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# The Cuckoo Bees of the Genus *Stelis* Panzer, 1806 in Europe, North Africa and the Middle East

A Review and Identification Guide

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**Cover Picture:**
*Stelis annulata* (Lepeletier, 1841) (photograph: M. Kasparek)

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# The Cuckoo Bees of the Genus *Stelis* Panzer, 1806 in Europe, North Africa and the Middle East

## A Review and Identification Guide

by

Max Kasparek

# Table of Contents

# Introduction

*Stelis* bees are relatively small-sized bees known as cuckoo bees: they lay their eggs in the nests of other bees, reminiscent of the behaviour of cuckoo birds. Their parasitic larva destroys the host's egg or kills the young larvae of its host. The scientific name *Stelis* already points to this parasitic character: *Stelis* is the Greek word for "mistletoe", a parasitic plant. As the *Stelis* larva consumes the stored food of its host, this form of parasitism is called "cleptoparasitism". Hosts of *Stelis* are exclusively members of the Megachilinae, i.e. the same subfamily of bees to which the parasite itself belongs. The appearance of some species of *Stelis* is so similar to Megachilinae, especially to the members of the genus *Anthidium* (s.l.), that they are sometimes difficult to distinguish; some *Stelis* species have originally been described in the genus *Anthidium*. *Stelis* species are of equal size or smaller than their hosts.

Females can easily be distinguished from other Anthidiini bees as they lack a pollen-collecting structures (the scopa) on the underside of the abdomen. Being parases, *Stelis* females do not construct their own nests.

The genus name *Stelis* also refers to a genus of plants: *Stelis* Olof Peter Swartz, 1799 is the name of a genus of leach orchids, which comprises approximately 500 species. These mainly epiphytic plants are found predominantly in tropical North and Central America. In a few cases, the usage of the name *Stelis* for both an animal and a plant genus has caused some confusion. There is even a plant species and a bee species which bear the same name: *Stelis gigantea* Friese, 1921 is a Middle Eastern bee species, while *Stelis gigantea* Pridgeon & M. W. Chase, 2002 is an orchid, which occurs in the tropical Central America.

The genus *Stelis* comprises approximately 105 species worldwide, with about 20 to 25% of them occurring in the Western Palaearctic and the Middle East.

In one of the first reviews, Nylander (1852) recognised four species of *Stelis* for Central Europe. The first comprehensive account of *Stelis* has been given by Friese (1895) within his synopsis of the bees of Europe. His work is a compilation of the hitherto known information and includes the reproduction of the original species descriptions in the original language (mostly Latin, but also French and German). Friese's work comprises 14 species of *Stelis*, and is still a very useful source today. Almost at the same time, de Dalla Torre (1896) published his world list of Hymenoptera. Although this work did not include descriptions or similar information, the list of synonyms and literature references constituted an important compilation which helps to shed light on the sometimes confusing diversity of names. The worldwide list of de Dalla Torre covered 35 species of *Stelis*. Schmiedeknecht (1907) , in his work "Die Hymenopteren Mitteleuropas", covered nine Central European species of *Stelis* and provided an identification key for these species.

The genus *Stelis* was intensively studied by the Russian zoologist Vladimir B. Popov (1933, 1935, 1939, 1941, 1944, 1956). While none of the West Palaearctic *Stelis* taxa described by him is still regarded as valid, one of Popov's main achievements clearly was to introduce the morphology of male genitalia for species identification. For most species, his drawings are still the only ones available.

Also the German entomologist Johann Dietrich Alfken (1862–1945) needs to be mentioned here among those who contributed much to our knowledge of Palaearctic *Stelis* bees. He published over 200 works on bees, several of which included information on *Stelis*. The Polish entomologist Jan Noskiewicz (1890–1963) described several new taxa, three of which are included here as valid species: *S. hungarica*, *S. iugae*, and *S. odontopyga*. Some of Noskiewicz's illustrations were used in this identification guide. The Greek entomologist Georgios A. Mavromoustakis (b. 1901) made significant contributions to the studies of the bee fauna, and in a series of publications which appeared between 1939 and 1968, he dealt with the bees of Cyprus and Greece, as well as Israel, Lebanon, Syria and other Mediterranean countries. Mavromoustakis is the author of two species, *Stelis pentelica* and *S. rhodia*. The Belgian entomologist Jean J. Pasteels, whose work was mainly focused on African bees, made in two works, both published in 1969, significant contributions mainly to the higher taxonomy of Anthidiini.

The subgeneric classification of the genus *Stelis* has been treated by Charles D. Michener and Terry L. Griswold (1994), and this system has principally been applied by Michener in his epochal work "The Bees of the World" (2000, 2007).

Klaus Warncke (1937–1993) was the first after quite some time who intensively researched the genus *Stelis* again. His work resulted in a comprehensive list of the West Palaearctic species and was based on rich new, own material mainly from Turkey and other Middle East countries, as well as extensive museum studies (Warncke 1992). He described two new species, *Stelis maroccana* and *S. orientalis*, and synonymized several names. His descriptions and explanations are usually very brief and not accompanied by drawings; some of his conclusions still need to be fully verified. Klaus Warncke's identification key to the West Palaearctic species is still the most comprehensive account and was used as the principal basis for this work.

While quite a lot of new information has become known since Warncke's (1992) account, his work still remains the most comprehensive work on Palaearctic *Stelis* species. More recent publications include those of Donald B. Baker, who published in 1999 a "Provisional list of species-group names in old-world *Stelis*" and described two new species; Jérôme G. Rozen and Soliman M. Kamel (2009), who published a review of *Stelis* biology; Maximilian Schwarz and Fritz Gusenleitner (2010), who described *Stelis ortizi* and re-examined the status of *S. hispanica*; and Concepción

Ornosa, F. Torres and F. Javier Ortiz Sánchez (2009), who provided a key in Spanish to the 10 species occurring on the Iberian Peninsula. Many others contributed to our knowledge mainly in the frame of faunistic work – too many to be listed here individually. Our understanding of this group of bees is now much better than a few decades ago, but a comprehensive review of this information was so far not available.

The only comprehensive identification keys for *Stelis* bees are, therefore, those by Friese (1895), Schmiedeknecht (1907) and Warncke (1992). None of them have illustrations; and Warncke's key is very brief and concise, which makes species identification often a difficult task especially for those less experienced. Other available keys include that by Scheuchl (1996, revised edition 2006), which is a modern key with a sufficient amount of descriptive text and good illustrations, and covers the Central European species including Hungary, Slovenia and Slovakia, i.e. 10 of the 29 species included here in this guide. Banaszak & Romasenko (1998, revised edition 2001) presented a key to the European species, which covers 14 taxa. For Central Europe, there is also the illustrated guide to the bees of Switzerland by Amiet, Herrmann, Müller & Neumeyer (2004); it includes 13 species of *Stelis*; for the Iberian Peninsula there is the key by Ornosa, Torres & Ortiz-Sánchez (2009), which covers 10 species, and for the British Isles there is a brief key by Else (1998) for the four species occurring there. Thus, it is still very difficult to identify e.g. Mediterranean *Stelis* species, let alone species from the Middle East. Moreover, all available keys – with the exception of the one by Banaszak & Romasenko (1999, 2001) – have been published in German or Spanish, and no key is available for those who are not familiar with these languages. It is therefore the purpose of this work to compile existing knowledge on the Western Palaearctic *Stelis* species, especially to bring together descriptions and illustrations, and to make it available to a wider audience in English. This will hopefully help to give a boost to our knowledge of this interesting and highly specialised bee group.

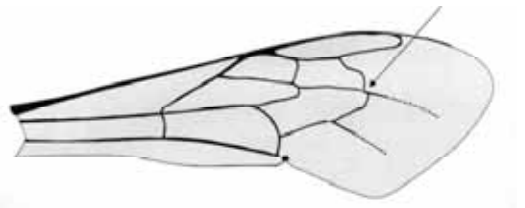
# General Part

## Description of the Genus

The genus *Stelis* comprises small to rather large (4-14 mm long) cleptoparasitic bees varying in colouration from completely black to richly marked with cream, yellow, or orange. The female's scopa is absent. According to Michener (2007), characters of the genus include: The preoccipital carina is absent, as are thoracic carinae, or there may be weak carinae on the lateral part of the preoccipital ridge and on the pronotal lobe. The scutellum, little produced, is rounded. Behind the propodeal spiracle there is sometimes a fovea, which forms the lateral extremity of a series of pits (often broken medially) commonly forming a narrow subhorizontal or slanting zone across the base of the propodeum; this basal zone is often merely roughened, not pitted, or is pitted only laterally. Tergum 7 (T7) of the male is small and only a little exposed; its apex is rounded, weakly bilobed, or weakly trilobed, or it has a median angle exceeding a bilobed base. The male gonostylus has a slender base and an expanded, angulate distal part often directed mesad at an angle to the basal part; there is a strong projecting angle on the outer margin at the base of the expanded portion. The volsellar lobe is present.

The hosts of *Stelis* are other Megachilinae. In most cases the parasite, after locating a host's nest, returns to it repeatedly to place an egg in each of several host cells before they are closed. Larvae of most *Stelis* are active and have sharp mandibles with which they destroy eggs or larvae of the host.

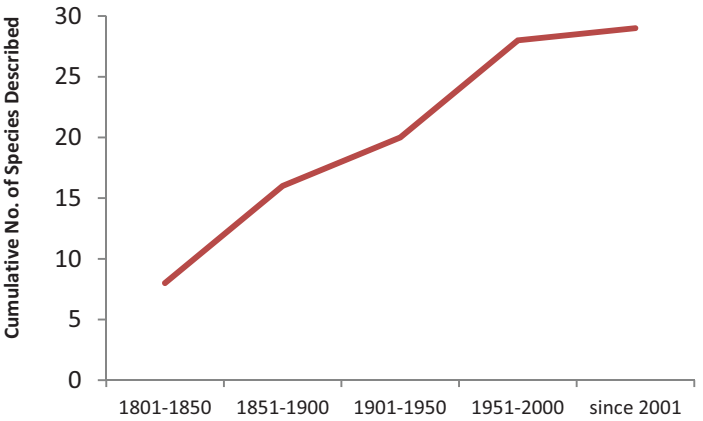
The genus *Stelis* is primarily Holarctic in distribution but extends south to Costa Rica, Malaysia, and Kenya. One species has also been described from South Africa (Griswold & Parker 2003), and another species has recently been described from the Caribbean region (Gonzalez et al. 2012).



Typical forewing of Anthidiini bees. Note the position of the second recurrent vein (here: male *Stelis ruficornis*, drawing by MK).

## Number of Species Described

*Stelis* is a relatively little-differentiated group. 29 species are regarded here as valid species known so far from the Western Palaearctic and the Middle East. More than half of these species have been described in the 19th century. In the 21st century, only one species has been described as new to science. Taxonomy is thus relatively stable.




Number of species described since the early 19th century (cumulative graph). Only those species which are still regarded as valid are shown here.

## Species Diversity on Country Level

From the general distribution pattern of the members of the genus *Stelis*, it can be expected that at least half a dozen of species can be found in each of the countries of the Western Palaearctic. However, more than five species of *Stelis* have been found in only 27 of the 69 countries considered here, and only these can be regarded as more or less

Table: Species diversity in the countries of Europe and the Middle East.

| | |
|---|---|
| **0 species** | Albania, Andorra, Bahrain, Bosnia & Herzegovina, Estonia, Iceland, Ireland, Jordan, Kosovo, Kuwait, Latvia, Malta, Moldova, Monaco, Norway, Oman, Qatar, San Marino, Saudi Arabia, Qatar, Yemen. |
| **1-5 species** | Armenia, Belarus [some older records may be listed under Russia], Bulgaria, Cyprus, Denmark, Egypt, Great Britain, Georgia, Iraq, Lebanon, Liechtenstein, Libya, Macedonia (Rep.), Montenegro, Palestinian Territories, Portugal, Serbia, Sweden, Syria, Tunisia, United Arab Emirates. |
| **6-10 species** | Algeria, Austria, Azerbaijan, Belgium, Croatia, Finland, Germany, Iran, Israel, Lithuania, Luxembourg, Morocco, The Netherlands, Poland, Romania, Slovenia, Ukraine. |
| **11-15 species** | Czech Republic, France, Hungary, Italy, Russian Federation, Slovakia, Spain, Switzerland. |
| **>15 species** | Greece, Turkey. |

sufficiently known. The *Stelis* fauna of the remaining 42 countries should be regarded as poorly known.

While the diversity of species is clearly higher in the south than in the north, the number of species per country mainly reflects the level of collection efforts rather than geographic differences. With 16 species in Greece and 19 species in Turkey, these countries turned out to be the countries with the richest (known) *Stelis* fauna in the region. While a thorough review of museum specimens and national faunistic literature may bring some more country records to light, it is thought that the table below gives a good first overview of our knowledge on *Stelis* species on country level.

## Abundance of *Stelis*

The species of *Stelis* are generally rare in nature, and not many specimens are found in scientific collections. Several species have been described on the basis of single specimens, and have not been found again since. From *Stelis hungarica*, *S. hispanica, S. laverna*, *S. orientalis*, and *S. ortizi*, for example, only the females are known. The following table makes an attempt to classify the Western Palaearctic and Middle Eastern *Stelis* bees according to their abundance. Even those species which are classified here as "widespread and relatively abundant" are rare in comparison to other groups of bees. This classification is surely sometimes rather subjective, but gives a first idea on the relative species abundance.

Table: Classification of the members of the genus *Stelis* according to their abundance. As our knowledge about most species is still very poor, the table should be regarded only as a first attempt to understand abundances.

| **Widespread, relatively abundant** | **Not uncommon** | **Rare** | **Very rare, mostly only known from the type specimens** |
|---|---|---|---|
| *breviuscula* | *aculeata* | *denticulata* | *hispanica* |
| *franconica* | *aegyptiaca* | *gigantea* | *hungarica* |
| *minuta* | *annulata* | *pentelica* | *laverna* |
| *murina* | *iugae* | *rhodia* | *maroccana* |
| *nasuta* | *minima* | *ruficornis* | *orientalis* |
| *odontopyga* | *scutellaris* | | *ortizi* |
| *ornatula* | | | *saxicola* |
| *phaeoptera* | | | |
| *punctulatissima* | | | |
| *signata* | | | |
| *simillima* | | | |

## Host Associations

*Stelis* bees are cleptoparasites, but relatively little is known about their host relationships. Their hosts are almost exclusively members of the Megachilinae, i.e. the same bee subfamily to which the parasite itself belongs. Hosts not belonging to the Megachilinae have been reported (*Ceratina*; also members of the Chalcidoidea, Hymentopera), but confirmation is needed.

Species of the subgenus *Heterostelis* seem to have an affinity to *Trachusa*: *Trachusa interrupta* serves as the host for ***Stelis annulata***, and *T. pubescens* and/or *T. laticeps* are the presumed hosts of ***S. gigantea***. Also some North American species of the *Heterostelis* subgenus parasitize members of the genus *Trachusa*: Thorp (1966) found that

Table: Comparison of the cleptoparasitic *Stelis* species with their hosts. A preliminary, and necessarily also sometimes subjective, assessment was made whether the habits of cleptoparasites and hosts are similar or not similar.

| **High level of similarity between host and parasite** | **Low level of similarity between host and parasite** |
|---|---|
| – *Stelis annulata – Trachusa interrupta.*<br>– *Stelis gigantea – T. pubescens / T. laticeps.*<br>– *Stelis signata – Anthidiellum strigatum.*<br>– *Stelis minuta* – several species of Osmiini bees of the genera *Hoplitis, Heriades, Osmia* and *Chelostoma.*<br>– *Stelis minima – Chelostoma campanularum / Ch. distinctum* (*Heriades truncorum*?).<br>– *Stelis odontopyga – Hoplosmia spinulosa.*<br>– Stelis *ornatula – Osmia leucomelana* and *O. claviventris.*<br>– *Stelis phaeoptera – Osmia niveata, O. emarginata*, and *O. leaiana.*<br>– *Stelis punctulatissima – Osmia* (*= Hoplitis*) *adunca, O. brevicornis,* O. *niveata, O. leaiana, O. niveata, O. tunensis aurulenta* (*= O. aurulenta*), and *O. ventralis* [level of similarity varies with species].<br>– *Stelis breviuscula – Osmia (Heriades) truncorum, O. fuliginosa (O. rapunculi), O. (spinolae) adunca, Eriades nigricornis*, and *Heriades crenulatus*.<br>– *Stelis rhodia – Eoanthidium clypeare.* | – *Stelis nasuta – Megachile parietina / M. pyrenaica.*<br>– *Stelis franconica – Osmia mustelina.*<br>– *Stelis murina – Osmia signata* and *O. notata* (more information required).<br>– *Stelis ornatula – Osmia tridentata, O. acuticornis, O. caerulescens*, and *O. maritima.*<br>– *Stelis ornatula – Anthidium scapulare* and *Ceratina cucurbitina.*<br>– *Stelis phaeoptera – Osmia* (*Hoplitis) anthocopoides, Osmia bicolor, O. florisomnis, O. inermis*, *O. leucomelana, O. loti, O. parietina, O. rufa, H. spinulosa, O. truncorum,* and *O. tubercula.* Also *Megachile rotundata* and *Anthidium manicatum.*<br>– *Stelis punctulatissima – Anthidium manicatum, A. oblongatum, A. lituratum,* and *A. scapulare.* Also *Megachile parietina.*<br>– *Stelis simillima – Lithurgus cornutus, L. chrysurus.* |

Examples for similarities between the host and its cleptoparasite. Above: Left *Rhodanthidium septemdentatum* (host), right *Stelis ruficornis* (cleptoparasite). Middle: Left *Trachusa interrupta* (host) and *Stelis annulata* (cleptoparasite). Below: Left *Anthidiellum strigatum* (host) and *Stelis signata* (cleptoparasite). All specimens show males. Photographs: MK.

Examples for dissimilarities between the host and its cleptoparasite. Above: *Megachile parietina* and its cleptoparasite *Stelis nasuta* (right). Below: *Osmia mustelina* (left) with its cleptoparasite *Stelis franconica* (right). All specimens females. Photographs: MK.

the North American species *Stelis* (*Heterostelis*) *hurdi* is a parasite of *Trachusa perdita*, and there is evidence that *Stelis* (*Heterostelis*) *manni* (Crawford, 1917) is the parasite of *Trachusa manni* (Crawford, 1917). On the other hand, ***S. ruficornis*** parasitizes on *Rhodanthidium septemdentatum* (Latreille, 1809), a relatively similar, but larger member of the Anthidiini.

The only species of the subgenus *Protostelis*, ***Stelis signata***, parasitizes *Anthidiellum strigatum*, and the host and the parasite are so similar that it is not easy to distinguish them without a detailed examination.

From the subgenus *Stelidomorpha*, only the host of ***Stelis nasuta*** is known: both *Megachile parietina* (Geoffroy, 1785) and *M. pyrenaica* Lepeletier, 1841 are known to serve as hosts. While *S. nasuta* is a small, 5-8 mm long parasite with a conspicuous light colour pattern, *Megachile parietina* is with 14-18 mm much larger. The female is entirely black or blackish and the male has a dark brown pubescence; *M. pyrenaica* is 13-16 mm long and has a black and white pubescence. Unlike other host-parasite relationships in *Stelis*, in this case there are no morphological similarities between the cleptoparasite and its hosts, neither in size nor in structure or colour pattern. Baur & Amiet (2000) report a possible host relationship of *Stelis nasuta* with *Leucospis* (Hymenoptera: Chalcidoidea), but confirmation is needed.

For members of the subgenus *Stelis* (*Stelis*) s.str., the following cleptoparasite-host relationships were observed:

***Stelis iugae*** is a cleptoparasite of *Heriades truncorum* (Linnaeus, 1758), a 6–8 mm long, black species with terga having narrow white apical bands of hairs. The 6-7 mm long cleptoparasite thus resembles its host with its black colouration and narrow, ochreous apical bands of hairs on the terga.

The dark and small, only 5-7 mm long ***Stelis minuta*** is not very host-specific and parasitizes various species of *Hoplitis, Heriades, Osmia* and *Chelostoma*: *Hoplitis leucomelana* (Kirby, 1802)*, H. claviventris* (Thomson, 1872)*, H. tridentata* (Dufour & Perris, 1840)*, H. anthocopoides* (Schenck, 1853)*, Heriades truncorum* (Linnaeus, 1758)*, Osmia gallarum* Spinola, 1808*, Chelostoma campanularum* (Kirby, 1802), and *Ch. rapunculi* (Lepeletier, 1841). All these host species are small, more or less of the same or similar size as the parasite. *Heriades truncorum* is 4-8 mm long, sometimes even slightly smaller than its parasite, while *Hoplitis tridentata*, which is 10-12 mm long, is on average slightly larger. All hosts are dark coloured in general, and most species have light apical bands of hairs on the terga, and some species have brownish or ochreous pubescence on the thorax. There is thus a high degree of similarity in the general appearance between the host and its parasites.

The only 3–5 mm long ***Stelis minima*** – which is very similar to and treated by some authors as conspecific with *Stelis minuta* – is specialised on the also very small hosts *Chelostoma campanularum* and *Ch. distinctum* (Stoeckhert, 1929). It is almost impossible to distinguish *S. minuta* from *S. minima* on the basis of morphological characters alone, but the host specificity of *S. minima* may be used as a good character for identification. However, *Chelostoma campanularum* has also been (wrongly?) listed as a host for *Stelis minuta*, and Banaszak & Romasenko (2001) give also *Heriades truncorum* for *Stelis minima* – which should actually be a host of *S. minuta*. Thefeore, there is still much room for clarification.

***Stelis franconica*** is the cleptoparasite of *Osmia mustelina* Gerstäcker, 1869, a 10-15 mm long mason bee with ochreous pubescence. The cleptoparasite with its black body, light white pubescence and smaller size is thus distinctly different from its host.

Also, ***Stelis murina*** parasitizes *Osmia* species and was found on *O. signata* Erichson, 1835 and *O. notata* (Fabricius, 1804). These two host species are closely related and both belong to the *signata*-group of the subgenus *Helicosmia*. The two species are dark brown to black with light brown pubescence and light brown apical bands of hairs on the terga. *Stelis murina* has a shining, black body with scarce whitish to yellow pubescence. The cleptoparasite and its host thus differ distinctly.

***Stelis odontopyga*** parasitizes on *Osmia spinulosa* (Kirby, 1802), a small (7-8 mm long) mason bee. The parasite and its host have practically the same size and both the parasite and the host have thin, apical bands of hairs on the terga. There is thus a relatively high level of similarity.

***Stelis ornatula*** parasitizes a number of Osmiini species. Its main hosts seem to be *Hoplitis leucomelana* (Kirby, 1802) [= *Osmia leucomelana*] and *H. claviventris* (Thomson, 1872) [= *Osmia claviventris*], while it is sometimes also found with *H. tridentata* (Dufour & Perris, 1840) [= *O. tridentata*], *H. acuticornis* (Dufour & Perris, 1840) [= *O. acuticornis*], *Osmia caerulescens* (Linnaeus, 1758), and *Osmia maritima* Friese, 1885. Hosts probably also include *Pseudoanthidium scapulare* (Latreille, 1809) and *Ceratina cucurbitina* (Rossi, 1792). The latter species does not belong to Anthiini and confirmation is required. The cleptoparasite is 4-8 mm long, has a black body with light lateral maculations on the first terga. The two main hosts (*H. leucomelana* and *H. claviventris*) are similar in size and have white, medially interrupted apical bands on the first terga or only lateral maculae. While the habitus and colouration of these two species are quite similar, *H. tridentata* is significantly larger (10-12 mm) and has a brownish pubescence; *H. acuticornis* is slightly larger (8-11 mm) and has a similar colouration pattern; and *O. caerulescens* is 9-10 mm long and has a blackish-blue ground colouration with white pubescence and interrupted white apical bands of hairs on the terga. *Pseudoanthidium scapulare* and *Ceratina cucurbitina* have a quite different habitus, with *Pseudoanthidium* having a conspicuous black-yellow colour pattern and *Ceratina* being entirely black with a typical *Ceratina*-like body shape.

For ***Stelis phaeoptera***, a relatively large number of Osmiini species is known as hosts, although it is in most cases not clear whether they serve as hosts regularly. Main hosts seem to be *Osmia niveata* (Fabricius, 1804) [= *O. fulviventris], O. emarginata* Lepeletier, 1841, and *O. leaiana* (Kirby, 1802), all of them members of the subgenus *Helicosmia*. Sporadic host records include *Osmia* (*Hoplitis) anthocopoides, Osmia bicolor, O. florisomnis, O. inermis*, *O. leucomelana, O. loti, O. parietina, O. rufa, O. (Hoplosmia) spinulosa, O. truncorum,* and *O. tubercula*. Also *Megachile rotundata* and *Anthidium manicatum* have been listed as hosts. All these species have very different levels of similarity: While those species which are thought to be the main hosts are relatively similar to the cleptoparasite, *Megachile rotundata* and *Anthidium manicatum* are highly different in size, structure, pubescence, and colouration.

The host relationships of ***Stelis punctulatissima*** are insufficiently known. It appears to be that it is a cleptoparasite of only *Anthidium*, in particular of *Anthidium manicatum*. Other *Anthidium* species reported include *A. oblongatum, A. lituratum* and *A. scapulare*. Further to this there is evidence that it (sporadically?) parasitizes *Osmia* (= *Hoplitis*) *adunca, O. brevicornis, O. niveata* (Fabricius, 1804) [= *O. fulviventris], O. leaiana, O. tunensis aurulenta* (= *O. aurulenta*), *O. ventralis*, and *O. brevicornis*. The Carpenter Bee *Megachile parietina* seems to be another sporadic host. While the *Anthidium* species, which seem to be the main hosts, have a completely different colouration pattern, some of the presumed other hosts have a similar appearance.

***Stelis simillima*** is a medium-sized, 9-11 mm long species with black, shining body and short face. Two *Lithurgus* species are known as hosts (*Lithurgus cornutus, L. chrysurus*), and both are considerably larger (13-19 mm) and have rich pubescence.

*Osmia (Heriades) truncorum* is the preferred host of **Stelis *breviuscula***, and there is evidence that it also parasitizes at least occasionally *Osmia fuliginosa, O. (spinolae) adunca, Eriades nigricornis*, and *Heriades crenulatus. S. breviuscula* is thus relatively similar to its hosts or presumed hosts.

***Stelis rhodia***: There is evidence that *Eoanthidium clypeare* is the host, which shows some similarities with the cleptoparasite.

## Flower Preferences

Being cleptoparasites, *Stelis* species do not collect pollen (and therefore do not have the scopa, which is a morphological adaptation for pollen collection), but they visit flowers for feeding on nectar. In a few cases we know that they visit the same flowers as their hosts. *Stelis* bees have so far been found on a wide range of flowers belonging to many different families and the following table gives a first overview of our knowledge about it. The list comprises species from more than 30 genera. As no detailed assessment of flower visits by *Stelis* bees has been conducted, it still needs to be found out to what degree the list below represents random selection or real flower preferences.

Table: List of *Stelis* species and flowers they were found feeding upon.

| ***Stelis*** | **Plant species** | **Plant order / family / subfamily** |
|---|---|---|
| *S. annulata* | • Scabious *(Scabiosa* sp.*)* | Dipsacales: Caprifoliaceae: Dipsacoideae |
| *S. breviuscula* | • Melilot (*Melilotus* sp.)<br>• Fleabane (*Pulicaria dysenterica*)<br>• Hawkweed (*Hieracium* sp.)<br>• Ragwort (*Senecio jacobaea*)<br>• Fireweed (*Chamaenerion angustifolium*)<br>• Large-flower fleabane (*Erigeron grandiflorus*)<br>• Aspen fleabane (*Erigeron speciosus*)<br>• Common madia (*Madia elegans*)<br>• Gold-moss stonecrop (*Sedum acre*)<br>• Corn sow thistle (*Sonchus arvensis*)<br>• Willowleaf yellowhead (*Inula salicina*)<br>• Common yarrow (*Achillea millefolium*)<br>• Common tansy (*Tanacetum vulgare*)<br>• Scentless mayweed (*Tripleurospermum inodorum*)<br>• Spear Thistle (*Cirsium vulgare*)<br>• Hawkweed oxtongue (*Picris hieracioides*)<br>• Mouse-ear hawkweed (*Hieracium pilosella*) | Asterales: Asteraceae : Astereae<br>Asterales: Asteraceae: Asteroideae (incl. Inuleae)<br>Asterales: Asteraceae: Carduoideae<br>Asterales: Asteraceae: Cichorioideae<br>Asterales: Campanulaceae<br>Dipsacales: Caprifoliaceae<br>Fabales: Fabaceae: Faboideae<br>Myrtales: Onagraceae<br>Rosales: Rosaceae<br>Saxifragales: Crassulaceae |

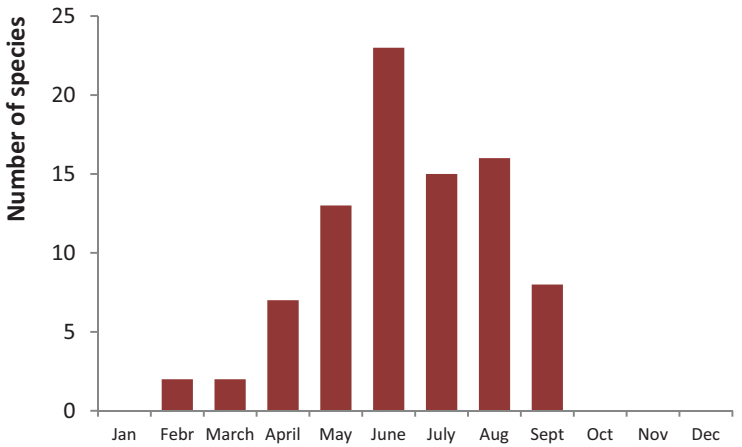
| *Stelis* | Plant species | Plant order / family / subfamily |
|---|---|---|
| | • Sheep's bit scabious (*Jasione montana*)<br>• Blackberry (*Rubus fruticosus)*<br>• Field Scabious(*Knautia arvensis*)<br>• Canada golden-rod (*Solidago canadensis)* | |
| *S. franconica* | • Field scabious *(Knautia arvensis)*<br>• True thistle (*Carduus collinus*)<br>• *Jurinea mollis* | Asterales: Asteraceae: Carduoideae<br>Dipsacales: Dipsacaceae: Dipsacoideae |
| *S. gigantea* | • Pale Viper's-bugloss *(Echium italicum)* | Boraginales: Boraginaceae: Boraginoideae |
| *S. minima* | • Goldmoss stonecrop (*Sedum acre)*<br>• Sheep's bit scabious *(Jasione montana)*<br>• Common yarrow (*Achillea millefolium*)<br>• Common tansy (*Tanacetum vulgare*)<br>• Yellowhead (*Inula* sp.)<br>• Hawkweed (*Hieracium* sp.) | Asterales: Asteraceae: Asteroideae<br>Asterales: Asteraceae: Cichorioideae<br>Asterales: Campanulaceae<br>Saxifragales: Crassulaceae |
| *S. minuta* | • Bellflower *(Campanula* sp.)<br>• Common dandelion (*Taraxum officinale)*<br>• Cranesbill (*Geranium* sp.) | Asterales: Asteraceae: Cichorieae<br>Asterales: Campanulaceae: Campanuloideae<br>Geraniales: Geraniaceae |
| *S. nasuta* | • Mountain germander (*Teucrium montanum*)<br>• Bugleweed (*Ajuga* sp.)<br>• Germanders *(Teucrium* sp.)<br>• Stiff hedgenettle (*Stachys recta*)<br>• Heal-all *(Stachys* sp.)<br>• White horehound (*Marrubium vulgare)* | Lamiales: Lamiaceae: Ajugoideae and Lamioideae |
| *S. odontopyga* | • Various species of Apiaceae, Asteraceae and Boraginaceae<br>• Hawkweed *(Hieracium* sp.)<br>• Fall dandelion (*Leontodon autumnalis = Scorzoneroides autumnalis)*<br>• Tansy (*Tanacetum vulgare*)<br>• Inula *(Inula* sp.) | Apiales: Apiaceae<br>Asterales: Asteraceae: Asteroideae<br>Asterales: Asteraceae: Cichorioideae<br>Incertae sedis: Boraginaceae |
| *S. ornatula* | • Mouse-ear hawkweed (*Hieracium pilosella)*<br>• Canadian hawkweed (*Hieracium umbellatum)*<br>• Bird's-foot-trefoil (*Lotus corniculatus)*<br>• Cinquefoil (*Potentilla* sp.)<br>• Ragwort (*Senecio jacobaea*)<br>• Fleabane (*Pulicaria dysenterica*)<br>• Hawk's-beard (*Crepis* sp.) | Asterales: Asteraceae: Asteroideae and Cichorioideae<br>Fabales: Fabaceae: Faboideae<br>Lamiales: Plantaginaceae<br>Myrtales: Onagraceae<br>Rosales: Rosaceae: Rosoideae |

| ***Stelis*** | **Plant species** | **Plant order / family / subfamily** |
|---|---|---|
| | • Fireweed (*Chamaenerion angustifolium*)<br>• Nipplewort (*Lapsana communis*)<br>• Autumn hawkbit (*Leontodon autumnalis*)<br>• Germander speedwell (*Veronica chamaedrys*)<br>• Heath speedwell (*Veronica officinalis*)<br>• Hawkweed oxtongue (*Picris hieracioides*)<br>• *Lapsana communis*<br>• Catsear (*Hypochoeris radicata*)<br>• Blackberry (*Rubus fruticosus)*<br>• Cinquefoil (*Potentilla* sp.) | |
| *S. pentelica* | • Mint *(Mentha* sp.) | Lamiales: Lamiaceae: Nepetoideae |
| *S. phaeoptera* | • Centaury *(Centaurea* sp.*; C. jacea; C. scabiosa*)<br>• Hawkweed (*Hieracium pilosella*)<br>• Mouse-ear Hawkweed (*Hieracium pilosella)*<br>• Fall Dandelion (*Leontodon* = *Scorzoneroides autumnalis)*<br>• Bird's-foot-trefoil (*Lotus corniculatus*)<br>• Field scabious (*Knautia arvensis*)<br>• Spear thistle (*Cirsium vulgare*)<br>• Speedwell (*Veronica* sp.)<br>• Broadleaf arnica (*Arnica latifolia*)<br>• Welted thistle (*Carduus crispus*)<br>• Cotton thistle (*Onopordum acanthium*)<br>• *Crepis biennis* | Asterales: Asteraceae: Carduoideae and Cichorioideae<br>Dipsacales: Caprifoliaceae: Dipsacoideae<br>Fabales: Fabaceae<br>Lamiales: Plantaginaceae |
| *S. punctulatissima* | • European Michaelmas daisy *(Aster amellu*)<br>• Inula *(Inula hirta)*<br>• Hawkweed (*Hieracium* sp.)<br>• Ragwort (*Senecio jacobaea*)<br>• Spiny starwort (*Pallenis spinosa)*<br>• Scabious (*Scabiosa maritima*)<br>• Centaury *(Centaurea* sp.)<br>• Stonecrops *(Sedum* sp.*)*<br>• Common mallow (*Malva sylvestris*)<br>• Bird's-foot-trefoil (*Lotus corniculatus*)<br>• Bramble (*Rubus fruticosus*)<br>• Wild marjoram (*Oreganum vulgare*)<br>• Common fleabane (*Pulicaria dysenterica*)<br>• Yarrow (*Achillea millefolium*)<br>• Spear thistle (*Cirsium vulgare*) | Asparagales: Amaryllidaceae: Allioideae<br>Asterales: Asteraceae: Asteroideae, Helenieae<br>Asterales: Asteraceae: Astereae<br>Asterales: Asteraceae: Carduoideae<br>Asterales: Asteraceae: Calenduleae<br>Asterales: Asteraceae: Cynareae<br>Dipsacales: Caprifoliaceae: Dipsacoideae<br>Dipsacales: Dipsacaceae<br>Fabales: Fabaceae: Faboideae<br>Geraniales: Geraniaceae |

| ***Stelis*** | **Plant species** | **Plant order / family / subfamily** |
|---|---|---|
| | • Field marigold (*Calendula arvensis)*<br>• Tyrol knapweed (*Centaurea nigrescens*)<br>• Fireweed (*Chamaenerion* angustifolium)<br>• Creeping thistle (*Cirsium arvense*)<br>• Large-flower fleabane (*Erigeron grandiflorus*)<br>• Wood cranesbill (*Geranium silvaticum*)<br>• Sneezeweed (*Helenium pumilum* and *H. pilosella*)<br>• Purple toadflax (*Linaria purpurea*)<br>• Pigeon scabious (*Scabiosa columbaria*)<br>• Gold-moss stonecrop (*Sedum acre*)<br>• Betony (*Stachys olympicus*)<br>• Breckland thyme (*Thymus serpyllum*)<br>• Red clover (*Trifolium pratense*)<br>• Welted thistle (*Carduus crispus*)<br>• Cotton thistle (*Onopordum acanthium*)<br>• Brown knapweed (Centaurea jacea)<br>• Fall dandelion (*Leontodon autumnalis* = *Scorzoneroides autumnalis)*<br>• Onion (*Allium cepa*)<br>• Broad-leaved thyme (*Thymus pulegioides*)<br>• White clover (*Trifolium repens*) | Lamiales: Lamiaceae: Labiatae<br>Lamiales: Plantaginaceae<br>Malves: Malvaceae<br>Myrtales: Onagraceae<br>Rosales: Rosaceae<br>Saxifragales: Crassulaceae: Sempervivoideae |
| *S. rhodia* | • Headed savory (*Thymus capitatus)* | Lamiales: Lamiaceae |
| *S. signata* | • Reflexed (Blue) stonecrop *(Sedum reflexum)*<br>• Wild thyme *(Thymus serpyllum*)<br>• Broad-leaved thyme (*Thymus pulegioides)*<br>• Sheep's bit scabious *(Jasione montana)*<br>• Fireweed (*Chamaenerion angustifolium*)<br>• Hawkweed (*Hieracium* sp.)<br>• Canadian hawkweed (*Hieracium umbellatum* [= *A. canadendse*])<br>• Bird's-foot trefoil (*Lotus corniculatus*)<br>• Silver cinquefoil (*Potentilla argentea*)<br>• Large hop trefoil (*Trifolium aureum*)<br>• Wild mignonette (*Reseda lutea*)<br>• Blackberry (*Rubus fruticosus*)<br>• Sheep's bit scabious (*Jasione montana*)<br>• Fireweed (*Epilobium angustifolium*) | Asterales: Asteraceae<br>Asterales: Campanulaceae<br>Brassicales: Resedaceae<br>Myrtales: Onagraceae<br>Fabales: Fabaceae<br>Myrtales: Onagraceae: Onagroideae<br>Rosales: Rosaceae<br>Saxifragales: Crassulaceae |

## Flight Season

The flight season of Palaearctic *Stelis* species extends from February to September. The highest number of species at the same time can be found between May and August with a distinctive peak in June. The earliest species are *S. aegyptiaca* and *S. murina*, which have been found as early as February and March in areas such as the Persian Gulf, Egypt and Algeria. In Central Europe, *S. franconica* is usually the earliest species, which has been found as early as March in Germany. Autumn species are so far not known.




