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Aradus reuterianus (Hemiptera: Heteroptera: Aradidae): first record from Bulgaria and confirmed occurrence in Tunisia

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Abstract. *Aradus reuterianus* Puton, 1875 (Hemiptera: Heteroptera: Aradidae: Aradinae) is recorded for the first time from Bulgaria, and its occurrence in Tunisia is confirmed. The distribution of the species is reviewed.

Key words: Hemiptera, Heteroptera, Aradidae, faunistics, Bulgaria, Tunisia, Palaearctic Region.

Introduction

The flat bugs or bark bugs (Aradidae) are a remarkable group including dark-coloured (black or dark brown) true bugs with rugose to granulate surface and bodies often (but not always) remarkably flattened (Usinger & Matsuda 1959; Heiss & Péricart 2007; Schuh & Weirauch 2020). Most flat bugs are mycophagous (except phytophagous *Aradus cinnamomeus* Panzer, 1806), living hidden under the bark of trees or in forest litter infested by fungal hyphae (e.g., Heiss & Péricart 2007; Schuh & Weirauch 2020).

The hidden way of life as well as the disappearance of their habitat make most of the flat bug species rare to find even in conditions of well-studied European fauna. Except for very few common species (such as *A. betulae* (Linnaus, 1758), *A. betulinus* Fallén, 1807, *A. cinnamomeus*, *A. conspicuus* Herrich-Schaeffer, 1835, and *A. depressus* (Fabricius, 1794) – see Heiss 2001a; Heiss & Péricart 2007), the remaining ones are mostly rare with records widely dispersed in both space and time. Among such species, we can also include *A. reuterianus* Puton, 1875, known from scattered records in the western, northern and north-eastern Mediterranean, from the Canary Islands and Maghreb to Anatolia (Heiss 2001a; Heiss & Péricart 2007). In this paper, we provide the first record of this species from Bulgaria, and a confirmation concerning its distribution in Tunisia.

Material and methods

Photographs were made using a Canon MP-E 65 mm macrolens attached to a Canon EOS 550D camera. Final images were stacked from multiple layers using the Helicon Focus 5.1 Pro software. The distribution map was created using SimpleMappr (Shorthouse 2010).

Results

***Aradus reuterianus* Puton, 1875** (Figs 1–3)

Material examined. BULGARIA: Bulg. mer., Bachkovo, 8.VII.1938, 3 ♀♀ (macr.), L. Hoberlandt lgt. & det., P. Kment and E. Heiss revid. [Fig. 3]. **SPAIN:** Escorial, Hi. Centr., V.1943, 1 ♂ (macr.), G. Rey & C. Koch lgt., F. Stöcklein det., P. Kment and E. Heiss revid. [Fig. 1]. **TUNISIA:** Env. de Mactar, Vauloger, L. Hoberlandt det., P. Kment and E. Heiss revid. [Fig. 2]. All the specimens are deposited in the collection of the National Museum, Prague, Czech Republic.

Identification. *Aradus reuterianus* seems to be isolated within the genus *Aradus*, forming, together with *A. mirus* Bergroth, 1894, a separate *A. mirus* species group, remarkable for the clavate antennae (Vásárhelyi 1976, Heiss & Péricart 2007). *Aradus reuterianus* differs from *A. mirus* by its brown colouration, lateral margins of pronotum sinuate and finely dentate, and distinct pronotal carinae (*A. mirus* is black, with lateral margins of pronotum nearly straight, without dentation, and pronotal carinae indistinct) (Vásárhelyi 1976; Heiss & Péricart 2007). Larvae of both species can be identified using the keys by Vásárhelyi (1985) and Heiss & Péricart (2007). Both the species are strictly allopatric, *A. mirus* being limited to Central Europe north-east of the Alps: north-east Austria, westernmost Hungary, Slovakia, Czech Republic, southern Poland (Upper Silesia) and south-eastern Germany (Thuringia) (Heiss 2001a; Heiss & Péricart 2007; Gierlasiński & Regner 2018; Küßner 2021).

