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Bark and Ambrosia Beetles Collected from Turkey Oak (*Quercus cerris* L.) Forests in Isparta Province of Turkey

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Abstract: In this study, bark and ambrosia beetle species collected by red winged sticky traps in *Quercus cerris* L. forests of Aksu District in Isparta Province, South-Western Turkey during the years 2011 and 2012 were evaluated. A total of 8 species belonging to 3 tribe of the Scolytinae were recorded. All collected species were found the first time in Isparta Province. Among those species, *Taphrorychus ramicola* (Reitter, 1894), *T. villifrons* (Dufour, 1843), *Scolytus intricatus* (Ratzeburg, 1837), *Anisandrus dispar* (Fabricius, 1792), *Xyleborus dryographus* (Ratzeburg, 1837) and *X. monographus* (Fabricius, 1792) were recorded as new species for the Scolytinae fauna of the Western Mediterranean region of Turkey. *X. dryographus* was also found the first time in the whole of Mediterranean Region and Southern part of country. *T. ramicola* and *Scolytus rugulosus* (Muller, 1818) were determined the first time on *Quercus cerris* in the world by this study. In addition to these two species, *S. intricatus*, *X. dryographus* and *X. monographus* were recorded on *Q. cerris* in Turkish forests for the first time. Among the collected specimens, *X. saxesenii* (Ratzeburg, 1837) (64.3%), *A. dispar* (Fabricius, 1792) (28.25%) and *T. villifrons* (5.13%) were found as abundant species.

Key words: Bark and ambrosia beetles, Scolytinae, *Quercus cerris*, red winged sticky traps, Turkey

INTRODUCTION

Bark and ambrosia beetles of the subfamily Scolytinae (Col.: Curculionidae) are spread in range areas by their ecological adaptations to different habitats. These beetles consist of about 10% of total weevil diversity with >6000 species all around the world (Jordal and Cognato, 2012). Species diversity of the Scolytinae occurs, especially in recently dead wood and other lignified plant material of weaken trees in forest stands (Browne, 1958).

The damage of bark and ambrosia beetles could have economically importance by their creating galleries in timber and transporting pathogenic fungi to other living trees during feeding periods (Knizek and Beaver, 2007). Bark and ambrosia beetles are distinguished by their feeding on host tree. Bark beetles feed under bark on the surface of the wood on phloem tissue while ambrosia beetles enter into the wood and cultivate and feed on fungus in the galleries. Also, many ambrosia beetles have symbiotic relationship with fungus (Jordal and Cognato, 2012). Totally 130 bark and ambrosia beetle species from the Scolytinae were determined by earlier studies in Turkey till today (Lobl and Smetana, 2011). Several of them are important on Quercus trees in Turkish forests by their damages. Quercus species are distributed on approximately 6.5 million ha area in Turkey (Ozcan and Baycu, 2005). Among 18 oak species in Turkish forests, one of the common oak species is Turkey oak (*Quercus cerris* L.) which grows naturally from central and South-Eastern Europe to Anatolia.

There are some records of bark and ambrosia beetles belonging to the Scolytinae associated with *Q. cerris* stands in Turkey while there is no detailed research about *Q. cerris* forests in the Mediterranean Region of country. The aim of present study is to determine bark and ambrosia beetles of *Q. cerris* forests in Isparta Province of Turkey by ethanol baited red winged sticky traps.

MATERIALS AND METHODS

The bark and ambrosia beetles were collected from pure *Quercus cerris* L. stands of Aksu district (37°80'N, 31°07'E) in Isparta Province (Fig. 1) by using ethanol baited red winged sticky traps in 2011 and 2012. Studies were conducted in two sites which are located in Akpinar and Yakaafsar States. These sites have similar characteristics by 50-60 years old trees.

