Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 12, No. 5, p. 70-80, 2018
http://www.innspub.net

INNSPUB
RESEARCH PAPER
OPEN ACCESS

Survey of some species of Culicinae (Diptera, Culicidae) from different localities in South of Iraq

Haneen Saad Jabbar[1], Razzaq Shalan Augul[2*], Soolaf A. Kathiar[1]

[1]*Department of Biology, College of Science for Women, University of Baghdad, Iraq*

[2]*Iraq Natural History Research Center and Museum, University of Baghdad, Iraq*

Article published on May 13, 2018

Key words: Culicidae, Diptera, Iraq, Mosquitoes, Survey.

Abstract

Due to important the species of Culicidae, we collected the larvae from different region of the south of Iraq for identification and re-description. Diagnosed key is provided for fourth stage larvae of the mosquito species that belong to subfamily Culicinae which they collected from the south of Iraq; these species were: *Culiseta subochrea* Edward, *Aedesdorsalis* Meigen, *Ae. caspius* Pallas, *Culexpipiens* L., and *Cx. quinquefasciatus* Say. The investigation was proved by a brief morphological description, and the main characters were illustrated.

***Corresponding Author:** Razzaq Shalan Augul ✉ razzaqaugul@yahoo.com

Introduction

Culicinae belongs to the family Culicidae (Order, Diptera) comprises about 3,600 species (Crosskey, 1988); it is a large and abundant guild that occurs throughout temperate and tropical regions of the world (Harbach and Howard, 2007). They strong epidemiological importance due to females with hematophagy habits facilitating the transmission of viruses, protozoa and helminthes to vertebrates, including man (Eiras, 2005).

Many of the species prefer the environments that contain from the moderate component of the organic matters which necessary for their growth and development, such as ponds and stagnant water (Ouda and Al-Chalabi, 1986).

In 1920, the first study of the mosquitoes in Iraq was conducted by Barraud, this investigation included a description of some species in the south of Iraq; and then followed by Christopher and Shortt (1921) also Pringle (1952 & 1954); and Khatat (1955) studied and listed the Culicinae in the central region during August to November, 1954; after that Al-Murayati (1956) registered the *Aedes aegypti* (Linnaeus) in Baghdad, and Abul-Hab (1968) worked on the keys for Iraqi culicine larvae in general; also Khalaf (1962) presented a handbook about the mosquito species that recorded in Iraq and given a brief description of some species; whereas Ibrahim *et al.* (1983) was conducted taxonomical study on fourth-instar larvae for specimens that collected from different region of Iraq for the period 1973-1980, they registered a two new record for Iraqi fauna: *Culex deserticola* Kirkpatrick, 1924 and *Cs. decens* The obald, 1901; while Hudson and Abul-Hab (1987) was designed a key to adults of Culicinae.

Recently, there are some scattered studies; for example, Hasson (2017) studied the distribution of mosquito species in Diyala province and their seasonal prevalence.

The aim of this study to survey the mosquito species in the south of Iraq and Identify the species present there,, and then provide a key based on fourth instar larvae.

Materials and methods

Sampling of larval mosquitoes and sites

During this investigation, collections of and larvae was made between January -June 2017 from DhiQar, Al Diwaniyah and Al Muthanna provinces, south of Iraq; the specimens were captured using scoop 250 ml, then these specimens are transferred to the laboratory to identify and preserved.

Preserved the larvae

The larvae should first be killed in hot water just below boiling point to denature the proteins (Snell, 2005); this prevents the larvae from curling up and later darkening (Upton, 1991); then the specimens are placed in 80% ethanol to preserve it (Walker *et al.*, 1988).

Identification of the larvae

The specimens were identified to subfamilies, genera and species according to many diagnostic keys: (Mattingly and Knight, 1956; Abdel-Malek, 1960; Harbach, and Knight, 1980; Harbach, and Knight, 1982; Ibrahim *et al.*, 1983; Harbach, 1985;Snell, 2005; Azri-Hamidian, and Harbach, 2009; Dehghan *et al.*, 2016).

Results and discussion

In the current study, there were five species collected from different regions of the south of Iraq these species are: *Culiseta subochrea* Edward, *Aedesdorsalis* Meigen, *Ae. caspius* Pallas, *Culexpipiens* Linnaeus, and *Cx. quinquefasciatus* Say.

