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A Survey of *Aleiodes* WESMAEL, 1838 (Hymenoptera: Braconidae: Rogadinae) of Turkish Western Blacksea Region

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Abstract

Western Blacksea Region which is located in north-west part of Turkey. Geographic structure of the region is composed of mountains rising parallel to the sea and forest areas. This region of Turkey consists of forests, agricultural fields and meadows. The study was carried out between 2000-2003 of *Aleiodes* WESMAEL, 1838 (Hymenoptera: Braconidae: Rogadinae) in Turkish Western Blacksea Region to determine the species belonging to the genus in 21 localities. The rogradin genus *Aleiodes* is worldwide in distribution, but is particularly species rich in the Holarctic region. *Aleiodes* species are koinobiont endoparasitoid of Macrolepidopteran larvae (especially Noctuidae and Geometridae). For this reason the members of this group are potentially very important biological control agents for pest insects. Nine species are reported for the first time in the study area. This research is the first faunistic study on *Aleiodes* fauna of Western Blacksea Region of Turkey. *A. (A.) bicolor* (SPINOLA) is found in 6 of the 9 habitats, and appears to perform the highest ecological valance. In this study that have given general distribution, and hosts of these species.

Key words: *Aleiodes*, Hymenoptera, Rogadinae, Fauna, Turkey.

Introduction

The Rogadinae (Hymenoptera: Braconidae) differ from other cyclostome braconids by the presence of a deep groove between the first and second metasomal tergites, and the posteroventral margin of the first tergite and anteroventral margin of the second tergite being distinct (TOBIAS 1986). Parasitoid *Aleiodes* WESMAEL, 1838 wasps lay their eggs generally in Macrolepidopteran larvae (Noctuoidea and Geometroidea, rarely Arctioidea, Sphingoidea and Papilionoidea). Therefore, these wasps are called koinobiont-endoparasitoids in terms of their life cycles (AYDOĞDU & BEYARSLAN 2005, 2006).

The larvae of *Aleiodes* species complete their feeding and pupate within the shrunken and mummified remains of the host caterpillar. In all known cases, the form of the mummy caused by a particular *Aleiodes* species is characteristic for that host and parasitoid; thus, the mummified caterpillar remains are of considerable diagnostic value

and should be retained with the parasitoid when reared. Host caterpillar mummies are usually found attached to the host plant substrate on leaves, stems, or bark. Most caterpillar mummies are firmly attached to the substrate by a glue-like substance that is exuded through a prosternal hole chewed by the parasitoid larva. The inside of the mummy is lightly lined with silk by the parasitoid larva, but the main support for the mummy seems to come from a premature cuticle of host pupa below the remaining larval cuticle. For this reason, members of this genus are potentially very important biological control agents against pest insects (QUICKE & SHAW 2005, SHIMBORI & SHAW 2014, AYDOĞDU 2015, BEYARSLAN 2015).

Nine Rogadinae species were identified within 1 genus and 2 subgenera in this study, and all rogradin species were recorded for the first time for the fauna of Turkish Western Blacksea Region. These species are as follows: *A. (Aleiodes) bicolor* (SPINOLA, 1808), *A. (A.) circumscriptus* (NEES, 1834), *A. (A.) gastritor* (THUNBERG, 1822), *A. (A.) nocturnus* (TELENGA, 1941), *A. (A.) pallidator* (THUNBERG, 1822), *A. (A.) rossicus* (KOKOUJEV), *A. (A.) signatus* (NEES, 1811), *Aleiodes (Neorhogas) dissector* (NEES, 1834), and *A. (N.) ductor* (THUNBERG, 1822).