Biology. Little is known about the biology of *A. reuterianus*. The species seems bound to conifers: mainly to pines (*P. silvestris*, *P. nigra*, *P. canariensis*, *P. halepensis*) similarly to the related *A. mirus* (Ramade 1960; Ribes 1984; Moulet 1986; Heiss & Péricart 2007), but also to fir (*Abies* sp.) (Tamanini 1982). Associations

Figs. 1-3. Habitus photos of *Aradus reuterianus* Puton, 1875: 1 – male, Spain: Escorial (body length 4.31 mm); 2 – female, Tunisia: Mactar env. (4.41 mm); 3 – female, Bulgaria: Bachkovo (4.60 mm).

with other plants, such as *Picea*, *Genista* or *Quercus* seems to be occasional and secondary (Tamanini 1982; Heiss & Péricart 2007; Parmain et al. 2013). In southern France, it was collected in numbers by beating branches of dried *Pinus silvestris* and *P. nigra*, partly burnt (Heiss & Péricart 2007; Parmain et al. 2013). In NE Italy, several adults and nymphs were collected in various localities on bundles of pine branches, either freshly cut or rotting on the ground, but also on a fir trunk with several stem decay fungi; in Aosta valley, an adult was found under a stone in a pinewood (Tamanini 1982). On Lesbos island (Greece) it was found in old pine cones (Heiss & Péricart 2007). The finding of the species in a 'group of rocks with stones in front' in May in Spain (Bator 1957) or under a stone in a pinewood (Tamanini 1982) may refer to a hibernation shelter, while the finding in old cones in September on Lesbos may be an aestivation place (Heiss & Péricart 2007).

Distribution (Fig. 4)**. AFRICA:** Canary Islands (Gran Canaria, La Palma) (Heiss & Péricart 2007), Morocco (Parmain et al. 2013), Algeria (Heiss & Péricart 2007), Tunisia (Sienkiewicz 1964). **EUROPE:** Portugal (Baena & Zuzarte 2012), Spain (including Mallorca) (Bator 1957, Ribes 1984, Heiss & Péricart 2007), southern France (including Corse) (Puton 1875, 1879; Lambertié 1910; Reuter 1913; Ramade 1960; Sienkiewicz 1964; Moulet 1986; Heiss & Péricart 2007; Parmain et al. 2013), Switzerland (Valais) (Heiss & Péricart 2007), northern Italy (Aosta, Alto Adige) (Mancini 1958, Tamanini 1982, Heiss & Péricart 2007), Croatia (Horváth 1897, Langhoffer 1899, Protić 2001), Bulgaria (**new record**), Greece (Peloponnesos, Lesbos) (Heiss 1998, 2006; Heiss & Péricart 2007). **ASIA:** western Turkey (Alanya env.) (Heiss & Péricart 2007). For review of all the known localities see Table 1.

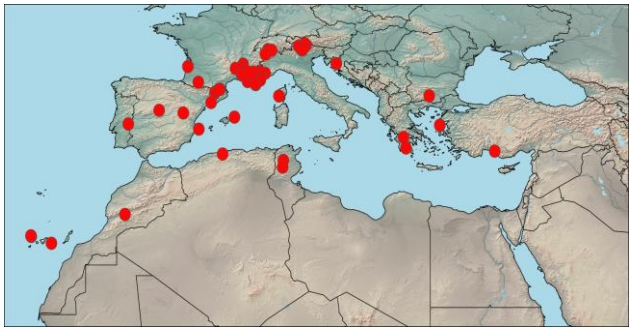

Fig. 4. Distribution map of *Aradus reuterianus* Puton, 1875.

Comments. *Aradus reuterianus* was reported from Tunisia by Sienkiewicz (1964) from localities Sbeitla and environs of Mactar. However, Carapezza (1997) considered those records as 'likely to refer to *Aradus obscurus*' Vásárhelyi, 1988. This opinion was accepted by Heiss & Péricart (2007) and Aukema et al. (2013). However, the voucher specimen from Mactar env. found in the collection of National Museum in Prague confirms its occurrence in Tunisia and most probably the correctness of Sienkiewicz's original identification.