The identification key to genera and species followed by a brief morphological description are given:

Key to genera and species

1) Siphonwith one pair of sub-ventral tuft (Fig.1-C, 3-C, 5-C) 2

- Siphon with many pairs of sub-ventral tufts

- (Fig. 7-D, 9-D) 4

2) Sub-ventral tuft placed at near the base of siphon (Fig.1-C) ..... Genus of *Culiseta* Felt, 1904.

- Sub-ventral tuft placed at near the middle of siphon (Fig.3-C, 5-C) ..... *Aedes* Meigen, 1818 3

3) Mid and inner frontal hairs on head simple (Fig. 3-B); Pectin teeth varies and more than 20 ..... *A. caspius*

- Mid and inner frontal hairs on head branched (2 – 3 branches) (Fig. 5-B); Pectin teeth varies and less than 20..... *A. dorsalis*

4) Third and fourth abdominal segments with double sub-dorsal hairs (Fig.9-C); Hairs 6-III to 6-V with three branches..... *Culexpipiens*

- Third and fourth abdominal segments with a single sub-dorsal hair (Fig.7 C-7-D); Hairs 6-III to 6-V double ..... *Cx. quinquefasciatus*

Culiseta subochrea (Edward, 1921)

Theobaldias bubochrea Edwards, 1921=

=*Culiseta ferruginata* Martini, 1924.

Morphology (Fig. 1, 2): siphonal index: 4.7, dorsal mandibular seta (DMS) located at the lower of teeth(VT); maxilla with two setae; maxillary palp with single node; prementum with 26 teeth; antenna spinous, A-1 with four short setae; C-4 have four branches and short hairs located at the middle of first quarter of head dorsally, C-5, 6 with 4-6 long branches that consist of triangle with pervious seta.

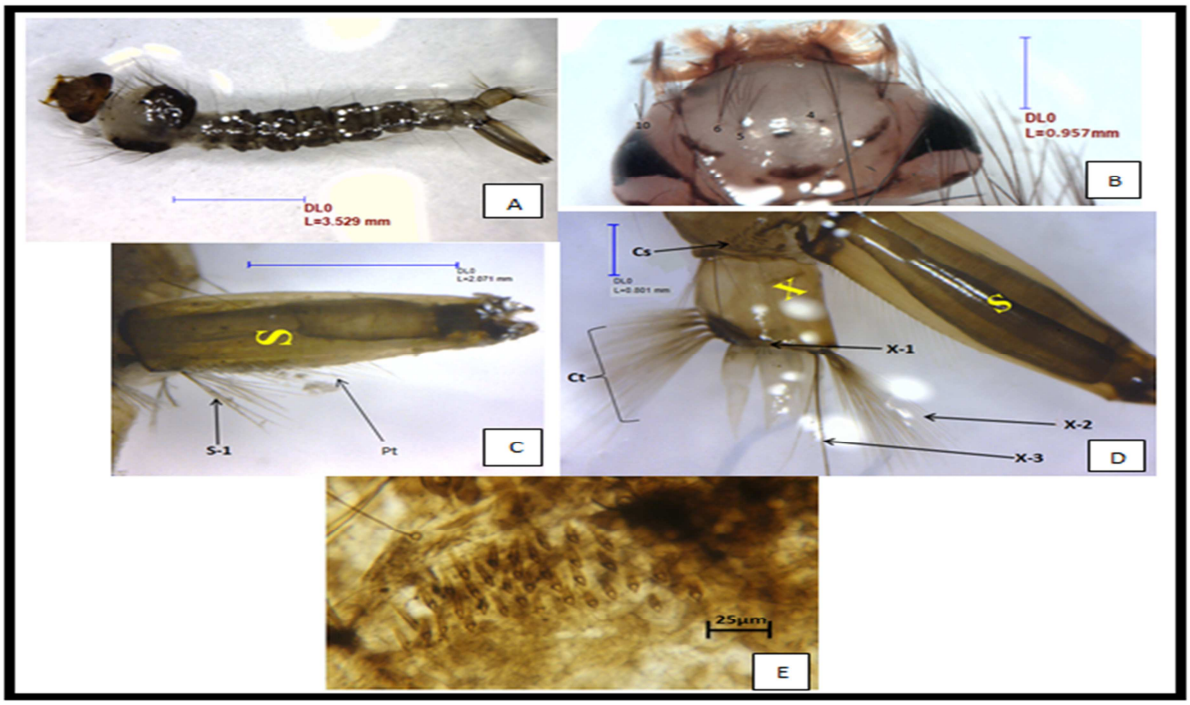

Fig. 1. The species of *Cs. Subochrea*; A: Fourth instar larvae, B: Head of larvae, C: Siphon, D: Tenth segment and siphon, E: Comb scales on VIII+IX segments.

