A Cytogenetic Study of Vadonia unipunctata (Coleoptera: Cerambycidae) and Its Distribution in Turkey

Authors: Okutaner, Atilay Yagmur, Ozdikmen, Huseyin, Yuksel, Esref, and Kocak, Yavuz

Source: Florida Entomologist, 94(4) : 795-799

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/024.094.0410

A CYTOGENETIC STUDY OF *VADONIA UNIPUNCTATA* (COLEOPTERA: CERAMBYCIDAE) AND ITS DISTRIBUTION IN TURKEY

ATILAY YAGMUR OKUTANER[1], HUSEYIN OZDIKMEN[2], ESREF YUKSEL[2] AND YAVUZ KOCAK[3]
[1]Giresun University, Sebinkarahisar M.Y.O, Giresun, Turkey
E-mail: atilayyagmur@gmail.com

[2]Gazi University, Faculty of Science, Department of Biology, 06500 Ankara, Turkey

[3]Ahi Evran University, Faculty of Science and Arts, Department of Biology, Kırsehir, Turkey

ABSTRACT

The paper gives the results of the first cytogenetic study of *Vadonia unipunctata* (F. 1787) on the basis of the mitotic metaphase plate, karyogram, and the male genitalia. The distribution of this species in Turkey is also presented.

Key Words: cytogenetic, karyology, *Vadonia unipunctata*

RESUMEN

Este informe provee los resultados del primer estudio citogénetico de V*adonia unipunctata* (F. 1787) basado sobre el plato de la metafase mitótica, cariograma y los genitales de los machos. Se presenta l distribucion de esta especie en Turquía.

Cytogenetic studies may be helpful in classifying a taxon when external taxonomic traits are not adequate to do so unambiguously. Comparative karyology can have advantages in taxonomic studies of animals because chromosomal characters are essentially morphological characters (Gokhman & Kuznetsova 2006). Cytogenetic studies on the Cerambycidae, in particular, have been realized poorly worldwide until now (Ehara 1956; Teppner 1966, 1968; Kudoh et al. 1972; Smith & Virkki 1978; Vidal 1984; Vaio et al. 1985; Lachowska et al. 1996; Holecova et al. 2002; Rozek et al. 2004; Dutrillaux et al. 2007). The diploid number of chromosomes in long-horned beetle species range between 10 and 36. The sex-chromosome system of long-horned beetles is the parachute type (Xy_p). The most frequent diploid chromosome number in the Cerambycidae is 2n = 20 (18AA + Xy_p) (Smith & Virkki 1978).

Until now no cytogenetic investigations had been conducted on the genus *Vadonia* Mulsant 1863 (Coleoptera: Cerambycidae: Lepturinae: Lepturini) including the species, *Vadonia unipunctata* (Fabricius 1787). In this species, we determined the diploid number of chromosomes in the mitotic metaphase to be 2n = 20.

The members of *Vadonia* closely resemble each other in their external morphology; and identification of these species on the basis of external morphology, therefore, is either very difficult or impossible. Generally the identification of *Vadonia* species is necessarily based solely on characteristics of the male genitalia. Therefore the discovery of new taxonomic characters of *Vadonia* species by means of cytogenetic investigations may prove to be useful for both the identification of species and also the proper classification of the genus.

MATERIALS AND METHODS

The specimens were collected from Ankara province of Turkey in 2009 and 2010 and were deposited in Gazi University, Ankara, Turkey. The chromosomes were obtained according to the method of Rozek (1994) with some alterations as follows. The specimens were placed in a killing jar charged with ethyl acetate. Abdomens of the specimens were cut open and the abdominal contents, especially testicular tissue of the male, and midgut tissue in both males and females, were transferred into petri dishes with distilled water for 10-15 min. Next the tissues of a single specimen were transferred into a cryotube with 0.05% cholchicine solution, held for 45-60 min at room temperature, and then fixed in 3:1 fresh ethanol-acetic acid solution for at least 1 h. Small pieces from the treated tissues were taken and each piece was mounted on a clear slide. Other tissue pieces were placed in a drop of 45% acetic acid and dissected with a dissection pin and a scalpel. Then, each tissue piece was mounted on a slide, covered either with a cover slip or another glass slide and pressed firmly. These preparations were

