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A new species of **Rhytimorpha** Szépligeti (Hymenoptera: Braconidae: Braconinae) from Israel

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The distinctive braconine wasp genus **Rhytimorpha** Szépligeti is distributed through Africa and the Near East. We provide photographic illustrations of the type specimens of the two species of **Rhytimorpha** known up to the present, **R. coccinea** Szépligeti and **R. nigriceps** Szépligeti. Previous published records of **R. coccinea** from Israel by J. Papp are confirmed. A new species, **R. pappi** Quicke & Butcher sp. n. is described based on a female from Holot Agur, a semi-desert area in the Negev Dunes in northeastern Sinai Peninsula.

http://www.zoobank.org/urn:lsid:zoobank.org:pub:B5CDA65C-5341-4A61-9C85-2A7A70D7D4C1

\textbf{Keywords:} Middle East; parasitoid; Bathyalacina; arid land

**Introduction**

**Rhytimorpha** Szépligeti, 1901 is a highly distinctive genus of Old World braconine parasitoid wasps known currently from two species, both widespread and moderately common in Subsaharan Africa (Papp, 1988; Yu, van Achterberg, & Horstmann, 2012). An unidentified species has also been recorded from Saudi Arabia (Sarhan & Quicke, 1993), but no previous records exist for the genus from the Eastern Mediterranean region. A previous record from Iran by Hedwig (1957) in which he described a new species (**Rhytimorpha mirabilis** Hedwig, 1957) was shown by Quicke (1985) actually to be a member of the genus **Iphiaulax** Förster (hence **Iphiaulax iranicus** Quicke, 1985, replacement name for **Rhytimorpha mirabilis** Hedwig, which was a secondary homonym of **Iphiaulax mirabilis** Szépligeti, 1901), though Gadallah and Gharari (2015) incorrectly still refer to this species as **Iphiaulax mirabilis**.

The systematic placement of **Rhytimorpha** is still somewhat uncertain. Its short fore wing marginal cell together with large, ventrally produced scapus and distally expanded fore wing 2\textsuperscript{nd} submarginal cell suggest affiliation with the Bathyalacina or Glyptomorphina (both previously afforded full tribe status) (Quicke, 1987).
Material and Methods
Terminology follows Van Achterberg (1988) except for wing venation nomenclature which follows Sharkey and Wharton (1997); see also Fig. 2.2 in Quicke (2015) for comparison of wing venation naming systems.

Collections holding specimens are abbreviated as follows: Canadian National Collection of Insects, Ottawa (CNCO); Natural History Museum, London (NHMUK); Hungarian Natural History Museum, Budapest, Hungary (HNNHMUKHM); Tel Aviv University, Tel Aviv, Israel (TAU); Museum für Naturkunde, Humboldt Universität, Berlin, Germany (MFN).

DNA extractions from single mid-legs were carried out using standard protocols for 96-well plates (Ivanova, deWaard, & Hebert, 2006). COI sequences were amplified using the following primers LepF1 (5’-GGT CAA CAA ATC ATA AAG ATA TTG G-3’) and LepR1 (5’-TAA ACT TCA GGG TGA CCA AAA AAT CA-3’) (Hebert, Cywinska, Ball, & deWaard, 2003; Hebert, Penton, Burns, Janzen, & Hallwachs, 2004; Park, Suh, Oh, & Hebert, 2010).

The specimen of the new species was imaged using an Olympus SXZ16 microscope with automated multiple image capture at preset focal levels using an Olympus DP72 camera, and image combination using the Cell^D image processing system.

Results
Rhytimorpha Szépligeti, 1901
Type species: Rhytimorpha coccinea Szépligeti, 1901.
Diagnosis. The genus may be recognised from all other genera of Braconinae using the key by Quicke (1987). It is the only genus in the subfamily with the combination of a dentate posterior margin of the 5th metasomal tergite (Figures 2c, 3c, 4c) and a much shortened fore wing marginal cell (Figure 3a).

