

**A redescription of *Tetrastichus diopsisi* (Hymenoptera: Eulophidae), a pupal parasitoid of *Diopsis macrophthalma* (Diptera: Diopsidae), and data on its parasitism in Malawi**

by

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**ABSTRACT.** — *Tetrastichus diopsisi* (Risbec) is redescribed and a lectotype and paralectotypes are designated. Records concerning hosts of *T. diopsisi* are discussed. Data on parasitism in Malawi in 1971-1975 are given.

During studies on the ecology and economic importance of the stalk-eyed fly *Diopsis macrophthalma* Dalman, a rice stem-borer in Malawi (Feijen 1979a, 1979b) a hymenopteran parasitoid was regularly bred from *Diopsis* pupae; this parasitoid was identified as *Tetrastichus diopsisi* (Risbec), an eulophid wasp which was originally placed in the genus *Aprostocetus*.

Thanks to the kindness of the "Office de la Recherche Scientifique et Technique Outre Mer" (Orstom) in Bondy (France) slides with specimens studied and described by Risbec could be examined. The specimens of Risbec were collected by Descamps in Cameroon in 1955 and have been preserved dry in slides. One slide contains a male and female *Tetrastichus* and is labelled "*Aprostocetus diopsisi* Risbec; types ♀ ♂ Descamps 144". The two specimens are shrivelled and broken and both are considered unsuitable to choose a lectotype from. In addition there are two slides with in total about 200 specimens, labelled "*Aprostocetus diopsisi* Risbec; ex *Diopsis thoracica*; Descamps, Garoua".

It is very likely that the types and the specimens from above mentioned slides belong to the same series (c.f. Risbec 1956a). A female specimen from one of these slides was chosen by us as lectotype and mounted on a card point, while 100 female and 15 male specimens, mounted in the same way were designated as paralectotypes. According to Descamps (1957) the specimens were bred from *Diopsis thoracica* Westwood (= *D. macrophthalma*) pupae collected in rice fields near Garoua (Cameroon) in May 1955.

In the original description Risbec (1956a) writes that the specimens were obtained from "Larves de *D. thoracica*". This must be considered an error.

The lectotype and most paralectotypes are preserved by Orstom in Bondy. Some paralectotypes and specimens collected in Malawi have been deposited in the Institute of Taxonomic Zoology (Zoologisch Museum), Entomology Department, University of Amsterdam. To facilitate the identification of *T. diopsisi* a redescription is given.

