Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi
Journal of AgriculturalFaculty of GaziosmanpasaUniversity
http://ziraatdergi.gop.edu.tr/

Araştırma Makalesi/*ResearchArticle*

JAFAG
ISSN: 1300-2910
E-ISSN: 2147-8848
(2018) 35 (2), 141-146
doi:**10.13002/jafag4394**

First report on the chromosome number of a saproxylic beetle, *Ropalopus clavipes* (Cerambycidae: Cerambycinae: Callidiini)

Atılay Yağmur OKUTANER[1]* Yavuz KOÇAK[2]

[1]Ahi Evran University, Faculty of Arts and Sciences, Department of Anthropology, Kırşehir
(orcid.org/ 0000-0001-6585-1824)
[2]Ahi Evran University, Faculty of Engineering and Architecture, Department of Environmental Engineering, Kırşehir
(orcid.org/ 0000- 0003- 3865- 2103)
*e-mail: atilayyagmur@gmail.com

Alındığı tarih (Received): 13.12.2017 Kabul tarihi (Accepted): 30.05.2018
Online Baskı tarihi (Printed Online): 11.07.2018 Yazılı baskı tarihi (Printed): 29.08.2018

Abstract: Cerambycidae is poorly known in terms of its cytogenetics. Therefore, longhorn beetles are favorable for intensive chromosome studies. There is little if any chromosomal study in the family for both the tribe Callidiini Kirby, 1837 and its genus *Ropalopus* Mulsant, 1839. The main objective of the present study is to describe the karyotype of the longhorn beetle *Ropalopus clavipes* (Fabricius, 1775) and thus make a contribution to the karyological data of the family. The karyological analysis of testis of *R. clavipes* adults showed a diploid chromosome number of 2n=22 ($n♂=10+Xy_p$). The present investigation constitutes the first cytogenetic analysis of *R. clavipes*.

Keywords: Chromosome, cerambycidae, callidiini, *ropalopus clavipes*

Saproksilik kınkanatlı *Ropalopus clavipes* (Cerambycidae: Cerambycinae: Callidiini)'in kromozom sayı hakkında ilk çalışma

Özet: Cerambycidae familyası, sitogenetiği açısından iyi bilinmemektedir. Bu nedenle kromozom çalışmaları için uygun bir gruptur. Familyada hem Callidiini Kirby, 1837 tribusu hem de onun genusu *Ropalopus* Mulsant, 1839 için kromozomal çalışmalar yok denecek kadar az seviyededir. Bu çalışmanın asıl amacı *Ropalopus clavipes* (Fabricius, 1775) türünün karyotipini tanımlamak ve böylece familyanın karyolojik verisine katkı sağlamaktır. *R. clavipes* erginlerinin testislerindeki karyolojik inceleme türün diploid kromozom sayısının 2n=22 ($n♂=10+Xy_p$) olduğunu göstermiştir. Bu çalışma *R. clavipes* üzerine yapılan ilk sitogenetik incelemedir.

Anahtar kelimeler: Kromozom, cerambycidae, callidiini, *ropalopus clavipes*

1. Introduction

In Turkey, we have a better understanding of Cerambycidae fauna and taxonomy than its other biological patterns. The accumulated information about Turkish longhorn beetles remains far from satisfactory due to the lack of planned faunistic studies, and most of taxonomic studies are focused on external morphological characteristics. Nevertheless, the morphological approach coupled with increasing knowledge of geographical distribution is still indispensable to cerambycid studies and continue to serve useful purpose (Alkan and Eroğlu, 2001; Sama and Rejzek, 2002; Tezcan and Rejzek, 2002; Özdikmen and Çağlar, 2004; Özdikmen and Hasbenli, 2004; Özdikmen and Demirel, 2005; Özdikmen and Okutaner, 2006; Özdikmen and Şahin, 2006; Özdikmen, 2007; Danilevsky, 2010; Yardibi and Tozlu, 2013; Şabanoğlu and Şen, 2016; Şabanoğlu and Sert, 2016; Özdikmen and Cihan, 2016; Danilevsky, 2017; Yıldız, 2017).

