

Notes on some palaearctic and oriental *Systropha*, with descriptions of new species and a key to the species (Hymenoptera: Apoidea: Halictidae)

D. B. BAKER

Hope Entomological Collections, University Museum, Oxford OX1 3PW, UK

(Accepted 2 February 1996)

An annotated list of the palaearctic and oriental species of the genus *Systropha* Illiger, 1806, includes additional records for some less well-known species. A lectotype is designated for *Systropha hirsuta* Spinola, 1839. *Systropha christae* Warncke, 1992, is synonymized with *S. hirsuta*. *Systropha androsthene*s and *S. diacantha*, spp. n., are described from the Gulf States. A key for the separation of the males is given.

KEYWORDS: Apoidea, Halictidae, Rophitinae, *Systropha* Illiger, *Systropha androsthene*s, n. sp., *Systropha diacantha* n. sp., palaearctic, oriental, type material.

Introduction

Systropha is a small genus of rophitine bees (Halictidae, Rophitinae) best represented in the Ethiopian and Palaearctic Regions, in the latter largely confined to the Mediterranean Subregion but extending eastwards to western China, and but sparingly represented in the Oriental Region, where a few species occur in the Peninsular, Indian and Indo-Chinese Subregions. With other Old-World rophitine genera, it was briefly noticed by Michener (1965: 322) in a review of the western hemisphere genera of the Dufoureaeinae, under which name the subfamily was until recently known.

Systropha is particularly characterized, in the males, by an abrupt diminution in size, and spiral arrangement, accompanied or not by a reduction in their number, of the apical segments of the antennae. In this sex, the forms of the seventh (S7) and eighth (S8) metasomal sterna are also characteristic: S7 is cruciform, the apical lobes either simple or themselves produced in simple or folded terminal lobate or styliform processes; S8 bears an elongate, strongly sclerotized, capitate, apical process, the collum commonly slender but occasionally expanded (*planidens*, *ruficornis*), the inflated capitulum commonly orbicular but occasionally dentate or otherwise modified. S1 is usually mutic but may bear a massive median apophysis (*hirsuta*); S2 may bear either a massive median apophysis (two oriental species, *difformis* and *inexpectata*) or, more usually, paired more or less dentiform apophyses or transverse callosities; S3–5 are progressively less-modified or unmodified. S6 is often longitudinally carinate, with or without erect discal or marginal teeth, its apical margin often with a median emargination. The genitalia do not show great variation from the basic form (e.g. that of the type species, *curvicornis*, Fig. 1); the gonostyli however

may be either short or elongate and more or less arcuate. The genitalia are encapsulated by the unusually developed T7 (Figs 2, 3).

The females, which are smaller than the males, show no marked structural modifications comparable with the secondary sexual characters of that sex and few very evidence diagnostic characters. They are most readily recognized by association, confirmed by details of integumental sculpture and vestiture which in this genus are commonly shared by the two sexes. There is no well-developed tibial or basitarsal scopa: Friese (1901: 185), confirmed by personal observation, noted 'Thierchen oft mit der dichten Seitenbehaarung des ganzen Abdomen sammelnd', and the metasoma of museum specimens often carries a dense pollen load.

The common European species (*curvicornis*, *planidens*) are markedly protandric, with the males appearing three or four weeks before the females. Continuous observation of other species has not covered periods long enough to confirm whether this degree of protandry is general. A heavy preponderance of males appears to be general. So far as known all species depend on Convolvulaceae for pollen, although of course other plants are visited for other purposes: Friese, for example (1901: 186) records *curvicornis* sheltering from rain in the flowers of *Cichorium intybus* L.

The palaearctic species of *Systropha* were substantially revised by Ponomareva (1967), who described one new species, *S. popovi*, from Turkmenia and gave a description and figures of the species she took to be *S. hirsuta* Spinola (in fact, *S. pici* Pérez). Since 1967 a few additional palaearctic species and one from Thailand have been inadequately described, details of surface sculpture being sometimes given at length but important structural characters ignored. The present paper lists, with some additional records, the palaearctic and oriental species described to date; gives descriptive notes and figures for some previously described species; describes two new species from S.W. Asia; and gives an artificial key for separation of the males. It is not intended as a revision, since adequate material of certain species is lacking and since the unique holotypes of certain others are held in private collections.

Systematic

Systropha Illiger, 1806

Systropha Illiger, 1806: 145. Type species (*Andrena spiralis* Olivier, 1789 =) *Eucera curvicornis* Scopoli, 1770 (monobasic).

Systropha (*Systrophidia*) Cockerell, 1936: 477. Type species *Systropha* (*Systrophidia*) *ogilviei* Cockerell, 1936 (monobasic). *Syn. nov.*

The characters given for *Systropha sensu stricto* by Batra and Michener (1966) in a table comparing *Systropha* and *Systrophidia* with the newly described Indian species *punjabensis* Batra and Michener are not generally applicable. The characters of *punjabensis*, with weakly modified sterna, and of the new species *androsthenes*, with still further reduced antennae, go some way towards bridging the gap between *Systropha* and *Systrophidia*, which is not seen as meriting generic rank.

Annotated list of palaearctic and oriental *Systropha*

The species are listed in chronological sequence of description. Citations are standardized in the format: reference to original description; sex(es) described; type locality. The holding institutions of primary type material, where known, are indicated in parentheses, thus (OUM), immediately following citations.

Systropha curvicornis (Scopoli, 1770)

(Figs 1–3)

Eucera curvicornis Scopoli, 1770: 9; [♂]; Circa Cremnizium in Hungaria (Slovakia: Kremnica).

Type material presumed lost.

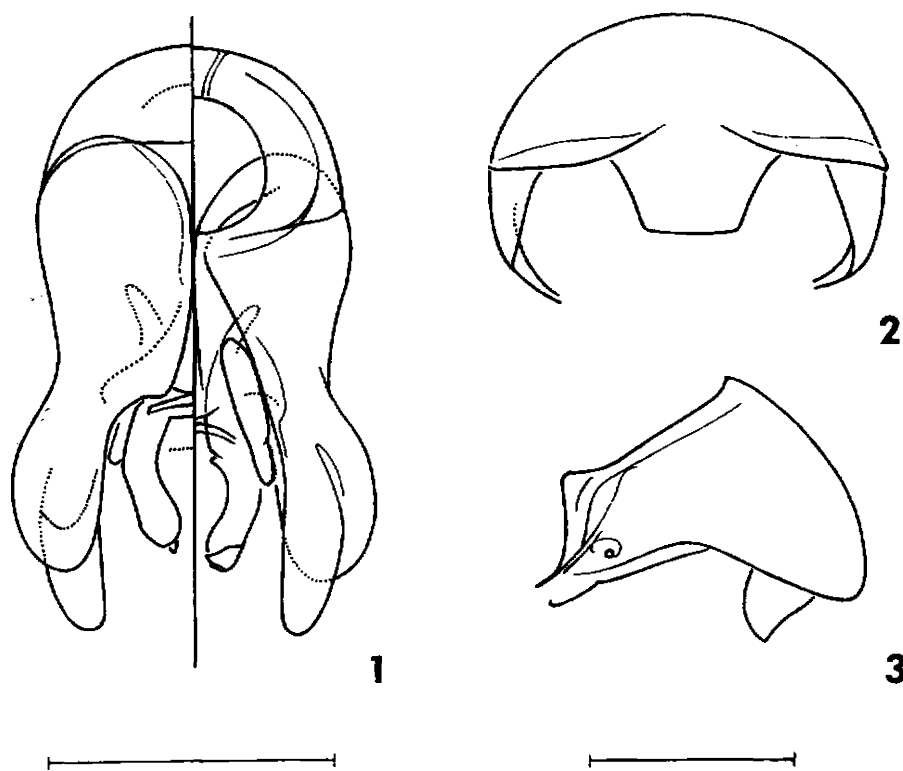
Tenthredo convolvuli Pallas, 1773: 731; [♂]; (Russia). *Syn. nov.*
Andrena spiralis Olivier, 1789: 135 (after 1818, pl. 383 Fig. 5, 6); [♂]; Provence ('... en Provence: elle m'a été communiquée par M. Danthoine, médecin à Manosque'). Type material not traced, possibly MNHNP.

Andrena labrosa Eversmann, 1852: 10 (in key), 22; ♀; in provincia Orenburgensi, in promontoriis Uralensibus. (ZISP).

Figured. Saunders, 1884: 260, pl. XIII Fig. 13–13b; Ponomareva, 1967: 682.

Remarks. This is *curvicornis* as usually interpreted, although Scopoli's '*Longicornis* [*Eucera longicornis* (L.)] paulo minor' perhaps applies better to *planidens* Giraud. However, since the smaller species has universally been recognized as *curvicornis*, there is no case for designating a neotype to preserve that usage. Both species are found in the Kremnica area.

There is a suggestion in Olivier's description of *spiralis* that his material might have been composite ('L'abdomen est ... armé, en-dessous, de deux ou trois épines, de chaque côté'), and certainly *planidens* is common in Provence.

