

REDESCRIPTION AND SOME POLYMORPHISM NOTES IN
WORKERS OF *CAMPONOTUS XERXES* FOREL, 1904
(HYMENOPTERA: FORMICIDAE; FORMICINAE)

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ABSTRACT

The specimens of *Camponotus xerxes* Forel, 1904 were collected from different localities in Iraq; the purpose of morphological study of this species in details throughout the present study.

The description was based on major workers belonging to this species, also some notes of polymorphism in workers have been mentioned; the most important of morphological features are illustrated and figured.

Key words: *Camponotus*, Formicidae, Formicinae, Hymenoptera, Polymorphism, Redescription.

INTRODUCTION

Formicidae is a family of order Hymenoptera, which also includes sawflies, bees, and wasps; this family within Vespoidea superfamily, which are composed with the Apoidea and Chrysidoidea a guild of Aculeata, and follow to the suborder of Apocrita (Goulet and Huber, 1993). Ants are an important and ubiquitous component of the fauna on all terrestrial habitats, except the poles, with about 140 million years of evolutionary history (Moreau and Bell, 2013). There are currently more than 13,000 ant species recognized worldwide (Bolton, 2014). They play crucial ecological roles as predators, soil engineers, seed dispersers, plant symbionts, nutrient cycles and more (Del Toro *et al.*, 2012). In tropical forests; the ants are represented, simultaneously with termites, a major proportion of the animal biomass (Fittkau and Klinge, 1973).

Formicinae has the characteristics that distinguish it from other subfamilies belong to Formicidae: ocelli always present; petiole with a distinct single node or scale; gaster without a projecting sting, first and second gasteral tergite not separated by a distinct constriction, apex of gaster with a circular orifice, in some genera a protruding tube fringed with setae (Collingwood and Agosti, 1996).

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The genus of *Camponotus* Mayr, 1861 are recognized by many features such as: Antenna 12-segmented, antennal insertion with clearly distant from clypeal margin, dorsal surface of thorax clearly curved in lateral view (Collingwood, 1985; Collingwood and Agosti, 1996).

The previous studies that deal with ants in Iraq, especially with respect to taxonomic studies of this genus, are very few, for example Khalaf (1958) listed the species of *Camponotus compressus* (Fabricius), while Abdul-Rassoul *et al.* (1978) reported *C. xerxes* Forel (mistakenly written as *C. tertus*), and then Abdul-Rassoul *et al.* (1988) listed the species *C. festai* Emery, *C. giedeli* Pisarski, *C. kurdistanicus* Emery and *C. thoracicus* F. for the fauna of Iraq.

Recently, in the catalogue of Borowiec (2014) were listed many species for Iraq that belonging to genus of *Camponotus*, namely: *C. cilicius* Emery, *C. evansi* Crawley, *C. fellah* Dalla Torre, *C. gestroi* Emery, *C. kurdistanicus* Emery, *C. oasisium* Forel, *C. riedeli* Pisarski, *C. shaqualavensis* Mayr; *C. staryi* Pisarski, *C. vogti* Forel and *C. xerxes* Forel.

The aim of the present study is a redescription of the major workers of *Camponotus xerxes* with some observations on their morphological polymorphism in workers.

MATERIALS AND METHODS

Collecting and Preserving Insects:

There were two methods to collect the workers of ants; the first one, large specimens were captured by forceps and brush; whereas the smaller specimens were collected by aspirator; then put them in test tubes and small plastic containers, and transferred to the laboratory to complete the conservation and diagnosed. The specimens were preserved in two groups as follows:

1. **Conservation by alcohol:** Some of specimens were preserved in plastic tubes containing 75 % ethyl alcohol; the date and localities of collection were provided.
2. **Mounting of the specimens:** Others were mounted on cardboards.

The preparation of microscopic slides:

Some diagnostic characters cannot be studied or drawn and figured easily, so these parts were mounted on permanent slides. The slides were prepared in two methods:

- (1)The direct method: Most parts of the ants were mounted directly such as: antennae, mandibles and legs; and adding appropriate amount of canada balsam and covered by cover slips.
- (2)The indirect method: The parts of specimens were put in potassium hydroxide (KOH) concentration of it 10 % for 24 hours to make samples softer and transparency. Under dissecting microscope, the head was placed in a watch glass and removed the mouthparts; these parts were washed 3 by distill water and then washed in the 70 to 96 % ethyl alcohol, respectively for 3 minutes. The parts were dried by filter papers and placed in a watchglass that filled with glacial acetic acid to remove the remains of alcohol, then mounted on the slides.

Diagnosis of specimens and the examination of characters:

The camera Lucida was used with binocular dissecting microscope to illustrate some parts; furthermore, the Samsung galaxy S4, GT-19500 was used for taking photos with using a binocular dissecting microscope.

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The specimens were identified by using keys provided by Collingwood (1985), Collingwood and Agosti (1996), Mohamed *et al.* (2001), Ionescu-Hirsch (2009), Karamanand and Aktaç (2013), Taylor (2015); also were compared with previously determined species deposited in the Iraq Natural History Research Museum collection.

The measurements:

According to Collingwood and Agosti (1996), the following abbreviations of measurements (in millimeters) were used:

CI (cephalic index): $HW \times 100 / HL$

EL (eye length): The maximum diameter of the eyes.

HL (head length): The length of head, with the excepting of mandibles, measured in a straight midline.

HW (head width): The maximum width of head, excluding eyes.

PH (petiole high): The maximum high at node.