The red winged sticky traps which were used in this study, consist of two red-colored and crosswise mounted sticky plates with a 1 L white colored plastic bottle hanging just below and each wings of oblong sticky plates with adhesive glue has 15×21 cm size. Ten traps used for each site from mid March to mid October. They were placed 2 m above the ground and positioned 50 m from each other. Mix attractant which contains 96%

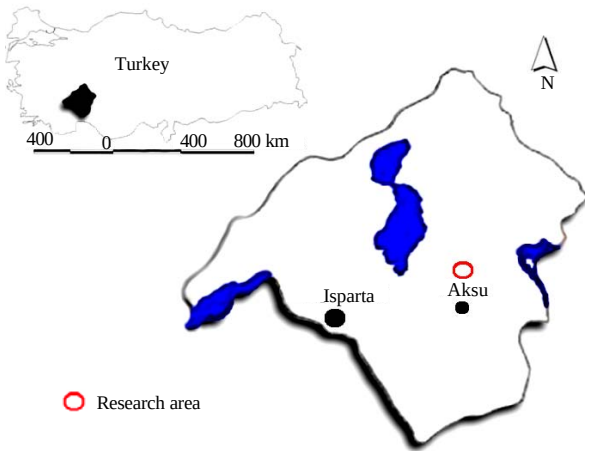

Fig. 1: Location of sampling sites

alcohols and 1% toluen were used in traps. Checking was made bi-weekly and traps were replaced with new ones at 1 month intervals. Captured beetles taken to the laboratory for mounting and sent to specialist for identification. All samples were deposited in the collection of Entomological Museum of Suleyman Demirel University, Faculty of Forestry, Isparta, Turkey.

RESULTS AND DISCUSSION

A total of 1207 specimens were collected from 8 species belonging to 3 tribe of the Scolytitae supertribe. The species were considered according to the classification and nomenclature in Lobl and Smetana (2011) for this study as follows:

Supertribe Scolytitae (Latreille, 1804), Tribe Dryocoetini (Lindemann, 1876), *Taphrorychus ramicola* (Reitter, 1894)
Material examined: 3 exs., 06.VI.2011; 2 exs., 24.V.2012. Totally 5 specimens.

Host plants: *Carpinus orientalis*, *Corylus avellana*, *Fagus sylvatica* ssp. *sylvatica*.

Distribution: Bulgaria, Canada, Caucasus, Russia, Syria and Turkey (Bright and Skidmore, 2002; Lobl and Smetana, 2011).

Distribution and hosts in Turkey: Bartin, Hatay, Sakarya, Trabzon on *Corylus avellana*, *Fagus sylvatica* ssp., *orientalis* (Selmi, 2011). First record for the Western Mediterranean Region of Turkey. First record on *Quercus cerris* for the whole distribution areas.

Taphrorychus villifrons (Dufour, 1843)
Material examined: 4 exs., 08.V.2011; 8 exs., 20.V.2011; 17 exs., 06.VI.2011; 1 ex., 05.VIII.2011; 9 exs., 01.V.2012; 18 exs., 13.VI.2012, 4 exs., 30.VI.2012, 1 ex., 19.VII.2012. Totally 62 specimens.

Host plants: *Betula alba*, *Carpinus betulus*, *C. orientalis*, *Castanea sativa*, *Fagus sylvatica* ssp. *orientalis*, *Quercus canariensis*, *Q. castaneifolia*, *Q. castaneifolia* var. *incana*, *Q. cerris*, *Q. frainetto*, *Q. ilex*, *Q. lusitanica*, *Q. patraea*, *Q. robur*, *Q. suber*, *Salix cinerea* (Haack and Cavey, 1997; Borumand, 1998; Coope, 1998; Hastings, 1998; Voolma and Mandelshtam, 1998; Bright and Skidmore, 2002).

Distribution: Algeria, Armenia, Austria, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Egypt, France, Germany, Great Britain, Hungary, Iran, Italia, Libya, Macedonia, Morocco, Portugal, Serbia, Slovakia, Spain, Switzerland, Tunisia, Turkey and Ukraine (Lobl and Smetana, 2011).