Ebmer (1994: 810) stated: 'Nördlich der großen Gebirgzone Asiens sind die bisher östlichsten Funde von *Systropha* aus Turkmenien und dem Iran (Warncke 1980:


FIGS 1–3. *Systropha curvicornis* (Scopoli), ♂, Kobylí env., vii. 1944 (V. Balthasar) (1) genitalia; (2) tergum 7, caudal aspect; (3) tergum 7, lateral aspect [Prep. no. 1973.95]. Scale lines represent 1 mm. Hair characters omitted.

377–378) sowie aus Tadjikistan (Warncke 1992: 745) nach Literaturangaben bekannt. Aus der gesamten Ostpaläarktis ist weder aus der Literatur noch mir persönlich eine *Systropha* bekannt geworden. So sind nach der bisherigen Kenntnis *S. difformis* und *S. inexpectata* die beiden östlichsten Vertreter dieser Gattung.'

It may be observed (1) that Ponomareva (1967: 681) recorded *curvicornis* from three localities in China, and (2) that the Nan Shan extend to beyond 100°E longitude.

Systropha hirsuta Spinola, 1839

(Figs 4–8)

(Without name) Savigny, 1809–1813: pl. 5 [Andrènes] Fig. 16; ♂; Egypt.

Systropha hirsuta Spinola, 1839: 516; ♂; Egypt, Nubia or Arabia (cf. p. 437) [Egypt]. (MRSNT)

Systropha pilosa Spinola: Casolari and Casolari Moreno, 1980: 159, '1, 23, 95, 2' (= Spinola, Egypte, Walzl, 2 specimens).

Systropha christae Warncke, 1992: 742, Fig. 1, 2; ♀♂; 8 km O Yeroham, Israel. [OLL] **Syn. nov.**

Figured. Savigny, 1809–1813, pl. 5 (whole insect, numerous details); Warncke, 1992: 746 (as *christae* Warncke).

Remarks. The two ♂ syntypes of *hirsuta* in the Spinola Collection in Torino are labelled in pencil '*Systropha pilosa*, m. / Ann. Soc. Ent. ♂ / D. Walzl Egypte'. The pin labels are modern, and taken from Spinola's drawer label (cf. Casolari and Casolari Moreno, 1980). It is evident that here, as occasionally elsewhere, Spinola changed the specific name prior to publication. The specimen in better condition, with leg R II present, is now designated as **LECTOTYPE**.

Warncke's description and figures of *christae* unequivocally indicate identity with *hirsuta*. Spinola's description does not mention the diagnostic apophysis of sternum 1, but in both syntypes the metasoma is strongly deflexed and the apophysis is little obvious between the posterior coxae. Nevertheless, Spinola's species, mistakenly identified by authors with *pici* Pérez, should have been readily recognizable from other details given in his description. The massive, bifurcate apophysis of S1 (Fig. 4) is an unique apomorphy of *hirsuta*.

There appears to be some error both in the original description of *christae* (1992: 742: 'Das einzige Männchen dieser Art fing meine Frau östlich Yeroham') and in Blank and Kraus' catalogue of the type material of Warncke's nominal taxa (1994: 760: '... Christa Warncke who collected the only male specimen of the new species'), since the latter authors record (l.c.) the presence of two male paratypes.

Descriptive notes. Male: apical antennal segments short, compressed (Fig. 5); mouthparts of moderate length. Second cubital cell narrow, 2nd abscissa of Rs about half length of 1 r-m (1:1.9); basitarsus III elongate, narrow, arcuate. S1 with massive bifurcate apophysis; apophyses of S2 moderately developed, thornlike; S3–S5 mutic; S6 with median, longitudinal carina, subdentate near base and dentate at apex, apical margin of sternite with median semicircular emargination; S7, S8 and genitalia: Figs 6–8. Species with copious grey pubescence, the metasoma appearing fasciate. Wing veins, except Sc + R, and calcaria pale yellow.

Female: similar, smaller (9 mm). Head moderately transverse, width: length ratio 1:0.86; lateral ocelli separated from vertex by 2× their diameter. Mesoscutum dull, densely, finely punctate; scutellum slightly glossy, less densely punctate. Terga weakly coriaceous, moderately densely and rather coarsely punctate, little denser or coarser on more apical terga; marginal areas depressed, decoloured, overlain by long pale hairs arising from premarginal areas of discs, giving a fasciate appearance; pygidial plate acute. Black; anal fimbria yellow; setae of basitarsi III entirely pale.

Additional records. **Egypt:** 35 km E of Wadi Natrun, 17. iv. 1992 (C. G. Roche), 1♂



FIG 4. *Systropha hirsuta* Spinola, ♂, Israel: Dimona, 6–8. v. 1975 (K. M. Guichard): metasoma, basal sternum, oblique aspect [Neg. 149.14]. [Prep. no. 1979.135].

[DBB]. Israel: Dimona, 6–8. v. 1975 (K. M. Guichard), 1♂ 2♀; Palmachim, 2. v. 1975 (K. M. Guichard), 1♂ [BMNH].

Systropha planidens Giraud, 1861

Systropha planidens Giraud, 1861: 451; ♂♀; 'Je possède des mâles provenant de l'Espagne . . . , du midi de la France . . . et quelques uns que j'ai capturés en Autriche. J'en ai vu deux . . . dans le Musée de Vienne . . . d'Amasie, dans l'Asie-Mineure'. Type material, other than the two specimens from Amasia (NMW), apparently lost, but there can be no doubt as to the identity of Giraud's Austrian syntypes. Restricted typical locality 'Österreich' (Warncke 1977: 96).

Systropha chrysura Pérez, 1905: 85; ♀; Tarragona. [MNHNP, lectotype, designated by Warncke (1977: 96; Tarragona).]

Systropha planidens anatolica Warncke, 1977: 96; ♂♀; Tunceli, Türkei. [OLL] **Syn. nov.**

Figured. Ponomareva, 1967: 692.

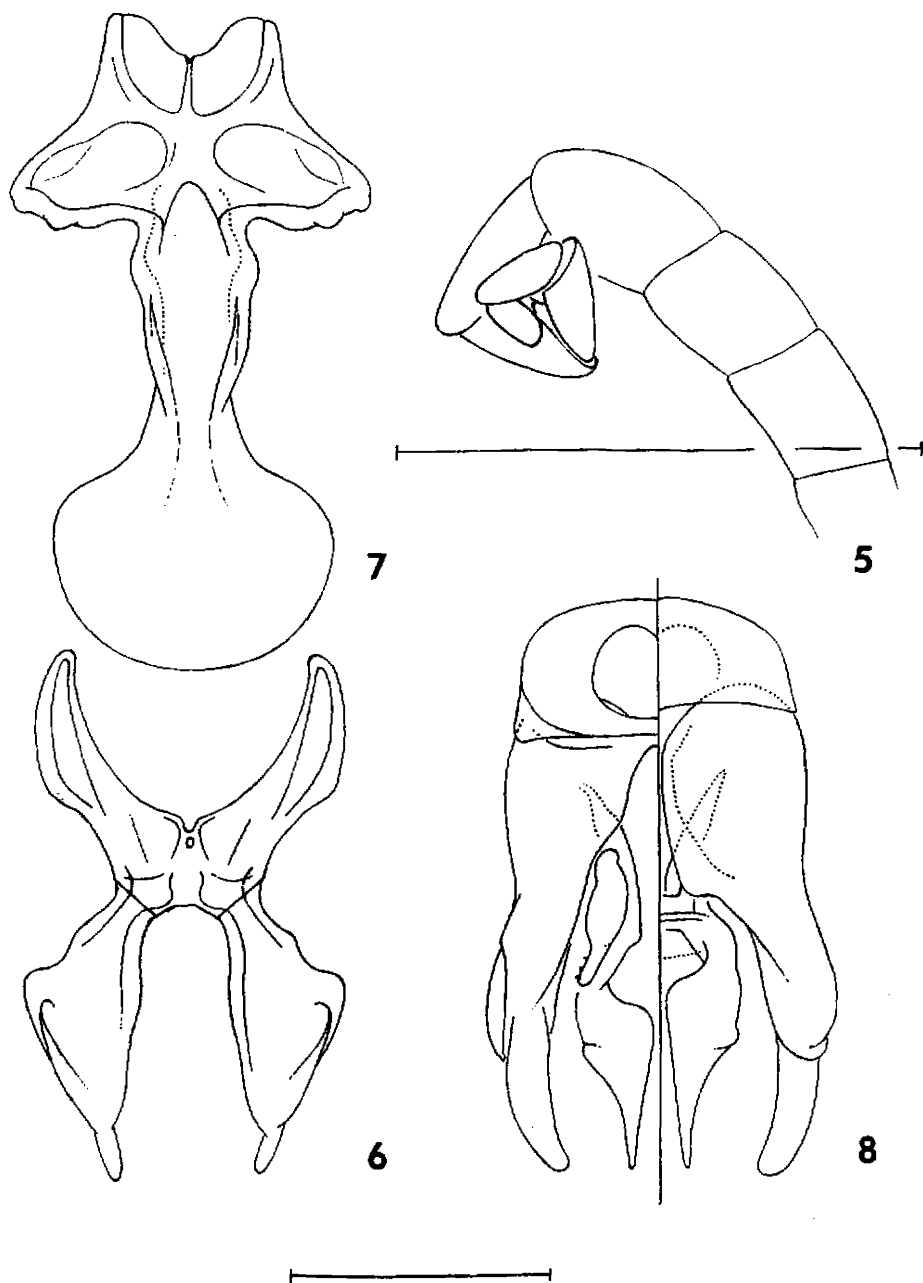
Remarks. Warncke's description of *anatolica* gives no adequate grounds for recognizing the southern Anatolian (Tunceli) and later recorded (1992: 742) Palestinian populations as subspecifically distinct. Equally, available material from the Balkans and western Anatolia is inadequate to demonstrate whether clinal variation obtains. Males from Bitlis are not distinguishable from males from Greece and Iran.

