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Systematics of the genera with reduced mandible of Eulophidae (Hymenoptera: Chalcidoidea): parasitoids of thrips (Thysanoptera)*

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Abstract

Thrips parasitoid genera with reduced mandible of Eulophidae (Hymenoptera: Chalcidoidea) are reviewed, with providing Ceranisinae subfam.n. and comments on their systematic placement, and reasons for this placement are discussed. Three new genera, *Sergueicus* gen.n. by combining *Ceranisus barsoomensis* (TRIAPITSYN), *Guelsenia* gen.n., *Gaziantepus* gen.n., and a new species, *Gaziantepus oguzeliensis* O. DOĞANLAR are described, *Thripoctenus* CRAWFORD, and its type species, *Thripoctenus russelli* CRAWFORD, *Epomphale* GIRAULT and *Urfacus* DOĞANLAR were reinstated as valid taxa. *Thripobius* FERRIERE was synonimised under *Thripoctenus*. The characters of nine included genera, *Ceranisus* WALKER, *Entedonomphale* GIRAULT, and *Goetheana* GIRAULT, *Epomphale* GIRAULT, *Thripoctenus*, *Urfacus* DOĞANLAR, and three new ones, are discussed. Some diagnostic characters of the taxa were illustrated and a key to identify the genera is provided.

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Zusammenfassung

Die Gattungen der Thrips-Parasitoiden Familie Eulophidae (Hymenoptera: Chalcidoidea) mit reduzierten Mandiblen werden revidiert; die Unterfamilie Ceranisinae subfam. n. wird vorgeschlagen, und Erläuterungen über systematische Stellungen sowie Begründungen für diese Stellung werden angeführt. Drei neue Gattungen, *Sergueicus* gen.n, durch die Kombination *Ceranisus barsoomensis*, *Geulsenia* gen.n., *Gaziantepus* gen.n., und eine neue Art, *Gaziantepus oguzeliensis* O. DOGANLAR werden beschrieben; *Thripoctenus* CRAWFORD, und ihre Typus-Art, *Tripoctenus russelli* CRAWFORD, *Epomphale* GIRAULT und *Urfacus* DOGANLAR erden als valide Taxa etabliert; *Thripobius* FERRIERE wird mit *Thripoctenus* synonymisiert. Die Merkmale von neun eingeschlossenen Gattungen, *Ceranisus* WALKER, *Entedonomphale* GIRAULT, *Goetheana* GIRAULT, *Epomphale* GIRAULT, *Thripoctenus*, *Urfacus* DOGANLAR und die drei neue Gattungen, werden diskutiert. Diagnostische Merkmale der Taxa werden dargestellt und ein Gattungsschlüssel vorgestellt.

Introduction

GRAHAM (1959) provided the keys to the British genera and species of Elachertinae, Eulophinae, Entedontinae and Euderinae of Eulophidae (Hym., Chalcidoidea). Later, the genera of family Eulophidae were also keyed by several works in four subfamilies, Eulophinae, Euderinae, Tetrastichinae and Entedoninae (PECK et al. 1964; TRIAPITSYN 1978; GRAHAM 1987; BOUCEK 1988; SCHAUFF et al. 1997; BURKS 2003). BOUCEK (1988) stated that the former Elachertinae (maitained until RIEK 1970), separated from Eulophinae by the presence of the complete notauli, was shown not to be a natural group and two have been united (GRAHAM 1975; BOUCEK & GRAHAM 1978). The Eulophinae include Euplectrini (as a tribe), mentioned as subfamily Euplectrinae by RIEK (1970). On the other hand BOUCEK (1988) provided the Anselmellini and the Keryini as most primitive and ancestral ones found in Eulophinae, and stated that the Anselmellini appear to be phytophagous, have distinctly 11-segmented antenna, and may be a plesiomorphic sister group of Ophelimini (Eulophinae), and the single known specimen of Keryini has a 12-segmented antenna and although placed in Eulophinae, it may be a plesiomorphic sister group of Euderinae plus Tetrastichinae in which the proximal flagellar segments are reduced in size and often also in number, and BOUCEK (1988) mentioned that the ground plan number of antennal segments (including anelli) in Tetrastichinae is also 12 and the Euderinae and Tetrastichinae seems to be closely related and, apart from antenna, both have a number of plesiomorphic features in common with the Keryini, Anselmellini and Ophelimini of the present Eulophinae. BOUCEK (1988) divided the Eulophidae as follows: Subfamily Eulophinae (with the tribes Anselmellini, Keryini, Ophelimini, Eulophini, Euplectrini and Elachertini), subfamily Euderinae, subfamily Tetrastichinae (with the tribes Tetrastichini and Gyrolasomyiini), subfamily Entedoninae (with the tribes Platytetracampini, and Entedonini). SHAFEE et al. (1988) created a new tribe Euderomphalini of Eulophidae (Hymenoptera: Chalcidoidea), and LA SALLE & SCHAUFF (1994) revised Entedonini and discussed the placement of the Euderomphalini SHAFEE, RIZVI & KHAN 1988 in the Entedonine. GAUTHIER et al. (2000) studied on phylogeny of Eulophidae (Hymenoptera: Chalcidoidea), with a reclassiication of Eulophinae and the

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recognition that Elasmidae are derived eulophids, recorded it as tribe Elasmini FÖRSTER 1856. KIM & LASALLE (2005) provided Boucekelimini trib.nov. (Hymenoptera: Eulophidae) from Western Australia. SHA et al. (2006) elevated *Cirrospilini* LASALLE 2000 to subfamily rank of Eulophidae by the works on molecular phylogeny of eulophid wasps inferred from partial 18S gene sequences. HANSSON & STRAKA (2009) found that the name Euderinae ERDÖS 1956 (Hymenoptera: Eulophidae) is a junior homonym of Euderinae LACORDAIRE 1866 (Coleoptera), and synonymized Euderinae with Entiinae HEDQVIST 1974 which was already created as family Entiidae by HEDQVIST (1974). The subfamily Entodoninae has been characterized by SCHAUFF (1991) in having the following synapomorphies;: (1) the scutellum with a single pair of setae; (2) male scape with sensory pores restricted to the ventral edge; (3) submarginal vein with 2 dorsal setae; (4) mesoscutal midlobe with two pairs of setae; (5) position of frontal sulcus; (6) subspiracular propodeal tubercle; (7) marginal vein much longer than submarginal; (9) submarginal vein broken, and SCHAUFF et al. (1997) gave a key to identify the genera of Entedoninae in two tribes, Entedonini and Euderomphalini. BURKS (2003) stated that "the problems of ambiguous morphological data and lack of other definitive grouping evidence apply to all four currently recognized subfamilies of Eulophidae and to most current tribes within these subfamilies. It has been difficult to decide in which subfamily the more problematic groups, such as Anselmellini, Euderomphalini, Ophelimini, and Platytetracampini, could belong. Uncertain homology in morphological characters presents a situation where molecular data could be helpful in determining the position of these groups and in addressing these questions of homology." BURKS et al. (2011) discussed the characters of Entedoninae, gave some exceptional situations of the characters in several genera of Eulophidae and presented a new combined molecular and morphological phylogeny of the Eulophidae with special reference to the subfamily Entedoninae.

Up to now the genera with reduced mandible of Eulophidae were accepted as belong to the subfamily Entedoninae by the works mentioned above in recording the most of their characters as unique ones for the genera. For examples: GAUTHIER et al. (2000) found that *Ceranisus* and *Thripobius* FERRIERE formed an unsupported clade with *Emersonella* as in figs 1, 2, and *Ceranisus* and *Thripobius* formed again a clade out of Entedoninae as in figs 3 and 5. GUMOVSKY (2002) stated that two representatives of *Ceranisus* genus-complex (genera *Ceranisus* and *Thripobius*, both are parasitoids on thrips) are closely related in the obtained trees and this assemblage has high bootstrap support (74). The morphological background for such grouping is based on the following characters: vertexal suture stretching behind posterior ocellus, mandibles reduced (without any teeth), and temples wide. Monophyly of this group (*Ceranisus*, *Goetheana*, *Thripobius*, *Entedonastichus*) is quite reliable, the thrips-parasitizing genera are traditionally treated as a monophyletic unit, and the internal subdivision of this complex into genera is more problematic (BOUČEK 1977; SCHAUFF 1991). The subdivision of the eulophid parasites of Thysanoptera was keyed by BOUČEK (1976) and accepted in general by SCHAUFF (1991). TRIAPITSYN & MORSE (2005) stated that it is still possible the species of thrips-parasitizing entedonine genera represent one and the same genus including some species groups, indeed. BURKS et al. (2011) found that *Ceranisus* was consistently the sister group of *Paracrias* in parsimony results (figs 43 and 44) by inserting to their analysis only the sequence of *Ceranisus menes*, and they stated *Ceranisus* is part of an assemblage of entedonine parasitoids of thrips united by the presence of a transverse groove

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across the vertex. No morphological data have suggested any relationship between this group and either *Emersonella*, or *Paracrias* (GAUTHIER et al. 2000; BURKS et al. 2011).

The genera with reduced mandible of Eulophidae has been known as thrips-attacking genera, *Ceranisus* WALKER 1841 (including *Epomphale* GIRAULT 1915, *Urfacus* DOĞANLAR 2003, *Gaziantepus* gen.n., *Guelsenia* gen.n. and *Sergueicus* gen.n.) (22 spp.), *Entedonomphale* GIRAULT 1915(= *Entedonastichus* GIRAULT 1920) (14 spp.), *Goetheana* GIRAULT 1920 (4 spp.), *Tripoctenus* CRAWFORD 1911 (=*Thripobius* FERRIERE 1938) (3 spp.), and they have been recorded as larval parasitoids of Thysanoptera from all over the world (BOUCEK 1976; 1988; SCHAUFF 1991; LASALLE & SCHAUF 1994; TRIAPITSYN & HEADRICK 1995; GAUTHIER et al. 2000; TRIAPITSYN 2005; TRIAPITSYN & MORSE 2005; DOĞANLAR 2003; DOĞANLAR & TRIAPITSYN 2007; DOĞANLAR et al. 2009; DOĞANLAR et al. 2010 a; DOĞANLAR et al. 2011; BURKS et al. 2011; NOYES 2011).

By the time there has not many works on the morphology of mouth parts of Chalcidoidea. GRAHAM (1987) firstly used labiomaxillary complex of Eulophidae in identification key of subfamilies and stated that maxillary palpi two and labial palpi one segmented in Eulophinae; maxillary and labial palpi two segmented in Euderinae; maxillary and labial palpi one segmented in Entedoninae and Tetrastichinae. BOUCEK (1988) recorded maxillary and labial palpi two segmented in Euderinae. GIBSON & HUBER (2000) figured the labiomaxillary complex of Rotoitidae, and stated that maxillary palpus two-segmented and labial palpus one-segmented with three long apical setae in this family. HERATY & SCHAUFF (1998) studied the external morphology and origin of the specialized tooth of mandible, its distribution within Chalcidoidea, its function, and its potential significance and limitations for determining phylogenetic relationships.

HANSSON (1985) figured type of sensillae in *Chrysocharis* species, such as multiporous sensilla and sensilla basiconica (as in figs 160, 161). HANSSON (1990) studied usefulness of the shape of sense organ, and stated that there are three types of sensilla basiconica (type I, II and III as figs 1, 2, and 8, respectively) on each segment of flagellum in some genera of Entedoninae (such as *Neochrysocharis* has sense organ of type I, *Chrysonotomyia* and *Ceranisus* with type II, *Eugerium* and *Holcopelte* which are now synonym of *Omphale* HALIDAY 1833 have sense organ of type III), he also stated that the consistent possession of only one type within each genus is striking. BURKS (2003) stated that the sense organ of type III is present in *Ceranisus menes* WALKER 1839. BURKS et al. (2011) called them as basiconic peg sensilla and illustrated as in figs 9-11 of BURKS et al. (2011).

Taxonomic history

In Europe WALKER (1839) described *Pteroptrix menes* as new species from London, England, transferred to *Ceranisus* by GRAHAM (1959) and later WALKER (1841) described *Ceranisus* with type-species, *Cirrospilus pacuvius* WALKER 1838 by monotypy. In USA CRAWFORD (1911) described *Thripoctenus* with type-species *Thripoctenus russelli* CRAWFORD from Compton, California; it was also synonymised under *Ceranisus* by GRAHAM (1959). In Australia GIRAULT (1915) described *Epomphale* with type-species, *Epomphale auriventris* GIRAULT 1915, by original designation, and later described *Epomphale rubensteina* GIRAULT 1934, it was synonymized under *Ceranisus* by BOUCEK

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(1988). In Europe, the species of *Ceranisus* were first keyed by GRAHAM (1963), who also described a new species, *C. lepidotus*, from Great Britain. ERDÖS (1966) then described *C. planitianus* from Hungary. More recently, CAMERON et al. (2004) described *C. antalyacus* S. TRIAPITSYN 2004, from the Asian part of Turkey (Antalya) and compared it with the related the Holarctic species of the genus. TRIAPITSYN & HEADRICK (1995) reviewed the Nearctic species of *Ceranisus* and TRIAPITSYN & MORSE (2005) revised the New World fauna of the genus. TRIAPITSYN (2005) gave a world taxonomic revision of *Ceranisus* and three other, related entedonine genera of thrips parasitoids and listed their known host associations.

In Turkey DOĞANLAR (2003) described *Urfacus* with type-species *Urfacus bozovaensis* DOĞANLAR by monotypy and original designation, and later it was synonymized under *Ceranisus* by DOĞANLAR & TRIAPITSYN (2007). DOĞANLAR & TRIAPITSYN (2007) described *Ceranisus hirsitus*, from Turkey and corrects the descriptions of the female and male of *C. bozovaensis* (DOĞANLAR 2003), and provide an identification key to both sexes of *Ceranisus* in Europe and Turkey. DOĞANLAR et al.(2009) and DOĞANLAR et al. (2010a) studied on the DNA sequences of some European species of *Ceranisus*, provided the filogenetic trees for the *C. menes* and *C. pacuvius* groups of *Ceranisus* and described new species from, Turkey.

Recently DOĞANLAR et al. (2010b) found that the genus *Ceranisus* is a complex of genera rather than a single one according to principal component analysis on morphological characters of the European and Turkish species of *Ceranisus*, and also according to the phylogenetic relationships by maximum likelihood inference method on the DNA sequences of about 30 specimens of the genera with reduced mandible from the Palearctic Region and from Australia.

DOĞANLAR et al. (2011) studied Ukrainian species of *Ceranisus*, described some species and provides a key to both sexes of the species of Ukraine.

The systematic of most of the genera mentioned above is also problematic by following ambiguous morphological data and lack of some definitive grouping evidence. In this work the systematic of the genera with reduced mandible was cleared by aid of new morphological characters and the results of phylogenetic analysis of the sequences of 28S D_2 region and of analysis of morphological characters of many species in Eulophidae.

Material and Methods

This study is based upon examination and identification of the specimens collected from several parts of Anatolia (Türkiye), and the specimens in Ukraine including Crimea and obtained from Australia.. The examined specimens were deposited in Insect Museum of Plant Protection Department, Agriculture Faculty, Mustafa Kemal University, Antakya, Hatay, Turkey (MKUI). Specimens were collected by sweeping and putting the whole contents of the swept materials directly in 96 % ethanol. After sorting the materials, individuals were stored in absolute ethanol at deep freeze (-20°C). Some specimens were used for both, morphological and molecular studies. The types were slide mounted in Canada balsam, and deposited in the MKUI.

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DNA amplification and sequencing

The genomic DNA was extracted from single specimen using the DNeasy Tissue Kit (Qiagen) by freezing and heating method (Qiagen, Leusden, the Netherlands). Sequence fragments displaying an increasing degree of variability were analyzed the conserved D2 expansion of the 28S nuclear gene. Standard 50 µl PCR reactions were performed using 0.2 U Taq DNA polymerase (Fermantas), 5 µl, 10x Taq Buffer with KCl (Fermantas), 3 µl, 25mM $MgCl_2$ (Fermantas) , 1 µl 10x dNTPs (Fermantas), 1 µl of each primers, 2 µl template DNA and 36.8 µl dH2O (Sigma). Primers sequences for the 28S rDNA D1F (ACC CGC TGA ATT TAA GCA TAT), D2R (TTG GTC CGT GTT TCA AGA CGG) were from HARRY et al. (1996) and CAMPBELL et al. (1993), respectively. Two PCR conditions were used for the Ceranisinae species, they were: first condition: 30 cycles of 94 °C denaturation (30 s), 55 °C annealing (30 s) and 72 °C elongation (1:30 s) with an initial 94 °C denaturation (3 min) and a final 72 °C extension (30 min), second condition: 30 cycles of 94 °C denaturation (30 s), 62 °C annealing (30 s) and 72 °C elongation (60 s) with an initial 94 °C denaturation (3 min) and a final 72 °C extension (10 min). After DNA amplification, 5 µl product with 1 µl loading dye (Fermantas) were loaded on a 1% agarose gel for DNA checking. DNA was loaded on a 1.5% agarose gel with ethidium bromide, separated by electrophoresis at 140 V for 1 h, visualised under UV. The remainder of the amplified product was purified using a Qiaquick Gel Extraction Kit (Qiagen GmbH, Leusden, the Netherlands). DNA fragments were run on ABI 3100 Avant Genetic Analyzer'a (Applied Biosystems, Foster City, CA).

Sequence alignment and analysis of gene

Sequences were aligned with the program Clustal W (THOMPSON et al.1994) in MEGA 3.1 (KUMAR et al.2005) using the default setting (Open gap penalty=15; extend gap penalty =6.66). The alignments were checked manually and we didn't make any insertion or deletion. Sequences and alignment are available on second author. All species and accession numbers were given table 1.

Equally weighted maximum parsimony (MP) analyses were performed using PAUP (4.0 beta version) (SWOFFORD 1998). For MP analysis, a heuristic search procedure was used with the following default settings: 10 replicates of random taxon addition, tree-bisection-reconnection branch swapping, multiple trees retained, no steepest descent and accelerated transformation. Gaps were treated as missing data. Bootstrap analysis with 1000 replicates was calculated as a measure of support for individual clades for MP trees. As the MP analyses usually gave multiple trees, we used strict consensus tree calculated by PAUP. The sequences of *Epiclerus* sp. (AJ274510, GAUTHIER et al. 2001), *Foersterella reptans* (GQ374782, HERATY et al. 2011) and *Tetracampe* sp. (Hymenoptera; Tetracampidae) (JN623840, MUNRO et.al. 2011) were used as out-group for this analyses.

Table 1. Current name, revised name, their classifications and accession number of specimens used in this study.

