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A review of the phylogeny of Palaearctic mealybugs (Hemiptera: Coccomorpha: Pseudococcidae)

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Abstract

The mealybugs form the second largest family group within the scale insects (Hemiptera: Coccomorpha), with about 2,300 species in almost 300 genera, and is currently considered to include two families, Pseudococcidae and Rhizoecidae. D.A. Downie & P.J. Gullan undertook the first molecular phylogenetic study of the group, and recognised three major clades which more or less equated to the Pseudococcinae, Phenacoccinae and Rhizoecinae. More recently, N.B. Hardy and co-workers did a similar large study with more taxa, and included a morphological data matrix based on the adult female, adult males and first-instar nymphs; their results were broadly similar to those of Downie & Gullan except they found that the Rhizoecinae were included within the Phenacoccinae. Since this latter study, the Rhizoecinae has been recognized as a separate family, Rhizoecidae, and is used as an outgroup in this study. Both previous studies used mainly Nearctic, Tropical and Australian species in their analysis but, in the present study, we use only species collected in the Palaearctic and, in addition to a molecular study, add a data matrix based on the morphology of the adult female. We (1) review the phylogeny of mealybugs, focusing on Palaearctic taxa; (2) improve our understanding of mealybug molecular phylogeny based on Palaearctic mealybug taxa; (3) add morphological characters not previously included in systematic analyses; and (4) identify morphological characters that diagnose apparently monophyletic subgroups within the Pseudococcidae. The overall congruence between gene trees provides strong support for the subfamilies Pseudococcinae and Phenacoccinae, and for the tribes Planococcini, Trabutinini and Pseudococcini. Our results also strongly suggest that, as currently understood, the genera *Phenacoccus* (in Phenacoccinae) and *Trionymus* and *Pseudococcus* (in Pseudococcinae) are non-monophyletic. These results are discussed and compared with earlier studies.

Key words

Non-monophyly, Phenacoccus, Peliococcus, Trionymus, morphology, tribal diagnosis.

1. Introduction

Along with the infraorders Aphidomorpha (aphids), Psyllomorpha (plant lice) and Aleyrodomorpha (whiteflies), the Coccomorpha (scale insects) are members of the Sternorrhyncha (Hemiptera). The scale insects are more diverse in terms of major evolutionary lineages (families), species richness, genetic systems (such as male haploidy, hermaphroditism, facultative and obligate parthenogenesis) and morphology than any of the other

sternorrhynchan groups (Hodgson & Hardy 2013). The adult females are sap-sucking and paedomorphic (resembling nymphs), perhaps due to neoteny, and the males display complete metamorphosis (Gullan & Kosztarab 1997; Gullan & Martin 2009). Individual scale insects are small to minute, typically less than 5 mm long, and are cryptic in habit, often resembling parts of their host plant. Their common name derives from the appearance



of the insects themselves and also from the frequent presence of a protective covering, often of secreted wax, as found on most mealybugs. Currently, about 52 extant and extinct families are recognised within the Coccomorpha, of which the mealybugs form the second largest family group, with 2,256 species in 291 genera in two families: Pseudococcidae (2,012 species in 273 genera) and Rhizoecidae (244 species in 18 genera) (Ben-Dov et al. 2015). Of these, about 700 species in 106 genera are known from the Palaearctic (Kozár 1998). Mealybugs feed on a wide variety of woody and herbaceous plants, and are often restricted to a specific part of their host. Quite a few mealybug species are confined to beneath the leaf sheaths of grasses, whilst the Rhizoecidae are mainly confined to the roots and leaf litter.

Earlier workers classified all mealybugs in a single family Pseudococcidae, which was divided into about five subfamilies, namely Pseudococcinae, Phenacoccinae, Trabutininae, Rhizoecinae and Sphaerococcinae (Koteja 1974 a,b; Danzig 1980; Williams 1985; Tang 1992). The family Putoidae has been recognized as a separate family since 1969 (Beardsley 1969; Tang 1992), although there is still some disagreement as to its status (Gavrilov-Zimin & Danzig 2012; Danzig & Gavrilov-Zimin 2014). Here, based on DNA evidence (Cook et al. 2002), adult male morphology (Hodgson & Foldi 2006) and the review by WILLIAMS et al. (2011) of the status of species then included in the genus, we consider Putoidae to be a good family and, along with members of the recently recognized Rhizoecidae (Hodgson 2012) and an Acanthococcus species, have used it as an outgroup in our analysis.

The purpose of this paper is to: (1) review the phylogeny of mealybugs, focusing on Palaearctic taxa; (2) improve our understanding of mealybug molecular phylogeny based on Palaearctic mealybug taxa; (3) add morphological characters not previously included in systematic analyses, and (4) identify morphological characters that diagnose apparently monophyletic subgroups within the Pseudococcidae. The results are discussed and compared with earlier studies.

2. Materials and methods

2.1. Materials

Fresh specimens of 61 species (81 specimens) of Pseudococcidae plus three species of Putoidae, two species of Rhizoecidae and one species of Acanthococcidae (the latter three families used as outgroup taxa) were collected in Bulgaria, Hungary, Russia and Turkey (Table 1) and preserved in 95% ethanol.

The cuticle of each specimen used for the DNA analysis was slide mounted and used as a voucher specimen. The specimens were mounted using Kosztarab & Kozár's (1988) methodology with some modification. These specimens are deposited in the Coccoidea Collection of the University of Çukurova, Adana, Turkey (KPCT). Although these vouchers were often poor specimens, they did allow accurate species determination, especially important where mixed-species collections are suspected. Identifications were made using the plates and keys in Danzig (1980, 1997, 1998, 2001, 2003, 2006, 2007), Danzig & Miller (1996), Kosztarab & Kozár (1988) and Williams (2004). Only non-parasitised adult females were used for DNA extraction.

2.2. Molecular studies

Prior to DNA extraction, all specimens were examined under the microscope for the presence of parasitoids. DNA was extracted from a single parasitoid-free adult female with the DNA-easy tissue kit (Qiagen, Inc, Valencia, CA).

PCR products were generated from a mitochondrial gene, cytochrome oxidase I (COI), and one nuclear gene: a fragment of the D₂ and D₃ regions of the large subunit ribosomal DNA gene (28S). Primers for both amplification and sequencing were 5' - CAA CAT TTA TTT TGA TTT TTT GG – 3' (C1-J-2183 aka Jerry) and 5' – GCW ACW ACR TAA TAK GTA TCA TG - 3' (C1-N-2568 aka BEN3R, designed by T.R. Schultz, Smithsonian Institution) for COI; 5' – TCG GAR GGA ACC AGC TAC TA-3' (A335 REVERSE) and 5'-GAG AGT TMA ASA GTA CGT GAA AC - 3' (S3660 FORWARD) for 28S. PCR reaction components and final concentrations were 1.5–2.5 mM MgCl₂, 0.2 mM dNTPs, and 1 unit *Taq* polymerase in a proprietary buffer (PCR Master Mix, Promega Biotechnology), 0.2 µM of each primer, and 5 μl DNA template in a final volume of 25 μl. The PCR cycling protocol for COI was 95°C for 7 m, followed by 40 cycles of 95°C for 1 m, 45 °C for 1 m, and 72°C for 1 m 30 s with a final extension at 72°C for 5 m. The protocol for 28S was 94°C for 4 m followed by 35-45 cycles of 94°C for 1 m, 49-52°C for 1 m, and 72°C for 1 m, 30 s with a final extension at 72°C for 4 m.

PCR products were purified and sequenced by ION-TEK (İstanbul, Turkey). Contigs were assembled using CodonCode Aligner v. 3.7.1 (CodonCode Corp.) and multiple alignments were performed by using ClustalW in BioEdit for each gene region. Each alignment was controlled visually and cut if there were big gaps in the alignments. Gaps of this kind can occur if there were too many taxa in the study. All alignments and morphological matrix were then combined by using MacClade 4.08 (Maddison & Maddison 2005). Please see supplementary file for the combined data.

2.3. Phylogenetic analyses

Maximum likelihood (ML) and Bayesian analyses were used to estimate trees. The data were analysed for each locus separately and with data for the two loci combined. ML trees were constructed using Mega6, with four data partitions: 3 codon positions for COI, and one partition for 28S. A separate GTR, nucleotide substitution model was applied to each partition. Ten thousand non-parametric bootstrap replicates were performed using GTR, with every 100 bootstrap tree used as the starting tree for ML optimisation. Phylogenies were also reconstructed with Bayesian inference methods using MRBAYES v. 3.1.2 (RONQUIST & HUELSENBECK 2003) under the packed program Geneious 5.6 by adding morphological characters. For this analysis, morphological character data were concatenated to the DNA data using Python. The evolution of the morphological data was modelled with an mk1 model (character changes unordered), with coding set to variable. We applied a separate GTR model with gamma-distributed rates and a proportion of invariant sites (GTR) to each partition, using default priors. Four Markov chains, three hot and one cold (program default), were run simultaneously for five million generations, with trees sampled every 1000 generations. A plot of loglikelihood over time was examined, and the first 1000 trees, generated before the analysis had achieved stationary, were discarded as 'burn-in'.

2.4. Morphological studies

All specimens which had been used for molecular studies were used for the morphological analyses. The characters used for compiling the data matrix were those of HARDY et al. (2008), with some modifications. The morphological matrix was concatenated to the molecular data as explained above (2.3) and analysed using Bayesian inference methods.

2.5. Morphological characters

All characters refer to adult females. Those listed under "Additional characters" below are additional to those in HARDY et al. (2008). The morphological character matrix is presented in Table 2.

Venter

- 1. Number of antennal segments: (1) 9; (2) 8; (3) 7; (4) <7
- 2. Apical antennal segments: total number of fleshy setae: (0) > 5; (1) 5; (2) < 5.
- 3. Number of intersegmental setae on each antenna: (0) 3 pairs; (1) 1 pair.
- 4. Antennae: basiconic sensilla: (0) present; (1) absent.

- 5. Antennae: coeloconic sensilla: (0) absent; (1) 2 present on apical antennal segment, plus one on both of segments II and V; (2) only on apical segment.
- **6.** Antennae with clavate setae: (0) absent; (1) present.
- 7. Labium, number of setae on middle segment: (0) 2 pairs; (1) 1 pair.
- 8. Labium, apical segment: number of setae on anterior surface (excluding fleshy subapicals) (see Koteja 1974b): (0) > 3; (1) 3.
- Labium, apical setae (see Koteja 1974b): (0) absent;
 present.
- **10.** Labium, number of fleshy subapical setae (see Koteja 1974b): **(0)** 2; **(1)** 4.
- Ventral sclerotization on head: (0) absent; (1) present.
- **12.** Legs, development: (1) well developed; (2) absent.
- **13.** Legs, number of campaniform sensilla on each side of trochanter: **(0)** 4; **(1)** 2.
- **14.** Legs, translucent pores on hind legs: (0) present; (1) absent
- 15. Legs, distribution of translucent pores on hind legs:
 (0) absent; (1) on coxa as a pore-plate only; (2) on coxa and tibia; (3) on femur only; (4) on femur and tibia; (5) on tibia only; (6) on coxa, femur and tibia.
- **16.** Legs, denticle on claw: (0) present; (1) absent.
- 17. Legs, claw: (0) typical (broad basally, not extended); (1) long and slender.
- **18.** Legs, tarsal digitules: (0) undeveloped/absent; (1) developed.
- 19. Multilocular disc pores with 6 or more loculi: (0) present throughout venter; (1) confined to abdomen;(2) absent; (3) present on abdomen and near spiracles; (4) near spiracles only.
- 20. Quinquelocular disc pores: (0) present; (1) absent.
- 21. Trilocular disc pores: (0) present; (1) absent.
- 22. Discoidal pores: (0) present; (1) absent.
- 23. Oral-collar ducts on dorsum: (0) present; (1) absent.
- **24.** Circuli, structure: (0) evaginated and truncate; (1) sessile.
- 25. Circuli, distribution: (0) more than one; (1) only one, on abdominal sternite III; (2) only one, in intersegmental membrane between abdominal sternites III and IV; (3) absent.
- **26.** Spiracles: (0) small, typical size for coccoids; (1) grossly developed, without shrunken trilocular pores lining the atrium; (2) grossly developed, with shrunken trilocular pores lining atrium.
- 27. Anal lobe bar: (0) absent; (1) present.
- **28.** Posterior abdominal segments (V–VIII): (0) membranous; (1) sclerotised.
- **29.** Eyes: **(0)** present; **(1)** absent.
- **30.** Multilocular disc pores and/or tubular ducts in clusters: **(0)** absent; **(1)** present.
- **31.** Vulva: (0) directed ventrally; (1) directed posteriorly.

Dorsum

32. Ostioles: **(0)** both pairs present; **(1)** posterior pair present, anterior pair absent; **(2)** both pairs absent.

Table 1. Collection details of specimens and outgroup taxa from which DNA was extracted.