In abdomen, VIII+IX segments with scatter comb scales that consist of three irregular rows; siphon with a single tuft hair at base, consist of 6-8 branches and medium in length; pectin teeth hairy shaped and consist of 16-25 pairs;X-1 consist of 7 branches and short which placed at near of the free end of saddle part; X-2 with 10-12 long branches; X-3close to X-2 and consist of single to three branches that diverse in length; X-4 or ventral brush consist of cratal tufts (9-10 pairs of long hair tufts), whereas precratal tufts absent. This species characterized by many morphological features that determine from closely species such as *Cs. longiareolata* (Macquart, 1838) and *Cs. annulata* Schrank (1776),these features are:

pectin teeth of siphon long and hairy in *Cs.subochrea*, but the pectin teeth are spiny and widely spaces in *Cs. longiareolata*. Also this species characterized by the distance between inner frontal hairs more than distance between post-clypeal hairs; on the contrary, larva of CS. *annulata* is differ, that near equally distance.

Materials: 48 specimens, 20.III.2017, Hamza, Diwaniya province.

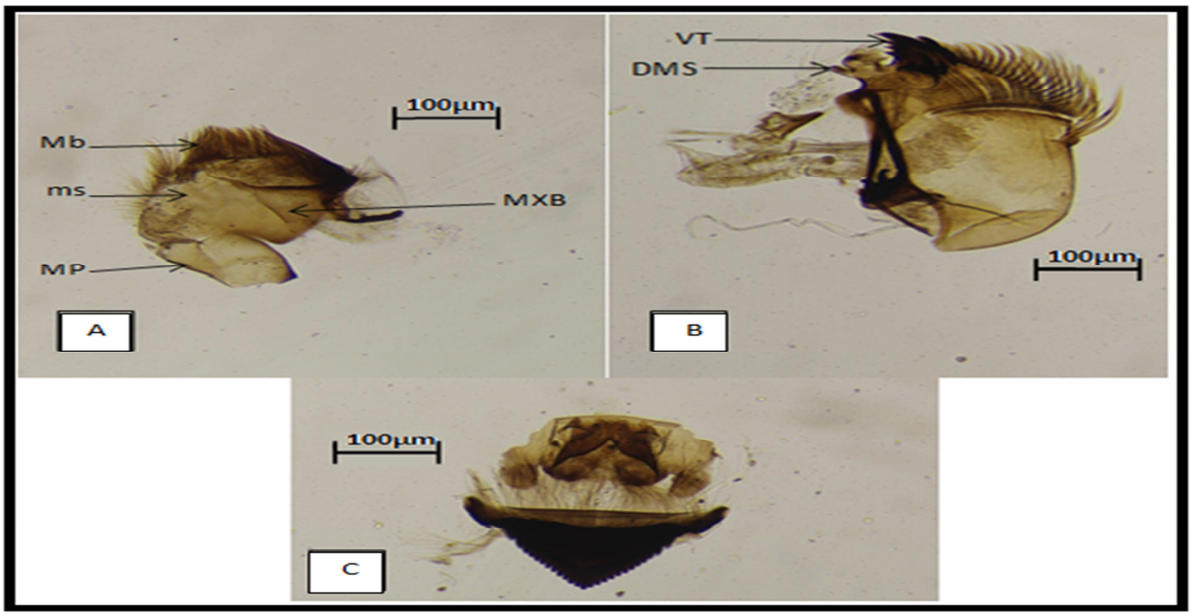

Fig. 2. Mouth parts of fourth instar larva in Cs. *subochrea*; A: Maxilla, B: Mandible, C: Prementum.