Additional records. (Other than from European localities.) **Turkey:** Bitlis, 1700 m, vi. 1970 (F. Schubert), ♂♂ [DBB]. **Iran:** central Alborz, Karaj Valley, Gach-e-Sar, 2150 m, 17–19. vii. 1965 (D. B. Baker), series ♂♂ ♀♀ [DBB].

Systropha difformis Smith, 1879

(Figs 9–10)

Systropha difformis Smith, 1879: 60; ♂; Burmah. [BMNH: B. M. Type Hym. 17 a 1837; examined.]



FIGS 5-8. *Systropha hirsuta* Spinola, ♂, Israel: Dimona, 6-8. v. 1975 (K. M. Guichard): (5) apical antennal segments; (6) sternum 7; (7) sternum 8; (8) genitalia [Prep. no. 1979.135]. Scale lines represent 1 mm. Hair characters omitted.

Systropha difformis Smith: Bingham, 1897: 466, Fig. 152.

Systropha difformis Smith: Ebmer, 1994: 808, Fig. 4, 6-9.

Remarks. Bingham (1897: 466) recorded having 'found the males frequenting the flowers of what looked like a species of spurge in the beds of dry streams in

Tenasserim'. Three of Bingham's Tenasserim ♂♂—he did not encounter the ♀—are extant in BMNH, all collected at different localities: Ataran Valley, ii. 1893; Thaungyin Valley, v. 1893; Martaban, 5 ii. 1894. The Thaungyin and Martaban localities have not previously been reported.

Ebmer (1994: 807) wrote: 'Die Syntypenreihe der wenigen Exemplare von *Systropha difformis* Smith ♂ in der Sammlung des Britischen Museums erwies sich als konspezifisch. . . . Aus der Erinnerung sind es über 5, höchstens 10 Exemplare'. In reality, Smith's description was based on a single ♂, one of 52 Hymenoptera included in a mixed lot purchased from Stevens and recorded in the British Museum Accessions Register (Annulosa) under the entry 1857–16. [The Register further recorded that the insects entered under that number were collected by a Mrs Waring, whose identity has not been established, or it might have been possible to give a more exact locality for her material. An S. L. Waring was elected to membership of the Entomological Society of London in 1850, but of him nothing appears to be on record. A George Waring wrote (1868: 136): 'Many years ago, when a maker of morphia, I . . .', which might suggest some possible connection with Burma, as a source of opium, but again no useful information has yet been found.] Indeed, in the mid-XIXth century: it would have been most unusual for any purchase or other acquisition to have included more than a very few examples of any one species, and by far the majority of Smith's many bee taxa were described from but one or two examples (Baker, 1993).

The holotype of *difformis* is labelled 'Birmah, ⁵⁷/₁₆' and '*Systropha difformis*. Sm. Birmah' [Smith's hand]; it has been staged and is now extensively damaged: both antennae are reduced to the three basal segments [Smith noted that the three apical segments were rufo-testaceous]; legs I are intact but IIR ends with the trochanter and the remaining three lack distal tarsal segments.

Ebmer (1994: 808) noted two references to *difformis* by Friese (1911, 1913), and went on to state '*S. difformis* wurde also diagnostisch, vor allem mit Zeichnungen, nie dargestellt', but *difformis* had already in fact been redescribed and illustrated by Bingham (1897: 466). Bingham's figure gave well the habitus of the species. Ebmer's figures (1994: 819), based on one of Bingham's ♂♂, give little idea (his Figs 6, 7) of the form of the apophysis on S2, now illustrated at Figs 9 and 10. S7 was figured by him (his Fig. 8), together with a lateral view of the apical portion of S8 (his Fig. 9): S8 and the genitalia are not illustrated in the present paper because both of these structures are extensively damaged in Ebmer's preparation (*cf.* under *inexpectata*).

Descriptive notes. Ultimate antennal segment elongate, slightly compressed; glossa and labial palpi strongly elongated, the maxillary palpi shorter, not reaching to end of second segment of labial palpi. T2 and T3 inflated and laterally carinate; S1 mutic, clothed with erect, plumose pubescence; S2 with a transverse carina rising strongly mesad to form a columnar apophysis with concave summit; the general shape of the summit area is trapezoidal and posteriorly it is prolonged to form a strong longitudinal carina, convex in lateral aspect, that descends to the margin of the segment; S3 with low transverse carina interrupted in median fifth; S4 with strong postgradular depression; S6 produced and longitudinally carinate apically, the carina at apex in lateral aspect bifurcate.

Systropha ruficornis Morawitz, 1880

Systropha ruficornis Morawitz, 1880: 356; ♂; Bei Krasnowodsk. [ZISP]

Systropha rufiventris Dalla Torre, 1896: 192; *lapsus calami aut memoriae*.

Systropha rufiventris Friese, 1901: 192; error, presumably copied from Dalla Torre.



FIGS 9–10. *Systropha difformis* Smith, holotype ♂, Burma [Myanmar], metasoma, lateral and latero-ventral aspects [Neg. 146–1, 146–5]. FIGS 11–12. *Systropha inexpectata* Ebmer, holotype ♂, Thailand: Nan, 24.i.19** (T.D.A. Cockerell): (11) metasoma, dorso-lateral aspect [Neg. 140–16]; (12) metasoma, lateral aspect [Neg. 140–15].

Systropha ...
holotyp

Figured.

Systropha p
(1967: 6
(*Systropha*
(*Systropha*

Figured.
Additional
Roberts),
data excep
P. M. Rob
P. M. Rob
Else), 4♂ 2
[BMNH,

Systropha g

Remarks.
'(Antiga,
96) purpo
invalid un
no inform
grandima
not comp
of a lecto
Systropha

Systropha
1851, l
Systropha
by Ebr

Remarks.
Systropha
Systropha
Ethiopian
that taxon
Descriptiv
shorter th
on S3; S4

Systropha
Ludhik

Systropha ruficornis Morawitz: Ponomareva 1967: 683, Fig. 6–10; ♂ redescribed from holotype.

Figured. Ponomareva, 1967: 684.

Systropha pici Pérez, 1895

Systropha pici Pérez. 1895: 175; ♀: Aïn Sefra. [MNHN, lectotype designated by Ponomareva (1967: 691).]

(*Systropha hirsuta* Spin.: Ponomareva 1967: 685; misidentification.)

(*Systropha hirsuta* Spin.: Warncke 1977: 95; misidentification.)

Figured. Ponomareva, 1967: 687 (as *hirsuta* Spinola).

Additional records. **Morocco:** Km 40 Erfoud–Tinejdad road, 13. iv. 1993 (*S. P. M. Roberts*), 1♂; same data except 14. iv. 1993, 3♂, at *Convolvulus spinosus* Burman; same data except (*G. R. Else*), 1♂ 1♀ [no plant record]; 12 km N of Erfoud, 11. iv. 1993 (*S. P. M. Roberts*), 2♂, at *Convolvulus spinosus*, 2♀; 16 km S of Goulmima, 9. iv. 1993 (*S. P. M. Roberts*), 1♂ 1♀, at *Convolvulus spinosus*; same data except 10. iv. 1993 (*G. R. Else*), 4♂ 2♀ [no plant record]; Tansikht, 25 km S Agdz, 17. iv. 1987 (*M. Edwards*), 5♂ [BMNH, DBB, SPMR].

Systropha grandimargo Pérez, 1905

Systropha grandimargo Pérez. 1905: 84; ♂♂: Catalogne.

Remarks. *S. grandimargo* was described from an unspecified number of syntypes: '(Antiga, Bofill). Paraît commun sur divers points de la Catalogne'. Warncke (1977: 96) purported to designate as lectotype a ♂ from Barcelona (MNHN) but this is invalid under the Code (Article 74(d) and Recommendation 74C) since Warncke gave no information identifying any particular specimen. According to Warncke, *S. grandimargo* is a synonym of *S. planidens* Giraud, but Pérez' description of the ♂ is not compatible with this placement. The identity of *grandimargo* and the designation of a lectotype are questions best left to a revision of the Iberian and NW African *Systropha*.

Systropha tropicalis Cockerell, 1911

Systropha tropicalis Cockerell, 1911: 227; ♂♀: Ceylon, Kandy. [BMNH, B. M. Type Hym. 17 a 1851, labelled 'E. COMBER [print] Feb '10 / Kandy [MS]'; examined.]

Systropha butteli Friese, 1913: 87; ♀♂: [Ceylon:] Seenigoda. [MNHUB, lectotype ♂ designated by Ebmer (1994: 811).]

