 2006. (1, J.D.); Ventspils distr., Moricsala Nature reserve, 30. VII 2005. (1, U.V.).

Silvanidae Kirby, 1837

111. Uleiota planata (Linnaeus, 1761) - Daugavpils distr., 55°55'02"N, 026°33'38"E, pine forest, 24. IV 2009. (2, R.C.), near Daugavpils beltway, behind Mežciems, 29. III 2009. (6, A.B., K.B.), 05. VII 2009. (9, A.B.; 5, K.B.); Jēkabpils distr., Dunava, 15.-18. VII 2009. (1, A.B.); Krāslava distr., Ūdrīši, "Zapoļniki', 18.-19. IV 2009. (1, M.J.).

112. Dendrophagus crenatus (Paykull, 1799) - Daugavpils distr., Nature park „Silene", 01.-03. VI 2008. (1, N.M.), pine forest, 55°54'03"N, 026°34'42"E, 05. V 2009. (1, R.C.); Jēkabpils distr., Dunava, 07. I 2007. (1, A.B.), 22. III 2009. (3, A.B.), Dunava, pine forest, 08. IV 2007. (1, A.B.).

113. Psammoecus bipunctatus (Fabricius, 1792) - Preiļi distr., Jersika, „Kurpnieki", 04. V 2006. (2, K.B.).

Cryptophagidae Kirby, 1837

114. Antherophagus pallens (Linnaeus, 1758) - Daugavpils distr., Nature park „Silene", protected area „Ilgas", 05. VI – 03. VII 2006. (1, A.L.).

Erotylidae Latreille, 1802

115. Dacne bipustulata (Thunberg, 1781) - Daugavpils distr., Nature park „Silene", protected area „Ilgas", 27. VI 2007. (2, A.B.).

116. Tritoma bipustulata Fabricius, 1775 - Talsi distr., Kaļķi, protected area „Kaļķupes ieleja", 57°32'31"N, 022°30'45"E, 12. V 2009. (1, A.B.).

117. Tritoma subbasalis (Reitter, 1896) - Tukums distr., 56Ś56'04"N, 023Ś10'50"E, 19. VII 2005. (1, A.B., U.V., A.P., A.S.).

118. Triplax aenea (Schaller, 1783) - Daugavpils distr., Nature park „Silene", protected area „Ilgas", clearing, near pine, 55°41'34"N, 26°47'06"E, VII 2005. (1, A.B.), 55°41'29"N, 26°47'06"E, VII 2005. (1, A.B.); Šedere, „Straumēni', 22. IV 2007. (2, M.J.); Ventspils distr., Moricsala Nature reserve, window trap, 13. VI 2008. (1, M.N.).

119. Triplax russica (Linnaeus, 1758) - Daugavpils distr., Daugavpils city, Vienības str.-13, 14. VII 2008. (1, V.A., A.Pa.); Rīga distr., Salaspils, 14. VIII 2006. (1, J.D.).

120. Triplax rufipes (Fabricius, 1781) - Daugavpils distr., Nature park „Silene", protected area „Ilgas", 27. VI 2009. (1, A.B.); Ventspils distr., Moricsala Nature reserve, window trap, *Sorbus aucuparia,* VIII 2009. (2, A.P.).

Endomychidae Leach, 1815

121. Endomychus coccineus (Linnaeus, 1758) - Jēkabpils distr., Dunava, 01.-08. VI 2009. (1, K.B.).

122. Mycetina cruciata (Schaller, 1783) - Jēkabpils distr., Dunava, 01.-08. VI 2009. (2, K.B.); Talsi distr., Slītere National park, window trap, 14. VI 2008. (1, A.P.).

Mycetophagidae Leach, 1815

123. Mycetophagus quadripustulatus (Linnaeus, 1761) - Daugavpils distr., Bebrene, 21. X 2006. (2, E.R.), Bebrene, 56°03'51"N, 26°07'02"E, 07. V 2006. (1, E.R.), Daugavpils city, Vienības str.-13, 14. VII 2008. (1, V.A., A.Pa.), Daugavpils distr., Nature park „Silene", protected area „Ilgas", 14.-20. VI 2002. (2, A.B.), 01.-05. VII 2006. (2, A.B.), 18. VI 2008. (1, R.C.), Šedere, „Straumēni", 16.-17. V 2009. (4, M.J.); Jēkabpils distr., Dunava, 01.-08. VI 2009. (1, K.B.), Tadenava, Dviete – Tadenava forest, pheromone trap, VII 2009. (1, A.B.); Madona distr., Krustkalni Nature reserve, clearing, 01. XI 2006. (1, U.V.); Ventspils distr., Moricsala Nature reserve, 14. VI 2008. (1, A.P.), 14. VII 2009. (3, A.B.), Moricsala Nature rezerve, window trap, 13. VI 2008. (10, M.N.), Moricsala Nature reserve, window trap, *Sorbus aucuparia,* 04. VI – 14. VII 2009. (23, A.B.), window trap, *Quercus robur,* VII 2009. (4, A.P.).

Melandryidae Leach, 1815

124. Orchesia undulata Kraatz, 1853 - Talsi distr., Slītere National park, „Zilie kalni", window trap, 21. IX 2009. (1, A.P.); Ventspils distr., Moricsala Nature reserve, window trap, *Sorbus aucuparia,* VII 2009. (1, A.P.).

125. Melandrya dubia (Schaller, 1783) - Daugavpils distr., Elerne, 07. VI 2002. (1, A.B.); Preiļi distr., Bicānu lake, 24. VI 2009. (1, A.B.); Ventspils distr., Moricsala Nature reserve, window trap, 13. VI 2008. (1, M.N.).

Mordellidae Latreille, 1802

126. Mordellochroa abdominalis (Fabricius, 1775) - Daugavpils distr., Bebrene, Nature park „Dvietes paliene", 25. VI 2006. (1, E.R.), Nature park „Silene", protected area „Ilgas", VIII 2002. (1, A.B.), protected area „Ilgas", clearing, near maple, VI 2005. (1, A.B.); Rīga distr., Kūdra, 16. VI 2006. (1, A.T.); Talsi distr., Kaļķi, "Puiškalns", protected area „Kaļķupes ieleja", 02.

VI 2009. (1, A.B.), Slītere National park, 06. VI 2002. (1, A.B.), 27. VI 2006. (3, A.B.; 5, A.B., U.V., A.P.), Slītere national park, „Dāvida pļavas", 02. VI 2009. (8, A.B.), Slītere National park, „Zilie kalni", 10. VII 2004. (2, A.B.; 1, R.C.), 14. VI 2008. (1, M.N.); Ventspils distr., Moricsala Nature reserve, window trap, 03. VIII 2004. (1, U.V.).

Zopheridae Solier, 1834

127. *Bitoma crenata* (Fabricius, 1775) – Daugavpils distr., Šedere, „Straumēni", 18.-20. V 2007. (1, M.J.).

128. *Orthocerus clavicornis* (Linnaeus, 1758) - Jēkabpils distr., Dunava, dry meadow, IV 2002. (1, A.B.).

Tenebrionidae Latreille, 1802

129. *Opatrum sabulosum* (Linnaeus, 1761) - Daugavpils distr., 55°55'02"N, 026°33'38"E, pine forest, 24. IV 2009. (1, R.C.), Bebrene, Nature park „Dvietes paliene", 18. IV 2009. (1, A.B.), Elerne, V 2002. (3, A.B.), Ļubesti, near lake Žīdu, inland dunes, 17. IV 2009. (1, A.B., K.B., A.A.), Nature park „Daugavas loki", Neiciškas, 55°52'58"N, 026°45'28"E, 30. VII 2009. (1, R.C.), Nature park „Daugavas loki", 2.8 km S Naujene, 1.5 km SSW Vecpils, Daugava river valley, Starozankovij rov river glen, broad-leaved forest and meadowy with glens, 55°54'71,0"N, 026°43'51,5"E, 09. V 2009. (1, U.V.), near Daugavpils beltway, behind Mežciems, 08. VI 2008. (1, A.B., K.B.), Rīga – Krāslava beltway, Ļubesti, 17. V 2007. (1, A.B., K.B.), Nature park „Silene", protected area „Ilgas", IV 2002. (10, A.B.), VIII 2002. (3, A.B.), 27. VI 2007. (1, A.B.), protected area „Ilgas", Jakubova, 01. VIII 2007. (1, A.B.), Svente, VI 2002. (12, A.B.), Šedere, Šarlote, 01. VI 2008. (1, K.A.); Jēkabpils distr., Dunava, dry meadow, IV 2002. (1, A.B.); Krāslava distr., Izvalta, V (6, A.B.), Kaplava, Vecborone park, 26. IV 2008. (1, G.J.), Šķeltova, „Barševski", VII 2002. (1, A.B.), Ūdrīši, „Zapoļniki", 15. IV 2007. (2, M.J.); Tukums distr., Kandava, bank of Abava river, 13. V 2009. (1, A.B.); Ventspils distr., Moricsala Nature reserve, 03. VIII 2004. (4, A.B.), Moricsala Nature reserve, window trap, *Quercus robur,* VIII 2009. (1, A.P.), Nature park „Užvas upe", 25. X 2006. (1, A.B., A.P.).

130. *Melanimon tibialis* (Fabricius, 1781) - Daugavpils distr., Ļubesti near lake Žīdu, inland dunes, 17. IV 2009. (7, A.B., K.B., A.A.), Rīga – Krāslava beltway, near Ļubesti, 17. V 2007. (2, A.B., K.B.); Jēkabpils distr., Dunava, 23.-30. VI 2007. (1, K.B.).

131. *Uloma culinaris* (Linnaeus, 1758) - Daugavpils distr., Butišķi, valley of Daugava river, 01. VII 2009. (1, A.Bu., M.B.); Jēkabpils distr., Dunava, 15. VII 2009. (1, A.B.), 15.-18. VII 2009. (3, A.B.); Preiļi distr., Preiļi, 23. XI 2008. (1, O.V.).

132. *Uloma rufa* (Piller & Mitterpacher, 1783) - Daugavpils distr., 55°55'02"N, 026°33'38"E, pine forest, 24. IV 2009. (2, R.C.), 0,5 km W Jaunie Stropi, pine forest, 55°54'54,2"N, 026°34'13,5"E, 29. IV 2008. (1, R.C.); Madona distr., Kusa, 08. XI 2008. (1).

133. *Tenebrio molitor* (Linnaeus, 1758) - Daugavpils distr., Bebrene, 27. VI 2005. (2, E.R.), 08. VII 2006. (1, E.R.), Nature park „Dvietes paliene", 25. VI 2006. (1, E.R.), VII 2006. (1), Daugavpils city, Ruģeli, VI 2007. (1, V.Ko.), VII 2006. (1, V.Ko.), 15. VI 2007. (1, V.Ko), VII 2007. (1, V.Ko.), Nature park „Silene", protected area „Ilgas", 05. VI – 06. VII 2006. (1, N.N.), Šedere, „Straumēni", VII 2009. (2, M.J.), 13. VII 2009. (1, M.J.), Šedere, Šarlote, 20. VIII 2008. (1, J.A.); Jēkabpils distr., Dunava, 15. VII 2006. (1, A.B.); Krāslava distr., 3.6 km NEE Skaista, Grundāni, Nature park „Dridža ezers", 15. VII 2008. (1, R.C.), Krāslava city, 27. VI 2001. (1, G.L.), Krāslava city, near pond, (2, J.J.), Ūdrīši, „Zapoļniki", 10.-12. VII 2009. (1, M.J.); Preiļi distr., Aglonas stacija, 02. VIII 2008. (1, J.S.), Jersika, „Kurpnieki", 16. VIII 2008. (1, A.B.), Rušona, Aglonas stacija, 08. VII 2007. (2, J.S.); Ventspils distr., Moricsala Nature reserve, 03.-04. VIII 2004. (1, A.B.).

134. *Pseudocistela ceramboides* (Linnaeus, 1758) - Ventspils distr., Moricsala Nature reserve, 14. VII 2009. (1, A.B.).

135. Isomira murina (Linnaeus, 1758) - Rīga distr., Mārupe, 07. VII 2009. (1, A.B., K.B.).

136. Bolitophagus reticulatus (Linnaeus, 1767) - Cēsis distr., "Dāvida dzirnavas", 24. III 2007. (13, E.R.); Daugavpils distr., Nature park „Silene", protected area „Ilgas", 09. VI 2008. (1, A.B., A.S.), 27. VI 2009. (1, A.B.), near Daugavpils beltway, behind Mežciems, 05. VII 2009. (1, A.B.), Stropi, maist forest, 14. V 2009. (1, A.Bu.), Šedere, „Straumēni", 12.-13. VI 2007. (1, M.J.), VII 2009. (1, M.J.); Gulbene distr., Lejasciems, V 2005. (1, A.B.); Jēkabpils distr., Dunava, 15.-18. VII 2009. (1, A.B.), Dunava, Tadenava forest, 07. VI 2009. (1, A.B.); Rēzekne distr., clearing near Kauguri lake, 22. VII 2009. (1, M.B.), Puša, 26. VI 2002. (9, A.B.); Talsi distr., protected area „Kaļķupes ieleja", window trap, VI – 13. VII 2009. (1, A.B., U.V., A.P.), Slītere National park, „Zilie kalni", 13. VII 2009. (1, A.B.); Ventspils distr., Moricsala Nature reserve, 26. VI 2004. (5, A.B.), 29. VI 2006. (1, A.B.), 10. VIII 2006. (1, A.B.), 15. VII 2008. (5, A.B.), Moricsala Nature reserve, window trap, 13. VI 2008. (10, M.N.), window trap, *Quercus robur*, VIII 2009. (1, A.B.).

137. Crypticus quisquilius (Linnaeus, 1761) - Daugavpils distr., Červonka, 29. VI. 2008. (1, M.N.), Daugavpils city, 03. VII 2007. (4, A.B., K.B.), Daugavpils city, Arodu str. 25, VIII 2009. (1, M.J.), Daugavpils city, Cietokšņa str. 66, 11. VI 2006. (2, K.B.), 03. VI 2007. (8, K.B.), Daugavpils city, Esplanāde, 07. VII 2008. (1, M.J.), Nature park „Silene", 01.-03. VII 2008. (1, M.N.), Nature park „Silene", protected area „Ilgas", VIII 2002. (1, A.B.), meadow, pit-fall trap, VI 2006. (1, A.B.), Daugavpils city, Mežciems, road from Jaunciema str. 2 till Vaļņu str. 10, 19. VII 2007. (1, M.J., K.A.), Mežciems, Jaunciema str. 2, 19. VII 2007. (1, M.J., K.A.), Daugavpils city, Vienības str. 13, 05. VII 2007. (1, A.S.), Elerne, V 2002. (3, A.B.), Elerne, Daugava river valley, VII 2002. (2, A.B.), Nature park „Silene", protected area „Ilgas", VI 2002. (5, A.B.), 01.-05. VII 2006. (1, A.B.), 17.-20. VI 2008. (1, J.Da., A.Z.), protected area „Ilgas", meadow, pit fall trap, VI 2006. (3, A.B.), Šedere, „Straumēni", 10.-12. VII 2009. (1, M.J.); Jēkabpils distr., Dunava, V 2002. (4, A.B.), 11.-22. VI 2009. (1, K.B.); Krāslava distr., Izvalta, VI (2, A.B.), VII 2002. (2, A.B.), Ūdrīši, „Zapoļniki", 12. VI 2005. (1, M.J.), 09. VI 2007. (12, M.J.), 27.-28. VI 2009. (2, M.J.), VII 2009. (1, M.J.); Liepāja distr., Liepāja, dunes, 11. VIII 2008. (2, A.B.); Talsi distr., Mazirbe, 05. VI 2003. (1, A.B.).

138. Neomidia haemorrhoidalis (Fabricius,1787) - Ventspils distr., Moricsala Nature reserve, window trap, *Quercus robur,* VIII 2009. (1, A.P.).

139. Diaperis boleti (Linnaeus, 1758) - Aizkraukle distr., Taurkalne, 03. VII 2006. (1, J.D.); Cēsis distr., Taurene, Brežģa mount., 03. VII 2006, (1, A.B., U.V., A.P.); Daugavpils distr., Bebrene, 27. III 2005. (2, E.R.), Nature park „Silene", 01.-03. VII 2008. (3, R.C.), Nature park „Silene", protected area „Ilgas", 14.-20. VI 2002. (4, A.B.), 28.-29. VI 2007. (1, A.B.), 18. VI 2008. (5, R.C.), 01.-04. VII 2008. (2, R.C.), Vecsaliena, Rozališķi, Nature park „Daugavas loki", 55°59'87"N, 26°80'93"E, 29. IV 2008. (2, U.V., A.P.); Gulbene distr., Lejasciems, VI 2005. (3, A.B., J.La.), VII 2005. (1, A.B., A.Bu., R.C.), VII 2006. (2, A.B.); Rēzekne distr., Puša, 26. VI 2002. (1, A.B.); Rīga distr., Ķemeri, 2002 (1, A.B.); Talsi distr., Slītere National park, 13. IX 2005. (1, A.B.), Slītere National park, „Zilie kalni", 17. VII 2007. (4, A.B.); Valka distr., Mežole, 26. VI 2006. (1, J.D.); Ventspils distr., Moricsala Nature reserve, VI (1, A.B.), 03. VII 2004. (1, A.B.), 29. VI 2006. (1, A.B.), 10. VIII 2006. (9, A.B.), 15. VII 2008. (1, V.A., A.Pa.), 14. VII 2009. (1, A.B.), Moricsala Nature reserve, window trap, 13. VI 2008. (1, M.N.), 23. VIII 2008. (1. A.B., A.S.).

Meloidae Gyllenhal, 1810

140. Meloe proscarabaeus Linnaeus, 1758 - Daugavpils distr., Nature park „Silene", protected area „Ilgas", 05.-09. VI 2006. (1, O.D.).

Pythidae Blanchard, 1845

141. Pytho depressus (Linnaeus, 1767) - Bauska distr., Iecava, Ķekava, Dimzukalns, 05. XI 2008. (1).

Pyrochroidae Latreille, 1807

142. *Pyrochroa coccinea* (Linnaeus, 1761) - Daugavpils distr., Nature park „Silene", protected area „Ilgas", 05.-09. VI 2009. (1, O.D.), Šedere, „Straumēni", 30.-01. V 2009. (1, M.J.); Jēkabpils distr., Dunava, 01.-08. VI 2009. (1, K.B.), 11.-22. VI 2009. (3, K.B.); Talsi distr., Laidze, „Zaļmeži", 07. VIII 2009. (1, E.B).

143. *Schizotus pectinicornis* (Linnaeus, 1758) - Talsi distr., Kaļķi, protected area „Kaļķupes ieleja", 57ţ32'31"N, 022ţ30'45"E, 12. V 2009. (1, A.B.), Slītere National park, window trap, 14. VI 2008. (1, A.P.), Slītere National park, „Dāvida pļavas", 02. VI 2009. (2, A.B.); Ventspils distr., Moricsala Nature reserve, 13. V 2009. (1, A.B.), Moricsala Nature reserve, window trap, 13. VI 2008. (1, M.N.).

Salpingidae Leach, 1815

144. *Salpingus ruficollis* (Linnaeus, 1761) - Daugavpils distr., Bebrene, 15. I 2005. (1, E.R.), Bebrene, 56Ś03'39"N, 026Ś08'09"E, 18. III 2006. (1, E.R.), Bebrene, Nature park „Dvietes paliene", 11 XI 2005. (1, E.R.), Nature park „Silene", protected area „Ilgas", clearing, 15. XI 2005. (1, A.Bu., U.V.), protected area „Ilgas", clearing, 55Ś41'29"N, 16Ś47'00"E, VII 2005. (1, A.B.); Talsi distr., Mordanga, 17. VIII 2006. (8, J.D.), Slītere National park, window trap, 29. VII 2005. (1, U.V.), 14. VI 2008. (2, A.P.); Ventspils distr., Moricsala Nature reserve, 10. VI 2005. (2, A.B.), Moricsala Nature reserve, window trap, *Sorbus aucuparia,* VIII 2009. (2, A.P.).

Anthicidae Lacordaire, 1825

145. *Anthicus axillaris* Schmidt, 1842 – Liepāja distr., Liepāja city, dunes, 11. VIII 2008. (11, A.B.).

Scraptiidae Mulsant, 1856

146. *Cyrtanaspis phalerata* (Germar, 1831) – Daugavpils distr., 1,5 km N Daugavpils, edge of pine forest. 29. VI 2009. (1, A.Bu.).

Cerambycidae Latreille, 1802

147. *Prionus coriarius* (Linnaeus, 1767) - Daugavpils distr., Jaunie Stropi, pine forest with spruce understorey, 29. VII 2009. (1, G.J.).

148. *Arhopalus rusticus* (Linnaeus, 1758) - Daugavpils distr., Līksna, Daugavpils beltway, 3,5 km from Rīga road, clearing, 01. VII 2008. (4, A.B.), near Daugavpils beltway, behind Mežciems, 05. VII 2009. (4, A.B.; 1, K.B.); Jēkabpils distr., Dunava, 12.-18. VII 2009. (1, K.B.), Tadenava, Dviete – Tadenava forest, pheromone trap, VII 2009. (1, A.B.); Preiļi distr., Jersika, „Kurpnieki", 01. VIII 2008. (1, A.B.); Talsi distr., Slītere National park, Bažu mire, 12. VII 2008. (1, M.P.).

149. *Asemum striatum* (Linnaeus, 1758) - Daugavpils distr., Demene, 2 km from Kurcums, 06. VI 2009. (1, A.B.); Gulbene distr., Lejasciems, pine forest, 08. VI 2005. (1, A.B.), Ušūrs, burning, window trap, VI 2005. (1, A.B., J.La.); Preiļi distr., Jersika, „Kurpnieki", 10. V 2009. (1, K.B., 1, A.B.), 30. V. 2009. (1, A.B., 3, K.B.), 22.-24. VI 2009. (2, A.B.).

150. *Tetropium castaneum* (Linnaeus, 1758) - Aizkraukle distr., Taurkalne, 03. VII 2006. (2, J.D.); Bauska distr., Skaistkalne, 09. VI 2009. (1, A.B., R.O.); Daugavpils distr., Dviete, Dviete – Tadenava forest, near Kinkausku mire, 56Ś12'50,3"N, 26Ś26'16,2'E, 22. VI 2008. (2, A.B.), clearing, 20. VII 2008. (1, A.B.), Nature park „Silene", protected area „Ilgas", 05.-10. VI 2006. (1, M.V.), 28. VIII 2009. (1, R.C.); Gulbene distr., Gulbītis, forest and mire burning, naer Ušūrs lake, V – VI 2003. (1, A.B., O.Ko.); Jēkabpils distr., Dunava, Dviete – Tadenava forest, 31. V 2009. (2, A.B.), Dunava, Tadenava forest, 07. VI 2009. (2, A.B.); Madona distr., Krustkalni Nature reserve, VI 2005. (1, A.B.); Rīga distr., Olaine, 30. VI 2006. (1, J.D.), 17. VII 2006. (1, J.D.); Valka distr., Mežole, 26. VI 2006. (2, J.D.); Ventspils distr., Moricsala Nature reserve, VI (1, A.B.), 18. VII 2007. (1, A.B., U.V., A.P., A.S.), Moricsala Nature reserve, 57Ś11'29"N, 022Ś08'05"E, (1, U.V.).

151. *Tetropium fuscum* (Fabricius, 1787) - Aizkraukle distr., Taurkalne, 16. VI 2006. (1, J.D.), 03. VII 2006. (1, J.D.); Rīga distr., Olaine, 30. VI

2006. (1, J.D.); Talsi distr., Mordanga, 28. IV 2006. (1, J.D.); Ventspils distr., Moricsala Nature reserve, VI (4, A.B.), Moricsala Nature reserve, window trap, 29. VI 2006. (2, A.B.).

152. *Oxymirus* (*Toxotus) cursor* (Linnaeus, 1758) - Talsi distr., Slītere National park, „Dāvida pļavas", 02. VI 2009. (1, A.P., R.C.); Ventspils distr., Moricsala Nature reserve, window trap, 13. VI 2008. (2, M.N.), Moricsala Nature reserve, window trap, *Sorbus aucuparia*, 04. VI – 14. VII 2009. (1, A.B.).

153. *Stenocorus meridianus* (Linnaeus, 1758) - Talsi distr., Slītere National park, „Zilie kalni", 13.VII 2009. (1, J.I.), „Zilie kalni", „Dāvida pļavas", 16. VII 2008. (2, A.B., V.A.).

154. *Pachyta quadrimaculata* (Linnaeus, 1758) - Daugavpils distr., Nature park „Silene", 01. III 2007. (1, R.C.); Talsi distr., Kaļķi, protected area „Kaļķupes ieleja", 13. VII 2009. (2, A.B., R.C.), Slītere National park, 13. VII 2009. (1, A.B.).

155. *Gaurotes virginea* (Linnaeus, 1758) - Daugavpils distr., Nature park „Silene", protected area „Ilgas", 19.-22. VI (1), 08. VI 2009. (1, J.S.), Līksna, inland dunes, near Daugavpils beltway, 22. VII 2008. (1, A.B.); Jēkabpils distr., Dunava, Tadenava, clearing, 29. VI 2008. (1, A.B.); Talsi distr., Kaļķi, protected area „Kaļķupes ieleja", 13. VII 2009. (3, A.B., R.C.), Slītere National park, „Zilie kalni", 13. VII 2009. (6, A.B.).

156. *Cortodera femorata* (Fabricius, 1787) - Daugavpils distr., Nature park „Silene", protected area „Ilgas", 06.-15. VI 2004. (1, A.B.); Ventspils distr., Moricsala Nature reserve, 25. VI 2004. (1, A.B., U.V.).

157. *Grammoptera ruficornis* (Fabricius, 1781) - Daugavpils distr., Bebrene, 14. VI 2007. (1, E.R.); Talsi distr., Slītere National park, „Zilie kalni", 10. VII 2004. (1, A.B.).

158. *Anoplodera sexguttata* (Fabricius, 1775) - Ventspils distr., Moricsala Nature reserve, window trap, *Sorbus aucuparia,* 04. VI – 14. VII 2009. (3, A.B.).

159. *Anoplodera scutellata* (Fabricius, 1781) - Talsi distr., Slītere National park, „Zilie kalni", „Dāvida pļavas", VII 2008. (1, M.P.), 16. VII 2008. (1, A.B.; 4, V.A., A.Pa.), 13. VII 2009. (1, A.B.).

160. *Anoplodera virens* (Linnaeus, 1758) - Madona distr., Jumurda, near lake Lācīšu, 19. VII 2008. (1, A.B.).

161. *Judolia sexmaculata* (Linnaeus, 1758) - Gulbene distr., Lejasciems forestry, forest burning, VII 2003. (1, I.K., A.B.); Talsi distr., Sītere National park, 17. VII 2007. (1, A.B., U.V., A.P., A.S.), Slītere National park, „Dāvida pļavas", 02. VI 2009. (5, A.B.).

162. *Leptura (Etorufus) pubescens* (Fabricius, 1787) - Daugavpils distr., Demene, ~2 km from Kurcums, 06. VI 2008. (1, A.B.); Talsi distr., Slītere National park, „Zilie kalni", 13. VII 2009. (1, A.B.).

163. *Leptura annularis* Fabricius, 1801 - Valka distr., Mežole, 26. VI 2006. (1, J.D.).

164. *Leptura maculata* Poda, 1761 - Talsi distr., Kaļķi, protected area „Kaļķupes ieleja", 13. VII 2009. (6, A.B., R.C.), Neveja, 13. VII 2009. (1, A.B., U.V., R.C.); Slītere National park, „Zilie kalni", 16. VII 2008. (4, V.A., A.Pa.), 13. VII 2009. (9, A.B., 3, U.V.; 1, J.I.; 2, R.C.).

165. *Leptura (Stenurella) bifasciata* Müller, 1776 - Daugavpils distr., Eglaine, 20. VIII 2008. (1, A.B.), Līksna, inland dunes, near Daugavpils beltway, 22. VII 2008. (3, A.B.); Krāslava distr., Krāslava, dry meadow, 21. VII 2008. (4, A.B.); Rīga distr., Spuņciems, 06. VIII 2009. (1, A.B.).

166. *Leptura (Stenurella) nigra* Linnaeus, 1758 - Kuldīga distr., Alsunga, protected area „Užavas augštece", 28. VIII 2005. (1, A.B., A.Bu., U.V.); Liepāja distr., Sakas, Grīņi Nature reserve, 27. VII 2001. (1, A.B.); Talsi distr., Kaļķi, protected area „Kaļķupes ieleja", 13. VII 2009. (2, A.B., R.C.), Kaļķupe, "Puiškalns", protected area "Kaļķupes ieleja", 02. VI 2009. (1, A.B.), Slītere National park, "Dāvida pļavas", 02. VI 2009. (1, A.B.), "Zilie

kalni", "Dāvida pļavas", 16. VII 2008. (1, A.B.); Ventspils distr., Ovīši, 04. VIII 2004. (1, A.B.).

167. *Strangalia attenuata* (Linnaeus, 1758) - Aizkraukle distr., protected area „Aizkraukles purvs un meži", 01. VII 2008. (5, A.Bu.).

168. *Necydalis major* Linnaeus, 1758 - Kuldīga distr., Padure, protected area „Ventas ieleja", mixed forest near Padure river valley, 30. VII 2009. (1, R.C.); Rīga distr., Olaine, 01. VIII 2006. (1, J.D.).

169. *Obrium cantharinum* (Linnaeus, 1767) - Jēkabpils distr., Dunava, 25.-29. VI 2006. (5, K.B.), 02. VII 2008. (1, A.B.); Krāslava distr., Ūdrīši, „Zapoļniki", 10.-12. VII 2009. (1, M.J.); Ventspils distr., Moricsala Nature reserve, 16. VII 2004. (2, U.V.).

170. *Molorchus minor* (Linnaeus, 1758) - Aizkraukle distr., Taurkalne, 03. VII 2006. (1, J.D.); Jēkabpils distr., Dunava, 01.-08. VI 2009. (1, K.B.); Preiļi distr., Jersika, „Kurpnieki", 31. V 2008. (1, A.B.); Talsi distr., Slītere National park, „Dāvida pļavas", 02. VI 2009. (1, A.B.).

171. *Aromia moschata* (Linnaeus, 1758) - Daugavpils distr., Nature park „Dvietes paliene", VII 2006. (1); Jēkabpils distr., Dunava, 23. VII 2008. (1, A.B.), 12.-18. VII 2009. (1, K.B.), Vandāni, bank of Daugava river, on *Salix*, 04. IX 2009. (1, M.B.); Preiļi distr., Jersika, „Kurpnieki", 09.-12. VII 2009. (1, A.B.); Ventspils distr., Moricsala Nature reserve, 23. VIII 2008. (1, A.B., A.S.).

172. *Hylotrupes bajulus* (Linnaeus, 1758) - Daugavpils distr., Daugavpils city, Vāveru str., 07. VII 2006. (1, A.P.), Nature park „Dvietes paliene", VII 2006. (2).

173. *Callidium coriaceum* (Paykull, 1800) - Talsi distr., Slītere National park, VI 2006. (1, A.B., E.R.).

174. *Callidium violaceum* (Linnaeus, 1758) - Bauska distr., Skaistkalne, 09. VI 2009. (1, A.B., R.O.); Daugavpils distr., Līksna, 3.5 km E from Daugavpils beltway, clearing, 08. VI 2008. (1, A.B.), Nature park „Silene", protected area „Ilgas", 05. VI – 04. VII 2006. (1, I.G.), Šedere, „Straumēni", 01. VI 2008. (1, M.J.); Jēkabpils distr., Dunava, 01.-07. VI 2009. (1, K.B.); Krāslava distr., Ūdrīši, „Zapoļniki", 18.-19. IV 2009. (1, M.J.); Preiļi distr., Jersika, „Kurpnieki", 30. V 2009. (1, K.B.).

175. *Callidium aeneum* (De Geer, 1775) - Ventspils distr., Moricsala Nature reserve, 57°11'39"N, 022°08'10"E, 11. VII 2005. (1, U.V.).

176. *Cyrtoclytus capra* (Germar, 1824) - Talsi distr., Slītere National park, „Zilie kalni", „Dāvida pļavas", 02. VII 2009. (2, A.B.).

177. *Phymatodes testaceus* (Linnaeus, 1758) - Ventspils distr., Moricsala Nature reserve, 57°11'39"N, 022°08'10"E, 11. VII 2005. (1, U.V.), Moricsala Nature reserve, window trap, 11. VII 2005. (1, U.V.), Moricsala Nature reserve, window trap, *Quercus robur,* VIII 2009. (1, A.P.).

178. *Lamia textor* (Linnaeus, 1758) - Daugavpils distr., Maļinova, (1, V.D.), Nature park „Silene", 01.-03. VII 2008. (1, N.M.), Nature park „Silene", protected area „Ilgas", 05.-09. VI 2006. (1, O.D.), 05. VI – 14. VII 2006. (1, I.G.), 26.-30. VI 2009. (1, M.Z.); Jēkabpils distr., Dunava, 12.-18. VII 2009. (1, K.B.); Krāslava distr., Ūdrīši, „Zapoļniki", 28.-28. VI 2009. (1, M.J.); Preiļi distr., Jersika, „Kurpnieki", 15. IV 2007. (1, A.B.).

179. *Pogonocherus hispidulus* (P.& Mitterpacher, 1783) - Rīga distr., Jūrmala, Kūdra, 25. V 2008. (1, A.T.).

180. *Pogonocherus hispidus* (Linnaeus, 1758) - Rīga distr., Jūrmala, Kūdra, 04. VI 2006. (1, A.T.).

181. *Pogonocherus fasciculatus* (De Geer, 1775) - Daugavpils distr., Bebrene, 23.-28. I 2007. (1, E.R.), Dviete, forest clearing near Dviete – Tadenava road, 23. VII 2008. (5, A.B.), Dviete, Dviete – Tadenava forest, clearing, 20. VII 2008. (1, A.B.), 10. VIII 2008. (1, A.B.), Elerne, 16. VI 2002. (1, A.B.); Gulbene distr., Lejasciems, burning, 20. VIII 2004. (1, A.B.), Lejasciems, forest burning, VIII 2003. (1, A.B., I.K.), 20. VIII 2004. (1,

A.B.); Liepāja distr., Pavilosta, dunes, 13. VIII 2008. (1, A.B.); Jēkabpils distr., Dunava, Dviete – Tadenava forest, pheromone trap, VII 2009. (3, A.B.); Madona distr., Krustkalni Nature reserve, forest, VI 2005. (1, A.B., J.L.), 56°45'37"N, 026°07'29"E, VI 2005. (1, A.B., J.L.); Preiļi distr., Jersika, „Kurpnieki", 24. V 2009. (1, A.B., K.B.); Rīga distr., Jūrmala, Kūdra, 16. VI 2006. (1, A.T.), Olaine, 01. VIII 2006. (1, J.D.); Talsi distr., Slītere National park, 30. V 2006. (1, A.B.); Tukums distr., window trap, 56°56'09"N, 023°10'75"E, 10. VIII 2006. (1, A.B.), Ķemeri National park, Lielaisciems, 17. VII 2007. (1, A.B., U.V., A.P., A.S.); Valka distr., Mežole, 15. VIII 2006. (1, J.D.); Ventspils distr., Moricsala Nature reserve, VI (1, A.B.), Moricsala Nature reserve, window trap, *Quercus robur,* VIII 2009. (2, A.P.).

182. *Pogonocherus decoratus* Fairmaire, 1855 - Gulbene distr., Gulbītis, forest and mire burning, near Ušūrs lake, V – VI 2003. (1, A.B., O.Ko.); Preiļi distr., Jersika, „Kurpnieki", 22.-24. VI 2009. (1, A.B.).

183. *Aegomorphus clavipes* (Schrank, 1781) - Daugavpils distr., Dviete forest clearing, near Dviete – Tadenava road, 23. VII 2008. (4, A.B.), Dviete, Dviete – Tadenava forest, clearing, 20. VII 2008. (1, A.B.); Jēkabpils distr., Dunava, 15.-18. VII 2008. (2, A.B.), Dunava, aspen clearing near Tadenava road, 10. VIII 2008. (1, A.B.), Tadenava, Dviete – Tadenava forest, pheromone trap, VII 2009.
(1, A.B.).

184. *Aegomorphus wojtylai* Hilszczanski, Bystrowski, 2005 - Ventspils distr., Moricsala Nature reserve, window trap, *Quercus robur*, VIII 2009. (1, A.P.).

185. *Leiopus nebulosus* (Linnaeus, 1758) - Aizkraukle distr., protected area „Aizkraukles purvs un meži", 06. VIII 2008. (1, A.Bu., M.B.); Rīga distr., Olaine, 17. VII 2006. (1, J.D.); Krāslava distr., Šķeltova, „Barševski", 05. VII 2006. (1, A.B.); Ventspils distr., Moricsala Nature reserve, *Sorbus aucuparia*, VI – 14. VII 2009. (1, A.B). In this year mainly from Scandinavia and some other parts of Europe H.Wallin, U.Nylander &T. Kwamme(2009) described new sibling species *Leiopus linnei* Wallin, Nylander & Kwamme, 2009. All examined specimens in DUBC are *Leiopus nebulosus* (L)

186. *Acanthocinus griseus* (Fabricius, 1792) - Aizkraukle distr., Taurkalne, 03. VII 2006. (1, J.D.); Daugavpils distr., Dviete, Dviete – Tadenava forest, clearing, 20. VII 2008. (1, A.B.); Valka distr., Mežole, 15. VIII 2006. (1, J.D.); Ventspils distr., Blāzma, border of a forest clearing, 57Ś21'12"N, 22Ś04'47"E, 22. VIII 2008. (3, A.B., U.V., K.A.).

187. *Stenostola dubia* (Laicharting, 1784) - Ventspils distr., Moricsala Nature reserve, on *Corylus avellana*, VI . 2009. (2, A.B.).

188. *Saperda carcharias* (Linnaeus, 1758) - Talsi distr., Kaļķi, protected area „Kaļķupes ieleja", 13. VII 2009. (1, A.B., R.C.).

189. *Saperda scalaris* (Linnaeus, 1758) - Daugavpils distr., Nature park „Silene", 01.-03. VII 2008. (1, R.C.); Jēkabpils distr., Dunava, 11.-22. VII 2009. (1, K.B.), 12.-18. VII 2009. (1, K.B.); Talsi distr., Laidze, „Zaļmeži", 07. VIII 2009. (1, E.B.).

190. *Saperda perforata* (Pallas, 1773) – Krāslava distr., Ūdrīši, „Zapoļņiki", VII.2009., (1, M.J.); Ventspils distr., Moricsala Nature reserve, window trap, *Quercus robur,* VIII 2009. (1, A.P.).

191. *Oberea oculata* (Linnaeus, 1758) - Aizkraukle distr., protected area „Aizkraukles purvs un meži", 01. VII 2008. (1, A.P.); Rīga distr., Rīga, Purvciems, Deglava str. 41a, 09.-10. VII 2008. (1, A.B.).

192. *Phytoecia nigricornis* (Fabricius, 1781) - Dobele distr., Naudīte, „Pokaiņu mežs", 20. VII 2004. (1, A.B.).

193. *Phytoecia virgula* (Charpenter, 1825) - Daugavpils distr., Nature park „Silene", protected area „Ilgas", 27. VI 2009. (1, A.B.); Krāslava distr., Ūdrīši, „Zapoļniki", 08.-10. V 2009. (2, M.J.).

194. *Tetrops praeusta* (Linnaeus, 1758) – Gulbene distr., Ušūrs, near marsh, 08. VI 2005. (1, A.B.); Preiļi distr., Jersika, „Kurpnieki", 31. V 2008.

(1. A.B.); Rīga distr., Kūdra, 02. VI 2006. (1, A.T.), 05. VI 2006. (1, A.T.).

Chrysomelidae Latreille, 1802

195. Clytra quadripunctata (Linnaeus, 1758) - Jēkabpils distr., Dunava, 31. V 2009. (2, A.B.).

196. Cryptocephalus coryli (Linnaeus, 1758) - Daugavpils distr., Nature park "Silene", protected area "Ilgas", 05. VI – 03. VII 2006. (1, A.L.).

197. Chrysolina graminis (Linnaeus, 1758) - Daugavpils distr., Elerne, bank of Daugava river, 55Ś55'05"N, 26Ś41'18"E, 19. V 2009. (1, R.C.), Nature park „Silene", protected area „Ilgas", 05.-09. VI 2006. (1, O.D.), 05. VI – 03. VII 2006. (1, A.L.).

Anthribidae Billberg, 1820

198. Platyrhinus resinosus (Scopoli, 1763) - Daugavpils distr., 3 km from Daugavpils, inland dunes, 27, V 2009. (1, A.Bu.); Gulbene distr., Ušūrs, burning, VI 2005. (1, A.B., J.L.); Kuldīga distr., Padure, protected area, ditch of river, with elm, near Padures (Beltes) castle mound, 19. VIII 2009. (1, R.C.).

199. Platystomus albinus (Linnaeus, 1758) - Daugavpikls distr., Nature park „Silene", protected area „Ilgas", VI 2006. (1, R.M.); Preiļi distr., Jersika, „Kurpnieki", 22.-24. VI 2009. (1, A.B.), 23.-24. VI 2009. (1, K.B.); Talsi distr., protected area „Kaļķupes ieleja", window trap, VI – 13. VII 2009. (1, A.B., U.V.), Slītere National park, „Zilie kalni", window trap, 16. X 2008. (1, A.P.); Ventspils distr., Moricsala Nature reserve, *Sorbus aucuparia*, VIII 2009. (1, A.P).

Attelabidae Billberg, 1820

200. Neocoenorrhinus aequatus (Linnaeus, 1767) - Daugavpils distr., Stropi, 23. VI 2009. (1, A.Bu.); Jēkabpils distr., Dignāja, 12. VII 2009. (1, M.B.); Preiļi distr., Jersika, „Kurpnieki", 30. V 2009. (1, K.B.), 28. VI 2009. (5, A.B.), 03. VII 2009. (8, A.B.), 09.-12. VII 2009. (6, K.B.).

201. Rhynchites cupreus (Linnaeus, 1758) - Daugavpils distr., 0,5 km W Jaunie Stropi, pine forest, 55°54'54,2"N, 026°34'13,5"E, 29. IV 2008. (1, R.C.), Mežciems, edge of pine forest, 01. VI 2008. (1, A.Bu.), Šedere, „Straumēni", 01.-03. V 2008. (1, M.J.); Jēkabpils distr., Dunava, 09.-10. VIII 2009. (1, A.B.); Ogre distr., Dzelmes, 12. VI 2009. (1, A.B.); Preiļi distr., Jersika, „Kurpnieki", 24. V 2008. (2, A.B.), 17. VI 2008. (9, A.B.), 01. VIII 2008. (1, A.B.), 07. IX 2008. (1, K.B.), 27. V 2009. (6, A.B.), 30. V 2009. (1, A.B.), 28. VI 2009. (4, A.B.), 03. VII 2009. (1, K.B.), 09.-12. VII 2009. (2, A.B.); Rēzekne distr., Sprukti, 08. VII 2008. (1, M.B.); Talsi distr., Slītere National park, „Dāvida pļavas", 02. VI 2009. (1, A.B.); Ventspils distr., Moricsala Nature reserve, 29. V 2006. (1, E.R.).

202. Byctiscus betulae (Linnaeus, 1758) - Aizkraukle distr., Rīteri, 08. VI 2009. (1, A.B., R.O.); Bauska distr., Bārbele, 28. V 2009. (1, A.B., R.O.); Daugavpils distr., Dviete, Dviete – Tadenava forest, near Kinkausku mire, 56°12'50,3"N, 26°26'16,2"E, 22. VI 2008. (1, A.B.), Līksna, 3 km N Daugavpils, inland dunes, edge of pine forest, 03. IX 2009. (1, A.Bu.), Šedere, Šarlote, 01. VI 2008. (2, K.A.); Jēkabpils distr., Dunava, 15.-18. VII 2009. (1, A.B.); Preiļi distr., Jersika, „Kurpnieki", 30. V 2009. (1, A.B.), 31. V 2008. (1, A.B.); Rēzekne distr., 5 km from lake Lubāns, 28. V 2009. (1, M.B.).

203. Byctiscus populi (Linnaeus, 1758) - Aizkraukle distr., Valle, 12. VIII 2008. (2, A.B.); Bauska distr., Bārbele, 28. V 2009. (2, A.B.), Vecumnieki, Zvirgzde, 06. VIII 2009. (1, A.B.); Daugavpils distr., Dviete, Nature park „Dvietes paliene", near Berezovka river, 12. V 2009. (1, A.P., M.N.), Eglaine, 20. VIII 2008. (1, A.B.), Līksna, 2 km N Daugavpils, edge of pine forest, 17. V 2008. (3, A.Bu.), Līksna, 2,5 km from Rīga road, forest on continental dunes, 16. VI 2008. (2, A.B.), Līksna, 3 km from Daugavpils, inland dunes, 28. VI 2009. (2, A.Bu.), Līksna, 4 km N Daugavpils, old cutting area, 29. VI 2009. (1, A.Bu.), near Daugavpils beltway, behind Mežciems, 05. VII 2009. (3, A.B.), Nature park „Silene", protected area „Ilgas", 05. VI – 07. VII 2006. (1, R.M.), 18. VI 2008. (1, R.C.), Stropi, clearing, 02. VII 2008. (1, A.Bu.); Jēkabpils distr., Dunava, Tadenava, clearing, 29. VI 2008. (8, A.B.), Viesīte, clearing,

08. VIII 2008. (1, A.B.); Krāslava distr., Sauleskalns, 04. V 2008. (1, K.B.), Šķeltova, „Barševski", 03. VI 2008. (2, A.B.), 11. VIII 2009. (1, A.B.); Kuldīga distr., Skrunda, 05. IX 2008. (7, A.B.); Liepāja distr., Durbe, 05. IX 2008. (1, A.B., R.O.); Limbaži distr., country territory of Salacgrīva, Veczemu rock, 17. VIII 2008. (1, A.B.); Ogre distr., Dzelmes, near Velnadobe, 08. IX 2009. (1, A.B.); Rēzekne distr., Stalerova, Šortu lake env., clearing, 29. VII 2009. (1, M.B.); Talsi distr., Kaļķupe, "Puiškalns", protected area „Kaļķupes ieleja", 02. VI 2009. (1, R.C.), Slītere National park, „Zilie kalni", 22. VIII 2008. (1, A.B.);

204. *Deporaus betulae* (Linnaeus, 1758) - Aizkraukle distr., Rīteri, V 2009. (1, A.B.); Bauska distr., Bārbele, 08. VI 2009. (1, A.B., R.O.); Daugavpils distr., Medumi, Kurcums, 18. V 2009. (1, A.A., A.B.), Stropi, on *Padus*, 14. V 2009. (1, A.Bu.); Jēkabpils distr., Dunava, 01. VIII 2008. (2, K.B.); Jelgava distr., near Rīga – Šiauliai (Lithuania) road, 15. VI 2008. (1, A.B., R.O.); Rēzekne distr., Gaigalava, old clearing, 15. VII 2009. (1, A.Bu., M.B.); Talsi distr., „Kaļķupes ieleja", Kaļķupe, "Puiškalns", 02. VI 2009. (1, A.B.); Ventspils distr., Moricsala Nature reserve, 02. V 2006. (1, U.V.), 29. V 2006. (1, E.R.), 30. V 2006. (1, A.B., E.R.), 15. VII 2008. (2, V.A., A.Pa.).

205. *Apoderus coryli* (Linnaeus, 1758) - Aizkraukle distr., protected area "Aizkraukles purvs un meži", 01. VII 2007. (3, A.P.); Cēsis distr., Gauja National park, near river Rauna, 15. VII 2008. (1, D.P.); Daugavpils distr., Naujene, Nature park "Daugavas loki", 25. VI 2008. (1, R.C.), Nature park „Silene", protected area „Ilgas", 19.-22. VI (1); Rēzekne distr., Gaigalava, old clearing, 15. VII 2009. (1, A.Bu., M.B.); Talsi distr., Kaļķi, protected area "Kaļķupes ieleja", 57°32'31"N, 022°30'45"E, 12. V 2009. (2, A.P.), Slītere National park, Vaide, 06. VIII 2009. (1, A.B.); Tukums distr., Lielaisciems, Ķemeri National park, 16. VII 2008. (1, V.A.).

206. *Apoderus erythropterus* (Gmelin, 1790) - Madona distr., Ošupe, wet meadow and bank of river Aiviekste, 2,5 km NE lake Lubāns, 56°50'03"N, 026°56'05"E, 06. VII 2008. (1, A.Bu., M.B.).

Curculionidae Latreille, 1802

207. *Otiorhynchus sulcatus* (Fabricius, 1775) - Rīga distr., Rīga, Purvciems, Deglava str. 41a, 11. VII 2008. (1, A.B.).

208. *Otiorhynchus ligustici* (Linnaeus, 1758) - Daugavpils distr., Dviete, Nature park „Dvietes paliene", 56°03'04"N, 026°20'41"E, 12. V 2009. (3, A.P., M.N.), Nature park „Dvietes paliene", near Berezovka river, 12. V 2009. (1, A.P., M.N.), Nature park „Silene", protected area „Ilgas", 05.-09. VI 2006. (1, O.D.), Vecsaliena, Mārkalne river, Lejzemnieki, 21. V 2008. (1, A.P.); Jēkabpils distr., Dignāja, 12. VII 2009. (1, M.B.), Dunava, 01.-08. VI 2009. (2, K.B.); Ogre distr., Dzelmes, 12. VI 2009. (1, A.B.); Preiļi distr., Jersika, „Kurpnieki", 22.-24. VI 2009. (1, A.B.), 23.-24. VI 2009. (3, K.B.), 28. VI 2009. (1, A.B.), 03. VII 2009. (1, A.B.); Ventspils distr., Moricsala Nature reserve, 02. V 2006. (1, U.V.), 29. V 2006. (1, E.R.), 30. V 2006. (1, A.B., E.R.).

209. *Brachyderes incanus* (Linnaeus, 1758) - Daugavpils distr., near Daugavpils beltway, 08. III 2008. (14, A.B., K.B.), Līksna, 3 km N Daugavpils, clearing, 27. VII 2008. (1, A.Bu.).

210. *Liophloeus tessulatus (*Müller, 1776) - Daugavpils distr., Vecsaliena, Mālkalne, Lejzemnieki, 21. V 2008. (4, A.P.); Preiļi distr., Jersika, „Kurpnieki", 04. VI 2008. (1, A.B.), 09.-12. VII 2009. (1, K.B.).

211. *Larinus sturnus* (Schaller, 1783) - Aizkraukle distr., Ērberģe, 06. VIII 2008. (2, A.B.); Daugavpils, 17. VII 2008. (1, R.O.); Jēkabpils distr., Dunava, 15.-18. VII 2009. (4, A.B.); Preiļi distr., Jersika, „Kurpnieki", 04. VI 2008. (1, A.B.).

212. *Tanymecus palliatus* (Fabricius, 1787) - Daugavpils distr., Nature park „Dvietes paliene", VII 2006. (1); Jēkabpils distr., Dunava, 01. VI 2008. (1, A.B.); Preiļi distr., Jersika, „Kurpnieki", 23.-24. VI 2009. (5, K.B.).

213. *Sitona gressorius* (Fabricius, 1792) - Rīga distr., Jūrmala, Kūdra, VIII 2008. (1, A.T.).

*214. Sitona griseus (*Fabricius, 1775) - Daugavpils distr., Līksna, 1.5 km N Daugavpils, inland dunes, 27. V 2009. (1, A.Bu.).

215. Hypera zoilus (Scopoli, 1763) - Rīga distr., Jūrmala, Kūdra, 17. V 2008. (1, A.T.).

216. Grypus eguiseti (Fabricius, 1775) - Aizkraukle distr., protected area „Aizkraukles purvs un meži", 01. VII 2008. (1, A.Bu.); Daugavpils distr., Butišķi, valley of river Daugava, 26. V 2008. (1, A.Bu.), Šedere, „Straumēni", 10.-26. IV 2009. (2, M.J.), 16.-17. V 2009. (1, M.J.).

217. Cryptorhynchus lapathi (Linnaeus, 1758) - Jēkabpils distr., Dunava, 18. V 2008. (2, A.B.), 01. VI 2008. (1, A.B), 22. VI 2008. (1, A.B.), 31. V 2009. (1, A.B.), 01.-07. VI 2009. (1, K.B.), 01.-08. VI 2009. (2, K.B.), 15.-18. VII 2009. (7, A.B.), Vandāni, bank of Daugava river, on *Salix*, 14. VI 2009. (2, M.B.); Limbaži distr., country territory of Salacgrīva, „Veczemju klintis", 17. VIII 2008. (1, A.B.); Preiļi distr., Jersika, „Kurpnieki", 23.-24. VI 2009. (1, K.B.); Rēzekne distr., Īdeņa env., bank of Lubāns lake, on *Salix*, 21. VII 2009. (2, M.B.); Rīga distr., Rīga, Purvciems, Deglava str. 41a, 09.-10. VII 2008. (1, A.B.), 11. VII 2008. (1, A.B.).

218. Hadroplontus (Ceutorhynchus) litura (Fabricius, 1775) - Aizkraukle distr., protected area „Aizkraukles purvs un meži", 06. VIII 2008. (1, A.Bu., M.B.).

219. Scolytus ratzeburgi Janson, 1856 – Ventspils distr., Moricsala Nature reserve, window trap, 03. VIII 2004. (1, U.V.).

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NEW SPECIES OF ROVE BEETLES (COLEOPTERA: STAPHYLINIDAE) IN THE FAUNA OF LATVIA

Raimonds Cibuļskis, Arvīds Barševskis, Uldis Valainis

Cibuļskis R., Barševskis A., Valainis U. 2009. New species of rove beetles (Coleoptera: Staphylinidae) in the fauna of Latvia. *Acta Biol. Univ. Daugavp., 9(2): 161 - 162.*

9 species of rove beetles (Coleoptera: Staphylinidae) recorded from Latvia first time: *Tachinus (s.str.) scapularis* Stephens, 1832; *Atheta (Trochanterella) ischnocera* Thomson, 1870; *Atheta (s.str.) boletophila* (Thomson, 1856); *Atheta (s.str.) coriaria* (Kraatz, 1856); *Atheta (Bessobia) monticola* (Thomson, 1852); *Atheta (Bessobia) excellens* (Kraatz, 1858); *Thinobius (s.str.) brevipennis* Kiesenwetter, 1850; *Paederus (Eopaederus) limnophilus* Erichson, 1840; *Lathrobium (s.str.) castaneipenne* Kolenati, 1846.

Key words: Coleoptera, Staphylinidae, Latvia, fauna, new species.

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INTRODUCTION

The article contains data about 9 rove beetles species, which are not reported to be found in Latvia till now. The information about species of Latvian rove beetles fauna was based on North European catalogue of beetles (Silfverberg 2004) and Check-list of Latvian beetles (Telnov 2004). „Catalogue of Palearctic Coleoptera, Volume 2" (Lobl & Smetana 2004) were used for the nomenclature of scientific names of the species.

