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ORIGINAL ARTICLE

REVISION OF THE GENUS *XYLOCOPA* LATREILLE, 1802 (HYMENOPTERA, APIDAE) WITH A NEW RECORD OF SPECIES IN IRAQ



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ABSTRACT

In this study, the genus *Xylocopa* Latreille, 1802 (Hymenoptera: Apidae) was revised. There were 4 species registered in our investigations: *X. hottentotta* Smith, 1854; *X. olivieri* Lepeletier, 1841; *X. pubescens* Spinola, 1838 and *X. valga* Gerstäcker, 1872, the first species was described as being found for the first time for the insect fauna of Iraq, which were obtained from *Solanum melogena* L. flowers. Key to the species was constructed and supported by figures of the main diagnostic characters and some morphological features, illustrated and compared with other species, which are recorded in the current survey.

Keywords: Apidae, Carpenter bee, Iraq, Revision, *Xylocopa Hottentotta*

INTRODUCTION

Arthropods and pathogens have the most developed relationships with host plants through the evolution process (Adhab and Schoelz, 2015; Adhab, 2021; Adhab *et al.*, 2019). They have always been linked to agricultural losses through history (Al-Ani *et al.*, 2009, 2011; Adhab 2021). The family Apidae is one of the largest families of order Hymenoptera, including about 6484 described species that are important pollinators of natural plants and agricultural crops (GBIF Secretariat, 2022). The larvae and adults of this family feed on flowers, nectar and pollen to acquire energy (Delaplane and Mayer, 2000). Bees have a significant role in the natural pollination of flowering plants and greatly benefit humans by increasing food security, improving livelihoods and preserving biodiversity in agricultural and natural ecosystems (Eardley *et al.*, 2010). According to Michener (2007), this family includes three subfamilies, Apinae, Nomadinae and Xylocopinae, commonly known as carpenter bees because they build their nests by making holes in the stems of dead plants and wood, They are either characterized by biological diversity and solitary with social tendencies (He and Zhu, 2020). The large carpenter bee *Xylocopa* Latreille, 1802, wide spread worldwide, contains about 473 species (Michener, 2007).

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Xylocopa Latreille, 1802 characterized by several morphological features that includes: head transvers, ocellar triangle ocelli arranged below the vertex, compound eyes larger in male, labial palp flattened and sheath like; antennae geniculate, three submarginal cells in the forewing, marginal cell of forewing short, submarginal cross veins developed, pterostigma absent, jugal lobe less than one fourth as long vannal lobe (Michener, 2007).

The species of *Xylocopa* are distributed around the world, such as in Asia and the Middle East: Lebanon, Turkey, Palestine, Turkmenistan, Iran, and Afghanistan (Terzo and Rasmont, 2011; Terzo and Rasmont, 2014; Ascher and Pickering, 2021); South of Africa (Grace, 2010). In Iraq, *Xylocopa fenestrata* (Fabricius, 1798) was listed by Derwesh (1965); *X. olivieri* Lepeletier, 1841, *X. rufa* Friese, 1901, and *X. aestuans* (Linnaeus, 1758) were listed by Khalaf and Al-Omar (1974). As well *X. pubescens* Spinola, 1838, and *X. violacea* (Linnaeus, 1758) were recorded by Swailem *et al.* (1974) and *X. varentzowi* Morawitz, 1895 was registered by Ahmed (2015). Finally, Augul (2018) referred to recent records of family species through an update of the list of pollinators in Iraq. In the present paper, a new record species of *X. hottentotta* Smith, 1854 is redescribed, contributing to identify the carpenter bees in Iraq.

MATERIALS AND METHODS

Specimens' collection: Specimens used in this investigation were collected during the field surveys in different regions of Iraq throughout 2022 with irregular periods. Totally, 11 specimens were collected from Baghdad, Diyala, Kerbala, Saladin and Wasit Provinces in Iraq using sweep nets on a sunny day throughout the entire flowering period of plants. The collected bee specimens were kept in plastic containers. At the laboratory, specimens were mounted by insect pins; each specimen was labelled by two cards which contained the host plant, date and localities of collecting. All specimens were kept in wooden insect boxes. The photographs were taken by Huawei nova 7i (Sony-IMX586) and used a binocular dissecting microscope (MB. MARIOBROMA, Roma) to magnify the morphological features.