The record from Yugoslavia (Josifov 1986, Heiss 2001) probably refers to Croatia (see Protić 2001, Aukema et al. 2013). This old Croatian record was actually omitted by Heiss & Péricart (2007). Bator (1957) also

listed its distribution in Albania, and Mancini (1958) from 'Austria meridionale'. However, there are no published records from those countries; the latter mention refers obviously to South Tirol, currently in northern Italy (see Heiss 2001; Heiss & Péricart 2007; Aukema et al. 2013).

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Table 1. Distribution records of *Aradus reuterianus* Puton, 1875. The coordinates were traced from internet maps.

State	Locality	Coordinates	Reference
Canary Islands	La Palma: Cumbre, alt. 2000 m	28.6970208N, 17.8534347W	Heiss & Péricart (2007)
Canary Islands	La Palma: Roque de los Muchachos	28.7542289N, 17.8848850W	Heiss & Péricart (2007)
Canary Islands	Gran Canaria: Pirada Tamadava [= Pinar de Tamadaba], alt. 1300 m	28.0496233N, 15.6880239W	Heiss & Péricart (2007)
Morocco	Haut-Atlas: Tadmamt	30.7746525N, 7.7924319W	Parmain et al. (2013)
Algeria	Massif des Mouzaïa	36.4625189N, 2.6891431E	Heiss & Péricart (2007)
Tunisia	Mactar [= Maktar] env.	35.8667006N, 9.2077675E	Sienkiewicz (1964), this paper
Tunisia	Sbeitla	35.2303636N, 9.1313411E	Sienkiewicz (1964)
Portugal	Alto Alentejo, Portalegre, Campo de Tiro, P.N. Sao Mamede	39.2912103N, 7.4326542W	Baena & Zuzarte (2012)
Spain	Alicante: Denia Javea [Dénia–Xàbia]	38.8064469N, 0.1343575E	Heiss & Péricart (2007)
Spain	Catalonia: Guardiola de Berguedà	42.2307517N, 1.8779006E	Ribes (1984)
Spain	Catalonia: Refugi de Rebost	42.2872475N, 1.8851311E	Ribes (1984)
Spain	Madrid: Escorial	40.5836411N, 4.1281428W	Bator (1957)
Spain	Mallorca: Sta. Galdana [= ? Cala Galdana]	39.9371133N, 3.9610308E	Heiss & Péricart (2007)
Spain	Tarragona: Sierra de Montruell [= Montmell]	41.3151822N, 1.4542794E	Heiss & Péricart (2007)
Spain	Teruel: Sierra de Albaracín, Moscardon, alt. 1000 m	40.3324789N, 1.5368889W	Heiss & Péricart (2007)
France	Alpes-Maritimes: Saint-Martin-Vésubie, alt. 1200 m	44.0700772N, 7.2565003E	Heiss & Péricart (2007)
France	Alpes-Maritimes: Thorenc	43.8048436N, 6.8048661E	Heiss & Péricart (2007)
France	Alpes-de-Haute-Provence: Allos	44.2409317N, 6.6288511E	Heiss & Péricart (2007)
France	Alpes-de-Haute-Provence: Digne [-les-Bains] env., Forêt des Mées	44.0918144N, 6.2351431E	Heiss & Péricart (2007)
France	Alpes-de-Haute-Provence: Sisteron	44.1963467N, 5.9443792E	Heiss & Péricart (2007)
France	Ardèche: La Sablière [=Sablières]	44.5317800N, 4.0743536E	Sienkiwicz (1964)
France	Bouches-du-Rhône: Chaîne de l'Étoile [= Massif de l'Étoile]	43.4007700N, 5.5068656E	Ramade (1960)
France	Bouches-du-Rhône: La Montagnette, Barbentane	43.8986064N, 4.7477258E	Moulet (1986)
France	Bouches-du-Rhône: Marseille	43.2961742N, 5.3699525E	Heiss & Péricart (2007)

