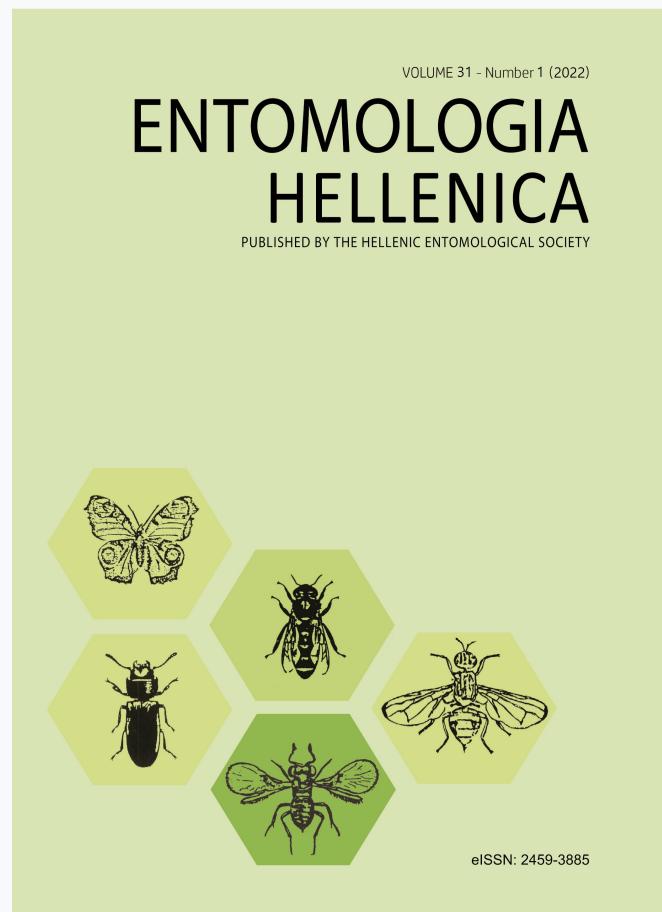


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First record of the genus *Scelio* (Hymenoptera: Platygastridae, Scelionidae, Scelioninae) egg parasitoids in tomato greenhouses of southeastern Algeria

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ABSTRACT

This is the first record of genus *Scelio* (Latreille, 1805) in Algeria. Within the two-year period 2019–2020, two species of *Scelio*, i.e. *S. poecilopterus* (Priesner, 1951) and *S. vulgaris* (Kieffer, 1908), were collected from tomato greenhouses in El Alia and El Hadjeb regions of the Biskra province, in southeastern Algeria, using yellow pan traps, yellow bottles and Barber traps, followed by laboratory methods or preservation and identification. Photographic material and information on these species are presented and described on female specimens to expand the knowledge about the distribution and biodiversity of egg parasitoids in the country.

KEY WORDS: distribution, first record, *Scelio*, *Scelio poecilopterus*, *Scelio vulgaris*, southeastern Algeria.

Introduction

Scelioninae is the most important subfamily of Platygastridae (Norman et al. 2019). It's a cosmopolitan taxon comprising more than 3000 species belonging to 160 genera (Masner and Lars 1989; Aguiar et al. 2013), all primary egg endoparasitoids of other insect species or spiders (Ghahari et al. 2015; Madl 2016). Because of their biology, some members contribute significantly to pest biological control (Popovici et al. 2014), such as of grasshoppers and crickets (Orthoptera), gypsy moths (*Lymantria dispar* Linnaeus), sunn pests (*Eurygaster integriceps* Puton), bedbugs (*Triatoma* spp. Laporte; *Rhodnius* spp. Stal) and horse flies (*Tabanus* spp.

Linnaeus) (Samin et al. 2011; Galloway et al. 1992; Ghahari et al. 2015). Members of this large family are very diverse in appearance, with respect to the shape and size of the host egg from which they emerge: cylindrical to depressed, elongated and fusiform to short and stocky (Galloway et al. 1992; Samin et al. 2011).