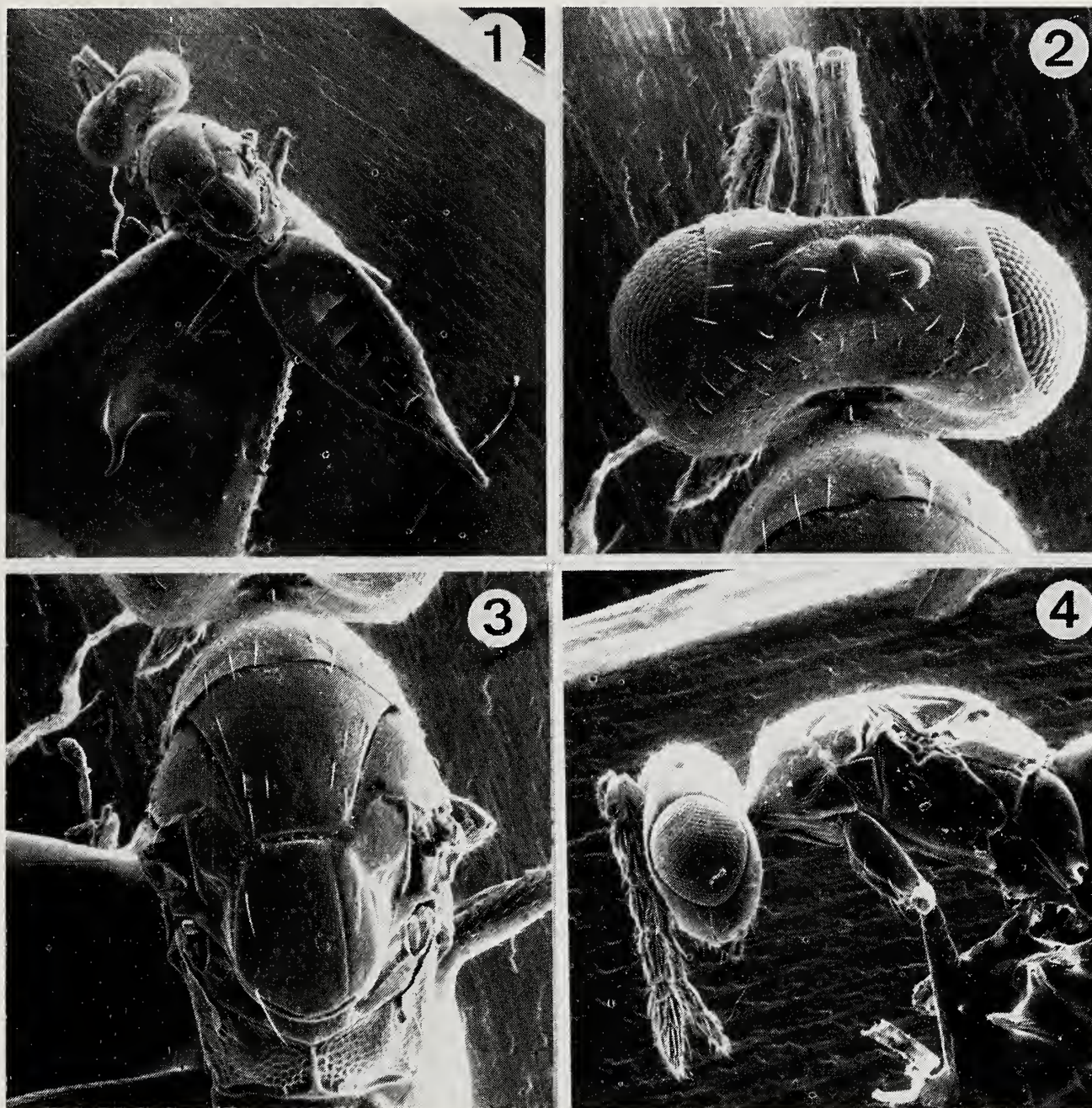
**Redescription**

**Female.** — Length 1.1-2.2 mm; abdomen somewhat longer than thorax and head together (fig. 1); head and abdomen often deformed due to desiccation.

**Colour.** — Head metallic green but mandibles, clypeal region and facial lines ochre (face in some paralectotypes yellowish-green); antenna with scapus yellowish-white, flagella brown; thorax metallic green, scapulae yellowish-white; gaster with terga 1-2 largely and tergum 3 anteriorly ochre; side margins, especially of terga 1 and 3, greenish-brown (yellow area looks like an irregular round spot), remainder of terga green, darker towards end of gaster; sterna 1-3 largely ochre, remainder of sterna green, darker towards end of gaster; front coxae yellowish-white, middle coxae largely brown, hind coxae greenish-brown; legs yellowish-white, apical tarsal segments dark, wings hyaline, venation yellowish-brown.

**Structure.** — Head transverse somewhat depressed anteriorly, vertex narrow, ocellar triangle elevated, distance between lateral ocelli 1.6-1.7 times distance from lateral ocellus to eye margin, occiput with row of bristles, some bristles in ocellar triangle and near eye margin, eye somewhat oval, almost bare (fig. 2). Malar space about two thirds the length of eye, malar sul-





