ISRAEL JOURNAL OF ENTOMOLOGY, Vol. 41–42, 2011–2012, pp. 145–163ge iew2

A review of the *Xylocopa* species (Hymenoptera: Apidae) of Israel

MOSHE GUERSHON AND ARMIN IONESCU-HIRSCH
Department of Zoology, The George S. Wise Faculty of Life Sciences, Tel Aviv University, Tel Aviv 69978, Israel. E-mail: mois@post.tau.ac.il

ABSTRACT

In this paper we list ten *Xylocopa* species from Israel, *X. fenestrata*, *X. iris*, *X. olivieri*, *X. pubescens*, *X. rufa*, *X. sulcatipes*, *X. ustulata*, *X. valga*, *X. varentzowi* and *X. violacea*. The distribution in Israel of the newly recorded species *X. ustulata*, a widespread, mainly African species that reaches its northern distribution limit in southern Israel, and *X. varentzowi*, an Irano–Turanian species that reaches its western distribution limit in northern Israel, is published for the first time. We provide a key for the ten Israeli species, and in order to prevent further confusion, we include also the Afrotropical *X. hottentotta*, since various *Ctenoxylocopa* from western Asia, including Israel, were often misidentified with this species in faunistic reports. In addition, information is given on the species' geographical distribution, worldwide and in Israel, as reported in the literature and recorded in the National Collections of Natural History at Tel Aviv University (TAUI).

KEYWORDS: *Xylocopa*, list, key, distribution, Israel

INTRODUCTION

The subfamily Xylocopinae (Hymenoptera: Apidae) includes bees that are superficially very varied: the large and robust (13 to 33 mm long) Xylocopini as opposed to the small and slender (3 to 13 mm) Allodapini, Ceratinini and Manueliini (Michener, 2007). In this paper, which deals with the Israeli Xylocopini (*Xylocopa* Latreille 1802: subgenera *Copoxyla* Maa, *Ctenoxylocopa* Michener, *Koptortosoma* Gribodo, *Proxylocopa* Hurd and Moure and *Xylocopa* Lepeletier), we follow the higher classification of Minckley (1998) and Michener (2007).

The genus *Xylocopa* includes about 450 species (Michener, 2007). The genus has most likely an Oriental-Palearctic origin and the present distribution of the subgenera, mainly in tropical and subtropical climates and occasionally in temperate areas, resulted primarily from independent dispersal events (Hurd and Moure, 1963; Leys and Hogendoorn, 2008). Most subgenera do not cross boundaries of main zoogeographical regions (Leys et al., 2002), but Israel's unique location at the junction of three biogeographical regions (Palearctic, Oriental and Afrotropical) brings together *Xylocopa* species from more than one region, as in other animal taxa (Furth, 1975).

Some Israeli *Xylocopa* species were the subject of extensive ecological and behavioral studies (e.g., Eizikowitch, 1987; Gerling et al., 1989; Gottlieb et al., 2005; Ionescu-Hirsch, 2001; Kaesar, 2010 and literature cited therein), but little has been published regarding their taxonomic status. Bodenheimer's Prodromus (1937) listed seven species (*X. pubescens* Spinola, 1838 (as *X. aestuans* (Linnaeus, 1758)), *X. fenestrata* (Fabricius, 1798), *X. sulcatipes* Maa 1970 (as *X. hottentotta* Smith F., 1854); *X. iris* (Christ, 1791); *X. olivieri* Lepeletier, 1841; *X. valga* Gerstaecker, 1872; and *X. violacea* (Linnaeus, 1758)). Since this work, only a revision of the subgenus *Koptortosoma* (Lieftinck, 1964), another revision of the subgenus *Ctenoxylocop*a (Maa, 1970), a regional review of the genus (Warncke, 1982) and a revision of the subgenus *Copoxyla* (Terzo and Rasmont, 1997) were published. While the first two revisions imposed nomenclatural changes in the list of the Israeli *Xylocopa*, Warncke's review added one species to that list (*X. rufa* Friese, 1901), but created some nomenclatural confusion by reverting to the older nomenclature for *X. pubescens* and *X. sulcatipes*, i.e., "*X. aestuans pubescens* Spinola" and "*X. hottentotta* Smith F.", respectively (Warncke, 1982). In fact, *X. hottentotta* is still reported from western Asia (see also Hannan et al., 2012).

Online information on *Xylocopa* species from Israel includes a species list reporting *X. ustulata* and *X. varentzowi*, a citation based on a conference abstract by the first author (Guershon, 2010), at http://en.wikipedia.org/wiki/List_of_bees_of_Israel, global distribution maps at http://www.discoverlife.org/mp/20q?search=Xylocopa&flags=subgenus, and palearctic distribution maps at http://zoologie.umh.ac.be/hymenoptera/page.asp?id=214, where the occurrence of *X. varentzowi* in Israel is shown.

The question concerning the taxonomic rank of *X. pubescens* is of lesser importance for the present study because both Lieftinck (1964) and Warncke (1982) apply the same name, *pubescens*, to the same bee. However, it is worth noting that a recent report of *X. aestuans* from Saudi Arabia (Hannan et al., 2012) highlights the necessity of further studies concerning the identity of these species, since Lieftinck's key characters are problematic and the two species were neatly separated based on allopatric distribution, with *X. pubescens* ranging from Morocco to India and *X. aestuans* from India to the Sunda Islands.

The taxonomic history of *X. hottentotta* is marked by confusion and many misidentifications (Maa, 1970). Smith (1854) described *X. hottentotta* based on a series of females from Cape Natal and Sierra Leone and re-described the species following the addition of mals and associated females from Aden (Smith, 1874). However, Maa (1970) recognized two different species within Smith's female type series, designed the Cape Natal specimen as lectotype and removed this species from the subgenus *Ctenoxylocopa* (presently *X. hottentotta* is the type species of the subgenus *Xylomelissa* (Hurd and Moure, 1963; Eardley, 1983; Michener, 2007)). Further, Maa (1970) described a new species, *X. sulcatipes*, based on Smith's mals of *X. hottentotta* from Aden and resurrected *X. ustulata* Smith F., 1854 from synonymy with *X. hottentotta*. Nevertheless, Warncke (1982) listed *X. hottentotta* from Israel, although the key characters he provides show that "*hottentotta*" sensu Warncke is *X. sulcatipes* and not *X. hottentotta*, neither *X. ustulata*.

In this paper we provide an updated list and a key to the local *Xylocopa* species, and data concerning their geographical distribution.

MATERIALS AND METHODS

This study is based on the material deposited in the National Collections of Natural History in Tel Aviv University, Israel (TAUI). Localities are listed from west to east and north to south. Locality names in Hebrew labels are transliterated according to the "Israel Touring Map" (1:250,000) and "List of Settlements", published by the Survey of Israel, Ministry of Labor. When names of localities have changed since the labels were prepared, the most recent Hebrew names are cited with old names appearing in the label given in parentheses, as in the following example: "En Hemed [Aquabella]". The number of specimens and sexes from each locality are given in parentheses.

The key to Israeli species is partly adapted from Hurd and Moure (1963), Maa (1970), Warncke (1982) and Michener (2007), e.g., for couplets concerning unexamined material, namely, females of *X. fenestrata*, *X. ustulata* and *X. varentzowi* Morawitz, 1895. We include *X. hottentotta* in our key, but within brackets denoting that this species is not part of the Israeli fauna. The inclusion is done in order to avoid further confusion and because *X. sulcatipes* and *X. ustulata* were seemingly not compared with *X. hottentotta*, although detailed descriptions of these three species are available (Maa, 1970; Eardley, 1983).

