

## Research Article

# First records of three species with their description from the family Figitidae (Hymenoptera, Cynipoidea) from Iraq

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**Abstract:** In the present study, three species belonging to the family Figitidae *Gronotoma micromorpha* (Perkins, 1910), *Kleidotoma kraussi* (Yoshimoto, 1963) and *Pycnostigmus incognito* (Buffington & van Noort, 2007) were recorded for the first time in Iraq. The wasps specimen in this study was collected between January and December 2021 from different ways and different regions in Basrah Province, southern Iraq. These species were described, and illustrations of diagnostic characters and distributional data of the species were provided.

**Keywords:** Eucoilinae, Figitidae, New record, Iraq.

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## Introduction

The family Figitidae Thomson, 1862 (Hymenoptera Linnaeus, 1758: Cynipoidea Billberg, 1820) is a cosmopolitan group, comprising about 133 genera and over than 1,400 described species (Ronquist 1999; Fontal-Cazalla et al. 2002). Most figitids are small insects, which have a shining mesoscutum, whereas all cynipids have a dull mesoscutum and higher and more or less compact metasoma. The vast majority of Figitidae have a closed marginal cell, and they often have either a prominent lateral pronotal carina or a well-defined, strongly raised pronotal plate (Fontal-Cazalla et al. 2002).

Ronquist (1995) recognised Eucoilinae as a subfamily of Figitidae. The Eucoilinae is a diverse and important group of parasitoids Diptera, particularly leaf miners and fruit flies (Akhtar et al. 2003). This group is a distinct group, with small wasps with 1-5mm in length, but a few species can reach 30mm. They are usually black or brown in colour and never metallic. In most species, both

sexes are fully winged. Compared with most other Hymenoptera, females usually have 11 flagellomeres, and males have 12 or 13 flagellomeres. Males usually have the first flagellomere enlarged and excavated laterally. Eucoilinae is easily distinguished from all other Cynipoidea by its own scutellar plate with a glandular release pit existing in the centre (Ronquist 1995; Fontal-Cazalla et al. 2002).

The second important subfamily of Figitidae is Pycnostigminae (Weld 1952). This subfamily was recognised by Rasnitsyn (1980) (Ronquist 1995). Fontal-Cazalla et al. (2002) and Buffington & Van Noort (2007) hypothesised that pycnostigminae are monophyletic and sister to Eucoilinae, but pycnostigminae do not have a modified scutellar plate, with an associated glandular release pit, which is possessed by all Eucoilinae (Fontal-Cazalla et al. 2002). The taxonomy and biology of cynipoids are unknown in Iraq (Ahmed & Kareem 2020; Alfrhany & Kareem 2022), and they have not been studied

thoroughly. Therefore, this work aims to provide information about this important group in Iraq and enhance the Iraqi fauna with new species.

### Materials and methods

Specimens were collected from January to December 2021 using sweeping nets, yellow pan traps, and Malaise trap from different regions of Basrah Province, Southern Iraq (30°30'7.23"N, 47°50'30.93"E). They were placed in containers containing 70% ethanol. In the laboratory, each material was poured into a Petri dish and placed on the base of a stereomicroscope to collect wasps using tweezers or a tiny hook using magnification. Specimens were identified and photographed using a Nikon camera installed on an EZ4 binocular stereomicroscope with identification keys. Then, the specimens were deposited in vials containing 70% ethanol at the Natural History Museum of London and Museum of Natural History, Baghdad University, Iraq. The morphological terminology used in this study was in accordance with Quinlan (1978), Beardsley (1990), Forshage & Nordland (2008) and Suay et al. (2019).

### Results

During this study, the family Figitidae (Cynipoidea) was recorded for the first time in Iraq with three species of *Gronotoma micromorpha*, *Kleidotoma kraussi* and *Pycnostigmus incognito*. All the species were identified for the first time in Iraq as follows:

#### Description

**Order:** Hymenoptera

**Family:** Figitidae

**Subfamily:** Eucoilinae

**Genus:** *Gronotoma* Foster, 1869

**Species 1:** *Gronotoma micromorpha* Perkins, 1910

**Synonym:** *Eucoilidea rufula* Yoshimoto, 1962

**Female Body** (Fig. 1a): Smooth, shiny with a brownish-black colour, mandibles, antennae tegulae, veins and legs more or less yellowish brown. Total length of 1.11-1.32mm.