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MBK149 4562 Turkey, Hakkari road MBK008 4643 Bulgaria, W. Rhodopes MBK077 4389 Turkey, Van, Başkale MBK020 4656 Bulgaria, Alibotosh MBK020 4656 Bulgaria, Alibotosh MBK020 4656 Turkey, Arvin, Borçka MBK021 4241 Turkey, Arvin, Savşat Boad MBK065 4241 Turkey, Hakkari, Esendere Badd MBK074 4242 Turkey, Hakkari, Esendere Badd MBK074 4242 Turkey, Hakyari, Esendere Badd MBK074 4242 Turkey, Hakyari, Esendere Badd MBK074 4242 Turkey, Jaykari, Saykale MBK034 4027 Turkey, Kars, Ardahan Road MBK049 4657 Turkey, Kars, Ardahan Road MBK040 4657 Turkey, Britis-Siir Border MBK075 4250 Turkey, Britis-Siir Border <	key, Hakkari road garia, W. Rhodopes key, Van, Başkale key, İğur, Tuzluca, Gaziler garia, Alibotosh garia, Alibotosh key, Hakkari, Başkale key, Hakkari, Başkale key, Hakkari, Başkale key, Hakkari, Başkale key, Jayarbakı, Malabadi ngary, Nagykovoicsi key, İğur, Gaziler garia, Alibotosh key, Erican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road ssia, Vorovezk, Plunogrie key, Kars, Ardahan Road ssia, Vorovezk, Harskaya st. key, Bitlis-Siirt Border ssia, Vorovezk, Harskaya st.	02.ix.2009 24.vi.2009 02.ix.2009 12.vi.2009 11.vi.2009 14.vi.2009 16.vii.2010 22.v.2008 23.v.2008 23.v.2008 05.xi.2005 03.x.2005 03.x.2005 19.vi.2009 08.vii.2010 16.ix.2009 1316.ix.2009 09.vi.2009	37°39'067" 38°07'093" 40°05'717" 41°21'182" 37°32'058" 38°09'335" 40°06'332" 40°47'718	043°52'994" 044°05'640" 043°34'183" 041°41'162" 041°58'542" 044°32'976" 044°32'976" 041°12'785" 043°29'423" 039°52'499"	Artemisia sp. Undetermined Salvia sp. Artemisia sp. Tifolium sp. Lactuca sp. Undetermined Euphorbia sp. Phragmites sp. Ohrysopogon gryllus D-Vac	M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan
MBK008 4643 Bulgaria, W. Rhodopes MBK227 4570 Turkey, Van, Başkale MBK020 4655 Bulgaria, Aibtotosh MBK020 4655 Bulgaria, Aibtotosh MBK128 4616 Turkey, Artvin, Şavşat Road MBK065 4241 Turkey, Artvin, Şavşat Road MBK074 4242 Turkey, Hakkari, Esendere Road MBK074 4242 Turkey, Hakkari, Esendere Road MBK074 4242 Turkey, Hakkari, Esendere Road MBK074 4649 Hungan, Nagykovoicsi MBK074 4645 Hungari, Ailbotosh MBK075 4627 Turkey, Kars, Ardahan Road MBK049 4672 Turkey, Kars, Ardahan Road MBK056 4627 Turkey, Kars, Ardahan Road MBK075 4650 Turkey, Bitis, Siir Boag MBK075 4250 Turkey, Bitis, Siir Boag MBK075 4250 Turkey, Bitis, Siir Road MBK101 4357 Turkey, Jan, Bakkari, Road MBK102 4557 Turkey, Jan, Makari, Road <	key, Van, Bhodopes key, Van, Başkale key, İğdır, Tuzluca, Gaziler garia, Alibotosh key, Hakkari, Bargkale key, Hakkari, Bargkale key, Hakkari, Başvale key, Hakkari, Başvale key, Jiyarbakı, Malabadi garia, Alibotosh key, İğdır, Gaziler garia, Alibotosh key, Erzican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road ssia, Vorovezk, Plunogrie key, Kars, Harskaya st. key, Bitlis-Siirt Border ssia, Vorovezk, Harskaya st.	24.vi.2009 02.ix.2009 12.vi.2009 13.vi.2009 14.vi.2009 16.vii.2010 22.v.2008 23.v.2008 25.v.2008 05.xi.2005 03.x.2005 03.x.2005 03.x.2005 19.vi.2009 1316.vi.2009 16.ix.2009 16.ix.2009	38°07'093" 40°06'717" 41°21'182" 37°42'405" 38°09'335" 40°06'332" 40°47'718	044°05'640" 043°34'183" 041°41'162" 041°58'542" 043°52'976" 043°20'423" 039°52'499" 039°52'499"	Undetermined Salvia sp. Artemisia sp. Tiriolium sp. Lactuca sp. Undetermined Euphorbia sp. Phragmites sp. Ohrysopogon gryllus D-Vac	I. Gavrilov M.B. Kaydan M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan I. Gavrilov M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan
MBK227 4570 Turkey, Van, Başkale MBK077 4389 Turkey, İdir, Tuzluca, Gaziler MBK128 4616 Turkey, Arvin, Borçka MBK128 4616 Turkey, Arvin, Borçka MBK292 4926 Turkey, Hakkari, Başkale MBK034 4241 Turkey, Hakkari, Başkale MBK014 4649 Hungary, Nagykovoicsi MBK014 4649 Hungary, Nagykovoicsi MBK034 1402 Turkey, İdir, Gaziler MBK100 4649 Hungary, Nagykovoicsi MBK101 4649 Hungary, Nagykovoicsi MBK104 4649 Hungary, Nagykovoicsi MBK105 4627 Turkey, Kars, Ardahan Road MBK104 4657 Russia, Vorovezk, Plunogire MBK089 4325 Turkey, Kars, Ardahan Road MBK089 4325 Turkey, Hakkari, Başkale MBK089 4325 Turkey, Hakkari, Başkale MBK089 4325 Turkey, Hakkari, Başkale MBK089 4520 Turkey, Hakkari, Garler MBK132	key, Van, Başkale key, İğdır, Tuzluca, Gaziler İgaria, Alibotosh key, Artvin, Borçka key, Artvin, Şavşat Road key, Artvin, Şavşat Road key, Hakkari, Esendere Road key, Diyarbakır, Malabadi ngary, Nagykovoicsi key, İğdır, Gaziler garia, Alibotosh key, Ezican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Van, Gevag key, Van, Gevag key, Van, Gevag key, Harskari Border ssia, Vorovezk, Hrafskaya st.	02.ix.2009 12.vi.2008 19.vi.2009 17.ix.2009 16.vii.2010 22.v.2008 23.v.2008 05.xi.2008 05.xi.2009 19.vi.2009 13.x.2009 16.ix.2009 16.ix.2009 16.ix.2009	38°07'093" 40°06'717" 41°10'322" 37°42'405" 38°09'335" 40°06'332" 40°47'718	044°05′640″ 043°34′183″ 041°41′162″ 041°58′542″ 044°32′040″ 041°12′785″ 043°29′423″ 043°52′493″ 043°06′344	Salvia sp. Artemisia sp. Trifollum sp. Lactuca sp. Undetermined Euphorbia sp. Phragmites sp. Ohrsopogon gryllus D-Vac	M.B. Kaydan M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan F. Kozár M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan
MBK020 4389 Turkey, Iğdri, Tuzluca, Gaziler MBK020 4655 Bulgaria, Alibotosh MBK128 4916 Turkey, Arvin, Borçka MBK095 4241 Turkey, Arvin, Borçka MBK065 4241 Turkey, Hakkari, Esendere Road MBK074 4242 Turkey, Hakkari, Esendere Road MBK014 4649 Hungan, Nagykovoicsi MBK014 4649 Hungan, Nagykovoicsi MBK034 1402 Turkey, Hakkari, Esendere Road MBK034 1402 Turkey, Britis, Ardahan Road MBK039 4627 Turkey, Mar, Ardahan Road MBK089 4255 Turkey, Mar, Britis-Sirit Border MBK089 4250 Turkey, Mar, Britis-Sirit Border MBK08 4250 Turkey, Mar, Britis-Sirit Border MBK08 4250 Turkey, Mar, Britis-Sirit Border MBK09 4250 Turkey, Mar, Britis-Sirit Border MBK035 4250 Turkey, Mar, Britis-Sirit Border MBK118 4557 Turkey, Mar, Britis-Sirit Border MBK135 1696	key, İğdır, Tuzluca, Gaziler İgaria, Alibotosh key, Artvin, Borçka key, Artvin, Şavşat Road key, Hakkari, Başkale key, Hakkari, Esendere Road key, Diyarbakır, Malabadi ngary, Nagykovoicsi key, İğdır, Gaziler garia, Alibotosh key, Ezican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Hrafskaya st. ssia, Vorovezk, Hrafskaya st.	12.vi.2008 19.vi.2009 17.ix.2009 16.wii.2010 23.v.2008 26.v.2008 05.xi.2008 05.xi.2009 08.xii.2010 19.vi.2009 1316.vi.2009 16.ix.2009 16.ix.2009	40°06717" 41°10'322" 37°33'058" 37°47'405" 38°09'335" 40°06'332" 40°47'718	043°34'183" 041°41'162" 041°58'542" 043°52'976" 044°32'040" 041°12'785" 043°29'423" 043°52'499" 043°06'344	Artemisia sp. Tirifallum sp. Lactuca sp. Undetermined Euphorbia sp. Phragmites sp. Ohrysopogon gryllus D-Vac	M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan F. Kozár M.B. Kaydan I. Gavrilov M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan
MBK020 4655 Bulgaria, Alibotosh MBK128 4616 Turkey, Artvin, Borçka MBK022 4926 Turkey, Artvin, Borçka MBK034 4241 Turkey, Hakkari, Esandere Road MBK014 4642 Turkey, Baykovicsi MBK014 4649 Hungari, Maykovicsi MBK014 4649 Hungari, Maykovicsi MBK014 4649 Hungari, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK034 4607 Turkey, Kars, Ardahan Road MBK049 4672 Turkey, Kars, Ardahan Road MBK043 4657 Turkey, Hakkari, Başkale MBK043 4666 Russia, Vorovezk, Harskaya st. MBK050 4250 Turkey, Bahr, Başkale MBK101 4357 Turkey, Bahr, Baskale MBK103 4359 Turkey, Bahr, Baskale MBK101 4357 Turkey, Wan, Bakkale MBK232 3379 Turkey, Bahr, Bakkali, Bakkali MBK239 <t< td=""><td>legaria, Alibotosh key, Artvin, Borçka key, Artvin, Savşat Road key, Artvin, Şavşat Road key, Hakkari, Başkale key, Hakkari, Esendere Road key, Diyarbakır, Malabadi ngary, Nagykovoicsi key, İğdır, Gaziler garia, Alibotosh key, Ezican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Mar, Gevag key, Milis-Siirt Border ssia, Vorovezk, Hrafskaya st. key, Hakkari, Başkale key, Hakkari, Başkale</td><td>19.vi.2009 17.ix.2009 17.ix.2009 16.vii.2010 22.v.2008 23.v.2008 26.v.2008 05.xi.2005 03.v.2005 19.vi.2009 16.ix.2009 16.ix.2009 16.ix.2009 16.ix.2009</td><td>41°21'182" 41°10'322" 37°38'058" 37°42'405" 38°09'335" 40°06'332" 40°47'718</td><td>041°41'162" 041°58'542" 043°52'976" 044°32'040" 041°12'785" 043°29'423" 039°52'499"</td><td>Infolium sp. Lactuca sp. Undetermined Euphorbia sp. Phragmites sp. Ohrsopogon gryllus</td><td>I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan F. Kozár M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan</td></t<>	legaria, Alibotosh key, Artvin, Borçka key, Artvin, Savşat Road key, Artvin, Şavşat Road key, Hakkari, Başkale key, Hakkari, Esendere Road key, Diyarbakır, Malabadi ngary, Nagykovoicsi key, İğdır, Gaziler garia, Alibotosh key, Ezican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Mar, Gevag key, Milis-Siirt Border ssia, Vorovezk, Hrafskaya st. key, Hakkari, Başkale key, Hakkari, Başkale	19.vi.2009 17.ix.2009 17.ix.2009 16.vii.2010 22.v.2008 23.v.2008 26.v.2008 05.xi.2005 03.v.2005 19.vi.2009 16.ix.2009 16.ix.2009 16.ix.2009 16.ix.2009	41°21'182" 41°10'322" 37°38'058" 37°42'405" 38°09'335" 40°06'332" 40°47'718	041°41'162" 041°58'542" 043°52'976" 044°32'040" 041°12'785" 043°29'423" 039°52'499"	Infolium sp. Lactuca sp. Undetermined Euphorbia sp. Phragmites sp. Ohrsopogon gryllus	I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan F. Kozár M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan
MBK128 4616 Turkey, Artvin, Borçka MBK0292 4926 Turkey, Artvin, Şavşat Road MBK034 4241 Turkey, Hakkari, Esendere Road MBK018 4326 [b] Turkey, Hakkari, Esendere Road MBK014 4649 Hungan, Maykovoicsi MBK014 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK010 4623 Turkey, Kars, Ardahan Road MBK030 10xfey, Kars, Bitlis, Sirt Border MBK031 10xfey, Wan, Markari, Başkale MBK032 10xfey, Wan, Balan, Boad MBK033 10xfey, Mar, Markari, Carriera MBK034 4505 Turkey, Man, Markari, Carriera </td <td>key, Artvin, Borçka key, Artvin, Şavçat Road key, Hakkari, Başkale key, Hakkari, Esendere Road key, Diyarbakır, Malabadi ngary, Nagykovoicsi key, İğdır, Gaziler garia, Alibotosh key, Ezican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Misis-Siirt Border ssia, Vorovezk, Hrafskaya st. ssia, Vorovezk, Hrafskaya st.</td> <td>17.ix.2009 16.vii.2010 22.v.2008 23.v.2008 26.v.2008 05.xi.2005 03.v.2005 19.vi.2009 16.ix.2009 16.ix.2009 16.ix.2009</td> <td>41°21'182" 41°10'322" 37°39'058" 37°42'405" 38°09'335" 40°06'332" 39°35'506"</td> <td>041°41'162" 041°58'542" 043°52'976" 044°32'040" 041°12'785" 043°29'423" 039°52'499"</td> <td>Lactuca sp. Undetermined Euphorbia sp. Phragmites sp. Chrysopogon gryllus D-Vac</td> <td>M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan F. Kozár M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan</td>	key, Artvin, Borçka key, Artvin, Şavçat Road key, Hakkari, Başkale key, Hakkari, Esendere Road key, Diyarbakır, Malabadi ngary, Nagykovoicsi key, İğdır, Gaziler garia, Alibotosh key, Ezican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Misis-Siirt Border ssia, Vorovezk, Hrafskaya st. ssia, Vorovezk, Hrafskaya st.	17.ix.2009 16.vii.2010 22.v.2008 23.v.2008 26.v.2008 05.xi.2005 03.v.2005 19.vi.2009 16.ix.2009 16.ix.2009 16.ix.2009	41°21'182" 41°10'322" 37°39'058" 37°42'405" 38°09'335" 40°06'332" 39°35'506"	041°41'162" 041°58'542" 043°52'976" 044°32'040" 041°12'785" 043°29'423" 039°52'499"	Lactuca sp. Undetermined Euphorbia sp. Phragmites sp. Chrysopogon gryllus D-Vac	M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan F. Kozár M.B. Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan
MBK092 4926 Turkey, Arvin, Şavşat Road MBK074 4242 Turkey, Hakkari, Başkale MBK078 4242 Turkey, Hakkari, Esendere Road MBK018 4326 (b) Turkey, Diyarbakır, Malabadi MBK014 4649 Hungary, Nagykovolicsi MBK010 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK010 4672 Turkey, Erzican, Tercan Road MBK010 4672 Turkey, Kars, Ardahan Road MBK010 4627 Turkey, Kars, Ardahan Road MBK010 4627 Turkey, Kars, Ardahan Road MBK010 4627 Turkey, Mars, Ardahan Road MBK010 4520 Turkey, Mars, Ardahan Road MBK011 4357 Turkey, Hakkari, Başkale MBK012 4250 Turkey, Hakkari, Başkale MBK013 3379 Turkey, Hakkari, Başkale MBK03 12017 Turkey, Wan, Başkale, Hoşap MBK13 4557 Turkey, Wan, Başkale, Hoşap MBK13 1696 Turkey, Wan, Muradiye, Şelale MBK13 1531 Turkey, Wan, Muradiye, Şelale MBK13 1531 Turkey, Mars, Oğubayazıt, İshakpaşa MBK03 1531 Turkey, Mar, Muradiye, Selale MBK18 4482 Turkey, Mars, Raiz, Roğuran Road MBK05 4265 Turkey, Mars, Roğuran Road MBK06 4298 Turkey, Hatay, Harbiye MBK08 1459 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Goğubayazıt Road MBK080 4379 Turkey, Man, Hatkari Road MBK192 4549 Turkey, Wan, Hatkari Road MBK192 4549 Turkey, Man, Hatkari Road MBK192 4563 Turkey, Hatay, Harbiye	key, Artvin, Şavşat Road key, Hakkari, Başkale key, Hakkari, Esendere Road key, Diyarbakır, Malabadi ngary, Nagykovoicsi key, İğdır, Gaziler garia, Alibutosh key, Erzican, Tercan Road key, Erzican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Hrafskaya st. ssia, Vorovezk, Hrafskaya st. key, Hakkari, Başkale key, Hakkari, Başkale	16.vii.2010 22.v.2008 23.v.2008 26.v.2008 05.xi.2005 03.v.2005 19.vi.2009 13.mi.2010 16.ix.2009 16.ix.2009 16.ix.2009	41°10'322" 37°39'058" 38°09'335" 40°06'332" 40°47'718	041°58'542" 043°52'976" 044°32'040" 041°12'785" 043°29'423" 039°52'499"	Undetermined Euphorbia sp. Phragmites sp. Chrysopogon gryllus D-Vac	M.B. Kaydan M.B. Kaydan M.B. Kaydan M.B. Kaydan F. Kozár M.B.Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan M.B. Kaydan
MBK074 4242 Turkey, Hakkari, Başkale MBK074 4242 Turkey, Hakkari, Esendere Road MBK014 4649 Hungary, Nagykovoicsi MBK013 1402 Turkey, Baziler MBK010 4645 Bulgaria, Alibotosh MBK150 4789 Turkey, Baziler MBK150 4627 Turkey, Rars, Ardahan Road MBK049 4672 Turkey, Kars, Ardahan Road MBK089 4325 Turkey, Rars, Ardahan Road MBK089 4325 Turkey, Man, Gewas MBK089 4325 Turkey, Man, Gewas MBK075 4250 Turkey, Man, Gewas MBK075 4250 Turkey, Man, Gayler MBK075 4250 Turkey, Wan, Başkale, Hoşap MBK075 4250 Turkey, Wan, Başkale MBK075 4250 Turkey, Wan, Başkale MBK075 4250 Turkey, Wan, Başkale MBK075 4250 Turkey, Wan, Başkale MBK181 4257 Turkey, Wan, Başkale MBK173 Turkey, Wan, Muradiye, Şelale MBK173 4467 Turkey, Wan, Muradiye, Şelale MBK173 4467 Turkey, Man, Muradiye, Selale MBK173 Turkey, Man, Muradiye, Selale MBK173 Turkey, Man, Muradiye, Selale MBK184 4482 Turkey, Man, Muradiye, Selale MBK186 4265 Turkey, Harkari, Üzümcü MBK07 4265 Turkey, Harkari, Üzümcü MBK08 4298 Turkey, Haray, Harbiye MBK192 4549 Turkey, Gububayazıt Road MBK192 4549 Turkey, Wan, Harky Harbiye MBK199 4503 Turkey, Wan, Harky Harbiye	key, Hakkari, Başkale key, Hakkari, Esendere Road key, Diyarbakır, Malabadi ngary, Nagykovoicsi key, İğdır, Gaziler garia, Alibutosh key, Erican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Harahan Road key, Kars, Hafakarı Border key, Bitlis-Siirt Border sasia, Vorovezk, Hrafskaya st. key, Hakkari, Başkale key, Hakkari, Başkale	22.v.2008 23.v.2008 26.v.2008 05.xi.2005 03.v.2005 19.vi.2009 1316.vi.2009 16.ix.2009 16.ix.2009 16.ix.2009	37°39'058" 37°42'405" 38°09'335" 40°06'332" 39°35'506" 40°47'718	043°52'976" 044°32'040" 041°12'785" 043°29'423" 039°52'499"	Euphorhia sp. Phragmites sp. Chrysopogon gryllus D-Vac	M.B. Kaydan M.B. Kaydan M.B. Kaydan F. Kozár M.B.Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan
MBK074 4242 Turkey, Hakkari, Esendere Road MBK086 4326 (b) Turkey, Diyarbakr, Malabadi MBK014 4649 Hungany, Nagykovoicsi MBK010 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK150 4627 Turkey, Bax, Ardahan Road MBK107 4623 Turkey, Kars, Ardahan Road MBK107 4623 Turkey, Man, Gavas MBK049 4672 Turkey, Man, Gavas MBK040 4650 Turkey, Man, Gavas MBK075 4250 Turkey, Man, Bakale MBK075 4250 Turkey, Man, Bakale MBK130 4357 Turkey, Wan, Başkale, Hoşap MBK131 4557 Turkey, Wan, Başkale, Hoşap MBK132 2017 Turkey, Wan, Diable Road MBK133 10xfey, Wan, Diable Road MBK134 4467 Turkey, Man, Bulanta Road MBK157 4516 Turkey, Marxi, Diabuch MBK184 4482 Turkey, Marxi, Gurman MBK038 1531	key, Hakkari, Esendere Road key, Diyarbakır, Malabadi ngary, Nagykovoicsi key, İğdır, Gaziler garia, Alibotosh key, Ezican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Harakaya st. key, Bitlis-Siirt Border ssia, Vorovezk, Hrafskaya st. key, Hakkari, Başkale key, Hakkari, Başkale	23.v.2008 26.v.2008 05.xi.2005 03.v.2005 19.vi.2009 08.vii.2010 16.ix.2009 13 – 16.vi.2009 16.ix.2009	37°42'405" 38°09'335" 40°06'332" 39°35'506" 40°47'718	044°32'040" 041°12'785" 043°29'423" 039°52'499" 043°06'344	Phragmites sp. Chrysopogon gryllus D-Vac	M.B. Kaydan M.B. Kaydan F. Kozár M.B.Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan
MBK088 4326 (b) Turkey, Diyarbakr, Malabadi MBK014 4649 Hungany, Nagykovoicsi MBK010 4645 Bulgaria, Alibotosh MBK010 4645 Bulgaria, Alibotosh MBK150 4627 Turkey, Erzican, Tercan Road MBK107 4627 Turkey, Kars, Ardahan Road MBK108 4627 Turkey, Mar, Gevaş MBK089 4325 Turkey, Mar, Gevaş MBK089 4325 Turkey, Mar, Bakari, Border MBK075 4250 Turkey, Harkari, Başkale MBK075 4250 Turkey, Harkari, Başkale MBK18 4557 Turkey, Van, Başkale, Hoşap MBK18 4557 Turkey, Van, Başkale, Hoşap MBK13 2017 Turkey, Van, Başkale, Hoşap MBK13 1696 Turkey, Wan, Başkale, Hoşap MBK13 1531 Turkey, Mar, Bulantk Road MBK13 4467 Turkey, Mar, Rajuank Road MBK18 4565 Turkey, Mars, Rajuank Road MBK18 4286 Turkey, Haray, Harbinge	key, Diyarbakır, Malabadi ngary, Nagykovoicsi key, İğdır, Gaziler garia, Alibotosh key, Erican, Tercan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Ardahan Road key, Bitlis-Siir Border ssia, Vorovezk, Hrafskaya st. key, Hakkari, Başkale key, Hakkari, Başkale	26.v.2008 05.xi.2005 03.v.2005 19.vi.2009 08.vii.2010 16.ix.2009 13 – 16.vi.2003 16.ix.2009	38°09'335" 40°06'332" 39°35'506" 40°47'718	041°12'785" 043°29'423" 039°52'499" 043°06'344	Chrysopogon gryllus D-Vac	M.B. Kaydan F. Kozár M.B.Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan
MBK014 4649 Hungany, Nagykovoicsi MBK034 1402 Turkey, İğdır, Gaziler MBK010 4645 Bulgaria, Alibotosh MBK012 4728 Turkey, Erican, Tercan Road MBK150 4627 Turkey, Kars, Ardahan Road MBK049 4672 Turkey, Kars, Ardahan Road MBK040 4623 Turkey, Mar, Gevaş MBK043 4666 Hussia, Vorovezk, Hrafskaya st. MBK043 4666 Hussia, Vorovezk, Hrafskaya st. MBK075 4250 Turkey, Barkari, Barkari MBK075 4250 Turkey, Harkari, Barkari MBK18 4557 Turkey, Van, Başkale, Hoşap MBK18 4557 Turkey, Van, Başkale, Hoşap MBK133 2017 Turkey, Van, Dajb Road MBK134 4557 Turkey, Wan, Dajb Road MBK135 1531 Turkey, Marai, Quimcra MBK184 4467 Turkey, Marai, Quimcra MBK185 4516 Turkey, Mars, Kajzman Road MBK058 4265 Turkey, Haray, Harbiye	ngary, Nagykovoicsi key, İğdır, Gaziler garia, Alibotosh key, Erzican, Tercan Road key, Kars, Ardahan Road ssia, Vorovezk, Plunogne key, Kars, Ardahan Road key, Kars, Ardahan Road key, Kars, Hardaya Sasa, Vorovezk, Harskaya St. key, Bitlis-Siirt Border ssia, Vorovezk, Harskaya St. key, Hakkari, Başkale key, Hakkari, Başkale	05.xi. 2005 03.v.2005 19.vi. 2009 08.vii. 2010 16.ix. 2009 13 – 16.vi. 2003 16.ix. 2009 09.vi. 2009	40°06'332" 39°35'506" 40°47'718	043°29'423" 039°52'499" 043°06'344	D-Vac	F. Kozár M.B.Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan
MBK034 1402 Turkey, İğdır, Gaziler MBK010 4645 Bulgaria, Alibotosh MBK150 4627 Turkey, Kars, Ardahan Road MBK150 4627 Turkey, Kars, Ardahan Road MBK049 4672 Turkey, Kars, Ardahan Road MBK107 4623 Turkey, Rars, Ardahan Road MBK108 4325 Turkey, Britis-Siirt Border MBK030 4325 Turkey, Britis-Siirt Border MBK031 4250 Turkey, Harkari, Başkale MBK032 3798 Turkey, Wan, Bahçesaray MBK118 4557 Turkey, Wan, Bahçesaray MBK132 3379 Turkey, Wan, Bakyale, Hoşap MBK138 4557 Turkey, Wan, Muradiye, Şelale MBK138 1696 Turkey, Wan, Dajal Road MBK133 1696 Turkey, Wan, Dajal Road MBK134 4467 Turkey, Wan, Muradiye, Şelale MBK137 4467 Turkey, Wan, Bulanik Road MBK184 4482 Turkey, Harkari, Üzümcü MBK058 4265 Turkey, Harkari, Üzümcü </td <td>key, İğdır, Gaziler İgaria, Alibotosh key, Erzican, Tercan Road key, Kars, Ardahan Road ssia, Vorovezk, Plunogne key, Kars, Ardahan Road key, Van, Gevaş key, Bitlis-Siirt Border ssia, Vorovezk, Harfskaya st. key, Hakkari, Başkale</td> <td>03.v.2005 19.vi.2009 08.vii.2010 16.ix.2009 13 – 16.vi.2003 16.ix.2009 09.vi.2009</td> <td>40°06'332" 39°35'506" 40°47'718</td> <td>043°29'423" 039°52'499" 043°06'344</td> <td>Undo+orminad</td> <td>M.B.Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan</td>	key, İğdır, Gaziler İgaria, Alibotosh key, Erzican, Tercan Road key, Kars, Ardahan Road ssia, Vorovezk, Plunogne key, Kars, Ardahan Road key, Van, Gevaş key, Bitlis-Siirt Border ssia, Vorovezk, Harfskaya st. key, Hakkari, Başkale	03.v.2005 19.vi.2009 08.vii.2010 16.ix.2009 13 – 16.vi.2003 16.ix.2009 09.vi.2009	40°06'332" 39°35'506" 40°47'718	043°29'423" 039°52'499" 043°06'344	Undo+orminad	M.B.Kaydan I. Gavrilov M.B. Kaydan M.B. Kaydan
MBK010 4645 Bulgaria, Alibotosh MBK286 4789 Turkey, Erican, Tercan Road MBK150 4627 Turkey, Kars, Ardahan Road MBK049 4672 Russia, Vorovezk, Plunogrie MBK107 4623 Turkey, Kars, Ardahan Road MBK205 4530 Turkey, Britis-Siir Border MBK073 4250 Turkey, Britis-Siir Border MBK075 4250 Turkey, Harkari, Başkale MBK101 4357 Turkey, Wan, Bahçesaray MBK118 4557 Turkey, Wan, Bahçesaray MBK118 4557 Turkey, Wan, Bakyale, Hoşap MBK118 4557 Turkey, Wan, Bakyale, Hoşap MBK135 1696 Turkey, Wan, Muradiye, Şelale MBK138 1696 Turkey, Wan, Muradiye, Şelale MBK139 1531 Turkey, Wan, Muradiye, Şelale MBK137 4467 Turkey, Wan, Muradiye, Şelale MBK138 1531 Turkey, Wan, Muradiye, Şelale MBK184 4482 Turkey, Mars, Kağızman Road MBK058 4265 Turkey, Ha	Igaria, Alibotosh key, Erzican, Tercan Road key, Kars, Ardahan Road ssia, Vorovezk, Plunogne key, Kars, Ardahan Road key, Kars, Ardahan Road key, Bitlis-Siirt Border ssia, Vorovezk, Harfskaya st. key, Hakkari, Başkale key, Hakkari, Başkale	19.vi.2009 08.vii.2010 16.ix.2009 13 – 16.vi.2003 16.ix.2009 09.vi.2009	39°35′506″ 40°47′718	039°52′499″	Olluelellilliau	I. Gavrilov M.B. Kaydan M.B. Kaydan
MBK/136 4789 Turkey, Kars, Ardahan Road MBK/150 4627 Turkey, Kars, Ardahan Road MBK/107 4623 Turkey, Kars, Ardahan Road MBK/107 4520 Turkey, Kars, Ardahan Road MBK/205 4530 Turkey, Bay Bulis-Sint Border MBK/208 4325 Turkey, Bay Bulis-Sint Border MBK/103 4250 Turkey, Hakkari, Başkale MBK/210 4250 Turkey, Hakkari, Başkale MBK/21 4357 Turkey, Wan, Başkale, Hoşap MBK/11 4357 Turkey, Wan, Markari, Başkale MBK/13 4557 Turkey, Wan, Maradiye, Şelale MBK/13 4467 Turkey, Wan, Muradiye, Şelale MBK/13 4467 Turkey, Wan, Muradiye, Şelale MBK/13 4467 Turkey, Wan, Muradiye, Şelale MBK/13 1531 Turkey, Wan, Muradiye, Selale MBK/13 4467 Turkey, Wan, Massan, Üzümcü MBK/13 4467 Turkey, Hakkari, Üzümcü MBK/184 4265 Turkey, Haray, Harbiye MBK/068 4296	key, Erzican, Tercan Road key, Kars, Ardahan Road ssia, Vorovezk, Plunogrie key, Kars, Ardahan Road key, Kars, Ardahan Road key, Britis-Siirt Border ssia, Vorovezk, Harfskaya st. key, Hakkari, Başkale key, Hakkari, Başkale	08.vii.2010 16.ix.2009 13—16.vi.2003 16.ix.2009 09.vi.2009	39°35′506″ 40°47′718	039°52'499"	Rosa sp.	M.B. Kaydan M.B. Kaydan
MBK150 4627 Turkey, Kars, Ardahan Road MBK049 4672 Russia, Vorovezk, Plunogrie MBK107 4623 Turkey, Kars, Ardahan Road MBK205 4530 Turkey, Van, Gevaş MBK089 4325 Turkey, Britis-Siirt Border MBK075 4250 Turkey, Britis-Siirt Border MBK075 4250 Turkey, Hakkari, Başkale MBK101 4357 Turkey, Wan, Başkale, Hoşap MBK130 4357 Turkey, Wan, Hakkari, Gaziler MBK131 4557 Turkey, Wan, Maradiye, Şelale MBK132 4467 Turkey, Wan, Muradiye, Şelale MBK133 4467 Turkey, Wan, Muradiye, Şelale MBK133 456 Turkey, Wan, Muradiye, Şelale MBK134 4467 Turkey, Wan, Muradiye, Selale MBK135 4516 Turkey, Kars, Kağızman Road MBK184 4482 Turkey, Kars, Kağızman Road MBK058 4265 Turkey, Hatay, Harbiye MBK068 4298 Turkey, Hatay, Harbiye MBK080 4299 Turkey, Ga	key, Kars, Ardahan Road ssia, Vorovezk, Plunogrie key, Kars, Ardahan Road key, Van, Gevaş key, Bitlis-Siirt Border ssia, Vorovezk, Hrafskaya st. key, Hakkari, Başkale	16.ix.2009 13—16.vi.2003 16.ix.2009 09.vi.2009	40°47′718	043°06′344	Quercus sp.	M.B. Kaydan
MBK049 4672 Russia, Vorovezk, Plunogrie MBK107 4623 Turkey, Kars, Ardahan Road MBK205 4530 Turkey, Rar, Ardahan Road MBK089 4325 Turkey, Britis-Siirt Border MBK073 4656 Russia, Vorovezk, Hrafskaya st. MBK075 4250 Turkey, Hakkari, Başkale MBK101 4357 Turkey, Wan, Bahesaray MBK132 4357 Turkey, Wan, Başkale, Hoşap MBK139 2017 Turkey, Wan, Makkari, Boad MBK239 2017 Turkey, Wan, Muradiye, Şelale MBK133 4467 Turkey, Wan, Muradiye, Şelale MBK134 4467 Turkey, Wan, Muradiye, Şelale MBK135 4516 Turkey, Kars, Kağızman Road MBK157 4516 Turkey, Kars, Kağızman Road MBK058 4265 Turkey, Haray, Harbiye MBK068 4206 Turkey, Haray, Harbiye MBK069 4298 Turkey, Haray, Harbiye MBK080 4299 Turkey, Gard, Doğubayazıt Road MBK080 4379 Turkey, Wan	ssia, Vorovezk, Plunogrie key, Kars, Ardahan Road key, Van, Gevaş key, Bitlis-Siirt Border ssia, Vorovezk, Hrafskaya st. key, Hakkari, Başkale	13 – 16.vi.2003 16.ix.2009 09.vi.2009			Thymus sp.	- F / 1
MBK107 4623 Turkey, Kars, Ardahan Road MBK205 4530 Turkey, Van, Gevaş MBK089 4325 Turkey, Bitlis-Siirt Border MBK043 4666 Russia, Vorovezk, Hrafskaya st. MBK075 4250 Turkey, Hakkari, Başkale MBK101 4357 Turkey, Van, Baheesaray MBK132 3379 Turkey, Wan, Hakkari, Baziler MBK138 4557 Turkey, Van, Hakkari Road MBK239 2017 Turkey, Van, Muradiye, Şelale MBK133 4467 Turkey, Wan, Muradiye, Şelale MBK135 4467 Turkey, Wan, Muradiye, Şelale MBK137 4467 Turkey, Wan, Muradiye, Şelale MBK157 4467 Turkey, Kars, Kağızman Road MBK184 4482 Turkey, Harkari, Üzümcü MBK058 4265 Turkey, Harkari, Üzümcü MBK068 4298 Turkey, Haray, Harbiye MBK069 4298 Turkey, Harbiy, Harbiye MBK080 4379 Turkey, Wan, Hakkari Road MBK080 4379 Turkey, Wan, Hakkari	key, Kars, Ardahan Road key, Van, Gevaş key, Bitlis-Siirt Border ssia, Vorovezk, Hrafskaya st. key, Hakkari, Başkale	16.ix.2009 09.vi.2009			Undetermined	M.B. Kaydan
MBK055 4530 Turkey, Van, Gevaş MBK089 4325 Turkey, Bitlis Siirt Border MBK043 4666 Russia, Vorovezk, Hrafskaya st. MBK075 4250 Turkey, Hakkari, Başkale MBK130 3798 Turkey, Man, Bahçesaray MBK101 4357 Turkey, Man, Başkale, Hoşap MBK132 3379 Turkey, Wan, Başkale, Hoşap MBK239 1017 Turkey, Van, Hakkari Road MBK239 1017 Turkey, Van, Muradiye, Şelale MBK133 4467 Turkey, Wan, Ozalp Road MBK134 4467 Turkey, Wan, Maskari, Çukurca MBK187 4516 Turkey, Hakkari, Çukurca MBK184 4482 Turkey, Harkari, Üzümcü MBK058 4265 Turkey, Harkari, Üzümcü MBK068 4298 Turkey, Harby, Harbiye MBK069 4298 Turkey, Bazığ, Doğubayazıt Road MBK080 4379 Turkey, Gar, Bayay, Harbiye MBK199 4503 Turkey, Wan, Hakkari Road	key, Van, Gevaş key, Bitlis-Siirt Border sısıa, Vorovezk, Hrafskaya st. key, Hakkari, Başkale kev Van Bahresarav	09.vi.2009	41°04′320′′	041°50′112″	Poaceae	M.B. Kaydan
MBK089 4325 Turkey, Bitlis-Siirt Border MBK043 4666 Russia, Vorovezk, Hrafskaya st. MBK075 4250 Turkey, Hakkari, Başkale MBK230 3798 Turkey, Bahçesaray MBK101 4357 Turkey, Bah, Başkale, Hoşap MBK132 4357 Turkey, Bah, Başkale, Hoşap MBK139 4577 Turkey, Wan, Makari Road MBK133 4657 Turkey, Wan, Muradiye, Şelale MBK173 4467 Turkey, Wan, Muradiye, Şelale MBK173 4467 Turkey, Hakkari, Çukurca MBK184 4487 Turkey, Hakkari, Üzümcü MBK185 4265 Turkey, Harkari, Üzümcü MBK058 4265 Turkey, Harkari, Üzümcü MBK068 4298 Turkey, Harby, Harbiye MBK080 4298 Turkey, Blaziğ, Doğubayazıt Road MBK080 4379 Turkey, Blaziğ, Doğubayazıt Road MBK199 4503 Turkey, Wan, Hakkari Road	key, Bitlis-Siirt Border ssia, Vorovezk, Hrafskaya st. key, Hakkari, Başkale key Van Bahnesaray		38°16′663″	043°03′898″	Poaceae	M.B. Kaydan
MBK043 4666 Russia, Vorovezk, Hrafskaya st. MBK075 4250 Turkey, Hakkari, Başkale MBK230 3798 Turkey, Van, Bahçesaray MBK101 4357 Turkey, Van, Başkale, Hoşap MBK132 3379 Turkey, Van, Başkale, Hoşap MBK133 457 Turkey, Van, Başkale, Hoşap MBK235 1017 Turkey, Van, Muradiye, Şelale MBK133 4667 Turkey, Yan, Muradiye, Şelale MBK184 4467 Turkey, Hakkari, Çukurca MBK185 4516 Turkey, Hakkari, Üzümcü MBK184 4482 Turkey, Harkari, Üzümcü MBK058 4265 Turkey, Harkari, Üzümcü MBK068 4296 Turkey, Haray, Harbiye MBK068 4298 Turkey, Haray, Harbiye MBK080 4379 Turkey, Jazy, Harbiye MBK080 4379 Turkey, Van, Harkari Road MBK199 4503 Turkey, Van, Harkari Road	ssia, Vorovezk, Hrafskaya st. Key, Hakkari, Başkale kev Van Rahnesarav	26.v.2008	38°11′772′′	041°49′067″	Cynodon dactylon	M.B. Kaydan
MBK075 4250 Turkey, Hakkari, Başkale MBK230 3798 Turkey, Van, Bahçesaray MBK101 4357 Turkey, Jan, Başkale, Hoşap MBK18 4557 Turkey, Aan, Başkale, Hoşap MBK139 12017 Turkey, Van, Başkale, Hoşap MBK239 12017 Turkey, Van, Dağla Boad MBK133 4467 Turkey, Van, Muradiye, Şalale MBK173 4467 Turkey, Hakkari, Çukurca MBK183 4516 Turkey, Hakkari, Çukurca MBK184 4482 Turkey, Hakkari, Üzümcü MBK058 4265 Turkey, Hakkari, Üzümcü MBK068 4298 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Glazığ, Doğubayazıt Road MBK199 4503 Turkey, Van, Hakkari Road	key, Hakkari, Başkale key Van Bahcesaray	29.v.2004			Poaceae	M.B. Kaydan
MBK230 3798 Turkey, Van, Bahçesaray MBK101 4357 Turkey, İğdır, Tuzluca, Gaziler MBK232 3379 Turkey, Van, Başkale, Hoşap MBK138 4557 Turkey, Van, Başkale, Hoşap MBK239 2017 Turkey, Van, Dağıb Road MBK235 1696 Turkey, Van, Muradiye, Şelale MBK173 4467 Turkey, Man, Doğubeyazı, İshakpaşa MBK183 4516 Turkey, Hakkari, Çukurca MBK184 4482 Turkey, Hakkari, Üzümcü MBK058 4265 Turkey, Hakkari, Üzümcü MBK068 4298 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Elaziğ, Doğubayazıt Road MBK199 4503 Turkey, Van, Hakkari Road	kev Van Bahcesarav	23.v.2008	37°55'816"	044°04′631″	Poaceae	M.B. Kaydan
MBK101 4357 Turkey, Iğdır, Tuzluca, Gaziler MBK232 3379 Turkey, Van, Başkale, Hoşap MBK118 4557 Turkey, Van, Hakkari Road MBK239 2017 Turkey, Van, Özalp Road MBK135 1696 Turkey, An, Muradiye, Şelale MBK173 4467 Turkey, An, Doğubeyazı, İshakpaşa MBK187 4516 Turkey, Hakkari, Çukurca MBK187 4482 Turkey, Hakkari, Üzümcü MBK058 4265 Turkey, Hakkari, Üzümcü MBK068 4296 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Elaziğ, Doğubayazıt Road MBK199 4503 Turkey, Van, Hakkari Road	in in deal of the color of the	25.vi.2007	38°08′765′′	042°51′506″	Poaceae	M.B. Kaydan
MBK132 3379 Turkey, Van, Başkale, Hoşap MBK118 4557 Turkey, Van, Hakkari Road MBK239 2017 Turkey, Van, Özalp Road MBK135 1696 Turkey, Van, Muadiye, Şelale MBK173 4467 Turkey, Ağrı, Döğubeyazı, İshakpaşa MBK173 4516 Turkey, Ağrı, Döğubeyazı, İshakpaşa MBK157 4516 Turkey, Hakari, Çukurca MBK184 4265 Turkey, Hakari, Üzüncü MBK058 4265 Turkey, Hakari, Üzüncü MBK068 4298 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Elaziğ, Döğubayazıt Road MBK199 4503 Turkey, Jarkari Road MBK199 4503 Turkey, Jarkari Road	key, Iğdır, Tuzluca, Gaziler	29.v.2008	40°06′218″	043°27′952″	Undetermined	M.B. Kaydan
MBK118 4557 Turkey, Van, Dalp Road MBK239 2017 Turkey, Van, Ozalp Road MBK235 1696 Turkey, Van, Muradiye, Şelale MBK173 4467 Turkey, Ağrı, Doğubeyazıt, Ishakpaşa MBK178 4516 Turkey, Hakkari, Çukurca MBK157 4516 Turkey, Hakkari, Çukurca MBK184 4482 Turkey, Kars, Kağızman Road MBK058 4265 Turkey, Hakkari, Üzümcü MBK07 4642 Bulgaria, W. Rhodopes MBK08 4298 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Elaziğ, Doğubayazıt Road MBK199 4503 Turkey, Jar, Boğubayazıt Road MBK199 4503 Turkey, Van, Hakkari Road	key, Van, Başkale, Hoşap	25.v.2007	38°15′268″	043°52′669″	Brassicaceae	M.B. Kaydan
NBK239 2017 Turkey, Van, Özalp Road NBK235 1696 Turkey, Van, Muradiye, Şelale NBK173 4467 Turkey, Ağrı, Doğubeyazıt, İshakpaşa NBK188 1531 Turkey, Hakkari, Çukurca NBK157 4516 Turkey, Muş, Bulanık Road NBK184 4482 Turkey, Kars, Kağızman Road NBK058 4265 Turkey, Hakkari, Üzümcü MBK07 4642 Bulgaria, W. Rhodopes MBK068 4298 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Elaziğ, Doğubayazıt Road MBK199 4503 Turkey, Van, Hakkari Road	key, Van, Hakkari Road	02.ix.2009	37°41'157"	043°57′433″	Phragmites communis	M.B. Kaydan
MBK135 1696 Turkey, Van, Muradiye, Şelale MBK173 4467 Turkey, Ağrı, Döğubeyazıt, İshakpaşa 1467 Turkey, Ağrı, Döğubeyazıt, İshakpaşa 1531 Turkey, Hakkari, Çukurca 140) MBK157 4516 Turkey, Muş, Bulanık Road 140) MBK184 4482 Turkey, Kars, Kağızman Road 140) MBK058 4265 Turkey, Hakkari, Üzümcü 1400 MBK007 4642 Bulgaria, W. Rhodopes 1400 MBK068 4298 Turkey, Hatay, Harbiye 1410 MBK192 4549 Turkey, Hatay, Harbiye 1410 MBK199 4503 Turkey, İgdır, Döğubayazıt Road 1410 MBK199 4503 Turkey, Van, Hakkari Road	key, Van, Özalp Road	05.vii.2005	38°39′522′′	043°57′287″	Bromus sp.	M.B. Kaydan
NBK173 4467 Turkey, Ağrı, Doğubeyazıt, İshakpaşa nko) MBK038 1531 Turkey, Hakkari, Çukurca nko) MBK157 4516 Turkey, Muş, Bulanık Road nko) MBK184 4482 Turkey, Kars, Kağızman Road NBK058 4265 Turkey, Hakkari, Üzümcü MBK07 4642 Bulgaria, W. Rhodopes MBK068 4298 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Elaziğ, Doğubayazıt Road MBK199 4503 Turkey, Jan, Hakkari Road	key, Van, Muradiye, Şelale	08.vi.2005	39°03′388″	043°45′453″	Poa bulbosa, Taraxanum sp.	M.B. Kaydan
rko) MBK038 1531 Turkey, Hakkari, Çukurca nko) MBK157 4516 Turkey, Muş, Bulanık Road nko) MBK184 4482 Turkey, Kars, Kağızman Road NBK058 4265 Turkey, Hakkari, Üzümcü MBK007 4642 Bulgaria, W. Rhodopes MBK068 4298 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Elaziğ, Doğukent Us) MBK080 4379 Turkey, İgdır, Doğubayazıt Road MBK199 4503 Turkey, Van, Hakkari Road	key, Ağrı, Doğubeyazıt, İshakpaşa	03.vi.2009	39°31'905"	044°07′100″	Cynodon dactylon	M.B. Kaydan
nko) MBK157 4516 Turkey, Muş, Bulanık Road nko) MBK184 4482 Turkey, Kars, Kağızman Road NBK058 4265 Turkey, Hakkari, Üzümcü MBK007 4642 Bulgaria, W. Rhodopes MBK068 4298 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Elaziğ, Doğukent Us) MBK080 4379 Turkey, İgdır, Doğubayazıt Road MBK199 4503 Turkey, Van, Hakkari Road	key, Hakkari, Çukurca	17.v.2005	37°14′836″	043°36′646″	Mentha sp.	M.B. Kaydan
nko) MBK184 4482 Turkey, Kars, Kağızman Road MBK058 4265 Turkey, Hakkari, Üzümcü MBK007 4642 Bulgaria, W. Rhodopes MBK068 4298 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Elaziğ, Doğukent Us) MBK080 4379 Turkey, İgdır, Doğubayazıt Road MBK199 4503 Turkey, Yan, Hakkari Road	key, Muş, Bulanık Road	10.vi.2009	38°52′220″	041°56′557″	Undetermined	M.B. Kaydan
MBK058 4265 Turkey, Hakkari, Üzümcü MBK007 4642 Bulgaria, W. Rhodopes MBK068 4298 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Elaziğ, Doğukent us) MBK080 4379 Turkey, İğdır, Doğubayazıt Road MBK199 4503 Turkey, Yan, Hakkari Road	key, Kars, Kağızman Road	04.vi.2009	40°12′011″	043°02′827″	Convolvulus arvensis	M.B. Kaydan
MBK007 4642 Bulgaria, W. Rhodopes MBK068 4298 Turkey, Hatay, Harbiye MBK192 4549 Turkey, Elaziğ, Doğukent us) MBK080 4379 Turkey, İğdır, Doğubayazıt Road MBK199 4503 Turkey, Van, Hakkari Road	key, Hakkari, Üzümcü	22.v.2008	37°29'899"	043°35′368″	Papaver rhoas	M.B. Kaydan
Iranicus (Kiritshenko) MBK068 4298 Turkey, Harbiye MBK192 4549 Turkey, Elazig, Doğukent nduliferus (Borchsenius) MBK080 4379 Turkey, İğdır, Doğubayazıt Road suir Kaydan MBK199 4503 Turkey, Van, Hakkari Road	garia, W. Rhodopes				Apiaceae	I. Gavrilov
MBK192 4549 Turkey, Elazig, Doğukent nduliferus (Borchsenius) MBK080 4379 Turkey, İğdır, Doğubayazıt Road scui Kaydan MBK199 4503 Turkey, Van, Hakkari Road	key, Hatay, Harbiye	27.v.2008	36°07′859′′	036°08′653″	<i>Papaver</i> sp.	M.B. Kaydan
MBK199 4503 Turkey, lğdır, Doğubayazıt Road MBK199 4503 Turkey, Van, Hakkari Road	key, Elazığ, Doğukent	08.vi.2009			Cornus sp.	M.B. Kaydan
MBK199 4503 Turkey, Van, Hakkari Road	key, Iğdır, Doğubayazıt Road	29.v.2008	39°47'487"	044°08′630″	Euphorbia seguieriana	M.B. Kaydan
	key, Van, Hakkari Road	06.vi.2009	38°22′248″	043°35′176″	Euphorbia seguieriana	M.B. Kaydan
	Turkey, Ani Kars Road	14.vii.2010	40°34'302"	043°30′520″	<i>Euphorbia</i> sp.	M.B. Kaydan
ale Road	key, Hakkari, Başkale Road	02.ix.2009	37°58′790′′	044°04′775″	Euphorbia sequiriana	M.B. Kaydan
senius MBK131 4556 Turkey, Hakkari, Çukurca yolu	key, Hakkari, Çukurca yolu	01.ix.2009	37°29'902"	043°34′230″	Cynodon dactylon	M.B. Kaydan
MBK027 4662 Hungary, Budapest	ngary, Budapest	11.v.2005			Fraxinus excelsior	F. Kozár
Phenacoccus alibotush Gavrilov MBK017 4652 Bulgaria, Alibotosh	garia, Alibotosh	19.vi.2009			Trifolium sp.	I. Gavrilov