The geographical areas of Israel are shown in the map in Fig. 26, which is adapted from Fishelson (1985). Information on world distribution is based primarily on Ascher and Pickering (2010) and Terzo and Rasmont (2011), and on Bodenheimer (1935), Maa (1970), and Warncke (1976, 1982).

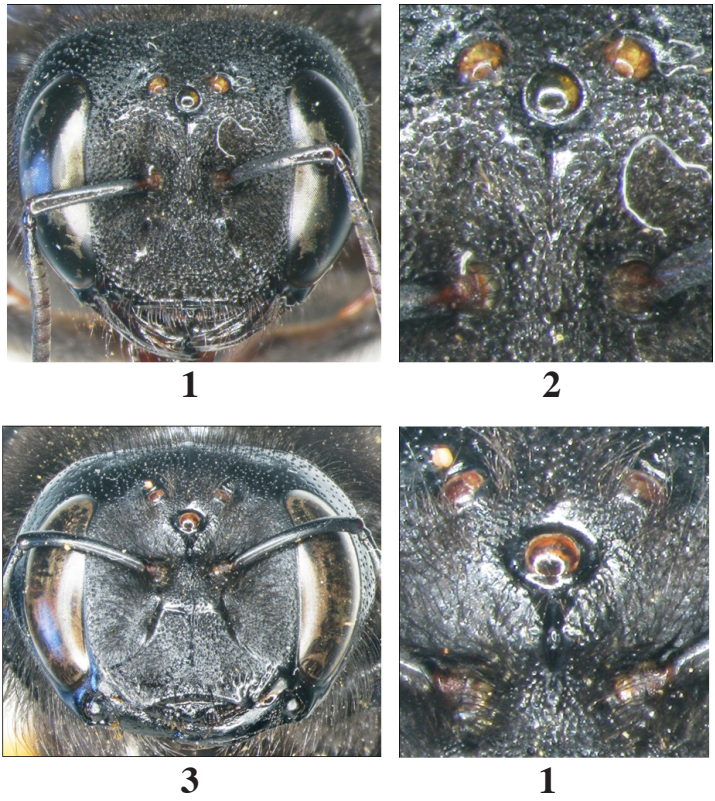
Morphological terminology follows Michener (2007).

RESULTS

KEY TO *XYLOCOPA* SPECIES IN ISRAEL

1. Integument brown **2**
-. Integument black **3**
2. Metasomal tergites brown, hairy, bearing a continuous, light-colored hair band on posterior edge (Fig. 22); center of 2nd and 3rd tergites densely punctuated ..... ***X. (Proxylocopa) olivieri* Lepeletier**
-. Metasomal tergites dark redish-brown, mostly hairless, with interrupted hair bands on postero-lateral edges (Fig. 23); center of 2nd and 3rd tergites with scattered punctuation ..... ***X. (Proxylocopa) rufa* Friese**
3. Mesosoma covered dorsally with yellow to yellow-greenish hairs (Fig. 24) ..... ***X. (Koptortosoma) pubescens* Spinola**
-. Mesosoma covered dorsally with black hairs, sometimes intermixed with few whitish-gray hairs **4**
4. Antenna with 12 segments (females, Fig. 9) **5**
-. Antenna with 13 segments (males, Figs. 10, 11) **12**
5. Median ocellus intersected by interocellar line (Figs. 1, 2); pygidial plate simple, without spines ..... ***X. (Copoxyla) iris* (Christ)**
-. Median ocellus not intersected by interocellar line (Figs. 3, 4); pygidial plate bearing spine on each side **6**

6. Frontal carina (from median ocellus towards frons) elevated as a keel; eyes parallel or convergent ventrally (Fig. 7) **7**
-. Frontal carina sulcated from median ocellus towards frons; eyes parallel or divergent ventrally (Fig. 3) **10**
[7. Antennocular distance two or more times larger than clypeoantennal distance (Figs. 5, 6); mandible bidentate at apex ..... ***X. (Xylomelissa) hottentotta* Smith F.**]
-. Antennocular distance less than two times clypeoantennal distance (Figs. 7, 8), usually subequal or shorter; mandible tridentate at apex **8**
8. Interocellar distance subequal to ocellocular distance (Fig. 7) ..... ***X. (Ctenoxylocopa) sulcatipes* Maa**
-. Interocellar distance distinctly greater than ocellocular distance **9**
9. Frontal carina in profile gradually elevated from base to apex, with ascending slope at right angle to descending apical slope; apical half of clypeus with evenly dense punctures, distance between punctural-series half the diameter of punctures ..... ***X. (Ctenoxylocopa) ustulata* Smith F.**
-. Frontal carina in profile not gradually elevated from base to apex, ascending slope acute (ca. 75º) to descending apical slope; apical half of clypeus not evenly punctuated, distance between punctural-series subequal to diameter of punctures ..... ***X. (Ctenoxylocopa) fenestrata* (Fabricius)**
10. Basitibial plate with 5–6 longitudinal series of denticles (Fig. 16) ..... ***X. (Xylocopa) valga* Gerstaecker**
-. Basitibial plate with at most two longitudinal series of denticles (Fig. 17) **11**
11. Wing with violet reflection; basitibial plate strongly denticulate along entire anterior and posterior margins, bilobed at apex (Fig. 17) ..... ***X. (Xylocopa) violacea* (Linnaeus)**
-. Wing with bluish-green reflection; basitibial plate weakly denticulate along part of anterior and posterior margins, apically simple or very feebly bilobed ..... ***X. (Xylocopa) varentzowi* Morawitz**
12. Apex of basitibial plate bifid **13**
-. Apex of basitibial plate entire **15**
13. Basitarsus 3 sulcated in anterior view (Fig. 18) ..... ***X. (Ctenoxylocopa) sulcatipes* Maa**
-. Basitarsus 3 cylindrical (Fig. 19) **14**
14. Clypeus with purely black setae; forewing with very conspicuous hyaline area at base (Fig. 12) ..... ***X. (Ctenoxylocopa) fenestrata* (Fabricius)**
-. Clypeus with mixture of pale and black setae; forewing with hardly discernible hyaline area at base (Fig. 13) ..... ***X. (Ctenoxylocopa) ustulata* Smith F.**
[15. Apex of hind tibia without teeth in dorsal view (Fig. 14) ..... ***X. (Xylomelissa) hottentotta* Smith F.**]
-. Apex of hind tibia with at least one tooth in dorsal view (Fig. 15) **16**
16. Forewing up to 15 mm long ..... ***X. (Copoxyla) iris* (Christ)**
-. Forewing more than 18 mm long **17**
17. Antenna entirely black (Fig. 11) ..... ***X. (Xylocopa) valga* Gerstaecker**
-. Antenna ferruginous ventrally, with 11th, 12th, and sometimes 10th segments completely orange (Fig. 10) **18**
18. Posterior surface of tibia and basitarsus 1 with black to brownish black pubescence (Fig. 20) ..... ***X. (Xylocopa) violacea* (Linnaeus)**
-. Posterior surface of tibia and basitarsus 1 with white pubescence (Fig. 21) ..... ***X. (Xylocopa) varentzowi* Morawitz**



Figs. 1–4. Female head of *Xylocopa*, frontal view. 1. *X. iris*. 2. *X. iris*, ocelli. 3. *X. valga*. 4. *X. valga*, ocelli.