Distribution and hosts in Turkey: Amasya, Ankara, Bolu, Bursa, Hatay, Istanbul, Karabuk, Sakarya, Sinop, Tokat on *Carpinus betulus*, *Fagus sylvatica* ssp. *orientalis*, *Quercus cerris*, Q. *frainetto* (Selmi, 2011). First record for the Western Mediterranean region of Turkey.

Tribe Scolytini (Latreille, 1804), *Scolytus intricatus* (Ratzeburg, 1837)
Material examined: 1 ex., 22.VIII.2012; 2 exs., 07.IX.2012; 4 exs., 29.IX.2012. Totally 7 specimens.

Host plants: *Aesculum hippocastaneum*, *Betula alba*, *B. costata*, *B. verrucosa*, *Castanea sativa*, *Fagus sylvatica* ssp. *orientalis*, *Fagus sylvatica* ssp. *sylvatica*, *Ostrya carpinifolia*, *Parrotia persica*, *Populus* sp., *Quercus canariensis*, *Q. castaneifolia*, *Q. castaneifolia* var. *incana*, *Q. cerris*, *Q. coccifera*, *Q. frainetto*, *Q. ilex*, *Q. lusitanica*, *Q. petraea*, *Q. pubescens*, *Q. robur*, *Ulmus minor*, *U. leavis* and *Zelkova carpinifolia* (Bright and Skidmore, 2002).

Distribution: Algeria, Austria, Azerbaijan, Belarus, Belgium, Bosnia abd Herzegovina, Bulgaria, Canada, Caucasus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, Iran, Italia, Kazakhstan, Latvia, Lithuania, Luxembourg, Macedonia, Morocco, The Netherlands, North Korea, Norway, Poland, Romania, Russia, Serbia, Slovakia, Spain, Sweden, Switzerland, Tunisia and Turkey (Markovic and Stojanovic, 1996; Tiberi and Ragazzi, 1998; Zubrik *et al*., 1999; Lobl and Smetana, 2011).

Distribution and hosts in Turkey: Duzce, Hatay, Istanbul, Sinop on *Fagus sylvatica* ssp. *orientalis*, *Ostrya carpinifolia*, *Quercus frainetto*, *Q. petraea*, *Q. robur* (Selmi, 2011). First record for the Western Mediterranean region of Turkey. First record on *Quercus cerris* in Turkey.

***Scolytus rugulosus* (Muller, 1818)**

Material examined: 2 exs., 05.VIII.2011; 6 exs., 29.IX.2012. Totally 8 specimens.

Host plants: *Amelanchier ovalis*, *Amygdalus communis*, *Armeniaca vulgaris*, *Cerasus avium*, *C. vulgaris*, *Cotoneaster multiflora*, *Crataegus* sp., *Eriobotrya japonica*, *Laurocerasus officinalis*, *Malus pumila*, *M. sylvestris*, *Mespilus germanica*, *Padellus mahaleb*, *Padus avium*, *Persica vulgaris*, *Rhamnus* sp., *Rosa* sp., *Sorbus aria*, *S. aucuparia*, *S. torminalis*, *Prunus bucharica*, *P. domestica*, *P. insititia*, *P. spinosa*, *Pyrus communis* and *Taxus baccata* (Alekseev, 1995; Lombardero, 1995; Mendel *et al*., 1997; Smith, 1998; Ozgen *et al*., 2012).

Distribution: Albania, Algeria, Austria, Azerbaijan, Azores, Belgium, Bosnia and Herzegovina, Belarus, Bulgaria, Canada, Caucasus, China, Croatia, Cyprus, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, Iran, Iraq, Ireland, Israel Italy, Kazakhstan, Latvia, Lebanon, Lithuania, Luxembourg, Macedonia, Malta, Mongolia, Montenegro, Morocco, The Netherlands, Norway, Pakistan, Poland, Portugal, Romania, Russia, Saudi Arabia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Syria, Turkey, Tunisia, Ukraine and USA (Bright and Skidmore, 2002; Lobl and Smetana, 2011).