Identification: The specimens were identified by using different keys, such as Bingham (1897), Michener (2007), Eardly *et al.* (2010), and Guershon and Hirsch (2012). The synonyms mentioned in the current results are based on the GBIF Secretariat (2022).

Abbreviations:

1r-m: First radio– medial cross vein	M: Basal vein	SMC2: Second submarginal cell
2r-m: Second radio – medial cross vein	Mc: Marginal cell	SMC3:Third submarginal cell
C: Claws	Ms: Mesothorax	S: Spine
Cl: Clypeus	Mt: Metathorax	T: Tergite
Co: Coxa	N: Notum	Te: Tegula
E: Compound eye	O: Ocellus	Ti: Tibia
Fc: Frontal carina	P: Pedicel	Tr: Trochanter
Fe: Femur	Pa: Papillate	Ts: Tarsus
Fl: Flagellum	S: Spur	VI: Vanal lobe
Jl: Jugal lobe	Sc: Scape	
L: Labrum	SMC1: First submarginal cell	

RESULTS AND DISCUSSION

The results showed nine species, four of them were collected from different provinces in Iraq. The species *Xylocopa pubescens* was the highest distribution of Iraq, but the species *Xylocopa olivieri* was the lowest which only one specimen was collected from Baghdad Province.

Key to the species of *Xylocopa* occurring in Iraq:

- 1- Integument black..... 2
 - Integument brown. (Pl. 1A) *X. olivieri*
- 2- Scutum covered with bright yellow hairs dorsally. (Pl. 1B)..... *X. pubescens*
 - Scutum covered with black or intermixed with whitish hairs dorsally 3
- 3-Frontal carina from median ocellus towards frons elevated as a keel. (Pl. 1C) *X. hottentotta*
 - Frontal carina sulcated from median ocellus towards frons. (Pl. 1D) *X. valga*

Subfamily, Xylocopinae

Tribe, Xylocopin

Genus, *Xylocopa* Latreille, 1802

Synonym: *Hyllocopa* Kirchner, 1857

Common name: Carpenter Bee

Xylocopa hottentotta Smith, 1854

Synonyms: *Xylocopa carinata* Smith, 1874

X. fimbriatopilosa Enderlein, 1903

X. flavilabris Smith, 1874

X. fraterna Vachal, 1899

X. natalensis Vachal, 1899

X. producta Smith, 1874

X. tarsata Smith, 1854

Materials examined (2♀): The specimens collected from Wasit Province, Al-Aziziyah 32.911836°N 45.061348°E, 26. vii. 2022.

Distribution: Egypt (Grace, 2010); Ethiopia, Senegal, Togo, Nigeria, Somalia, Congo, Rwanda, Kenya, Namibia and Zimbabwe (Pauly *et al.*, 2018).

Description of Female: Body length 13-19 mm; completely black. (Pl. 2A, B, C); head black, densely punctate; compound eyes dark brown with pale areas, parallel, convergent ventrally without any setae between compound eyes, ocelli dark brown, arranged as triangle shape, median ocellus bigger than lateral ocelli, lateral ocelli lower than upper margin of compound eyes and equal in size, median ocellus not intersected by interocellar line, clypeus black, densely punctate, without lateral tubercles (Pl. 3A). Frontal carina elevated as a keel, gena narrow, antenocular distance two times larger than clypeoantennal distance (Pl. 3B). Antennae black consist of twelve segments, scape longer than pedicel about three times, first flagellomere longer than each rest segments (Pl. 3C). Thorax width 8-9 mm; mesothorax larger than prothorax and metathorax, densely punctate, mesonotum and sides of scutellum punctate, hairless in the middle, metathorax contain black hair lateral, tegulae large and black