Species		Classification			
Name	**Revised Name**	**Subfamily**	**Tribe**	**Accession No.**	**References**
Achrysocharoides insignitellae	_	Entedoninae	Entedonini	AF477587	LOPEZ-VAAMONDE et al. 2005
Achrysocharoides carpini	_	Entedoninae	Entedonini	AF477589	LOPEZ-VAAMONDE et al. 2005
Asecodes sp.	_	Entedoninae	Entedonini	AJ274475	GAUTHIER et al. 2000
Astichomyiia latiscapus P	_	Entedoninae	Entedonini	HM364935	BURKS et al. 2011
Chrysocharis nephereus	_	Entedoninae	Entedonini	AJ274477	GAUTHIER et al. 2000
Chrysocharis gemma	_	Entedoninae	Entedonini	AJ306203	GAUTHIER et al. 2000
Chrysonotomyia maculata	_	Entedoninae	Entedonini	HM364914	BURKS et al. 2011
Closterocerus chamaeleon	_	Entedoninae	Entedonini	AB508836	ADACHI-HAGIMORI et al. 2011
Closterocerus trifasciatus	_	Entedoninae	Entedonini	AJ274479	GAUTHIER et al. 2000
Emersonella albicoxa	_	Entedoninae	Entedonini	AY771681	CUIGNET et al. 2007
Horismenus petiolatus	_	Entedoninae	Entedonini	HM364925	BURKS et al. 2011
Horismenus longicornis	_	Entedoninae	Entedonini	HM364926	BURKS et al. 2011
Neochrysocharis formosa	_	Entedoninae	Entedonini	AJ306205	GUMOVSKY A. 2001
Omphale clypealis	_	Entedoninae	Entedonini	AJ274484	GAUTHIER et al. 2000
Omphale radialis	_	Entedoninae	Entedonini	HM364915	BURKS et al. 2011
Paracrias sp.	_	Entedoninae	Entedonini	HM364922	BURKS et al. 2011
Pediobius alcaeus	_	Entedoninae	Entedonini	AJ274486	GAUTHIER et al. 2000
Entedononecremnus krauteri	_	Entedoninae	Euderomphalini	JN623965	MUNRO et al. 2011
Euderomphale sp.	_	Entedoninae	Euderomphalini	AJ274491	GAUTHIER et al. 2000
Neopomphale sp.	_	Entedoninae	Euderomphalini	AJ274494	GAUTHIER et al. 2001

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Species		Classification			
Name	**Revised Name**	**Subfamily**	**Tribe**	**Accession No.**	**References**
Aulogymnus sp.	_	Eulophinae	Cirrospilini	DQ390414	SHA et al. (unpublished)
Dasyomphale sp.	_	Entedoninae	Euderomphalini	HM364938	BURKS et al. 2011
Cirrospilus ingenuus	_	Eulophinae	Cirrospilini	AJ274433	GAUTHIER et al. 2001
Zagrammosoma buselus	_	Eulophinae	Cirrospilini	AJ274447	GAUTHIER et al. 2001
Dicladocerus westwoodii	_	Eulophinae	Eulophini	HM364952	BURKS et al. 2011
Elachertus laevigatus	_	Eulophinae	Eulophini	AJ274414	GAUTHIER et al. 2001
Eulophus sp.	_	Eulophinae	Eulophini	HM364955	BURKS et al. 2011
Euplectrus sp.	_	Eulophinae	Eulophini	HM364953	BURKS et al. 2011
Pnigalio vidanoi		Eulophinae	Eulophini	GU361554	GEBIOLA et al. 2010
Astichus mirissimus	_	Entiinae	_	AY599261	GILLESPIE et al. 2005
Astichus trichopthalmus	_	Entiinae	_	AY599260	GILLESPIE et al. 2006
Euderus albitarsis	_	Entiinae	_	AJ274496	GAUTHIER et al. 2001
Euderus sp.	_	Entiinae	_	AF345609	GOOLSBY et al. 2001
Ophelimus maskelli	_	Opheliminae	_	HM364944	BURKS et al. 2011
Ophelimus eucalypti	_	Opheliminae	_	AJ274499	GAUTHIER et al. 2001
Ceranisus planitianus	*Epomphale planitianus*	Ceranisinae	_	EU557276	DOGANLAR et al. 2011
Ceranisus planitianus (Gölbasi isolate)	*Epomphale planitianus* (GÖLBASI)	Ceranisinae	_		
Ceranisus menes (Turkey isolate)	*Epomphale menes*	Ceranisinae	_	GQ452247	DOGANLAR et al. 2009
Ceranisus menes (Turkey isolate2)	*Epomphale menes*	Ceranisinae	_	GQ452248	DOGANLAR et al. 2009
Ceranisus menes (Kenya isolate)	*Epomphale menes*	Ceranisinae	_	AJ274476	Gauthier et al. 2001
Ceranisus menes (India isolate)	*Epomphale menes*	Ceranisinae	_	HM364921	Burks et al. 2011
Ceranisus menes isolate 3	*Epomphale menes* isolate 3	Ceranisinae	_		
Ceranisus menes (Teknepinar)	*Epomphale menes* (TEKNEPINAR)	Ceranisinae	_		
Ceranisus amanosus	*Guelsenia amanosus*	Ceranisinae	_	GQ452244	DOGANLAR et al. 2009

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Species		Classification			
Name	**Revised Name**	**Subfamily**	**Tribe**	**Accession No.**	**References**
Ceranisus antalyacus	_	Ceranisinae	_	EU557271	DOGANLAR et al. 2011
Ceranisus pacuvius	_	Ceranisinae	_	EU557275	DOGANLAR et al. 2011
Ceranisus pacuvius sp1	_	Ceranisinae	_		
Ceranisus pacuvius sp2	_	Ceranisinae	_		
Ceranisus pacuvius sp3	_	Ceranisinae	_		
Ceranisus onuri	_	Ceranisinae	_	EU557272	DOGANLAR et al. 2011
Ceranisus hirsutus (Islahiye isolate)	*Gaziantebus hirsutus*	Ceranisinae	_	GQ452245	DOGANLAR et al. 2009
Ceranisus hirsutus (Nurdagi isolate)	*Gaziantebus hirsutus*	Ceranisinae	_	GQ452246	DOGANLAR et al. 2009
Ceranisus hirsutus (Turkey isolate)	*Gaziantebus hirsutus*	Ceranisinae	_	EU557274	DOGANLAR et al. 2011
Ceranisus bozovaensis isolate 2	*Urfacus bozovaensis* isolate 1	Ceranisinae	_		
Ceranisus bozovaensis isolate 3	*Urfacus bozovaensis* isolate 2	Ceranisinae	_		
Ceranisus bozovaensis isolate 4	*Urfacus bozovaensis* isolate 3	Ceranisinae	_		
Ceranisus bozovaensis isolate 5	*Urfacus bozovaensis* isolate 4	Ceranisinae	_		
Ceranisus bozovaensis isolate 6	*Urfacus bozovaensis* isolate 5	Ceranisinae	_		
Aprostocetus lycidas	_	Tetrastichinae	_	AY580328	DELVARE et al. 2004
Aprostocetus luteus	_	Tetrastichinae	_	AY580329	Delvare et al. 2004
Epiclerus sp.	Outgroup	Tetracampidae		AJ274510	GAUTHIER et al. 2001
Foersterella reptans	Outgroup	Tetracampidae		GQ374782	HERATY et al. .2011
Tetracampe sp.	Outgroup	Tetracampidae		JN623840	MUNRO et al. 2011

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Terminology and abbreviations

Morphological terminology follows GIBSON (1997) and TRIAPITSYN (2005). Abbreviations used in the key and descriptions are: C = claval segment, and F = funicular segment, OOL=distance between ocello-ocular line, POL= distance between posterior ocelli. mv= marginal vein; st: stigmal vein; pmv: postmarginal vein;

Wings and antennae of types were slide-mounted in glycerin. Photographs of diagnostic characters of the genera were taken by using Leica DM 5500 B microscope with a digital Leica DFC 295 camera attached to it. Electron micrographs were taken from uncoated specimens with a JEOL JSM 5600LV scanning electron microscope.

Morphological characters

The morphological component of this study includes 39 characters (Table 2). Some of the characters of the genera in Eulophidae were taken from BURKS et al. (2011).

1-**Number of flagellomeres**: 0= 4-segmented; 1= 5-segmented; 2= 6-segmented; 3= 7-8-segmented. In this work the flagellomeres were counted using slide-mounted specimens in species of genera.

2-**Number of separate claval segments in females**: coded using actual number, from 1 to 3.

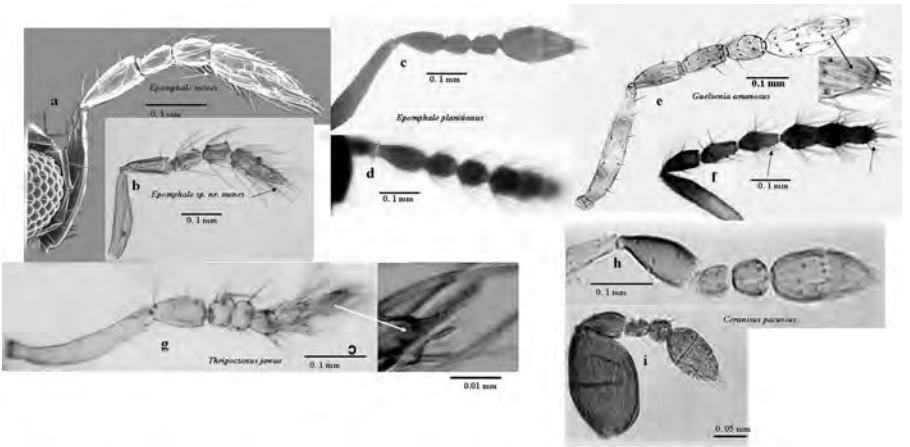

Fig. 1: Shape of flagellomeres in some genera of Ceranisinae. (**a,c,e,g,h**) female; (**b,d,f,i**) male. Arrow shows trichoid sensilla.

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113-**Shape of flagellomeres in males**: 0 = cylindrical and without branches (figs 1 a-e, g-i; fig. 5: flg. of BURKS et al. 2011); 1= nodose, with a rounded expanded section bearing elongate setae (fig. 2. of BURKS et al. 2011); 2 = bearing two or three branches (figs 6 and 7 of BURKS et al. 2011); 3 = cylindrical apically but with a slight basal expansion (fig.1 f; fig. 8 of BURKS et al. 2011).

4-**Shape of basiconic peg sensilla of flagellum**: 0 = symmetrical (fig. 2a); 1 = slightly symmetrical, angular (fig. 2b); 2 = strongly asymmetrical, spear-shaped (fig. 2d). In this work the examples taken from the genera with reduced mandible (fig. 2).

5-**Carinae of pedicel**: 0 = absent (fig. 12: pdl of BURKS et al. 2011)); 1 = present (fig. 13 of BURKS et al. 2011).

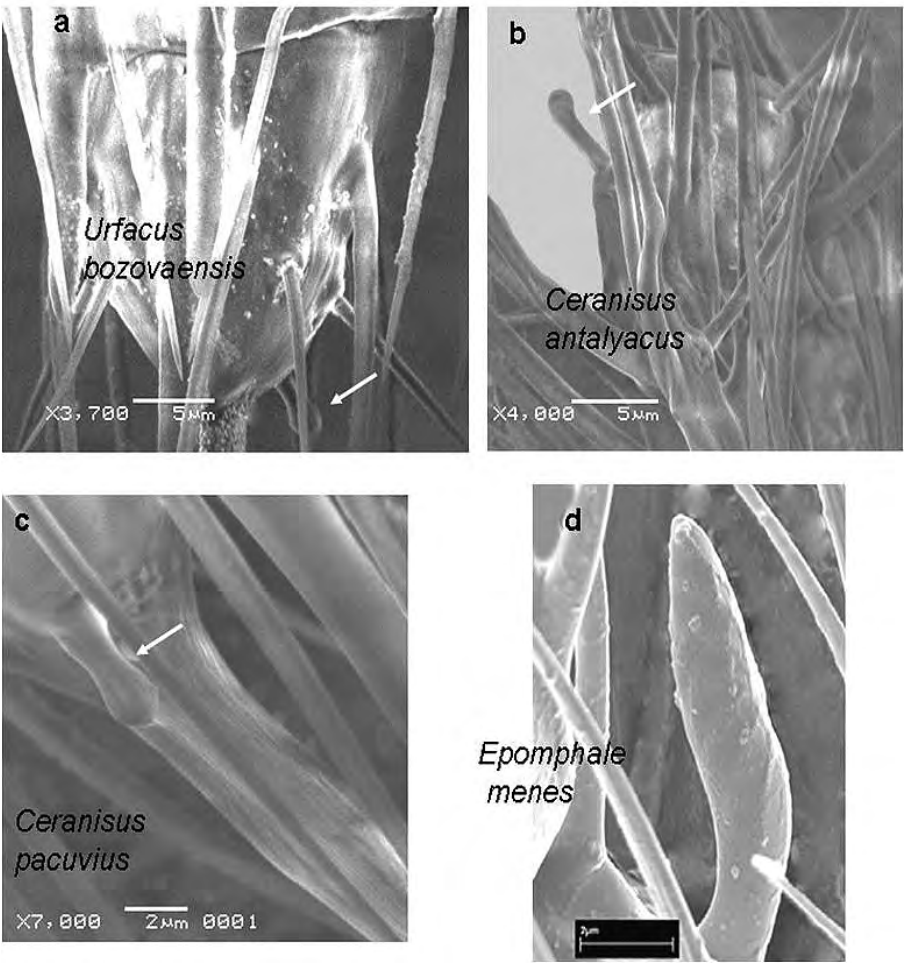

Fig. 2: Types of sensilla basiconica on flagellar segments in Ceranisinae.

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6-**Position of sulcus across vertex**: 0 = absent (fig. 14 of BURKS et al. 2011); 1 = present between median and lateral ocelli (fig. 15: sulcus of BURKS et al. 2011); 2= present across vertex behind lateral ocelli (fig. 3).

There is a different sulcus crossing the vertex behind the ocellar triangle in *Ceranisus* Walker and other thrips parasitoids in Entedonini (SCHAUFF 1991). BURKS et al. (2011) stated that the vertex sulcus in *Ceranisus* would be autapomorphic. In this work the genera with reduced mandible have a distinct vertexal sulcus behind lateral ocelli in various forms as in fig. 3, and in *Entedonomphale* and *Gaziantepus* gen.n. with Y-shaped (fig. 3 f,g).

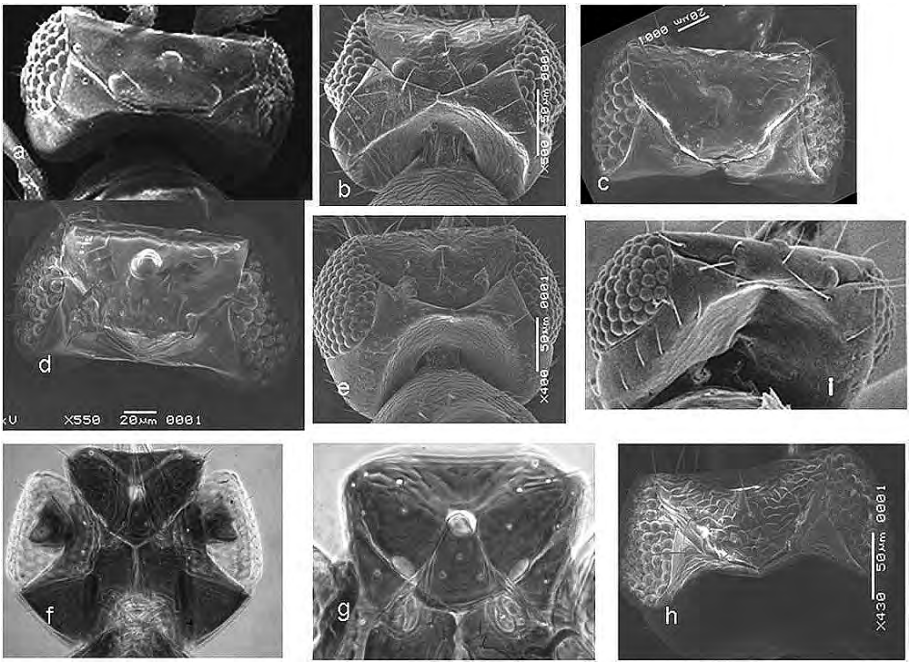

Fig. 3: Head in dorsal view and vertexal sulcus in Ceranisinae. (**a**) *Ceranisus pacuvius*; (**b**) *Urfacus bozovaensis*; (**c**) *Ceranisus antalyacus*; (**d,e**) *Urfacus* spp.; (**f**) *Gaziantepus oguzelinus*; (**g**) *G. hirsutus*; (**h**) *Urfacus atcanacus*; (**i**) *Epomphale menes*.

7-**Vertex posterior carina**: 0 = absent (fig. 14 of BURKS et al. 2011); 1 = present (fig. 16: carina of BURKS et al. 2011).

8-**Transverse facial sulcus**: 0 = absent; 1 = present and adjacent to the median ocellus (fig. 17: tfs of BURKS et al. 2011); 2 = separated from the median ocellus by at least the diameter of the median ocellus (fig. 18: tfs of BURKS et al. 2011).

This character is a modified version of a previous interpretation of the transverse facial sulcus in Entedonini by LASALLE & SCHAUFF (1994), which used the distance between the median ocellus and toruli as a point of comparison.

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9-**Subtorular grooves**: 0 = absent; 1 = present, extending from ventral edge of torulus (fig. 18: stg of BURKS et al. 2011); 2 = present, extending from lateral edge of torulus (fig. 19: stg of BURKS et al. 2011).

10-**Delimitation of clypeus**: 0 = delimited at least by lateral grooves (figs 20 and 21: cly of BURKS et al. 2011); 1 = not delimited (fig. 18 of BURKS et al. 2011).

11-**Clypeus width**: 0 = not enlarged, width less than malar space (fig. 20: cly of BURKS et al. 2011); 1 enlarged, width greater than or equal to malar space (fig. 21: cly of BURKS et al. 2011).

12-**Pronotal collar carina**: 0 = absent (figs 23–27 and 33 of BURKS et al. 2011); 1 = present (fig. 16: prc of BURKS et al. 2011).

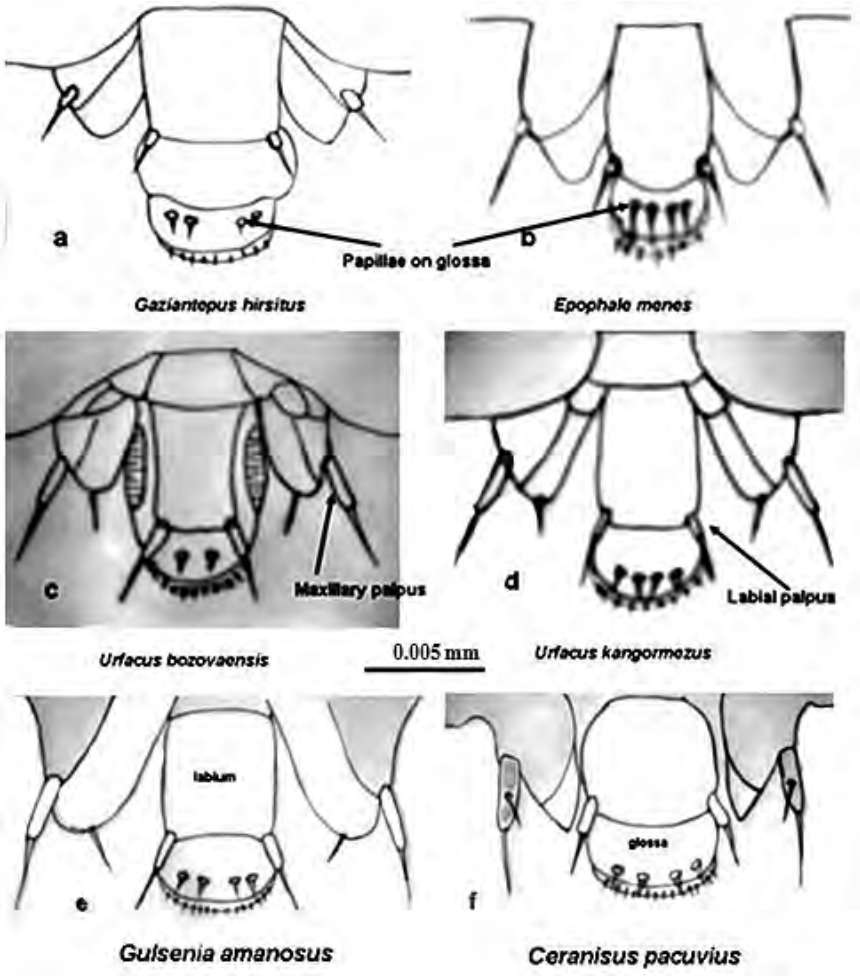

Fig. 4: Mouth parts of the some genera of Ceranisinae.

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13-**Mandibulae**: 0 = absent (fig. 4); 1 = present.

Reduced mandible without any teeth is present only in the thrips-parasitoid genera of Eulophidae (fig. 4). This character is also an autapomorphic for the thrips-parasitoid genera. In other genera of Chalcidoidea the teethed mandible is present.

14-**External completeness of notauli posteriorly**: 0 = reaching trans-scutal articulation (figs 23 and 26 of BURKS et al. 2011); 1 = not reaching trans-scutal articulation, essentially absent (figs 24, 25, 28 and 33 of BURKS et al. 2011).

15-**Pairs of mesoscutal midlobe bristles**: coded using the actual number, from 0 to 3 except that 3 includes counts of 3 or greater (fig. 5).