Flight season of *Stelis* species in the Palaearctic region. The graph shows the number of species found on the wing in the respective months.

## Sexual Dimorphism

The sexes are often quite different from one another, and in the key the sexes have to be treated separately. As in most bee species, males of *Stelis* are characterised by 13 antennal segments and 7 abdominal terga, while females have only 12 antennal segments and 6 abdominal terga.

As in other members of the tribe Anthidiini, there is also considerable sexual dimorphism beyond these differences. The sexes differ in many species in their colour pattern and in morphologic features including e.g. the shape of clypeus, the shape of basitarsi or punctation of the integument. The degree of sexual dimorphism varies with species and in some species, there are only a few characters which are common to both sexes.

## Geographic Variation

While little is known on geographic variation, it is evident that those species with yellow colour pattern tend to have more and larger yellow maculations in the south (Mediterra-

nean area, Middle East) than in the north. *Stelis signata* is a good example of that. The yellow colouration on its head varies considerably and a few varieties and subspecies have been described accordingly. However, little is known whether the colour pattern shows a clinal distribution, and how high is the variation within populations.

## Taxonomy: The Subgenera of *Stelis*

The genus *Stelis* has been divided into several subgenera. Friese (1895) put all European species into two subgenera, *Stelis* Panzer and *Stelidomorpha* Morawitz, and erected a third one, *Protostelis* Friese. Noskiewicz (1961) modified this classification through putting *S. minuta* and *S. ornatula* into a newly erected subgenus, *Leucostelis* Noskiewicz, and assigning *S. phaeoptera* to the North American subgenus *Pavostelis* Sladen. Pasteels (1969b) combined *Leucostelis* with *Stelis* s. str., and regarded *Afrostelis* Cockerell as a subgenus of *Stelis*. Warncke (1992) raised principal doubts whether a subgeneric classification is useful for the genus *Stelis*, and was convinced that at the most, *Stelis* (*Stelidomorpha*) could be separated from *Stelis* s. str. on the subgenus level. I follow here Michener (2007) and distinguish five subgenera: the subgenus *Stelidomorpha* with three species (*aegyptiaca*, *nasuta*, *pentelica*); the subgenus *Protostelis* with one species only (*signata*); the subgenus *Heterostelis* with five species (*annulata*, *gigantea*, *hungarica*, *hispanica*, *ruficornis*); the subgenus *Pseudostelis* with three species (*denticulata, minuta, minima*); and *Stelis* s.str. with 15 species. The classification is not unambiguous and changes depending on an author. Michener (2007) regards *Afrostelis* Cockerell a genus rather than a subgenus of *Stelis* Panzer.

Some confusion was caused by Michener (2000) as he gave *Stelis freygessneri* Friese, 1885, a synonym of *Stelis annulata* (Lepeletier, 1841), incorrectly as the type species of *Protostelis*. This was later corrected by Michener himself (Michener 2007),

Fore tibia of *Stelis*: in the subgenus *Stelidomorpha*, the anterior spine of front and middle tibiae is conspicuous, enlarged, and curved posteriorly, while in all other subgenera the two spines are moree or less equal in length. Left: fore tibia of *Stelis nasuta*, right fore tibia of *S. phaeoptera*. Photographs of material in SMF by MK.

but for that reason, *S. annulata* (Lepeletier, 1841) is sometimes placed into the subgenus *Protostelis* (e.g. Ornosa et al. 2008).

*Stelis hispanica* is placed here in the subgenus *Heterostelis* (not as "status uncertain" as e.g. by Kuhlmann 2013) due to its close relationship with *S. annulata*; and for the same reason, *S. hungarica* was attributed to *Heterostelis*. Kuhlmann (2013) places *S. minima* and *S. minuta* in different subgenera, although the species are almost indistinguishable and are regarded as conspecific by many authors. Both of them are attributed here to *Pseudostelis*. Ornosa et al. (2008) put *S. breviuscula* also to the subgenus *Pseudostelis*, while it is placed in *Stelis* s.str. by other authors. The subgeneric classification is thus at present far from being final, and the classification used here should be regarded only as a preliminary attempt.

**Key to the subgenera of *Stelis* Panzer** (adapted from Michener 2007)

1 Clypeus protruding well over mandibles, its apex bilobed, strongly so in females; anterior spine of front and middle tibiae conspicuous, enlarged, curved posteriorly ..... *Stelis (Stelidomorpha)*

– Clypeus not greatly protruding over mandibles, truncate or subtruncate; anterior spine of front and middle tibiae less than twice the size of posterior spine ..... 2

2 Scutellum not carinate laterally; head and thorax without light markings; hind tibial apex with two spines or angles, one near outer middle of apical tibial margin (if with only one spine, as in *S. simillima*, then not on posterior apical angle) or the spines united to form truncate margin, the area sparsely hairy and the structure thus easily seen; omaulus not carinate ..... *Stelis* (*Stelis* s.str.)

– Scutellum carinate laterally; head and thorax with light markings; hind tibial apex with a single spine (sometimes a mere angle) largely hidden in hairs near the posterior apical angle of the tibia, in front of which the apex of the tibia presents a convex margin; omaulus usually carinate ..... 3

3 Hind basitarsus with carina along inner dorsal angle; middle tibia flattened, apically enlarged, twice as wide apically as basally; S1 with transverse carina overhanging apical margin ..... *Stelis* (*Heterostelis*)

– Hind basitarsus without carina; middle tibia not flattened, little enlarged apically, at most 1.5 times as wide apically as basally; S1 without transverse carina ..... 4

4 Pronotum without notch between lobe and rest of pronotum; omaulus not carinate; carinate pitted basal zone of propodeum extending behind spiracle ..... *Stelis* (*Protostelis*)

– Pronotum with notch between lobe and rest of pronotum; omaulus usually carinate; carinate pitted basal zone of propodeum not extending behind spiracle ..... *Stelis* (*Pseudostelis*)

Only recently, Parker & Griswold (2013) described ten new species of *Stelis* found in North America, and announced that this is only the first of several planned batches of descriptions of new species. This taxonomic work is carried out together with molecular phylogenetic studies based on DNA analysis (Litman et al. 2013) and includes apparently also some Palaearctic *Stelis* species for comparison (see data already deposited in GenBank). We can therefore expect from that American research group new findings on the evolution and phylogeny of both Palaearctic and Nearctic *Stelis* species.

For a key to the Neotropical cleptoparasitic genera of Anthidiini, see Urban & Parizotto (2012).

Table: Subgeneric classification of the genus *Stelis*. Species assignment to the subgenera was adapted from several sources, but is not unambiguous and changes depending on author.

| | |
|---|---|
| *Stelis* / Subgenus *Heterostelis* Timberlake, 1941 | *Stelis (Heterostelis) annulata*<br>*Stelis (Heterostelis) gigantea*<br>*Stelis (Heterostelis) hungarica*<br>*Stelis (Heterostelis) hispanica*<br>*Stelis (Heterostelis) ruficornis* |
| *Stelis* / Subgenus *Protostelis* Friese, 1895 | *Stelis (Protostelis) signata* |
| *Stelis* / Subgenus *Pseudostelis* Popov, 1956 | *Stelis (Pseudostelis) denticulata*<br>*Stelis (Pseudostelis) minuta*<br>*Stelis (Pseudostelis) minima* |
| *Stelis* / Subgenus *Stelidomorpha* Morawitz, 1875 | *Stelis (Stelidomorpha) aegyptiaca*<br>*Stelis (Stelidomorpha) nasuta*<br>*Stelis (Stelidomorpha) pentelica* |
| *Stelis* / Subgenus *Stelis (Stelis)* Panzer, 1806 | *Stelis (Stelis) aculeata*<br>*Stelis (Stelis) breviuscula*<br>*Stelis (Stelis) franconica*<br>*Stelis (Stelis) iugae*<br>*Stelis (Stelis) laverna*<br>*Stelis (Stelis) maroccana*<br>*Stelis (Stelis) murina*<br>*Stelis (Stelis) odontopyga*<br>*Stelis (Stelis) orientalis*<br>*Stelis (Stelis) ornatula*<br>*Stelis (Stelis) phaeoptera*<br>*Stelis (Stelis) punctulatissima*<br>*Stelis (Stelis) saxicola*<br>*Stelis (Stelis) scutellaris*<br>*Stelis (Stelis) simillima* |
| *Stelis* / Subgeneric status uncertain | *Stelis ortizi*<br>*Stelis rhodia* |

# Coverage and Methodology

## Geographic and Taxonomic Coverage

This works covers all species occurring in the Western Palaearctic region and includes the entire Arabian Peninsula and Iran; it hereby goes beyond the classical borders of the Western Palaearctic. Central Asian taxa are not included.

The distribution is described country-wise. No attempt has been made to describe the distribution pattern within the countries. Detailed country records including literature references are available in a dataset which can be obtained from the author. It was attempted to confine the number of references to 1-3 per country. These references are mostly, but not necessarily the original sources.

The species-level taxonomy in this work follows principally the "Bee Species World Checklist" published in 2008 by ITIS, the Integrated Taxonomic Information System, and available at http://www.itis.gov/beechecklist.html (ITIS 2008). This list provides today the most comprehensive and most reliable source of names. I followed the list with the following exceptions:

*Stelis hispanica* Dusmet & Alonso, 1921 is regarded as a valid species based on the re-examination by Schwarz & Gusenleitner (2010).

*Stelis murina* Pérez, 1884 was accepted as a valid taxon based on the judgement of Baker (1999).

*Stelis ortizi* Schwarz & Gusenleitner, 2010 has been added to the list as a species which was described only recently, i.e. after the publication of the Bee Species World Checklist (ITIS 2008).

Both Fauna Europaea (www.faunaeur.org) and the EU nomen list (www.eu-nomen.eu) list *Stelis tridentata* (Schimmel, 1829) as a valid bee species occurring in Poland. According to Baker (1999) *Stelis tridentata* Schimmel, 1829 is a nomen nudum. Fauna Europaea linked the name to the Global Biodiversity Informatics Facility (GBIF), which finally leads to *Stelis tridentata* Lindl., an orchid species.

Lists of synonyms are included to allow an unequivocal identification of all taxa. However, we did not aim at giving complete lists of synonyms. For older synonyms, it is recommended to consult in particular de Dalla Tore (1896) and Friese (1895).

Subspecies and "forms" are included in the list of synonyms, but no efforts were made to provide information on their identification. Our knowledge and understanding of subspecies is in general still very poor.

## Terminology and Abbreviations

Terminology used here follows almost exclusively Michener (2007). Attention should be given to the following issues:

- abdomen: as the first abdominal segment is actually the propodeum, which is incorporated in the thorax, preference is given to the usage of metasoma;
- axilla: plural: axillae;

- denticle = small tooth;
- fore tibia = front tibia;
- mesepisternum (plural: mesepisterna) = mesopleuron;
- metasoma: see abdomen;
- pilosity: see pubescence;
- pubescence: longer, erect or suberect hairs; pilosity: minute and appressed hairs;
- punctate = punctured;
- punctation = punctuation = puncturation;
- scutellum: in *Stelis*, the scutellum is always separated from the axillae. The term "scutellum" was therefore used for the scutellum s.str., i.e. without axillae;
- scutum = mesoscutum = dorsal plate of the middle thoracic segment;
- sternum (plural: sterna) = sternite. The term "sternum" refers here always to metasomal sterna;
- tergum (plural terga) = tergite. The term "tergum" refers here always to metasomal terga;
- thorax: including the propodeum, which is actually the first true abdominal segment;
- S1, S2, … sternum 1, sternum 2, … (first, second, etc., metasomal sternum);
- T1, T2, … tergum 1, tergum 2, … (first, second, etc., metasomal tergum).

## Depositories

| | |
|---|---|
| OLL | Oberösterreichisches Landesmuseum, Linz, Austria |
| SIZK | I. I. Schmalhausen Institute of Zoology, National Academy of Sciences, Kiev, Ukraine |
| SMF | Senckenberg Museum, Frankfurt, Germany |
| SMNS | Staatliches Museum für Naturkunde Stuttgart, Germany |
| ZMB | Museum für Naturkunde Berlin, Germany |
| ZSM | Zoologische Staatssammlung München, Germany |
| coll. Schwarz | collection Maximilian Schwarz, Ansfelden |
| MK | Max Kasparek, Heidelberg |

## Maps

The baseline map for the distribution maps was designed based on an open source vector world map at http://landkartenkostenlos.blogspot.de. This map was modified and adapted to the needs of this publication. The boundaries shown on this map have a limited accuracy and are an approximation to actual country boundaries; their exact location cannot always be shown.

## Photographs

Most photographs were taken with a Canon MP-E65/2.8 lens mounted on a Canon EOS 600D camera. Multiple photographs were taken of each specimen and then combined to a picture of a specimen completely in focus. The camera was moved between the shorts

with a Cognisys StackShot Rail. A Canon Twin Lite MT24EX Macro Flash was used. Subsequently, the pictures were processed with Helicon Focus (version 6.0.18) software to combine the pictures and to create one completely focused image from several partially focused images (image stacking). Usually 15-25 photographs have been taken at different focus distances to give a resulting image with a greater depth of field than any of the individual source images. The resulting images were further processed with Adobe Photoshop.

## Acknowledgements

My sincerest thanks are due to Maximilian Schwarz, Ansfelden (Austria), who allowed me to work in his collection, provided photographs (especially for *Stelis ortzeni* and *L. hispanica*), and thoroughly revised an early draft of the manuscript. I am also grateful to the curators and other staff of the following collections: Hungarian Natural History Museum, Budapest (Zoltán Vas), Museum für Naturkunde, Berlin (Frank Koch), Oberösterreichisches Landesmuseum, Linz (Fritz Gusenleitner), Senckenberg Museum, Frankfurt a.M. (Jens Kopelke, Patricia Peters), I. I. Schmalhausen Institute of Zoology, Kiev (Vladimir G. Radchenko, M. D. Zerova), Staatliches Museum für Naturkunde, Stuttgart (Lars Krogmann), and Zoologische Staatssammlung, Munich (Stefan Schmidt). Mrs. Lisa Haitzinger from OLL kindly took for me several of the photographs used here, and Victor Fet (Marshall University, Huntington) provided linguistic advice. Josef Dvorak (Czech Republic) and Andrej Gogala (Slovenia) kindly gave permission to use their photographs previously published in the internet.

# Key to the West Palaearctic and Middle Eastern Species of *Stelis*

This key to the West Palaearctic and Middle Eastern Species of *Stelis* is principally based on Warncke (1992). It was translated from German and adapted, modified and extended as needed to reflect our present knowledge. Although it was attempted to provide unambiguous characters for all species, the available information on the variation of colouration and morphological features of several species is unfortunately still very poor especially as about 25 per cent of all speciesare known only from a single specimen, or very few specimens, and for several species, only the female is known. For identifying rare species, reference should therefore be made to the full species accounts given below.

## 1. Key to females

1 Legs dark, mesosoma predominantly black or red ..... 2

• Legs yellow or red; terga with large yellow maculations or bands ..... 20

***Species with black legs and predominantly black or red mesosoma***

2 Terga black (if with small lateral milky-white maculations, then mesepisternum at least in the upper part sparsely punctate with shining interstices) ..... 3

• Terga 1-4 red, relatively long light (white or greyish) pubescence on head and thorax (refer to species descriptions) ..... *Stelis ortizi* and *S. laverna*

3 Terga with wide, yellowish horn-coloured apical margins ..... 4

• Dark colouration of terga extends to their apical margins; margins at most slightly brightened up to a light brown ..... 6

4 Head wider than long; mandibles bent outwards at base, giving them a snout-like shape in lateral view; clypeus flattened with fine and dense punctation, dull, without pubescence; punctation of face more than twice as strong as of clypeus; apical tergum obtusely triangular, subapical area polished and almost impunctate ..... *Stelis simillima*

• Head conspicuously longer than wide; mandibles not protuberant; punctation of clypeus fine to coarse; apical tergum widely and bluntly rounded, subapical area with dense, honeycomb-like punctation ..... 5

5 Surface of clypeus almost flat, punctation of apical one third almost as fine and as dense as in *S. simillima*, becoming coarser with thin shining interstices towards base; punctation of supraclypeal area much coarser than of clypeus; genal area moderately densely punctate, punctures separated by almost half their diameter, interstices shining ..... *Stelis iugae*

Different types of terga in the group of dark *Stelis* species. Left: terga with wide, yellowish to horn-coloured apical margins (female *S. punctulatissima*); Middle: apical margins of terga with dense, white bands of hairs (female *S. breviuscula*); Right: Terga with only sparse hairs at apical margins, slightly denser at the sides (female *S. phaeoptera*). Photographs: MK.

- Surface of clypeus bulging or convex, punctation as strong as on adjacent parts of lower face; genal area densely honeycomb-like punctate, dull; T6 with dense punctation. Apical margins of T1-T4 with transverse, almost transparent pale yellow bands, giving the metasoma a banded appearance. 8-11 mm ..... *Stelis punctulatissima*

6 Body with dark brown or black pubescence; axilla produced in the form of a long blunt tooth; apical tergum short, laterally angulate and with dense pubescence. Relatively large species (12 mm) ..... *Stelis aculeata*

- Body with light pubescence; axilla rounded to slightly angulate, rarely projecting; apical tergum rounded or laterally slightly angulate, lateral fringe of hairs and apical carina absent. Usually 8–10 mm ..... 7

7 Apical margins of terga 1-2 (-3) laterally with dense, white bands of hairs ..... 8

- Terga without continuous bands of hairs, at most some hairs ..... 11

8 Axilla forming a strong blunt tooth pointed posteriorly; apical margin of sternum S5 with narrow white band. Large species (almost 10 mm) *Stelis scutellaris*

- Axilla at most angulate and slightly projecting; apical margin of S5 without light band ..... 9

9 Relatively large species (9-10 mm). Clypeus rather evenly punctate throughout; head rounded; T1 with dispersed, widely separated punctures, distance between punctures on disc 1-3 times their diameter ..... *Stelis orientalis*

- Smaller species up to 8 mm. Apical side of clypeus much finer punctate than proximal one; head longer than wide; T1 densely punctate, distance between punctures mostly conspicuously less than their diameter ..... 10

Left: Apical margin of terga yellow horn-coloured: *Stelis punctulatissima* (male)

Left: Terga without bands, horn-coloured margins or spots:*Stelis odontopyga* (female).

Left: Terga with bands of white hairs at apical margin: *Stelis breviuscula* .(male).

Terga with lateral brown maculae: *Stelis minuta* (male; left) and *Stelis ornatula* (female, right).

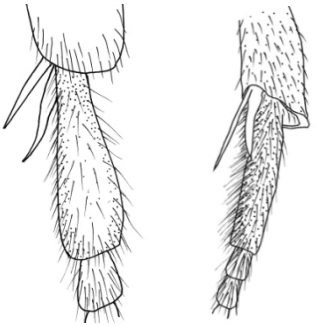
Examples of different terga features in dark *Stelis* species. All photographs: Andrej Gogala.

10 Head almost twice as long as wide; length of vertex almost two ocellar diameters; apical end of abdomen rounded. 8 mm ..... *Stelis maroccana*

• Head about 1.5 times as long as wide; length of vertex one ocellar diameter; T1-T4 fringed medially with apical bands of short, flimsy, light-coloured (silvery) hairs; upper side of propodeum shiny; end of abdomen obtusely triangular; punctures on median portion of T2 dense, separated by less than a puncture width. 5-7 mm ..... *Stelis breviuscula*

11 Hind basitarsi clubbed, thickened apically; head wider than long; T1-T3 (rarely also T4) with a pair of widely separated creamy-yellow spots; scutellum overhanging postscutellum medially; segments of antennae longer than wide ..... *Stelis ornatula*

• Hind basitarsi parallel-sided; head rounded to slightly elongate; terga dark or with ochreous maculae ..... 12



Shape of the hind basitarsi. Note the clubbed shape in female *Stelis ornatula* (left), while the sides are more or less parallel in many other species (here: male *S. odontopyga*). Drawings by MK (left: after a drawing by Amiet et al. 2004, right after own material).

12 Terga laterally with small light (yellowish) maculations ..... 13

• Terga completely dark ..... 14

13 Mesepisternum densely punctate, punctures separated by up to half their diameter. 5-6 mm long ..... *Stelis minuta*

• Punctures on mesepisternum usually separated by more than their diameter; punctation of terga less sparse and therefore shinier; maculations on terga often absent. 4-5 mm long ..... *Stelis minima*

14 Very small species (4-5 mm) (see above) ..... *Stelis minima*

• Larger species (6-12 mm) ..... 15

15 Outer side of hind tibia with conspicuously short bristle-like pubescence; terga densely punctate, punctures separated by about half their diameters; vertex 1.5 ocellar diameters long; spurs of tibia dark; small species, 6-7 mm long ..... *Stelis odontopyga*

- Hairs at outer side of hind tibia longer than antenna diameter; terga at least medially sparsely punctate, punctures separated by more than their diameters; larger species, 7-12 mm ..... 16

16 Punctation of T4 and T5 increasingly finer and denser towards the base; clypeus appears longer than wide, finely punctate ..... *Stelis saxicola*

- T4 and T5 almost evenly punctate, punctures relatively scattered; clypeus appears wider than long, with stronger punctation ..... 17

17 Scutellum depressed at apical end; punctation on T1 coarser than in the centre of the scutum; apical fringe of S6 yellowish to silvery. 9-11 mm ..... *Stelis franconica*

- Scutellum mostly flat; punctation of T1 coarse, almost as coarse as that in the centre of the scutum; punctures on T2 and T3 mostly separated by 2 to 4 times their diameter; apical fringe of hairs on S6 golden yellow ..... 18

18 Pubescence on vertex and thorax ochreous; punctation less dense (see detailed description in text). Especially punctation on median portion of T2 less dense, separated by a puncture width or more ..... *Stelis phaeoptera*

- Pubescence light grey; punctation dense (see detailed description in text) ..... 19

19 Abdomen red, clypeus distinctly wider than long with a Iength/breadth ratio of 1:1.7 ..... *Stelis laverna*

- Abdomen black; clypeus wider than long with a Iength/breadth ratio of 1:1.5, emarginated in the middle; Tergite T6 with longitudinal keel at apical end ..... *Stelis murina*

***Species with yellow or red legs and with large yellow spots or bands on mesosoma***

20 Clypeus protruded, with deep semicircular median emargination at apical end; inner tooth on fore tibia claw-like and several times longer than outer one ..... 21

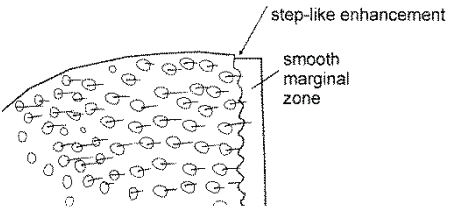
- Clypeus not protuberant, truncated; the two teeth on apical end of fore tibia short and of almost equal length ..... 23

21 Antennae black to blackish-brown; legs red; terga with two to four white maculae on each side. Vertex four ocellar diameters long. 6-7 (-10) mm long ..... *Stelis nasuta*

- Antennae reddish yellow ..... 22

22 Length of vertex 5 ocellar diameters; punctation of T1 and scutum similar; clypeus yellow; anterior side of scutum with wide yellow maculation; most of apical terga yellow. Larger species (9-11 mm) ..... *Stelis pentelica*

- Length of vertex 3 ocellar diameters; punctation of tergum T1 fine, hardly half as strong as of scutum; clypeus and apical tergum black. Smaller species (7-8 mm) ..... *Stelis aegyptiaca*




Tergum 1 (T1) of *Stelis signata*. Note the step-like enhancement of the tergum surface against its smooth and narrow marginal zone.

23 Clypeus entirely or almost entirely yellow ..... 24

• Clypeus at least in the middle black to blackish-red or entirely black or entirely light red ..... 26

24 Vertex short, less than 2 ocellar diameters long; horizontal basal area of propodeum with a single, honeycomb-like row of punctures, sharply separated from the declivous posterior surface; marginal zone of T1 narrow, separated from disc by a step-like edge; apical margin of clypeus edentate; antennae entirely black. Small species, 6-7 mm long ..... *Stelis signata*

• Vertex longer, more than 2 ocellar diameters long; posterior surface of propodeum without horizontal region, declivous, with several rows of fine honeycomb-like punctures; transition from disc to marginal zone of T1 smooth ..... 25

25 Vertex 3 ocellar diameters long; vertex and scutum with dense, honeycomb-like punctation; scutellum with apical carina; axilla rounded or angulate, at most slightly projecting; underside of antennae red; apical end of clypeus dentate; length of pubescence on vertex and outer side of hind tibia shorter than antennal diameter. 10-11 mm .....
.....*Stelis annulata* species group (incl. *S. hungarica* and *S. hispanica*)

• Vertex 4 ocellar diameters long; interspaces between punctures on vertex and scutum narrow and shining; posterior margin of scutellum widely rounded, in particular on both sides of the middle; axilla projecting forming a blunt tooth pointed posteriorly; pubescence on vertex and outer side of tibia more than 2 antennal diameters long. Large species (14 mm) .. *Stelis gigantea*

26 Marginal zone of T1 narrow, separated from the disc by a step-like edge; vertex short, less than 2 ocellar diameters long; horizontal basal area of propodeum with a single, honeycomb-like row of punctures, sharply separated from the declivous posterior surface ..... *Stelis signata*

• Marginal zone of T1 wider and transition to disc smooth; length of vertex almost two ocellar diameters or more; upper part of posterior surface of propodeum more or less declivous, with granular to fine honeycomb-like sculpture ..... 27

27 Mesepisterna with dense, honeycomb-like punctation, dull, punctures separated by narrow ridges; punctation of T1 stronger than that of scutellum; punctation of T4 conspicuously finer than that of T1; proximal half of marginal zone finely and densely punctate; sternum S4 medially with dense apical band of hairs ..... *Stelis ruficornis*

• Mesepisterna coarsely punctate with narrow, shining interstices; punctation of scutellum conspicuously stronger than that of T1; punctation of T4 stronger than that of T1; marginal zones impunctate; no apical band of hairs on S4 ..... 28

28 Distance between antennal bases (interantennal distance) slightly less than antennal diameter, almost carinated; scutellum nearly twice as wide as long; apical margin of T6 medially smooth, producing to a carinated tooth directed upwards ..... *Stelis denticulata*

• Space between antennal bases flattened, distance approximately two times the antennal diameter, but increasing to three times towards frons; scutellum slightly more than 2.5 times wider than long; T6 dull with dense, honeycomb-like sculpture, and with crenulated apical margin ..... *Stelis rhodia*

## 2. Key to *Stelis* males

As the males of *Stelis hungarica*, *S. hispanica, S. laverna*, *S. orientalis*, and *S. ortizi* are not known, these species are not included in this part of the identification key.

1 Legs black, mesosoma black (if there are small yellowish-white maculations, then at least upper side of mesepisternum sparsely punctate with shining interstices) ..... 2

• Legs yellow or red; terga with large yellow maculations or bands ..... 16

***Species with black legs and generally predominantly black mesosoma***

2 Marginal zones of terga widely translucent or yellowish horn-coloured ..... 3

• Marginal zone of terga dark brown or black, at most brightened up to a slightly lighter brown ..... 5

3 Apical half of mandibles flattened and slightly curved upwards; clypeus flat with dense, fine punctation, dull; punctation of face twice as strong as on clypeus; T6 with an impunctate area medially (width of this area 2-3 puncture diameters); S4 strongly depressed medially with erect hairs in depression; dark comb on apical margin of S4 V-shaped ..... *Stelis simillima*

• Mandibles of ordinary shape; clypeus convex, finely to coarsely punctate, interspaces between punctures shining; punctation of T6 throughout; S4 flat medially, hairs appressed and pointed posteriorly; dark comb on S4 straight..... 4

4 Punctation of clypeus half as strong as that of paraocular areas; dark comb of S4 as wide as the length of the outer spur of hind tibia ..... *Stelis iugae*

- Punctation of clypeus as strong as that of paraocular area; apical margins of T1-T4 with transverse, almost transparent pale yellow bands, giving the metasoma a banded appearance. Comb of S4 hardly as wide as half the length of the outer spur of hind tibia ..... *Stelis punctulatissima*

5 Pubescence of body dark brown or black; axilla produced in the form of a blunt tooth; punctures on scutellum and in particular on terga more than their diameter apart, interstices shiny; apical tergum T7 medially with longitudinal sharp-edged, shiny carina, forming a long tooth-like projection; S3 widely V-shaped medially projecting; the dark comb of S4 comprises half the length of the apical margin. Relatively large species (10 mm) *Stelis aculeata*

- Pubescence of body light; axilla rounded to slightly angulate, rarely also forming a blunt tooth; apical tergum T7 without or only with inconspicuous median carina; S3 truncated; length of the dark comb of S4 mostly less than half the length of the apical margin. Usually significantly below 8 mm ..... 6

6 Apical margins of T1-T3 with white lateral bands of hairs ..... 7

- Terga without bands of hairs, at most scattered hairs ..... 9

7 Axilla with strong projection pointed posteriorly; scutum very coarsely punctate; dark comb of S4 comprises one third of the sternum's apical margin; apical margin of S5 medially with deep V-shaped emargination *Stelis scutellaris*

- Axilla at most angulate, not forming a tooth-like projection; scutum with relatively fine and dense punctation ..... 8

8 Head more than 1.5 times as long as wide; length of vertex almost two ocellar diameters; the dark comb of S4 comprises almost half of the width of the sternum's apical margin. Length 8 mm ..... *Stelis maroccana*

- Head only slightly longer than wide; length of vertex one ocellar diameter; dark comb of S4 comprises hardly one fifth of the sternum's apical margin. Punctures on median portion of T2 dense, separated by less than a puncture width. Length 5-6 mm ..... *Stelis breviuscula*

9 Apical margin of T7 rounded ..... 10

- Apical margin of T7 medially projecting in the form of a short tooth ..... 14

10 Punctation of terga fine and dense, punctures separated by half their diameter; T1-T3 usually with a pair of widely separated creamy-yellow spots; S3 with short median subapical bump and a short row of hairs at apical margin (hairs longest in the centre, length decreasing towards the outer sides); segments of antennae at least as long as wide. ..... *Stelis ornatula*

- Punctation of terga medium strong and mostly sparse; terga never with yellow spots; bump at S3 absent; apical margin of S3 with long hairs with all hairs having more or less the same length or even becoming longer towards the outer sides ..... 11

11 Dark comb of S4 significantly less wide than length of outer spur of hind tibia; clypeus appears wider than long ..... 12

- Dark comb of S4 about 1.5 times as wide as length of outer spur on hind tibia; clypeus appears longer than wide ..... *Stelis saxicola*

12 Scutellum usually flattened to slightly convex, with larger spaces between punctures; space between punctures of T1 not larger than on scutum; punctures of T3 often separated by their diameters ..... 13

- Apical end of scutellum usually depressed, densely punctate; punctures of T1 coarser than those of scutum; T3 with regular punctation, punctures usually separated by less their diameters. Length 8-10 mm. ..... *Stelis franconica*

13 T6 with acute apical angle. Face slightly elongated ..... *Stelis phaeoptera*

- Apical angle of T6 obtuse; apical margin of clypeus emarginate; face wider and rounder; punctation of head and mesosoma denser, resulting in a dull surface; pubescence grey; tibial spurs dark ..... *Stelis murina*

14 Outer side of hind tibia with erect pubescence, length of hairs about antennal diameter; terga often with yellow maculations; S3 medially V-shaped notched and with a short median row of hairs; tibial spurs yellow ..... 15

- Hind tibia with conspicuously short pubescence; terga always dark; notch at apical margin of S3 absent, at most slight emargination and with wide fringe of hairs; small tooth at apical end of T7; tibial spurs black. Length 6-8 mm ..... *Stelis odontopyga*

15 Punctures on mesepisternum and on terga T4 and T5 usually half their diameter apart. Length 5-6 mm ..... *Stelis minuta*

- Punctures on mesepisternum and on T4-T5 separated by their diameter; terga often without white maculations. Length 3-4 mm ..... *Stelis minima*

***Species with yellow or red legs and with large yellow spots or bands on mesosoma***

16 Inner tooth of fore tibia claw-like, several times longer than outer one; clypeus slightly protruding, its apical margin slightly emarginate ..... 17

- Both teeth of fore tibia short and almost equally long; clypeus not protruding, truncated ..... 19

17 Antennae black to dark brown; legs red; clypeus emarginate; S4 medially straight to slightly depressed; vertex more than 3 ocellar diameters long; length 5.5-9 mm ..... *Stelis nasuta*

- Antennae reddish-yellow; S4 with a deep, median depression, which is delimited on both sides by carinae; carinae dark brown and thus easily visible from adjacent surface ..... 18

18 Length of vertex usually slightly more than 3 ocellar diameters; punctation of T1 and scutum similar; scutum with wide yellow margins; apical tergum T7 largely yellow. Larger species (9-10 mm) ..... *Stelis pentelica*

Differences in the arrangement of yellow maculae on abdominal terga: Principally four rows of spots are present in *Stelis nasuta* (left), and two rows in *S. aegyptiaca* (middle) and *S. pentelica* (righht). Photograph of specimens in SMF (left and middle; photograph: MK) and in coll. Schwarz (right; photograph: OLL).