immersed in liquid nitrogen. The slide and cover slip or the 2 pressed together slides were separated and left to dry. Next the dry preparations were stained with 4% Giemsa Phosphate Buffer (pH = 6.8) for 10 min, and washed with distilled water. After drying, the preparations were examined under a stereo compound microscope (Leica DMLB). The observed chromosomes were photographed with 10X·100X zoom lenses.

Results and Discussion

Subfamily Lepturinae Latreille, 1802

Tribe Lepturini Latreille, 1802

Genus *Vadonia* Mulsant, 1863

Type species: *Leptura unipunctata* F. 1787

Vadonia Mulsant 1863 is a Palearctic genus with the exception of the oriental species *V. eckweileri* Holzschuh 1989 found in Pakistan. *Vadonia* is represented by a total of 22 species and 17 subspecies. These species are distributed from Spain to Kazakhstan and Pakistan. *V. unipunctata* (F. 1787) is the most widely distributed member of the genus. According to Sama (2002), the records from North Africa concerning *Vadonia* species are erroneous.

Thirteen *Vadonia* species are endemic to different countries. According to Özdikmen & Turgut (2009) in Turkey, *Vadonia* is represented by the following 15 species: *V. bicolor* (Redtenbacher 1850), *V. bipunctata* (Fabricius 1781), *V. bisignata* (Brullé 1832), *V. bitlisiensis* (Chevrolat 1882), *V. bolognai* Sama 1982, *V. ciliciensis* K. Daniel & J. Daniel 1891, *V. danielorum* Holzschuh 1984, *V. frater* Holzschuh 1981, *V. imitatrix* K. Daniel & J. Daniel 1891, *V. instigmata* (Pic 1889), *V. ispirensis* Holzschuh 1993, *V. moesiaca* K. Daniel & J. Daniel 1891, *V. monostigma* Ganglbauer 1881, *V. soror* Holzschuh 1981 and *V. unipunctata* (F. 1787). On the other hand, Löbl & Smetana (2010) listed twelve species for Turkey as follows: *V. bicolor* (Redtenbacher 1850), *V. bitlisiensis* (Chevrolat 1882), *V. bolognai* Sama 1982, *V. ciliciensis* K. Daniel & J. Daniel 1891, *V. danielorum* Holzschuh 1984, *V. frater* Holzschuh 1981, *V. instigmata* (Pic 1889), *V. ispirensis* Holzschuh 1993, *V. moesiaca* K. Daniel & J. Daniel 1891, *V. monostigma* Ganglbauer 1881, *V. soror* Holzschuh 1981 and *V. unipunctata* (F. 1787).

The following 7 species are endemic to Turkey: *V. bolognai* Sama 1982, *V. ciliciensis* K. Daniel & J. Daniel 1891, *V. danielorum* Holzschuh 1984, *V. frater* Holzschuh 1981, *V. instigmata* (Pic 1889), *V. ispirensis* Holzschuh 1993 and *V. soror* Holzschuh 1981. *V. monostigma* Ganglbauer 1881 was listed only for Turkey in Löbl & Smetana (2010), but it is distributed in both Turkey and Greece; therefore it is not endemic to Turkey. The 3 species, *V. insidiosa* Holzschuh 1984, *V. mainoldii* Pesarini & Sabbadini 2004 and *V. parnassensis* (Pic 1925), are endemic to Greece. On the other hand, *V. eckweileri* Holzschuh 1989, *V. hirsuta* K. Daniel & J. Daniel 1891 and *V. saucia* (Mulsant et Godart 1855) are endemic to Pakistan, Romania and Crimea, respectively.