Remarks. Ebmer (1994: 811), in a paper entitled '*Systropha difformis* Smith 1879 und *Systropha inexpectata* n. sp., die beiden östlichen Vertreter der altweltlichen Gattung *Systropha* Illiger 1806' [which gave also a list of the nominal species described from the Ethiopian Region], gave a partial redescription of *tropicalis*, based on the lectotype ♂ of that taxon and on a paralectotype ♀ of *butteli*.

Descriptive notes. Apical antennal segments compressed, black. Second abscissa of Rs shorter than 1 r-m (1 : 1.8). Apophyses of S2 and S3 low, mammiform, better developed on S3; S4 and S5 unmodified; S6 apically with median, bilobate (in lateral aspect) lamella.

Systropha punjabensis Batra and Michener, 1966

Systropha punjabensis Batra and Michener, 1966: 650, Fig. 1–3, 6, 8, 10–16; ♂♀: India, Punjab, Ludhiana. [SEM; paratype examined.]

Descriptive notes. Antenna 12-segmented; glossa and labial palpi short, maxillary palpi comparatively long. Second abscissa of Rs much shorter than 1 r-m (1:2.5). Sterna little modified, apophyses of S2 low, convex; S6 basally with median longitudinal carina.

Systropha iranica Popov, 1967

Systropha iranica Popov, 1967: 193, Fig. 4; ♂; [Iran:] Kerman. [ZISP]

Remarks. Popov recorded that the ♂ holotype of *iranica* was taken at *Punica granatum* L. Warncke (1980: 378) recorded *iranica* as visiting *Convolvulus leiocalycinus* Boissier and *C. spinosus* Burman: in view of the uncertainty over what Warncke understood by *iranica* (*vide infra, sub popovi*), these records require confirmation.

Systropha popovi Ponomareva, 1967

Systropha popovi Ponomareva, 1967: 691, Fig. 22–26; ♀♂; Kirzheli; 100 km SE Kizyl-Arvat, Turkmenia. [ZISP]
[*Systropha ruficornis* Morawitz: Popov, 1960: 253; misidentification.]

Remarks. Although the spelling of the type locality is different (Kirzheli: Kirpili), the holotype of Ponomareva's species appears to have been the ♂ recorded by Popov under *ruficornis*, the data given, 100 km SE Kizyl-Arvat, 15 V 1953 (E. Arens), being otherwise the same.

According to Warncke (1980: 377), 'Die Beschreibung und die Abbildungen [of *popovi*] stimmen völlig mit *S. iranica* POP. überein—syn. nov.'. In fact, Popov's and Ponomareva's figures show numerous differences, and the synonymy, though possible, requires confirmation. In the event of synonymy, Popov's name (before August, 1967) has priority over Ponomareva's (December). Warncke further remarks 'Sehr ähnlich, vielleicht sogar gleich, ist *Systropha ruficornis* MORAWITZ, 1888 [*sic, recte* 1880]'. This is in fact highly improbable, as comparison of Ponomareva's descriptions and figures of *popovi* and of the holotype of *ruficornis* will clearly show. Ponomareva herself placed *ruficornis* and *popovi* in different species-groups.

Additional record. **Pakistan:** Quetta, v. 1903, 1♂ (diss., 79.134), vi. 1903, 1♂ 1♀ (all *Col. C. G. Nurse*) [BMNH].

Descriptive notes. Femur II moderately expanded; coxa III mutic; femur II not expanded; tibia III not greatly expanded apicad; basitarsus III slender, parallel-sided, slightly arcuate; S1 mutic, with long erect hair; S2 with strong, blunt, conical, apophyses; S3 with similarly formed but slightly smaller, more sharply pointed, apophyses; S4 mutic, with weak basal depression; S6 with median longitudinal carina in basal half, small erect terminal tooth, and lateral longitudinal carinae bearing erect fimbriae in their posterior half; capitulum of S8 transverse, laterally broadly rounded. Antennae dark.

Systropha maroccana Warncke, 1977

Systropha maroccana Warncke, 1976: 94 (in key), 97, Fig. 1–4; ♂; Süd-Marokko, km 6 Sidi Ifni—Goulimine Road. [BMNH, B. M. Type Hym. 17 a 3006; examined].

Additional records. **Morocco:** 6 km NW of Agdz, 7. iv. 1993 (*S. P. M. Roberts*), 3♂ 1♀, at *Convolvulus trabutianus* Schweinfurth & Muschler in Fedde; Km 6 Sidi Ifni—Goulimine road, 29. iii.—1. iv. 1974 (*G. R. Else* and *K. M. Guichard*), 1♂; Km 9 Sidi Ifni—Goulimine road, 31. iii. 1993 (*S. P. M. Roberts*), 2♂, at *Convolvulus trabutianus*;

Gorges du Ziz, 40 km N Er-Rachida, 23. iv. 1987 (M. Edwards), 1♂ [BMNH, DBB, SPMR].

***Systropha villosa* Ebmer, 1978**

Systropha villosa Ebmer, 1978: 86, Fig. 70, 72; ♂♀; 150 km E Bandar Abbas. [AWE]

Systropha villosa Ebmer: Warncke 1980: 376, 377 (in keys), 378; description of holotype (♂) amplified.

Remarks. Ebmer's outline figures are poor: that of S7 shows the sclerite distorted, and that combining S8 and the genitalia shows only the capitulum of the former. According to Ebmer (*in litt.*, 16 January, 1995), the collum of the process of S8 is slender. Again according to Ebmer (*l.c.*), S6 has 'die Sternitfläche mitten der Länge nach mit erhabenem Kiel' but Warncke noted of the same specimen that the sternum was merely 'mitten flach längsgewölbt'.

***Systropha tadjika* Warncke, 1992**

Systropha tadjika Warncke, 1992: 743, Fig. 3, 4; ♂; 3 km W Dusti / 130 km S Duschanbe / Tadjikistan. [OLL]

Remarks. *S. tadjika* was described in a paper entitled: 'Die Bienengattung *Systropha* neu für ... Zentralasien'. The genus was not in fact new to Central Asia: Morawitz (1880: 356) had described *S. ruficornis* from Krasnovodsk (Turkmenia), Popov (1960: 254) had recorded what he took to be the ♀ of *ruficornis* [i.e., *popovi*] from Kirpili and Uch-Adzhi (Turkmenia), and Ponomareva (1967: 681) had recorded *curvicornis* from the Tien Shan and Nan Shan.

Warncke's Figs of S6 and S7 of *tadjika* are crude, but the form of S7 would appear to be diagnostic.

***Systropha inexpectata* Ebmer, 1994**

(Figs 11–15)

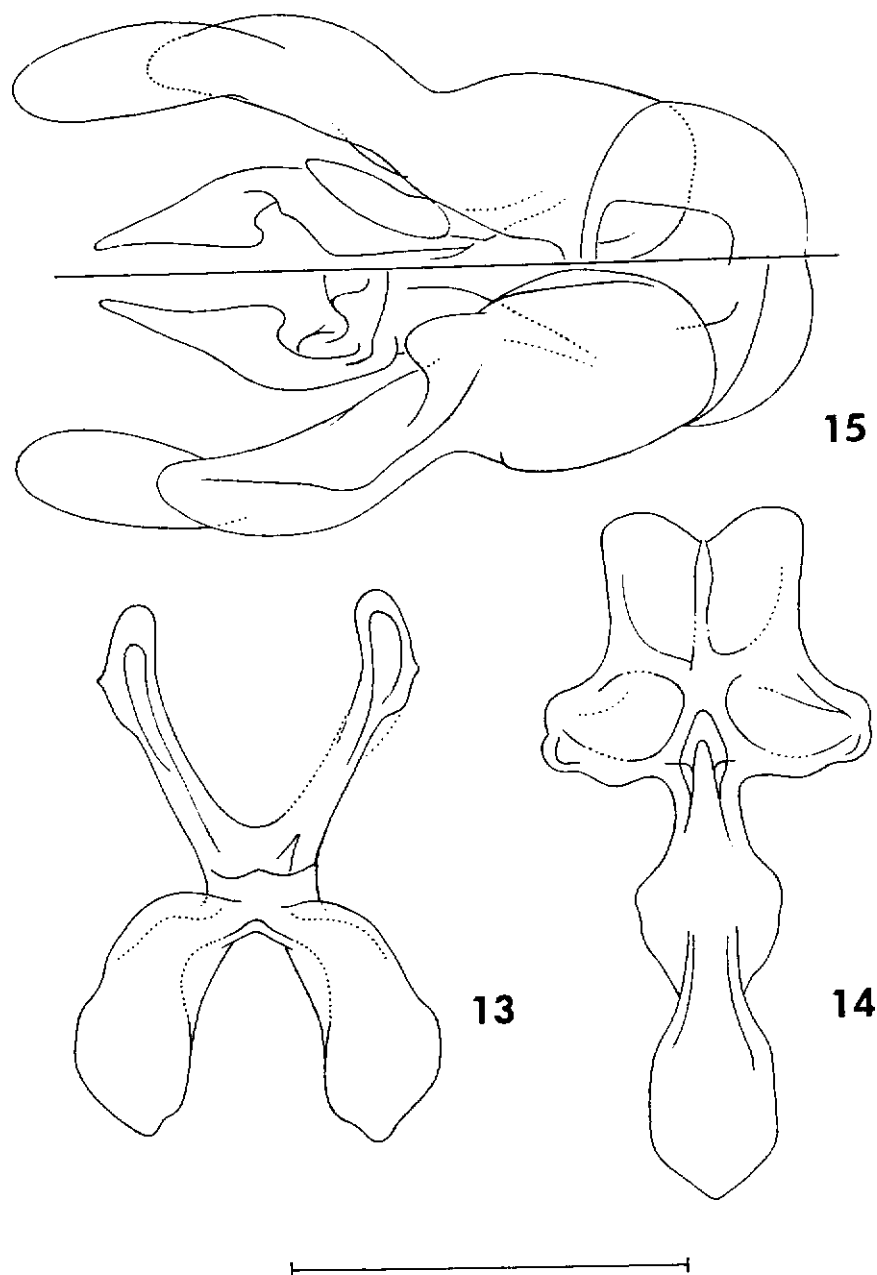
Systropha inexpectata Ebmer, 1994: 808, Fig. 10–14; ♂; Nan, Siam. [BMNH, B. M. Type Hym. 17 a 3007; examined].