- Length of vertex usually slightly more than 2 ocellar diameters; punctation of T1 fine, hardly half as strong as that of scutum; scutum and apical tergum T7 black. Smaller species (6-7 mm) ..... *Stelis aegyptiaca*

19 Marginal zone of T1 separated from disc by a step-like edge; vertex short, less than 2 ocellar diameters; horizontal basal area of propodeum with a single, honeycomb-like row of punctures, sharply separated from the declivous posterior surface; antennae black; apical margin of clypeus edentate. Small species (6-7 mm) ..... *Stelis signata*

- Transition from disc to marginal zone of T1 smooth; vertex longer, more than 2 ocellar diameters; posterior surface of propodeum declivous, without horizontal basal area, and with several rows of honeycomb-like punctation ..... 20

20 T7 obtusely tridentate; on S2 concave sharp median transverse carina which extends over almost half of the apical margin; apical margin of S5 medially with deep, V-shaped notch ..... 21

- T7 with one or two teeth; S2 flat; apical margin of S5 truncated to slightly emarginate in the middle ..... 22

21 Dark comb of S4 extends over almost half of the sternum's apical margin; scutum without yellow; axilla produced in the form of a blunt tooth pointed posteriorly ..... *Stelis gigantea*

- Dark comb of S4 narrow, longer than wide; scutum framed with wide yellow, interrupted margins; axilla not projecting, at most slightly angulate; apical end of clypeus crenulated; antennae reddish, vertex 3 ocellar diameters long ..... *Stelis annulata*

22 T7 strongly bidentate; dark comb of S4 wide, extending over half of the sternum's apical margin; S2 and S3 with dense and long pubescence; S5 with median, semicircular, shiny area which is delimited by a carina, and is open towards the posterior side ..... *Stelis ruficornis*

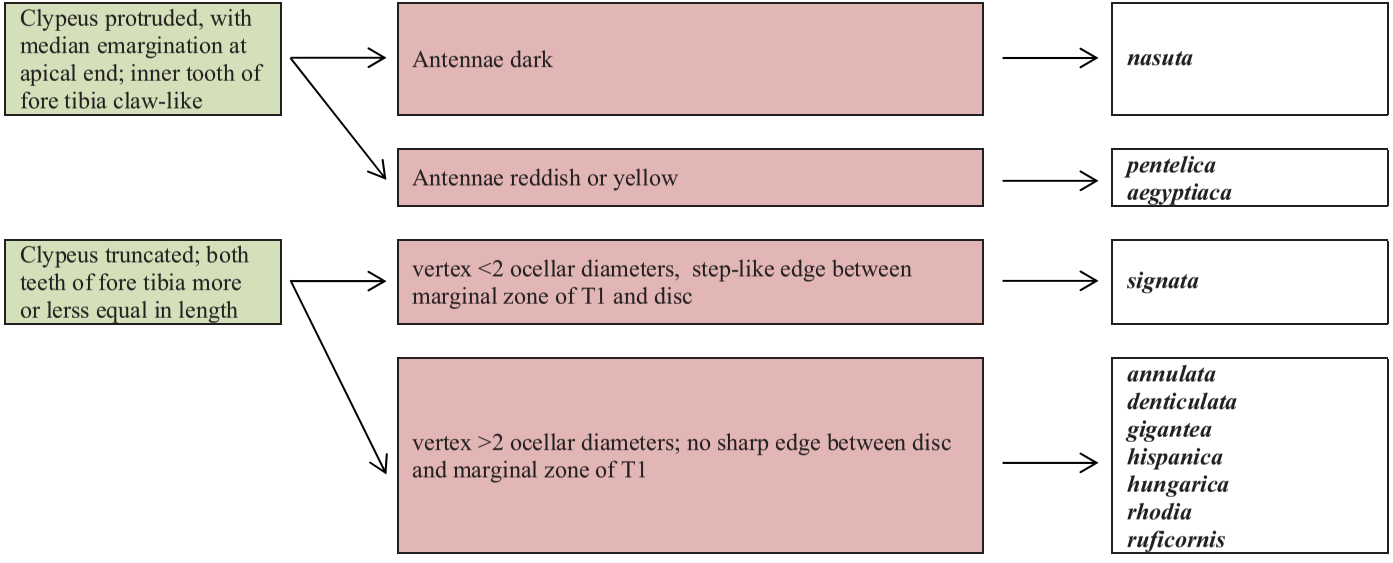
- T7 with a short median tooth; dark comb of S4 short, extending over hardly one fifth of its apical margin; S2 and S3 almost without hairs, S5 flattened ..... 23

23 Interantennal distance almost as long as antennal diameter, area between antennal sockets almost carinated; scutellum slightly wider than long ..... *Stelis denticulata*

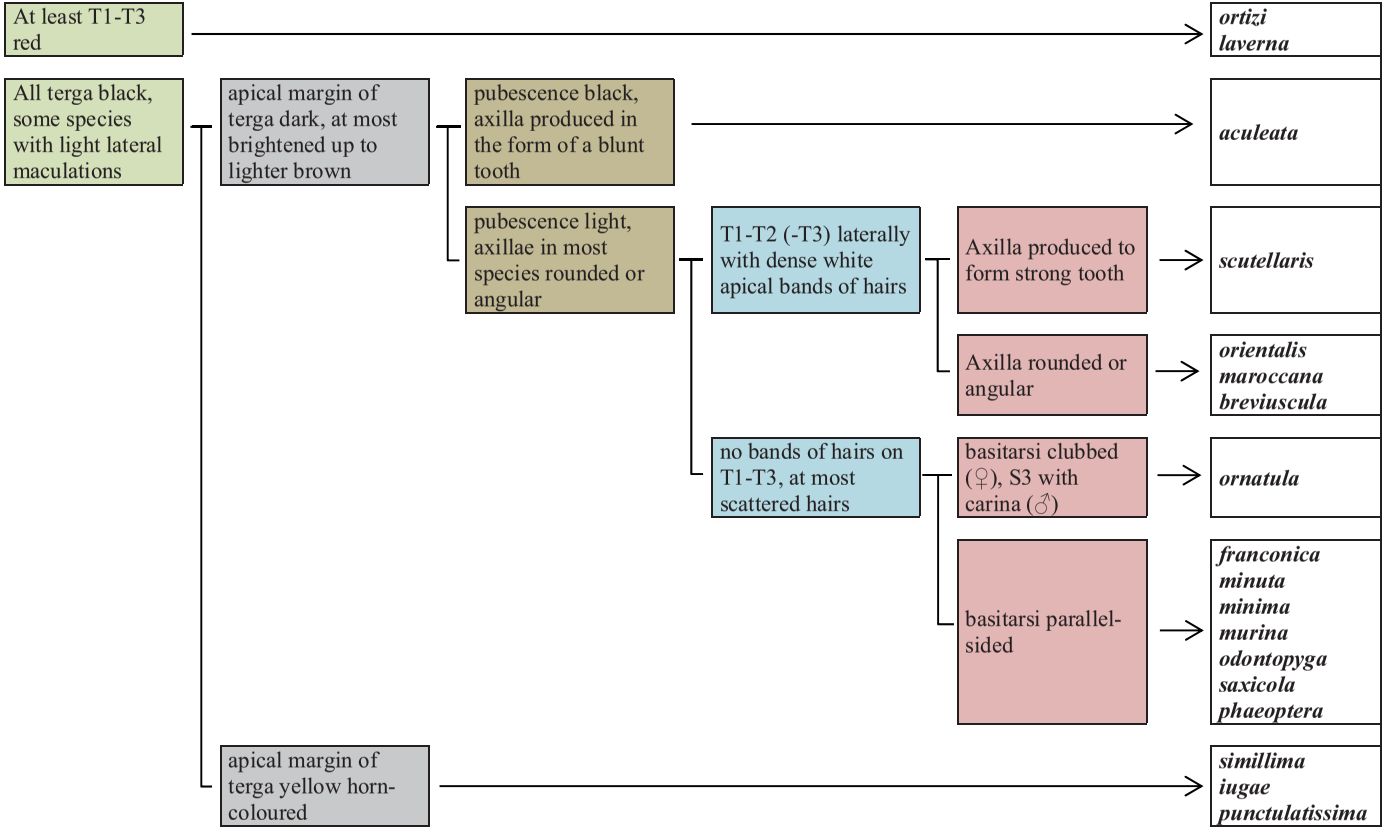
- Area between antennal sockets flattened, interantennal distance two antennal diameters long, becoming three diameters towards frons; scutellum almost 2.5 times wider than long ..... *Stelis rhodia*

## The genus *Stelis*: Principal Identification Scheme (simplified)

### Group 1: Legs yellow or red, terga with yellow



## Group 2: Legs black or dark brown



# Species Accounts

The species are listed here in alphabetical order.

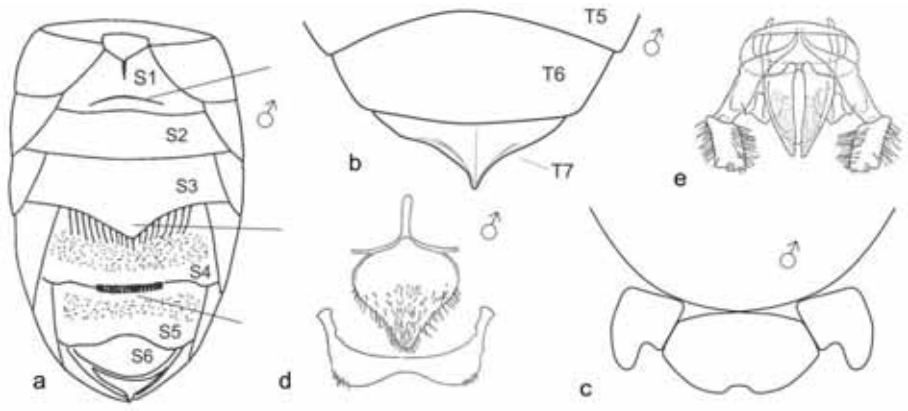
## *Stelis aculeata* Morawitz, 1880

**Synonymy:**
*Stelis aculeata* Morawitz, 1880. Bull. acad. sci. St. Petersbourg 26: 374-375 (Mongolia).

**Identification**: With 9-12 mm a relatively large member of the genus. A Central Asian species, whose distribution extends as far west as Turkey.

Both sexes are dark brown to glossy black and are characterised by a dark brown or black pubescence, while the pubescence of all other *Stelis* species with dark body is light (mostly grey). Axillae produce in both sexes in the form of relatively long teeth, while they are rounded or angular in most other dark *Stelis* species. An exception is *S. scutellaris*, whose axillae are also produced in the form of relatively long teeth. Habitus and colouration are similar to *Stelis phaeoptera* and *S. franconica*, but can be distinguished from them by the colouration of the pubescence and in males also by the form of the apical tergum T7. Moreover, the third antennal segment is slightly longer than the forth in *aculeata*, while it is shorter than the forth in *phaeoptera* and *franconica.*

***Female***: Apical tergum T6 short, laterally angulate and with dense pubescence; apical margin formed by a sharp horn-coloured carina.




*Stelis aculeata*, male. **a.** Underside of the male abdomen. Note the transverse carina on S1, the V-shaped projection of S3 and the width of the black comb of S4 which is as wide as about half of the width of the sternum. **b.** Terminalia. Note the carinated form of the elongate T7. **c.** Scutellum and axillae. **d.** The "hidden" male sterna S7 and S8. **e.** Genitalia [a. Modified after Warncke (1992). b-c. Drawing by MK after a specimen from Mongolia in SMF. d-e. From: Popov (1935)].

*Stelis aculeata*: male. Above: habitus in lateral and dorsal view. Below: Head and last terga (T6-T7). Note the longitudinal carina on T7. Photographs: MK (material from Mongolia in SMF).

***Male***: Clypeus and supraclypeal area densely punctate, supraclypeal area with an impunctate median line; vertex and preoccipital area less densely punctate with wide glossy spaces between punctures; third segment of antennae slightly longer than succeeding segments; punctures of scutum and terga more distant from each other than their diameters, space between punctures shining; wings dark brown infuscate with black veins; legs black, only tarsi dark brown. T7 pointed with a sharp, shiny, longitudinal median carina; this shape is very characteristic, although Warncke (1992) found that it is similar to *S. phaeoptera*. Apical margin of sternum S3 protruding V-shaped; the dark comb on S4 as wide as approximately half of the width of sternum.

**Biology:** Found in Turkey in late June and July (Warncke 1992, Özbek & Zanden 1993), in Buryatia in Siberia in June and August (Proshchalykin 2007) and in Mongolia in June and July (ZMB). A presumed host is *Hoplitis princeps* (Fateryga et al. 2013).

**Distribution:** From Central Asia (Mongolia, Pamir, Tibet) over Buryatia and Lake Aral to Turkey in the west. Collected in Turkey up to 2200 m (Özbek & Zanden 1993) and in Mongolia at an altitude of 3720 m (ZMB).

Distribution of *Stelis aculeata.*

## *Stelis aegyptiaca* Radoszkowski, 1876

**Synonymy:**

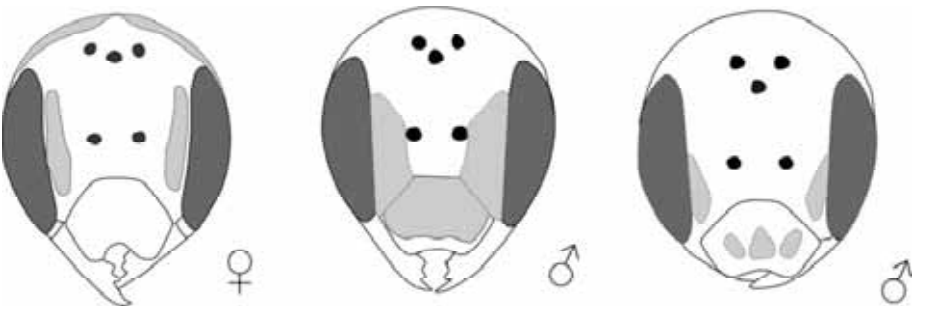
*Stelidomorpha aegyptiaca* Radoszkowski, 1876. Horae Soc. ent. Ross. 12: 120 (Egypt).
*Stelis vachali* Pérez, 1895. Esp. nouv. Melliferes Baibarie, Bordeaux, p. 22 (Tunisia).
*Stelis thebaidis* Friese, 1899. Ent. Nachr. 25: 284 (Egypt).
*Stelis aegyptiaca* ssp. *canaria* Warncke, 1992. Entomofauna 13: 361 (Canary Islands, Spain).
*Stelis aegyptiaca ssp. fuerteventurae* Tkalců, 1993. Veröff. Überseemus. Bremen 12: 792 (Canary Islands, Spain).

**Identification:** Small species (5.5-9 mm) whose range extends from the Canary Islands over North Africa to the Persian Gulf. It has conspicuous yellow markings on head, thorax and terga. The species belongs together with *nasuta* and *pentelica* to the *Stelidomorpha* subgenus, whose members are characterised by a protruded, medially emarginate clypeus and the claw-like form of the inner tooth of the fore tibia.

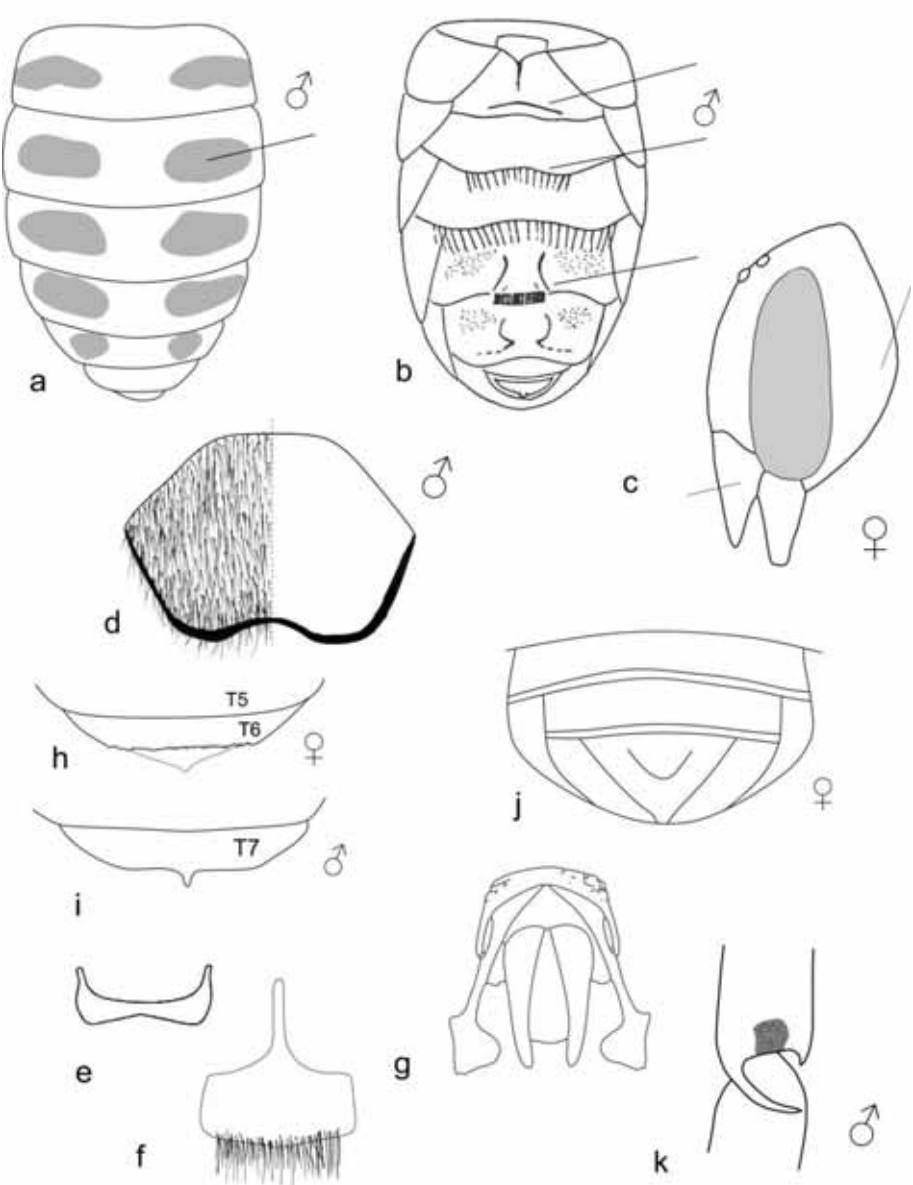
The species is distinguished from the closely related *nasuta* by having on each tergum two large yellow maculations rather than four. The propodeum has a well-developed horizontal basal area and a sculptured (not smooth) posterior surface. The species is further distinguished from *nasuta* by reddish or ochreous (not dark) antennae. Usually, the first segments of the antennae of *aegyptiaca* are dark brown, the others ochreous. Mandibles reddish-brown. The clypeus of the male is mostly entirely off-white, but sometimes this colouration is confined to two or three maculae (in *nasuta*, the clypeus has usually white spots and is rarely entirely white). Face of male with long white pubescence. Another characteristic feature of the male is the shape of the third and forth sternum: two hairless spots at each side of S3; fringe of hairs at the apical margin of S3 extend over entire length in *aegyptiaca*, but are confined to the median area in *nasuta*.

*Stelis aegyptiaca* in lateral and dorsal view (male from Egypt in SMF). Photographs by MK.

*Stelis aegyptiaca.* Left a female, right male. Note in particular the different clouration of clypeus (specimens from Egypt in SMF). Photographs by MK




Head of *Stelis aegyptiaca* (frontal view). Yellow maculations shown in light grey. Left: female, middle and right: males. Note the differences in the extension of the yellow maculations in the paraocular area and on clypeus. – Source: Redrawn by MK after Noskiewicz (1961).




*Stelis aegyptiaca*. **a.** Abdomen, ♂, dorsal view; **b.** Abdomen, ♂, ventral view. **c.** Head, ♀, lateral view. **d.** Clypeus, ♂. **e-f.** The "hidden" male sterna S7 and S8. **g.** Male genitalia. **h.** Female terminalia. **i.** Male terminalia. **j.** Ventral view of apical end of female abdomen. **k.** Female mandible. **l.** Male fore tibia. – *Sources*: a, c, e-j. Redrawn from Noskiewicz (1961) by MK; b. Modified after Warncke (1992); d, k, l. Drawn by MK after specimens from Egypt and Turkey in SMF.

*Stelis aegyptiaca*, female. Head in dorsal view. Note the uninterrupted reddish-yellow anterior band. The vertex is unusually long in this specimen from Egypt. Specimen in SMF. Photograph: MK.

The length of the vertex is usually approximately 3 ocellar diameters in females and 2-3 ocellar diameters in males, while it is 5 respectively 3 diameters in *pentelica*. There is, however, some overlap and this character should not be used to distinguish *aegyptiaca* from *pentelica*.

A very detailed description of the male and a re-description of the female is given by Noskiewicz (1961) based on a larger series. Warncke (1992) described on the basis on a single male the subspecies *canaria* from Canary Islands, which is distinguished from the nominate subspecies, among others, by an almost entirely dark clypeus, the confinement of the yellow colouration in the paraocular area to its lower end, and a reddish-yellow colouration of the hind margin of vertex and scutellum. Tkalců (1993) shortly after Warncke described the subspecies *fuerteventurae* also from the Canary Islands without being aware of Warncke's description of *canaria*, and so *fuerteventurae* is apparently a synonym of *canaria*.

**Biology:** The species appears already in February in the Persian Gulf and in Egypt, the latest record is from June in Turkey. Aguib et al. (2014) recorded the species in Algeria on the wing at *Antirrhinum ramosissimum* Coss. & Durieux (Scrophulariaceae) and *Atractylis serratuloides* (Cass.) (Asteraceae).

**Distribution:** The distribution area extends from the Persian Gulf over Turkey, the Levant and North Africa to Spain and includes the Canary Islands.

Distribution of *Stelis aegyptiaca*. Note the occurrences in Canary Islands and the U.A.E.

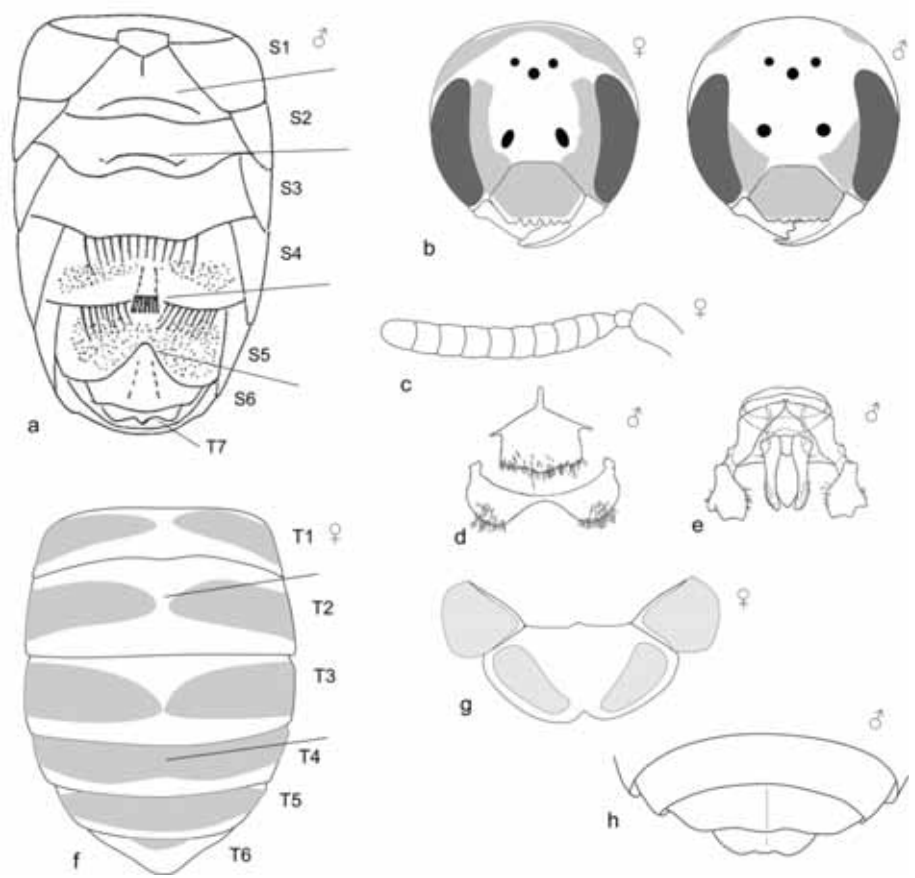
## *Stelis annulata* (Lepeletier, 1841)

**Synonymy:**
*Anthidium annulata* Lepeletier, 1841. Hist. Nat. Insect. Hym. 2: 388-389 (France).
*Stelis frey-gessneri* Friese, 1885. Ent. Nachr. 11: 83-84 (Switzerland).
*Stelis (Protostelis) freygessneri* Friese, 1885.

**Identification:** An uncommon, medium-sized to large species (8-12.5 mm) with much yellow on head, mesosoma and abdominal terga. It can easily be confused with *Anthidium* and was originally described in this genus. *Stelis freygessneri* is today mostly regarded as synonymous with *S. annulata*, although some authors still treat it as good species. *Stelis hungarica* and *S. hispanica* are very close relatives of *S. annulata*, and are difficult to distinguish (see under these species). Schwarz & Gusenleitner (2010) recently provided evidence that *S. hispanica* is actually a separate taxon. As *S. hungarica* and *S. hispanica* are known only from their female holotypes, little can be said about individual variation, overlap in characteristic features and finally on possible synonymy.

*Stelis annulata* is characterised by its black ground colour with rich yellow maculations on body and legs in both sexes. Specimens from southern parts of the distribution area (Mediterranean region) are normally richer in yellow colouration compared to more

*Stelis annulata* (male): Habitus dorsal and head (upper row) and habitus lateral under underside of abdomen (lower row). Ex coll. Kasparek. Photographs: MK.




*Stelis annulata*: **a.** Male, underside of abdomen. **b.** Head (left female ["S. frey-gessneri"], right male). **c.** Head and antenna of female. **d-e.** Sternum S7-S8 and genitalia of male; **f-g.** Terga and scutellum of female; **h.** Male terminalia. – *Sources*: a. Modified from Warncke (1992). b [female], c, f-g. Redrawn by MK from Noskiewicz (1962). b (male). Drawing after a specimen from Turkey by MK. d-e. From: Popov (1933). h. Drawing by MK after specimens from Turkey.

northern (Central European) specimens. The yellow spots on scutellum sometimes absent. Antennae red or reddish in both sexes, apical margin of clypeus crenulate. Scutellum with sharp, translucent apical margin.

Male tergum T7 protuberant with three obtuse teeth (the median one sometimes slightly acute), but sometimes apical margin only undulated without clear teeth. T6 and occasionally also T7 with longitudinal median carinae, sometimes inconspicuous or even absent. Black comb on S4 longer than wide with approximately 12 straight bristles (not bent at the end). S5 deeply V-shaped emarginate (similar to *S. gigantea*). Axilla projecting with rounded to slightly acute angles.

**Biology:** Flight season in Switzerland given as July to September by Amiet et al. (2004). Found in Turkey in May (coll. Kasparek, OLL) and June and July (Schwarz & Gusenleitner 2010), in Italy in July (Schwarz & Gusenleitner 2010), in Spain already in April, and again June, July and August (Dusmet & Alonso 1921, Ornosa et al. 2009, Schwarz & Gusenleitner 2010), and in Bulgaria in June (Schwarz & Gusenleitner 2010). The host is *Trachusa interrupta* (Friese 1895, Mavromoustakis 1960). Found feeding on *Scabiosa* together with its host (Schmiedeknecht 1907). M. Kasparek (unpubl.) found it in SW Turkey in 2013 together with *T. interrupta* on *Scabiosa*.

**Distribution:** Mediterranean region extending from Algeria in the west to Turkey in the east. In the north its range extends to France and Switzerland. In Hungary, it is regarded as extinct (Józan 2011), but this may actually refer to *Stelis hungarica*.


Distribution of *Stelis annulata*, *S. hispanica* and *S. hungrica*. Both *S. annulata* and *S. hispanica* have been found in Spain.

## *Stelis breviuscula* (Nylander, 1848) [Small Dark-bee]

**Synonymy:**

*Heriades breviuscula* Nylander, 1848. Notis. Sällsk. Fauna Flora Fenn. Förhdl. 1 (Adnot.): 272-273 (Sweden).
*Stelis breviuscula* Nylander, 1852. Notis. Sällsk. Fauna Flora Fenn. Förhdl. 2 (Adnot.): 106.
*Stelis pygmaea* Schenck, 1853. Jahrb. Ver. Naturk. Nassau 9: 204 (Germany).
*Heriades paxillorum* Chevrier, 1872. Mitt. schweiz. ent. Ges. 3: 506-508 (Switzerland).
*Stelis pusilla* Morawitz, 1867. Horae soc. entomolog. Ross. 5: 70.

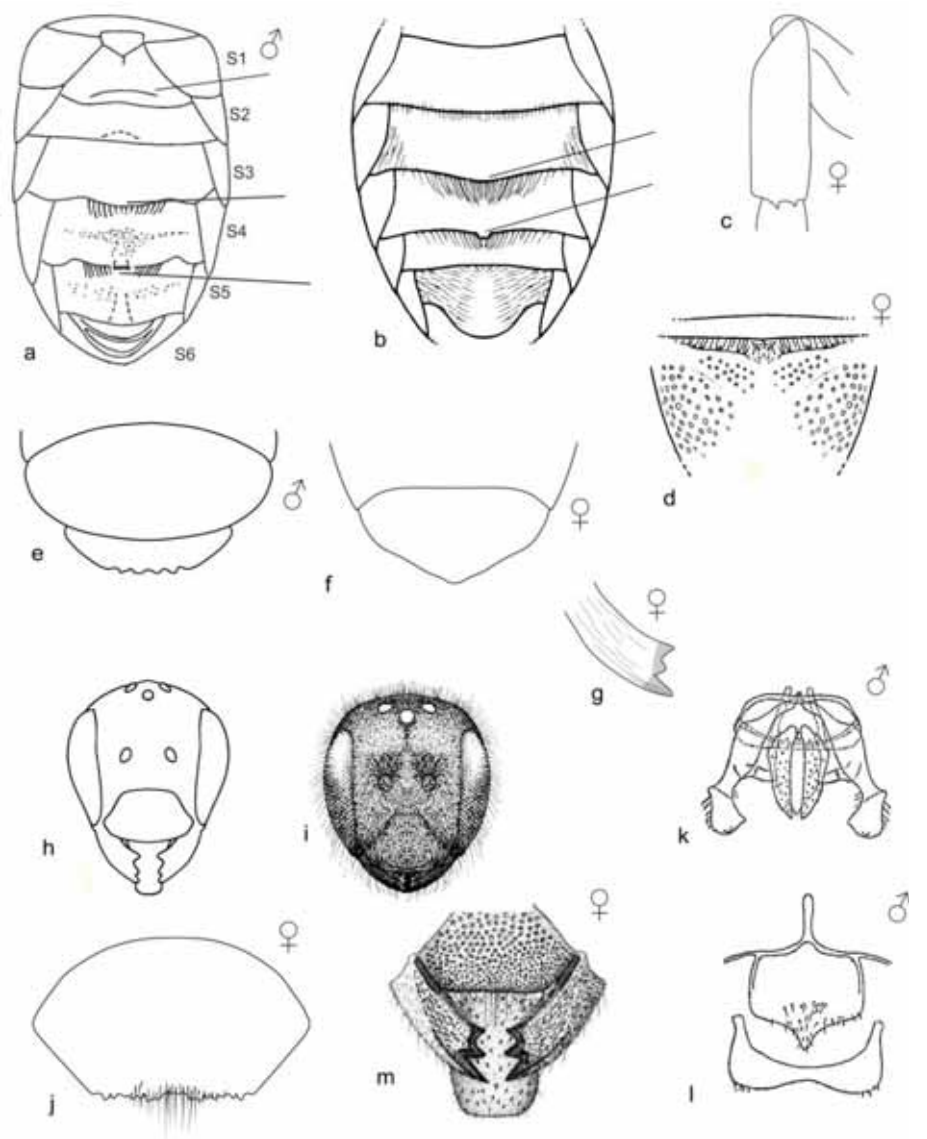
**Identification:** Small species (4.5-7 mm) with a habitus similar to *Stelis minuta* and *S. minima*. Can be distinguished from these species in both sexes by the elongated head, which is clearly longer than wide (almost round in *minuta* and *minima*). Compared with its congeners, the species is relatively abundant; its preferred host is in Central Europe the mason bee *Heriades* (= *Osmia) truncorum*, which has a similar habitus and with which it can be confused at first view. *S. breviuscula* also closely resembles *S. phaeoptera* but the majority of specimens of the former are considerably smaller than those of the latter.