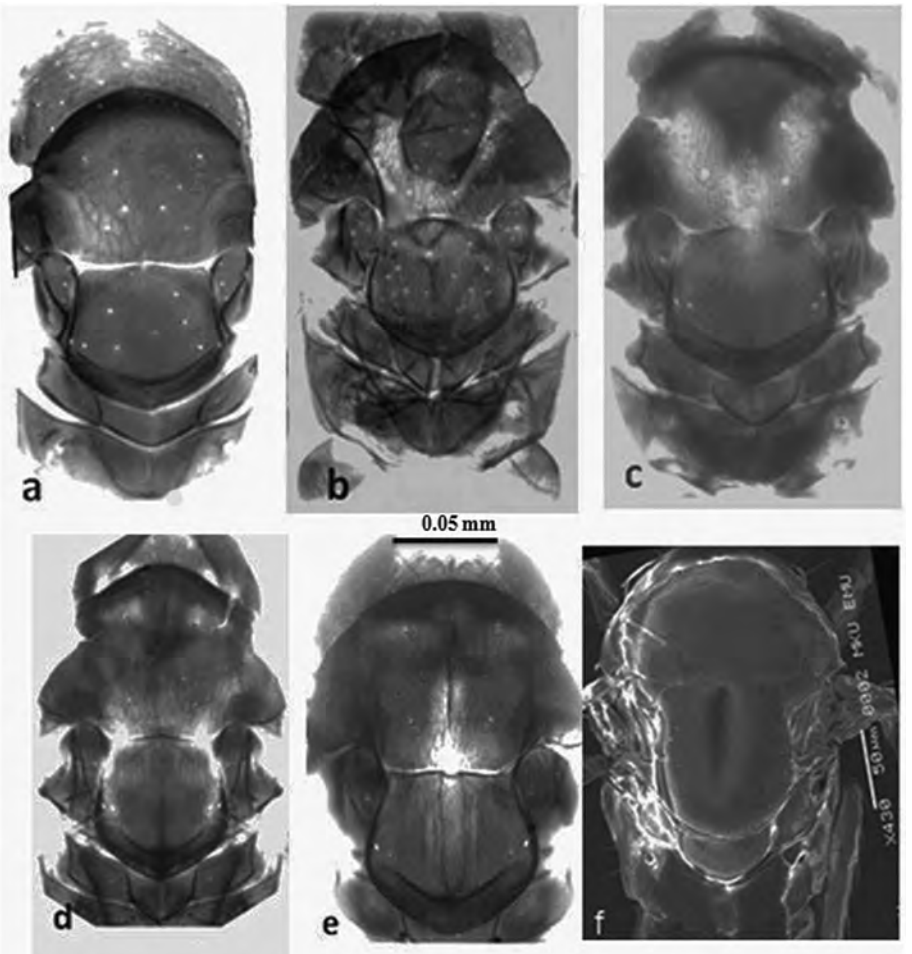

Fig. 5: Mesosoma of some genera of Ceranisinae. (**a**) *Gaziantepus hirsutus*; (**b**) *G. oguzelus*; (**c**, **d**, **e**) *Urfacus* spp.; (**f**) *Ceranisus pacuvius*. Scale bar= 0.05 mm.

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In the genera with reduced mandible only in *Gaziantepus* gen.n. at least 4 pairs of setae and in *Ceranisus* and *Urfacus* 2-3 pairs of setae are present (fig. 5), in *Thripoctenus* 1 pair of setae is present, but in *Goetheana* there is no seta.

16-**Advancement of axillae**: 0 = dorsal axillar surface not completely advanced beyond anterior margin of scutellar disc (figs 23, 24, 26–28 and 33: ax of BURKS et al. 2011); 1 = dorsal axillar surface completely advanced beyond anterior margin of scutellar disc (fig. 25: ax of BURKS et al. 2011).

17-**Pairs of scutellar disc setae**: coded using the actual number, from 1 to 3 except that 3 includes counts of 3 or greater (fig. 5).

In the genera with reduced mandible only in *Gaziantepus* gen.n. has additional setae on the scutellar disc.

18-**Scutellar grooves**: 0 = absent (figs 23, 24, 28 and 33 of BURKS et al. 2011); 1 = present as a U-shaped groove open anteriorly (fig. 26: scg of BURKS et al. 2011); 2 = present as parallel grooves open both anteriorly and posteriorly (fig. 27: scg of BURKS et al. 2011).

19-**Forewing blade on upper side with a distinct semi-oval bare area at posterior margin behind base of marginal vein, demarcated anteriorly by a sinuate line of setae**: 0= absent (fig. 6a, d), 1 = present (fig. 6c).

This character is present in *Epomphale* and *Guelsenia* gen.n. of the genera with reduced mandible (fig. 6 c), but not any genera of Eulophidae.

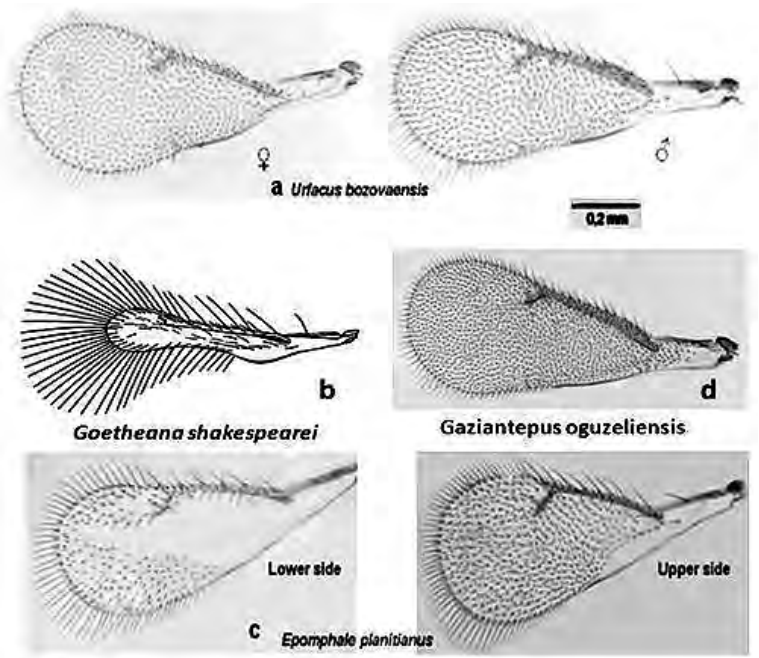

Fig. 6: Fore wings of the some genera of Ceranisinae.

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20-**Expanded male scape**: 0= absent (fig. 7 a,b,d); 1= present (fig. 7c).

This character is present in *Ceranisus* and *Goetheana* of the genera with reduced mandible (fig. 7 c,e), and in *Diaulinopsis* CRAWFORD 1912 of Eulophinae and some species of Tetrastichinae, but not any other genera of Eulophidae.

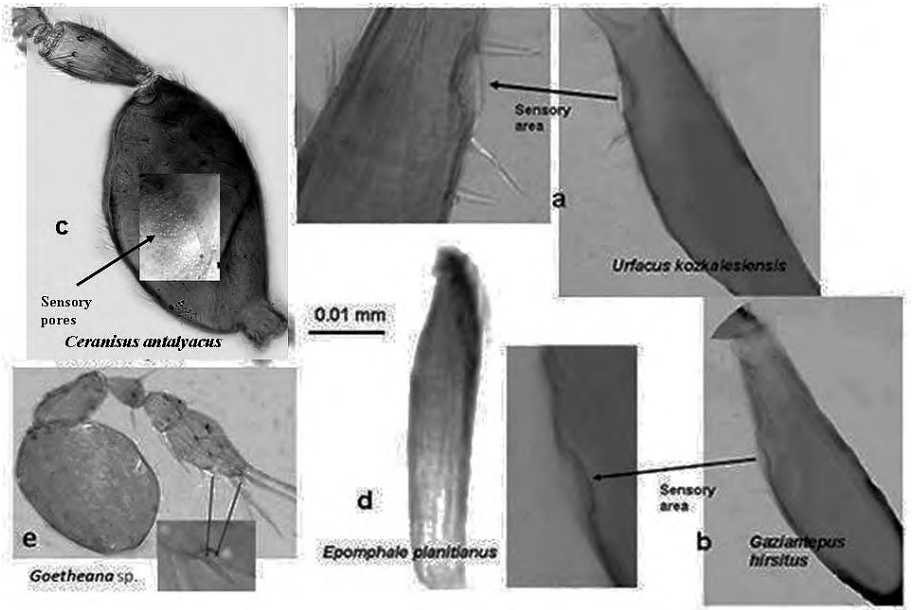

Fig. 7: Male scapes of the some genera of Ceranisinae.

21-**First funicular segments with sensilla basiconica**: 0 = absent; 1 = present.

This character is present in *Epomphale* and *Thripoctenus* of the genera with reduced mandible and in many genera of Eulophidae in several forms.

22-**Second funicular segment with sensilla basiconica**: 0 = absent; 1 = present .

This character is present as only one sensilla basiconica in three of the genera with reduced mandible, *Epomphale*, *Thripoctenus* and *Guelsenia*, and present as at least two sensilla basiconica in the genera of Entedoninae, Tetrastichinae and Entiinae, but absent in *Ophelimus maskelli*, and in the genera with reduced mandible, *Ceranisus*, *Goetheana* and *Gaziantepus*.

23- **Sensilla basiconica on first claval segment**: 0 = absent; 1 = present .

This character is absent in the genera with reduced mandible, *Guelsenia*, *Gaziantepus Goetheana*, and the species of *Ceranisus jabantarlaensis* and *C. onuri*, and present in other genera of Eulophidae.

24. **Sensilla basiconica on second claval segment**: 0 = absent; 1 = present .

This character is absent in the genera of Eulophinae, Tetrastichinae, *Ophelimus maskelli* of Eulophidae, and Tetracampidae, but present in other genera of Eulophidae.

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25-**Clava expanded**: 0 = absent; 1 = present.

This character is present in female of the genera with reduced mandible, except *Thripoctenus*, and in *Ophelimus maskelli*, *Makarora obesa* and some genera of Tetrastichinae, but whole of them with 3 funicular segments, and also teethed mandible, while it is absent in both sexes of *Thripoctenus* and in male of *Epomphale*, *Entedonomphale* and *Guelsenia* in the genera with reduced mandible, and in other eulophids.

26-**Submarginal vein setae**: coded using the actual number, where 3 includes counts of 3 or greater (BURKS et al. 2011).

27-**Postmarginal vein length**: 0 = more than one third stigmal vein length (fig. 8a); 1 = less than or equal to one-third stigmal vein length (fig. 8b).

In the genera with reduced mandible the postmarginal vein is short in *Epomphale*, *Goetheana*, *Gaziantepus*, *Thripoctenus* and some species of *Urfacus* (fig. 8b), and long in *Ceranisus*, *Guelsenia* and some species of *Urfacus* and *Entedonomphale* (fig. 8a).

28-**Temples wider than 1/3 length of eye in dorsal view**: 0 = absent; 1 = present (fig. 2).

This character is present in the genera with reduced mandible as apomorphic, and absent in the genera of other Eulophidae.

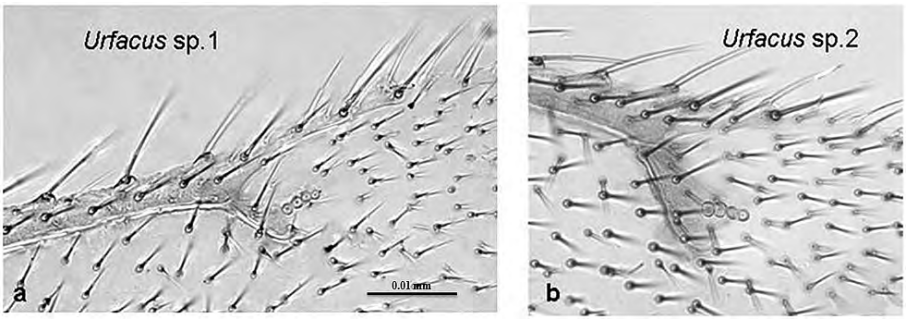

Fig. 8: Postmarginal and stigmal veins in *Urfacus* spp.

29-**Number of volsellar digital spines**: 1 = 1 volsellar spine; 2 = 2 or more volsellar spines (figs 41 and 42: vds of BURKS et al. 2011).

Most eulophids have a pair of spines on each digitus including the genera with reduced mandible. A single spine is present on each volsellar digitus in *Chrysonotomyia* (HANSSON 2004).

30-**Body with sculpture:** 0 = absent; 1 = present.

This character is present in three genera with reduced mandible, *Gaziantepus*, *Urfacus* and *Guelsenia* (fig. 5a-e) as well as in the other genera of Eulophidae, but absent in the genera, *Ceranisus*, *Epomphale*, *Goetheana*, *Entedonomphale* and *Thripoctenus* (fig. 5f).

31-**Parasitoid of thrips**: 0 = absent; 1 = present.

This character is present in the genera with reduced mandible as apomorphic one, while *Pediobius thysanopterus* BURKS 1971 and *Thripastichus gentilei* (DEL GUERCIO 1931)

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were recorded as parasitoids of *Gynaikothrips ficorum* (MARCHAL 1908) (Thysanoptera: Phlaeothripidae). In my opinion, the host records of the species mentioned above need confirmation, because they may become hyperparasitic on the primary ones, such as any species of the genera with reduced mandible.

32-**Segment number of maxillary palps**: 0= 1-segmented; 1= 2-segmented.

The maxillary palpi are two segmented in Eulophinae; Euderinae and Opheliminae; and one segmented in Entedoninae and Tetrastichinae, including the genera with reduced mandible.

33-**Segment number of labial palps**: 0= 1-segmented; 1= 2-segmented

The labial palpi are two segmented in Euderinae and Opheliminae; one segmented in Eulophinae, Entedoninae and Tetrastichinae including the genera with reduced mandible.

34-**No of apical setae of maxillary and labial palps**: 0= one apical seta; 1= 2 or more apical setae.

The apical setae of maxillary and labial palps are one apical seta in the genera with reduced mandible, and in *Closterocerus*, while the other genera of Eulophidae with 2 or more apical setae.

35-**Shape of glossa**: 0= glossa simple, without any spines; 1= glossa having many distinct spines, and most of the genera of Eulophidae with paraglossa distinctly developed.

The glossa, apical part of labium, is simple, without any spines in the genera with reduced mandible, while in the other genera of Eulophidae the glossa is completely developed, with many distinct spines, and in most of them with paraglossa distinctly developed.

36-**Length of maxillary palps**: 0= at most twice as long as width; 1= 3-5 times as long as width; 2= 6 times or more as long as width.

This character is at most twice as long as width in *Epomphale*, *Thripoctenus*, *Gaziantepus* and *Goetheana*, 3-5 times as long as width in *Ceranisus*, *Urfacus*, *Guelsenia*, and 6 times or more as long as width in the other subfamilies of Eulophidae.

37-**Vertex with transverse black band:** 0 = absent (figs 9a,b); 1 = present (figs 9c,d).

This character is absent in, *Ceranisus*, *Urfacus*, *Guelsenia*, *Gaziantepus* and *Goetheana*, and in other eulophdes (figs 9 a,b);, while present in *Epomphale*, and *Thripoctenus* (figs 9c,d).

38-**Forewing very narrow, posterior margin strongly sinuate, fringe setae much longer than transverse wing width**: 0= absent (figs 6 a,c, d); 1= present (fig. 6 b).

39-**Ovipositor exerted**: 0= absent; 1= present.

This character is unique for *Sergueicus* gen.n. (fig. 18), and absent in most of other eulophines, excepts Tetrastichinae. No morphological data have suggested any relationship between the Ceranisinae and Tetrastichinae.

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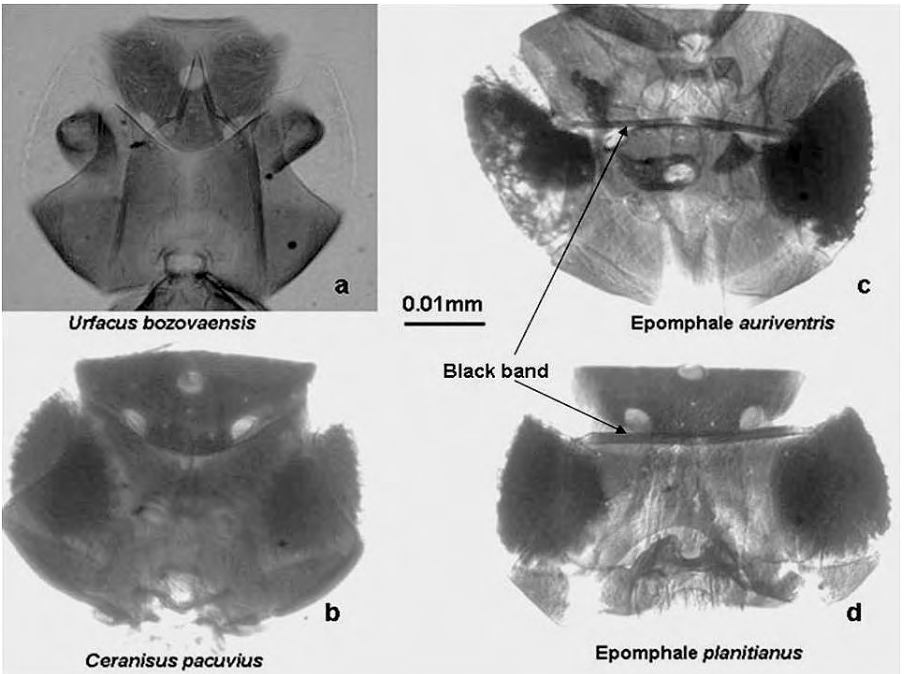

Fig. 9: Head in dorsal view of the some genera of Ceranisinae.

Results and discussion

The genera with reduced mandible belong to Eulophidae in having forewing membrane smooth and hind wing never forked apically, stigmal vein arising at obtuse angle from marginal vein; metafemur not enlarged; tarsi four segmented, protibial spur short and straight; mandible without rasp-like appendage; head without dark H-shaped lines on vertex and face, and with distance between toruli usually about equal or less than to distance from torulus to eye margin; flagellum at most 8-segmented; propodeum without median triangular area; protibial spur short and straight.

Discussion and relationships

The strict consensus of UPGMA analysis of morphological data (fig. 10) show that the genera with reduced mandible created a distinct clade wide apart from the groups, Entedoninae, Entiinae, Tetrastichinae and Eulophinae as a new subfamily, Ceranisinae. On the other hand Eulophiane has a distinct clade together with Eulophini, Cirrospilini, Euplectrini; Entiinae has a distinct clade together with Entiini and Ophelimini; Entedoninae has another clade together with Entedonini and Euderomphalini; and

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Tetrarastichinae has another distinct clade. As out group Tetracampidae has another clade.

The size of the amplified 28S D2 expansion region of the rDNA gene fragment ranged from 400 to 585 bp. The base composition of the sequence had a strong bias toward cytosine and guanine, which constituted approximately 61.8% of the total. The alignment of the sequenced fragment resulted in 438 characters, including gaps. Of these, 154 characters were constant, 122 characters were variable and parsimony-uninformative and 162 characters were parsimony-informative. The alignment was relatively straightforward and did not require insertion gaps. The base composition of the 28S D2 region was as follows: A, 0.1453; C, 0.2954; G, 0.3370; T, 0.2221. The slight G bias evident in the 28S sequences was noted in Chalcidoidea by GILLESPIE et al. (2005), and can be attributed to guanine's ability to base pair with both cytosine and uracil in RNA molecules (GUTELL et al. 1994). Maximum parsimony analysis of the amplified 28S D2 expansion region of the rDNA gene fragment produced 766 equally parsimonious trees [Tree length= 847, consistency index (CI) = 0.4876, retention index (RI) = 0.6778]. The 50% majority-rule strict consensus tree with bootstrap analysis results are given in fig. 11.

In the strict consensus tree, produced by Parsimony analyses, all subfamilies were well clustered and located in different branchs. The main differences were in the position of the (Entedonini) Entodoninae-Ceranisinae group and other supfamilies, these groups were clearly separated from other Eulophidae species with 51 bootstrapp values and 22 bp differences.. In the analysis, high bootstrap values (69, 99, 89-79%) were determined among Entedonini (Entodoninae) and *Urfacus-Guelsenia-Gaziantebus* group, *Ceranisus*, *Epomphale* and *Urfacus* (Ceranisinae) with 4, 10, 15 and 7 bp differences. Other tribes which are Euderomphalini, Ciroospilini represented by tree species and Eulophini represented by five species occurred monophyletic group in the phylogenetic tree. fig. 11.