ANNOTATED LIST OF *XYLOCOPA* SPECIES OF ISRAEL

Xylocopa (Ctenoxylocopa) fenestrata **(Fabricius, 1798)**
(Fig. 12)

Material Examined

ISRAEL: No material from Israel was available for examination.

INDIA: Uttaranchal 550 m. Yamuna River banks ~20 km NE Kalsi, 30º30.99′N 77º55.62′E, 23.v.2003, I. Yarom (2♂)

Distribution

World: Syria, Iraq, Iran, Pakistan, Nepal, India, Israel (?), Burma, China, Madagascar, Reunion.

Israel: uncertain , see Notes below.

5

6

7

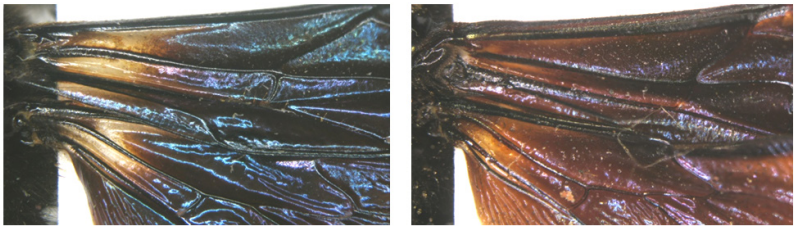
8

Figs. 5–8. Female head of *Xylocopa*, frontal view. 5. *X. hottentotta*. 6. *X. hottentotta*, antenoclypeal area. 7. *X. sulcatipes*. 8. *X. sulcatipes*, antenoclypeal area.

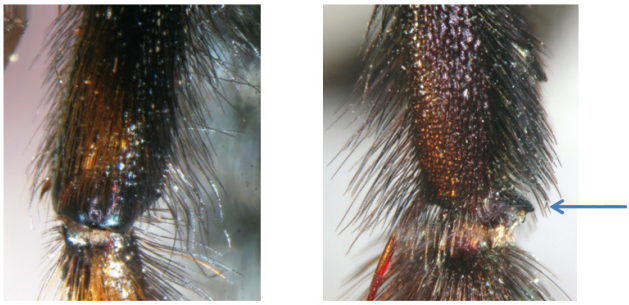
Notes

According to Maa (1970) previous records of this species from Palestine are probably referable to *X. sulcatipes,* however, Bodenheimer (1937), not mentioned in Maa (1970), and Warncke (1982) reported this species from Israel. No specimens could be located in TAUI (which includes specimens from Bodenheimer's collection), and neither in Warncke's personal collection deposited at the Oberösterreichisches Landenmuseum Linz in Austria (G. Holzler, personal communication). Nevertheless, based on the known distribution of *X. fenestrata* its presence in Israel is likely, and it is therefore included in the list of Israeli species.

9 10 11

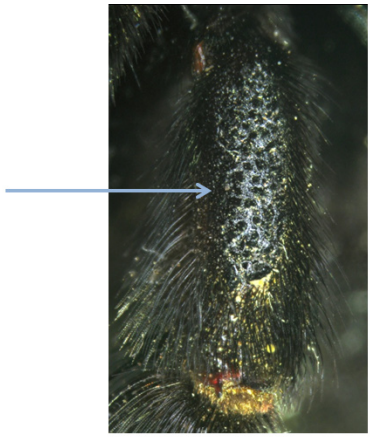


12 13



14 15

Figs. 9–11. Antenna. 9. *X. violacea* female. 10. *X. violacea* male. 11. *X. valga* male. Figs. 12–13. Forewing. 12. *X. fenestrata*. 13. *X. ustulata*. Figs. 14–15. Apex of hind tibia. 14. *X. hottentotta*. 15. *X. iris* (apical tooth indicated by arrow).



16

17

18

19

Figs. 16–19. Hind leg. 16. *X. valga* female basitibial plate (indicated by arrow). 17. *X. violacea* female basitibial plate. 18. *X. sulcatipes* male tibia (sulca indicated by arrow). 19. *X. ustulata* male tibia.

Xylocopa (Copoxyla) iris (Christ, 1791)

(Figs. 1, 2, 15)

Material Examined

ISRAEL: Nahal 'Iyyon [N Ayun Tanur], 11.vi.1981, I. Yarom (1♀); Mezudat Nimrod [Qala'at Nemrod] 24.iv.1982 F. Kaplan (1♂); Mazzuva 18.iii.1951 J. Wahrman (2♀, 2♂); Nahal Dishon [N Dishon], 15.v.1973, M. Kaplan (1♀); Ma'alot Tarshiha, 1.ix.1973, A. Freidberg (1♀); Har Meron [Mt Meron], 6.v.1986, G. Eldar (1♀); Hurfeish, 8.iii.1921, ? (1♀, 2♂); Qazrin, 9.vi.1991, A. Bear (1♂); Nahal 'Ammud, 30.ix.1975, M. Kaplan (1♂); Kefar Nahum, 1.iii.1981, M. Kaplan (1♀); En Gev, 11.iv.1968

20

21

22

23

Figs. 20–21. Male foreleg vestiture. 20. *X. violacea*. 21. *X. varentzowi*. Figs. 22–23. Metasoma tergites. 22. *X. olivieri*. 23. *X. rufa*.

(1♀); Yagur [Jagur], 28.iv.1946 (1♀); Qiryat Tiv'on [Tivon], 15.iii.1972, M. Kaplan (1♀); Yif'at, 9.vii.1980, Y. Knaani (1♂); Kinneret, 1.iv.1968, M. Pener (1♀); Ramat haShofet, 28.viii.1954 (1♀); Bet She'an, 10.viii.1981, D. Gerling (1♀, 3♂); Har Gerizim [Mt Gerizim], 8.vi.1968, D. Gerling (1♀); Ma'ale Efrayim, 29.iii.1986, J. Kugler (2♀); Kefar Daniyyel, 18.i.1956, J. Wahrman (1♀, 1♂); Tal Shahar, 19.iv.1960, Kaminsky

24

25

Figs. 24–25. *X. pubescens* gynandromorphy. 24. Dorsal view. 25. Head in frontal view.

(1♀); Hartuv [Ar Tuv], 31.iii.1952, E. Swirski (3♀); Qiryat 'Anavim [Kirj. Anavim, K Anavim], 10.vi.1943, H. Bytinski-Salz (1♂); 18.vi.1943 (1♀); En Hemed [Aqua Bella], 23.viii.1960, Fatal (1♂); Yerushalayim [Jerusalem], 15.vi.1939, H. Bytinski-Salz (1♀); 11.vii.1940 (4♀); 5.v.1940 (1♀); 26.v.1940 (2♀); 2.vi.1940, H. Bytinski-Salz (1♀); 13.vi.1940 (2♀); 10.iii.1943, H. Bytinski-Salz (2♀); 15.viii.1945, J. Wahrman (3♀); 22.ii.1946 (2♂); 6.vi.1946 (1♀, 1♂); 7.vi.1946 (1♀, 1♂); 14.vi.1946 (4♀); 27.vi.1946, ? (1♀); 13.ii.1947 (2♂); 18.vi.1950 (1♂); 14.v.1972, M. Tintpulver (1♀); 10.vii.1973, M. Tintpulver (1♀); Nahal Samar [Wadi Samar], 28.ix.1944, H. Bytinski-Salz (1♀); Lakhish [Lachish], 24.ix.1961, P. Amitai (1♂).