PL (petiole length): The length of petiole from its attachment with propodeum to gaster.

SI (scape index): $SL \times 100 / HW$.

SL (scape length): The straight line length of antennal scape not including basal neck.

TL (total length): The total outstretched length of the individual.

RESULTS AND DISCUSSION

The Morphology of the major workers

General description:

Color (Plate 1): Black, semi-shining with exception of the following parts: flagellum, pedicel and legs reddish brown; lower part of thorax including propodeum and petiole dark brown. Generally, body covered with fine and moderately densely pubescences.

Measurements: TL: 13-16 mm, SI: 80.0-83.1, CI: 73.0-98.7; EL: 0.83-0.90 mm, HL: 3.70-3.75 mm; EL/HL: 0.22-0.24, HW: 3.45- 3.60 mm; PL: 1.0-1.3mm; PH: 1.5- 1.9 mm; SL: 2.76-3.00 mm.

Head (Plate 2, Figure 1): Head quadrate shaped in frontal view; three small ocelli; compound eyes relatively large, oval shaped, with flat surface; clypeus semi oblong with convex surface, particularly upper two-third; apical margin of clypeus straight with brown setae varying in length, extended with longitudinal axis of head, lateral sides of apical margin with right-angled not extend under genae (Figure 1, Plate 2).

Frontal line very clear; lower half of frons with very distinctly frontal carinae, W- shaped like and exceeds antennary pits.

Antennal insertions distant from fronto-clypeal suture; in frontal view, face with five pairs of black erect setulae arrange into rows varying in length along sides of frontal line.

In general, head with fine scattered pits leaving very wide distance in many parts; covered with very fine scattered pubescences that appeared clearly at vertex.

Vertex with flat edge in frontal view, slightly elevated on side; genae consist of wide area, foramen magnum near at upper part of head surrounding by occipital carina in upper half; labium and maxillae are settled in oral fossa, upper parts of oral fossa surrounding by hypostoma. Posterior side of head glabrous (Plate 2 B, C) this characters is very useful to determine this species from closely species *C. fallah* Dalla Torre, 1893; in dorsal view occiput consist of widely area that extended from behind vertex to occipital carina.

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Antennae (Plate 3): Geniculate - filiform type; scape slightly bent and elongated compared with length of other parts, narrowed at the base, covered with fine moderately densely pubescences, also with short, scattered and paler hairs, vary in length and formed sharp angle with scape that inclined with acute angle toward apex of scape. Pedicel short, cylindrical segment and 1.25 times longer than first segment of flagellum. Flagellum composed of 10 segments that called flagellomeres; length of first, second and third equal; the diameter of flagellomeres decreases gradually toward apex of flagellum, remaining segments decreased gradually in length, but apical segment elongated and acuminate with a rounded tip; flagellomeres covered with dense and scattered micro-pubescences.

Mouth parts:

Mandible (Plate 4 A, B): Mandibles strong, wide and resembling foot shaped in internal side, sickle shaped in dorsal view; covered with scattered, brown setae, varying in length on dorsal surface, setae become longer and stronger near the teeth, internal margin with seven teeth including apical extension; teeth different in sizes and shaped, generally most of teeth triangular shaped; apical tooth long with slightly acuminate apex, three teeth that following apical tooth large and triangular, shorter and wider than apical; remaining teeth smaller and varying in sizes.

Maxilla (Figure 2):

Cardo shorter and smaller sized than second part of maxilla, base of cardo articulates with hypostoma, apical part joined with stipes; stipes large and elongated, concave toward internal side, external surface corrugated or wavy, carrying on its apex rest of maxilla parts that include maxillary palp and galea.

Maxillary palp placed on outer apex of stipes, consist from six segments, first segment short, second longer than rest; remaining segments, with length gradually decreases as well as diameters, covered with fine and short hairs.

Galea located at internal side of stipes apex, fleshly and enlarged portion, apex rounded, clothed with fine and densely hairs, lacinia absent.

Labrum (Plate 4A): Base of this portion wide and articulated with clypeus, but narrowed laterally at median, anterior margin or free edge with invagination V- shaped like; covered with fine and dense hairs.

Labium (Figure 3): Located at lower of previous of mouth parts, consists of following parts: Submentum; small and semi-triangular shaped, base connected with hypostoma, apex slightly concave and attached with mentum and prementum.

Mentum and prementum integrated with each other, fleshly, oval and elongated shaped; clothed with scattered fine hairs; other parts of labium located at its apex.

Labial palps: Placed on both sides of mentum-prementum apex; each of this part composed of four segments, covered with little and fine hairs.

Glossae: Combined as one structure, swollen and oval shaped, base sclerotized dark area with dense, short and fine hairs.

Paraglossae: Located on either side of glossae, narrowed and tape shaped; surfaces of these parts covered by dense, short and finer hairs.

Alitrunk (Plate 5, Figure 4, 5):

Dorsal surface of alitrunk curved in lateral view; semi-shining, without clearly sculptures, although, we can identify microsculptures in high power that similar to fingerprints. Generally, alitrunk in worker of ants consists of following parts:

Prothorax: This part is large; and like other Hymenoptera, it does consists of pronotum and propleuron, prosternum reduced, and not clear.

Pronotum: Wide and semi-triangle in lateral view; middle of dorsal surface convex in lateral view and with three long and erect setae on each side; anterior part of pronotum with depression and narrow dorsally to form neck in association with small area from apex of propleuron.