Rhytimorpha pappi Quicke & Butcher sp. n. (Figures 1, 2)

Length of body 4.7 mm, of fore wing 4.4 mm, of ovipositor (part exserted behind metasoma) 1.2 mm. – Head: Antennae incomplete, 32 flagellomeres remaining. Median flagellomeres 1.3x longer than wide. 1st flagellomere 1.1x longer than both the 2nd and 3rd flagellomeres separately. Width of head: width of face: height of eye = 2.0: 1.1: 1.0. Face coarsely rugose. Inter-tentorial distance: tentorio-ocular distance = 2.0: 1.0. Frons flat with weak, narrow, median groove. Shortest distance between posterior ocelli: transverse diameter of posterior ocellus: shortest distance between posterior ocellus and eye 1.8: 1.0: 2.7. Length of eye in dorsal view 1.4 x length of head behind eye. – Meso soma: Mesosoma 1.43x longer than high, smooth, shiny, largely glabrous. Notauli deep and distinctly crenulate, ending well before scutellar sulcus. Scutellar sulcus narrow and punctate. Propodeum smooth. – Wings: Fore wing. Lengths of veins r-rs: 3RSa: 3RSb = 1.0: 10.0: 10.0. Lengths of veins 2RS: 3RSa: rs-m = 1.0: 1.5: 1.3. Vein 3RSa sinuate. Marginal cell short, vein 3RSb reaching wing margin, 0.42 of distance between apex of pterostigma and wing tip. Vein 1-M curved. Vein 2CUa quite sharply angled posteriorly. Base of hind wing with area of reduced setosity postero-distal to vein cu-a. – Legs: Lengths of fore femur: fore tibia: fore tarsus = 1.0: 1.0: 1.3. Lengths of hind femur: hind tibia: hind tarsus = 1.0: 1.15: 1.05. Hind femur 3.8 x longer than wide. Hind basitarsus distinctly tapering distally. – Metasoma: First tergite approximately as long as wide posteriorly. Second metasomal tergite with small but clearly-defined mid-basal, largely smooth, triangular area giving rise to weak, irregular midlongitudinal carina; 1.9 x wider basally than medially long, 1.15 x longer than 3rd tergite. Tergites 4 and 5, with rugose sculpture; somewhat domed in profile, but the raised central areas not divided
Figure 1. *Rhytimorpha pappi* Quicke & Butcher sp. n., holotype, female. (a) Habitus, dorsal view, (b) face, (c) head, dorsal view, (d) head and pronotum, lateral view.

Medially by a trough. Posterior margin of 5th tergite with deep medial emargination bordered by a pair of teeth, but denticles lateral to this rather weak and rounded. – *Colour*: Antennae black. Head orange-red with piceous to black broadly on middle of frons, stemmaticum, vertex extending to slightly below middle of temple. Palps black. Rest of body orange-red. Legs yellowish orange. Wings largely dark smokey grey with dark brown venation and entirely dark brown-black pterostigma; fore wing with clear mark below basal part of pterostigma, and another below apex of pterostigma extending around vein rs-m.

Males unknown.

Etymology. Named after the recently late Hungarian entomologist, Dr Jenő Papp (1933–2017) in recognition of his major contribution to braconid systematics.