In fact, parasitoid wasps of the genus *Scelio* (Latreille, 1805) are solitary and obligate parasites of Acrididae eggs in agricultural and natural habitats (Baker et al. 1996; Dangerfield et al. 2001; Yoder et al. 2009, 2014), with a parasitism rate varied from 10% to 15% (Greathead et al. 1994; Baker et al. 1996). Despite their importance, these tiny wasps have been largely ignored and are still poorly known

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in many countries due to classification difficulties (Buhl et al. 2016), as well as the difficulty in accumulating new material of these species for re-examination them, especially in the African countries (Yoder et al. 2014; Asadi-Farfar et al. 2021). Recent research shows that the genus *Scelio* (Latrelle, 1805) comprises 255 valid species, among 500 species that have been estimated worldwide (Yoder et al. 2014). In the Afrotropical zone, 18 species in the pulchripennis group were reviewed by Yoder et al. in 2009; Then, 62 species were treated and classified into the groups of ernstii (12 species, 9 new), howardi (23 species, 19 new), ipomeae (6 species, 5 new), irwini (4 species, 3 new), simoni (3 new species) and walkeri (12 species, 9 new) in 2014 (Yoder et al. 2014), but the geographic range of treated species remained limited to Sub-Saharan Africa and Madagascar (Yoder et al. 2009, 2014). While the range and taxonomy of this genus in North African fauna has been poorly and sporadically studied, with the exception of rare records in Egypt, Mauritania, Mali, and

Niger (Irshad et al. 1978; Yoder et al. 2014), these parasitoid wasps are previously not recorded in Algeria. So, the aim of this paper is to document and describe the first records of *Scelio* (Latrelle) species in Biskra province and to create the first database of Scelioninae fauna in the country.

Materials and Methods

Study area: Sampling was carried out in the province of Biskra ($34^{\circ}51'01''N$, $5^{\circ}43'40''E$) in southeastern Algerian Sahara, at two communes, El Alia ($34^{\circ}50'43.9332''N$, $5^{\circ}44'53.5092''E$) and El Hadjeb ($34^{\circ}48'24.3''N$, $5^{\circ}39'16.3''E$) (Fig.1), where tomato crops (*Lycopersicon esculentum* Mill.) were cultivated in greenhouses and surrounded by palm trees. It is part of the Saharan bioclimatic stage, with an annual precipitation rate of 125 mm (maximum of 21 mm in winter and a minimum of 0 mm during the dry period) (Harrat and Moussi 2007).

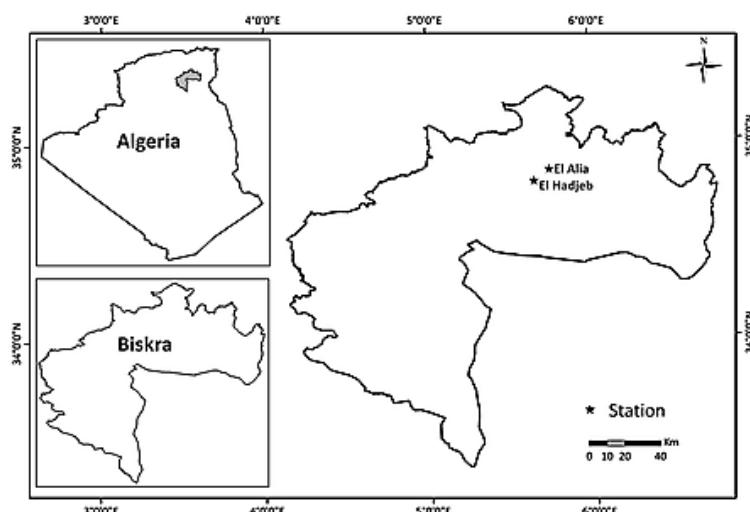


FIG.1: Locations of the study area in Biskra.

Sampling and laboratory methods: Insects were randomly collected under the tomato greenhouses over the cultivation periods of 2019-2020, using yellow pans and barber traps filled with water and a few drops of liquid soap (Mukundan & Rajmohana 2016; Selmane et al. 2016), in addition to placing yellow bottles on stakes at plant level, where each bottle was filled with sweet liquid (water + sugar) (Roth 1972). For morphological observation, all ethanol preserved specimens were cleared in Histo-Clear and permanently observed with Wild M10 stereomicroscope objectives of 40X, 60X magnifications, and photographs were taken with a Leica Q2 digital camera attached to a stereomicroscope. The specimens have been deposited in the Laboratory of DEDSPAZA, University Mohamed Khider, Biskra, Algeria.