*Stelis breviuscula*, female. Habitus dorsal and lateral, and head. Note the apical fringes of white hairs on terga and the elongated head, which is almost round in the closely related species *minuta* and *minima*. Clypeus densely punctate. Specimen from Germany in SMF. Photographs: MK.

***Female***: Body black with white pubescence; clypeus dark brown, truncate with crenulated apical margin, coarsely and densely punctate at the base (punctures almost touching each other), but finer towards the median end. Mandibles wide, dark brown, tridentate, with one large tooth distally and two smaller teeth proximally; teeth black. Labrum elongated, scarcely punctate, shining. Antennae short. Head and scutum densely punctured.

Propodeal triangle shining, relatively densely punctate, carinated at the base. – Terga with coarse and dense punctation and narrow, white apical fringes of dense of white hairs. On T6, no fringe of hairs, but irregularly scattered, relative long erect hairs. T6 convex with flat wide margin. Sterna with fringes of hairs; apical margin of S4 convex; S5 in the middle dull black with a velvet-like surface.

***Male***: Body colouration and pubescence similar to female, but slightly more compact; punctation on head and scutum coarse and dense; clypeus slightly finer punctate,

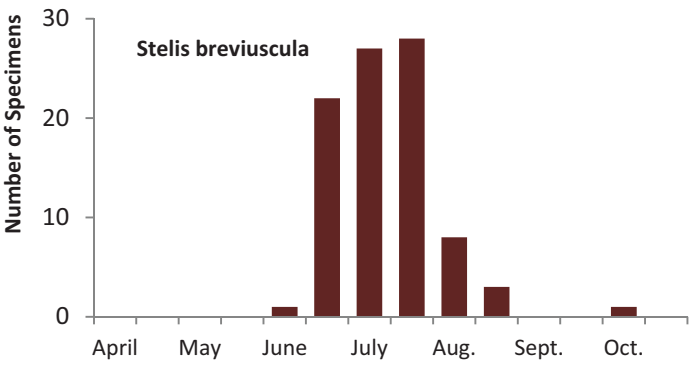



*Stelis breviuscula*. **a-b.** Male abdomen, ventral views. Note the different drawings as regards pubescence and shape of S5. **c.** Fore tibia, female. **d.** Propodeal triangle. **e-f.** Apical tergum: male (left: e) and female (right: f). **g.** Mandible of female. **h-i.** Face, frontal view. Note the elongated shape. **j.** Clypeus of female. **k-l.** Genitalia and hidden sterna S7+S8 of male. **m.** Clypeus and mandible, female. – *Sources*: a. Modified after Warncke (1992). b, d, h. From: Scheuchl (2006). c, e, f, g, j. Drawings after specimens in SMF by MK. i. From: Amiet et al. (2004). k-l. From: Popov (1933). m. From: Ornosa et al (2009).


*Stelis breviuscula*, female. Clypeus and mandibles. Specimen from Germany in SMNS. Photograph: MK.

truncated; propodeal triangle as in female. – Terga with narrow, apical white bands of hairs as in female; punctation of terga coarse and dense; T7 rounded; S2 coarsely punctate, punctures on disc scattered, therefore shining. S3-S4 depressed with long, reddish-yellow hairs laterally.

**Biology:** Main flight season June to July/August with occasional records in May and September. The species is not abundant and can rarely found on flowers; more frequently it is found sitting on old trunks of trees or fences. Friese (1895) found it on melilot *Melilotus* (Fabaceae), Elfving (1968) in Finland on fireweed, *Chamaenerion angustifolium* (Onagraceae), large-flower fleabane, *Erigeron grandiflorus* and aspen fleabane, *E. speciosus* (Asterales), common madia, *Madia elegans*, goldmoss stonecrop, *Sedum acre* (Crassulaceae), and corn sow thistle, *Sonchus arvensis*( Asteraceae). Else (2012) listed from the United Kingdom fleabane (*Pulicaria dysenterica*) (Asteraceae), hawkweed (*Hieracium* sp.) and ragwort (*Senecio jacobaea*), all belonging to the family Asteraceae.




Flight season in Germany (redrawn after: Wildbienenkataster 2013).

Westrich (1989) mentions *Inula salicina*, *Achillea millefolium*, *Tanacetum vulgare*, *Tripleurospermum inodorum*, *Senecio jacobaea*, *Cirsium vulgare*, *Sonchus arvense*, *Picris hieracioides*, *Hieracium pilosella*, *Jasione montana*, *Rubus fruticosus*, *Knautia arvensis*, and *Sedum acre*. Also found on Canada golden-rod *Solidago canadensis* (Warncke 1981).

*Heriades (= Osmia) truncorum* is the preferred host of *Stelis breviuscula*, and this has been confirmed through captive breeding (Westrich 1989). Ivanov & Kobetskaya (2011) made observations on *S. breviuscula* in Ukraine parasitizing *Heriades crenulatus* (see also Westrich 1989). There is evidence that it also parasitizes at least occasionally *Osmia rapunculi (= O. fuliginosa = Heriades nigricornis)* and *Hoplitis adunca* (Friese 1895, Schmiedeknecht 1907, Warncke 1992, Westrich 1983, 1989). The habitus of *S. breviuscula* is relatively similar to its hosts or presumed hosts.

**Distribution:** Widely distributed from North Africa and Europe up to 63° N (Central Sweden, Finland) to West and Central Asia. The range includes the Middle East from Egypt to Turkey, from where it extends to Transcaucasia. In Switzerland, found up to 1500 m (Amiet et al. 2004).

Distribution of *Stelis breviuscula*.

## *Stelis denticulata* Friese, 1899

Synonymy:

*Stelis denticulata* Friese, 1899. Ent. Nachr. 25: 337-338 (Palestinian Territories, nec Israel).

*Stelis wahrmani* Mavromoustakis, 1954. Bull. Res. Counc. Israel 4: 274-275 (Israel).

**Identification**: 5.5-6.5 mm. A small East Mediterranean species with rich yellow markings on head, thorax and terga. It resembles *Stelis signata*. While the last tergum (T7) in male *S. denticulata* is emarginate and has a small median hump, it is protuberant in *signata* and has a relatively large median tooth on a wide base. The apical margin of the clypeus is irregularly dentate in *denticulata* (name!), while it is crenulate in *signata*. Female *denticulata* can be distinguished from *signata* also by the red underside of the abdomen.

*Stelis denticulata*, female. Habitus in dorsal and lateral view and underside of abdomen. Note the characteristic reddish-brown ground colour of the abdomen underside. Specimen from Turkey in SMF. Photographs: MK.

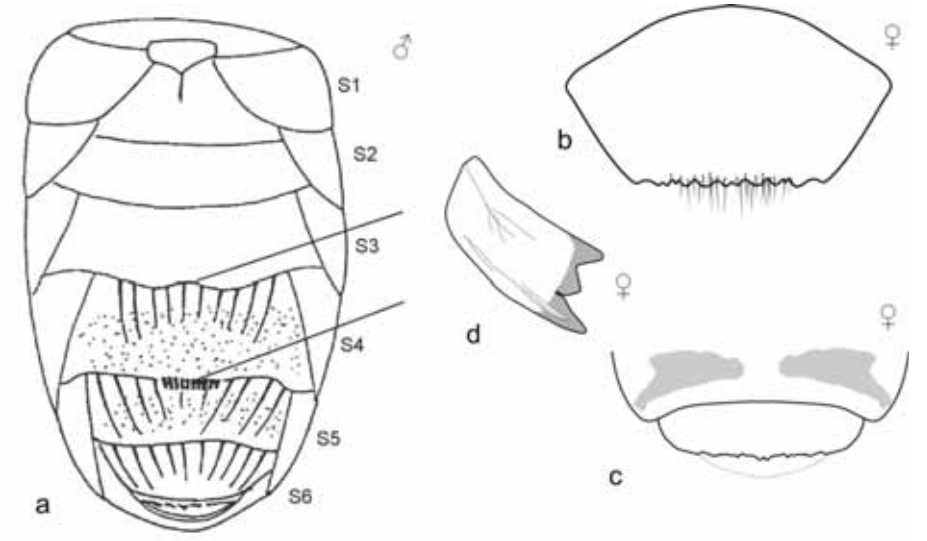
*Stelis denticulata* is also similar to *S. rhodia*, from which it can be distinguished best by the closeness of the antennae: the distance between the antennal sockets is only about one antennal diameter in *denticulata*, but at least two diameters in *rhodia*. There is a small interantennal carina in *denticulata*, but the area is flat in *rhodia*. The scutellum including axillae is about twice as wide as long in *denticulata*, but 2.5 times as long as wide in *rhodia*.

Head of *Stelis denticulata*. Left female, right male. Note the close distance between the antennal sockets, which is characteristic for this species. Both specimens from Turkey in SMF and OLL. Photographs: MK and OLL.

*Stelis denticulata*. Left: Clypeus and mandible of female; Right: apical terga of male. Both specimens from Turkey in SMF and OLL. Photographs: MK and OLL.

Intraspecific variation concerns mainly the extent of yellow colouration. In general, specimens from the Levant have more yellow than those from Turkey. The maculations, which are usually yellow, are reddish-brown in some animals. Mavromoustakis (1954) described *Stelis wahrmani* with a slightly depressed black disc of the much protruding scutellum and a wide and nearly parallel-sided T6, whose apical margin is nearly straight and crenulate (female). He believed that these characters are so unique that this taxon is not related to any of the known Palaearctic species of *Stelis*. However, Warncke (1992), after re-examining the type material, put it into synonymy with *S. denticulata.*

***Female***: Head and thorax coarsely, rugosely punctate, punctation of terga finer; clypeus twice as wide as long, dark brown to ochreous (lateral parts often lighter, sometimes




*Stelis denticulata.* **a.** Sterna of male. **b.** Female clypeus. **c.** Apical terga T5-T6 of female (the fine dotted line shows the apical sternum, which is visible from above; the yellow maculae are indicated in the drawing in grey). **d.** Female mandible. – *Sources*: a. Modified from Warncke (1992). b-d. Drawings by MK after a specimen from Turkey in SMF.

almost yellow), apical margin dentate. Paraocular area yellow. Mandibles red-brown to light brown with three black teeth. Antennae red to red-brown, becoming darker distally. 2nd segment of antennae as long as 3rd one, but much shorter than 4th one. Yellow or reddish-yellow maculations are present on pronotum, pronotal lobes, scutum, scutellum and mesepisternum. Scutellum overhanging metanotum (postscutellum) and with a median emargination. – Yellow or reddish-brown bands on T1-T5, which are more or less interrupted medially. T6 almost dark, quadrangular, truncate; apical margin finely crenulate; sterna reddish-brown. S6 quadratic. Apical end of S6 often protrudes beyond terga and is thus visible from above. – Legs ochreous to reddish-brown, wings fuscate, veins dark brown.

***Male***: Similar to female, but slightly larger. Clypeus black, with one circular yellow maculation on each side; T6 and T7 entirely black, T7 slightly emarginate and with a small median hump. Sterna (at least S3) concave, S3-S5 with long reddish-yellow hairs.

**Biology:** Found in the Palestinian Territories in April (Friese 1899) and June (coll. Schwarz), in Israel in May (Mavromoustakis 1954) and in Turkey in June and August (Warncke 1992).

**Distribution:** Eastern Mediterranean region: Turkey (Özbek & Zanden 1996), Palestinian Territories (Alfken 1935) and Israel (Mavromoustakis 1954). In Turkey, up to 1800 m (Özbek & Zanden 1996).

Distribution of *Stelis denticulata*.

## *Stelis franconica* Blüthgen, 1930

**Synonymy:**

*Stelis phaeoptera franconica* Blüthgen, 1930. Arch. f. Insektenkde. Oberrheingeb. 2: 277-278 (Germany).

*Stelis franconica* Blüthgen, 1930 [Tkalců 1971: 226].

See also list of synonyms under *S. phaeoptera*.

**Identification:** 9-12 mm. A black *Stelis* species with weak, white pubescence. *Stelis franconica* has been described as subspecies of *S. phaeoptera*, and was later given species rank by Tkalců (1971). While authors such as Westrich (1984), Scheuchl (2006), etc. followed this approach, others including Warncke (1992) continued to treat it under *phaeoptera*. All records on distribution and biology therefore need to be carefully re-examined in order to be sure which of these two taxa they actually refer to.

Often described as larger, more robust and clumsier than *S. phaeoptera*. Actually, there is a broad overlap and this character alone cannot be used for species identification. Both species are difficult to separate from each other and usually more than one specimen from the same locality is needed for unambiguous identification. Punctation on terga T2 and T3 is generally a good character in both sexes: punctures are denser, deeper and larger in *franconica* than in *phaeoptera*. The apical margin of the clypeus is crenulate in female *phaeoptera* (and often slightly emarginate), while it is usually straight in *franconica*. This feature is not always unambiguous. Also the shape of the clypeus (flat in *phaeoptera*, protuberant in *franconica*) and the scutellum (apical end flat to slightly convex in *phaeoptera*, slightly emarginate in *franconica*) may be used as additional character features for identification, although overlap between the two species exists. Pubescence is richer and longer than in *phaeoptera*. Female sterna S3-S4 with long and dense fringe of hairs, S6 with appressed silvery hairs.

**Biology:** Flight season May to June (Banaszak & Romasenko 2001). March to May in Germany (Blüthgen 1930, Westrich 1984), June in the Czech Republic (Tkalců 1971), July in Italy (SMF), May to July in Switzerland (Westrich 1984, Amiet et al. 2004). Cleptoparasite of *Osmia mustelina* Gerstäcker, 1869 (Amiet et al. 2004, Westrich 1984,

*Stelis franconica*: female. Habitus dorsal and lateral, and head frontal. Specimen from Tyrol, Italy, in SMF. Photographs: MK.

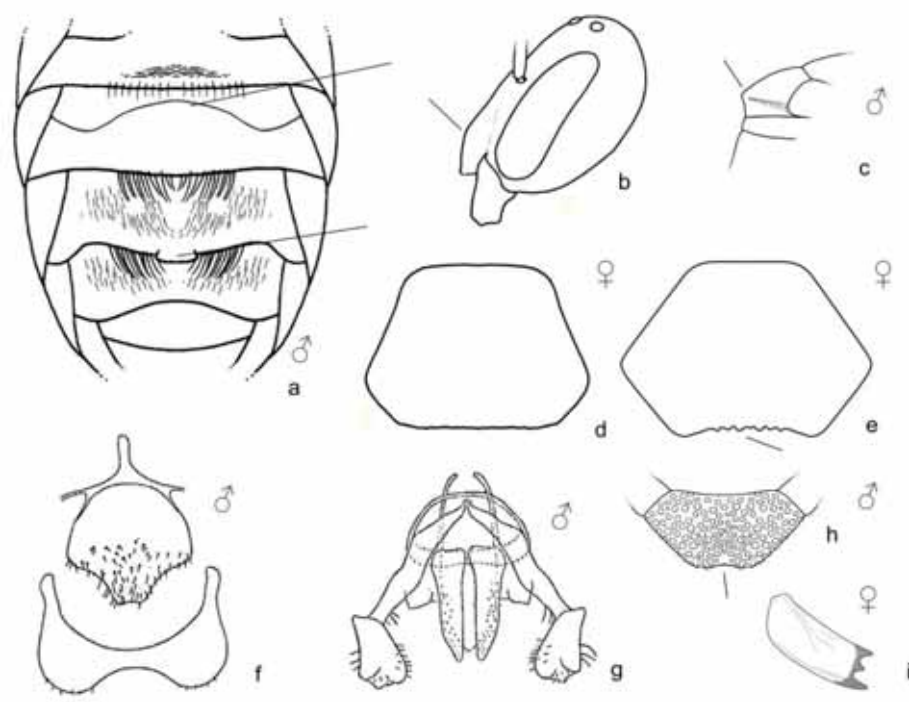
Table: Comparison of some characters of *Stelis phaeoptera* with *S. franconica.*

| | ***Stelis franconica*** | ***Stelis phaeoptera*** |
|---|---|---|
| Length | 8-12 mm | 6-11 mm |
| Scutellum | Usually depressed at the apical end, densely punctate | Usually flat, punctures well separated |
| Clypeus | Convex. Usually no distinctive teeth. | Apical end usually crenulate. |
| Tergum 1 | More coarsely punctate than scutum medially | Punctation of T1 and central scutum similar. |
| Tergum 2-3 | Densely punctate, punctures separated by usually 1 to 2 times their diameters, in males often less than one diameter. Punctures usually deeper and larger than in *phaeoptera*. | Distance between intended punctures usually 2 to 4 times their diameter. |
| Sternum 3-4 | Females: With dense apical fringe of hairs | Apical fringe of hairs less dense, hairs shorter |
| Sternum 6 | Females: Apical fringe of hairs yellowish to silvery | Apical fringe golden yellow |

Comparison of the puctation of terga of female *Stelis franconica* (left) and *S. phaeoptera* (right). Note the denser and coarser punctation in *S. phaeoptera*. Females from Italy (*S. franconica*) and Germany (*S. phaeoptera*) in SMF. Photographs: MK.


Comparison of the sterna of female *Stelis franconica* (left) and *S. phaeoptera* (right). Note the denser and coarser punctation in *S. phaeoptera*. Note the relatively long, light fringe of hairs on the apical margin of S4 in *S. franconica* (but in this specimen only short, scattered hairs on S3, which is not typical). Females from Italy (*S. franconica*) and Germany (*S. phaeoptera*) in SMF. Photographs: MK.

The scutellum of *Stelis franconica* is densely punctate. Male from Italy(Tyrol) in SMF. Photograph: MK.




*Stelis franconica*. **a.** Ventral side of abdomen, male. **b.** Lateral view of head. Note the protuberant clypeus in both sexes. **c.** Clypeus in lateral view. Note the angular shape (rounded in *phaeoptera*). **d-e.** Clypeus of female. Two different drawings to show the variation of the apical margin. Note the slightly crenulate and emarginate clypeus in the right specimen, which is actually more typical for *S. phaeoptera*, but still falls into the variation of *franconica*. **f.** Sterna S7+S8 of male. **g.** Genitalia of male. **h.** Clypeus from dorsal. Note the slight median depression at apical end; **i.** Mandible of female. – *Sources*: a-d, h. From: Scheuchl (2006). e, i. Drawing by MK after a specimen in SMF. f-g. From: Popov (1933).

1989). This includes *Osmia emarginata* (see e.g. Tkalců 1971), which is regarded as synonymous to *M. mustelina*. Lives sympatrically with *Stelis phaeoptera* and is found together with it in the same habitats (Westrich 1984). Was found in Germany on the wing on Field Scabious, *Knautia arvensis* (Blüthgen 1930). Tkalců (1974) mentions the true thistle *Carduus collinus* and *Jurinea mollis*.

**Distribution:** From Central Europe from northern Italy to Poland, and extending in the east into Central Asia. Ebmer (2009) reported records from Eastern Kazakhstan and Wu (2006) from China. The distribution thus exceeds in the east the distribution area of its host, *Osmia mustelina*, which means that the species may have other hist species there (Ebmer 2009). As *S. franconica* is treated as subspecies of *S. phaeoptera* by some authors, most distribution records need careful re-examination and confirmation.

In the Swiss Alps, up to 2000 m (Amiet et al. 2004), in Kazakhstan, up to 1400 m (Ebmer 2009) and in China, up to 2400 m (Wu 2006).

Distribution of *Stelis franconica*. The occurrence in the Russian Federation is given according to Fauna Europaea (no details available).

## *Stelis gigantea* Friese, 1921

**Synonymy:**

*Stelis* (*Prostelis*) *gigantea* Friese, 1921. Arch. Naturg. 87 A, 3: 175-176 (Turkey, nec Armenia).

*Stelis gigantes* Friese, 1921 [mis-spelling by Warncke 1985].

**Identification:** 12-14 mm. This species has been described as the largest species of the genus ("*gigantea*"!), but some other species reach or almost reach this species' size including *S. aculeata*, *S. hispanica*, and *S. ruficornis*. The size alone should therefore not be used for identification.

*Stelis gigantea* is a rare species whose female has not been described. However, Warncke (1992) included it in his key without providing detailed information, apparently on the basis of a specimen from Iran (leg. Mavromoustakis) which is today deposited in the coll. Schwarz. The species is not unsimilar to *Trachusa pubescens* and *T. laticeps*, its presumed hosts. However, males can easily be distinguished by the unarmoured apical end of the abdomen and some depressed sterna. Some characters are similar to *Stelis hispanica*, and as both species are known only from a very limited number of specimens, the overlap between the two species in morphological and colour features needs to be examined.

***Female***: Vertex 4 ocellar diameters long. The interspaces between the punctures on vertex and scutum narrow, smooth and shining. Apical end of scutellum widely rounded on both sides, emarginated medially. Axilla produced in the form of a strong, blunt tooth projecting posteriorly. Pubescence on vertex and the outer side on hind tibia more than two antennal diameters long.

***Male***: Punctation of head and scutum relatively coarsely wrinkled, almost dull. Head longer than wide, small, and much less wide than thorax. Clypeus almost twice as wide as long, almost entirely yellow with the exception of a small dark brown spot at the base;

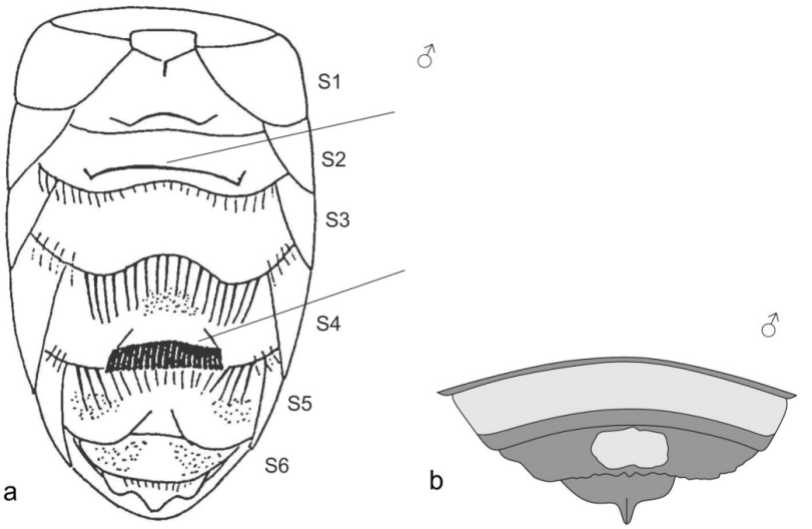

*Stelis gigantea*. Habitus. Left: Female from Iran, right: male from Turkey. Material in OLL. Photographs: OLL.

*Stelis gigantea*. Left: Female from Iran, right: male from Turkey. Note the differencein the extension of yellow colouration on supraclyperal area and frons. Material in OLL. Photographs: OLL.

apical margin black and crenulate. Labrum and mandibles dark brown to black. Paraocular areas yellow. Small yellow maculations at each side of vertex. Antennae relatively short. Scutum dark, without yellow markings, with relatively long ochreous hairs; scutellum densely punctured, partially wrinkled; axilla elongated posteriorly to form a tooth. – Terga T1-T2 with elongated yellow spots on each side, T3-T5 with wide yellow bands notched in the middle (band on T3 sometimes interrupted), and T6-T7 entirely black. T6 has a reddish base, T7 very short, with obtusely tridentate shape. The dark comb on T4 almost half of the width of sternum, consisting of approximately 50 points; the points of the comb straight, not bent inwards; sterna S1-S3 emarginate medially, especially S3; S2


*Stelis gigantea*, abdomen. Above left: Female from Iran, above right: male from Turkey. Below: ventral view of male from Turkey. Note the shape of S3, the bright yellow fringes of hairs and the width of the dark comb. Material in OLL. Photographs: OLL.

with a median, semicircular carina, almost half the width of sternum; S3 with long yellow to reddish hairs; S5 deeply, V-shaped emarginate; S1-3 punctured, S4-S5 almost smooth and slightly shining. – Legs black, apical end of femur and tarsi reddish-yellow; pubescence of legs yellowish; wings infuscate, veins brown; tegulae rufous, anterior side yellow; pronotal lobes black with a dense reddish-yellow pubescence.




*Stelis gigantea*. Left underside of the male abdomen, right dorsal view of terminal terga T5-T7 (left modified after Warncke 1992, right drawing by MK after material in OLL).

**Biology:** Found on the wing in May, June and July. Collected at Pale Viper's-bugloss *Echium italicum* (Zanden 1998). Friese (1921) assumes *Trachusa pubescens* being the host of the species, while Standfuss et al. (2003) supposes *Trachusa laticeps* as a host. Confirmation is needed in both cases.

**Distribution:** The distribution range extends from Greece over Turkey to Iran. Armenia is often wrongly cited; the record from Iran (Warncke 1985) was omitted by the same author in his review (Warncke 1992). Close to sea level in Greece (Standfuss et al. 2003) and up to 1300 m in Turkey (Warncke 1992).

Distribution of *Stelis gigantea*.

## *Stelis hispanica* Dusmet & Alonso, 1921

**Synonymy:**

*Stelis hispanica* Dusmet y Alonso, 1921. Mem. Real. Soc. Espan. Hist. Nat. 50 (Jubiläumsband): 184-185 (Spain).

**Identification:** 12 mm. A very rare species, which is only known from its female holotype. The species has been treated as synonymous with *Stelis annulata* by Warncke (1992), and has only recently been regained species status through the work by Schwarz & Gusenleitner (2010), who found after re-examining the holotype that it is a "completely different species". *Stelis hispanica* is also similar to *S. hungarica* and *S. gigantea*.

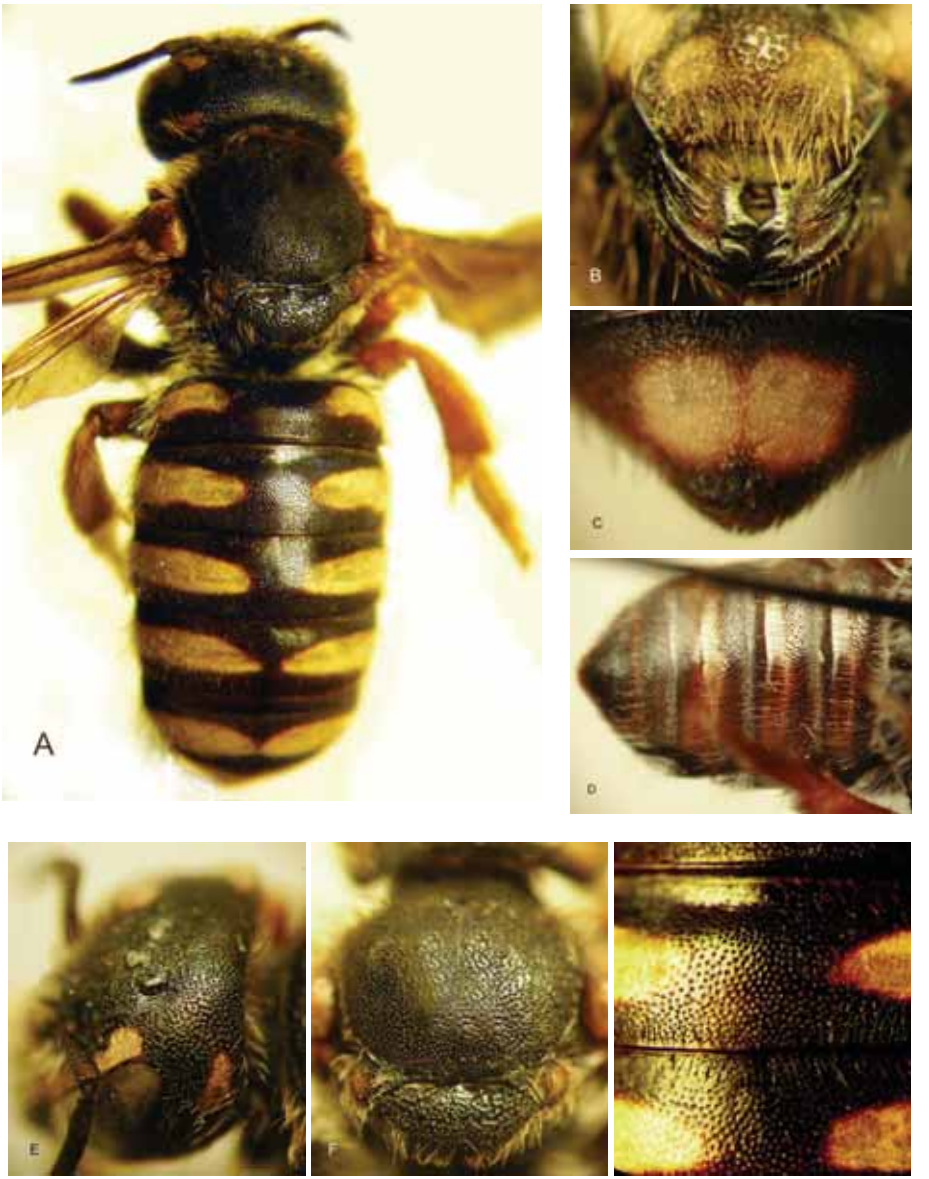
The general appearance is similar to *Stelis annulata*: a medium- to large-sized *Stelis* species with a conspicuous black-yellow colour pattern. The yellow lateral maculations of the abdomen increase in size from T1 to T5, and meet on T5 in the middle, where they form a band extending over one side to the other. On T6, there is a somewhat blurred almost rectangular spot. The differences to *S. annulata* are given in the table.

**Biology:** The holotype of this species was under the 4$^{th}$ sternum infected by the parasite *Stylops* sp., a Strepsiptera (Dusmet & Alonso 1921). The holotype was collected in June.

**Distribution:** Only known from Spain (Dusmet & Alonso 1921). See map under *Stelis annulata*.

Table: Comparison of some characters of the females of *Stelis hispanica* and *S. annulata*. Summarised and modified after Schwarz & Gusenleitner (2010).

| | ***Stelis hispanica*** ♀ | ***Stelis annulata*** ♀ |
|---|---|---|
| Clypeus | Wide, convex only in the middle of its basal part; long and dense pubescence; punctation on apical and lateral parts fine and dense, but coarse and scattered at base, interstices between punctures here partly larger than puncture diameter. | Narrower, strongly convex; pubescence inconspicuous, short and appressed, longer hairs only at apical margin; punctation uniform, coarse and dense with very narrow interstices. |
| Vertex | Relatively long, hind margin evenly rounded; punctation relatively fine with distances between punctures almost their diameter. | Shorter, increasing towards the hind margin; hind margin angular. Punctation coarse and dense with very narrow interstices. |
| Punctation of scutum and scutellum | As coarse as on vertex with narrow, but conspicuous interstices. Punctures separated by up to 2 times their diameter. | Punctures convergent, practically without interstices; punctures of scutellum slightly coarser with narrow interstices in the middle. |
| Axillae and scutellum | Outer margins of axillae evenly rounded; apical margin of scutellum rounded, especially medially. | Axilla produced in the form of a small blunt tooth; apical margin of scutellum sharp-edged crenulated. |
| Scutum | With relatively long, erect hairs. | Pubescence very short and appressed; inconspicuous. |




*Stelis hispanica*, female. A: habitus; B: mandibles and clypeus; C: apical tergum (T6); D: underside of abdomen; E-G: punctation of body parts: vertex (E ), mesonotum (F) and scutellum and terga T2-T3 (G). All photographs: M. Schwarz (first published in Schwarz & Gusenleitner 2010).

## *Stelis hungarica* Noskiewicz, 1962

**Synonymy:**

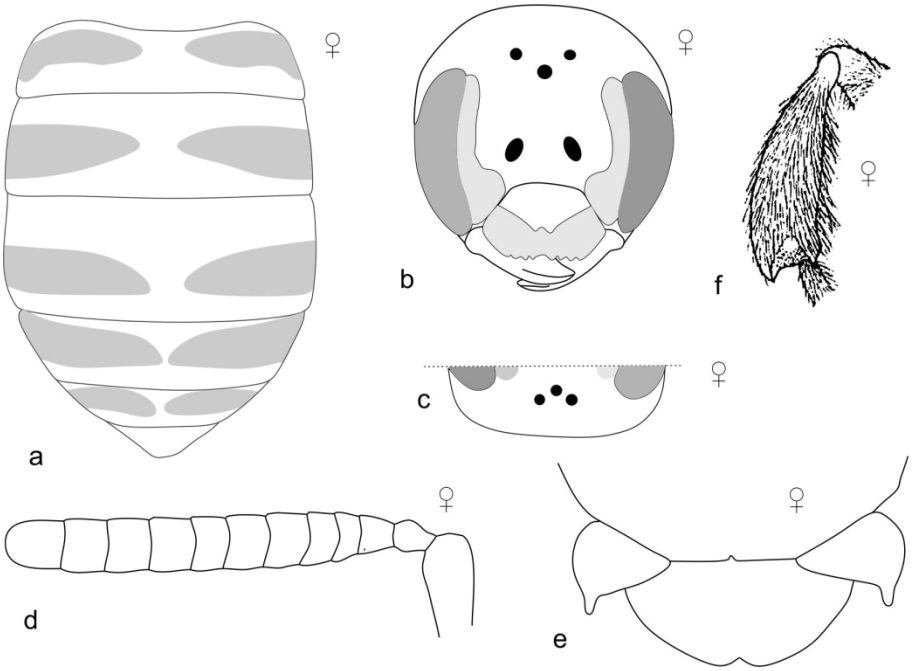
*Stelis hungarica* Noskiewicz, 1962. Bull. ent. Pologne (Polsk. Pismo ent.) 32: 58-62 (Hungary).

Often treated as synonym to *Stelis annulata* (Lepeletier, 1841), for example by Warncke (1992), Kuhlmann (2013), etc.

**Identification**: *Stelis hungarica* is a close relative of both *S. hispanica* and *S. annulata* and some authors regard all three species as conspecific. As *S. hungarica* is only known only from a single female, nothing can be said about individual variation and possible overlap in characters with the other two congeners.

Length: 10.5 mm. General body colouration black, particularly thorax; body clumsy; only pronotal lobes and anterior side of tegulae yellowish. Pale yellow transverse band near the apical end of clypeus; paraocular area pale yellow; apical bands of abdomen also pale yellow: bands on T1-T3 well separated medially, band on T4 notched medially. T6 entirely black. Legs reddish, base of tibia yellowish. Pubescence of body grey-white.