Table 1 continued.

Conceptences MRR174 44531 Turkey, Van Ceases 60 kt 2009 20	Phenacoccus chatakicus Kaydan & Kozár	MBK241	3903	Turkey, Van, Çatak-Narlı	03.vii.2007	37°55′258″	042°59′138″	Undetermined	M.B. Kaydan
woole MBKTGS 4559 Turkey, fan, Arlaham Road 60 a. 2009 37/11/22/F 10.06/15/26/F feel MBKTG 4659 Turkey, fan, Arlaham Road 0.0 a. 2009 47/14/22/F 10.06/25/26/F feel MBKTG 4659 Turkey, fan, Arlaham Road 0.0 a. 2009 47/14/22/F 0.0 a. 2009 47/14/22/F 0.0 a. 2009 47/14/22/F 0.0 a. 2009 0.	Phenacoccus emansor Williams & Kozárzhevskaya	MBK174	4531	Turkey, Van, Gevaş	09.vi.2009	38°16′663″	043°03′898″	Bifora radians	M.B. Kaydan
MBKG10 MBKG10 4,619 Turkey, Strike Inchesion Read 16 h, 2009 4119/1207 0415/2017 1016/	Phenacoccus evelinae (Tereznikova)	MBK155	4590	Turkey, Hatay, Erzin	08.ix.2009	37°01′224″	036.09'561"	Sorghum halepense + Cynodon dactylon	M.B. Kaydan
Hole) MBKTQ5 45457 Turkey, Blits Riner DRAW 2009 37:270 897 06/270 987 nonv MBKTQ5 4550 Turkey, Blits Riner 27 iv 2009 3677 869 06/270 869 nonv MBKTQ5 4330 Turkey, Blits Riner 27 iv 2009 3677 869 06/270 869 Returnelo MBKTQ5 4320 Turkey, Blits Riner 28 iv 2009 06/270 869 06/270 869 Returnelo MBKTQ6 4258 Turkey, Blits, Rajaman 28 iv 2009 06/270 869 06/270 869 NBSCQ1 4278 Turkey, Blits, Markey, More Good, Arctic Riner 18 iv 2009 40/270 17 06/270 869 06/270 869 NBSCQ2 4478 Turkey, Blits, Markey, Markey, Markey 18 iv 2009 40/270 17 06/270 869 06/270 869 NBSCQ3 4475 Turkey, Blits, Markey, Markey, Markey 18 iv 2009 40/270 17 06/270 867 06/270 867 06/270 867 06/270 867 06/270 867 06/270 867 06/270 867 06/270 867 06/270 867 06/270 867 06/270 867 06/270 867 06/270 867	Phenacoccus hordei (Lindeman)	MBK134	4619	Turkey, Kars, Ardahan Road	16.ix.2009	41°04′320″	041°50′112″	Thymus sp.	M.B. Kaydan
MRKEND M	Phenacoccus incertus (Kiritshenko)	MBK120	4567	Turkey, Van, Hakkari Road	02.ix.2009	.,190,68,18	043°52′992″	Cynodon dactylon	M.B. Kaydan
MRKINGS 4300 Lukey, Legamen A 20, 2008 360, 120, 120, 120, 120, 120, 120, 120, 12	Phenacoccus kareliniae Borchsenius	MBK210	4534	Turkey, Bitlis River	09.vi.2009	38°20′899′′	042°01′898″	Avena sterilis	M.B. Kaydan
Kintchenko) MRKIB64 458.03 Turkey, Bas, Sagarman D4 vi. 2009 40°F0°F18 427.7927 Brains) MBKC03 3503 Turkey, Bas, Casaler 28,42008 40°F0°F18 04°F0°F18 Brains) MBKC03 4285 Turkey, Han, Geos, Arras 27,42008 36°F159 04°F0°F18 Brains) MBKC03 4283 Turkey, Han, Geos, Arras 23,42008 36°F159 04°F0°F18 Brains MBKC03 4283 Turkey, Laken, Kagaman Road 12,42008 36°F159 04°F0°F18 Brains MBKC03 426 Turkey, Laken, Kagaman Road 12,42008 37°40.98F7 04°F0°F18 Brains MBKC03 426 Turkey, Laken, Kagaman Road 12,400.98F7 426 17,400.97F7 04°F0°F18 Brains MBKC18 458.7 Turkey, Laken, Kagaman Road 12,400.98F7 04°F0°F18 04°F0°F18 Brains MBKC18 488.7 Turkey, Laken, Kagaman Road 17,400.98 47°F0°F18 04°F0°F18 Brains MBKC18 488.7 Turkey,	Phenacoccus nurmamatovi Bazarov	MBK055	4300	Turkey, Hatay, Harbiye	27.vi.2008	36°07′859′′	.036°08′653″	Avena fatua	M.B. Kaydan
(b) MB0038 43.50 Turkey, Mon, Liutua, Gaeller 29 v.2008 36707 8527 (0.5009 4217 Senius MB0030 42.96 Turkey, Mon, Geag, Arton 27 v.2008 38 For 1789 0.0009 6537 MB0030 42.98 Turkey, Habby, Habby Anney Arton 20 v.2008 37 v.2008 38 For 1789 0.000 650 650 MB0030 44.72 Turkey, Habby, Habby MB003 42.72 Turkey, Habby, Habby 10 v.2008 37 v.2008 37 v.2008 37 v.2008 37 v.2008 40 v.000 650 750 40 v.000 650 40 v.000 650 750 40 v.000 650 40 v.000 650 750 40 v.000 650 40 v.000 650 750 40 v.000 650 40 v.000 650 750 40 v.000 650 40 v.000 650 750 40 v.000 650	Phenacoccus phenacoccoides (Kiritchenko)	MBK164	4483	Turkey, Kars, Kağızman	04.vi.2009	40°12′011′′	043°02′827″	Poaceae	M.B. Kaydan
MBCO39 Turkey, Man. Georg, Artos Gr. v. 2007 381 F195 G47/09/295 MBCO30 4783 Turkey, Hath Jehthyje 23 v. 2008 37 4/108 37 4/108 MBCO35 4783 Turkey, Hathy Hathyje 23 v. 2008 37 4/108 1047/3379 MBCO39 4478 Turkey, Hathy, Hathyje Hathyje 23 v. 2008 37 4/108 1047/3379 mins MBRCO39 4556 Turkey, Hathy, Enin 104 v. 2008 47 4/109 1047/3379 richablejii MBRCO39 4565 Turkey, Hathy, Enin 104 v. 2008 47 4/109 1047/3379 MBRCO3 478 Turkey, Hathy, Enin 104 v. 2009 47 4/109 47 4/109 MBRCO3 478 Turkey, Hathy, Enin 104 v. 2008 47 4/109 47 4/109 MBRCO3 478 Turkey, Marky, Enin 104 v. 2008 47 4/109 47 4/109 MBRCO3 478 Turkey, Artini, Saya Road 107 x. 2009 47 1/107 47 4/109 MBRCO3 478 Turkey, Artini, Hang 10 x. 2009 47 1/107 <td< td=""><td>Phenacoccus pumilus Kiritshenko</td><td>MBK098</td><td>4350</td><td>Turkey, Iğdır, Tuzluca, Gaziler</td><td>29.v.2008</td><td>40°06′218′′</td><td>043°27'952"</td><td>Undetermined</td><td>M.B. Kaydan</td></td<>	Phenacoccus pumilus Kiritshenko	MBK098	4350	Turkey, Iğdır, Tuzluca, Gaziler	29.v.2008	40°06′218′′	043°27'952"	Undetermined	M.B. Kaydan
MBK060 4296 Turkey, Haby, Hathley 27.0,2008 38°10'0881* 04°10'087 one MBK035 4283 Turkey, Habkar, Vibsekroa, Oraç Rad 23.0,2008 41°10'917* 04°10'3376* one MBK035 438 Turkey, Arkin 1 04 100 41°10'917* 04°10'918* 06°10'91	Phenacoccus querculus (Borchsenius)	MBK233	3503	Turkey, Van, Gevaş, Artos	05.vi.2007	38°16′159′′	043°08′421″	.dnercus sp.	M.B. Kaydan
MBK0RP 4283 Turkey, Hakkar, Viksekova, Oraç Road 23 x 2008 37*408176* 471917* 041*20764* noa MBK200 44718 Turkey, Arks, kâgman Road 16 xi 2008 40*161917* 041*20764* nobas MBK200 43.6 Turkey, Hake, Kats, kâgman Road 40*47089 40*16317* 041*20764* richesius MBK0079 43.6 Turkey, Hake, Kats, kâgman Road 40*60218* 04*06718* 04*076718* nabboliji MBK167 4456 Turkey, Kats, kâgman Road 10*8 x5008 40*06718* 04*07115* na MBK167 4456 Turkey, Hatey, Samandağ 10*8 x5009 37*11045* 04*07115* na MBK167 4552 Turkey, Hatey, Samandağ 10*0.00 37*11045* 03*07*13* na MBK167 4552 Turkey, Hatey, Samandağ 10*0.00 37*11045* 03*07*13* na MBK167 4755 Turkey, Hatey, Samandağ 10*0.00 37*11045* 03*07*13* na MBK148 4867 Turkey, Athrin, Sayaşı Road	Phenacoccus sp.	MBK060	4296	Turkey, Hatay, Harbiye	27.v.2008	36°07′859″	036°08′653″	Poaceae	M.B. Kaydan
MBX295 4918 Turkey Artin Turkey Artin Turkey Artin Turkey Artin Turkey Artin A1*200 41*2091 O4*2098 A1*2057 A1*2075 A1*	Phenacoccus sp.	MBK062	4283	Turkey, Hakkari, Yüksekova, Ortaç Road	23.v.2008	37°40′881′′	044°03′376″	Poaceae	M.B. Kaydan
ope MBK200 4472 Turkey, Kars, Kagbranan Boad 04 v. 2009 40°16'55F* 04°2755F* Ankbord 4246 Turkey, Hakkari, Yüksekorle Road 23 v.2008 37°40'018 04°375989 Ankoloji MBK160 4456 Turkey, Hakkari, Mishanan 18) k.2008 40°10'08'10" 043°07'115* Adable Turkey, Hakina Kagman 18) k.2008 37°40'398* 043°07'115* Ambrido MBK173 4555 Turkey, Hatina Samanda 08 k.2009 37°40'398* 03°70'115* Ambrido MBK218 460'2 Turkey, Hatina Samanda 07 k.2009 41°10'80' 03°70'115* Ambrido MBK218 460'2 Turkey, Hatina Samanda 17 k.2009 41°10'80' 03°70'116* Ambrido MBK218 460'2 Turkey, Hatina Samanda 17 k.2009 41°10'80' 03°7'20'46* Ambrido MBK218 478'5 Turkey, Marchina Road 17 k.2009 41°10'280' 04°3'20'7' Ambrido MBK231 17 k.2009 17 k.2009 17 k.2009 17 k.2009	Phenacoccus sp.	MBK295	4918	Turkey, Artvin	16.vii.2010	41°10′917′′	041°50′764″	Apiaceae	M.B. Kaydan
MBR073 4246	Phenacoccus specificus Matesova	MBK200	4472	Turkey, Kars, Kağızman Road	04.vi.2009	40°16'351"	042°52′275″	Thymus sp.	M.B. Kaydan
rchsenius MBK1099 4.356 Turkey, Igdir, Turluca, Gaziler 32 y. 2008 4.006 218° 043°07'115° 140.06616 MBK160 4446 Turkey, Katar, Kagaman 191, 2008 4.009 4.005'07'115° 140.06616 MBK167 4456 Turkey, Rativa, Enamendag 68 x. 2009 37°07.395° 037°07'484° 104.066, MBK103 4657 Turkey, Gaziantep, Pistacia Research Institute 04 viii 2008 37°07'395° 037°07'484° 104.066, MBK103 4657 Turkey, Gaziantep, Pistacia Research Institute 04 viii 2008 37°07'395° 037°07'484° 104.066, MBK103 4657 Turkey, Gaziantep, Nur mount Bahçe Read 17 iii. 2009 41°10'40' 041.58490° 114.066, MBK103 4657 Turkey, Atrivin, Saysal Read 17 iii. 2009 41°10'40' 041.58490° 114.066, MBK203 460° 114.066, MBK203 4735 Turkey, Atrivin, Saysal Read 07 viii. 2010 41°10'20' 041.58490° 114.066, MBK203 4735 Turkey, Halkari, Cultura Read 04 vii. 2010 41°10' 2006 041.58490° 114.066, MBK203 445° 114.066, MBK203 445° 114.066, MBK203 445° 114.066, MBK203 445° 114.066, MBK203 445° 114.066, MBK203 445° 114.066, MBK203 445° 114.066, MBK203 445° 114.066, MBK204 445° 114.066, MBK204 445° 114.066, MBK204 445° 114.066, MBK204 445° 114.066, MBK204 445° 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 4550 114.066, MBK206 114.066, MBK206 114.066, MBK206 114.066, MBK206 114.066, MBK206 114.066, MBK206 114.066, MBK206 114.066, MBK206 114.066, MBK206 114.066, MBK206 114.066,	Phenacoccus strigosus Borchsenius	MBK073	4246	Turkey, Hakkari, Yüksekova Road	23.v.2008	37°40′919′′	.044~03,289"	Undetermined	M.B. Kaydan
Bix.2008 4466 Turkey, Rass, Ragizman 13 ix.2008 40°08 160°7 167°7 167°7 168°7 1458°7 Turkey, Rass, Ragizman 15 ix.2008 36°04.852° 10°08°18° 10°08°	Phenacoccus tergrigorianae Borchsenius	MBK099	4356	Turkey, Iğdır, Tuzluca, Gaziler	29.v.2008	40°06′218″	043°27'952"	Peganum harmala	M.B. Kaydan
MBK/197 4587 Turkey, Hatay, Erzin 08 ix, 2009 37°03395° 03°20 def* MBKR016 4455 Turkey, Gaziantep, Tistacia Research Institute 00 kix, 2009 37°11045° 03°20 def* MBK103 4575 Turkey, Gaziantep, Nur mount, Baltge, Road 07 kix, 2009 37°11045° 03°5°43'007° MBK148 4602 Turkey, Arvin, Savgat Road 07 kix, 2009 41°10'280° 041.58492° MBK236 1 Urkey, Arvin, Savgat Road 07 kix, 2009 41°10'280° 041.58492° tij MBK236 1 Urkey, Hatay, Samandag 22 kin, 09 41°10'280° 041.58492° tij MBK236 1 Urkey, Hatay, Logur Road 07 kii, 2009 41°10'280° 041°58'3995° tij MBK231 3592 Turkey, Hakari, Qukura Road 04 vii, 2007 40°67'291° 043°37'288° enius MBK201 4455 Turkey, Jen, Muradiye 03 vii, 2009 39°13'682° 044°07'100° koj MBK706 4467 Turkey, Man, Addamer 11 vii, 2009 39°3'13'687° 041°3'57'38° koj <td>Phenacoccus transcaucasicus Hadzibejli</td> <td>MBK160</td> <td>4446</td> <td>Turkey, Kars, Kağızman</td> <td>19.ix.2008</td> <td>40°08′160″</td> <td>043°07′115″</td> <td>Malus communis</td> <td>M.B. Kaydan</td>	Phenacoccus transcaucasicus Hadzibejli	MBK160	4446	Turkey, Kars, Kağızman	19.ix.2008	40°08′160″	043°07′115″	Malus communis	M.B. Kaydan
MBK167 4455 Turkey, Gaziantep, Pistacia Research Institute 04 viii.2008 37°03395" 037°20464"	Planococcus citri (Risso)	MBK147	4587	Turkey, Hatay, Erzin	08.ix.2009			Cyperus rotundus	M.B. Kaydan
MBK202 4562 Turkey, Hatay, Samandağ 08 ix 2009 36°04 852'' 065°59'' 9nal MBK148 4675 Turkey, Banandağ 10'10'x 2009 41°10'260' 041.58'490'' 9nal MBK216 4687 Turkey, Arvin, Bayar Road 17 ix 2009 41°10'280' 041.58'490'' 10 MBK236 37°10'45' 47.00'' 10''' 041.58'490'' 041.58'490'' 10 MBK234 3990 Turkey, Gimişhane 10 km 04 vii.2010 41°0'''278'' 043°32''395'' 20 MBK234 3990 Turkey, İğdr, Digor Road 13 vii.2009 40°0'''278'' 043°32''395'' 20 MBK234 144'6 Turkey, İğdr, Digor Road 13 vii.2009 40°0''''278'' 043°32'''33'' 20 MBK182 4461 Turkey, İğdr, Digor Road 10 vii.2009 39°3'''''''' 043°3'''''''''''''' 20 MBK182 4461 Turkey, İğdr, Digor Road 10 vii.2009 39°3''''''''' 043°3'''''''''''' 20 MBK182 4467 Turkey, İmis Adilevez 11 vii.20	Planococcus ficus (Signoret)	MBK167	4455	Turkey, Gaziantep, Pistacia Research Institute	04.viii.2008	37°03′395″	037°20'464"	Morus sp.	M.B. Kaydan
MBK133 4575 Turkey, Gaziantep, Nur mount, Bahçe Road 07 ix, 2009 37*11'045** 0.08*43'007** MBK148 4602 Turkey, Arvin, Sayat Road 17 ix, 2009 41*10*280* 0.15*842** th MBK216 4802 Turkey, Arvin, Appa 22 vii .09 41*10*280* 0.15*842** th MBK307 4735 Turkey, Gimişhane 10 km 0.7 vii .2010 41*00*306* 0.83*43*95** zig MBK731 3590 Turkey, İdir, Digor Road 0.4 vi. 2009 40*0*1278* 0.43*277*33* senius MBK084 4346 Turkey, İdir, Digor Road 13 vi. 2009 40*0*128* 0.43*277*33* senius MBK084 4457 Turkey, İdir, Digor Road 13 vi. 2009 39*0*188* 0.43*0*188* senius MBK084 4467 Turkey, İdir, Digor Road 13 vi. 2009 39*0*188* 0.43*0*18* MBK045 4467 Turkey, İdir, Digor Road 17 vii. 2010 40*0*17*38* 0.43*0*18* MBK045 4467 Turkey, İdir, Mighamar 14 vi. 2003 39*0*18* <t< td=""><td>Planococcus ficus (Signoret)</td><td>MBK202</td><td>4582</td><td>Turkey, Hatay, Samandağ</td><td>08.ix.2009</td><td>36°04′852″</td><td>035~29,807"</td><td>Vitis vinifera</td><td>M.B. Kaydan</td></t<>	Planococcus ficus (Signoret)	MBK202	4582	Turkey, Hatay, Samandağ	08.ix.2009	36°04′852″	035~29,807"	Vitis vinifera	M.B. Kaydan
MBK146 4602 Turkey, Artvin, Savgat Road 17 is, 2009 41°10′280′ 041.58′492′ 10°480′	Planococcus vovae (Nasonov)	MBK133	4575	Turkey, Gaziantep, Nur mount, Bahçe Road	07.ix.2009	37°11′045″	036°43′007″	Cupressus sp.	M.B. Kaydan
th MBK216 4687 Turkey, Hatay, Samandağ 22 vii.09 th MBK228 Turkey, Hatay, Gimighane 10 km 07 vii.2010 41°00′306″ 039°43′995″ tig MBK234 3390 Turkey, Gimighane 10 km 04 vii.2007 37°87 25″ 043°32′706″ enius MBK181 4476 Turkey, İğdr, Digor Road 04 vii.2007 40°07′278″ 043°32′706″ enius MBK034 4346 Turkey, İğdr, Digor Road 13 vi.2009 40°07′278″ 043°37′706″ kol MBK206 4467 Turkey, İğdr, Doğubeyazi, İshapaşa 03 vi.2009 38°01′230″ 043°37′706″ kol MBK206 4467 Turkey, Man, Muradiya 10 vi.2009 39°31'906″ 043°37′706″ kol MBK206 4467 Turkey, Man, Muradiya 11 vi.2009 39°31'906″ 043°37′706″ kol MBK206 4668 Russia, Voroezk, Hafskaya st. 14 vi.2003 39°31'906″ 043°37′706″ kol MBK308 4715 Turkey, Kars, Kagizman Road 17 vii.2009 38°47'809″	Pseudococcus comstocki (Kuwana)	MBK148	4602	Turkey, Artvin, Şavşat Road	17.ix.2009	41°10′280″	041.58'492"	Punica granatum	M.B. Kaydan
t) MBK238 Turkey, Artvin, Hopa O7 vii; 2010 41°00:306° 03943:995° t) MBK234 Jurkey, Gümüşhane 10 km 07 vii; 2010 41°00:306° 03943:995° zig MBK234 13990 Turkey, Hakkırığıdı, Digor Road 04 vii; 2007 40°07/278° 043°37/238° enius MBK181 4476 Turkey, İgür, Digor Road 13 xi.2009 40°07/278° 043°37/238° senius MBK084 4346 Turkey, İğür, Digor Road 13 xi.2009 40°07/278° 043°37/238° senius MBK086 4467 Turkey, İdür, Digor Road 13 xi.2009 38°01/290° 043°37/238° ko) MBK0165 4668 Russia, Yorovezi, Hariskaya st. 14 x.2003 38°01/290° 04°07/30° MBK105 4529 Turkey, May, Bulanık 10 xi.2009 38°47/80° 42°57/59° MBK106 4654 Turkey, Muş, Bulanık 13 x.2006 38°47/80° 42°42'57/39° MBK166 4554 Turkey, Antalya, Elmal 13 x.2006 38°47/80° 42°47'144° <th< td=""><td>Pseudococcus cryptus Hempel</td><td>MBK216</td><td>4687</td><td>Turkey, Hatay, Samandağ</td><td>22.vii.09</td><td></td><td></td><td><i>Citrus</i> sp.</td><td>M.B. Kaydan</td></th<>	Pseudococcus cryptus Hempel	MBK216	4687	Turkey, Hatay, Samandağ	22.vii.09			<i>Citrus</i> sp.	M.B. Kaydan
t) MBK307 4735 Turkey, Gimüşhane 10 km O7.vii.2010 41°00'306" 039°43'995" zig MBK334 3390 Turkey, İdür, Digor Road 04,vii.2007 37°287'25" 043°32'831" enius MBK181 4376 Turkey, İğdr, Digor Road 13,vi.2007 40°67'29" 043°37'133" enius MBK182 4461 Turkey, İğdr, Digor Road 13,vi.2007 40°67'29" 043°37'133" senius) MBK182 4461 Turkey, İddr, Digor Road 13,vi.2007 40°67'29" 043°37'133" kel) MBK182 4461 Turkey, İddr, Digor Road 13,vi.2007 38°1'1'390" 043°37'133" kel) MBK206 4467 Turkey, İddr, Digor Road 13,vi.2009 39°3'1'905" 043°37'100" ko) MBK206 4467 Turkey, İddr, Bulank 10,vi.2009 39°3'1'905" 044°5'5'93" ko) MBK308 4715 Turkey, Mar, Bulank 10,vi.2009 33°4'5'09" 42°5'5'59" MBK308 4715 Turkey, Britis Adilcevaz, Ahlat Road 17,vii	Pseudococcus viburni (Signoret)	MBK238		Turkey, Artvin, Hopa				Undetermined	M.B. Kaydan
zig MBK/34 3990 Turkey, Hakkari, Çukurca Road 04 vii.2007 37°28/726" 043°32/831" enius MBK/181 4476 Turkey, İddr. Digor Road 04 vii.2009 40°07/278" 043°37/708" enius MBK084 4365 Turkey, İddr. Digor Road 13 vi.2009 40°07/278" 043°37/708" senius) MBK084 4366 Turkey, İddr. Digor Road 13 vi.2009 38°01/290" 040°27/38" senius) MBK206 4467 Turkey, İdn. Doğubeyazıt, İshakpaşa 03 vi.2009 39°31'905" 043°37/100" NB MBK201 4522 Turkey, İdn. Doğubeyazıt, İshakpaşa 11 vii.2009 39°31'905" 043°07'100" MBK102 4523 Turkey, İdn. Bulanık 10 vi.2009 39°31'905" 041°57'598" MBK108 4715 Turkey, Muş, Bulanık 10 vi.2009 33°45'709" 42°57'598" MBK108 4554 Turkey, Muş, Bulanık 13 vi.2006 38°47'808" 042°47'44" MBK108 4554 Turkey, Antın, Borça Turkey, Artın, Borça 11 vi.2009	Pseudococcus viburni (Signoret)	MBK307	4735	Turkey, Gümüşhane 10 km	07.vii.2010	41°00′306″	039°43′995″	Undetermined	M.B. Kaydan
mbK181 4476 Turkey, İğdir, Digor Road 04.vi.2009 40°07′278" 043°37′708" enius MBR231 3592 Turkey, İğdir, Digor Road 13.vi.2007 40°07′291" 043°37′733" senius MBK084 4346 Turkey, Diyarbakır, Silvan 28.v.2008 38°01′290" 043°37′733" senius MBK206 4467 Turkey, Van, Mogubeyazıt, İshakpaşa 03.vi.2009 39°31′306" 043°45′468" senius MBK206 4467 Turkey, Van, Adamar 09.06.2009 39°31′306" 043°45′468" ko) MBK302 4487 Turkey, Adamar 09.06.2009 39°31′306" 043°45′468" MBK179 4529 Turkey, Mus, Bulanık 10.vi.2009 33°45′709" 041°53′478" MBK179 4554 Turkey, Bitlis Adilcevaz, Ahlat Road 29 vi.2009 38°47′809" 42°47′598" MBK188 4654 Turkey, Bitlis river 09 vi.2009 38°27′86" 042°47′44" MBK298 4946 Turkey, Artin, Burçka Turkey, Bitlis river 09 vi.2009 38°47′809"	Spilococcus vashlovanicus Danzig	MBK234	3990	Turkey, Hakkari, Çukurca Road	04.vii.2007	37°28′725″	043°32′831″	Brassicaceae	M.B. Kaydan
mbK/231 3592 Turkey, light, Digor Road 13 xi 2007 40°67'291" 043°37'233" senius MBK084 4346 Turkey, Diyarbakır, Silvan 28 x 2008 38°01'390" 040°39'388" senius MBK706 4461 Turkey, Main, Muradiye 03 xi, 2009 38°01'390" 040°39'388" ko) MBK206 4467 Turkey, Ağrı, Doğubeyazı, İshakpaşa 03 xi, 2009 39°31'905" 044°07'100" ko) MBK201 4522 Turkey, Ağrı, Doğubeyazı, İshakpaşa 14 x, 2003 39°31'905" 044°07'100" MBK302 4934 Turkey, Maris, Kağıman Road 17 xii 2010 40°16'283" 42°57'588" MBK308 4715 Turkey, Maris, Bulanık 10 xi 2009 33°47'809" 42°47'589" MBK019 4654 Turkey, Alitis Adilcevaz, Ahlat Road 29 xi 2010 38°47'809" 42°47'593" MBK165 4554 Turkey, Ani, Borçka Tirkey, Artin, Borçka 11 xi 2009 38°27'865" 042°47'844" MBK298 4946 Turkey, Artin, Borçka 11 xi 2009 38°47'809"	Trabutina crassispinosa Borchsenius	MBK181	4476	Turkey, Iğdır, Digor Road	04.vi.2009	40°07′278″	043°37′708″	<i>Tamarix</i> sp.	M.B. Kaydan
MBK182 4461 Turkey, Diyarbakn, Silvan 28.v.2008 38°01′290° 040°29′388° senius) MBK182 4461 Turkey, Van, Muradiye 03.vi.2009 39°03′682° 043°45′468° senius) MBK206 4467 Turkey, Ağrı, Doğubeyazıt, İshakpaşa 03.vi.2009 39°31′905° 044°07′100° NBK201 4522 Turkey, Mars, Rağızman Road 17.vii.2010 40°16′283° 42°57′598° MBK302 4934 Turkey, Mars, Rağızman Road 17.vii.2010 40°16′283° 42°57′598° MBK179 4654 Turkey, Bitlis Adilcevaz, Ahlat Road 29.vi.2010 38°47′806° 42°47′593° MBK165 4654 Turkey, Antalya, Elmalı 13.v.2005 38°23′265° 042°47′444″ MBK168 4654 Turkey, Bitlis river 09 vi.2009 38°23′265° 042°47′444″ MBK208 4946 Turkey, Bitlis river 16.vii.2010 41°22′168° 042°47′593° MBK204 4512 Turkey, Bitlis river 09 vi.2009 38°23′86° 042°47′593° MBK204 4512	Trabutina crassispinosa Borchsenius	MBK231	3592	Turkey, lğdır, Digor Road	13.vi.2007	40°67′291″	043°37′233″	<i>Tamarix</i> sp.	M.B. Kaydan
senius) MBK182 4461 Turkey, Van, Muradiye 03.vi.2009 39°03′682" 043°45′468" senius) MBK206 4467 Turkey, Van, Akdamar 03.vi.2009 39°31′305" 044°07′100" Iko) MBK201 4522 Turkey, Van, Akdamar 09.06.2009 40°40′7100" MBK302 4934 Turkey, Kars, Kağızman Road 17.vii.2010 40°16′283" 42°57′588" MBK179 4529 Turkey, Mars, Rağızman Road 10.vi.2009 33°45′709" 041°53′478" MBK179 4529 Turkey, Mars, Bulanık 10.vi.2009 33°45′709" 42°42′558" MBK18 4554 Turkey, Antalya, Elmalı 13.v.2005 38°47′809" 42°42′593" MBK18 4554 Turkey, Anı, Gevaş, Tavan 09.vi.2009 38°20′899" 042°47′444" MBK298 4946 Turkey, Artin, Borçka Tlukin, 2009 38°47′809" 042°47′593" MBK204 4512 Turkey, Artin, Aditovaz, Ahlat road 11.vi.2009 38°47′809" 042°47′593"	Trionymus aberrans Goux	MBK084	4346	Turkey, Diyarbakır, Silvan	28.v.2008	38°01′290′′	040°29′388″	Адгоругоп герепѕ	M.B. Kaydan
senius) MBK206 4467 Turkey, Ağrı, Doğubeyazıt, İshakpaşa 03.vi.2009 39°31'905" 044°07'100" ko) MBK201 4522 Turkey, Van, Akdamar 09.06.2009 39°31'905" 044°07'100" MBK302 4688 Russia, Vorovezk, Hrifskaya st. 11,xii.2010 40°16'283" 42°57'598" MBK302 4934 Turkey, Maç, Bulanık 10,xi.2009 33°45'709" 041°53'478" MBK308 4715 Turkey, Bitlis Adilcevaz, Ahlat Road 29.xi.2010 38°47'809" 42°42'5'93" MBK019 4654 Turkey, Antalya, Elmalı 13.x.2005 38°47'809" 42°42'5'93" MBK048 4671 Bulgaria, Rila mountains 27.xii.2008 38°27'66" 042°47'44" MBK298 4946 Turkey, Artin, Borçka Turkey, Bitlis river 09.xi.2009 38°47'809" 042°47'809" MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11.xi.2009 38°47'809" 042°47'593"	Trionymus artemisiarum (Borchsenius)	MBK182	4461	Turkey, Van, Muradiye	03.vi.2009	39°03′682′′	043°45′468″	<i>Artemisia</i> sp.	M.B. Kaydan
NBK01 4522 Turkey, Van, Akdamar 09.06.2009 MBK045 4668 Russia, Vorovezk, Hrafskaya st. 14.v.2003 MBK302 4934 Turkey, Kars, Kağızman Road 17.vii.2010 40°16′283″ 42°57′598″ MBK179 4529 Turkey, Muş, Bulanık 10.vii.2009 33°45′709″ 041°53′478″ MBK179 4529 Turkey, Bilis Adilcevaz, Ahlat Road 29.vii.2010 38°47′809″ 42°42′593″ MBK165 4554 Turkey, Antalya, Elmalı 13.v.2005 38°47′809″ 42°42′93″ MBK165 4554 Turkey, Bitlis river 09.vii.2009 38°23′265″ 042°47′444″ MBK188 4533 Turkey, Bitlis river 09.vii.2009 38°20′899″ 042°01′898″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11.vii.2010 38°47′809″ 042°42′593″	Trionymus artemisiarum (Borchsenius)	MBK206	4467	Turkey, Ağrı, Doğubeyazıt, İshakpaşa	03.vi.2009	39°31′905″	044°07′100″	<i>Artemisia</i> sp.	M.B. Kaydan
MBK045 4668 Russia, Vorovezk, Hrafskaya st. 14.v.2003 MBK302 4934 Turkey, Kars, Kağızman Road 17.vii.2010 40°16′283″ 42°57′598″ MBK179 4529 Turkey, Muş, Bulanık 10.vi.2009 33°45′709″ 041°53′478″ MBK308 4715 Turkey, Bitlis Adilcevaz, Ahlat Road 29.vi.2010 38°47′809″ 42°425′93″ MBK165 4554 Turkey, Van, Gevaş, Tatvan 09.vi.2009 38°23′265″ 042°47′444″ MBK188 4571 Bulgaria, Rila mountains 27.vii.2008 38°23′265″ 042°41′88″ MBK188 4533 Turkey, Bitlis river 09.vi.2009 38°20′899″ 042°01′898″ MBK298 4946 Turkey, Artin, Borçka 11.vi.2010 41°22′168″ 042°47′553″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11.vi.2009 38°47′809″ 042°42′553″	Trionymus multivorus (Kiritchenko)	MBK201	4522	Turkey, Van, Akdamar	09.06.2009			Apiaceae	M.B. Kaydan
MBK302 4934 Turkey, Kars, Kağızman Road 17.vii.2010 40°16′283″ 42°57′598″ MBK179 4529 Turkey, Muş, Bulanık 10.vi.2009 33°45′709″ 041°53′478″ MBK308 4715 Turkey, Bitlis Adilcevaz, Ahlat Road 29.vi.2010 38°47′809″ 42°425′93″ MBK019 4654 Turkey, Antalya, Elmalı 13.v.2005 38°47′809″ 42°425′93″ MBK165 4554 Turkey, Van, Gevaş, Tatvan 09.vi.2009 38°23′265″ 042°47′444″ MBK188 4571 Bulgaria, Rila mountains 27.vii.2008 38°23′265″ 042°41′88″ MBK298 4946 Turkey, Bitlis river 09.vi.2009 38°20′899″ 042°01′898″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11.vi.2009 38°47′809″ 042°42′593″	Trionymus perrisii (Signoret)	MBK045	4668	Russia, Vorovezk, Hrafskaya st.	14.v.2003			Poa sp.	M.B. Kaydan
MBK179 4529 Turkey, Muş, Bulanık 10.vi.2009 33°45′709′′ 041°53′478′′ MBK308 4715 Turkey, Bitlis Adilcevaz, Ahlat Road 29.vi.2010 38°47′809′′ 42°425′93′′ MBK019 4654 Turkey, Antalya, Elmalı 13.v.2005 38°47′809′′ 42°425′93′′ MBK165 4554 Turkey, Van, Gevaş, Tatvan 09.vi.2009 38°23′265′′ 042°47′444″′ MBK188 4533 Turkey, Bitlis river 09.vi.2009 38°20′899′′ 042°01′898″′ MBK298 4946 Turkey, Artin, Borçka 16.vii.2010 41°22′168″ 042°91′55″′ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11.vii.2009 38°47′809″ 042°47′453″	Trionymus perrisii (Signoret)	MBK302	4934	Turkey, Kars, Kağızman Road	17.vii.2010	40°16′283″	42°57′598″	Poaceae	M.B. Kaydan
MBK298 4715 Turkey, Bitlis Adilcevaz, Ahlat Road 29.vi.2010 38°47′809″ 42°425′93″ MBK019 4654 Turkey, Antalya, Elmalı 13.x.2005 38°23′265″ 042°47′444″ MBK165 4554 Turkey, Van, Gevaş, Tatvan 09.vi.2009 38°23′265″ 042°47′444″ MBK188 4533 Turkey, Bitlis river 09.vi.2009 38°20′899″ 042°01′898″ MBK298 4946 Turkey, Artin, Borçka 16.vii.2010 41°22′168″ 041°39′155″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11.vii.2009 38°47′809″ 042°42′2593″	Volvicoccus volvifer (Goux)	MBK179	4529	Turkey, Muş, Bulanık	10.vi.2009	33°45′709″	041°53′478″	Poaceae	M.B. Kaydan
MBK019 4654 Turkey, Antalya, Elmalı 13.v.2005 38°23′265″ 042°47′444″ MBK165 4554 Turkey, Van, Gevaş, Tatvan 09.vi.2009 38°23′265″ 042°47′444″ MBK048 4671 Bulgaria, Rila mountains 27.vii.2008 38°20′899″ 042°01′898″ MBK188 4533 Turkey, Bitlis river 09.vi.2009 38°20′899″ 042°01′898″ MBK298 4946 Turkey, Artin, Borçka 16.vii.2010 41°22′168″ 041°39′155″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11.vii.2009 38°47′809″ 042°42′2593″	Volvicoccus volvifer (Goux)	MBK308	4715	Turkey, Bitlis Adilcevaz, Ahlat Road	29.vi.2010	38°47′809″	42°425'93"	<i>Stipa</i> sp.	M.B. Kaydan
MBK/165 4554 Turkey, Antalya, Elmali 13.v.2005 38°23′265" 042°47′444" MBK/165 4554 Turkey, Van, Gevaş, Tatvan 09.vi.2009 38°23′265" 042°47′444" MBK/048 4671 Bulgaria, Rila mountains 27.vii.2008 38°23′265" 042°47′444" MBK/188 4533 Turkey, Bitlis river 09.vi.2009 38°20′899" 042°01′898" MBK/298 4946 Turkey, Artin, Borçka 16 vii.2010 41°22′168" 042°42′593" MBK/204 4512 Turkey, Bitlis, Adileevaz, Ahlat road 11.vi.2009 38°47′809" 042°42′593"	Putoidae								
MBK165 4554 Turkey, Van, Gevaş, Tatvan 09.vi.2009 38°23'265" 042°47'444" MBK048 4671 Bulgaria, Rila mountains 27.vii.2008 38°20'899" 042°01'898" MBK188 4533 Turkey, Bitlis river 09.vi.2009 38°20'899" 042°01'898" MBK298 4946 Turkey, Artin, Borçka 16 vii.2010 41°22'168" 041°39'155" MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11.vi.2009 38°47'809" 042°42'593"	Puto israelensis Ben-Dov	MBK019	4654	Turkey, Antalya, Elmalı	13.v.2005			Quercus coccifera	S. Ülgentürk
MBK288 4671 Bulgaria, Bitlis river RId mountains 27.vii.2008 38°20′899″ 042°01′898″ MBK288 4533 Turkey, Bitlis river 16.vii.2010 41°22′168″ 042°01′898″ MBK298 4946 Turkey, Artin, Borçka 16.vii.2010 41°22′168″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adileevaz, Ahlat road 11.vii.2009 38°47′809″ 042°42′593″	Puto megriensis (Borchsenius)	MBK165	4554	Turkey, Van, Gevaş, Tatvan	09.vi.2009	38°23′265″	042°47'444"	Undetermined	M.B. Kaydan
MBK188 4533 Turkey, Bitlis river 09.vi.2009 38°20′899″ 042°01′898″ MBK298 4946 Turkey, Artin, Borçka 16.vii.2010 41°22′168″ 041°39′155″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11.vii.2009 38°47′809″ 042°42′593″	Puto superbus (Leonardi)	MBK048	4671	Bulgaria, Rila mountains	27.vii.2008			Роасеае	M.B. Kaydan
MBK204 4512 Turkey, Artin, Borçka 16. vii. 2010 41°22′168″ 041°39′155″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11. vii. 2009 38°47′809″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Allat road 11. vii. 2009 38°47′800″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Allat road 11. vii. 2009 38°47′800″ 042°42′593″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Allat road 11. vii. 2009 38°47′800″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Allat road 11. vii. 2009 38°47′800″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Allat road 11. vii. 2009 38°47′800″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Allat road 11. vii. 2009 38°47′800″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Allat road 11. vii. 2009 38°47′800″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Allat road 11. vii. 2009 38°47′800″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Allat road 11. vii. 2000 38°47′800″ MBK204 4512 Turkey, Bitlis, Adilcevaz, Allat road 11. vii.	Puto superbus (Leonardi)	MBK188	4533	Turkey, Bitlis river	09.vi.2009	38°20′899″	042°01′898″	Aegilops sp.	M.B. Kaydan
MBK204 4512 Turkey, Bitlis, Adilcevaz, Ahlat road 11.vi.2009 38°47'809" 042°42'593"	Rhizoecidae								
MBK204 4512 Turkey, Bitlis, Adiloevaz, Ahlat road 11.vi.2009 38°47'809" 042°42'593"	Ripersiella sp.	MBK298	4946	Turkey, Artin, Borçka	16.vii.2010	41°22′168″	041°39′155″	Poaceae	M.B. Kaydan
MADIZODO ARCA II	Ripersiella parva (Danzig)	MBK204	4512	Turkey, Bitlis, Adilcevaz, Ahlat road	11.vi.2009	38°47'809"	042°42′593″	Sedum sp.	M.B. Kaydan
AADVOOD AAAA III B. J	Acanthococcidae								
MBK029 4664 Hundary, Budapest	Acanthococcus aceris Signoret	MBK029	4664	Hungary, Budapest	11.v.2005			Acer campestris	F. Kozár

