

A new species of the genus *Tetrastichus* Haliday (Hymenoptera: Eulophidae), parasitoid of *Kokujewia ectrapela* Konow (Hymenoptera: Argidae) in Iran

Новый вид рода *Tetrastichus* Haliday (Hymenoptera: Eulophidae) – паразитоид *Kokujewia ectrapela* Konow (Hymenoptera: Argidae) в Иране

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Tetrastichus kokujewiae sp. nov. (Hymenoptera: Eulophidae) is described from Iran. It was reared from pupa of *Kokujewia ectrapela* Konow, 1902 (Hymenoptera, Argidae). *T. kokujewiae* is a gregarious parasitoid developing in the cocoons of sawfly.

Tetrastichus kokujewiae sp. nov. (Hymenoptera: Eulophidae) описан из Ирана. Он был выведен из *Kokujewia ectrapela* Konow, 1902 (Hymenoptera, Argidae). *T. kokujewiae* является гregarным паразитоидом, который развивается в коконах пилильщика.

Key words: parasitoids, Iran, Hymenoptera, Eulophidae, *Tetrastichus*, Argidae, *Kokujewia*, new species

Ключевые слова: паразитоиды, Иран, Hymenoptera, Eulophidae, *Tetrastichus*, Argidae, *Kokujewia*, новый вид

INTRODUCTION

The genus *Tetrastichus* Haliday, 1844 is a large cosmopolitan genus. Its known hosts include Coleoptera (usually Chrysomelidae, occasionally Coccinellidae), Hymenoptera (Tenthredinoidea, Braconidae), occasionally Lepidoptera and Diptera, and rarely Coccidae (Kostjukov, 1976). The parasitoids attack host larvae or pupae, some of them are hyperparasitic (Graham, 1991).

Species of *Tetrastichus* are diagnosed by the following characters. Malar sulcus straight or very slightly curved, anterior margin of clypeus bidentate (Fig. 1). Antenna of female with 2–3 anelli (sometimes with one anellus). Antenna of male with scape, ventral plaque and four funical segments,

but often without whorls of long setae. Mid lobe of mesoscutum with one row of adnotaular setae. Scutellum with submedian lines normally distinct. Propodeal median carina distinct; plicae present at least posterior; spiracles with paraspicular carina (Fig. 3). Callus with 2–10 setae. SMV usually with one dorsal seta (Fig. 4) (Graham, 1991).

Only one species of the genus *Tetrastichus*, *T. epilachnae* (Giard, 1986) was mentioned from Iran (Herting, 1973).

The *Rumex* leaf defoliator sawfly, *Kokujewia ectrapela* Konow, 1902 is a new host record for *Tetrastichus* species. *Kokujewia ectrapela* may belong to the Caspian fauna according to the definition of de Lattin (1967). It was collected in the Stavropol Territory (Dadurian, 1962), North Ossetia

(Gussakovskij, 1935), Georgia, Armenia, Azerbaijan and northwestern part of Iran. Adults occur from the lowlands (Azerbaijan: e.g. Mugan Plain = Muganskaya Steppe) up to about 2500 m (Iran: Takht-e Suleyman Massif in Alborz = Elburz Mountains). The larvae were found living on *Rumex* spp. (Polygonaceae) (Gussakovskij, 1935).

Kokujewia ectrapela complete four generations within the growing season and hibernates at the pupal stage inside the protective cocoon in the plant litter surrounding the dock plants. The larvae of each generation occur on host plants for 10–20 days depending on the natural conditions. Fully grown larvae of the first, second and third generation pupate within silken brownish cocoons spun by the penultimate larvae, among or outside the host plants. The development of *K. ectrapela* from egg to emerging adult takes 25–35 days (Karimpour, 2007). The taxonomic status of *K. ectrapela* was defined by Blank and Taeger (1998).

MATERIAL AND METHODS

The paper is based on 253 specimens of the genus *Tetrastichus* reared by Dr. Y. Karimpour. During 2006–2008, a total of 128 larvae of *K. ectrapela* were collected near Urmia City (Iran) in May, August and October every year. The collected larvae were brought to the laboratory and transferred into glass boxes (70×50×30 cm) covered by muslin, for rearing on host plant (*Rumex obtusifolius* L.). The larvae were reared at a temperature of 24±1 °C, relative humidity 65±5% and natural day light. The larvae were fed daily with fresh leaves of host plant until the pupal stage. After 2–3 days of rearing, the larvae pupated. The pupae were placed in separate Petri dishes and checked daily until the adult sawfly and parasitoids emerged. Emergence of *Tetrastichus* adults from parasitized host occurs 10–14 days after pupation. Out of 128 larvae of *K. ectrapela* collected in three years, 24 were parasitized by a new species of *Tetrastichus*. The new species is a gregarious

parasitoid and as few as 19 and as many as 68 adults of it emerged from a single parasitized host during three years of personal observations by the third author (unpublished data). This species of *Tetrastichus* overwinters as fully developed larvae and pupal stage inside the host cocoons, which are spun by penultimate larvae of the host before pupation.