Identification keys: Species taxonomy was discussed according to morphological characteristics such as structure and colorization of the different parts of the body (a) head characteristics: frontal depression, mandibles, position of lateral ocelli, antennal form and segments (b) mesosomatic characteristics: wing venation, form of tibial spur (c) metasomatic characteristics: shape and general structure of the metasoma. Generally, Afrotropical *Scelio* (Latreille, 1805) species are classified in the *pulchripennis* group, the key of which can be found in Yoder et al. (2009) which is specific to females and many males. Also, several keys were followed to identify specimens to family, genus and species level, for example: Revision of *Scelionidae* (Hymenoptera) (Kieffer 1908); A synopsis of the African species of *Scelio* (Latreille) (Nixon 1958); Monograph of the Afrotropical species of *Scelio* (Latreille) (Yoder et al. 2014), Key to genera of *Scelionidae* of the Holarctic region, with descriptions of new genera and species (Masner 1980).

Abbreviations used in figures: The morphological terms and abbreviations used throughout this work are principally those used by Masner (1980), and the following terms require further explanation (see figures).

LOL- lateral ocellar line; **OOL-** ocular ocellar line; **POL-** posterior ocellar line; **md-** mandible; **T1, T2,...** Tergites; **io-** inner orbit; **ao-** anterior ocellus.

Results and Discussion

Species Group – *Scelio pulchripennis*

Nixon (Nixon 1958)

Order Hymenoptera

Super family Platygastroidea Haliday
(Haliday 1833)

Family Scelionidae Haliday
(Haliday 1839)

Subfamily Scelioninae Haliday
(Haliday 1839)

Genus *Scelio* Latreille (Latreille 1805)

Scelio poecilopterus (Priesner, 1951)

Materials examined: Algeria: Biskra, El Alia, 34°50'43.9332"N, 5° 44'53.5092"E, –120 m, yellow pan trap, in tomato greenhouses, 08.03.2020, 1♀; El Hadjeb, 34°48'24.3"N, 5°39'16.3"E, –125 m, yellow pan trap, in tomato greenhouses, 22.03.2020, 2♀ (Afissa), UMKB coll.

Description: female specimens in medium size compared to other *Scelio* species, body length 4 mm; with a body of different colours and a completely smooth black head at the dorsal level (Fig. 2A) characterized by uniform areas of sculpture on the head (Fig. 3A), and an orange mesoscutum, sometimes brown to dark brown medially, without any trace of metallic coloration (Fig. 2B); The setae of upper frons usually oriented laterally or dorsally, and the antennae of females, according to Kozlov (1988) and Yoder et al. (2009), are brown to dark brown coloration. The mandible for each female has a slightly extended lower tooth with a slight extension

of the internal-ventral margin (Fig. 3A); general sculpture softly imprinted, often effaced by plates; sculpture of the medial mesoscutum mostly smooth and shiny except for the hair pits, posterior margin is adjacent to the mesoscutellum with short parallel grooves of variable length, it's largely separated from the medial mesoscutum (Fig. 2B); propodeum slightly flattened, clearly visible in dorsal view with longitudinal reticulate ridges, its surface uniformly covered, propodeum angles relatively uniformly rounded (Fig. 2B, 3B); in the lateral view of metasoma, more or less symmetrical tergites and sternites, slightly convex, often irregularly reticulate, with some longitudinal tendency fine to gross sculpture. The colour in female metasoma is orange at the base (typically T1- T3) to brown

until dark brown at the apex (Fig. 2C, 3C); the thorax and abdomen have straight brownish hairs. Forelegs often lighter in color than the middle and posterior legs with fine sculpture erased by traces. Female coxa colour is orange-brown to dark brown and female leg colour beyond coxa is orange-brown to dark-brown, the legs without spines or other evident structure, smooth behind the femur, with distinct lines of raised setae along the anterior and dorsoventral margins. The wing is surrounded by at least one transverse hyaline fascia cutting immediately above the stigma and usually a second cutting across the radial cell, the basal pigmented spot on the wing that has a very light coloration, with a clear decrease in the venation of the wings (Fig. 3D).