Head in frontal view wider than long. Malar area very narrow, almost non-existent; genae in lateral view slightly wider than eye; vertex long; clypeus approximately twice as




*Stelis hungarica*. **a.** Female abdomen. b. Female head. c. vertrex in dorsal view. d. Antenna. e. Female scutellum. – Source: Noskiewicz (1962), redrawn by MK.

Table: Comparison of some morphological features between female *Stelis hungarica* and *S. annulata*.

| | ***Stelis hungarica*** ♀ | ***Stelis annulata*** ♀ |
|---|---|---|
| Clypeus | Slightly protuberant, black with yellow transverse band close to its apical end; punctation of base coarser and deeper than at apical end; apical margin slightly crenulate with short hairs. | Stronger protuberant, entirely yellow, shallowly and honeycomb-like punctate; apical margin slightly stronger crenulate than in *hungarica*, with long, golden hairs. |
| Vertex | Black. | With yellow transverse band. |
| Antennae | 2nd and 3rd antennal segments conspicuously wider than long. | 2nd and 3rd segments subquadratic. |
| Scutum | Black, only pronotal lobes and partly tegulae yellow; mesepisternum black with dense, long, pale yellow pubescence. | Extended, curved yellow maculation on each side; pronotal lobes, sides of scutellum and axillae yellow. Small yellowish maculation on mesepisternum; short, dense and erect pubescence. |
| Scutellum | Axilla produced in the form of a pointed tooth projecting posteriorly. | Axilla angular, only slightly producing. |
| Terga | Shining, coarsely and densely punctate; spaces between punctures on discs normally the size of their diameter; marginal zones smooth with finer punctation than on disc. Pale yellow bands on terga T1-T4, well interrupted medially on T1-T3, strongly notched in T4. T6 black. | Strongly shining, very coarsely and densely punctate; spaces between punctures narrow; marginal zone very densely punctate, slightly finer than disc. Apical bands of abdomen dark yellow, bands of T1-T3 interrupted medially, T4 only slightly notched. Base of T6 yellow. |
| Sterna | Disc of S2-S4 densely and coarsely punctate; no punctation in the wide, smooth and depressed marginal zones, which are smooth and shining brown. Disc of S5 and S6 with appressed golden pubescence. | Disc of S2-S4 densely and very coarsely punctate, their depressed marginal zones much narrower than in *hungarica*; smooth, reddish yellow. Punctation of S5 similar preceding ones, S6 slightly less densely punctate; appressed golden pubescence only on S6. |

wide as long, truncated, weakly crenulate; punctation of clypeus dense, coarser and deeper at the base and finer and less deep apically; antennae relatively short and thick, 2nd segment slightly shorter than its apical diameter, 3rd and 4th segments wider than long, succeeding segments subquadratic, only the apical one slightly longer than wide. – Pronotal lobes conspicuously large, flat with very fine and dense punctation; scutum weakly shining with coarse and dense, honeycomb-like punctation; punctation on scutellum

similar, but slightly coarser on disc and denser on axillae; axilla elongated tooth-like. Posterior triangular surface of propodeum large and shining with scattered punctures in its centre and with denser punctation marginally. – Abdominal terga coarsely and densely punctate also on depressions; only marginal zone smooth. Distances between punctures on disc of T1-T4 normally up to the size of their diameter, shorter on T5. T6 very densely and finely punctate. Discs of S2-S4 densely and coarsely punctate, but no punctation in the wide, smooth and depressed marginal zones, which are polished brown; S5 and S6 slightly finer punctate than preceding ones, with golden pubescence on disc.

Some characters which separate *hungarica* from *annulata* are given in the table. The similar *S. hispanica* has rounded axillae (not forming teeth), and long, golden hairs in the face (including clypeus) (hairs short in *hungarica*); punctation of terga is much finer and pubescence of terga longer than in *hispanica*. Additionally, *hispanica* has a large, yellow transverse maculation on T6.

**Biology:** Found in June (Noskiewicz 1962).

**Distribution:** Only known from its type locality in Hungary (Noskiewicz 1962). However, *Fauna Europaea* also shows an additional record from north-west Russia (source not given). See map under *Stelis annulata*.

## *Stelis iugae* Noskiewicz, 1962

**Synonymy:**

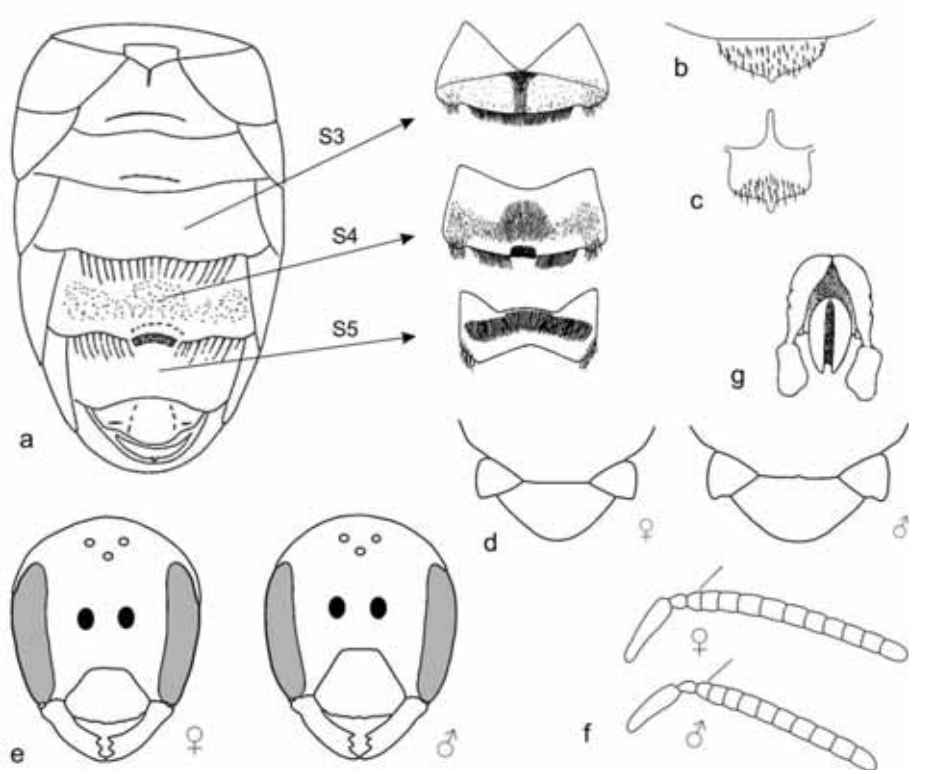
*Stelis iugae* Noskiewicz, 1962. Bull. ent. Pologne (Polsk. Pismo ent.) 32: 62-68 (Romania).

Note: The spelling ***j****ugae*, which is found in various sources (e.g., Banaszak & Romasenko 1999, 2001; Global Name Index; Warncke 1992), is not correct.

**Identification** (6-7.5 mm): A species from southeast Europe and Turkey, closely related to *Stelis odontopyga,* but also not easily distinguished from some other dark *Stelis* species.

Noskiewicz (1962) in his description of this species mentions that the face is as long as wide, but shows in his drawings that it is actually longer than wide. Warncke (1992) gives the elongated face as an important identification feature.

***Female***: Clypeus wide, twice as wide as long; flat to slightly protuberant; apical one third as finely and densely punctate as in *simillima*; punctation becomes slightly coarser and denser towards the base; clypeus almost hairless. Punctation of supraclypeal area coarser; malar area very narrow, almost absent; genal area almost as wide as eye, punctation less dense than on clypeus with distances between punctures less than half their diameter; vertex short; frontal line shiny and extending to the supraclypeal area; antennae short and slender; 2$^{nd}$ segment shorter than its apical diameter; 3$^{rd}$ segment subquadratic, succeeding segments nearly quadratic, only the apical segment longer than wide. – Punctation of terga in general dense and relatively coarse, slightly finer in the depressed marginal zones. Apical margin of terga greyish-brown. Pubescence of body white, relatively long hairs in paraocular areas. Scutum with short, whitish, erect hairs.




*Stelis iugae*. **a.** Male abdomen, ventral view. **b.** Tergum T7 of male. **c.** Hidden sterna S8 of male. **d.** Scutellum and axillae of male and female. **e.** Head of male and female in frontal view. **f.** Antennae of male and female. **g.** Male genitalia. – *Sources*: a. Modified combination from Warncke (1992) and Noskiewicz (1962). b-f. Redrawn from Noskiewicz (1962) by MK.

***Male***: Similar to female. As in female, malar area very narrow, almost absent, and vertex short; clypeus densely and finely punctate, but density of punctation still only half of that of paraocular area; truncated. Antennae slender; 2nd segment shorter than its apical diameter; other segments subquadratic, with the exception of the apical one which is longer than wide. Axilla slightly produced to form an angle or a tooth. – The first 5 terga T1-T5 with narrow, depressed marginal zones, with depressions much finer than discs; very narrow, brownish, shining margin. T7 rounded and (as in *odontopyga*) forming a small apex. Dark comb of sternum S4 as wide as the length of the spur of hind tibia (i.e. approximately one fifth of the width of the apical margin of the sternum). – Head, thorax and terga with short white pubescence, similar to *odontopyga*.

**Biology:** Flight season July and August (Noskiewicz 1962, Warncke 1992). Cleptoparasite of *Heriades truncorum*.

Table: Comparison of some characters of *Stelis iugae* with *S. odontopyga*. Modified after Noskiewicz (1962).

| | ***Stelis iugae*** | ***Stelis odontopyga*** |
|---|---|---|
| Head | Longer than wide in frontal view. | Rounded (shorter and wider than in *iugae*) |
| Clypeus | Flat to slightly protuberant; punctation coarse at base, very fine at apical end. | Protuberant; punctation at apical end slightly finer than at base. |
| Frontal line (between median ocellus and clypeus) | Present. | Absent. |
| Axillae | Angular (female) to forming spines (male). | Hardly modified. |
| Terga | T1-4 with narrow ochreous apical bands; T2-5 depressed at apical ends, depressions clearly separated from discs; punctation of terga generally coarse and not very dense. | Black colouration of T1-4 extends to apical margins (apical margins sometimes inconspicuously reddened); T2-T5 not or only weakly depressed; punctation of terga generally finer and denser. |
| Sterna: females | Sterna with rich white pubescence; S2-S4 with apical fringes of hairs. | Pubescence scarce; no fringes of hairs on S2-S4. |
| Sterna: males | S3 with glossy longitudinal depression; shallow and scattered punctation at each side. Dark median comb of S4 as wide as about one-fifth of width of sternum. | No longitudinal depression on S3; punctation of S4 medium fine and shining. Dark comb of S4 as wide as about one-third of width of sternum. |

**Distribution:** *Stelis iugae* occurs in eastern and south-eastern Europe and Turkey.

Distribution of *Stelis iugae*. The occurrence in the Russian Federatin according to Fauna Europaea (no details available).

## *Stelis laverna* Baker, 1999

**Synonymy:**

*Stelis laverna* Baker, 1999. Mitt. Mus. Naturkde. Berlin, Dtsch. entomolog. Zeitschr. 46: 231-242.

**Identification:** 7.5 mm. Baker (1999) called this species in his description a "structurally unremarkable *Stelis*", which is, however, distinguished from it congeners by its unusual colouration, with red abdomen. The species is known from a single female only; it is closely related to *Stelis murina* and *S. phaeoptera*, but has a distinctly wider clypeus (the length/breadth ratio is 1:1.7, while it is 1:1.5 in *murina*). It agrees with *murina* in the long and conspicuous pubescence of the head and thorax, but presents an even duller appearance owing to the denser punctation, especially that of the metasoma where it is also much finer. The relationship with *S. ortizi*, the only other known Palaearctic species with red abdominal segments, still needs to be clarified.

Female (in parentheses characters of *murina*): The head in frontal aspect relatively wider than in *murina*, length: width ratio 1:1.38 (1:1.23 in *murina)*; apical margin of clypeus straight (medially variably deeply semicircularly emarginate in *murina*); ocelli smaller and separated from eye by 3.15x their diameter (2.3x in *murina*). Axillae slightly protuberant (lateral margins of axillae and scutellum forming a nearly continuous curve), scutellum shorter, distinctly convex and more broadly rounded.

Apical margin of T6 evenly, semicircularly rounded (laterally subangular and medially slightly advanced in *murina*), in profile concave preapically (straight in *murina*). General surface glossy, with no evident microsculpture at 25x, but appearing dull by reason of the denseness of the macrosculpture. Head and thorax densely, strongly punctate, generally the punctures separated by less than their own diameter; anterior face of mesepisternum with well-separated punctures dorsally, becoming impunctate below. Basal metasomal terga slightly less densely punctate and glossier than thorax, but the punctation becoming denser caudad; marginal areas impunctate; T6 finely, reticulately punctate; sterna very finely and densely punctate, lacking distinct marginal areas, sterna S5 and S6 dull (terga in *murina* glossy, with well-separated punctures, S2-S4 glossy, relatively strongly punctate and with wide, impunctate, marginal areas, S5 depressed in basal half).

Pubescence of head and mesosoma as in *murina*, unusually long and rich for a *Stelis* species (length on mesosoma generally about 2x flagellar diameter), white; hairs of lower part of face denser than in *murina*, subdecumbent, largely concealing clypeal surface. Metasomal terga with very short and inconspicuous pubescence, only T1 laterally with longer hairs forming rudimentary marginal fasciae; sterna densely clothed with very fine, subdecumbent hair, forming weak marginal fimbriae on S2-S5.

Black, disc of mandibles obscurely reddish; distal tarsal segments reddish; T1-T4 red; margins of S2-S5 obscurely reddish.

**Biology:** No information available.

**Distribution:** So far known only from Algeria.

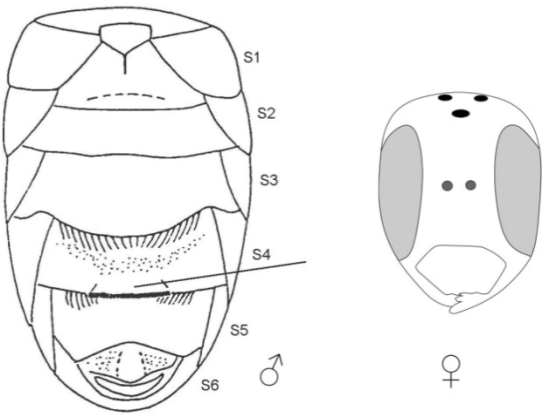
Distribution of *Stelis laverna*.

## *Stelis maroccana* Warncke, 1992

**Synonymy:** None.
*Stelis maroccana* Warncke, 1992. Entomofauna 13: 341-376 (Algeria).

**Identification:** With 8 mm, slightly larger than *breviuscula* (5-7 mm). The species is particularly similar to *Stelis breviuscula*. Both are small *Stelis* species with light apical bands of hairs on the abdominal terga. *S. maroccana* is also similar to *S. scutellaris* and *S. orientalis*.

***Female***: Head almost twice as long as wide (ratio 1.5:1 in *breviuscula*). Clypeus convex, punctation at base about twice as dense as at apical end; length of vertex almost two ocellar diameters (only one ocellar diameter in *breviuscula*). Punctation of thorax slightly stronger than in *breviuscula*; punctures of disc more scattered than in *breviuscula*,




*Stelis maroccona*. Left: underside of the male abdomen; right: head of female. – *Sources*: Left adapted from Warncke (1992), right drawing by MK after material from Algeria in coll. Schwarz.

*Stelis maroccana*, female (left) and male (right). Note in particular the bands of white hairs on the apical margins of terga, which are reduced in this male. Female from Algeria, male from Morocco. The female is a paratype. Both specimens from coll. M. Schwarz. Photographs: OLL.

often separated by more than their diameters (less than half their diameter in *breviuscula*). – Punctation of T1 also more scattered than in *breviuscula* with distances between punctures 1-2 times their own diameter (densely punctured in *breviuscula*); depression brightened up to reddish-brown and finely and densely punctate; punctation of succeeding terga similar, in general more scattered than in *breviuscula*. Terminal terga rugosely punctate. T6 flat semicircular (broadly triangular in *breviuscula*) with a relatively obviously impunctate middle line.

***Male***: Slightly larger than *breviuscula* (5-6 mm). Head longer than wide with a ratio length:width 1.5:1, thus less elongated than in female. Length of vertex almost two ocellar diameters. Clypeus and vertex as in female. Scutum slightly less punctate compared to *breviuscula.* – Intensity of punctation increases from T1 to T7, while it remains more or less the same on all terga in *breviuscula*. An important feature to distinguish *maroccana* from *breviuscula* is the width of the dark comb of S4: it is approximately as wide as

*Stelis maroccana*, face. Left female paratype, right male. Both specimens from coll. M. Schwarz. Photographs: OLL.


*Stelis maroccana*, apical terga. Left female paratype, right male. Both specimens from coll. M. Schwarz. Photographs: OLL.

half the width of sternum in *maroccana*, but is confined to a small median area (one-fifth of width of sternum) in *breviuscula*.

**Biology:** Found on the wing in Morocco in August (Warncke 1992).

*Stelis maroccana*, ventral view of male abdomen. Specimens from Marocco ex coll. M. Schwarz. Photographs: OLL.

**Distribution:** Algeria and Morocco (Warncke 1992).

Distribution of *Stelis maroccana*.

## *Stelis minima* Schenck, 1861

**Synonymy:**
*Stelis minima* Schenck, 1861. Jahrb. Ver. Naturk. Nassau 14: 350-351 (Germany).
*Stelis minima* forma *unicolor* Alfken, 1944. Mitt. dtsch. ent. Ges. 12: 23 (Germany).

**Identification** (3-5 mm): *Stelis minima* is morphologically little differentiated from *S. minuta* and is often treated as its subspecies. *S. minima* is on average significantly smaller than *minuta* (3-5 instead of 5-7 mm), and parasitizes on different hosts. Host specificity is used as evidence for the status of *minima* as a good species, while unambiguous separation on the basis of morphologic features alone is normally not possible. For a comparison of morphologic characters it is recommended to consult Pittioni (1949), who, after examination of a large material, came to the conclusion that all differences are not

qualitative, but only quantitative. An useful redescription of material from Poland is given by Celary & Wiśniowski (2013).

Body black, usually scattered punctate and therefore slightly more shining than in *minuta*; first terga (usually T1-T2 in females and T1-T3 in males) entirely black or black with lateral whitish spots. Alfken (1944) was the first who has shown that these white maculations may be absent; in a series of 15 specimens from northern Germany, he found almost none with light maculations, and described on this basis the "forma *unicolor*". Babiy (1970) found among a series of 35 females from Austria 7 specimens with light maculations only on T1, while the remaining 28 specimens had white maculations on both T1 and T2. In some cases, however, the maculations on T2 were much reduced and represented only by a narrow diagonal line. In a large series also from Austria, which comprised 185 females, Pittioni (1949) found that 40% had uniformly black terga without any light maculations.

***Female***: Shining black; rounded head, width of clypeus about 1.5 times of its length; punctation of body more scattered than in *S. minuta*. Scutellum has nearly triangular shape, protruding posteriorly; legs black, hind basitarsi almost parallel-sided (not widened on the distal part), distances between punctures on mesopleurae approximately as big as their diameter, posterior margins of terga black and without lateral bands of hair; T1 or T1-T2 with small, lateral, yellowish-white maculations, which may also be absent.

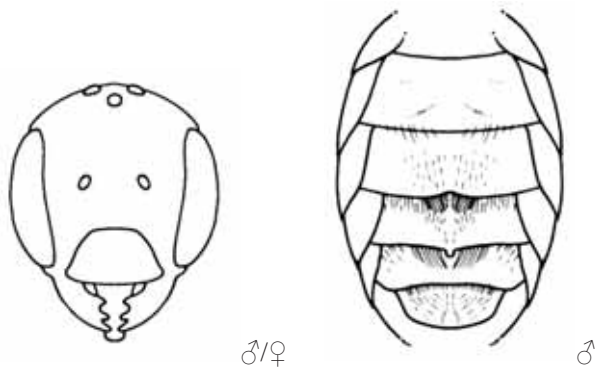
***Male***: Scutellum triangular with a small obtuse apex; T1-T3 usually with lateral whitish maculation. Distances between punctures on mesopleurae and terga T4-T5 approximately as big as their diameter; apical margins of terga black and without lateral bands of hair; T1-T2 or T1-T3 with small, lateral yellowish white maculations; T7 pointed with

*Stelis minima* (above) and *Stelis minuta* (below). Left: females, right: males. Note the size difference in both sexes. Photographs: MK.

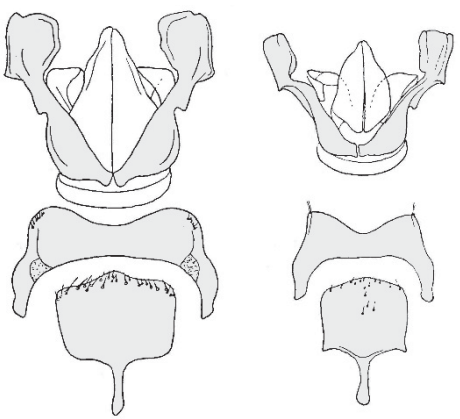
*Stelis minima*. Habitus lateral, abdominal terga and face of a female from Germany in SMF. Photographs: MK.

short mid-process. Apical margin of S3 with slight, triangular emargination; black comb on S4 normally with 5-8 bristles, but always less than 10 bristles (over 10, mostly 15-18 in *minuta*). Legs black.

**Biology:** Flight season June to July (Banaszak & Romasenko 2001); in Switzerland, June to August (Amiet et al. 2004); in Germany sporadically till September (Wildbienenkataster 2013).




*Stelis minima*. Left: head (both sexes alike), right: underside of male abdomen. From: Scheuchl (2006).



*Stelis minuta* (left) and *S. minima* (right). Above, male genitalia, below the hidden sterna S7+S8. Adapted from Pittioni (1949).

Cleptoparasite of the very small, solitary bees *Chelostoma campanularum* and *Ch. distinctum* (Amiet et al. 2004, Hausl-Hofstätter 2001, Freundt 2004). Banaszak & Romasenko (2001) and Celary & Wiśniowski (2013) list also *Heriades truncorum* as a host species; and Babiy (1970), lists *Chelostoma florisomne.* The species has been found several times in swarms: 35 specimens together found by Babiy (1970) and 187 specimens together found by Pittioni (1949)). The function of these swarms is not yet fully understood, as they consisted almost entirely of females and therefore cannot be directly related to mating. Found on the wing in Finland on Goldmoss stonecrop, *Sedum acre* (Elfving 1968). Westrich (1989) additionaly lists *Jasione montana*, *Achillea millefolium*, *Tanacetum vulgare*, *Inula* sp., and *Hieracum* sp. Has never been reported from *Campanula*, the preferred plant of its host *Chelostoma campanularum.*

**Distribution:** Europe up to 63°N (Central Finland), but apparently absent from most southern parts. Because of the difficult separation from *minuta* and the fact that *minima* is often treated as subspecies of *minuta*, the distribution area is insufficiently known and needs to be clarified. Specimens in the Kiev Zoological Museum (SIZK) have been identified as *minima* and represent, together with records from the Russian Federation, so far the southernmost records. In the east to Poland. In the Swiss Alps, up to 1350 m (Amiet et al. 2004).

Distribution of *Stelis minima*. Since this species is not always treated as a separate taxon in literature but is often merged with *Stelis minuta*, some distribution records are not unambiguous.

## *Stelis minuta* Lepeletier & Audinet-Serville, 1825

**Synonymy:**
*Stelis minuta* Lepeletier & Serville 182S. Encycl. méthod. Insect. 10: 480-481 (France).
*Stelis nana* Schenck, 1853. Jb. Ver. Naturk. Nassau 9: 204 (Germany).

**Identification** (5-7 mm): Body black, metasomal terga with white lateral maculations; face (in frontal view) as long as wide; antennae short and black, undersides reddish brown, segments shorter than wide; legs black with grey pubescence; inner sides of basitarsi of hind legs with dense white pubescence; spurs pale; hind basitarsi with parallel sides. Inner spurs of 3rd tibiae slightly longer than outer ones. See also *Stelis minima*, which is often regarded as subspecies.

***Female***: Pubescence usually short, pale grey. Terga almost hairless; T1-T2, often T1-T3 with one white lateral maculation (often with brownish edges) on each side; T6 rounded with obtuse tooth; sterna with apical bands of erect hairs;

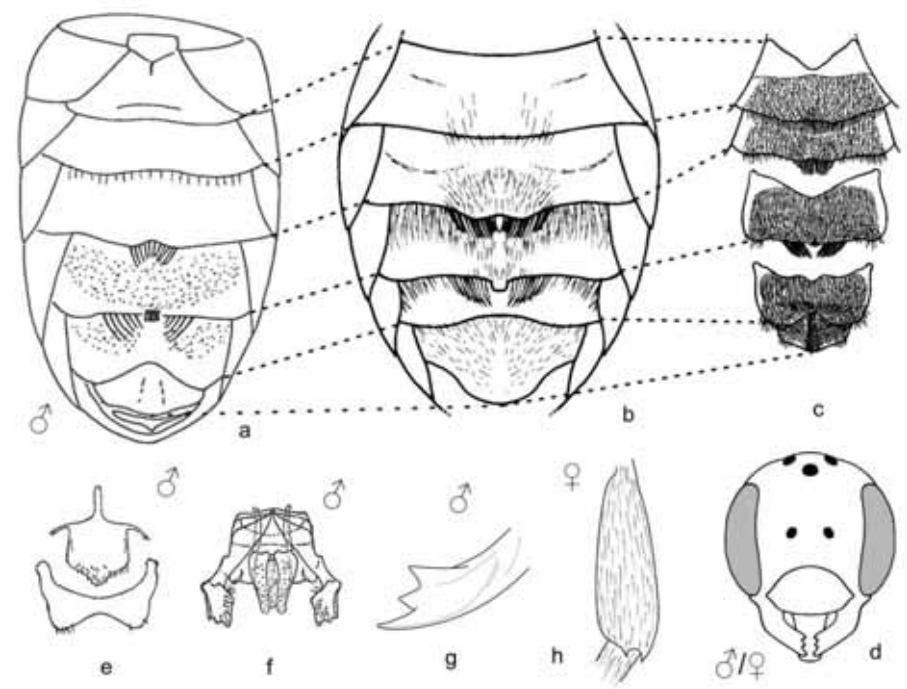
***Male***: Similar to female; pubescence of body mostly short, pale grey; punctation of body (especially of terga) denser than in *S. minima*. Terga almost hairless, T1-T2, often T1-T3, with one white lateral maculation (often with brown margins) on each side; T7 truncated with a small median tooth. S3 emarginate medially; dark comb on S4 with more than 10 bristles, mostly 15-18 (less than 10 in *minima*).


*Stelis minuta*, female from Germany in SMNS. Photograph: MK.

*Stelis minuta*, female from Germany in SMNS. Photographs: MK.

**Biology:** Flight season June to August with a peak in the second half of July. An early record from May in Croatia (Józan 2009), late records from September available from Switzerland. Rarely found on flowers (e.g. on *Campanula*, Friese 1895), mostly sitting on stakes, wooden fences and beams. Westrich (19890) mentions *Taraxum officinale*, *Geranium* and *Campanula*.

Cleptoparasite of various small species of *Hoplitis*, *Heriades*, *Osmia* and *Chelostoma*: *Hoplitis leucomelana, H. claviventris, H. tridentata, H. anthocopoides, Heriades truncorum, Osmia gallarum, Chelostoma campanularum*, and *Ch. rapunculi* (Morawitz 1893, Friese 1895, Warncke 1992, Westrich 1989, Amiet et al. 2004). The general




*Stelis minuta*. **a-c.** Underside of the male abdomen from three different authors. Note for example the shape of the apical margin of S5 which is deeply emarginate in (a) and (c), but only slightly emarginate in (b). **d.** Head (sexes alike). **e.** Hidden sterna S7+S8 of male; **g.** Mandible of male; h. Foretibia of female. – *Sources*: a. From: Warncke (1992); b, d. Modified from Scheuchl 2006); c. From Noskiewicz (1961); e-f. From: Popov (1933). g-h. Drawing by MK after a specimen in SMF.

appearance of the hosts (size, colouration) is similar to the parasite. Verhoeff (1892) made some observations on the host-parasite relationships of S. minuta (see also Enslin 1925).

The ichneumonid wasp *Hoplocryptus bellosus* (Curtis, 1837) has been found as parasitoid of *S. minuta* (Schwarz 2007).

**Distribution:** Widespread. The range extends from North Africa and the entire Mediterranean region over temperate Europe between 43° and 64° N (Finland). Absent from England, in the east extending to the Volga River (Warncke 1992). Also found in Azerbaijan. As many records are not separated for *minuta* and *minima*, the distribution of these two species actually needs to be analysed. In the Swiss Alps, up to 1500 m (Amiet et al. 2004) and 1800 m (Beaumont 1958); in Turkey, up to 1800 m (Özbek & Zanden 1993).

Distribution of *Stelis minuta*. The light colour shows literature records without sufficient documentation. Since this species is not always treated as a separate taxon in literature but is merged with *S. minuta*, some distribution records are not unambiguous.

## *Stelis murina* Pérez, 1884

**Synonymy:**
*Stelis murina* Pérez, 1884. Act. Soc. Linn. Bordeaux 37: 272-273 (Tunisia).
*Stelis cassiopaea* Saunders, 1908. Trans. ent. Soc. London 2: 257 (Algeria).
*Stelis murina* ssp. *cretica* Mavromoustakis, 1963. Ann. Mag. Nat. Hist. (13)5: 752 (Greece: Crete).
*Stelis phaeoptera murina* Pérez, 1884 [Warncke 1992 and others]

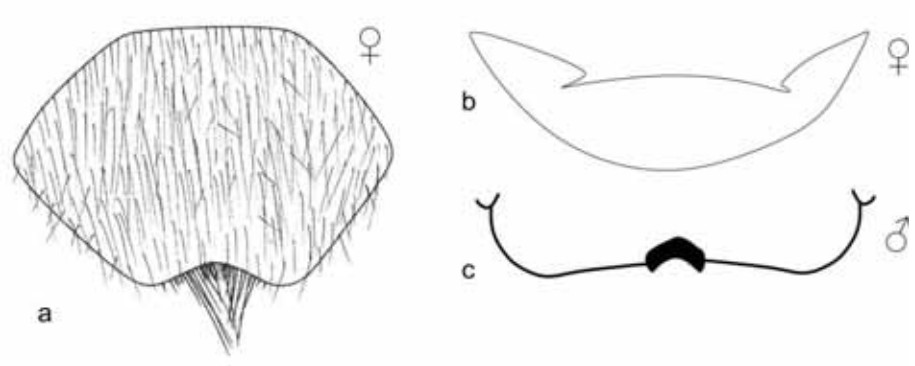
Friese (1895) assumed that *Stelis murina* Pérez, 1884 is a "southern variation of *Stelis phaeoptera*", and Warncke (1992) treated it as subspecies of *S. phaeoptera.* It was subsequently not accepted as valid species in the Bee Species World Checklist (2008). However, I follow here Baker (1999), who noted that Pérez's (1884) description is "good", and "the identity of this taxon is clear", and that "the differences go beyond those noted by Warncke (1992)".

**Identification:** 7-8 mm. This species is so closely allied to *phaeoptera*, that only its differential characters are pointed out here. In both sexes, the face of *murina* is wider and therefore rounder. *S. murina* has a light grey to white pubescence (in this respect similar also to *Stelis franconica*); punctation of head and thorax is much denser than in *phaeoptera* so that the surface is quite dull (almost no shining interstics). Pubescence more even and denser with grey hairs. T6 of male *phaeoptera* has a stronger apical angle. Spines of tibiae dark (light in *phaeoptera*); the apical end of the clypeus is more or less semicircular emarginate without crenulation (crenulated and without or only with slight emargination in *phaeoptera*). The dark comb on S4 of males is narrow and almost semicircularly emarginate.

Mavromoustakis (1963b) described the subspecies *cretica*, whose female differs from nominate *murina* in having stronger and sparser punctation, the pterostigma and veins black (both brown in nominate *murina*), the flagellum dark brownish-black (light brown in nominate race), and the apical median longitudinal carina of T6 more developed than in the nominate subspecies.

Comparison of some characters of the females of *Stelis murina* and *S. phaeoptera* (after: Mavromoustakis 1963b).

| | ***Stelis murina*** ♀ | ***Stelis phaeoptera*** ♀ |
|---|---|---|
| Clypeus | Apical margin emarginate in the middle and without crenulation. | Apical margin emarginate in the middle and slightly crenulate. |
| Axillae | Edentate. | Slightly dentate. |
| Tergum T6 | Apical margin obtuse and nearly truncate. | Apical margin pointed at the apex in the middle. |
| Sterna S2-S4 | Apical margin broadly impunctate, polished and shining. | Apical margin dull very finely punctate. |




*Stelis murina*. a: female clypeus; b: scutellum of male; c: sternum S4 of male. Note that the narrow black comb is almost semicircularly emarginate. – *Sources*: Drawings by MK after material in coll. OLL (a, b) and photograph in Aguib et al. 2014 (c).

**Biology:** The species is a cleptoparasite of *Osmia*. Pérez (1884) found it parasitizing *O. signata*, and Warncke (1992), *O. notata* in Morocco. Warncke (1992) also mentions *O. mustelina* [= *O. emarginata*] referring to Friese (1895), but this author actually observed *murina*-like *Stelis* in Austria, apparently belonging to *S. phaeoptera*. Dusmet y Alonso (1921) mentions *Osmia vidua*, which is a synonym to *O. signata*. Saunders (1908) found the species on the wing in Algeria as early as February; and Storey (1916), in Egypt in March. The flight season extends at least to June (Mavromoustakis 1963b). Aguib et al. (2014) recorded the species in Algeria visiting the flowers of *Carduus nitans* L., 1753 (Asteraceae) and *Rosmarinus officinalis* L., 1753 (Lamiaceae).

**Distribution:** West Mediterranean to circum-Mediterranean species with a certain focus on Northern Africa. The range includes the Canary Islands. Has been also recorded as far north as France and Croatia. It is not clear whether, and if so, to what degree, its range overlaps with that of *S. phaeoptera*.