Unknown locality: 2.vi.1940, H. Bytinski-Salz (1♀); 1.iii.1947 (1♀); xii.1975, D. Gerling (2♀); 20.ii.1976, M. Kaplan (2♂)**.**

Distribution

World: Germany, Moravia, Slovenia, Ukraine, European Russia, Kazakhstan, France, Austria, Hungary, Romania, Spain, Italy, Albania, Macedonia, Bulgaria, Geor-

gia, Greece, Turkey, Armenia, Turkmenistan, Tajikistan, Crete, Cyprus, Iran, Afghanistan, Morocco, Israel.

Israel: Upper Galilee, Golan Heights, Lower Galilee, Carmel Ridge, Valley of Yizre'el, Jordan Valley and Southern Golan, Samaria, Foothills of Judea, Judean Hills, Southern Coastal Plain (Fig. 27).

Xylocopa (*Proxylocopa*) *olivieri* Lepeletier, 1841
(Fig. 22)

Material Examined

ISRAEL: Har Hermon [Mt Hermon], 6.vi.1973, D. Gerling (1♀); 22.vi.1973, M. Kaplan (1♀); 22.vi.1973, M. Kaplan (2♀); 16.vi.1977, A. Freidberg (1♀); 18.ix.1981, M. Kaplan (1♀); Newe Ativ, 29.viii.1981, A. Freidberg (2♀); Horbat Panyas [Banias], 25.vii.1985, A. Freidberg (2♀); Hanita, 22.viii.1963, P. Amitai (1♀, 1♂); Kefar Shammay, 5.v.1987, A. Eitam (1♂); Rosh Pinna, 9.v.1940, H. Bytinski-Salz (1♂); 10.v.1940, H. Bytinski-Salz (1♀); 12.v.1940, H. Bytinski-Salz (1♂); Kare Deshe, 8.v.1968, A(?). Gasith (1♀); En Gev, 4.viii.1968 (2♂); Tirat Zevi [Tirat Tzvi], 1.v.1979 (1♀); Ramat haSharon, 10.ii.1982, D. Gerling (1♀); Azarya, 2.v.1971, K. Yefenof (2♀); Nu'eima, 18.ix.1967, M. Pener (1♀); Hartuv [Ar-Tuv], 31.iii.1952, E. Swirski (3♂); Yerushalayim [Jerusalem], 4.v.1940, Dolychos (1♂); Bet haKerem, vi.1949, H. Bytinski-Salz (1♀); Yerushalayim [Jerusalem], 25.viii.1951 (1♂); 4.v.1954, A. Nagler (1♂); 7.vii.1955, M. Pener (1♀); 26.vii.1961, J. Wahrman (1♂); 17.iv.1963, E. Kamon (1♂); 9.vii.1966 (1♀); 9.iv.1967, M. Pener (1♂); 10.iv.1967, Pshemislavski (1♀); 11.v.1967, M. Pener (1♂); 22.v.1967, Werner (1♂); 17.v.1969, Mandelbrod (1♂); 22.iv.1972 (1♂); Newe Ya'aqov, 26.vi.1945, A. Freidberg (1♀); 'En Gedi [Ein Gedi], 2.viii.1971, K. Yefenof (1♀); 24.v.1976, D. Gerling (1 pupae); 24.v.1976, D. Gerling (1♂); 25.ii.1979, R. Gairon (1♂); Be'er Sheva', 9.vi.1972 (1♀); Nahal Sekher [N Secher], 11.iv.1982, J. Kugler (1♂); Revivim, 2.viii.1958, J. Kristal (1♀).

Unknown locality: [Bet Arich], 12.iv.1987, G. Muller (1♂).

Distribution

World: Albania, Macedonia, Kyrgyzstan, Greece, Turkey, Crete, Cyprus, Iraq, Iran, Afghanistan, Israel.

Israel: Mount Hermon, Upper Galilee, Golan Heights, Jordan Valley and Southern Golan, Central Coastal Plain, Foothills of Judea, Judean Hills, Dead Sea area, Northern Negev, Central Negev (Fig. 28).

Xylocopa (Koptortosoma) pubescens Spinola, 1838
(Figs. 24, 25)

Material Examined

ISRAEL: Qiryat Shemona, 20.viii.1992, R. Kasher (2♀); Lahavot haBashan [L'havoth Habashan], 7.vi.1958, L. Fishelsohn (1♂); Elon [Eilon Wady Karkara], 14.vii.1945, ?

(1♂); Hulata, 10.vi.1952(1♀); Rosh Pinna, 12.vi.1950 (1♀); 1.ix.1951 (1♀); 6.x.1951, Verechson (1♀); Mezad Ateret, 11.xii.1992, R. Kasher (1♀); Nahal 'Amud [Wadi el Amud], ?; Kare Deshe, 2.ix.1968, Gasith (1♀); Teveriya [Tveria], 20.iii.1981, Y. Yarden (1♀); 'En Gev, 4.viii.1968, ? (1♀); Daliyat el Karmil [Daliat el Carmel], 14.viii.1954, J. Kugler (1♀); Kefar Yehoshua', .iii.19??, student (1♂); Deganiya, 15.ix.1951, J. Wahrman (1♀); 24.viii.1972, F. Nachbar (1♀); Dor [Tantura], 14.ix.1949, J. Wahrman (1♀); Pardes Hanna-Karkur, 17.iii.1951, J. Wahrman (1♀); 10.x.1951, ? (1♀); Bet Yannay [Bet Yanai], 23.iv.1990, W. Ferguson (1♀); Ramat haSharon, 23.ix.1978, D. Gerling (1♀); Kefar Sava, Bet Berl, 27.v.1957, K. Yefenof (?); 15.vi.1970, K. Yefenof (1♀); 1.xi.1971, K. Yefenof (1♀); 7.v.1978, K. Yefenof (1♀); Tel Aviv, 6.iv.1944 (1♀); 4.vii.1958, J. Krystal (1♀); 18.viii.1978, D. Gerling (1♀); 22.i.1980 (1♀); 24.vi.1981, M. Hershkovich (1♀); 18.vi.1981, D. Gerling (1♀, 1♂); 18.iii.2010, M. Guershon (1♀); 9.iii.2010, W. Kozlitzky (1♀); Tel Aviv, Abu Cabir, 14.ix.1959, L. Fishelsohn (1♀); 14.ix.1959, J. Kugler (1♀); 27.viii.1970, M. Kaplan (1♂); 29.v.1979, M. Kaplan (2♀); Ramat Gan, ?.vi.1960, Ch. Burshtein (1♀); Bat Yam, 23.iv.1959, J. Wahrman (1♂); Rehovot, 3.iv.1956, N. Gerber (1♀); Nes Ziyyona [Nes Tsiona], 5.v.1964, S. Ninio (1♂); Yeriho [Jericho], iv.1926, O. Theodor (1♂); 27.vii.1935, J. Wahrman (1♀); 24.iv.1940, H. Bytinski-Salz (1♀); 23.ii.1941, H. Bytinski-Salz (1♂); 7.vii.1942, H. Bytinski-Salz (1♂); 13.iii.1943, H. Bytinski-Salz (2♀); 19.ix.1945 (5♀); 29.i.1981, D. Gerling (gynandromorph); 'Ein es Sultan [Jericho tall es-Sultan], 5.v.1945 (1♀); 19.ix.1945 (2♀); Yerushalayim [Jerusalem], 2.ix.1972, M. Tintpulver (1♀); Bet ha'Arava, 23.iii.1946 (1♂); Qalya, 18.vi.1939, H. Bytinski-Salz (1♀); 17.iv.1940, H. Bytinski-Salz (1♀); 'En Gedi [Ein Geni, Ein Geddi], 14.iii.1953, J. Wahrman (1♀, 1♂); 16.viii.1957, J. Wahrman (5♀); 7.v.1959, L. Fishelsohn (1♀); 19.iii.1960, Ch. Lewinsohn (1♀); 16.iii.1961, L. Fishelsohn (2♀); 17.v.1963, Margalit (1♂); 27.iii.1964, Margalit (1♀); 17.viii.1966, J. Kugler (3♀); 29.v.1968, P. Amitai and Avgar (1♂); 27.vi.1969, P. Amitai (1♂); 28.x.1971, M. Tintpulver (1♀); 22.iii.1974, M. Kaplan (1♂); 24.iii.1975, M. Kaplan (1♂); 15.iii.1975, D. Gerling (2♂); 25.v.1976, D. Gerling (1♂); 15.x.1981, D. Gerling (1♀); 3 km south 'En Gedi, 7.iv.1972, D. Gerling (1♂); Hazeva, 4.iv.1979, A. Hefetz (1♀); 'En Yahav, 26.xi.1974, D. Gerling (1♀); 30.iii.1978, D. Gerling (1♀); Yotvata, 4.v.1989, A. Eitam (1♀); Elat Field School, 23.vii.1999, I. Renan.