Remarks. The holotype was collected by Cockerell and is labelled in his hand. Cockerell's second label does *not* read 'flowers visit. convolvulus' as given by Ebmer, but 'fls white convolvulus'.

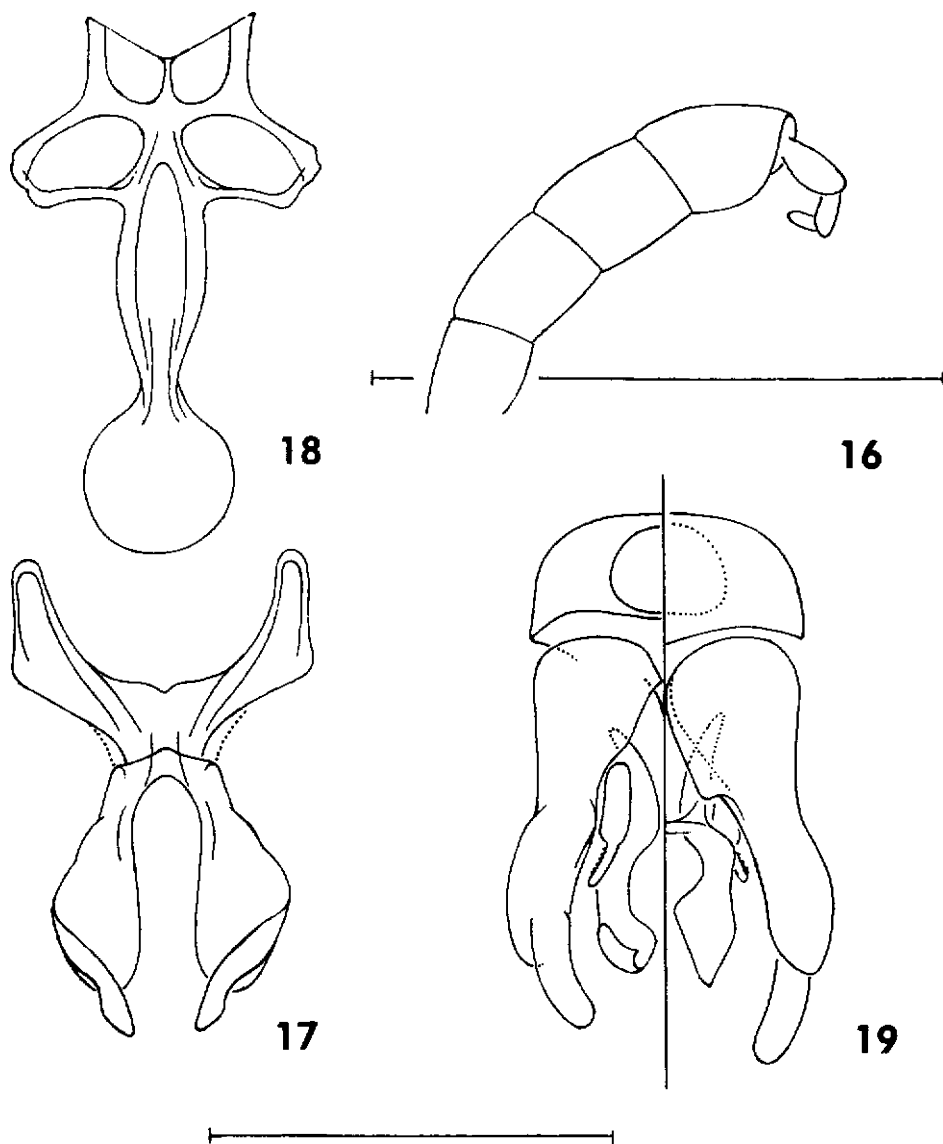
The type is now in poor condition and the original labels discoloured. The seventh and eighth sterna and the genitalia, all more or less damaged, were found to be embedded in adhesive on a piece of paper in such a way as to render examination and drawing unnecessarily difficult. Ebmer's figures of S7 and S8 were bad. S7 and S8 have now been dismounted, freed of excess adhesive, cleared in KOH, redrawn (Figs 13, 14), and preserved in glycerol in a microvial attached to the pin. The genitalia, not figured by Ebmer, have been similarly treated (Fig. 15).

Ebmer's description omitted several important particulars.

Descriptive notes. Length 9 mm. Second abscissa of Rs \approx 1st r-m; tibia III expanded apicad, basitarsus III arcuate. T2, T3 inflated laterad (Fig. 11); T7 not examined: driven back inside metasoma presumably when the type was 'dissected'; S1 thinly clothed with long, erect hair; S2 with massive median apophysis (Fig. 12); S3 with two low, transverse, carinate callosities; gradulus of S4 and S5 advanced mesially, forming a distinct raised platform; S7, S8, genitalia: Figs 13–15; length; width gonostylus = 1:0.64.



FIGS 13–15. *Systropha inexpectata* Ebmer, holotype ♂, Thailand: Nan, 24. i. 19** (*T. D. A. Cockerell*): (13) sternum 7 (disc damaged); (14) sternum 8 (central region damaged); (15) genitalia (gonobase damaged). Scale line represents 1 mm. Hair characters omitted.



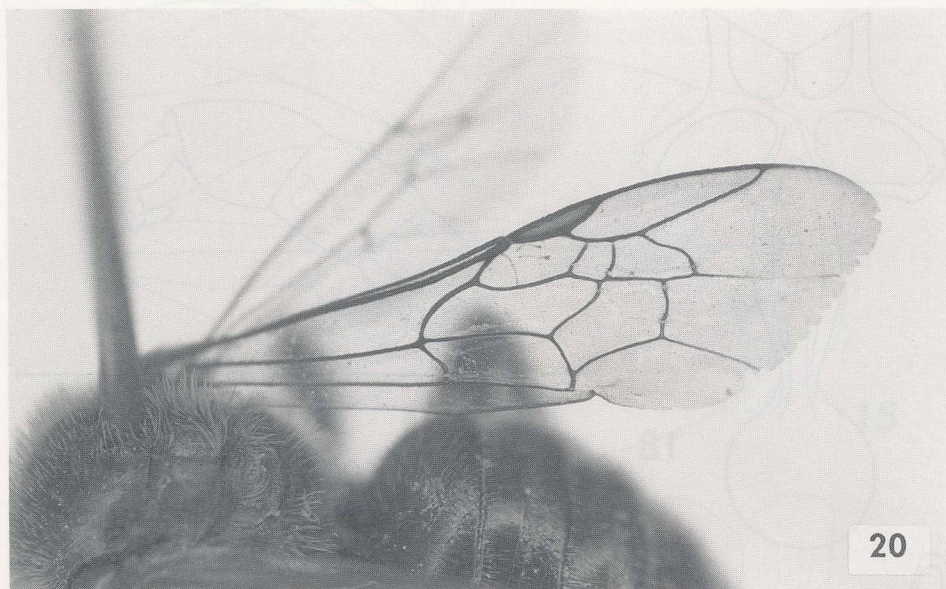
FIGS 16–19. *Systropha androsthene* sp. nov. U.A.E.: Al Ain (*J. L. Hamer*): (16) paratype ♂, 8. iv. 1993, apical antennal segments; (17–19) paratype ♂, 26. iii. 1993: (17) sternum 7; (18) sternum 8; (19) genitalia. Scale lines represent 1 mm. Hair characters omitted.

Systropha androsthene spec. nov.

(Figs 16–19)

Etymology. Androsthene, sent by Alexander to explore the Arabian coast of the Persian Gulf, reaching perhaps Abu Dhabi and the beginning of the projection ending in Ras Masandam.