Materials and methods

Following a sampling of the hymenopteran parasitoid fauna in Western Blacksea Region, and identification of the collected specimens, the taxonomical aspects of the genus *Aleiodes* (Hymenoptera: Braconidae: Rogadinae) have been studied. Western Blacksea Region which is located in north-west part of Turkey. Geographic structure of the region is composed of mountains rising parallel to the sea and forest areas. This region of Turkey consists of forests, agricultural fields and meadows. Adult wasps were collected by sweeping nets from different altitudes and habitats of study area. The studied materials were examined in the laboratory under a binocular stereomicroscope and identified. Relevant literature was used for taxonomical examination of the material TOBIAS (1986) and SHAW et al. (2006). Information on parasitoids, hosts, general distributions (in terms of zoogeographical region), and hosts of the species are given according to YU et al. (2012).

Subfamily *Rogadinae* FORSTER, 1862

Genus *Aleiodes* WESMAEL, 1838

Subgenus *Aleiodes* s.str. WESMAEL, 1838

Aleiodes (Aleiodes) bicolor (SPINOLA, 1808)

Material examined: Bartın, hazelnut garden, 10 m, 09.VI.2002, ♀; -Çamlık, pasture, 60 m, 30.VI.2001, ♀, ♂; Bolu-Çaydurt, pasture, 720 m, 28.VI.2001, ♀; -Gerede-Güney, pasture, 1200m, 13.VI.2002, ♂; -Mengen-Kıyaslar, pine forests, 610 m, 28.VI.2001, ♀; -Siyamoğlu, mixed forests, 600 m, 28.VI.2001, 2♀♀; Düzce-Kabalar, hazelnut garden, 250 m, 03.IX.2001, ♂; Kastamonu-Araç-Akgeçit, pine forests, 400 m, 28.VIII.2002, ♀; -Cide-Kuscukoy, pasture, 220m, 10.06.2002, ♂; -Daday Ballıdağ, mixed forests, 1750 m, 01.VII.2001, ♀; -İnceğiz, pasture, 750 m, 01.VII.2001, 3♂♂; -Hanönü, pasture, 450 m, 02.VII.2001, ♀, ♂; 06.VIII.2001, ♀; -Taşkoprü-Alamaşlı, pasture, 620 m, 02.VII.2001, ♀; -Tosya-Ekinci, orchard, 1000 m, 31.VIII.2002, 2♀♀;

Sinop-Boyabat-Salar, pasture, 450 m, 03.VII.2001, 6♀♀, 2♂♂; -Yabanlı, pasture, 900 m, 07.IX.2001, ♂; -Boyalı, orchard, 1400 m, 11.VI.2002, 2♀♀; -Demirci, orchard, 30 m, 03.VII.2001, 8♀♀; 11.VI.2002, ♂; -Kabalı, pasture, 70 m, 11.VI.2002, ♂; -Yeniçam, pasture, 30 m, 06.IX.2001, 2♀♀, 2♂♂; vegetable garden, 02.VII.2001, 2♀♀; Karabük-Çay, orchard, 470 m, 13.VI.2002, 2♂♂, -Safranbolu-İnceçay-Sarıçiçek dağı, mixed forests, 1000 m, 30.VI.2001, ♀; Zonguldak-Çaycuma Kayıklar, orchard, 20 m, 30.VI.2001, 2♂♂; -Çukurören, pasture, 70 m, 29.VI.2001, ♀; -Devrek-Orman işletme, pine forests, 800 m, 28.VI.2001, 2♀♀; - Davulga, mixed forests, 800 m, 29.VI.2001, 2♂♂; -İlksu, pasture, 25 m, 08.VI.2002, ♀.

General distribution: Palaearctic.