**Head:** Black, smooth and shiny. In the dorsal view,

subquadrate slightly wider than mesosoma. In the lateral view, ocelli, clypeus and occiput with sparse short setae with a length and width of 0.33 and 0.22mm, respectively.

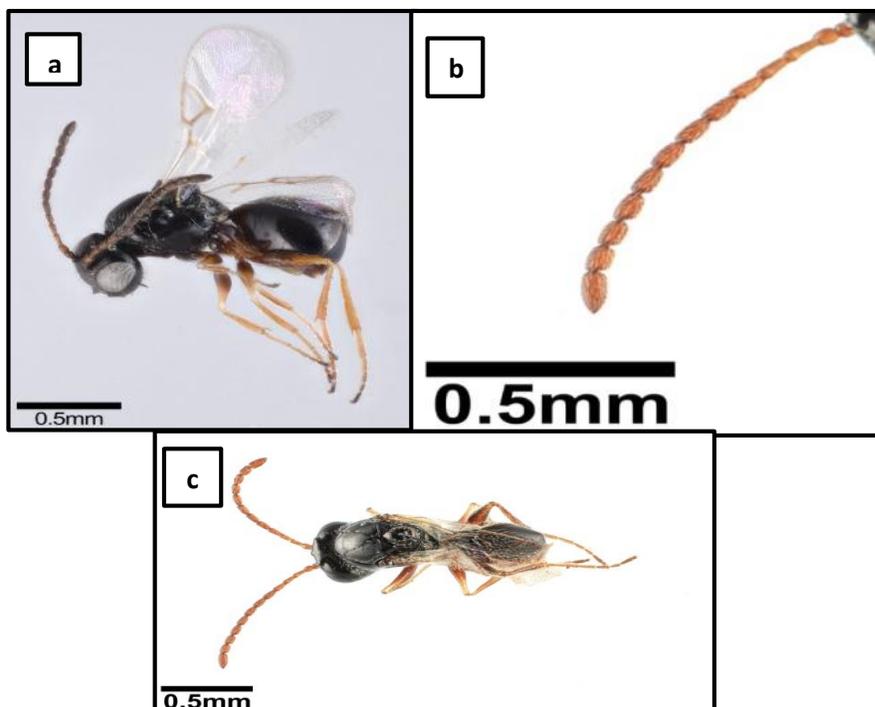
**Antenna** (Fig. 1b): Filiform with a 13-segmented, antennal socket weakly projected with a total length of 1.01 mm.

**Mesosoma** (Fig. 1c): Smooth, shiny, with black colour. Pronotum setose, pronotal plate distinct, posterior margin of pronotum lightly concave; outer pronotal plate with a distinct ridge posteriorly and laterally; lateral portion of pronotum crenulate on outer margin of pronotal plate, scutellar plate strongly raised, anterior stem sharply declivous and less elongated, posteriorly not reaching hind margin of scutellum. Notauli complete and convergent posteriorly, with sparse setae. Series of sculptures present along lateral margins of mesoscutum with sparse setose. Scutellum with foveae at the base; apical third of scutellar cup with a large depression, having a large pit in centre, margin of depression with about 12 small pits, each small pit bearing a short fine seta; scutellar disc punctate-reticulate, with setae, apex of disc not merged by scutellar cup. Mesopleural suture distinct; subtriangle with a little hair, relatively broad and short lower portion of mesopleurite. Metapleuron pubescent. Propodeum pubescent; lateral propodeal carinae weakly curved medially in the dorsal view.

**Wings:** Fore wing hyaline with a length and width of 0.96 and 0.48mm, respectively. Marginal cell closed, triangular, elongated, with a length and width of 0.23 and 0.12 mm, respectively. M and Rs + M veins weakly indicated; wing surface fully ciliated.

**Legs:** Pale brownish. Femur 4.4 times as long as wide. Subequal to the length of tibiae and femur. Length of first tarsal segment 2.2 times the remaining segments combined.