- **33.** Cerarii, surrounding cuticle: **(0)** sclerotised; **(1)** membranous.
- **34.** Cerarii, number of marginal pairs: **(0)** 0; **(1)** 18; **(2)** 16–17; **(3)** 2–15; **(4)** 1.
- **35.** Cerarii, number of stout setae per anal lobe cerarius: (0) 0; (1) 2; (2) > 2.
- **36.** Cerarii, additional cerarii on dorsum in mid-line: (0) absent; (1) present.
- 37. Cerarii, auxiliary setae: (0) present; (1) absent.
- **38.** Cerarii, with minute discoidal pores: (0) present; (1) absent.
- **39.** Cerarii, number of trilocular pores on each anal cerarius: (0) 5-10; (1) 11-20; (2) > 30.
- **40.** Hairlike/setose setae on derm surface apart from those on cerarii: (0) present; (1) absent.
- **41.** Lanceolate/conical spine-like setae on derm surface apart from those on cerarii: **(0)** absent; **(1)** present.
- **42.** Multilocular disc pores (those with more than 6 loculi): **(0)** present; **(1)** absent.
- **43.** Quinquelocular disc pores: (0) present; (1) absent.
- **44.** Trilocular pores: **(0)** present; **(1)** absent.
- **45.** Tritubular/bitubular pores: (0) absent; (1) present.
- **46.** Oral-collar tubular ducts: **(0)** present, with collars; **(1)** present, without collars; **(2)** as oral-rim ducts (mushroom type); **(3)** absent.
- **47.** Tubular ducts with satellite discoidal pores: **(0)** absent; **(1)** present.
- **48.** Anal ring, development: (0) exposed, ring complete; (1) exposed, with pronounced interruption along anterior margin, appearing V-shaped; (2) deeply invaginated.
- **49.** Anal ring, cortex (outermost ring): **(0)** complex, several pores deep; **(1)** simple, single row of round pores; **(2)** lacking pores; **(3)** as a series of linear pores; **(4)** as spinules.
- 50. Anal ring, medulla (inner ring): (0) simple, single row of round pores; (1) reticulated network of large polygonal pores; (2) several cells, especially those along anterior margin, with a reticulate appearance, reticulations not extending to lightly pigmented areas inside ring; (3) more pronounced reticulation, extending onto the lightly pigmented area inside ring.
- **51.** Multilocular disc pores and/or tubular ducts: (0) present together in groups; (1) not in groups, if both present, then pores and ducts separate.