Vadonia unipunctata (F. 1787)

Original combination: *Leptura unipunctata* F. 1787

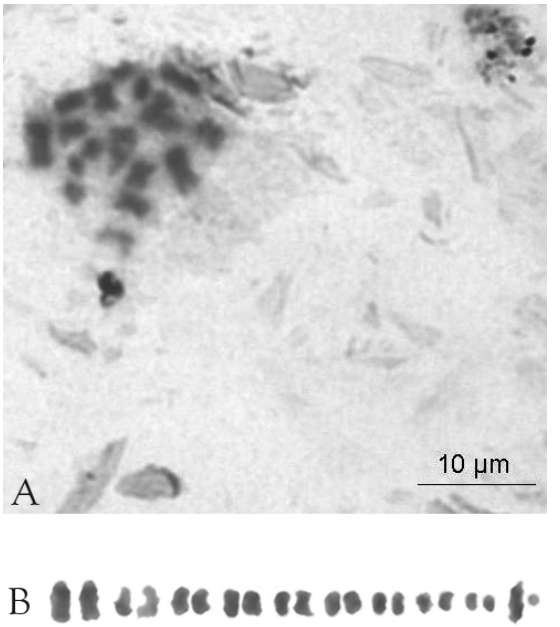
This species is the type species of *Vadonia* Mulsant 1863. According to Löbl & Smetana (2010), *V. unipunctata* has 6 subspecies. The species is represented only by the nominative subspecies in Turkey. It is widely distributed in Turkey. With respect to the remaining known subspecies, *V. unipunctata dalmatina* (Müller 1907) occurs only in Croatia, *V. unipunctata makedonica* Holzschuh 1989 occurs only in Greece, *V. unipunctata occidentalis* (Daniel & Daniel 1891) occurs in Spain, France and Italy, *V. unipunctata ohridensis* Holzschuh 1989 occurs in Greece and Macedonia, and *V. unipunctata syricola* Holzschuh 1993 occurs in Syria and Lebanon.

Vadonia unipunctata unipunctata (F. 1787)

Material Examined. Ankara prov.: Beypazarı, Inözü Valley, 02.VI. 2009, 9 specimens; 24.V.2010, 3 specimens; 27.V.2010, 1 specimen; Ankara prov.: Polatlı, Polatlı-Ayas road, 04.VI.2009, 1 specimen; Ankara prov.: Kızılcahamam, Isık Mountain, 26.V.2010, 3 specimens (Fig. 1).

Cytogenetics. Only small numbers of cells in the examined material were observed to undergo mitotic and meiotic divisions. Long-horned beetles, like beetles generally, have holometabolous development. The frequencies of mitotic and meiotic divisions in the larval, pupal and imaginal stages of different holometabolous insect taxa are quite diverse. This matter in the Cerambycidae was evaluated by Teppner (1968) with regard to spermatogenesis; and he found that spermatogenesis begins in the last instar larva and is continued in adult and meiosis begins in pre-pupal stage. Teppner asserted that the phases of spermatogenesis in the various life stages vary among the subfamilies. Thus spermatogenesis, which occurs in the last instar larva, decelerates in the adult stages in the subfamilies, Lepturinae and Aseminae, while it is continues unabated in the adult stages in the Cerambycinae and Lamiinae. Moreover, Teppner found that the duration of meiosis differs from stage to stage. The chromosomes of long-horned beetles were found to be small. The position of the centromere and the length of the arms of each chromosome are not clear. Nevertheless the chromosome number of

Fig. 1. Habitus of *Vadonia unipunctata* (dorsal view).



Figs. 2A and 2B. 2A, Mitotic metaphase plate from testicular tissue of *Vadonia unipunctata*. 2B, Karyogram of *Vadonia unipunctata* (2n = 20).

each species can be ascertained and this number has some value with respect to taxonomy.

In the present work, cytogenetic investigations were carried out on adult *V. unipunctata* specimens because identification of larvae and pupae to the species level is very difficult. The diploid number of chromosomes of *V. unipunctata* was determined as 2n = 20 in the mitotic metaphase in testicular tissues (Fig. 2).