**Metasoma:** Brownish black, smooth and shiny with a length and height of 0.47 and 0.39mm, respectively. Tergite 2 with sparse setae basolaterally, enclosing posterior segments.



**Fig.1.** Female: **a-** Lateral view of hall body, **b-** Antenna and **c-** Dorsal view of hall body.

**Biology:** Parasitoids of leaf-mining and stem-mining Agromyzidae (Buffington 2011).

**Distribution:** Worldwide, primarily the Holarctic region and Iraq in the present study.

**Material Examined:** 82 females.

**Order:** Hymenoptera

**Family:** Figitidae

**Subfamily:** Eucoilinae

**Genus:** *Kleidotoma* Westwood, 1833

**Species 2:** *Kleidotoma kraussi* Yoshimoto, 1963

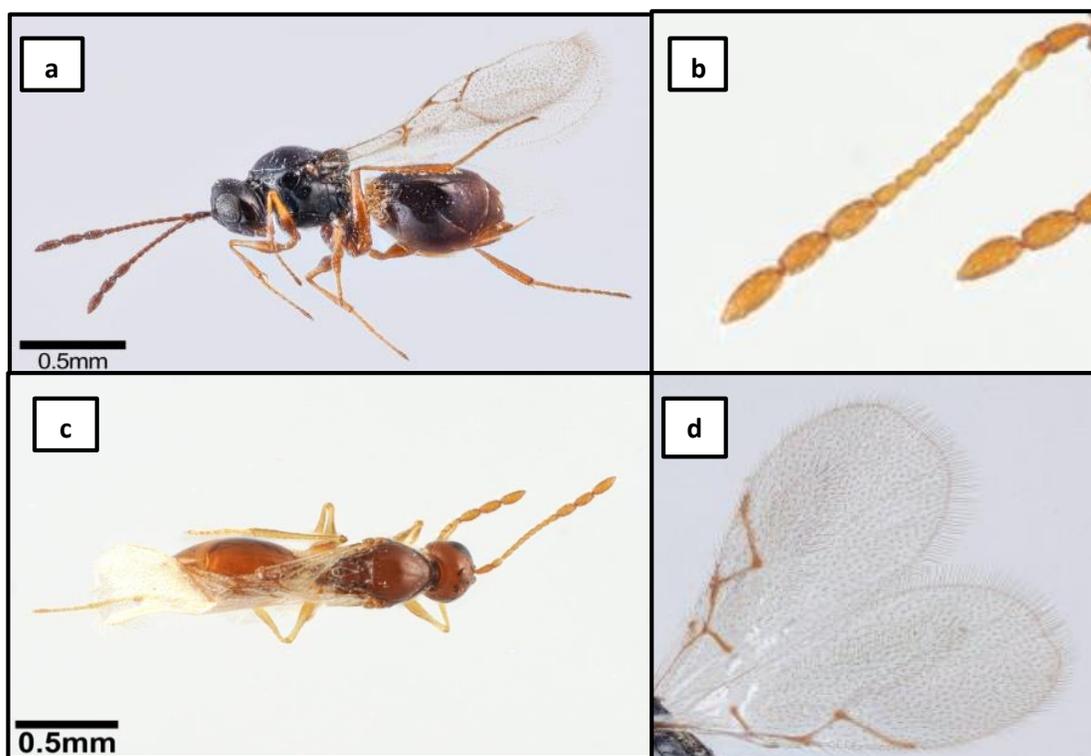
**Female Body** (Fig. 2a): Smooth, shiny with a brownish-black colour, antennae, tegulae and legs yellowish-brown. Total length 1.42-1.66mm.

**Head:** In dorsal view, head slightly as wide as the thorax; length in lateral aspect about 0.7 times as long as width, and front between compound eyes about 2.4 times their width. Occipital area with transverse costae, costate area not extending forward to lateral ocelli, vertex smooth and shiny.