EGYPT [Israel, Sinai]: El 'Arish [El Arish], 4.v.1971, D. Gerling (1♀); Wadi Feiran [Sinai Firan Oasis], 9.vi.1973, F. Nachbar (1♂); Wadi Feiran [Sinai Firan Oasis], 10.iv.1973, F. Nachbar (2♀); Nuweiba [Sinai, Neviot], 8.viii.1979 (1♀); Dahab [Sinai Dahab junct.], 14.iii.1982, A. Freidberg (1♂).

Unknown locality: 8.iv.1951, J. Wahrman (1♀); 1.ix.1952, M. Costa (1♀); 4.v.1969, M. Tintpulver (1♀); 24.vi.1973, G. Tsabar (1♀); 21.viii.1978 (2♀); 24.viii.1978 (1♀, 1♂); K. Yefenof (1♀).

Distribution

World: Turkey, Syria, Iran, Pakistan, Morocco, Algeria, Egypt, Israel, Nepal, United Arab Emirates, India, Burma, Senegal, Ghana, Sudan, Ethiopia, Yemen, Kenya, Tanzania, Mozambique.

Israel: Upper Galilee, Golan Heights, Lower Galilee, Jordan Valley and Southern Golan, Carmel Ridge, Valley of Yizre'el, Northern Coastal Plain, Central Coastal Plain, Southern Coastal Plain, Dead Sea area, 'Arava Valley, Southern Negev (Fig. 29).

Notes

The above mentioned world distribution may be problematic because some records are doubtful given the uncertain taxonomy of *X. pubescens* vs. *X. aestuans* (see Introduction). A gynandromorph of this species found within the examined material is shown in Figs. 24 and 25. It shows bilateral asymmetry with male coloration on its right half of the head, right foreleg and left metasoma vs. complementary female coloration. Also the shape and size of the right half of the head are typically male vs. female on the left, whereas both mandibles are female shaped. Moreover, both left and right hindlegs present female pubescence.

Xylocopa (Proxylocopa) rufa Friese, 1901

(Fig. 23)

Material Examined

ISRAEL: Nahal Zafit (Tel Zafit?) [N Tsafit], 7.viii.1978, D. Gerling (2♀); 'En Gedi [Ein Gedi], 10.vi.1973 (1♂); Rosh Zohar, 9.v.1961, O. Theodor (1♂); Nahal Sekher [N Secher], 6.iv.1988, A. Shlagman (1♂); Revivim, 2.viii.1958, J. Krystal (4♀); Dimona, 21.iv.1981, F. Kaplan (1♂); Yeroham [Bir Rakhme], 18.iv.1952 (2♀); Mash`abe Sade [Bir Asluj], 22.iii.1970 (1♂); Yeroham, 11.iv.1982, M. Sokolover (1♂); Horbat Shivta [Subeita], 3.iv.1945 (3♂); 13.iv.1946 (3♂); Sede Boqer [Sde Boker], 13.viii.1952, J. Wahrman (1♂); Mizpe Ramon, 16.vi.1986, A. Freidberg (2♀, 2♂).

EGYPT [Israel, Sinai]: Abu Shenar [Ein Shnar], 11.vii.1969, A. Freidberg (3♀); St. Katharina, 12.v.1978, J. Kugler (1♀, 1♂); Judean Desert, 6.iii.19??, D. Gerling (1♀).

Distribution

World: Armenia, Kazakhstan, Kyrgyzstan, Turkmenistan, Tajikistan, China, Iran, Pakistan, Egypt, Israel, India.

Israel: Hills of Judea, Dead Sea area, Southern Negev (Fig. 30).

Xylocopa (Ctenoxylocopa) sulcatipes Maa, 1970

(Figs. 7, 8, 19)

Material Examined

ISRAEL: Rosh Pinna, 26.iii.1952 (1♀, 1♂); Qazrin, 6.vii.1981, D. Gerling (1♂); Nahal 'Ammud [W Amud], 6.vi.1958, L. Fishelsohn (1♀); Teverya, 6.ix.1951 (1♀); 'En Gev, 11.iv.1968 (1♂); 20.v.1968 (3♂); Nahal Yarmouk [Yarmuk], 6.viii.1956, J. Wahrman (1♀); Nahal 'Iyyon [N Ayun Tanur], 8.iii.1952 (1♂); Geva', 2.iii.1944, J. Wahrman