Records in Turkey. Afyon prov. [Dinar, Erkmen valley] (Demelt & Alkan 1962; Demelt 1963; Adlbauer 1988; Özdikmen 2007); Aksaray prov. [Sultanhanı] (Adlbauer 1988); Ankara prov. [Gölbası, Kavaklıdere, Beytepe, Incek] (Demelt & Alkan 1962; Demelt 1963; Öymen 1987; Özdikmen et al. 2009); Antalya prov. [Toros Mountains] (Bodemeyer 1900); Amasya prov. [Ezinepazarı] (Villiers 1967; Öymen 1987); Artvin prov. [Savsat-Karagöl, Karagöl-Okurlar district] (Tozlu et al. 2002; Özdikmen 2007); Bayburt prov. [Aydıntepe] (Tozlu et al. 2002); Bilecik prov. [Central] (Tozlu et al. 2002); Bingöl prov. (Fuchs & Breuning 1971); Bolu prov. [Devrek to Mengen road, Mengen, Yeniçaga] (Özdikmen 2007); Burdur prov. [Bucak] (Adlbauer 1988); Elazıg prov. [Harput] (Fuchs & Breuning 1971); Erzurum prov. and near [4. Kuyu, University Campus, Kargapazarı Mts., Horasan-Okçular, Ispir-Madenköprübası, Oltu-Basaklı, Çamlıbel, Sarısaz, Sütkans, Olur-Coskunlar, Pazarroad-Kartal Plateau, Tortum-Çiftlik, Pehlivanlı, Uzundere-Dikyar, Ösvank, Selale] (Özbek 1978; Tozlu et al. 2002); Isparta prov. [Egirdir, Yalvaç-Elegi village] (Demelt & Alkan 1962; Demelt 1963; Tuatay et al. 1972; Özdikmen & Çaglar 2004; Özdikmen et al. 2005); Izmir prov. [Kemalpasa] (Gül-Zümreoglu 1975); Kahramanmaras prov. [Afsin-Kabaagaç, Emirli-Gergel, Göksun-Göksun to Çardak road, Gücük plateau, Mehmetbey] (Özdikmen & Okutaner 2006); Karabük prov. [between Eflani and Pınarbası] (Özdikmen 2007); Kars prov. [Sarıkamıs] (Tozlu et al. 2002); Kastamonu prov. [Kastamonu to Tosya road-Tosya & Ilgaz pass, Agılı to Azdavay road-Yumacık village, between Azdavay and Pınarbası, Pınarbası to Azdavay road-Karafasıl village, Azdavay-Ballıdag Wild Life Protection District, Küre-Masruf pass env., Devrekani to Çatalzeytin road, Yaralıgöz pass, Tosya & Ilgaz pass, Tosya to Kastamonu road] (Özdikmen 2007); Kocaeli prov. [Izmit-Ballıkayalar Natural