**Antennae** (Fig. 2b): Capitulate, 13 segmented, with a distinct three-segmented club; each one with longitudinal weak rhinaria; scape 1.65 times as long

as wide; pedicel fusiform; flagellar segment F1 elongated, F4 longer than F3; F1–10 subcylindrical, segment F10 distinctly smaller than F11; segments 11 and 12 subequal; F 13 slightly longer than F12.

**Mesosoma** (Fig. 2c): Smooth, shiny and sparsely hairy with a total length of 0.57mm. Pronotal plate relatively large, anterior part distinctly rugose, dorsal margin smoothly curved and dorsal and lateral margins well-separated from rest of pronotum by a distinct ridge. Mesoscutum smooth, shiny and longitudinally striated along lateral margins. The scutellum with one basal foveae; scutellar plate elongated but not extending to apex of disc, smoothly arched with a narrow, elongated, anterior neck, posterior part narrowly tear-shaped with a large subapical pit and tow of prominent setae and a rounded pit on the posterior end. Mesopleurite smooth, shining, pronotal plate moderately large; anterior portion distinctly transversely rugose, dorsal and lateral margins forming a distinct ridge. Mesoscutum largely smooth, shiny and longitudinally striated along lateral margins. Scutellar plate elongated, smooth



**Fig.2.** Female: **a-** Lateral view of hall body, **b-** Antenna, **c-** Dorsal view of hall body, and **d-** Fore wing.

and arched extending to apex of disc, posterior part narrowly tear-shaped; subapical pit moderately large. Mesopleurite smooth, shining.

**Wings** (Fig. 2d): Forewing hyaline, strongly incised apically, with long hair from middle of anterior margin to middle of posterior margin, veins well-pigmented brown, with a length and width of 1.19 and 0.69mm, respectively. Marginal cell fully opened, triangular and elongated; 2.41 times as wide and as long; M and Rs + M veins not indicated; wing surface fully ciliated outer part of radial vein extending near wing margin. Thus, wing surface appears to extend beyond marginal cell proper and discal setae vestigial, represented by setal bases. Hindwing hyaline, more than 5.70 times as long and as wide.

**Legs:** The legs are brown yellowish except for the dark brown coxae. The wing veins are brown.

**Metasoma:** Large, smooth and polished with a length of 0.75mm. Setae ring at the base of second target incomplete at posterior.

Male (Fig. 3a): Similar to female but more thin, length (1.1-1.39) mm, antennae (Fig. 3b) filiform

with 15 segmented, with 13 flagellumeres, rhinaria present on all segments, first flagellumer weakly curved and flattened on outer side, length 1.84mm (Fig. 3c), forewings strongly incised apically, with long hairs from the middle of anterior margin to the middle of posterior margin, 2.49 as long as width, Marginal cell fully opened, triangular, elongate, 2.16X as wide as long.

**Distribution:** Worldwide, Afrotropical region, Hawaii, Korea, India, Yemen, Iraq in the present study.

**Biology:** Parasitoids of flies (Drosophilidae, Sepsidae and Ephydriidae) living on dung and decaying organic material, carrion, fruit, fungi, sea wrack and aquatic plants (Quinlan 1986).