*Rhytimorpha coccinea* Szépligeti, 1901 (Figure 3)
Holotype: Female: Vivi, Democratic Republic of the Congo (HMNH) [Condition good: Quicke, 1991].
Distributional notes and variation. The species has been reported from Gabon (Szépligeti, 1914c; see Rasmussen & Ascher, 2015 for re-interpretation of the locality Democratic Republic of the Congo (Szépligeti, 1901), Namibia (Szépligeti, 1914b), South Africa (Brues, 1924), Sudan (Shenefelt, 1978), Tanzania (Szépligeti, 1914a), the disputed territory of Cabinda (locality Chinchoxo in Szépligeti, 1914a) and Israel (Papp, 1988). Szépligeti (1914a, 1914c) additionally reported colour variants of *R. coccinea* with slightly more black markings on the head. Szépligeti (1914c) noted a female specimen from Democratic Republic of the Congo (Popokabaka [as Popocabacca]) with “Stirn und Scheitel schwarz, Augenrand schmal rot”; Szépligeti (1914a) noted a specimen in the Berlin museum from Egypt collected by Staudinger which he referred to as “var. 1” which differed from the type in having “nur Stemmaticum schwarz”, and three specimens from Tanzania which he referred to as “var. 2” differing in having “Stirnmittle und Hinterkopf zum Teil schwarz” with the data: Parumbira, 22.x.1893 col. Dr S. Bumiller; Musa, Bezirk Tanga, no date, col. Fischer; Dar es Salaam, no date, col. S. G. Regner. In addition, we have studied one female from Angola, Luanda, vi–vii.”1957 and 1958”, det. W. R. M. Mason (CNCO); a male from Egypt, Sinai Peninsula, Wadi Nasib, vii.1927, col. Theodor Budenheimer (BMNH); a specimen of unknown sex, Malawi, Chiromo, 1917, col. R. C. Wood (NHMUK); 6 males and 4 females, Egypt, Siwa, vi–vii.1935, coll. J. Omer-Cooper (BMNH); 2 females from Saudi Arabia (NHMUK); 1 female from Yemen (NHMUK); 2 females, Israel, Rt 70 N Zin (TAU).
Rhytimorpha nigriceps Szépligeti, 1906 (Figure 4)


Rhytimorpha nigriceps has also been recorded from Namibia (Szépligeti, 1914b: as atriceps [lapsus]) and we examined additional specimens: 1 specimen of unknown sex (missing apex of metasoma), Tanzania, Dar es Salaam, 14.ix.1961, coll. G. Heinrich (CNCO); 1 female, Malawi, Mlanje (NHMUK); 1 female from Nigeria that has the head largely dark (reddish on the genae), although a bit discoloured and not jet black (NHMUK). Another 2 females with intermediate head colouration (the face red except for black centre) between R. coccinea and R. nigriceps in the NHMUK from Uganda (Entebbe) and Namibia, Otshu, Hoarusib (-19.0666, 12.55), March 1926, [South African] Museum expedition (SAM-HYM-P06925 – images available on WaspWeb) (SAMC); the following 5 females have the typical black head with rufous crescents (images present on WaspWeb) from South Africa: 1 female, Northern Cape, Jackals Water (-29.8247, 22.5384), Bushmanland, Lightfoot, Oct 1911, Rhytimorpha coccinea, Brues determination, SAM-HYM-P002509 (SAMC); 2 females, Northern Cape, Aggenys (-29.1981, 18.8471), or Bushmanland, between Springbok and Pella, [South African] Mus. Staff, Oct 1939, SAM-HYM-P006996 & SAM-HYM-P007003 (SAMC); 1 female, Naib (-29.3593, 18.3353), or Bushmanland, between Springbok and Pella, (-29.1981, 18.8471) [South African] Mus. Staff, Oct 1939, SAM-HYM-P086340 (SAMC); 1 female, Western Cape, Travellers Rest, 20 km NE Clanwilliam, 330 m, 32°05.08’S 19°05.39’E, 6 Nov 1998, S. van Noort, Succulent Karoo SAM-HYM-P020739 (SAMC).
Differential diagnosis and discussion

DNA barcode sequences were obtained for three specimens of *Rhytimorpha*: two females of *R. coccinea* from Rt 70 N Zin, Israel (TAU, specimen vouchers CCDB-27844-B02 and CCDB-27844-B03 and Genbank accessions MG949746 and MG949748, respectively) and one of the holotype of *R. pappi* sp. n. (TAU specimen voucher CCDB-27844-C12, Genbank accession MG949747). The region of overlap between the two *R. coccinea* sequences was 286 BPs and they differed at one base. The region of overlap between the *R. israelica* sp. n. sequence and the longer of the *R. coccinea* sequences was 521 BPs and they differed at 34 positions (6.5%).