Diagnostic characters. Male: antennae 11-segmented, segments 9–11 minute (Fig. 16); mouthparts moderately elongate. 2nd abscissa of Rs conspicuously shorter than 1 r-m (1:1.7). Terga unmodified. S1 mutic; S2 with paired, well-developed, apically

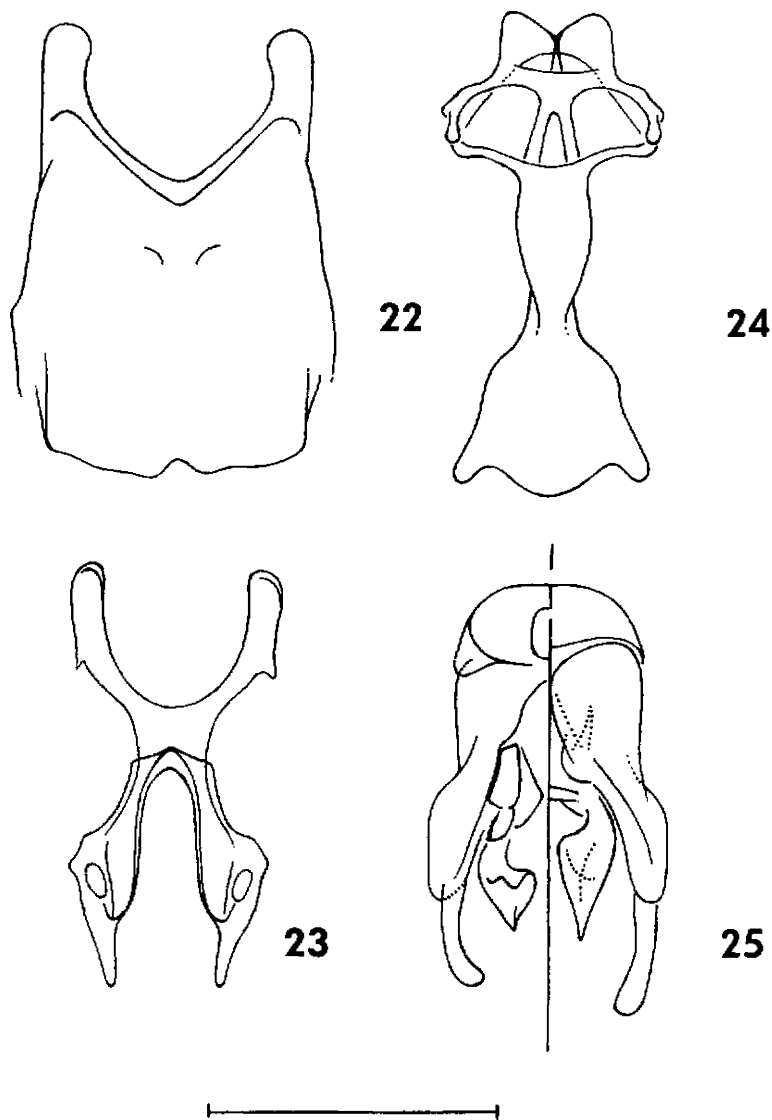


FIGS 20–21. *Systropha diacantha* sp. nov., paratype ♂, Oman: Khasab, 4–7, iv. 1976 (K. M. Guichard): (20) forewing [Neg. 149.19]; (21) metasoma, latero-ventral aspect [Neg. 149–11].

compressed, truncate apophyses; apophyses of S3 weak, low, mammiform; S4 and S5 mutic; S6 basally with well-developed, blunt, longitudinal, median ridge, apically with independent, curved, blunt spine; S7 apical lobes with infolded styli (Fig. 17); S8 collum slender, capitulum orbicular, simple (Fig. 18); gonostyli incurved, elongate, exceeding gonocoxites by more than twice their width (genitalia, Fig. 19). Length: 5.5–7 mm. Integument black, the antennae pale beneath towards apex, the small

FIGS 22–
Gu
13:

apical se
Cu, and
superfici
in *hirsut*
Fem
Type m
Hotell))
data as
specime



FIGS 22–25. *Systropha diacantha* sp. nov., paratype ♂, Oman: Khasab, 4–7, iv. 1976 (K. M. Guichard): (22) sternum 6; (23) sternum 7; (24) sternum 8; (25) genitalia [Prep. no. 1979–133]. Scale line represents 1 mm. Hair characters omitted.

apical segments, the wing-veins except Sc + R and the area about the fork of M and Cu, and the calcaria pale yellow. Vestiture: inconspicuously pubescent, in this superficially resembling a small *curvicornis*, the metasoma not evidently fasciate as in *hirsuta* or *pici*.

Female: not known.

Type material. HOLOTYPE ♂ labelled: 'U.A.E. / Al Ain (I'con [Intercontinental Hotel]) / 8-iv-1993 / I. L. Hamer'. [OUM] PARATYPES: **United Arab Emirates:** same data as holotype, 6 ♂♂; same locality but 26. iii. 1993, 5 ♂♂ [DBB, ILH]. All specimens were taken at an unidentified low-growing *Convolvulus*.

Systropha diacantha spec. nov.

(Figs 20–25)

Etymology. The name refers to the capitulum of sternum 8.

Diagnostic characters. Male: antennae 13-segmented. Forewing with second abscissa of Rs shorter than 1 r-m (1:1.5) (Fig. 20). Terga unmodified. S1 mutic; S2 with unpaired, median apophysis forming a high, transverse arcuate ridge (Fig. 21); apophyses of S3 weak, low, tending to mammiform in larger examples; S4 and S5 mutic; S6 with fine median longitudinal carina, the carina becoming obsolete apicad, without apical spine, the apical margin with shallow median emargination (Fig. 22); S7 with apical processes attenuate, styliiferous (Fig. 23); S8 collum slender, capitulum orbicular with prominent apicolateral projections (Fig. 24); gonostyli elongate, incurved (genitalia, Fig. 25). Length 7–9.5 mm. Integument black, wing-veins dark, calcaria II and III pale yellow, darker apicad. Vestiture: inconspicuously pubescent, in this superficially resembling a small *curvicornis*.

Female: similar, smaller (7.5 mm). Head transverse, width: length ratio 1:0.79; lateral ocelli separated from vertex by 1.8x their diameter; antennae becoming yellowish beneath apicad. Mesocutum dull, densely finely punctate; scutellum slightly glossy, slightly less densely punctate. Terga weakly coriaceous, the anterior terga with well-spaced, fine setigerous punctures, the punctures becoming progressively denser and coarser on succeeding terga; marginal areas not strongly depressed, not decoloured; anal fimbria fuliginous; pygidial plate acute.

Type material. HOLOTYPE ♂ labelled; 'Oman / W Khabb / 25-iv-1987 / I. L. Hamer' [OUM] Paratypes: **Oman:** W[adi] Khabb, 25. iv. 1987 (I. L. Hamer), 1♂. Khasab, 4–7. iv. 1976, 2♂ 1♀; Behla, 500 m, 4. iii. 1976, 1♂ 2♀; Muscat, Ruwi, iii. 1976, 5♂ (all K. M. Guichard). **United Arab Emirates:** Hatta (Htl) [Hotel], 28. iv. 1989 (I. L. Hamer), 1♂. [BMNH, DBB].

Key to ♂♂

S. grandimargo omitted; *S. ruficornis*, *iranica*, *villosa* and *tadjika* included on the basis of published descriptions and figures. Available species were coded on a basis of 25 characters with up to five character states, but even with only 20 selected characters the inadequacy of published information meant that the above-named species could not be coded sufficiently to permit the completion of a data matrix or the use of other methods of assessing relationships. Consequently the construction of a 'natural' key, one reflecting a cladogram, was not possible. It might however be noted that species with unique modifications (e.g. the massive apophysis of S1 in *hirsuta* or the dentate T6 of *maroccana*) are not necessarily those with the highest number of modifications, or those with modifications affecting the widest range of body parts.

No key is given for the females. A key to the western palaearctic species known to him (*curvicornis*, '*hirsuta*' [*pici*], *iranica*, *maroccana*, *planidens*, *villosa*) was given by Warncke (1980: 375). As noted in the introduction, the females show no modifications comparable with the striking secondary sexual characters of the males, and few very evident diagnostic characters. In practice this usually poses no problems, since it is unlikely from their distribution that more than two or three species will be found flying together, and, where this is known, the species are quite dissimilar and the sexes may be associated on the basis of shared sculptural characters. Moreover, females of *androthenes*, *difformis*, *inexpectata*, *iranica*, *ruficornis* and *tadjika* are either unknown or unrecorded; of *hirsuta* only two specimens have been available, of

popovi and *tropicalis* one each, of *punjabensis* and *villosa* none. While the few specimens of these species that are available can be separated on characters such as size, venational differences, surface sculpture and vestiture, it is uncertain whether or to what extent these characters are valid for the *species*.