**Material Examined:** 20 females, 4 males.

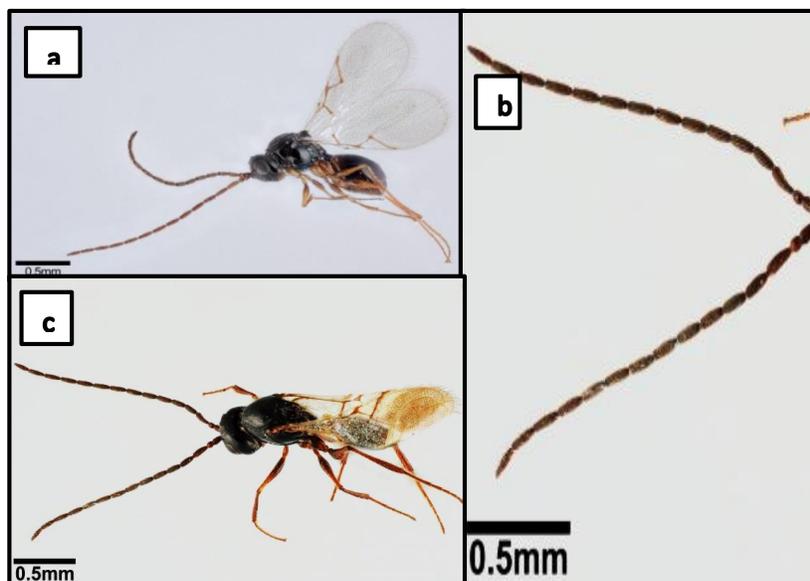
**Order:** Hymenoptera

**Family:** Figitidae

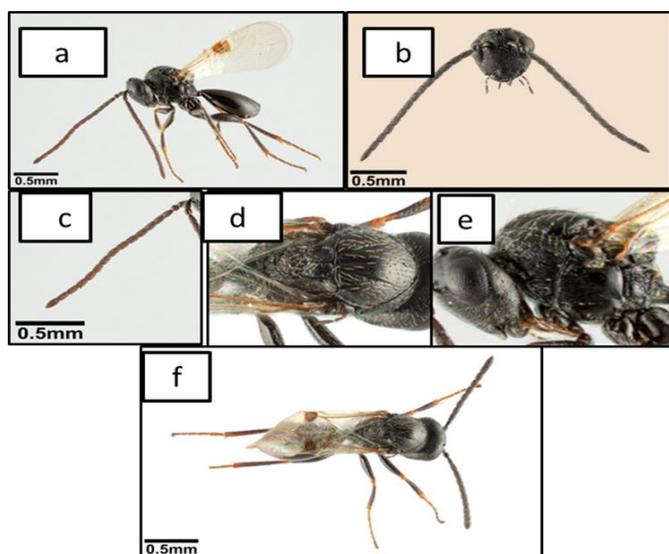
**Subfamily:** Pycnostigminae

**Genus:** *Pycnostigma* Cameron, 1905

**Species 3:** *Pycnostigmus incognito* Buffington & van Noort, 2007



**Fig.3.** Male: **a-** Lateral view of hall body, **b-** Antenna, and **c-** Dorsal view of the body.



**Fig.4.** **a-**Lateral view of hall body, **b-** Head and antennae, **c-** Antenna, **d-** Mesosoma, **e-**Metapleuron and **f-** dorsal view of hall body.

**Female Body** (Fig. 4a): Head, mesosoma and metasoma; black, non-metallic and not densely pubescent; antennae, tegulae and legs more or less brown. Total length 2.0–2.8mm.

**Head** (Fig. 4b): Black with weak sculptures around ocelli and on vertex; frons shagreened, cheeks with microsculptures; frons and occiput with scattered setae.

**Antenna** (Fig. 4c): Filiform, length 1.26mm, entirely dark brownish black; scape fusiform with a length

of 0.12mm. All 14 flagellomeres covered with short setae.

**Mesosoma** (Fig. 4d, e and f): Black, with a length of 0.81mm, pronotum smooth with a few carinae; in lateral aspect entirely and weakly rugulose, not foveolate, with few long setae. Mesopleuron smooth except for faint striations at anterior end of mesopleural carina; ventral and dorsal margins of mesopleural triangle clearly with few scattered setose. Mesoscutum smooth, lacking a

microsculpture, with several sparse setae present on entire surface; notaulices incomplete; area between posterior junction of notaulices designed by two teardrop-shaped impression. Scutellum in lateral view rounded. Disc of scutellum with a single dominant carina present around it, maintaining surface with distinct rugulose; margin of disc well-delineated by raised, deep carina. Metapleuron with long hairs on dorsal half and glabrous on ventral half. Propodeum crenulate and sparsely setose.

**Wings:** Hyaline fore wings with a length of 1.71 mm, with an elongated marginal cell and strongly sclerotised pseudostigma.

**Legs:** Black coxae and femora, covered with setae; remaining portion of legs orange; legs evenly covered with long, non-setae claws.

**Metasoma:** Black, smooth and shiny with a length of 1.10 mm. Petiole without setae and hidden anteriorly by syntergum. Smooth and shiny syntergum.