Additional characters

- **52.** Ventral oral rim tubular ducts: (0) present; (1) absent.
- 53. Ventral multilocular disc pores and oral collar tubular duct present together in a cluster anterior to anterior spiracle: (0) absent; (1) present.
- **54.** Enlarged tubular ducts on margin of dorsum: (0) absent; (1) present.
- **55.** Labium basal segment: (0) with two setae; (1) with three setae.
- **56.** Macrotubular ducts: (0) absent; (1) present.
- 57. Anal ring spinules: (0) setose; (1) dome-shaped.

Following the analyses, the morphological characters diagnosing each clade were studied and further characters were identified which appeared to be apomorphic for particular clades (see under each section below).

Results

3.1. Molecular alignment

The alignment obtained from the molecular analysis comprised 1250 characters, of which 400 were from the COI dataset and 850 from 28S (Fasta files in the electronic supplement: Files 1-3).

3.2. Phylogenetic trees

The maximum-likelihood tree (ML) recovered from the analysis of the COI and 28S data is presented in Fig. 1, with posterior probabilities (PP) values above each node. The morphological character matrix is presented in Table 2. The Bayesian analysis results support the results from the combined molecular and morphological data analysis.

We obtained two principal clades within Pseudococcidae from our Palaearctic samples, which we equate to the Pseudococcinae and the Phenacoccinae, each with strong support (99.9%). We also obtained strong support for the division of the Pseudococcinae into three tribes (Planococcini, Trabutinini and Pseudococcini).

3.2.1. Phenacoccinae

The apomorphic morphological character states that diagnose the adult females of this subfamily are: (i) tarsal digitules setose "(18-0)"; (ii) claws with a denticle "(16-0)"; (iii) presence of quinquelocular pores "(20-0)"; (iv) antennae usually nine-segmented "(1-1)"; (v) anal ring with dome-shaped spinules in outer ring "(57-1)", and (vi) spine-like setae on dorsum "(41-1)" (Fig. 2). Our results strongly suggest that the genus *Phenacoccus* is not monophyletic, as its species are currently included in three of the main clades. Within the Phenacoccinae, we recognise six clades (Clades A–F in Fig. 1), all but two with Bayesian values greater than 95%.

Clade F includes two subclades, of which one has *Artemicoccus bispinus* (Fig. 3), *Coccidohystrix samui* and *Pararhodonia amena* (Fig. 4), all of which share the absence of dorsal ostioles "(32-2)", and which are sister to 3 *Peliococcus* species (with 6 specimens), all of which have dorsal spinose setae with an associated trilocular pore at their base (Fig. 1D). The species in this clade tend to be found on xerophilous plants and are widespread on

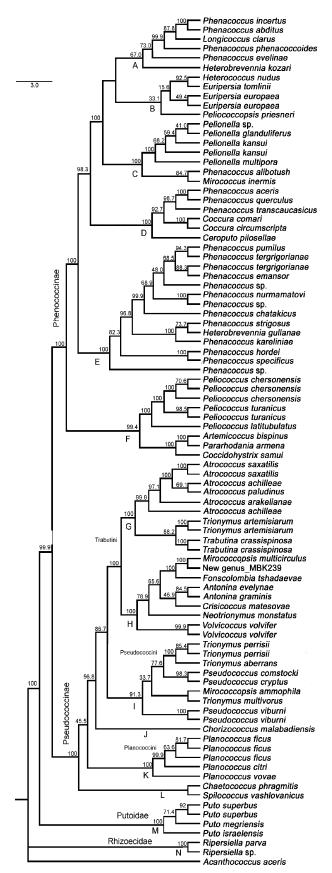


Fig. 1. Palaearctic pseudococcid phylogeny based on 28S and COI gene regions plus morphological characters, with three species of Putoidae, two species of Rhizoecidae and *Acanthococcus aceris* (Acanthococcidae) as outgroup taxa. Figures above nodes refer to posterior probabilities (PP).

steppe flora. This clade is sister to the remaining Phenacoccinae.

The remaining Phenacoccinae fall into two main clades: clade E and the group of subclades A–D. Clade E includes 12 species of *Phenacoccus* plus *Heterobrevennia gullanae*, all of which share: (i) spine-like setae on the intersegmental membranes between antennal segments VI and VII "(3-0)" (Fig. 5), and (ii) multilocular disc pores on the dorsum. Further work is needed to clarify differences between the species in this clade and those in clades A–D, including the possible transfer of *H. gullanae* to whatever taxon is formed from the species in clade E.

Clade A has four *Phenacoccus* species plus *Longicoccus clarus* and *Heterobrevennia kozari*, all of which share: (i) "dome-shaped" setae on the intersegmental membranes between antennal segments VI and VII (Fig. 6), and (ii) a reduced number of pores in the anal ring (generally with an inner ring of pores and an outer ring of spinules: Fig. 7).

Clade C contains the genus *Pelionella* Kaydan (KAYDAN 2015), with the following combination of characters: (i) multilocular disc pores each with two rings of loculi, in clusters on dorsum, differing from those on venter which have only a single ring of loculi; (ii) dorsal setae spine-like, each lacking trilocular pores near their base, and thus differing from cerarian setae; (iii) a circulus on abdominal segment III "(25-1)" (rather than in the intersegmental membrane between III and IV); and (iv) multilocular disc-pore clusters with dorsal oral collar tubular ducts of one or two sizes, each cluster with the smallest ducts in the centre and the larger ducts among the disc pores towards the outside (Fig. 8).

Clade D includes three *Phenacoccus* species (namely P. aceris (the type species of Phenacoccus), P. querculus and P. transcaucasicus), two Coccura species and Ceroputo pilosellae, all of which have similarly-shaped, wide circuli (sometimes more than one), which perhaps provide good attachment to their hosts (Fig. 9). The three Phenacoccus species are found on Rosaceae, Fagaceae, Oleaceae, etc and are regarded as wood feeding species. It is clear from this study that *Phenacoccus* is not monophyletic because there are several species groups within the genus. The generic concept of Phenacoccus, therefore, needs further study. Although the two Coccura spp. and Ceroputo pilosellae are placed in the Clade D, it is clear that these species do not belong to *Phenacoc*cus sensu stricto. It is here considered that their presence in Clade D is due to lack of sampling and therefore that their separation will be clear when further taxa are stud-

Thus, the genera which fell within the Phenacoccinae in our study are *Artemicoccus* Balachowsky, *Ceroputo* Šulc, *Coccidohystrix* Lindinger, *Coccura* Šulc, *Euripersia* Borchsenius, *Heterococcus* Ferris, *Heterobrevennia* Kaydan, *Longicoccus* Danzig, *Mirococcus* Borchsenius, *Pararhodania* Ter-Grigorian, *Peliococcus* Borchsenius, *Peliococcopsis* Borchsenius, *Pelionella* Kaydan and *Phenacoccus* Cockerell.

 Table 2. Character matrix of material examined.