Hosts: Lepidoptera, Crambidae: *Loxostege sticticalis* (LINNAEUS, 1761); *Pyrausta purpuralis* (LINNAEUS, 1758); *P. sanguinalis* (LINNAEUS, 1767). Geometridae: *Apocheima cinerarius* (ERSCHOFF, 1874); *Archicaris parthenias* (LINNAEUS, 1761); *Eupithecia liniariata* (DENIS & SCHIFFERMÜLLER, 1775); Operophtera (HÜBNER, 1825). Lycaenidae: *Aricia agestis* (DENIS & SCHIFFERMÜLLER, 1775); *A. artaxerxes* (FABRICUS, 1793); *Cupido alceas* (HÖFFMANNSEGG, 1804); *C. minimus* (FUESSLY 1775); *Lysandra coridon* (Poda, 1761); *Plebejus idas* (LINNAEUS, 1761); *Polyommatus albicans* (GERHARD, 1851); *P. damon* (DENIS & SCHIFFERMÜLLER, 1775); *P. eros* (OCHSENHEIMER, 1808); *P. icarus* (ROTTEMBERG, 1775). Lymantriidae: *Dasychira albodentata* BREMER, 1864; *Leucoma salicis* (LINNAEUS, 1758). Noctuidae: *Apamea sordens* (HUFNAGEL, 1766). Nymphalidae: *Maniola jurtina* (LINNAEUS, 1758); *Aglais urticae* (LINNAEUS, 1758). Pterophoridae: *Emmelina monodactyla* (LINNAEUS, 1758); *Hellinsia tephradactyla* (HÜBNER, 1813). Zygaenidae: *Jordanita chloros* (HÜBNER, 1813); *J. graeca* (JORDAN, 1907); *Rhagades pruni* (DENIS & SCHIFFERMÜLLER, 1775); *Zygaena filipendulae* (LINNAEUS, 1758); *Z. lonicerae* (SCHEVEN, 1777); *Z. purpuralis* (BRUNNICH, 1763); *Z. viciae* (DENIS & SCHIFFERMÜLLER, 1775).

***Aleiodes (Aleiodes) circumscriptus* (NEES, 1834)**

Material examined: Kastamonu-Arac-Toprakcuma, crop field, 350m, 13.06.2002, ♀; - Daday Ballıdağ, mixed forest, 1600 m, 09.VII.2003, 2♀♀; -İlgaz mountains-Catören, mixed forests, 1280m, 03.07.2001, ♀.

General distribution: Palaearctic.

Hosts: Lepidoptera, Arctiidae: *Atolmis rubricollis* (LINNAEUS, 1758); Lymantriidae: *Leucoma salicis* (LINNAEUS, 1758). Gelechiidae: *Caryocolum amaurella* (HERING, 1924). Geometridae: *Thera variata* (DENIS & SCHIFFERMÜLLER, 1775); *Abraxas grossulariata* LINNAEUS, 1758; *Bupalus piniarius* LINNAEUS, 1758; *Cyclophora ruficiliaria* (HERRICH-SCHAFFER, 1855); *Epirrhoe galiatav* (DENIS & SCHIFFERMÜLLER 1775); *Epirrita autumnata* (BORKHAUSEN, 1794); *Eupithecia alliaris* (STAUDINGER, 1870); *E. liniariata* (DENIS & SCHIFFERMÜLLER, 1775); *E.subfuscata* (HAWORTH, 1809); *Gymnoscelis ruffasciata* (HAWORTH, 1809); *Hylaea fasciaria* (LINNAEUS, 1758); *Lycia isabellae* (HARRISON, 1914). Noctuidae: *Apamea crenata* (HUFNAGEL, 1766); *Autographa gamma* (LINNAEUS, 1758); *Diarsia rubi* (VIEWEG, 1790); *Helicoverpa armigera* (HÜBNER, 1808); *Hoplodrina octogenaria* (GOEZE, 1781); *Lithomoia solidaginis* (HÜBNER 1803); *Mamestra brassicae* (LINNAEUS, 1758); *Noctua fimbriata* (SCHREBER, 1759); *N. pronuba* (LINNAEUS, 1758); *Orthosia gracilis* (DENIS & SCHIFFERMÜLLER 1775); *Orthosia incerta* (HUFNAGEL, 1766); *O. stabilis* (DENIS & SCHIFFERMÜLLER, 1775); *Penicillaria jocosatrix* GUENEE, 1852; *Pseudaletia unipuncta* (HAWORTH, 1809); *Spodoptera exigua* (HÜBNER, 1808); *Xestia agathina* (DUPONCHEL, 1827); *X. baja* (DENIS & SCHIFFERMÜLLER, 1775); *X. xanthographa* (DENIS & SCHIFFERMÜLLER, 1775). Pterophoridae: *Pterophorus pentadactyla* (LINNAEUS 1758). Pyralidae: *Dioryctria abietella* (DENIS & SCHIFFERMÜLLER, 1775); *Ebulea crocealis* (DENIS & SCHIFFERMÜLLER, 1775). Tortricidae: *Archips rosana* (LINNAEUS, 1758); *Croesia bergmanniana* LINNAEUS, 1758; *C. holmiana* LINNAEUS, 1758; *Cydia conicolana* (HEYLAERTS, 1874); *C. strobilella* (LINNAEUS, 1758); *Pammene amygdalana* (DUPONCHEL, 1842); *P. gallicolana* (LIENIG & ZELLER, 1846); *Tortrix viridana* (LINNAEUS, 1758); *Zeiraphera griseana* (HÜBNER, 1799).