Morphological terms and measurement follows that of Graham (1991) and Noyes (2004). Head: HW – head width in facial view; HL – head length in facial view (excluding the mouthparts); HE – height of eye; WE – width of eye; POL – the minimum distance between the posterior ocelli; OOL – the minimum distance between the eye margin and the adjacent posterior ocellus; SL – length of scape; PL – length of pedicel; F1–F4 – first, second, third and fourth segments of antennal funicle; LC – length of clava. Thorax: PL – length of propodeum; PW – width of propodeum; FL – length of forewing; FW – width of forewing; SMV – submarginal vein; MV – marginal vein, PMV – postmarginal vein; SV – stigmal vein. Gaster: LG – length of gaster; WG – width of gaster. Measurements in mm are used only for body and fore wing lengths; other measurements are given in µm.

The material studied is deposited at the Zoological Institute, Russian Academy of Science, St Petersburg, Russia (ZIN).

RESULTS

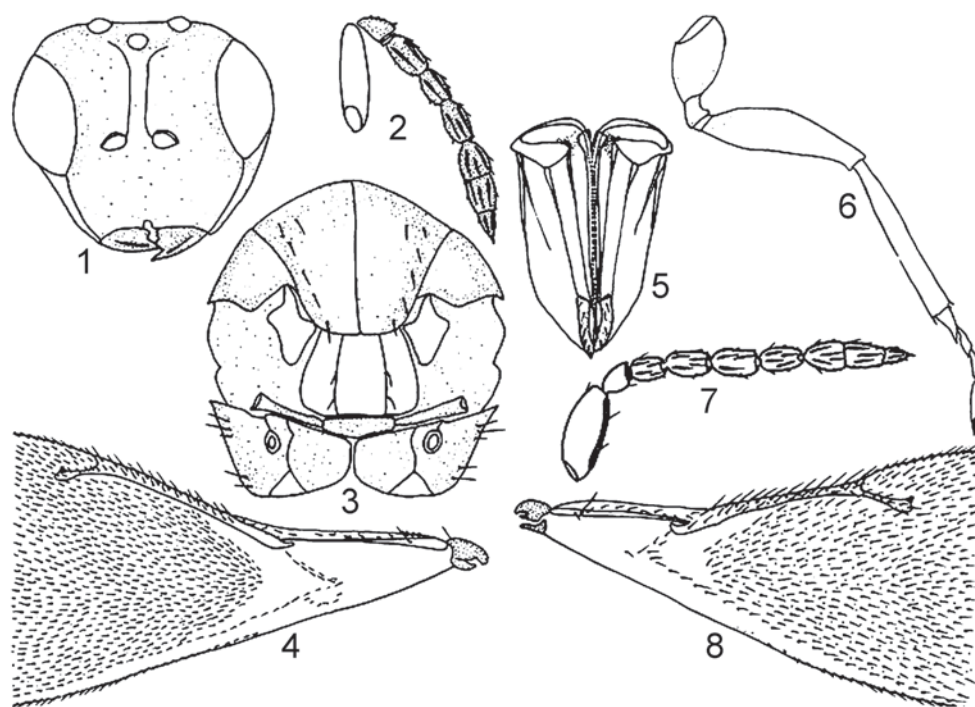
Family **EULOPHIDAE**

Subfamily **TETRASTICHINAE**

Genus *Tetrastichus* Haliday, 1844

Tetrastichus kokujewiae Yegorenkova & Yefremova **sp. nov.**
(Figs 1–8)

Holotype. Female, **Iran**, 12 km Northwest of Urmia [= Urümiyeh] City near Tâzekand-e-Qâterchi Vill., 37°39'N, 44°58'E, altitude 1335 m, reared from *K. ectrapela*, July 2007, leg. Y. Karimpour (ZIN).



Figs 1–8. *Tetrastichus kokujewiae* sp. nov. 1–6, female: 1, head; 2, left antenna; 3, thorax; 4, left forewing; 5, ovipositor; 6, mid leg. 7, 8, male: 7, left antenna; 8, right forewing.

Paratypes. Eighty females, 26 males, same locality and host as for holotype (ZIN).

Additional material examined. Ninety eight females, 49 males, same locality and host as for holotype (ZIN). This material possibly belongs to the same species, but it is in poor condition and may be useful only for morphological studies.

Diagnosis. Female (body length 1.25–2.20 mm): malar sulcus curved (Fig. 1); mesoscutum on each side with five adnotaular setae and a second partial row of one seta; plicae present, curved, with branch towards hind corner of propodeum; callus with five long setae (Fig. 3). Length of ventral plaque of male antenna 0.8 SL (Fig. 7).