In the list of species are given plase where species was found, short information about biotope, collecting date, number of collected specimens, collector's name and collection where material stored. Abbreviations used in list of species: d – district; p – parish; DUBC - the collection of the Institute of Systematic Biology, Daugavpils University; LDM - the collection of the Latvian Natural History Museum.

LIST OF SPECIES

Tachinus (s.str.) scapularis Stephens, 1832

Rīga d., Rīga, 19.IX.1974., 1 ex., M.Stiprais leg. (LDM), garden near Juglas lake, 26.VI.1947., 1 ex., M.Stiprais leg. (LDM), Miera iela 59, 19.VI.1975., 1 ex., M.Stiprais leg. (LDM), 01.X.1941., 1 ex. (LDM); Rīga d., Jūrmala, Ķemeri, 28.VIII.1964., 1 ex., M.Stiprais leg. (LDM).

Atheta (Trochanterella) ischnocera Thomson, 1870

Daugavpils d., Līksna p., Augšpole, 26.VII.1995., 1 ex., R.Cibuļskis leg. (DUBC).

Atheta (s.str.) boletophila (Thomson, 1856)

Ventspils d., Moricsala nature reserve, 03.-05.VIII.2002., 1 ex., U.Valainis leg. (DUBC).

Atheta (s.str.) coriaria (Kraatz, 1856)

Ventspils d., Moricsala nature reserve, 06.IX.2002., 1 ex., U.Valainis leg. (DUBC).

Atheta (Bessobia) monticola (Thomson, 1852)

Krāslava d., Šķeltova, 21.VIII.1992., 1 ex., A.Barševskis leg. (DUBC), 22.VII.1994., 1 ex., A.Barševskis leg. (DUBC).

Atheta (Bessobia) excellens (Kraatz, 1858)

Krāslava d., Šķeltova, 21.VIII.1992., 1 ex., A.Barševskis leg. (DUBC).

Thinobius (s.str.) brevipennis Kiesenwetter, 1850

Daugavpils d., Dviete p., Janopole, 56°02'07N 026°19'49E, „Dvietes paliene" nature park, Ilūkste river bank, 15.VII.2005., 1 ex., R.Cibuļskis leg. (DUBC).

Paederus (Eopaederus) limnophilus Erichson, 1840

Jelgava d., Zaļenieki, 20.VI.1972., 1 ex., M.Stiprais leg. (LDM).

Note. This species was published from Latvia previously (Ulanowski 1883; Stiprais, Varzinska 1985), but not included in catalogue of Latvian beetles.

Lathrobium (s.str.) castaneipenne Kolenati, 1846

Jelgava d., Zaļenieki, 21.VI.1972., 1 ex., M.Stiprais leg. (LDM).

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METHODOLOGICAL ASPECTS OF STUDY ON BIOLOGY AND DEVELOPMENT CYCLES OF *DYTISCUS LATISSIMUS* (COLEOPTERA: DYTISCIDAE) IN LABORATORY ENVIRONMENT. SPRING-SUMMER PERIOD

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Vahruševs V. 2009. Methodological aspects of study on biology and development cycles of *Dytiscus latissimus* (Coleoptera; Dytiscidae) in laboratory environment. Spring-summer period. *Acta Biol. Univ. Daugavp., 9(2): 163 - 172.*

The direction of our research is based on the aim to study the biology of *Dytiscus latissimus* in its natural habitat and to identify its position in biocenoses in order to further elaborate the concept of an ecosystem protection as a unified landscape. We as well strive to study the ethology, reproduction and a development cycle of this species in a laboratory environment with its further possible inception into the zoo-culture with a prospective of its reintroduction in a natural environment.

Key words: Dytiscus latissimus, Coleoptera, Dytiscidae, larva, pupa, zoo-culture

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INTRODUCTION

There are many white spots in the biology of the *Dytiscus latissimus* beetle. The beetle is leading a very covert life. The species are very sparse in all the habitat area. It is considered very rare in many regions and is listed in the Red Book. The species, being the extremely interesting, with original morphology and individual behaviour, can undoubtedly be considered a rare object for a detailed inspection and planning of various measures on nature protection and preservation. Therefore, in order to properly understand and study the nature of this species, a part of the research activity has been moved to a laboratory with a purpose to model the natural micro-climate in an artificial environment aiming to identify the natural behaviour of the object in its life cycle (4).

Keeping the species in an artificial environment on one hand is not very hard, if talking about imago. On the other hand, keeping of larvae is becoming an increasingly complicated process due to the morphological peculiarities of their different development stages and adaptation of the species to another habitat environment, as well as due to the present stereotypes among the researchers, which stem from the warm-watered aquaria concept and terrarium concept. Being a Palaearctic aquatic, this species is very demanding with regards to a specific temperature regime, which in most of the cases might not correspond to the microclimate provided by not properly equipped laboratory premises. Seasonal life activity of *Dytiscus latissimus* in natural conditions flourishes within the range of

relatively low water temperatures from +2şŃ in winters to +22°Ń in summers.

D. latissimus in the imago stage is an amphibian and can survive quite extreme water quality conditions with lots of nitrates and low water oxygen content. The larva, on contrary, is very demanding to the water quality. Therefore for breathing it is using both the atmosphere oxygen (it breathes through a couple of spiracles located towards the end of the carcass) and water oxygen (skin breathing is featured by the larvae of small sizes at their first development stages) (5). Thus, our experiments are having similarities to those of Japanese scientists, who have created a closed aqua-system in their lab in order to breed *D.sharpi* and further reintroduce it as a part of nature preservation projects in Japan. (2,3) Thus, today in Latgale zoo, we created a special aqua-laboratory for studies of *D.latissimus*, which has already provided us with several discoveries in the life of this species.

MATERIALS AND METHODOLOGY

The practical part of our study of *D.latissimus* in the springtime can be split into the following main phases:

1) Fine-tuning the laboratory equipment and preparing of the equipment for keeping the gathered material.
2) Coarse material gathering in the wild environment (gathering of eggs and larvae).

Fig.1. Breeding locations of *D. latissimus*

3) Transferring the gathered material to the laboratory.
4) Adaptation of the objects to the artificial environment.
5) Monitoring lifecycles of the species development and their behaviour.

Gathering of the original material was made on the territory of the former fish hatchery in the region of Rugeli (Daugavpils, Latvia) (55°52’34.01"C 26°35’17.41"B). The search for breeding locations in the area of habitat of *D. latissimus* and process of its eggs gathering has a standard proven methodology as follows.

One has to identify suitable plants in the locations of beetles’ clutches (usually located on the sunny side along the coast of a water reservoir) (Fig.1). The person gathering the material has to grasp with fingers the underwater part of the identified plant stem reaching almost to its base, and slowly palpate it by letting it through the fingers in the upwards direction. The upwards direction is imperative, as stems of many sedge plants have microscopic thorns which are rooting upwards. If this method is not followed, an injury of a palm can occur. A stem of the plant which has protruding bumps on it guarantees the presence of a clutch (Fig.2,3,4). A stem in its normal condition is usually smooth and often flat. Such plants as *Caltha palustris* which have fleshy stem are to be studied in addition visually as eggs can be located inside the stem itself. This can be identified from locating specific cuts on it(Fig.5). Stems with clutches are to be cautiously pulled out and placed into polyethylene bags for transportation. Transportation is being made in special thermal boxes in order to avoid temperature shifts. A rise of temperature is particularly dangerous, and one has to be wary of it especially in a sunny weather when the bag is being warmed up.

Upon delivery to a laboratory, the plants are being placed in water vessels with the water level of approximately 10-15 centimetres. In order to avoid formation of a bacterial membrane on the surface of the water and to improve the aeration, each vessel is to be supplied with air by using an air

Fig.2. *D. latissimus* egg laying inside the stem of *Carex acuta*

Fig.3. *D. latissimus* egg laying inside the stem of *Carex rostrata*

Fig.4. *D. latissimus* egg position inside the stem of *Carex rostrata*

Fig.5. *D. latissimus* egg laying inside the stem of *Caltha palustris*

distributor and an aquarium compressor. The incubation temperature of eggs is to be maintained within the range of 18-20°Ń degrees.

Hatching and keeping the larvae

After some time one can observe the hatching of larvae. The larvae hatching time in our case is of no importance, as we are unaware of the exact timing when the clutch was laid. Thus, larvae can either hatch during the same day or in 8-10 days. Therefore in order to cover all the chances, we are keeping the gathered eggs laying in vessels up to 10-15 days.

The hatching of larvae usually is going on daily and in clusters. We have to remember that clutches of another close species of the diving beetles can be usually found in the gathered plants. The hatched larvae may also terminate each other due to their predatory nature. Here we have to give credit to the larvae of *D. latissimus*, which did not demonstrate aggression to their own kind during the fist stages of life, as per their species' characteristics.

While keeping the larvae one has to also consider the fact, that these larvae have an

Fig.6. Instar II larva attacking a caddis larva (with exuvium on its left)

Fig.7. *D. latissimus* instar III larva

external type of digestion, i.e. digestive secret being provided by the larva into its prey and its initial digestion is happening outside its carcass. This has to be taken into consideration when keeping larvae in artificial conditions. The water in the vessels with larvae has to be properly filtered and aerated or regularly substituted with a fresh one. Besides, the surface of the water should not be covered with any bacterial or greasy membrane. This can lead to larvae experiencing problems in breathing and their possible death at different development stages. In order to avoid the tangible contact between larvae we have been placing them isolated one from another into separate specifically made nurse-cages. The nurse-cages themselves were placed in a common vessel with a filtration function. The other part of larvae was placed in a common nurse-cage in order to monitor the species' behaviour and its impact of their life-cycle.

After three to four hours from hatching the larvae start to hunt actively. We have been offering *Limnephilidae* caddis larvae them as a feed, which we have gathered in natural water reservoirs (1). Instar I larvae were receiving 3-4 caddis larvae per day (Fig.6). Instar III larvae, after having acquired an ability to pupate, are striving to leave the water and get out of the nurse-cages. They refuse the feed and swim actively. Such larvae have to be taken out and placed into a specially prepared vessel for pupation. (see equipment section). At this development stage larvae body length reaches 6-6,5 cm and their weight is within the range of 2,18-2,66 grams (fig.7). Usually, soon after larvae reach the dry surface, they start digging in. Such behaviour is a good sign of their normal condition. The nurse-cages for pupation are being covered and placed into a dark place with a moderate temperature of +21şŃ to +23şŃ degrees. The first visual check of larvae after they have dug into the soil is to be made on the third-fourth day. This delay can be explained by larva preparing a place for pupation (constructing a cradle and further moving to a pupa stage (Fig.8).

From the moment of pupa appearing the check is being made once per two days. A beetle which came out of pupa stays for some time in a state of rest (see results section). During the first few hours after leaving the pupa, at the time of formation of wings, the integuments of an insect are soft and light-yellowish in colour. After several hours the integuments of an imago gain their normal forms and colour (Fig.9-10). Approximately after 24 hours after the metamorphosis one has to remove the observation cover-glass, otherwise at the time of "waking up" the young imago can lose strength or even die while trying to get out of the cradle.

A B C

Fig. 8 *D.latissimus* pupa.: A – front view, B – side view, C – rear view

Once the beetle starts to get out of the cradle, it can be placed into an aquarium for its further keeping (see equipment section).

Keeping of imago in summertime

The moment of an imago's first contact with water is very important. One has to provide for the imago's independent contact with water in order to avoid accidents (it is widely known that some animals in case of an enforced contact with water can drown). Thus, the insect is placed on an artificial island from which it can on its own plunge into the water for the first time. During this or on another day one can offer some feed to the beetles. The adult beetle diet is quite diverse – it includes bits of fresh codfish, beef heart, chicken stomachs. One can also offer earthworms and moth. Young imagos have to eat properly in order to facilitate hardening of their integument and to gain necessary energy for the forthcoming mating season and hibernation.

Adult beetles can be kept in a common aquarium with quite high density of habitation. For example, 10-15 objects can easily survive in a 200 litres vessel. While keeping them in such conditions a gender ratio is not that important. The intra-species aggression is not present for these beetles. One has to only equip the aquarium with numerous hideouts for beetles, and maintain the water temperature at +21şŃ to +22şŃ degrees.

Equipment

Nurse-cages for keeping larvae The single-object nurse-cages had been made out of five-litres polyethylene cans. By using a soldering iron we have made large holes along the walls of the can. We have cut the bottleneck of the can in order to provide for an access to the nurse-cage from above. We have put a fragment of a stocking

Fig.10. Young *D.latissimus* imago. Male. 24 hours after metamorphosis

A B C

Fig. 9. Young *D.latissimus* imago. Female couple of hours after metamorphosis.: A – immediately after metamorphosis, B – in 6 hours, C – in 24 hours (integuments gained their normal colour).

Fig. 11. Improvised nurse-cage for keeping larvae

Fig. 12. Common nurse-cage for keeping larvae

on the top of the can, which simultaneously provided for a free circulation of water and an isolation of larvae. The stocking surface material appeared to serve as well a convenient perch for larvae. This construction is fast to make but is not convenient for observations and monitoring. (Fig.11)

The nurse-cages made as per above method, had been placed into a large aquarium of 140x70x45h with the water level of 15-20 cm. (Fig.12) We have connected a microclimate system to the aquarium, which was using a thermostat *AquaEL* TS 500 (dual) and a cooling element (a standard freezer for cooling consumable liquids, which we have adapted for our study). The aquarium system was equipped with the internal bio-filter and an additional water aeration system.

Larvae nurse-cages
water quality ratios
t: +20şC
pH: 7,2
NH3: 0
NO2: 0
NO3: 0

Cages for pupation

We have used a plastic disposable jar of 15x10x10 with a tightly closing lid as a cage for pupation. (Fig.13)The sides of the jar had been perforated with needle in order to improve aeration. We have filled up the jar with peat layer of 5-6 cm. and placed a special observation glass on the top of the peat, which was fulfilling a watch-window function and provided for a convenient

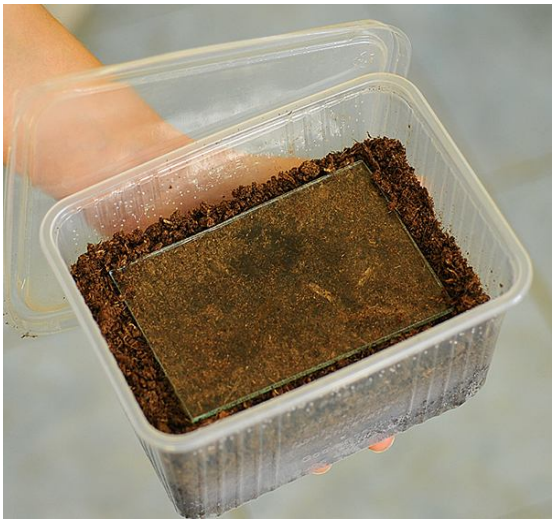

Fig.13 Nurse-cage for pupation

observation of larvae during their development. On the second or third day after the metamorphosis of the larvae one has to remove the glass from the nurse-cage.

The final version of the construction of a closed aqua-system for keeping and breeding *D. latissimus* is currently in the development stage. Therefore, the equipment data mentioned above have a purely experimental nature.

RESULTS AND DISCUSSION

At the current stage we can state the following with a great deal of certainty:

1. In natural conditions in the natural water reservoir the species are using at least three types of plants: *Carex acuta, Carex rostrata, Caltha palustris* (Fig.1-5) for laying eggs. We as well have discovered that at least three other types of *Dytiscus sp*. are laying eggs into the same plants (their belonging to particular species is not yet identified). Thus, we see a competition of several *Dytiscus* species for their breeding locations.
The inter-species competition of the *Dytiscus* genus larvae is very severe. Keeping of *D. latissimus* larvae together with the other *Dytiscus* species usually leads to the total extermination of the former. In turn, the larvae of *D. latissimus* have appeared to be much more friendly and less aggressive not only towards each other but also to the other *Dytiscus* genus species. Therefore at their initial development stages, the *D. latissimus* larvae can be painlessly kept together in a common nurse-pond, providing there is a proper supply of feed and plenty of hideouts – perches. Instar II larvae II and especially instar III larvae have an inclination towards cannibalism.

2. The best feed for *D.latissimus* larvae in natural conditions are still the caddis fly larvae *(Limnephilidae)*. For a single larva development from the moment of its birth in the laboratory conditions we needed approximately 110-120 caddis larvae, which makes up to 5-6 caddis larvae per day.

3. The development cycle of *D.latissimus* in laboratory conditions is a new discovery in the studies of this species' biology in itself and can be depicted as follows (see table 1):

4. During the study we have observed a high mortality level of the animals. (see table 2). Despite this sad fact, the study had turned out to be the most successful during the several years of research and experiments. In most of the previous cases we had been succeeding to get a larva up to its instar III, as mortality rate of the animals in the artificial conditions stayed at a 100% level.

Our studies in the area of keeping and breeding *D.latissimus* go on for several years already. At the current stage we have a certain success, whereas at the initial stages of the studies we practically had no idea on where and how this species are living.

As can be seen from the results of the study, the life processes of the species at the initial stages of development are going on very intensively. This partially explains the place of this species in the biocenoses system of a water reservoir. The faster the larvae grow the fewer enemies they shall face. This is undoubtedly a big benefit in the natural conditions, but such pace of metabolic processes can seriously complicate the breeding and keeping of the species in an artificial environment. For example, possible diseases can and do develop in a very fast pace, which does not leave any reaction time for diagnosis.

One case of strange death of larvae at their latest development stages leaves the question about its reason unanswered. Although all the larvae had been kept in the absolutely same conditions and were fed with the same feed, the change in behaviour and desire to go out to the dry surface was exhibited by only part of the larvae, and almost simultaneously (Fig.2: 2,1-2,2). It was not

Table 1. The length of the development life cycle of *D.latissimus* excluding the incubation period of an egg, days

№	Development life cycle	Temperature tºC	Days
1	Instar I larva.	20	4-5
2	Instar II larva.	20	5-6
3	Instar III larva up to the moment of entering the dry surface.	20	11-15
	Larva development cycle from its birth up to the moment of entering the dry surface.	20	20-26
4	Pupation of larva from the moment of entering the dry surface.	21-23	5-7
5	Pupa.	21-23	10-11
6	State of rest of young imago from the moment of metamorphosis up to the „awakening" and returning to the water.	21-23	4-5
	Development on the dry surface up to the moment of returning to the water	21-23	18-22
	Total development cycle from the birth of larva up to the moment of the young imago returning to the water.	20-23	39-49

Fig. 14. *D.latissimus* larva, died just before pupation

Fig. 15. *D. latissimus* larva, died during pupation

Fig. 16. Dead *D.latissimus* (male) couple of hours after metamorphosis

identified up to today what factors contributed to such adjustment in behaviour.

1. One can come up with numerous hypotheses regarding reasons of death of the objects during the study, and one of these can be water penetration into a trachea system of the larvae (choking). The initial reasons of this may be as follows:

Table 1. Survival and mortality rate of *D.latissimus* during the course of the study

№	Instar and survival rate at the certain stage of development of an individual	Quantity	Notes
1	Just born larvae.	75	Out of the clutches gathered in nature
2	Instar III larvae.	34	Death of larvae of different instars due to various reasons.
2.1	Larvae which have left the water.	15	All of the larvae which went out to the dry surface exhibited an active aim to leave the water, which is a normal demonstration of reflexes at this development stage.
2.2	Larvae which stayed in the water	19	Larvae, which stayed in the water have gradually lost their interest in feed, and then without any obvious reasons have died one after another, without even trying to get out of the water. Due to some reason, they failed to launch a reflex for aiming at pupation.
2.3	Larvae which died before pupation (Fig.14).	3	The cradle was already made and the larvae were in the state of rest.
2.4	Larvae which died during pupation (Fig.15).	3	
3	Pupae.	9	The larvae have successfully pupated and looked normal.
3.1	Died pupae.	2	The pupae have died at the latest stages of development.
4	Imago stage.	7	The integuments of the beetle have started to change colour and became brown, which may evidence of a presence of some bacterial infection.
4.1	Imago death 1 day after metamorphosis (Fig.16).	1	The death was caused by not removing the observation glass from the pupation cage in time. The beetle, which tried to get out to the soil surface, was stuck between the wall of the jar and the glass.
4.2	Imago death 4 days after metamorphosis.	1	One beetle had integuments defects and experienced problems in the diving process, thus it lived for a couple of days before becoming a prey of its peer.
4.3	Imago death after returning into the water.	3	The other two beetles died in an accident due to the aqua-system equipment failure.
4.4	Survived imago.	2	At present stage of the study we have 1 male and 1 female beetle, which had been bred in a laboratory conditions.

2. Existing of a greasy bacterial membrane on the surface of the water, which is caused by larvae defecation that usually takes place during feed in-taking;
3. Inability of larvae to reach up to the water surface and to steadily hold on there for aeration of their tracheae. This, in turn, may be caused by a number of factors. One has to take into consideration that *Dytiscus latissimus* larvae especially at the end of instar II, instar III before pupation, as well as full-stomach larvae and larvae with a prey are bad swimmers and need a perch for their breathing system aeration;
4. Vibrations and shaking of different kind due to the fact that aquarium equipment working 24-hours per day is located inside the same water vessel where the animals are being kept (this version requires a more thorough check);
5. It is possible that with higher temperatures of keeping the larvae become more prone to "choking".

One can save the „choked" instar III larvae if acting promptly and have dug them into a wet

soil for 24-hours. Such “resurrection” is usually not successful with instar I and II larvae (pers. comm. Ŕ. Shelega).

In any case, one can state with certainty that the reason provoking disturbances in the vital functions of the larvae is the imperfect keeping conditions. Thus, the system of life support of the laboratory’s aqua-system requires further proper improvements.

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CONCEPTUAL APPLICATION OF *DYTISCUS LATISSIMUS* LINNAEUS, 1758 (DYTISCIDAE, COLEOPTERA) GATHERING METHODS IN NATURAL HABITAT

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Vahruševs V. 2009. Conceptual application of *Dytiscus latissimus* Linnaeus, 1758 (Dytiscidae, Coleoptera) gathering methods in natural habitat. *Acta Biol. Univ. Daugavp., 9(2): 173 - XXX.*

This material is compiled on the basis of a conceptual understanding of the issue of methodology on gathering this species which stems from my many-year research of this topic.
This work is an attempt to compile the behavioural specifics of *D. latissimus* and its reaction to various irritants, the use of which can bring success in gathering of these animals. The knowledge of these peculiarities and the use of a maximal diversity of traps and methodologies can significantly enhance the researchers' abilities while working in the area of ecology and fauna. Thus a good ratio of gathering species can be achieved even during unfavourable weather conditions at any time of the year.

Key words: *Dytiscus latissimus*, *Coleoptera, Dytiscidae*, larva, pupa, imago, trap

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INTRODUCTION

The analysis of available sources proves that gathering of *D.latissimus* in natural habitat can be made by applying the following methods which are commonly accepted in entomology:

1. Methods of catching invertebrates during their natural migrations (M.N.Tsurikov, 2003).

- Pitfalls, funnel traps, pitfall trenches. Also, ordinary trap for catching stoneflies which are leaving the water.

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2. Methods of catching aquatic invertebrates with the use of nets, water hoop-nets and similar devices (M.N.Tsurikov, 2003).

- crayfish trap, crayfish scoop, nets;
- mowing a hoop-net;
- Partial extraction of substances with invertebrates dwelling inside.
  - in water reservoirs (scraper and drag, device for gathering water plants from water reservoirs;
- extracting clutches with plant leaves.

3. Attraction

Following are the methods of making the animals move towards the pitfalls or traps by impacting their senses **(**M.N.Tsurikov, 2003).

3.1. Impacting photoreceptors of invertebrates (catching methods, based on positive reaction of invertebrates on light sources (phototaxis),

on water surface gloss (wet asphalt shine from street lights, or shine from a glossy car surface or from a dark oilcloth which is located beneath a light source);

- light traps (traps where light sources are being used for attracting invertebrates; In funnel traps a light source, such as shiny UV sticks meant for fishing, can be combined together to create an additional light-bait (pers.com. Dave)

3.2. Use of a smell from living animal for attracting invertebrates.

- Use of a smell of sexual pheromones (alive females as bait).

3.3. Use of a smell from dead animals for attracting invertebrates.

- effective method of catching and marking water beetles (M.N.Tsurikov, 2003);

3.4. Attracting invertebrates by using comfortable temporary shelters

- in water reservoirs (trap for aquatics, collector for aquatics, collector for waterfowl invertebrates (M.N.Tsurikov, 2003);
- on the ground surface (catching pieces of bark, catching bundles of brushwood (M.N.Tsurikov, 2003);

MATERIALS AND METHODOLOGY

Skills which are acquired for catching animals depend on one's knowledge of biology and location of the species to catch in the whole ecological system of a water reservoir. Thus, the *Dytiscus latissimus* field research is being defined by the species' seasonal activity which can be divided into the following stages:

Winter season. November-December-January-February-March. Hibernation**.**
Spring season. March-April-May-June. Spring migrations, reproduction. Incubation of eggs and developing of larvae.

Summer season. June-July-August-September-October. Pupation of larvae, metamorphosis, active feeding, imago.

Autumn season. October-november-December. Preparation for winter. Mating.

Correspondingly the methodology of gathering of imago, larvae and eggs of *D. latissimus* in natural habitat includes the following tasks:

Catching in the water:

1. Method of visual inspection of a water reservoir and its coastal line from the shore, as well as inspection of shallow waters from a boat. This method allows monitoring an animal in natural habitat during summer-autumn season, during day-time or as well during dusk while using a flashlight. Monitoring and catching of animals is being done with hands or hoop-net and heavily depends on low lucky one is. This method is time- and patience consuming and usually provides minimum results. Eggs gathering is to be made in April-May. In this case one has to gather the potential target plants and make their further visual examination. Then the selected perspective plants with clutches are being transferred to a laboratory and placed into water vessels for incubation. Each plant has to be placed in a separate vessel. This method also allows determining an inter-species' competition of *Dytiscus* genus in their reproduction locations and a certain species' appeal to a defined plant genus type.

2. Method of under-water visual inspection of a water reservoir and its coast. This method is convenient during spring, autumn and winter seasons. During these seasons water in reservoir is much more transparent than during hot seasons. This method requires diving equipment and certain extreme-conditions explorer skills. It is not so effective although can provide

an extraordinary result while watching animal behaviour in their natural habitat during day-time and night-time.

3. Mowing a hoop-net. The most commonly used method, which represents a number of mowing movements with a special – robust hoop-net in the shallow and coastal waters of a reservoir with a dense water and near-water vegetation. This method can be used during any season, including winter "hunting" in an ice-hole (especially effective during fish extermination period). This method is very effective and usually requires a considerable muscle effort of entomologist.

4. Method of pulling dredges etc. This method is useful only during spring-summer season and requires additional muscle power, as the process is very effort consuming. This methodology allows examining large coastal line area during one set at any given point of time. This method is not convenient in case the water reservoir's bottom has lots of snags.

5. Use of agricultural devices – rake, metal bucket with holes and rope in an overgrown pond also can bring some result. Rakes are especially effective, as water plants get winded up on these very well. This is an effective method of catching in an overgrown pond. (*Ceratophyllumž sp., Potamogeton sp.*, *Utricularia sp., Hydrocharis sp., Spirogyra sp.,* etc.). Plants, being caught by a rake usually bring along also the needed animals.

6. Method of traps installation. This method can be used during any season, including under-ice catching. Crayfish traps of a funnel type are being installed with bait (usually bits of fresh beef heart for imago or caddis fly larvae for larvae. Still both imago and even more larvae are glad to find caddis fly larvae in traps). Some specialists use frogs' corpses or singed mice. (Pers.com. H.Shaverdo). One has to remember that one edge of the trap must always be above the water level so that insects can breathe. One has to pay special attention to this during summer-time. In the late autumn and in winter with low temperatures the traps can be fully dipped under water, as metabolism of animals is not so intensive. The method has justified itself and allows examining large areas and making audit of a genus content of a biocenosis.

7. Method of catching with fishing nets. One can use fishing nets made of strings with a cell size of 18-22 mm. We have identified that the best season for installing the nets is late autumn. During late autumn the beetles feature mating behaviour. Males are actively swimming in search of female. While mating, the male is holding and taking the female along, thus the mating couple can accidentally entangle in the net, and this probability is rather high providing the net is correctly installed.

Catching on the ground:

1. Monitoring imago during migration period. Monitoring imago during spring air migration of some species from one water reservoir to another during summer period – March to May. Is possible also during autumn season migration from September to October. Catching on light with the use of light and a light screen, as well as street lights. Catching pitfalls with improvised lids can also be used.

2. Monitoring of adult larvae during process of leaving the water reservoir and striving to pupate. Ordinary trap for catching stoneflies which are leaving water (M.N.Tsurikov, 2003).

3. Gathering of pupae and young beetles. Usually made under an artificial or natural shelters marked in advance. During our trials we have made a good use of pieces

of sawn wood, plywood or slate and similar items, which were placed near the water reservoir. The beetle larvae, which were going to pupation usually prefer to dig themselves under some article in order to create a cradle. In natural conditions we usually found pupae under natural shelters, such as snags or logs, which lie near the banks of a water reservoir.

One has to remember that by installing the above devices, the researcher undertakes a severe responsibility regarding the well-being of any animals which have been caught in these traps. Apart from the needed beetle, the traps can also catch other animals living in the biocenosis under research. Thus, one has to check the traps at least every second day, and at least daily during summer season. Nets have to be installed for the night and must be checked twice a day. Nets with such size of a cell practically cannot harm the fish population, as large fish does not stay in the net, since the strings are being easily torn. We would like to repeatedly emphasise that such method of gathering demands a grave responsibility and legally approved action of a researcher, who has to obtain all the necessary permissions from all the applicable institutions

Transportation of alive gathered material.

Eggs
Stems with clutches are to be cautiously pulled out and placed into polyethylene bags for transportation. Transportation is being made in special thermal boxes in order to avoid temperature shifts. A rise of temperature is particularly dangerous, and one has to be wary of it especially in a sunny weather when the bag is being warmed up. (V.Vahrusevs, 2009)

Larvae:
A newly-born larvae are very sensitive to any transportation conditions, therefore one has to get larvae in laboratory conditions. (V.Vahrusevs, 2009). In extreme cases, one can attempt to transport them in a water vessel with some amount of water plants in it, which can be used as perches or "breakwaters", since water fluctuations during transportation can become destructive for animals. In such cases animals either get injured on the vessel walls or drown. The elder instar larvae can be transported in dry containers with water plants, separately one by one, in order to avoid larvae injuring one another.

Beetles
One can transport them in a common dry container with enough of moist substance inside such as water plants or sphagnum moss. The container must be well aerated. One can also remember of possible temperature fluctuations while transporting animals, therefore all the precautions must be taken in order to avoid these.

Equipment
Equipment consists of ordinary devices. Sometimes made from scrap materials or bought in shops ready for use on purpose, and sometimes slightly adapted for our requirements. In this section, we present only the most proven examples of equipment, which had been successfully used for a long time.

Entomological water hoop-net
It can be made by oneself or bought in the shop. The only requirement is that the product should be robust, with both pole and hoop having a tight water resistant cloth on them.

Crayfish traps, trap nets
All of these gears are also constructed using a funnel entrance into them. They could be found in any fishing gear stores (Fig.2.). Their main advantage versus plastic is a presence of a net in their construction. The net allows one to properly aerate the water inside the trap. It is extremely important in catching large diving beetles. During summer months, on the sun light and in the the warm water such traps can become cluttered with hundreds of these beetles. Beetles in the stress often emit a secretion with an unpleasant smell. This secretion is located in the prothorax and pigidial glands, and also contains high

concentrations of steroids. (E. Shaverdo, 2003). Correspondingly, even with air access in a plastic trap, some animals inside it can die from poisoning.

Traps are being placed on the bottom of a water reservoir, or are dipped in the water, and one has to attach these or link to the coastal vegetation in the place of installation.

Fishing nets
Can be bought in a shop. Nets are placed along the shore or in the "windows" in the midst of water plants. "Windows" cab be prepared in advance using dredges or grapnel. The installation methods are as commonly used.

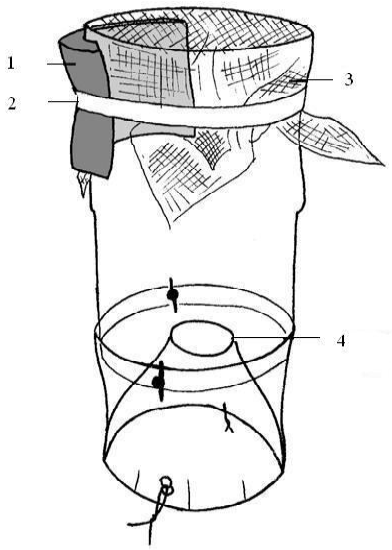

Fig.1. Funnel trap for gathering living *D.latissimus*
(from Jan G.M. Cuppen and other):
1 – float; 2- rubber; 3 – aeration net;
4 – entrance Ø 30 mm.

RESULTS AND DISCUSSION

As a result of the many years individual application of the material gathering methods was a possibility to catch on regular and predictable basis a required number of animals for our laboratory research.

The key to a successful egg collection is a search of the plants used by beetles during their reproduction period, as well as the correct locating of clutches. Such plants in our reservoir under study are *Carex acuta, Carex rostrata, Caltha palustris*. One has to identify suitable plants in the locations of beetles' clutches (usually located on the sunny side along the coast of a water reservoir). The person gathering the material has to grasp with fingers the underwater part of the identified plant stem reaching almost to its base, and slowly palpate it by letting it through the fingers in the upwards direction. The upwards direction is imperative, as stems of many sedge plants have microscopic thorns which are rooting upwards. If this method is not followed, an injury of a palm can occur. A stem of the plant which has protruding bumps on it guarantees the presence of a clutch. A stem in its normal condition is usually smooth and often flat. Such plants as *Caltha palustris* which have fleshy stem are to be studied in addition visually as eggs can be located inside the stem itself. This can be identified from locating specific cuts on it. (Vahrusevs 2009)

Below is an example from field notes of catching beetles during the autumn season:
"The research on the reservoir was done during 11.10.2009 - 28.10.2009.

The weather conditions were favourable. It was quite warm and windless all this time in order to work comfortably. Water temperature was +7-8 ţ C. We worked as usual on the proven location. Coordinates in Google Earth (latitude 55 ° 52'33 .95 "C; longitude 26 ° 35'18 .78" H).

We prepared the traps in advance (they had to be repaired and mended, and modernized a little. (Fig.2.).

We took along 21 trap to the water reservoir. The bait was pieces of beef heart. The traps were placed along the coastline. The first "throw" was kept in the water for almost a week with regular check ups made every day or every second day. Traps were installed partly dipped under water.

A B

Fig.2. Fishing tackle bought in a shop: A – standard; B – modernized

Thus the caught insects would be able to breathe. To our surprise the first week did not bring the expected results, i.e. we have not caught any of *D. latissimus*. However, related species occasionally were present. It was obvious that we were doing something wrong.

Still during our movement along the water reservoir in the search of new locations to install traps, we have found an installed fishing tackle, of a much larger size. To our surprise it contained 14 objects of *D. latissimus*; including one female. The catch contained also *Cybister lateralimarginalis*. (Fig. 3.) To our dismay, all the beetles appeared to be lifeless. A fisherman was using wheat bread as bait. However, it seems that the majority of *D. latissimus* males were attracted to the smell of the female, which apparently got into the trap by chance. Judging upon the condition of beetles, the net was in the water for quite a while, as some specimens have begun to decompose, still the vast majority were fresh. Upon arrival to the laboratory, one of the beetles started to subtly move his legs. We had put him in a container with moist sphagnum moss and left overnight. By morning the beetle had caught his breath. So the cold water in this case had provided for positive results, and sometimes one can attempt to resurrect suffocated beetles in this way.

We have noticed one more very important point. The fishing net was on the bottom of the water reservoir fully submerged, and in amidst the water plants, as well as all our traps were placed on the surface of water. It became a key discovery of catching *D. latissimus* during the cold season. Thus, there is logical explanation: beetles in the cold water rarely rise to the water surface and are mainly involved with exploration of the bottom of reservoir during most of the period of their winter activity. Water temperature near the bottom of a water reservoir in the winter is always warmer than on its surface. Once we realized this, we have used exactly the same principle during our next throw of traps, and were installing the traps at the bottom of reservoir, near snagged and overgrown banks. Thus, in a day our traps have caught the first *D. latissimus*. (Fig. 4.) The frequency and quantity of the catch, of course, had its own, yet unexplainable rhythm or cycle. Though there was certain regularity in this. Usually, beetles were caught in certain places - their regular dwelling locations, I suppose. Therefore, out of each check of 21 trap, we were getting one or two *D. latissimus*. During the

Fig 3. The result of uncontrolled use of fishing tackle by fish. Handful of dead *D.latissimus* and *C. lateralimarginalis*

Fig 4. First success. Alive *D.latissimus* males

successful days there were 3-4, including the fecundated females.

Thus, within 17 days of research, the entire catch was 12 males and 4 females. There were also other species: *D. dimidiatus, D. circumcinctus, C. lateralimarginalis*.

The weather was still warm. According to our observations, with the water temperature being at +2-4 ° C, *C. lateralimarginalis*, for example, almost practically grow torpid, and therefore does not get into a trap. Other species of the genus Dytiscus are also being very rarely caught. Still, A D. latissimus is being awake during this time, as practice shows."

D. latissimus really occurs much less frequently than the other related species of the genus *Dytiscus*. Partially, the cause of the rarity may be not only his specific peculiarity, but also our insufficient knowledge of the biology of these species. In particular, it has not previously been known that it is more beneficial to catch these beetles during the autumn season - the time of their mating season. It is yet early to assume why beetles are being rarely caught during summer time. Why the beetles are being rarely caught by a hoop-net? The answer again is a mystery. According to one of our guesses, the beetle is dwelling at the bottom of water reservoir, and is striving dig himself into the mud. At least our observations in the laboratory confirm this hypothesis. The beetle is very covert, likes to hide in shelters, preferring snags and roots of bushes in natural environment. Larvae, which sit at the water surface in the conditions of a laboratory, also had instantly dived in case of a danger, striving to get into the mudded bottom part of the aquarium. An active search for a prey among this species is related to the search of some bottom-dwelling organisms. One of the reasons for this species being rather rarely encountered in nature is their food preferences. (Vahrushev 2009) Another thing is that the part of the investigated reservoir, where species are dwelling, has murky water with visibility of 40-50 cm.

CONCLUSION

One has to take into consideration that we have been applying our methods for many years in the conditions of a single water reservoir, which contains large population of the species (Coordinates in Google Earth (latitude 55°52'33.95"N; longitude 26°35'18.78"E)). Therefore, this implies possible corrections of the gathering methods of *D. latissimus* in case

these are being applied in the different type of natural habitat.

ACKNOWLEDGMENTS

We shall be very grateful for any comments to this material from our colleagues or amateurs – enthusiastic nature supporters, as well as for any new additional information on this species. Special thanks to: Prof. Arvīds Barševskis – the head of the Daugavpils university for his personal interest and support of this species studies; dr. Mihails Pupiņš – the director of Latgale zoo (Latgales zoodārzs) for kindly providing study facilities and for a long-term cooperation and understanding; mgr. Evgēnijs Burovs, Ainis Bērziņš and Jeļena Ivanova for their assistance in the field work and laboratory studies and experiments, and to Jeļena Krivkina for her assistance in editing and translation of the article text.

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TO THE KNOWLEDGE OF LATVIAN CHRYSOMELINAE (COLEOPTERA: CHRYSOMELIDAE)

Andris Bukejs

Bukejs A. 2009. To the knowledge of Latvian Chrysomelinae (Coleoptera: Chrysomelidae). *Acta Biol. Univ. Daugavp., 9 (2): 181 - 195.*

In the article faunistical, ecological and bibliographical information on leaf-beetles genera *Leptinotarsa*, *Colaphus*, *Gastrophysa*, *Phaedon*, *Hydrothassa*, *Prasocuris*, *Plagiodera*, *Linaeidea*, *Entomoscelis* and *Timarcha* of Latvian fauna is summarized and presented. A total of 985 specimens of these genera were reviewed. During the current research, the occurrence of 13 species of 8 genera was confirmed for the Latvian fauna. *Entomoscelis adonidis* (Pallas, 1771) and *Timarcha tenebricosa* (Fabricius, 1775) are deleted from the list of Latvian Coleoptera. One species, *Timarcha goettingensis* (Linnaeus, 1758) is mentioned for Latvia only in old bibliographical sources but not recorded in 20th centenary and recently. An annotated list of Latvian species is given.

Key words: Coleoptera, Chrysomelidae, Chrysomelinae, Latvia, fauna.

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INTRODUCTION

This article continues the study on leaf-beetles subfamily Chrysomelinae of the Latvian fauna (Bukejs 2009) and contains faunistical, ecological and bibliographical information on 10 genera: *Leptinotarsa* Chevrolat, 1836, *Colaphus* Dahl, 1823, *Gastrophysa* Chevrolat, 1836, *Phaedon* Dahl, 1823, *Hydrothassa* Thomson, 1866, *Prasocuris* Latreille, 1802, *Plagiodera* Chevrolat, 1836, *Linaeidea* Motschulsky, 1860, *Entomoscelis* Chevrolat, 1836 and *Timarcha* Latreille, 1829.

The subfamily Chrysomelinae comprises more than 130 genera and approximately 3000 species distributed throughout the world (Lopatin 1977). Some species of Chrysomelinae are pests of cultivated plants (Kryzhanovskij 1974). In Latvia, *Leptinotarsa decemlineata* (Say, 1824) is mentioned as pest of potatoes (Smarods, Liepa 1956; Spuris 1974; Ozols 1963; Šmits, Spuris 1966; Čudare 1969; Pavasars 1972), *Phaedon cochleariae* (Fabricius, 1792) – as pest of cultivated Cruciferae (radish, cabbage etc.) (Tomsons 1940; Danka 1950; Smarods, Liepa 1956; Trauberga 1957; Ozols 1948, 1963), *Linaeidea aenea* (Linnaeus, 1758) – as pest of Alnus incana (Brammanis 1940; Danka 1950; Rupais 1959; Šmits, Spuris 1966; Spuris 1974; Pūtele 1977, 1984).

The aim of the current work is to summarise data on Chrysomelinae of the Latvian fauna. The

bibliographic information on these leaf-beetles genera in Latvia is summarized for the first time. New faunal data on 13 species are presented. The article also contains the annotated list of Latvian species.

MATERIAL AND METHODS

A total of 985 specimens of these genera were reviewed, representing 13 species and 8 genera of Chrysomelinae. The reviewed material is stored in the collection of the Daugavpils University Institute of Systematic Biology (DUBC) and in the private collection of the author.

The following identification keys were used for identification of specimens: Bieńkowski 1999, 2004; Lopatin & Nesterova 2005; Mohr 1966; Warchałowski 2003. The systematics suggested by Silfverberg (2004). An interactive on-line manual (Borowiec 2004) and monograph (Lopatin & Nesterova 2005) were used for the nomenclature and synonymy.

Host plants are listed citing the monograph of Lopatin & Nesterova (2005). The general distribution of species is given according to Bieńkowski (1999, 2004), Borowiec (2004), Hayashi *et al*. (1984), Lopatin (1977, 1986), Lopatin & Kulenova (1986), Lopatin & Nesterova (2005), Medvedev (1992), Medvedev & Dubeshko (1992) and Warchałowski (2003).

Classification of chorotypes follows as suggested by Taglianti *et al*. (1999). The transcript of chorotypes codes: OLA – Holarctic, ASE – Asiatic-European, SIE – Sibero-European, WPA – West Palaearctic, CEU – Centraleuropean.

The following information is given for each species: scientific name & author, published bibliographic sources for Latvia, faunal data (locality, collecting date, number of collected specimens in oval brackets, information on the habitat and the collector's name), host plants, phenology (Latvian data only; IV, VI, VII, VIII, IX, X – months from April to October respectively; in oval brackets – ten-day period), general distribution of species and the chorotype code.

Explanations of the abbreviations used: d. – administrative district (system of administrative districts used in Latvia from 1991 to 2009), env. – environs, Isl. – Island, mts. – mountains, syn. – synonym, C – Central, S – South, N – North, E – East, W – West.

RESULTS AND DISCUSSION

During the current research, the occurrence of 13 species of 8 genera (*Leptinotarsa*, *Colaphus*, *Gastrophysa*, *Phaedon*, *Hydrothassa*, *Prasocuris*, *Plagiodera* and *Linaeidea*) was confirmed for the Latvian fauna.

Entomoscelis adonidis (Pallas, 1771) and *Timarcha tenebricosa* (Fabricius, 1775) are deleted from the list of Latvian Coleoptera.

Two species were not confirmed during this research. *Timarcha goettingensis* (Linnaeus, 1758) is mentioned only in old bibliographical sources (Precht 1818; Seidlitz 1872-1875, 1887-1891; Heyden 1903) and in the published catalogues of Latvian Coleoptera (Telnov et al. 1997; Telnov 2004) but not recorded in 20th centenary and recently. Its occurrence in the Latvian fauna needs confirmation. *Hydrothassa hannoveriana* (Fabricius, 1775) is not recorded in Latvia more than 30 years.

Ulanowski (1883) reported *Timarcha metallica* (Laicharting, 1781) and *Timarcha* ***gibba*** Hagenbach, 1825 [syn. *Timarcha globosa* H. Schaff.] for Livonia ["Inflant Polskich", in present time it is territory of E Latvia (Latgale)]. *Timarcha metallica* (Laicharting, 1781) is generally distributed in mountains and foothills of C Europe and Balkans, but *Timarcha gibba* Hagenbach, 1825 is distibuted in E Alps and N Dinaric Alps (Borowiec 2004; Warchałowski 2003) and their occurrence in the Latvian fauna is impossible. Therefore these species are not mentioned in the current list.

Timarcha pratensis (Duftschmid, 1825) was deleted in the check-list of Latvian Coleoptera (Telnov et al. 1997; Telnov 2004). The species is generally distributed in N Italy and Croatia (Warchałowski 2003). Its occurrence in the Latvian fauna is impossible, therefore this species is not mentioned in the current list.

Analysis of the chorotypes of Latvian species of studied genera of subfamily Chrysomelinae reveals that the range of chorotypes is rather wide: Holarctic – six species [*Leptinotarsa decemlineata* (Say, 1824), *Gastrophysa polygoni* (Linnaeus, 1758), *G. viridula* (DeGeer, 1775), *Phaedon armoraciae* (Linnaeus, 1758), *Prasocuris phellandrii* (Linnaeus, 1758) and *Plagoidera versicolora* (Laicharting, 1781)], Asiatic-European – one species [*Phaedon cochleariae* (Fabricius, 1792)], Sibero-European – three species [*Hydrothassa marginella* (Linnaeus, 1758), *H. hannoveriana* (Fabricius, 1775) and *Linaeidea aenea* (Linnaeus, 1758)], West Palaearctic – two species [*Hydrothassa glabra* (Herbst, 1783) and *Prasocuris junci* (Brahm, 1790)], Centraleuropean – three species [*Colaphus sophiae* (Schaller, 1783), *Phaedon laevigatus* (Duftschmid, 1825) and *Timarcha goettingensis* (Linnaeus, 1758)].

LIST OF SPECIES OF THE LATVIAN FAUNA

CHRYSOMELIDAE
Chrysomelinae Latreille, 1802

Leptinotarsa Chevrolat, 1836
***L. decemlineata* (Say, 1824)**

References: Smarods, Liepa 1956; Ozols 1963; Šmits, Spuris 1966; Čudare 1969; Pavasars 1972; Pūtele 1974, 1982; Spuris 1974; Stiprais 1977; Stiprais, Varzinska 1985; Barševskis 1988, 1993, 2002; Telnov et al. 1997; Princovs 2000; Telnov 2004; Bukejs, Telnov 2007.

Examined material: 119 exx: Daugavpils d.: Bebrene, 07.X.2006 (2, leg. E.Rudāns); Butiški 12.VIII.2006 (6, agrocenosis, leg. A.Bukejs & M.Balalaikins); Daugavpils, 18.VIII.1996 (1, leg. A.Barševskis), 07.VI.2007 (1, leg. A.Barševskis), Daugavpils, Esplanāde, 03.VI.2007 (1, leg. K.Barševska); Červonka, 29.VI.2008 (1, leg. N.Mihailova); Demene, 01.VI.2000 (7, leg. R.Cibuļskis); Eglaine, 27.VI.2008 (1, leg. T.Vasiljeva); Ilgas, Silene Nature Park, 29.IV-10.VII.2000 (1, leg. A.Rutka); Līksna, VIII.1993 (1, leg. R.Cibuļskis), 17.IX.1994 (1, leg. R.Cibuļskis), 03.VI.2000 (1, leg. R.Cibuļskis); Lociki, 31.VII.2008 (3, leg. A.Barševskis); Šarlote, 01.VI.2008 (1, leg. K.Aksjuta); Šedere, Straumēni house, 23-24.VI.2007 (1, leg. M.Murd), 01-02.IX.2007 (3, leg. M.Murd); Subate, 11.VIII.2000 (1, leg. I.Leiskina); Vecpils, 21.VIII.2006 (3, agrocenosis, leg. A.Bukejs); Vecstropi, 15.VII.2007 (6, agrocenosis of potato field, leg. A.Bukejs); Višķi, 10.VI.1986 (1, leg. A.Barševskis); Jēkabpils d.: Dignāja, 27.VII.2001 (1, leg. I.Leiskina); Dunava, 20.IX.1992 (2, leg. A.Barševskis), 24.VIII.1995 (1, leg. A.Barševskis), 11.VIII.2002 (1, leg. A.Barševskis), 10-18.VI.2006 (1, leg. K.Barševskis), 18-22.VI.2006 (10, leg. K.Barševska), 25.VI.2006 (2, leg. K.Barševska), 02-05.VI.2007 (5, leg. K.Barševska), 10-19.VI.2007 (3, leg. K.Barševska), 15.VII.2007 (1, leg. A.Barševskis), 01-08.VIII.2007 (1, leg. K.Barševska), 20-30.VIII.2007 (1, leg. K.Barševska), 30.IX.2007 (3, leg. A.Barševskis), VIII.2008 (1, leg. K.Barševska), 01-14.VIII.2008 (1, leg. K.Barševska), 16.VIII.2008 (4, leg. A.Barševskis); Rubeņi, VIII.1995 (1, leg. I.Leiskina); Jūrmala: Kauguri, 20.VIII.1995 (5, seashore, dunes, leg. A.Barševskis); Krāslava d.: Šķeltova, 20.VIII.1986 (4, leg. A.Barševskis), 02.V.1987 (1, leg. A.Barševskis), VIII.1991 (1, leg. A.Barševskis), 26.VIII.1992 (2, leg. A.Barševskis), 16.VII.1993 (9, leg. A.Barševskis), 03.IX.1995 (1, leg. A.Barševskis), 14.VIII.2006 (1, leg. A.Barševskis), 28.VI.2008 (2, leg. A.Barševskis); Liepāja d.: Liepāja, 11-13.VII.2006 (1, seashore, leg. A.Barševskis); Limbaži d.: Dunte, 16.VIII.2008 (1, leg. A.Barševskis); Salacgrīva, 27.VII.2007 (1, near the sea, leg. A.Barševskis), 17.VIII.2008 (1, Veczemu rock, leg. A.Barševskis); Preiļi d.: Jersika, Kurpnieki house, 23-24.VI.2006 (1, leg. A.Barševskis, K.Barševska), 05.IX.2007 (1, leg. K.Barševska, A.Barševskis); Pelēči, 09.VII.1997 (1, leg. I.Jurkjāne); Rušona, Aglona train station, 16-18.VIII.2007 (1, leg. J.Staskeviča); Tukums d.: Tukums, IX.2007 (1, leg. A.Barševskis); Talsi d.: Mazirbe, 26.VI.2006 (1, Baltic Sea dunes, leg. A.Barševskis, U.Valainis, A.Pankjāns).

Host plants: Solanaceae (*Solanum tuberosum, S.dulcamara, S.lycopersicum, Atropa belladonna, Hyoscyanus niger*). Pest of potatoes.
Phenology: IV, V, VI, VII, VIII, IX, X
General distribution: Introduced from N America, distributed in almost whole Europe, Caucasus. [OLA]
Note: Very common and widely distributed pested species in Latvia.

***Colaphus* Dahl, 1823**
syn.: *Colaphellus* Weise, 1916
***C. sophiae* (Schaller, 1783)**
syn.: *erythropus* (Gmelin, 1790)
References: Ulanowski 1883 (*Colaspidema sophiae* Schall.); Müthel 1889; Seidlitz 1887-1891; Rathlef 1905; Pūtele 1974, 1980, 1981a (*Colaphellus*); Telnov et al. 1997; Telnov 2004.
Examined material: 2 exx: Daugavpils d.: Ilgas, Silene Nature Park, 06.VII.2001 (1, leg. G.Lociks); Jēkabpils d.: Dunava, 16-21.VI.2007 (1, leg. K.Barševska).
Host plants: *Brassica, Sinapis, Raphanus, Sisymbrium*.
Phenology: V, VI, VII
General distribution: Ń and SE Europe, Turkey, Armenia. [CEU]
Note: Very rare species in Latvia; known from four actual localities. According to the catalogue of Silfverberg (2004), it is mentioned for Denmark, Latvia and Lithuania. North border of main distribution area.