Species name	00000000111111111122222222223333333334444444444
Antonina evelynae	12-1-01111020-01000-31010001-00011-111100102001100100
Antonina graminis	12-1-01111020-01000-31010001-00011-11110001020011001
Artemicoccus bispinus	$2\;2\;1\;1\;1\;0\;1\;1\;1\;1\;0\;1\;0\;1\;0\;0\;0\;0\;1\;0\;0\;0\;0\;-\;3\;0\;0\;0\;0\;0\;0\;2\;0\;2\;2\;1\;1\;2\;3\;1\;1\;1\;1\;0\;0\;4\;0\;0\;0\;1\;1\;0\;0\;1\;0\;1$
Atrococcus achilleae	$\begin{smallmatrix} 2 & 2 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1$
Atrococcus arakelianae	$\begin{smallmatrix} 2 & 2 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1$
Atrococcus paludinus	$2\ 2\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0\ 0\ -\ 3\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 3\ 1\ 0\ 1\ 1\ 1\ 0\ 0\ 0\ 1\ 0\ 0\ 2\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 1$
Atrococcus saxatilis	$2\ 2\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 0\ 1\ 1\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 3\ 1\ 0\ 0\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ 0$
Ceroputo pilosellae	122110111101110000100001000012111111111
Chaetococcus phragmitis	42-1-01111020-41000-31010002-00011-110100100001100100
Chorizococcus malabadiensis	2211101111011051011100012000000131000100110020000100100
Coccidohystrix samui	22111011110101000010000-30000020221123111100400011100101
Coccura circumscripta	$1\ 2\ 1\ 1\ 2\ 0\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 0\ 1\ 0\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\$
Coccura comari Crisicoccus matesovae	$1\ 2\ 1\ 1\ 2\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 1\ 0\ 1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\$
Fonscolombia tshadaevae	321110111101101101101100012000000131001000110010001100100
Euripersia europaea	42111011110111000010000-3000000110011100000001100101
Euripersia tomlinii	32112011110111000010000000000011101111000000
Heterobrevennia gullanae	12111011110110400010000-3000000111010100000100001
Heterococcus kozari	121110111101110000010001200000131012011000010001
Heterococcus nudus	12111011110110400000000-3000000141011011001010001100101
Longicoccus clarus	1 2 2 1 1 0 1 1 1 1 0 1 1 0 6 0 0 0 1 1 0 0 0 - 3 0 0 0 0 0 1 0 0 0 1 1 0 0 1 1 1 0 0 1 0 1 0 1 1 0 0 1 0 1 1 0 0 1 0 1
Mirococcopsis ammophila	4 2 1 1 1 0 1 1 1 1 0 1 1 1 1 0 1 0 1 0 1
Mirococcopsis multicirculus	$4\;2\;1\;1\;1\;0\;1\;1\;1\;1\;0\;1\;1\;0\;1\;1\;0\;1\;1\;1\;0\;0\;1\;1\;0\;0\;0\;0\;0\;0\;0\;0\;1\;4\;1\;0\;1\;1\;0\;0\;0\;1\;1\;0\;0\;2\;0\;0\;0\;0\;1\;1\;0\;0\;1\;0\;0$
Mirococcus inermis	$1\; 2\; 1\; 1\; 1\; 0\; 1\; 1\; 1\; 1\; 0\; 1\; 1\; 0\; 4\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 1\; 2\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 1\; 0\; 0\; 0\; 1\; 1\; 0\; 0\; 0\; 0\; 1\; 0\; 0\; 0\; 1\; 0\; 0\; 1\; 0\; 0\; 1\; 0\; 0\; 1\; 0\; 0\; 1\; 0\; 0\; 1\; 0\; 0\; 1\; 0\; 0\; 1\; 0\; 0\; 0\; 1\; 0\; 0\; 0\; 0\; 1\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\;$
New Genus MBK239	$4\;2\;1\;1\;1\;0\;1\;1\;1\;0\;1\;1\;1\;0\;1\;0\;1\;0\;1\;0\;0\;0\;-\;3\;0\;0\;0\;0\;0\;0\;0\;0\;1\;0\;0\;0\;1\;0\;0\;0\;0\;0\;0$
Neotrionymus monstatus	$\begin{smallmatrix} 2 & 2 & 1 & 1 & 0 & 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1$
Pararhodania armena	$2\;2\;1\;1\;1\;0\;1\;1\;1\;1\;0\;1\;0\;1\;0\;0\;0\;0\;1\;0\;0\;0\;0\;-\;3\;0\;0\;0\;0\;0\;0\;2\;0\;2\;2\;1\;1\;2\;3\;1\;1\;1\;1\;0\;0\;4\;0\;0\;0\;1\;1\;0\;0\;1\;0\;1$
Peliococcopsis priesneri	12111011110110400030000-30000110013101101100001000100101
Peliococcus chersonensis	1211101111011100100000001012000000111111
Peliococcus chersonensis	121110111101110000000101200000011111110110
Pelionella kansui	1 2 1 1 1 0 1 1 1 1 0 1 1 1 0 0 0 0 1 1 0 0 0 0 1 2 0 0 0 0
Peliococcus multipora	1211101111011100001100012000001310111110100100000100101
Pelionella sp.	12111011110111000010001200001110111111010010
Pelionella glanduliferus Peliococcus turanicus	1211101111011100001000120000111011111010010
Phenacoccus abditus	$1\ 2\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 0\ 0\ 0\ 0\ 0\ 1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 1\ 1\ 1\ 0\ 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1\ 0\ 1$
Phenacoccus aceris	12111011110110100010000-30000001310110111100100001100101
Phenacoccus alibotush	121110111101110000100000000000001110111
Phenacoccus chatakicus	121110111101110000000000000000001110111
Phenacoccus emansor	12111011110105000011000-3000000110110110100100001100101
Phenacoccus evelinae	12111011110111000011000012000000131011111111
Phenacoccus hordei	1 2 1 1 1 0 1 1 1 1 0 1 1 0 4 0 0 0 1 0 0 0 0
Phenacoccus incertus	1 2 1 1 1 0 1 1 1 1 0 1 1 1 0 0 0 0 1 1 0 0 0 0 - 3 0 0 0 0 0 0 1 3 1 0 1 1 0 1 1 1 1 0 0 1 0 0 0 0
Phenacoccus kareliniae	$1\; 2\; 1\; 1\; 1\; 0\; 1\; 1\; 1\; 1\; 0\; 1\; 1\; 1\; 0\; 0\; 0\; 0\; 1\; 0\; 0\; 0\; 0\; 1\; 2\; 0\; 0\; 0\; 0\; 0\; 0\; 1\; 1\; 1\; 0\; 1\; 1\; 0\; 1\; 1\; 0\; 1\; 0\; 0\; 0\; 0\; 0\; 1\; 1\; 0\; 0\; 1\; 0\; 0\; 0\; 1\; 1\; 0\; 0\; 1\; 0\; 0\; 0\; 0\; 1\; 1\; 0\; 0\; 1\; 0\; 0\; 0\; 0\; 1\; 1\; 0\; 0\; 1\; 0\; 0\; 0\; 0\; 1\; 1\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\;$
Phenacoccus nurmamatovi	$1\; 2\; 1\; 1\; 1\; 0\; 1\; 1\; 1\; 1\; 0\; 1\; 1\; 1\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\; 0\;$
Phenacoccus phenacoccoides	$2\;2\;1\;1\;1\;0\;1\;1\;1\;1\;0\;1\;1\;0\;5\;0\;0\;0\;1\;1\;0\;0\;0\;-\;3\;0\;0\;0\;0\;0\;1\;3\;1\;0\;1\;1\;1\;1\;1\;0\;0\;1\;0\;0\;0\;1\;1\;0\;0\;1\;0\;1$
Phenacoccus pumilus	12111011110111000011000-300000131011011010000001100101
Phenacoccus querculus	1211101111011000000000000000001120101111100100
Phenacoccus sp.	121110111101100000000000000000000000000
Phenacoccus specificus	121110111101110000000000000000001110111
Phenacoccus strigosus	$1\ 2\ 1\ 1\ 1\ 0\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\ 1\$
Phenacoccus tergrigorianae	12111011110111000011000-30000013101101101000001100101
Phenacoccus transcaucasicus	1221101111011100001000220000011101111111
Planococcus citri	$\begin{smallmatrix} 2&2&1&1&1&0&1&1&1&1&1&1&1&1&1&1&1&1&1&1&$
Planococcus ficus	2211101111011011011010100012010000
Planococcus vovae Pseudococcus comstocki	$\begin{smallmatrix} 2 & 2 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 & 1$
Pseudococcus cryptus	22111011110110010101
Pseudococcus viburni	2211101111011001011110001200000002100200110020001000100
Spilococcus vashlovanicus	22111011110110410131000120000000210012001100210001100100
Trabutina crassispinosa	421110111101101101101001000000000000000
Trionymus aberrans	22111011110110110110110110120000001410012000100100100001100100
Trionymus artemisiarum	3211201111011011011011000-3000000111001100110
Trionymus multivorus	$\begin{smallmatrix} 2 & 2 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 1 & 1$
Trionymus perrisii	2211101111011011011011011011010100000000
Volvicoccus volvifer	3211201111011011011011010-30000001100011
Puto israelensis	1201101111010100001000022000000521112111
Puto megriensis	1201101111011100001001012000000521112111
Puto superbus	12011011110111000010010120000
Ripersiella parva	421011111111111011011011010000000000000
Ripersiella sp.	42101111111111111011011011010000000-00011-000101100311100100
Acanthococcus aceris	3211-011110110100121011-300000000-011-101110400101101012

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3.2.2. Pseudococcinae

The apomorphic morphological character states that appear to diagnose the adult females of this subfamily are: (i) all tarsal digitules apically knobbed "(18-1)"; (ii) claws without a denticle "(16-1)"; (iii) quinquelocular pores absent "(20-1)"; (iv) antennae generally with eight or fewer segments "(1-2,3,4)"; (v) anal ring with setose-like spinules "(57-1)", and (vi) hair-like dorsal setae "(40-0)" (Fig. 10). As in the Phenacoccinae, some genera appear to be non-monophyletic, particularly *Trionymus*, species of which occur in two main clades, but also *Pseudococcus* Westwood which has species in two separate subclades. In this study, the Pseudococcinae were divided into eight clades (clades G–L, Fig. 1).

The Trabutinini are considered to be represented by the species in clades G + H, and includes the genera Antonina Signoret, Atrococcus Goux, Crisicoccus Ferris, Fonscolombia Lichtenstein, Mirococcopsis Borchsenius, Neotrionymus Borchsenius, Trabutina Marchal and Volvicoccus (Goux). This group is diagnosed by the following character states: (i) their blue-black colour both when alive and especially when in KOH, and (ii) tubular ducts of rather variable size but with a distinctly sclerotized structure (sclerotized collar or rim, or with a sclerotized inner part) "(46-0)" (Fig. 11). The five species of Atrococcus (A. saxatilis with two specimens) in clade G all have oral rim ducts "(46-2)" (Fig. 11a) and form a well-supported monophyletic clade (99.9%). Clade G also contains Trionymus artemisiarum, the only Trionymus species in this clade. Unlike most other Trionymus species (which are in clade I, Figs. 13, 14), T. artemisiarum (Fig. 12) has: (i) oral collar ducts with a sclerotized inner end to the duct; (ii) fewer setae on the hind tibia (a total of nine on *T. artemisiarum*; 12 on *T. perrisii*: Fig. 13; 20–22 on T. multivorus: Fig. 14) and (iii) T. artemisiarum also has a different placement and number of coeloconic sensilla on each antenna (i.e., two on each apical segment, and one on segment IV, compared with two on each apical segment, and one on both segments II and IV on T. multivorus and T. perrisii) (Figs. 12, 13, 14).

Clade I is considered to equate to the Pseudococcini, and here includes three species of *Trionymus*, three species of Pseudococcus plus Mirococcopsis ammophila. These species share the following character states: (i) each anal lobe cerarius with a large number of trilocular pores, hair-like setae and simple discoidal pores "(38-0), (39-2)"; (ii) dorsal setae similar to those on the venter, all hair-like/setose; and (generally) (iii) tubular ducts with associated discoidal pores. In addition to Trionymus and Pseudococcus spp., Downie & Gullan (2004) and Har-DY et al. (2008) also included some *Dysmicoccus* Ferris species in the Pseudococcini (D. brevipes (Cockerell), D. neobrevipes Beardsley, D. boninsis (Kuwana) and Dysmicoccus sp.). Their tribal diagnosis was "adult females with 16 or 17 pairs of cerarii with auxiliary setae" (and this also applies to all species included in our clade I). No Dysmicoccus were available in our study although a few species do occur in the Palaearctic. The three Pseudococ-

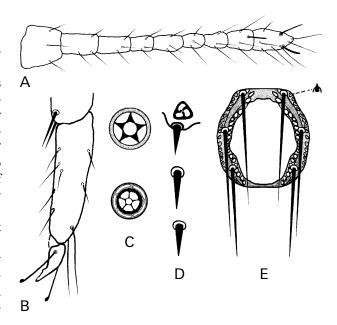


Fig. 2. Diagnostic features of adult females of Phenacoccinae: (A) nine-segmented antennae, (B) legs (tarsal digitules setose; claw with denticle); (C) presence of quinquelocular pores; (D) dorsal setae spine-like; (E) anal ring with an outer ring of dome-shaped spinules.

cus species included in this study occur in two separate subclades, i.e., *P. viburni* in one subclade, diagnosed by the presence of simple pores next to the eyes, and *P. cryptus* and *P. comstocki* in another subclade that lacks simple pores next to the eye (WILLIAMS 2004).

Clade J contains only Chorizococcus malabadiensis Kaydan (described recently by Kaydan et al. 2014; Fig. 15), diagnosed by the following combination of character states: (i) oral rim ducts on both dorsum and venter "(46-2)"; (ii) translucent pores present on hind femur and tibia "(14-0)", and (iii) cerarii restricted to the last two abdominal segments "(34-3)". In the Palaearctic region, Chorizococcus species share the presence of oral rim tubular ducts with Atrococcus, Spilococcus Ferris and Pseudococcus. However, of these four genera, only Atrococcus is believed to be restricted to the Palaearctic, the other three genera (Chorizococcus, Pseudococcus and Spilococcus) are thought to have originated from elsewhere. These four genera occur in separate clades in our analysis and further studies are needed to resolve their generic position.

Clade K equates to the tribe Planococcini, which is here monophyletic and well supported (100%). The tribe is well characterized in having: (i) an anal lobe bar "(27-1)"; (ii) 18 pairs of marginal cerarii "(34-1)", and (iii) slightly flagellate cerarian setae (Cox 1989; Danzig & Gavrilov-Zimin 2010). In our study, the Planococcini clade included only *Planococcus* species.

Thus, the genera that fall within the Pseudococcinae in our study are *Antonina* Signoret, *Atrococcus* Goux, *Chaetococcus* Maskell, *Chorizococcus* McKenzie, *Cri*-

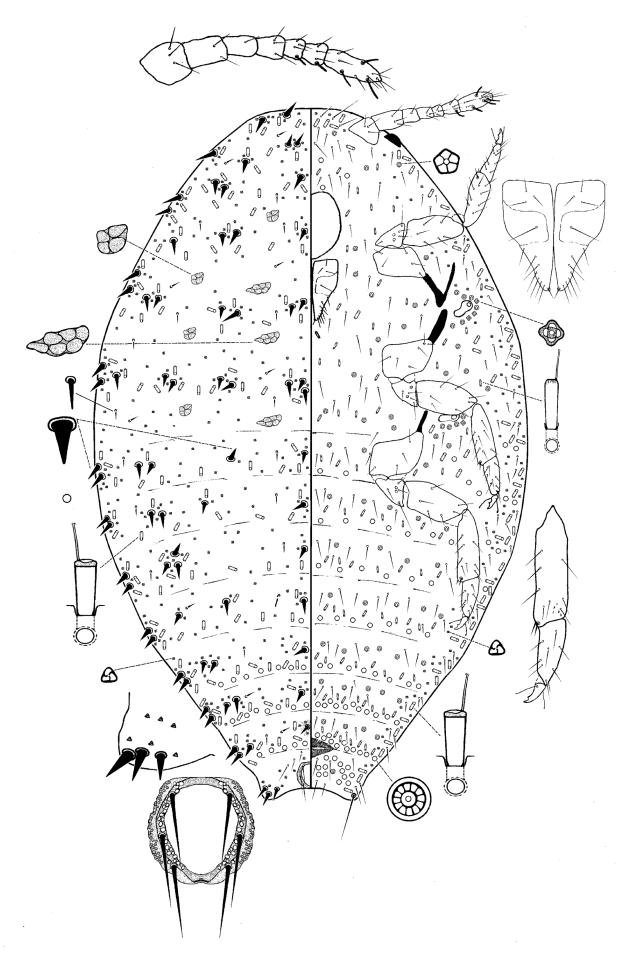


Fig. 3. Artemicoccus bispinus (Borchsenius), paratype, female, original (after Danzig et al. 2012) (Note: absence of dorsal ostioles).

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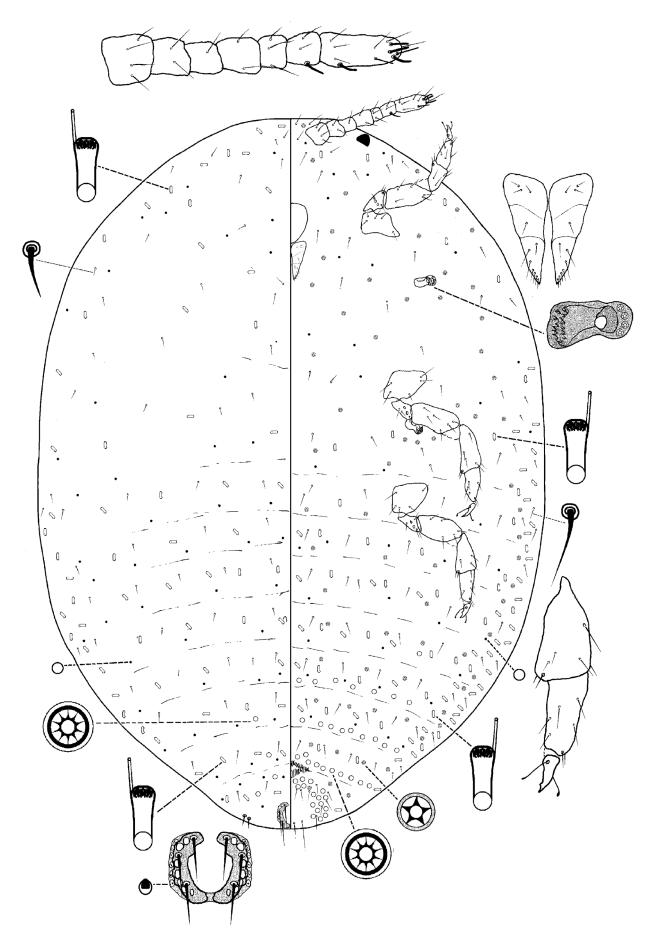


Fig. 4. Pararhodania armena Ter-Grigorian (after KAYDAN & KOZÁR 2010) (Note: absence of dorsal ostioles, presence of a large denticle on the claw, reduced antennae and an anal ring with dome-shaped spinules).

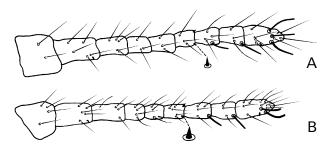


Fig. 5. Antennae of **(A)** *Phenacoccus nurmamatovi* Bazarov and **(B)** *Phenacoccus specificus* Matesova showing the spine-like setae on membrane between segments VI and VII.

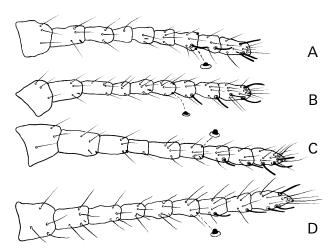


Fig. 6. Antennae of **(A)** *Phenacoccus incertus* (Kiritshenko), **(B)** *Phenacoccus phenacoccoides* (Kiritchenko), **(C)** *Longicoccus clarus* (Borchsenius) and **(D)** *Heterobrevennia kozari* Kaydan showing dome-shaped setae on membrane between segments VI and VII.

sicoccus Ferris, Fonscolombia Lichtenstein, Mirococcopsis Borchsenius, Neotrionymus Borchsenius, Planococcus Ferris, Pseudococcus Westwood, Spilococcus Ferris, Trabutina Marchal, Trionymus Berg and Volvicoccus (Goux).

General discussion

Downie & Gullan (2004) undertook the first molecular phylogenetic study of the Pseudococcidae, using 64 species from 35 genera, plus an aclerdid, a monophlebid and four putoids as outgroup taxa, and recognised three major clades which more or less equated to the Pseudococcinae, Phenacoccinae and Rhizoecinae. However, the boundaries of these clades differed from those of earlier authors, apart from Koteja (1974c). In addition, Downie & Gul-

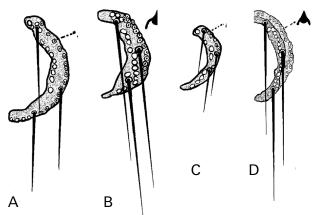


Fig. 7. Anal rings of **(A)** *Longicoccus clarus*, **(B)** *Phenacoccus evelinae* (Tereznikova), **(C)** *Phenacoccus phenacoccoides* (Kiritchenko) and **(D)** *Heterobrevennia kozari* Kaydan showing shape of spinules in outer ring (*Note*: pores restricted to inner ring only; outer ring composed of spinules, number of both [i.e pores and spinules] reduced compared with other clades in Phenacoccinae).