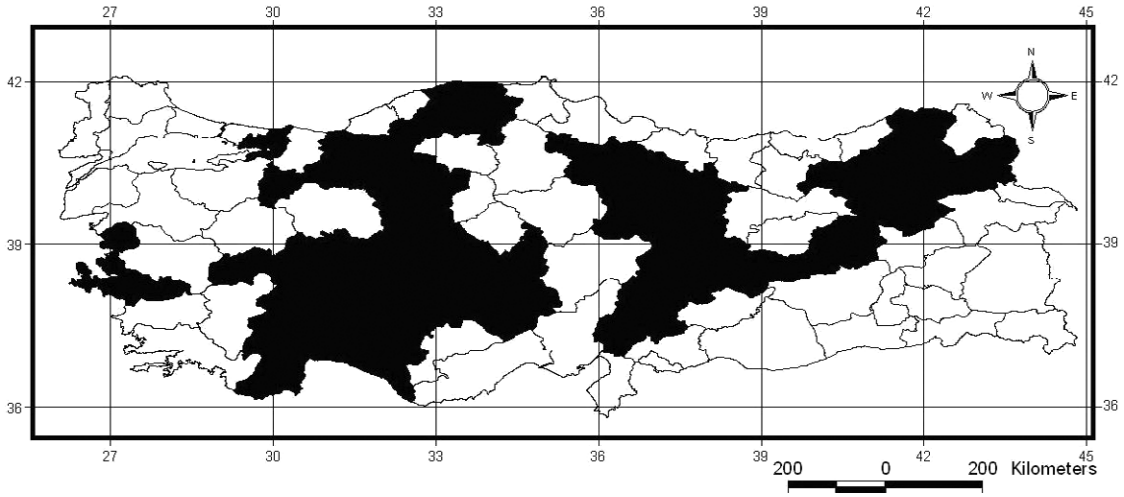
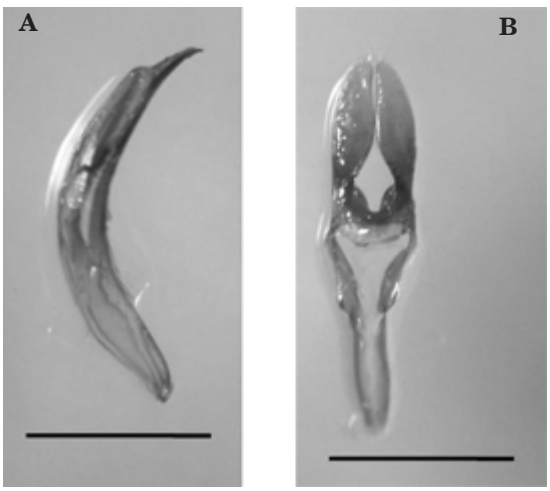


Fig. 3. Distribution of *Vadonia unipunctata* in the provinces of Turkey. The black areas show the provinces in which *V. unipunctata* has been recorded to date.

Park] (Özdikmen & Demirel 2005); Konya prov. [Seydisehir to Antalya road, Derebucak-Tekebeli pass env., Bozkır-Kozagaç and Baybogan villages env.] (Turgut & Özdikmen 2010); Malatya prov. [Darende] (Fuchs & Breuning 1971); Nevsehir prov. [Ürgüp-Göreme] (Fuchs & Breuning 1971; Adlbauer 1988); Nigde prov. [Çamardı, Çiftehan] (Bodemeyer 1900; Adlbauer 1988); Osmaniye prov. [Central, Entry of Yarpuz, Yarpuz road-Karatas place, Yesil village-Hasanbeyli] (Özdikmen & Demirel 2005; Özdikmen 2007; Özdikmen et al. 2010); Sivas prov. [Central] (Tozlu et al. 2002); Tokat prov. [Central] (Tozlu et al. 2002); Usak prov. [Banaz] (Adlbauer, 1988) (Fig. 3).



Figs. 4A and 4B. Male genitalia of *Vadonia unipunctata*. A. Aedeagus, B. Paramers. Scale bar: 1 mm.

Range. Europe (Spain, France, Italy, Croatia, Bosnia-Herzegovina, Serbia, Macedonia, Greece, Bulgaria, European Turkey, Romania, Hungary, Austria, Czechia, Slovakia, Poland, Slovenia, Ukraine, Moldavia, European Russia, European Kazakhstan), Caucasus (Azerbaijan, Armenia, Georgia), Turkey, Syria, Lebanon.

Chorotype. Turano-European or Turano-Europeo-Mediterranean; Since, according to Sama (2002), the records from North Africa are erroneous.

Genitalia. Aedeagal apex pointed distinctly like a claw. Its sclerotization is rather strong. Lobes of parameres are rather long and thick with sparse and clear long hairs, their inner margins are nearly parallel. The inner gab is "U" shaped basally (Fig. 4).

Acknowledgments

This work was supported by a project of Gazi University (05/2008-44). The data were derived from the Ph.D. Thesis of A. Y. Okutaner.

References Cited

Adlbauer, K. 1988. Neues zur Taxonomie und Faunistik der Bockkäferfauna der Türkei (Coleoptera, Cerambycidae). Entomofauna 9(12): 257-297.