Many cerambycid groups, on the other hand, are known to present a complex taxonomy (Gardiner, 1961; Gressitt, 1978; Sama, 1993; Lingafelter, 2008; Wallin et al., 2009; Özdikmen et al., 2009; Dascălu, 2010; Grzymala and Miller, 2013; Santos-Silva et al., 2013; Bjørnstad, 2014; Sláma, 2015; Schapker 2017). Since taxonomic studies were limited to simple morphological characteristics, techniques other than traditional

morphology have been sought to enhance taxonomic diagnoses. Of these, karyotypic features are considered to be of great importance as a taxonomic character in solving taxonomic problems, in the phylogenetic classification and in assessing relationships (Gokhman and Kuznetsova, 2006). There is therefore a good opportunity for a comparison of the morphological and karyological findings in a comparative framework (Jackson, 1971). Unfortunately, despite their taxonomic relevance, chromosome numbers are known for less than 1% of all cerambycids and merely 6 longhorn beetles have hitherto been karyotyped from Turkish Cerambycidae fauna consists of about 650 taxa (Löbl and Smetana, 2010; Okutaner et al., 2011a, 2011b, 2011c, 2011d; Okutaner et al., 2012; Tokhatyan and Karagyan, 2013; Karagyan and Kalashian, 2016).

Turkish Callidiini is composed of 23 species belonging to 8 different genera. Of these, the genus *Ropalopus* Mulsant, 1839 has been represented by 8 species. In this genus, *Ropalopus clavipes* (Fabricius, 1775) has been recorded by different authors from various localities in Turkey (Özdikmen, 2007; Özdikmen, 2008; Cebeci et al., 2011). *R. clavipes* is classified in the IUCN European Red List of Saproxylic Beetles (Nieto and Alexander, 2010; Özdikmen, 2016). Saproxylic cerambycids (dead wood dependent) and other saproxylic beetles are considered to be a useful indicator of forest biodiversity (Pavuk and Wadsworth, 2012). As known, the polyphagan family Cerambycidae consists of phytophagous, especially xylophagous species of agricultural importance. Thereof, those beetles have received increasing attention.

This work is an attempt to throw some light on the phylogenetic relationships of cerambycid beetles by means of chromosome studies. To achieve this goal, we describe here for the first time the conventional karyotype of *R. clavipes* and provide comparative cytogenetic analysis of related taxa.

2. Materials and Method

Adult male specimens of *R. clavipes* collected from the environs of Çorum province (Turkey) between May and July 2014, formed the material for the present investigations. The individuals were kept in plastic vials and brought alive to the laboratory. Prior to karyological studies, the beetles were anesthetized with ethyl acetate and then their gonads were dissected out of the abdomens under a binocular microscope. Afterwards, the testes were fixed in a freshly prepared solution of ethanol:glacial acetic acid (3:1) and were stored at −20 °C. Chromosome preparations were obtained by using the classical method of testicular follicles squashing described by Rozek (1994) with some modifications and finally stained with Giemsa (4 %, pH 6.8) as usual. The preparations were inspected at 100X magnification, using a Leica DMLB 2 photomicroscope equipped with a Leica DFC320 camera. Well-spread spermatogonial metaphases were selected and photographed for determining the chromosome number.

3. Results and Discussions

In the present paper, we described the chromosomes of *R. clavipes* from Turkey. Spermatogonial metaphases revealed 22 chromosomes of various sizes and they are most likely metacentrics and submetacentrics. The male karyotype of *R. clavipes* is constituted by 10 autosomal bivalents and the Xy_p sex-chromosome system of parachute type; therefore a meioformula of $10+Xy_p$ is assigned to this species (Figure 1).