Table 2. Codes and Numbers of morphological characters of specimens used in this study

Codes and Numbers of Morphological Characters																																								
SPECİES	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**
Ach	2	1	0	0	0	0	0	1	0	1	0	0	1	1	2	0	1	0	0	0	0	1	0	1	0	2	0	0	2	1	0	0	0	1	1	2	0	0	0
As	2	1	0	0	0	0	0	1	1	1	0	0	1	0	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Ast	2	3	0	0	0	0	0	1	0	1	0	1	1	0	1	0	1	0	0	0	0	1	0	1	0	3	0	1	2	1	0	0	0	1	1	2	0	0	0
Chry	3	2	0	1	0	0	0	1	0	1	0	0	1	0	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Chr1	2	3	0	1	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	1	1	0	1	0	3	0	0	1	1	0	0	0	1	1	2	0	0	0
Chr2	2	3	0	1	0	0	0	1	1	0	0	0	1	0	1	0	1	0	0	0	1	1	0	1	0	3	0	0	1	1	0	0	0	1	1	2	0	0	0
Clo1	2	3	0	1	0	0	0	1	1	0	0	0	1	0	1	0	1	0	0	0	1	1	0	1	0	3	0	0	1	1	0	0	0	0	0	2	0	0	0
Clo2	2	3	0	1	1	0	0	1	1	1	0	0	1	0	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	0	0	2	0	0	0
Clo3	2	3	0	1	1	0	0	1	1	1	0	1	1	0	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	0	0	2	0	0	0
Emer	2	1	0	0	0	0	0	1	0	1	0	1	1	0	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Ente	2	2	0	0	0	0	0	1	0	1	0	1	1	1	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Hflo	2	2	0	0	0	0	0	1	0	1	0	1	1	0	2	0	1	0	1	0	1	1	1	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Hlon	2	2	0	0	0	0	0	1	0	1	0	0	1	0	2	0	1	0	1	0	1	1	1	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Ncli	2	3	0	0	0	0	0	1	1	1	0	0	1	0	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Nfor	2	3	0	0	0	0	0	1	1	1	0	0	1	0	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Omp1	2	1	0	2	0	0	0	1	0	0	1	0	1	0	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Omp2	2	1	0	2	0	0	0	1	0	1	1	0	1	0	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Parac	2	3	0	0	0	0	1	1	0	1	0	0	1	1	2	0	1	0	0	0	1	1	1	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Pala	2	2	0	0	0	0	1	1	0	1	0	1	1	1	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Ppul	2	2	0	0	0	0	1	1	0	1	0	0	1	0	2	0	1	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Dchi	2	3	0	0	0	0	0	2	0	0	0	0	1	1	3	0	2	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Enec	2	3	0	0	0	0	0	0	0	0	0	0	1	1	3	0	2	0	0	0	1	1	0	1	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Eu	2	3	0	0	0	1	0	0	0	0	0	0	1	1	2	1	2	0	0	0	0	0	0	0	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
Neop	2	3	0	0	0	1	0	2	0	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	2	0	0	2	1	0	0	0	1	1	2	0	0	0
Aulo	3	3	0	0	0	0	0	1	0	1	0	0	1	0	3	0	2	1	0	0	0	0	0	0	0	3	0	0	2	1	0	1	0	1	1	2	0	0	0
Cir	2	3	0	0	0	0	0	1	0	1	0	0	1	0	3	0	2	1	0	0	0	0	0	0	0	3	0	0	2	1	0	1	0	1	1	2	0	0	0

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Codes and Numbers of Morphological Characters

SPECİES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
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Apr1	3	3	3	0	0	0	0	1	2	1	0	0	1	0	3	0	2	1	0	0	0	0	0	0	0	3	0	0	2	1	0	0	0	1	1	2	0	0	0
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Serg	1	2	2	0	0	2	0	2	0	1	0	0	0	0	2	0	1	0	0	0	0	0	1	1	1	2	1	1	2	1	1	0	0	0	0	1	0	0	1

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Codes and Numbers of Morphological Characters																																									
SPECİES	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**
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As	3	3	2	0	0	0	0	2	0	1	0	0	1	0	3	0	2	0	0	0	1	1	1	1	0	3	0	0	2	1	0	1	1	1	1	2	0	0	0
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Ach: *Achrysocharoides* sp.; As: *Asecodes* sp.; Ast: *Astichomyiia latiscapus*; Chry: *Chrysocharis* sp.: Chr1: *Chrysonotomyia* sp.; Chr2: *Chrysonotomyia maculata*; Clo1: *Closterocerus germanicus*; Clo2: *Closterocerus tau*; Clo3: *Closterocerus trifasciatus*; Emer: *Emersonella planiceps*; Ente: *Entedon ?diotimus*; Hflo: *Horismenus floridensis*; Hlon: *Horismenus longicornis*; Ncli: *Neochrysocharis clinias*; Nfor: *Neochrysocharis formosa*; Omp1: *Omphale chryseis*; Omp2: *Omphale radialis*; Parac: *Paracrias pubicornis*; Pala: *Pediobius alaspharus*; Ppul: *Pediobius pullipes*; Dchi: *Dasyomphale chilensis*; Enec: *Entedononecremnus* sp.; Eu: *Euderomphale* sp.; Neop: *Neopomphale* sp.; Aulo: *Aulogymnus* sp.; Cir: *Cirrospilus* sp.; Zag: *Zagrammosoma* sp.; Dwes: *Dicladocerus westwoodi*; Ela1: *Elachertus* sp.1; Ela2: *Elachertus* sp.2; Eul: *Eulophus* sp.*;* Eup: *Euplectrus* sp.*;* Pni: *Pnigalio* sp.; Apr1: *Aprostocetus* sp. 1; Apr2: *Aprostocetus* sp. 2; Epo: *Epomphale menes*; Epla: *Epomphale planitianus*; Tja: *Tripobius jawae*; Guel: *Guelsenia amanosus*; Cpa: *Ceranisus pacuvius*; Can: *Ceranisus antalyacus*; Con: *Ceranisus onuri*; Cuk: *Ceranisus ukraniensis*; Cja: *Ceranisus jabantarlaensis*; Ubo: *Urfacus bozovaensis*; Uka: *Urfacus kangormezus*; Uad: *Urfacus adıyamanensis*; Uko: *Urfacus kozkalesiensis*; G2: *Gaziantepus hirsutus*; G1: *Gaziantepus oguzeliensis*; Enph: *Entedonomphale*; Goe: *Goetheana* sp.; Serg: *Sergueicus*; Ami: *Astichus mirissimus*; As: *Astichus* sp.; Eud: *Euderus* sp.; Ophe: *Ophelimus maskelli;* Epic1: *Epiclerus* sp.1; Epic2: *Epiclerus* sp.2; Foers: *Foersterella reptans*; Tetra: *Tetracampe* sp.

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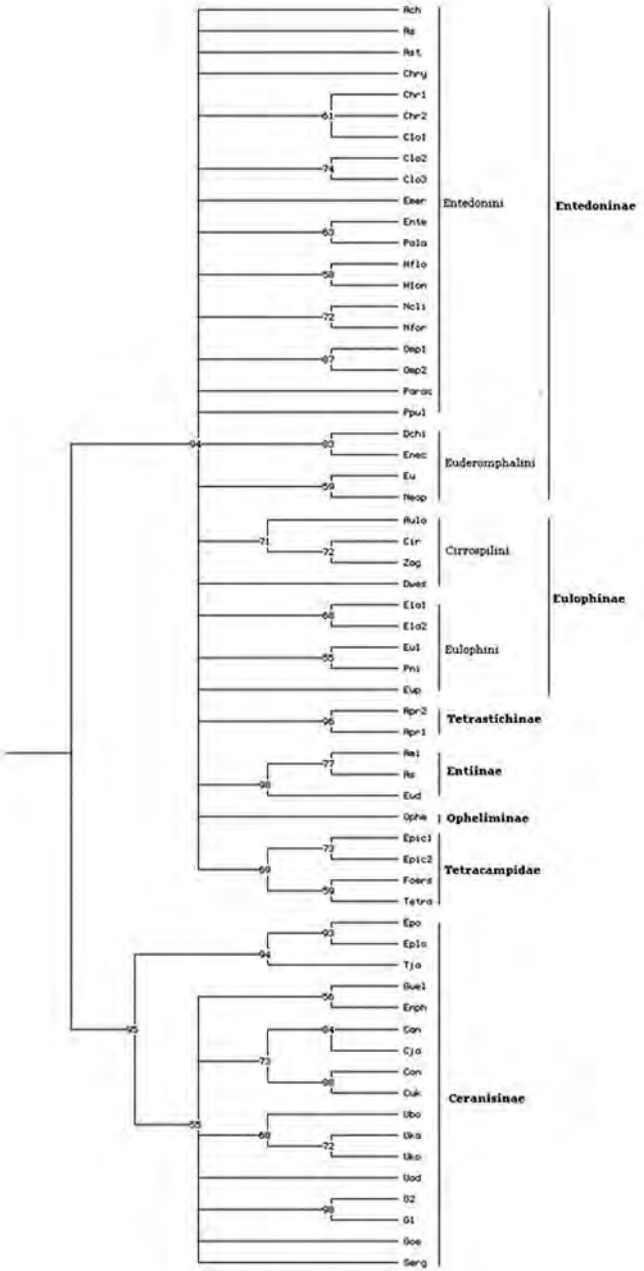

Fig. 10: Bootstrap %50 majority rule consensus tree inferred by UPGMA analyses of the morphological data.

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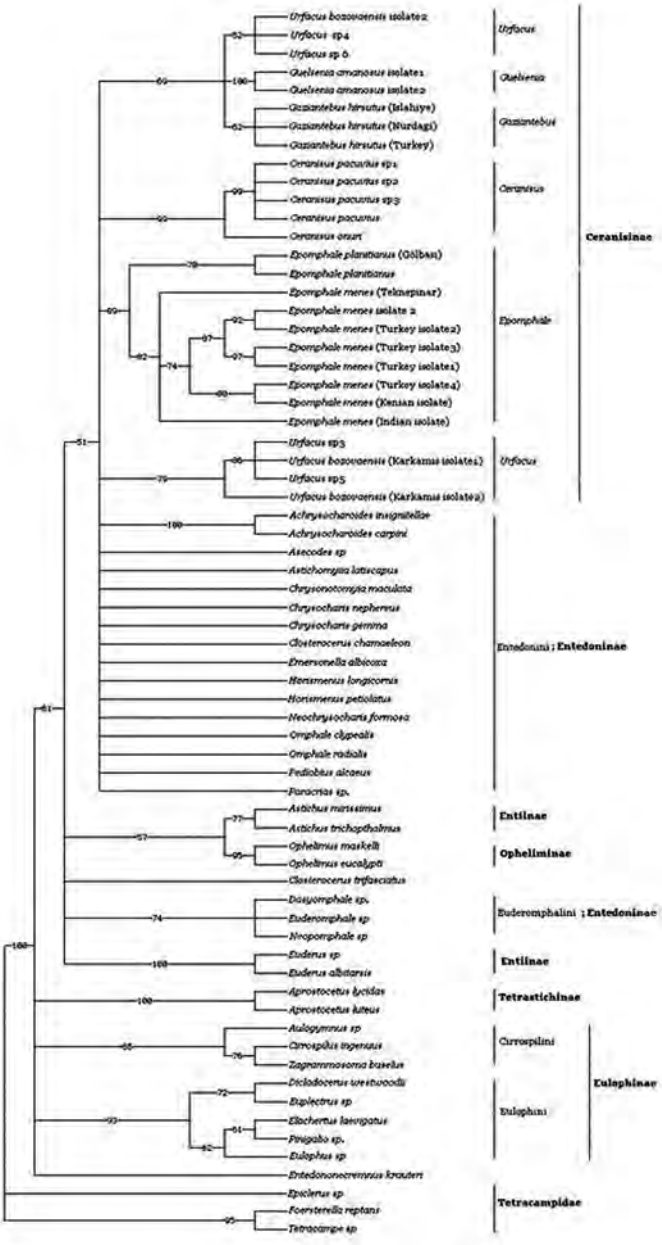

Fig. 11: The strict consensus most parsimonious tree, inferred by 28S D2 rDNA sequences. Numbers above lines represent bootstrap values from 1,000 replicates on all parsimony-informative characters, only bootstrap values >50% shown.

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Key to the subfamilies of Eulophidae

1 Mandibulae reduced, without teeth; maxillary and labial palpi one-segmented, the both with only one apical seta; vertexal sulcus present and usually conspicuous behind posterior ocelli; temples wider than 1/3 length of eye in dorsal view, head almost spherical; Forewing with submarginal vein strongly tapering at apex, not smoothly joining the parastigma; parasitoids of Thysanoptera ..... Ceranisinae

- Mandibulae distinct, with some teeth; maxillary and labial palpi 1- or 2-segmented, with at least two or more apical seta, except *Closterocerus* with one apical seta; vertexal sulcus absent, if present between ocelli; temples at most wider than 1/4 length of eye in dorsal view, head distinctly wider than long; forewing with submarginal vein strongly tapering at apex, or not; parasitoid of other orders of Insecta 2

2 Maxillary and labial palpi 1-segmented; forewing with submarginal vein strongly tapering at apex, not smoothly joining the parastigma 3

- Maxillary palpi 2-segmented and labial palpi 1-or 2-segmented; forewing with submarginal vein strongly tapering at apex, or not 4

3 Mesoscutum with deep and straight notauli; axillae angulately advanced along hind portion of the straight, groove-like notauli; maxillary and labial palpi apically with one long sensilla and at least 3 setae; scutellum with 2 pairs of setae, except Gyrolasomyiini with some hairs .....Tetrastichinae

- Mesoscutum with notauli anteriorly abruptly directed sideward and before the bend at least shortly interrupted; axillae not angulately advanced; maxillary and labial palpi without sensillae and with 1-3 apical setae; scutellum with 1 pairs of setae, except Euderomphalini with 2-or more pairs of setae ..... Entedoninae

4 Maxillary and labial palpi 2-segmented; forewing with submarginal vein strongly tapering at apex, not smoothly joining the parastigma ..... Entiinae

- Maxillary palpi 2-segmented and labial palpi 1-segmented; forewing with submarginal vein smoothly joining the parastigma..... Eulophiane

C e r a n i s i n a e subfam. n.

D i a g n o s i s : Small parasitoids, generally less than 1 mm in length. mandible reduced (without teeth); vertexal sulcus present and conspicuous behind posterior ocelli; frontal sulcus reaching eyes at level of median ocellus; malar sulcus present; flagellum with 1 anellus, 2 funicle segments and a distinct 1-3-segmented clava; apical claval segment with an apical spicula in both sexes (except female of some species of *Entedonomphale* without spicula); clava mostly expanded, at least 1.5 times as wide as the last funicular segment; notauli indistinct, sometimes distinct but faint; midlobe of mesoscutum with mostly 0-2 pairs of setae (except *Gaziantepus* with more than 4 pairs of setae); anterior margin of scutellum straight; scutellum with mostly 1 pair of setae (except *Gaziantepus* with more than 3 pairs of setae); forewing broadened beyond submarginal vein (except species of *Goetheana*); petiole at most as long as wide, notably wider than long; maxillary and labial palps 1 segmented with one apical seta, in several form; the subspiracular propodeal tubercle is absent.

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Monophyly of the subfamily Ceranisinae

The following characters support the overall monophyletic of the subfamily.

Mandible reduced, without teeth (fig. 4)

All Ceranisinae have the mouth with reduced mandible, without teeth. It is not present in any other Chalcidoidea, which have distinct teethed mandible.

Vertexal sulcus present and usually conspicuous behind posterior ocelli between hind margins of eyes (fig. 3)

This character is present as broadly Y-shaped in *Gaziantepus* and *Sergueicus*, straight, with black band in *Epomphale* and *Thripoctenus*, and broadly V-or C-shaped in other genera of Ceranisinae, and rare in Entedoninae. The vertexal sulcus is present between anterior and posterior ocelli in species of *Cabeza* HANSSON & LASALLE, *Euderomphale* GIRAULT and *Neopomphale* LASALLE & SCHAUFF, and present behind posterior ocelli in *Baeoentedon* Girault of tribe Euderomphalini, but the vertexal sulcus situated just below the median ocellus (LASALLE & SCHAUFF 1994). In Ceranisinae vertexal sulcus situated between hind margins of eyes behind posterior ocelli.

Placement of sensilla basiconica on flagellar segments. In Ceranisinae one sensilla basiconica is present on each flagellar segment of *Epomphale* and *Thripoctenus*, while in other genera of Ceranisinae some of the flagellar segments have no sensilla basiconica, and some *Urfacus* species with female clava two-segmented have two sensilla basiconica on the last segment of clava. In other genera of Eulophidae, if present, the sensilla basiconica is present on each flagellar segment, and at least two or more ones on each segment.

Temples wider than 1/3 length of eye in dorsal view, head almost spherical. If head is not collapsed, in Ceranisinae head is almost spherical, and temples is wider than 1/3 length of eye in dorsal view. In other genera of Eulophidae head is almost at least twice as wide as long, temples is at most wider than 1/4 length of eye in dorsal view.

Clava mostly expanded, at least 1.5 times as wide as the last funicular segment. This character is present in all genera of Ceranisinae, except males of the genera, *Epomphale*, *Thripoctenus*, *Entedonomphale* and *Guelsenia*, in which the antennae are filiform. In other genera of Eulophidae the antennae have clava at most slightly wider than last funicular segment.

Hosts are thrips. All Ceranisinae species whose biologies are known are parasitoids of Thyasanoptera. This biology is not known in any other Eulophidae, except this host record has been known that *Pediobius thysanopterus* BURKS 1971 and *Thripastichus gentilei* (DEL GUERCIO 1931) were recorded as parasitoids of *Gynaikothrips ficorum* (MARCHAL 1908) (Thysanoptera: Phlaeothripidae) in Eulophidae. But they do not seem particularly related to the Ceranisinae, in having mandible with teeth and vertexal sulcus absent.

Synapomorphies in Ceranisinae

1-Shape of maxillary and labial palpi (fig. 4).

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Maxillary and labial palpi are one-segmented, small, maxillary palps are at most 5 times and labial palpi twice as long as wide, and they have only one apical seta, except *Ceranisus* has an extra small seta on about middle of maxillary palpi.

In Entedoninae and Tetrastichinae maxillary and labial palpi are also one segmented, but they have many apical setae and also some more setae on other parts of palpi.

2-Presence of sensory area on scape of male antenna (fig. 7).

In Entedoninae sensory area on scape of male antenna was presented by HANSSON (1994, 1995) as indicating differences of close ancestor of *Neochrysocharis* and *Closterocerus* from *Chrysonotomyia* ASHMEAD, *Ceranisus*, *Thripoctenus*, and *Entedonastichus* GIRAULT **(**synonymised under *Entedonomphale* by TRIAPITSYN 2005). In the species of *Urfacus* and *Gaziantepus*, and at least two species of *Entedonomphale* studied sensory area are present on the scape of male antenna (fig. 7a,b), like *Neochrysocharis* and *Closterocerus*, while *Ceranisus* has sensory area as small tiny pores on whole suface of scape (fig. 7c), and *Guelsenia* and *Epomphale*, *Thripoctenus* and *Entedonomphale* (may be some species) have no sensory area on the scape (fig. 7d).

3-Presence of black, straight, complete band on the margin of vertexal suture (fig. 9).

Species of *Epomphale* and *Thripoctenus* have black, straight and complete band on the margin of vertexal suture (fig. 9c,d), while species of the other genera in Ceranisinae have no black band (fig. 9a,b).

4-Presence of expanded marginal vein (fig. 6).

Species of *Urfacus*, *Gaziantepus* have expanded marginal vein in the most male specimens, even in females there is also slightly expanded marginal vein as *Entedonomphale postmarginalis* SCHAFFE, RIZVI & KHAN (fig. 6a,d), while species of the other genera in Ceranisinae have always narrow marginal vein in both sexes (fig. 6a,c). In Eulophinae there is also some species with expanded marginal vein, such as some species of *Entedon* (Entedoninae), and *Diglyphus* (Eulophinae), but no morphological data have suggested any relationship between those groups which have also teethed mandible.

5-Presence of semi-oval bare area at posterior margin behind base of marginal vein, demarcated anteriorly by a sinuate line of setae (fig. 6).

The forewing blade having a distinct semi-oval bare area at posterior margin behind base of marginal vein, demarcated anteriorly by a sinuate line of setae (fig. 6c) is present in *Epomphale*, *Thripoctenus*, *Guelsenia*, *E. postmarginalis* and male of *E. bulgarica* BOYADZIEV & TRIAPITSYN but it absent in any other genera of the Eulophinae.

6-Number of setae on scutellum and on mid lobe of mesoscutum (fig. 5)

In the species of *Gaziantepus* new. gen. there are 3- 4 pair of setae on scutellum and 4-5 pairs of setae on mid lobe of mesoscutum in *hirsutus*, and with 10 pairs of setae on scutellum and 15 pairs on midlobe of mesoscutum in *G. oguzeliensis* O. DOĞANLAR nov.sp. (fig. 5a,b), while species of other genera in Ceranisinae have only one pair of setae on scutellum, and 0-3 pairs on mid lobe of mesoscutum (fig. 5c-f).

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Key to the genera of Ceranisinae

1 Forewing recurved along posterior margin, nearly parallel sided below marginal vein; longest marginal seta much greater than width of forewing (fig. 4b); maxillary and labial palpi very small, almost as long as wide (fig. 1b); the last two claval segments with only one sensilla basiconica type III. ..... *Goetheana* GIRAULT 1920

- Shape of forewing not as above; longest marginal setae at most equal to (usually much less than) width of forewing (figs 4a,c,d); length of maxillary and labial palpi, presence on flagellar segments and type of sensilla basiconica variable 2

2 Female with solid clava, without spicula; male having flagellum either with 2 funicle segments and 3-segmented (or rarely entire) clava or with 3 funicle segments and a solid clava; each of flagellar segments, except first, with only one sensilla basiconica type I; both sexes with petiole at least as long as wide, often notably longer than wide; parasitoids of Phlaeothripidae (Tubulifera) .... *Entedonomphale* GIRAULT 1915

- Female with 2-3-segmented clava, with distinct spicula; male having flagellum with 2 funicular segments and 3-segmented clava; presence of sensilla basiconica on flagellar segments variable; both sexes with petiole at most as long as wide, often notably wider than long; parasitoids of Thripidae (Terebrantia) 3

3 Female with ovipositor exerted beyond apex of gaster by about 1/3 of its total length, about as long 3.4 times length of hind tibia; head triangular in lateral view; vertexal sulcus broadly Y-shaped; notauli faint, but complete; clava about 1.5 times as wide as last funicular segment in female ..... *Sergueicus* gen.n.