Bodemeyer, H. E. V. 1900. Quer durch Klein Asien, in den Bulghar Dagh; Eine Naturwissenschafliche Studien-Reise. Druck-und Verlagsaktien-Gesellschaft vormals Dölter. Emmendingen, 196 pp.

Demelt, C. V. 1963. Beitrag zur Kenntnis der Cerambycidenfauna Kleinasiens und 13. Beitrag zur Biologie palaearkt. Cerambyciden, sowie Beschreibung einer neuen Oberea-Art. Entomol. Blätter 59(3): 132-151.

DEMELT, C. V., AND ALKAN, B. 1962. Short information of Cerambycidae Fauna of Turkey. Bitki Koruma Bülteni 2(10): 49-56.

DUTRILLAUX A. M., MOULIN S., AND DUTRILLAUX B. 2007. Presence d'un caryotype tres original a 53-54 chromosomes chez *Vesperus xatarti* Mulsant 1839 (Coleoptera: Cerambycidae: Vesperinae). Ann. Soc. Entomol. France (n. s.) 43(1): 81-86.

EHARA, S. 1956. A comparative histology of male gonads in some cerambycid beetles with notes on the chromosomes. J. Fac. Sci. Hokkaido Univ. Ser. 6(12): 309-316.

FUCHS, E., AND BREUNING, S. 1971. Die Cerambycidenausbeute der Anatolienexpedition 1966-67 des Naturhistorischen Museums, Wien. Ann. Naturhistorischen Museum Wien 75: 435-439.

GOKHMAN, V. E., AND KUZNETSOVA, V. G. 2006. Comparative insect karyology: Current state and applications. Entomol. Rev. 86(3): 352-368.

GÜL-ZÜMREOGLU, S. 1975. Investigations on taxonomy, host plants and distribution of the longhorned beetles (Cerambycidae-Coleoptera) in Aegean Region. T. C. Ministry of Food, Agriculture and Stockbreeding No: 28, Istiklal Yay., Izmir, 208 pp.

HOLECOVA M., LACHOWSKA D., AND KARAGYAN G. 2002. Karyological notes on six beetle species from Armenia (Coleoptera: Tenebrionidae, Cerambycidae, Curculionidae). Folia Biol. (Krakow) 50: 9-12.

KUDOH K., KONDOH I., AND SAITOH K. 1972. Chromosome studies of beetles IV. A further chromosome survey of five species of the Subfamily Lamiinae (Cerambycidae). Kontyu 40: 293-296.

LACHOWSKA, D., ROZEK, M., AND HOLECOVA, M. 1996. A cytogenetic study on eight beetle species (Coleoptera: Carabidae, Scarabaeidae, Cerambycidae, Chrysomelidae) from Central Europe. Folia Biol. 44(3-4): 99-103 (1996).

LÖBL, I., AND SMETANA, A. [ED.]. 2010. Catalogue of Palaearctic Coleoptera Vol. 6. Stenstrup: Apollo Books, 924 pp.

ÖYMEN, T. 1987. The Forest Cerambycidae of Turkey. I. Ü. Forest Faculty, Istanbul, 146 pp.

ÖZBEK, H. 1978. *Hylotrupes bajulus* (L.) Serville in Erzurum and the near, and some others longhorn beetles. Atatürk Üniversitesi Ziraat Fakültesi Dergisi 9(1): 31-44.

ÖZDIKMEN, H. 2007. The Longicorn Beetles of Turkey (Coleoptera: Cerambycidae) Part I - Black Sea Region. Munis Entomol. Zool. 2: 179-422.

ÖZDIKMEN, H., AND ÇAGLAR, Ü. 2004. Contribution to the knowledge of longhorned beetles (Coleoptera, Cerambycidae) from Turkey, Subfamilies Prioninae, Lepturinae, Spondylidinae and Cerambycinae. J. Entomol. Res. Soc. 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 (GUZM) for Turkish Fauna (Coleoptera, Cerambycidae). J. Entomol. Res. Soc. 7(3): 13-38.