- 1 Antenna 11- or 12-segmented, the 9th and following segments minute. [2nd cubital cell narrow. S2 with paired apophyses; S6 basally with median longitudinal carina, apically with spine or blunt tooth. Small species, 5.5-7 mm. S and SW Asia.] 2
- Antenna 13-segmented 3
- 2 Antenna 11-segmented (Fig. 16); second abscissa of Rs shorter than 1 r-m, as 1:1.7; S2 with well-developed, apically compressed, truncate, apophyses; apophyses of S3 weak, low, mammiiform; capitulum of S8 orbicular. [S6 basally with well-developed, blunt, median longitudinal ridge, apically with independent, curved, blunt spine; S7, S8 and genitalia: Figs 17-19.] United Arab Emirates *androsthene* n. sp.
- Antenna 12-segmented; second abscissa of Rs <0.5 as long as 1 r-m, as 1:2.5; apophyses of S2 low, convex; S3 mutic; capitulum of S8 transverse. [S6 (*ex descr.*) with median longitudinal ridge ending in a sharp apical tooth; S7, S8 and genitalia: Batra and Michener, 1966: 652, Figs 1-3.] India: Punjab. *punjabensis* Batra and Michener, 1966
- 3 S1 with massive, bifurcate apophysis (Fig. 4). [Apical antennal segments short, compressed, testaceous (Fig. 5); apophyses of S2 moderately developed, thornlike; S6 with median longitudinal carina, subdentate near base and erectly dentate at apex, the apical margin of the sternite with median semicircular emargination; S7, S8 and genitalia: Figs 6-8. Larger species (10.5-11 mm) with copious grey pubescence, the metasoma appearing fasciate.] Egypt; Israel. *hirsuta* Spinola, 1839
- S1 mutic. 4
- 4 S2 with median, unpaired, apophysis 5
- S2 with paired apophyses 7
- 5 T2 and T3 unmodified; apophysis of S2 a high, transverse crescentic ridge (Fig. 21); capitulum of S8 orbicular, with prominent apicolateral projections (Fig. 24). [S6 with median, longitudinal carina, the carina becoming obsolete apicad, without apical spine, the apical margin with shallow median emargination; gonostyli elongate, incurved. S6, S7, and genitalia: Figs 22, 23, 25. Length 7-9.5 mm.] UAE and Oman. *diacantha* n. sp.
- T2 and T3 inflated laterad (Fig. 11, *inexpectata*): apophysis of S2 not a transverse crescentic ridge; capitulum of S8 without paired projections. [Larger species, 10-12 mm.] Oriental. 6
- 6 Apophysis of S2 high, columnar, with concave apex and posterior carina (Figs 9-10). Burma. *difformis* Smith, 1879
- Apophysis of S2 high, laterally compressed and having an irregular profile (Fig. 12). Thailand *inexpectata* Ebmer, 1994
- 7 T6 laterally dentate; apical processes of S7 laterally with retrograde projections; apical margin of capitulum of S8 with recurved median tooth. [Apical antennal segments elongate, slender; S6 with median longitudinal carina elevated at apex.] N. W. Africa *maroccana* Warncke, 1977
- T6 mutic; apical processes of S7 variable but lacking retrograde projections; capitulum edentate. 8
- 8 Collum of process of S8 greatly expanded, little narrower than disc. [Apophyses of S2 well-developed, oblique, compressed, broadly truncate, of S3 weak, transverse, in anal aspect rounded, in lateral aspect acute; S4 and S5 mutic; S6 ccarinate, marginal area broadly impunctate and glabrous and preceded by a narrow tract of outwardly directed hairs. Larger species, 9.5-12 mm] Iberian peninsula, southern and central Europe, eastwards to Iran and Urals. *planidens* Giraud, 1861
- Collum of process of S8 narrow, at most little wider than one-third width of disc. 9

- 9 Oriental species. [2nd cubital cell narrow, 2nd abscissa Rs conspicuously shorter than 1 r-m (as 1 : 1.8), apophyses of S2 and S3 low, convex, better developed, mammiform, on S3; S4 and S5 unmodified; S6 with median apical lamella bilobate in lateral aspect; capitulum of S8 subacute. For other characters *vide* Ebmer, 1994, pp. 811–813 and Figs 15–23.] Sri Lanka. *tropicalis* Cockerell, 1911
– Palaearctic species. 10
- 10 Marginal area of S6 broadly impunctate and glabrous, apical margin produced in median third as a narrow lip tuberculate at either extremity. [S2 and S3 with equally well developed apophyses, those of S2 apically compressed, narrowly truncate, those of S3 acute; S3 and S4 mutic. S6–S8 as Ponomareva, 1967: 682, Fig. 1–3, genitalia Fig. 1.] Central and southern Europe eastwards through Central Asia to western China. *curvicornis* (Scopoli, 1770)
– Apical margin of S6 with small median projection or erect tooth. 11
- 11 Gonostylus exceeding gonocoxite by $>2\times$ its mid-length width; capitulum of S8 broadly spatulate, truncate. [Femur and tibia III strongly expanded distally; basitarsus III arcuate; S6 with median longitudinal ridge, produced as a short spine over a semicircular excision of the apical margin of the sternum; terminal styli form processes of apical lobes of S7 elongate, similar in proportions to gonostyli. 10 mm.] Iran. *villosa* Ebmer, 1978
– Gonostylus shorter, exceeding gonocoxite by at most twice its mid-length width; capitulum of S8 not truncate 12
- 12 Apical processes of S7 of exceptional form, narrow, widening gradually apicad, sub-bifurcate, the inner branch more acute than the outer, styli not apparent (Warncke, 1992: 746, Fig. 4). [Median carina of S6 produced beyond apical margin of sternum, in lateral aspect its apex dentiform (Warncke 1992: 746, Fig. 3); S8 and genitalia described as being similar to those of *ruficornis*, but [capitulum of ?] S8 laterally angular rather than rounded. 8 mm.] Tadjikistan. *tadjika* Warncke, 1992
– Apical processes of S7 not so modified. 13
- 13 Collum of S8 broader, but <0.5 width of disc and little more than half width of capitulum (tending to form in *planidens*, but much narrower than in that species); capitulum transverse oval, $2\times$ as broad as long, laterally narrowly rounded; apices of gonostyli ovately rounded (Ponomareva, 1967: 684, Figs 8, 9). [Antennae from segment 4 ferruginous; marginal areas of terga testaceous; apophyses of S2 strong, apically rounded, of S3 weak; apical margin of S6 with median semicircular emargination (Ponomareva, 1967: 684, Fig. 6). 9–5 mm.] Turkmenia. *ruficornis* Morawitz, 1880
– Collum of S6 slender, considerably <0.5 width of capitulum; capitulum more nearly orbicular; gonostyli subtruncate. 14
- 14 N.W. Africa. S7, S8 and genitalia as Ponomareva, 1967: 687 (as *hirsuta*). [Antennae from segment 4 testaceous beneath; S2 with low, apically compressed, narrowly truncate apophyses; S3 with weak callosities; S4 and S5 mutic; S6 longitudinally carinate with well developed, erect, discal and apical teeth. 8.5–10 mm] Morocco to Tunisia. *pici* Pérez, 1895
– W. Asia. S7, S8 and genitalia as Popov, 1967: 195, Fig. 4, *partim* (*iranica*) or Ponomareva, 1967: 693, Fig. 23–25 (*popovi*).
 [*iranica* Popov, 1967 (Iran: Kirmān)
 [*popovi* Ponomareva, 1967 (Turkmenia; Pakistan)

As noted in the text, these two nominal taxa have been synonymized by Warncke, but, although they are obviously closely allied, the figures given by Popov and Ponomareva appear to show distinct differences, especially in for the form of S7, which, in *iranica*, has the apical processes laterally with distinct angulations and inwardly with small lobes preceding the elongate terminal styli. For other characters of *popovi* see text.

Acknowledgements

The author is indebted to Messrs. I. L. Hamer and S. P. M. Roberts, who placed material in their personal collections at his disposal; to the Keeper and staff of the Department of Entomology, the Natural History Museum, London, for access to collections and the loan of material; and to Dr P. Scaramozzino, Museo Regionale di Scienze Naturali, Torino, for the loan of types of Spinola. P. A. W. Ebmer, Puchenau, sent, at the author's request, information omitted from the description of *S. villosa*.

Abbreviations

Collections

AWE	A. W. Ebmer collection, Puchenau
BMNH	Natural History Museum, London [formerly the British Museum (Natural History)]
DBB	D. B. Baker collection, Ewell
ILH	I. L. Hamer collection, Hemel Hempstead
MNHNP	Musée National d'Histoire Naturelle, Paris
MNHUB	Museum für Naturkunde der Humboldt-Universität zu Berlin
MRSNT	Museo Regionale di Scienze Naturali, Torino
NMW	Naturhistorisches Museum, Wien
OLL	Oberösterreichisches Landesmuseum, Linz [Warneke Collection]
OUM	University Museum, Oxford [Hope Entomological Collections]
SEMK	Snow Entomological Museum, University of Kansas
SPMR	S. P. M. Roberts collection, Salisbury
ZISP	Zoological Institute, St Petersburg

In descriptive text

LI, LII, LIII	anterior, intermediate and posterior legs
L, R	of left / right side
T1, T2 etc	metasomal terga
S1, S2 etc	metasomal sterna

References

- AUDOIN, J. V., 1825–1827, Explication sommaire des planches d'insectes de l'Égypte et de la Syrie, publiées par Jules-César Savigny, membre de l'Institut, offrant simplement la distinction des genres et des espèces ..., par Victor Audouin ..., pp. 187–202. In: *Description de l'Égypte, ou recueil des observations et des recherches qui ont été faites en Égypte pendant l'expédition de l'armée française (1798–1801)*, publié par les ordres de sa majesté l'empereur Napoléon le Grand. Histoire naturelle, 1 (4), Sommaire des planches dont les dessins ont été fournis par M. J. C. Savigny pour l'histoire naturelle de l'ouvrage, (Paris: Imprimerie Royale).
- BAKER, D. B., 1993, *The type material of the nominal species of exotic bees described by Frederick Smith*, Unpublished PhD thesis. pp. (i)–vi, 1–311, 14 pl.
- BATRA, S. W. T., and MICHENER, C. D., 1966, The nest and description of a new bee, *Systropha punjabensis* from India (Hymenoptera: Halictidae). *Journal of the Kansas Entomological Society*, **39**, 650–658.
- BINGHAM, C. T., 1897, Hymenoptera.- Vol. I. Wasps and bees. In: Blandford W. T. ed. *The fauna of British India, including Ceylon and Burma*, (London: Taylor & Francis). pp. (i)–xxix, [1]–579, 189 Fig., 4 pl.
- BLANK, S. M. and KRAUS, M., 1994, The nominal taxa described by K. Warneke and their types (Insecta, Hymenoptera, Apoidea). *Linzer biologische Beiträge*, **26**, 665–761.
- CASOLARI, C., and CASOLARI MORENO, R., 1980, *Cataloghi I – Collezione Imenopterologica di Massimiliano Spinola* (Torino: Museo Regionale di Scienze Naturali) pp. [3: recto and verso of [1] blank]–165.