Propleuron: Narrowed in lateral view, striped shaped and elongated, acuminated toward neck. In ventral view, consist from semi-elongated two triangular shaped portions, and separated by median longitudinal line, each portion wide at near coxae, but acuminated or narrowed in anterior parts; propleuron clothed with erect and vary hairs.

Mesothorax: Dorsal surface curved and continuous with prothorax in lateral view; convex in dorsal view; this part narrower than pronotum in dorsal view; first sclerite continuous laterally, dorsal surface with one pair of erect and similar to that setae, which located on dorsal surface of pronotum and another single behind anterior, but slightly shorter; dorsal surface of mesonotum becomes narrowed toward posterior part at near metanotum. Mesopleuron elongated and narrowed toward mid coxae that semi-oblong shaped like.

Metathorax: Dorsal surface much narrower than other parts of thorax, metanotum very narrow and reduced in lateral view, it's appeared as inverted triangle shaped. At lower area of this part can be determined second thoracic spiracles, these spiracles with semi-oval shaped. Metapleuron similar to mesopleuron, but narrower, extended from under metathoracic spiracles, slightly widened at near hind coxae. Sternites of thoracic segments reduced.

Propodeum: Dorsal surface curved and continue with previous parts; declivity abrupt; dorsal surface with group of erected long setae, one pair situated in middle and three setae located at near of declivity, although slightly decrease in length, especially in last three and bend at apex toward anterior parts of body; at end of lateral sides of propodeum with distinct pair of propodeal spiracles with two opposite lips like shaped.

The legs (Plate 6): Legs varying in length, and increase gradually from fore to hind legs, but inverse, thickness of legs gradually decreases. Coxae very closely in ventral side of thorax, so that sternites of thoracical segments not obvious.

Fore Legs: Coxae like semi conical shaped with wide base and narrowed at apex, anterior side with three varying in length and erect setulae located at apical half of coxae; posterior side of surface with row composed of various setulae, thinner than previous setulae, these setulae separated by different distance and found at apical half of segment. Trochanter, clothed with scattered setulae, erect and shorter than setulae on posterior surface of coxae. Femur cylindrical shaped, elongated; apex half with depression along of ventral or inner side; inner side of two third of base part with a row of five setulae, moderate in length and with wide and varying in distance that separated from one each to other, apex of femur with many short and strong of setae on outer side. Tibia shorter and clearly thinner than femur, but diameter increase at apex; inner surface with a row of short, erect and varying in thickness of

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setulae; apex of tibia with long spur like a thumb shaped on inner side, inner side of spur with a row of very fine and closely of hairs; and there are many spines located at near spur. Tarsus consists of five tarsomeres, basitarsus cylindrical like shaped, elongated with clearly depressed on side that opposite of tibial spur, concave or depression on base of basitarsomere covered by a row of fine hairs; length of tarsomeres decreases from second to fourth tarsomere that very shorter than basitarsus, while fifth slightly longer than second tarsomere; last tarsomere or fifth segment carrying a pair of claws, apex with arolium medially, apical of this tarsomere with many setulae that varying in length and thicker. Generally, tarsomeres from first to fourth spinous especially basitarsomere but spines located at apices of rest tarsomeres.

Mid Legs: Coxae shorter and smaller than fore coxae, also conical form; posterior side with three to four erect setulae and varying in length. Trochanter similar to fore leg in shaped, but with two erects and short of hairs. Femur similar to shape of fore leg, but thinner and slightly longer; posterior surface contained three moderately, wide separated, erect setulae on basal half; apical part of femur with short several spinules, and located around apex. Tibia thinner and longer than fore leg, basal part narrowed than apex; ventral surface with row of strongly and short setae, and length increase toward of tibial apex, separated by widely distance from one to others; apical part of tibia with pair of spinules, one on ventral and other on outer side, these spinules with medium length; also ventral side of apex with long and straight spur and different by shaped compared with spur on apical part of fore tibia, also this spur contain short, fine and very closely hairs on side that opposite of depression side of basitarsus. Tarsus similar to description of fore leg with exception basitarsus with slightly concave on inner side.

Hind Legs: Coxae similar to previous coxae but elongated and less swollen than fore coxae and clearly larger than mid coxae; hind coxae glabrous. Trochanter cup shaped, with single hair at median part of posterior surface. Femur longer than fore and mid femur, but thinner, with scattered, short and erect setulae; basal half straight, but apical half slightly curved, and acuminate toward apex; ventral surface of apex with several short spinules. Tibia cylindrical and elongated; ventral surface very important for diagnostic of this species, there is a row of setae and separated by different distance, this row contains from 8-13 pairs of spiny hairs on inner surface or side, near to apical half of tibia; apex with long spur compared to spur on mid tibia. Tarsus such as previous tarsi, but tarsomeres longer than fore and mid tarsi.

The Abdomen:

Petiole (Plate 5,7, Figure 4): Petiole composed of single nod, slightly higher than long, anterior surface curved, posterior surface flattened with six long and erect setulae, three on top of anterior side and others located at top posterior surface; apex of node acuminate and slightly rounded in dorsal view. On ventral side; anterior base of petiole with a group of setulae that characterized by erect, short and different length; median of lateral sides with small and rounded spiracles.