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(Pl. 3D). Forewings length 14-18 mm, dark brown with purple reflection, veins darker brown, marginal cell long, narrow and extends along margins of wing, three submarginal cells (SMC), the third submarginal cell (SMC3) larger than SMC1 and SMC2, 1rs-m curved inward, 2rs-m curved outward, basal vein (M) straight, jugal lobe (JL) of hind wing less than vanal lobe (VL), ends of forewings and hind wings densely papillate (Pl. 4A, B). Coxae rounded, black, with dense black setae, trochanter rectangular, narrow at base, wider at the apex with black setae, femora black slender in shape, wide at base and narrowed apically, with dense black setae erected downwards, tibia narrow basally, wider apically, surface with densely punctate with dense long and black setae, tibial spur one on each leg, tibiae with single spur and spine at posterior apices. Tarsi black consists of five tarsomeres with densely black setae, tarsal claws branched, arolia with short black setae (Pl. 4 A, B, C). Abdomen width 5-7mm, six segments, densely punctate, tergum 2 (T2) wider than other terga; lateral sides of terga and sterna with black setae, pygidial plate black with dense black setae, posterior margin with short brown spine. Sterna with densely punctates, dense and black setae at apical edges (Pl. 5 A, B).

Diagnostic characters: Pubescence and integument black, clypeus without lateral tubercles, but with a more or less prominent tubercle in the center; sometimes the median carina a little more prominent in front lateral sides of terga and sterna with black setae.

Xylocopa olivieri Lepeletier, 1841

Synonym: *Xylocopa hellenica* Spinola, 1843

Material examined (1♀) Baghdad Province, Abu Ghraib, 33°17'31"N 44°03'56"E, 23.vi.2022. Distribution: Iraq (Derwesh, 1965), Turkey (Warncke, 1982.), Israel (Guershon and Hirsch, 2012), Albania, Azerbaijan, Greece, Crete, Cyprus, Iran, Kyrgyzstan, Macedonia, Syria and Turkmenistan (Ascher and Pickering, 2018). West Palaearctic: Northern and Eastern Mediterranean to the Western Caspian Sea and Lebanon (Grace, 2010)

Xylocopa pubescens Spinola, 1838

Synonyms: *Xylocopa (Koptortosoma) aestuans subsp. rubida* Gribodo, 1884

X. pubescens Eardley, 1987

X. rubida Gribodo, 1884

Materials examined (4♀♀, 1♂): (1 ♀) Baghdad Province, Jadriyah, 33°17'17"N 44°23'35"E, 6.vii.2022; (2♀♀). Wasit Province, Al-Aziziyah, 32.911836°N 45.061348°E, 26.vii.2022; (1 ♂, 1♀) Saladin Province, Al-Eshaqi, 34°17'00"N 43°46'00"E; 28.vii.2022.

Distribution: Iraq (Swailem *et al.*, 1974); Egypt, Algeria, Burma, Ethiopia, Iran, India, Israel, Morocco, Afghanistan, Nepal, Pakistan, Turkey, Syria, Senegal, Sudan, Kenya, Mozambique and Tanzania (Warncke, 1982; Ascher and Pickering, 2018).

Xylocopa valga Gerstaecker, 1872

Materials examined (2♀♀, 1♂): (1 ♀) Baghdad Province, Jadriyah, 33°17'17"N 44°23'35"E; 6.vii.2022. (1♂, 1♀) Babylon Province, Al-Musayyib, 32.778611°N 44.29°E, 6.ix.2022. Distribution: Iraq (Ascher and Pickering, 2018). West Palaearctic: Widespread in Europe and East of the Mediterranean basin to China, scattered records in North Africa (Terzo and Rasmont, 2014; Ascher and Pickering, 2021).

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Xylocopa aestuans Linnaeus, 1758

Synonyms: *Apis aestuans* Linnaeus, 1758

Xylocopa confusa Pérez, 1901

X. leucothorax (DeGeer, 1773)

Distribution: Iraq (Khalaf and Al-Omar, 1974); United Arab Emirates (Harten, 2005); Saudi Arabia (Hannan *et al.*, 2012); Indonesia and the Malay Peninsula (Pauly, 2016).

Xylocopa fenestrata Fabricius, 1798

Synonym: *Apis fenestrata* Fabricius, 1798

Distribution: Iraq (Derwesh, 1965); Turkey (Warncke, 1982); Afghanistan, Burma, China, Iran, Pakistan, India, Mauritius, Madagascar, Nepal, Sri Lanka and Reunion (Ascher and Pickering, 2018).