***Gastrophysa* Chevrolat, 1836**
syn.: *Gastroidea* Hope, 1840
***G. polygoni* (Linnaeus, 1758)**
syn.: *elongata* Jolivet, 1951
References: Precht 1818 (*Chrysomela*); Seidlitz 1872-1875, 1887-1891; Ulanowski 1883 (*Gastroidea*); Heyden 1903; Rathlef 1905 (*Gastroidea*); Brammanis 1930 (*Gastroidea*); Priedītis 1958 (*Gastroidea*); Pūtele 1974, 1980, 1981, 1981a, 1982 (*Gastroidea*); Cinītis 1975 (*Gastroidea*); Stiprais 1977 (*Gastroidea*); Barševskis 1988, 1993, 2002; Telnov et al. 1997; Telnov 2004; Petrova et al. 2006; Bukejs, Telnov 2007.
Examined material: 133 exx: Aizkraukle d.: 6 km N Aizkraukle, Aizkraukles purvs (bog) PNT, 01.VII.2008 (1, leg. A.Bukejs); Cēsis d.: Bērzkrogs, 03.VII.2006 (6, leg. A.Barševskis); Cēsis, 21.V.1995 (1, leg. R.Cibuļskis); Daugavpils d.: Bebrene, 14.V.2006 (1, leg. E.Rudāns); Butiški, 21.VIII.2006 (1, valley of the Daugava River, dry meadow, leg. A.Bukejs & M.Balalaikins); Daugavpils, Esplanāde, 07.VI.2007 (1, leg. A.Barševskis), 03.VII.2007 (2, leg. K.Barševska, A.Barševskis), 08.VIII.2007 (1, leg. K.Aksjuta, M.Murd), 05.V.2008 (4, leg. K.Barševska, A.Barševskis), Daugavpils, Mežciems, 19.VII.2007 (17, leg. K.Aksjuta, M.Murd), 01.VIII.2007 (12, leg. K.Aksjuta, M.Murd); Demene, 17.V.1994 (1, leg. A.Barševskis); Elerne, 24.V.2007 (1, leg. U.Valanis); Ilgas, Silene Nature Park, 06.VI.1994 (1, leg. A.Barševskis), 08.VI.1994 (1, leg. A.Barševskis), 09.V.1996 (3, leg. A.Barševskis), 25.V.1997 (1, leg. A.Barševskis), 29.IV-10.VII.2000 (1, leg. L.Bogdāne), 28-30.VI.2004 (1, leg. A.Barševskis); Līksna, 27.V.1995 (1, leg. R.Cibuļskis); Līksna parish, 2 km N Daugavpils, 04.V.2008 (1, inland dunes, edge of pine forest, leg. A.Bukejs); Līksna parish, Mežciems env., 15.VI.2006 (1, leg. A.Barševskis); Naujene, 07.VII.1995 (1, leg. A.Barševskis); Stropi, 13.V.2006 (1, leg. A.Bukejs), 03.VI.2006 (1, leg. A.Bukejs), 27.VI.2006 (1, leg. A.Bukejs), 13.V.2007 (1, agrocenosis, leg. A.Bukejs), 20.V.2007 (1, agrocenosis, leg. A.Bukejs), 26.V.2007 (1, agrocenosis, leg. A.Bukejs), 28.V.2007 (1, meadow, leg. A.Bukejs), 29.V.2007 (1, agrocenosis, leg. A.Bukejs), 05.VI. 2007 (1, old clearing, leg. A.Bukejs), 08.VI.2008 (5, leg. A.Bukejs); Vabole, 27.V.1995 (1, leg. R.Cibuļskis), 24.VII.1995 (1, leg. R.Cibuļskis); Višķi, 27.V.1987 (1, leg. A.Barševskis), 03.VIII.1998 (3, leg. A.Barševskis); Jēkabpils d.: Dunava, 08.VIII.1994 (5, leg. A.Barševskis), 27.V.1995 (1, leg. A.Barševskis), 11-12.VIII.1998 (1, leg. A.Barševskis), 10-18.VI.2006 (1, leg. K.Barševska), 18-22.VI.2006 (1, leg. K.Barševska), 20-31.VII.2006 (1, leg. K.Barševska), 01-08.VIII.2006 (1, leg. A.Barševskis & K.Barševska), 03.VI.2007 (4, leg. A.Barševskis), 06-09.VI.2007 (1, leg. K.Barševska), 01-09.VIII.2007 (2, leg. K.Barševska), 09-10.VIII.2008 (2, leg. K.Barševska); Rubeņi, 15.VI.1997 (1, leg.

I.Leiskina), 27.IV.1999 (2, leg. I.Leiskina), 06.VII.1999 (1, leg. I.Leiskina), 17.VII.1999 (1, leg. I.Leiskina), 05.VIII.1999 (1, leg. I.Leiskina), 26.VII.2001 (1, leg. I.Leiskina), 23.VIII.2001 (2, leg. I.Leiskina); Zasa, 15.VIII.2000 (1, leg. I.Leiskina); Krāslava d.: Šķeltova, 18.V.1986 (4, leg. A.Barševskis), 28.VIII.1992 (1, leg. A.Barševskis); Ūdrīši, Zapoļniki house, 30.VIII-01.IX.2007 (2, leg. M.Murd); Liepāja d.: Pape, 23-25.VI.1994 (1, seashore, dunes, leg. N.Savenkovs); Ludza d.: Šuškova, 19.VII.1989 (1, leg. A.Barševskis); Madona d.: Ošupe env., 2.5 km NE Lake Lubāns, 56°50‘03“N 26°56‘05“E, 06.VII.2008 (2, wet meadow and bank of the Aiviekste River, leg. M.Balalaikins, A.Bukejs); Preiļi d.: Rušona, Aglona train station, 16.VII.2007 (3, leg. J.Staskeviča); Lake Bicānu, 24.VI.2002 (1, leg. A.Barševskis); Jersika, Kurpnieki house, 23-24.VI.2006 (1, leg. A.Barševskis, K.Barševska); Pelēči, 24.VII.1997 (1, leg. I.Jurkjāne), 18.VIII.1997 (1, leg. I.Jurkjāne); Rēzekne d.: Dricāni (1, leg. anonymous); Ventspils d.: Jūrkalne, 28.VII.2005 (2, leg. A.Barševskis, A.Bukejs, U.Valainis); Moricsala Isl., Moricsala Nature Reserve, VII.2007 (1, leg. A.Barševskis).

Host plants: Polygonaceae (mostly on *Polygonum aviculare*, *Persicaria*, rarely on *Rumex*).

Phenology: V, VI, VII, VIII, IX, X(1)

General distribution: Europe, Caucasus, Siberia, Altai, Tuva, Kazakhstan, Central Asia (excuding Turkmenia and Pamir), Far East of Russia, N America. [OLA]

Note: Common species in Latvia.

***G. viridula* (DeGeer, 1775)**

syn.: *raphani* (Herbst, 1783)

References: Fleischer 1829 (*Chrysomela raphani* F.); Seidlitz 1872-1875, 1887-1891; Ulanowski 1883 (*Gastroidea*); Rathlef 1905 (*Gastroidea*); Lindberg 1932 (*Gastroidea*); Pūtele 1974 (*Gastroidea*); Stiprais 1977 (*Gastroidea*); Barševskis 1988, 1993, 2002; Telnov et al. 1997; Telnov 2004; Bukejs, Telnov 2007.

Examined material: 318 exx: Daugavpils d.: 2 km SE Apses, Daugavpils env., 10.VI.2006 (4, bank of åšó Daugava River, on *Rumex*, leg. A.Bukejs); Butišķi, 06.VIII.2001 (3, leg. G.Lociks), 12.VIII.2006. (1, valley of the Daugava River, leg. A.Bukejs & M.Balalaikins), 27.V.2007 (2, valley of the Daugava River, leg. A.Bukejs), 02.VII.2007 (12, valley of the Daugava River, on *Rumex*, leg. A.Bukejs), 26.V.2008 (4, valley of the Daugava River, leg. A.Bukejs), 09.IX.2007 (3, valley of the Daugava River, leg. A.Bukejs, M.Balalaikins); Daugavpils, intown, 28.V.2006 (7, sandy bank of the Daugava River, on *Rumex*, leg. A.Bukejs, M.Balalaikins), 08.VII.2007 (4, leg. K.Aksjuta, M.Murd), Daugavpils, Esplanāde, 24.VI.2006 (4, leg. A.Barševskis), 13.V.2007 (5, leg. K.Barševska, A.Barševskis), 03.VII.2007 (4, leg. K.Barševska, A.Barševskis), 05.V.2008 (2, leg. K.Barševska, A.Barševskis), Daugavpils, Mežciems, 19.VII.2007 (8, leg. K.Aksjuta, M.Murd); Dviete, 22.VIII.2006 (4, leg. A.Barševskis); Elerne, Muravki house, 26.VI.2005 (4, leg. A.Barševskis, K.Barševska), 24.V.2007 (3, leg. A.Pankjāns), 24.V.2007 (6, leg. U.Valainis), 31.V.2007 (6, leg. M.Murd), 13.IX.2007 (1, leg. A.Barševskis, K.Barševska); Ilgas, Silene Nature Park, 29.IV-10.VII.2000 (2, leg. L.Bogdāne), 29.IV-10.VII.2000 (1, leg. A.Rutka), 15.IV.2003 (1, leg. U.Valainis); Ilūkste, 17.IV.1993 (1, leg. A.Barševskis), 13.V.2007 (1, leg. A.Pankjāns); Kalkūni, 04.VI.1997 (1, leg. I.Leiskina); Krauja, 26.III-10.IV.2002 (1, leg. A.Barševskis); Kurcums, Lake Kurcums env., 06.VI.2008 (3, leg. A.Barševskis); Līksna, 14.VI.1994 (1, leg. R.Cibuļskis), 26.V.1995 (4, leg. R.Cibuļskis); Līksna parish, 2 km N Daugavpils, 17.V.2008 (1, inland dunes, edge of pine forest, leg. A.Bukejs); Lociki, 26.V.2001 (1, leg. G.Lociks), 06.VIII.2001 (1, leg. G.Lociks), 08.VIII.2001 (2, leg. G.Lociks); Ļūbaste env., near Daugavpis beltway, 17.V.2007 (1, leg. A.Barševskis, K.Barševska); Naujene, 20.VI.1996 (1, Juzefova park, leg. R.Cibuļskis), 27.IV.2007 (14, Juzefova park, leg. K.Aksjuta, M.Murd), 29.IV.2008 (22, valley of the Daugava River, leg. A.Pankjāns, U.Valainis); Pilskalne, Pilskalnes Siguldiņa Nature Park, 09.V.2005 (1, leg. A.Barševskis); Saliena parish, Daugavsargu precipice, Daugavas Loki Nature Park, 17.V.2007 (2, leg. A.Pankjāns); Šedere, Straumēni house, 01-03.V.2008 (2, leg. M.Janovska); Slutišķi, 29.IV.2008 (1, bank of the Daugava River, leg. A.Pankjāns, U.Valainis); Stropi, 26-27.V.2006 (2, leg. A.Bukejs), 21.V.2007 (1, agrocenosis, leg. A.Bukejs), 20.VII.2007 (1, agrocenosis, on *Rumex*, leg. A.Bukejs), 27.IV.2008

(1, bank of Lake Lielais Stropu, leg. A.Bukejs); Tabore, Knupišķi house, 02.VII.2007 (1, bank of the Daugava River, leg. A.Pankjāns); Vabole, 1993 (1, leg. M.Jukšs), 08.V.1994 (1, leg. R.Cibuļskis), 28.V.1994 (1, leg. R.Cibuļskis), 10.VII.1994 (1, leg. R.Cibuļskis); Vasarģelišķi, Daugavas Loki Nature Park, 26.VI.2001 (1, leg. G.Lociks), 29.IV.2008 (6, Bondaru glen, leg. A.Pankjāns, U.Valainis); Vecsaliena parish, Orehovka env., Ververu precipice, Daugavas Loki Nature Park, 18.V.2008 (2, leg. G.Jurševska, P.Evarts-Bunders); Zaļumi, 31.VII.2001 (1, leg. G.Lociks); Jēkabpils d.: Dignāja, 01.VIII.2005 (3, leg. A.Barševskis); Dunava, 21.VII.1993 (1, leg. A.Barševskis), 12.IX.1993 (1, leg. A.Barševskis), 17.VII.1995 (1, leg. A.Barševskis), 01.VI.2002 (2, leg. A.Barševskis), 01.V.2006 (1, leg. A.Barševskis), 10-18.VI.2006 (5, leg. K.Barševska), 18-22.VI.2006 (2, leg. K.Barševskis), 25-29.VI.2006 (2, leg. K.Barševska), 01-08.VII.2006 (1, leg. A.Barševskis), 15.VII.2006 (1, leg. A.Barševskis), 29.IV.2007 (1, leg. K.Barševska, A.Barševskis), 13.V.2007 (3, leg. K.Barševska, A.Barševskis), 02-05.VI.2007 (2, leg. K.Barševska), 03.VI.2007 (3, leg. A.Barševskis), 10-19.VI.2007 (1, leg. K.Barševska), 11-17.VII.2007 (1, leg. K.Barševska), 18.V.2008 (1, leg. A.Barševskis), 01.VI.2008 (2, leg. A.Barševskis), 04-20.VI.2008 (2, leg. K.Barševska), 22.VI.2008 (1, leg. A.Barševskis), 25-30.VI.2008 (3, leg. K.Barševska), 02.VII.2008 (1, leg. A.Barševskis), 23.VII.2008 (1, leg. A.Barševskis); Jēkabpils, Krustpils, 02.VII.2001 (1, leg. I.Leiskina), Jekabpils, near Nereta road, 08.VIII.2008 (3, leg. A.Barševskis); Rubeņi, 14.VII.1997 (1, leg. I.Leiskina), 26.VIII.1997 (1, leg. I.Leiskina), 16.VII.1998 (1, leg. I.Leiskina), 21.V.1999 (1, leg. I.Leiskina), 06.V.2000 (1, leg. I.Leiskina); Sudrabkalns vill., 11.VIII.2007 (1, bank of the Daugava River, leg. A.Bukejs); Vandāni, 16.VIII.2008 (4, bank of the Daugava River, leg. M.Balalaikins); Krāslava d.: Kaplava, 10.VII.1991 (1, leg. A.Barševskis); Piedruja, V.1993 (4, leg. A.Barševskis); Šķeltova, 09.V.1993 (1, leg. A.Barševskis); 2.3 km SSW Tartaks, Misjūni, 55°52‘814“N 26°56‘278“E, 09.V.2008 (3, valley of the Daugava River, leg. R.Cibuļskis); Ūdrīši, Zapoļņiķi house, 26-27.IV.2008 (1, leg. M.Janovska); Velnezers Nature Reserve, 11.VII.2008 (1, leg. A.Barševskis, V.Alekseev); Ludza d.: Mežvidi, 20.V.2008 (1, leg. M.Balalaikins); Madona d.: Jumurda, 19.VII.2008 (1, bank of Lake Lācīšu, leg. A.Bukejs); Madona d.: Ošupe env., 2.5 km NE Lake Lubāns, 56°50‘03“N 26°56‘05“E, 06.VII.2008 (2, wet meadow and bank of the Aiviekste River, leg. M.Balalaikins, A.Bukejs); Preiļi d.: Jersika, 16.IV.1993 (1, leg. A.Barševskis), 24.VI.2005 (4, leg. A.Barševskis), 04.V.2006 (1, leg. K.Barševska), 20.V.2006 (1, leg. K.Barševska), 26-28.V.2006 (9, leg. K.Barševskis), 04.VI.2006 (6, leg. K.Barševska), 06-07.VI.2006 (25, leg. A.Barševskis, K.Barševska), 23-24.VI.2006 (1, leg. A.Barševskis, K.Barševskis), 15.VII.2006 (2, leg. K.Barševska), 12.V.2007 (2, leg. A.Barševskis), 20.V.2007 (14, leg. A.Barševskis), 09-10.VI.2007 (1, leg. K.Barševska, A.Barševskis), 22-25.VI.2007 (1, leg. A.Barševskis), 04-05.VIII.2007 (1, leg. A.Barševskis), 02.V.2008 (2, leg. A.Barševskis), 13.VI.2008 (1, leg. A.Barševskis), 17.VI.2008 (2, leg. A.Barševskis).

Host plants: Polygonaceae (mostly on *Rumex,* rarely on *Rheum, Polygonum*).

Phenology: IV, V, VI, VII, VIII, IX, X

General distribution: Europe, Caucasus, Asia Minor, W and C Siberia, Altai, Kazakhstan; reported also from East Siberia, Korean Peninsula and N Anerica (USA). Other subspecies occurs in Far East of Russia and Mongolia. [OAL]

Note: Very common and widely distributed species in Latvia.

***Phaedon* Dahl, 1823**

syn.: *Emmetrus* Motschulsky, 1860

***Ph. laevigatus* (Duftschmid, 1825)**

syn.: *grammicus* (Duftschmid, 1825); *sabulicola* Suffrian, 1851

References: Seidlitz 1887-1891; Rathlef 1905; Pūtele 1974; Barševskis 1993, 2002; Telnov et al. 1997; Telnov 2004; Bukejs, Telnov 2007 (misidentification).

Examined material: 2 exx: Balvi d.: Kuprava, 19.V.1991 (2, leg. A.Barševskis).

Earlier report of this species “Daugavpils d.: Lociki” (Bukejs, Telnov 2007) was based on misidentification.

Host plants: Labiatae (mostly on *Galeopsis*).

Phenology: V

General distribution: C, S and SE Europe, Caucasus. [CEU]
Note: Very rare species in Latvia; known from few localities. According to the catalogue of Silfverberg (2004), it is mentioned for Estonia, Latvia and Lithuania. This species is also known from Belarus (Lopatin & Nesterova 2005).

***Ph. cochleariae* (Fabricius, 1792)**
syn.: *egenus* (Gyllenhal, 1827); *galeopsis* Letzner, 1849; *grammicus* Suffrian, 1851; *omissus* Sahlberg, 1838; *regnianum* Tottenham, 1941
References: Precht 1818 (*Chrysomela cochleariae*); Fleischer 1829 (*Chrysomela*); Seidlitz 1872-1875, 1887-1891; Rathlef 1905; Tomsons 1940; Danka 1950; Smarods, Liepa 1956; Trauberga 1957; Priedītis 1958; Ozols 1948, 1963; Pūtele 1974, 1980, 1981, 1981a, 1982; Cinītis 1975; Stiprais 1977; Barševskis 1993, 2002; Telnov et al. 1997; Telnov 2004; Bukejs, Telnov 2007.
Examined material: 79 exx: Balvi d.: Kuprava, 10.VII.1991 (1, leg. A.Barševskis); Daugavpils d.: Butiški, 06.VIII.2001 (4, leg. G.Lociks); Daugavpils, 14.IV.1991 (1, leg. A.Barševskis), 02.V.1993 (1, city centr, bank of the Daugava River, leg. A.Barševskis), 08.VIII.2007 (2, city centr, leg. K.Aksjuta, M.Murd); Līksna parish, Mežciems env., 24.VI.1991 (1, leg. A.Barševskis); Elerne, Muravki house, 29.XII.2006 (2, leg. A.Barševskis, K.Barševska); Ilgas, Silene Nature Park, 30.VI.1989 (1, leg. A.Barševskis), 01.VII.1989 (2, leg. A.Barševskis), 29.IV-10.VII.2000 (1, leg. A.Rutka), 06-15.VI.2004 (1, leg. A.Barševskis), 01-03.VII.2008 (1, leg. N.Mihailova); Naujene, 13.VI.1989 (1, leg. A.Barševskis), 29.IV.2008 (1, valley of the Daugava River, leg. U.Valainis, A.Pamkjāns); Vabole, 05.IV.1994 (1, leg. R.Cibuļskis); Višķi, 02.V.1988 (1, leg. A.Barševskis), 22.V.1988 (1, leg. A.Barševskis), 11.VI.1989 (1, leg. A.Barševskis); Jēkabpils d.: Dunava, 06.XII.1992 (5, leg. A.Barševskis), I.1993 (2, leg. A.Barševskis), 11.IV.1993 (2, leg. A.Barševskis), 06.IV.1996 (1, forest, leg. A.Barševskis), 10-18.VI.2006 (2, leg. K.Barševska); Rubeņi, 06.VI.1999 (1, leg. I.Leiskina), 12.VI.1999 (2, leg. I.Leiskina), 25.VI.1999 (1, leg. I.Leiskina), 01.VII.1999 (4, leg. I.Leiskina), 20.VII.1999 (1, leg. I.Leiskina), 08.VII.2001 (1, leg. I.Leiskina); Krāslava d.: Indrica, 12.VI.1989 (1, leg. A.Barševskis), 29.V.1991 (2, leg. A.Barševskis); Izvalta, 18.I.1987 (1, leg. A.Barševskis), 18.IV.1987 (1, leg. A.Barševskis); Piedruja, VII.1988 (1, leg. A.Barševskis), 16.VI.1989 (2, leg. A.Barševskis), 28.V.1991 (1, leg. A.Barševskis); Škeltova, 04.II.1989 (1, leg. A.Barševskis), 19.VII.1989 (2, leg. A.Barševskis), 29.VII.1989 (1, leg. A.Barševskis), 08.IV.1991 (1, leg. A.Barševskis), 09.V.1993 (1, leg. A.Barševskis); Ludza d.: Šuškova, 19.III.1989 (1, leg. A.Barševskis); Zaļesje, 19.VII.1989 (1, leg. A.Barševskis); Preiļi d.: Jersika, 1992 (4, leg. A.Barševskis), 24.VI.2005 (1, leg. A.Barševskis), 04.VI.2006 (1, leg. A.Barševskis), 23-24.VI.2006 (1, leg. A.Barševskis, K.Barševska); Talsi d.: Ances mežs un purvi (forest and bog) PNT, 27.VI.2006 (1, leg. U.Valainis); Sabile, 56°55‘27“N 22°31‘37“E, 19.VII.2007 (1, leg. A.Pankjāns, A.Soldāns, U.Valainis, A.Barševskis).
Host plants: Cruciferae. Pest of radish, cabbage, rutabaga etc.
Phenology: IV, V, VI, VII, VIII, IX
General distribution: Europe, Asia Minor, Caucasus, Siberia, Kazakhstan, Central Asia, Far East of Russia, China, Korean Peninsula; introduced also to N America. [ASE]
Note: Very common species in Latvia.

***Ph. armoraciae* (Linnaeus, 1758)**
syn.: *betulae* Küster, 1846
References: Fischer 1784, 1791 (*Chrysomela*); Seidlitz 1872-1875, 1887-1891; Rathlef 1905; Trauberga 1957; Stiprais 1977; Barševskis 1993, 2002; Telnov et al. 1997; Telnov 2004.
Examined material: 9 exx: Daugavpils d.: Silene Nature Park, Ilgas, 09.V.1996 (1, leg. A.Barševskis); Jēkabpils d.: Dunava, 06.XII.1992 (1, leg. A.Barševskis), 23.VI.1993 (1, leg. A.Barševskis); Rubeņi, 22.VI.1997 (1, leg. I.Leiskina), 30.VIII.1998 (1, leg. I.Leiskina), 08.VIII.2001 (2, leg. I.Leiskina); Krāslava d.: Skaiste, 12.XI.2006 (1, leg. S.Ungurs); Škeltova, 25.VI.1989 (1, leg. A.Barševskis).
Host plants: Cruciferae, Ranunculaceae, Polygonaceae, Scrophulariaceae (*Veronica*).
Phenology: V, VI, VII, VIII
General distribution: Europe, Asia Minor, Caucasus, Siberia, Kazakhstan (mts.), Central

Asia (mts.), Mongolia, Far East of Russia, N America (Canada, USA). [OLA]
Note: Rather infrequent species in Latvia.

***Hydrothassa* Thomson, 1866**
***subgenus Agrostithassa* Jacobson, 1921**
***H. glabra* (Herbst, 1783)**
syn.: *aucta* Fabricius, 1787; *egena* Suffrian, 1851 non Gyllenhal, 1827
References: Fleischer 1829 (*Chrysomela aucta* F.); Seidlitz 1872-1875 (*aucta* F.), 1887-1891 (*Prasocuris*); Rathlef 1905 (*aucta* F.); Stiprais 1977; Pūtele 1980, 1981a; Barševskis 1993; Telnov et al. 1997; Telnov 2004.
Examined material: 1 ex.: Daugavpils d.: Ilgas, Silene Nature Park, 06.VI.1994 (1, leg. A.Barševskis).
Host plants: *Ranunculus* (Ranunculaceae).
Phenology: V, VI
General distribution: Europe, N-W Africa (Morocco), W Siberia. [WPA]
Note: Very rare species in Latvia; known from three localities.

subgenus *Hydrothassa* s.str.
***H. marginella* (Linnaeus, 1758)**
References: Precht 1818 (*Chrysomela*); Seidlitz 1872-1875, 1887-1891 (*Prasocuris*); Rathlef 1905; Trauberga 1957; Pūtele 1974; Stiprais 1977; Barševskis 1988, 1993, 2002; Telnov et al. 1997; Telnov 2004.
Examined material: 41 exx: Balvi d.: Kuprava, 19.V.1991 (1, leg. A.Barševskis); Daugavpils d.: Bebrene, 05.V.2006 (1, leg. E.Rudāns), 07.V.2006 (1, leg. E.Rudāns), 18.VI.2006 (2, leg. Rudāns), 24.VI.2006 (1, leg. E.Rudāns); Ilgas, Silene Nature Park, 09.V.1995 (1, leg. A.Barševskis), 11.V.1996 (1, leg. R.Cibuļskis); Ilūkste, 13.V.2007 (1, leg. A.Pankjāns); 2.8 km S Naujene, 55°54‘710“N 29°43‘51“E, 09.V.2008 (1, leg. R.Cibuļskis); Pilskalne, Pilskalnes Nature Park, 16.V.1991 (1, leg. J.Soms), 09.V.2005 (2, leg. A.Barševskis); Stropi, 05.V.2008 (1, leg. A.Bukejs); Vabole, 12.III.1994 (1, leg. R.Cibuļskis), 22.II.1997 (2, leg. R.Cibuļskis); Višķi, 29.II.1987 (1, leg. A.Barševskis), 01.III.1987 (1, leg. A.Barševskis), 08.III.1987 (6, leg. A.Barševskis), 22.III.1987 (1, leg. A.Barševskis), 18.I.1993 (1, leg. A.Barševskis); Jēkabpils d.: Rubeņi, 29.V.1997 (1, leg. I.Leiskina), 21.IV.2000 (1, leg. I.Leiskina); Zasa, 30.X.1998 (1, leg. I.Leiskina); Krāslava d.: Izvalta, Murāni house, 21.VIII.1992 (1, bog, leg. A.Barševskis); Šķeltova, 13.III.1993 (2, leg. A.Barševskis), 09.V.1993 (1, leg. A.Barševskis), 26.IX.2006 (1, leg. A.Barševskis, K.Barševska); Preiļi d.: Jersika, Kurpnieki house, 1992 (1, leg. A.Barševskis), 10.III.1993 (1, leg. A.Barševskis), 20.V.1995 (1, wet meadow, leg. A.Barševskis), 23-24.VI.2006 (1, leg. A.Barševskis, K.Barševska), 25.V.2007 (1, leg. A.Barševskis); Rēzekne d.: Rēzekne, Nakotnes Str. 17/19, 18.V.2008 (1, leg. J.Burovs).
Host plants: Ranunculaceea (*Caltha, Ranunculus*).
Phenology: IV(3), V, VI, VII, VIII, IX
General distribution: Europe (excluding S), Siberia, Altai, Kazakhstan, Far East of Russia. [SIE]
Note: Rather infrequent species in Latvia.

***H. hannoveriana* (Fabricius, 1775)**
syn.: *ranunculi* (Herbst, 1783)
References: Fleischer 1829 (*Chrysomela*); Seidlitz 1887-1891 (*Prasocuris*); Rathlef 1905; Stiprais 1977; Telnov et al. 1997; Telnov 2004.
Examined material: Not confirmed by the author.
Host plants: Ranunculaceea (*Caltha palustris, Ranunculus*).
Phenology: V
General distribution: Europe (excluding S), Siberia, Far East of Russia. [SIE]
Note: Very rare species in Latvia; known only from single locality in C Latvia (Stiprais 1977).

***Prasocuris* Latreille, 1802**
syn.: *Hellodes* Redtenbacher, 1845
***P. junci* (Brahm, 1790)**
syn.: *beccabungae* (Illiger, 1794)
References: Seidlitz 1872-1875 (*beccabungae* Ill.), 1887-1891; Rathlef 1905; Barševskis 1993; Telnov et al. 1997; Leiskina 1999; Telnov 2001, 2004; Bukejs, Telnov 2007.
Examined material: 18 exx: Daugavpils d.: Lociki, 05.VIII.2001 (1, leg. G.Lociks); Jēkabpils d.: Dunava, 23.VI.1993 (14, leg. A.Barševskis); Rubeņi, 17.V.1997 (1, leg. I.Leiskina), 03.V.1998 (1, leg. I.Leiskina); Liepāja d.: Pape, 23-25.VI.1994 (1, seashore, dunes, leg. N.Savenkovs).

Host plants: *Veronica*, *Sium*. In the literature (Bieńkowski 2004), *Cicuta* and *Oenanthe* are also mentioned as host plants.
Phenology: V, VI, VII, VIII
General distribution: Europe, N Africa, Caucasus, Asia Minor. [WPA]
Note: Rare species in Latvia.

***P. phellandrii* (Linnaeus, 1758)**
References: Precht 1818 (*Helodes*); Seidlitz 1872-1875, 1887-1891; Ulanowski 1883; Rathlef 1905; Spuris 1953; Trauberga 1957; Stiprais 1977; Barševskis 1988, 1993, 2002; Telnov et al. 1997; Telnov 2004.
Examined material: 21 exx: Daugavpils d.: Daugavpils, 29.III.1994 (1, leg. A.Barševskis); Ilgas, Silene Nature Park, 08.VI.1994 (1, leg. A.Barševskis), 15.V.1993 (1, leg. A.Barševskis), 25-30.V.1998 (1, leg. A.Barševskis); Līksna, 27.V.1995 (1, leg. R.Cibuļskis); Vabole, VIII.1993 (2, leg. R.Cibuļskis); Višķi, 1987 (1, leg. A.Barševskis), 27.V.1987 (2, leg. A.Barševskis); Jēkabpils d.: Dunava, 23.VI.1993 (1, leg. A.Barševskis), 25.VII.1993 (2, leg. A.Barševskis); Jūrmala: Ķemeri, 11.VII.1991 (1, leg. A.Barševskis); Krāslava d.: Peipiņi, 4 km W Šķeltova, 27.VIII.1989 (2, along Lake Aksenovas, leg. A.Barševskis); Liepāja d.: Pape, 06.VI.1996 (1, leg. N.Savenkovs); Madona d.: Mārciena, 07.VII.2006 (1, bank of the Arona River, leg. A.Pankjāns, A.Barševskis); Preiļi d.: Jersika, 22.V.2005 (1, leg. A.Barševskis); Rēzekne d.: Lukna, 25.IV.1993 (1, leg. A.Barševskis); Talsi d.: Slītere National Park, Davida pļavas (meadows), 26.VI.2002 (1, leg. A.Barševskis).
Host plants: Umbelliferae (*Sium, Cicuta, Oenanthe*).
Phenology: IV, V, VI, VII, VIII
General distribution: Europe, Asia Minor, Siberia, Kazakhstan, Mongolia, Far East of Russia, N America. [OLA]
Note: Rather infrequent species in Latvia.

***Plagiodera* Chevrolat, 1836**
syn.: *Plagiosterna* Motschulsky, 1860
***P. versicolora* (Laicharting, 1781)**
References: Seidlitz 1872-1875 , 1887-1891 (*Plagiodera armoraciae* L.); Ulanowski 1883; Rathlef 1905; Pūtele 1974, 1981, 1981a, 1982, 1984; Stiprais 1977; Barševskis 1993, 2002; Telnov et al. 1997; Telnov 2004; Bukejs, Telnov 2007.
Examined material: 130 exx: Aizkraukle d.: Valle, 12.VIII.2008 (1, leg. A.Barševskis); Balvi d.: Kuprava, 19.V.1991 (1, leg. A.Barševskis); Cēsis d.: Dzērbene, 03.VII.2006 (1, leg. A.Barševskis, U.Valainis, A.Pankjāns); Daugavpils d.: Daugavpils, Križi, 20.V.2001 (2, leg. G.Lociks), Daugavpils, Mežciems env., 01.VI.2008 (2, edge of forest, on *Salix*, leg. A.Bukejs); Ilgas, Silene Nature Park, 03.VII.1994 (1, leg. A.Barševskis), 30.VI.1995 (2, leg. A.Barševskis), 30.V.1996 (1, leg. A.Barševskis), 06.VI.1996 (2, leg. A.Barševskis), 18.VI.1996 (4, leg. A.Barševskis), 11.IX.1997 (1, leg. A.Barševskis), 29.IV-10.VII.2000 (2, leg. A.Rutka), VI-VII.2000 (6, leg. I.Haka & G.Hļebnaja), 15.VI.2001 (1, leg. G.Lociks), 06-15.VI.2004 (1, leg. A.Barševskis), 27-28.VI.2005 (1, leg. A.Barševskis), 30.VI.2005 (1, leg. A.Barševskis), 04.VII.2005 (1, leg. A.Barševskis), 08.VII.2005 (2, leg. A.Barševskis), 10.V.2006 (1, leg. A.Barševskis), 28-29.VI.2007 (1, leg. A.Barševskis), 17-20.VI.2008 (1, leg. V.Krone, J.Staskeviča); Lociki, 26.V.2001 (1, leg. G.Lociks); Stropi, 03.VI.2006 (1, leg. A.Bukejs), 09.VI.2006 (9, leg. A.Bukejs), 25.V.2007 (11, old clearing, leg. A.Bukejs), 02.VII.2008 (1, clearing, leg. A.Bukejs); Višķi, 25.V.1987 (8, leg. A.Barševskis); Jēkabpils d.: Dunava, 21.VII.1996 (1, leg. A.Barševskis), 28.VII.1997 (1, leg. I.Leiskina), 15.VII.2006 (6, leg. A.Barševskis); Jēkabpils, near Jēkabpils hospital, 13.V.2006 (4, leg. K.Barševska, A.Barševskis); Klaucānu & Priekulānu PNT, 29.VIII.2005 (1, leg. A.Barševskis); Rubeņi, 30.VII.1997 (1, leg. I.Leiskina); Viesīte, 08.VIII.2008 (1, clearing, leg. A.Barševskis); Gulbene d.: Gulbītis env., Lake Ušūrs, 11.VIII.2005 (2, leg. A.Barševskis); Krāslava d.: Grāveri, bank of Lake Čertoks, 04.V.2008 (1, leg. A.Barševskis); Kuldīga d.: Rudbārži, 09.VIII.2004 (2, leg. A.Barševskis); Madona d.: Krustkalnu Nature Reserve, 11.VIII.2005 (3, leg. A.Barševskis); Preiļi d.: Jersika, Kurpnieki house, 24.VI.2005 (11, leg. A.Barševskis), 23-24.VI.2006 (22, leg. A.Barševskis, K.Barševska); Līvāni, 30.V.2005 (1, leg. A.Barševskis); Rēzekne d.: Lake Zolvu env., 12.VI.2008 (1, leg. A.Barševskis, U.Valainis); Talsi d.: Slītere National Park, Zilie Kalni (hills), 11.VI.2005 (1, leg. A.Barševskis); Tukums d.:

Ķemeri National Park, 26.VI.2006 (1, leg. A.Pankjāns, A.Barševskis, U.Valainis); Valka d.: Strenči, 03.VII.2006 (3, leg. A.Barševskis, U.Valainis, A.Pankjāns).
Host plants: *Salix, Populus*.
Phenology: V, VI, VII, VIII, IX
General distribution: Europe, Siberia, Kazakhstan, Central Asia, Far East of Russia, Japan, N America. [OLA]
Note: Very common species in Latvia.

***Linaeidea* Motschulsky, 1860**
syn.: *Plagiosterna* Motschulsky, 1860; *Melasoma* Stephens, 1831 partim
***L. aenea* (Linnaeus, 1758)**
syn.: *coeruleoviolacea* (DeGeer, 1775)
References: Fischer 1784, 1791 (*Chrysomela*); Groschke 1805 (*Chrysomela*); Precht 1818 (*Chrysomela*); Seidlitz 1872-1875, 1887-1891 (*Lina aenea* L.); Ulanowski 1883 (*Melasoma*); Sintenis 1900 (*Lina aenea* L.); Rathlef 1905 (*Melasoma*); Brammanis 1940 (*Melasoma*); Danka 1950; Trauberga 1957 (*Melasoma*); Rupais 1959 (*Melasoma*); Šmits, Spuris 1966 (*Melasoma*); Spuris 1974 (*Melasoma*); Pūtele 1974, 1977, 1980, 1981, 1981a, 1984 (*Melasoma*); Stiprais 1977 (*Melasoma aenea* L.); Barševskis 1988, 1993 (*Chrysomela*), 2002; Telnov et al. 1997; Telnov 2004; Bukejs, Telnov 2007.
Examined material: 112 exx: Aizkraukle d.: 6 km N Aizkraukle, Aizkraukles purvs (bog) PNT, 01.VII.2008 (1, leg. A.Bukejs), 06.VIII.2008 (2, on *Alnus incana*, leg. A.Bukejs, M.Balalaikins); Balvi d.: Kuprava, 19.V.1991 (2, leg. A.Barševskis); Cēsis d.: Drabeši, 02.VII.1997 (1, leg. I.Leiskina); Daugavpils d.: Bebrene, 13.VI.2006 (1, leg. E.Rudāns); Daugavpils, Vienības Str., 27.XI.2008 (1, leg. D.Pilāte); Ilgas, Silene Nature Park, 13.VI.1985 (3, leg. A.Barševskis), 17.VI.1987 (1, leg. A.Barševskis), 02.III.1988 (1, leg. A.Barševskis), 1993 (1, leg. R.Cibuļskis), 18.VI.1993 (1, leg. A.Barševskis), 10.VII.1993 (1, leg. A.Barševskis), 05.VI.1994 (1, leg. A.Barševskis), 03.VII.1995 (1, leg. A.Barševskis), 11.V.1996 (2, leg. R.Cibuļskis), 30.V.1996 (6, leg. A.Barševskis), 18.VI.1996 (1, leg. A.Barševskis), 25-30.VI.1998 (1, leg. A.Barševskis), 10.VI.2001 (1, leg. G.Lociks), 18.V.2005 (8, leg. A.Barševskis), 30.VI.2005 (1, leg. A.Barševskis), 05-10.VI.2006 (2, leg. M.Verdenfelde), 17-20.VI.2008 (1, leg. V.Krone, J.Staskeviča); Šedere, Straumēni house, 09.XII.2007 (1, leg. M.Janovska), 01-03.V.2008 (1, leg. M.Janovska); Slutišķi, 12.VI.1987 (1, leg. A.Barševskis); Zaļumi, 31.VII.2001 (1, leg. G.Lociks), 03.VIII.2001 (1, leg. G.Lociks); Jēkabpils d.: Dignāja, 28.VII.1999 (1, leg. I.Leiskina); Klaucānu & Preikulānu PNT, 12.VIII.2005 (1, leg. A.Bukejs); Rubeņi, 17.VIII.1997 (1, leg. I.Leiskina), 02.VIII.1999 (1, leg. I.Leiskina); Zasa, 29.VII.1999 (1, leg. I.Leiskina), 19.VI.2000 (2, leg. I.Leiskina); Jūrmala: Kūdra, 05.VI.2006 (1, leg. A.Titovs); Kuldīga d.: Rudbārži, 09.VIII.2004 (2, leg. A.Barševskis); Liepāja d.: Durbe, 05.IX.2008 (1, leg. R.Orlovskis, A.Barševskis); Liepāja d.: Pape, 06.VI.1996 (1, leg. N.Savenkovs); Madona d.: Krustkalni Nature Reserve, 11.VIII.2005 (2, leg. A.Barševskis), 07.VII.2006 (1, leg. A.Pankjāns, A.Barševskis, E.Rudāns); Ogre d.: Ķegums, left bank of the Daugavpils River, 13.VII.2006 (3, leg. A.Barševskis, K.Barševska); Ogre d.: the Ņeģa River connection with the Daugava River, 29.VI.2006 (1, leg. A.Barševskis); Preiļi d.: Jersika, Kurpnieki house, 26-28.V.2006 (1, leg. K.Barševska); Rēzekne d.: Feimaņi, bank of Lake Rušons, 02.VI.2007 (1, leg. A.Barševskis); Talsi d.: Ances meži un purvi (forests and bogs) PNT, 27.VI.2006 (4, leg. A.Barševskis); Mazirbe, 05.VI.2002 (1, leg. A.Barševskis), 26.VI.2006 (2, Baltic Sea dunes, seashore, leg. A.Barševskis, U.Valainis, A.Pankjāns); Slītere, 03.VII.1997 (1, leg. R.Cibuļskis), VI.2002 (1, leg. A.Barševskis); Slītere National Park, Zilie Kalni (hills) and Davida Pļavas (meadows), VII.2003 (5, leg. A.Barševskis), 11.VI.2005 (11, leg. A.Barševskis), 22.VIII.2008 (9, leg. A.Barševskis); Valka d.: Launakalne parish, Mežole, 15.VII.2005 (1, leg. J.Donis), 10.VI.2006 (1, leg. J.Donis); Ventspils d.: Moricsala Isl., Moricsala Nature Reserve, 03.IX.2004 (1, leg. U.Valainis), 29.V.2006 (1, leg. A.Barševskis), 29.V.2006 (3, leg. E.Rudāns), 29.VI.2006 (1, window trap, leg. A.Barševskis), 15.VII.2008 (1, leg. A.Barševskis), 15.VII.2008 (1, leg. V.Alekseev, A.Pavlova); Muižnieki, 57°28‘20“N 21°43‘19“E, 29.VII.2005 (1, leg. A.Barševskis, A.Bukejs, U.Valainis).
Host plants: *Alnus* (especially on *A. incana*).
Phenology: V, VI, VII, VIII, IX(1)

General distribution: Europe, Siberia, E Kazakhstan, Mongolia, Far East of Russia, Japan. [SIE]
Note: Very common species in Latvia.

***Entomoscelis* Chevrolat, 1836**
(-) *E. adonidis* (Pallas, 1771)
syn.: *trilineata* (Fabricius, 1777); *dorsalis* Fabricius, 1777
References: Precht 1818 (*Chrysomela*); Seidlitz 1872-1875, 1887-1891; Rathlef 1905; Trauberga 1957; Telnov et al. 1997; Telnov 2004.
Examined material: Not confirmed by the author.
Host plants: Cruciferae, Ranunculaceae.
General distribution: S and E Europe, Caucasus, Asia Minor (Syria), Siberia, Afghanistan, N Iran, Kazakhstan, Central Asia, Mongolia, Far East of Russia, N China. [ASE]
Note: The species is mentioned only in old bibliographical source (Precht 1818; Seidlitz 1872-1875, 1887-1891). Actual faunal data on this species in Latvia is absent. Therefore it is deleted from the list of Latvian Coleoptera. According to the catalogue of Silfverberg (2004), the species is mentioned for Latvia, Lithuania and Karelia (as introduced species). In Belarus it is not known (Lopatin, Nesterova 2005). The nearest known localities of this species are in S Lithuania (V. Tamutis pers. comm.), S Poland and Ukraine (A. Warchałowski pers. comm.).

***Timarcha* Latreille, 1829**
subgenus *Timarcha* s.str.
(-) *T. tenebricosa* (Fabricius, 1775)
References: Precht 1818 (*Chrysomela*); Telnov et al. 1997; Telnov 2004.
Examined material: Not confirmed by the author.
Host plants: In the literature (Bieńkowski 2004), *Galium, Rubia* and *Asperula* are mentioned as host plants.
General distribution: England, W and S Europe (from N Spain to Bulgaria), Crimea, Asia Minor, Caucasus. [CEU]
Note: The species is mentioned only in old bibliographical source (Precht 1818) and in the published catalogues of Latvian Coleoptera (Telnov et al. 1997; Telnov 2004). Faunal data on this species in Latvia is absent. The nearest known localities of this species are in Romania and Crimea. Its occurrence in Latvian fauna is impossible. Therefore this species is deleted from the list of Latvian Coleoptera.

subgenus *Timarchostoma* Motschulsky, 1860
***T. goettingensis* (Linnaeus, 1758)**
syn.: *violaceonigra* **Degeer, 1775;** *coriaria* **Laicharting, 1781 nec Oliver, 1807**
References: Precht 1818 (*Chrysomela coriaria*); Seidlitz 1872-1875 (*Timarcha coriaria* F.), 1887-1891 (*Timarcha coriaria* Laich.); Heyden 1903; Rathlef 1905 (*violaceonigra* DeGeer); Telnov et al. 1997; Telnov 2004.
Examined material: Not confirmed by the author.
Host plants: In the literature (Bieńkowski 2004), *Galium* and *Asperula* are mentioned as host plants.
Phenology: no data.
General distribution: S, W and C Europe (northward to SW Poland and Romania). [CEU]
Note: In Latvia this species is not recorded more than 100 years. Heyden (1903) mentioned this species from SE environs of Rīga, ca. 50 verst upstream the Daugava [Düna] rivers. Record needs confirmation. According to the catalogue of Silfverberg (2004), the species is mentioned for Latvia and Lithuania. In Lithuania, the species is known from single old record in Palanga (NW Lithuania) (V. Tamutis pers. comm.). It is also known from Belarus (Lopatin & Nesterova 2005).

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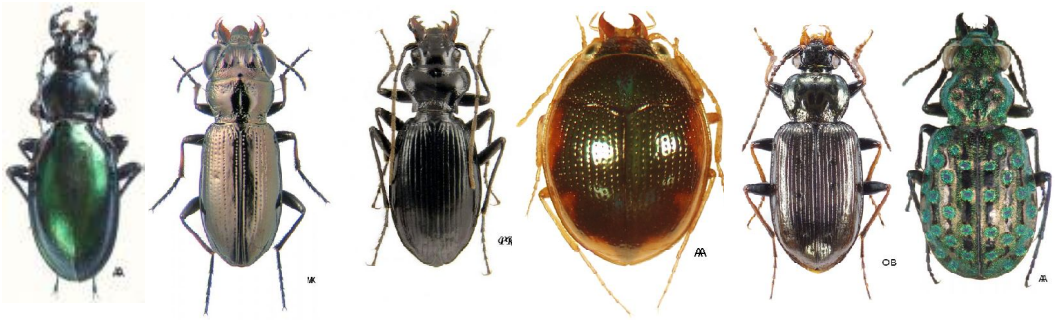

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REVIEW OF LEAF-BEETLES SUBFAMILY GALERUCINAE (COLEOPTERA: CHRYSOMELIDAE) OF THE LATVIAN FAUNA

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Bukejs A. 2009. Review of leaf-beetles subfamily Galerucinae (Coleoptera: Chrysomelidae) of the Latvian fauna. *Acta Biol. Univ. Daugavp., 9 (2): 197 - 220.*

New faunal data on 19 species of the subfamily Galerucinae Latreille, 1802 are presented. In total 1796 specimens were reviewed. The bibliographical information on this leaf-beetles subfamily in Latvia are summarized for the first time. Two species, *Galeruca dahlii* (Joannis, 1866) and *Luperus luperus* (Sulzer, 1776), are deleted from the list of Latvian Coleoptera. An annotated list of Latvian Galerucinae is given, including 21 species and 10 genera.

Key words: Coleoptera, Chrysomelidae, Galerucinae, Latvia, fauna, bibliography.

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INTRODUCTION

The subfamily Galerucinae Latreille, 1802 comprises six tribes and approximately 5800 species (Wilcox 1971-1975) distributed throughout the world but predominantly in the tropics. Of them, 43 species and 14 genera are reported for eastern Europe (Bieńkowski 2004) and 28 species and 11 genera are known in northern Europe (Silfverberg 2004).

Hitherto, in the second edition of check-list of Latvian beetles (Telnov 2004) were reported 23 species and 10 genera of subfamily Galerucinae Latreille, 1802. In adjacent areas the number of recorded species of this subfamily slightly varies: in Belarus – 27 species and 11 genera (Lopatin, Nesterova 2005), in Estonia – 18 species and 8 genera, in Lithuania – 23 species and 10 genera (Silfverberg 2004), in St.-Petersburg and Leningrad region (western Russia) – 22 species and 8 genera (Romantsov 2007).

The first information on species of Galerucinae in Latvia was published at the end of the 18th century in a monograph on natural history of Livland (Fischer 1784, 1791). Subsequently, more than 50 other works were published where fragmentary information on this subfamily can be found.

Latvian Galerucinae have been irregularly investigated until now. In 1993, A. Barševskis published his monograph "The Beetles of Eastern Latvia" containing data on 16 species of this subfamily, mostly from eastern and southeastern parts of the country. Scarce faunistical data can be found in the following other articles (Mikutowicz 1905; Lackschewitz 1927, 1942; Brammanis 1930; Lackschewitz, Mikutowicz 1939; Pūtele 1974, 1981a; Stiprais 1977; Rūtenberga 1992; Barševskis 1993, 2001; Telnov *et al*. 2006; Bukejs, Telnov 2007). Some papers are dedicated to study of biology and ecology of selected leaf-beetles species: Ozols

1929 [*Galerucella tenella* (L.)], Rupais 1962 [*Pyrrhalta viburni* (Pk.)], Pūtele 1976 [*Lochmaea caprea* (L.)], Pūtele 1977 [*Agelastica alni* (L.)].

Imago of Galerucinae feed on foliage of herbaceous plants (mostly on *Lythrum*, *Artemisia*, *Rumex*, *Polygonum*, *Filipendula*, *Fragaria*, *Cirsium*, *Nymphaea*, *Nuphar*, *Comarum*, *Calluna*, *Galium*, *Thalictrum*, *Scutellaria* and other) and deciduous trees and shrubs (mostly on *Salix*, *Alnus*, *Populus*, *Betula*, *Ulmus*, *Viburnum*, *Crategus* and other), rarely on coniferous tree (*Pinus*) (Bieńkowski 2004; Lopatin, Nesterova 2005).

Some species of the subgenus Galerucinae are pests of cultivated plants (Kryzhanovskij 1974). In Latvia *Galerucella tenella* (Linnaeus, 1761) and *Galeruca tanaceti* (Linnaeus, 1758) are reported as the pests of strawberry (Čakstiņa 1962; Priedītis 1971a; Dūks 1976; Petrova *et al*. 2000, 2006); *Pyrrhalta viburni* (Paykull, 1799) – as pest of viburnum (Rupais 1959).

The aim of the current work is to summarize information on subfamily Galerucinae Latreille, 1802 in Latvia. The bibliographical information on this leaf-beetles subfamily in Latvia are summarized for the first time. New faunal data on nineteen species are presented. Two species, *Galeruca dahlii* (Joannis, 1866) and *Luperus luperus* (Sulzer, 1776), are deleted from the list of Latvian Coleoptera. In the article also the annotated list of Latvian species is presented. Altogether, 21 species of 10 genera of Galerucinae Latreille, 1802 are reported in Latvia.

MATERIAL AND METHODS

In total 1796 specimens of leaf-beetles were processed during the current investigation, representing 9 genera and 19 species of Galerucinae. Material studied is stored in the collection of Daugavpils University Institute of Systematic Biology (DUBC), the entomological collection of the Latvian University Institute of Biology (Salaspils), private collection of author (Daugavpils), and collection of V. Pūtele (Institute of Biology, Salaspils).

The following identification keys have been used for identification of specimens: Beenen 2007; Bieńkowski 2004; Lopatin, Nesterova 2005; Mohr 1966; Ogloblin 1936; Warchałowski 2003. Genera and species are listed taxonomically. We follow the systematics suggested by Silfverberg (2004). The monograph (Warchałowski 2003), an interactive on-line manual (Borowiec 2004) and series of articles (Beenen 1999, 2002, 2007, 2008) were used for the nomenclature and synonymy.

Host plants are listed citing the monograph of Lopatin & Nesterova (2005). The general distribution of species is given according to Bezdģk (2004), Bieńkowski (2004), Borowiec (2004), Lopatin (1977, 1986), Lopatin & Kulenova (1986), Lopatin & Nesterova (2005), Medvedev (1992), Medvedev & Dubeshko (1992), Ogloblin (1936) and Warchałowski (2003).

Classification of chorotypes follows as suggested by Taglianti et al. (1999), the transcripts of chorotypes codes are: ASE – Asiatic-European, CAE – Centralasiatic-European, CEM – Centralasiatic-Europeo-Mediterranean, EUR – European, PAL – Palaearctic, SIE – Sibero-European.

The following information is given for each of the species: scientific name & author, published bibliographical sources for Latvia, faunistic data (the place where it was found and the collecting date are indicated, in brackets are indicated the number of specimens collected, information about habitat and collector‘s name), host plants, phenology (Latvian data only; IV, VI, VII, VIII, IX, X – months from April to October, respectively; in oval brackets – ten-day period), general distribution of species and the chorotype code. Species marked with dashes (-) have been previously recorded for the Latvian fauna, but in fact appear to be absent from Latvia, and it is doubtful whether they ever occurred here (earlier records, probably based on misidentifications or misinterpretations). These species are herewith excluded from the list of Latvian Coleoptera.

Explanations of used abbreviations: d. – administrative district (system of administrative districts used in latvia from 1991 to 2008), env. – environ, PNT – protected nature territory, vill. – village or settlement, syn. – synonym, C – central, S – South, N – North, E – East, W – West.

RESULTS AND DISCUSSION

During the current research, occurrence of 19 species and 9 genera of Galerucinae were confirmed for Latvia. Two species, *Lochmaea crataegi* (Forster, 1771) and *Xanthogaleruca luteola* (Müller, 1766), were not confirmed during the research. Occurrence of these species in the Latvian fauna needs further confirmation.

Galerucella nymphaeae-complex includes *G. nymphaeae* (Linnaeus, 1758), *G. aquatica* (Geoffroy, 1785), *G. sagittariae* (Gyllenhal, 1813) and *G. kerstensi* Lohse, 1989. They are very similar morphologically. Differences in structure of aedeagus, shape of last abdominal sternite in females, size and coloration of body are weak (Bieńkowski 2004; Lohse 1989; Kippenberg, Döber, 1994). They feed on different host plants: *G. nymphaeae* – on *Nymphaea* and *Nuphar*; *G. aquatica* – on Polygonaceae (*Polygonum amphibium, Rumex hydrolapathum* and *R. aquaticus*); *G. sagittariae* and *G. kerstensi* – on *Comarum palustre* (Lohse 1989; Bieńkowski 2004; Lopatin & Nesterova 2005; Romantsov 2007). During the preparation of Galerucinae section of volume 6 of the Catalogue of the Palaearctic Coleoptera (Lobl & Smetana eds.), Beenen (2008) has summarized the information on molecular, morphological and ecological studying of *Galerucella nymphaeae*-complex (Hippa & Koponen 1986; Kangas 1991; Lohse 1989; Nokkala 1989; Nokkala & Nokkala 2004; Pappers 2001; after Beenen 2008) and it will not be split in species or subspecies. The taxa hitherto separated from *Galerucella nymphaea* are to be regarded as host races and are therefore intrasubspecific (Beenen 2008). Borghuis et al. (2009) confirms that the host-associated taxa of the *Galerucella nymphaeae* species complex are not defined as distinct gene pools under the phylogenetic species concept, however, the species complex as a whole is.

Galerucella nymphaeae (Linnaeus, 1758) is mentioned in current list of Latvian Galerucina. In Latvia, specimens were recorded on *Nymphaea*, *Nuphar* and *Rumex hydrolapathum*, and also were reports on *G. sagittariae* (Mikutowicz 1905; Rathlef 1921; Lackschewitz 1927).

Two species, *Galeruca dahlii* (Joannis, 1866) and *Luperus luperus* (Sulzer, 1776), are excluded from the list of Latvian Coleoptera. Overall, the list of species of subfamily Galerucinae of Latvian fauna includes 21 species and 10 genera.

Analysis of the distribution of the Latvian species of the subfamily Galerucinae reveals that the range of chorotypes is rather wide: Palaearctic – one species [*Xanthogaleruca luteola* (Müll.)], Asiatic-European – six species [*Galerucella grisescens* (Joann.), *G. lineola* (F.), *G. calmariensis* (L.), *Lochmaea caprea* (L.), *Galeruca tanaceti* (L.), *Agelastica alni* (L.)], Sibero-European – eight species [*Galerucella nymphaeae* (L.), *G. tenella* (L.), *Lochmaaea crataegi* (Forst.), *Pyrrhalta viburni* (Pk.), *Galeruca laticollis* Sahlb.), *Phyllobrotica quadrimaculata* (L.), *Luperus longicornis* (F.), *L. flavipes* (L.)], Centralasiatic-Europeo-Mediterranean – one species [*Galeruca interrupta* (Ill.)], Centralasiatic-European – three specie [*Galerucella pusilla* (Duft.), *Galeruca pomonae* (Scop.), *Sermylassa halensis* (L.)], European – two species [*Lochmaea suturalis* (Thoms.), *Calomicrus pinicola* (Duft.)].