Gaster (Plate 7): Semi-pear shaped like; gaster consists from five segments called gasteral segments or abdominal segments; size of segments decreased toward posterior end. Sculptures as of thorax, similar to fingerprints in high magnification. Each gasteral segment composed of gasteral tergite and sternite, but pleuron reduced; generally anterior region of gasteral tergites with pair of spiracles at lower parts. Posterior margin of T1-T3 with clearly shining narrow stripe line; gasteral tergites covered with regular, dark and moderately density of micropubescentences that leaving wide distances. Two rows of long and erect setae found on surface of tergites and sternites, first row located at anterior of tergites, second row located at near of posterior margin and separated by clearly and widely distances, these setae

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concentrated in middle parts of sternites and become more density, especially at near of acidopore, but they don't compose like a brush.

Diagnostic characters: EL/HL > 0.2, ocelli absent, pronotum normally, genae and posterior head without hairs, dorsum of alitrunk entirely black, dorsal surface of petiole rounded and squamiform shaped.

Specimens examined: (161major workers): The specimens were collected from outdoor places that containing gardens and Agricultural fields. Baghdad province, Bab- Al Mudham (103 specimens), 21, 14.I.2016, 29, 28.I. 2016, 14, 4. IV.2016, 2, 14.V. 2016, and 1 specimen was collected at 29.VI.2016; Palestine street, 3 specimens were collected in 20. III. 2016; Al-Sadder city, 16 specimens were collected in 13. II. 2016; Gherai'at, 10 specimens were collected in 18. III.2016; Taji, 4 specimens were collected in 13.II.2016; Sha'ab District, 10 specimens were collected in 6. III. 2016; Hayy Al-Bnouk, 6 specimens were collected in 27. III.2016. Maysan province: Ali Al-Gharbi, 6 specimens were collected in 5. II.2016. Basra province; Al-Midaina district, 33 specimens, 23, 13.II.2016 and 10 specimens were collected at 26. II.2016. Dhi Qar, Al Refai district, 6 specimens were collected in 17. III. 2016.

Distribution: Saudi Arabia, United Arab Emirates, Egypt, Iran, Iraq, Israel, Oman, Qatar, Turkey, Turkmenistan and Uzbekistan (Borowiec, 2014).

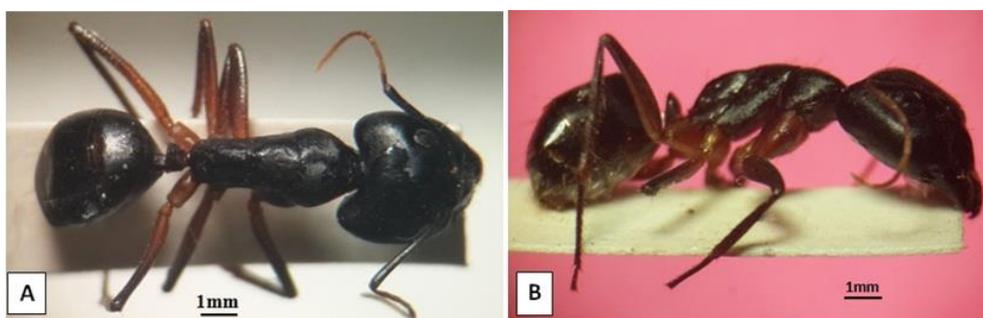


Plate (1): Worker of *Camponotus xerxes*; A- dorsal view B- lateral view

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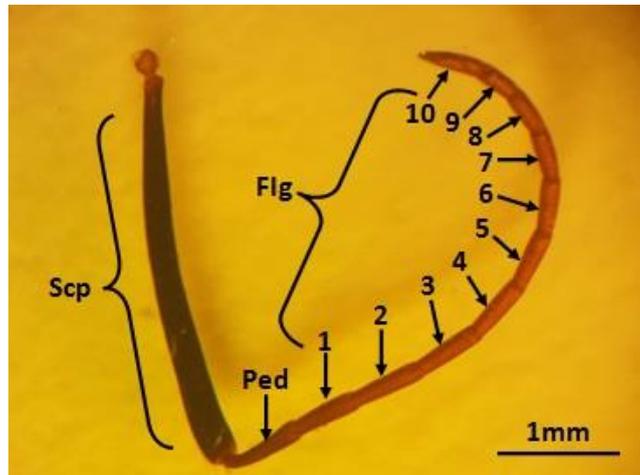
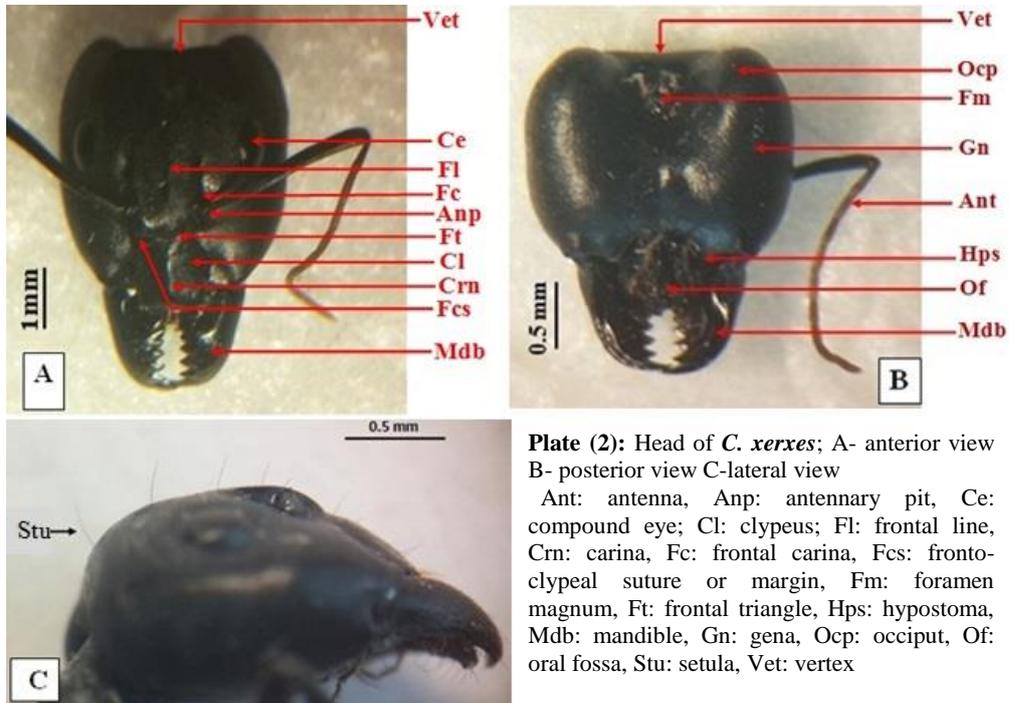