(1♂); Kefar Ruppin, 20.vi.1959, J. Krystal (♂); Nahal Tirza [Wadi Faria], 3.vi.1977, A. Freidberg (1♀); Yeriho [Jericho], iv.1926, O. Theodor (1♂); 25.iii.1941, H. Bytinski-Salz (2♀, 2♂); 27.ii.1941, H. Bytinski-Salz (1♂); 19.ix.1945 (4♀); 5.v.1945 (1♀); 13.vii.1946 (3♀, 2♂); Duyuk Nu'eima, 9.vii.1967, M. Pener et al. (1♂); 'Ein Duyuk, 28.v.1971, student (2♂); 14.v.1972, student (1♀); Yerushalayim [Jerusalem], 14.vi.1946 (1♂); 2.ix.1972, M. Tintpulver (1♀); 'En Qelt [Ein Kelt], 5.viii.1971, M. Tintpulver (1♂); 16.ii.1973, M. Tintpulver (1♀); Deir Qilt, Nahal Perat, 9.iv.1947 (1♀); Nahal Perat [Wadi Kelt, W Kelt, W Fara], 4.iii.1944 (1♀); 14.ix.1967, D. Gerling (1♂); 16.iv.1972, F. Nachbar (2♀); Qalya, 11.iv.1968, M. Pener et al. (1♂); 20.iv.1969, student (1♂); 'En Gedi [Ein Gedi, Ein Geddi], 8.iv.1947 (1♂); 8.iv.1951, J. Wahrman (2♀); 12.iv.1953 (1♀, 1♂); 14.iii.1953, J. Wahrman (1♀, 2♂); 15.vi.1956, J. Wahrman (1♂); 1.v.1957, J. Kugler (1♀); 26.iii.1957, Shulov et al. (1♀, 4♂); 16.viii.1957, J. Wahrman (1♀, 5♂); 8.vi.1958, L. Fishelsohn (1♂); 28.iii.1959, J. Kugler (1♂); 19.iii.1960, Ch. Lewinsohn (3♂); 1.vii.1961, P. Amitai (6♀); 16.iii.1961, L. Fishelsohn (1♂); 17.iii.1961, L. Fishelsohn (1♂); 23.vi.1961, J. Halperin (1♂); 17.v.1963, Margalit (1♀); 27.iii.1964, Margalit (1♀); 28.iv.1964, S. Pobmansky (1♀); 16.iii.1965, L. Fishelsohn (1♂); 30.iii.1965, J. Kugler (2♂); 17.viii.1966, J. Kugler (1♀); 29.v.1968, P. Amitai and Avgar (1♀, 1♂); 15.v.1973, H. Bytinski-Salz (1♀); 15.iii.1975, D. Gerling (2♂); 29.iii.1976, M. Kaplan (1♂); 7.xii.1979, J. Yifat (1♀); 8.iv.1984, A. Freidberg (1♂); vii.1984, A. Hefetz (22♀); Nahal 'Arugot [Wadi Arugot, N Arugot], 16.iv.1955 (1♀); 14.iii.1972 (1♂); Mezada [Massadah], 13.iv.1953 (2♂); 18.iii.1960, Ch. Lewinsohn (1♂); Arad, 26.vi.1969, M. Broza (1♂); 'En Boqeq [Ein Boqueq], 10.iv.1967, M. Pener et al. (1♂); Ne'ot haKikkar, 20.v.1974, M. Kaplan (1♀); 'Iddan, 16.iv.2007, Y. Hollander (1♂); 18.iii.2008, Y. Hollander (2♀, 6♂); 'En Hazeva, 12.x.1953, L. Fishelsohn (2♀, 1♂); 06.iii.2007, Y. Mandelik (1♂); 20.iii.2008, H. Carmely (5♂); 20.iii.2008, Y. Hollander (1♂); 5.v.2008, Y. Hollander(1♀); Hazeva, 2.ix.1976, D. Simon (1♀); 1.i.1979, D. Gerling (1♀); 19.iii.2007, I. Lalzar (1♂); 19.iii.2008, H. Carmely (3♂), deposited TAUI@Rehovot); 19.iii.2008, Y. Hollander (14♂); 20.iii.2008, Y. Hollander (5♂); 20.iii.2008, M. Turki (1♂); 10.iv.2008, Y. Hollander (2♀, 1♂), 10.iv.2008, M. Turki (1♂); Sappir, 17.iii.2008, Y. Hollander (3♂); Yotvata, vi.1966, J. Kugler (1♀, 1♂); 27.iii.1979, B. Salmon (1♂); Dead Sea, 21.vii.1939 (1♂).

EGYPT [Israel, Sinai]: Tor(?), vii.1927, F.S. Bodenheimer and O. Theodor (1♀): Mahlaga, 5.ix.1968, G. Tsabar (1♂); Wadi Hibran [W. Hibran], 16.vii.1969, A. Freidberg (2♀); Dahab, 7.iv.1973, M. Kaplan (1♀); Wadi Tlach, 28.viii.1975, D. Gerling (1♀); Nuweiba [Sinai, Neviot], 13.viii.1978, D. Gerling (1♀); 8.viii.1979, D. Gerling(?) (1♀); Ofira, 22.iii.1981, A. Freidberg (2♀, 1♂).

JORDAN: Sumar, 12.iv.2007, M. Turki (1♀) (identified as *X. hottentotta* Smith F. by M. Terzo); 31.v.2007, M. Turki (1♂) (identified as *X. hottentotta* Smith F. by M. Terzo).

Unknown locality: 5.vii.1941, H. Bytinski-Salz (1♀); 8.iv.1951, J. Wahrman (2♀); 31.iii.1963 (1♂).

Distribution

World: Transcaspia, Israel, Egypt, Arabia, Yemen.

Israel: Upper Galilee, Golan Heights, Lower Galilee, Jordan Valley and Southern Golan, Yizre'el Valley, Samaria, Dead Sea area, Judean Hills, Judean Desert, Central Negev, 'Arava Valley, Southern Negev (Fig. 31).

Xylocopa (Ctenoxylocopa) ustulata Smith F., 1854

(Figs. 13, 19)

Material Examined

ISRAEL: Elat [Eilath], 14.i.1958, L. Fishelsohn (2♂).

EGYPT [Israel: Sinai]: Wadi Isla, 7.1927(?), F.S. Bodenheimer and O. Theodor (1♂); Wadi Hibran, 11.iv.1973, F. Nachbar (1♂); Dahab, 7.iv.1973, M. Kaplan (1♂); 3.iv.1974, D. Furth (1♂); Nuweiba [Sinai, Neviot], 13.viii.1978, D. Gerling (1♂), 8.vi.1979, D. Gerling(?) (1♂); 5 km N Ofira, 22.v.1981, A. Freidberg (1♂).

Distribution

World: Israel, Algeria, Egypt, Gambia, Mauritania, Mali, Sudan, Yemen, Ethiopia.

Israel: Southern Negev, 'Arava Valley (Fig. 32).

Xylocopa (Xylocopa) valga Gerstaecker, 1872

(Figs. 3, 4, 9, 16)

Material Examined

ISRAEL: Har Hermon [Mt Hermon], 2200 m, 16.vi.1968, H. Bytinski-Salz (2♂); 28.x.1968, G. Tsabar (1♂); 30.v.19??, R. King (1♂); 2000 m, 20.viii.1970, Blondheim et M. Broza (1♂); 8.viii.1973, F. Nachbar (1♀, 3♂); 22.v.1973, A. Freidberg (1♂); 22.vi.1973, M. Kaplan (2♂); 25.v.1977, D. Gerling (1♂); 5.v.1977, D. Simon (1♂); 1900 m, 2.viii.1978, D. Furth (1♀); 3.viii.1978, D. Gerling (1♀); 4.viii.1978, D. Gerling (1♀); 23.v.1978, J. Kugler (1♂); 1700 m, 17.vi.1977, A. Freidberg (5♀); 33°18.1′N 35°46.2′E, 1600 m, 24.v.2010, M. Guershon (2♀); 1500 m, 14.vi.1978, D. Furth (1♀); 1400 m, H. Lin (1♂); 9.vi.1977, P. Lazarovici (2♀); Kefar Gil'adi, v.1947 (1♀); Dan, 30.v.1960 (1♀); Dan, 17.vii.1967, J. Kugler (1♀); Madjal Shams [Magdal Shams], 25.ii.1968 (1♀); Bet haKerem, 24.v.1951, O. Theodor (1♀).

Distribution

World: Poland, Estonia, Lithuania, European Russia, Moravia, Ukraine, Kazakhstan, France, Switzerland, Austria, Hungary, Slovenia, Romania, Yugoslavia, Mongolia, China, Portugal, Spain, Corsica, Italy, Albania, Macedonia, Bulgaria, Georgia, Uzbekistan, Kyrgyzstan, Turkey, Armenia, Turkmenistan, Tajikistan, Sicily, Crete, Morocco, Algeria, Israel, Iran, Pakistan, India.