LAN (2004) distinguished four Pseudococcinae subclades which they equated to the tribes Planococcini, Trabutinini, Pseudococcini and an informal Ferrisia group. These relationships were largely poorly resolved, apart from Rhizoecinae appearing to be sister to the other taxa. DOWNIE & GULLAN (2004) included the genera Pseudococcus, Dysmicoccus, Trionymus and a few smaller genera in the Pseudococcini; *Planococcus* and possibly Planococcoides Ezzat & McConnell in the Planococcini; Amonostherium Morrison & Morrison, Antonina, Balanococcus Williams, Nipaecoccus Šulc, the non-African species of Paracoccus Ezzat & McConnell, plus a few other genera in Trabutinini, and Ferrisia Fullaway and Anisococcus Ferris in the Ferrisia group. They considered that Antonina and Chaetococcus Maskell were not sister taxa and therefore that the Sphaerococcinae either did not exist or was paraphyletic. In addition, in Downie and Gullan's study, the Phenacoccinae contained just Phenacoccus and Heliococcus Šulc.

Hardy et al. (2008) did a further large study (as an extension of that of Downie & Gullan 2004) that included a further 33 species from 27 genera, giving a total of 97 species in 35 genera and, in addition to analysing molecular data, they added a morphological data matrix based on adult females, adult males and first-instar nymphs. Their results basically agreed with those of Downie & Gullan (2004) except that the Rhizoecinae fell within the subfamily Phenacoccinae. However, more recently, Hodgson (2012) compared the morphology of the adult

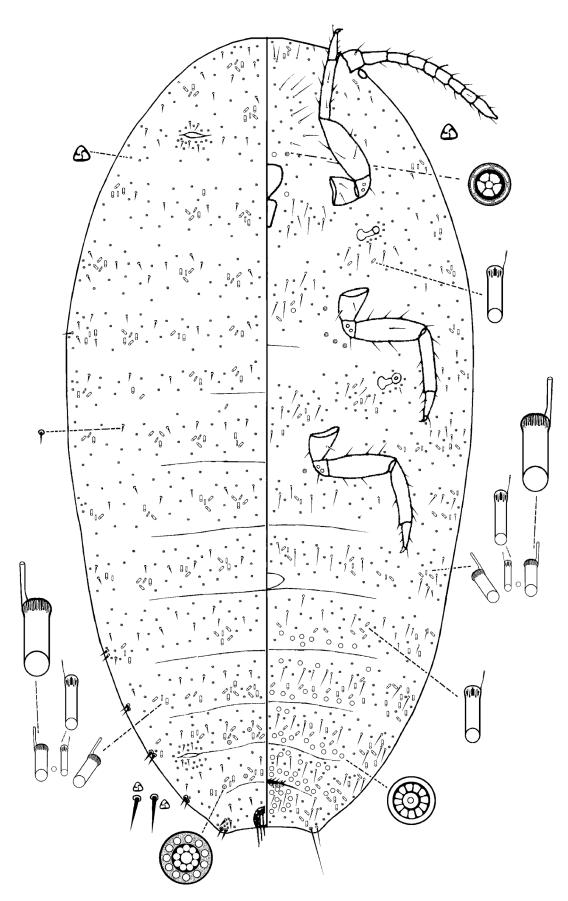


Fig. 8. *Pelionella glanduliferus* (Borchsenius) (after Danzig 2001, with modifications) (*Note*: (i) dorsal multilocular disc pores, each with two rings of loculi, in clusters; (ii) ventral multilocular disc-pores with only a single ring of loculi; (iii) spine-like dorsal setae, each lacking trilocular pores near their base; (iv) a circulus apparently on abdominal segment III; and (v) oral collar tubular ducts of two sizes on dorsum).

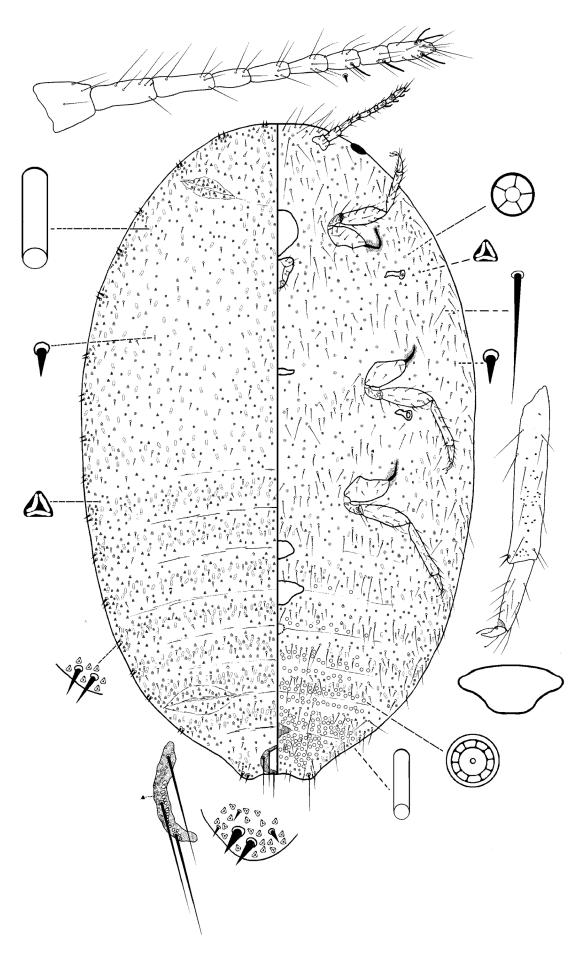


Fig. 9. Phenacoccus aceris (Signoret), original (Note: presence of three circuli, one unusually large).

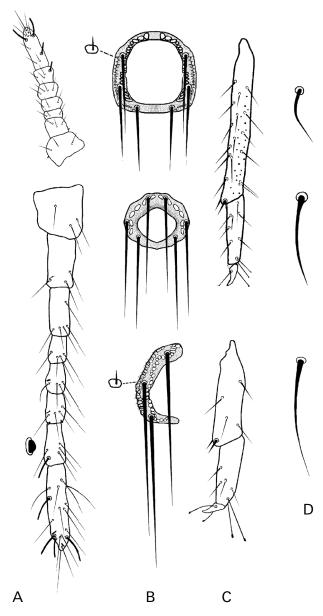


Fig. 10. Diagnostic features of adult female Pseudococcinae: (**A**) antennae with eight or fewer segments; (**B**) anal ring with setose-like spinules; (**C**) legs with knobbed tarsal digitules and claws without a denticle; and (**D**) dorsal setae hair-like.

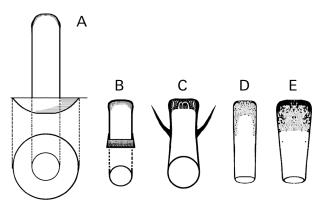


Fig. 11. Tubular ducts as found in three pseudococcid genera: (**A,B**) *Atrococcus*; (**C**) *Volvicoccus*, and (**D,E**) *Trabutina*.

males of the rhizoecine, phenacoccine and pseudococcine mealybugs and concluded that the hypogaeic mealybugs formed a separate family, Rhizoecidae Williams, sister to the Pseudococcidae. Examples of the Rhizoecidae were therefore included as outgroup taxa in our analysis.

Earlier, Cook et al. (2002) and Gullan & Cook (2007) had undertaken a molecular study of most families in the Coccoidea and concluded that Puto was not a neococcoid but might be sister to or part of a sister group to the neococcoids. Although this conclusion has not been accepted by all authors (e.g., Gavrilov-Zimin & Danzig 2012; Danzig & Gavrilov-Zimin 2014), Puto has been shown to have eubacterial endosymbionts in different genera from those of the Pseudococcidae (BUCHNER 1965; TREMBLAY 1989), and the Putoidae was recognised by Hodgson & Foldi (2006) based on adult male characters. Since then, WILLIAMS et al. (2011) have reviewed the taxonomic history of Puto and concluded that Putoidae Tang is a valid family. Moreover, WILLIAMS et al. (2011) considered that Ceroputo was not a putoid but belonged to the Phenacoccinae, supporting the observations of several earlier workers (e.g., Koteja 1974b; Tang 1992; HARDY et al. 2008). Thus, the "mealybugs" are currently considered to include two families: Rhizoecidae Williams and Pseudococcidae Westwood.

These two previous studies (Downie & Gullan 2004; Hardy et al. 2008) had included mainly species from the Holarctic and Australasia, whereas our analysis used species collected entirely within the western Palaearctic. Of the 61 pseudococcoid species (81 specimens) used in the present analysis, only seven had been included in the earlier studies. Nonetheless, our results have much in common.

The present analysis produced a well-supported tree, with about 65% of all internal nodes with Bayesian support greater than 90% (and with 44% of nodes greater than 95%). This proportion is slightly less than obtained by HARDY et al. (2008). On the other hand, both of the earlier studies had constructed two major clades, which they equated to the subfamilies Phenacoccinae and Pseudococcinae and our analysis produced 100% support for the monophyly of both subfamilies. This division was also recently supported by an analysis of adult male morphology (Hodgson & Hardy 2013). Within the Phenacoccinae, we obtained at least three well-supported clades, one (clade F) with several *Peliococcus* species, one (clade E) with mainly *Phenacoccus* species (although Phenacoccus appeared to be non-monophyletic) and a third clade (consisting of subclades A-E) with a wide range of genera including the recently described genus Pelionella Kaydan. It is clear that some of the systematic relationships suggested by these clades need further study. HARDY et al. (2008) provided a list of genera that they considered belonged to the Phenacoccinae. To this list can be added Artemicoccus Balachowsky, Heterobrevennia and possibly Euripersia Borchsenius. This latter genus had been included in the Pseudococcinae by HAR-DY et al. (2008) but the two species included in this study clearly fall within the Phenacoccinae (but they may, of

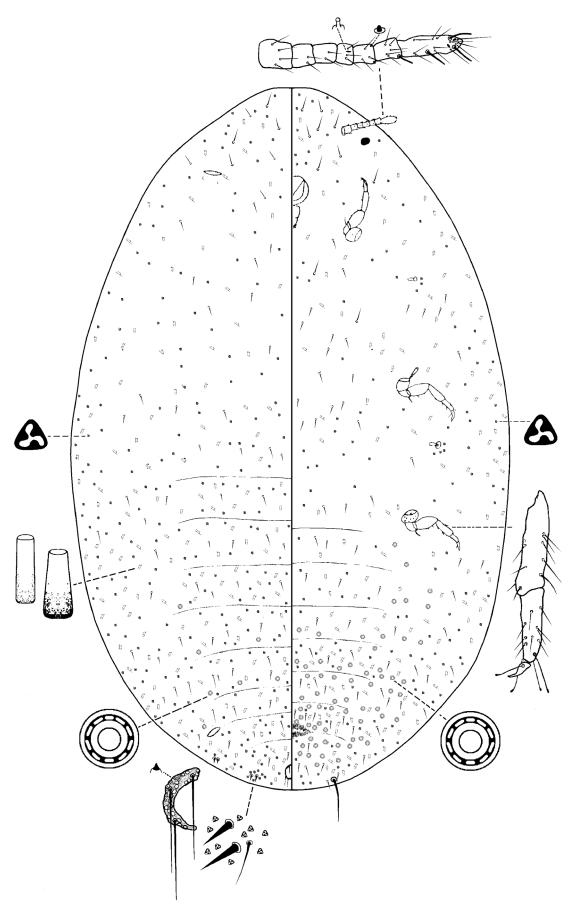


Fig. 12. *Trionymus artemisiarum* (Borchsenius) (after Ter-Grigorian 1973, with modifications) (*Note*: (i) oral collar ducts with a sclerotized inner end; (ii) only nine setae on hind tibia; and (iii) two coeloconic sensilla on apical antennal segment, plus one sensillum on segment IV but none on segment II).

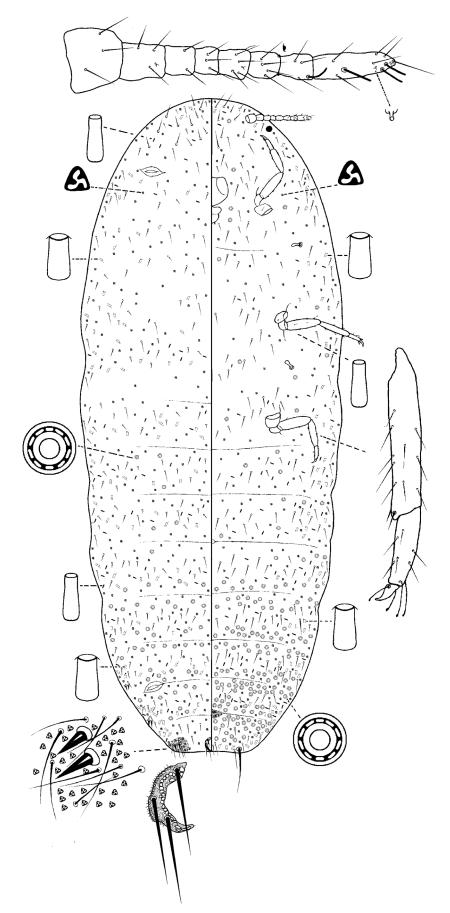


Fig. 13. *Trionymus perrisii* (Signoret) (after Ter-Grigorian 1973 with modifications) (*Note*: (i) oral collar ducts lacking a sclerotized inner end; (ii) a total of 12 setae on each hind tibia; and (iii) two coeloconic sensilla on each apical antenna segment, plus one on both segments II and IV).

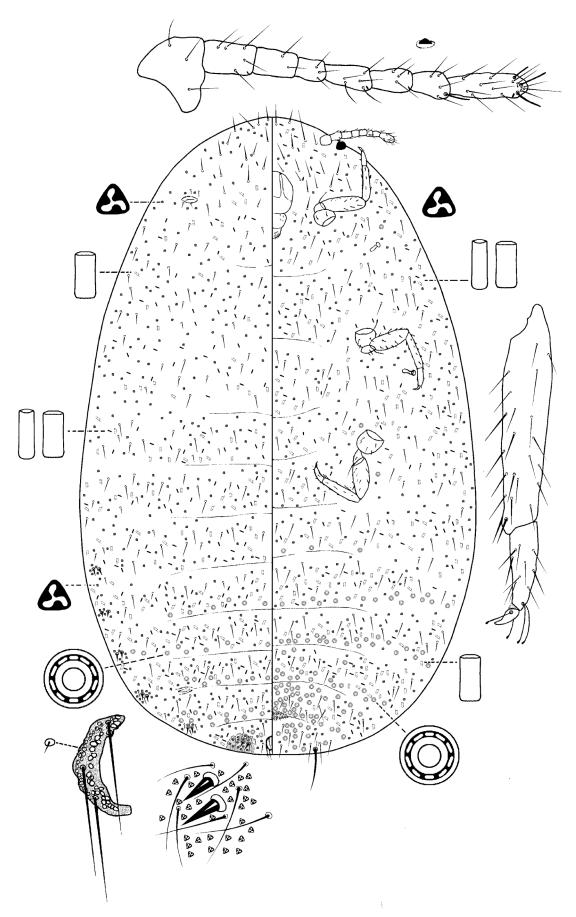


Fig. 14. *Trionymus multivorus* (Kiritchenko) (after Ter-Grigorian 1973 with modifications) (*Note*: (i) oral collar ducts lacking a sclerotized inner end; (ii) a total of 20–22 setae on each hind tibia; and (iii) two coeloconic sensilla on each apical antenna segment, plus one on both segments II and IV).

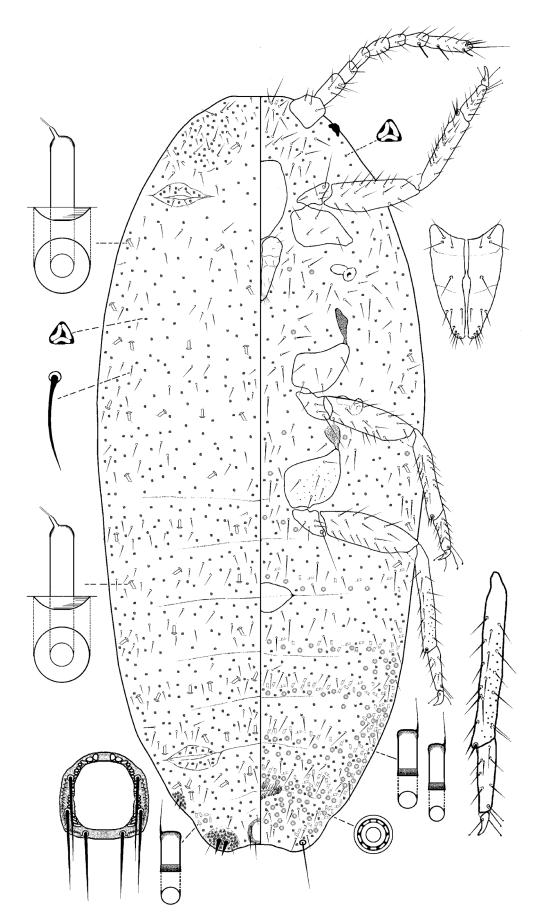


Fig. 15. Chorizococcus malabadiensis Kaydan (after KAYDAN et al. 2014) (*Note*: (i) oral rim ducts on dorsum and venter; (ii) translucent pores present on hind coxa and tibia; and (iii) cerarii restricted to the last two abdominal segments).

course, not be congeneric with *E. amnicola*, the type species of *Euripersia*).

Within the Pseudococcinae, our analysis provides strong support for the tribes Trabutinini (100%), Planococcini (100%) and Pseudococcini (90%). The possible characters diagnosing these tribes are discussed above. Our study did not include any species related to *Ferrisia* or to *Antonina* and *Chaetococcus* and so we can offer no comment on the *Ferrisia* group of the earlier studies or on the Sphaerococcinae. As in the previous studies, there is much non-monophyly in many of the genera, particularly *Phenacoccus* in the Phenacoccinae and *Trionymus* and *Pseudococcus* in the Pseudococcinae.

Very recently, Danzig & Gavrilov-Zimin (2014) published a new concept of Pseudococcidae phylogeny based on their morphological studies. Their results are very different from those of the present work, particularly in the generic concepts of *Atrococcus*, *Phenacoccus* and *Euripersia* and the relationships between *Chaetococcus* and *Antoninia*.

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Electronic Supplement Files

at http://www.senckenberg.de/arthropod-systematics ("Contents")

- **File 1:** kaydan&al-coccoideaphyl-asp2015-electronicsupplement-1.fas. Combined alignment of 28S and COI gene regions plus morphological characters, with three species of Putoidae, two species of Rhizoecidae and *Acanthococcus aceris* (Acanthococcidae) as outgroup taxa.
- File 2: kaydan&al-coccoideaphyl-asp2015-electronicsupplement-2.txt. – Alignment (uncleaned) of 28S gene region with outgroup
- **File 3:** kaydan&al-coccoideaphyl-asp2015-electronic supplement-3.fas. Alignment (uncleaned) of COI gene region with outgroup taxa.