Plate (3): Antenna of *C. xerxes*
 Flg: flagellum, Ped: pedicel, Scp: scape
 (The numbers refer to the flagellomeres)

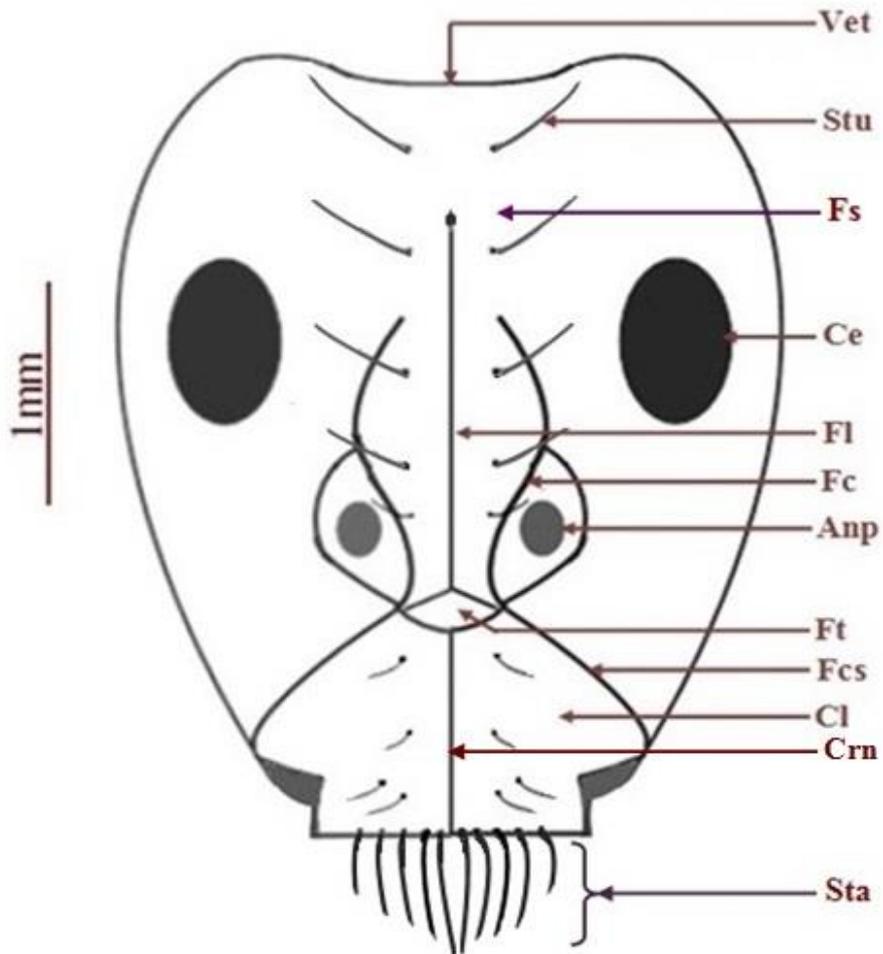


Figure (1): Head of *C. xerxes* (Anterior view)

Anp: antennary pit, Ce: compound eye, Cl: clypeus, Crn: carina, Fc: frontal carina, Fcs: fronto-clypeal suture or margin, Fl: frontal line, Fs: frons, Ft: frontal triangle, Sta: setae, Stu: setula, Vet: vertex

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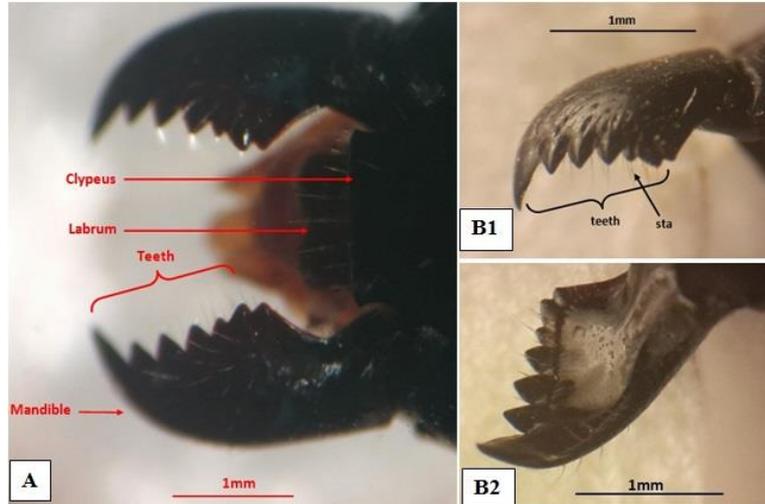