Israel: Mount Hermon, Upper Galilee, Judean Hills (Fig. 33).

Xylocopa (Xylocopa) varentzowi Morawitz, 1895
(Fig. 21)

Material Examined

ISRAEL: Har Hermon [Mt Hermon], 2000 m, 4.viii.1978, D. Gerling (2♂); Nahal Mahanayim, 2.xii.1978, Y. Evri (1♂); Horbat Hushaniye, iv.1976, B. Sh. A. (1♂).

Distribution

World: Turkey, Turkmenistan, Iran, Afghanistan, Israel.

Israel: Mount Hermon, Upper Galilee, Golan Heights (Fig. 34).

Xylocopa (Xylocopa) violacea (Linnaeus, 1758)
(Figs. 10, 11, 17, 20)

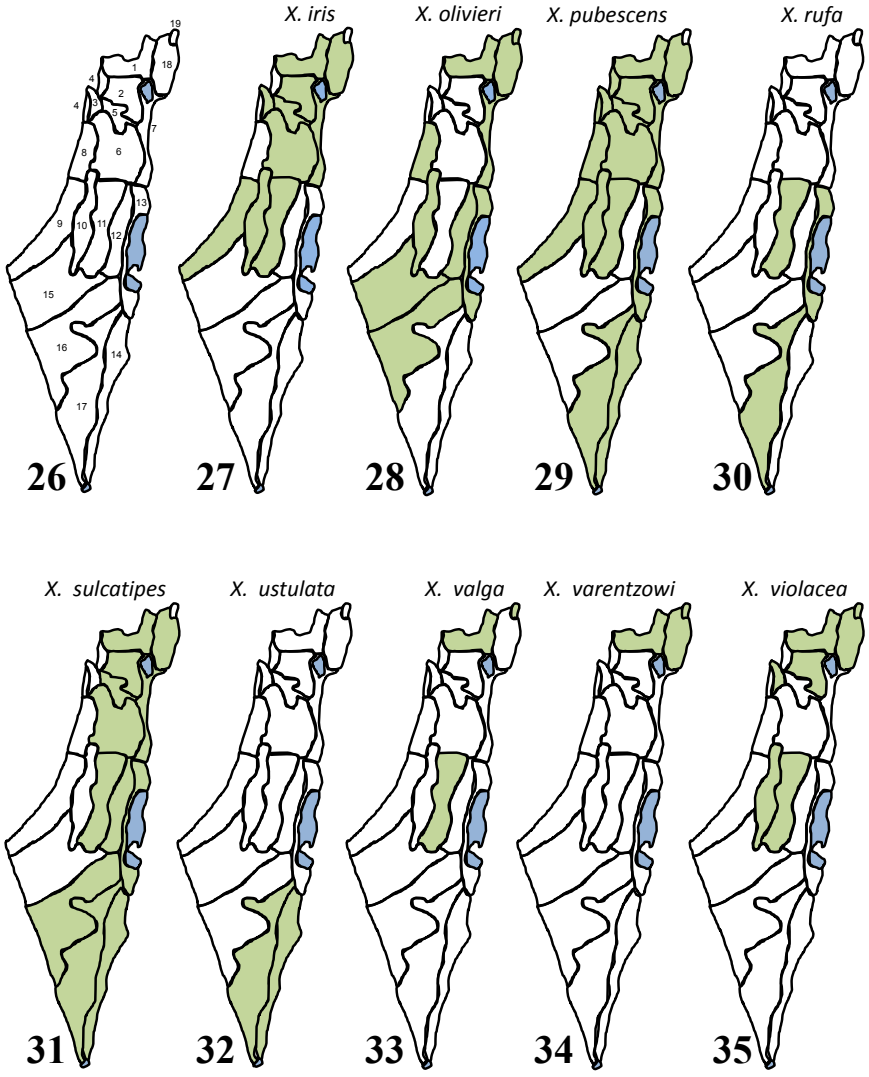
Material Examined

ISRAEL: Har Hermon [Mt. Hermon], 2000 m, 19.vii.1972, J. Kugler (1♀); 22.vi.1973, F. Nachbar (1♂); 4.viii.1978, D. Gerling (5♀, 2♂); 18.vii.1978, D. Gerling (1♂); 1900 m, 30.v.1990, E. Oren (1♂); 33º18.1′N 35º46.2′E, 1600 m, 24.v.2010, M. Guershon (3♀); Har Hermon Field School, 25.v.2010, M. Guershon (1♀); Panyas 33º14.8′N 35º41.7′E, 365m, 25.v.2010, M. Guershon (1♀); Nahal Koren [W Kuren], 2.iv.1958, Ch. Lewinsohn (1♀); Dan, 20.iii.1941, H. Bytinski-Salz (1♂); Dan 33º14′N 35º39′E, 2.vi.2008, E. Amsalem (1♀); Tel Dan [Dan Tall al Qadi, Hula Valley], 16.vii.1945 (1♀); Mezudat Nimrod [Qala'at Nimrod], 24.iv.1982, A. Hefetz (2♂); Monfort, 4.iv.1971, M. Kaplan (1♀); Ma'alot Tarshiha, 11.ix.1984, A. Hefetz (1♀); 14.ix.1984 A. Hefetz (1♀, 2♂); Har Meron [Har Meiron (Jarmaq), Mt. Meron], 19.ii.1960, J. Wahrman (3♂); 20, vi.1971, D. Gerling (1♀); 17.v.1976, A. Freidberg (1♂); 27.iv.1984, I. Yarom (1♂); Kefar Shammay, 7.v.1985, N. Levy (1♂); Yagur [Yagur haKarmel], 15.ix.1970, ? (1♀); Nahal Bezeq, 9.iv.1968, M. Pener et al. (1♀); [Hula Valley], 16.vii.1945 (1♀); Ya'ar 'Adulam,12.iv.2010, T. Koznichki (1♀); Darbushiye (Judea), 9.v.1983, D. Gerling (1♂).

Distribution

World: Finland, Sweden, European Russia, United Kingdom, Netherlands, Poland, Belgium, Germany, Bohemia, Moravia, Ukraine, France, Switzerland, Austria, Hungary, Romania, Croatia, Serbia, Italy, Bosnia, Bulgaria, Georgia, Turkestan, Portugal, Spain, Corsica, Sardinia, Greece, Macedonia, Turkey, Iran, Tajikistan, Sicily, Malta, Crete, Cyprus, Morocco, Algeria, Tunisia, Israel, India.

Israel: Mount Hermon, Upper Galilee, Golan Heights, Lower Galilee, Carmel Ridge, Judean Hills (reported by Shmida and Dukas, 1990), Foothills of Judea (Fig. 35).



Figs. 26–35: Distribution of *Xylocopa* species in Israel, shaded areas. 26. Geographical areas of Israel. 27. *X. iris*. 28. *X. olivieri*. 29. *X. pubescens*. 30. *X. rufa*. 31. *X sulcatipes*. 32. *X. ustulata*. 33. *X. valga*. 34. *X. varentzowi*. 35. *X. violacea*.