**Distribution:** Afrotropical region, Iraq in the present study.

**Biology:** Unknown

**Material Examined:** 12 females.

### Discussion

The Iraqi fauna of Cynipoidea is completely unexplored, and not a single species is reported so far (Jabbar et al. 2022; Najim & AL-Hadlag 2022). In this work, three species belonging to the family Figitidae were reported for the first time from Iraq. Descriptions, illustrations of diagnostic characters and distributional data of the species were provided.

Cynipoidea is an economically important and globally diverse group of Hymenoptera. The members of some families are all primary parasitoids, and they attack endopterygote insects and externally develop as koinobiont endoparasitoids on the host. Thus, many species of cynipoid wasps can be economically beneficial for the biological control of pests. On the contrary, some cynipoid wasps can be significant pests of many plants, where they induce the formation of

galls, thereby reducing plant production and vigour (Stone et al. 2002; Melika 2012; Pujade-Villar et al. 2014). Other species of cynipoids can be pests in agriculture where they reduce the abundance of natural enemies of aphids (Ronquist 1999; Buffington et al. 2007; Ros-Farré & Pujade-Villar 2007).

Figitidae are an important family of Cynipoidea, which is common worldwide. The members of this group are solitary koinobiont endoparasitoids that attack larvae of cyclorrhaphous Diptera (Buffington et al. 2007; Paretas-Martínez et al. 2013). Some species of the genus *Gronotoma* are parasitoids of Agromyzidae (Buffington 2002). Van den Berg et al. (1995) revealed that many species of *Gronotoma* are prevalent amongst the cynipoidea parasitoids of the pest.

*Gronotoma micromorpha* is known as a dominant parasitoid of *Liriomyza trifolii* on many cole crops and cucurbits (Schreiner et al. 1986; Beardsley 1988; Konishi 1998; Johnson 1993). It is the most abundant species, and it accounts for the vast majority of specimens encountered by Cynipoidea worldwide.

The genus *Kleidotoma* is widely distributed, and it is considered an important ecological group. Most species are larval and pupal parasitoids of cyclorrhaphous Diptera (Beardsley 1990; Forshage & Nordlander 2008). The majority of the genus *Kleidotoma* have the apex of the forewing distinctly incised in females. However, in a few males and females, the wings may be truncated apically. The radial cell is fully open, and the vein that forms the base of the marginal cell is thickened and short. This genus is distinct and readily separated from all others by the striated scutellar disc. Tergite 2 of the gaster has a distinct hairy ring, which is usually incomplete on the dorsal surface (Quinlan 1986; Beardsley 1989, 1990). Dalla Torre & Kieffer (1910) divided *Kleidotoma* into many subgenera based on the number of club segments of the female antenna. Genus *Kleidotoma* has a wide range of host fly families worldwide (Paretas-Martínez et al.

2013). Few *Kleidotoma* species have been reared from puparia of *Leptocera* spp., and few species are associated with animal dung or decaying organic material. In addition, few species have been collected from ponds of brackish water, and they may be parasitic on the larval and pupal of Diptera in it (Beardsley 1993; Buffington 2010).

Species of the subfamily Pycnostigminae are easily separated from all other Figitidae by the presence of a pseudostigma on the forewing. The biology and hosts for Pycnostigminae remain unknown, and the phylogeny of Figitidae in Ronquist (1999) indicates that Diptera is the potential host.

Knowledge of Cynipoidea, particularly in Iraq, is still lacking. Comparing Iraqi Figitidae with the fauna of its neighbouring countries, Iraq currently has a greater species richness. The present study demonstrates superficial knowledge about Figitidae in Iraq. Thus, several recommendations are proposed to increase knowledge in this field. Specimen collection should be conducted in different places at different times using several methods to obtain a rich material. In particular, the rearing of hosts, particularly economically important pest species of Diptera, is necessary. Determination keys must be prepared for the correct and reliable identification of Iraqi Figitidae. Hosts of Iraqi Figitidae and Figitidae parasitoid species of hosts, particularly Diptera in Iraq, must be determined and analysed for the practical biological control of pests. Thus, potential Cynipoidea parasitoids would be used to control pests in ecosystems.

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