Plate (4):Some of mouth parts in major worker of *C. xerxes*; A- anterior view for lower parts of head that showed the mandible and labrum B- mandible B1, dorsal surface B2, ventral surface (Sta: seta)

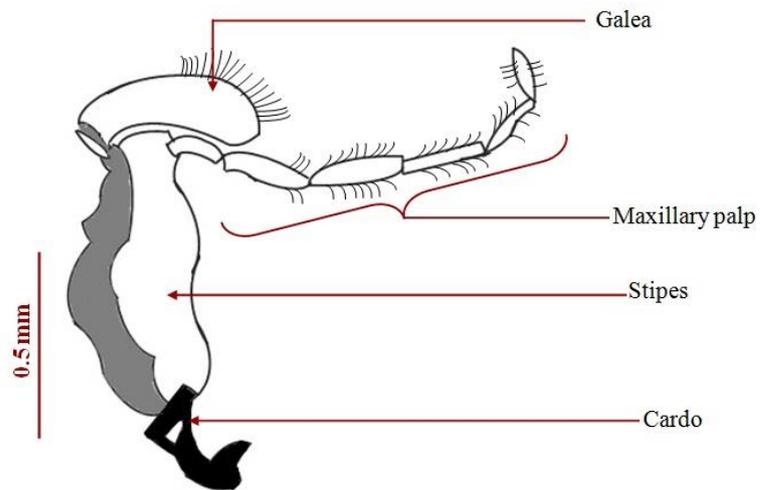


Figure (2): Maxilla of *C. xerxes*

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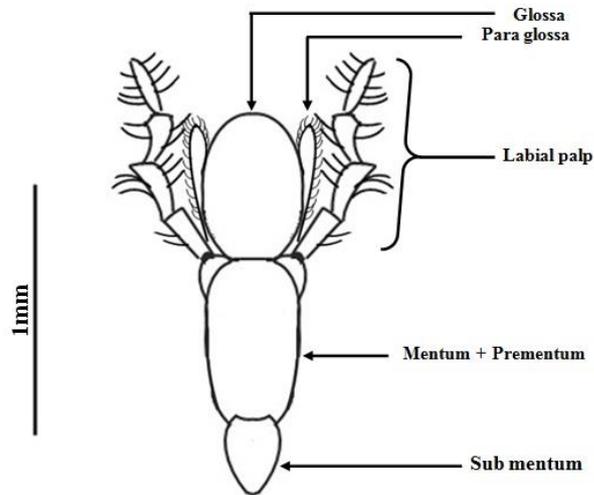


Figure (3): Labium of *C. xerxes*

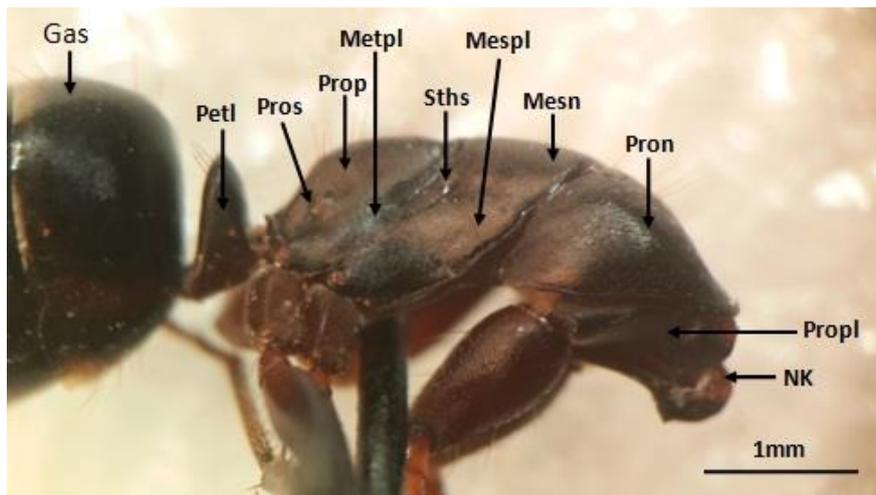


Plate (5): Lateral side of alitrunk and some parts of abdomen in major worker of *C. xerxes*
 Gas: gaster, Mesn: mesonotum, Mespl: mesopleuron, Metpl: metapleuron, NK: neck, PetI: petiole, Pron: pronotum, Prop: propodeum, PropI: propleuron, Pros: propodeal spiracle, Sths: second thoracic spiracle

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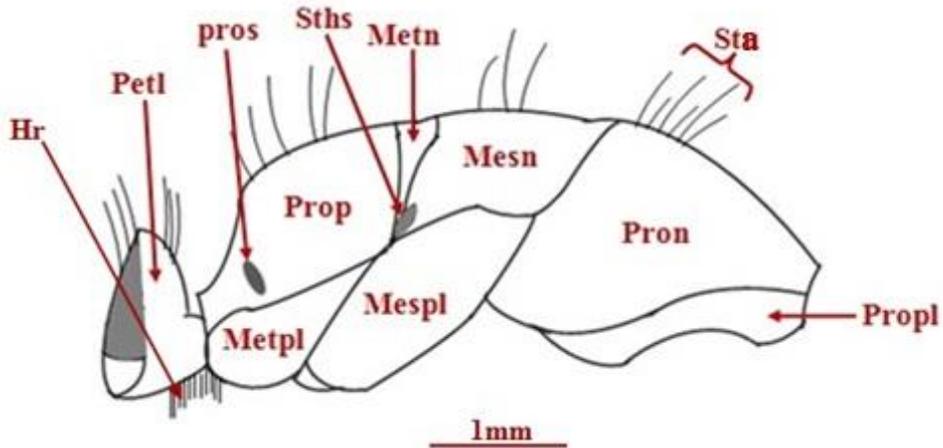