In *Lochmaea caprea* (L.) (Fig. 1.) and *L. suturalis* (Thoms.) (Fig. 2), differences in body coloration, shape and sculpture of antennal calluses, punctures of frons and vertex are weak. Bieńkowski (2004) paid attention that external characters do not permit the separation of these species and determination is possible only after shape of aedeagus. I have studied aedeagi (Fig. 3) and sculpture of antennal calluses and vertex (Fig. 4) in these species.

LIST OF SPECIES OF LATVIAN FAUNA

Chrysomelidae
Galerucinae Latreille, 1802
Galerucini Latreille, 1802
***Galerucella* Crotch, 1873**
subgenus *Galerucella* s.str.

***1. G. nymphaeae* (Linnaeus, 1758)**

References: Precht 1818 (*Galleruca nympheae*); Kawall 1865, 1866; Seidlitz 1872-1875 (*Galleruca*), 1887-1891 (*Galeruca*); Rathlef 1905; Mikutowicz 1905 (*Galeruca sagittariae* Gyll.); Rathlef 1921 (*sagittariae* Gyll.); Lackschewitz 1927 (*sagittariae* Gyll.); Spuris 1953, 1974; Šmits, Spuris 1966; Pūtele 1974, 1980, 1981a, 1981b, 1984; Stiprais 1977; Barševskis 1988, 1993, 2002; Telnov *et al.* 1997; Telnov 2004; Kalniņš et al. 2007.

Examined material: 149 specimens: Daugavpils d.: Dviete, Dvietes paliene Nature Park, 56°01‘38“N 26°21‘04“E, 11.V.2008 (1, Daugava riverside, leg. A.Pankjāns); Elerne, 31.V.2007 (1, bank of the Daugava River, leg. M.Murd); Ilgas, Silene Nature Park, 10.VII.1993 (1, leg. A.Barševskis), VI-VII.2000 (4, leg. I.Haka & G.Hļebnaja), 14-20.VI.2002 (1, leg. A.Barševskis); Medumi, Lake Ilgas, 02.VIII.2007 (32, on *Nuphar luteum* leaves, leg. M.Murd); Pilskalne, 5 km NE Ilukste, Lake Paukštes, 14.VIII.2007 (4, on *Nuphar luteum*, leg. U.Suško); Šedere, Lake Marinova, 12.VIII.2007 (7, leg. M.Murd); Višķi, 1987 (1, leg. A.Barševskis), 27.V.1987 (4, leg. A.Barševskis), 20.V.2007 (1, bank of Lake Višķu, leg. M.Murd); Jēkabpils d.: Dunava, 23.VI.1993 (5, leg. A.Barševskis), 21.VII.1993 (4, leg. A.Barševskis), 01-05.VIII.1997 (5, leg. A.Barševskis), 04.IX.2004 (2, leg. A.Barševskis), 10-18.VI.2006 (1, leg. K.Barševska), 18-22.VI.2006 (8, leg. K.Barševska), 01-08.VIII.2006 (17, leg. A.Barševskis & K.Barševska), 29.VIII.2006 (1, leg. A.Barševskis), 09-10.VIII.2008 (1, leg. A.Barševskis); Rubene, 25.IV.1998 (1, leg. I.Leiskina), 23.IV.1999 (1, leg. I.Leiskina), 08.VIII.1999 (1, leg. I.Leiskina); Vandāni, 12.VIII.2007 (1, bank of the Daugava River, leg. A.Bukejs); Krāslava d.: Asūne, 10.VIII.1998 (2, leg. I.Plotka); Izvalta, 31.III.1989 (1, leg. A.Barševskis); Saltupe house, 55°51‘01“N 27°17‘17“E, Augšdaugva PNT, 28.IV.2009 (1, leg. M.Nitcis, A.Anishtchenko); 3.7 km SW Varnaviči, 55°47‘55“N 27°16‘32“E, 05.IX.2008 (1, leg. R.Cibuļskis); Vecokra, 26.VII.2008 (3, leg. A.Soldāns); Velnezers Nature Reserve, 11.VII.2008 (1, leg. A.Barševskis, V.Aleksejev); Kuldīga d.: Lake Lielais Nabes, 57°04‘04“N 21°48‘26“E, 28.VII.2005 (2, leg. A.Bukejs, A.Barševskis); Skrunda, bank of the Venta River, 11.VII.2006 (2, leg. A.Barševskis, K.Barševska); Limbaži d.: Vīķi, 57°51‘42“N 24°47‘53“E, 22.VIII.2006 (1, leg. A.Barševskis); Preiļi d.: Jersika, Kurpnieki house, 04.V.2006 (1, leg. K.Barševska); Rozukalne, S bank of Lake Lielais Kalūpes, 07.VII.2007 (1, leg. U.Suško); Rēzekne d.: Andzeļi, Lake Ežezers, Lielā Laču Is., 24.VII.2008 (1, leg. R.Cibuļskis, U.Valainis); Bērzgale, 29.VII.1992 (8, lake, leg. A.Barševskis); Īdeņa env., 06.VII.2008 (1, leg. A.Bukejs, M.Balalaikins), 15.VII.2009 (6, Lake Lubāns, on *Nuphar*, leg. A.Bukejs, M.Balalaikins); 7 km SW Kaunata, Lipušķi, Lake Razna, 18.V.2009 (1, leg. A.Bukejs); Lūznava, Zosna, Rāzna National Park, 24.VII.2008 (1, leg. R.Cibuļskis, U.Valainis); Mākoņkalns, 03.VIII.1992 (2, leg. A.Barševskis); Lake Micānu, 28.VII.2009 (1, leg. M.Balalaikins); Rīga d.: Spuņciems, 10.VIII.2006 (1, leg. E.Rudāns, A.Barševskis); Valmiera d.: Mazsalaca, 57°43‘04“N 25°07‘75“E, 21.VIII.2006 (4, leg. A.Barševskis, A.Pankjāns); Ventspils d.: Moricsala Is., Moricsala Nature Reserve, VII.2007 (1, leg. A.Barševskis); Usma forestry env., 05.V.2008 (1, leg. A.Pankjāns, U.Valainis, A.Soldāns, E.Tamanis).

Host plants: *Nymphaea, Nuphar* (Nymphaeaceae), *Polygonum amphibium, Rumex hydrolapathum, R. aquaticus* (Polygonaceae), *Comarum palustre* (Rosaceae).

Phenology: IV(3), V, VI, VII, VIII, IX(1)

General distribution: Europe, Siberia. [SIE]

Note: Common species in Latvia.

***2. G. grisescens* (Joannis, 1865)**

References: Spuris 1953; Stiprais 1977; Pūtele 1980, 1981b; Barševskis 1988, 1993, 2002; Telnov *et al.* 1997; Telnov 2004; Kalniņš et al. 2007; Bukejs, Telnov 2007.

Examined material: 37 specimens: Daugavpils d.: Ilgas, Silene Nature Park, 18.VI.2008 (1, leg. R.Cibuļskis); Krauja, 29.V.2007 (2, old wet

clearing, leg. A.Bukejs); Oborūni, 27.VII.2001 (1, leg. G.Lociks); Stropi, 27.V.2006 (1, leg. A.Bukejs), 20.V.2007 (1, swampy bank of Lake Lielais Stropu, leg. A.Bukejs), 27.IV.2008 (3, bank of Lake Lielais Stropu, leg. A.Bukejs); Višķi, 22.III.1987 (1, leg. A.Barševskis), 05.IV.1987 (1, leg. A.Barševskis); Jēkabpils d.: Rubene, 27.III.1998 (1, leg. I.Leiskina); Zasa, 15.VII.1998 (1, leg. I.Leiskina), 19.VI.2000 (2, leg. I.Leiskina); Krāslava d.: Ezernieki, Garaudži, Rāzna National Park, 24.VII.2008 (1, leg. U.Valainis, R.Cibuļskis); Izvalta, Murāni house, 21.VIII.1992 (1, leg. A.Barševskis); Peipiņi, 4 km W Šķeltova, 28.VIII.1989 (1, leg. A.Barševskis); Šķeltova, 17.X.1992 (1, leg. A.Barševskis), 20.V.1995 (1, wet meadow, leg. A.Barševskis); Preiļi d.: Jersika, Kurpnieki house, 26-28.V.2006 (1, leg. K.Barševska), 23-24.VI.2008 (2, leg. A.Barševskis), 01-10.V.2009 (1, leg. K.Barševska, A.Barševskis); Talsi d.: Šķēde, 24.VII.1972 (6, leg. V.Pūtele); Slītere National Park, Zilie kalni (hills) and Dāvida pļavas (meadows), 10.VIII.2006 (1, leg. A.Barševskis), 01.IX.2006 (1, leg. A.Pankjāns, E.Rudāns, U.Valainis); Valmiera d.: Mazsalaca, 57°51‘83“N 25°02‘07“E, 27.VIII.2006 (2, leg. A.Barševskis); Ventspils d.: Moricsala Is., Moricsala Nature Reserve, X.2003 (1, window trap, leg. U.Valainis), 14.V.2004 (1, leg. A.Barševskis), 15.VII.2008 (1, leg. A.Bukejs).

Host plants: *Lysimachia vulgaris, Hydrocharis morsusranae*. In the literature, *Polygonum, Rumex, Filipendula, Fragaria, Comarum* (Bieńkowski 2004) and *Lythrum* (Romantsov 2007) are also mentioned as host plants.

Phenology: V, VI, VII, VIII, IX

General distribution: Europe, Siberia, Russian Far East, Mongolia, N China, N Japan. [ASE]

Note: Rather infrequent species in Latvia.

subgenus *Neogalerucella* Chūjo, 1962

***3. G. lineola* (Fabricius, 1781)**

References: Precht 1818 (*Galleruca lineola*); Seidlitz 1872-1875 (*Galleruca*), 1887-1891(*Galeruca*); Rathlef 1905; Spuris 1953; Pūtele 1974, 1980, 1981a, 1981b, 1984; Stiprais 1977; Barševskis 1988, 1993, 2002; Telnov *et al*. 1997; Telnov 2004; Kalniņš et al. 2007; Bukejs, Telnov 2007.

Examined material: 267 specimens: Aizkraukle d.: 6 km N Aizkraukle, Aizkraukles purvs (bog) PNT, 01.VII.2008 (1, leg. A.Bukejs); Nereta, 15.IV.2008 (2, leg. A.Barševskis); Bauska d.: Bauska Nature Park, 56°24‘10“N 24°10‘41“E, 03.V.2008 (1, leg. A.Pankjāns); Mežotne env., 56°44‘185“N 24°04‘865“E, 03.V.2008 (4, bank of the Lielupe River, leg. U.Valainis, A.Pankjāns, A.Soldāns, E.Tamanis); Cēsis d.: Bērzkrogs, 03.VII.2006 (4, leg. A.Barševskis); Daugavpils d.: 2 km SE Apses, Daugavpils env., 011.VIII.2009 (2, bank of the Daugava River, leg. A.Bukejs); Bebrene, 14.V.2006 (2, leg. E.Rudāns); Butiški, 12.VIII.2006 (1, valley of the Daugava River, leg. A.Bukejs & M.Balalaikins); Daugavpils, 30.IV.1994 (1, leg. A.Barševskis), 10.IX.1998 (1, leg. I.Leiskina), 06.V.2007 (2, leg. A.Baščevskis), Daugavpils, Mežciems, 19.VII.2007 (1, leg. K.Aksjuta, M.Murd), Daugavpils, Cietoksnis, 07.VIII.2008 (1, bank of the Daugava River, leg. A.Bukejs, M.Balalaikins); Ilgas, Silene Nature Park, 10.VII.1989 (1, leg. A.Barševskis), 20.VI.1993 (1, leg. A.Barševskis), 07.VII.1993 (1, leg. A.Barševskis), 21-24.IV.1995 (1, leg. A.Barševskis), 29.IV-10.VII.2000 (1, leg. L.Nikitina), 15.VI.2001 (1, leg. G.Lociks), 17-20.VI.2008 (1, leg. V.Krone, J.Staskeviča), 18.VI.2008 (1, leg. R.Cibuļskis); Kalnišķi, 55°52‘54“N 26°44‘03“E, 21.VIII.2009 (4, bank of the Daugava River, on *Salix*, leg. A.Bukejs, M.Balalaikins); Lociki, 05.VIII.2001 (2, leg. G.Lociks); Naujene, Daugavas Loki Nature Park, 29.IV.2008 (8, bank of the Daugava River, leg. A.Pankjāns, U.Valainis); Slutišķi, 01.VII.1995 (1, valley of the Daugava River, leg. A.Barševskis), 07.VII.1996 (1, old valley of the Daugava River, leg. A.Barševskis); Stropi, 28.VI.1992 (2, leg. A.Barševskis), 20.V.2007 (4, swampy bank of Lake Lielais Stropu, leg. A.Bukejs), 25.V.2007 (5, swampy bank of Lake Lielais Stropu, leg. A.Bukejs), 28.V.2007 (1, meadow, leg. A.Bukejs), 27.IV.2008 (2, leg. A.Bukejs); 1.5 km SSW Vecpils, Starozamkovij rov (river glen), 55°54‘710“N 26°43‘515“E, 09.V.2008 (1, valley of the Daugava River, broad-leaved forest and meadow, leg. U.Valainis); Svente, near Lake Svente, 11.V.2008 (1, roadside, leg. A.Barševskis); Višķi, 30.III.1987 (3, leg. A.Barševskis), 05.IV.1987 (1, leg. A.Barševskis), 15.V.1987 (1, leg. A.Barševskis),

25.V.1987 (1, leg. A.Barševskis); Jēkabpils d.: Ābeļu parish, bank of the Daugava River, 17.V.1995 (3, leg. A.Barševskis); Asare, 02.V.1998 (1, leg. I.Leiskina), 12.IX.1998 (1, leg. I.Leiskina); Dignāja, 28.VII.1999 (7, leg. I.Leiskina); Dunava, 08.VIII.1994 (9, leg. A.Barševskis), 25.III.1995 (3, along the Daugava River, leg. A.Barševskis), 15-16.IV.1995 (1, in hibernation place, leg. A.Barševskis), 17.VII.1995 (11, leg. A.Barševskis), 06.IV.1996 (1, forest, leg. A.Barševskis), 03.VII.2005 (1, bank of the Daugava River, leg. A.Barševskis), 10-18.VI.2006 (2, leg. K.Barševska), 01.IV.2007 (21, leg. A.Barševskis), 13.V.2007 (2, leg. K.Barševska, A.Barševskis), 29.VI.2008 (1, leg. A.Barševskis), 01-07.VI.2009 (2, leg. K.Barševska); Rubene, 18.V.1997 (2, leg. I.Leiskina), 06.IX.1997 (1, leg. I.Leiskina), 17.IV.1999 (1, leg. I.Leiskina), 29.X.1999 (1, leg. I.Leiskina), 21.IV.2000 (1, leg. I.Leiskina); 6 km NW Vandāni, Vimbaru forest, 12.VIII.2008 (1, leg. M.Balalaikins); Zasa, 29.VII.1999 (1, leg. I.Leiskina), 19.VI.2000 (2, leg. I.Leiskina); Jelgava d.: Jelgava N env., Hercogi (=Vītoļini), 09.VI.1977 (1, leg. V.Pūtele); Jelgava, Rullļi, 02.VI.1977 (2, leg. V.Pūtele); Jūrmala: Kauguri, 01.V.1992 (4, leg. A.Barševskis); Krāslava d.: Asūne, 10.VIII.1998 (3, leg. I.Plotka); Izvalta, Stivriņi, 08.IV.1995 (1, under stone, leg. A.Barševskis); Piedruja, 16.VI.1989 (1, leg. A.Barševskis); Šķeltova, 17.V.1987 (3, leg. A.Barševskis), 02.XI.1987 (1, leg. A.Barševskis), 20.V.1987 (1, wet meadow, leg. A.Barševskis); Liepāja d.: Pape, 17-27.IV.1995 (1, on light, leg. N.Savenkov), 06.V.1996 (2, dunes, leg. N.Savenkovs); Madona d.: Ošupe, 2.5 km NE Lake Lubāns, 56°50‘03“N 26°56‘05“E, 06.VII.2008 (3, wet meadow and bank of the Aiviekste River, leg. M.Balalaikins, A.Bukejs); Preiļi d.: Jersika, 01.VII.1997 (1, leg. I.Leiskina); Jersika, Kurpnieki house, 26.VI.2005 (1, leg. A.Barševskis), 04.V.2006 (3, leg. K.Barševska), 06-07.VI.2006 (2, leg. A.Barševskis, A.Barševska), 08.VII.2006 (1, leg. A.Barševskis), 15.IV.2007 (2, leg. A.Barševskis), 29.IV.2007 (1, leg. K.Barševska, A.Barševskis), 20.V.2007 (1, leg. A.Barševskis), 10.VII.2007 (3, leg. A.Barševskis, K.Barševska), 06.VIII.2008 (1, leg. K.Barševska), X.2008 (9, leg. A.Barševskis), 11-12.IV.2009 (2, leg. A.Barševskis), 10.V.2009 (1, leg. A.Barševskis); Rēzekne d.: Bērzgale, 08.VII.2008 (1, leg. M.Balalaikins); Īdeņa env., 56°44‘38“N 26°55‘11“E, 06.VII.2008 (4, bank of Lake Lubāns, leg. A.Bukejs, M.Balalaikins), 15.VII.2009 (1, bank of Lake Lubāns, leg. A.Bukejs, M.Balalaikins); Gaigalava env., bank of Lake Lubāns near the Aiviekste River, 15.VII.2009 (1, leg. A.Bukejs, M.Balalaikins), 08.VIII.2009 (1, on *Salix*, leg. M.Balalaikins); Lūznava, Zosna, Rāzna National Park, 24.VII.2008 (2, leg. R.Cibuļskis, U.Valainis); bank of Lake Zolvu, 12.VI.2008 (6, leg. A.Barševskis, U.Valainis); Rīga d.: Kūdra, 07.V.2006 (1, leg. A.Titov); Talsi d.: Dundaga, 02.V.2006 (1, leg. A.Barševskis); Slītere National Park, Zilie Kalni (hills) and Dāvida Pļavas (meadows), 11.VI.2005 (4, leg. A.Barševskis), 02.V.2006 (2, leg. A.Barševskis), 30.V.2006 (1, leg. A.Barševskis), 17.VII.2007 (1, leg. U.Valainis, A.Pankjāns, A.Soldāns, A.Barševskis), 02.VI.2009 (1, leg. A.Barševskis); Valka d.: Launkalne parish, Mežole, 15.VII.2005 (1, leg. J.Donis), 10.VI.2006 (1, leg. J.Donis), 26.VI.2006 (1, leg. J.Donis), 02.X.2006 (1, leg. J.Donis); Ventspils d.: Usma, bank of Lake Usmas, 28.VI.2006 (1, leg. A.Barševskis, A.Pankjāns, U.Valainis); Moricsala Is., Moricsala Nature Reserve, VII.2003 (2, leg. U.Valainis), 10.VI.2005 (1, leg. A.Barševskis), 11.VII.2005 (2, leg. U.Valainis), 14.IX.2005 (2, leg. A.Barševskis), 21.X.2005 (6, leg. A.Bukejs, U.Valainis), 02.V.2006 (4, leg. A.Barševskis & U.Valainis), 03.V.2006 (4, leg. A.Barševskis), 29.V.2006 (1, leg. A.Barševskis), 29.V.2006 (5, leg. E.Rudāns), 30.V.2006 (4, leg. A.Barševskis & E.Rudāns), 30.VII.2006 (2, leg. A.Barševskis), 21.IX.2008 (2, window trap, leg. A.Pankjāns).

Host plants: *Salix, Populus* (Salicaceae), *Alnus* (Betulaceae).

Phenology: IV, V, VI, VII, VIII, IX

General distribution: Europe, Caucasus, Siberia, Kazakhstan, Central Asia, Mongolia, Russian Far East, Japan. [ASE]

Note: Very common and widely distributed species in Latvia.

***4. G. calmariensis* (Linnaeus, 1767)**

syn.: *aquatica* Müller, 1776

References: Seidlitz 1872-1875 (*Galleruca*), 1887-1891(*Galeruca*); Rathlef 1905; Pūtele 1974, 1980, 1981a, 1981b, 1984; Stiprais 1977; Barševskis

1993; Telnov *et al.* 1997; Telnov 2004; Kalniņš et al. 2007; Bukejs, Telnov 2007.

Examined material: 31 specimens: Cēsis d.: Lake Inesis, 15.VII.1976 (1, leg. V.Pūtele); Daugavpils d.: Butišķi, 01.VII.2009 (1, valley of the Daugava River, leg. A.Bukejs, M.Balalaikins); Medumi, Kurcums, 18.V.2009 (1, leg. A.Barševskis, A.Anishtchenko); Naujene, 27.IV.2007 (1, Jezufov's park, leg. J.Staskeviča, V.Krone), 29.IV.2008 (1, valley of the Daugava River, leg. A.Pankjāns, U.Valainis); Stropi, 25.V.2007 (1, swampy bank of Lake Lielais Stropu, leg. A.Bukejs); Vecsalienas parish, Orehovka N env., Ververu krauja (precipice), 15.VI.1989 (1, leg. A.Barševskis); Jēkabpils d.: Dunava, 25-29.VI.2006 (1, leg. K.Barševska), 01-08.VI.2009 (1, leg. K.Barševska); Jūrmala: Kauguri, 13.VIII.1994 (1, leg. A.Barševskis); Krāslava d.: Auleja, bank of Lake Auleja, 07.VIII.2007 (3, leg. M.Murd); Kuldīga d.: bank of Lake Lielais Nabes, 57°04'04"N 21°48'26"E, 28.VII.2005 (2, leg. A.Bukejs, A.Barševskis); Liepāja d.: Pape, 24-25.V.1994 (2, seashore, dunes, leg. N.Savenkovs); Madona d.: Ošupe, 2.5 km NE Lake Lubāns, 56°50'03"N 26°56'05"E, 06.VII.2008 (1, wet meadow and bank of the Aiviekste River, leg. M.Balalaikins, A.Bukejs); Preiļi d.: Jersika, Kurpnieki house, 14.V.2006 (1, leg. K.Barševska), 20.V.2006 (1, leg. K.Barševska), 04.VI.2006 (1, leg. K.Barševska), 23-24.VI.2006 (1, leg. A.Barševskis, K.Barševska), 23-24.VI.2008 (2, leg. A.Barševskis), 03.VII.2009 (2, leg. K.Barševska); Rēzekne d.: Īdeņa env., 15.VII.2009 (2, bank of Lake Lubāns, leg. A.Bukejs, M.Balalaikins); Puša, 26.VI.2002 (3, leg. A.Barševskis).

Host plants: *Lythrum salicaria, L.virgatum* (Lythraceae).

Phenology: IV(3), V, VI, VII, VIII

General distribution: from Catalonia and the British Isles to Japan; introduced also to N America (USA). [ASE]

Note: Rather infrequent species in Latvia.

5. G. pusilla (Duftschmid, 1825)

References: Pūtele 1974, 1980, 1981a, 1981b; Telnov *et al.* 1997; Barševskis 2002; Telnov 2004; Petrova *et al.* 2006; Kalniņš et al. 2007; Bukejs, Telnov 2007.

Examined material: 19 specimens: Daugavpils d.: Butiški, 12.VIII.2006. (1, valley of the Daugava River, leg. A.Bukejs & M.Balalaikins); Daugavpils, 06.V.2007 (1, leg. A.Baščevskis); Ogre d.: Jumprava, 10.VII.2008 (1, leg. A.Barševskis); Preiļi d.: Jersika, Kurpnieki house, 23-24.VI.2006 (3, leg. A.Barševskis, K.Barševska), 04-05.VIII.2007 (1, leg. A.Barševskis), 23-24.VI.2008 (3, leg. A.Barševskis), 03.VII.2009 (2, leg. K.Barševska); Rēzekne d.: Īdeņa env., 15.VII.2009 (1, bank of Lake Lubāns, leg. A.Bukejs, M.Balalaikins); Puša, 25.V.2002 (2, leg. A.Barševskis); Talsi d.: Mazirbe, 05.VIII.2002 (2, leg. A.Barševskis); Ventspils d.: Moricsala Is., Moricsala Nature Reserve, VI.2003 (2, leg. U.Valainis).

Host plants: *Lythrum* (Lythraceae).

Phenology: V, VI, VII, VIII

General distribution: Europe, Caucasus, Kazakhstan, Central Asia (Kyrgyzstan), Mongolia. [CAE]

Note: Rather infrequent species in Latvia.

6. G. tenella (Linnaeus, 1760)

References: Fleischer 1829 (*Galleruca tenella* F.); Seidlitz 1872-1875 (*Galleruca*), 1887-1891(*Galeruca*); Rathlef 1905; Ozols 1929; Trauberga 1957; Čakstiņa 1962; Ozols 1948, 1963; Šmits, Spuris 1966; Spuris 1974; Priedītis 1971a; Pūtele 1974, 1980, 1981a, 1981b, 1981c, 1982, 1984; Dūks 1976; Stiprais 1977; Barševskis 1988, 1993, 2002; Rūtenberga 1992; Telnov *et al.* 1997; Petrova *et al.* 2000; Telnov 2004; Petrova *et al.* 2006; Kalniņš et al. 2007; Bukejs, Telnov 2007.

Examined material: 167 specimens: Aizkraukle d.: Jaunjelgava, 56°36'28"N 25°02'44"E, 11.VIII.2006 (1, bank of the Daugava River, leg. E.Rudāns, A.Barševskis); Skrīveri, 21.VI.2006 (1, leg. A.Barševskis); Balvi d.: Kuprava, 19.V.1991 (1, leg. A.Barševskis), 26.VIII.1994 (1, leg. A.Barševskis); Viļaka, 27.VII.1992 (1, leg. A.Barševskis); Cēsis d.: Bērzkrogs, 03.VII.2006 (1, leg. A.Barševskis); Daugavpils d.: Bebrene, Dvietes palienes Nature Park, 23.VI.2006 (1, leg. E.Rudāns); Daugavpils, Mežciems env., 01.VI.2008 (1, edge of pine forest, leg. A.Bukejs); Ilgas, Silene Nature Park, 06.VII.1992 (1, leg. A.Barševskis), VI-VII.2000 (3, leg. I.Haka & G.Hļebnaja), 09.VI.2001 (1, leg. G.Lociks),

VIII.2002 (2, leg. A.Baarševskis), 18.V.2005 (8, leg.A.Barševskis), 01-03.VII.2008 (1, leg. N.Mihailova); Kalnišķi, 55°52‘54“N 26°44‘03“E, 21.VIII.2009 (1, bank of the Daugava River, leg. A.Bukejs, M.Balalaikins); Krauja, 29.V.2007 (1, old wet clearing, leg. A.Bukejs); Lociki, 21.VII.2001 (1, leg. G.Lociks); Pilskalne, Pilskalnes Nature Park, 09.V.2005 (3, leg. A.Barševskis); Šedere, Raudas meži (forests) Nature Park, 11.V.2008 (1, leg. K.Aksjuta); Stropi, 25.V.2007 (1, swampy bank of Lake Lielais Stropu, leg. A.Bukejs), 27.IV.2008 (7, bank of Lake Lielais Stropu, leg. A.Bukejs), 05.V.2008 (2, leg. A.Bukejs), 04.V.2009 (3, leg. A.Bukejs), 14.V.2009 (4, moist forest, leg. A.Bukejs); Vasarģelišķi, 29.IV.2008 (1, leg. A.Pankjāns, U.Valainis); Višķi, bank of Lake Dotkas, 13.V.1995 (3, leg. A.Barševskis); Zaļumi, 03.VIII.2001 (1, leg. G.Lociks); Jēkabpils d.: Dunava, 20-31.VII.2006 (1, leg. K.Barševska), 01-07.VI.2009 (1, leg. K.Barševska); Rubene, 17.V.1997 (2, leg. I.Leiskina), 22.V.1997 (1, leg. I.Leiskina), 05.VIII.1997 (1, leg. I.Leiskina), 02.V.1998 (1, leg. I.Leiskina), 04.VI.1999 (1, leg. I.Leiskina), 21.VII.1999 (1, leg. I.Leiskina); Zasa, 28.VII.1998 (1, leg. I.Leiskina); Jelgava d.: Vilce Nature Park, 56°25‘13“N 23°32‘31“E, 03.V.2008 (1, leg. A.Soldāns, U.Valainis, A.Pankjāns, E.Tamanis); Krāslava d.: Asūne, 20.VIII.1998 (1, leg. I.Plotka); Baltinava, 23.VI.2009 (1, leg. A.Bukejs); Ezernieki, Rāzna National Park, 24.VII.2008 (1, leg. U.Valainis, R.Cibuļskis); Sauleskalns (hill), 4.5 km NE Kombuļi, 04.V.2008 4, leg. K.Barševska, A.Barševskis); Šķeltova, 17.V.1987 (5, leg. A.Barševskis), 1987 (1, leg. A.Barševskis), 11.VIII.2009 2, leg. A.Barševskis); Kuldīga d.: Alsunga, Augšužavas PNT, 28.VIII.2005 (4, leg. A.Barševskis, A.Bukejs, U.Valainis); bank of Lake Lielais Nabes, 57°04‘04“N 21°48‘26“E, 28.VII.2005 (1, leg. A.Bukejs, A.Barševskis); Ludza d.: Bļaši, 10.VIII.2008 (4, meadow, leg. M.Balalaikins); Rundēni, 10.IV.2008 (11, edge of forest, leg. A.Bukejs); Madona d.: Ošupe, 2.5 km NE Lake Lubāns, 56°50‘03“N 26°56‘05“E, 06.VII.2008 (2, wet meadow and bank of the Aiviekste River, leg. M.Balalaikins, A.Bukejs); Sauleskalns vill., 07.VII.2006 (1, leg. A.Pankjāns, E.Rudāns & A.Barševskis); Preiļi d.: Jersika, Kurpnieki house, 15.V.2005 (1, leg. A.Barševskis), 14.IX.2005 (1, leg. A.Barševskis), 06-07.VI.2006 (3, leg. A.Barševskis, K.Barševska), 12.V.2007 (1, leg. A.Barševskis), 23-24.VI.2008 (1, leg. A.Barševskis), 01-10.V.2009 (1, leg. K.Barševska, A.Barševskis); Pelēči, 19.VIII.1997 (1, leg. I.Jurkjāne); Rēzekne d.: Puša, 25.V.2002 (2, leg. A.Barševskis); Rīga d.: Garupe, 31.V.1974 (1, meadow, leg. anonymous); Olaine, 19.IX.2006 (1, leg. J.Donis); Spuņciems, 06.VIII.2009 (2, leg. A.Barševskis); Talsi d.: Kaļķi, 57°32‘31“N 22°30‘45“E, 12.V.2009 (2, leg. A.Barševskis); Mazirbe, 04.IX.2004 (2, leg. A.Barševskis); Puiškalnciems, Kaļķupes ieleja PNT, 02.VI.2009 (11, leg. R.Cibuļskis); Sabile, 04.VIII.1998 (1, meadow, leg. A.Barševskis); Slītere, 29.V.1978 (6, leg. V.Pūtele); Slītere National Park, Zilie kalni (hills) and Dāvada pļavas (meadows), 10.VIII.2004 (1, leg. R.Cibuļskis), 29.VII.2005 (3, leg. A.Barševskis, A.Bukejs, U.Valainis), 02.V.2006 (2, leg. A.Barševskis), 27.VI.2006 (3, leg. A.Barševskis), 10.VIII.2006 (3, leg. A.Barševskis), 01.IX.2006 (3, leg. A.Pankjāns, E.Rudāns, U.Valainis), 17.VII.2007 (3, leg. A.Soldāns), 22.VIII.2008 (1, leg. A.Barševskis); Stende, 57°07‘19“N 22°32‘26“E, 19.VII.2007 (1, clearing, leg. A.Barševskis, U.Valainis, A.Barševskis, A.Soldāns); Tukums d.: Klapkalnciems, 13.VI.1974 (1, cultivated meadow, leg. anonymous), 01.VII.1974 (1, cultivated meadow, leg. anonymous); Ventspils d.: Moricsala Is., Moricsala Nature Reserve, 29.VI.2002. (1, leg. U.Valainis), V.2003 (1, leg. U.Valainis), VI.2003 (1, leg. U.Valainis); IX.2003. (1, leg. U.Valainis); Puze, 13.VI.1974 (2, leg. V.Melecis), 29.VII.2005 (1, leg. A.Barševskis).

Host plants: *Filipendula ulmaria* (Rosaceae). In the literature, *Fragaria, Spiraea* and *Potentilla* are also mentioned as host plants (Bieńkowski 2004).

Phenology: V, VI, VII, VIII, IX

General distribution: from Catalonia, E England and W Norway to basin of Amur and Ussuri. [SIE]

Note: Very common species in Latvia.

***Pyrrhalta* Joannis, 1865**

***7. P. viburni* (Paykull, 1799)**

References: Fleischer 1829 (*Galleruca*); Kawall 1866 (*Galeruca*); Seidlitz 1872-1875 (*Galleruca*), 1887-1891 (*Galeruca*); Ulanowski 1883

(*Galerucella*); Rathlef 1905 (*Galerucella*); Rupais 1959, 1962 (*Galerucella*), 1999; Šmits, Spuris 1966; Spuris 1974 (*Galerucella*); Pūtele 1974 (*Galerucella*); Stiprais 1977; Barševskis 1993, 2002; Telnov *et al*. 1997; Telnov 2004; Kalniņš et al. 2007; Bukejs, Telnov 2007.

Examined material: 181 specimens: Daugavpils d.: Ilgas, Silene Nature Park, VI.2002 (14, leg. A.Barševskis); Lociki, 24.VII.2001 (1, leg. G.Lociks), 20.VIII.2001 (1, leg. G.Lociks); Maļinova, 05.VIII.2007 (8, leg. M.Murd); Šedere, Straumēni house, 29.VII.2007 (7, leg. M.Murd); Jēkabpils d.: Asare, 25.VII.2001 (2, leg. I.Leiskina); Dunava, 15-23.VII.2008 (1, leg. K.Barševska); Krāslava d.: Šķeltova, 31.VII.1992 (2, leg. A.Barševskis), 18.VIII.1992 (1, leg. A.Barševskis), 28.VIII.1992 (14, leg. A.Barševskis), 18.VIII.1994 (2, leg. A.Barševskis); Limbaži d.: Dunte, 16.VIII.2008 (4, leg. A.Barševskis); Preiļi d.: Aglona, 14.VIII.2009 (1, leg. A.Barševskis); Jersika, Kurpnieki house, 03.VIII.2005 (20, leg. A.Barševskis), 11.VIII.2005 (36, leg. A.Barševskis), 03.IX.2005 (1, leg. A.Barševskis), 15.VII.2006 (12, leg. K.Barševska), 27.VIII.2006 (1, leg. A.Barševskis), 04-05.VIII.2007 (6, leg. A.Barševskis), 01.VIII.2008 (2, leg. A.Barševskis), 06.VIII.2008 (1, leg. A.Barševskis), 18-20.VII.2009 (1, leg. A.Barševskis), 25.VII.2009 (8, leg. A.Barševskis); Rēzekne d.: Bērzgale, 29.VII.1992 (8, on *Viburnum*, leg. A.Barševskis); Talsi d.: Slītere National Park, Zilie kalni (hills) and Dāvida pļavas (meadows), 05.IX.2002 (3, leg. A.Barševskis), 10.VIII.2006 (9, leg. A.Barševskis), 22.VIII.2008 (15, leg. A.Barševskis).

Host plants: *Viburnum* (Viburnaceae).

Phenology: V, VI, VII, VIII, IX

General distribution: Europe, Caucasus, NW Kazakhstan, SW Siberia, Russian Far East. [SIE]

Note: Rather infrequent species in Latvia.

Xanthogaleruca Laboissičre, 1934

8. X. luteola (Müller, 1766)

References: Pūtele 1974 (misidentification), 1981a, 1981b, 1984 (*Galerucella*); Priedītis, Pūtele 1976; Telnov *et al*. 1997; Telnov 2004.

Examined material: Not confirmed by the author. Earlier record of this species "Jelgava d.: Jelgava N env., Hercogi (=Vītoliņi), 09.VI.1972 (1, leg. V.Pūtele)" (Pūtele 1974) was based on misidentification. Probably other reports of this species by V.Pūtele (Priedītis, Pūtele 1976; Pūtele 1981a) were based also on misidentifications.

Host plants: *Ulmus* (Ulmaceae).

Phenology: V

General distribution: Europe, NW Africa, Asia Minor, Caucasus, Iran, Afghanistan, Kazakhstan, Central Asia, W Siberia, N China; introduced also to N America. [PAL]

Note: Occurrence of this species in Latvia needs further confirmation. In catalogue "Enumeratio nova Coleopterorum Fennoscandiae, Daniae et Baltiae" (Silfverberg 2004) this species is mentioned for Denmark, Latvia, Lithuania and Sweden. It is also known from Belarus (Lopatin, Nesterova 2005). Reports of this species for Lithuanian fauna are not confirmed by faunal data (Tamutis pers. comm.).

Lochmaea Weise, 1883

9. L. caprea (Linnaeus, 1758)

References: Precht 1818 (*Galleruca capreae*); Seidlitz 1872-1875 (*Adimonia*), 1887-1891; Ulanowski 1883 (*Galeruca*); Sintenis 1900; Rathlef 1905; Brammanis 1940; Pūtele 1974, 1976, 1980, 1981a, 1981b, 1981c, 1982, 1984; Stiprais 1977; Stiprais, Varzinska 1985; Rūtenberga 1992; Barševskis 1993, 2002; Telnov *et al*. 1997; Telnov 2004; Kalniņš et al. 2007; Bukejs, Telnov 2007.

Examined material: 253 specimens: Aizkraukle d.: Aizkraukle, 06.VIII.2002 (3, leg. A.Barševskis); 6 km N Aizkraukle, Aizkraukles purvs (bog) PNT, 04.V.1995 (2, leg. A.Barševskis), 01.VII.2008 (7, leg. A.Bukejs), 06.VIII.2008 (3, leg. A.Bukejs, M.Balalaikins); Rīteri, 14.VI.2006 (2, leg. A.Barševskis), V.2009 (1, leg. A.Barševskis); Skrīveri, 20.VI.2006 (2, bank of the Daugava River, leg. A.Barševskis); Balvi d.: Kaplava, 10.VII.1991 (1, leg. A.Barševskis); Cēsis d.: Sudas purvs (bog), near Lake Zviedru, 31.VII.1973 (1, leg. A.Kacīna); Daugavpils d.: Bebrene, 04.V.2006 (2, leg. E.Rudāns), 14.V.2006 (1, leg. E.Rudāns); Butiški, 12.VIII.2006 (1, valley of the Daugava River, leg. A.Bukejs & M.Balalaikins), 21.VIII.2006 (1, valley of the Daugava River, leg. A.Bukejs & M.Balalaikins), 01.VII.2009 (1, valley of the Daugava River, leg. A.Bukejs, M.Balalaikins); Daugavpils, Križi, 20.V.2001 (1, leg. G.Lociks), Daugavpils, 55°54'03"N 26°34'42"E, 05.V.2009 (1,

pine forest, leg. R.Cibuļskis); Elerne, 31.V.2007 (1, bank of the Daugava River, leg. M.Murd); Ilgas, Nature Park Silene, 01.VII.1989 (1, leg. A.Barševskis), 30.V.1992 (1, leg. A.Barševskis), 29.IV-10.VII.2000 (1, leg. L.Nikitina), 29.IV-10.VII.2000 (1, leg. A.Rutka), VI-VII.2000 (2, leg. I.Haka & G.Hļebnaja), 20.VIII.2002 (1, leg. A.Barševskis), 18.V.2005 (3, leg. A.Barševskis), 04.VII.2005 (1, leg. A.Barševskis), 08.VII.2005 (1, leg. A.Barševskis), 10.V.2006 (3, leg. A.Barševskis), 04-10.VI.2006 (2, leg. L.Jakubāne); 4 mn NE Geitvinišķi, 55°54‘51“N 26°53‘47“E, 23.V.2008 (1, leg. U.Valainis); Kalnišķi, 55°52‘54“N 26°44‘03“E, 21.VIII.2009 (3, bank of the Daugava River, on *Salix*, leg. A.Bukejs, M.Balalaikins); Līksna parish, Mežciems env., 01.VI.2008 (1, edge of pine forest, leg. A.Bukejs); Lociki, 26.V.2001 (1, leg. G.Lociks), 21.VII.2001 (1, leg. G.Lociks), 07.VIII.2001 (1, leg. G.Lociks); Medumi, Kurcums, 18.V.2009 (2, leg. A.Barševskis, A.Anishtchenko); Naujene, Nature Park Daugavas Loki, 20.V.1988 (1, leg. A.Barševskis), 29.IV.2008 (4, valley of the Daugava River, leg. A.Pankjāns, U.Valainis), 25.VI.2008 (1, clearing, leg. K.Aksjuta); Nīcgale, 26.VI.1996 (1, leg. R.Cibuļskis); Lake Plotišķu N side, Viduspoguļanka env., 55°54‘943“N 26°29‘789“E, 21.IV.2008 (1, leg. U.Valainis); Šarlote, 01.VI.2008 (2, leg. K.Aksjuta); Šedere, Straumēni house, 01-03.V.2008 (2, leg. M.Janovska); Silene, 03.VII.1992 (1, leg. A.Barševskis); Slutišķi, Nature Park Daugavas Loki, 12.VI.1987 (2, leg. A.Barševskis), 29.IV.2008 (2, bank of the Putānu nullah, leg. A.Pankjāns, U.Valainis); Stropi, 28.VI.1992 (1, leg. A.Barševskis), 20.IV.2008 (2, clearing, leg. A.Bukejs), 27.IV.2008 (14, bank of Lake Lielais Stropu, leg. A.Bukejs), 10.VIII.2009 (2, on *Salix*, leg. A.Bukejs); Vabole, 20.VIII.1972 (1, leg. V.Pūtele); Višķi, 02.VI.1987 (2, leg. A.Barševskis); Gulbene d.: Lejasciems, Lejasciems forestry, IX-X.2003 (1, forest burning, leg. I.Kampāne & A.Barševskis); Ušūrs, 10.VII.2005 (3, leg. A.Barševskis); Jēkabpils d.: Asare, 05.IX.1997 (1, leg. I.Leiskina); Dunava, 21.VI.1992 (1, leg. A.Barševskis), 20.VIII.2000 (2, leg. I.Leiskina), 24.VIII.1995 (1, leg. A.Barševskis), 18.V.2008 (2, forest, leg. A.Barševskis), 01.VI.2008 (1, leg. A.Barševskis), 25.VI.2008 (1, clearing, leg. A.Barševskis), 25.IV.2009 (1, leg. A.Barševskis), 01-07.VI.2009 (1, leg. K.Barševska); Jēkabpils, near hospital, 13.V.2006 (6, leg. K.Barševska, A.Barševskis); Rubeņi, 18.V.1997 (1, leg. I.Leiskina), 18.VII.1997 (1, leg. I.Leiskina), 17.VIII.1997 (2, leg. I.Leiskina), 16.VII.1999 (1, leg. I.Leiskina); Tadenava, 22.VII.2001 (1, leg. A.Barševskis); Zasa, 28.VII.1998 (1, leg. I.Leiskina), 15.VIII.2000 (1, leg. I.Leiskina); Jelgava d.: Jelgava, near Rīga-Šiauliai road, 15.VI.2008 (3, leg. A.Barševskis, R.Orlovskis); Jelgava E env., Mežciems, 13.VIII.1972 (1, leg. V.Pūtele); Jekabpils E env., Kārniņi, 01.VI.1974 (1, leg. V.Pūtele); Jūrmala: Sloka, 20.IX.1974 (1, meadow, leg. anonymous); Krāslava d.: Grāveri, Lake Čertokas, 04.V.2008 (2, leg. A.Barševskis); Krāslava, 11.VI.1987 (3, leg. A.Barševskis), 16.VI.1987 (1, leg. A.Barševskis), 05.VI.1989 (1, leg. A.Barševskis); Sauleskalns, 4.5 km NE Kombuļi, 04.V.2008 (1, leg. K.Barševska, A.Barševskis); Šķeltova, Barševski house, 08.VI.1987 (1, leg. A.Barševskis), 13.VI.1987 (1, leg. A.Barševskis), 16.VI.1987 (2, leg. A.Barševskis), 31.VII.1995 (2, leg. A.Barševskis), 03.VI.2008 (1, leg. A.Barševskis), 28.VI.2008 (2, leg. A.Barševskis), 11.VIII.2009 (1, leg. A.Barševskis); Liepāja d.: Durbe, 05.IX.2008 (5, leg. R.Orlovskis, A.Barševskis); Liepāja, 11.VIII.2008 (1, leg. A.Barševskis), 05.IX.2008 (5, leg. R.Orlovskis); Ludza d.: Rundēni, 10.IV.2008 (2, edge of forest, leg. A.Bukejs); Madona d.: territory of Lake Lubāns, Ezernieki house, 21.VIII.2008 (3, leg. A.Barševskis); Mārciena, near the Arona River, 07.VII.2008 (1, leg. A.Pankjans, A.Barševskis); Ogre d.: Jumprava, 16.V.1984 (1, leg. anonymous), 10.VII.2008 (1, leg.

Figs 1-2. Habitus, dorsal: 1 – *Lochmaea caprea* (L.), 2 – *L. suturalis* (Thoms.).

A.Barševskis); 4 km NW the Dīrikupīte River conect. with the Daugava River, 03.V.2006 (1, leg. A.Barševskis, U.Valainis, E.Rudāns); Preiļi d.: Jersika, 05.V.2005 (1, leg. I.Gurčonoks); Jersika, Kurpnieki house, 24.VI.2005 (1, leg. A.Barševskis), 23-24.VI.2006 (2, leg. A.Barševskis, K.Barševska), 04.IX.2007 (2, leg. A.Barševskis), 05.IX.2007 (4, leg. K.Barševska, A.Barševskis), 07.IX.2008 (1, leg. A.Barševskis, K.Barševska), 01-10.V.2009 (1, leg. A.Barševskis, K.Barševska), 30.V.2009 (2, leg. K.Barševska); Rēzekne d.: Gaigalava, 15.VII.2009 (1, old clearing, leg. A.Bukejs, M.Balalaikins); 6.5 km SE Mākoņkalns, Krepši, 24.VI.2008 (3, leg. R.Cibuļskis); Rīga d.: Rīga SE env., Rūķīši, 17.VII.1972 (1, leg. V.Pūtele); Talsi d.: Dundaga, 57°32‘31“N 22°30‘45“E, Kaļķupes ieleja PNT, 12.V.2009 (2, leg. M.Nitcis); Dāvida pļavas and Zilie kalni, Slītere National Park, 05.IX.2002 (3, leg. A.Barševskis), 11.VI.2005 (3, leg. A.Barševskis), 02.V.2006 (2, leg. A.Barševskis), V.2006 (1, leg. A.Barševskis), 10.VIII.2006 (1, leg. A.Barševskis); Kaļķi, 57°32‘31“N 22°30‘45“E, Kaļķupes ieleja PNT, 12.V.2009 (2, leg. A.Barševskis); Mazirbe, 24.VII.2004 (2, leg. A.Barševskis); Tukums d.: Ķemeri National Park, 26.VI.2006 (4, leg. A.Pankjāns, A.Barševskis, U.Valainis); Lielaisciems, Ķemeri National Park, 16.VII.2008 (4, leg. V.Alekseev); Pūre, 18.VII.2003 (1, leg. A.Barševskis); Valka d.: Mežole, 10.VI.2006 (1, leg. J.Donis); Seda, Sedas bog, 03.VII.2006 (1, leg. A.Barševskis, U.Valainis, A.Pankjāns); Strenči, 03.VII.2006 (1, leg. A.Barševskis, U.Valainis, A.Pankjāns); Valmiera d.: Kauguri parish, forest near the Gauja River, 03.VII.2006 (5, leg. A.Barševskis, U.Valainis, A.Pankjāns); Talava, 21.VIII.2006 (2, leg. A.Barševskis); Ventspils d.: Blāzma, 57°21‘12“N 22°04‘47“E, 22.VIII.2008 (1, clearing, leg. U.Valainis, K.Aksjuta, A.Barševskis); Moricsala Is., Moricsala Nature Reserve, VII.2003 (1, leg. U.Valainis), IX.2003. (3, leg. U.Valainis), 14.V.2004 (5, leg. A.Barševskis), 11.VII.2005 (1, leg. U.Valainis), 30.V.2006 (2, leg. E.Rudāns, A.Barševskis), 29.IX.2006 (2, leg. E.Rudāns, A.Barševskis), 15.VII.2008 (1, leg. A.Bukejs), 13.V.2009 (1, leg. A.Barševskis).

Host plants: *Salix, Betula*. In Latvia the species occurs mostly on *Salix* and *Betula*, rarely on *Alnus*, *Corylus*, *Populus* and *Quercus* (Pūtele 1976, 1984). In the literature, *Vaccinium* and *Ledum* (Ericaceae) are also mentioned as host plants (Bienkowski 1999, 2004).

Phenology: IV, V, VI, VII, VIII, IX

General distribution: Europe, Caucasus, Asia Minor, Kazakhstan (excl. S), Siberia, Russian Far East, China, Japan, Korean Peninsula. [ASE]

Note: Very common and widely distributed species in Latvia.

10. L. suturalis (Thomson, 1866)

References: Mikutowicz 1905; Rathlef 1921; Lackschewitz 1942; Pūtele 1974; Rūtenberga 1992; Barševskis 1993; Telnov *et al*. 1997; Telnov 2004; Kalniņš et al. 2007; Spuņģis 2008.

Examined material: 38 specimens: Daugavpils d.: Līksna parish, 2 km N Daugavpils, 04.V.2008 (3, inland dunes, edge of pine forest, on *Calluna*, leg. A.Bukejs); Līksna parish, 4 km N Daugavpils, 29.VI.2009 (2, edge of dry pine forest, on *Calluna*, leg. A.Bukejs); 3 km N Līksna, 24.IV.2008 (2, inland dunes, pine forest, on *Calluna*, leg. A.Bukejs); Ļūbaste env., near Svente‘s bridge, 16.IV.2007 (2, leg. A.Pankjāns); 3 km SW Oborūni, 29.IV.2008 (6, pine forest, on *Calluna*, leg. A.Bukejs); Pilskalne, Nature Park Pilskalnes Siguldiņa, 09.V.2005 (1, leg. A.Barševskis); Zaļumi, 02-16.IX.2001 (1, leg. G.Lociks); Jēkabpils d.: Dunava, 25.IV.2009 (1, leg. A.Barševskis); Rubeņi, 17.V.1997 (1, leg. I.Leiskina); Jelgava d.: Vecsvirlauka, 24.V.1972 (2, leg. V.Pūtele); Jūrmala: Kauguri, 01.V.1992 (1, leg. A.Barševskis); Kūdra, 01.V.2008 (1, leg. A.Titovs); Krāslava d.: Lake Čertoks env., 27.IV.2007 (1, leg. K.Aksjuta, M.Murd); Ludza d.: 1.5 km SW Gāgari, 56°26‘44“N 27°50‘02“E, 10.V.2008 (1, old clearing, leg. A.Bukejs); Ogre d.: Lēdmane, 17.VIII.2008 (1, leg. A.Barševskis); Preiļi d.: Jersika, Kurpnieki house, 06-07.VI.2006 (1, leg. A.Barševskis, K.Barševska); Līvani, 04.V.2006 (6, leg. A.Barševskis, K.Barševska); Talsi d.: Slītere National Park, Davida Pļavas (meadows) and Zilie Kalni (hills), 30.V.2006 (1, leg. A.Barševskis); Ventspils d.: Moricsala Is., Moricsala Nature Reserve, IX.2003 (1, leg. U.Valainis), 29.V.2006 (2, leg. A.Barševskis, E.Rudans), 30.V.2006 (1, leg. E.Rudāns), 29.IX.2006 (1, leg. E.Rudāns, A.Barševskis).

Host plants: *Calluna vulgaris* (Ericaceae). Monophagous species.
Phenology: IV, V, VI, VII, VIII, IX
General distribution: Europe. [EUR]
Note: Rather infrequent and insufficiently known species in Latvia.

11. L. crataegi (Forster, 1771)

References: Pūtele 1974 (misidentifications); Barševskis 1993 (misidentifications); Telnov *et al*. 1997; Telnov 2004; Kalniņš et al. 2007.
Examined material: Not confirmed by the author. Some previous reports of this species, "Jelgava d.: Jelgava E env., Mežciems, 13.VIII.1972 (1, leg. V.Pūtele)" (Pūtele 1974), "Rīga d.: Rīga SE env., Rūķīši, 17.VII.1972 (1, leg. V.Pūtele)" [in collection of V.Pūtele], and "Daugavpils d.: Naujene, 20.V.1988 (1, leg. A.Barševskis); Višķi, 02.VI.1987 (1, leg. A.Barševskis)" (Barševskis 1993), were based on misidentifications.
Host plants: *Crateagus, Malus, Prunus* (Rosaceae).
General distribution: Europe, Siberia, Kazakhstan, Mongolia, Russian Far East. [SIE]
Note: Very rare species in Latvia; reported only from Gauja National Park (Kalniņš et al. 2007). According to the catalogue of Silfverberg (2004), it is mentioned for Denmark, Latvia, Lithuania and Sweden; known also from S Belarus (Lopatin, Nesterova 2005).

Galeruca Geoffroy, 1762

syn.: *Adimonia* Laicharting, 1781

12. G. tanaceti (Linnaeus, 1758)

Fig. 3. Aedeagus, dorsal and lateral: A – *Lochmaea caprea* (L.), B – *L. suturalis* (Thoms.).