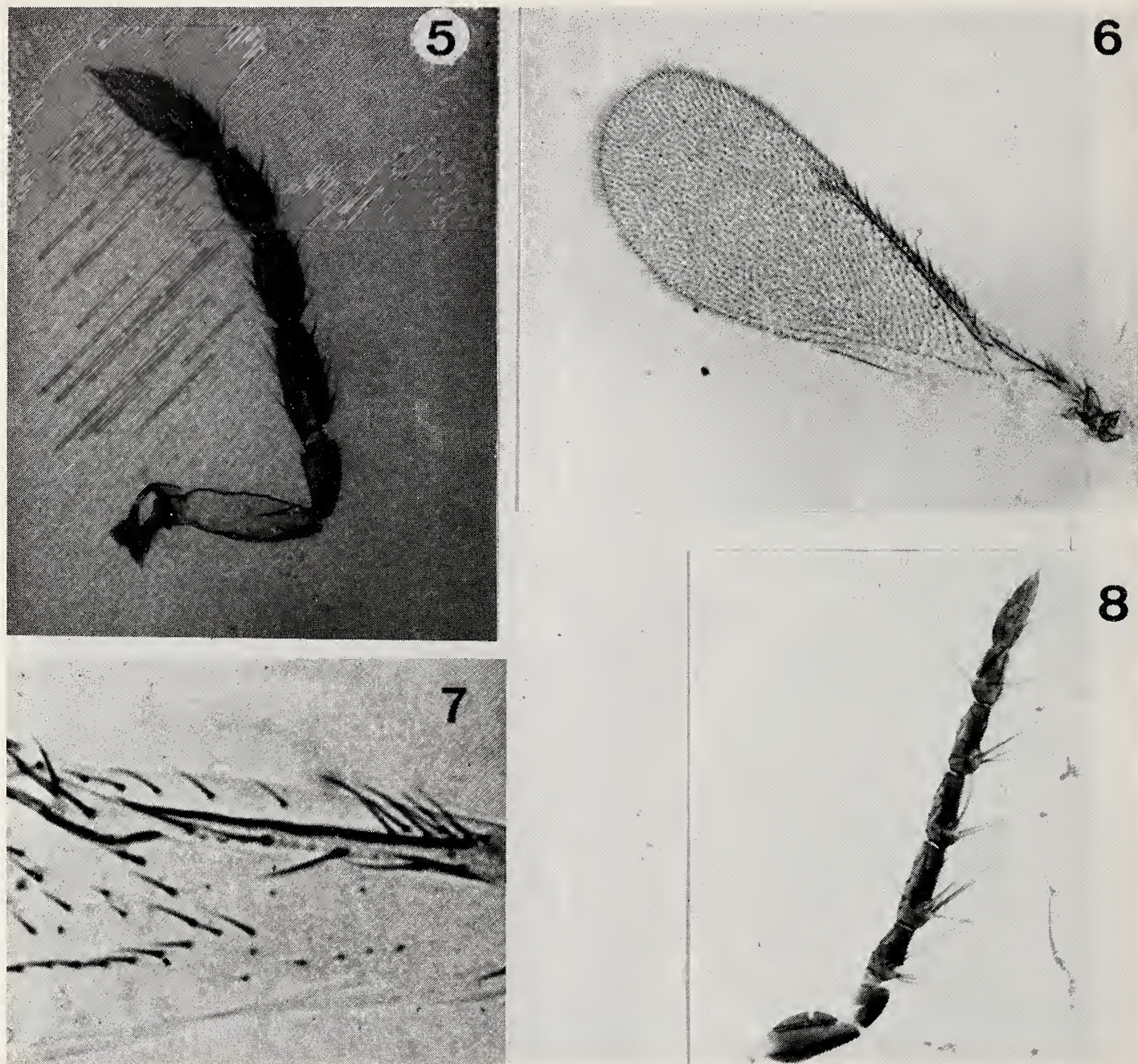
Figs. 1-4. Scanning electron micrographs of *Tetrastichus diopsisi* (Risbec). 1, female paralectotype (wings removed); 2, head; 3, thorax; 4, head and thorax in profile.

cus straight, head frontally with deep depression, broadest in the middle, antenna inserted a little above lower eye margin, clypeus margin with two rounded protrusions in the middle, mandible with two sharp teeth, upper margin of mandible irregularly rounded below second tooth.