Xylocopa rufa Friese, 1901

Distribution: Iraq (Khalaf, 1958).Caucasus, Sudan, Turkestan, Pakistan, Israel and Iran (Warncke, 1982). Armenia, Kyrgyzstan, Turkmenistan, India, Tajikistan and China (Ascher and Pickering, 2018). West Palaearctic: Eastern Mediterranean to China (Terzo, and Rasmont, 2014).

Xylocopa violacea Linnaeus, 1758

Synonym: *Apis violacea* Linnaeus, 1758

Distribution: Iraq (Swailen *et al.*, 1974); East Palaearctic: Widespread across Europe, scattered records from North Africa and further east in the Mediterranean to Tajikistan (Terzo and Rasmont, 2014; Ascher and Pickering, 2021).

Xylocopa varentzowi Morawitz, 1895

Distribution: Iraq (Khalaf and Al – Omar, 1974). Afghanistan, Iran, Israel, Turkmenistan and Turkey (Ascher and Pickering, 2021).

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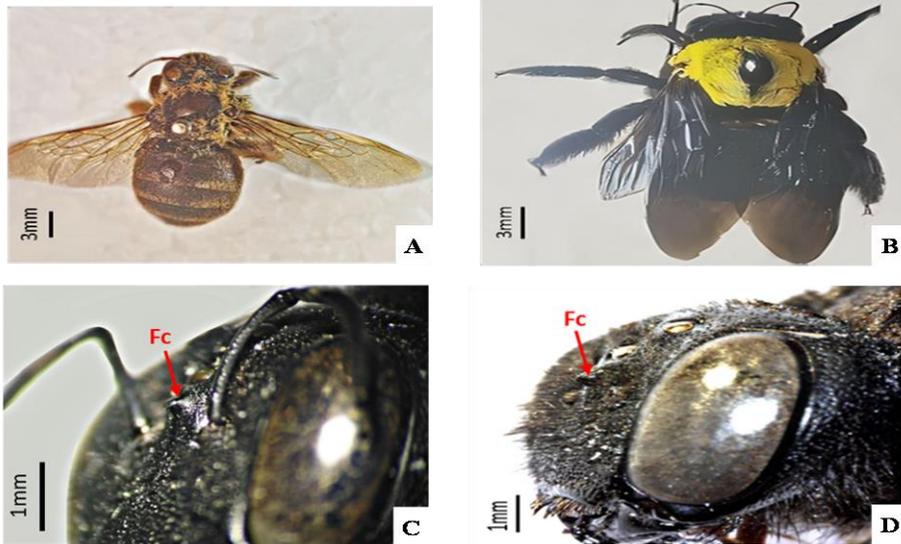


Plate (1): (A) Dorsal view of *X. olivieri*, (B) Dorsal view of *X. pubescens*, (C) Lateral view of head *X. hottentotta*, (D) Lateral view of head *X. valga*.