- Female with ovipositor not exerted beyond apex of gaster, at most twice length of hind tibia; head almost spherical; shape of vertexal sulcus variable; notauli incomplete; clava at least twice as wide as last funicular segment in female 4

4 Forewing blade on upper side with a distinct semi-oval bare area at posterior margin behind base of marginal, demarcated anteriorly by a sinuate line of setae vein (fig. 6c); maxillary palpi with only one apical seta (figs 4a-e) 5

- Forewing blade on upper side without a distinct semi-oval bare area (figs 6a,d); maxillary palpi with one apical seta or an additional seta around middle (fig. 4f)..... 7

5 Maxillary palpi at least trice longer than wide, labial palpi at least twice as long as wide (fig. 4e); upper margin of vertexal sulcus without black band (fig. 9b); sensilla basiconica type II present on second funicular segment and claval segments in female, and on second funicular segment and two apical claval segments in male; male with sensory area on apical part of scape; forewing blade on lower side distinctly setous (fig. 6a)..... *Guelsenia* gen.n.

- Maxillary and labial palpi very small, maxillary palpi at most twice longer than wide, labial palps as long as wide (fig. 4b); upper margin of occipital suture with a black, straight, complete band (figs 9c,d); each flagellar segments with only one sensilla basiconica type III (fig. 2d); forewing blade on lower side broadly bare below marginal vein, and having a distinct bare area extending from stigma to almost tip of forewing (fig. 6c); male without sensory area on apical part of scape (figs 7e,d) 6

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6 Female flagellum with short, normal pilosity, in male with only long setae, without trichoid sensilla (figs 1a-d); thorax elongate, pronotum distinctly visible dorsally, scutellum not very convex; mesoscutum with 2 pairs of setae ..... *Epomphale* GIRAULT 1915 (Stat. rev.)

- Flagellum in both sexes with long, trichoid sensilla (fig. 1g); thorax subquadrate to rounded, pronotum almost hidden dorsally; mesoscutum 1 pair of setae ..... *Thripoctenus* CRAWFORD 1911 (Stat. rev.)

7 Body without distinct reticulation (fig. 5f); maxillary palpi with an extra small seta around middle (fig. 4f); male scape expanded (fig. 1h), with many dense, fine sensory pores on whole surface (fig. 7c); only one sensilla basiconica of type II present only on first and second segments of clava in female, and second and third segments of clava in male ..... *Ceranisus* WALKER 1841

- Body with distinct reticulation (figs 5a-e); maxillary palpi without small seta around middle, with only one apical seta (figs 4a-f); male scape at most slightly expanded (figs 1a,g), with sensory pores on distinct area 1/4 apical part; numbers and locations of sensilla basiconica of type I on clava variable 8

8 Midlobe of mesoscutum with 2-3 pairs, scutellum one pair of setae and axillae with 1 seta; forewing with marginal vein expanded in male, basal wide mostly twice wider than apical wide of marginal vein (fig. 4a); maxillary and labial palpi very long, maxillary palpi at least 3.5 times longer than wide, labial palpi at least twice as long as wide; labium with glossa having 2-4 papillae on apical margin (figs 1c,d); clava 2-3 segmented in female and 3-segmented in male; one sensilla basiconica of type I present on first segment of clava and two sensilla basiconica on second segment in female with two segmented clava, and one sensilla basiconica of type I present on each segment of clava in both sexes with 3-segmented clava; ovipositor as long as or slightly shorter than hind tibia ..... *Urfacus* DOĞANLAR 2003 (Stat. rev.)

- Midlobe of mesoscutum with at least 4-5 pairs, scutellum at least 3-4 pairs of setae and axillae with 2-3 pairs of seta; forewing with marginal vein expanded (figs 4c,d) in male and female; maxillary palpi at most twice longer than wide, labial palpi as long as wide; labium with glossa having 4 papillae on apical margin (fig. 1a); clava 3 segmented in both sexes; one sensilla basiconica of type II present on second and third segments of clava; ovipositor 1.26 times as long as hind tibia ..... *Gaziantepus* gen. n.

Ceranisus WALKER 1841 (figs 1h,i; 3b; 4f; 5f; 7c; 9b)

Ceranisus WALKER 1841: vi, pl. N, fig. 2. Type species: *Cirrospilus pacuvius* WALKER 1841 by monotypy.

Ceranisus: TRIAPITSYN 2005: 288-307 (world revision including list of synonyms, diagnosis, key to females).

Ceranisus: DOĞANLAR & TRIAPITSYN 2007: 105-110 (revision of European species, including list of synonyms, diagnosis, key to male and females).

D i a g n o s i s : vertexal sulcus present and usually conspicuous; frontal grooves reaching eyes at level of median ocellus; malar sulcus present and straight; maxillary and labial palps very long, maxillary palpi at least 4 times as long as wide, labial palpi at least twice as long as wide; mandible reduced (without teeth); female flagellum with two funicle segments and a distinct 2- or 3-segmented clava (usually 2-segmented but 3-segmented in *C. onuri* O. DOĞANLAR 2010 and *C. ukraniensis* DOĞANLAR, GUMOVSKY,

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O. DOĞANLAR 2011); apical claval segment with an apical spicula in both sexes; male antenna having a swollen scape with many dense, fine sensory pores on whole surface, flagellum with 2-segmented funicle and 3-segmented clava; mesosoma usually smooth or at most lightly sculptured); notauli indistinct, sometimes distinct but faint; midlobe of mesoscutum with 2 pairs of setae; anterior margin of scutellum straight; scutellum with 1 pair of setae; forewing broadened beyond submarginal vein; forewing disc uniformly setose beyond base of marginal vein; marginal vein of forewing not expanded; fore wing blade with distinct setae on both side; petiole at most as long as wide, notably wider than long.

Monophyly and relationships

Ceranisus is best defined as monophyletic in Ceranisinae by the following characters:

Maxillary palpi have an extra small seta around middle (fig. 4f). This form of maxillary palpi is not seen in the other Ceranisinae, but it is present in *Closterocerus* of Entedoninae.

Male scape with many dense, fine sensory pores on whole surface (fig. 7c). This is a unique character which is not seen in other Eulophidae; except *Hyssopus* GIRAULT 1916 (Eulophinae) in which the pores are scattered over nearly the entire surface of scape (fig. 20 of SCHAUFF 1985).

Only one sensilla basiconica of type II is present on first and second segments of clava in female with two-segmented clava, and on second and third segments of clava in male and female with 3-segmented clava (figs 2b,c). This character is same in Goetheana, in which forewing unique shape, while it is different in other genera of Ceranisinae, and of Eulophidae.

Male scape is expanded, at most twice as long as wide (fig. 1i). This character is present in *Ceranisus* and *Goetheana* of the genera of Ceranisinae (figs 7c,e), and in *Diaulinopsis* CRAWFORD 1912 of Eulophinae, in *Neochrysocharis pictipes* (CRAWFORD 1912) of Entedoninae, and some species of Tetrastichinae, which are not seem morphologically related to the Ceranisinae, in having teethed mandible and vertexal sulcus absent, but not any other genera of Eulophidae.

Body with light engraved reticulation, or almost smooth (fig. 5). This character is present in the genera, Epomphale, Thripoctenus, Goetheana, and Entedonomphale of Ceranisinae, but it is absent in three genera, Gaziantepus, Urfacus, Guelsenia and Sergueicus of Ceranisinae, as well as in the other genera of Eulophidae.

Biology. Larval parasitoids of various Thripidae (Terebrantia).

D i s t r i b u t i o n : Worldwide.

C o m m e n t s : TRIAPITSYN (2005) listed four distinct groups of species within *Ceranisus*, the *C. menes* species group, two of which, *C. menes* and *C. planitianus*, were transferred to *Epomphale* GIRAULT 1915 (stat.rev.), and *udnamtak* is transfered to *Guelsenia* gen.n. together with *C. amanosus* DOĞANLAR, GUMOVSKY & O. DOĞANLAR 2009; the *C. pacuvius* species group; the *C. russelli* species group, containing *C. russelli* which is transferred to *Thripoctenus*, in having sensilla basiconica type III (com. n.); and

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the *barsoomensis* species group, comprised of the single species, *C. barsoomensis* TRIAPITSYN 2005, which is transferred to *Sergueicus* gen.n.

DOĞANLAR et al. (2010) described *C. onuri* O. DOĞANLAR from Turkey, and DOĞANLAR et al. (2011) described *C. ukrainensis* and *C. jabantarliensis* from Ukraine.

Included species

pacuvius (WALKER). *Cirrospilus pacuvius* WALKER 1838: 383.

H o s t s : *Kakothrips pisivorus* (THOMPSON 1955), *K. robustus* (BOUCEK 1961; BOUCEK & ASKEW 1968; TRJAPITZIN 1978)

D i s t r i b u t i o n : Afghanistan (TRJAPITZIN 1978); Europe (WALKER 1838; FERRIÈRE 1936; THOMPSON 1955; ERDÖS 1956; BOUCEK 1961; 1965; BOUCEK & ASKEW 1968; BOUCEK & GRAHAM 1978; TRJAPITZIN 1978; SZELÉNYI 1981; HANSSON 1987; 1991; KALINA 1989; TEULON, CAMERON & LOOMANS 1996; THUROCZY & JENSER 1996, VIDAL 2001; HEDQVIST 2003; TRIAPITSYN 2005; DOGANLAR & TRIAPITSYN 2007); Turkey (DOGANLAR & TRIAPITSYN 2007); Ukranie (DOĞANLAR, GUMOVSKY & DOĞANLAR 2011)

antalyacus TRIAPITSYN. *Ceranisus antalyacus* TRIAPITSYN, CAMERON, TEULON, TRIAPITSYN& TUNÇ 2004: 378-381.

H o s t s : *Thrips major* (CAMERON, TEULON, TRIAPITSYN & TUNÇ 2004)

D i s t r i b u t i o n : Turkey (CAMERON, TEULON, TRIAPITSYN & TUNÇ 2004; DOĞANLAR & TRIAPITSYN 2007)

onuri O. DOĞANLAR. *Ceranisus onuri* O. DOĞANLAR 2010. DOGANLAR, DOGANLAR & FRARY 2010: 286-288.

H o s t s : *Thrips meridionalis* (DOGANLAR, DOGANLAR & FRARY 2010).

D i s t r i b u t i o n : Turkey (DOGANLAR, DOGANLAR & FRARY 2010).

ukrainensis DOĞANLAR, GUMOVSKY & DOĞANLAR. *Ceranisus ukrainensis* DOĞANLAR, GUMOVSKY & DOĞANLAR 2011: 225-227.

H o s t s : Unknown.

D i s t r i b u t i o n : Ukraine (DOGANLAR, GUMOVSKY & DOGANLAR 2011).

jabantarliensis DOĞANLAR, GUMOVSKY Q DOĞANLAR. *Ceranisus jabantarliensis* DOĞANLAR, GUMOVSKY & DOĞANLAR 2011.

H o s t s : Unknown.

D i s t r i b u t i o n : Ukraine (DOGANLAR, GUMOVSKY & DOGANLAR 2011).

votetoda TRIAPITSYN. *Ceranisus votetoda* TRIAPITSYN 2005: 297-298.

H o s t s : Unknown.

D i s t r i b u t i o n : Australia: Western Australia (TRIAPITSYN 2005).

nigrifemora DE SANTIS. *Ceranisus nigrifemora* DE SANTIS 1961: 16-19.

H o s t s : Unknown.

D i s t r i b u t i o n : Argentina, Venezuela (TRIAPITSYN & MORSE 2005).

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loomansi TRIAPITSYN & HEADRICK. *Ceranisus loomansi* TRIAPITSYN & HEADRICK 1995: 237-238.

H o s t s : Unknown.

D i s t r i b u t i o n : USA: Arizona (TRIAPITSYN & HEADRICK 1995); California, Colarado (TRIAPITSYN & MORSE 2005); Canada: Alberta, British Columbia, Manitoba, New Brunswick, Ontario, Prince Edward Island, Saskatchwan (TRIAPITSYN & MORSE 2005).

hoddlei TRIAPITSYN & MORSE. *Ceranisus hoddlei* TRIAPITSYN & MORSE 2005: 77-78.

H o s t s : Unknown.

D i s t r i b u t i o n : Mexico, Estado de Mexico, San Francisco, Costa Rica, Francisco Morazan, Venezuela, Merida (TRIAPITSYN & MORSE 2005).

There are some of undescribed species from Turkey will be studied later.

***Urfacus* DOĞANLAR 2003** (Stat. rev.) (figs 2a, 3b,de,h, 4c,d, 5c-e, 6a, 7a, 8a,b, 9a, 12a,b)

Urfacus DOĞANLAR 2003: 182. Type species: *Urfacus bozovaensis* DOĞANLAR; 2003 by monotypy and original designation. (Synonymised with *Ceranisus* WALKER by DOĞANLAR& TRIAPITSYN 2007: 105).

D i a g n o s i s : Body with distinct reticulation (figs 5a-e); maxillary palpi with only one apical seta (figs 4a-f); forewing with marginal vein mostly expanded; male scape at most slightly expanded (figs 1a,g), with sensory pores on distinct area in 1/4 apical part; midlobe of mesoscutum with 2-3 pairs, scutellum one pair of setae; maxillary palpi at least 3.5 times, labial palpi at least twice as long as wide; labium with glossa having 2-4 papillae on apical margin (figs 1c,d); clava 2-3 segmented in female and 3-segmented in male; one sensilla basiconica of type I present on first segment of clava and two sensilla basiconica on second segment in female with two segmented clava, and one sensilla basiconica of type I present on each segment of clava in both sexes with 3-segmented clava.

Monophyly and relationships.

Urfacus is best defined as monophyletic by the following characters:

Presence of the male scape with sensory area restricted to a small semispherical area on apical part of scape (fig. 2). This form of sensory area on male scape is seen in *Gaziantepus* and in some of other Eulophidae which are not seem morphologically related to the Ceranisinae, in having teethed mandible and vertexal sulcus absent.

Body distinctly reticulated (figs 5c-e). This form of body is seen only *Gaziantepus*, *Sergueicus* and *Guelsenia* in Ceranisinae, but *Gaziantepus* has many setae on Scutellum and midlobe of mesoscutum, *Guelsenia* has forewing blade on upper side with a distinct semi-oval bare area at posterior margin behind base of marginal vein, demarcated anteriorly by a sinuate line of setae and *Sergueicus* has exerted ovipositor.

Two sensilla basiconica of type I are present on second segments in female with 2-segmented clava. This character is absent in other genera of Ceranisinae, but one sensilla basiconica present on each segments of clava in both sexes of *Urfacus* with 3-segmented

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clava, but in *Gaziantepus*, *Ceranisus jabantarlaensis*, and *C. onuri* which have also three-segmented clava in female, the first claval segment has no sensilla basiconica, and other segments with one sensilla basiconica.

Expanded marginal vein. This character is present in the species group of *U. bozovaensis* mainly on wings, but it is absent in the species group of *lepidotus*. (fig. 6a).

H o s t s : Known host for *U. bozovaensis* is Phlaeothripidae (Tubulifera).

D i s t r i b u t i o n : Southeastern Anatolia, Eastern part of Mediterranean Region.

Redescription. Body dark brown to black; vertexal suture broadly V-shaped; frontal grooves reaching eye at level of anterior ocellus (fig. 12a); malar sulcus present and straight; maxillary palpi at least 4 times longer than width, labial palpi at least twice as long as wide; labium with glossa having apically 2-4 papillae (fig. 12b,c); mandible reduced (without teeth); antennal scape (in both sexes) notably expanded in basal half and narrowing distally; the scape of male antenna with sensory pores on distinct area in 1/4 apical part of scape; on female flagellum with 2 funicle segments and a distinct 2-3-segmented clava, apical claval segment with an apical spicula in both sexes; male flagellum with 2 funicle segments and 3-segmented clava; only one sensilla basiconica of type I is present on first segment of clava and two on second segments in female with 2-

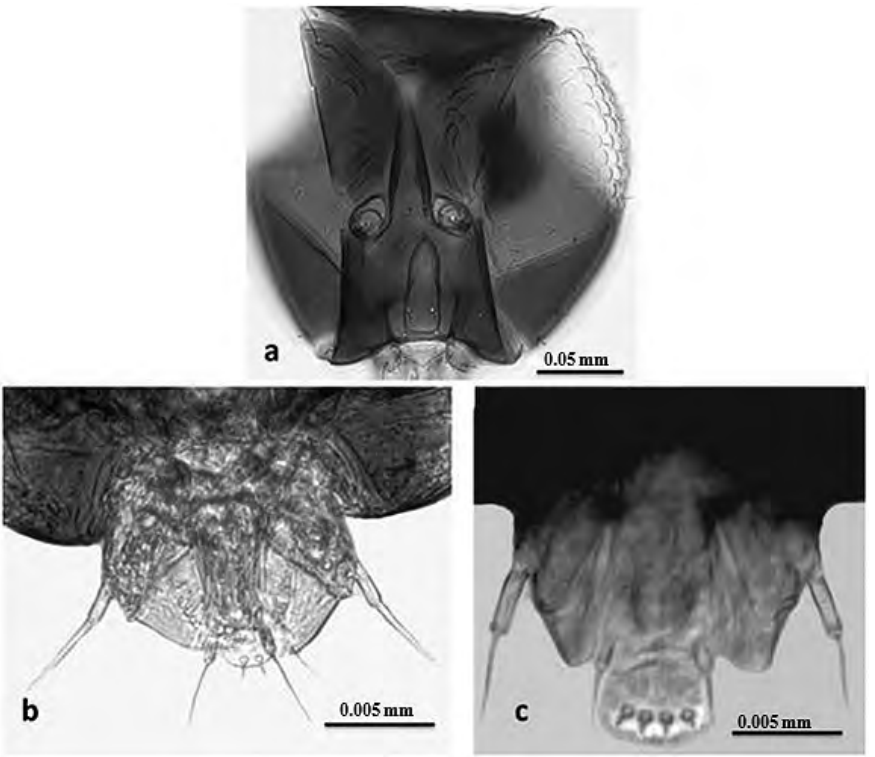

Fig. 12: *Urfacus* spp. (**a**) head, in frontal view; (**b**) mouth parts in *U. bozovaensis* group; (**c**) mouth parts in *U. lepidotus* group.

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segmented clava, one sensilla basiconica present on each segments of clava in both sexes with 3-segmented clava; notauli indistinct; midlobe of mesoscutum with 2-3 pairs, scutellum with 1 pair of setae; anterior margin of scutellum almost straight; forewing broadened beyond submarginal vein; with marginal vein expanded, especially in male, basal wide twice wider than apical width of marginal vein (fig. 4a) in *U. bozovaensis* group, and narrow in *U. lepidotus* group; fore wing blade with distinct setae on both side; petiole as long as wide.

C o m m e n t s : The genus includes two species group, the *U. bozovaensis* species group and the *U. lepidotus* species group. In the *U. bozovaensis* group labium has glossa with 2 papillae apically (fig. 12b); female flagellum with 2 funicle segments and a distinct 2-segmented clava; midlobe of mesoscutum with 2 pairs of setae;

In the *U. lepidotus* group labium has glossa with 4 papillae apically (fig. 12b); female flagellum with 2 funicle segments and a distinct 2-3-segmented clava; midlobe of mesoscutum with 2-3 pairs of setae.

Included species

The *bozovaensis* group:

bozovaensis DOĞANLAR. *Urfacus bozovaensis* DOĞANLAR 2003: 182-184.

H o s t s : Phlaeothripidae (Tubulifera) (DOĞANLAR 2003; DOĞANLAR & TRIAPITSYN 2007).

D i s t r i b u t i o n : Turkey: Southeastern Anatolia, Eastern part of Mediterranean Region (DOĞANLAR 2003; DOĞANLAR & TRIAPITSYN 2007)

There are two undescribed species from Turkey which will be studied later.

The *lepidotus* group:

lepidotus (GRAHAM). comb.n. *Ceranisus lepidotus* GRAHAM 1963: 271, 272.

H o s t s : *Frankliniella occidentalis* and *Limothrips cerealium* (LACASSA et al. 1996)

D i s t r i b u t i o n : Greath Britain (GRAHAM 1963); England (UK), Spain (TRIAPITSYN 2005).

There are at least 4 undescribed species from Turkey which will be studied later.

***Gaziantepus* gen.n.** (figs 3f,g; 4a; 5a,b; 6d; 7b; 13;14 a-g; 15a-g)

Type species: *Gaziantepus oguzeliensis* O. DOĞANLAR 2010:

E t y m o l o g y : The name was derived from name for Gaziantep, locality of the type species; Gender masculine.