References: Precht 1818 (*Galleruca*); Seidlitz 1872-1875 (*Adimonia*), 1887-1891 (*Adimonia*); Ulanowski 1883; Rathlef 1905; Brammanis 1930; Trauberga 1957; Pūtele 1974, 1980, 1981a, 1981b; Stiprais 1977; Barševskis 1988, 1993 (*Galerucha*), 2002; Telnov *et al*. 1997; Princovs 2000; Telnov 2004; Petrova *et al*. 2006; Kalniņš et al. 2007; Bukejs, Telnov 2007.
Examined material: 199 specimens: Aizkraukle d.: Mazzalve, VIII.2007 (2, leg. A.Grenciņa-Grencione); Pļaviņas, Gostiņi house, 06.VIII.2007 (1, leg. A.Barševskis); Rīteri, 21.VI.2006 (1, leg. A.Barševskis); Daugavpils d.: Bebrene, 02.IX.2006 (4, leg. E.Rudāns), 23.IX.2006 (1, leg. E.Rudāns); Butišķi, Nature Park Daugavas Loki, 03.VIII.2007 (1, valley of the Daugava River, leg. A.Bukejs & M.Balalaikins), 25.VII.2008 (1, valley of the Daugava River, meadow, leg. A.Bukejs); Daugavpils N env., Mežciems env., 01.VII.1991 (1, leg. A.Barševskis); Dviete, 20.VIII.2006 (1, leg. A.Barševskis), 31.VII.2008 (1, forest, leg. A.Barševskis); Ilgas, Silene Nature Park, 04.VII.1989 (1, leg. A.Barševskis), 07.VII.1991 (1, near Lake Riču, leg. A.Barševskis), 29.IV-10.VII.2000 (3, leg. A.Rutka), VI-VII.2000 (6, leg. I.Haka & G.Hļebnaja), 14.VI.2001 (2, leg. G.Lociks), 14.V.2002 (1, leg. U.Valainis), V.2002 (3, leg. U.Valainis), 14-20.VI.2002 (3, leg. A.Barševskis), VI.2002 (4, leg. A.Barševskis), 12.VII.2002 (3, leg. U.Valainis), VIII.2002 (4, leg. A.Barševskis), 02.IX.2002 (1, leg. A.Barševskis), 25-29.VI.2007 (1, leg. V.Krone), 13.IX.2007 (4, leg. A.Barševskis), 17.VI.2008 (1, leg. R.Cibuļskis), 17-20.VI.2008 (4, leg. V.Krone, J.Staskeviča), 17-20.VI.2008 (1, leg. J.Daņilova, A.Zdankovska), 27.VI.2008 (2, leg. T.Vasiljeva, S.Pupiņa), 01.VII.2008 (1, leg. I.Irbe), 02.VII.2008 (5, leg. T.Vasiljeva), 01-03.VII.2008 (2, leg. N.Mihailova), 01-04.VII.2008 (2, leg. R.Cibuļskis); Līksna parish, 3 km N Daugavpils, 28.VI.2009 (1, inland dunes, leg. A.Bukejs); Lociki, 25.VI.2007 (3, leg. A.Barševskis); Salienas parish, Daugavsargu loks, 1.5 km NW Ritāni, 30.VI.2009 (1, edge of forest, leg. A.Bukejs); Slutišķi, 14.VI.1989 (1, leg. A.Barševskis); Stropi, 02.VII.2008 (1, clearing, leg. A.Bukejs), 10.VIII.2009 (1, leg. A.Bukejs); Svente, 13.VII.2008 (1, meadow, leg. A.Bukejs); Vasarģelišķi, Nature Park Daugavas Loki, 11.VII.2008 (4, valley of the Daugava River, leg.

A.Barševskis, V.Alekseev); Dobele d.: near Liepāja road, near Ķemeri National Park, 02.X.2008 (1, leg. R.Orlovskis); Jēkabpils d.: Asare, 10.VIII.2001 (1, leg. I.Leiskina); Dunava, 26.VIII.1999 (1, leg. I.Leiskina), 01-08.VII.2006 (2, leg. A.Barševskis, K.Barševska), 07-08.X.2006 (11, leg. A.Barševskis), 21.X.2006 (1, leg. A.Barševskis), 10-19.VI.2007 (1, leg. K.Barševska), 16-21.VI.2007 (1, leg. K.Barševska), 23-30.VI.2007 (4, leg. K.Barševska), 20-30.VIII.2007 (2, leg. K.Barševska), 30.IX.2007 (9, leg. A.Barševskis), 01-14.VIII.2008 (1, leg. K.Barševska); Gārsene, 10.VIII.2001 (1, leg. I.Leiskina); Jēkabpils, 16-17.VIII.2008 (1, aerodrome, leg. M.Balalaikins); Rubeņi, 18.VII.1997 (1, leg. I.Leiskina), 06.VII.1999 (1, leg. I.Leiskina), 14.VII.1999 (1, leg. I.Leiskina); Zasa, 15.VIII.2000 (1, leg. I.Leiskina), 28.VII.2001 (1, leg. I.Leiskina); Zasa NW env., Leimaņi, 14.VIII.2001 (1, leg. I.Leiskina); Krāslava d.: Ezernieki, Garaudži house, Rāzna National Park, 24.VII.2008 (3, leg. U.Valainis, R.Cibuļskis); Indrica, 17.VI.1989 (1, leg. A.Barševskis); Izvalta, VI (3, leg. A.Barševskis); Krāslava, 26.IX.2007 (1, leg. K.Igaune); 3.6 km NEE Skaista, Grundāni, Lake Dridzis Nature Park, 15.VII.2008 (5, leg. R.Cibuļskis); Šķeltova, 12.VII.1986 (3, leg. A.Barševskis), VII.2002 (1, leg. A.Barševskis), 17.VII.2008 (1, leg. A.Barševskis), VII.2009 (1, leg. A.Barševskis); Stivriņi, 26.VII.1986 (1, leg. A.Barševskis); Ūdrīši, Zapoļniki house, 30.VIII-01.IX.2007 (2, leg. M.Murd); Tartaks, 05.VII.2008 (1, leg. A.Soldāns); Velnezers Nature Reserve, 11.VII.2008 (2, leg. A.Barševskis, V.Alekseev); Kuldīga d.: Skrunda, 05.IX.2008 (2, leg. R.Orlovskis, A.Barševskis); Ogre d.: Jumprava, 10.VII.2008 (1, leg. A.Barševskis); Preiļi d.: Jersika, 30.IV.2005 (1, leg. I.Gurčonoks); Jersika, Kurpnieki house, 04-05.VIII.2007 (1, leg. A.Barševskis), 01.VIII.2008 (1, leg. A.Barševskis), 07.IX.2008 (1, leg. A.Barševskis, K.Barševska), 22-25.IX.2008 (2, leg. A.Barševskis), 22-24.VI.2009 (1, leg. A.Barševskis); Rēzekne d.: Lūznava, Zosna, Rāzna National Park, 24.VII.2008 (1, leg. R.Cibuļskis, U.Valainis); Makoņkalns vill., 03.VIII.1992 (1, leg. A.Barševskis); Sprukti, 08.VII.2008 (1, leg. M.Balalaikins); Stoļerova, Lake Šostu env., 29.VII.2009 (1, leg. M.Balalaikins); Rīga city: Biķernieki, 04.XI.2008 (2, leg. V.Ferber); Rīga, Daugavgrīva, 10.X.1992 (2, leg. M.Kalniņš); Rīga d.: Mārupe env., 07.VII.2009 (1, leg. K.Barševska, A.Barševskis); Saulkalne, 22.IX.2007 (3, leg. A.Barševskis); Saulkrasti SW env., Inčupe train station env., 16.IX.1974 (1, flood-lands, leg. anonymous); Talsi d.: Slītere National Park, Zilie Kalni and Dāvida Pļavas, VII.2003 (1, leg. A.Barševskis), 10.VII.2004 (1, leg. A.Barševskis), VII.2008 (1, leg. A.Barševskis, U.Valainis); Tukums d.: 56°556‘04“N 23°10‘50“E, 19.VII.2007 (1, leg. A.Barševskis, A.Soldāns, A.Pankjāns, U.Valainis); 5 km NW Tukums, near Jaunmoku castle, 16.VII.2008 (1, leg. A.Barševskis); Valka d.: Strenči, 03.VII.2008 (2, leg. A.Barševskis, U.Valainis, A.Pankjāns); Valmiera d.: Sprosti house, 57°34‘58“N 25°20‘15“E, 21.VIII.2006 (1, leg. A.Pankjāns); Ventspils d.: Moricsala Is., Moricsala Nature Reserve, 29.VI.2002 (2, leg. U.Valainis), IX.2003 (1, leg. U.Valainis), X.2003 (1, leg. U.Valainis), 09.VII.2004 (1, leg. A.Barševskis), 06.X.2006 (4, leg. J.Staskeviča, A.Barševskis), 26.X.2006 (9, leg. E.Rudāns), 04-05.X.2007 (2, leg. A.Barševskis).

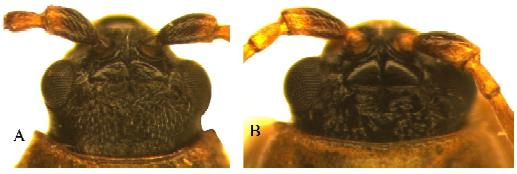

Fig. 4. Head, dorsal: A – *Lochmaea caprea* (L.), B – *L. suturalis* (Thoms.).

Host plants: Compositae, Labiatea, Fabaceae. In the literature, Brassicaceae, Caryophyllaceae, Solanaceae, Plantaginaceae, Boraginaceae and Ranunculaceae are also mentioned as host plants (Bieńkowski 2004).

Phenology: V, VI, VII, VIII, IX, X

General distribution: Europe, Caucasus, Asia Minor, Siberia, S Kazakhstan, Central Asia (Kyrgyzstan), Russian Far East, Mongolia, Japan, E China, Korean Peninsula; introduced also to N America. [ASE]

Note: Very common and widely distributed species in Latvia.

***13. G. interrupta* (Illiger, 1802)**
References: Lackschewitz, Mikutowicz 1939 (*interrupta* Ol.); Stiprais 1977; Telnov *et al*. 1997; Telnov 2004.
Examined material: 2 specimens: Liepāja d.: Pape, 23-25.VI.1994 (2, dunes, seashore, leg. N.Savenkovs).
Host plants: *Artemisia* (Compositae).
Phenology: VI
General distribution: Europe, NW Africa, Asia Minor, Near East, Caucasus, Central Asia, Mongolia. [CEM]
Note: Very rare, known from five localities.

***14. G. pomonae* (Scopoli, 1763)**
syn.: dispar Joannis, 1866; *erratica* Joannis, 1865; *rustica* Thomson, 1866; *rustica* Schaller, 1883
References: Precht 1818 (*rustica*); Seidlitz 1872-1875 (*Adimonia rustica* Schall.), 1887-1891 (*Adimonia rustica* Schall.); Ulanowski 1883; Rathlef 1905; Trauberga 1957; Stiprais 1977; Barševskis 1993 (*Galerucha*); Telnov *et al*. 1997; Telnov 2004; Kalniņš et al. 2007.
Examined material: 9 specimens: Daugavpils d.: Daugavpils, 08.VII.1991 (1, xeric habitat, leg. A.Barševskis); 4 km NE Geitviniški, 55°54‘51“N 26°53“47“E, 13.VIII-17.IX.2008 (1, leg. A.Bukejs, A.Pankjāns); Līksna parish, 3 km N Daugavpils, 55°56‘01“N 26°33‘36“E, 28.VII.2009 (1, inland dunes, leg. A.Bukejs); Slutišķi, 05.IX.1994 (1, leg. A.Barševskis); Krāslava d.: Kaplava S env., Varnaviči, Augšdaugava PNT, 06.IX.2008 (1, leg. A.Pankjāns); NEE Skaista, Grundāni house, Lake Dridzis Nature Park, 15.VII.2008 (1, leg. R.Cibuļskis); Šķeltova, 28.VIII.1992 (1, leg. A.Barševskis); Jēkabpils d.: Dunava, 56°12‘93“N 26°12‘17“E, 07-08.X.2006 (1, leg. A.Barševskis); Preiļi d.: Aglona, 28.VI.2008 (1, leg. J.Kundziņš).
Host plants: Compositae. In the literature, Cruciferae are mentioned also as host plants (Bieńkowski 2004).
Phenology: VI, VII, VIII, IX, X (1)
General distribution: Europe, Caucasus, Asia Minor, N Iran, south part of W Siberia, Kazakhstan, Central Asia, Mongolia. [CAE]
Note: Rare species in Latvia.

***15. G. laticollis* Sahlberg, 1838**
References: Seidlitz 1872-1875 (*Adimonia*), 1887-1891; Rathlef 1905; Pūtele 1974, 1980, 1981a, 1981b, 1984; Telnov *et al*. 1997; Telnov 2002, 2004.
Examined material: 10 specimens: Jēkabpils d.: Dignāja, 01.VIII.2005 (1, leg. A.Barševskis); Madona d.: Ošupe env., 2.5 km NE Lake Lubāns, 56°50‘03“N 26°56‘05“E, 06.VII.2008 (3, wet meadow, leg. M.Balalaikins, A.Bukejs); Valka d.: Smiltene, 03.VIII.1973 (1, leg. V.Pūtele); Talsi d.: Slītere, 13.VIII.1977 (1, leg. V.Pūtele), 27.VII.1982 (2, leg. V.Pūtele), 21.VIII.1983 (1, leg. V.Pūtele), 22.VIII.1983 (1, leg. V.Pūtele).
Host plants: *Thalictrum flavum, Aconitum napelus* (Ranunculaceae).
Phenology: VII, VIII
General distribution: Europe, Kazakhstan, Siberia. [SIE]
Note: Very rare, known from five localities.

(-) *G. dahlii* (Joannis, 1865)
References: Telnov *et al*. 1997; Telnov 2004.
Examined material: Not confirmed by the author. Earlier record of this species, “Valka d.: Smiltene, 03.VIII.1973 (1, leg. V.Pūtele)” [in collection of V.Pūtele], was based on misidentification and concern to *G. laticollis* Sahlb.
Host plants: *Cirsium* (Compositae), *Thalictrum* (Ranunculaceae) (Bieńkowski 2004).
General distribution: Europe (from France, N Italy, Germany, Austria, northern part of basin of Danube, S Poland, Romania, S Ukraine, Crimea), Siberia. [SIE]
Note: The occurrence of the species in Latvian fauna is doubtful. Faunistical data on this species in Latvia are absent. Only in Seidlitz (1872-1875, 1887-1891) *dahlii* Joann. was mentioned as synonym of *laticollis* Sahlb. Therefore it is deleted from the list of Latvian Coleoptera.

HYLASPINI CHAPUIS, 1875

***SERMYLASSA* REITTER, 1912**
***16. S. halensis* (Linnaeus, 1767)**
References: Barševskis 2001; Telnov 2004; Telnov *et al.* 2006.
Examined material: 14 specimens: Liepāja d.: Medze env., Upmaļi, 12.VII.2008 (13, sea-coast,

leg. A.Barševskis); Pape, 28.VIII-04.IX.1995 (1, leg. N.Savenkovs).

Host plants: *Galium* (Rubiaceae). In the literature, *Urtica* is also mentioned as host plant (Bieńkowski 2004).

Phenology: VII, VIII

General distribution: Europe (excluding N), Caucasus, south part of W Siberia, Altai, Kazakhstan and Central Asia. [CAE]

Note: Very rare species with three known localities in SE Latvia (Liepāja district, Baltic Sea coast). North border of main distribution area.

Agelastica Chevrolat, 1836

17. A. alni (Linnaeus, 1758)

References: Fischer 1784 (*Chrysomela*), 1791 (*Chrysomela*); Groschke 1805 (*Chrysomela alni*); Precht 1818 (*Galleruca alni*); Kawall 1866 (*Chrysomela alni*); Seidlitz 1872-1875, 1887-1891; Ulanowski 1883; Sintenis 1900; Rathlef 1905; Brammanis 1940; Danka 1950; Trauberga 1957; Rupais 1959, 1999; Šmits , Spuris 1966; Spuris 1974; Pūtele 1974, 1977, 1980, 1981a, 1981b, 1982, 1984; Priedītis, Pūtele 1976; Stiprais 1977; Priedītis 1979; Barševskis 1988, 1993, 2002; Rūtenberga 1992; Telnov *et al*. 1997; Telnov 2004; Kalniņš et al. 2007; Bukejs, Telnov 2007; Spuņģis 2008.

Examined material: 267 specimens: Aizkraukle d.: Aizkraukle, 06.VIII.2002 (4, leg. A.Barševskis); 6 km N Aizkraukle, Aizkraukles purvs (bog) PNT, 01.VII.2008 (2, leg. A.Pankjāns), 01.VII.2008 (3, leg. A.Bukejs); Ērberģe, 12.VIII.2008 (1, leg. A.Barševskis); Nereta, 15.IV.2008 (3, leg. A.Barševskis); Rīteri, 14.VI.2006 (4, leg. A.Barševskis), 20.VI.2006 (1, leg. A.Barševskis), 21.VI.2006 (1, leg. A.Barševskis), 26.IV.2008 (2, leg. A.Barševskis), V.2009 (3, leg. A.Barševskis); Skrīveri, 19.VI.2006 (1, leg. A.Barševskis), 21.VI.2006 (1,valley of the Daugava River, leg. A.Barševskis), 21.VI.2006 (1, leg. M.Nitcis), 26.IV.2008 (2, arboretum, leg. A.Barševskis); Valle, 12.VIII.2008 (3, leg. A.Barševskis); Balvi d.: Kuprava, 26.VIII.1994 (1, leg. A.Barševskis); Bauska d.: Bārbele, 08.V.2009 (1, leg. A.Barševskis, R.Orlovskis); Cēsis d.: Ciruļīšu rock, 24.III.2007 (1, leg. E.Rudāns); Daugavpils d.: Bebrene, 04.V.2006 (7, leg. E.Rudāns), 05.V.2006 (4, leg. E.Rudāns), 14.V.2006 (2, leg. E.Rudāns), 20.V.2006 (1, leg. E.Rudāns), 15.VI.2006 (1, leg. E.Rudāns), 23.IX.2006 (1, leg. E.Rudāns), 25-26.XII.2006 (1, under bark, leg. E.Rudāns); Butišķi, 01.VII.2009 (1, valley of the Daugava River, leg. A.Bukejs, M.Balalaikins); Daugavpils, Centre, 02.V.1993 (1, bank of the Daugava River, leg. A.Barševskis), Daugavpils, Križi, 20.V.2001 (1, leg. G.Lociks), Daugavpils, near Mežciems, 01.VI.2008 (1, bank of the Daugava River, leg. A.Bukejs), Daugavpils, Ruģeļi, 16.V.2006 (1, leg. V.Kokina); Dviete, 11.V.1996 (2, leg. A.Lapa), 11.V.2008 (1, Daugava riverside, leg. A.Pankjāns), 31.VII.2008 (2, forest, leg. A.Barševskis); Elerne, Muravki house, 26.VI.2006 (1, leg. A.Barševskis, K.Barševska); Ilgas, Silene Nature Park, 19.VI.1994 (1, leg. A.Barševskis), 21-24.IV.1995 (1, leg. A.Barševskis), 09.V.1996 (1, leg. A.Barševskis), 09.IX.1997 (3, leg. A.Barševskis), 29.IV-10.VII.2000 (9, leg. L.Nikitina), 29.IV-10.VII.2000 (2, leg. A.Rutka), VI-VII.2000 (7, leg. I.Haka & G.Hļebnaja), 06-15.VI.2004 (4, leg. A.Barševskis), 18.V.2005 (3, leg. A.Barševskis), 21.VI.2005 (1, bank of Lake Riču, on *Alnus incana*, leg. A.Bukejs), 17.VII.2005 (1, leg. A.Barševskis), 05-10.VI.2006 (1, leg. L.Jakubāne), 27.VI.2009 (1, leg. A.Barševskis); Ilūkste, 28-29.VI.2008 (1, leg. S.Piopiņa); Kalnišķi, 55°52‘54“N 26°44‘03“E, 21.VIII.2009 (1, bank of the Daugava River, on Salix, leg. A.Bukejs, M.Balalaikins); Līksna parish, 2 km N Daugavpils, 04.V.2008 (1, inland dunes, edge of pine forest, leg. A.Bukejs), 3 km N Daugavpils, 27.V.2009 (1, inland dunes, roadside, leg. A.Bukejs); Lociki, 26.V.2001 (1, leg. G.Lociks); Ļūbaste, 18.IV.1993 (4, leg. A.Barševskis); Naujene, Daugavas Loki Nature Park, 04.V.2008 (1, leg. K.Barševska, A.Barševskis); Nīcgale, 12.V.2001 (1, leg. G.Lociks); Šarlote, 01.V.2008 (1, leg. K.Aksjuta), 11.V.2008 (2, leg. K.Aksjuta); Šedere, Straumēni house, 01-03.V.2008 (1, leg. M.Janovska), 01-04.V.2009 (3, leg. M.Janovska); Slutišķi, 12.VI.1987 (3, leg. A.Barševskis); Svente, Sasaļu forest PNT, 20.I.2008 (1, leg. A.Barševskis); Vabole, 1993 (2, leg. M.Jukšs); 1.5 km SW Vecpils, 55°54‘710“N 26°43‘515“E, 09.V.2008 (1, leg. R.Cibuļskis); Vecsaliena, Lejzemnieki house, 21.V.2008 (1, bank of the Mārkalne River, leg. A.Pankjāns); Višķi, 02.VI.1987 (1, leg. A.Barševskis); Gulbene d.: Lejasciems, 30.IX.2005 (1, leg. A.Barševskis, A.Bukejs, U.Valainis); Ušurs, 08.VI.2005 (1, along marsh,

leg. A.Barševskis); Jēkabpils d.: Ābeļu parish, bank of Rive Daugava, 17.V.1995 (2, leg. A.Barševskis); Aknīste, 10.VIII.2001 (1, leg. I.Leiskina); Asare, 02.III.1998 (1, leg. I.Leiskina); Dignāja, 28.VII.1999 (1, leg. I.Leiskina); Dunava, 20.VIII.2000 (1, leg. I.Leiskina), 07.VIII.2001 (1, leg. I.Leiskina), 14.V.2005 (1, leg. A.Barševskis), 10-18.VI.2006 (1, leg. K.Barševska), 18.V.2008 (1, forest, leg. A.Barševskis), 01.VI.2008 (1, leg. A.Barševskis), 09-10.VIII.2008 (1, leg. A.Barševskis); Jēkabpils, near Jēkabpils hospital, 13.V.2006 (4, leg. K.Barševska & A.Barševskis); Mežāre, 04.IX.2009 (1, leg. M.Balalaikins); Rubene, 25.IV.1998 (1, leg. I.Leiskina), 11.IV.1999 (1, leg. I.Leiskina), 02.VIII.1999 (1, leg. I.Leiskina); Vandāni, 16.VIII.2008 (2, bank of the Daugava River, leg. A.Barševskis); Zasa, 15.VIII.2000 (1, leg. I.Leiskina), 14.VIII.2001 (1, leg. I.Leiskina); Krāslava d.: Krāslava, 11.VI.1987 (8, leg. A.Barševskis); Sauleskalns, 4.5 km NE Kombuļi, 04.V.2008 (2, leg. K.Barševska, A.Barševskis); Šķeltova, 09.V.1993 (1, leg. A.Barševskis), 21.V.1994 (1, leg. A.Barševskis), 15.VII.1994 (2, leg.A.Barševskis); Ūdrīši, Zapoļniki house, 06.V.2007 (1, leg. M.Murd); Kuldīga d.: Skrunda, 05.IX.2008 (5, leg. R.Orlovskis, A.Barševskis); Liepāja d.: Durbe, 05.IX.2008 (3, leg. R.Orlovskis, A.Barševskis); Limbaži d.: Salacgrīva, Veczemu rock, 17.VIII.2008 (2, leg. A.Barševskis); Madona d.: Kalsnava, 03.VII.2006 (1, leg. A.Barševskis, U.Valainis, A.Pankjāns); Ogre d.: Lēdmane, 17.VIII.2008 (3, leg. A.Barševskis); Lielvārde, 19.IX.1992 (1, leg. anonymous); the Ņega River connect. with the Daugava River, 29.VI.2006 (3, leg. A.Barševskis), 29.VI.2006 (1, leg. U.Valainis), 29.VI.2006 (5, leg. A.Pankjāns); Robežnieki, 30.V.2006 (2, leg. E.Rudāns); Preiļi d.: Aglona, near the Tartaka River, 56°08‘94“N 26°59‘27“E, 14.VIII.2006 (1, leg. A.Barševskis); Jersika, 16.IV.2005 (2, leg. I.Gurčonoks); Jersika, Kurpnieki house, 22.V.2005 (1, leg. A.Barševskis), 04.V.2006 (9, leg. K.Barševska), 14.V.2006 (1, leg. K.Barševska), 20.V.2006 (1, leg. K.Barševska), 26-28.V.2006 (3, leg. K.Barševska), 04.VI.2006 (2, leg. K.Barševska), 07.VI.2006 (1, leg. A.Barševskis, K.Barševska), 10-18.VI.2006 (1, leg. K.Barševska), 17.VI.2006 (2, leg. A.Barševskis), 23-24.VI.2006 (3, leg. A.Barševskis, K.Barševska), 02.IX.2006 (1, leg. A.Barševskis), 05-06.V.2007 (10, leg. K.Barševska, A.Barševskis), 12.V.2007 (2, leg. A.Barševskis), 15.V.2007 (1, leg. A.Barševskis), 20.V.2007 (3, leg. A.Barševskis), 27.V.2007 (1, leg. A.Barševskis), 09-10.VI.2007 (1, leg. K.Barševska, A.Barševskis), 05.IX.2007 (3, leg. K.Barševska, A.Barševska), 27.IV.2008 (1, leg. K.Barševska), 09.V.2008 (1, leg. A.Barševskis), 24.V.2008 (1, leg. A.Barševskis), 31.V.2008 (1, leg. A.Barševskis), 13.VI.2008 (2, leg. A.Barševskis), 17.VI.2008 (1, leg. A.Barševskis), 23-24.VI.2008 (2, leg. A.Barševskis), 07.IX.2008 (2, leg. A.Barševskis, K.Barševska), 22-25.IX.2008 (4, leg. A.Barševskis), 11-12.IV.2009 (1, leg. A.Barševskis), 28.IV.2009 (1, leg. A.Barševskis, K.Barševska), 01-10.V.2009 (2, leg. A.Barševskis, K.Barševska); Pelēči, 18.VIII.1997 (1, leg. I.Jurkjāne); Sutri, 14.VIII.2008 (3, leg. A.Barševskis); Rēzekne d.: Puša, 25.V.2002 (1, leg. A.Barševskis); Rīga d.: Carnikava, 22.V.1974 (1, meadow, leg. Varzinska); Mālpils, 16.VIII.2008 (3, leg. A.Barševskis); Olaine, 19.IX.2006 (1, leg. J.Donis); Saulkalne, 20.V.2006 (1, leg. A.Barševskis); Saulkrasti, 16.VIII.2008 (2, leg. A.Barševskis); Saukrasti SW env., Inčupe train station env., 14.VI.1974 (1, meadow, leg. anonymous); Saldus d.: Brocēņi, 05.IX.2008 (1, leg. A.Barševskis, R.Orlovskis); Talsi d.: Ances meži un purvi (forests and bog) PNT, 27.VI.2006 (1, leg. U.Valainis); Krievragciems, 18.VI.1958 (1, leg. J.Zariņš); Mazirbe, 05.VIII.2002 (3, leg. A.Barševskis); Slītere National Park, Zilie Kalni and Dāvida Pļavas, 06.VI.2002 (1, leg. A.Barševskis), VII.2003 (1, leg. A.Barševskis); Valmiera d.: Burtnieku parish, Briede, 57°39‘85“N 25°13‘54“E, 21.VIII.2006 (4, leg. A.Barševskis).

Host plants: *Alnus*, rarely on *Betula, Corylus*. In Latvia, the species occurs mostly on *Alnus*, rarely on *Betula*, *Corylus avelana*, *Salix*, *Populus* and *Padus racemosa* (Pūtele 1977).

Phenology: IV, V, VI, VII, VIII, IX

General distribution: Europe, Asia Minor, Caucasus, Siberia, Kazakhstan, Cenrtal Asia, NW China, Korean Peninsula; introduced also to North America. [ASE]

Note: Very common and widely distributed species in Latvia.

LUPERINI GISTEL, 1848

***PHYLLOBROTICA* CHEVROLAT, 1836**

***18. Ph. quadrimaculata* (Linnaeus, 1758)**
References: Precht 1818 (*Galleruca*); Seidlitz 1872-1875, 1887-1891; Ulanowski 1883; Rathlef 1905; Pūtele 1974, 1984; Stiprais 1977; Barševskis 1988, 1993, 2002; Telnov *et al*. 1997; Telnov 2004; Kalniņš et al. 2007; Bukejs, Telnov 2007.
Examined material: 51 specimens: Aizkraukle d.: Aizkraukle, 21.VI.1995 (4, broad-leaved forest, leg. A.Barševskis); Daugavpils d.: Ilgas, Silene Nature Park, 01.VI.1986 (1, leg. A.Barševskis), 29.VI.1988 (1, leg. A.Barševskis), 16.VI.1995 (1, leg. A.Barševskis), 27.VI.1995 (1, leg. A.Barševskis), 05.VII.1995 (1, leg. A.Barševskis), 28.VI.1996 (1, leg. A.Barševskis), 25-27.VI.2007 (1, leg. A.Čukļiņa, J.Daņilova), 01.VII.2008 (2, leg. I.Irbe), 01-03.VII.2008 (1, leg. J.Kundziņš), 27.V-01.VI.2009 (1, leg. R.Cibuļskis); Stropi, 17.VII.2006 (2, leg. A.Bukejs); Višķi, 09.VI.1986 (1, leg. A.Barševskis); Jēkabpils d.: Dunava, 16.VII.1995 (3, leg. A.Barševskis), 17.VII.1995 (5, leg. A.Barševskis); Vandāni, 16.VIII.2008 (1, bank of the Daugava River, leg. M.Balalaikins); Zasa, 19.VI.2000 (1, leg. I.Leiskina); Krāslava d.: 4 km W Skaista, Orupi, Lake Dridzis Nature Park, 15.VII.2008 (2, leg. R.Cibuļskis); Šķeltova, 31.VII.1993 (1, leg. A.Barševskis); Ogre d.: Ķegums, left bank of the Daugava River, 11.VII.2006 (1, leg. A.Barševskis); Rēzekne d.: Ezernieki, Rāzna National Park, 24.VII.2008 (1, park, leg. R.Cibuļskis, U.Valainis); Rīga d.: Carnikava, Gauja train station, 16.VII.1992 (1, meadow, leg. R.Matrozis), 19.VII.1992 (1, leg. R.Matrozis); Saldus d.: Blīdene, 11.VII.2006 (1, leg. A.Barševskis & K.Barševska); Talsi d.: Šķēde, 25.VII.1975 (2, leg. V.Pūtele); Valmiera d.: Mazsalaca NW env., Ģenderti house, 13.VIII.1992 (1, leg. anonymous); Ventspils d.: Moricsala Is., Moricsala Nature Reserve, 29.VI.2002 (1, leg. U.Valainis), V.2003 (1, leg. U.Valainis), IX.2003 (1, leg. U.Valainis), X.2003 (1, window trap, leg. U.Valainis), 03.VIII.2004 (1, leg. U.Valainis), VII.2005 (1, leg. A.Barševskis), 15.VII.2008 (3, leg. A.Bukejs), 15.VII.2008 (4, leg. V.Alekseev, A.Pavlova), 15.VII.2008 (1, leg. A.Barševskis); Jūrkalne, 28.VII.2005 (1, leg. A.Barševskis, A.Bukejs, U.Valainis); ? d.: Klumpji, 16.VIII.1973 (1, leg. V.Pūtele).
Host plants: *Scutellaria galericulata, Stachys palustris* (Labiatae).
Phenology: V, VI, VII, VIII, IX
General distribution: Europe, N Caucasus, N and E Kazakhstan, Siberia. [SIE]
Note: Rather infrequent and insufficiently known species in Latvia. Hitherto, it was known only from 8 localities.

***Calomicrus* Dillwyn, 1829**
***19. C. pinicola* (Duftschmid, 1825)**
References: Seidlitz 1887-1891 (*Luperus*); Rathlef 1905 (*Luperus*); Ozols 1982, 1985; Telnov *et al.* 1997; Telnov 2004; Kalniņš et al. 2007; Spuņģis 2008; Barševskis *et al*. 2008.
Examined material: 2 specimens: Talsi d.: Slītere National Park, 29.VII.2005 (1, leg. A.Barševskis); Tukums d.: Ķemeri National Park, 28.VI.2006 (1, leg. A.Pankjāns).
Host plants: *Pinus* (Pinaceae).
Phenology: V, VI, VII
General distribution: Europe, Turkey. [EUR]
Note: Rare species in Latvia, with few records.

***Luperus* Geoffroy, 1762**
(-) *L. luperus* (Sulzer, 1776)
syn.: *lyperus* Bedel, 1897; *niger* Goeze, 1777; *rufipes* Goeze, 1777
References: Barševskis 1993 (misidentification); Telnov *et al*. 1997; Telnov 2004.
Examined material: Not confirmed by the author. Earlier records of this species, "Jēkabpils d.: Dunava, 23.VI.1993 (2, leg. A.Barševskis)" (Barševskis 1993), and "Daugavpils d.: Špoģi, 07.VII.1977 (1, leg. V.Pūtele); Cēsis d.: Lake Inesis, 10.VII.1977 (1, leg. V.Pūtele) " [in collection of V.Pūtele], were based on misidentifications.
Host plants: *Salix, Ulmus*.
General distribution: C and S Europe, south part of W Siberia, Altay, Mongolia. [CAE]
Note: Faunal data on this species in Latvia are absent. Therefore it is deleted from the list of Latvian Coleoptera. This species is reported also for Belarus (Lopatin, Nesterova 2005) and Lithuania (Silfverberg 2004).

***20. L. longicornis* (Fabricius, 1781)**
syn.: *betulinus* Joanis, 1865; *diniensis* Bellier, 1870; *rufipes* Gyllenhal, 1813
References: Fleischer 1829 (*rufipes* F.); Seidlitz 1872-1875, 1887-1891; Rathlef 1905; Stiprais 1977;

Priedītis 1971b, 1979; Pūtele 1980, 1981b, 1984; Telnov *et al*. 1997; Telnov 2004; Kalniņš et al. 2007.

Examined material: 48 specimens: Aizkraukle d.: 6 km N Aizkraukle, Aizkraukles purvs (bog) PNT, 01.VII.2008 (1, clearing, on *Salix*, leg. A.Bukejs), 06.VIII.2008 (1, leg. A.Bukejs, M.Balalaikins); Cēsis d.: Rozula, 11.VII.1977 (1, leg. V.Pūtele); Daugavpils d.: Ilgas, Silene Nature Park, 14-20.VI.2002 (1, leg. A.Barševskis), 10-12.IX.2002 (1, leg. A.Barševskis); Līksna parish, 4 km N Daugavpils, 29.VI.2009 (6, inland dunes, roadside in pine forest, on *Betula*, leg. A.Bukejs); Ļūbaste env., 01.VII.1995 (4, xeric meadow, leg. A.Barševskis); Rēzekne d.: Gaigalava, 15.VII.2009 (2, old clearing, leg. A.Bukejs, M.Balalaikins); Stoļerova, Lake Šostu env., 29.VII.2009 (1, clearing, leg. M.Balalaikins); Rīga d.: Lake Kanieris, Ķemeri National Park, 16.VI.2007 (1, leg. A.Pankjāns); Talsi d.: Stende, 19.VII.2007 (25, clearing, leg. A.Barševskis, U.Valainis, A.Pankjāns, A.Soldāns); Slītere National Park, Zilie Kalni (hills) and Dāvida Pļavas (meadows), 17.VII.2005 (2, leg. A.Barševskis); Ventspils d.: Puze, 30.VII.1974 (1, leg. V.Melecis).

Host plants: *Salix, Ulmus*.

Phenology: VI, VII, VIII, IX

General distribution: Europe, Caucasus, Siberia, Russian Far East. [SIE]

Note: Rare species in Latvia.

***21. L. flavipes* (Linnaeus, 1767)**

References: Kawall 1866; Seidlitz 1872-1875, 1887-1891; Rathlef 1905; Trauberga 1957; Stiprais 1977; Priedītis 1971b, 1979; Barševskis 1993, 2002; Telnov *et al*. 1997; Telnov 2004; Kalniņš et al. 2007; Bukejs, Telnov 2007.

Examined material: 52 specimens: Aizkraukle d.: 6 km N Aizkraukle, Aizkraukles purvs (bog) PNT, 01.VII.2008 (4, old clearing, on *Salix*, leg. A.Bukejs); Cēsis d.: Lake Inesis, 10.VII.1977 (1, leg. V.Pūtele); Daugavpils d.: Bebrene, 13.VI.2006 (1, leg. E.Rudāns), 16.VI.2006 (1, leg. A.Barševskis); Daugavpils, near Cietoksnis, 28.V.1993 (2, leg. A.Barševskis), 25.VI.2009 (1, bank of the Daugava River, leg. A.Bukejs), Daugavpils, near Mežciems, 01.VI.2008 (1, bank of the Daugava River, leg. A.Bukejs); Elerne, Muravki house, 26.VI.2005 (1, leg. A.Barševskis, K.Barševska); Līksna, 23.VII.1996 (1, leg. R.Cibuļskis); Līksna parish, 4 km N Daugavpils, 29.VI.2008 (2, old clearing, leg. A.Bukejs); Lociki, 26.V.2001. (4, leg. G.Lociks), 22.VI.2001 (1, leg. G.Lociks); Špoģi, 07.VII.1977 (1, leg. V.Pūtele); Jēkabpils d.: Dunava, 23.V.1993 (2, leg. A.Barševskis), 23.VI.1993 (2, leg. A.Barševskis), 24.VII.1994 (1, leg. A.Barševskis), 22-23.VI.1998 (2, leg. A.Barševskis), 01.VI.2002 (6, leg. A.Barševskis), VI.2002 (1, leg. A.Barševskis), 10-18.VI.2006 (1, leg. K.Barševska); Rubeņi, 17.VII.1997 (1, leg. I.Leiskina); Jūrmala: Kūdra, 11.VI.2008 (1, leg. A.Titovs); Krāslava d.: Indrica, 17.VI.1989 (1, leg. A.Barševskis); Piedruja, 23.V.1989 (1, leg. A.Barševskis); Ludza d., Bļaši, 23.VI.2009 (1, leg. M.Balalaikins); Preiļi d.: Jersika, Kurpnieki house, 17.VI.2006 (1, leg. A.Barševskis), 09-10.VI.2007 (4, leg. K.Barševska, A.Barševskis), 22-25.VI.2007 (1, leg. A.Barševskis), 31.V.2008 (2, leg. A.Barševskis), 23-24.VI.2008 (1, leg. A.Barševskis); Rēzekne d.: Rēzekne, Nakotnes Str. 17/19, 18.V.2008 (1, leg. J.Burovs); Rīga d.: Mārupe env., 07.VII.2009 (1, leg. K.Barševska, A.Barševskis); Turaida env., Gaujas senleja, Turaidas loks (precipice), 02.VII.1974 (1, leg. V.Melecis), 21.VI.1975 (1, meadow near River Vējupīte, leg. V.Melecis); Tukums d.: Mustene, 04.VII.1974 (1, leg. V.Pūtele).

Host plants: *Alnus, Salix, Ulmus*.

Phenology: V, VI, VII

General distribution: Europe, Caucasus, Siberia, W and NE Kazakhstan, Mongolia, Russian Far East. [SIE]

Note: Rather infrequent species in Latvia.

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DISTRIBUTION OF *SCOLYTUS RATZEBURGI* JANSON, 1856 (COLEOPTERA: CURCULIONIDAE, SCOLYTINAE) IN THE NATURE PARK „DAUGAVAS LOKI"

Dainis Lazdāns

Lazdāns D. 2009. Distribution of *Scolytus ratzeburgi* Janson, 1856 (Coleoptera: Curculionidae, Scolytinae) in the Nature Park „ Daugavas loki". *Acta Biol. Univ. Daugavp., 9(2): 221 – 224.*

In the article information about distribution of *Scolytus ratzeburgi* Janson, 1856 (*Coleoptera: Curculionidae, Scolytinae*) in the Nature Pak "Daugavas loki" has been given. The information has been gathered on the basis of observation of burrow holes' characteristic drawing on birch trunks. In the territory of the nature park this species has been observed in 23 places in birch stands of medium and older age. Beetles' emergency holes observed on sear and windfall trees testified that on one tree this species develops in great numbers. Significant damage to birch trees growing in the territory of the Nature Park "Daugavas loki" was not observed.

Key words: *Scolytus ratzeburgi, Coleoptera: Curculionidae, Scolytinae*, Nature Park „ Daugavas loki", Latvia, fauna.

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INTRODUCTION

Scolytus ratzeburgi Janson, 1856 (*Coleoptera: Curculionidae, Scolytinae*) is one of the most commonly traced bark beetles' species in Latvia, however hitherto a few information about distribution of this species in our country has been published. One of the latest data about distribution of this species in Eastern Latvia have been published in A.Barševskis' monograph "Beetles of Eastern Latvia" (Barševskis 1993), in which three findings have been mention for this species: Ilgas, Svente and Šķeltiņi (Šķeltova). In another article about faunistic peculiarities of Augšdaugava beetles in the segment of Daugava river from Piedruja till Daugavpils A.Barševskis (1997) indicates 12 *Scolytidae* species without specification of their list. Therefore no published data can be found about *Scolytus ratzeburgi* Janson, 1856 distribution in Daugava valley and in the Nature Park "Daugavas loki" till now.

In the Baltic States and Northern Europe *Scolytus ratzeburgi* Janson, 1856 can be traced in the whole region (Silfverberg 2004). In Belarus as well the species is known from the whole territory of the country (Alexandrovitch et al. 1996).

Scolytus ratzeburgi Janson, 1856 distribution in the Nature Park "Daugavas loki" has been investigated in the time period from 2005 till 2009 during separate expeditions and survey of forests (mainly birch stands). The species was found mainly due to characteristic burrow holes on birch

trunks under the bark. Taking into consideration the fact that this species develops on sear, weakened or live birch trunks and thus can be harmful to forestry the aim of this article is to gather information disposable by authors about *Scolytus ratzeburgi* Janson, 1856 distribution in the territory of the Nature Park "Daugavas loki" on the basis of observations of species activities in forest stands of various ages.

The Nature Park "Daugavas loki" is located in south eastern part of Latvia, in the territories of Daugavpils and Krāslava counties. The area of the protected territory is 12562 ha. The coordinates of the geographic centre of the nature park - latitude: N 55°53'19'', longitude: E 26°55'22'', LKS_X 680700, LKS_Y 199400, the code of especially protected territory is 3002, CORINE code: V60601100, this is also NATURA 2000 territory of EU significance.

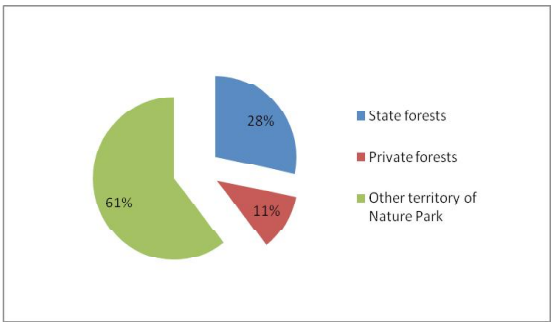

Fig. 1. Forest areas in the Nature Park "Daugavas loki"

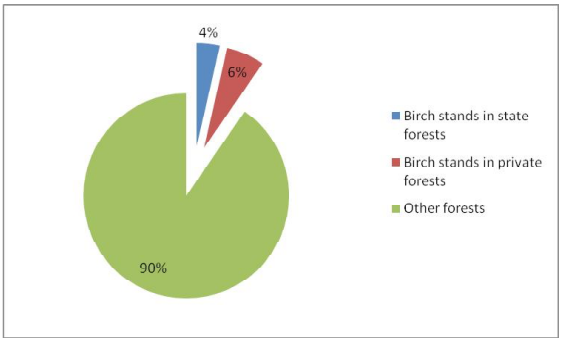

Fig. 2. Areas of birch stands in the Nature Park "Daugavas loki"

FOREST STRUCTURE IN THE INVESTIGATED AREA

In the territory of the nature park forests occupy 4969 ha, which is 39 % of the total area. The area of state forests – 3548 ha. The area of private forests – 1421 ha. (see pict.1)

In the territory of nature parks dry mineral soil forests – pine-spruce forests are dominant. Distribution of *Scolytus ratzeburgi* Janson, 1856 species is defined by birch stands and separate birch trees in the territory of the Nature Park "Daugavas loki". Total area of birch stands is 478 ha (in state forests - 180 ha; in private forests - 298 ha), it makes 10 % of total forests' area. (see pict.2)

Age structure of birch stands has been given in Table 1. In the territory of the nature park mostly middle aged birch forest stands are found, they occupy 174,23 ha. There are also lots of adult birch stands – 120,4 ha. Middle aged and older birch stands are the most appropriate for distribution of *Scolytus ratzeburgi* Janson, 1856 species. Beetles' emergency holes observed on sear and windfall trees testified that on one tree this species develops in great numbers, however there were no evidence that this species would harm the neighbouring birch trees.

MATERIAL AND METHODS

In the researches of distribution of *Scolytus ratzeburgi* Janson, 1856 species both cameral and field research methods were used. During the survey of birch forest stands sear tree trunks were inspected visually, *Scolytus ratzeburgi* Janson, 1856 emergency holes or characteristic feature made by burrow holes were searched on them. *Scolytus ratzeburgi* Janson, 1856 were traced in 23 places in the

whole territory of the Nature Park "Daugavas loki" (Fig. 4).

The tracks of activities of bark beetles in the nature were taken with the photo camera Canon EOS – 1 Mark II Ds.

The most important stage in doing inventory is study of research territory and location of birch stands in the Nature Park "Daugavas loki". In the solution of this exercise the most important tool for data processing and visualization are geomatic technologies – GIS (Geographic information system), GPS and various geospatial data. With these technologies the user gathers information about various measures of characteristics and their mutual interaction (e.g. location, areas, age structures of birch stands a.o.).

Data base of forest stands prepared by State Forest Service was taken as the basis and it was linked to LKS-92 coordinate system. The data base contains information about contents, age structure of forest stands etc. With GIS software birch stands were selected (see pict.3) and their location in the Nature Park "Daugavas loki" defined. The obtained data were imported into GPS receiver, which eased inspection of the territory in field conditions.

RESULTS

Distribution of *Scolytus ratzeburgi* Janson, 1856 in the Nature Park „ Daugavas loki" are presented in figure 4. This species were collected in 23 places in the whole territory of the Nature Park "Daugavas loki". The tracks of activities of

Table 1. Age structure of birch stands

	In state forests (ha)	In private forests (ha)	Total area (ha)
Young birch stand	27,7	41,2	**68,9**
Middle aged birch stand	52,63	121,6	**174,23**
Birch pre-mature stand	3,07	55,4	**58,47**
Mature birch stand	49,4	71	**120,4**
Over mature birch stand	47,2	8,8	**56**
TOTAL	**180**	**298**	**478**

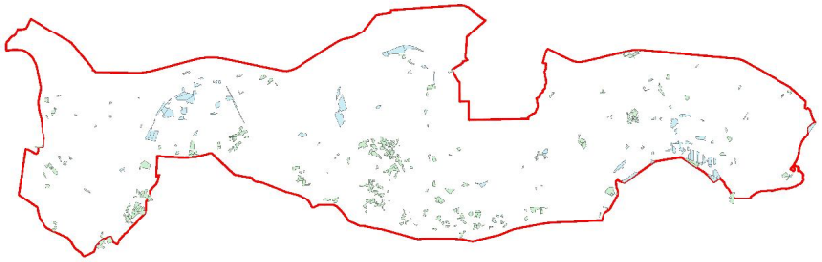

Fig.3. Location of birch stands in the Nature Park "Daugavas loki"

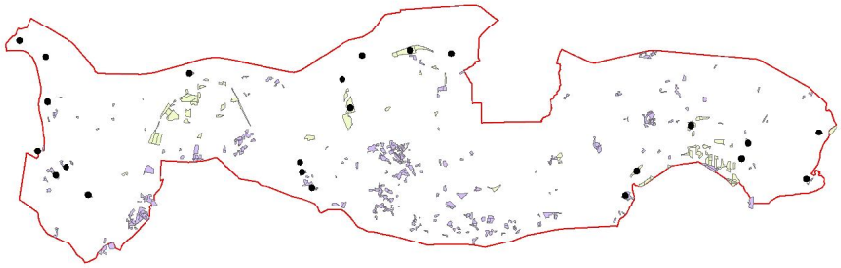

Fig.4. Distribution of *Scolytus ratzeburgi* Janson, 1856 in the Nature Park „ Daugavas loki"

Scolytus ratzeburgi Janson, 1856 much more frequently were observed in middle aged birch stand, birch pre-mature stand and birch mature stand. Separate findings were traced on sear birch trees in mixed wood forests as well. 8 findings are located in middle aged birch stands, 5 findings – in birch mature stands, 3 findings - in pre-mature birch stands, and only 2 findings – in over mature birch stands. 5 *Scolytus ratzeburgi* Janson, 1856 findings out of all 23 traced in the territory of the Nature Park "Daugavas loki" were located outside birch stands on separate trees in mixed forests. 1 finding near Elerne was located in small wood burning, where on all birch trees weakened by fire, great number of tracks of activities of this species were traced, which confirms implicitly that the species can breed in great number in forest burnings.

In this article first observation results about *Scolytus ratzeburgi* Janson, 1856 in the territory of the Nature Park "Daugavas loki" have been gathered. The uneven location of findings (Fig. 4) in the territory of nature park does not give evidence that there would be separate zones, where are more favourable conditions for development of this species. This could be explained by the methodology of the research, because the task of this work was not even inspection of all birch stands in this nature park, but only summarization of information about this species gained during the survey of beetles fauna in the Nature Park "Daugavas loki".

CONCLUSIONS

1) *Scolytus ratzeburgi* Janson, 1856 were traced in 23 places in the whole territory of the Nature Park "Daugavas loki". These are the first data about distribution of bark beetles' species in the territory of the Nature Park "Daugavas loki". *Scolytus ratzeburgi* Janson, 1856 observed on sear and windfall trees testified that on one tree this species develops in great numbers, however there were no evidence that this species would be harmful to forestry.

2) In the territory of the nature park mostly middle aged birch forest stands are found, they occupy 174,23 ha. There are also lots of mature birch stands – 120,4 ha. Middle aged and mature birch stands are the most appropriate for distribution of *Scolytus ratzeburgi* Janson, 1856 species.

3) Application of GIS methods in research of species distribution helps not only to show precisely every particular finding of the species, but also gives wide scope for application of faunistic data in investigation of species' ecology and impact on forestry.

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THE HISTORY OF INVESTIGATIONS OF WEEVILS, BARK BEETLES AND PINHOLE BORERS (COLEOPTERA: CURCULIONIDAE, INCL. SCOLYTINAE AND PLATYPODINAE) IN LATVIA

Maksims Balalaikins, Andris Bukejs

Balalaikins M., Bukejs A. 2009. The history of investigations of weevils, bark beetles and pinhole borers (Coleoptera: Curculionidae, incl. Scolytinae and Platypodinae) in Latvia. *Acta Biol. Univ. Daugavp., 9 (2): 225 - 240.*

The history of investigations of weevils, bark beetles and pinhole borers in Latvia is presented in this article. It is more than 220 years old. The first information about the weevils and bark beetles in Latvia can be found in the monographs (Fischer 1778, 1784, 1791). The bibliographical list of 182 sources is composed.

Key words: Coleoptera, Curculionidae, Scolytinae, Platypodinae, Latvia, investigations, history, bibliography.

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The number of species of weevils, bark beetles and pinhole borers (Curculionidea) of the world fauna is estimated on a miscellaneous, because the weevils are explored not with identical completeness in different parts of the world. Entomologists regularly discover and describe new species of weevils. Estimation of number of species of Curculionidae has grown from 30 000 (Endrödi 1961) to 50 000 (Kippenberg 1981). Hoffman (1950) even considered Curculionidae as the greatest family of animals. This opinion is supported also by newer data (Alonso-Zarazaga, Lyal 1999). According to this data in the world live about 500 000 species of weevils only about every tenth of which is described (Lyal, King 1996).

In this article we consider Curculionidae according to the taxonomy of J.F. Lawrence and A.F. Newton (1995). In current research we relate concept weevils to subfamilies: Brachycerinae, Curculioninae, Dryophthorinae, Cossoninae; concept bark beetles we relate to Scolytinae and concept pinhole borers we relate to Platypodinae.

The special research of the history of Curculionidae sensu lato in Latvia was not made till now. Historical review of research of bark beetles in Latvia is presented in monograph (Šmits 1960). The analogous works were made also on Elateridae (Spuris 1981), Cantharidae (Melecis 1975), Carabidae (Spuris 1983; Barševskis 2003),

Cerambycidae (Spuris1984), Coccinellidae (Spuris 1990), Scarabaeidae (Spuris 1991a) Dytisciformia (Spuris 1991b; Barševskis et al. 2005) and Chrysomelidae (Bukejs 2008).

The aim of this work is to summarize and to analyse the bibliographical data about the weevils, bark beetles and pinhole borers of Latvian fauna, to give the short essay about the history of investigations and to make bibliographical list.

The first data about the weevils of Latvian fauna was published in the second half of the 18th century in J.B. Fischer's (1778, 1784, 1791) works about the nature of Livland. In the first edition of the monograph (Fischer 1778) seven species of the weevils are mentioned (*Curculio cerafi* L., *C. frumentarius* L., *C. pini* L., *C. quercus* L., *C. pomorum* L., *C. nucum* L. and *C. incanus* L), one of them *Curculio frumentarius* L. in the modern taxonomy is the *Apion frumentarium* L. (Apionidae). After some additions (Fischer 1784), in the second edition of the monograph (Fischer 1791) 13 species are already mentioned, including *Curculio frumentarius* L. (Apionidae) and Curculio Germanus L., which in the modern taxonomy is the *Liparus germanus* L. This species is not mentioned in the catalogue of Latvian beetles (Telnov 2004). J.B. Fischer has mentioned one bark beetle species - *Ips typographus* (L.). The author has related this species to skin beetles (as *Dermestes typographus* L.). Z. Spuris (1981, 1983) regarded, that J.B. Fischer has made his investigations in the Rīga district.

Johan Groschke, the professor of the Gymnasium of Jelgava, has published some coleopterological articles in 19th century. There were mentioned 13 species of weevils for Kurzeme (*Curland*). In this investigation were mentioned species which are considered as pests (Groschke 1805).

In 1818 the first catalogue of beetles of Latvian fauna has been published. There are 725 species mentioned, those were found in the environs of Rīga and Rīga district (in that time it was a large territory including the Rūjiene environs). The author of this catalogue was not mentioned when the catalogue was published, but from other sources (Kawall 1868) is clear that it was the citizen of Rīga K.H. Precht (1818). This catalogue feature is that concrete places of finds are given for rare species in it. According to the J. Fabricius system there are 5 genera and 41 species of the weevils. Three species (*Calandra picea, Rhynchaenus festucae* and *Lixus incurvus*) in the catalogue are not determined for certain. *Lixus incurvus* was indicated as n. sp., new species for science, though the description of this species has not been published. Material that was in the K. Precht's collection is not remained.

In 1829 Benjamin Gimmerthal published the catalogue of the Livland beetles, in which about 800 species were listed. (Gimmerthal 1829). As B. Gimmerthal lived in Rīga it was possible to suppose that those species were observed in vicinities of Rīga. Some names of the species are repeated or are difficult to determine. Correctness of the data published in this paper can be checked up, because Gimmerthal's collection is remained at the Zoological museum of Latvian University in Rīga.

In the same year the citizen of Jelgava J.G. Fleischer had published a list of beetles of local fauna (Fleischer 1829). In this list are mentioned only new beetles species for the fauna of the East Baltic. There are 640 species in this list. Five species of them are referable to the bark beetles and 83 species are referable to weevils; one of them *Orobitis Lythri* F., in the modern taxonomy is the *Nanophyes marmoratus* Gz. (Apionidae) and one species (*Falciger guttula F.*) is not determined.

In the review of phenological observations in Kurzeme J.H. Kawall has mentioned some species of Curculionidae (Kawall 1865, 1866a, 1866b).