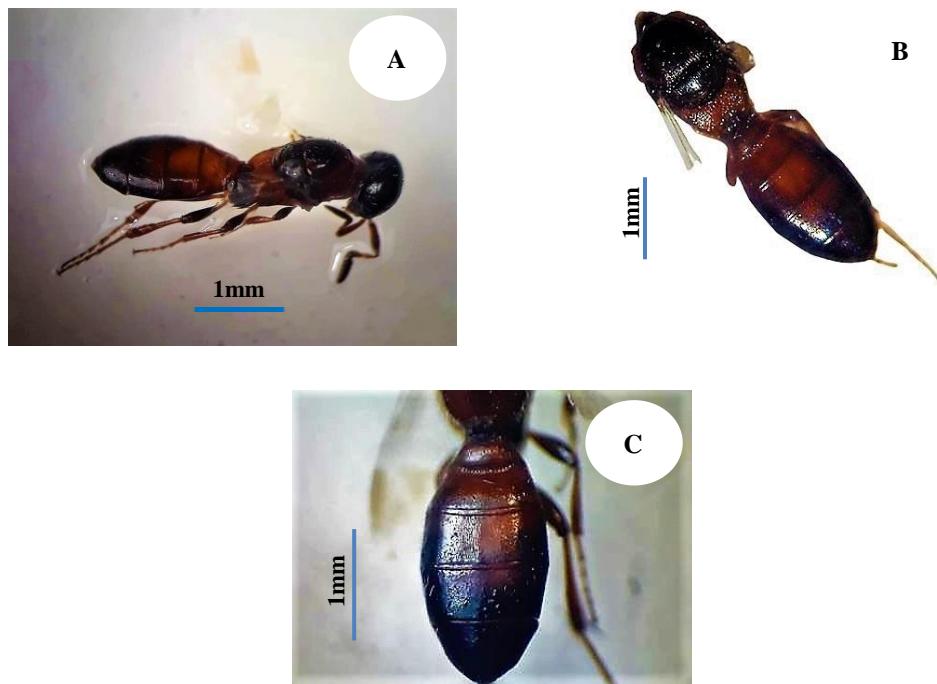


FIG. 2: *Scelio poecilopterus* (Priesner, 1951), ♀: (A) lateral view of specimen; (B) thorax and abdomen, dorsal view; (C) abdominal tergites, dorsal view.