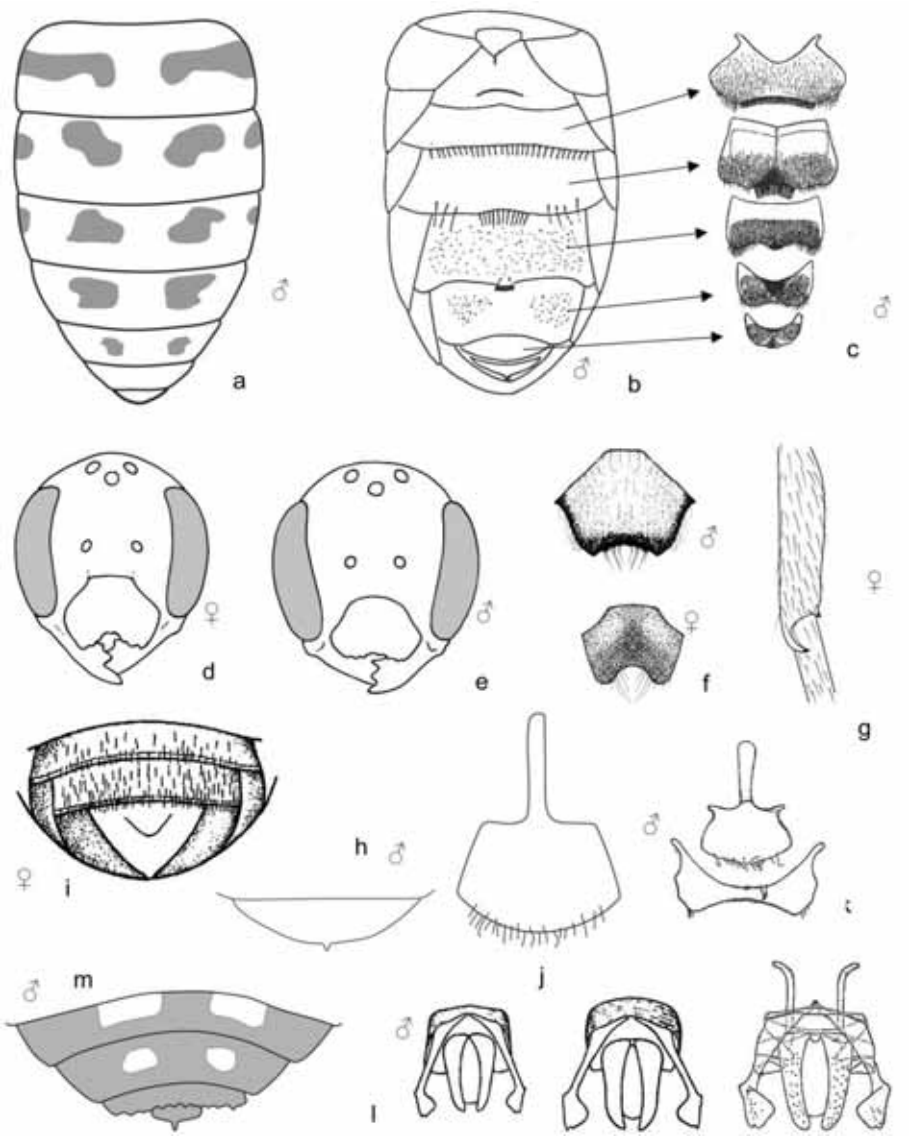
Distribution of *Stelis murina*.

## *Stelis nasuta* (Latreille, 1809) [German: Rotfleckige Düsterbiene]

**Synonymy:**
*Anthidium nasutum* Latreille, 1809. Ann. Mus. hist. nat. Paris 13: 48-49, 223 (France).
*Anthidium nasale* Latreille, 1809, incorrect secondary spelling, *Stelidomorpha nasuta* (Latreille, 1809).

**Identification:** A relatively widespread and not uncommon species whose occurrence is closely related to the occurrence of its host, the Solitary Leafcutter Bee, *Megachile parietina*. At least females are relatively easy to identify by the characteristic, strongly emarginate apical margin of the clypeus. In Central Europe, this is the only species with this

*Stelis nasuta*: female (left) and male (right). Note the colouration of vertex (reddish-yellow band in female, yellow maculae in male) and the narrow reddish band on scutellum in female (entirely black in male). Specimens from Croatia in SMF (Photograph: MK).




*Stelis nasuta.* **a.** Abdomen of male, dorsal view (yellow maculations are shown in grey). **b-c.** Ventral view. **d-e.** Head of female and male. **f.** Clypeus of male and female. **g.** Tibia of female. **h.** T7 of male. **i.** S6 of female. **j.** Hiddeen S8 of male. **k.** Hidden S7-S8 of male (drawing by another author). **l.** Male genitalia, three different drawings. **m.** Male terminal terga T4-T7. – *Sources*: a. Drawn after Noskiewicz (1961) by M. Kasparek. b. From Warncke (1992). c. From Noskiewicz (1961). d-e. Modified from Scheuchl (2006). f. From: Amiet et al. (2004). g & m. Drawing by MK after a specimen in OLL. h & j. Redrawn after Noskiewicz (1961) by MK. i. From: Noskiewicz (1961). k. From: Popov (1933). l. From: Popov (1933) and Noskiewicz (1961).

*Stelis nasuta*, habitus lateral (female from Croatia in SMF, photograph: MK).

character; in the Mediterranean region, this character is shared with *aegyptiaca* and *pentelica*. Abdomen is in both sexes black and has cylindric shape and lateral white or pale yellow maculae. Again in both sexes, the head is black with a conspicuous, wide ochreous band on vertex and genal area. Clypeus black in females and almost white in males.

***Female***: 5-10 mm. Two whitish maculations in the paraocular area. Clypeus protruding and strongly emarginate with wide lobes at each side; normally black, rarely dull white. Scutum with one whitish or yellow spot at each side. Scutellum prolonged, rounded and slightly emarginate at apex. Sometimes with small yellowish to reddish outer margin. – T1 with one elongate maculation at each side, T2-T4 with two maculations at each side (the outer maculations are slightly smaller than the inner ones); maculation on T5 normally reduced to one spot at each side or one large and another very small one, or completely absent; T6 entirely black, truncate with a crenulate apical margin; apical margin of sterna pale yellow; S6 triangular, depressed, with a small, blunt tooth; legs red, often darker on proximal parts.

***Male***: 5-8 mm. Clypeus less protruding than in female, almost white (dark in the female!); apical end emarginate, but much less than in female; one whitish, elongate maculation in paraocular area. Colour pattern of terga similar to female: T1 with one elongate maculation at each side, T2-T4 with two maculations at each side (the outer maculations are slightly smaller), T5 with one maculation at each side, but sometimes absent; T6-T7 entirely black. T7 very small, acuminate.

**Biology:** Main flight season from June to July (Banaszak & Romasenko 2001), but the first animals appear in Switzerland, Croatia, Algeria, Turkey and Greece already in May (Amiet et al. 2004, Józan 2009, Saunders 1908, SMF, OLL according to MK, unpubl.).

*Stelis nasuta*: face of female (left) and male (right). The clypeus is black in females and off-white in males. Specimens from Croatia in SMF (Photograph: MK).

Can still be observed in August (Amiet et al. 2004, Özbek & Zanden 1993) and even September (Croatia, specimen in SMF [MK]).

Friese (1895) found the species on Mountain Germander (*Teucrium montanum*), Stiff Hedgenettle (*Stachys recta*) and Bugleweed *Ajuga* sp. Dusmet y Alonso (1921) mentions in addition White Horehound *Marrubium vulgare*. Also found on *Teucrium chamaedrys*, *Ajuga genevensis*, and *Thymus pulegioides* (Westrich 1989).

Cleptoparasite of *Megachile parietina* (= *Chalicodoma muraria*) (Friese 1895, Schmiedeknecht 1907), *M. pyrenaica* (Amiet et al. 2004), and *M. sicula* (Westrich 1989). As the populations of the host species *M. parietina* are declining in many parts of its range, *Stelis nasuta* is becoming rare, too (Stöckl 2000). *S. nasuta* opens already closed nests of its host and closes them again after egg deposition. Usually several eggs are deposited in a host cell (Amiet et al. 2004). On observations on reproduction see also Maneval (1937).

Grissell (2007) reported that *Stelis nasuta* parasitizes also on *Melittobia acasta* and *Monodontomerus* aeneus, two Torymidae (Hymenoptera: Chalcidoidea).

Distribution of *Stelis nasuta*. The occurrence in the Russian Federation (orange colour) according to Fauna Europea (no details available).

*Stelis nasuta* deposit a number of eggs into the cell of the much larger *Megachile parietina*, whose provisions are adequate to feed up to six larval *nasuta*, as evidenced by the discovery of their cocoons in single host cells (Friese 1923, Maneval 1937). Rozen & Kamel (2009) raised the question of how the host offspring is eliminated: through assassination by *Stelis* larvae, through removal by the *Stelis* female, or through starvation resulting from competition with numerous feeding *Stelis* larvae. Assassination by *Stelis* larvae, though occurring elsewhere in the genus, seems unlikely, since larvae of *nasuta* are obviously not aggressive toward one another. Rozen & Kamel (2009) question whether a cleptoparasite larva would be able to distinguish between the early instar of siblings and that of the host.

**Distribution:** Widely distributed from North Africa (Morocco, Algeria) over Southern Europe to central Europe; the northernmost records are from 52° N, in Germany are from Thuringia (see Wildbienenkataster 2013). In the east, the distribution area extends from the Levant over Turkey, the Caucasus and Iran to North and Central Asia (Warncke 1985, 1992). In Switzerland, up to 1700 m (Amiet et al. 2004); in Turkey, up to 2000 m (Özbek & Zanden 1993).

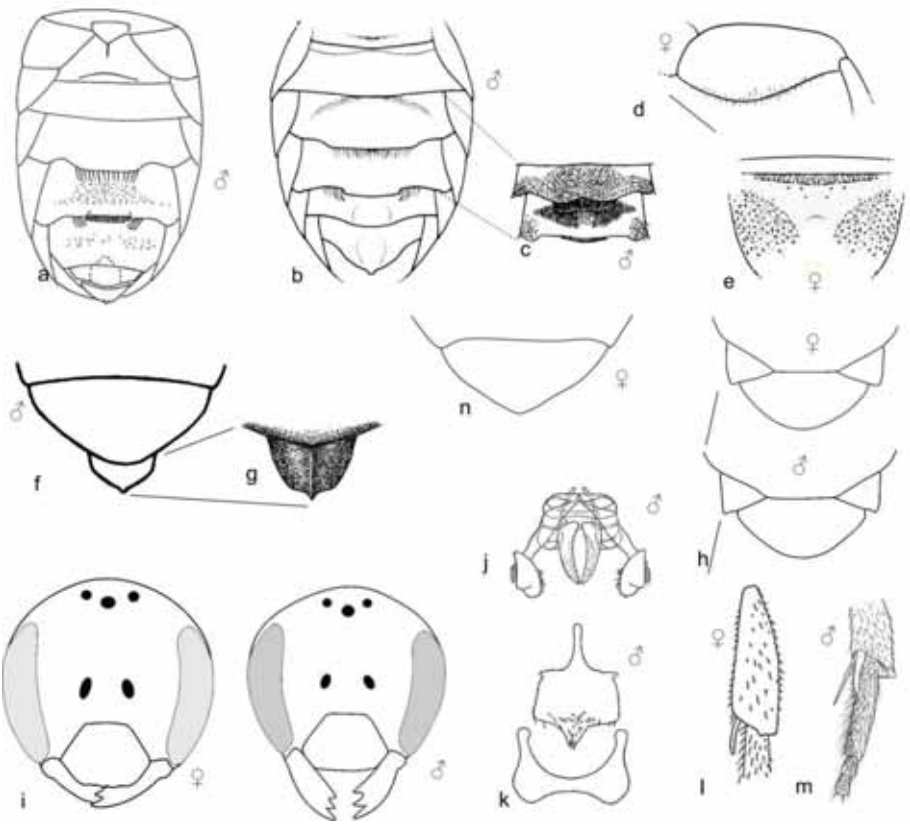
## *Stelis odontopyga* Noskiewicz, 1926

**Synonymy:** None.

*Stelis odontopyga* Noskiewicz, 1926. Bull. ent. Pologne (Polsk. Pismo ent.) 4, 1925: 230-231 (Ukraine).

**Identification:** Similar to *Stelis phaeoptera*, but smaller, plumper, weaker and with much denser punctation; pubescence much shorter and paler (hairs on head and thorax only half as long as in *phaeoptera*). T2-T4 with narrow, inconspicuous, translucent reddish-brown apical margins; S2-S4 with wider reddish apical margins; underside of femur with very short, regular pubescence; apical segments of tarsi and claws red-brown; tibial spurs darker than in *phaeoptera* (usually red-brown to brown in *odontopyga*, light yellow in *phaeoptera*).

*Stelis odontopyga*, habitus of female. Specimens from Coatia in SMF. Photographs: MK.



*Stelis odontopyga*. **a-c.** Underside of male abdomen (**c.** showing S3+S4); **d.** Underside of mid-femur of female; **e.** Propodeal triangle of female; **f-g.** Abdominal terga T6-T7 of male; **h.** Scutellum of female and male; **i.** Face of female and male; **j.** Male genitalia. **k.** Hidden sterna S7-S8 of male. **l.** Female tibia. **m.** Hind tibia of male. **n.** Abdominal tergum T6 female. – *Sources*: a, l. From: Warncke (1992). b, d-e: From: Scheuchl (2006); c, h, i: From: Noskiewicz (1962); f. Redrawn by MK after Banaszak & Romasenko (2001); g. From: Amiet et al. (2004); j-k. From: Popov (1933); m. drawing by MK. n. Drawing by MK after photograph in Ornosa et al. (2009).

***Female*** (6-7 mm): Body black. Punctation of proximal terga dense and slightly irregular with punctures hardly separated by more than their diameter; punctation of clypeus, frons and vertex coarser than in *breviuscula*; sculpture of basal region of propodeum with striae radiating from its base, sharply separated from the posterior surface; propodeal triangle with fine shagreen and only scattered punctures; scutellum projecting over post-scutellum and the almost rectangularly declivous propodeum. Pubescence in general shorter and denser than in other *Stelis* species; frons, vertex, scutum and scutellum with short, erect, pale ochreous hairs, pubescence of paraocular area longer and whitish; very short, regular pubescence on terga (as seen in profile); pubescence of outer sides of hind legs shorter than on inner sides.

*Stelis odontopyga*, abdomen in dorsal view (left female, right male). Note the dense punctation, short pubescence and the narrow, inconspicuous, translucent reddish-brown apical margins of terga. Specimens from Coatia in SMF. Photographs: MK.

*Stelis odontopyga*, head (left female, right male). Note the dense punctation and short pubescence. Specimens from Coatia in SMF. Photographs: MK.

***Male*** (5-8 mm): Similar to female. Tergum T7 with a weak median carina (not always clearly visible) and a small apical tooth. In this character, the species is similar to *minuta* and *minima*, but clearly distinguished from *phaeoptera*, which has a truncate or slightly rounded apical tergum. Dark comb at apical end of S4 almost twice as wide as in *phaeoptera*.

*Stelis odontopyga*, underside of abdomen (left female, right male). Specimens from Coatia in SMF. Photographs: MK.

**Biology:** Flight season June to August (Noskiewicz 1926, Banaszak & Romasenko 2001, Amiet et al. 2004, Celary & Wiśniowski 2007, Özbek & Zanden 1996). The species visits blooming plants of the families Apiaceae, Asteraceae and Boraginaceae (Celary & Wiśniowski 2007). Noskiewicz (1926) found them on *Inula* and *Tanacetum vulgare*. Found by Schmalz (1998) at *Hieracium* sp. and *Leontodon autumnalis.* Cleptoparasite of *Hoplosmia spinulosa (= Osmia spinulosa)* (Noskiewicz 1925, Celary & Wiśniowski 2007, Scheuchl 2006), which seems to be the only host (Westrich 1989).

*Stelis odontopyga*, terminal terga of male. Note the dense punctation and the small apical tooth of tergum T7. Specimens from Coatia in SMF. Photographs: MK.

**Distribution:** Widely distributed in southern and central Europe, extending from Spain in the south to Belgium and Thuringia in the north; in the east to Poland, Romania and Ukraine. However, the distribution is quite local and does not cover the entire range of its host, *H. spinulosa*, and it appears that while the host is quite tolerant to various climates, *S. odontopyga* is confined to warmer areas (Ebmer 1997). In Austria, up to 1200 m (Ebmer 1997); in Switzerland, up to 1500 m (Amiet et al. 2004); and in Turkey, up to 1700 m (Özbek & Zanden 1996).

Distribution of *Stelis odontopyga*. The occurrence in the Russian Federation (orange colour) according to Fauna Europea (no details available).

## *Stelis orientalis* Warncke, 1992

**Synonymy:**
*Stelis orientalis* Warncke, 1992. Entomofauna 13: 341-376 (Greece).

**Identification:** Rare species, which has been found so far only in Greece and Iran; only females are known. Never found again recorded after the description in 1992. Closely related to *Stelis phaeoptera*.

***Female***: With 9-10 mm, the species is as large as or slightly larger than *S. phaeoptera*. Body black as *phaeoptera*, but distinguished from it by the horn-coloured outer edge of the marginal zone of T1 and lateral white fringes of hairs in the marginal zones of T1-T3. Head almost round as in *phaeoptera*; clypeus gently convex, punctation even and dense with an almost honeycomb-like pattern; frons and antennae as in *phaeoptera*; punctation of vertex less dense with narrow, shining interstices; punctation of scutum stronger and more scattered than in *phaeoptera*; space between punctures shining, the punctures separated by 0.5 to 1.0 their own diameter (punctation in *phaeoptera* usually denser); punctation of scutum and scutellum alike. – T1 smooth, slightly less punctate than scutum (in *phaeoptera*, T1 is stronger punctate than scutum), punctures scattered; distance between punctures varying, mostly separated by 1 to 3 times the distance of their own diameter. The succeeding terga increasingly stronger and denser punctate; T6 triangular pointed with a small apical carina, disc smooth and shining, base impunctate medially, and scatteredly punctate with punctures separated by 1-2 times their diameters more laterally.

**Biology:** Collected in Iran in August (Warncke 1992).

**Distribution:** Only known from Greece and Iran (Warncke 1992).

Distribution of *Stelis orientalis*.

## *Stelis ornatula* (Klug, 1807) [Spotted Dark-bee]

**Synonymy:**

*Gyrodroma ornatula* Klug, 1807. Magaz. Ges. naturf. Freunde Berlin 2: 54-55 (Germany).

*Trachusa sexpunctata* Stschegloff in: Hummel, 1826. Essais ent., St. Pétersbourg 5: 44-45 (Russia).

*Stelis octomaculata* Smith, 1843. Zoologist 1: 261-262 (England).

*Stelis sexsignata* Costa, 1858. Riv. ent. monti Partenii, p. 21 and 28 (Italy).

*Stelis ornatula* var. *immaculata* Noskiewicz, 1926. Bull. ent. Pologne 4, 1925: 231-232 (Croatia).

*Stelis ornatula gussakovskii* Popov, 1933. Trudy Zoolog. Instituta Acad. Nauk SSSR 1, 1932: 375-414 (Uzbekistan).

*Stelis ornatula montana* Popov, 1933. Trudy Zoolog. Instituta Acad. Nauk SSSR, 1, 1932: 375-414 (Tajikistan).

*Stelis ornatula* ssp. *oreophila* Popov, 1935. Folia zool. hydrobiol. (Riga) 7: 216-221 (nomen nov. for *S. o. montana*).

**Identification** (4-8 mm): Body black, usually with white lateral maculations on first terga (T1-T4) (see below).

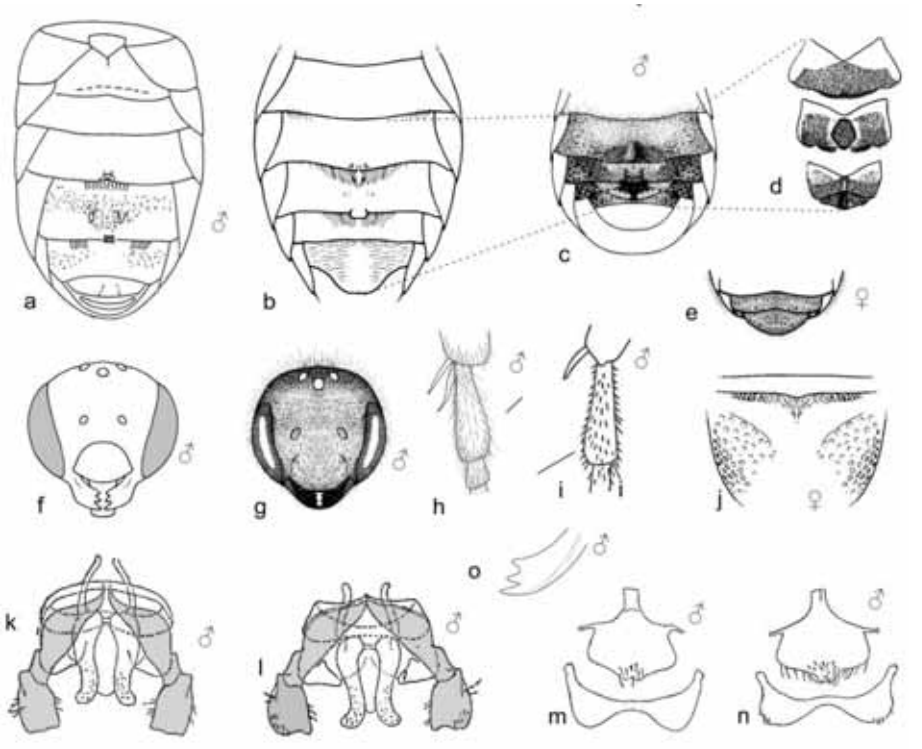
***Female***: Head in frontal view wider than long; segments of antennae usually longer than wide. Scutellum overhanging (and thus completely covering) metanotum (postscutellum); pubescence grey, distinctively longer than in *minuta*; scutum coarsely and densely punctured, spaces between punctures mostly smaller than their diameters; propodeal triangle polished, impunctate; sculpturing of basal zone not sharply separated from its posterior surroundings medially, but series of sharply separated, elongated pits laterally. – T6 with rounded sides, apical margin with short, brownish hairs. Legs black; inner sides of basitarsi of hind legs with dense light greyish pubescence; the two spurs of tibia 3 brown and almost equal size. Hind basitarsi club-shaped.

*Stelis ornatula*, habitus female. Specimens from Slovenia in SMF. Photographs: MK.

*Stelis ornatula*, face. Left female, right male. Note that the head in frontal view is wider than long in female, and approximately as wide as long in male. Specimens from Slovenia (female) and Germany (male) in SMF. Photographs: MK.

***Male***: Similar to female, but basitarsi not thickened towards their apical ends. Head in frontal view at least as wide as long. Propodeal triangle polished, impunctate or with very scattered punctation; sculpturing of basal zone not sharply separated from its posterior surroundings medially, but series of sharply separated, elongated pits are present laterally. – Terga sometimes without light (white or yellowish) spots; apical margins of terga with scattered hairs, not forming bands; S2 with not very coarse, regular, dense punctation; Margin of S3 truncate with a short and dense fringe of hairs, and a small, often indistinct bump medially; disc of S3 with regular and thin pubescence; S6 with relatively long hairs directed mesad.

The subspecies *gussakovskii* is distinguished from the nominate *ornatula* by a denser and coarser punctation on both tergites and sternites, and by large, light yellow lateral maculations on Terga T1-T4. These maculations become somewhat longer towards the apical end.




*Stelis ornatula.* **a-d.** Male, underside of abdomen. **e.** Female, apical sterna. **f-g.** Head (f: female/male, g: male). **h.** Tibia and basitarsus of male. **h-i.** Tibia of female (two different drawings). **j.** Propodeal triangle of female. **k-l.** Male genitalia (left nominate subspecies, right ssp. *S. o. oreophila* Popov, 1935). **m-n.** Hidden sterna S7-S8 of male (left nominate subspecies, right ssp. *S. o. oreophila* Popov, 1935). **o.** Mandible of male. – *Sources*: a, i: From Warncke (1992); b, f, j: From Scheuchl (2006); c, e, g: From Amiet et al. (2004); d: From Noskiewicz (1961); k-n: From Popov (1933); h. Drawing by MK after Amiet et al. (2004). o: Drawing after material in SMF by MK.

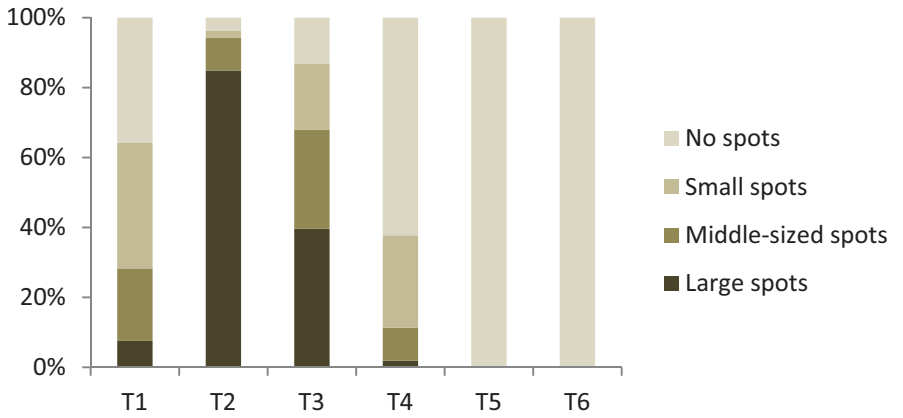
Micheli (1935) provided descriptions of the larva and cocoon of *S. ornatula* (see also Enslin 1925).

**Biology:** Relatively long flight season extending from April to September, with peak season mid-June to late August. Ornosa et al. (2009) list records from January in Spain, but these need confirmation.

Was observed on the wing visiting Mouse-ear Hawkweed *Hieracium pilosella* (Westrich 1983), Bird's-foot-trefoil (*Lotus corniculatus*), Cinquefoil (*Potentilla* sp.), Ragwort (*Senecio jacobaea*), Fleabane (*Pulicaria dysenterica*) and Hawk's-beard (*Crepis* sp.) (Else 2012). Elfving (1968) lists Finland Fireweed (*Chamaenerion angustifolium*), Nipplewort (*Lapsana communis*), Autumn hawkbit (*Leontodon autumnalis*), Germander

Distribution of white maculae on the terga of female *Stelis ornatula*. N=53 from various parts of its distribution range (based on material in OOE and SMF). Two specimens had no maculations at all.

| | T1 | T2 | T3 | T4 | T5 | T6 |
|---|---|---|---|---|---|---|
| No spots | 19 | 2 | 7 | 33 | 45 | 45 |
| Small spots | 19 | 1 | 10 | 14 | 0 | 0 |
| Middle-sized spots | 11 | 5 | 15 | 5 | 0 | 0 |
| Large spots | 4 | 45 | 21 | 1 | 0 | 0 |




Presence of white maculae on the terga of females of *Stelis ornatula*.

speedwell (*Veronica chamaedrys*), and Heath speedwell (*V. officinalis*). Westrich (1989) lists *Picris hieracioides*, *Lapsana communis*, *Hypochoeris radicata*, *Leontodon autumnalis*, *Hieracium umbellatum*, *Lotus corniculatus*, *Rubus fruticosus*, *Potentilla* sp., and *Veronica chamaedrys*. Collected from a dry stem of *Rubus* (Warncke 1981).

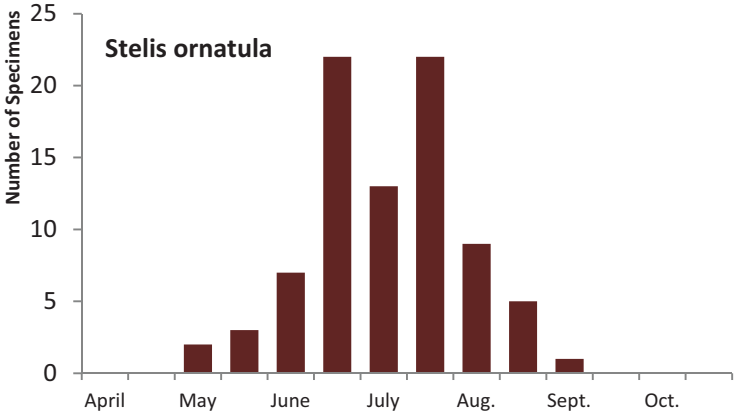
Cleptoparasite of *Hoplititis* (= *Osmia*) *leucomelana* and *Hoplititis* (= *Osmia*) *claviventris*, sometimes also of *Osmia* (= *Hoplititis*) *tridentata*, *H.* (= *O.*) *acuticornis*, and *Osmia maritima*. Westrich (1989) also found it parasiting *H.* (= *O.*) *caerulescens* and Amiet et al. (2004) list also *Anthidium scapulare*. Hosts apparently include also *Ceratina cucurbitina* (Schmiedeknecht 1907) and *Chelostoma*, but this was questioned by Westrich (1989) and Warncke (1992).

The ichneumonids *Hoplocryptus confector* (Gravenhorst, 1829) and *H. bellosus* (Curtis, 1837) have been found as a parasitiods (Schwarz 2007). Else (2012) reports that the chalcid wasp *Pteromalus apum* has been reared from a cocoon of *S. ornatula*.


*Stelis ornatula*, abdomen, ventral side. Left female, right male. Note the thickened end of the hind basitarsi (club-shaped) in the female, while the basitarsi are almost parallel-sided in males. Specimens from Slovenia (female) and Germany (male) in SMF. Photographs: MK.

*Stelis ornatula*, abdomen, lateral view: male. The punctuation on the terga has been used to distingusih subspecies. Here specimens from Germany (male) in SMF. Photograph: MK.

Höppner (1904a, 1904b) made observations on the behaviour of the *Stelis ornatula* larvae and their hosts. In the United Kingdom, *S. ornatula* has been reared frequently from Bramble (*Rubus fruticosus* agg. L.), Rose (*Rosa* sp.) and Ragwort (*Senecio jacobaea*) stem-nests of *Hoplititis claviventris* (Else 2012). The *Stelis* cocoons can readily be distinguished from those of its host species by their dense silken walls (through which the prepupae cannot be seen) and the presence of a conspicuous apical nipple; the




Flight season in Germany (after data in Wildbienenkataster 2013).

*H. claviventris* cocoons differ by having thinner silken side walls which are more or less transparent, and a widely rounded apex which lacks a nipple-like projection.

In southern England, it is found at both inland and coastal sites, including heathland, chalk grassland, open broad-leaved woodland, coastal dunes and landslips (Else 2012).

**Distribution:** Mediterranean area from Morocco in the west to Turkey in the east, and central and Northern Europe up to 63° N (Warncke 1992). The distribution area extends in the east into Iran, Central Asia and the Ussuri region in the Russian Far East (Scheuchl 2006). In Turkey, up to 1650 m (Özbek & Zanden 1993), at Mount Olymp in Greece up to 1900 m (Warncke 1992), in the Swiss Alps, up to 2100 m (Amiet et al. 2004, see also Beaumont 1958), ands on Madeira (Portugal) up to 1200 m (Fellendorf et al. 1999). Also known from the Petra Pervogo Range in the north-western Pamir Mountains, Tajikistan (approx. 2000 m) (Popov 1933).

Distribution of *Stelis ornatula*.

## *Stelis ortizi* Schwarz & Gusenleitner, 2010

**Synonymy:** None.
*Stelis ortizi* Schwarz & Gusenleitner, 2010. Linzer biol. Beitr. 42: 1311-1321 (Spain).

**Identification:** 7 mm. This species has been described only recently, in 2010, and only the female is known from two specimens so far. It has a red abdomen and shares this character among Palaearctic *Stelis* species only with *Stelis laverna* Baker, 1999. Schwarz & Gusenleitner (2010) in their description of *S. ortizi* did not refer to *S. laverna* Baker, 1999, and as no unambiguous distinctive features can be derived from the published descriptions, the differences between these two species still need to be elaborated. *S. ortizi* has so far not been assigned to any subgenus.

Female: Black. Head wider than long, head and thorax (especially the upper part of the mesepisternum) with relatively long, grey-white pubescence. Basal part of clypeus slightly convex, distal part flattened, apical margin crenulated; punctation fine and very dense, but slightly coarser at base. Mandibles short, tridentate, and with some inconspicuous brown-red colouration at base of teeth; pronotal lobes and tegulae black. Vertex about twice as long as ocellar diameter. Preoccipital ridge rounded. Punctation of paraocular area, supraclypeal area and frons similar to punctation of clypeus, punctures partly converging. Punctation of scutum and vertex similar, but distances between punctures becoming larger towards posterior end; at the apical margin the punctures are separated by their own diameters. Axilla with small blunt projection pointed posteriorly; punctation very dense, but much finer than on scutum. Punctation of scutellum slightly

*Stelis ortizi,* female (holotype). Note the red colouration of the abdomen. Ex coll M. Schwarz. Photograph: M. Schwarz.

*Stelis ortizi,* female (holotype). Upper row: abdomen in dorsal and ventral view. Lower row: face and scutellum. Ex coll M. Schwarz. Photograph: M. Schwarz.

coarser than on mesonotum, scutellum depressed medially. Propodeal triangle polished, weak sculpturing with fine punctures and wrinkles at base. Spurs and the three apical tarsal segments of all legs reddish. – T1-T4 red; small light maculations at the sides of T1; depression of T1 with narrow, stepped apical margin; depressions of T2-T5 with regular plain margin. Punctation of T1-T5 regular and similar to that of scutum; interstices shining and partly reaching puncture diameter; punctation becomes slightly denser on T5, and punctures on T6 separated by only half of their diameter. T2-T4 laterally with inconspicuous, light hairs. S2 has in the middle a small, semicircular cavity (often difficult to see) with long hairs; S2-S6 finely punctate medially, punctation extends to the apical margin; the narrow depressions of S1-S3 brightened reddish. Photographs mainly of the punctation of various body parts are given in Schwarz & Gusenleitner (2010).

**Biology:** Has been found in Spain in June at *Teucrium polinum* (Schwarz & Gusenleitner 2010).

**Distribution:** Known only from southern Spain (Schwarz & Gusenleitner 2010).

Distribution of *Stelis ortizi*.

## *Stelis pentelica* Mavromoustakis, 1963

**Synonymy:**
*Stelis pentelica* Mavromoustakis, 1963. Ann. Mag. Nat. Hist. (13)5: 692-695 (Greece).
*Stelis bicornuta* Pasteels, 1969. Israel J. Entom. 4: 409-434 (Israel).

**Identification:** Medium-sized species (9-11 mm) with yellow markings on black abdomen; *S. pentelica* belongs to the subgenus *Stelidomorpha* and is characterised by a protruded clypeus with a median, apical emargination, and claw-like inner tooth of fore tibia. It has a relatively long vertex, which is five ocellar diameters long in females and at least three in males. From *aegyptiaca*, it is distinguished among other characters by the sculpture of the first tergum: in *pentelica*, punctation of T1 is similar to that of scutum, whereas it is much finer in *aegyptiaca*.

Mavromoustakis (1963a) described the female only. Warncke (1992) believed that the male described by Pasteels (1969a) under the name *S. bicornuta* is the male of *S. pentelica.* A final confirmation is still missing, in particular as it remains unclear whether Warncke has seen other males and whether he could thus confirm the presence of the two spines on sternum S3.