At the end of the 19th century the George Seidlitz's monograph about the fauna of Baltic beetles was published. This monograph was published in two editions (Seidlitz 1872-1875, 1887-1891). It is

important to know that the Baltic States in that time were Estonia and Latvia, without Latgale. G. Seidlitz writing his monograph used data from local collections of beetles. A lot of the beetles collected in Kurzeme have been passed to the author by researchers of the nature – J.H. Kawall, A. Rozenberg and K. Bitner (Spuris 1984). Unfortunately the localities for species are rarely mentioned in this monograph, usually there is evaluation of distribution. Sometimes there are directions to Kurzeme (Curland), especially in the first edition, Livland and Rīga or it is mentioned, that in Europe the species are distributed till Kurzeme or Estonia. That's why it is not possible to define the number of species exactly for Latvia and Estonia. In the monograph we can find keys for determination of families, genera and all species (including also potential species). In the first edition of monograph (Seidlitz 1872-1875) 235 species of the weevils are described, but there are concrete localities (Curland, Rīga and other) for 50 species in Latvia, in the second edition (Seidlitz 1887-1891) respectively 242 species of the weevils totally and only 33 species feasibly to Latvia. In this monographs author has mentioned 31 species of bark beetles. Spuris (1973) argues away the importance of the Seidlitz's monograph as the basic work for the fauna of Latvian beetles.

In 1883 the article about the beetles of Poland Lifland was published (Ulanowski 1883). At that time Latgale (the eastern part of Latvia) belonged to Poland Lifland. It should be mention, that these faunal data are very inexact and doubtful (Barševskis 1993). In the lists of beetle families in Latvia published earlier a lot of authors did not take account of this publication (Šmits 1960; Spuris 1981, 1983, 1984, 1990, 1991a, 1991b; Barševskis 2003; Barševskis et al., 2005; Bukejs 2008).
In this time two small articles (Müthel 1886, 1889) were published, where we can find faunal data on ten species of the weevils. Information about weevils and bark beetles in Latvia can be found also in Sintenis (1900).

The first information about the bark beetles and weevils as pests of wood can be found in articles published by Willkom (1871), Fritsche (1879), Fromm (1880), Ostvald (1880), Buhse (1880) and Baltiņš (1899). In the first half of the 20th century a few publications where it is possible to find the information about bark beetles and weevils as the pests of wood were published (Rodzjanko 1915; Brammanis 1928, 1929, 1930b, 1937, 1938, 1940; Lorencs 1926; Ions 1927; Saars 1930; Stauvers 1935).

In 1905 the catalogue of the beetles of the Baltic fauna was published. The author of this catalogue is H. von Rathlef. This catalogue was written according to the Seidlitz's (1887-1891) monograph and other faunal publications of that time. In this catalogue with the supplement (Rathlef 1905, 1921), 267 species of weevils and 32 species of bark beetles are mentioned.

In this period noteworthy papers were published by L. Heyden, J. Mikutowicz, T. Lackschewitz, L. Brammanis, H. Lindberg and L. Gailītis. Heyden (1903) in his article mentioned 18 weevil species for Lielvārde; Lindberg (1932) mentions 36 species for Latvian fauna.

Brammanis (1930a) mentions 24 species of weevils and 4 species of bark beetles from Inčukalns forestry. Information about the bark beetles in Cīrava was published (Brammanis 1926 cf. Šmits 1960). The author has mentioned 24 species of bark beetles in this article, three of them are new for Latvian fauna.

Gailītis (1932) in his promotion work has mentioned 36 species of bark beetles, five species of them are new for Latvian fauna. The author has published also other papers where wood pests are mentioned (Gailītis 1926, 1928, 1929a, 1929b, 1930a, 1930b, 1931, 1933, 1934, 1935, 1936, 1940).

J. Mikutowicz and T. Lackschewitz are the authors of several faunal publications about beetles in Latvia. In their publications (Mikutowicz 1905, 1911; Lackschewitz, Mikutowicz 1939; Lackschewitz 1927) authors has mentioned 61 species of weevils and 17 species of bark beetles.

The Professor E. Ozols (1955) has collected in Rīga 2 new species of bark beetles for Latvian fauna. Šmits (1960) has collected in Ogre one new species for Latvian fauna.

In the 20th century a lot of authors have published articles where weevils are mentioned as pests of cultivated plants and wood. Thomson (1939-1940, 1940) has studied the pests of sugar beets and has mentioned beet weevil *Chromoderus fasciatus* Müll. as the pest of sugar beets. Eglītis (1956a, 1956b) have published the article about corn pests and has mentioned 3 weewils (*Sitophilus granarius* L., *S. oryzae* L., *S. zeamais* Motsch.); Žuravska (1986) has written about weevils on rape, but Petrova et. al. (2000, 2006) – on strawberries. Priedītis (1971) has mentioned 14 weevil species and 5 bark beetles as apple tree pests. About the weevils and bark beetles meaning in agrocenosis and forest was published by Danka (1950), Eglītis (1954), E. Ozols (1948, 1955, 1963, 1973), Peņģerots-Svešais (1927), Rupais (1959, 1962, 1981, 1999), Smarods, Liepa (1956), Priedītis (1979).

It is necessary to give particular attention to Gints Ozols and co-authors works on study of weevils and bark beetles as forest pests. G. Ozols studied separate species of the weevils as wood pests: *Philopedon plagiatus* (Schall.) (Ozols 1959) and *Brachyderes incanus* (L.) (Ozols 1962ą).

In paper about spruce pests and that ecological groups G. Ozols (1968c) mentioned 5 weevil species *Pissodes harcyniae* (Hrbst.), *Hylobius abietis* (L.), *Hylobius pinastri* (Gyll)., *Hylobius piceus* (Deg.), *Magdalis* sp. and 25 bark beetle species.

Ozols (1982) has published the material about insects of pine and spruce, where 23 weevils species and 33 bark beetles species, their ecological individuality, phenological and faunal data.

In monograph "Dendrophagous insects of pine and spruce in the Latvian forests" ["Priedes un egles dendrofāgie kukaiņi Latvijas mežos"] (Ozols 1985) are mentioned 23 weevil species and 36 species of bark beetles. The author has published also other papers where are mentioned weevils and bark beetles as forest pests (Ozols 1957, 1958a, 1958b, 1958c, 1960a, 1960b, 1960c, 1962b, 1962c, 1962d, 1963, 1964a, 1964b, 1965, 1966, 1967, 1968a, 1968b, 1970, 1971a, 1971b, 1971c, 1971d, 1971e, 1973, 1974a, 1974b, 1975a, 1975b, 1981).

There were investigations dedicated to the study how to fight against dangerous wood pests. M. Bičevskis and G. Ozols have published some articles about pests of forest where there is information on biology of bark beetles and weevils, about economic meaning and methods of struggle against them (Ozols, Bičevskis 1971, 1973 1976a, 1976b, 1976c, 1978a, 1978b, 1978c, 1979, 1980a, 1980b, 1981, 1982a, 1982b; Ozols et al. 1973, 1983; Bičevskis, Ozols 1983, 1984; Bičevskis 1983). Similar information can be found in other authors publications (Šmits 1964; Baumanis, Ozols 1976; Kaucis 1967; Saksons 1966, 1967, 1973, 1976; Vītola et al. 1977; Vilks 1983).

In 1960 was published monograph "The bark beetles" ["Mizgrauži"] (Šmits 1960). There are data about the history of research of bark beetles in Latvia, their ecological peculiarity, phenological data and information on bark beetles morphology. In this monograph we can find keys for determination of Latvian species. V. Šmits has mentioned 53 bark beetles species for Latvian fauna.

Information about the largest families of the beetles can be found in the books "Latvian animals" ["Latvijas dzīvnieki"] (Šmits, Spuris 1966) and "The world of Latvian animals" ["Latvijas dzīvnieku pasaule"] (Spuris1974). There can be found general information about the weevils and bark beetles. There are mentioned 400 species of Curculionidae id est. 346 weevil species and 54 species of bark beetles (Šmits, Spuris 1966) and about 408 species of Curculionidae id est. 350 weevil species and 58 species of bark beetles (Spuris1974) for the Latvian fauna.

Spuris (1953) also was published article about animal species of lake habitat, where are also

mentioned Curculionidae species. In 1957 was published guides to Latvian Coleoptera (Trauberga 1957), where keys for determination of some species of weevils and bark beetles can be found.

There is information about weevils of Latvian fauna in Dieckman (1968, 1973, 1980), where faunal data for some species were mentioned. R. Varzinska and G. Mileders in their publication about the Moricsala Nature Reserve have meant 19 weevil species (Varzinska, Milenders 1981). There are data about three species of the weevils and one species of the bark beetles in review of beetles of pig-breeding complex in Jumprava (Stiprais, Varzinska 1985).

In 1993 the monograph "The beetles of Eastern Latvia" (Barševskis 1993) was published where the author has mentioned 167 weevil species, but later the author mentions six species (*Otiorhynchus* sp., *Omiamima concinna* Boh., *Phyllobius roberetanus* Gredl., *Polydrusus impar* Gz., *Coniocleonus nigrosuturatus* Gz., *Acalles lemur* Germ.), misidentified and deleted from the list of beetles of Eastern Latvia. Author has mentioned also 25 species of the bark beetles. Coleopterological material for this publication was collected in Latgale, Augšzeme and eastern part of Vidzeme. In this monograph besides the large amount of faunal data, there are also a review of history of research of beetles in eastern Latvia, detailed description of collecting methods, the ecological review of habitats, and morphological and systematic notes for some groups of beetles.

In 1996 Danish coleopterologist Eivind Palm has published monograph "The weevils of northern Europe" (Palm 1996). In this monograph new data on weevils of Latvian fauna are found. The author personally has determined material from eastern Latvia. In this monograph totally 54 weevil species with the concrete localities are mentioned.

Silferberg (1992, 1996 and 2004) and Lundberg (1995) in their catalogues of Coleoptera are mentioned information about Latvian weevils and bark beetles.

Barševskis (1997a) has mentioned 344 species of the weevils in article "The materials about the weevils (Coleoptera: Curculionidae) fauna of Latvia and check-list of species". The history of research of weevils is analysed and a check-list of weevils of Latvian fauna is presented in this article. There are faunal data on 226 species, including 2 new species for North Europe, 5 – for the Baltic States and 25 new species for Latvia. In total about 3200 specimens processed in this research, major part of coleopterological material was collected by author in eastern Latvia. This paper is the most valuable work dedicated to investigation of weevils in Latvia.

Barševskis (1997c) has published article where pinhole borer species *Platypus cylindrus* (F.) for Latvian fauna was mentioned for the first time. This species was collected by the author in Silene Nature Park. It is single record of this species in the Baltic States.

In 1997 the catalogue of Latvian Coleoptera was published (Telnov et al. 1997), where 384 species of Curculionidae are mentioned, id est. 316 weevil species, 67 bark beetle species and one pinhole borer. In the second edition of the catalogue (Telnov 2004) the number of species of Curculionidae is larger – 442 species, id est. 373 weevil species, 68 species of bark beetles and one pinhole borer.

In the list of Coleoptera of Silene Nature Park, 198 species of Curculionidae (171 weevils, 26 bark beetles and one pinhole borers species) are mentioned (Barševskis 2002). In similar publication on Invertebrates of Gauja National Park (Kalniņš et al. 2007), 170 species of Curculionidae (139 weevils and 31 bark beetles species) are reported.

In theses of different conferences, some information about Latvian weevils and bark beetles can be found (Leiskina 1999, 2000; Bojāre 2000; Princovs 2000; Balalaikins 2009; Bukejs, Balalaikins 2009).

D. Telnov and co-authors has published some articles where new faunal data about weevils and

bark beetles in Latvia can be found (Telnov, Kalniņš 2003; Telnov et al. 2005, 2006, 2007, 2008). In these papers authors mentions 21 new weevils species and some rare species of weevils and bark beetles for Latvian fauna.

A lot of authors mention some rare and new species of weevils and bark beetles for Latvian fauna in their publications (Barševskis 1996, 1997b, 2001; Barševskis at al. 2004, 2008; Rūtenberga 1992; Cibuļskis 1996; Cinītis 1997).

In Latvian fauna, 462 species of Curculionidae (392 of them are weevils, 69 are bark beetles and one is pinhole borer) are known now. We are going to continue our study of the Curculionidae.

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GENETIC DIFFERENCES AMONG THE *E. ARGENTELLA AND E. BIFASCIELLA* SPECIES GROUPS (LEPIDOPTERA: ELACHISTIDAE: ELACHISTINAE)

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Paulavičiūtė B., Paulauskas A., Sruoga V. 2009. Genetic differences among the *E. argentella and E. bifasciella* species groups (Lepidoptera: Elachistidae: Elachistinae). *Acta Biol. Univ. Daugavp., 9(2): 241 - 248.*

The polymorphic patterns of genomic DNA amplified by RAPD-PCR were detected in the *E. argentella and E. bifasciella species groups populations in Lithuania.* Nine oligonucleotide primers were tested for analysing genetic differences of *Elachista.* Reproducible polymorphic amplification patterns were obtained using two primers: OPA-09 and OPA-10. Each primer provided a distinct and reproducible pattern of the amplified PCR fragments In present study, RAPD-PCR was conducted to identify genetic differences of *Elachista* in Lithuania.

Key words: Elachista, species group**,** genetic polymorphism, PCR, RAPD methods

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INTRODUCTION

Elachista Treitschke, 1833 is the largest genus in the family Elachistidae, containing about 550 named and two hundred discovered, but still undescribed species worldwide (Kaila and Ståhls, 2006). All members of the genus are small moths with wingspan from 5 to 14 mm. Forewing patterns mainly consist either of a white fascia and spots on dark background or fuscous marks on light background, some moths are monochromatic (white, yellowish or cream). Larvae of *Elachista* are typical leaf-miners, trophically dependent on monocotyledonous grasses (Traugott-Olsen and Nielsen, 1977; Sruoga and Ivinskis, 2005).

The *Elachista* genus has been divide into the smallest groups by Stainton (1849, 1854), Herrich-Schaffer (1855) and Frey (1855). The latter works have been based on the external features of the moths only. Other scientists (Pierce, Metcalfe, 1935; Braun, 1948) for classification of species of this genus have been used the external features as well as features of genitalia and divided the *Elachista* genus in to 3 groups.

Later Traugott-Olsen, Nielsen (1977) characterized 4 species groups of *Elachista*

genus: gleichenella, tetragonella, bifasciella and bedelella. The last 2 groups have been divided in to 3 subgroups. This classification based on external, adult genitalia and wing venation features. But the wings venation using for classification has been contradicted by Albrecht & Kaila (1997).

According results of phylogenetic analysis of subfamily of *Elachistinae, Elachista* genus has been grouped to four subgenus: *Dibrachia*, *Hemiprosopa*, *Aphelosetia* and *Elachista* (Kaila, 1999).

At present *Elachista* genus contain 11 species groups Kaila (Kaila, 1997, 1999). This suggested conception has been used in our work.

The 3 species of *Elachista* from the 2 subgenus (*Aphelosetia* and *Elachista*) and 2 species groups (*Elachista argentella* and *E.bifasciella*) have been investigated in our research.

The application of molecular markers to the study of insects has provided new insights into their population structures and taxonomic relationships. Insects have been studied at individual, population and species level. Different methods, including random amplified polymorphic DNA (RAPD) have been used to study these organisms (Reineke et al., 1998, Kawamura et al., 2002). RAPD provides class of highly polymorphic markers. This technique uses a single primer with a very short sequence (8–10 base pairs) to amplify small regions of the genome. The minor variations in theDNA sequences among different isolates lead to distinct fingerprinting patterns that are discriminatory. In this way the RAPD analysis can provide a simple and reliable method for measuring genomic variation (Lynch and Milligan 1994). RAPD technique is ideal for DNA fingerprinting, with particular utility in the field of population genetics. In many instances, only a small number of primers are necessary to identify polymorphism within species. A single primer may often be sufficient to distinguish all of the sampled varieties (Williams et al. 1990).
In present study, RAPD-PCR was conducted to identify genetic differences of *Elachista* in Lithuania.

MATERIAL AND METHODS

Sample collection

The material was collected using an entomological net and during light trapping at night (160W DRL type bulb lamp was used) in the different parts of Lithuania: in Neringa municipality, Kaišiadorys, Kaunas, Tauragė and Trakai administrative districts (Table1).

Species were identified using external appearance and genitalia of the moths according

Table1. *Elachista* species samples locality and notation of populiations

Species and author	Locality	Coordinate	Marking
Elachista argentella Clerck.	Kaišiadorys, Strėvininkai f.	54°48'42,6"N, 24°21'37,2"E;	Sarg
	Neringa t., Grobštas nature reserve	55°17'12,1"N, 20°58'30,1"E;	Garg
	Neringa t., Smiltynė env.	55°42'15"N, 21°06'57"E;	KNarg
	Trakai, Čiužiūnai	54°35'45"N, 24°34'32"E;	Czarg
Elachista maculicerusella Bruand.	Kaišiadorys, Rumšiškės	54°52'38,1"N, 24°10'44,7"E;	Rmac
	Tauragė, Viešvilė nature reserve	55°10'47,6"N, 22°27'40,3"E;	Tmac
Elachicta pollinariella Zeller.	Neringa t., Grobštas nature reserve	55°17'12,1"N, 20°58'30,1"E;	Gpol
	Trakai, Čiužiūnai	54°35'45"N, 24°34'32"E;	Czpol

Traugott-Olsen and Nielsen, 1977 and Sruoga, 2005.

Molecular study

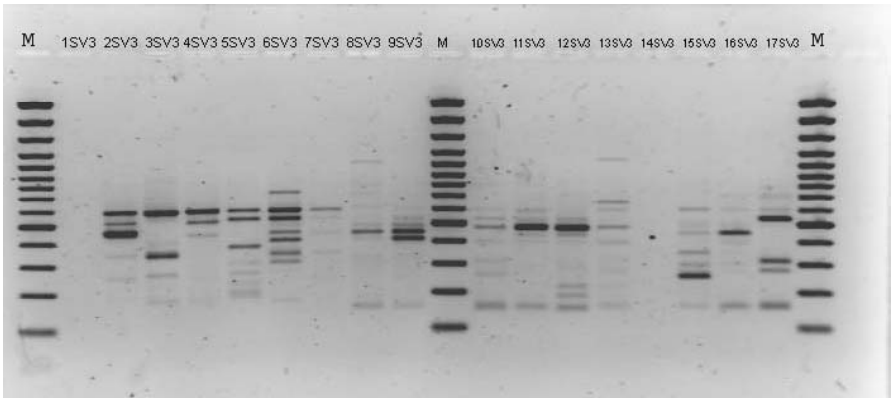
We used pined specimens and specimens which were stored in 96% ethanol. DNA was extracted usually from head or thorax using the Nucleospin Tissue Kit (Machery-Nagel, Düren, Germany) according to manufacturer's protocols.

The polymorphism of *Elachista* species was analyzed using random amplified polymorphic DNA method. The 50 DNR samples of *Elachista* species were used for RAPD reaction. Nine oligonucleotide primers were tested for analysing genetic differences of *Elachista* genus (Table 2). Two random oligonucleotide primers OPA-09 and OPA-10, synthesized in MBI Fermentas, were most informative and usefulness for the typing of *Elachista* species.

PCR was performed in reaction volume of 25 containing 12,5ģl 2X PCR Master Mix (MBI Fermentas, Lithuania), 2ģl 10-oligonucleotide primer (stock 10 pmol/ģl) (MBI Fermentas, Lithuania), 6,5ģl ddH_2O and 4ģl DNR of moth sample. All reactions were carried out in Eppendorf PCR system *"Mastercycler personal"* thermal cycler. Samples were initially denatured for 1 min at 94ţC. Subsequent cycles were at 94 ţC for 30 sec (denaturation), 35ţC for 30 sec (primers annealing), and 72ţC for 3 min (extension). After amplification, PCR products were separated by electrophoresis in 1.5 % agarose gel. Agarose gel was stained with ethidium bromide and photographed under the UV light (EASY Win32, Herolab, Germany). DNA fragment sizes were assessed by comparison with GeneRuler™ 100bp DNA Lader Plus (MBI Fermentas, Lithunia).

The Nei and Li algorithm (Nei and Li 1979) contained in the TREECON computer package program (Van de Peer and De Wacher 1994) were used to evaluate the genetic distances between the individuals of Elachista species. The dendrogram were constructed by UPGMA (Unweighted Pair Group with Arihmetic Mean) method.

We used the PopGen32 program (Yen and Boyle, 1997) to calculate genetic distances and genetic identity between populiations (Nei, 1973)



M 1 2 3 4 5 6 7 8 9 M 10 11 12 13 14 15 16 17 M

Fig. 1. Reproducibility of RAPD fingerprinting. DNA fingerprinting for different samples of *Elachista* species were obtained by PCR with primer OPA-09. M lines – 100bp marker; 1-17 lines DNA fingerprints from different samples.

RESULTS AND DISCUSSION

The total 50 DNA samples of *Elachista* species were used for RAPD analyses: 17 from Kaišiadorys distr., 4 from Tauragė distr., 4 from Trakai distr. and 15 from Neringa f. The list of the examined *Elachista* moths is shown in Table 1. Reproducible polymorphic amplification patterns were obtained using two primers: OPA-09 and OPA-10. The 50 DNA samples were amplified with these primers. Each primer provided a distinct and reproducible pattern of the amplified PCR fragments (Fig. 1).

Primer OPA-09 produced from 1 to 8 fragments, the fragment size varied from 170 to 1500 bp among the individuals. Primer OPA-10 produced 2-4 fragments from 170 to 700 bp. Fragments were produced in all *Elachista* moths individuals.

Genetic differences of *Elachista* species from different regions of Lithuania were calculated and a genetic dendrogram was drawn (Fig. 2). Dendrogram showed that *Elachista* species from different of populations are different. Individuals that originated from the same region were distributed over different clusters. Tauragė population of *E.maculicerusella* (Tmac) species is heterogenous.

We analyzed 33 loci per 7 populiations and all of them were polymorphic. The percentage of polymorphic loci of the seven analyzed populations: Strėvininkai f. (*E. argentella*), Grobštas nature reserve (*E. argentella*), Čiūžūnai (*E. argentella*), Grobštas nature reserve (*E.polinariella*), Čiūžūnai (*E.polinariella*), Rumšiškės (*E.maculicerusella*), Viešvilė nature reserve (*E.maculicerusella*) were 51.52%, 39.39%, 24.24%, 15.15%, 21.21%, 63,64% and 18.18% respectively.

According to calculated values of genetic distances among populations of *Elachista* species, populations from Tauragė (*E.maculicerusella*) and Čiūžūnai (*E.polinariella*) are heterogenic. Research results from Rumšiškės (*E.maculicerusella*), Strėvininkai f. (*E. argentella*), Grobštas nature reserve (*E.argentella*) and Čiūžūnai (*E.argentella*) represent some identical genotypes in this locality (Fig. 2).

Populations**.** Nei's (1979) genetic identity and genetic distance of 7 *Elachista* moths populations were listed in Table 3. The genetic distance ranged from 0.0209 (between Czpol and Tmac populations) to 0.9794 (between Tmac and Czpol populations). Phylogenetic tree of the 7

Table 2. Primer names and sequences amplified by RAPD-PCR for individuals of *Elachista*.

Primer	Sequence (5?to 3?)
OPA-01	5?CAGGCCCTT-<C>3?
OPA-04	5?AATCGGGCT-<G>3?
OPA-05	5?AGGGGTCTT-<G>3?
OPA-07	5?GAAACGGGT-<G>3?
OPA-08	5?GTGACGTAG-<G>3?
OPA-09	5?GGGTAACGC-<C>3?
OPA-10	5?GTGATCGCA-<C>3?
OPA-11	5?CAATCGCCG-<T>3?
OPA-17	5?GGTCCCTGA-<C>3?

Table 3. 7 *Elachista* moths populations Nei's genetic identity and genetic distance

Populations	Sarg	Garg	Czarg	Gpol	Czpol	Rmac	Tmac
Sarg	****	0.9734	0.9575	0.8959	0.9426	0.9302	0.9473
Garg	0.0270	****	0.9752	0.9224	0.9641	0.9162	0.9530
Czarg	0.0434	0.0251	****	0.9407	0.9721	0.8915	0.9654
Gpol	0.1099	0.0808	0.0611	****	0.9664	0.8508	0.9427
Czpol	0.0591	0.0366	0.0283	0.0341	****	0.9086	0.9794
Rmac	0.0723	0.0875	0.1148	0.1616	0.0958	****	0.8852
Tmac	0.0542	0.0481	0.0352	0.0590	0.0209	0.1220	****

Elachista populations were constructed based on Nei's genetic distance (Fig. 3). The lowest genetic variability was between Czpol (Čiužiūnai, *E.polinariella*) and Tmac (Tauragė, *E.maculicerusella*) populations. They formed own branch in dendrogram. Sarg (Strėvininkai f., *E.argentella*) and Garg (Grobštas nature reserve, *E.argentella*) formed also own branch.

Principal coordinate analysis (PCA) is one of the multivariate approaches of grouping based on similarity coefficients or variance–covariance values of the component traits of the entities (Liu et al.,2001). In present study according PCA analysis *Elachista* moths grouped into three distinct groups (Fig.4.). *Elachista maculicerusella* from Rumšiškės (Rmac) formed one group, *E.argentella* moths from Čiužiūnai

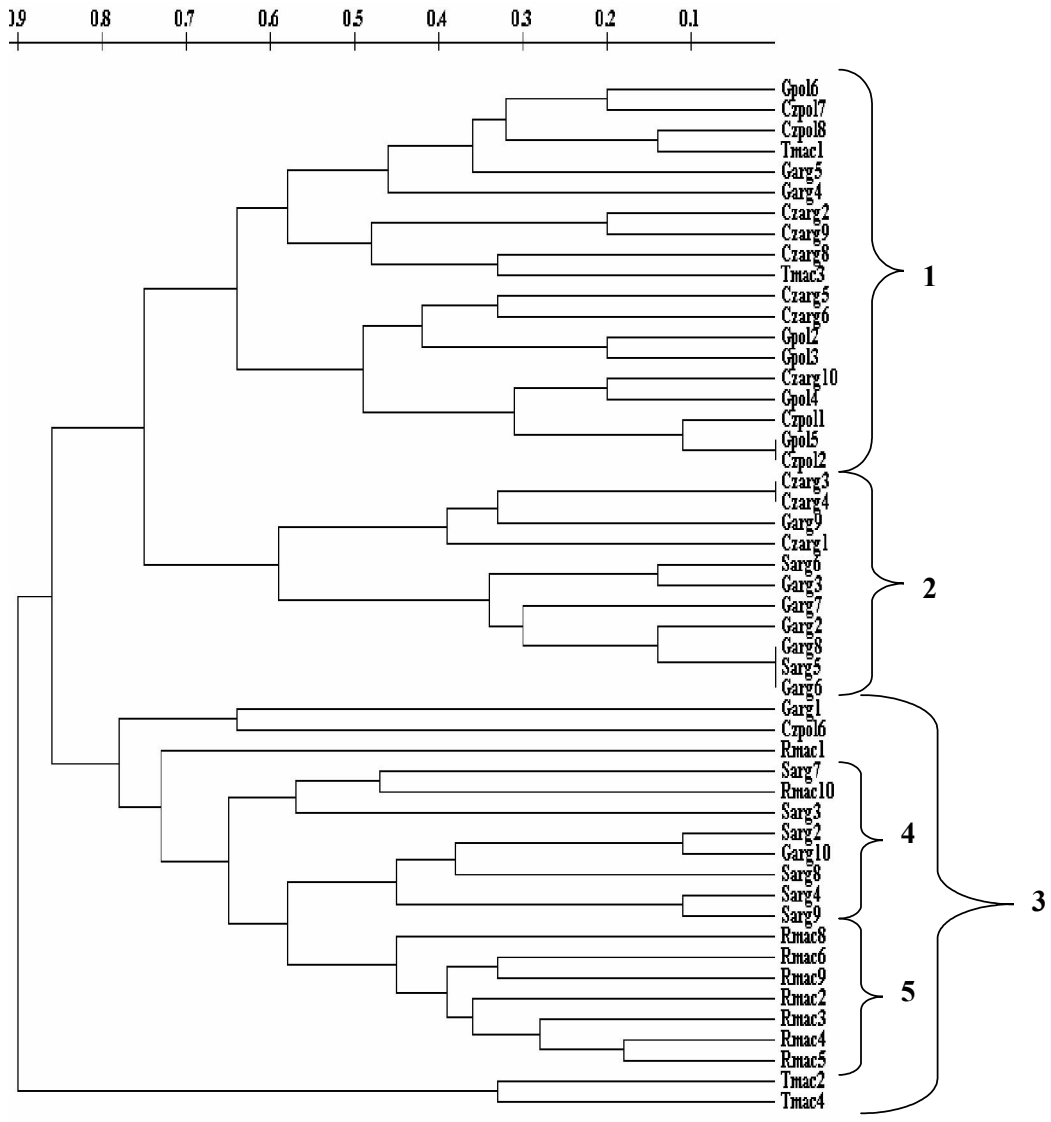


Fig. 2. Dendrogram of 7 *Elachista* populiations based on Nei's genetic distance (1979) according to eight RAPD primers using UPGMA method. The marking of populations shown in the Table 1.

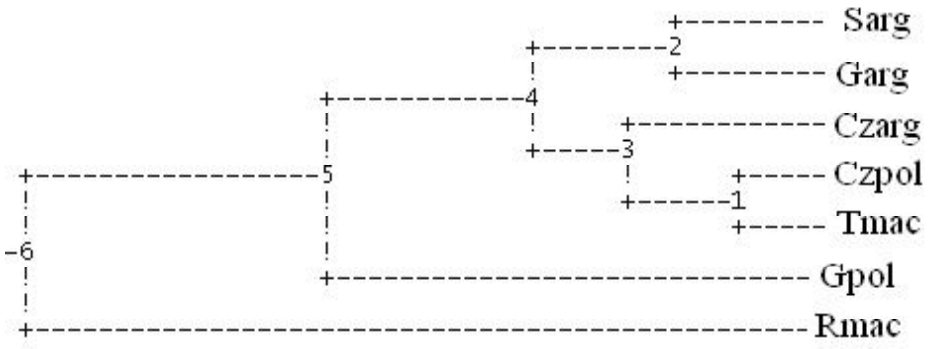


Fig. 3 The dendrogram based on Nei's genetic distances (Method UPGMA, modified from NEIGHBOR procedure of PHYLIP Version 3.5) constructed for seven analysed Lithuanian populations of Elachista species. The marking of populations shown in the Table 1.

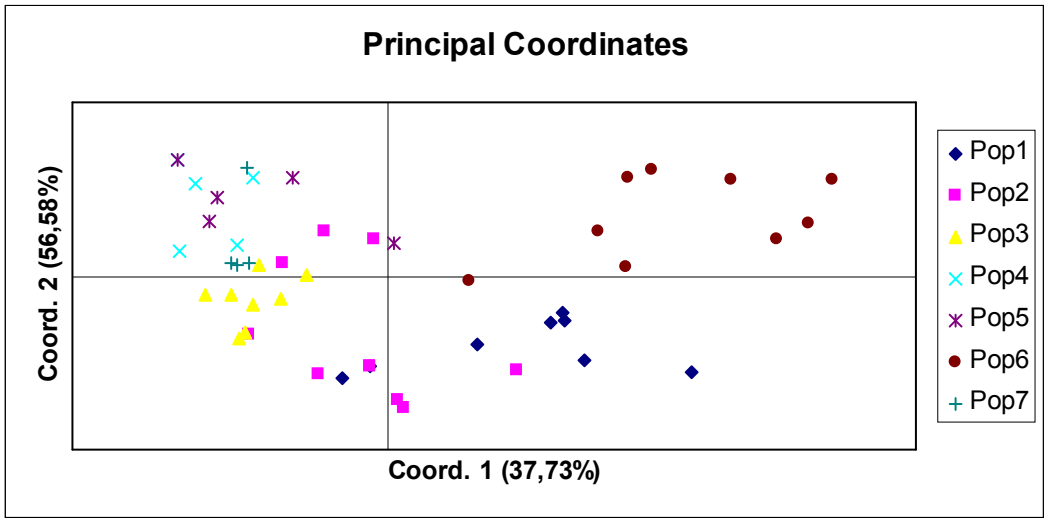


Fig. 4. Association among 7 *Elachista* populiations by principal coordinates analysis. Pop1 – Sarg, Pop2 – Garg, Pop3 – Czarg, Pop4 – Gpol, Pop5 – Czpol, Pop6 – Rmac, Pop7 – Tmac. The marking of populations shown in the Table 1. Genotyping was done on 50 *Elachista* moths.

(Czarg) formed second group and *E.argentella* from Strėvininkai f. (Sarg) belongs for third group. *Elachista polinariella* moths from Čiužiūnai (Czpol), *E.polinariella* from Grobštas nature reserve (Gpol) and *E.argentella* from Grobštas nature reserve (Garg) are most distinctly separated.

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THE IMPACT OF PHYTOHORMONES ON PASQUEFLOWER *(PULSATILLA)* REGENERATION *IN VITRO*

Ingrida Šaulienė, Erika Brinkytė

Šaulienė I., Brinkytė E. 2009. The impact of phytohormones on pasqueflower (Pulsatilla) regeneration in vitro. *Acta Biol. Univ. Daugavp., 9(2): 249 - 254.*

Pulstatilla Mill. is a perennial ornamental and medical plant belonging to *Ranunculaceae* Juss. family. Some species of *Pulstatilla* Mill. are endangered therefore included into the Red Data Books of European countries in which it occurs. One of the pathway for *Pulstatilla* gene fund protection is the conservation of plants *ex situ*. Botanical gardens are among the leaders of *ex situ* conservation. At the same time germoplasma banks with cultures *in vitro* can be an alternative choice. The aim of this research was to establish the phytohormonal ratio for *Pulsatilla* regeneration and proliferation *in vitro*. Murashige&Skoog (MS) media was chosen to induce the pasqueflowers regeneration. The impact of the different ratio (1:1; 1:2; 1:5) of phytohormones 6-benzylaminopurine (BAP) and indole-3-acetic acid (IAA) was analysed. Final experiments' results have showed that the biggest number of regenerates can be achieved when *Pulsatilla* cultivates in MS media is supplemented by phytohormones with ratio 1IAA:2BAP. Despite casual rhizogenesis, the process of root formation was not induced after various manipulations. According to some specific literature root formation is conditioned by mycorrhiza. On the other hand, transfer of this process *in vitro* is a question for discussion and future researches.

Key words: *Pulsatilla,* regeneration *in vitro*, phytohormonal induction

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INTRODUCTION

In many countries around the world conservation of biodiversity has currently become a priority task (Ryttari et al. 2003, Röder 2007, Röder & Kiehl 2006, Strode & Roze 2009). There is no exception in Lithuania either where the landscape is unique and interesting but the increment of human activity generates a serious risk. Peoples' desire to manage the environment with local typical plants, interest in nature, new view on the ornamental characteristics of wild plants, is becoming a serious problem and raises threats for rare and unique plants. For this reason, the system of protected areas is developed with a purpose to preserve the cultural heritage and biodiversity. The *ex situ* method of wild plant species is very important for the conservation (Danova et al. 2007, Hamilton 2002), because it helps to preserve the survival of threatened plants before their introduction to the natural environment. Unfortunately what attracts our

attention is often heavily maintained and it is necessary to find ways to facilitate faster access to plants or clones. The *in vitro* method of plant propagation is being applied for various purposes around the world and may help solve this problem (Beruto & Debergh 1992, Beruto & Debergh 2004, Jabeen et al. 2007, Klavina et al. 2004, Pugliesi et al. 1992). Still, there is another problem that *ex situ* may not be able to create the optimal conditions for plant growth (such of the environment *in situ*).

Ornamental characteristics of pasqueflower (*Pulsatilla* Mill.) because of its indifferent beauty can be very attractive for urban gardening. Unfortunately, this is one of the determinants of the loss plants in nature. Thus, the ability to obtain the required number of individuals within a short period while preserving the parent plant may not only ensure the success of the formation of urban green areas, but also maintain populations in nature. Based on this trend, the work analyzes the potency of pasqueflower regeneration *in vitro*. Plant cultivation *in vitro* protocols established by scientists caused problems for exploring the possibilities of initiated the pasqueflowers' regeneration and induce the usage of regenerants for rhizogenesis (Klavina et al. 2004). Furthermore it was found that the regeneration competence is essentially fates by plant genetic characteristics and environmental condition which leads the success of pasqueflower propagation *in vitro* (Klavina et al. 2004, Moora et al. 2004, Opik 2004, Röder 2007).

The aim of the study was to find out the phytohormonal ratio which determines the biggest number of pasqueflower regenerants *in vitro*.

MATERIALS AND METHODS

The seeds of *P. vulgaris* and *P. grandis* which are collected in Siauliai University Botanic Garden in 2008 were used for the studies. The collected seeds were disinfected for 5 minutes in sodium hypochlorite solution. Materials were

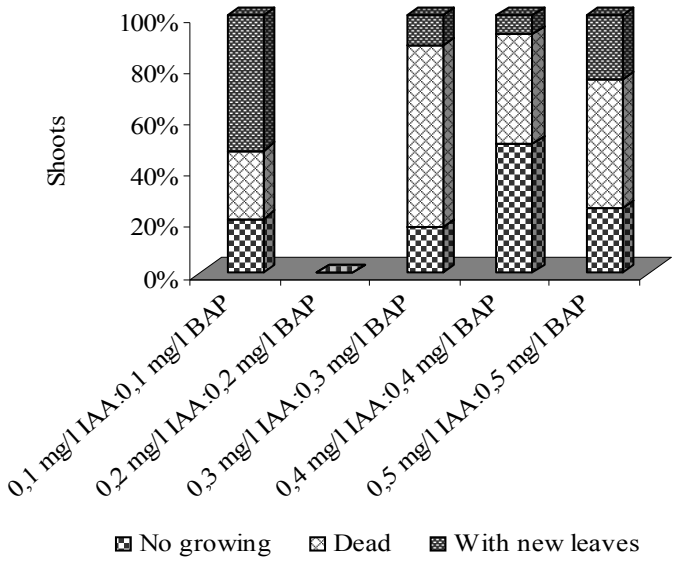

Fig. 1. The impact of phytohormones on shoot's development

cultivated in Murashige & Skoog (MS, 1962) medium supplemented with growth regulators IAA (indolil-3-acetic acid) and BAP (6-benzilaminopurin). Quantities of phytohormones were chosen considering Klavina et al. (2004) research where growth regulators were used in concentrations from 0.1 to 0.5 mg / l. Five different versions of MS media (with different concentrations of phytohormones) were prepared. In all the cases the ratio of phytohormones was 1:1. Cultivation of explants *in vitro* was held in the special chamber with the temperature set at 25° C and the photoperiod of 16 hours.

Analysis of the data was presented on the basis of *P. vulgaris* explants' regeneration and development results. At the end the comparison of regeneration potency between the *P. vulgaris* and *P. grandis* was made.

RESULTS AND DISCUSSION

The first step covered the stabilization *in vitro* of the research material. Whereas sodium hypochlorite is a substance often used to disinfect organs before they are transferred into *in vitro* environment (Galvysis et al. 2007; Sliesaravičius & Stanys 2005), therefore in our case exceptional difficulties have not been encountered. The seedlings used for studies of phytohormones impact emerged within 20 days. The roots of *P. vulgaris* seedlings were removed and the shoots were transferred to MS medium supplemented with different amount of phytohormones. The results of the experiment showed that the regenerates cultivated in MS (+) medium developed normally and formed leaves, but the rhizogenesis has not been induced. The evaluation of phytohormonal signal to the shoot regeneration potency have highlighted that *P. vulgaris* explants cultivated in the first variant (when the MS medium was supplemented with 0.1 mg/l IAA and 0.1 mg/l BAP) formed a greater number of viable shoots in comparison with other test cases (Fig. 1).

This result allowed the continuation of the investigation with the purpose to determine the significance of phytohormonal signal for pasqueflowers' regeneration *in vitro*. Findings of the optimal phytohormonal ratio MS medium supplements were done under a well-known conception, which argues that the shoot regeneration takes place when the nutrition medium ratio of auxins and cytokinins is in excess of cytokinins. While cytokinins encourage the sharing of cells (mitosis) the increased concentration of BAP in nutrition medium was used to expect the activation of organogenesis in pasqueflowers' explants. The evaluation of the

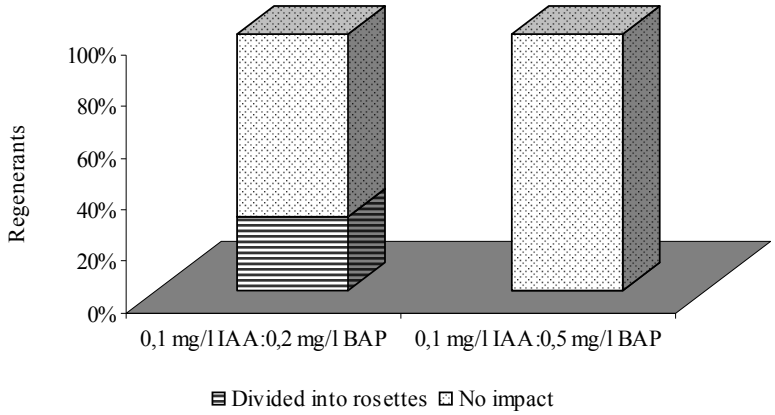

Fig. 2. Induction of new rosettes forming when explants are transferring into MS media without phytohormones

above-presented results of the regeneration potency, two versions of MS medium supplemented with phytohormonal ratio 1IAA:2BAP and 1IAA:5BAP were prepared. Explants in such composition of MS medium were cultivated for a month. However, the propagation characteristics of *P. vulgaris* explants transferred to MS medium without phytohormones have not been set. This change in nutrition medium composition was intended to cause the stress. Other culture conditions maintained the same as before.

After a month of exposure in medium without phytohormones, a response to changed cultivation conditions was fixed in the new shoot number. It was found that part of the mother shoots, which were cultivated in medium with 0.1 mg / l IAA 0.2 mg / l BAP, began to form new rosettes. This effect was not found with shoots previously exposure in media with high amount (0.5 mg / l) of cytokinins (Fig. 2).

With a purpose to induce the rhizogenesis, shoots of *P. vulgaris* from the media with phytohormones complexes (0.1 mg / l IAA: 0.2 mg / l BAP and 0.1 mg / l IAA: 0.5 mg / l BAP), were moved into the environment with the maximum quantity of auxin (0.5 mg / l IAR). However after making a large number of repeats the expected rhizogenesis was not induced (Fig. 3).

Pulsatilla root formation was not induced in the experiments of other scientists (Klavina et al. 2004) too. Reason why rhizogenesis *in vitro* conditions failed could be that the naturally growing pasqueflower has peculiarity of mycorrhiza (Opik 2004). This assumption is not conclusive, because in case of *P. grandis* the rooted shoots were established.

To confirm the results of the investigation and to establish the needs of species features *P. vulgaris* and *P. grandis* regeneration potential were compared (Figure 4). The data showed that *P. vulgaris* formed less rosettes in comparison with *P. grandis*. In addition, the rhizogenesis with *P. vulgaris* shoots have failed, but 20% of *P. grandis* regenerates formed the roots, though the cause has not been determined. Summarizing the investigation it can be said that the varied and constant manipulation with phytohormones ratio in nutrition media and stress generation (regenerants transfer to medium without phytohormones) allows to change the way of development.

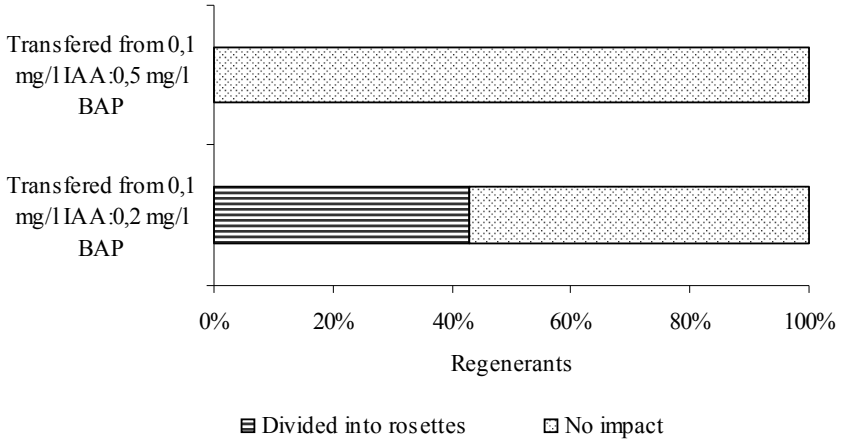

Fig. 3. 0.5 mg / l IAA impact on *P. vulgaris* shoots

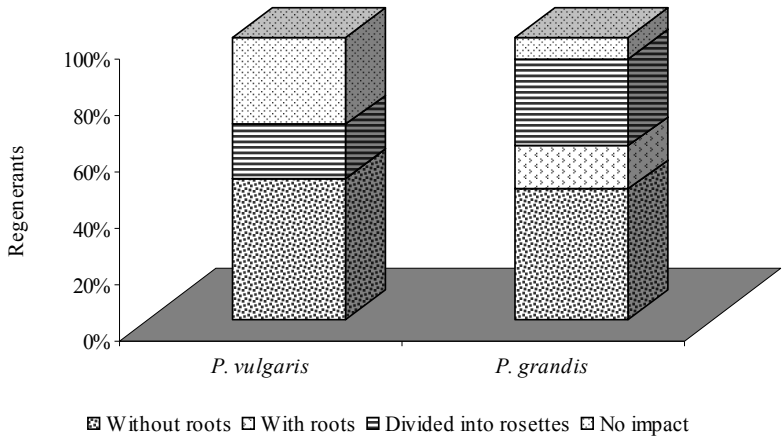

Fig.4. Comparison of *P. vulgaris* and *P. grandis* regeneration

However, regeneration potency is definitely determined by the type of genetic features. The comparison results of two species of propagation *in vitro* have shown that the effect of phytohormones is more intensive in case of *P. grandis*.

Moreover, higher regeneration potential and regenerants for rooting are more likely for these species than *P. vulgaris*. Despite this fact, the main purpose of the study to find out the phytohormonal ratio for stimulation of rosette proliferation was achieved. It was found that the MS medium supplemented with 0.1 mg / l IAA: 0.2 mg / l BAP can induce shoot multiplication and thus in a short period of time it is possible to obtain the new *Pullsatila* individuals that may be used for various purposes starting from biodiversity conservation tasks and usage in ornamental plants gardening.

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Ryttari T., Kukk U., Kull However, regeneration potency is definitely determined by the type of genetic features. The comparison results of two species of propagation *in vitro* have shown that the effect of phytohormones is more intensive in case of *P. grandis*. T., Jakalaniemi A., Reitalu M. 2003. The Finnish environment. Monitoring of threatened vascular plants in Estonia and Finland – methods and experiences. Helsinki: Finnish environment institute.

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THE DISTRIBUTION OF AIRBORNE *AMBROSIA* POLLEN IN LITHUANIA

Ingrida Šaulienė, Laura Veriankaitė

Šaulienė I., Veriankaitė L. 2009. The distribution of airborne *Ambrosia* pollen in Lithuania. *Acta Biol. Univ. Daugavp., 9(2): 255 - 262.*

The increased number of ragweed pollen in Lithuania caused an alarm between botanists and allergists. Airborne pollen data are collected in three aerobiological monitoring stations in Lithuania. For the analysis of air masses movement we used the backward trajectory calculations with the HYSPLIT 4 model. The technique was employed for the evaluation of the direction of coming air masses, on the grounds of which Europe was divided into 5 regions. Ragweed pollen was observed in Lithuania in 2004. The biggest amount was fixed in 2008. The concentration of ragweed pollen in the air increased significantly since 2004. It was demonstrated that ragweed pollen fall was recorded in cases when air masses from Central Europe (France, Germany, Italy, Switzerland, Czech Republic, Poland, Croatia, Slovakia and Hungary) dominated. However, analysis of the results showed that air masses movements from those territories not always transfer ragweed pollen in August-September.

Key words: back-trajectory, air masses, long-range transport, HYSPLIT

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INTRODUCTION

Ambrosia L. pollen are one of the most potent aeroallergens (Mandrioli et al. 1998, Dahl et al. 1999, Stach et al. 2007, Smith et al. 2008, Skjøth et al. 2009). The uncontrolled spread of ragweed pollen from the southern to the northern part of Europe raises the concern about sensitisation of human population. Moreover ragweed produces pollen in enormous amounts: one single plant alone may produce millions of pollen grains. Whereas the pollen grains are small (18–22 μm) they are often involved in episodes of long distance transport (Mandrioli et al. 1998).

The sensitivity to ragweed pollen is still under investigation. Prior empirical studies showed that most people sensitive to the ragweed pollen are symptomatic between 10 and 50 pollen grains/m^3 (Solomon 1984, Bergmann et al. 2008), but several

researches indicate that the allergy risk is observed when ragweed pollen reach just 5 pollen grains/m^3 (Déchamp et al. 2008). Estimations on the influence of climate change to pollination season demonstrate that duration of ragweed pollination season does not vary, but number of days with ragweed pollen increased (Jäger, Berger 2008).

The increased number of ragweed pollen in Lithuania caused an alarm between botanists and allergists. Ragweed plants are represented by two species – *Ambrosia artemisiifolia* L. and *A. trifida* L. *A. artemisiifolia* in Lithuania, which were first found in 1884, *A. trifida* – in 1947 (Gudzhinskas 1993). A numerous of ragweed group was observed in Vilnius (Saar et al. 2000). The flowering of these plants was fixed in August-September. The increasing problem to sensitisation to ragweed pollen in Europe triggered studies on ragweed pollen occurrence in Lithuania.

The aim of this research was to analyse the spread of *Ambrosia* pollen in the air of Lithuania.

MATERIAL AND METHODS

Airborne pollen data are collected in three aerobiological monitoring stations in Lithuania (Fig. 1). Seven day recording volumetric spore traps are used in Klaipėda, Vilnius and Šiauliai cities. The identification of samples are made under the microscope by checking 12 vertical sweeps on each slide. In this research the amount of pollen was estimated every 2 hours.

For the analysis of air masses movement we used the backward trajectory calculations with the HYSPLIT 4 model (Hybrid Single-Particle Lagrangian Integrated Trajectory). The model is provided by the Air Resources Laboratory of the National Oceanic and Atmospheric Administration (Draxler, Rolph 2003). The simulations were based on meteorological reanalysis data from NOAA archives (global coverage from 1948 to present) chosen for 2004 – 2009 (this year until the middle of August) and GDAS data (global cover from 2006 to present) from middle of August until the end of September of 2009. Backward air masses trajectories were calculated by using GDAS meteorological data. The air parcel motions were computed on the meteorological model's vertical velocity fields with the starting heights set at 500 m above the model ground level. The time period for each simulation was 72 hours. In total, for evaluation of air masses movement there were computed 378 backward trajectories.

Fig. 1. Aerobiological monitoring stations in Lithuania

The technique for the evaluation of the direction of coming air masses was employed on the grounds of Europe's division into 5 regions according to S. Kazakevičius, A. Mikelinskienė (2001). The regional division of Europe is presented in the following way. The 1st European region involves air masses that usually form in the North Atlantic. They move across the Scandinavian Peninsula, Great Britain, Denmark, the North Sea, the Norwegian Sea and the Baltic Sea. The 2nd region comprises air masses moving through Central Europe (France, Germany, Italy, Switzerland, Czech, Poland Croatia, Slovakia and Hungary). Air masses ascribed to the 3rd region move through the south-eastern part of Europe (Greece, Bulgaria, Romania, Ukraine and Belarus). The 4th region consists of northern air masses

moving from the Arctic Ocean, Spitsbergen, the Barents Sea and travelling over Finland, Karelia, Estonia, Latvia and Russia. The 5th region includes local air masses (the territory of Lithuania).

RESULTS AND DISCUSSION

In Lithuania investigations of alien plants have been carried out on the whole territory since 1987. However populations of ragweed plants are investigated rarely. Generally such types of research are performed during the realisation of various projects. One of the last researches was published by Saar et al. (2000). This is the main inconvenience in the process of pollen spread evaluation in the air. On the ground of botanists knowledge in hot and sunny summer and autumn ragweed plants can reach the pollination stage in northern Europe (Dahl et al. 1999, Saar et al. 2000). Ragweed pollen was observed since 2004 when aerobiological investigation started in Lithuania (Fig. 2).

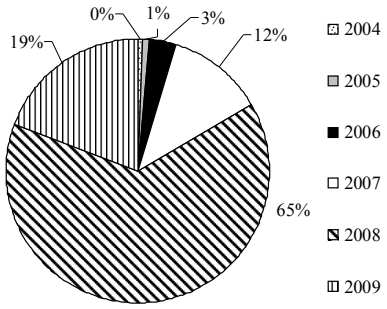

Fig. 2. *Ambrosia* pollen sum in Lithuania

Ragweed pollen concentrations in the air fluctuate from year to year. It is difficult to compare airborne pollen concentration and local plants flowering because of the gaps in plant distribution knowledge. It is evident that pollen concentration has been increasing in Lithuania since 2007. The amount of ragweed pollen per day is not large. The analysis of situation is essential because of few high potent aeroallergen can strengthen sensitivity to mugwort pollen (Dahl et al. 1999, Asero et al. 2006).

In the year of 2008 very big amount of airborne ragweed pollen was fixed in Lithuania (Fig. 3).

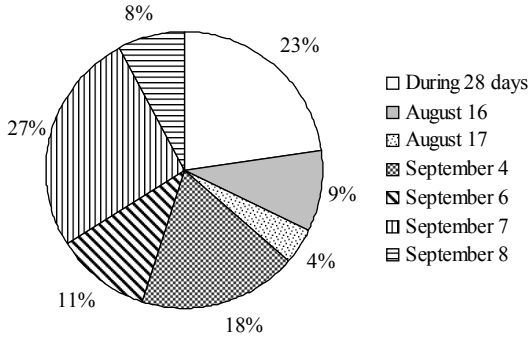

Fig. 3. Percentage of *Ambrosia* pollen counts in Vilnius aerobiological station in 2008

During the 34 days of August and September we fixed days with Ambrosia pollen. In 28 days of this period it was caught about 23 % of total pollen amount. Figure 3 shows that pollen concentration in separate days was high. The maximum counted in 7th of September was 61 pollen grains/m^3, it tots up to 27% of pollen amount per period. Such number of pollen is typical for Central Europe countries, especially for Hungary (Peeters 2000, Makra et al. 2005, Peternel et al. 2006).

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To sum up, the situation that 20 pollen/m^3 affect the majority of sensitive patients, the 4 days of September (since the 4th until the 8th) can be entitled as exceptional case for allergenic patients in Lithuania. We have done the analysis of ragweed pollen origination for all of these cases. Due to the fact that such amount of pollen can not be expected from local sources we analysed the probability of long distance transport.