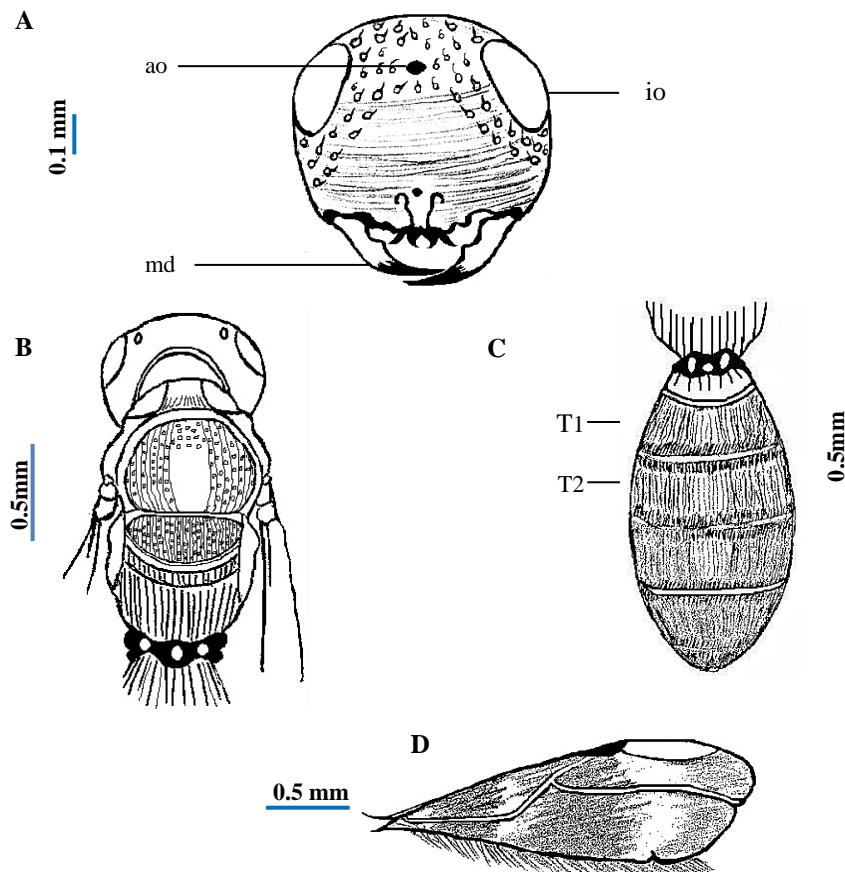


FIG. 3: Diagram of *Scelio poecilopterus* (Priesner, 1951), ♀: (A) head, frontal view; (B) thorax, dorsal sculpture; (C) abdomen, dorsal sculpture; (D) forewing ((md- mandible; T1, T2,...- Tergites; io- inner orbit; ao- anterior ocellus).

Differential diagnosis: The pigmentation of forewing transverse and longitudinal fascia in our female specimens is significantly lighter compared to other Oriental species, such as the specimens of Egypt, Saudi Arabia and United Arab Emirates.

Dimensions (in mm): Head length 0.5, head width 1; Pronotum length 0.7, pronotum width 1.1; Mesonotum length 0.3; Metanotum length 0.5; Total thorax length

1.5; abdomen length 2; Abdomen width 1.3; Antenna length 1.

Etymology: The specific epithet is composed of two Greek words: “ποικιλ-” (“poecil-” = variegated) and “πτερόν” (“pteron” = wing).

Hosts: Parasitoid of the eggs of *Acrotylus longipes* (Charpentier) (Orthopterans: Acrididae, Oedipodinae); *Diabolocatantops axillaris* (Thunberg) (Orthopterans: Acrididae, Catantopinae; cited as *Catantops*

axillaris); *Ochrilidia gracilis* (Krauss) (Orthopterans: Acrididae, Gomphocerinae); *Heteracris littoralis* (Rambur) (Orthoptera: Acrididae, Eyprepocnemidinae; cited as *Thisoicetrus littoralis*); *Locusta migratoria* (Linnaeus) (Nixon 1958).

Distribution: Egypt, Eritrea, India, Saudi Arabia, United Arab Emirates, Spain, Yemen, Oman (Yoder et al. 2009, 2014). *Scelio poecilopterus* recently documented with a strong representation in the Arabian Peninsula of the Ethiopian region (Priesner 1951; Abhilash and Rajmohana 2014); Iran; Turkmenistan (Samin et al. 2011; Ghahari et al. 2015); Algeria (first records).

Scelio vulgaris (Kieffer, 1908)

Materials examined: Algeria: Biskra, El Alia, 34°50'43.9332"N, 5° 44'53.5092"E, -120 m, yellow pan trap, in tomato greenhouses, 23.02.2020, 2♀; El Hadjeb, 34°48'24.3"N, 5°39'16.3"E, -125 m, Barber traps, in tomato greenhouses, 22.12.2019, 3♀ (Afissa), UMKB coll.

Description: Female body length 3 mm, completely black in color, with a transverse or subquadrate head and a smooth frons along the sides of the head which has an abundance of setae (Fig. 4A); Antennae as in Fig. 4A are apically clavate (Kozlov 1988); Occiput more or less concave, while lateral ocelli close to the eye margins. The oral apparatus is characterized by short three-segmented maxillary palps and very short two-segmented labial palps, while, the mandibles are very long, curved and bidentate, with equal length teeth. The back of the thorax is slightly reticulated, but the mesothorax without any trace of parapsidal grooves, the mesoscutum is large and longitudinally striated, and the scutellum separated from the metanotum by a line of deep punctures, followed by a smooth area (Fig. 4B, 5B). The sessile and lateral margins of the abdomen are acute, six tergites are present in the female abdomens, covered by tiny light-coloured hairs whereas

the last two tergites are very short; The parallel carinae of the abdominal tergites are dense and prominent with oblique lines divided longitudinally (Fig. 4C, 5A). The leg is defined by a coxa anteriorly with three oblique repli, a trochanter with some short hairs, a femur in black coloration then a short setae; Tibiae and tarsi are brown with fine short setae (Kieffer 1908; Ogloblin 1927). The forewings are transparent with a pale yellow stigma (Figs. 4D, 5C).