D i a g n o s i s : Midlobe of mesoscutum with at least 4-5 pairs, scutellum at least 3-4 pairs of setae and axillae with 2-3 pairs of seta; forewing with marginal vein expanded (fig. 15e) in both sexes; maxillary palpi at most twice longer than wide, labial palpi as long as wide; labium with glossa having 4 papillae on apical margin (fig. 13); flagellum with 2 funicular segments and 3-segmented clava in both sexes; one sensilla basiconica

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of type II present on second and third segments of clava; ovipositor 1.26 times as long as hind tibia.

Monophyly and relationships

Gaziantepus is best defined as monophyletic by the following characters:

Midlobe of mesoscutum with 4-5 pairs, scutellum with 3-4 pairs of setae, and axillae at least 2-3 pairs setae. This character is a unique for *Gaziantepus* in the Ceranisinae, while it is also present in some genera of Eulophidae, but which are not seem particularly related to the Ceranisinae, in having teethed mandible.

Vertexal sulcus broadly Y-shaped. This character is present in *Gaziantepus* and *Sergueicus* gen n. in the Ceranisinae.

Flagellum in both sexes with 2 funicular segments and a distinct 3-segmented clava.

Description. Female. Body dark brown to black; non-metallic. Head with vertexal sulcus broadly Y-shaped (figs 15c); frontal grooves reaching eye at level of anterior ocellus; malar sulcus present and straight; maxillary and labial palpi short, maxillary palpi at most twice as long as wide, labial palpi as long as wide (fig.13); labium with glossa having 4 papillae on apical margin; mandible reduced (without teeth); antennal scape (fig.14f) slightly expanded in basal half and narrowing distally; flagellum (figs 14a,f; 15d) with 2 funicular segments and a distinct 3-segmented clava, apical claval segment with an apical spicula in both sexes; notauli indistinct; midlobe of mesoscutum (figs 14b,c) with 4-5 pairs, scutellum with 3-4 pairs of setae, and axillae at least 2-3 pairs setae; body with distinct, reticulated sculpture; anterior margin of scutellum straight; forewing broadened beyond submarginal vein; with marginal vein mostly expanded; stigmal vein distinctly petiolate; basal cell with many short setae; marginal ciliae short. Gaster (fig. 14e) with petiole as long as wide. Male genitalia as fig. 14g.

H o s t s : Larval parasitoids of various Thripidae (Terebrantia).

D i s t r i b u t i o n : Southeastern Anatolia, Eastern part of Mediterranean Region

C o m m e n t s : It is distinct from all known genera of Ceranisinae by midlobe of mesoscutum with 4-5 pairs, scutellum with 3-4 pairs of setae.

Included species

hirsutus DOĞANLAR & TRIAPITSYN. *Ceranisus hirsutus* DOGANLAR & TRIAPITSYN 2007: 106-107.

H o s t s : Unknown.

D i s t r i b u t i o n : Turkey.

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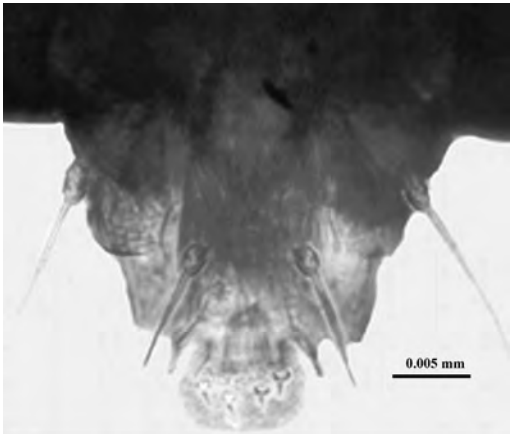

Fig. 13: Mouth parts of *Gaziantepus hirsutus* (DOĞANLAR & TRIAPITSYN).

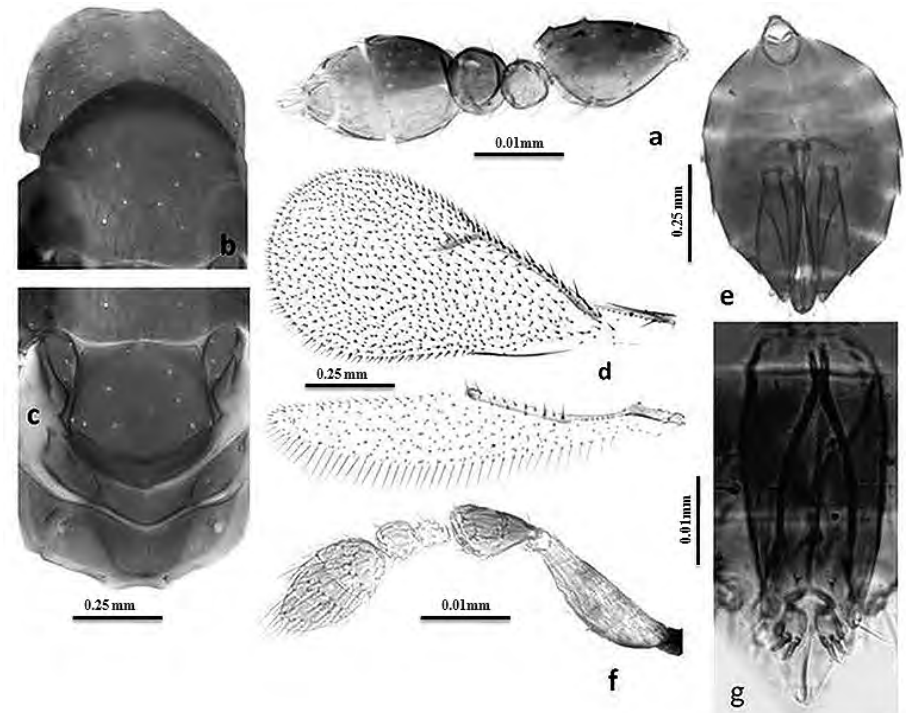

Fig. 14: *Gaziantepus hirsutus* (DOĞANLAR & TRIAPITSYN): (**a**) antenna; (**b**) mesoscutum; (**c**) scutellum; (**d**) forewing; (**e**) hindwing; (**f**) antenna.

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***Gaziantepus oguzeliensis* O. DOĞANLAR nov.sp.** (figs 15a-g)

Holotype ♀ (on slide), labelled: "TURKEY, Gaziantep, Oğuzeli, Keçikuyusu Willage, 15.V.2007, 36 58 41 N 37 34 01 E, 815 m, (in MKUI).

D e s c r i p t i o n

F e m a l e : Body length 1.26 mm. Head, antenna and mesosoma brown; legs, venation and metasoma light brown; wings hyaline.

Head. Vertexal suture broadly Y-shaped (fig. 15c). Antenna (fig. 14d) sparsely setaous; with scape slender, about 3.98 × as long as wide, pedicel slightly longer than scape 2.3 × longer than wide, F1 almost cylindirical and without sensilla, narrower than F2, 1.1 × as long as and 0.7× as wide as F2; F2 with 1 sensillum; clava three segmented, including spicula 1.9 × as long as wide, C1 wider and longer than C2 and C3.

Mesosoma (fig. 15b) and whole body longitudinally and densely striated; propodeum with many setae; mid lobe of mesosoma with at least 30 pairs of setae; side lobes with 26 setae; scutellum with 9 pairs of setae; axillae with 11 setae;; forewing with speculum closed almost nill, basal cell closed hairy, both side of forewing hairy; Forewing (fig. 15e) 2.1 × as long as wide; both side of forewing uniformly covered with numerous microtrichia; longest marginal cliae about 1/8 maximal width of forewing; submarginal vein with 2 long macrochaetae; postmarginal vein 0.5 × as long as stigmal vein, marginal vein+parasitigma 6.04×as long as stigmal vein. Hind wing as fig.15f.

Metasoma with petiole almost 2.05 × as long as wide. Ovipositor (fig. 15g) occupying about 1/3 length of gaster, slightly exserted; ovipositor length/metatibia length ratio 1:1.2.

Measurements: Body 1.26 mm; gaster 0.65 mm; mesosoma 0.43 mm; propodeum 0.054 mm; length of scutellum 0.108 mm; width of head 0.27 mm; pst+mv 0.297 mm; ped+flagellum 0.203 mm; club+spicula 0.08 mm.Relative measurements, as length or length / width: Antenna scape: 3.7/0.9; pedicel: 5.6/2.4; F1: 2.3/2.1; F2: 2.1/52.7; clava: 6+1.1/3.8, C1: 2.4/3.8, C2:1.8/3.4, spicula: 1.1; Forewing 35/17, longest marginal cilia 2.1, Ovipositor: 13.5.

D i a g n o s i s : By following the key of DOĞANLAR & TRIAPITSYN (2007) for The European and Turkish species of *Ceranisus* the new species, *G. yavuzeliensis*, runs to female of *G. hirsutus* in having midlobe of mesoscutum and scutellum with more than two pairs setae, but it differs from *G. hirsutus* in having mesosoma and scutellum (fig. 15b) with 15 and 9 pairs setae, respectively (in *G. hirsutus* mesoscutum and scutellum (fig. 14b,c) with 8 and 9 setae, respectively). The metasoma; mesoscutum, scutellum, and axillae with light engraved sculpturing in *G. hirsutus* (fig. 14b,c), but the whole body of *G. yavuzeliensis* longitudinally and densely striated (fig. 15b). Scape 3.98 × as long as wide (in *G. hirsutus* scape 4.8 ×as long as wide); pedicel (fig. 15d) 2.3 × as long as wide (in *G. hirsutus* pedicel 1.8× as long as wide).

M a l e : unknown.

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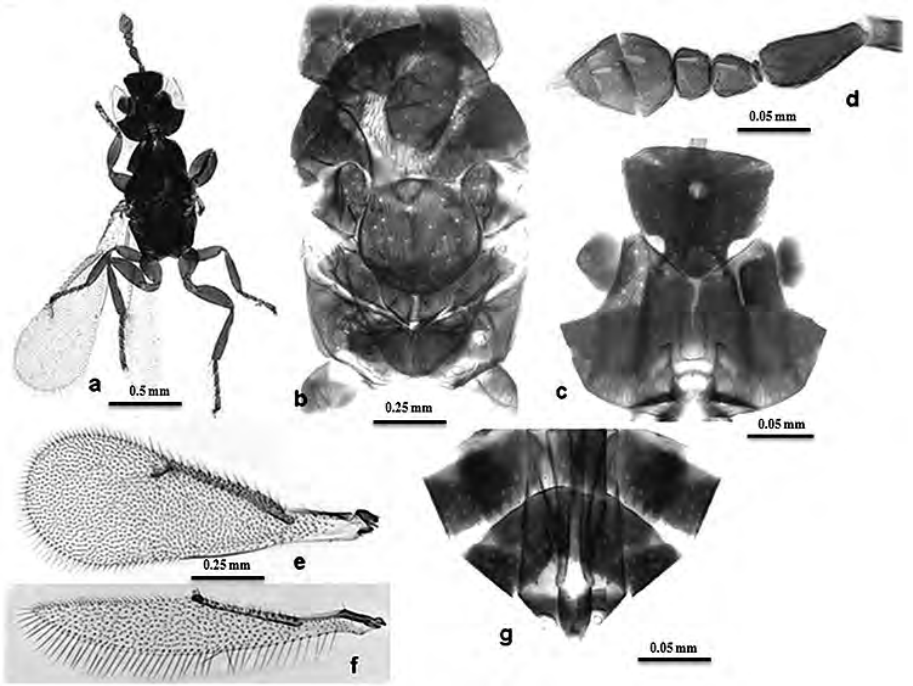

Fig. 15: *Gaziantepus oguzeliensis* (O. DOĞANLAR) (**a**) body; (**b**) mesoscutum and scutellum (**c**) head; (**d**) antenna; (**e**) forewing; (**f**) hindwing; (**g**) gaster and genitalia.

***Epomphale* GIRAULT 1915 (Stat. rev.)** (figs 1a-d; 2d; 4b; 6c; 9c; 16a-f)

Epomphale GIRAULT 1915: 211. Type-species, *Epomphale auriventris* GIRAULT 1915, by original designation, (synonymised under *Ceranisus* by BOUCEK 1988: 733).

D i a g n o s i s : Forewing blade on upper side with a distinct semi-oval bare area at posterior margin behind base of marginal, demarcated anteriorly by a sinuate line of setae vein, on lower side broadly bare below marginal vein, and having a distinct bare area extending from stigma to almost tip of forewing (fig. 6c); female flagellum with short, normal pilosity, in male with only long setae, without trichoid sensilla (figs 1a-d); male scape without sensory area on apical part (fig. 7d); Maxillary and labial palpi very small, with only one apical seta, maxillary palpi at most twice longer than wide, labial palps as long as wide (fig. 4b); upper margin of occipital suture with a black, straight, complete band (fig. 9c); each flagellar segments with only one sensilla basiconica type III (fig. 2d); thorax elongate, pronotum distinctly visible dorsally, scutellum not very convex; mesoscutum with 2 pairs of setae (fig. 16a,d).

R e d e s c r i p t i o n : Body with thorax dark brown to black and mostly with yellow gaster (fig. 16a); occipital suture straight; wertex with a narrow, black band (fig.9c); frontal grooves reaching eye at level of anterior ocellus; malar sulcus present; maxillary and labial palps short, almost as long as wide; labium with glossa having 4 papillae on apical margin (fig. 4b); mandible reduced (without teeth); antennal scape (in both sexes)

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slender shaped; flagellum in both sexes with 2 funicle segments, clava 2-segmented in female and 3-segmented in male, apical claval segment with an apical spicula in both sexes (fig. 2d); notauli indistinct; midlobe of mesoscutum with 2 pairs, scutellum one pair of setae and axillae with 1 seta; body lightly reticulated or smooth; anterior margin of scutellum straight; forewing broadened beyond submarginal vein; forewing blade on upper side with a distinct semi-oval bare area at posterior margin behind base of marginal vein, demarcated anteriorly by a sinuate line of setae; on lower side broadly bare below marginal vein and a distinct bare area extending from stigma to almost tip of forewing (fig. 6c); stigmal vein wide and sessile, its petiole almost nil.

Biology: Larval parasitoids of various Thripidae (Terebrantia).

D i s t r i b u t i o n : Worldwide.

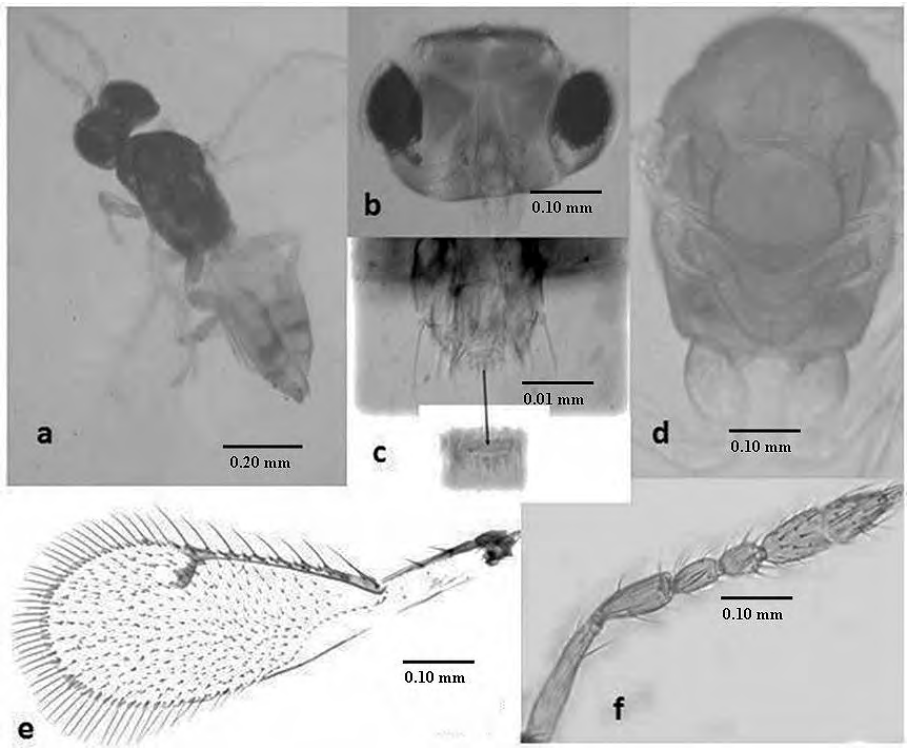

Fig. 16: *Epomphale* GIRAULT. Female. (**a**) body; (**b**) head in frontal view; (**c**) mouth parts; (**d**) mesonotum; (**e**) forewing; (**f**) antenna.

C o m m e n t s : In the genera of Ceranisinae *Epomphale* is similar to *Thripoctenus* and *Guelsenia* in having forewing blade on upper side with a distinct semi-oval bare area at posterior margin behind base of marginal vein, but it is different from *Thripoctenus* in having female flagellum with short, normal pilosity, in male with only long setae, without trichoid sensilla (figs 1a-d); thorax elongate, pronotum distinctly visible dorsally, scutellum not very convex; mesoscutum with 2 pairs of setae (in *Thripoctenus* flagellum in both sexes with long, trichoid sensilla (fig. 1g); thorax subquadrate to rounded, pro-

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notum almost hidden dorsally; mesoscutum 1 pair of setae (fig. 17a,b). *Epomphale* is also different from *Guelsenia* gen.n. by very small maxillary and labial palps fig. 3b) (in *Guelsenia* maxillary and labial palps very long, they are at least twice longer than wide (fig. 3e), and in having forewing blade on lower side below marginal vein with a distinct bare area extending from stigma to almost tip of forewing (figs 6b,c) (in *Guelsenia* with forewing blade setous in both sides).

Included species

menes (WALKER). *Pteroptix menes* WALKER 1839: 17-18. (com. n.)

H o s t s : Various Thripidae (LOOMANS & van LENTEREN 1995; TRIAPITSYN 2005).

D i s t r i b u t i o n : Cosmopolitan (LOOMANS & van LENTEREN 1995; TRIAPITSYN & HEADRICK 1995; TRIAPITSYN & MORSE 2005); Turkey (TRIAPITSYN 2005; DOĞANLAR & TRIAPITSYN 2007).

auriventris GIRAULT. *Epomphale auriventris* GIRAULT 1915: 211. (stat.rev.)

H o s t s : Unknown.

D i s t r i b u t i o n : Australia, QLD, Gordonvale.

References. The species was synonymised by BOUCEK (1988) under *Ceranisus menes*, and synonymy is accepted by TRIAPITSYN (2005).

rubensteina GIRAULT. *Epomphale rubensteina* GIRAULT 1934: 3. (stat.rev.)

H o s t s : Unknown.

D i s t r i b u t i o n : Australia, WA, Perth.

References. The species was synonymised by BOUCEK (1988) under *Ceranisus menes*, and synonymy is accepted by TRIAPITSYN (2005).

planitianus (ERDÖS). *Ceranisus planitianus* ERDÖS 1966: 408,409. (com.n.)

H o s t s : Unknown.

D i s t r i b u t i o n : Canada, USA, Israel, Moldova, spain (TRIAPITSYN & MORSE 2005); Czechoslovakia (LOOMANS & VAN LENTEREN 1995); Turkey (DOĞANLAR & TRIAPITSYN 2007); Ukraine (DOĞANLAR et al. (2011).

There are some of undescribed species from Turkey will be studied later.

***Thripoctenus* CRAWFORD 1911** (Stat.rev.) (figs 1g; 17a-d)

Thripoctenus CRAWFORD 1911: 233. Type-species *Thripoctenus russelli* CRAWFORD, by monotypy. (Synonymised under *Ceranisus* by PECK 1963: 117, BOUCEK 1976: 401-414, GRAHAM 1959: 203).
Thripobius FERRIERE 1938: 146. Type species: *Thripobius hirticornis* FERRIERE 1938, by monotypy. (syn.n.).
Thripobius FERRIERE: BOUCEK 1988: 734; SCHAUFF 1991:70, 71; LOOMANS & VAN LENTEREN 1995: 132-137. TRIAPITSYN 2005: 307-311.
D i a g n o s i s : The distinguishing characters were given by BOUCEK (1976; 1988); BURKS (2003) and TRIAPITSYN (2005) as *Thripobius* FERRIERE. Some additional features are as follows: Maxillary and labial palpi very small, maxillary palpi at most twice longer than wide, labial palpi as long as wide (fig. 4b); upper margin of occipital suture with a

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black, straight, complete band (figs 9c,d); each flagellar segments with only one sensilla basiconica type III; flagellum in both sexes with long, trichoid sensilla (fig. 1g); thorax subquadrate to rounded, pronotum almost hidden dorsally (fig. 17b).