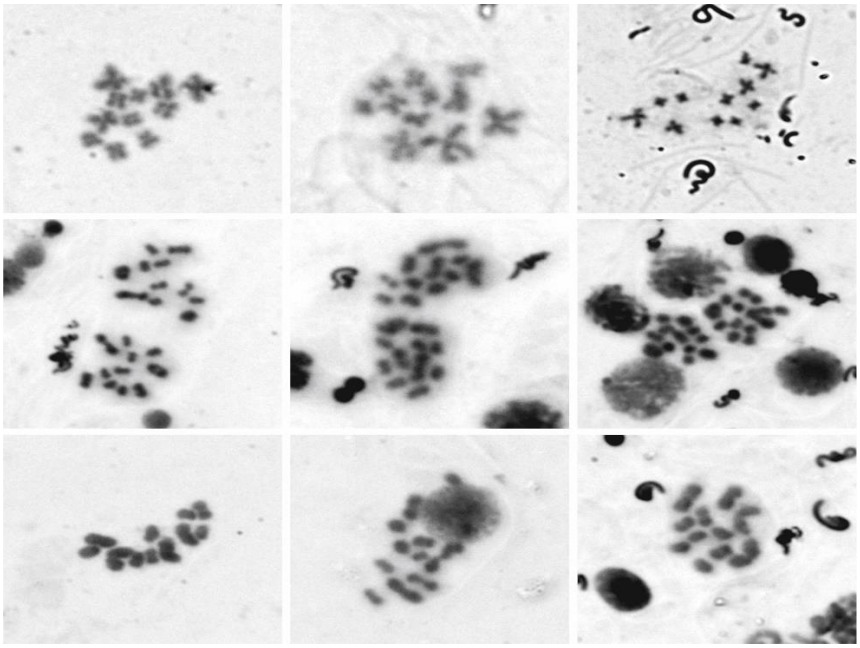

Figure 1. Meiotic chromosomes of *Ropalopus clavipes* [2n♂=22 (n=10+Xy$_p$)]
Şekil 1. *Ropalopus clavipes'in mayotik kromozomları [2n♂=22 (n=10+Xy$_p$)]*

To our knowledge, as of yet there have been no published reports describing the karyotype of the *R. clavipes*. Therefore, the current study is thought to be the first report of the chromosomal study of this beetle. Besides, the literature dealing with the chromosomes in the genus *Ropalopus* is very meager and the karyotype of only one species was available. Ehara (1956) reported that *R. signaticollis* has 22 chromosomes. The present diploid count of 2n=22 is, thus, in accordance with the previous record for the genus. Comparative karyotype analyses have been severely hampered by paucity of information regarding the cytogenetics of this genus. Moreover, despite the fact that the tribe Callidiini currently contains 206 species in 41 genera, very few species have been subjected to chromosomal studies, only 5 species of 4 genera (Ehara, 1956; Teppner, 1966; Abe et al., 1971; Smith and Virkki, 1978; Nearns et al., 2018). Chromosomal studies of Callidiini have heretofore been chiefly concerned with the chromosome numbers and sex chromosome mechanisms. These distinguishing karyological characters have been tabulated for all Callidiini species thus far studied cytogenetically (Table 1).

Table 1. Chromosomal data of species of Callidiini
Çizelge 1. *Callidiini türlerinin kromozomal verileri*

Species	Diploid number	Meioformula	References
Callidium violaceum	22♂	10+Xy	Smith and Virkki 1978
Callidium violaceum	20♀	…	Teppner 1966
Gonocallus collaris	…	6+Xy$_p$	Smith and Virkki 1978
Phymatodes maaki	…	9+Xy$_p$	Abe et al. 1971
Rhopalopus signaticollis	♂	11$_{II}$	Ehara 1956