The geographical areas of Israel. 1. Upper Galilee. 2. Lower Galilee. 3. Carmel Ridge. 4. Northern Coastal Plain. 5. Valley of Yizre'el. 6. Samaria. 7. Jordan Valley and Southern Golan. 8. Central Coastal Plain. 9. Southern Coastal Plain. 10. Foothills of Judea. 11. Judean Hills. 12. Judean Desert. 13. Dead Sea area. 14. Arava Valley. 15. Northern Negev. 16. Southern Negev. 17. Central Negev. 18. Golan Heights. 19. Mount Hermon.

[*Xylocopa (Xylomelissa) hottentotta* Smith F., 1854]
(Figs. 5, 6, 14)

Material Examined

SOUTH AFRICA: E. Tyl. Wolkberg, 30.viii.1975, R.H. Watmough (1♂); E. Tyl. Wolkberg, 5.ix.1976, R.H. Watmough (1♀).

Distribution

World: Senegal, Sierra Leone, Togo, Nigeria, Somalia, Guinea, Congo, Rwanda, Kenya, Namibia, Zimbabwe, South Africa.

ACKNOWLEDGMENTS

We are thankful to Dr. Amnon Freidberg, Mr. Leonid Friedman, and Ms. Naomi Paz for lively discussions and editorial remarks on an early version of this manuscript, to Dr. Connal Eardley for his kind gift of the two *X. hottentotta* specimens for examination, and to Mr. Gerald Holzler for the information on labels of all *X. fenestrata* specimens in Dr. K. Warncke's collection at the Oberösterreichisches Landenmuseum Linz, and to The Israeli Ministry of Science, Culture and Sport for supporting the National Collections of Natural History at Tel Aviv University as a biodiversity, environment, and agriculture research knowledge center.

REFERENCES

Ascher, J.S. and Pickering, J. 2010. Discover Life bee species guide and world checklist (Hymenoptera: Apoidea: Anthophila). *http://www.discoverlife.org/mp/20q?guide=Apoidea_species* Last accessed 5 August 2012.

Bodenheimer, F.S. 1937. Prodromus Faunae Palestinae. Essai sur les éléments zoogéographiques et historiques du Sud-Ouest du sous-règne Paléarctique. *Mémoires présentes à l'Institut d'Egypte*, 43: 1–286.

Eardley, C.D. 1983. A taxonomic revision of the genus *Xylocopa* Latreille (Hymenoptera: Anthophoridae) in southern Africa. *Entomology Memoir*, Department of Agriculture, Republic of South Africa 67 pp.

Eizikowitch, D. 1987. *Calotropis procra* (Ait.) Ait. F. (Asclepiadaceae) and *Xylocopa* spp.: a study of inter-relationships. Pp. 341–345. In: *Insects-Plants, Proceedings of the 6th International Symposium on Insect-Plant Relationships, PAU 1986*, ed. V Labeyrie, Fabres, D. Lachaise. Dr W. Junk Publishers, The Hague, 459 pp.

Fishelson, L. 1985. *Fauna palaestina: Insecta III. Orthoptera: Acridoidea*. The Israeli Academy of Sciences and Humanities, Jerusalem, 229 pp.

Furth, D.G. 1975. Israel, a great biogeographic crossroads. *Discovery* 11: 2–13.

Gerling, D., Hurd, P.D., and Hefetz, A. 1983. Comparative behavioral biology of two Middle East species of carpenter bees (*Xylocopa* Latreille) (Hymenoptera: Apoidea). *Smithsonian Contributions to Zoology* 369: 1–33.

Gerling, D., Velthuis, H.H.W., and Hefetz, A. 1989. Bionomics of the large carpenter bees of the genus *Xylocopa*. *Annual Review of Entomology* 34: 163–190.

Gottlieb, D., Keasar, T., Shmida, A., and Motro, U. 2005. Possible foraging benefits of bimodal daily activity in *Proxylocopa olivieri* (Lepeletier) (Hymenoptera: Anthophoridae). *Environmental Entomology* 34(2): 417–424.

Guershon, M. 2010. Two species of carpenter bees new to the Israeli fauna (Hymenoptera: Apidae: *Xylocopa*). *Proceedings of the 29th Conference of the Entomological Society of Israel*. Bet Dagan, Israel, p. 38 (in Hebrew).

Hannan, M., Alqarni, A., Owayss, A., and Engel, M. 2012. The large carpenter bees of central Saudi Arabia, with notes on the biology of *Xylocopa sulcatipes* Maa (Hymenoptera, Apidae, Xylocopinae). *ZooKeys*, 201: 1–14. doi: 10.3897/zookeys.201.3246

Hurd, P.D.,Jr. and Moure, J.S. 1963. *A Classification of the Large Carpenter Bees (Xylocopini) (Hymenoptera: Apoidea)*. University of California publications in Entomology, Volume 29, University of California Press, Berkeley, 365 pp.

Ionescu- Hirsch, A. 2001. *The behavioral ecology of foraging in the large carpenter-bee* Xylocopa pubescens. Ph.D. thesis, Tel Aviv University, 108 pp.

Kaesar, T. 2010. Large carpenters bee as agricultural pollinators. *Psyche* 2010: 1–7.

Leys, R. and Hogendoorn, K. 2008. Correlated evolution of mating behaviour and morphology in large carpenter bees (*Xylocopa*). *Apidologie* 39: 119–132.

Leys, R., Cooper, S.J.B., and Schwarz, M. 2002. Molecular phylogeny and historical biogeography of the large carpenter bees, genus *Xylocopa* (Hymenoptera: Apidae). *Biological Journal of the Linnean Society* 77: 249–266.

Maa, T.C. 1970. A revision of the subgenus *Ctenoxylocopa* (Hymenoptera: Anthophoridae). *Pacific Insects* 12(4): 723–752.

Michener, C.D. 2007. *The Bees of the World*. Johns Hopkins University Press, Baltimore and London, 913 pp.

Minckley, R.L. 1998. A cladistic analysis and classification of the subgenera and genera of the large carpenter bees, tribe Xylocopini (Hymenoptera: Apidae). *Scientific Papers, Natural History Museum, University of Kansas* 9:1–47.

Shmida, A. and Dukas, R. 1990. Progressive reduction in the mean body size of solitary bees active during the flowering season and its correlation to the sizes of bee flowers of the Mint family (Lamiaceae). *Israel Journal of Botany* 39: 133–141.

Smith, F. 1854. *Catalogue of hymenopterous insects in the collection of the British Museum. Vol. 1. Part II. Apidae*. British Museum (Natural History): 199–465, pis. 7–12.

Smith, F. 1874. Monograph of the genus *Xylocopa* Latr. *Transaction of the Entomological Society of London,* 247–302.

Terzo, M. and Rasmont, P. 1997. Révision des *Xylocopa* Latreille du sous-genre *Copoxyla* Maa des pays circum-méditerranéens (Hymenoptera, Apoidea). *Bulletin de la Société entomologique de France,* 102(4): 367–377.

Terzo, M. and Rasmont, P. 2011. Atlas of the European bees: genus *Xylocopa*. STEP Project, Atlas Hymenoptera, Mons, Gembloux. *http://www.zoologie.umh.ac.be/hymenoptera/page.asp?ID=214* Last accessed 5 August 2012.

Warncke, K. 1976. Beitrag zur Bienenfauna des Iran. 1. Die Gattung *Xylocopa* Latr. *Bollettino del Museo Civico di Storia Naturale di Venezia* 25: 85–92.

Warncke, K. 1982. Die Holzbienen des Vorderen Orients (Hym., Apidae). *Linzer Biologische Beiträge* 14: 23–37.