Differential diagnosis: *Scelio vulgaris* is closely similar regarding the morphological characteristics to *S. rugosulus* (Latreille, 1805) as described by Shamsi et al. (2015), but the females of *S. vulgaris* are clearly differentiated by wings without transverse hyaline bands.

Dimensions (in mm): Head length 0.5, head width 1; Pronotum length 0.5, pronotum width 0.6; Mesonotum length 0.2; Metanotum length 0.3; Total thorax length 1; Abdomen length 1.5; Abdomen width 0.6; Antenna length 1.

Etymology: The epithet *vulgaris* is a Latin adjective for usual, common, or vulgar.

Hosts: The hosts are the eggs of various species of grasshoppers (Orthoptera: Acrididae), including the small marsh grasshopper *Chorthippus albomarginatus* (De Geer) (O'Connor and Notton 2013); *Aeropedellus variegatus* (Fischer von Waldheim), *Chorthippus apricarius* (Linnaeus), *Gomphocerus sibiricus* (Linnaeus), *Stenobothrus nigromaculatus* (Herrich-Schäffer), *Stenobothrus* spp, *Stauroderus scalaris* (Fischer de Waldheim) (Dangerfield et al. 2001) and *Locusta migratoria* (Linnaeus) (Ferrière 1951; Yoder et al. 2014).

Distribution: West Africa, Ireland (Buhl et al. 2016); Europe (Ferrière 1951); Western Europe (Kozlov 1988); Austria, several European countries, Azerbaijan, Georgia and Turkey (O'Connor and Notton 2013); Algeria (first records).

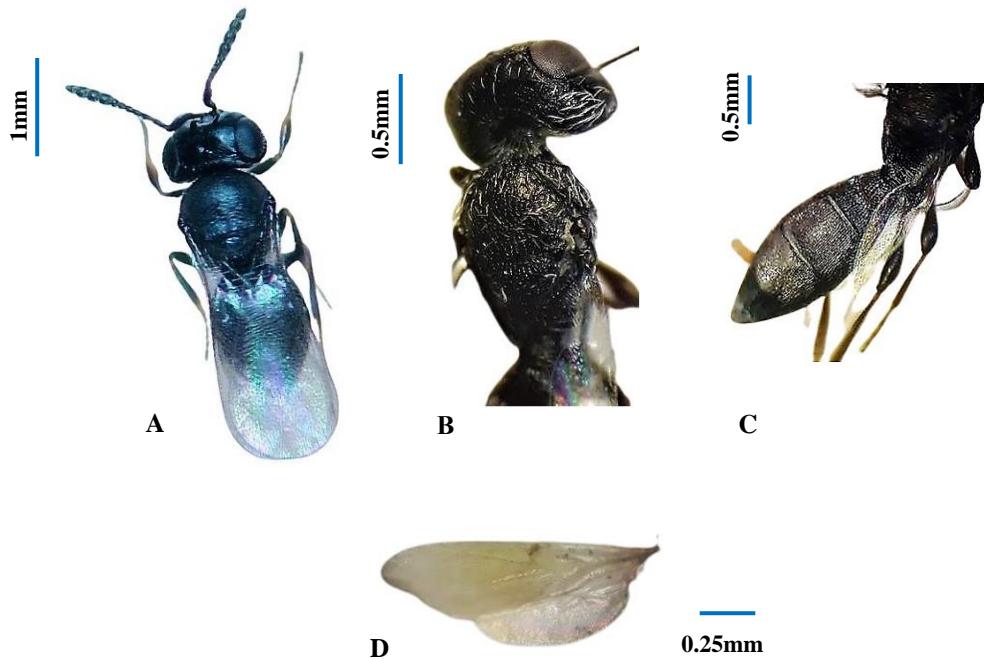


FIG. 4: *Scelio vulgaris* (Kieffer, 1908), ♀: (A) dorsal view of the specimen; (B) sculpture of the mesoscutum, dorsal view; (C) abdomen, dorsal view; (D) anterior wing.