The calculated trajectories by using HYSPLIT model showed that air masses

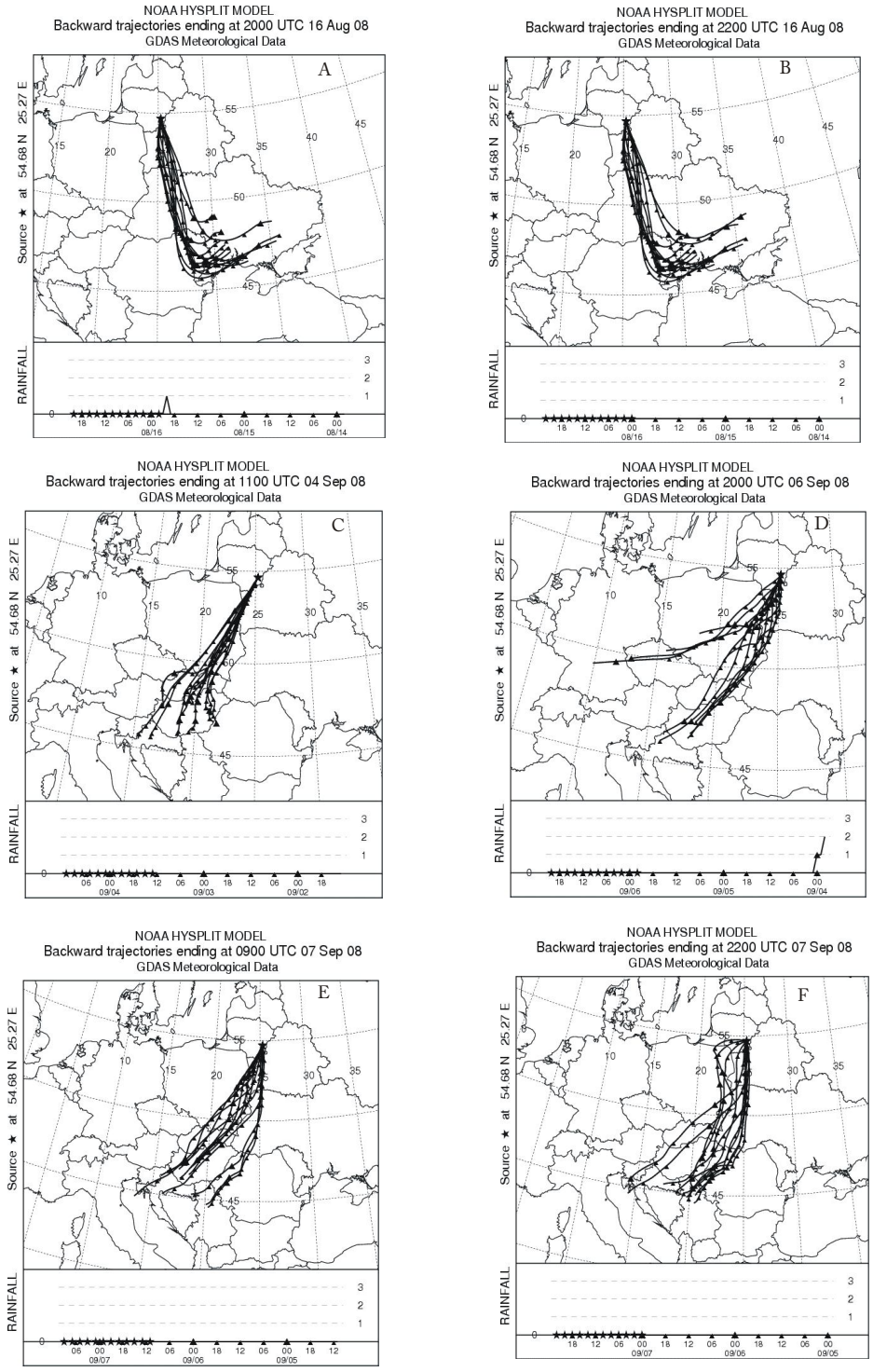

Fig. 4. Backward air masses trajectories (500 m height) reached Vilnius aerobiological station in 2008: A – 16th of August, B – 17th of August, C – 4th of September, D - 6th of September, E – 7th of September, F – 8th of September

arriving from Central and South Europe prevailed in days when ragweed pollen concentration in air exceeds 3% of total sum in 2008 (Fig. 4). This territory is under concern of all Europe because of abundance of ragweed plants group (Mosyakin, Yavorska 2002, Apatini et al. 2008, Pyšek et al. 2009).

The analysis of long distance air masses transport expose that ragweed pollen transport is possible. As demonstrated in Fig. 4 air masses on the road has not been rain, and pollen from Central Europe could be fixed in Vilnius aerobiological station. The fact that pollen number was variable and it was fixed only at certain hours strengthens our assumption about the pollen from non-indigenous origin. According to Smith et al. (2008) publication's similar survey of ragweed pollen origin was indicated in Poland in 2005. The impression is that in August-September air masses arrival from the potential regions can lead to an increase of the ragweed pollen in the air. However, not in all years have been caught so many ragweed pollen (Fig. 2). Therefore directions of air masses movement were analyzed of the whole period (Table 1).

It was found that more than half of the investigation period was dominated by the air masses arriving from the European region 1, formed in the North Atlantic. Ragweed pollen found by the aerobiologists in this area are generally referred to as long-range transport episodes (Skjøth et al. 2009). Thus, this region should not be a potential source of ragweed pollen. During the investigation period almost a quarter of arrived air masses came from the region 2, where the high ragweed plant group lays. France, Czech Republic, Hungary and scientists from other countries in this region regularly publish researches about increasing of Ambrosia pollen concentration (Peeters 2000, Déchamp et al. 2002, Macro et al. 2005, Peternel et al. 2006). These areas are a potential source of pollen fixed in Lithuania. Assumption is strengthened by the fact that ragweed pollen was trapped in aerobiological stations of Lithuania when the air masses transport from the region 2 dominated. The same situation was found in 2008, but an exceptional abundance of ragweed pollen in samples was recorded in aerobiological station Vilnius (Fig. 4). Analysis of results demonstrates that dominance of air masses from second

Table 1. Prevailing air masses reached aerobiological stations in Lithuania in 2004-2009

Aerobiological station	Year	Europe region (dominated air masses per period)			
		August 10-20	August 20-31	September 1-10	September 10-20
Klaipėda	2004	1/4	2	1	2
	2005	1	1	1	1
	2006	2	1	1	2
	2007	1	1	1	1
	2008	2	1	2	4
	2009	1	1	2	1
Šiauliai	2004	4	2	1	2
	2005	1	1	1	1
	2006	4	4	1	2
	2007	1	1	1	1
	2008	2	1	2	4
	2009	1	1	2	1
Vilnius	2005	1	3	1	1
	2006	3	2	1	1
	2007	3	1	1	1/2
	2008	2	2	2	4
	2009	1	1	2/3	3/4

European region were possible ragweed pollen releases with a long distant transport into the area of Lithuania in August-September. In the meantime, it is difficult to assess why a higher concentration of pollen released in Vilnius each year in comparison with Klaipėda and Šiauliai. Detailed planetary boundary layer depths calculations and analysis should be helpful to clear the situation. With this type of research it was found that the deep planetary boundary layer in Slovakia and Hungary could introduce Ambrosia pollen via long-range transport to neighboring countries such as Germany Canada, Denmark, and the Baltic countries (Smith et al. 2008). This could explain the irregular ragweed pollen fixing in different aerobiological monitoring station when air masses arrived from an area rich in potential ragweed pollen prevailed. Long distant transport of these pollen can be expected with air masses from the 3 region, which includes Romania, Bulgaria, Macedonia, Serbia. Ragweed plants and abundant pollen levels are described in publications of these countries (Šikoparija et al. 2009, Ianovici 2008). Our data showed that air masses from the third European region rarely reach Lithuania, only 7% during the period. The analysis of dominating air masses is a method that can be used only for the initial assumptions about the origin of the pollen, but an attempt to identify regularities requires an additional research, which could be initiated as joint investigation of scientists from different scientific fields (aerobiologists, botanists, meteorologists, physicists and others).

CONCLUSIONS

Studies have shown that each year ragweed pollen are recorded in the Lithuanian territory. The amounts of airborne ragweed pollen vary from a few grains up to around 300. The concentration of the pollen in the air increased significantly since 2004

The situation fixed in Vilnius aerobiological station in 2008 indicates that there is a real opportunity to get ragweed pollen allergy outbreaks in Lithuania, because of the days when the pollen concentration in the air exceeded 50 pollen grains/m3 have been established.

It was found that ragweed pollen fall recorded in cases when air masses from Central Europe (France, Germany, Italy, Switzerland, Czech Republic, Poland, Croatia, Slovakia and Hungary) dominated. However, analysis of the results showed that air masses movement from those territories in August-September transfer ragweed pollen not always.

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Extension of spring wheat breeding using doubled haploids technology

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In 1990ies, new spring wheat breeding programme was established at the State Stende Cereals Breeding Institute with the goal to create new varieties with the high grain yield and quality, conforming industry requirements, as well with the resistance to lodging and main diseases. Traditional breeding methods are dominant in cereals breeding till nowadays. Nevertheless, traditional breeding methods are slow and could take even 15 years till the developing of a new variety. Methods of biotechnology, like double haploids (DH) and molecular marker assisted selection could highly contribute to improving efficiency and to speeding up the breeding process. The application of the spring wheat breeding programme started with renovation and evolution of the genetic resources usable as an initial breeding material in Latvian conditions. DH technology and molecular marker methods were used in appropriate breeding stages. The protocol of DH lines obtaining from spring wheat anther culture was modified. As an initial material breeder's F_2 hybrids (Dragon/Aniina)/Fasan) of spring wheat were used. The cold (+4 ţC) pre-treatment of spikes was applied, then spikes were sterilized by 50% solution of bleach for 17 min. Isolated anthers were cultivated on the AMC induction medium with 2.5 mg/l $CuSO_4$ x $5H_2O$. Produced DH lines were multiplied and tested in field conditions. The DH line DH-3 shown very promising results and was passed to the State variety testing as a candidacy for a new spring wheat variety adapted to the Latvian conditions. Molecular certification of genetic homogeneity of the new potential variety by microsatellite DNA markers was applied.

Key words: wheat, double haploids, variety, molecular certification

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INTRODUCTION

Humans face new challenges impose by the growing impact of climatic changes. Climate data shows that the past decade have been the warmest recorded in history, and according to other sources the warmest in the last 1,000 years (Osborn and Briffa 2005). Climate modellers have been warned for a decade about the extent and seriousness of global climate change. In the next 50 years the global temperature will increase at least 3 to 5 ţC, with negative consequences such as desertification, soil erosion and water scarcity with unpredictable weather year on year delivering floods, hurricanes, etc. (Jones et al. 2003; SUSVAR Visions workshop, 2008). Climate changes are a real threat to world food security alongside a negative impact on nutrition quality. The main challenges from climate change to agriculture and food production are more frequent and severe drought and floods, and higher pressure from insects and diseases (Rosenzweig et al. 2001).

Different and multifunctional strategies are necessary to develop new varieties adapted to the local conditions. Currently grown crops used in agriculture, such as cereals, have been improved to become well adapted to environmental conditions.

Now plant breeders need to focus on the future as well as the present, and evaluate the huge genetic resources in gene banks and wild, that carry potential for adaptation of major crops to a changing climate. Genetic diversity that exists in landraces and wild species should be exploited and local knowledge should be used to guide crop and variety selection (Lane and Jarvis 2007). Climate change also gives impact on agricultural genetic resources.

In Latvia, spring wheat has become more popular crop by the last decade of 20th Century. Growing area each year range between 50 000 – 60 000 ha, but there is a tendency to increase the sowing area and the production. Traditionally, the spring wheat has a lower grain yield, but better grain quality (Blakman and Payne, 1987). Spring wheat mostly is used for food, less for feed or bio-ethanol production. The most popular use of spring wheat is conventional farming, but there are varieties suitable also for organic farming (Belederok *et al.*, 2000).

Spring wheat breeding programme was renewed at the State Stende Cereals Breeding Institute (CBI) since 1990, starting with expending and evolution of the genetic resources. The main goals of breeding programme were stated creating of new high yielding varieties with the grain quality conform to requirements of end users, with the resistance to lodging and main diseases.

Traditional breeding methods are dominant in the cereal breeding till nowadays. In conventional breeding desirable characters can be improved by selection in heterogenic hybrid material before line homosigotasition for several generations. For this reason traditional breeding methods are slow and could take even 15 years till the developing of a new variety. Another disadvantage of traditional breeding methods is inefficiency of selection in early generations because of the *heterozygosity* of the breeding material on this stage. Methods of biotechnology, like double haploids (DH) and molecular marker assisted selection could highly contribute to improving efficiency and speed up the breeding process.

DH technology and molecular marker methods (Rajaram 2001, Kasha and Maluszynski 2003) are used nowadays in appropriate breeding stages at the State Stende CBI. The objective of this paper is to describe a new wheat variety bred there on the base of DH approach and to give description of they characteristics.

MATERIAL AND METHOD

Obtaining of DH lines

One hundred three F_2 hybrids of spring wheat ([Dragon/Aniina/Fasan]/Fasan) from the State Stende CBI were used for DH producing. DH lines were obtaining from anther culture in the Institute

of Biology, University of Latvia. Donor plants were grown in a greenhouse at optimal growing conditions (+17 to 20 °C at night, +25 to 30 °C at day, humidity ~ 70%). Spikes were collected and preserved in +4 °C temperature. After two weeks the developmental stage of microspores was estimated. Spikes with microspores in mid or late uniculate stage were used for anther culture establishing. Spikes were sterilized with 50% bleach "Beļizna" water solution for 17 minutes (Grauda *et al.* 2005). AMC media supplemented with 2.5 mg/l $CuSO_4$ x $5H_2O$ (Jacquard *et al.* 2009) was used as embryo initial media.

After four weeks obtained embryos were moved on the regeneration media (190-2).When they started to develop green plantlets, embryos were planted on the rooting media (MS supplemented with 1 g/L coal) (Nicherlein 2003). Well developed plantlets were planted in the autoclaved sand and cultivated at 16/8 hours day/night photoperiod at +20 to 26 °C temperature, humidity ~70%. Two-three weeks after transferring plantlets in the sand number of chromosomes were doubled (Tuvesson *et al.* 2003). Two weeks later plants were planted in soil and cultivated in a growing room till maturity.

Field evolution of DH lines

During 2001-2008 produced DH lines were multiplied and tested in field conditions at the State Stende CBI in a conventional cereal breeding crop rotation field. The soil at the experimental site was sod-podzolic sandy loam, soil pH_{KCl} – 5.6, humus content – 15 mg kg^{-1}, P_2O_5 – 203 mg kg^{-1}, K_2O – 194 mg kg^{-1}. The pre crop was winter rapeseed, NPK 18:9:9 500 kg ha^{-1} was applied. As test varieties 'Dragon' and 'Vinjett' were used. Several agronomically and economically important traits were evaluated: period of maturity, plant height, ear length, grain yield, 1000 kernel weight, volume weight, resistance to lodging and to diseases, grain quality (protein, starch, gluten content, Zeleny index, Falling number). The grain quality was determined by the grain analyser 'Infratec 1241'. Statistical analyses were performed using the Agrobase 4 software package.

Molecular analysis

For molecular certification of genetic homogeneity of the new variety microsatellite DNA markers were applied. Genomic DNA from fresh leaf tissue of 6 plants of the line DH-3 was extracted using CTAB method (Cota-Sanchez et al., 2006). Polymerase chain reaction was performed in a volume of 20 µl in thermocycler Gene Amp® PCR System 9700. Eight, earlier found as polymorphic, primers Xgwm131, Xgwm148, Xgwm186, Xgwm219, Xgwm325, Xgwm332, Xgwm369, Xgwm539 were used. The reaction mixture contained 0.5 µM of each primer, 0.2 mM of each deoxynucleotide, 2 µL $MgCl_2$, 10.5 µL molecular water, 2 µL PCR 10 x buffer, 0.5 unit *Taq* polymerase, and 10–20 ng (1µ volume) of template DNA. 45 cycles were performed with 1 min at 94 °C, 1 min at 60 °C, 2 min at 72 °C, and a final extension step of 10 min at 72 °C (**Röder et al., 1998).** The amplified products were sequenced using Applied Biosystems 3130xl Genetic Analyser.

RESULTS AND DISCUSSION

Obtaining of DH lines

More then hundred spikes of F_2 hybrids were collected for anther culture creating. After three weeks since anther culture establishment development rate of embryos was 5% to planted anthers. It was rather low pollen embryogenesis percentage: some other hybrids used for DH obtaining in the same conditions shown embryos development efficiency up to 43%. However, 22% of embryos planted on regeneration media developed green leaves and roots after 2-4 weeks.Tventy three green plantlets were obtained from F_2 oh the hybrid combination [Dragon/ Aniina/Fasan]/Fasan, but only 4 plants produced seeds. DH lines obtained from that hybrid were passed to the State Stende CBI.

Selection of the line DH-3

Obtained DH lines were tested in the State Stende CBI. After three years of field evolution the best

Table 1. History of the doubled haploid line DH-3, a new potential spring wheat variety

Year	Activity
2001-2003	Producing hybrids at the state Stende CBI in the combination [Dragon/Aniina/Fasan]/Fasan
2004-2005	DH-3 line obtaining at the Institute of Biology, University of Latvia
2005	Propagation and disease resistance evaluation at the State Stende CBI (several plants)
2006	Propagation and evaluation at the State Stende CBI (plot size $2m^2$, 2 replications)
2007	Propagation and evaluation at the State Stende CBI (plot size 10 m^2; 4 replications)
2008	Official Value for Cultivation and Use (VCU) test in Latvia
2009	Official VCU test in Latvia, Distinction, Uniformity and Stability (DUS) test in Poland

Table 2. Some agronomically important traits of the line DH-3 in comparison with standard and parent varieties (average for 2006-2008)

Variety	Grain yield, t ha-1	+/- tha-1	1000 grain weight, g	Protein, content, G kg	Gluten content, %	Heading date
DH-3	**7.20**	**+0.04**	**38.61**	**137**	**29.5**	**01.07**
Vinjett (Standart)	7.16	-	38.89	146	31.8	28.06
Dragon (Parent)	6.55	-0.61	38.73	151	33.2	30.06
Fasan (Parent)	6.75	-0.41	38.58	142	30.3	30.06
Aniina (Parent)	5.82	-1.34	30.63	158	35.2	27.06

line (DH-3) was selected as a potential new variety and was submitted to the official variety testing. The line DH-3 is under VCU testing in Latvia from 2008 and DUS testing in Poland from 2009. All stages of creating and selection of the line DH-3 are presented in the Table 1.

Characteristics of the line DH-3in comparison with their parents varieties

Three varieties with wide-ranging agronomical important traits and adaptation ability for climate were used as parent varieties of the line DH-3. Variety 'Dragon' (released in 1990) is one of the most used varieties since 1991 (Johanson and Svenson 1998). It is medium late, characterized by high yield stability, lodging resistance, medium resistance to leaf diseases, grain quality corresponding to food. The variety 'Aniina' (released in 2001) is one of the earliest varieties, characterized with high grain quality, also corresponding to food. The variety 'Fasan' (released in 2002) was medium late, characterized with high yield stability, elite food quality. The line DH-3 is a middle-early (three days later compared with the standard 'Vinjett') and characterized by high yield potential (6-8 t ha^{-1}), moderate resistance to lodging (7), and plant height 93-98 cm (some agronomic characteristics of the line DH-3 and their parent varieties presented in the Table 2). The line has also a moderate resistance to *Blumeria graminis* f.sp. *tritici*, *Puccinia triticina*, *Septoria tritici* but the line is susceptible to *Drechslera tritici-repentis*. The grain quality is suitable for food.

Molecular certification

Homogeneity of DH-3 plants was observed in the all tested microsatellite loci.

CONCLUSION

Plant breeders need to focus to adaptation of major crops to a changing climate. Presented results demonstrated that on the base of collaboration between universities and breeding institutions it is possible to breed new varieties in rather short time, saving by this also financial recourses. If accepted, the line DH-3 will be the first spring wheat variety created in Latvia by using hybridisation with following doubled haploid biotechnological aproach.

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EVALUATION OF TERATOGENIC ACTIVITY OF THE SMOKE OF BURNING COMBUSTIBLE PLASTIC INFLUENCING THE *DROSOPHILA MELANOGASTER*

Zinaīda Sondore, Aija Brakovska, Elena M.Kirilova

Sondore Z., Brakovska A., Kirilova E.M. 2009. Evaluation of teratogenic activity of the smoke of burning combustible plastic influencing the *Drosophila melanogaster. Acta Biol. Univ. Daugavp., 9(2): 269 - 276.*

The experiments in which larvae and pupae of *Drosophila melanogaster* of various ages were influenced by different doses of the smoke produced by the burning plastic with the aim of evaluating its teratogenic activity at various stages of postembryonic development. The experiment results demonstrate that the frequency of imago with abdominal tergites (morphoses) grows with increasing doses of the smoke of burning plastic, namely polyethyleneterephtalane (PET) and polysterene (PS); it also depends on the age of larvae and pupae at the moment of the influence.

Larvae of younger age (24-32 hrs after the eggs are laid) and pupae of younger age (120-136 hrs after the eggs are laid) proved to be most sentitive to different doses of the teratogenic influence of the smoke of burning plastic (PET and PS). At these ontogenesis stages abdominal gistoblasts from which tergites develop, are actively mytotically dividing (Nothinger 1972). The conclusion arrived at is that the dividing cells are more sensitive.

Key words: *Drosophila melanogaster*, teratogenic activity, morphoses, abdominal imaginal disk, tergites, smoke of burning combustible plastic

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INTRODUCTION

The city environment is polluted not only by noxious car and industry emissions, but also by synthetic packaging, plastic bottles, etc, that are widely used everyday.

Once these become waste, they are not always removed to the waist deposit area, but are tossed around onto scrap-heaps of litter. From skips, they get into the suburban dumping-grounds. An unfrequent scene nowadays is an illegal dumping of litter in the suburnal forests and waste left behind in the resting places.

It is either not unfrequent that litter is set on fire in the dustbins due to somebody's carelessness or intentional actions. Some holiday-makers burn up synthetic packaging and plastic bottles after their picknics with the best intention to clean up the site.

A lot of people are even not aware of the danger that the smoke produced by the burning plastic present to them, that it is characterised by a mutagenic, carcinogenic and teratogenic activity. Burning of organic compounds including polymers is a complex physical-chemical process in course of which, first, decomposition of the original elements, with the appearance of less complex products (CO2, CO, HCl, COCl2, etc.) takes place. Those may be of low and high degree of toxicity. Second, the process of burning is accompanied by a number of free radical reactions in course of which such dangerous ecotoxicants as polyaromatic hydrocarbons can be synthesized in a thermo-chemical way (Harvey 1977), e.g. benzopyrenes, that are strong carcinogens (Dachs & Eisenreich 2000).). If a burning sample contains halogens, the likelihood of the appearance of halogenated alkanes and halogenated aromatic compounds, dioxins, dibenzofurans, etc is very high (O'Neil 1993; Karosek & Dickson 1987). Many of these substances have a distinct mutagenic, carcinogenic and teratogenic activity determined by their ability to form active metabolites during metabolism that are interacting with nucleic acids, and in so doing they damage the structure and functioning of the latter.

MATERIALS AND METHODS

The given paper presents an experiment in course of which larvae and pupae of *Drosophila melanogaster* of various ages were influenced by different doses of the smoke produced by burning plastic with the aim of evaluating teratogenic activity of the smoke at various stages of post-embryonic development.

The smoke dose was determined by the volume of a syringe filled with the smoke of burning plastic. This amount was injected into a tightly closed 3 –litre glass jar through the plastic lid. Larvae and pupae of various ages had been placed in the jar and were exposed to the smoke of burning plastic during 4 or 8 hours.

Larvae and pupae of wild type *Drosophila melanogaster* were treated with the smoke of two kinds of burning plastic, namely polyethyleneterephtalane (PET) and polysterene (PS).

To obtain larvae and pupae of a particular age, laid eggs were collected every 8 hours. A hundred of virgin females and a hundred of males were placed, using a funnel, into a 0.5 litre glass jar with plates of agar medium. These plates had been covered with filter paper over which barmy suspension was spread. After coupling, females laid eggs on the filter paper The agar plates were changed every 8 hours, the filter paper with laid eggs was then placed in the culture medium for embryonic and post-embrionic development of eggs. In this way, larvae and pupae of particular ages can be exposed to the smoke of burning plastic. Frequency of individuals with abnormal tergites (morphoses) after imago flew away was taken into account in variations of experiments.

RESULTS AND DISCUSSION

Results of the first series of experiments can be seen in Tables 1, 2 and in Figures 1, 2.

Amount of abdominal tergite anomalies in wild type *Drosophila melanogaster* depending on the dose of burning plastic (polyethyleneterephtalane) smoke and larvae age (hours after eggs are laid)

Results obtained in the first series of experiments demonstrate that frequency of imago with abnormal tergites (morphoses) grows with the increasing dose of smoke of burning polyethyleneterephtalane (PET), and depends on the age of larvae and pupae at the moment of exposure.

The second set of experiments yielded analogous results (See Tables 3, 4 and Figures 3, 4).

Table 1 Number of abdominal tergite anomalies depending on smoke doses of burning polyethyleneterephtalane and larvae age (hours since eggs are laid)

Larvae age since eggs are laid / Smoke dose per 3 l container and exposure length	24 - 32		32 - 40		40 - 48		48 - 56		56 - 64	
	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)
45ml · 4h	98	92± 2,7	62	71± 5,8	58	52± 6,5	84	27± 2,2	93	21± 4,2
45ml · 8h	102	93± 2,5	82	78± 4,6	100	80± 4,0	98	32± 4,8	100	56± 5,0
65ml · 4h	100	96± 1,96	110	73± 4,4	60	65± 6,2	73	52± 5,8	56	41± 6,5
65ml · 8h	86	96± 2,1	100	78± 4,14	92	55± 5,2	100	41± 4,9	70	50± 5,7
100ml · 4h	79	86± 3,9	70	73± 5,3	65	60± 6,1	56	43± 6,6	62	31± 5,0
Control	82	0								

Table 2 Amount of abdominal tergite anomalies in wild type *Drosophila melanogaster* depending on the dose of burning plastic (polyethyleneterephtalane) smoke and pupae age (hours after eggs are laid)

Larvae age since eggs are laid / Smoke dose per 3 l container and exposure length	120 - 128		128 - 136		136 - 144		144 - 152		152 - 160	
	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)
35ml · 4h	71	56± 5,9	102	88± 3,2	90	18± 4,0	98	10± 3,0	63	6,3± 3,1
35ml · 8h	100	70± 4,6	99	91± 2,9	113	23± 4,0	67	12± 4,0	88	10± 3,2
70ml · 4h	50	64± 6,8	79	37± 5,4	78	36± 5,4	96	7,3± 2,6	100	12± 3,2
70ml · 8h	100	85± 3,6	120	83± 3,5	87	37± 5,2	105	11± 3,0	93	18± 4,0
100ml · 4h	58	77± 5,5	91	69± 4,8	77	39± 5,6	200	23± 3,0	98	12± 3,3
Control	102	0								

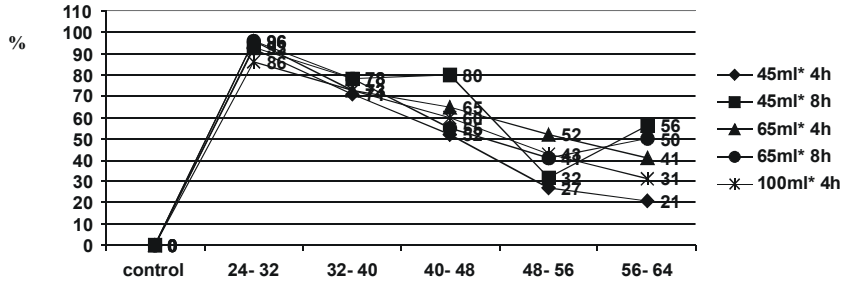


Fig. 1. Amount of abdominal tergite anomalies in wild type *Drosophila melanogaster* depending on the dose of burning plastic (polyethyleneterephtalane) smoke and larvae age (hours after eggs are laid)

Table 3 Amount of abdominal tergite anomalies in wild type *Drosophila melanogaster* depending on the dose of burning plastic (polysterene) smoke and larvae age (hours after eggs are laid)

Larvae age since eggs are laid / Smoke dose per 3 l container and exposure length	24 - 32		32 - 40		40 - 48		48 - 56		56 - 64	
	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)
45ml · 4h	80	28± 5,0	93	34± 4,9	86	23± 4,5	98	53± 5,0	63	54± 6,2
45ml · 8h	74	27± 5,1	78	33± 5,3	103	76± 4,2	100	73± 4,4	58	36± 6,3
65ml · 4h	70	31± 5,5	67	30± 5,6	140	81± 3,3	89	40± 5,2	93	21± 4,2
65ml · 8h	85	34± 5,1	103	46± 4,9	59	47± 6,5	87	41± 5,3	60	22± 5,3
100ml · 4h	100	41± 4,9	58	52± 6,5	61	64± 6,1	50	58± 7,0	79	20± 4,5
Control	323	0								

Table 4 Amount of abdominal tergite anomalies in wild type *Drosophila melanogaster* depending on the dose of burning plastic (polysterene) smoke and pupae age (hours after eggs are laid)

Larvae age since eggs are laid / Smoke dose per 3 l container and exposure length	120 - 128		128 - 136		136 - 144		144 - 152		152 - 160	
	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)	No of subjects	Morphoses (%)
35ml · 4h	91	78± 4,3	85	55± 5,4	89	88± 3,5	92	60± 5,1	70	74± 5,2
35ml · 8h	120	85± 3,2	89	62± 5,1	87	87± 3,6	93	61± 5,0	98	78± 4,2
70ml · 4h	98	83± 4,0	101	78± 4,1	100	87± 3,4	87	63± 5,2	91	77± 4,4
70ml · 8h	106	84± 3,6	92	79± 4,2	91	88± 3,4	68	62± 6,0	120	79± 3,7
100ml · 4h	58	84± 4,8	121	81± 3,6	64	84± 4,6	71	69± 5,9	53	53± 6,8
Control	119	0								

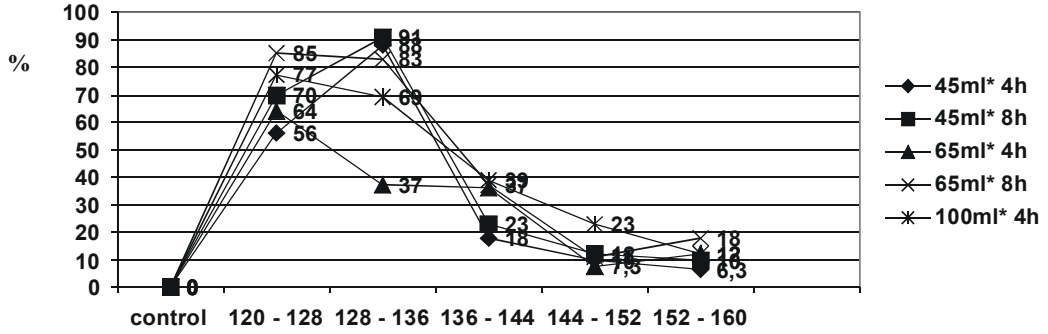


Fig. 2. Amount of abdominal tergite anomalies in wild type *Drosophila melanogaster* depending on the dose of burning plastic (polyethyleneterephtalane) smoke and pupae age (hours after eggs are laid)

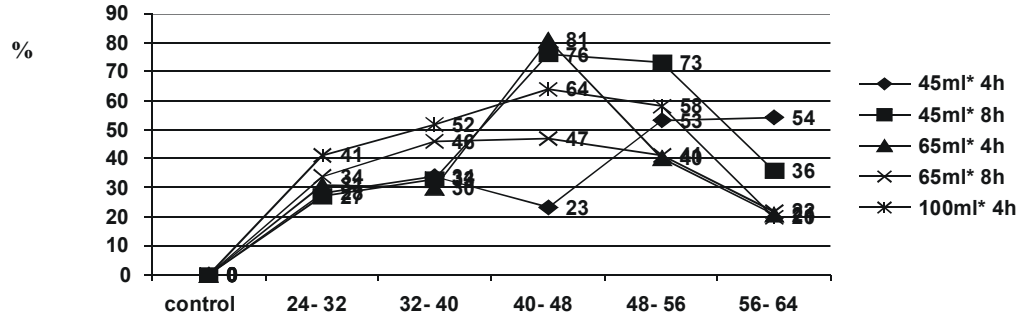


Fig. 3. Amount of abdominal tergite anomalies in wild type *Drosophila melanogaster* depending on the dose of burning plastic (polysterene) smoke and larvae age (hours after eggs are laid)

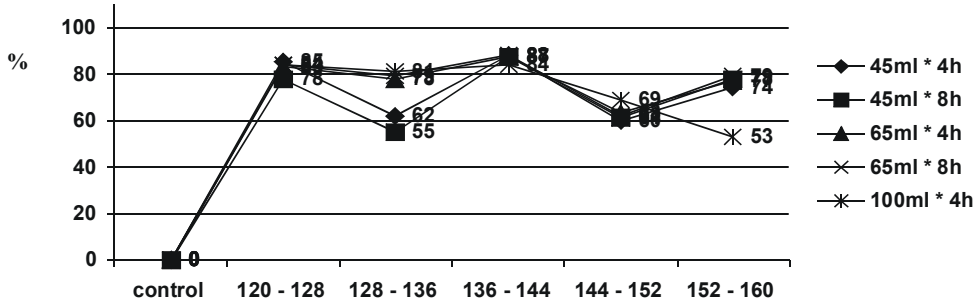
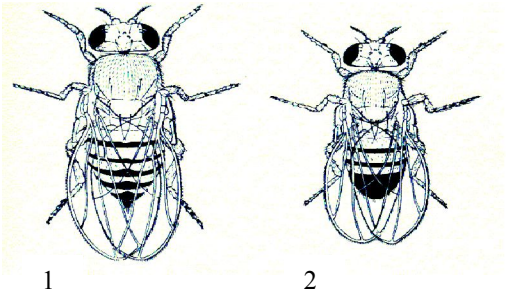


Fig. 4. Amount of abdominal tergite anomalies in wild type *Drosophila melanogaster* depending on the dose of burning plastic (polysterene) smoke and pupae age (hours after eggs are laid)



1 2

Fig. 5. Normally developed abdominal tergites of wild type *Drosophila melanogaster* (control variant); 1 – females, 2 – males (Medvedev 1968)

Frequency of imago with abnormal tergites (morphoses) grows with the increasing dose of smoke of burning polysterene (PS), and depends on the age of larvae and pupae at the moment of exposure.

Larvae and pupae of early age prove to be most sensitive to various doses of teratogenic influence of the smoke of burning plastic, both polyethyleneterephtalane (PET) and polysterene (PS).

According to some research (Nothinges 1972), abdominal gistoblasts of the *Drosophila melanogaster* larvae at the age of 24-36 hours, from which abdominal tergites develop, are formed in the result of mitotic division of cells; the number of the latter does not change till the end of the larvae stage and rises abruptly with the beginning of the pupae stage.

Data obtained in the sets of experiments demonstrating an increase of morphose frequency as a result of treating early larvae and pupae with the smoke of burning plastic (PET and PS), speak about a high degree of sensitivity of dividing cells to teratogenic factors.

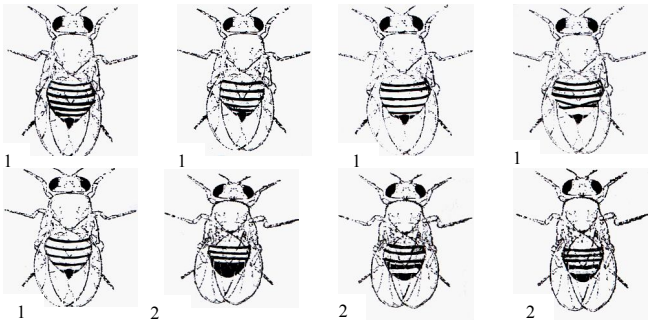


Fig. 6. Abdominal tergite anomalies in wild type *Drosophila melanogaster* in the result of treating larvae with the smoke of burning polyethyleneterephtalane; 1 – females, 2 – males

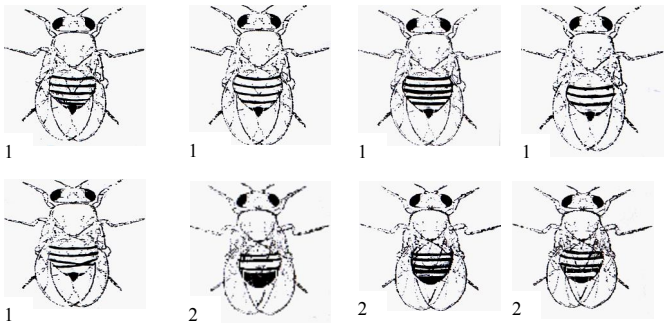


Fig. 7. Abdominal tergite anomalies in wild type *Drosophila melanogaster* in the result of treating pupae with the smoke of burning polyethyleneterephtalane; 1 – females, 2 – males

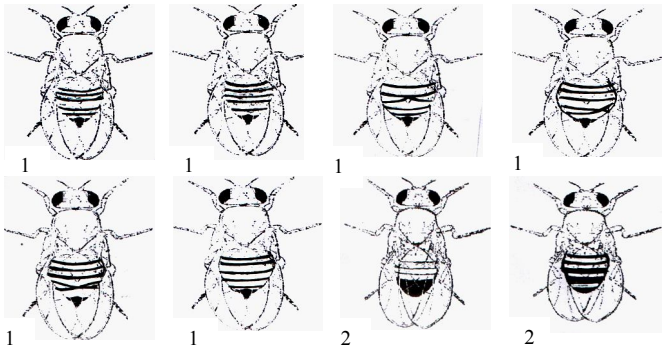


Fig. 8. Abdominal tergite anomalies in wild type *Drosophila melanogaster* in the result of treating larvae with the smoke of burning polysterene; 1 – females, 2 – males

It is worth mentioning though that in case of the smoke of burning polysterene (PS), quite a high frequency of morphoses is observed in result of the exposure of older larvae and pupae to the activity of this teratogenic factor (See Tables 3, 4 and Figures 3, 4).

The obtained results testify to the fact that influence mechanisms of the products of burning plastic, PET and PC, are different in nature. This can be accounted for by the different composition of smoke from burning plastic. It can be assumed that while molecules of PS are being destructed a range of olefins, i.e. unsaturated derivatives, are formed. The latter are analogous to styrene from which PS is obtained.

When PET burns, formation of oxygen-containing compounds, aldehydes, volalite carboxylic acids, and complex esters is more likely.

Given the difference in structure and hence in chemical and biological characteristics of the burning products of PET and PS, it is possible to assume that these substances have different mechanisms and speed of penetrating into living cells and further accumulation and functioning in cellular structures.

Normal abdominal tergites of wild type *Drosophila melanogaster* (control variant of the experiment) and a variety of abnormal abdominal tergites (morphoses) that resulted from

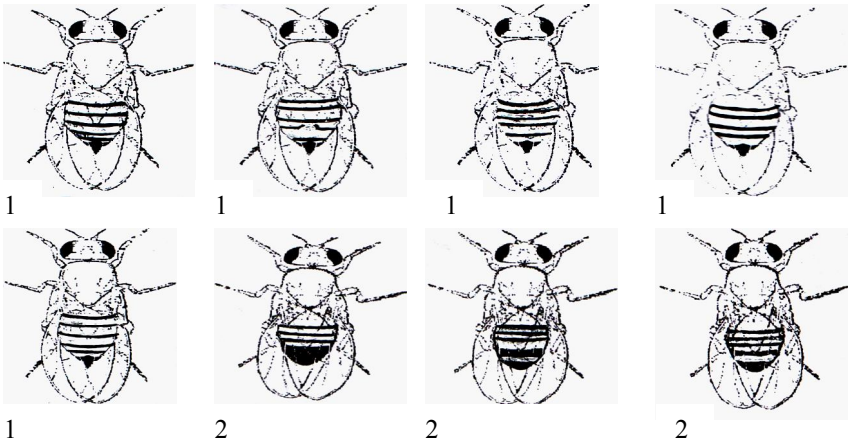


Fig. 9. Abdominal tergite anomalies in wild type *Drosophila melanogaster* in the result of treating pupae with the smoke of burning polysterene; 1 – females, 2 – males

the influence of the smoke of burning plastic, PET and PS, on larvae and pupae are presented in Figures 5 – 9.

After treating larvae and pupae of *Drosophila melanogaster* with products of burning plastic, PET and PS, imago with morphose tergites, swollen, with Morphose diversity irregular form, inosculated and/or fragmented, appear in big numbers.

Morphose diversity resulting from the activity of PET does not differ substantially from the one appearing after the influence of PS.

Females have eight well developed tergites, these are chitin plates of the abdomen back side. Males have six well developed tergites with the seventh and eighth ones having grown together/ inosculated.

CONCLUSIONS

The research that was carried out allows for the following conclusions.

1. Smoke of burning plastic, polyethyleneterephtalane (PET) and polysterene (PS), possesses a teratogenic activity.

2. Teratogenic activity of the above mentioned kinds of plastic was revealed by counting tergite morphoses of *Drosophila melanogaster.*

3. Somatic cells that are in the process of active mytotic division at the moment of exposure to teratogenic factors are most sensitive. In the given research these are cells of abdominal imaginal disk of early *Drosophila melanogaster* larvae and pupae.

4. Different structure, chemical and biological characteristics of the burning products of PET and PS determin different mechanisms and speed of their penetration in living cells, as well as differing impact on cellular structures

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ASSESSMENT OF THE INFLUENCE OF TERATOGENIC ACTIVITY OF CIGARETTE SMOKE ON *DROSOPHILA MELANOGASTER*

Zinaīda Sondore, Aija Brakovska, Jelena Oreha

Sondore Z., Brakovska A., Oreha J., 2009. Assessment of the influence of teratogenic activity of cigarette smoke on *Drosophila melanogaster. Acta Biol. Univ. Daugavp., 9(2): 277 - 282.*

Calculation of the fruit fly (*Drosophila melanogaster*) morphoses (abnormal tergites) makes a is a convenient testing system for the identification of teratogenic activity of cigarette smoke. The number of morphoses grows with the increase of the cigarette smoke dose.

Early larvae (at the age of 24-33 hours since the eggs are laid) and early pupae (at the age of 120-128 since the eggs are laid) prove to be most sensitive to the influence of cigarette smoke. At these stages of development, the cells of abdominal imaginal disks from which abdominal imaginal tergites develop, are very intensively mitotically dividing.

Key words: *Drosophila melanogaster*, teratogenes, morphoses, abdominal imaginal disk, tergites, larvae, pupae

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INTRODUCTION

The problem of preserving and protecting biological diversity is connected with the necessity to study mutagenic, cancerogenic and teratogenic activities of various factors which pollute environment. Among them are not only numerous chemicales that accompany mankind on the way to progress but also a usual cigarette smoke. Being the most widely spread and chronic intoxication in the world, smoking draws attention of researchers.

Researches describing negative influence of cigarette smoke on man (Doll1994; Simpson 2000) are mainly based on statistical data concerning the numbers those smokers who suffer from various diseases while failing to take into account all the totality of factor influencing man alongside smoking.

Neither can the data about negative influence of cigarette smoke on embryonic development of a child and smoking mothers (Fogelman, Manor 1988; Bennet 1999) disclose the mechanism of teratogenic impact of smoking because it is impossible to take into account all the environmental factors that influence pregnant women and alongside smoking influence negatively the embryonic development of man.

Disorders of embryonic development of the rodent, mice, rats and hamsters (Hutchings 1989) as well as apes and sheep (Suzuki et al. 1974; Manning et al. 1978) were demonstrated in the result of treating pregnant females with the main components of cigarette smoke (nicotine, carbon monoxide).

In the study of plant, rodent, and human cell cultures exposed to the cigarette smoke and its main components chromosome aberrations were shown (de Marini 1983). These experiments, though, do not give a clear picture of the impact of cigarette smoke on a living system, an organism where as individual chemical components may demonstrate varying mutagenic, cancerogenic and teratogenic activities.

Main classes of substances, which make part of tobacco smoke are presented in Table 1 below (Hoffmann 1989)

Some tobacco smoke components induce one-thread breaks/discontinuities of DNA (Sjakste, Sjakste, 1991). Treatment of various organisms with tobacco smoke often causes chromosome mutations (de Marini, 1983).

MATERIALS AND METHODS

The present paper gives an account of the experiments in which the fruit fly (*Drosophila melanogaster*) larvae and pupae of different ages were treated with different doses of cigarette smoke. The aim of these experiments was to evaluate teratogenic activity of cigarette smoke at the stage of post-embryonic development.

A dose of cigarette smoke in milliliters was measured by the volume of a syringe using which the smoke of a lit cigarette was released into a tightly closed 3-litre jar into which the fruit fly larvae and pupae of different ages were placed. In a number of experiments the larvae and pupae were exposed to the cigarette smoke for different time spans.

In two sets of experiments, the fruit fly larvae and pupae of different genotypes were exposed to the smoke of cigarettes of various brands.

Heterozygote w^+/w and hemizygote w^+/Y fruit fly (*Drosophila melanogaster*) larvae of various ages were processed by the smoke of the cigarettes "Prima HEBO".

1. Wild type fruit fly(*Drosophila melanogaster*) larvae and pupae of different ages were processed by the smoke of the cigarettes "Elita"

For getting larvae and pupae of a certain age, 100 virgin females and 100 males were placed into a 0.5 litre jar through a funnel. In the jar, there was a plate with an agar medium covered by a barmy suspension. After coupling, females laid eggs on the filter paper. Every 8 hours, the agar medium plates were removed and new ones were placed, and the filtter paper with eggs was placed in the culture medium for their embryonic and post-embryonic development. In this way, larvae and pupae can be exposed to the cigarette smoke at definite ages.

RESULTS AND DISCUSSION

Results of the 1st set of experiments presented in Table 2 and in Figure 1 show that frequency of imago with abnormal tergites (morphoses) raises with the increase of the "Prima HEBO" cigarette smoke dose, and depends on the age of the larvae at the exposure moment. Pupae were not studied in this set of experiments.

In the second set of experiments, similar data were obtained (See Table 3 and 4 and Fig. 2 and 3). The frequency of imago with tergite morphoses grew with the increase of the "Elita" cigarette smoke doses, and depended on the age of larvae and pupae at the exposure moment.

Abdominal imaginal disks of fruit fly (*Drosophila melanogaster*) larvae at the age of 24-32 hours proved most sensitive to various doses

Table 1 Assessment of tobacco smoke components
(In: Hoffmann, Smoking and Health. In: Курение и здоровье (Материалы МАИП): пер. с англ. 1989 – Под ред. Д. Г. Зарадзе, Р. Пето. – Гл. У, У1. – Москва: Медицина. – с. 384.)

Basic substances	Amount
Amides, imides	240
Carboniferous acids, anhydride	240
lactones	150
Compound ethers	475
Aldehydes	110
Ketones	520
spirits	380
phenols	285
Amines	200
N-nitrozamines	22
N-heterocyclic compounds	920
Hydrocarbons	755
Nitriles	105
Carbohydrates	45
Simple ethers	310
Total	4865

Table 2. Frequency of abdominal tergite abnormality (morphoses) in w^+/w and w^+/Y fruit flies (*Drosophila melanogaster*) depending on the "Prima HEBO" cigarette smoke dose and the age of the larvae (hours since the eggs were laid)

Dosa	24 - 32		33 - 40		41 - 48		49 - 56		57 - 64	
	Namber of imago	% morphoses	Namber of imago	% morphoses	Namber of imago	% morphoses	Namber of imago	% morphoses	Namber of imago	% morphoses
35ml · 4h	471	3,4± 0,84	346	2,6± 0,86	250	3,2± 1,11	429	2,1± 0,69	287	1,9± 0,81
35ml · 8h	348	4,6± 1,12	226	3,1± 1,15	375	3,2± 0,90	647	1,7± 0,50	400	1,5± 0,61
70ml · 4h	203	10,8± 2,18	328	5,8± 1,29	314	5,1± 1,24	408	4,9± 1,07	332	2,1± 0,79
70ml · 8h	87	12,6± 3,56	195	7,2± 1,85	197	4,6± 1,49	252	3,9± 1,2	226	3,1± 1,15
100ml · 4h	243	12,8± 2,14								
Control	2158	0,05± 0,04								

teratogenic influence of cigarette smoke. Sensitivity of abdominal imaginal disks of fruit fly (*Drosophila melanogaster*) larvae of older age (41-64 hours) falls sharply at the exposure to any dose of cigarette smoke. It is worth mentioning though that with the increasing dose of cigarette smoke to which older larvae (41-64 hours) are exposed, their death rate grows. It might be connected with the increasing breath intensity of older larvae and the increase of the cigarette smoke dose to the lethal level.

In accordance with some research (Nothinger 1972), in case of 24-32 hour old larvae, abdominal gistoblasts from which abdomonal tergites develop, are formed in the result of mitotic divisions of cells whose number does not change to the end of larval stage of development, and

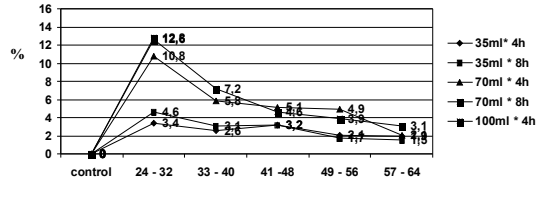

Fig. 1. Frequency of abdominal tergite abnormality (morphoses) in w^+/w and w^+/Y fruit flies (*Drosophila melanogaster*) depending on the "Prima HEBO" cigarette smoke dose and the age of the larvae (hours since the eggs were laid).

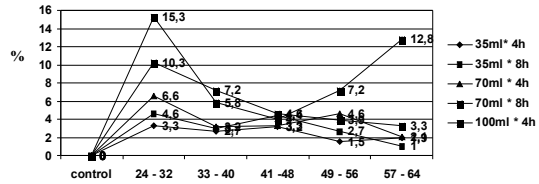

Fig. 2. Frequency of abdominal tergite abnormality morphoses in wild type fruit flies (*Drosophila melanogaster*) depending on the"Elita" cigarette smoke dose and the age of the larvae (hours since the eggs were laid)

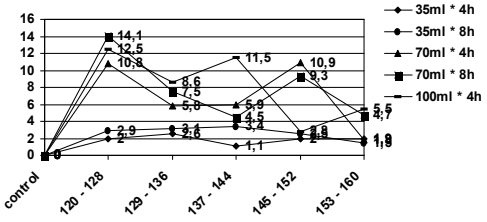

Fig. 3. Frequency of abdominal tergite abnormality morphoses in wild type fruit flies (*Drosophila melanogaster*) depending on the"Elita" cigarette smoke dose and the age of the pupae (hours since the eggs were laid)

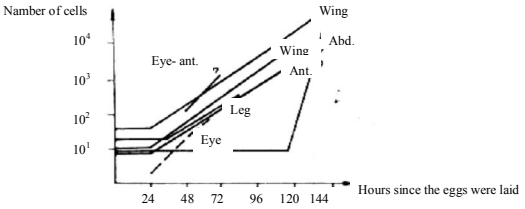

Fig. 4. Growth of imaginal disks of fruit fly (*Drosophila melanogaster*) in embryonic and postembryonic stages of development

Table 3. Frequency of abdominal tergite abnormality morphoses in wild type fruit flies (*Drosophila melanogaster*) depending on the"Elita" cigarette smoke dose and the age of the larvae (hours since the eggs were laid)

Dosa	24 - 32		33 - 40		41 - 48		49 - 56		57 - 64	
	Namber of imago	% morphoses	Namber of imago	% morphoses	Namber of imago	% morphoses	Namber of imago	% morphoses	Namber of imago	% morphoses
35ml · 4h	371	3,3± 0,42	336	2,7± 0,88	250	3,2± 1,11	340	1,5± 0,66	260	1,9± 0,85
35ml · 8h	348	4,6± 0,38	100	3,0± 1,71	275	4,4± 1,24	545	2,7± 0,69	400	1,0± 0,50
70ml · 4h	183	6,6± 1,82	220	3,2± 1,19	300	3,3± 1,03	304	4,6± 1,20	329	2,1± 0,79
70ml · 8h	87	10,3± 3,26	195	7,2± 1,85	197	4,6± 1,49	252	3,9± 1,22	215	3,3± 1,22
100ml · 4h	203	15,3± 2,53	328	5,8± 1,29	200	4,0± 1,39	195	7,2± 1,85	243	5,3± 1,44
Control	490	0,2± 0,21								

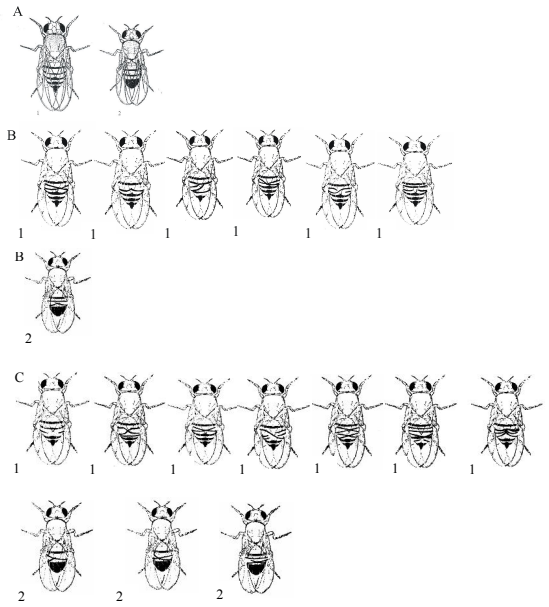

Fig. 5. A. Usual abdominal tergites of wild type fruit fly (*Drosophila melanogaster*) (control type of experiment). 1 - female, 2 - male (Medvedev 1968). Females have 8 well developed tergites, chitin plates from the spinal side of the abdomen.
Males have 6 tergites (the sixth and seventhes tergites are inosculated).
B. Abnormalities of wild type fruit fly (*Drosophila melanogaster* abdominal tergites) after the exposure of larvae to the cigarette smoke. 1 - female, 2 - male.
C. Abnormalities of wild type fruit fly (*Drosophila melanogaster*) abdominal tergites after the exposure of pupae to the cigarette smoke. 1 - female, 2 - male.

dramatically increases at the beginning of pupation stage (See Fig.4).

That is why treatment of the early age larvae (120-128 hours since the eggs were laid) with cigarette smoke in the second set of experimants increases the frequency of imago with abnormalities of abdominal tergites.

Usual abdominal tergites of wild type fruit fly (*Drosophila melanogaster*) (control type of experiment) and a variety of abnormal abdominal tergites that developed in the result of exposure of larvae and pupae to the cigarette smoke are shown in Fig.5

Abnormalities of abdominal tergites of a fruit fly (*Drosophila melanogaster*) can appear in the result of hyperploidy of one of the autosome or its fragment (Lindsley et al. 1972) in somatic cells under the influence of cigarette smoke during mitotic cell division of the abdominal imaginal disks from which abdominal tergites develop.

CONCLUSIONS

The results obtained in the experiments lead to the following conclusions.