Distribution and hosts in Turkey: Adana, Amasya, Ankara, Antalya, Balikesir, Bursa, Denizli, Istanbul, Izmir, Kahramanmaras, Malatya, Manisa, Mersin, Mugla, Nigde, Osmaniye, Trabzon on *Acer platanoides*, *A. undulatum*, *Crataegus* sp., *Cydonia oblonga*, *C. vulgaris*, *Malus domestica*, *Prunus armeniaca*, *P. amygdali*, *P. avium*, *P. cerasus*, *P. domestica*, *P. dulcis*, *P. persica*, *P. spinosa*, *Pyrus communis*, *P. malus*, *Sorbus aucuparia* and *Tilia tomentosa* (Selmi, 2011; Ozgen *et al*., 2012). First record on *Quercus cerris* for the whole distribution areas.

Tribe Xyleborini (LeConte, 1876), *Anisandrus dispar* (Fabricius, 1792)

Material examined: 2 exs., 10.IV.20011; 5 exs., 24.IV.2011; 14 exs., 08.V.2011; 48 exs., 20.V.2011; 25 exs., 06.VI.2011; 19 exs., 20.VI.2011; 11 exs., 04.VII.2011; 7 exs., 21.VII.2011; 5 exs., 05.VIII.2011; 3 exs., 22.VIII.2011; 1 ex., 07.IX.2011; 5 exs., 06.IV.2012; 6 exs., 18.IV.2012; 19 exs., 01.V.2012; 64 exs., 10.V.2012; 42 exs, 24.V.2012; 36 exs., 13.VI.2012; 21 exs., 30.VI.2012; 4 exs., 19.VII.2012; 3 exs., 07.VIII.2012; 1 exs., 22.VIII.2012. Totally 341 specimens.

Host plants: *Acer* sp., *Actinidia chinensis*, *Aesculus* sp., *Alnus* sp., *Betula* sp., *Carpinus betulus*, *Castanea sativa*, *Corylus avellana*, *Crataegus* sp., *Cydonia* sp., *Fagus sylvatica* ssp. *sylvatica*, *Fraxinus* sp., *Juglans regia*, *Malus domestica*, *Pinus radiata*, *Platanus* sp., *Populus nigra*, *Prunus cerasus*, *P. domestica*, *Punica* sp., *Pyrus* sp., *Quercus* sp., *Quercus cerris*, *Q. frainetto*, *Q. petraea*, *Robinia* sp., *Sorbus aucuparia*, *Tilia tomentosa*, *Ulmus* sp. and *Vitis vinivera* (Doane *et al*., 1936; Linsley and MacLeod, 1942; Bright, 1968; Markalas and Kalapanida, 1997; Hrasovec, 1998; Morone and Scortichini, 1998; Wermelinger *et al*., 1999; Romon *et al*., 2007).

Distribution: Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, Caucasus, Croatia, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, India, Iran, Italy, Japan, Latvia, Lithuania, Macedonia, Moldavia, Mongolia, North Korea, The Netherlands, Norway, Poland, Portugal, Russia, Siberia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, USA (Markalas and Kalapanida, 1997; Balestra *et al*., 2003; Rabaglia *et al*., 2006; Lobl and Smetana, 2011).

Distribution and hosts in Turkey: Adana, Ankara, Artvin, Bartin, Bolu, Bursa, Corum, Denizli, Giresun, Gumushane, Hatay, Istanbul, Karabuk, Kastamonu, Mugla, Nigde, Ordu, Rize, Sakarya, Samsun, Trabzon, Zonguldak on *Actinidia chinensis*, *Carpinus betulus*, *Castanea sativa*, *Corylus avellana*, *Malus domestica*, *Populus nigra*, *Prunus cerasus*, *Quercus* sp., *Tilia* sp. and *Ulmus* sp. (Schimitschek, 1944; Cebeci and Ayberk, 2010; Saruhan and Akyol, 2012). First record for the Western Mediterranean Region of Turkey.