***Female*** (characters of *aegyptiaca* given in parentheses): Clypeus deep lemon-yellow (black in *aegyptiaca*); subapical area narrowly light reddish-brown, apical margin less deeply semicircularly emarginate (wide apical semicircular emargination) and black-brown. Paraocular area widely deep lemon-yellow (reddish-brown) nearly to the tip of eyes. Scutum with a curved, narrow yellow stripe at each side in front, not reaching the basal middle of the scutum, a little surpassing the tegulae (entirely black), very strongly and densely punctured (very densely rugosely and slightly finely punctured). Scutellum triangularly projecting behind over propodeum, its sides sharp-edged and very slightly crenulate; apical margin narrower than base and slightly emarginate in the middle (nearly

*Stelis pentelica*: Habitus of female dorsal and lateral. Female from Turkey in SMF. Photographs: MK.

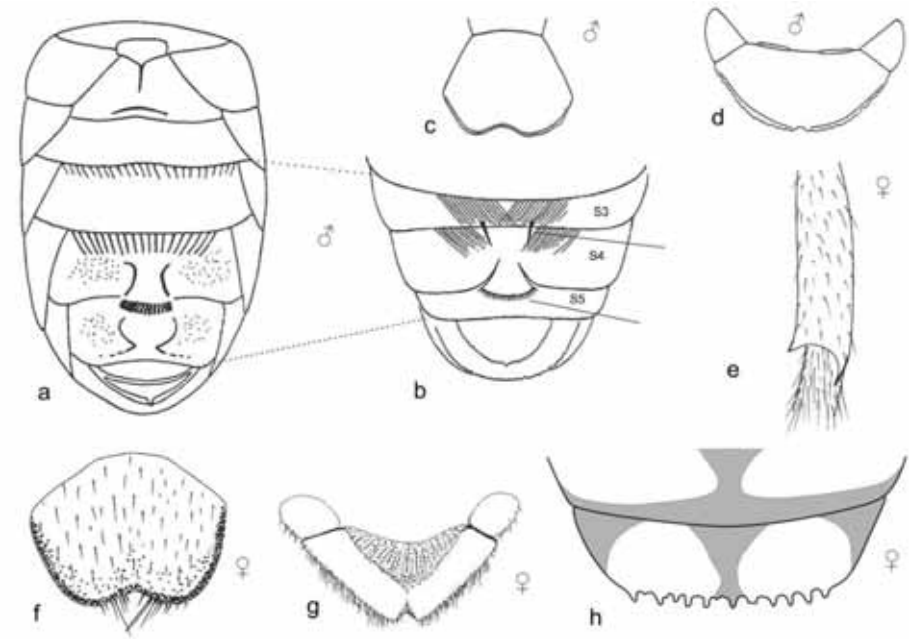
semicircular shape in *aegyptiaca,* apical margin reddish-brown and obtusely edged, nearly straight and very slightly infuscate mostly on hind margin). – T1-T4 with stronger and with less dense punctures (rather densely and very finely punctured); T1-T6 rich bright yellow (in *aegyptiaca*, T1-T5 with transverse discal, wide pale yellow stripe at each side not reaching the extreme sides and the middle; the pale yellow stripe of the last tergum the smallest).

***Male*** (after Pasteel's description of "*bicornuta*"): Ground colour black; golden-yellow are: base of mandible, paraclypeal and paraocular areas, a large quadrangle mark above the genae (surrounded by a reddish margin), the pronotal lobes, the anterior angles of mesonotum, the axillae and two large marks on the scutellum. T1-T6 bearing each a pair of large marks only separate in the middle by a narrow black bridge; base of terga black, posterior part red. Antennae, T7 and all sterna red. Mandibles narrow, tridentate as in *nasuta*. Clypeus with two overhanging lobes (but not so produced as in *nasuta*) and with a distinct thickened margin. Eyes very converging. Genae as wide as the eye seen in profile. Vertex very elongate. Scutellum clearly emarginate in the middle; axillae rounded without spines. – Abdomen elongate, T6-T7 similar to *nasuta,* but the crenulate margin of T6 is rounded (transverse in *nasuta* and *aegyptiaca*). S3 truncate (emarginate in

*Stelis pentelica*: Upper row: face of a female fom Israel and a male frrom Turkey. Lower row: apical abdominal terga of the same specimens (left female, right male). Ex coll. M. Schwarz. Photographs: OLL.

Scutellum of *Stelis pentelica*. Typical characters are the V-shaped form with a slight emargination at the apical end, the colour pattern and the pubescence (Source: Female in SMF. Photograph: MK).

*nasuta* and *aegyptiaca*) and bears a pair of paramedial spines (entirely absent in all other species of the genus). However, these spines have not been described by other authors and are absent in material examined e.g. by M. Schwarz. Also the fringe of hairs on S3 and S4 is normally uninterrupted, but has been described by Pasteels as interrupted in the




*Stelis pentelica*. **a-b.** Underside of male abdomen. Note that the right drawing shows two spines on S3, and the fringe of hairs on S3 and S4 is interrrupted in the middle. **c.** Male clypeus. **d.** Male scutellum and axillae. **e.** female fore tibia. **f.** Female clypeus. **g.** Female scutellum. **h.** Female terga T5-T6. – *Sources*: a: from Warncke (1992), b-d. from Pasteels (1969a), e-h. drawings by MK after material in OLL.

middle (see figure). The dark comb of S4 is wider than in *nasuta* and *aegyptiaca*, is fan-shaped and bears 20 bristles. Clypeus with shallow punctures, with a thin, slightly elevated impunctate line in the middle. Scutum and scutellum with coarse punctures, very dense. Terga with deep punctures, very densely and regularly arranged. – Pubescence: White. Very dense and woolly on the sides of the face, with a dense fringe around the antennal sockets. Very disperse on the clypeus. Vertex with short erect hairs, less dense above than beneath.

**Biology:** Found in Iran in May (Warncke 1985; but see below) and in Greece, Turkey and Israel in May and June (Mavromoustakis 1963a, Pasteels 1969a, coll. Schwarz). Collected in Greece at *Mentha* sp. (Mavromoustakis 1963a). Was found in Iran together with *Anthidium spiniventre*, the possible host (Warncke 1985).

**Distribution:** Eastern Mediterranean species found so far in Greece, Turkey and the Levant. A record in Iran by Warncke (1985) was omitted in his later review (Warncke 1992) for unknown reasons.

Distribution of *Stelis pentelica*.

## *Stelis phaeoptera* (Kirby, 1802) [Plain Dark-bee]

**Synonymy:**
*Apis phaeoptera* Kirby, 1802. Monogr. apum Angl. 2: 231-232 (England).
*Stelis phaeoptera* ssp. *meridionalis* Popov, 1933. Trav. Inst. zool. Acad. Sci. URSS 1, 1932: 399-401 (Azerbaijan).

**Identification:** Species very similar to the central European *S. franconica*, which has often been treated as its subspecies. Also very similar to the Mediterranean *S. murina*, whose species status needs confirmation. Body black with scarce whitish to reddish-yellow pubescence, shining; pubescence of vertex and scutum ochreous; punctation of T1 and scutum similar; punctation on T2-T3 more scattered than in *S. franconica*,

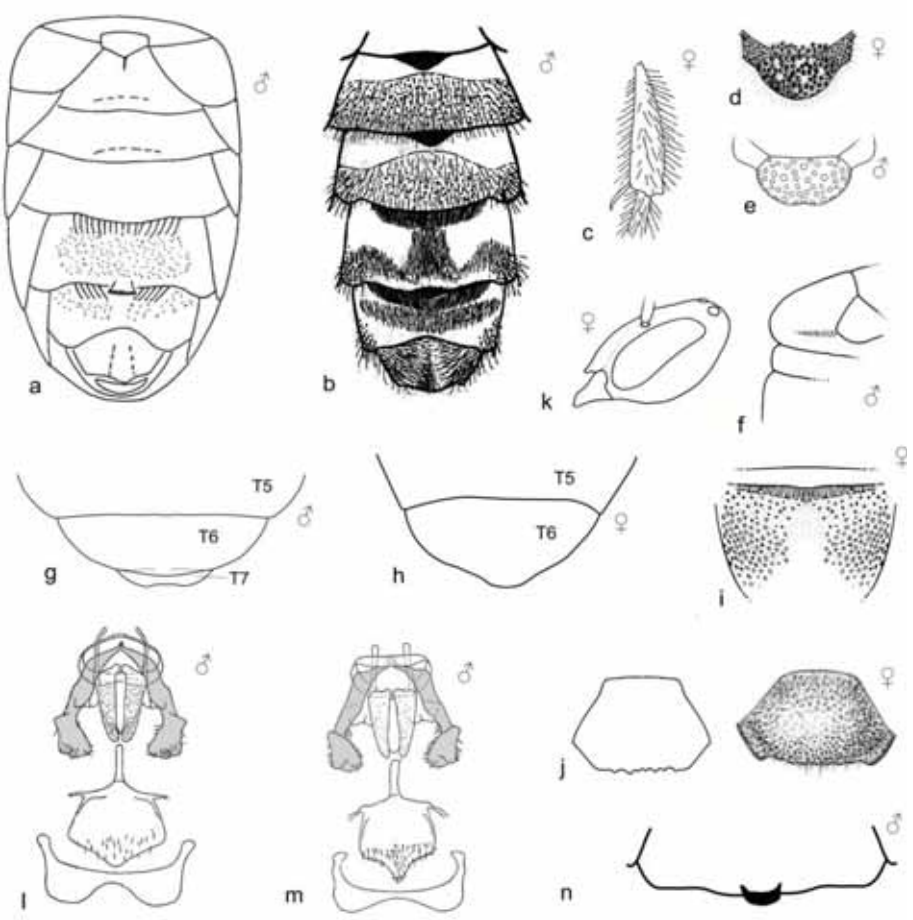
*Stelis phaeoptera,* female (habitus). Germany, SMF. Photograph: MK.

*Stelis phaeoptera,* female (left side: habitus and head; right side: abdominal surface). Germany, SMF. Photograph: MK.

punctures shallower and smaller; axilla rounded or with a small tooth-like projection. For a description of the species, compare also the species accounts on *S. franconica* and *S. murina.*

***Female*** (7-11 mm): Clypeus less protuberant than in *franconica*, apical margin irregularly crenulated and with sparse reddish-yellow hairs; propodeal triangle dull, more or less densely punctate, basal zone with elongated pits, sharply separated from posterior surface; pubescence of vertex and scutum ochreous; legs black with thin ochreous pubescence; spurs brown. – Punctation of T1 and scutum similar; punctures of T2-T3 scattered (denser in S. *franconica*) and punctures shallower and smaller than in *franconica*; punctures of T2-T3 two times smaller than those of scutellum. T6 with a slightly angular shape, almost pentagonal; apical margin with sparse, short, ochreous (or yellowish-grey) hairs; apical fringe of hairs on S3-S4 shorter and less dense than in *S. franconica;* S6 apically with appressed golden fringe of hairs.

***Male*** (6-8 mm): Similar to female; clypeus not protuberant, pubescence less dense than in *franconica*; apical margin of clypeus straight and crenulate, sometimes slightly rounded emarginate in the middle; antennae slightly longer than in female; interspaces between punctures on upper side of mesepisternum shining. Scutum less dense punctate




*Stelis phaeoptera.* **a-b.** Underside of male abdomen; **c.** Female tibia; **d.** Female scutellum; **e.** Male scutellum; **f.** Male scutellum, lateral view; **g.** Male apical terga; **h.** Female apical terga; **i.** Female propodeal triangle; **j.** Female clypeus (two drawings); **k.** Head of female in lateral view; **l-m.** Male genitalia and hidden sterna S7-S8 (left nominate *phaeoptera*, right ssp. *meridionalis*). **n.** S4 of male. Note the narrow, convex black comb. – *Sources*: a, c. From Warncke (1992); b. From Noskiewicz (1961; d. From Amiet et al. (2004); e, f, i, j (left), k. From Scheuchl (2006); g-h. Drawings after material in SMF by MK; j. From Ornosa et al. (2009). l-m. From Popov (1933). o. Drawing by MK after photograph in Aguib et al. (2014).

than in *franconica*, spaces between punctures larger; scutellum mostly slightly convex or flat; rounded in lateral view. Mesepisternum at least in upper part with smooth and glossy spaces between punctures. Propodeal triangle dull, more or less densely punctate, basal zone with elongated pits, sharply separated from posterior surface. – Apical margins of terga with scattered, irregular pubescence; hairs more or less erect; punctures of T2 and T3 scattered, and less deep and smaller than in *franconica*. Punctures of T2-T3

two times smaller than that of scutellum; T6 and T7 rounded; disc of S3 depressed, S3-S4 with long ochreous hairs at apical margin. Black comb of S4 narrow (approximately 24 bristles) and slightly convex.

The subspecies *meridionalis,* which occurs in the Caucasus and Central Asia, is very similar to the nominate subspecies, but differs by the following characters: dark or dark brown spurs of hind tibiae, coarse punctures of T1-T5 extending over the entire surface; light, white and shorter hairs of the body; light red hairs on apical margin of clypeus, mandibles, vertex and genal area; denser, shorter and lighter pubescence on T1-T5 and more strongly emarginated apex of S3.

**Biology:** Extended flight season from April to September, mostly from May to August. According to Banaszak & Romasenko (2001), the species is cleptoparasite of *Hoplitis anthocopoides, H. spinulosa, Osmia emarginata, O. niveata* (Fabricius, 1804) [= *O. fulviventris], O. leaiana, O. rufa, O. inermis*, and *Megachile rotundata*. Westrich (1989) gives *O. niveata (= O. fulviventris)* and *O. leaiana*, and Ivanov et al. (2013) give *O. dimidiata* in the Crimea. Westrich (1989) added *Osmia tubercula* as possible host. Warncke (1992) believes cleptoparasitism of nominate subspecies is confined to *Osmia niveata* and *O. emarginata*, both members of the *Helicosmia* subgenus, while all other observations may refer to sporadic records of "wrong" hosts. He lists *Osmia rufa* (Smith, 1855), *O. anthocopoides* (Bischoff, 1927), *O. parietina* (Friese, 1895), *O. bicolor* (Blüthgen, 1919), *H. spinulosa* (Kirby, 1802), *O. leucomelana* (Blüthgen, 1919*), O. loti* (Blüthgen, 1919), *O. truncorum* (Alfken, 1912), *O. florisomnis* (Lebedev, 1933), and *Anthidium manicatum* (Bischoff, 1925).

Visits flowers of thistles (Asteraceae) and *Centaurea* (Schmiedeknecht 1907, Dylewska & Bąk 2005). Westrich (1983, 1989) gives *Cirsium vulgare*, *Carduus crispus*, *Onopordum acanthium*, *Centaurea jacea*, *C. scabiosa*, *Hieracium pilosella*, *Crepis biennis*, and Bird's-foot-trefoil, *Lotus corniculatus.* Else (2012) lists for Great Britain also *L. corniculatus*, and Field Scabious (*Knautia arvensis*), Hawkweed (*Hieracium* sp.), Spear Thistle (*Cirsium vulgare*) and Speedwell (*Veronica* sp.), Elfving (1968) for Finland Fall Dandelion (*Leontodon = Scorzoneroides autumnalis*), Mouse-ear Hawkweed (*Hieracium pilosella*), and Wideleaf Arnica (*Arnica latifolia*), and Aguib et al. (2014) for Algeria *Centaurea nicaeensis* All. 1785, *Carduus* sp., and *Onopordon* sp. (Asteraceae).

Distribution of *Stelis phaeoptera.*

**Distribution:** Mediterranean region, central and northern Europe up to 66° N (northern Finland); in the east extending into Russia and Western Asia (Uzbekistan, Iran). The limits of the distribution area are still insufficiently known due to taxonomic uncertainties (e.g. treating *Stelis franconica* and *S. murina* as separate species). In Turkey, up to 1800 m (Özbek & Zanden 1993); in Switzerland, up to 2200 m (Beaumont 1958). In Great Britain, the populations have been decreased alarmingly in the last decades and the species is provisionally listed as "vulnerable" (Else 2012).

## *Stelis punctulatissima* (Kirby, 1802) [Banded Dark-bee, Düsterbiene]

**Synonymy:**

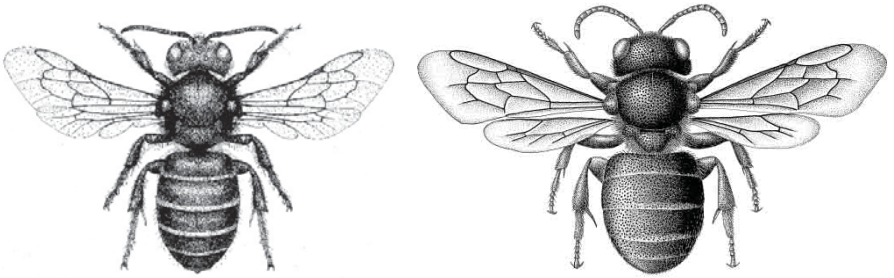
*Apis aterrima* Panzer, 1798. Faun. Insect. Germ. 5: 56, T. 15 (Germany) (nec *Apis aterrima* Christ 1791, Naturgesch. Insec., p. 189, T. 16, F. 6).
*Apis punctulatissima* Kirby, 1802. Monogr. apum Angl. 2: 231-232, T. 16, F. 9 (England).
*Trachusa aterrima* (Panzer, 1798) (homonym).
*Stelis aterrima* (Panzer, 1798) (homonym).
*Gyrodroma aterrima* (Panzer, 1798) (homonym).
*Gymnus aterrima* (Panzer, 1798) (homonym).
*Ceraplastes aterrima* (Panzer, 1798) (homonym).
*Stelis punctulatissima* ssp. *punctulatissima* (Kirby, 1802).
*Stelis aterrima* ssp. *hellenica* Mavromoustakis, 1959. Ann. Mag. Nat. Hist. (13)2: 298-299 (Greece).
*Stelis beaumonti* Noskiewicz, 1962. Bull. ent. Pologne 32: 54-58 (Syria) [= ssp. *hellenica* Mavromoustakis, 1959 according to Warncke 1992]
*Stelis* (*Stelis*) *moravica* Tkalců, 1970. Acta Musei Moraviae (Sci. nat.) Brno 55: 199-202 (Czech Republic) [= nominate subspecies according to Warncke 1992].

**Identification:** 6-11 mm (length varies greatly). As in *simillima* and *iugae*, the first four abdominal terga (rarely only T2-T4) are black with brightened, transparent apical margins, giving the abdomen a banded appearance. *S. punctulatissima* can in both sexes be separated from *iugae* by the punctation of the clypeus (as coarse as in lower paraocular area in *punctulatissima;* much finer in *simillima* and still finer in *iugae*) and the dense punctation of the malar area (punctures separated in *iugae* by about half their diameter). Males can be separated on the basis of the shape and width of the dark comb on S4.

Face in frontal view rounded according to Amiet et al. (2004), but Warncke (1992) says that *punctulatissima* and *iugae* have elongated faces, a character that can be used to separate them from *simillima*. Terga in *punctulatissima* coarsely punctate; punctation of T5 as dense and as coarse as of T6. Body with short, scarce, ochreous pubescence. Clypeus truncated and irregularly emarginate at apex. Propodeal triangle dull, punctation as dense as on rest of propodeum, basal area with elongated pits, which are sharply separated from the posterior surface. Legs coarsely punctate, wings infuscate.

Females and males very similar. Female 8-11 mm, male usually slightly smaller, 6-9 mm. Male: Sterna S1-S2 slightly sinuate, S3-S4 depressed and apical margin with

*Stelis punctulatissima.* Habitus of female. Specimen from Germany in SMF. Photograph: MK.



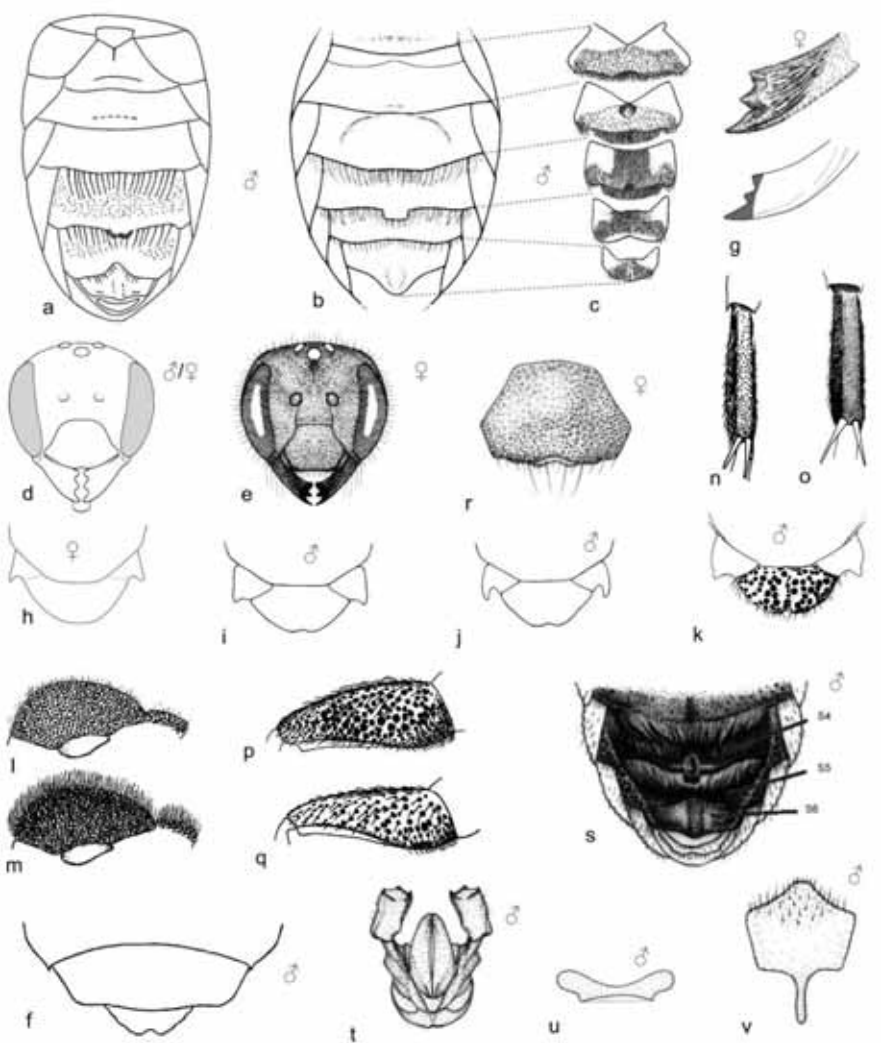
*Stelis punctulatissima.* Left female, right male. Drawings from Amiet et al. (2004) (left) and Ornosa et al. (2009) (right).

*Stelis punctulatissima.* Head and abdominal terga. Note the brightened, transparent apical margin of terga. Female from Germany in SMF. Photograph: MK.

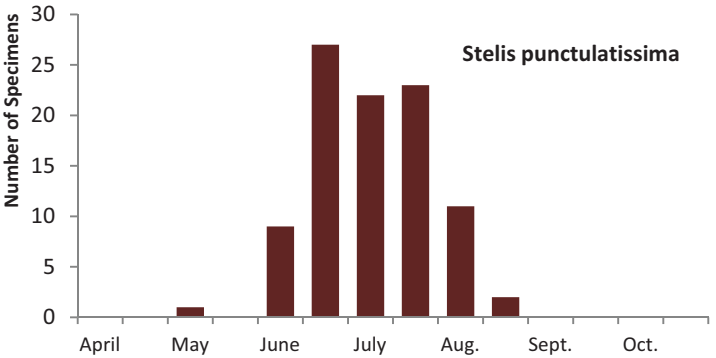
reddish-yellow bristles. Fringe of short bristles on S1-S2, fringes of long, golden hairs on S3-S5. T7 of male truncated with obtuse angles.

As in many other bee species, specimens from the southern part of the distribution area are brighter, hairs are shorter, wings darker and axillae on average more pointed. It needs to be clarified whether a separation of subspecies is justified. Specimens from Greece have been described as subspecies *hellenica*, and all populations from the southern Mediterranean may belong to it. This subspecies is distinguished from the nominate form by the strongly infuscate wings, the scarcity of pubescence which is shining white and a different punctation.

For a description of the cocoon, see Westrich (1989).




*Stelis punctulatissima*. **a-c.** Underside of male abdomen. **d-e.** Head. Note the slight differences in the shape of the clypeus; **f.** Apical terga of male (the drawing refers to *S. beaumonti*, which is a synonym to *S. punctulatissima*). **g.** Mandible (two different drawings). **h-k.** Scutellum and axillae: **h.** female, **i.** nominate subspecies male, **j.** *S. punctulatissima hellenica* (= *S. beaumonti* Noskiewicz, 1962), male. **k.** male of paratype of *hellenica* subspecies. **l-m.** Scutum and scutellum in lateral view, with l. referring to *S. punctulatissima hellenica* [*S. beaumonti* Noskiewicz, 1962]); **n-o.** Inner side of hind tibia (n. refers to *S. moravica* Tkalců, 1970, which is regarded as synonymous to *S. punctulatissima*). **p-q.** Outer side of the hind femur (q. refers to Tkalců's "*Stelis moravica*"). **r.** Female clypeus. **s.** Male sterna. **t.** Male genitalia. **u-v.** S7+S8. – *Sources*: a. from Warncke (1992); b. from Scheuchl (2006); c, f, i-j, l-m. from Noskiewicz (1962); d. modified after Scheuchl (2006); e. from Amiet et al. (2004); g. drawing after material in SMF by MK; h. from Banaszak & Romasenko (2001); k, n, o-q. from Tkalců (1970). g (upper), r-v. from: Ornosa et al. (2009), u. from: Ornosa et al. (2009), re-drawn by MK.




Flight season of *Stelis punctulatissima* in SW Germany (adapted from: Wildbienenkataster 2013).

**Biology:** Flight season May to August, rarely extending into September. An early specimen from April in ZMB. Peak flight season June and July.

Lives in a wide variety of habitats including gardens. The species is abundant in many areas, but can easily be overlooked because of its inconspicuous behaviour. Feeds on Compositae according to Westrich (1983); Stöckl (1998) mentions specifically *Aster amellus*. Was collected in Greece on Spiny Starwort *(Pallenis spinosa)* and the Scabious *(Scabiosa maritima)* (Mavromoustakis 1959). Friese (1895) mentions *Centaurea* and *Sedum,* Tkalců (1970) found it on *Inula hirta*, Dylewska & Bąk (2005) in Poland on *Ajuga*. In the United Kingdom found on Common Mallow (*Malva sylvestris*), Bird's-foot-trefoil (*Lotus corniculatus*), Bramble (*Rubus fruticosus* agg.), Wild Marjoram (*Oreganum vulgare*), Ragwort (*Senecio jacobaea*), Common Fleabane *(Pulicaria dysenterica*), Yarrow *(Achillea millefolium*), Spear Thistle *(Cirsium vulgare)* and Hawkweed *(Hieracium* sp.) (Else 2012). Elfving (1968) gives for Finland Field marigold *(Calendula arvensis)*, Tyrol knapweed *(Centaurea nigrescens)*, Fireweed *(Chamaenerion angustifolium)*, Creeping thistle *(Cirsium arvense)*, Large-flower fleabane *(Erigeron grandiflorus)*, Wood cranesbill *(Geranium silvaticum)*, Sneezeweed *(Helenium pumilum)* and *(H. pilosella)*, Purple toadflax *(Linaria purpurea)*, Pigeon scabious *(Scabiosa columbaria)*, Gold-moss stonecrop *(Sedum acre)*, Betony *(Stachys olympicus),* Breckland thyme *(Thymus serpyllum)*, and Red clover *(Trifolium pratense)*. Westrich (1989) additionally mentions *Carduus crispus*, *Onopordum acanthium*, *Centaurea jacea*, *Leontodon autumnalis, Allium cepa, Thymus pulegioides,* and *Trifolium repens.*

Although many authors (including Westrich 1989) give *Osmia* (= *Hoplitis*) *adunca* and other *Osmia* species such as *Osmia niveata* (Fabricius, 1804) [= *O. fulviventris], O. leaiana, O. tunensis aurulenta* (Fabricius, 1787) [= *O. aurulenta]*, *O. ventralis* and *O. brevicornis* (Fabricius, 1798), as hosts, Westrich & Dathe (1997) believe that the species is a cleptoparasite only of *Anthidium*, in particular of *Anthidium manicatum*. Else (2012) mentions specimens reared from a nest of *A. manicatum* in the Natural History Museum, London. Amiet et al. (2004) also listed *A. manicatum*, as well as *A. oblongatum* and *A. scapulare*, and in addition supposed that *Osmia leaiana*, *O. niveata* and *O. brevicornis*

are hosts. Also found in a closed cell of *Megachile* (= *Chalicodoma*) *parietina* (Westrich 1989). A literature record for *Anthidium lituratum* also needs to be confirmed (Warncke 1992). *S. punctulatissima* lays its egg into the host's cell before it is closed by the host.

Tkalců (1970) described the species *Stelis moravica* mainly based on the fact that it is a specific cleptoparasite of *Pseudoanthidium lituratum*. Morphologically, it is very similar to *S. punctulatissima* and currently is regarded as its synonym.

**Distribution:** From North Africa over temperate Europe to 62°N (southern Finland), in the east extending into the Middle East and Caucasus and further to Central Asia. In Turkey, from sea level to 1800 m (Özbek & Zanden 1993, 1996). Highest altitudes are 1600 m in Switzerland (Beaumont 1958, Amiet et al. 2004) and 1600-1700 m in Austria (Ebmer 1997).

Distribution of *Stelis punctulatissima*.

## *Stelis rhodia* Mavromoustakis, 1960

**Synonymy:** None.

*Stelis rhodia* Mavromoustakis, 1960 Ann. Mag. Nat. Hist. 1959 (13) 2: 299-302 [publ. 15.03.1960] (Greece: Rhodes).

**Identification:** Species with yellow markings on abdomen. It superficially looks like *Eoanthidium clypeare*, its presumed host. – Males of the similar *Stelis aegyptiaca* are distinguished from *S. rhodia* by grey hairs, the yellow ornamented face, and colouration of T1-T5, which are in *aegyptiaca* widely yellow maculated at each side. – In both sexes, *rhodia* is distinguished from *denticulata* by the flat (not carinated) area between the antennal sockets, the distance between the sockets (about twice as long as antennal diameter in *rhodia*, but only one diameter in *denticulata*). In addition, the scutellum is in *rhodia* 2.5 times wider than long, compared to 2.0 times in *deticulata*. – *S.s rhodia* superficially also resembles *S. signata*, but apart from many colour differences, *signata* has the propodeum basally shining, narrowly strongly and transversely keeled, the axillae rounded on outer side (in *rhodia*, the axillae are straight on outer side and the propodeum is different), and T7 of the male triangularly produced in the middle.

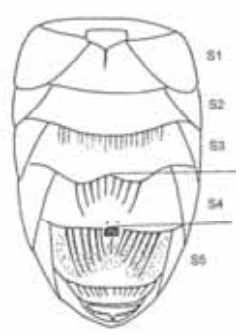

*Stelis rhodia*, habitus and head. Left: female, right: male. The female is from Turkey, the male from Greece, both from coll. M. Schwarz. Photograph: OLL.

***Female*** (6.5-7.0 mm): Black; mandibles deep reddish-brown, tridentate; clypeus wider than long, shining, strongly and rugosely and densely punctate, the punctures less strong towards the apical margin which is straight and finely crenulate; vertex strongly and very densely punctate, shining; antennae with scapes brownish-black, remaining segments black-brown and brown beneath except the 2nd and 3rd segments. Lower paraocular area with a small creamy yellow maculation not reaching the apex, and with a creamy yellow spot near the lower edge of the eyes. – Scutum densely, strongly and rugosely punctured, shining, with a wide creamy yellow stripe at each side in front; scutellum produced, a


*Stelis rhodia*, apical abdominal terga. Left: female, right: male. The female is from Turkey, the male from Greece, both from coll. M. Schwarz. Photograph: OLL.

*Stelis rhodia*, male. Underside of abdomen. Note in particular the shape of sternum S3 and the relatively narrow black comb and the long golden hairs of S4. Specimen from Greece in coll. M. Schwarz. Photograph: OLL.

little wider than long, apical margin fairly sharply edged, rounded at each side and emarginate in the middle; axillae not modified, united with the scutellum, outer side straight; scutellum with fairly stronger punctures than of the scutum, dense and partly rugose, with a subapical creamy yellow stripe at each side and with the extreme apical margin light reddish-brown at each side. – Abdomen moderately shining; T1-T3 fairly strongly and rugosely punctured, the punctures denser towards the sides, apical margin polished, impunctate, shining and deep brown; apical margin of T4 and T5 polished, impunctate, and shining; T1-T4 with wide creamy yellow lateral stripes, the stripes on T3 and T4 wider and longer, their extreme sides narrowly reddish-brown; T5 and T6 with short, transverse, discal deep reddish-brown stripe; T6 transversely very slightly concave towards the apical margin, rounded, apical margin crenulate. Sterna yellowish-reddish-




*Stelis rhodia*. Ventral view of male abdomen (adapted from Warncke 1992).

brown; S5 and S6 reddish-brown; S6 densely, strongly and rugosely punctured, with sparse and short yellowish-white hairs.

***Male*** (6 mm): Similar to the female; head entirely black; apical margin of clypeus straight and crenulate; pubescence on head scanty, very short and shining white, fairly denser in the frons. Scutum with a wide creamy yellow stripe at each side in front; tibiae and tarsi light yellowish-reddish-brown. – T1 with rounded creamy yellow maculation at each side; T2-T4 with larger creamy yellow maculations at each side, that on T4 nearly reaching the middle; T5 with obscure, hardly visible, pale yellow stripe at each side; T6 short, tinged with reddish-brown, with very strong and rugose punctures, transversely and subapically very slightly elevated and crenulate, extreme apical margin without crenulation; from the middle of apical margin with a fine, very short longitudinal carina; T7 hidden below T6, with rough disc, its margin fairly crenulate, with a very short spine in the middle of apical margin produced in front. – Sterna shining, yellowish-reddish-brown, basally tinged with brown; S3 slightly depressed from middle of disc to the medially and semicircularly emarginate apical margin; S4 in a depression, apical margin very widely concave in the middle and covered with the long hairs of the apical margin of S3.

Distribution of *Stelis rhodia*.

**Biology:** Found on the wing in June (Mavromoustakis 1959, Warncke 1992). Mavromoustakis (1959) collected the species at flowers of Headed Savory *Thymus capitatus* (Lamiaceae) together with *Eoanthidium clypeare*, and he believes that the latter species is the host of *S. rhodia*.