Thorax (figs. 3, 4) 1.6 times as long as broad, pronotum rather narrow, hemispherical with row of bristles before posterior margin, mid lobe of mesoscutum with two irregular rows of 3-8 adnotaular bristles, notaulices deep, scutellum with two submedian sutures and two pairs of admarginal bristles, smooth propodeum with median carina, spiracles close to hind margin of metanotum; 2 bristles laterally of spiracle, some bristles more posteriorly.

Antennal scapus of about equal length as length of eye, combined length of pedicellus and flagellum about twice the breadth of head. Pedicellus 1.9-2.2 times as long as broad and 0.7-0.8 times as long as the first funicular segment, first segment 2.4-2.6 times as long as broad and about 1.0-1.2 times as long as the second segment; second twice as long as broad, slightly longer than the third which is 1.6-2.0 times as long as broad; clava slightly broader than funicle, nearly 0.8-1.0 times length of segments 2 plus 3, pointed apically, 2.6-3.6 times as long as broad





Figs. 5-8. *Tetrastichus diopsisi* (Risbec). 5, antenna, female; 6, forewing; 7, proximal part of forewing; 8, antenna, male.

including the prominent terminal spine; many sensillae on each segment and on the clava; bristles of flagella standing out rather strongly (figs. 4, 5).

Legs slender; spur of mid tibia about 0.4-0.5 times the length of first tarsal segment, second segment 0.7-0.8 times the first, third segment 0.7-0.8 times the second and fourth segment 1.1-1.3 times the third.

Forewing 2.8 times as long as broad, not reaching tip of gaster. Costal cel 10-12.5 times as long as broad with a row of dispersed hairs, which starts on the submarginal vein with 4-6 hairs, then diverges and runs largely parallel to the vein until it approaches the edge; marginal vein 6.5-7 times length of stigmal vein, stigmal vein somewhat thinner proximally but gradually thickening to form a small stigma; speculum small, wing beyond thickly pilose; longest marginal fringe one-tenth of width of wing (fig. 6, 7). Hindwing rather blunt apically, longest marginal fringe about half of width of wing. Gaster elongate, strongly narrowing towards apex, tips of ovipositor sheaths clearly exposed. Terga with single row of bristles but apex of gaster with many bristles, and a pair of pygostylar bristles about three times as long as next longest bristle.

Sculpture: head, thorax and abdomen shiny with reticulate pattern, propodeum strongly reticulate.



Male. — Length of body 0.8-1.4 mm, same colouration, structure and sculpture as female but abdomen shorter; antenna with five funicular segments with basally at one-third to one-fourth of their length a row of 6-8 long bristles across the width forming an uncomplete ring (fig. 8).

*T. diopsisi* belongs to the species group of *viridimaculatus* (cf. Domenichini, 1965).

#### Variation and alternative hosts of *T. diopsisi*

Risbec (1956a, b) has described some variations as to colour and structure in *T. diopsisi* and names some hosts other than *D. macrophthalma*. Descamps (1957) gives a more extensive list of alternative hosts. In the collection at our disposal are some slides with *Tetrastichus* species, identified by Risbec as *T. diopsisi* which were bred from other Diopsid species as well as some specimens which are considered to be colour variations of *T. diopsisi*. All specimens from these slides have been mounted on card points by us and have been labelled according to the label on the slide (in so far as legible).