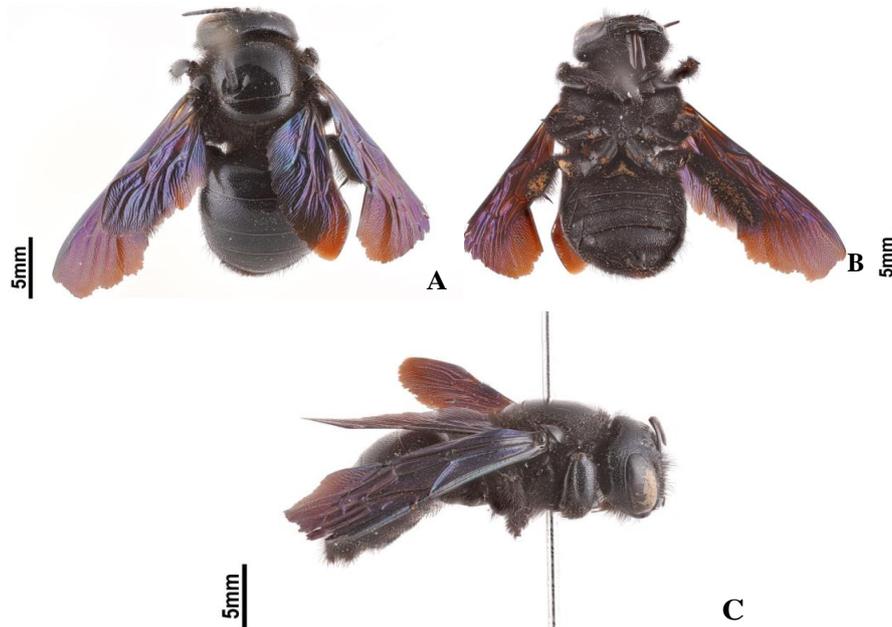


Plate (2): Female of *X. hottentotta*; (A) Dorsal, (B) Frontal and (C) Lateral view.

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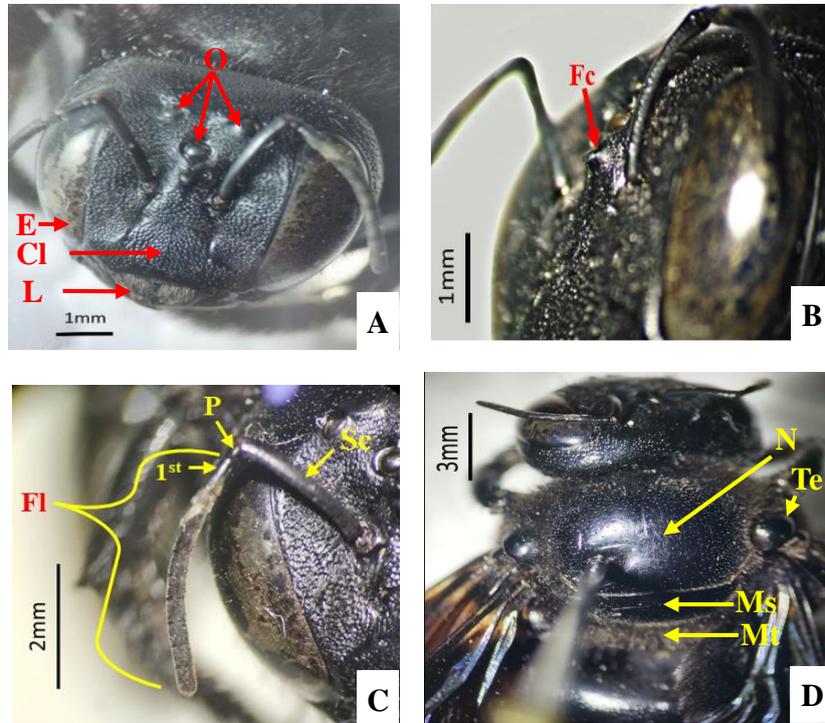


Plate (3): *X. hottentotta*; (A) Head, frontal view, (B) Head, lateral view, (C) Antenna, (D) Thorax, dorsal view.