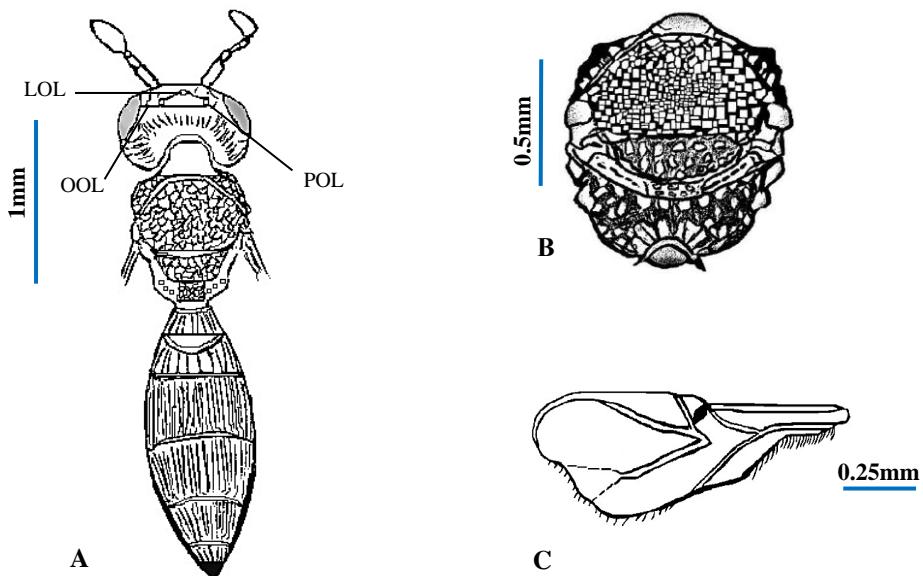


FIG. 5: Diagram of *Scelio vulgaris* (Kieffer, 1908), ♀: (A) dorsal view of the specimen; (B) thorax sculptures, dorsal view; (C) forewing (LOL- lateral ocellar line; OOL- ocular ocellar line; POL- posterior ocellar line).

Conclusion

The genus *Scelio* (Latreille, 1805) is one of the most important genera of the subfamily Scelioninae with an estimated total of over 500 species (Yoder et al. 2009). The pulchripennis group was first recognized and diagnosed by Nixon (1958) on the African species of *Scelio*, and then the group is readily diagnosed far from the global species by Yoder et al. (2009). Species in this genus are found worldwide, and the available host data suggest that they are exclusively parasitoids of orthopteran eggs (Dangerfield et al. 2001), and some *Scelio* species have been used as important biological control agents of migratory locusts in Niger and Mali (Popov 1959; Greathead et al. 1994; Lomer and Jürgen 2001). In this paper, the two species *Scelio poecilopterus* (Priesner) and *Scelio vulgaris* (Kieffer) are identified as the first records in the North African countries in general and in the oases of Biskra province (southeastern Algeria) especially, with a total description of their distribution and morphological characteristics, taking into account the differences that exist in the appearance compared to African and oriental species, where it seems likely that

Scelio is composed of several distinct species groups.

Although the current study confirms the presence of Scelioninae fauna in the south of the country in small numbers, some habitats in the north, northwestern and central parts of the country have not yet been studied and the real number is expected to be much higher. Therefore, it is necessary to collect more samples to provide a clearer picture of how these species are distributed and established in arid and Mediterranean areas, also to increase the knowledge of their diversity, the parasitism rate on local hosts and the possibility of applying this important group of parasitoids in the lab and the field of this area, which is often susceptible to the invasion of African locusts at all cultivation seasons.

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First record of the genus *Scelio* (Hymenoptera: Platygastridae, Scelionidae, Scelioninae) egg parasitoids in tomato greenhouses of southeastern Algeria

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ΠΕΡΙΛΗΨΗ

Πρόκειται για την πρώτη καταγραφή του γένους *Scelio* (Latreille, 1805) στην Αλγερία. Μέσα την διετία 2019-2020, δύο είδη του γένους *Scelio*, τα *S. poecilopterus* (Priesner, 1951) και *S. vulgaris* (Kieffer, 1908), συλλέχθηκαν από θερμοκήπια τομάτας στις περιοχές El Alia και El Hadjeb regions της επαρχίας Biskra, στη νοτιοανατολική Αλγερία. Στην παρούσα εργασία παρουσιάζεται φωτογραφικό υλικό και πληροφορίες για δείγματα θηλυκών, ώστε να διευρυνθούν οι γνώσεις σχετικά με τη διασπορά και τη βιοποικιλότητα των ωπαρασιτοειδών στη χώρα.