Figure (4): Lateral side of alitrunk and petiole in *C. xerxes*

Hr: hairs, Mesn: mesonotum, Mespl: mesopleuron, Meta: metanotum, Metpl: metapleuron, Petl: petiole, Pron: pronotum, Prop: propodeum, Propl: propleuron, Pros: propodeal spiracle, Sta: seta, Sths: second thoracic spiracle

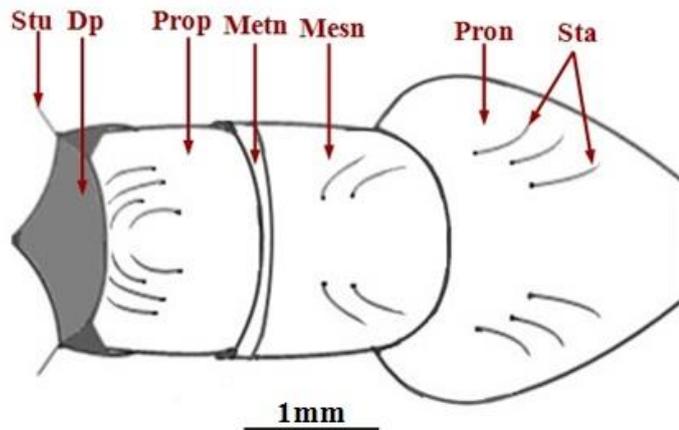


Figure (5): Dorsal view of alitrunk in *C. xerxes*

Dp: declivity of propodeum; Mesn: mesonotum, Metn: metanotum, Pron: pronotum, Prop: propodeum, Sta: setae, Stu: setulae

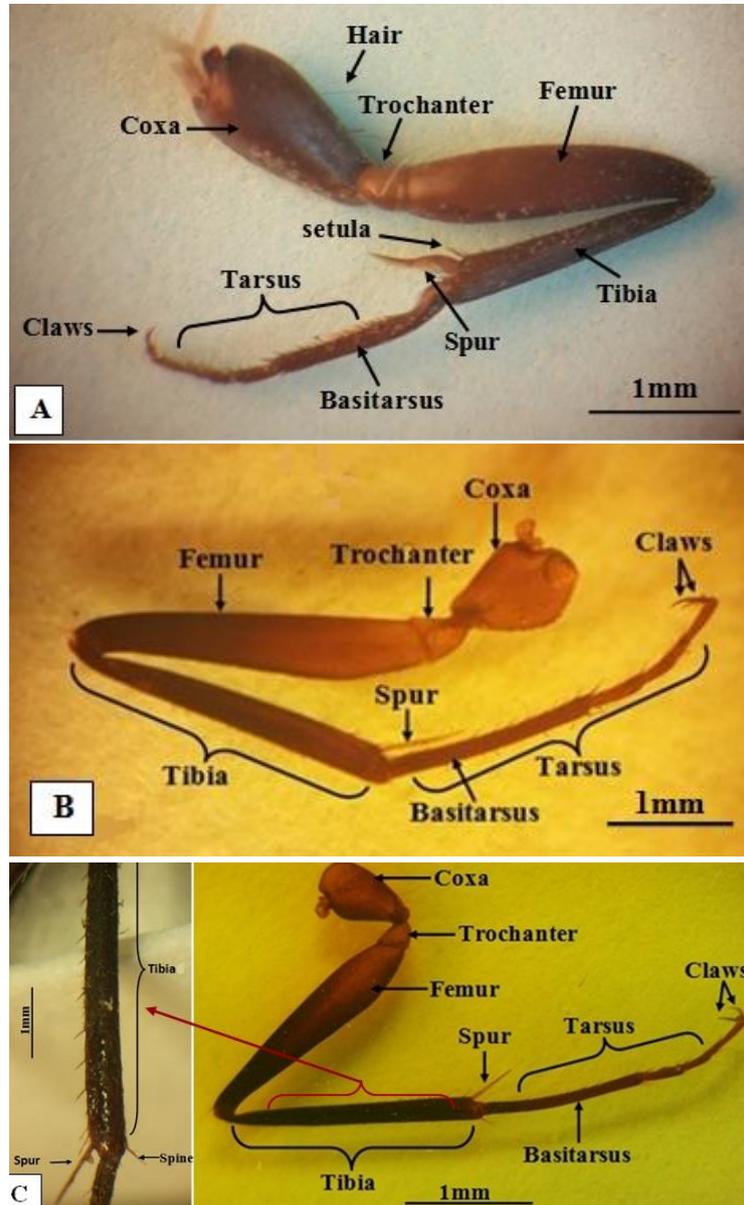


Plate (6): Legs of *C. xerxes*; A- fore leg B- mid leg C- hind leg

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Plate (7): Abdomen of *C. xerxes*
Ac: acidopore; Pet: petiole; S: sternite; Sta: setae; T: tergite

Polymorphism

The polymorphism in species of *C. xerxes* is clearly seen in workers cast, and appears morphological different, especially in the size and behavioral aspects. Throughout the present study, the workers are collected in three types depending on sizes: major, medium and minor; these results are agreed with Busher *et al.* (1985). Below a brief of some of the Polymorphism note from one to the other of these workers:

Major workers (as in the above description): This type was seen at closer to the colony.