C o m m e n t s : *Thripoctenus* is similar to *Epomphale* and *Guelsenia* in having forewing with on upper side with a distinct semi-oval bare area at posterior margin behind base of marginal vein, demarcated anteriorly by a sinuate line of setae, in *ruselli* line of setae slightly sinuate; but it differs from *Epomphale* in having forewing on lower side wholly setous (in *Epomphale* forewing on lower side with a distinct bare area), and it differs from *Guelsenia* in having each flagellar segments with sensilla basiconica type III, and maxillary and labial palpi are very small (in *Guelsenia* sensilla basiconica is type II, and sensilla basiconica is absent on the first funicular segment and first claval segments, and maxillary and labial palpi long). It is distinct from *Ceranisus* in having each flagellar segments with sensilla basiconica type III, and male scape almost cylinder, without sensory pores (in *Ceranisus* sensilla basiconica is type II, and is present only on claval segments, and male scape expanded, with tiny minute sensory pores on whole surface).

H o s t s : Larval parasitoids of various Panchaetothripinae (Terebrantiae: Thripidae).

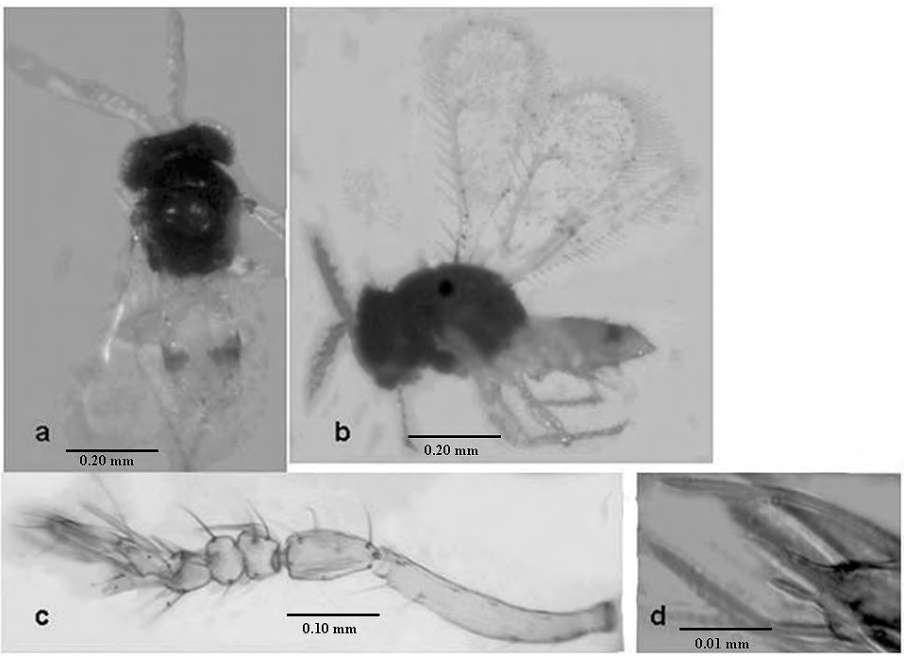

Fig. 17: *Thripoctenus jawae* (GIRAULT 1917). Female. (**a**) body in dorsal view; (**b**) body in lateral view; (**c**) antenna; (**d**) apical segment of clava with sensilla basiconica.

D i s t r i b u t i o n : Oriental and Australasian regions (except for the temperate zones) and also in the Afrotropical region (TRIAPITSYN 2005); Canada, Ontario, Quebec USA, Hawai; United Kingdom, England (RUSSELL 1912; THOMPSON 1955; PECK 1963;

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BOUCEK &ASKEW 1968; TRIAPITSYN & HEADRICK 1995; TRIAPITSYN 2005; TRIAPITSYN & MORSE 2005).

Included species

javae (GIRAULT). *Epomphale javae* GIRAULT 1917: 1. (Type locality:Salatiga, Java Island, Indonesia. (comb.n.).

H o s t s : *Brachyurothrips anomalus*, *Heliothrips* sp., *Heliothrips haemorrhoidalis*, *Panchaetothrips indicus*, *Rhipiphorothrips cruentatus*, *Selenothrips rubrocinctus*, *Sigmothrips aotearoana*, *S. aotearoana* (LOOMANS & VAN LENTEREN 1995). Vine thrips, *Heliothrips* on *Croton*, *Brachyurothrips anomalus* on *Hibiscus*, *Heliothrips haemorrhodalis* on *Viburnum* (TRIAPITSYN 2005). *Retithrips syriacus* on *Vitis vinifera* in Samandağ, Hatay, Turkey.

D i s t r i b u t i o n : Apparently native and widespread in the Oriental and Australasian regions (except for the temperate zones) and also in the Afrotropical region (TRIAPITSYN 2005); Java Island, Indonesia (GIRAULT 1917); Turkey (new record).

russelli CRAWFORD. *Thripoctenus russelli* CRAWFORD 1911: 233.

H o s t s : *Caliothrips fasciatus*; *Frankliniella tritici* , *Heliothrips fasciatus*, *H. haemorrhoidalis*, *Hercinothrips femoralis*, *H. fasciatus*, *Scirtothrips citri*, *Taeniothrips inconsequens*, *T. simplex*, *Thrips tabaci* (RUSSELL 1912; THOMPSON 1955; PECK 1963; BOUCEK & ASKEW 1968; BURKS 1979; TRIAPITSYN & HEADRICK 1995; TRIAPITSYN 2005; TRIAPITSYN & MORSE 2005).

D i s t r i b u t i o n : Canada, Ontario, Quebec (TRIAPITSYN & MORSE 2005); USA, Hawai; United Kingdom, England (RUSSELL 1912; THOMPSON 1955; PECK 1963; BOUCEK & ASKEW 1968; TRIAPITSYN & HEADRICK 1995; TRIAPITSYN 2005; TRIAPITSYN & MORSE 2005).

C o m m e n t s : TRIAPITSYN & HEADRICK (1995) stated that *C. russelli* with a finger like stelex sensillae (= sensilla basiconica) on flagellar segments, and morphological features are characteristic of *Thripobius* not *Ceranisus*, except the lack of a Y-shaped malar sulcus. In this study it was found that *Ceranisus* is distinct from *Thripobius* by the diagnostic characters given the key.

melikai (TRIAPITSYN). *Thripobius melikai* TRIAPITSYN 2005: 308. (comb.n.).

H o s t s : Unknown.

D i s t r i b u t i o n : China, Beijing Province, Mentougou District.

hirticornis (FERRIERE). *Thripobius hirticornis* FERRIERE 1938: 146-147. (comb.n.).

H o s t s : *Retithrips* sp.; *Retithrips syriacus* (HERTING 1971).

D i s t r i b u t i o n : Ghana, Kenya, Tanzania, Uganda, and Zimbabwe (LOOMANS & VAN LENTEREN 1995).

***Guelsenia* gen.n. (figs 4a-e; 6a,c; 9b; 18)**

Type species: *Ceranisus amanosus* DOĞANLAR, GUMOVSKY & O. DOĞANLAR 2009: 265-278.

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E t y m o l o g y : The name was derived from name my wife, Gülsen, who have helped in my works on Chalcidoidea; Gender feminine.

D i a g n o s i s : Head with vertexal sulcus broadly C-shaped; vertex without any black band (fig. 9b); maxillary palpi with only one apical seta (figs 4a-e); maxillary palpi at least trice, labial palpi at least twice as long as wide (fig. 4e); sensilla basiconica type II present on clava and second funicular segment; forewing blade on upper side with a distinct semi-oval bare area at posterior margin behind base of marginal, demarcated anteriorly by a sinuate line of setae vein (fig. 6c), on lower side distinctly setous (fig. 6a); postmarginal vein twice as long as stigmal vein; male with sensory area on apical part of scape (fig. 18e,f); petiole wider than long; ovipositor not exerted beyond apex of gaster, at most twice length of hind tibia.

Description. Body bicolored, head and mesosoma brown; metasoma pale brown to yellow. Female with head almost spherical; vertexal sulcus broadly C-shaped; vertex without a narrow, black band; frontal suture broadly V-shaped; malar sulcus present, split Y-shaped; (but seen on more heavily sclerotized specimens); antenna (fig. 18e); with scape slender, with a sensory pore area (fig. 18f); pedicel longer than wide; F1 and F2 longer than wide, clava including spicula almost trice longer than broad, clava at least twice as wide as last funicular segment in female C1 distinctly shorter than C2; sensilla basiconica type II present on clava and second funicular segment (fig. 18g); maxillary and labial palpi long, maxillary palpi almost 4 times as long as wide, labial palpi at least 2.5 time as long as wide (18b). Mesosoma almost as long as metasoma; mesoscutum, scutellum, and axillae with light engraved sculpturing, without metallic tint; midlobe of mesoscutum with 2 pairs, scutellum with one pairs of setae; notauli incomplete; forewing broadened beyond submarginal vein; forewing blade on upper side with a distinct semi-oval bare area at posterior margin behind base of marginal vein, demarcated anteriorly by a sinuate line of setae (fig. 18a,c); on lower side wholly setous; marginal setae short, at most 1.5 times longer than stigmal vein; the latter about 2.4 times as long as wide (fig. 18c,d); longest setae of marginal fringe about 3 times shorter than maximal forewing width; submarginal vein about as half as long as marginal vein plus parastigma, postmarginal vein twice as long as stigmal vein (fig. 18d), marginal vein plus parastigma 5 times as long as stigmal vein, the latter distincly petiolate. Hind wing about 5 times as long as wide, longest marginal cilia about as long as wing's maximal width. Coxae with light alutaceous sculpture consisted of elongate cells. Petiole wider than long; ovipositor not exerted beyond apex of gaster, at most twice length of hind tibia.

Male: Similar to female except as follow: metasoma in apical 1.3 brownish black. Antenna (fig. 18e) with scape slender, about 5.3 times as long as wide, with sensory area on apical part of scape; pedicel 2.1 times longer than wide; flagellum long, 1.58 times as long as width of head; funicular segments and club with distinct whorls of erect setae, F1 nearly as long as F2, about twice as long as broad; F2 slightly more than twice as long as broad; club including spicula 4.3 times as long as wide, C1 distinctly longer than C2 (3.7:3), C3 slightly shorter than C2 (2.6:3), spicula about 1/4 of C3. Metasoma, twice as long as broad.

C o m m e n t s : *Guelsenia* is similar to *Epomphale* and *Thripoctenus* by forewing blade on upper side with a distinct semi-oval bare area at posterior margin behind base of marginal vein, demarcated anteriorly by a sinuate line of setae. But it is distinct from both genera in having maxillary and labial palpi very long, maxillary palpi almost 4 times as long as wide, labial palpi at least 2.5 time as long as wide (fig. 18b) (in both

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genera maxillary and labial palpi are very small); flagellar segments with sensilla basiconica type II (in both genera flagellar segments with sensilla basiconica type III).

H o s t s : Larval parasitoids of various Thripidae (Terebrantia).

D i s t r i b u t i o n : Hatay, Turkey (DOĞANLAR et al. 2009).

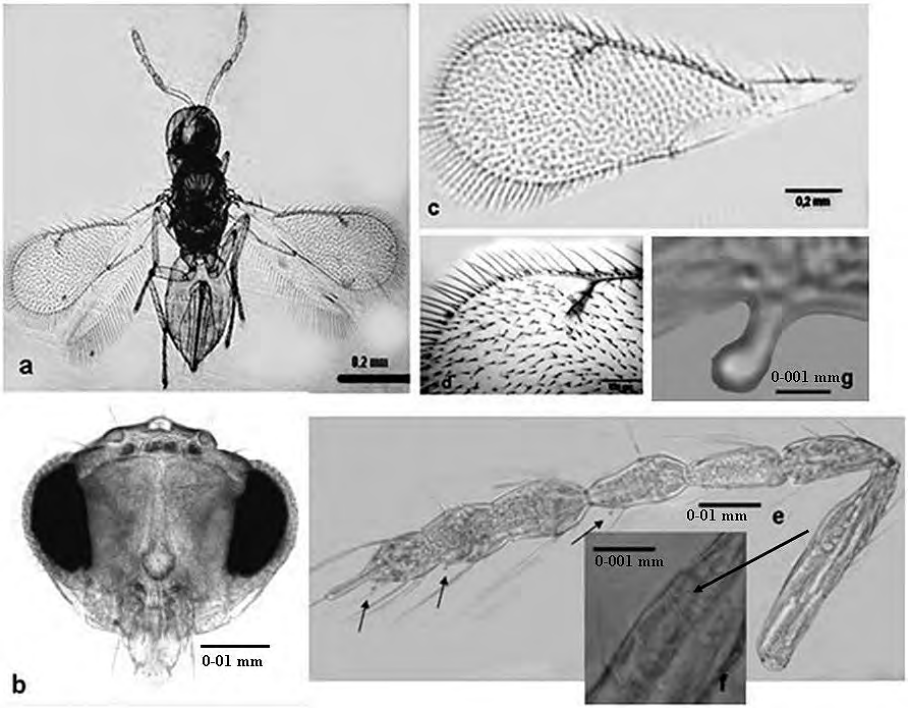

Fig. 18: *Guelsenia amanosus* (DOĞANLAR, GUMOVSKY & O. DOĞANLAR): (**a**) Female, body; (**b**) male, head with mouth parts; (**c**) forewing; (**d**) stigmal and postmarginal vein; (**e**) male antenna; (**f**) sensory pores on male scape; (**g**) sensilla basiconica on male antenna.

Included species

amanosus (DOĞANLAR, GUMOVSKY & O. Doğanlar). (comb.n.) *Ceranisus amanosus* DOĞANLAR et al. 2009: 265-278.

H o s t s : Larval parasitoids of various Thripidae (Terebrantia).

D i s t r i b u t i o n : Hatay, Turkey (DOĞANLAR et al. 2009).

udnamtak (TRIAPITSYN). (comb.n.) *Ceranisus udnamtak* TRIAPITSYN 2005: 295-297.

H o s t s : Unknown.

D i s t r i b u t i o n : Nepal, Katmandu (TRIAPITSYN 2005).

C o m m e n t s : The species was described under *Ceranisus* by TRIAPITSYN (2005) in having forewing with a distinct semi-oval bare area at posterior margin behind base of marginal vein, demarcated anteriorly by a sinuate line of setae, by this character it differs

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from *Ceranisus*, while by this character it is similar to *Epomphale*, but it differs from *Epomphale* in having forewing with very long postmarginal vein. By those characters it should be placed under *Guelsenia*, but its mouth parts, and the type and arrangement of sensilla basiconica should be studied.

***Sergueicus* gen.n.** (figs 19a,b)

Type species: *Ceranisus barsoomensis* TRIAPITSYN 2005: 290-292.

E t y m o l o g y : The name was derived from name of Dr. Serguei Triapitsyn, who made excellent works on this group. Gender masculine.

D i a g n o s i s : Ovipositor exerted beyond apex of gaster by about 1/3 of its total length, about as long 3.4 times length of hind tibia; vertexal sulcus broadly Y-shaped; mesosoma much shorter than gaster, pronotum long, slightly wider than long, slightly sculptured; mesoscutum reticulated; notauli faint, but complete; midlobe of mesoscutum with 2 pairs, scutellum one pair of setae; marginal setae short, about 1/5 maximal width of forewing; postmarginal vein short, but distinct.

D e s c r i p t i o n . Female body very long, with very long exerted ovipositor (fig. 19a); head almost triangular in lateral view; vertexal sulcus broadly Y-shaped; antenna (fig. 19b) with scape slender-shaped, only slightly broadened medially; flagellum with 2 long funicular segments, clava 2-segmented, 2.6 times as wide as long, about twice as wide as last funicular segment, apical claval segment with an small apical spicula; mesosoma much shorter than gaster, pronotum long, slightly wider than long, slightly sculptured; mesoscutum reticulated; notauli faint, but complete; midlobe of mesoscutum with 2 pairs, scutellum one pair of setae; anterior margin of scutellum straight; forewing broadened beyond submarginal vein; marginal setae short, about 1/5 maximal width of forewing; postmarginal vein short, but distinct. Forewing blade hyaline, uniformly setous. Petiole transverse, about twice wider than long. Ovipositor exerted beyond apex of gaster by about 1/3 of its total length, about as long as 3.4 times length of hind tibia.

C o m m e n t s : *Sergueicus* is a unique genus in Ceranisinae by very long body with distinctly excerted ovipositor in female. The other genera in Ceranisinae have gaster with at most slightly excerted ovipositor. It is similar to *Gaziantepus* in having mesoscutum reticulated, and vertexal sulcus broadly Y-shaped, but it differs in having midlobe of mesoscutum with 2 pairs, scutellum one pair of setae (in *Gaziantepus* midlobe of mesoscutum with at least 4 pairs, scutellum 3-4 pairs of setae).

H o s t s : Unknown.

D i s t r i b u t i o n : Australia

Included species.

barsoomensis (TRIAPITSYN). *Ceranisus barsoomensis* TRIAPITSYN 2005: 290-292.

H o s t s : Unknown.

D i s t r i b u t i o n : Australia, Western Australia, Mt. Singleton.

C o m m e n t s : There are only three females, Holotype on slide, 1 paratype on point (ANIC) and 1 paratype in UCRC. Male is unknown.

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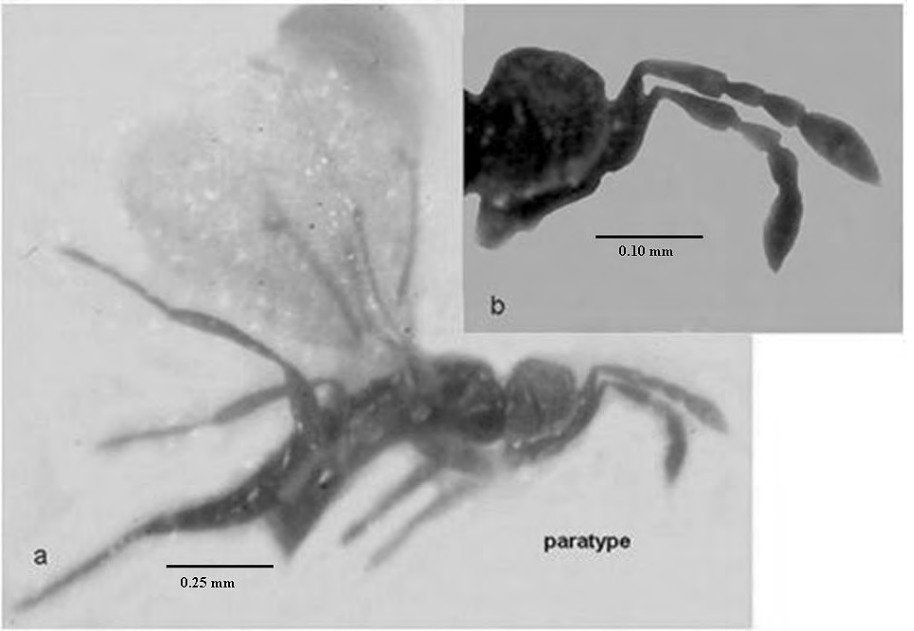

Fig. 19: *Segueicus barsoomensis* (TRIAPITSYN). Female, paratype. (**a**) body in lateral view; (**b**) head and antenna.

Goetheana GIRAULT 1920 (figs 20a-g)

Goetheana GIRAULT 1920: 97. Type species: *Goetheana shakespearei* GIRAULT 1920, by monotypy.
Dasyscapus GAHAN 1927: 26, 27. Type species: *Dasyscapus parvipennis* GAHAN 1927, by monotypy. Synonymised under *Goetheana* GIRAULT 1930: 4.
Goetheana GIRAULT: BOUCEK 1988: 734, 735; SCHAUFF 1991: 54; LOOMANS & VAN LENTEREN 1995: 137-146; TRIAPITSYN 2005: 264-269.

D i a g n o s i s : Body about 0.6-0.7 mm. Vertexal sulcus complete, almost straight across behind posterior ocelli, without black band; maxillary and labial palpi very small, almost as long as wide (fig. 1b); flagellum (figs 20a, b, f) with 2 funicular segments and 3-segmented clava with spicula in both sexes, clava combined with last funicular segment, seems to be 4-segmented; the last two claval segments with only one sensilla basiconica type III; male scape distinctly expanded (fig. 20f); midlobe of mesoscutum without seta, scutellum with one pair of setae; forewing recurved along posterior margin, nearly parallel sided below marginal vein; longest marginal seta much greater than width of forewing (fig. 20d); hind wing narrow with long marginal ciliae; petiole wider than long; ovipositor short, male genitalia (fig. 20g) compact, reduced in *G. shakespearei*; in other species lacking digiti or a separate aedeagus (TRIAPITSYN 2005).

H o s t s : Larval parasitoids of several Thripidae (Terebrantia) (TRIAPITSYN 2005).

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D i s t r i b u t i o n : Australia, South Africa, Oriental region, Europe, Turkey (new record).