Many efforts that are based on the analysis of few morphological characters of longhorn beetles have yielded taxonomic confusion, since morphological variation in the family Cerambycidae is extreme. Cerambycidae cytogenetics, thus, usually leads to different and/or new approaches and promotes the future taxonomic studies. In spite of many references in which chromosomal data for Cerambycidae are provided, the proportion of species analyzed so far is less than 1 %. While the widespread chromosome number is 2n=20, the range of diploid numbers in this family goes from 2n=10 in *Plocaederus obesus* Gahan (Cerambycinae) to 2n=53-54 in *Vesperus xatarti* Mulsant (Vesperinae). On the other hand, the "parachute" Xy_p is the most frequent sex-chromosome system among cerambycids while the others also were recorded (e.g. X0, Xy, XY, Xy_p and multiple sex chromosomes). It seems that the available results not sufficient to assess relatedness or to reconstruct phylogeny of this group. Therefore, additional karyological works are needed to better understand the diversity, distributional patterns and evolution of the family (Cesari et al., 2005; Dutrillaux et al., 2007; Okutaner et al., 2011a, 2011b, 2011c, 2011d; Okutaner et al., 2012; Tokhatyan and Karagyan, 2013; Dutrillaux and Dutrillaux, 2014; Giannoulis et al., 2014; Karagyan and Kalashian, 2016).

4. Conclusion

Adequately defined species and groups of species or groups of populations are prerequisites for phylogenetic, biogeographical and ecological studies. Endeavors in these fields may provide erroneous knowledge when based on poor taxonomic assessments (Löbl and Smetana, 2013). The use of cytogenetic methods in taxonomy has become a widespread and powerful tool for the delineation and identification of many insects, particularly in beetles (Lachowska et al., 2006). The karyotype is a part of the cytogenetic data required for a better definition of a species along with the other classical characters (Petitpierre, 1997). Undoubtedly, karyotypic findings provide valuable clues for debated taxonomic contexts, bringing data pertaining to a genetic differentiation between populations/species (Capanna and Civitelli, 1988). Species-specific karyotypes can therefore be deemed a definite element such as any morphological character for taxonomic purposes (Petitpierre, 1997; Lachowska et al., 2006). Since karyological peculiarities are actually morphological and they can be analysed in a way similar to that of the features of external morphology (Gokhman, 1997). Moreover, karyotype structure does not depend on environmental conditions, at least not directly (Baur et al., 2014).

Consequently, the systematic relationships within the family Cerambycidae are much less clear in terms of cytotaxonomic approach. The present paper, thus, sets out to provide a framework for future taxonomic and karyological work on the family and to demonstrate the value of chromosomal studies in its taxonomy.

Acknowledgments

We would like to thank Dr. Turgay TUNÇ for his help in collecting samples. This work was supported by research grants from the Ahi Evran University Scientific Research Projects Coordination Unit. Project Number: PYO-FEN.4001.12.034. The authors are thankful to all contributors.

References

Abe A, Kudoh K and Saitoh K (1971). Chromosome studies of beetles. I: on the male germ cell chromosomes of nine species of Cerambycidae. The Science Reports of the Hirosaki University, 18: 15-20.

Alkan H and Eroğlu M (2001). A contribution to the knowledge of Cerambycidae (Insecta: Coleoptera) species of the Eastern Black Sea Region in Turkey. Türkiye Entomoloji Dergisi, 25(4): 243-255.

Baur H, Kranz-Baltensperger Y, Cruaud A, Rasplus JY, Timokhov AV and Gokhman VE (2014). Morphometric analysis and taxonomic revision of *Anisopteromalus* Ruschka (Hymenoptera: Chalcidoidea: Pteromalidae) – an integrative approach. Systematic Entomology, 39: 691-709.

Bjørnstad A (2014). Studies in Afrotropical Cleomenini (Coleoptera, Cerambycidae, Cerambycinae). IV. revision of the genus *Brachysarthron* Thomson, 1864. Norwegian Journal of Entomology, 61(1): 76-81.

Capanna E and Civitelli MV (1988). A cytotaxonomic approach of the systematics of *Arvicanthls niloticus* (Desmarest 1822) (Mammalia Rodentia). Tropical Zoology, 1: 29-37.

Cebeci H, Özdikmen H and Turgut S (2011). Callidiine species in Turkey with zoogeographical remarks and some interesting and rare records (Coleoptera: Cerambycidae: Cerambycinae). Journal of Natural History, 45(7-8): 475-483.