Medium workers:

General description (Plate 8): Color: Generally, like to the major with exception the legs and antennae slightly lighter. The alitrunk with fewer setae compared with majors. Pedicel in length is similar to the first and second flagellomeres; apex of head rounded.

Measurements: TL: 7.0-8.5 mm, SI: 126.3, CI: 90.47; EL: 0.6 mm, HL: 2.1 mm; EL/HL: 0.28, HW: 1.9 mm; PL: 0.9 mm; PH: 0.6 mm; SL: 2.4 mm.

Specimens examined: (58 workers): Baghdad province, Bab- Al Mudham (23 specimens), 9, 14.I.2016, 8, 28.I. 2016, 4, 4. IV.2016 and 2 specimens were collected at 29.VI.2016; Taji, 2 specimens were collected in 13.II.2016; Sha'ab District, 3 specimens were collected in 6. III. 2016; Hayy Al-Bnouk, 5 specimens were collected in 27. III.2016. Maysan province: Ali Al-Gharbi, 2 specimens were collected in 5. II.2016. Basra province; Al-Midaina district, 15 specimens, 13, 13.II.2016 and 2 specimens were collected in 26. II.2016. Dhi Qar, Al Refai district, 8 specimens were collected in 17. III. 2016.

Minor workers:

General description (Plate 9): Color: Head brown, alitrunk yellowish brown, gaster dark brown with except the first gasteral segment is lighter than rest, antennae and legs light brown. Pedicel 1.2 times longer than the first and second flagellomeres. The setae found on propodeum only; apex of head rounded in frontal view that similar to medium workers.

Measurements: TL: 5-6 mm, SI: 152.84, CI: 72.35; EL: 0.58 mm, HL: 1.70 mm; EL/HL: 0.34, HW: 1.23 mm; PL: 0.76 mm; PH: 0.64 mm; SL: 1.88 mm.

Specimens examined: (99 workers): Baghdad province, Bab- Al Mudham (44 specimens), 16, 14.I.2016, 9, 28.I. 2016, 5, 4. IV.2016, 11, 14.V. 2016, and 3 specimens were collected in 29.VI.2016; Gherai'at, 10 specimens were collected in 18. III.2016; Sha'ab District, 6 specimens were collected in 6. III. 2016; Hayy Al-Bnouk, 5 specimens were collected in 27. III.2016. Maysan province: Ali Al-Gharbi, 15 specimens were collected in 5. II.2016. Basra province; Al-Midaina district, 10 specimens, 23, 13.II.2016. Dhi Qar, Al Refai district, 9 specimens were collected in 17. III. 2016.

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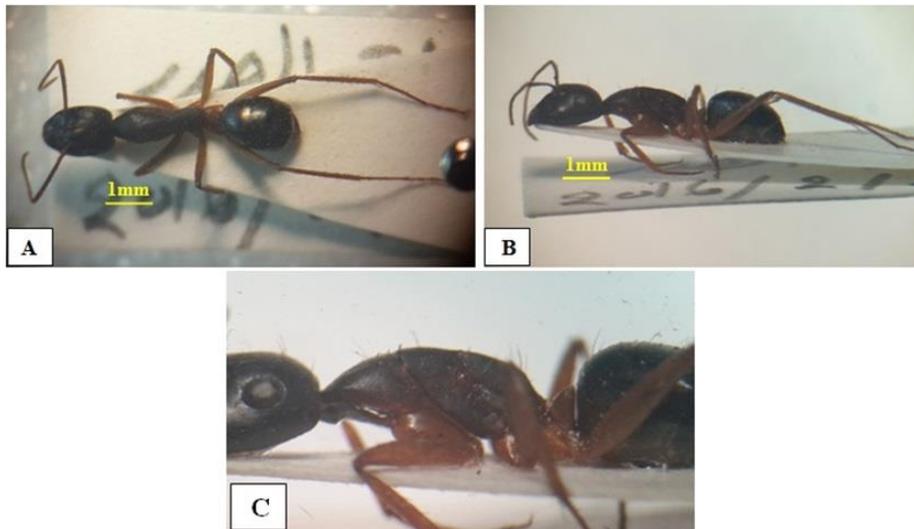


Plate (8): Medium worker of *C. xerxes*; A- dorsal view B- lateral view C- lateral view of thorax that shown the setae on alitrunk



Plate (9): Small worker of *C. xerxes*; A- dorsal view B- lateral view C- frontal view of head that shown the rounded apex D- lateral view of thorax that shown the setae on propodeum

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اعادة الوصف المظهري مع بعض الملاحظات لتعدد الاشكال في عاملات
النوع *Camponotus xerxes* Forel, 1904
من رتبة غشائية الاجنحة، عائلة النمل

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الخلاصة

جمعت عينات النوع *Camponotus xerxes* Forel, 1904 من مناطق مختلفة
للإعراق، لغرض دراسة هذا النوع مظهريا و بشكل مفصل خلال الدراسة الحالية.

إذ أستند الوصف على العاملات الكبيرة التي تعود لهذا النوع، كما تم الإشارة لتعدد
الأشكال في طبقة العاملات، إذ رسمت و صورت الصفات المظهرية الرئيسية و المهمة لدعم
النتائج الحالية.