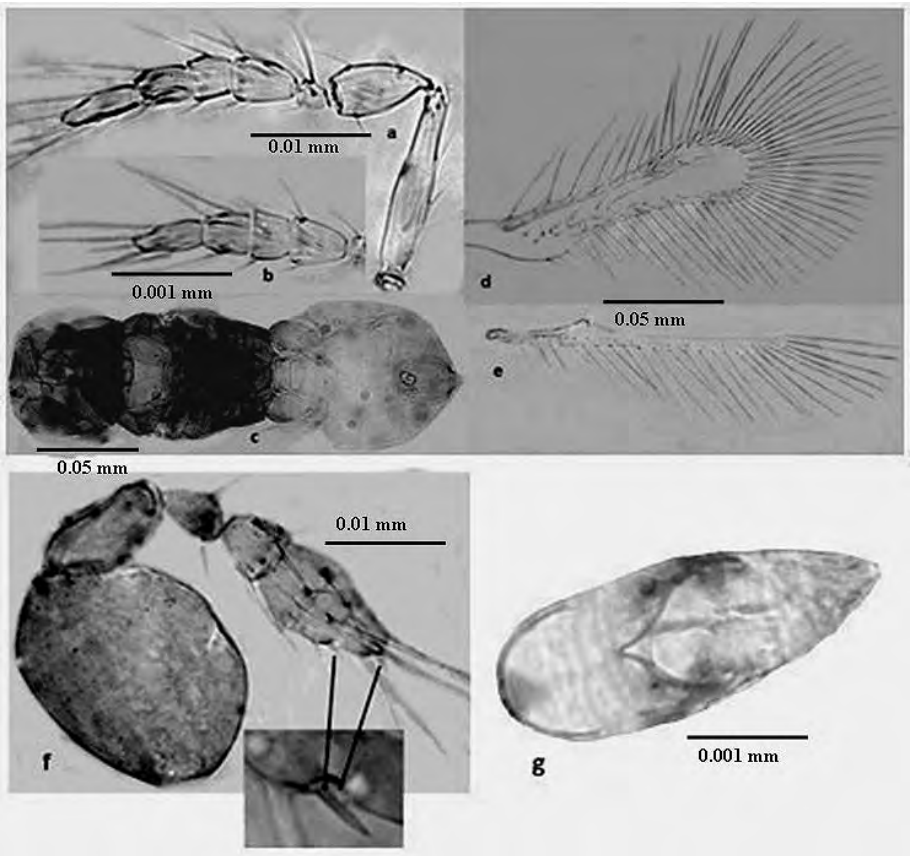

Fig. 20: *Goetheana* sp. from Bulgaria. Female. (**a**) antenna; (**b**) clava; (**c**) body, exclude appendages; (**d**) forewing; (**e**) hind wing; (**f**) male from Adıyaman, Turkey, antenna; (**g**) male genitalia.

Included species.

shakespearei GIRAULT. *Goetheana shakespearei* GIRAULT 1920: 97.

Synonymy and diagnosis were given by TRIAPITSYN (2005).

H o s t s : Various Thripidae (LOOMANS & VAN LENTEREN 1995)

D i s t r i b u t i o n : Australasian, Oriental region, and introduced to many countries (TRIAPITSYN 2005)

***Goetheana* sp1**. Male, Adıyaman, swept from chick pea field.

H o s t s : Unknown.

D i s t r i b u t i o n : Turkey, Adıyaman (new record).

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C o m m e n t s : It is similar to *G. shakespearei* in having scape expanded, but it differs by slightly reticulated scape. female is unknown.

***Entedonomphale* GIRAULT 1915** (figs 21a-e; 22a-d)

Entedonomphale GIRAULT 1915: 216. Type species: *Entedonomphale margiscutum* GIRAULT 1915, by original designation.
Synonymy and diagnosis were given by TRIAPITSYN (2005).

D i a g n o s i s : Some additional characters as follows: Female with 3-segmented funicular segments and solid clava without spicula, (clava combined with last funicular segment, seems to be 2-segmented, at least in *E. carbonaria* (figs 21b,c)); male antenna with sensory area on apical part of scape, flagellum either with 2 funicular segments and 3-segmented (or rarely entire) clava or with 3 funicular segments and a solid clava (TRIAPITSYN 2005); second flagellar segments, and apical two segments of clava with only one sensilla basiconica type II; petiole at least as long as wide, often notably longer than wide in both sexes.

H o s t s : parasitoids of Phlaeothripidae (Tubulifera).

D i s t r i b u t i o n : Bulgaria (BOYADZHIEV & TRIAPITSYN 2007); Hungary (ERDÖS 1954); Japan, Germany, Russia, Ukraine, Slovakia, Slovenia, Sweden, South Africa, Madagascar, Australia, Western Australia, Queensland, Victoria, New South Wales,

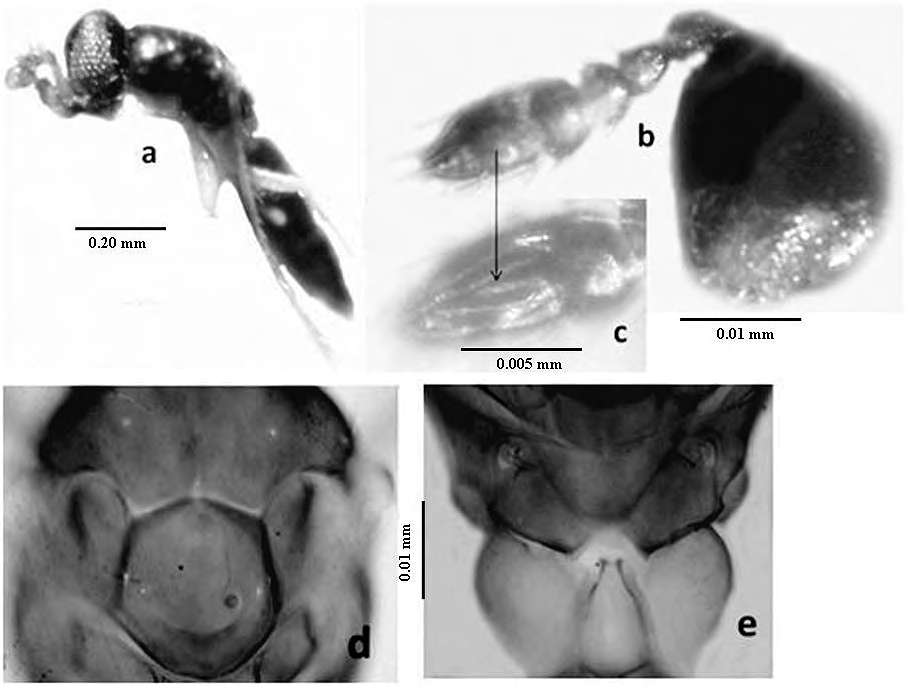

Fig. 21: *Entedonomphale carbonaria* (ERDÖS). Female. (**a**) body, in lateral view; (**b**) head and antenna, in lateral view; (**c**) clava; (**d**) mesoscutum and scutellum; (**e**) propodeum and petiole.

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Northern Territory, Canada, , USA, Masachusetts (LOOMANS & VAN LENTEREN 1995; TRIAPITSYN 2005).

C o m m e n t s : The genus seems to be a complex of some species goups or different genera. In order to solve the problem in placement of the species, their mouth parts and types and arrangment of sensilla basiconica on flagellar segments from slide mounted specimens should be studied.

Included species

bulgarica BOYADZHIEV & TRIAPITSYN. *Entedonomphale bulgarica* BOYADZHIEV & TRIAPITSYN 2007: 736-740.

H o s t s : Unknown.

D i s t r i b u t i o n : Bulgaria (BOYADZHIEV & TRIAPITSYN 2007).

C o m m e n t s : The male of *E. bulgarica* is similar to the male of *G. amanosus* by forewing blade on upper side with a distinct semi-oval bare area at posterior margin behind base of marginal vein, demarcated anteriorly by a sinuate line of setae (fig. 22a) and antenna (fig. 22b) with scape having sensory pore area (fig. 22c), and with second flagellar segments, and apical two segments of clava with only one sensilla basiconica type II (fig. 22d). But female forewing has no semi-oval bare area, and to make distinct decision in placement of the species, I could not able to study its mouth parts from its slide.

carbonaria (ERDÖS). *Thripoctenoides carbonaria* ERDÖS 1954: 345-346.

H o s t s : Unknown.

D i s t r i b u t i o n : Bulgaria (BOYADZHIEV & TRIAPITSYN 2007); Hungary (ERDÖS 1954);Canada, Germany, Russia, Slovakia, Slovenia, Sweden, and USA (TRIAPITSYN 2005).

C o m m e n t s : The species was described by ERDÖS (1954) and TRIAPITSYN (2005). By finding new materials from Bulgaria *E. carbonaria* was keyed together with *E. bulgarica* and *E. bicolorata* (ISHI), and diagnostic characters were given by BOYADZHIEV & TRIAPITSYN (2007).

The study presents an important phylogenetic analysis of Eulophidae where Ceranisinae has been supported as monophyletic. The dendrogram obtained by bootstrap 50% majority-rule consensus tree analysis of morphological data (fig. 10), and the phylogenetic tree presented as maximum Likelihood tree of 100 steps, unweighted parsimony analysis of molecular data (fig. 11) present strongly supported nodes, suggesting answers to some controversies concerning eulophid morphology. The analysis of morphological and molecular data show that Ceranisinae as a new subfamily is wide apart from the known subfamilies of Eulophidae, Entedoninae, Entiinae, Tetrastichinae and Eulophinae, while *Epomphale* of Ceranisinae created a separate clade close Entedoninae. On the other hand Opheliminae has a clade close to Entiinae. The Entedoninae has two clades, one of which together with *Astichus minissumus* (Entiinae) and *Entedonnecremnus* and *Pediobius*, and the other has 7 genera as in fig. 11. As out group Tetracampidae has another clade with the genera, *Epiclerus* and *Platynocheilus*. While GAUTHIER et al. (2000) found that *Ceranisus* and *Thripobius* FERRIERE formed an unsupported clade with *Emersonella* as in

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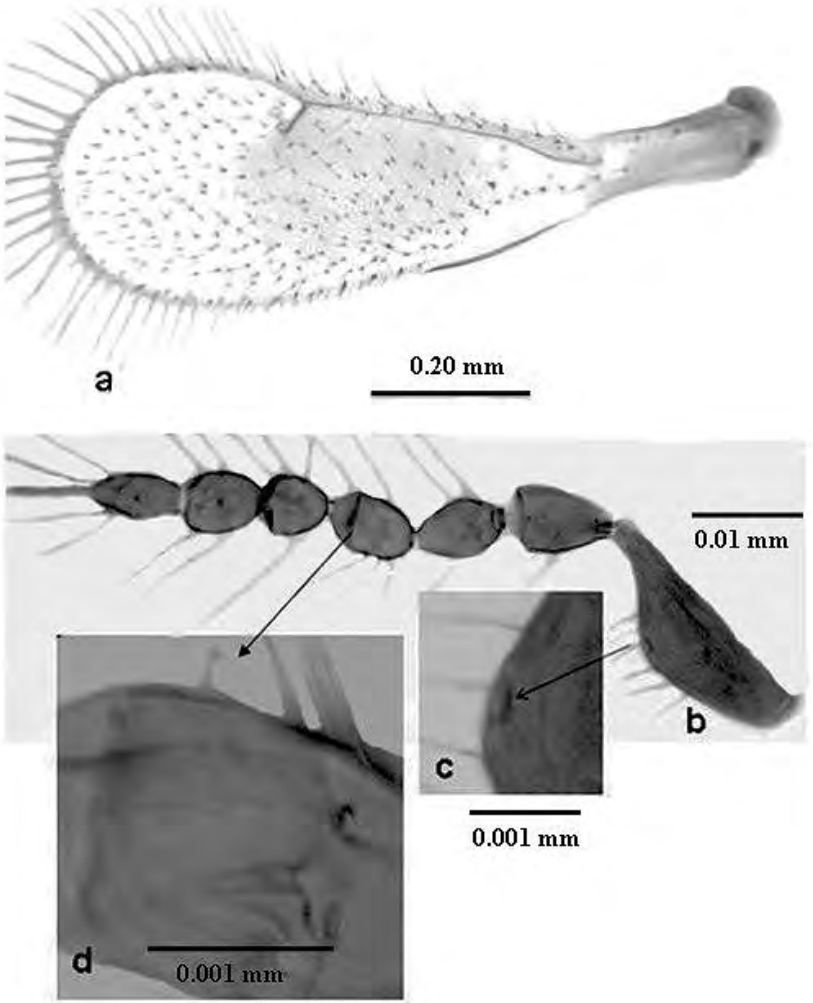

Fig. 22: *Entedonomphale bulgarica* BOYADZHIEV & TRIAPITSYN. Male. (**a**) Forewing; (**b**) antenna; (**c**) sensory pores area; (**d**) sensilla basiconica type II on second funicular segment.

figs 1, 2, and *Ceranisus* and *Thripobius* formed again a clade out of Entedoninae as in figs 3 and 5. GUMOVSKY (2002) stated that two representatives of *Ceranisus* genus-complex (genera *Ceranisus* and *Thripobius* (synonym of *Thripoctenus*), both are parasitoids on thrips) are closely related in the obtained trees and this assemblage has high bootstrap support (74). BURKS et al. (2011) found that *Ceranisus* was consistently the sister group of *Paracrias* in parsimony results (figs 43 and 44) by inserting to their analysis only the sequence of *Ceranisus menes*, and they stated *Ceranisus* is part of an assemblage of

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entedonine parasitoids of thrips united by the presence of a transverse groove across the vertex.

The addition of morphological characters and DNA sequences of many species from different genera led to much stronger answers that provided well supported nodes with alternative placements for the taxa, especially which were in Ceranisinae. On the other hand some of the disagreement between the morphological analyses (fig. 10) and molecular analyses (fig. 11) indicates that some controversy yet remains in eulophid phylogenetics.The addition of more gene regions, specified mouth parts and antennal characters, should provide greater clarity in future molecular analyses.

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Buchbesprechung

NAKANO S., YAHARA T. & T. NAKASHIZUKA (eds): **The Biodiversity Observation Network in the Asia-Pacific Region.** Toward further development of monitoring. – Springer Japan, Tokyo, 2012. 479 S.

Dass biologische Vielfalt für viele funktionierende Ökosysteme wichtig ist, dürfte allgemein bekannt und akzeptiert sein; ebenso wird die Bedeutung von Biodiversität für das menschliche Dasein nicht in Frage gestellt. Bewirken tut dies allerdings gar nichts, der Verlust an Biodiversität schreitet ungebremst voran. Die asiatisch-pazifische Region beinhaltet einerseits Länder mit hoher Entwicklungs- und Fortschrittstendenz, andererseits aber auch zahlreiche entwickelte Länder mit einer umfangreichen Datensammlung und Datenanalyse bezüglich ihrer Biodiversität. Beiden Kategorien fehlt allerdings meist eine grundlegende Basis über den status quo der Biodiversität in dieser Region. Es wäre dringend notwendig, eine Balance zwischen Entwicklung und Fortschritt sowie Naturschutz in dieser Region zu etablieren.

Dieser Band der Reihe "Ecological Research Monographs" stellt eine erste Kollektion an Informationen zur Biodiversität im asiatisch-pazifischen Raum vor.

Teil 1 beinhaltet mit 3 Aufsätzen eine allgemeine Einführung in die Thematik: Strategien zur Beobachtung und Beurteilung von Veränderungen der terrestrischen Biodiversität, ein Ausblick zur Biodiversität in Südostasien sowie Ökonomie und ökonomische Beurteilung von Ökosystemen und Biodiversität in Japan. Der 2. Teil beschreibt exemplarisch einzelne "Bestandteile" des Netzwerks, wie z.B. die Pflanzendiversität in zwei philippinischen Langzeitstudien, Biodiversitätsstudien in Thailand, China und Indonesien, die Fischbiodiversität im Mekong-Becken, im Yangtze-Fluss und in Flüssen Südkoreas. Teil 3 zeigt auf, welche Möglichkeiten zur Etablierung einer Biodiversitäts-Datenbank bestehen; hier liegt der Schwerpunkt auf Japan. Im 4. Teil werden neue Methoden und Analysen zu Biodiversitätsstudien virgestellt; u.a. DNA Barcoding, "Satelliten-Ökologie", long-term-monitoring, räumliche Modelle bei Süßwasserfischen zur Naturschutzplanung. Der abschließende 5. Teil beschäftigt sich mit Biodiversität und Ökosystem-Services im angewandten Bereich; u.a. CO_2-Bilanz und Biodiversität in tropischem Torfland, Etablierung von Indikatororganismen in einer umwelt-erhaltenden Landwirtschaft, Biodiversität in Reisfeld-Ökosystemen (Korea) und Wasserbecken im Dorfbereich (Sri Lanka), Biodiversität von Süßwasserfischen in Relation zur Inlandfischerei in Japan, Schutz und Restaurierung der Ufervegetation eines Sees in Japan sowie die generelle Förderung einer Fisch-Taxonomie (v.a. marin) in Südostasien (speziell die Schulung einheimischer Spezialisten).

Insgesamt eine hervorragende Übersicht und Zusammenstellung zur Biodiversität Südost-Asiens, v.a. für Ökologen, Naturschützer und Biologen.

R. Gerstmeier

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NENTWIG W.: **Invasive Arten.** – Haupt Verlag (UTB), Bern, 2010. 128 S.

Invasive Arten sind Pflanzen und Tiere, die nach 1492 auf unterschiedliche Weise in Gebiete neu eingeführt wurden, in denen sie ursprünglich nicht einheimisch waren. Sie etablieren sich dort und können sich nach einer gewissen Eingewöhnungsphase stark vermehren. Sie sind nicht unbedingt eine (positive) Breicherung der einheimischen Biodiversität, richten sie doch in vielen Fällen jährlich einen hohen wirtschaftlichen Schaden an.

In diesem Taschenbuch werden die für Europa relevanten invasiven Arten im Profil dargestellt, basierend auf den Kapiteln Absichtliche Freisetzung, Unbeabsichtigte Verschleppung, Beeinträchtigung der einheimischen Biodiversität, Wirtschaftlicher Schaden, Schädigung der menschlichen Gesundheit, Kontrolle und Bekämpfung, Gesetzliche Grundlagen sowie Information und Öffentlichkeit. Es bietet somit eine sehr übersichtliche, kompakte und informative Zusammenfassung zu dieser Thematik. Sehr nützlich und damit besonders lobenswert sind die entsprechenden Internetadressen im Anhang dieses Buches.

R. Gerstmeier

ENGELMANN W.E. & J. LANGE (Hrsg.): **Wirbellose (Zootierhaltung).** – Verlag Harri Deutsch, Frankfurt am Main, 2011. 1159 S.

Um Wirbellose in menschlicher Obhut möglichst gut zu halten, ist es nicht nur von Bedeutung, ihre artspezifischen Eigenheiten zu berücksichtigen, sondern auch die lebenswichtigen Faktoren der natürlichen Umwelt auf die künstlichen Verhältnisse eines Zoos, Aquariums oder Terrariums zu projezieren. Für den Pfleger wirbelloser Tiere sind Kenntnisse in zoologischer Systematik, Zoogeographie und Ökologie die Basis für seine immer notwendige Kreativität bei der Tierpflege und -zucht.

Im Prinzip könnte man dem Tierpfleger natürlich auch ein Buch über "Zoologische Systematik" oder "Spezielle Zoologie wirbelloser Tiere" in die Hand drücken, aber damit würde man ihn mit vielen zoologischen (physiologischen, anatomischen) Details überfrachten, die er für seinen Job gar nicht benötigt. Gefragt sind vielmehr grundlegende Kenntnisse in Systematik und Lebensweise seiner "Schützlinge", und vor allem wichtige Informationen zur Haltung, sprich Besatzdichte, Sauberkeit, abiotische Faktoren (Feuchtigkeit, Durchlüftung, Temperatur, Beleuchtung), Fütterung, Vermehrung, Lebensdauer und Lebensweise. Diese Hinweise werden in diesem Buch mehr oder weniger ausführlich, je nach Wissens- und Erfahrungszustand in so hervorragender Weise gegeben, dass es selbst bei erfahrenen Zoologen anerkennendes Staunen hervorruft. Was in diesem Buch an Details und Fachwissen zusammengetragen wurde ist höchst bemerkenswert, und dem Verlag muss ein großes Lob ausgesprochen werden, dass solche Bücher überhaupt verlegt werden. Die Einführung (131 S.) stellt wirbellose Tiere in ihrer Umwelt und im Zoo vor, informiert über Grundlagen der Riffaquaristik und der Insektenhaltung. Und dann geht es richtig los, von den Einzellern bis zu den Tunicaten, und da werden u.a. auch solche "Exoten" wie Hakenplattwürmer, Kratzer, Schnurwürmer, Spritzwürmer, Igelwürmer, Bärtierchen, Zungenwürmer, Hufeisenwürmer, Moostierchen, Pfeilwürmer und Geschwänzte Manteltiere vorgestellt. Eine beigelegte CD enthält ca. 830 Farbfotos der im Buch beschriebenen Arten.

Ein gewaltiges, sehr empfehlenswertes Informations- und Nachschlagematerial.

R. Gerstmeier

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