Cesari M, Marescalchi O, Francardi V and Mantovani B (2005). Taxonomy and phylogeny of Europan *Monochamus* species: first molecular and karyological data. Journal of Zoological Systematics and Evolutionary Research, 43(1), 1-7.

Danilevsky ML (2010). Four new *Phytoecia* (Coleoptera: Cerambycidae) from Turkey. Studies and Reports Taxonomical Series, 6(1-2): 19-30.

Danilevsky ML (2017). Several taxonomic notes on new descriptions of Turkish *Dorcadion* (Coleoptera, Cerambycidae). Humanity Space International Almanac, 6(1): 33-37.

Dascălu MM (2010). New species of Cerambycidae (Coleoptera) for the Romanian fauna. Analele Științifice ale Universității "Al. I. Cuza" Iași, s. Biologie Animală, LVI: 63-67.

Dutrillaux AM and Dutrillaux B (2014). Chromosome evolution of some Palaearctic and Nearctic species of *Monochamus* (Coleoptera: Cerambycidae: Lamiinae). Annales de la Société Entomologique de France (N.S.), 50(2): 213-218.

Dutrillaux A.M, Moulin S and Dutrillaux B (2007). Présence d'un caryotype très original à 53–54 chromosomes chez *Vesperus xatarti* Mulsant 1839 (Coleoptera: Cerambycidae: Vesperinae). Annales de la Societe Entomologique de France, 43(1), 81-86.

Ehara S (1956). A comparative histology of male gonads in some cerambycid beetles with notes on the chromosomes. Journal of the Faculty of Science Hokkaido University Series, 6(12): 309-316.

Gardiner LM (1961). Immature stages and biology of *Hyperplatys* spp. (Coleoptera: Cerambycidae) in Eastern Canada. The Canadian Entomologist, 93(11): 1011-1016.

Giannoulis T, Dutrillaux AM, Touroult J, Sarri C, Mamuris Z and Dutrillaux B (2014). Chromosomal and genetic characterization of four Caribbean Prioninae (Coleoptera: Cerambycidae) species with notes on biogeography. Insecta Mundi, 335:1-10.

Gokhman VE (1997). Chromosome number and other karyotypic features of parasitic wasps as a source of taxonomic information. Boletín de la Asociación Española de Entomología, 21: 53-60.

Gokhman VE and Kuznetsova VG (2006). Comparative insect karyology: current state and applications. Entomological Review, 86(3): 352-368.

Gressitt JL (1978). Evolution of the endemic Hawaiian cerambycid beetles. Pacific Insects, 18(3-4): 137-167.

Grzymala TL and Miller KB (2013). Taxonomic revision and phylogenetic analysis of the genus *Elytroleptus* Dugés (Coleoptera: Cerambycidae: Cerambycinae: Trachyderini). Zootaxa, 3659(1): 1-62.

Jackson RC (1971). The karyotype in systematics. Annual Review of Ecology and Systematics, 2: 327-368.

Karagyan GH and Kalashian MY (2016). Data on Katyotypes of Four Armenian Longhorn Beetles with a Review of Karyotype Variation within the Family (Coleoptera, Cerambycidae). VI. International Conference on The Karyosystematics of the Invertebrates, 27-30 August 2016, s.22, Saratov-Russia.

Lachowska D, Rozek M, Holecova M and Kajtoch L (2006). Cytogenetic differences between *Peritelus familiaris* and *Centricnemus leucogrammus* (Coleoptera: Curculionidae: Entiminae: Peritelini). European Journal of Entomology, 103: 687-690.

Lingafelter SW (2008). Seven new species of Elaphidiini (Coleoptera: Cerambycidae) from The Dominican Republic with taxonomic notes, new country records, and a key to *Elaphidion* Audinet-Serville from Hispaniola. The Coleopterists Bulletin, 62(3): 353-379.

Löbl I and Smetana A (2010). Catalogue of Palaearctic Coleoptera, Vol. 6. Chrysomeloidea. Apollo Books, Stenstrup, Denmark.

Löbl I and Smetana A (2013). Catalogue of Palaearctic Coleoptera, Vol. 8. Curculionoidea II. Brill, Leiden, Boston.