Description. Female (holotype; Figs 1–6). Body length 2.0 mm; fore wing length 1.9 mm.

Head (Fig. 1) 1.23 times as wide as long. POL 1.8 times as great as OOL. Face smooth; puncture of vertex and of area from frons to toruli moderate-sized and separated by more than their diameter. Eyes 1.2 times as high as long, without setae. Distance between eyes 2.9 times as long as eye.

Malar sulcus curved, its length 0.82 length of eye. Toruli inserted above lower margin of eyes. Clypeus bilobed. Mandible with 5 unequal apical teeth, two long and three much shorter. Scrobes depressed and parallel. Antenna (Fig. 2) with scape 4.6 times as long as broad, with pedicel having one discoid anellus, and with funicle. F1 2.3 times as long as broad and 1.1 times as long as F2; F2 2.0 times as long as broad and equal to F3 in length; F3 2.0 times as long as broad and 2.3 times shorter than clava; clava 3-segmented, 3.9 times as long as broad, with apical sensilla. Measurements in μm : HW 24.5; HL 20; POL 5.3; OOL 3; HE 8.5; WE 10; SL 10; PL 3; length of F1 4.5, of F2 4, and of F3 4; LC 9; length of apical sensilla 0.1.

Mesosoma. Thorax (Fig. 3) 1.4 times as long as broad. Pronotum very short, 3.2 times as broad as long. Mesoscutum with superficial reticulation, 1.1 times as broad as long, with median line indicated only near the scutellum, and with two rows of

adnotaular setae on each side (first row of five long adnotaular white setae, second partial row of one seta). Scutellum 1.2 times as broad as long, with the same sculpture as mesoscutum, with submedian and sublateral lines (distance between submedian lines 1.4 times as long as distance between submedian and sublateral lines), and with two pairs of setae. First pair of setae situated in posterior half of scutellum. Propodeum 4.4 times as broad as long, with raised reticulation and median carina. Plicae present, curved, with branch towards hind corner of propodeum. Spiracle round and large (its length 0.28 length of propodeum), with paraspircular carina; callus with 5 long setae. Forewings (Fig. 4) 2.34 times as long as broad; speculum relatively large and extending along to one-third of MV; SMV with 1 seta; MV with 12 setae; PMV absent. Hind wing rounded. Mid leg with trochanter and trochantellus (Fig. 6). Length of hind tibial spur 0.8 length of basitarsus. Measurements in μm : PL 5; PW 22; FL 76; FW 32.5; SMV 16.5; MV 21; SV 6; length of cilia 1.5.

Metasoma. Gaster 1.5 times as long as broad. Last tergite 2.8 times as broad as long. Sheaths of ovipositor (Fig. 5) slightly extended. Measurements in μm : LG 36; WG 24.

Colour. Head, thorax and gaster dark green. Eyes dark red. Ocelli yellow. Antenna with yellow scape and brown funicle. Venation yellow. Fore wing hyaline. Tegulae dark brown. Coxae and femora dark brown, tibia and tarsi yellow.

Variations. Length of body varies from 1.25 to 2.2 mm. Median line on mesoscutum varies from distinct to distinct over posterior 0.5. Adnotaular setae on mesoscutum vary from 5 setae in one row and 1 seta in second row to 5 setae in one row and 6 setae in second.

Male (Figs 7, 8). Body length 1.3–1.75 mm; fore wing length near 1.5 mm. Male identical to female in colour (only antenna with brown scape) but differs in structure of antenna and forewing.

Antenna (Fig. 7) with scape 2.7 times

as long as broad, with length of ventral plaque 0.8 length of scape, with pedicel, with one discoid anellus, and with funicle. F1 1.9 times as long as broad and 1.1 times shorter than F2; F2 2.0 times as long as broad and 1.1 times shorter than F3; F3 2.1 times as long as broad and 1.1 times longer than F4; F4 2.0 times as long as broad and 2.3 times shorter than clava; clava 3-segmented, 3.9 times as long as broad, with spine. Measurements in μm : SL 8.0; PL 3.0; length of F1 3.7, of F2 4, of F3 4.3, and of F4 3.9; LC 9.0.

Pronotum 3.4 times as broad as long; mesoscutum 1.1 times as broad as long; scutellum 1.2 times as broad as long; propodeum 3.8 times as broad as long; number of adnotaular setae on mesoscutum and type of sculpture of mesoscutum as in female. Fore wing (Fig. 8) 2.2 times as long as broad; speculum extending along one-third of MV; SMV as long as MV; measurements in μm : FL 59; FW 27; SMV 14; MV 14; SV 5. Gaster (LG 26; WG 16) 1.6 times as long as broad, much shorter than thorax.