***Aleiodes (Aleiodes) gastritor* (THUNBERG, 1822)**

Material examined: Kastamonu-Sarpun, fir forests, 1350 m, 01.VII.2001, 2♀♀; Zonguldak-Çaycuma Kayıkçılar, orchard, 20 m, 30.VI.2001, 2♀♀, ♂.

General distribution: Holarctic, Oceanic, Oriental.

Hosts: Lepidoptera, Crambidae: *Ostrinia nubilalis* (HÜBNER, 1796); *Phlyctaenia coronata* (HUFNAGEL, 1767). Drepanidae: *Cilix glaucata* (SCOPOLI, 1763). Elachistidae: eometridae: *Alsophila pometaria* (HARRIS, 1841); *Apocheima cinerarius* (ERSCHOFF, 1874); *A. hispidaria* (DENIS & SCHIFFERMÜLLER, 1775); *Chiasmia clathrata* (LINNAEUS, 1758); *Chloroclystis v-ata* (HAWORTH, 1809); *Digrammia gnophosaria* (GUENEE, 1857); *Epirrita autumnata* (BORKHAUSEN, 1794); *Erannis defoliaria* (CLERCK, 1759); *Eupithecia alliarda* (STAUDINGER, 1870); *E. miserulata* (GROTE, 1863); *E. pusillata* (DENIS & SCHIFFERMÜLLER, 1775); *Glenacribrataria* (GUENEE, 1858); *Hylaea fasciaria* (LINNAEUS, 1758); *Hypagyrtis unipunctata* (HAWORTH, 1809); *Isturgia limbaria* (Fabricius, 1775); *Lycia hirtaria* (CLERCK, 1760); *Lycia pomonaria* (HÜBNER, 1790); *Operophtera brumata* (LINNAEUS, 1758); *Phthonandria atrilineata* (BUTLER 1881); *Tephрина arenacearia* (DENIS & SCHIFFERMÜLLER, 1775). Lasiocampidae: *Malacosoma neustria* (LINNAEUS, 1758). Lymantriidae: *Euproctis chrysorrhoea* (LINNAEUS, 1758); *E. similis* (FUESSLY, 1775); *Hypena scabra* (FABRICIUS, 1798); *Leucoma salicis* (LINNAEUS, 1758). Noctuidae: *Grapha agnata* (STAUDINGER, 1892); *Autographa gamma* (LINNAEUS, 1758); *Harpyia hermelina* (STEPHENS, 1829); *Helicoverpa armigera* (HÜBNER, 1808); *Pseudaletia unipuncta* (HAWORTH, 1809); *Spodoptera exigua* (HÜBNER, 1808); *Trichoplusia ni* (HÜBNER, 1803). Notodontidae: *Cerura vinula* (LINNAEUS, 1758); *Thaumetopoea proceionea* (LINNAEUS, 1758). Yponomeutidae: *Prays oleae* (BERNARD, 1788). Tortricidae: *Archips rosana* (LINNAEUS, 1758); *Lobesia botrana* (DENIS & SCHIFFERMÜLLER, 1775).