***Xyleborinus saxesenii* (Ratzeburg, 1837)**

Material examined: 2 exs., 24.IV.2011; 14 exs.; 08.V.2011; 9 exs., 20.V.2011; 21 exs., 06.VI.2011; 25 exs., 20.VI.2011; 18 exs., 04.VII.2011; 39 exs., 21.VII.2011; 30 exs., 05.VIII.2011; 76 exs., 22.VIII.2011; 36 exs., 07.IX.2011; 17 exs., 21.IX.2011; 3 exs., 05.X.2011; 9 exs., 06.IV.2012; 19 exs., 18.IV.2012; 25 exs., 01.V.2012; 33 exs., 10.V.2012; 27 exs., 24.V.2012; 46 exs., 13.VI.2012; 31 exs., 30.VI.2012; 55 exs., 19.VII.2012; 43 exs., 07.VIII.2012; 102 exs., 22.VIII.2012; 61 exs., 07.IX.2012; 29 exs., 29.IX.2012, 6 exs., 14.X.2012. Totally 776 specimens.

Host plants: *Abies*, *Acacia*, *Araucaria*, *Betula* and *Camellia* sp., *Carpinus betulus*, *Castanea mollissima*, *Chamaecyparis*, *Cupressus*, *Eucalyptus*, *Fagus sylvatica* and *Fraxinus* sp., *Juglans regia*, *Larix*, *Malus*, *Pinus*, *Populus*, *Prunus* and *Pyrus* sp., *Quercus cerris*, *Q. petraea*, *Q. robur*, *Tilia cordata*, *Tsuga* sp., *Ulmus* sp. and *Weinmannia racemosa* (Grune, 1979; Wood and Bright, 1992).

Distribution: Albania, Algeria, Austria, Australia, Azerbaijan, Azores, Belarus, Belgium, Bulgaria, Brazil, Canada, Canary Islands, Caucasus, China, Croatia, Denmark, Egypt, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, India, Iran, Italy, Japan, Latvia, Libya, Lithuania, Luxembourg, Macedonia, Malta, Moldavia, Mongolia, Morocco, New Zealand, The Netherlands, North Korea, Norway, Poland, Portugal, Romania, Russia, Siberia, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Tunisia, Turkey, Ukraine, USA (Hosking, 1973; Mifsud and Knizek, 2009; Lobl and Smetana, 2011).

Distribution and hosts in Turkey: Amasya, Antalya, Artvin, Bolu, Duzce, Giresun, Hatay, Istanbul, Kocaeli, Konya, Mersin, Mugla, Ordu, Rize, Sakarya, Samsun, Sinop, Trabzon, Zonguldak on *Abies cilicica*, *A. nordmanniana* ssp. *bornmuelleriana*, *Actinidia chinensis*, *Alnus* sp., *Cedrus libani*, *Corylus avellana*, *Fagus sylvatica* ssp. *orientalis*, *Ficus carica*, *Fraxinus ornus*, *Juglans regia*, *Juniperus excelsa*, *Liquidambar orientalis*, *Pinus nigra*, *Prunus armeniaca*, *P. avium*, *Pyrus communis* and *Quercus cerris* (Chararas, 1965; Cebeci and Ayberk, 2010; Saruhan and Akyol, 2012).

***Xyleborus dryographus* (Ratzeburg, 1837)**

Material examined: 2 exs., 19.VII.2012; 1 ex.; 29.IX.2012. Totally 3 specimens.

Host plants: *Acer* sp., *Carpinus* sp., *Castanea sativa*, *Prunus laurocerasus*, *Quercus castaneifolia* var. *incana*, *Q. cerris*, *Q. ilex*, *Q. petraea*, *Q. pubescens*, *Q. robur*, *Q. suber*, *Tilia* sp. and *Ulmus* sp.