Comparison. The new species is similar to the *hylotomarum*-group of the genus *Tetrastichus* [this group differs from the *miser*-group in the structure of the female gaster, its ovipositor sheaths (Fig. 5) not reaching the apex of the last tergite] and especially to *Tetrastichus hylotomarum* (Bouché, 1834). The differences from the latter species are given in Table 1.

Etymology. The species name is derived from the genus name of the host genus *Kokujewia*, from which it was reared.

Distribution. Iran: environs of Urmia City.

Biology. Gregarious endoparasitoid of *K. ectrapela* (Hymenoptera, Argidae). The parasitoid is active from July till October. It overwinters as fully developed larvae and pupae inside the cocoons of the host on *Rumex obtusifolius* L.

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Table 1. Comparison of two very similar species of *Tetrastichus* with each other.

Species	<i>T. kokujewiae</i> sp. nov.	<i>T. hylotomarum</i> (Bouche)
Female	Length of malar sulcus 0.82 length of eye	Length of malar sulcus 0.70 length of eye
	Antenna not reaching median ocellus	Antenna reaching median ocellus
	Pedicel plus funicle 1.53 times longer than breadth of mesoscutum	Pedicel plus funicle about equal to breadth of mesoscutum
	F1 2.25 times as long as broad	F1 1.5–2.0 times as long as broad
	F2 2 times as long as broad	F2 1.5–1.7 times as long as broad
	F3 2 times as long as broad	F3 1.01–1.45 as long as broad
	Clava 3.9 times as long as broad	Clava 2.0–2.9 times as long as broad
	Mid lobe of mesoscutum with 6–11 setae on each side	Mid lobe of mesoscutum with 4–6 setae on each side
Male	Pronotum medially 2.4–2.9 times as long as dorsellum	Pronotum medially 1.3–1.5 times as long as dorsellum
	Scape 1.14 times as long as eye	Length of scape 0.9–1.0 length of eye
	Length of ventral plaque 0.8 length of scape	Length of ventral plaque 0.7–0.75 length of scape
	Length of pedicel plus funicle 2.1–2.2 times as great as breadth of mesoscutum	Length of pedicel plus funicle 1.35–1.45 times as great as breadth of mesoscutum
	Length of pedicel 0.8 length of F1	Pedicel slightly longer than F1
	F1 1.95 times as long as broad	F1 1.1–1.5 times as long as broad

REFERENCES

- Blank S.M. & Taeger, A.** 1998. Revision of the sawfly genera *Asiarge* Gussakovskij 1935 and *Kokujewia* Konow 1902 (Hymenoptera, Argidae). *Beiträge zur Entomologie*, **48**(2): 505–515.
- Dadurian H.B.** 1962. On the Sawflies and the Horntails of Armenian SSR. *Zoologicheskij sbornik [Zoological papers collection]*, **12**: 63–98. Yerevan: Academy of Sciences of the Armenian SSR. (In Russian).
- Graham M.W.R. de V.** 1991. A reclassifications of the European Tetrastichinae (Hymenoptera: Eulophidae): revision of the remaining genera. *Memoirs of the American Entomological Institute*, **49**: 1–322.
- Gussakovskij V.V.** 1935. *Chalastogastra. Part 1.* Fauna SSSR: Pereponchatokrylye [Faune of the USSR: Hymenoptera], **2**(1). Moscow–Leningrad: USSR Academy of Sciences. 453 p. (In Russian).
- Karimpour Y.** 2007. Biology of the *Rumex* leaf defoliator sawfly *Kokujewia ectrapela* Konow (Hymenoptera: Argidae) in Urmia region. *In: Julien M.H., Sforza R., Bon M.C., Evans H.C., Hatcher P.E., Hinz H.L. & Recator B.G.* (Eds) Proceedings of the XII International Symposium on Biological Control of Weeds: 250. Wallingford: CABI.
- Kostjukov V.V.** 1976. New species of the genus *Tetrastichus* (Hymenoptera, Chalcidoidea, Eulophidae), hyperparasites of Coccidae (Homoptera, Coccoidea) discovered in the USSR. *Entomologicheskoye Obozreniye*, **55** (1): 169–177. (In Russian).
- Lattin G. de.** 1967. Grundriss der Zoogeographie. *In: Borriß H. & Gersch M.* (Eds) *Hochschullehrbücher für Biologie*, **12**: 1–602. Jena: Gustav Fischer Verlag.
- Noyes J.S.** 2004. Encyrtidae of Costa Rica (Hymenoptera: Chalcidoidea), 2. *Metaphycus* and related genera, parasitoids of scale insects (Coccoidea) and whiteflies (Aleyrodidae). *Memoirs of the American Entomological Institute*, **73**: 1–459.

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