Table 4. Frequency of abdominal tergite abnormality morphoses in wild type fruit flies (*Drosophila melanog*

Dosa	120 - 128		129 - 136		137 - 144		145 - 152		153 - 160	
	Namber of imago	% morphoses	Namber of imago	% morphoses	Namber of imago	% morphoses	Namber of imago	% morphoses	Namber of imago	% morphoses
35ml · 4h	200	2,0± 0,99	346	2,6± 0,85	186	1,1± 0,76	429	2,0± 0,68	287	1,9± 0,81
35ml · 8h	138	2,9± 1,43	226	3,1± 1,15	264	3,4± 1,11	477	2,5± 0,71	200	1,5± 0,86
70ml · 4h	203	10,8± 2,18	328	5,8± 1,29	102	3,9± 1,92	91	10,9± 3,27	109	1,8± 1,27
70ml · 8h	78	14,1± 3,94	161	7,5± 2,08	89	4,5± 2,20	86	9,3± 3,13	86	4,7± 2,28
100ml · 4h	224	12,5± 2,33	231	8,6± 1,84	104	11,5± 3,13	282	2,8± 0,98	72	5,52± 2,69
Control	261	0,38± 0,37								

1. Depending on the dose, cigarette smoke demonstrates teratogenic activity when influencing a fruit fly (*Drosophila melanogaster*) in those stages of embryonic and post-embryonic development when cells of imaginal disks are in the process of intensive mitotic division. In case of abdominal imaginal disks, it is an early larval and early pupation stages when the biggest amount of morphoses of the imago abdominal tergites appear.

2. Calculation of abdominal tergite morphoses of fruit fly (*Drosophila melanogaster*) imago after exposure to any factor of environment at the early larval and pupation stages is a convenient testing system for the identification of teratogenic activity of this factor.

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INFLUENCE OF MAMMALIAN IMMUNODEPRESANT CYCLOSPORIN A ON SOME MOLECULAR PROCESS OF PLANT SENESCENCE

Natalja Shkute, Marina Savicka

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Mitochondria play an important role in programmed cell death (PCD) in plants as well as animals. The role of mitochondria in animal cell death has been studied for a number of years during which the involvement of opening of the mitochondrial permeability transition pore (PTP) has been suggested to be a factor in cell damage. Cyclosporin A is well-known inhibitor of pro-oxidant induced mitochondrial Ca^{2+} release and apoptosis in mammalian cells. But the existence of classical cyclosporin A sensitive pore in plant mitochondria a still discussed. Our results show that cyclosporin A significantly inhibits the growth of wheat seedling during development. We show that under the influence of CsA quickly decreases the superoxide production in first leaf and coleoptiles. The influence of cyclosporin A on nuclear DNA amount and its fragmentation in the first leaf cells of wheat was studied and it was shown that nuclear DNA fragmentation under the cyclosporin A influence is inhibited. The role of mitochondrial plant cell death is discussed and suggests that programmed cell death in plants and animals may be based on a general cell death process.

Key words: apoptosis, cyclosporin A, wheat seedling, DNA fragmentation, superoxid production

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INTRODUCTION

Plants have various forms of programmed cell death: one of them is realized as an obligatory development and ageing program, the other is a hypersensitive reaction. Programmed cell death (PCD) found in mezofile cells of ageing leaves: *Philodendron hastatum, Epipermnum aureum, Bauhimia purpured, Delonix regia, Butea monosperma*. Young leaves of these plants do not demonstrate apoptosis (Vanyushin 2001). PCD in plant cells has been described during several developmental stages, such as in leaf senescence and in xylogenesis, and in defense reactions when pathogenic attack induces the hypersensitive response (HR) (Jones 2001). Several abiotic stresses induce PCD in plant cells such as oxygen deprivation stress (Virolainen et al. 2002).

Mitochondria play a vital role in ATP production in both plants and animals. In animals, it has been shown that mitochondria also play an active role in apoptosis, a morphologically defined form of programmed cell death , by the regulated release of proteins that activate molecular pathways

leading to rapid and organized cell death. Although there is mounting evidence for the involvement of plant mitochondria in the decision between life and death, the molecular mechanisms by which mitochondria participate in the PCD process are not known (Balk et al. 2003). In mammals, there are at least three independent pathways linking mitochondria with the downstream events of apoptosis (Wang 2001). All three pathways are initiated by the release of mitochondrial proteins through the action of members of the Bcl-2 family. A more complex pathway is initiated by the release of cytochrome c (Liu et al. 1996). Recent research on zinnia cells showed that cyclosporin A (Cs A), an inhibitor of the mammalian permeability transition pore linked to cytochrome c release, did inhibit DNA fragmentation (TUNEL), whereas cytochrome c was released, or cytochrome c does not induce DNA fragmentation. Application of a PTP-inhibitor, CsA, did not prevent high amplitude swelling. However, an inhibitory effect of CsA under the same experimental conditions has been shown in potato tuber mitochondria (Arpagaus et al., 2002). In contrast, in another potato cultural *Bintje,* CsA-insensitive permeabilization has been detected under deenergized conditions (Fortes et al. 2001). It was found, that the swelling of mitochondria isolated from winter wheat not exposed to stress were sensitive to the treatment with cyclosporin A (Pavlovskaya et al. 2007).The existence of a classical cyclosporin A-sensitive pore in plant mitochondria is still being discussed.

In this study, we have for the first time investigated the influence of cyclosporin A on important phenomena involved in plant cell senescence: the nuclear DNA apoptotic fragmentation, and superoxide production in cells of the whole organs of wheat seedlings.

MATERIAL AND METHODS

Plants material

Wheat seedlings (*Triticum aestivum* L. cv Vinjet) were soaked for 24hr in the darkness at 26°C on the watered filter paper in a plastic covet. After germination, equally germinated seedlings were placed in two analogical plastic covets, one with aquatic solution (control) and the other with cyclosporin A solution (10 mg/l, 1 mg/l "Sigma"). The solution was removed each 12hr since cyclosporin A is unstable in aqueous solutions. Then at a certain time after germination, in 96hr, 120hr, and 144hr, the similarly developed etiolated seedlings were washed and the first leaf and coleoptile were separated on the ice.

DNA quantification

First leaves in different ages were fixed in the 96% ethanol and homogenized. The mixture was centrifuged 3 times and homogenized with the 96% ethanol, acetone, and ether to white powder for removing the lipid components. 1 ml 0,005M NaOH and 1 ml 2M $HClO_4$ were added to this powder and this material was incubated to 60°C for 3hr for the destruction of nucleic acids to nucleotide components. Then this hydrolyzate was centrifuged at 2000g for 10 min, 2 ml 3% diphenylamine were added to 1 ml from supernatant, and this mixture was incubated to 30°C for 16hr for obtaining the complex of desoxyribose with diphenylamine. Absorption of the blue solution was measured by a spectrophotometer at 600 nm and 700 nm. The amount of DNA was measured with a calibration line from standard thymus DNA ("Sigma") in this protocol with according of Burton method (Burton 1956).

Nuclear DNA extraction

The nuclear DNA was extracted with common method (Kirnos et al. 1999) with our modification. The plant material was iced with liquid nitrogen and carefully homogenated. The lysiting solution (50 mM Tris-HCl buffer, ph 8.25 mM EDTA 1% SDS and 0.5M $Na_2S_2O_5$2-β- mercaptoethonol, 0.12% dietilpirokarbonate) was added to the obtained powder and it was mixed and incubated for 1hr at 45°C. NaCl was added to the solution to get the concentration 1M. The mixture was deproteinisated by shaking with chloroform: isoamyl alcohol (10:1). It was centrifuged 5000 g

for 10 min at the room temperature. The top phase was replaced in other tubes. DNA was pelleted by adding three volumes of the 96% ethanol to top aqueous phase and centrifuged at the room temperature for 5min. The pellet was washed with 70% ethanol and centrifuged again for 2min. The resuspended DNA was placed for 30 min in sterile distilled water with ribonuclease A (50 mkg/ml) at 40°C.

DNA electrophoresis

DNA was analyzed by electrophoresis for 2 hr in 1% agarozes gels strength 5V/sm in TAE buffer, pH 8, with 0.1 μkg/ml ethidium bromide.

Superoxide production

Production of superoxide by the cells of the first leaf and coleoptile was determined by a nitroblue tetrazolium (NBT) reduction assay. Reduction of NBT was monitored spectrophotometrically at 530 wavelength (Shorning et al. 2000).

RESULTS AND DISCUSSION

IInfluence of cyclosporin A on the growth of the first leaf of etiolated wheat seedlings

Wheat seedlings were used as a model for the investigation of mitochondrial pore formation during development and senescence of plant cells. A wheat seedling is a unique model for investigating the molecular process of cell ageing in a whole organ. The first leaves which grow in standard conditions represent the population of synchronically dividing cells. In growing leaves, the endoreplication processes of genome do not occur. Synthesis of nuclear DNA is replicated and discrete in the first leaf cells (Kirnos et al. 1999).

We investigated the influence of cyclosporin A on the growth of intact plants. The influence of cyclosporin A was investigated in two concentrations: 1 mg/l and 10 mg/l. The obtained data are represented in Figure 1. As it is shown, the influence of cyclosporin A on the development of the first leaf of wheat seedlings is different. Cyclosporin A in concentration 1 mg/l did not influence the growth of the first leaf of wheat seedlings, but in concentration 10 mg/l it significantly inhibits this growth. Therefore, the mammalian immune-depressant cyclosporin A influences plants too.

Inhibition of the growth of wheat seedlings induced by mammalian immune-depressant cyclosporin A may be connected with its influence on very different cell metabolic processes, because of the most important properties of cyclosporin A is its influence on mitochondrial pore formation. CsA inhibited Ca^{2+} uptake pathway, but did not affect its release from Ca^{2+} - loaded Citrus mitochondria (Caixeta de Oliveira et al. 2007). Calcium ions control diverse cellular processes and serve as secondary messenger in numerous signal transduction pathways in eukaryotic cells (Carafoli 2002).

The mitochondrial pore formation plays an active role in programmed cell death in mammalian. During the last few years, a putative role of plant mitochondria as cellular stress sensors and as central organelles in programmed cell death has caused an increasing interest. Characteristic features of animal cell PCD have not been found as such in plant cell PCD, e.g. morphology of the dying cells and activation of caspases (Jones, 2000); increasing evidence exists for the involvement of plant mitochondria in stress sensing and in the cell death pathway. Caspase-like cysteine proteases have been detected in the *Arabidopsis thaliana* root tissue (Safadi et al. 1997) and in *Zea mays* roots (Subbaiah et al. 2000).

Mitochondria are a major source of reactive oxygen species (ROS) formation. An increase of ROS level was observed in many cases of cell death, including cell senescence. But the correlation between the CsA influence on cells and speed of the ROS production has not been investigated. That is why we investigated the influence of CsA on the rate of ROS production in some plant organs.

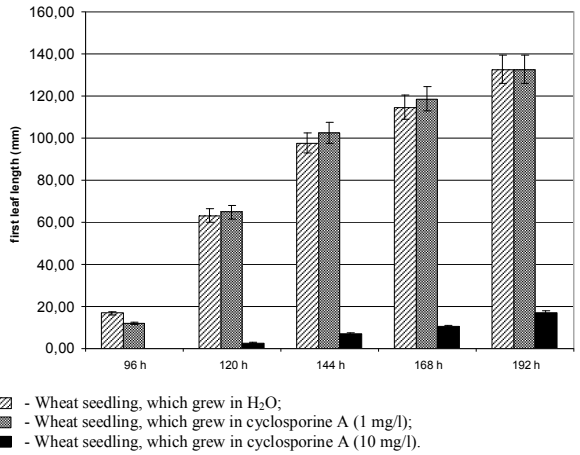

Fig.1. Influence of cyclosporin A on growth of first leaf of wheat seeding. Means with standard deviation (bars).

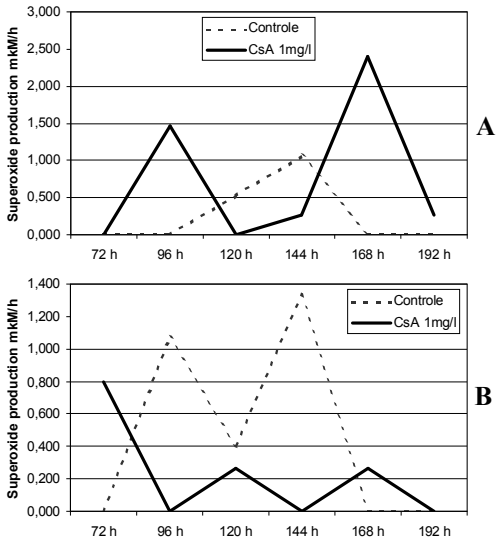

Fig. 2. Influence of cyclosporin A on superoxide production in first leaf (A) and coleoptile(B) of wheat seedling

Cyclosporin A influence on superoxide production

We investigated the influence of CsA on the rate of superoxide production in coleoptile. Our data are represented in Fig. 2. As it is shown, two peaks of reactive oxygen species production are found in the developing first leaf and coleoptile from the 3rd to 7th days. Analogical periodicity was shown at the later stage of development of wheat seedlings too (Shorning et al. 2000). The first peak of O_2^- production was found on the 4th day of coleoptile development. At this time, the DNA synchronic synthesis stopped. The second observed peak of production is achieved at the beginning of the 6th day of development, and the maximum within 24 hours. At this time, the DNA content in coleptile begins to decrease.

Our data shown, that the superoxide production in coleoptile significantly decreases under the influence of CsA. It is possible that this is connected with participation of mitochondria and the CsA-sensitive mitochondrial pore in reactive oxygen species formation in plants. It was shown, that CsA delayed the H_20_2 accumulation induced by fusicoccin in sycamore cell culture too (Contran et al. 2007). This observation suggests that inhibition of superoxide production by CsA influences cell division in investigated organs. CsA had some anti-proliferative effect on *Citrus* cell growth (Saviani et al.2002). Interestingly, the antioxidant jonol decreases the superoxide production and strongly inhibits the growth of wheat seedling also (Shorning et al. 1999).

Influence of cyclosporin A on DNA amount in the first leaf of wheat seedlings

The amount of nuclear DNA in the first leaf of wheat seedlings was determined at a 6-day-old

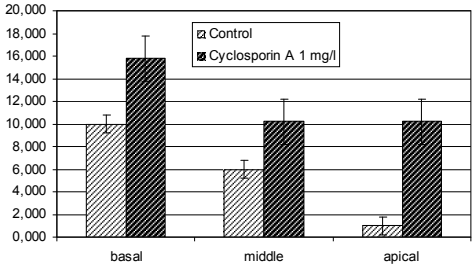

Fig. 3. Influence of cyclosporine A on amount of nuclear DNA in different parts of first leaf of wheat seedling at the age of 144h wheat seedling. Means with standard deviation (bars).

seedling (Fig. 3). The first leaf of wheat seedlings represents a different cell population, part of which synchronically divide and part come to the programmed cell death because nuclear DNA amount in different parts of the first leaf is different and decrease in basipetale direction. We investigated the influence of cyclosporin A (10 mg/l) on DNA amount in different parts of the leaf, basal, middle, and apical. In basal parts, there is cells division, whereas there is no cells division in apical parts. It was shown that cyclosporin A influences the amount of nuclear DNA in the first leaf of wheat seedlings. Its amount in different parts of leaves not decreased under the influence of cyclosporin A. A maximal increase of DNA amount under cyclosporin A occurs in apical parts of leaves, in which the PCD process takes place. The observed influence of cyclosporin A on the change of DNA amount in this part may be connected with its influence on opening of the mitochondrial permeability transition pore, which also plays an active role in programmed cell death. Fragmentation of nuclear DNA is one of the hallmarks of PCD in the apoptosis pathway in plant cells. That is why we investigated the influence cyclosporin A on DNA fragmentation in the first leaf cells.

DNA fragmentation in the first leaf of wheat seedlings treated with cyclosporin A

The nuclear DNA of the cells of a 6-day-old first leaf (144hr) of a wheat seedling was extracted and analyzed by electrophoresis (Fig. 4). It was shown that fragmentation of nuclear DNA occurs in different parts of the leaf. The programmed cell death which occurs during the leaf senescence of some plants involved an active process of nucleosomal DNA fragmentation. Our data show that the development of etiolated wheat seedlings is necessarily accompanied by apoptosis in the first leaf too. DNA fragmentation takes place in different parts of the first leaf of 6-day-old seedlings. The intermembrane-space protein AIF mediates both high-molecular-weight DNA fragmentation and peripheral chromatin condensation in a caspase-independent manner without the requirement of cytosolic proteins. A second pathway involving cytochrome c and the

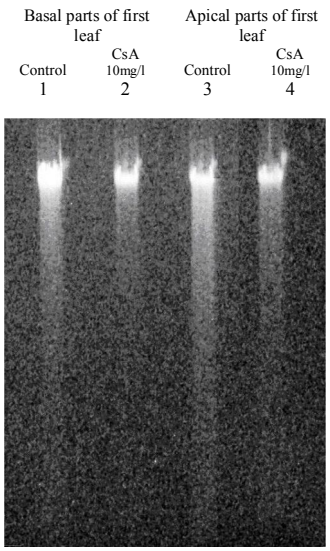

Fig. 4. Fragmentation of nuclear DNA from first leaf of wheat seedling at the age of 144 hr, which grew in H_2O (1 and 3) and in presence of cyclosporin A (10 mg/l) (2 and 4).

cytosolic proteins Apaf-1 and caspases, as well as the caspase-activated DNase CAD, leads to DNA laddering and advanced chromatin condensation into discrete (Lam 2004).

However, certain features observed in the plant cell-free system suggest a different nature of the two signaling pathways in plants and animals. For example, in contrast to mammals, the DNA laddering activity induced by mitochondria in isolated *Arabidopsis* nuclei is insensitive to caspase and other protease inhibitors. The submitochondrial localization of the activity is in agreement with the fractionation of cytochrome c by osmotic shock treatment; however, purified *Arabidopsis* cytochrome c could not replace the total mitochondria in inducing DNA laddering (Balk et al. 2003).

Our experiments show that cyclosporin A (10mg/l) strongly inhibits DNA fragmentation in apical parts of the first leaf. It suggests that PTP is not opening under the influence of CsA and cytohrome c did not release from plant mitochondria in cytosolic, and did not induce DNA fragmentation. It was shown, that CsA

strongly inhibits DNA fragmentation and cytochrome c release induced by fusicoccin in sycamore cell culture too (Contran et al. 2007).

CONCLUSION

PCD in plant plays a pivotal role in many developmental processes and it is involved in defense mechanisms against biotic and abiotic stress. A role for the mitochondrion as integrator of cell stress and regulator of PCD has been proposed for plants. But at least two others types of PCD have been reported in plants: the chloroplastic type, observed during leaf senescence, and vacuolar type, typical of formation of tracheary elements (Lam 2004).

Cytochrome c release from plant mitochondria has been detected in earlier experiments where permeability transition and PTP opening has been induced. Cytochrome c release from plant mitochondria to the cytosol has also been detected in plant cells during PCD, for example, in cucumber seedlings exposed to heat (Balk et al, 1999), tobacco protoplasts exposed to menadione treatment (Sun et al, 1999), maize suspension-cultured cells exposed to mannose (Stein and Hansen, 1999), and in anther cells of a sterile sunflower (Balk and Leaver, 2001). According to the results, cytochrome c release is considered to be an essential step in plant cell PCD as it is in animal PCD. However, no cytochrome c release from mitochondria was detected due to PCD in pollination-induced senescence of petunia petals (Xu & Hanson 2000). Different approaches have been used to reveal common steps between animal and plant cell PCD.

In animal tissues under particular conditions, treatment of mitochondria by butylated hydroxytoluene, the signal peptide mastoparan, the hormone thyroxine, and palmitic acid elicit a CsA-insensitive permeability transition (Sultan & Sokolove, 2001).When differently regulated, CsA-insensitive PTP has been described in yeast mitochondria. Taken together, these findings indicate that the induction and regulation of PTP and the release of cytochrome c (Martinou et al. 2000) can occur via several mechanisms and require specific conditions in both plant and animal tissues.

We have shown for the first time that mammalian immune-depressant cyclosporin A influences the whole plant organs. The growth of wheat seedlings is inhibited under the influence of cyclosporine A. It is possible that this occurs because CsA strongly inhibited reactive oxygen species production in the investigated organs of plants. Thus, it was known that reactive oxygen species play a significant role in cell division in plant culture. This inhibition may be a result of the presence of a cyclosporin A-sensitive pore in plant mitochondria. In the result the amount of superoxide decreases and cell senescence is inhibited; in this case DNA fragmentation does not occur and DNA amount does not decrease. Therefore, we have confirmed the existence of a classical cyclosporin A-sensitive pore in plant mitochondria, and assumed that cyclosporine A protects plant cells against cell death by decreasing the reactive oxygen species production in plant cells.

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THE EXPERIMENTAL DATA ON SUN-BASKING ACTIVITY OF EUROPEAN POND TURTLE *EMYS ORBICULARIS* IN NATURAL CLIMATE IN LATVIA: DYNAMICS AND CORRELATION WITH THE METEOROLOGICAL FACTORS

Mihails Pupins, Aija Pupina

Pupins M., Pupina A. 2009. The experimental data on sun-basking activity of European Pond Turtle *Emys orbicularis* in natural climate in Latvia: dynamics and correlation with the meteorological factors. *Acta Biol. Univ. Daugavp., 9 (2): 291 - 298.*

In 2007 the sun-basking activity of *Emys orbicularis* (n=31) was investigated by automatic photo recording in out-door terrarium in Latvia. Number of sun-basking *Emys orbicularis* (*Nsb*) had a daily dynamics with peak at 11:00 - 12:00 and less significant peak at 16:00 - 18:00. In May the maximal *Nsb* is registered, in June the *Nsb* decreases. This tendency continues in July and August. The time of sun-basking activity at the level *Nsb*e"10 (33% of n=31) in May 2007 was 9 h; in June 12 h; in July 11 h; in August 5 h. The meteorological factors were ranked by quantity of significant positive or negative correlations with *Nsb* for the interval of 8d"*Nsb*d"21. The most significant intensity of positive correlation with *Nsb* is noted for: 1) maximal value of UV radiation; 2) maximal value of Solar radiation; 3) middle value of Solar radiation; 4) middle and maximal air temperature; 5) minimal air temperature. The most significant intensity of negative correlation with *Nsb* is noted for the value of: 1) air humidity; 2) rain.

Key words: *Emys orbicularis*, sun-basking, Latvia, meteorological factors.

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INTRODUCTION

European pond turtle *Emys orbicularis* (Linnaeus, 1758) is the rare and preserved animal of Latvia (Ministru kabinets 2000). The basic limitative factor of the spreading of *Emys orbicularis* on the northern boundary of the area in Latvia (Fritz 2003) is a comparatively cold climate. Sun-basking (Kabish 1990) is the important element of the day activity of *Emys orbicularis*. Thus, the successful supporting of the optimal temperature of turtles' bodies during sun-basking that can take place both on the land and in the water becomes very important in Latvia.

MATERIAL AND METHODS

A study was conducted in 2005-2007. In 2005 the conditions of keeping of *Emys orbicularis* in a zooculture were determined for purposes of the experiment; in 2006 a piloting study of sun-basking activity of *Emys orbicularis* was carried out (the kinds of sun-basking activity of *Emys orbicularis* were determined, the equipment and

the programs for the automatic registration of data were selected and approved). In 2007 the sun-basking activity of *Emys orbicularis* was experimentally investigated in out-door terrarium under the natural climatic conditions of Latvia (Fig.1).

For the experiment a group of *Emys orbicularis* (n=31) was used, which consisted of the adult individuals caught in Latvia, and also of their descendants at the age of 2-4 years, obtained in zooculture. An experimental study was carried out under the out-door conditions of keeping (55°50' N; 26°29' E, H 105 m) in the Daugavpils region, the southeastern part of Latvia; where the greatest number of communications about findings of *Emys orbicularis* is registered for Latvia (Pupiòð, Pupiòa 2007). The out-door terrarium of 6x8 m was located in the natural meadow biotope, at a distance of 35 m from the nearest building, 205 m from the road. From the northern side of the terrarium the one-storied building with the devices for visual observation was located. The concreted pond of 5,5x6 m, 0,2 -1 m deep, with an island of 1x1 m was situated in the terrarium. *Emys orbicularis* were fed at random time, in sunny weather once in two days.

For the automatic photo recording of sun-basking activity the video camera *Logitech USB* was used, the procedure of photo recording was regulated by the program *Supervision Cam*. The terrarium and visible turtles were photographed each 10 min. 24 hours a day since May until August. The suitable for the analysis photographs (n=5172), made during the daylight time, were used for the evaluation of sun-basking activity. Turtles that got solar heat (*Number of*

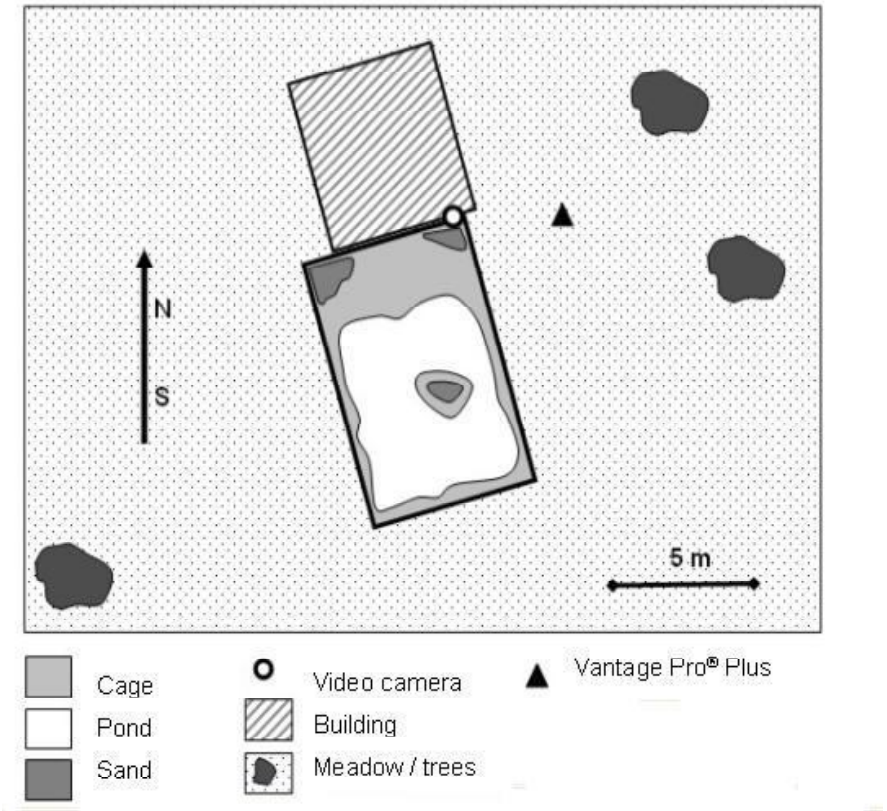

Fig.1. The schema of the experimental out-door terrarium.

sun-basking turtles: *Nsb*) were visually counted on the photographs. During the analysis of *Nsb* they were rounded off to the whole numbers, time was rounded off to the whole quantity of hours. The basic parameters were accounted for the *Nsb*=1 and for *Nsb*=10 (at the 30% level of n=31).

For the automatic recording of the meteorological parameters the station *Vantage Pro® Plus* and program *WheaterLink 5.7. for Vantage Pro* were used. The station was placed at a distance of 3 m from the terrarium, data were transferred with the aid of radio link to the computer, placed at a distance of 35 m from the station, and were fixed in the program *Microsoft Excel* (*Windows*).

The meteorological parameters and their minimums and maximums were recorded every hour: temperature of air, humidity of air, atmospheric pressure, speed and direction of wind, solar radiation, UV and other. The correlation between magnitudes of the meteorological parameters and quantity of sun-basking *Emys orbicularis Nsb* for the levels 8d"*Nsb*d"21 was calculated. The meteorological factors were ranked (intensity of correlation) by quantity of significant positive or negative correlations with *Nsb* for the interval of 8d"*Nsb*d"21. The part of the statistical calculations was produced in the laboratory of the Informatics of Daugavpils University.

RESULTS

As a result of the study, 4 basic forms of activity of *Emys orbicularis*, which were defined as sun-basking, were registered: comparatively static lying on the illuminated substratum; lying in the shadow; heating under the sun in the shoal; active displacement over the land (Fig. 2, 3, 4, 5.).

Dynamics of sun-basking activity of *Emys orbicularis* in the experiment

Sun-basking activity of *Emys orbicularis* in the experiment had a daily dynamics. The appearance of the first turtles on land is noted on average at

Fig.2. Basic forms of sun-basking activity of *Emys orbicularis* registered in the study: comparatively static lying on the illuminated substratum.

Fig.3. Basic forms of sun-basking activity of *Emys orbicularis* registered in the study: lying in the shadow.

Fig.4. Basic forms of sun-basking activity of *Emys orbicularis* registered in the study: heating under the sun in the shoal.

Fig.5. Basic forms of sun-basking activity of *Emys orbicularis* registered in the study: active displacement over the land.

05:00, their quantity grows and reaches the maximum *Nsb* Mean=14 (45%; n=31) by 12:00. Then their quantity decreases, last turtles are registered on land at 21:00. (Fig.6).

The daily dynamics of sun-basking activity of *Emys orbicularis* in the experiment varies in different months of active period (Fig.7.). So, in May the maximal *Nsb* (Mean=21) is registered, in June the maximal quantity of sun-basking turtles decreases (Mean=15). The tendency towards the decrease of the maximal *Nsb* continues in July (Mean=14) and August (Mean=12).

In the monthly graphs of daily sun-basking activity in 2007 two peaks of *Nsb* were noted. The first peak is registered at 09:00 - 12:00. The second, less significant, peak of *Nsb*, is observed at 15:00 - 18:00. This tendency remains during the entire investigated active period, it is marked more in May and June; the second peak of *Nsb* passes to plateau in July and has a tendency towards the disappearance in August.

The duration of sun-basking activity of *Emys orbicularis* at the level *Nsb* Meane”1 in different months varies and comes to: 17 h in May, 18 h in June, 17 h in July and 16 h in August.

Evaluating the intensity of sun-basking activity of *Emys orbicularis* under the natural climatic conditions of Latvia in 2007, the time interval in the course of twenty-four hours was also analyzed, in which a Mean of sun-basking turtles *Nsb* was more or equal to 10 (33% of the maximal n=31). In May *Nsb*e”10 for the first time at 09:00 and descends below this level at 17:00. In June 33% are reached considerably earlier, at 09:00 and fall below it for the last time after 18:00. In July *Nsb* reaches the level of 33% even earlier, at 08:00; also falling below it after 18:00. In August *Nsb*e”10 is reached considerably later, at 10:00 and falls below this level already after 14:00. Thus, the total time of sun-basking activity of *Emys orbicularis* at the level *Nsb*e”10 in May 2007 is 9 h; in June it grows to 12 h; in July 11 h; in August decreases to 5 h (Fig.8).

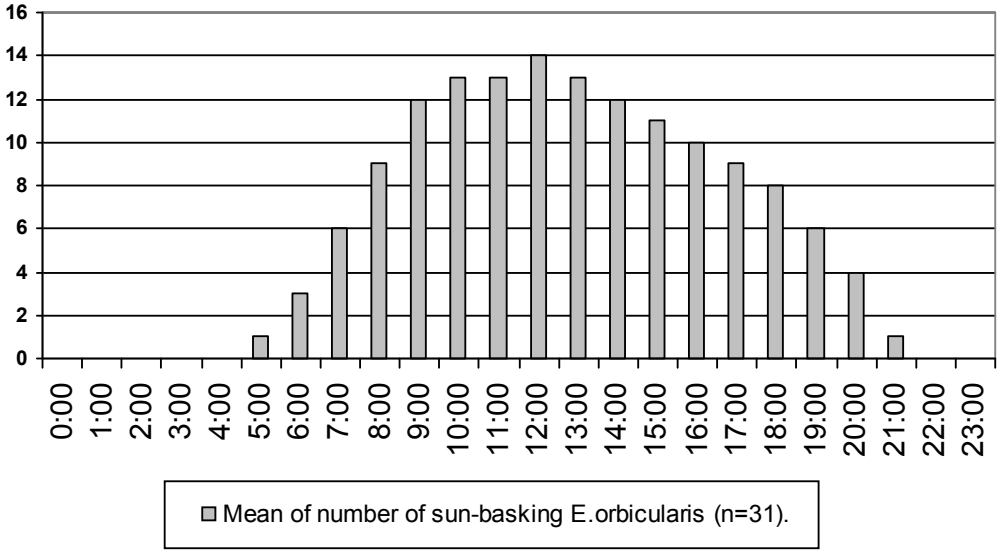

Fig.6. Daily dynamics of sun-basking activity of *Emys orbicularis*.

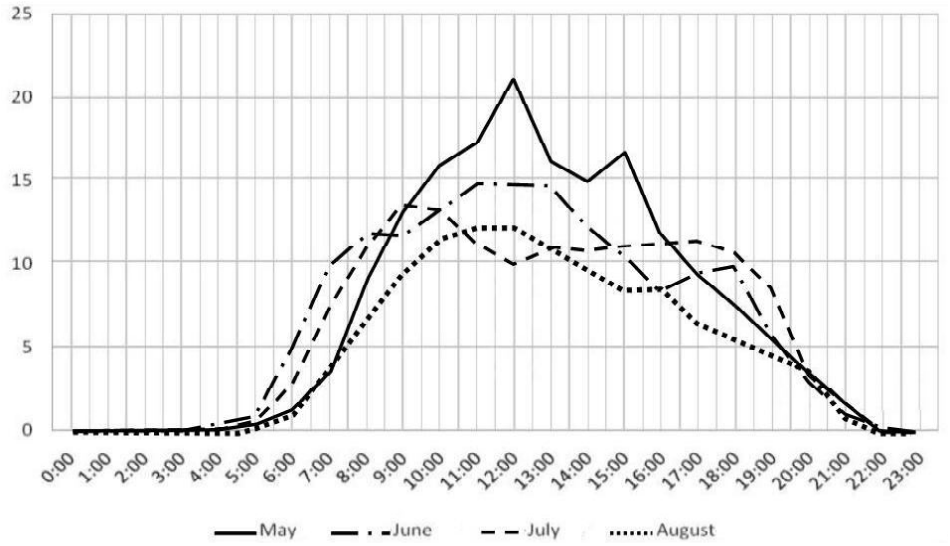

Fig.7. Dynamics of daily sun-basking activity of *Emys orbicularis* in different months in 2007.

Correlation of sun-basking activity of *Emys orbicularis* with the meteorological factors in the experiment

During the study the positive and negative correlations of sun-basking activity of *Emys orbicularis* with different meteorological factors at the levels of 8d"*Nsb*d"21 were registered (Fig. 9, 10). The meteorological factors were ranked by quantity of significant ($p<0,01$ and $p<0,05$) positive and negative correlations for the number of sun-basking *Emys orbicularis* in the interval of 8d"*Nsb*d"21. The factors, for which the

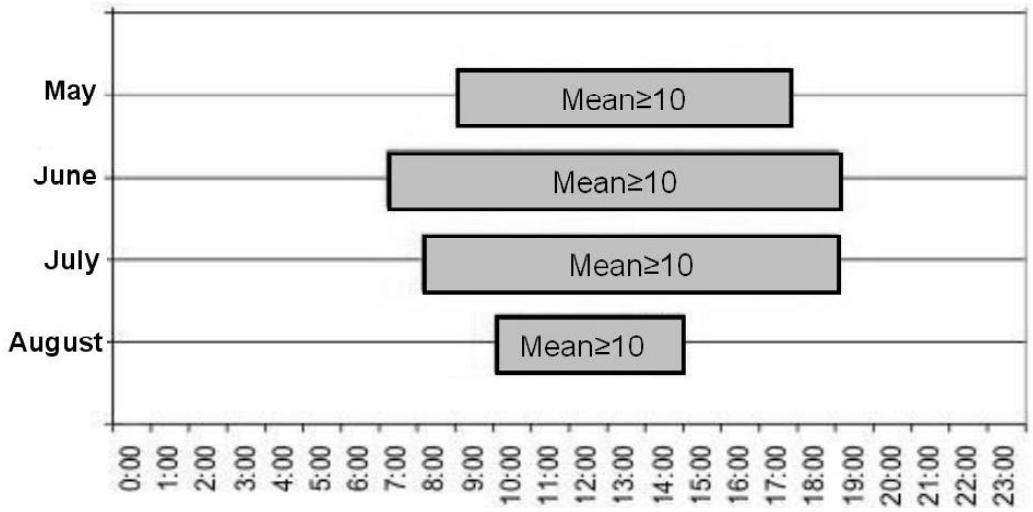

Fig.8. The time of daily sun-basking activity of *Emys orbicularis* at the level *Nsb* Meane"10 (33%) in different months in 2007.

Fig.9. Photo of the experimental terrarium in dry day.

Fig.10. Photo of the experimental terrarium during the rain.

correlation was noted with only one level of *Nsb*, were not considered during the ranking.

According to this criterion the most significant intensity of positive correlation is noted between *Nsb* and the maximal value of ultra-violet radiation during the day (*Hi UV*) (Fig.11), (r=0,645; 0,533; 0,600; 0,367; 0,422; 0,398; 0,537; 0,578; 0,515; p<0,01), (r=0,330; p<0,05).

The high significant intensity of positive correlation is noted also between *Nsb* and the maximal value of Solar Radiation (*Hi Solar*) (r=0,417; 0,546; 0,671; 0,403; 0,559; 0,433; 0,621; 0,554; p<0,01), (r=0,364; 0,351; p<0,05).

Positive significant correlation is noted between *Nsb* and the middle value of Solar Radiation (*Solar Radiation*) (r=0,498; p<0,01), (r=0,347; 0,338; 0,323; 0,386; 0,360; p<0,05). Next factor, according to the intensity of positive correlation with *Nsb*, is the middle air temperature (*Temperature*) (r=0,422; 0,535; p<0,01), (r=0,349; 0,368; p<0,05). The positive correlation between *Nsb* and the maximal air temperature (*Hi Temperature*) during the day has the same intensity (r=0,409; 0,535,

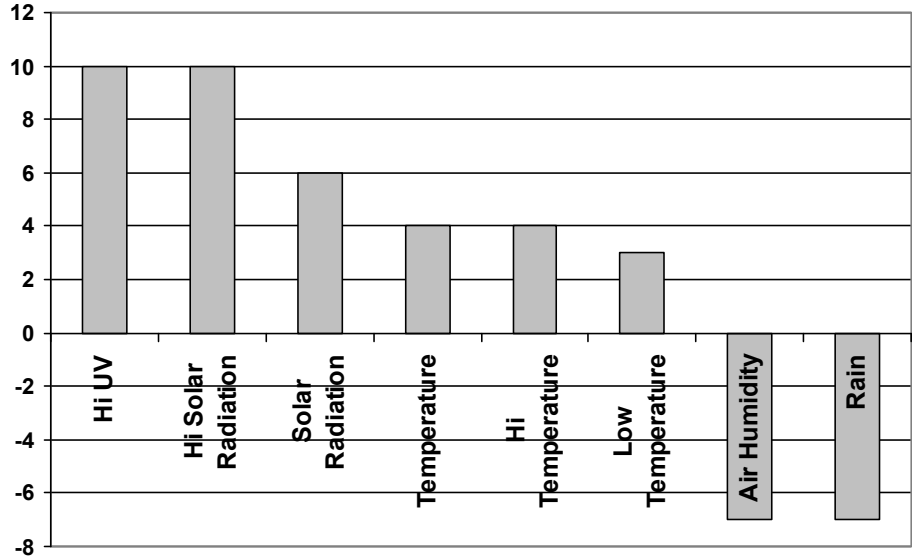

Fig.11. Ranking of meteorological factors by the quantity of significant positive or negative correlations with the number of sun-basking *Emys orbicularis* in the interval 8d"*Nsb*d"21.

p<0,01), (r=0,334; 0,348; p<0,05). Positive correlation between *Nsb* and the minimal air temperature (*Low Temperature*) during the day was also noted (r=0,528; p<0,01); (r=0,320; 0,332; p<0,05).

The most significant intensity of negative correlation with *Nsb* is noted for the value of air humidity (*Air Humidity*) (r=-0,543; -0,597; -0,667; -0,588; -0,406; p<0,01), (r=-0,372; -0,347; p<0,05). The highly significant negative correlation is noted between *Nsb* and the Rain (*Rain*) (r=-0,486; p<0,01), (r=-0,364; -0,343; -0,361; -0,365; -0,316; -0,324; p<0,05) (Fig.11).

DISCUSSION

During the experiment it was registered that sun-basking takes plenty time in day activity of *Emys orbicularis* under the climatic conditions of Latvia, as on the northern boundary of area in Germany, where *Emys orbicularis* also spend much time in spring and summer lying under the sun (Schneeweiss 2003). The correlation of sun-basking activity of *Emys orbicularis* with the solar activity noted in the experiment is close to the data of the study of sun-basking activity of *Emys orbicularis* in nature in France (Cadi, Joly 2003).

The reduction of average number of sun-basking *Emys orbicularis* in the period since May until August registered in the experiment is close to the data that a quantity of observed in the natural reservoirs sun-basking *Emys orbicularis* also decreases since May till August in Lithuania (Meeske 2006) and from spring to autumn in North Italy (Ficetola et al 2004).

Two peaks of daily sun-basking activity of *Emys orbicularis*, mostly significant in May, are noted in the study. In Dagestan 2 peaks of activity of *Emys orbicularis* are also noted in the middle of May: in 11:00 - 12:00 and 14:00 - 15:00 (Bannikow 1951, cited in: Fritz 2003). The difference in time of peaks can be connected with a difference in values of meteorological factors in Latvia and Dagestan in May.

In our research the frequent active displacement of *Emys orbicularis* over the land during sun-basking is noted. This displacement can be

connected with the fact that plastron of *Emys orbicularis* possesses larger thermal conductivity in comparison to carapax (Смирнов, Щеглова 1985). During the displacement to a new, thoroughly heated by the sun part of substratum, turtle gets from it additional warmth through plastron.

Overgrowing of biotopes of *Emys orbicularis* in Latvia (Pupiòð, Pupiòa 2007) leads obviously to the decrease of possibilities for their sun-basking activity; therefore the creation of convenient places for sun-basking must be taken into account while conducting measures for the preservation of *Emys orbicularis* in Latvia.

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THE EUROPEAN HARE (*LEPUS EUROPAEUS* PALLAS) POPULATION IN LITHUANIA: THE STATUS AND CAUSES OF ABUNDANCE CHANGE

Kęstutis Pėtelis, Gediminas Brazaitis

Pėtelis K., Brazaitis G. 2009. The European hare (*Lepus europaeus* Pallas) population in Lithuania: the status and causes of abundance change. *Acta Biol. Univ. Daugavp., 9(2): 299 – 304.*

The article content information abaut the status and causes of abundance change of the European hare (Lepus europaeus) population in Lithuania. The annual harvest of the European hare differs from 3% to 39%. The average annual harvest in 1000 ha of landed properties was 1.5 individual. In different regions observed great differences up to 29 times. In seven districts are hunted almost the half of the harvest (48.25 %).

Key words: European hare, Lepus europaeus, Lithuania, population.

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INTRODUCTION

The European hare (*Lepus europaeus* Pallas) is one out of two hare species in Lithuania. The former studies about European hare in Lithuania were carried out by Likevičienė N. (1973), Belova O. (1990, 1997), Pėtelis K. (2004), Pėtelis K. and Brazaitis G. (2005). The abundance and harvest statistics of European hare in Lithuania were varying. After Second World War the population in Lithuania was roughly 100 thou. animals. The highest harvest were estimated in 1956 (roughly 59.8 thou), 1962 (62,0 thou.), 1965 (59,1 thou.), 1966 (58 thou.). Later the harvest gradually decreased and in 1980 were shoot only 5100 hares as well as in 1992 – 4200 hares. The decrease of European hare abundance was observed in neighboring countries as well (Panek, 2005).
In the last decade of XX century the annual harvests were stabilized, but during the last years observed negative tendencies again. The mostly significant decrease of the European hare population was documented in mostly suitable region: Vilkaviškis, Marijampolė, Lazdijai districts. The aim of this study is to analyze the status and the use of the European hare population. The main tasks were to analyze the harvest dynamics in Lithuania in the last 5 years and estimate the reasons of abundance change. The study was done during 2000-2005 yrs, analyzing earlier period data as well.

STUDY AREA, MATERIALS AND METHODS

The game bag dynamics, population quality as well as hunting methods, game intensity were analyzed in Vilkaviškis, Marijampolė, Šakiai,

Raseiniai, Kėdainiai, Radviliškis districts, in 20 hunting units, totally covering 102 000 ha area. The censuses of European hares were implemented by "moving" line method, during the hunt by "moving" line or circular drive hunt (Navasaitis and Pėtelis, 1998; Pielowski, 1969; Rajska, 1968).

The data about game bags within the last 5 years were adopted from the hunting statistics official reports of Ministry of Environment as well as separate game clubs. The official data on 2005 of the Department of Statistics about area of landed properties for agriculture and not for agriculture were used in the study calculations as well. Landed properties for agriculture were classified into arable land, meadows, natural pastures and gardens. Landed properties for not agriculture was forest, shrubs and swamps.

Climate was evaluated under the data from the Meteorological Service. There were examined the diseases and parasites of 15 European hares from 4 game properties. The impact of traffic was studied in the "Via Baltica" 79 km length road section from Kalvarija to Kaunas during 2003-2005.

RESULTS AND DISCUSSION

The harvest of the European hare

The harvest of the European hare during the 1996/1997 – 1999/2000 yr. hunting seasons (4 yrs.) were 13750 individuals or 16.2 % of all population. The harvest of the European hare during the last 5 years (2000/2001 –2004/2005 hunting seasons) was 47557 individuals. The average annual harvest is 9511 individuals. The highest harvest of the European hare was 11606 individuals in 2002/2003 hunting seasons, as well as lowest harvest was 8346 individuals, observed during 2001/2002 hunting season, i.e. one season earlier. The average annual harvest in 1000 ha of landed properties was 1.5 individual. In different regions observed great differences up to 29 times. From 0.3 (Švenčionių dist.) to 8.7 (Vilkaviškis dist.). In the seven administrative districts were cumulated almost the half of all Lithuanian annual harvest of the European hare, as well as only in the Marijampolės county (Šakiai, Vilkaviškis, Marijampolė dist.) were hunted almost one third (30%). Therefore the changes of game bag in this region determine whole harvest statistics in Lithuania. That happens during the 2004/2005 hunting season. In Vilkaviškis dist. were harvested 306 hares less comparing with previous game season. This decrease has significant impact on whole harvest trends in Lithuania.

The factors determining the abundance of the European hare

The abundance of the European hare is under pressure of many environmental factors as well as their combined effect: climatic conditions, hunting, raptors, diseases and parasites, transport, agricultural activity.

The influence of the climatic conditions. The highest impact on the European hare abundance has the cumulative effect of three factors: 1) average precipitation during June and July, 2) average temperature during March and June and 3) the number of cold days during December and March.

Very favorable years are when even two of three factors are favorable: if during spring time is warm and during June-Julie dry or during December and March dominate warm days and summer is dry. Under the N. Litkevičienė (1973) the abundance of the European hare is dependent on climatic conditions in January, February and March. If during January is not very cold and not many snow, the rutting season starts early in January and February. The first juveniles of the European hares appear during the March - beginning of April and comparatively high part of them dies. And opposite, if during January, February and the beginning of March are high snow cover, the rutting season starts later and juveniles appear during milder late spring period. This determines higher survivor level. Also the impact of temperature and humidity during April,

June, Julie and August were documented (Likevičienė, 1973).

During the last 5 yrs. the highest abundance of the European hares was observed in 2002/2003 hunting season. This means, the climatic conditions during the end of 2001 and 2002 were favorable. Under the climatic conditions the discussed period was favorable because two factors out of three have appeared: spring (March) was warm and summer dry. The next hunting season was poor, that means the climatic conditions during the end of 2002 and 2003 was unfavorable. Under the climatic conditions the discussed period was unfavorable because two positive factors were not slashed: the spring (March) was warm, but summer rainy. To create prognosis for whole Lithuanian territory is difficult because the climatic conditions in separate regions differ. As were mentioned previously, the total harvest of the European hare in Lithuania is determined by 7 districts, situated in south west part of country.

The influence of the hunting intensity. The hunting intensity has huge direct impact on the European hare abundance and abundance dynamics.

The influence of the hunting season. Since 1997/1998 hunting season of the European hare were open from 1st November to 1st February. The hunting season cover 93 days. The hunting season match the European hare biology.

The influence of hunting method. Under the Hunting Regulation of the Republic of Lithuania is allowed to hunt the European hare by 7 hunting methods: the drive hunt, the still hunt, the stalking, the hunt by moving line, the circular drive hunt, with the dogs, with the falcon.

Very rare hunt is with the falcon, the greyhounds, the still hunt, the stalking for tracks. The drive hunt (special for hares) was rarely observed. This method was used in two investigated game management units.

Hunt by moving line was often observed. This method was applied in Marijampolė, Alytus, Kaunas counties, roughly in 30% of game management units.

The circular drive hunt is used in several game properties. In Marijampolė district roughly in 10% of game management units this method is applied regularly. Applied not origin of this method, but modified, in the begging of hunt not all area is surrounded, flanks are open.

Hybrid method of drive hunt and moving line hunt is dominating in Lithuania (60% of all game properties). One part of hunters is standing in the line and another position is in the line that moving thought the field. All has possibility to shot. There were found that the method of hunting has not influence on the European hare trend of abundance or harvest (table 1).

Table 1. The dependence between the European hare harvest change and hunting method (evaluated only the game management properties with normal hunting intensity)

Hunting method	The change of harvest within 5 yrs, %
Moving line	± (5 –10)
Drive hunt	± 3
Circular drive hunt	± (5 –10)
Drive hunt + moving line	± (5 –15)

The hunting method has influence on population structure of European hare. Mostly acceptable is a method that survived highest proportion of females. During the hunt by moving line the higher proportion of females is hunted because they keep shorter distance to hunters and later flushing. The method of drive hunt saves more females, because males firstly reach shooting line and females split through the flanks. In the forest or brushes during the drive hunt more females is shoot. But only this method is allowed in such habitats. The even ratio is created during the hunting by circular drive hunt method as well as

drive hunt + moving line, the amount of females and males is the same.

Very rarely (only 10 % of hunting properties) are used hounds for searching wounded animals. Without the dogs during the diving hunt and moving line is lost 15-20% off all wounded hares as well as circular drive and hunt + moving line up to 10%.

The influence of hunting intensity. The number of hunting days is unlimited. Separate clubs on the same property is organizing hunts from 1 to 5 times (table 2). While hares are hunted 1-1.5 time (i.e. hares again is shoot only in the part of area), the annual hare abundance is fluctuating by 5-10%. The abundance of hares is decreasing if hunts organized two times in the same area. If hunts are organized three times the game bag after a few years decrease up to 2.2 times. The population of hares is destroyed and the game bag after the few years is lower by 3.0-5.0 times if hunts are organized four times and more in the same areas. So, in the same area the mostly efficient hunting intensity is one –one and a half time per year.

Table 2. The dependence between the European hare abundance and hunting intensity.

The amount of organized hunts in the same area during one hunting season	The Change of game bag during 5 yr, %
One (up to one and half)	± (5 –10)
Two	(- 11) – (-25)
Three	(-100) – (-220)
Four and more	(-300) – (-500)

The influence of carnivore's ratio with the European hare abundance. The European hare is significant prey for many predators: most of medium size and small raptors, hedgehog, medium size and large birds, crows, white and black storks, large gulls, homeless dogs and cats. All these are accepted to call predators (Likevičienė, 1973). The influence of predators on the European hare depends on their abundance and part in the nutrition.

The Red fox is mostly important predators influencing hare abundance. The European hare comprise 10-15% in the Red fox nutrition. The main food of the Red fox is rodents, but during the periods of rodents abundance decline the proportion of the European hare in the nutrition of the predators increase very significant. Such situation happened in 2003, when the abundance of rodents was very low.

In general, in Lithuania the game bag of the European hare is lower the Red fox: the ratio is: 1 fox to 0.78 hare. This ratio is differing significantly among the regions from 1:4.0 (Vilkaviskis dist.) up to 1:0.15 (Kupiskis dist.).

In the districts where the harvest of the European hare is high, also the shooting intensity of the Red fox is significant (2.1-2.2 fox/1000 ha). So the use of the Red fox population is moderate. In these districts the ratio is 1:8-10 (fox : hare), and the Red fox population is two times overabundant. The Red fox is not significant factor influencing the abundance of the European hare in this region.

In the districts where the game bag of the Red fox is higher the European hare, i.e. the ratio is 1:0.5-2.0 (fox : hare), the red fox population is 40-20 times overabundant. The Red fox is one of the main factors influence the European hare abundance. There are only 5-13% out of all harvested Red foxes is hunted during mostly vulnerable period from April to November.

The part of the hares in the nutrition of the Raccoon dog is unclear. Also is unclear the part of the European hares in the nutrition of very abundant Rooks, Buzzards, White Storks.

The influence of diseases and parasites. All investigated hares were infected by parasites that inflict *coccidia*. Almost all hares (93.3 %) had *Trichostrongylidae* helminthes. There were also estimated that hares have nematodes

Trichostrongylus retortformis, Trichostrongylus instabilis, Nematodinus aspinosus, Obeliscoides leporis. More than a half hares (53.3 %) were infected by parasitic helminthes *Trichuris leporis* (54.5% males, 75% females, 25% juveniles). Only one hare has been infected by helminthes *Pasalurus ambiquus.*

The influence of traffic. The studied highway Via-Baltica cross the region through mostly suitable area for hares. There were evaluated that in average 52 hares are killed by traffic annually (in 79 km road section). That constitutes 5% of the European hare game bag.

CONCLUSIONS

1. The annual harvest of the European hare differs from 3% to 39%. The average annual harvest in 1000 ha of landed properties was 1.5 individual. In different regions observed great differences up to 29 times. In seven districts are hunted almost the half of the harvest (48.25 %).

2. The highest impact on the European hare abundance has the cumulative effect of three factors: average precipitation during June and July, average temperature during March and June, the number of cold days during December and March. Very favorable years are when even two of three factors are favorable: if during spring time is warm and during June-Julie dry or during December and March dominate warm days and summer is dry.

3. The European hares are often hunted by drive hunt + moving line method, as well as rarely moving line and very rare circular drive hunt and drive hunt. The abundance of hares does not dependent on the hunting method. During the hunt by moving line or in forest by drive hunt the higher proportion of females are shoot. During the hunting by circular drive hunt method as well as drive hunt + moving line, the amount of females and males is the same.

4. The European hare abundance dynamics is mostly dependent on hunting intensity. While hares are hunted 1-1.5 time (i.e. hares again is shoot only in the part of area), the annual hare abundance is fluctuating by 5-10%. The abundance of hares is decreasing if hunts organized two times in the same area.

10. The game bag of the European hare is lower the Red fox: the ratio is: 1 fox to 0.78 hare. In the districts of high hare abundance the ratio is 1:8-10 (fox : hare) and the fox is not main limiting abundance factor. In the districts where the game bag of the Red fox is higher the European hare, i.e. the ratio is 1:0.5-2.0 (fox : hare), the red fox is important factor limiting the European hare abundance.

12. The European hares are intensively infected by Coccidian, Trichostrongylidae and less by *Trichuris leporis*.

13. In 79 km road section average 52 hares are killed by traffic annually. That constitutes 5% of the European hare game bag.

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