The new species is readily separable from both *R. coccinea* and *R. nigriceps* by its considerably smaller body size (4.7 mm compared with 7.0–13.0 mm), its entirely black pterostigma, grey-black wings, short forewing vein r-rs and shorter forewing marginal cell, and crenulate notauli. That *R. pappi* sp. n. is not just a small and morphologically aberrant specimen of *R. coccinea* is strongly supported by the 6.5% difference in their barcodes.

The distinction between *R. coccinea* and *R. nigriceps* is not as dichotomous as implied by the original description of the latter by Szépligeti (1906) which is rather brief and is repeated here verbatim below: “Rh. nigriceps n. sp. female. Der Rh. coccinea
The type of *R. nigriceps* is morphologically nearly identical to *R. coccinea*, the only difference being the largely black head of the former. Both species have the pterostigma yellow basally (Figures 3, 4), the forewing marginal cell ends more than half way between the apex of the pterostigma and the wing tip, though there is some variation, and (at least in females) the terga of metasomal segments 4 and 5 with submedial swellings. As already noted by the descriptions of several varietal forms by Szépligeti, and from our observations most specimens can be assigned to one or other of these species, but one Ugandan specimen in the NHMUK and another in SAMC (SAM-HYM-P06925 – images available on WaspWeb) have a rather intermediate face and head coloration.

*Rhytimorpha coccinea* is apparently widely distributed from South Africa to Israel. In addition to colouration, there is a small amount of difference, among specimens that fall into *R. coccinea* in the length of the forewing marginal cell. We cannot at present exclude the possibilities that these two species are synonyms or that *R. coccinea* might constitute a cryptic species complex, or both.

In addition to *Rhytimorpha* material identified to named species, Quicke (1988) recorded two species, one from Kenya (Tsavo East National Park) in his study of Braconinae male genitalia, and a further unidentified specimen from Zimbabwe was included in a molecular investigation of the Braconinae based on the nuclear 28S rDNA gene by Belshaw et al. (2001). What remains of the vouchers specimens of these should be in the NHMUK but we have not been able to relocate them.

**Key to the species of *Rhytimorpha* (females)**

1. Pterostigma entirely black (Figure 1a); notauli distinctly crenulate (Figure 2a); fore wing vein 3RSa reaching wing margin less than 0.5x distance between apex of pterostigma and wing tip (Figure 1a); wing membrane dark, smokey grey with clear patches close to both base and apex of pterostigma; 5th metasomal tergites dorsally without medial depression between pair of submedial rounded bumps (Figures 2b, 2c); body length less than 6.0 mm .................................................. *Rhytimorpha pappi* sp. n.

2. Pterostigma basal 0.3–0.5 yellow (Figures 3a, 4a); notauli smooth (Figures 3a, 4a); fore wing vein 3RSa reaching wing margin more than 0.5x distance between apex of pterostigma and wing tip (Figure 4a); wing membrane brown with some yellow-brown patterning, without clear area at apex of pterostigma; 5th metasomal tergites with medial depression between pair of submedial rounded bumps (Figures 3a, 3c, 4c); body length more than 6.0 mm .................................................. 2

2. Head red with variably sized black mark around stemmaticum and on median part of frons (Figures 3a, 3b) ........................................... *Rhytimorpha coccinea*

   - Head including face largely black, narrowly rufous around dorsal margin of eye and on lower part of malar space (Figures 4a, b) ....... *Rhytimorpha nigriceps*

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**Disclosure Statement**

No potential conflict of interest was reported by the authors.

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