ÖZDIKMEN, H., GÜVEN, M., AND GÖREN, C. 2010. Longhorned beetles fauna of Amanos Mountains, Southern Turkey (Coleoptera: Cerambycidae). Munis Entomol. Zool. 5, suppl.: 1141-1167.

ÖZDIKMEN, H., AND OKUTANER, A. Y. 2006. A very interesting longicorn beetle, *Anatolobrium eggeri* Adlbauer, 2004, from Turkey (Coleoptera: Cerambycidae). Munis Entomol. Zool. 1(1): 169-170.

ÖZDIKMEN, H., ÖZDEMIR, Y., AND TURGUT, S. 2005. Longhorned beetles collection of the Nazife Tuatay Plant Protection Museum, Ankara, Turkey (Coleoptera: Cerambycidae). J. Entomol. Res. Soc. 7 (2): 1-33.

ÖZDIKMEN, H., AND TURGUT, S. 2009. A review on the genera *Pseudovadonia* Lobanov et al., 1981 and *Vadonia* Mulsant, 1863 (Coleoptera: Cerambycidae: Lepturinae). Munis Entomol. Zool. 4(1): 29-52.

ÖZDIKMEN, H., TURGUT, S., AND GÜZEL, S. 2009. Longhorned beetles of Ankara region in Turkey (Coleoptera: Cerambycidae). Munis Entomol. Zool. 4(1): 59-102.

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

ROZEK, M., LACHOWSKA, D., PETITPIERRE, E., AND HOLECOVA, M. 2004. C-bands on chromosomes of 32 beetle species (Coleoptera: Elateridae, Cantharidae, Oedemeridae, Cerambycidae, Anthicidae, Chrysomelidae, Attelabidae and Curculionidae). Hereditas 140: 161-170.

SAMA, G. 2002. Atlas of the Cerambycidae of Europe and the Mediterranean Area, vol. I, Kabourek, Zlin, 173 pp.

SMITH, S. G., AND VIRKKI, N. 1978. Animal Cytogenetics. vol.3: Insecta, part 5: Coleoptera. Gebrüder Borntraeger, Berlin–Stuttgart.

TEPPNER, H. 1966. Chromosomenzahlen einiger mitteleuropaischer Cerambycidae (Coleoptera) (Chromosome Numbers of some Central European Cerambycidae). Chromosoma (Berl.) 19: 113-125.

TEPPNER, H. 1968. Chromosomenzahlen einiger mitteleuropaischer Cerambycidae (Coleoptera) II (Chromosome Numbers of some Central European Cerambycidae II). Chromosoma (Berl.) 25: 141-151.

TOZLU, G., REJZEK, M., AND ÖZBEK, H. 2002. A contribution to the knowledge of Cerambycidae (Coleoptera) fauna of Turkey. Part I: Subfamilies Prioninae to Cerambycinae. Biocosme Mèsogèen, Nice 19(1-2): 55-94.

TUATAY, N., KALKANDELEN, A., AND AYSEV, N. 1972. Bitki Koruma Müzesi Böcek Katalogu (1961-1971). T. C. Tarım Bakanlıgı, Ankara, 53-55.

TURGUT, S., AND ÖZDIKMEN, H. 2010. New data for Turkish longhorned beetle fauna from Southern Turkey (Coleoptera: Cerambycidae). Munis Entomol. Zool. 5, suppl.: 859-889.

DE VAIO, E. S., DA SILVA, A., CRIVEL, M., POSTIGLIONI, A., PONCE DE LEON, R., AND LEIRA, M. S. 1985. Comparative description of male meiosis in two species of Cerambycines (Coleoptera: Cerambycidae). Rev. Brasil. Genet. 8(2): 263-269.

VIDAL, O. R. 1984. Chromosome numbers of Coleoptera from Argentina. Vidal Genet. 65: 235-239.

VILLIERS, A. 1967. Coléoptéres Cérambycides de Turquie (1. partie), L'entomol. 23: 18-22.