Our study reveals that a relatively large number of *T. diopsisi* identifications made by Risbec were incorrect. Those *Tetrastichus* specimens bred from pupae of *D. tenuipes* (= *D. tenuipes* Westwood) (= *D. apicalis* Dalman complex) and *D. ichneumonea* (Linnaeus) (= certainly misidentified) and from larvae of *D. collaris* Westwood (one slide) are not *T. diopsisi* but closely related *Tetrastichus* species. For further comments on the identification of Diopsidae by Descamps the reader is referred to Feijen, 1978. The *T. diopsisi* var. 1 (from larvae of *D. thoracica* = *D. macrophthalma*), the var. 2 (from pupae of *Diopsis* spec.), the var. 3 (from *D. thoracica* = *D. macrophthalma*) and female specimens (two slides each with two females) bred from two unidentified diptera pupae and labelled *T. diopsisi* var. are closely related *Tetrastichus* species too. Among the slides studied, there is one slide with *T. diopsisi* specimens which according to the label were bred from *D. collaris* Westwood and one slide with specimens from larvae of *D. curva* Bertoloni (misidentification for *D. circularis* Macquart) which are no doubt *T. diopsisi*. Descamps (1957) mentioned *T. diopsisi* also as an occasional parasitoid of larvae of *D. macrophthalma*. As a larval parasitoid *T. diopsisi* could behave as an external or as an internal parasitoid. This was never found in Malawi. As other additional hosts he recorded pupae of *D. servillei* Macquart and *Pachylophus* sp. (Diptera; Chloropidae) and larvae of *Atherigona* sp., the rice seedling fly (Diptera; Anthomyiidae). The specimens bred from these hosts were not present in the slides studied.

#### Other pupal parasitoids

Pupal parasitoids of *D. macrophthalma* mentioned by Descamps (1957) are *Opius annulicornis* Granger (Braconidae), *Eupelmella pedatoria* Ferrière (Eupelmidae), *Eurytoma diopsisi* Risbec (Eulophidae), *Pleurotropis dipterae* Risbec (Eulophidae) and *Tetrastichus brevistylus* Masi. In Malawi, in one case only, seven *T. diopsisi* emerged from a pupa but also a ♂ *Eupteromalus* species. Ten more *T. diopsisi* and five pteromaline pupae were also found in the same pupa.

#### Parasitism

In Malawi the rate of parasitism of pupae of *D. macrophthalma* by *T. diopsisi* never reached the high levels (on average 72%) mentioned by Descamps (1957) for the Cameroon. In the four years that pupae were collected the average rate of parasitism of full pupae was 15.5%, the highest rate of parasitism per year being 21.7% and per collecting day 50.0% (see also Table 1). This lower rate of parasitism might be due to the lower density of *Diopsis* pupae in the rice fields of Malawi. The number of pupae found per year also dropped considerably in the four years, although in later years more rice hills were examined. This was caused by an increasing rate of egg-parasitism by Trichogrammatidae (1971/72 43%, 1972/73 55%, 1973/74 73%, 1974/75 63%) and the subsequent decline of the *D. macrophthalma* population (Feijen & Schulten, 1981). In the 1971/72 season the highest average number of pupae of *D. macroph-*



Table 1. Rate of parasitism of pupae of *D. macrophthalma* — Malaŵi 1971-1975.

Rainy season	1971/72	1972/73	1973/74	1974/75	Total
No. of pupae collected	251	155	111	74	591
No. of empty pupae	183	105	59	51	398
% of empty pupae parasitized	3.8	9.5	8.5	9.8	6.8
No. of full pupae	68	50	52	23	193
% of full pupae parasitized	16.2	12.0	18.4	21.7	15.5
Average no. of wasps per pupa	18.2	14.3	22.3	16.6	18.7
Average % of ♀♀	85.3	100.0	87.9	93.2	89.1

*thalma* per rice hill per collecting day was 5.5, which in the 1974/75 season had declined to 0.7. On average 18.7 wasps hatched per pupa (range 1-52). Descamps found an average of 30 wasps per pupa (3-73). The percentage ♀♀ varied between 73% and 100% and was on average 89.1%. In the Cameroon the average percentage of ♀♀ was 84%. No relation was found between the percentage ♀♀ and the density of *Diopsis* pupae, but the number of data obtained was rather low. Of pupae collected in the field the longest time before wasps emerged was 25 days. A fresh pupa parasitized in the laboratory produced wasps after 23 days at 25 °C.

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