***Aleiodes (Aleiodes) nocturnus* (TELENGA, 1941)**

Material examined: Kastamonu-Toprakcuma, crop field, 350 m, 13.VI.2002, 2♀♀; - Cide, orchard, 60 m, 10.VI.2002, ♀; Zonguldak-Yolgeçen, orchard, 20 m, 09.VI.2002, ♀.

General distribution: Palaearctic.

Hosts: Lepidoptera, Lymantriidae: *Euproctis karghalica* (MOORE, 1878); Noctuidae: *Helicoverpa armigera* (HÜBNER, 1808); *H. zea* (BODDIE, 1850). Notodontidae: *Cerura menciiana* (MOORE, 1877); *C. vinula* (LINNAEUS, 1758); *Harpyia hermelina* (GOEZE, 1781).

***Aleiodes (Aleiodes) pallidator* (THUNBERG, 1822)**

Material examined: Bolu-Mengen-Kıyaslar, pine forests, 610 m, 28.VI.2001, ♀; Kastamonu-Taşköprü-Alamaşişli, vegetable garden, 620 m, 02.VII.2001, ♀.

General distribution: Holarctic, Neotropical, Oriental.

Hosts: Lepidoptera, Gelechiidae: *Anarsia lineatella* (ZELLER, 1839); *Caryocolum amaurella* (HERING, 1924). Geometridae: *Bupalus piniarius* (LINNAEUS, 1758); *Cyclophorapendularia* (HUFNAGEL, 1767); *C. punctaria* (LINNAEUS 1758); *C. quercimontaria* (BASTELBERGER 1897); *Dyscia conspersaria* (DENIS & SCHIFFERMÜLLER, 1775); *Eupithecia pimpinellata* (HÜBNER, 1813); *Hylaea fasciaria* (LINNAEUS 1758). Lasiocampidae: *Selenophera lobulina* (SCHIFFERMÜLLER, 1775). Lymantriidae: *Euproctis karghalica* (MOORE, 1878); *Orgyia definita* (PACKARD, 1865); *O. leucostigma* (SMITH, 1797). Noctuidae: *Agrotis segetum* (DENIS & SCHIFFERMÜLLER, 1775); *Heliothis virescens* (HUFNAGEL, 1766); *Helicoverpa armigera* (HÜBNER, 1808); *H. zea* (BODDIE, 1850); *Spodoptera exigua* (HÜBNER, 1808). Notodontidae: *Cerura menciiana* (MOORE, 1877); *C. vinula* (LINNAEUS, 1758); *Harpyia hermelina* (GOEZE, 1781). Psychidae: *Megalophanes viciella* (DENIS & SCHIFFERMÜLLER, 1775). Tortricidae: *Apotomis sororculana* (ZETTERSTEDT, 1839).

***Aleiodes (Aleiodes) rossicus* (KOKOUJEV, 1898)**

Material examined: Bolu-Gerede, trefoil, 1200m, 18.VI.2000, 2♀♀; Zonguldak-Devrek-Orman işletme, pine forests, 800 m, 07.VII.2000, 3♀♀.

General distribution: Palaearctic.