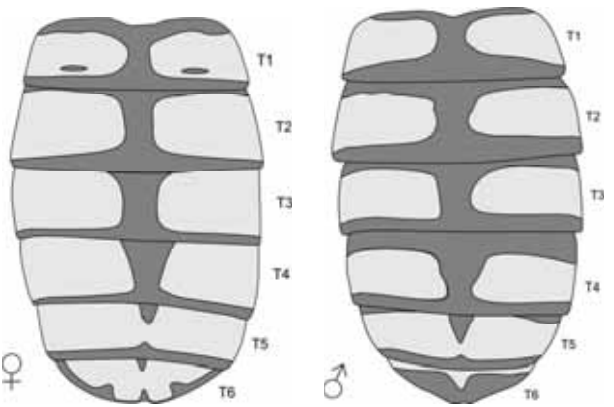
**Distribution:** East Mediterranean species, found in Greece and Turkey (Warncke 1992).

## *Stelis ruficornis* Morawitz, 1872

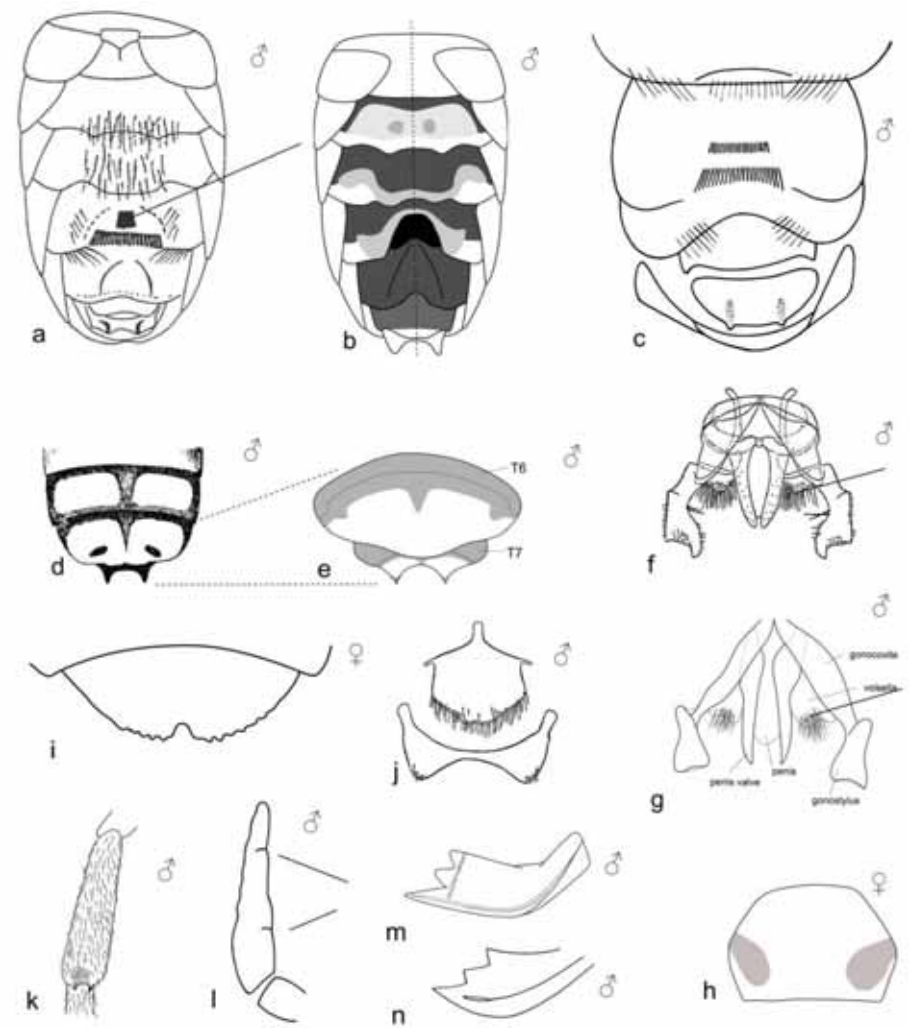
**Synonymy:**

*Stelis ruficornis* Morawitz, 1872. Hor. Soc. ent. Ross. 8: 210-211 (Greece: Rhodes).
*Anthidium paradoxum* Mocsáry, 1884. Természetrajzi Füzetek 8: 256 (Turkey).
*Doxanthidium paradoxum* Mocsáry, 1884 [Pasteels, Mém. Soc. Roy. Ent. Belg. 31, 1969: 28].
*Stelis ruficornis* ssp. *lebanensis* Mavromoustakis, 1963. Ann. Mag. Nat. Hist. (13)5: 753 (Lebanon).

**Identification:** (9.5-12 mm). An East Mediterranean species with conspicuous black and yellow colour pattern. Can reach the size *of Stelis gigantea*. The taxonomic situation had been somewhat confusing as the male of this species has initially been described asa member of the *Anthidium* genus, and later a separate subgenus (*Doxanthidium*) was erected for this species only (Pasteels 1969b). Some confusion is rooted on a insufficient description; Mocsáry (1884) described the male as bidentate, while the holotype (still available in the Hungarian National Museum) has a clearly tridentate mandible (Z. Vas, in litt.). The variation in both sexes is still poorly understood, and the subspecies *lebanensis*, which was not recognised by Warncke (1992), still needs re-examination. Warncke could not find differences between this subspecies and nominate specimens, and thus




*Stelis ruficornis*. Abdominal colour pattern. The grey colour stands for bright yellow. Note that in the male, T7 is hidden under T6. Drawing by MK after material from Turkey (female) and Lebanon (male) in coll. Kasparek.




*Stelis ruficornis*. **a-c.** Underside of male abdomen (yellow areas are shown in light grey in b). **d-e.** T6-T7 of male in dorsal view; **f-g.** Male genitalia; **h.** Female clypeus (yellow maculae are shown in grey). **i.** Female terminal terga; **j.** Hidden sterna S7-S8 of male; **k.** Tibia of male. **l.** Male maxillary palpus. **m-n.** Mandible (male). – *Sources*: a. From Warncke (1992); b, e, g, k, m. Drawings after specimen from Lebanon by M. Kasparek; I, h. Drawing by MK after specimen from Turkey in coll. Kasparek. c, l, n. From Pasteels (1969b); d. From Friese (1898); f, j. From Popov (1933).

ignored e.g. the colouration of S6 (black against yellow). Since Mocsáry's description of the male *Anthidium paradoxum* also does not fully concur with Morawitz's description of the male of *S. ruficorni*e, confirmation is needed whether it is actually a synonym.

*Stelis ruficornis*. Habitus. Above left female, right male in dorsal view. Below female in lateral view. Specimens from Lebanon (male) and Turkey (female) in coll. Kasparek. Photographs: MK.

***Female***: Head black with ochreous pubescence; clypeus black, yellow apical margin, densely punctate and wrinkled; two or more small well-separated and irregularly positioned teeth at apical margin of clypeus; yellow colouration of paraocular area extends up to the bases of antennae; wide yellow band on vertex; mandibles rusty-red, dull, densely and very finely wrinkled; tridentate, teeth obtuse; antennae red with apical segments being brownish; third antennal segment almost as long as wide, the following segments (with the exception of the last one) distinctively wider than long; scutum densely punctured with brown hairs; distance between punctures much shorter than their diameter; yellow bands laterally and frontally, frontal band broken medially; punctation on scutellum coarse, similar to scutum; scutellum overhanging metanotum (postscutellum); axillae with rounded angles, not producing to spines; legs reddish-yellow. – Terga slightly shining, coarsely and densely punctate, punctation becomes finer and denser towards the apical margins; T1-T4 with wide yellow bands (in T1 sometimes small longish black macula in the yellow band), interrupted medially; T5 yellow with a triangular

*Stelis ruficornis*. Underside of abdomen. Left female, right male. Specimens from Turkey (female) and Lebanon (male) in coll. Kasparek. Photographs: MK.

black notch and dark apical margin; T6 with black lateral margins and elongated, black maculae in the middle of disc. T6 with a small, apical, median semicircular emargination. Sterna yellow, S3-S5 with basal large, nearly hemispherical dark spots at sides; S6 entirely black (but with reddish-brown and reddish colouration in *lebanense* subspecies).

***Male*** (7-12 mm): Similar to female; pubescence on head and thorax longer and denser than in female; clypeus uniformly black with indistinctively crenulated apical margin; paraocular area with a narrow black stripe along the inner margin of eye; yellow stripe of vertex widely broken. – T6 yellow with black notch medially and small black spots at both sides; T7 black, deeply emarginate with small bumps at each side of the emargination; usually hidden under T6; sterna black with the exception of a subapical yellow band; fringe of long, light brown or golden hairs at apical margin of S2; S3 with golden fringe of hairs at apical margin and grey pubescence laterally; S4 with fringe of golden fringe of hairs at each side; dark comb of S4 emarginated with approximately 90-95 teeth that are bent inward at the end; proximally to this comb, a narrow second dark comb with straight, irregularly positioned teeth (approximately 30 teeth). V-shaped carina on S5.

**Biology:** Flight season late April to July (Warncke 1992); June in Lebanon (Mavromoustakis 1963b, M. Kasparek, unpubl.). A male specimen was extracted in Lebanon from an emtpy shell together with *Rhodanthidium septemdentatum* (Latreille, 1809), its host.


*Stelis ruficornis*. Head (upper row) and apical tergites (lower row). Left: female, right: male. Specimens from Turkey (female) and Lebanon (male) in coll. Kasparek. Photographs: MK.

*Stelis ruficornis*. Upper row: left male scutellum, right tergite T2+T3. Below: Female atenna. Specimens from Turkey (female) and Lebanon (male) in coll. Kasparek. Photographs: MK.

**Distribution:** East Mediterranean species whose range extends over Greece, Turkey and Lebanon. Up to 1700 m in eastern Turkey (Warncke 1992).

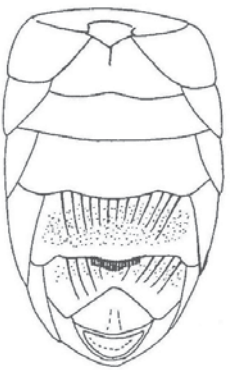
Distribution of *Stelis ruficornis*.

## *Stelis saxicola* Warncke, 1992

**Synonymy:**
*Stelis saxicola* Warncke, 1992. Entomofauna 13: 341-376 (Tunisia).

**Identification:** A rare species, known only from two specimens, a male and a female, from North Africa. Habitus similar to *phaeoptera* and *franconica*, but larger. Also similar to *murina*, who has similar pubescence, greyish-white in female and brownish-white in male.

***Female***: 11 mm. Pubescence greyish-white; apical bands on terga absent; clypeus slightly longer than wide (wider than long in *phaeoptera*); punctation of clypeus slightly weaker than in *phaeoptera*, but still dense and honeycomb-like; several coarse punctures



*Stelis saxicola*. Ventral view of male abdomen (from Warncke 1992).

at the base of the clypeus, well separated from each other; apical margin truncated. Punctation of frons slightly stronger than of lower half of face (distinctively stronger in *phaeoptera*). Punctation of scutum slightly finer and denser than in *phaeoptera* (punctures usually separated by less than half of their diameter). Punctation of terga coarser and denser than in *phaeoptera*, particularly obvious on T3 and T4, with punctures separated mostly by half their diameter (2-3 times their diameter in *phaeoptera*). On T4 and T5, punctation finer and denser on proximal parts than on disc (no such difference in the punctation pattern in *phaeoptera*); T6 dull with relatively fine and dense punctation (smooth with coarse and scattered punctation in *phaeoptera*).

***Male***: 9 mm. Compared to *phaeoptera*, pubescence more brownish-white, and hairs on frons and scutum shorter; punctation of head and scutum as in female finer and slightly denser than in *phaeoptera*, punctation of terga coarser. Apical terga densely punctate with finer and denser punctation on base of T4 and T5. Apical tergum T7 rounded without tooth as in *phaeoptera.* Dark comb of S4 distinctively wider than in *phaeoptera* (about 1.5 times as wide as the length of the outer spur).

**Biology:** Found in Morocco in June (Warncke 1992).

**Distribution:** Morocco and Tunisia (Warncke 1992).

Distribution of *Stelis saxicola*.

## *Stelis scutellaris* Morawitz, 1894

**Synonymy:**
*Stelis scutellaris* Morawitz, 1894. Horae Soc. Ent. Ross. 28: 54-56 (Tajikistan).
*Stelis scutellaris* ssp. *inamoena* Popov, 1933. Trav. Inst. Zool. Acad. Sci. URSS 1, 1932: 403-404 (Russia).

**Identification** (6.5-10 mm): Middle Eastern and Central Asian species, characterised in both sexes by axillae with tooth-like projections. Closely related to *Stelis phaeoptera, franconica* and *murina.* Characteristic features are the colour of the hind spur (reddish in *phaeoptera*, black in *scutellaris*) and of tarsal segments (rust-red in *phaeoptera*, black in *scutellaris*), the shape of scutellum (rounded in *phaeoptera*, apex slightly emarginate in *scutellaris*) and axillae (rounded in *phaeoptera*, dentate in *scutellaris*), and punctation of

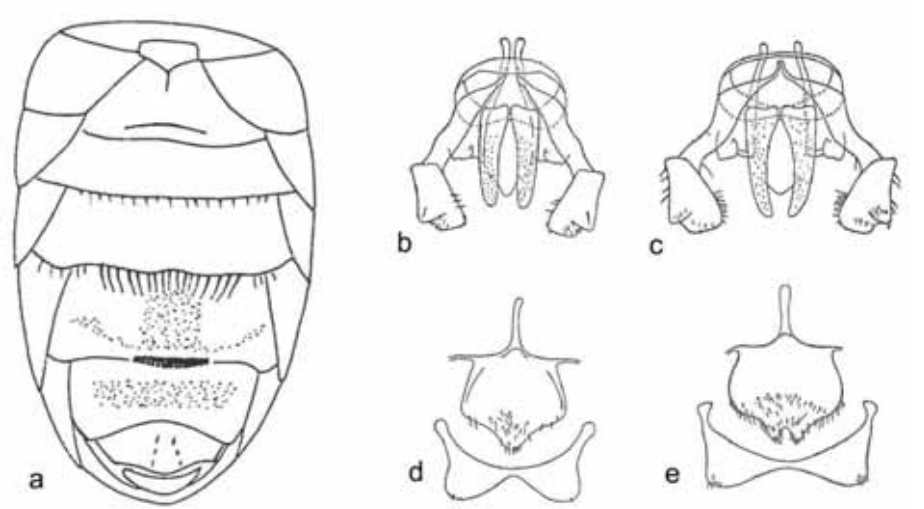

*Stelis scutellaris*, habitus. Left: female from Iran, right male from Turkey. Coll. Schwarz. Photographs: OLL.

*Stelis scutellaris*, head. Left: female from Iran, right male from Turkey. Coll. Schwarz. Photographs: OLL.

scutellum (less coarse in *scutellaris* than in *phaeoptera*). *S. scutellaris* is also similar to *S. aculeata* in its emargination of scutellum and the shape of axillae, but that species has for example black pubescence, and an carinated, acute T7.

*Stelis scutellaris*. Apical terga. Above left: female from Iran, right male from Turkey. Below: underside of male abdomen showing the dark comb. Coll. Schwarz.

***Female***: Body black. Clypeus slightly wider than long, finely and densely punctate, dull. Face including clypeus with whitish pubescence; frons and vertex coarsely punctate and shining, genal area with fine and wrinkled punctation. Legs including hind spur dark reddish-brown to black, claws reddish-brown. Antennae dark brown to black; 2nd antennal segments slightly shorter than 3rd ones; 3rd and 4th segments of equal length. Thorax with sparse whitish pubescence on upper parts becoming denser and longer at underside. Scutum and scutellum very coarsely punctate with glossy spaces between the punctures; the punctures separated by slightly less than their own diameter; scutellum almost semicircular with a flat emargination medially; axilla with a tooth-like projection. Wings strongly infuscate. Terga slightly less coarsely punctate than scutellum; white apical bands at both sides of the last tergum. Apical margin of last tergum slightly bending upward. Narrow white band at apical end of S5.




*Stelis scutellaris*, male. **a.** Underside of abdomen; **b-c.** Genitalia. **d-e.** Hidden sterna S7-S8 (b and d refer to nominate subspecies, c and e to the subspecies *inamoena)*. – *Sources*: a. From Warncke (1992); b-e. From Popov (1933).

***Male***: Face with long, white pubescence; 3rd and 4th antennal segments more or less the same length, and only slightly shorter than the succeeding segments; punctation of scutum and scutellum denser than in female. The last two terga (T6-T7) very densely punctate and wrinkled. S2 shining, punctation on disc medially less dense than laterally, with fringe of short white hairs at apical margin; S3 densely punctate, with a more or less distinct median longitudinal line; apical margin slightly convex with a long and dense fringe of white or yellowish hairs; dark comb on S4 as wide as about one third of width sternum. Apical margin of S5 deeply V-shaped emarginate.

Distribution of *Stelis scutellaris*.

**Biology:** Host unknown. Records from Iran are from June and July (Warncke 1985, ZMB).

**Distribution:** The range extends from eastern and south-eastern Europe over Turkey, the Caucasus and Iran into Central Asia (including Mongolia).

## *Stelis signata* (Latreille, 1809)

**Synonymy:**

*Anthidium signatum* Latreille, 1809. Ann. Mus. Hist. nat., Paris 13: 48, 232-233 (France).

*Anthidium parvulum* Lepeletier, 1841. Hist. Nat. Insect. Hym. 2: 403.

*Stelis strigata* Kriechbaumer, 1874. Correspondenzblatt des zool.-mineral. Ver. Regensburg 28: 74-75.

*Stelis signata* var. *flavescens* Friese, 1925. Konowia 4: 36-37 (Greece).

*Stelis signata* ssp. *eremica* Alfken, 1938. Dtsch. ent. Zeitschr. p. 430-431 (Israel).

**Identification:** Widespread, small species (5-7 mm) with conspicuous yellow pattern on head, scutum and abdomen. Legs predominantly yellow. Its host, *Anthidiellum strigatum*, is very similar and both species can easily be confused. Scutellum is semicircular in *S. signata*, but quadrangular in *A. strigatum*. The yellow maculations on the terga reach the lateral margin in *S. signata,* while in *A. strigatum* only those on the first two terga reach the margin, and the others are located more medially. Females of both species are easily distinguished by the lack of the ventral scopa in the cleptoparasite *S. signata*. *S. nasuta* has a similar shape, but the spots are white. Apical margin of the clypeus straight, not bilobed.

External characters of *S. signata* very similar in both sexes. Two yellow maculae in the paraocular area: one on the lower, the other in the upper area; scutum with two yellow stripes along anterior margin; large yellow spots at each side of scutellum; axillae yellow; tegulae and paranotal lobes at least partly yellow. – Terga with yellow maculae, almost all of them reaching the lateral margin; the yellow spots are largest on the third tergum and smallest on the first and last tergum.

The main colour of clypeus is black in females and yellow in males. The colour pattern, i.e. the distribution of black and yellow maculae, varies considerably both within populations and also geographically. The table gives on overview over the main colour patterns found in various parts of Europe.

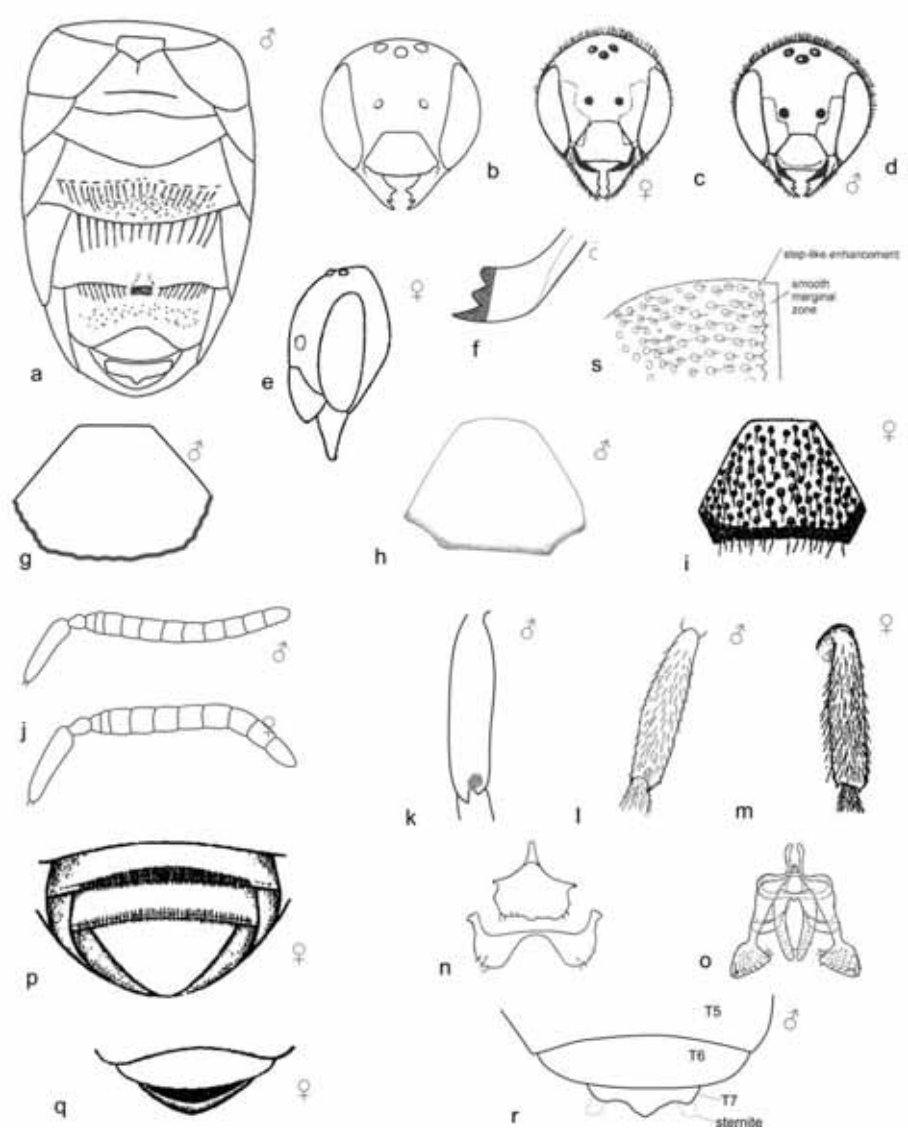
***Female***: T6 and the margins of all sterna fringed with short yellow hairs.

***Male***: T6 sometimes unspotted. Apical margin of S2 with dense, yellow fringe of hairs; these are shorter on S3 and longer, but interrupted on S4; dark comb on S4 narrow with approximately 12-14 straight bristles. Apical sternum with a small spine medially; sides slightly emarginate.

In general the yellow colouration pattern is very variable and several taxa have been described based mainly on the extent and the pattern of this colouration. Warncke (1992)

*Stelis signata*. Above: habitus of a male from Turkey. Below left: female from Germany, below right: face of a male from Turkey. Note the variation in the extension of yellow colouration on head, scutum, scutellum and abdominal terga. Specimens from SMNS and coll. Kasparek. Photographs: MK.

recognises three subspecies: nominate subspecies with yellow markings neither on mesepisternum nor normally on T5 or on clypeus (especially in females); *eremica* with extensive yellow markings in both sexes on head, sides of mesosoma and abdomen (usually including T6); and *flavescens*, in which females and partly also males have yellow markings on mesepisternum, clypeus and frons.




*Stelis signata*. **a.** Underside of male abdomen; **b-d.** Head (b. male & female, c. female, d. male); **e.** Female head, lateral view; **f.** Mandible of male; **g-i.** Clypeus (g-h. two different males, i. female: note the different shape of apical margin from slightly convex over truncated to slightly emarginate); **j.** Antenna (male and female); **k-m.** Fore tibia (k, l. different males, m. female); **n.** Hidden sterna (S7-S8) of male; **o.** Male genitalia; **p-q.** Female terminalia; **r.** Male apical terga (the thin line shows the last sternum, which can often be seen from above). **s**. Tergum T1, lateral view. – *Sources*: a, m. From Warncke (1992); b. From Scheuchl (2006); c-e, i-j, p-q. From Noskiewicz (1961), partly redrawn by MK; f-h, k-l, r-s. Drawing by MK after own material from Lebanon and Turkey; n-o. From Popov (1933).

*Stelis signata*. Male. Left: terga T2-T3, right: abdominal terga. Male from coll. Kasparek. Photographs: MK.

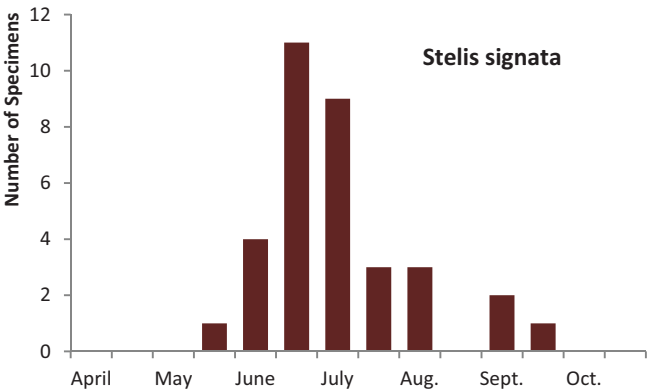
*Stelis signata*. Male. Underside of abdomen. Note the relatively narrow black comb on S4. Specimen from coll. Kasparek. Photographs: MK.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ♂ | | | | | 4 | 4 | 39 | 11 |
| ♀ | 7 | 6 | 3 | 1 | | | | |

*Stelis signata*. Colour pattern of the clypeus. The graph shows the distribution of black and yellow colour on the clypeus of N=75 males and females from various parts of Europe (OLL and coll. Kasparek).

**Biology:** Flight season May to September with a peak in June/July. Visits the flowers of Reflexed stonecrop *Sedum reflexum*, Breckland thyme *Thymus serpyllum,* Broad-leaved thyme *Thymus pulegioides,* Wild mignonette *Reseda lutea*, Blackberry *Rubus fruticosus*, Sheep's bit scabious, *Jasione montana*, fireweed *Epilobium angustifolium* and *Hieracium* (Westrich 1983, 1989). In Iran, found on the wing on *Centaurea virgata* (L. Dehghan Dehnavi et al., unpubl. manuscript). Elving (1968) mentions from Finland Fireweed, *Chamaenerion angustifolium*, Canadian Hawkweed, *Hieracium umbellatum (= H. canadendse)*, Bird's-foot Trefoil, *Lotus corniculatus*, Silver Cinquefoil, *Potentilla argentea*, and Large Hop Trefoil, *Trifolium aureum*.

Cleptoparasite of *Anthidiellum strigatum*, which is the only known host. Both species resemble each other and are difficult to distinguish at first glance.




Flight season in Germany (from: Wildbienenkataster 2013).

**Distribution:** Widely distributed from North Africa and the Middle East to the temperate Europe up to 62°N (Finland). In the east extending into Russia, Iran and Central Asia. Occurs in Switzerland up to 1600 m (Amiet et al. 2004), in Turkey from sea level up to 2200 m (Özbek & Zanden 1993).

Distribution of *Stelis signata*. Details for occurrence in Poland (orange) not available.

## *Stelis simillima* Morawitz, 1876

**Synonymy:**

*Stelis simillima* Morawitz, 1876. Hor. Soc. ent. Ross. 12: 68-69 (Azerbaijan, nec Armenia).

*Stelis cognata* Kohl, 1892. Ann. Naturhist. Hofmus. Wien 7: 230-231 (Caucasus, "Araxesthal" [Araks valley]; it is not possible to find out to which modern country this part of the Araks/Aras valley belongs]).

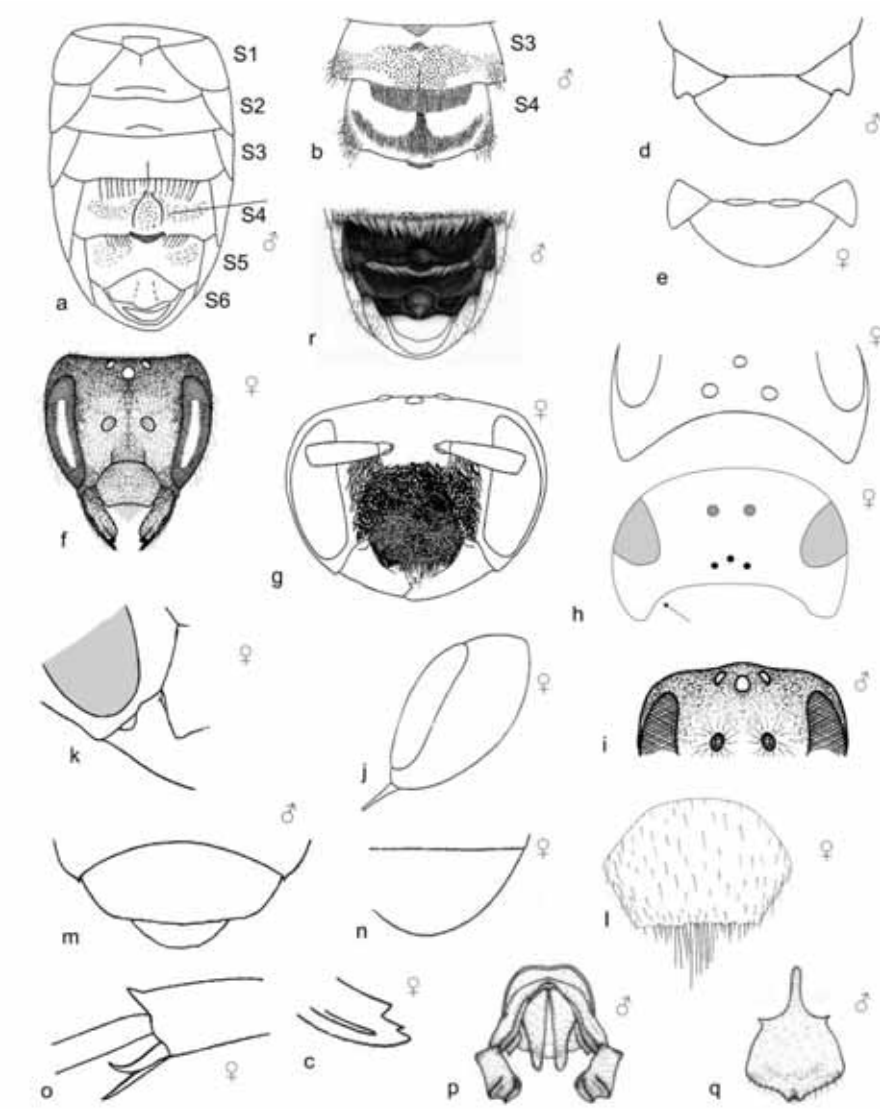
*Stelis genalis* Pasteels, 1969. Israel J. Entom. 4: 409-434 (Israel, nec Lebanon).

**Identification** (9-12 mm): Species with black, shining body and short face. Wings infuscate.

***Female***: Body black; head wider than long; clypeus black, flat (not protuberant), dull, densely and finely punctate (with punctures touching each other) to almost impunctate, indistinctly wrinkled; without pubescence, apical margin straight. Punctation of face more than twice as strong as of clypeus. Mandibles bent outwards at base, giving them a snout-like shape in lateral view. Vertex widely flattened. – Distances between punctures on scutum more than their diameter; punctation of scutellum much coarser than that of scutum; axillae triangular and protruding, almost impunctate and shining. – Apical margin of T1-T4 pale whitish; apical tergum T6 obtusely triangular, shining with finer and less dense punctation than on preceding terga; subapical area polished and almost impunctate.

***Male***: Similar to female, vertex less flattened, clypeus slightly protuberant. 3$^{rd}$ antennal segment longer than 4$^{th}$. T6 densely punctated and with a smooth, shining longitudinal stripe in the middle. S4 with two fields of golden yellow, appressed hairs; its apical margin with triangularly impressed mid-process (see photograph in Aguib et al. 2014). Warncke (1992) shows on a line drawing two long spines on S4, which could, however,

*Stelis simillima*, female. Marocco. Left: Habitus, right apical terga. Material in coll. Schwarz. Photograph: OLL.




*Stelis simillima*. **a.** Underside of male abdomen. Note the two long spines on S4. **b.** S3+S4 of the male abdomen; **c.** Male mandible; **d-e.** Scutellum and axilla (d: male, e: female); **f-g.** Face (female) in frontal view. **h-i.** Head in dorsal view (h: female, i: male; note the different shape of the head in two different drawings from different authors). **j.** Head in lateral view (female). **k.** Malar area and basal part of mandible ("*S. cognata*"). **l.** Clypeus, female. **m.** Male terminalia from dorsal. **n.** Apical tergum, female. **o.** Hind tibia, female ("*S. cognata*"). Note the distally upward-turning spine. **p.** Male genitalia. **q.** Hidden sternum S8. **r.** Male sterna. – *Sources*: a. From Warncke (1992). b, d, m. From Noskiewicz (1962). c, e, h (above), j, n: From Pasteels (1969a). f, i. From Amiet et al. (2004). g, k, o: From Tkalců (1970). h & l. Drawing by MK after material in OOE. p, q, r. From Ornosa et al. (2009).

*Stelis simillima*, female. Marocco. Face. Material in coll. Schwarz. Photograph: OLL.

not be confirmed. S5 often hidden under S4 and with a triangular depression in the centre; its apical margin covered with golden yellow hairs.

**Biology:** Flight season July and August; in Algeria, recorded on the wing also in May and June (Aguib et al. 2014). Cleptoparasite of *Lithurgus cornutus fuscipennis* according to Banaszak & Romasenko (2001) and *Lithurgus chrysurus* according to Noskiewicz (1923). It was reported to visit the Yellow Star-thistle *Centaurea solstitialis* (Asteraceae) (Rasmont et al. 1995). Aguib et al. (2014) give for Algeria *Centaurea* sp. and *Carduus* sp. (Asteraceae).

**Distribution:** Widely distributed from North Africa over western, southern and eastern Europe, the Caucasus and Iran to Central Asia. There seems to be a gap in the distribution area in central Europe. In Switzerland, the species was first recorded in 2010 and it is believed that this is a consequence of range extension (Gloor & Bontadina 2010). In Turkey up to 1690 m (Özbek & Zanden 1993).

Morawitz (1876) described the species based on a specimen collected in the "Akstafa Valley" in the Caucasus and the type locality has subsequently been given as Armenia. Actually, this locality (modern transcription is "Ağstafa") is located in today's Azerbaijan.

Distribution of *Stelis simillima*.

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Bees belonging to the genus *Stelis* have a cleptoparasitic mode of life, i.e. they parasitize other species of the same bee tribe, the Anthidiini. As they lay their eggs in the nests of other bees, they are also called “cuckoo bees”. This publication provides for the first time a comprehensive guide to the Stelis species of Europe, North Africa and the Middle East. It summarises our knowledge of all 29 species, and gives for the first time a comprehensive identification key in the English language. The sections on individual species are richly illustrated with 156 colour micro photographs and a total of 246 line drawings, most of which show the morphological details that are useful for identification. Information is provided for each species on the flowers visited and the seasonal occurrence together with a set of distribution maps.