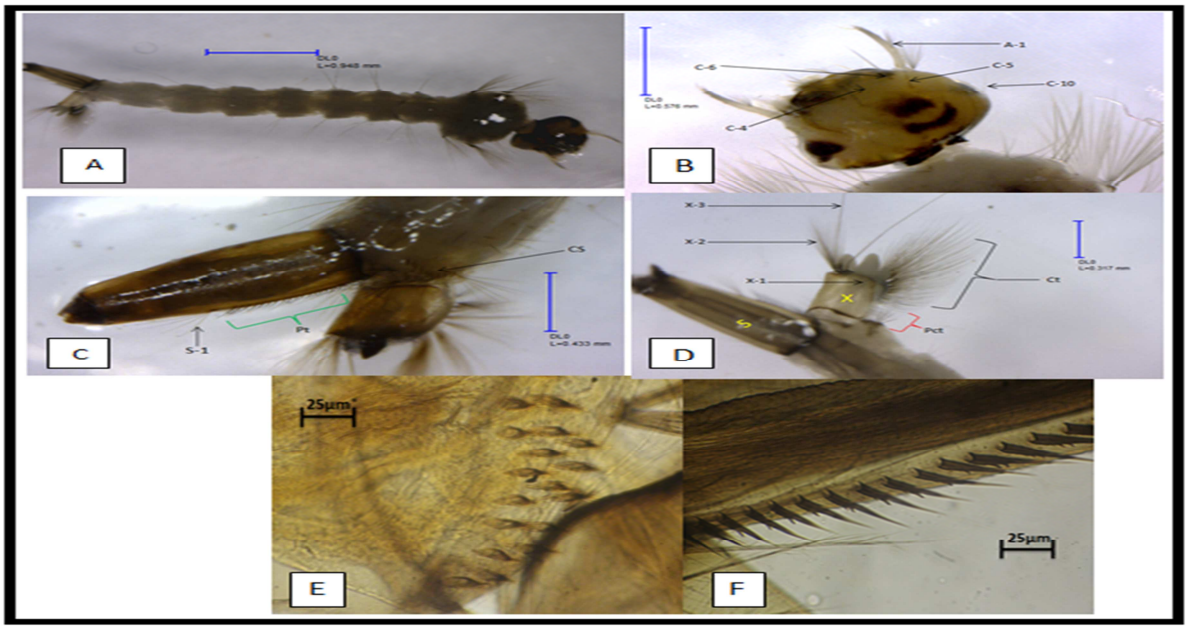

Fig. 3. The species of *Ae.caspius*; A: Forth instar larva, B:Head of larvae, C and D:Last abdominal segments, E:Comb scales on VIII+IX segments, E: Pectin teeth on siphon.

Distribution:

Iraq (Khattat,1955); Iran (Zaim and Cranston, 1986) Egypt, UK, Israel, Netherlands, Lebanon, Syria, Palestinian Territory, Belgium, Germany and Ireland which is included Palaearctic zoogeographic region (Gwannon, 2013).