Nearns EH, Lord NP, Lingafelter SW, Santos-Silva A, Miller KB and Zaspel JM (2018). Longicorn ID tool for diagnosing Cerambycoid families, subfamilies and tribes. http://cerambycids.com/longicornid/default.asp?a=fs&id=1007 (Accessed to web: 18.10.2017).

Nieto A and Alexander KNA (2010). European red list of saproxylic beetles. Luxembourg: Publications Office of the European Union. 45 p.

Okutaner AY, Özdikmen H, Yüksel E and Koçak Y (2011a). A cytogenetic study of *Vadonia unipunctata* (Coleoptera: Cerambycidae) and its distribution in Turkey. Florida Entomologist, 94(4): 795-799.

Okutaner AY, Özdikmen H, Yüksel E and Koçak Y (2011b). A synopsis of Turkish Certallini Fairmaire, 1864 with a cytogenetic observation (Coleoptera: Cerambycidae: Cerambycinae). Munis Entomology & Zoology, 6(2): 937-943.

Okutaner AY, Özdikmen H, Yüksel E and Koçak Y (2011c). Some cytogenetic observations of *Morimus orientalis* Reitter, 1894 (Coleoptera: Cerambycidae: Lamiinae: Lamiini). Munis Entomology & Zoology, 6(2): 912-919.

Okutaner AY, Özdikmen H, Yüksel E and Koçak Y (2011d). Some cytogenetic observations of two *Dorcadion* Dalman, 1817 species (Coleoptera: Cerambycidae: Lamiinae: Dorcadiini). Munis Entomology & Zoology, 6(2): 886-876.

Okutaner AY, Özdikmen H, Yüksel E and Koçak Y (2012). Cytogenetic observations of *Pachytodes erraticus* (Coleoptera: Cerambycidae: Lepturinae: Lepturini). Florida Entomologist, 95(3): 731-736.

Özdikmen H (2007). The longicorn beetles of Turkey (Coleoptera: Cerambycidae) Part I - Black Sea Region. Munis Entomology & Zoology, 2(2): 179-422.

Özdikmen H (2008). The longicorn beetles of Turkey (Coleoptera: Cerambycidae) Part II – Marmara Region. Munis Entomology & Zoology, 3(1): 7-152.

Özdikmen H (2016). An improved review of Turkish saproxylic Cerambycidae (Coleoptera) from the

European red list with additional twenty-one species. Munis Entomology & Zoology, 11(2): 542-572.

Özdikmen H and Cihan N (2016). Updated list of *Chlorophorus* Chevrolat, 1863 (Coleoptera: Cerambycidae: Cerambycinae) species from Turkey, with two new restorations. Pakistan Journal of Zoology, 48(2): 365-376.

Özdikmen H and Çağlar Ü (2004). Contribution to the knowledge of longhorned bettles (Coleoptera, Cerambycidae) from Turkey, subfamilies Prioninae, Lepturinae, Spondylidinae and Cerambycinae. Journal of Entomological Research Society, 6(1): 39-69.

Özdikmen H and Demirel E (2005). Additional notes to the knowledge of longhorned beetle collection from Zoological Museum of Gazi University, Ankara, Turkey (ZMGU) for Turkish fauna (Coleoptera, Cerambycidae). Journal of the Entomological Research Society, 7(3): 13-38.

Özdikmen H and Hasbenli A (2004). Contribution to the knowledge of longhorned bettles (Coleoptera, Cerambycidae) from Turkey, subfamily Lamiinae. Journal of Entomological Research Society, 6 (2): 25-49.

Özdikmen H and Okutaner AY (2006). The longhorned beetles fauna (Coleoptera, Cerambycidae) of Kahramanmaraş province. Gazi University Journal of Science, 19(2): 77-89.

Özdikmen H and Şahin Ö (2006). Longhorned beetles collection of the Entomology Museum of Central Anatolia Forestry Research Directorship, Ankara, Turkey (Coleoptera, Cerambycidae). Gazi University Journal of Science, 19(1): 1-8.