State	Locality	Coordinates	Reference
France	Corse [no details]	41.9263992N, 8.7376028E	Puton (1875, syntype), Puton (1879), Heiss (2001b, lectotype)
France	Drôme [no details]	44.9332275N, 4.8920811E	Puton (1879), Reuter (1913)
France	Drôme: Montélimar	44.5579392N, 4.7503181E	Sienkiewicz (1964)
France	Drôme: Nyons	44.3555000N, 5.1283800E	Sienkiewicz (1964), Heiss & Péricart (2007)
France	Gironde: Lanton	44.7035575N, 1.0360314W	Parmain et al. (2013)
France	Hautes-Pyrénées [no details]	43.2328581N, 0.0781019E	Lambertié (1910)
France	Hautes-Pyrénées: Tarbes	43.2328581N, 0.0781019E	Puton (1879), Reuter (1913)
France	Pyrénées-Orientales: Jujols	42.5700747N, 2.2950522E	Parmain et al. (2013)
France	Pyrénées-Orientales: Fillols, Route des Cortalets	42.5615431N, 2.4105667E	Parmain et al. (2013)
France	Pyrénées-Orientales: Sahorre, Coll de Fins	42.5393028N, 2.3387953E	Parmain et al. (2013)
France	Var: Fréjus	43.4330308N, 6.7360181E	Puton (1879), Reuter (1913), Heiss & Péricart (2007)
France	Var: Porquerolles	43.0043519N, 6.2331919E	Puton (1875, syntype), Reuter (1913), Heiss & Péricart (2007)
France	Var: Hyères	43.1202572N, 6.1301614E	Puton (1879), Reuter (1913), Heiss & Péricart (2007)
France	Vaucluse: Avignon	43.9492492N, 4.8059011E	Puton (1875, syntype), Puton (1879), Reuter (1913), Heiss (2001b, paralectotype), Heiss & Péricart (2007)
France	Vaucluse: Revest-du-Bion, alt. 900 m	44.0825889N, 5.5475433E	Heiss & Péricart (2007)
Switzerland	Valais: Sierre env.	46.2922522N, 7.5323194E	Heiss & Péricart (2007)
Switzerland	Valais: Pfynwald	46.2984781N, 7.5727658E	Heiss & Péricart (2007)
Switzerland	Valais: Visportorminen [= Vispertermi-nen]	46.2364564N, 7.9458917E	Heiss & Péricart (2007)
Italy	Alto Adige: Bressanone	46.7165492N, 11.6578508E	Tamanini (1982)
Italy	Alto Adige: Bressanone, Goller Eck, alt. 1100–1200 m	not identified	Tamanini (1982)
Italy	Alto Adige: Favogna	46.2727478N, 11.1835697E	Tamanini (1982)
Italy	Alto Adige: Fennhals	46.2980814N, 11.1885781E	Heiss & Péricart (2007)
Italy	Alto Adige: Laces, S. Martino, alt. 1331 m	46.6173433N, 10.8595386E	Tamanini (1982)
Italy	Alto Adige: Mules	46.8549386N, 11.5238006E	Tamanini (1982), Heiss & Péricart (2007)
Italy	Alto Adige: Pinzon	46.3210478N, 11.2940739E	Heiss & Péricart (2007)

State	Locality	Coordinates	Reference
Italy	Aosta: Champ de Praz [= Praz du Champ]	45.8783425N, 7.2788472E	Mancini (1958), Tamanini (1982)
Croatia	Senj	44.9897328N, 14.9030556E	Horváth (1897), Langhoffer (1899)
Bulgaria	Bachkovo	41.9507050N, 24.8601375E	this paper
Greece	Lesbos Island	39.1762208N, 25.9989797E	Heiss & Péricart (2007)
Greece	Peloponnisos: Kalavrita [= Kalavryta], alt. 1200 m	38.0325250N, 22.1128311E	Heiss (2006)
Greece	Peloponnisos: Mt. Taigetos, Anavriti [= Anavryti], alt. 1700 m	37.0311011N, 22.3725186E	Heiss (1998)
Turkey	Anatolia: Güzelbağ near Alanya	36.7328244N, 31.8980542E	Heiss & Péricart (2007)

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