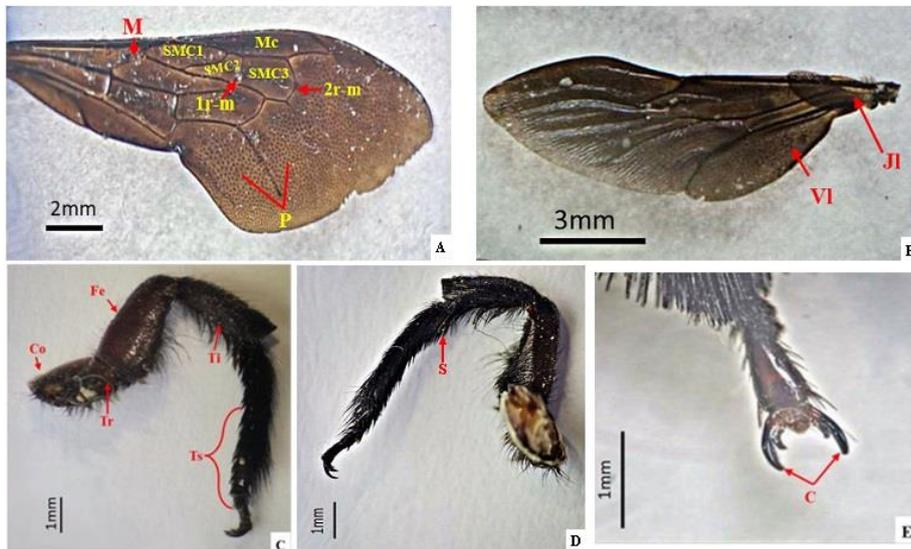


Plate (4): Wings and legs of *X. hottentotta*; (A) Forewing, (B) Hindwing; (C) Dorsal view, (D) Ventral view, (E) Claws.

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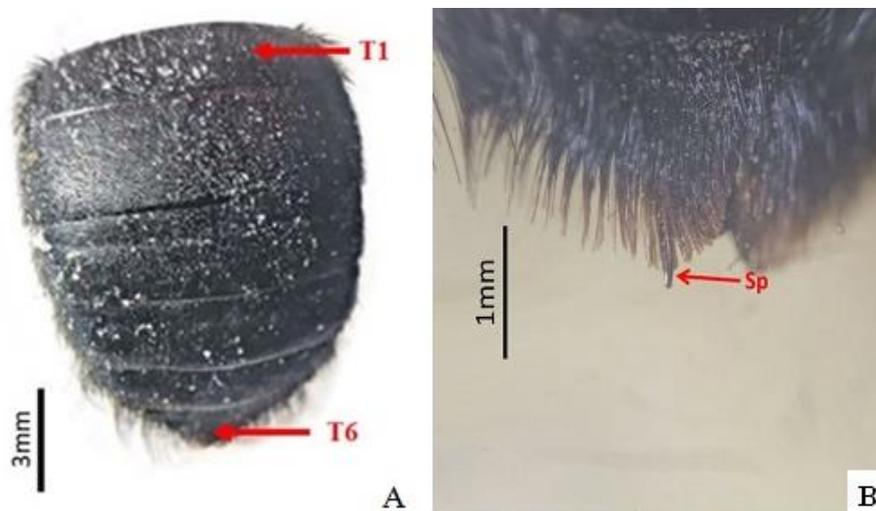


Plate (5): Abdomen of *X. hottentotta*; (A) Dorsal view, (B) Spine.

CONCLUSIONS

This study is the most comprehensive review of bees out of the genus *Xylocopa* in Iraq to date, which is poorly known in Iraq and many species of it remain to be described. The species which are belonging to it have a great importance in pollination of agricultural crops. According to database, references and checklists that related to this group, the genus *Xylocopa* is one of the most widespread genera in Iraq. Therefore, it is necessary to complete the investigation of its species in the different regions; and will expect to add more species to the Iraqi fauna.

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CONFLICT OF INTEREST STATMENT

The results of the present study are part of the requirements of M. Sc. in Insects, Department of Plant Protection, College of Agriculture Engineering Sciences-University of Baghdad for the first author. As well, we are the authors of this manuscript, declare and confirm that there is no significant financial or other relationship with any official institution.

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مراجعة للجنس *Xylocopa* Latreille, 1802
(Hymenoptera, Apidae)
مع تسجيل نوع جديد للعراق

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الخلاصة

جرى في هذه الدراسة مراجعة لجنس *Xylocopa* Latreille, 1802 (رتبة عثائية الاجنحة Hymenoptera، عائلة النحل Apidae)، اذ سُجِّلَ اربعة انواع شملت: *X. hottentotta* Smith, 1854، *X. pubescens* Spinola، *X. olivieri* Lepeletier, 1841، و *X. valga* Gerstaecker, 1838. حيث وصف النوع الأول كتسجيل جديد لأول مرة للمجموعة الحشرية العراقية، جمع هذا النوع من أزهار نبات الباذنجان *Solanum melogena* L. صُمم مفتاحاً لعزل أنواع هذا الجنس مدعوماً بالصور التوضيحية للصفات التشخيصية الرئيسية و بعض الصفات المظهرية للمقارنة بين الانواع التي سجلت خلال هذه المراجعة.