Özdikmen H, Turgut S and Güzel S (2009). Longhorned beetles of Ankara region in Turkey (Coleoptera: Cerambycidae). Munis Entomology & Zoology, 4(1): 59-102.

Pavuk DM and Wadsworth AM (2012). Longhorned beetle (Coleoptera: Cerambycidae) diversity in a fragmented temperate forest landscape [version 1; referees: 1 approved, 1 approved with reservations]. F1000 Research, 1(25):1-6.

Petitpierre E (1997). The value of cytogenetics for the taxonomy and evolution of leaf beetles (Coleoptera, Chrysomelidae). Miscel·lània Zoològica, 20(1): 9-18.

Rozek M (1994). A new chromosome preparation technique for Coleoptera (Insecta). Chromosome Research, 2(1): 76-78.

Sama G (1993). Notes on *Neomusaria* Plavilstshikov, 1928 with description of a new species from Turkey (Coleoptera: Cerambycidae). Koleopterologische Rundschau, 63: 293-297.

Sama G and Rejzek M (2002). Two new Cerambycidae from Turkey and Iran (Insecta Coleoptera Cerambycidae). Quoderno di Srudi e Notizie di Storio Noturole dello Romogno, 16: 105-110.

Santos-Silva A, Komiya Z and Nearns EH (2013). Revision of the genus *Prionacalus* White, 1845 (Coleoptera: Cerambycidae: Prioninae: Prionini). The Coleopterists Bulletin, 67(3): 201-240.

Schapker P (2017). The Lepturine longhorn beetles (Cerambycidae: Lepturinae) of the Pacific Northwest. http://osac.oregonstate.edu/PNW_Lepturinae (Accessed to web: 18.10.2017).

Sláma M (2015). Taxonomic remarks on some West-Palaearctic longhorn beetles (Coleoptera, Cerambycidae) and description of a new subspecies. Biocosme Mésogéen, Nice, 32(1-2): 33-50.

Smith SG and Virkki N (1978). Animal Cytogenetics, vol. 3. Insecta 5. Coleoptera. Gebrüder Bornstraeger, Berlin, Stuttgart.

Şabanoğlu B and Sert O (2016). A study on the genitalic structures of some Lepturini species from Turkey (Coleoptera: Cerambycidae, Lepturinae). Transactions of the American Entomological Society, 142(2): 97-111.

Şabanoğlu B and Şen İ (2016). A study on determination of Cerambycidae (Coleoptera) fauna of Isparta Province (Turkey). Türkiye Entomoloji Dergisi, 40(3): 315-329.

Teppner H (1966). Chromosomenzahlen einiger mitteleuropäischer Cerambycidae (Coleoptera). I. Chromosoma, 19:113-125.

Tezcan S and Rejzek M (2002). Longhorn beetles (Coleoptera: Cerambycidae) recorded in cherry orchards in western Turkey. Zoology in the Middle East, 27: 91-100.

Tokhatyan GH and Karagyan GH (2013). Karyotype of *Agapanthia persicola* Reitter, 1894 (Insecta, Coleoptera, Cerambycidae) with a Discussion on Karyotype Variation within the Family. The International Conference of Young Scientists, 3-5 May 2013, s.301-304, Armenia.

Wallin H, Nylander U and Kvamme T (2009). Two sibling species of *Leiopus* Audinet-Serville, 1835 (Coleoptera: Cerambycidae) from Europe: *L. nebulosus* (Linnaeus, 1758) and *L. linnei* sp. nov. Zootaxa, 2010: 31-45.

Yardibi M and Tozlu G (2013). Karabük ili Buprestidae, Cerambycidae ve Curculionidae (Coleoptera) türleri üzerinde faunistik çalışmalar. Artvin Çoruh Üniversitesi Orman Fakültesi Dergisi, 14(1): 136-161.

Yıldız Y (2017). *Anoplophora chinensis* (Forster, 1771) (Coleoptera: Cerambycidae) reported at new location in Turkey. Applied Ecology and Environmental Research, 15(4): 111-116.