- COCKERELL, T. D. A., 1911, Descriptions and records of bees.—XXXIV. *Annals and Magazine of Natural History*, (8) 7, 225–237.
- COCKERELL, T. D. A., 1936, Description and records of bees.—CLIV. *Annals and Magazine of Natural History*, (10) 17, 477–483.
- DALLA TORRE, C. G. de (K. W. von), 1896, *Catalogus hymenopterorum hucusque descriptorum systematis et synonymicus, Volumen X. Apidae (Anthophila)* (Lipsiae: Sumptibus Guilelmi Engelmann) pp. (i–iii), (I)–VIII, (1)–643.
- EBMER, A. W., 1978, *Halictus, Lasioglossum, Rophites und Systropha* aus dem Iran (Halictidae, Apoidea) sowie neue Arten aus der Paläarkt. *Linzer biologische Beiträge*, 10, 1–109.
- EBMER, A. W., 1994, *Systropha difformis* Smith 1879 und *Systropha inexpectata* n. sp., die beiden östlichen Vertreter der altweltlichen Gattung *Systropha* Illiger 1806 (Insecta: Hymenoptera: Apoidea: Halictidae: Rophitinae), *Linzer biologische Beiträge*, 26, 807–821.
- EVERSMANN, E. von, 1852, Fauna hymenopterologica Volgo-Uralensis. (Continuatio.) Familia Anthophilorum seu Apidarum. *Bulletin de la Société des Naturalistes de Moscou*, 25 (3), 3–137.
- FRIESE, H., 1901, *Die Bienen Europa's (Apidae europaeae) nach ihren Gattungen, Arten und Varietäten auf vergleichend morphologisch-biologischer Grundlage. Theil VI. Solitäre Apiden: Subfam. Panurginae Melutinae Xylocopinae* (Innsbruck: published by the author) pp. (1)–284.
- FRIESE, H., 1913, Neue Bienenarten von Ceylon. *Deutsche entomologische Zeitschrift*, 1913, 573–578.
- GIRAUD, J., 1861, Fragments entomologiques. I. Description de plusieurs Apides nouvelles et observations sur quelques espèces connues, *Verhandlungen der k. k. Zoologisch-Botanischen Gesellschaft in Wien*, 11, 447–470.
- ILLIGER, J. C., 1805 [1806], William Kirby's Familien der bienenartigen Insekten, *Magazin für Insektenkunde*, 5, 28–175.
- MICHENER, C. D., 1965, A generic review of the Dufoureae of the Western Hemisphere (Hymenoptera: Halictidae), *Annals of the Entomological Society of America*, 58, 321–326.
- MORAWITZ, F. F., 1880, Ein Beitrag zur Bienen-Fauna Mittel-Asiens, *Mélanges biologiques tirés du Bulletin l'Académie Impériale des Sciences*, 10, 443–518 [= *Bulletin*, 26, 337–389].
- OLIVIER, G-A., 1789, Andrene, *Andrena*. In: Anon., *Encyclopédie méthodique. Histoire naturelle. Entomologie, ou histoire naturelle des Crustacés, des Arachnides et des Insectes*, (Paris: Panckoucke; Liège: Plomteux,) 4, 130–140. After 1818. *Tableau encyclopédique et méthodique des trois Règnes de la Nature*, p. 383. (Anon.: authors not named, authorship indicated only as 'Une Société de gens de lettres, de savans et d'artistes'. According to Sherborn and Woodward (1893), the five sections of the *Discours préliminaires*, pp. (i)–ccclxxij, were written by Mauduyt de la Varenne, the systematic portion of the volume, pp. (1)–331, by Olivier. The plate illustrating *Systropha* was among those not published until some date after 1818.)
- PALLAS, P. S., 1773, *Reise durch verschiedene Provinzen des Russischen Reichs. Zweiter Theil. Erstes Buch vom Jahr 1770* (St. Petersburg: Kaiserlichen Akademie der Wissenschaften) Pp. (i–vi), (1)–744, pl. I–XIV, A–Z.
- PÉREZ, J., 1895, Excursion entomologique dans la Province d'Oran (Algérie) (Suite) Description des Hyménoptères nouveaux, *Revue scientifique du Bourbonnais et du Centre de la France*, 8, 173–180.
- PÉREZ, J., 1905, Espèces nouvelles d'Hyménoptères de Catalogne, *Butlletí de la Institució Catalana d'Historia Natural*, 5 (6), 81–88.
- PEYERIMHOFF, P. de, 1932, La Société entomologique de France (1832–1931), pp. (1)–86, pl. I–XIII, in: R. Jeannel, (ed.), *Livre du Centenaire*. Pp. (i)–xii, (1)–729, pl. I–XXXII, frontisp. col. Paris: Société Entomologique de France.
- PONOMAREVA, A. A., 1967, Notes sur les espèces paléarctiques du genre *Systropha* Ill. (Hymenoptera, Apoidea, Halictidae), *Polskie Pismo entomologiczne*, 37, 677–698 (in Russian, with French and Polish summaries).
- POPOV, V. V., 1960, New and little-known species of bees (Hymenoptera, Apoidea) from Turkmenia, *Trudy zoologicheskogo Instituta Akademii Nauk SSSR*, 27, 247–263 (in Russian).
- POPOV, V. A., 1967, The bees of Iran, *Trudy zoologicheskogo Instituta, Akademiya Nauk, SSSR*, 43, 184–216 (in Russian).

- SAUNDERS, E., 1884, Further notes on the terminal segments of Aculeate Hymenoptera, *Transactions of the Entomological Society of London*, **1884** (2) (XVIII): 251–267, pl. XIII.
- SAVIGNY, J.-C. de, 1809–1813, Pl. 1–20, Zoologie, Hyménoptères. In: *Description de l'Égypte, Histoire naturelle*. Paris; Imprimerie Royale, The text for Savigny's plates was never published: *vide* Audouin (1825–1827), de Peyerimhoff (1932).
- SCOPOLI, J. A., 1770, I. Dissertatio de Apibus, pp. (7)–47; J. A. Scopoli (ed.), *Annus IV. Historico-naturalis*, (Lipsiæ: Christ. Gottlob Hilscher).
- SHERBORN, C. D., and WOODWARD, B. B., 1893, On the dates of the 'Encyclopédie Méthodique (Zoology)', *Proceedings of the Zoological Society of London*, **1893**, 582–584.
- SMITH, F., 1879, *Descriptions of new species of Hymenoptera in the collection of the British Museum*, (London: Trustees of the British Museum) pp. (i)–xxi, (1)–240.
- SPINOLA, MARCHESE, M., 1839, *Compte rendu des Hyménoptères recueillis par M. Fischer pendant son voyage en Égypte, et communiqués par M. le Docteur Walzl à Maximilien Spinola*, *Annales de la Société Entomologique de France*, **7**, 437–546. (Conventionally dated to 1838, and the wrapper of the Part (4) including Spinola's paper is so dated. However, the Part is dated to January 1839 by Sherborn (MS, BMNH), and the fact that it includes also the *Compte rendu of the Séance du 19 décembre 1838* is itself suggestive of the later date.)
- WARING, G., 1868, *Coccinella variabilis*: how do the black spots acquire their colour? *Entomologist*, **4**, 136.
- WARNCKE, K., 1977, Missione Giordani Soika in Iran 1965. 6. Beitrag zur Bienenfauna des Iran: 2. Die Gattung *Systropha* Ill. *Bollettino del Museo Civico di Storia Naturale di Venezia*, **28**, 93–97.
- WARNCKE, K., 1980, Die Bienengattungen *Nomia* und *Systropha* im Iran mit Ergänzungen zu den *Nomia*-Arten der Westpaläarkt, *Linzer biologische Beiträge*, **12**, 363–384.
- WARNCKE, K., 1992, Die Bienengattung *Systropha* Ill. neu für Israel und Zentralasien, *Linzer biologische Beiträge*, **24**, 741–746.