Distribution: Austria, Azerbaijan, Belgium, Bosnia and Herzegovina, Bulgaria, Caucasus, Crimea, Croatia, Czech Republic, France, Great Britain, Germany, Greece, Hungary, Iran, Iraq, Italy, Japan Libya, Luxembourg, Macedonia, Morocco, Tunisia, Poland, Portugal, Russia, Slovakia, Slovenia, Spain, Turkey and Ukraine (Pfeffer, 1995; Lobl and Smetana, 2011).

Distribution and hosts in Turkey: Bursa, Istanbul, Trabzon on *Castanea sativa*, *Quercus frainetto*. First record for the whole of Mediterranean Region of Turkey. First record on *Quercus cerris* in Turkey.

***Xyleborus monographus* (Fabricius, 1792)**

Material examined: 2 exs., 06.VI.2011; 3 exs., 13.VI.2012. Totally 5 specimens.

Host plants: *Acer* sp., *Carpinus betulus*, *Castanea sativa*, *Fagus sylvatica* ssp. *sylvatica*, *Fagus sylvatica* ssp. *orientalis*, *Juglans regia*, *Prunus avium*, *Quercus canariensis*, *Q. castaneifolia* var. *incana*, *Q. cerris*, *Q. coccifera*, *Q. ilex*, *Q. lusitanica*, *Q. petraea*, *Q. pubescens*, *Q. robur*, *Q. suber*, *Ulmus laevis* (Selmi, 2011).

Distribution: Albania, Algeria, Austria, Azerbaijan, Belgium, Belarus, Bulgaria, Caucasus, Crimea, Croatia, Czech Republic, Denmark, Estonia, France, Germany, Great Britain, Greece, Hungary, Iraq, Italy, Latvia, Luxembourg, Macedonia, The Netherlands, Norway, Morocco, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey and Ukraine (Lobl and Smetana, 2011).

Distribution and hosts in Turkey: Bartin, Bursa, Hatay, Istanbul, Kocaeli on *Castenea sativa*, *Fagus sylvatica* ssp. *orientalis*, *Quercus frainetto* (Selmi, 2011). First record for the Western Mediterranean Region of Turkey. First record on *Quercus cerris* in Turkey.

In this study, a total of 8 species belonging to 3 tribe from Scolytitae supertribe of the Scolytinae were recorded in *Quercus cerris* forests of Aksu District in Isparta Province of Turkey. All collected species were recorded for the first time in Isparta Province and five species (*Taphrorychus ramicola*, *T. villifrons*, *Scolytus intricatus*, *Anisandrus dispar*, *Xyleborus dryographus* and *X. monographus*) were recorded for the first time from the Western Mediterranean Region of Turkey. Among these species, *X. dryographus* was also found the first time in the whole of Mediterranean Region and Southern part of country. *Quercus cerris* is reported for the first time in the world as a host plant of *Taphrorychus ramicola* and *Scolytus rugulosus* by this study. Besides them, *S. intricatus*, *Xyleborus dryographus* and *X. monographus* were determined for the first time on *Q. cerris* in Turkish forests. *Taphrorychus ramicola*, *T. villifrons*, *Scolytus rugulosus*, *Anisandrus dispar*, *Xyleborus saxesenii* and *X. monographus* were captured in both 2011 and 2012 while *Scolytus intricatus* and *X. dryographus* were found only in 2012. Among the collected total of 1207 specimens, *Xyleborus saxesenii*

(64.3%) was the more abundant species than the others. *A. dispar* and *T. villifrons* were followed this species with 28.25 and 5.13%, respectively.

CONCLUSION

The results of this study indicated that Bark and ambrosia beetles are important group in not only on Quercus species but also other decidous trees in forests of the Western Mediterranean Region with new records for this part of Turkey. However, there are no detailed studies about the *Scolytinae* species and their damage on decidous trees in Isparta Province and in the whole of Western Mediterranean Region. So, this gap should be fullfilled by more detailed studies.

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