Hosts: Lepidoptera, Notodontidae: *Cerura vinula* (LINNAEUS, 1758); *Harpya hermelina* (GOEZE, 1781); Drepanidae: *Cilix glaucata* (SCOPOLI, 1763); Pyraustidae: *Ostrinia nivalis* (HÜBNER, 1796); *Pyrausta sambucalis* (DENİS & SCHIFFERMÜLLER, 1777); Geometridae: *Eupithecia sobrinata* (HÜBNER, 1796); *Semiothisa dathrata* (LINNAEUS, 1758), *Tephрина arenacearia* (DENİS & SCHIFFERMÜLLER, 1777); *Chlorocyclistis coronata* (HÜBNER, 1796); *Erannis defoliaria* Cl., *E. jacobsoni* D., *Hylaea fasciaria* (LINNAEUS, 1758); *Lycia hirtarius* Cl., *L. pomonarius* HÜBNER, *Operophtera brumata* (LINNAEUS, 1758), *Apochemia hispidaria* (DENİS ve SCHIFFERMÜLLER, 1777); Lasiocampidae: *Malacosoma neustria* (LINNAEUS, 1758), Tortricidae: *Archips rosana* (LINNAEUS, 1758); *Lobesia botrana* (DENİS & SCHIFFERMÜLLER, 1777); Noctuidae: *Callis tegemi* (CLERCK, 1759); *Helicoverpa armigera* (HÜBNER, 1796); *Spodoptera exigua* (HÜBNER, 1796); Lymantriidae: *Autographa gamma* (LINNAEUS, 1758), *Euproctis similis* (FUESSLY, 1775); *E. chrysorrhoea* (LINNAEUS, 1758); *Leucoma salicis* (LINNAEUS, 1758).

***Aleiodes (Aleiodes) signatus* (NEES, 1811)**

Material examined: Bolu-Gerede-Güney, pasture, 1200m, 13.VI.2002, 3♀♀; Karabük-Çay, orchard, 470 m, 13.VI.2002, ♂.

General distribution: Palaearctic.

Hosts: Lepidoptera, Arctiidae: *Arctia caja* (LINNAEUS, 1758); *Coscinia cribraria* (LINNAEUS, 1758); *Epicallia villica* (LINNAEUS, 1758); *Ocnogyna baetica* (RAMBUR, 1837). Lymantriidae: *Euproctis chrysorrhoea* (LINNAEUS, 1758); *E. similis* (FUESSLY, 1775); *Gynaephora selenitica* (ESPER, 1789); *Orgyia antiqua* (LINNAEUS, 1758); *O. aurolimbata* (GUENEE, 1835). Lasiocampidae: *Euthrix potatoria* (LINNAEUS, 1758). Noctuidae: *Acronicta psi* (LINNAEUS, 1758); *A. rumicis* (LINNAEUS, 1758); *Autographa gamma* (LINNAEUS, 1758); *Noctua fimbriata* (SCHREBER, 1759); *N. pronuba* (LINNAEUS, 1758). Notodontidae: *Taumatopoea pityocampa* (DENİS & SCHIFFERMÜLLER, 1775); *T. processionea* (LINNAEUS, 1758). Tortricidae: *Spilionota ocellana* (DENİS & SCHIFFERMÜLLER, 1775).

Subgenus *Neorhogas* s.str. SZÉPLIGETI, 1906

***Aleiodes (Neorhogas) dissector* (NEES, 1834)**

Material examined: Sinop-Boyabat-Salar, pasture, 450 m, 03.VII.2001, ♀.

General distribution: Palaearctic.

Hosts: Lepidoptera, Noctuidae: *Acronicta rumicis* (LINNAEUS, 1758); *A. tridens* (DENİS & SCHIFFERMÜLLER, 1775); *Orthosia incerta* (HUFNAGEL, 1766).

***Aleiodes (Neorhogas) ductor* (THUNBERG, 1822)**

Material examined: Kastamonu-Araç-Akgeçit, pine forest, 400 m, 28.VIII.2002, ♀; Sinop-Yeniçam, pasture, 30 m, 06.IX.2001, 2♀♀.

General distribution: Palaearctic.

Hosts: Lepidoptera, Lasiocampidae: *Anarta (Calocestra) trifolii* (HUFNAGEL, 1766); *Autographa gamma* (LINNAEUS, 1758); *Euthrix potatoria* (LINNAEUS, 1758); *Mamestra brassicae* (LINNAEUS, 1758). Nymphalidae: *Brenthis ino* (ROTTEMBERG, 1775). Sesiidae: *Synanthedon scoliaeformis* (BORKHAUSEN, 1789).

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