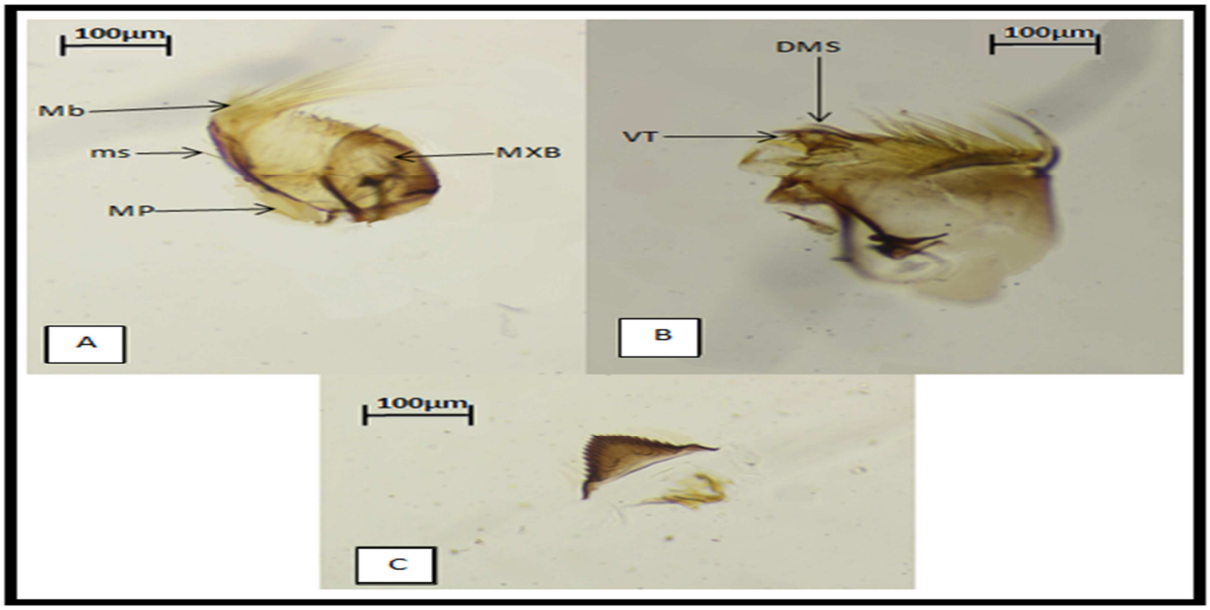

Fig. 4. Mouth parts of Ae. caspius; A: Maxilla, B: Mandible, C: Prementum.

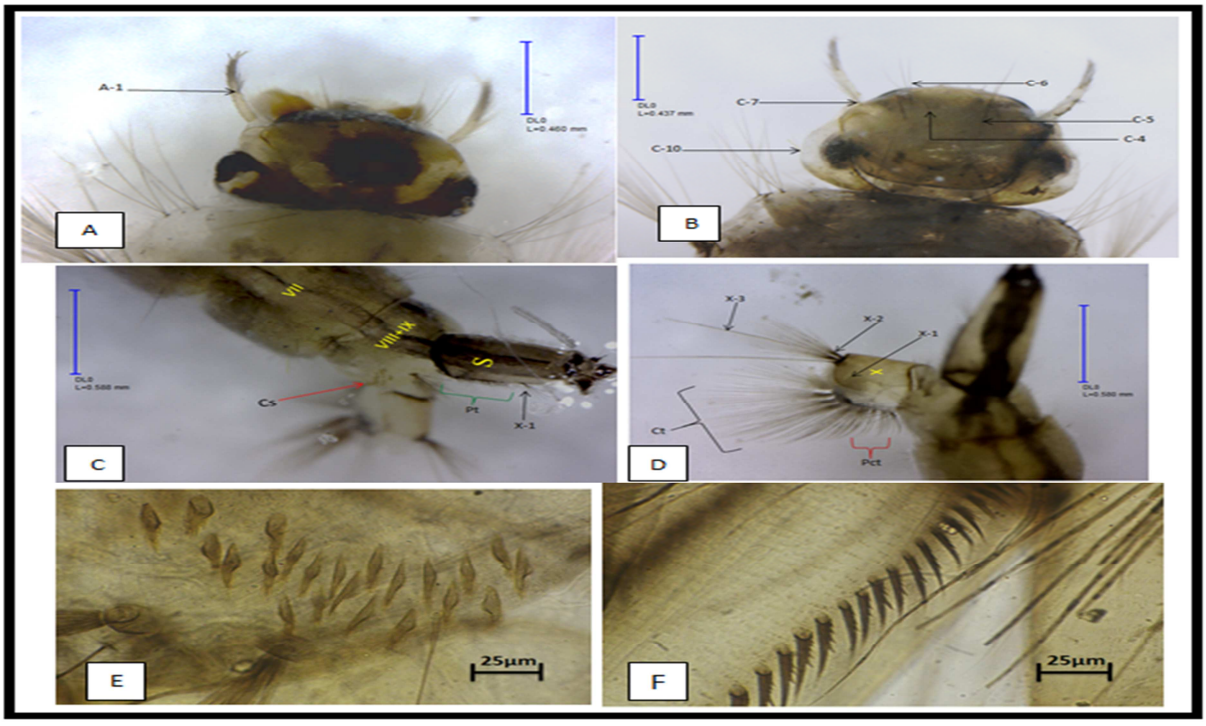

Fig. 5. The species of *Ae.dorsalis*; A: Antennal hair (A-1), B: Head of larvae, C: Last of abdominal segments with siphon, D: Tenth abdominal segment, E: Comb scales on VIII+IX segment , F: Pectin.

Aedescaspius (Pallas, 1771)
=*Aedesquaylei* Dyar & Knab, 1906
Culexarabicus Becker, 1910=
=*Aedes epsilon* Seguy, 1924
Morphology (Fig. 3, 4): Siphonal index: 4.2-3.8, dorsal mandibular seta located at the upper of teeth; maxilla with single setae, maxillary palp with three node; prementum with 21 teeth; antenna spinous, A-1 with 3-4 short setae; C-4 have 3 to 4 branches and short hairsthat placed at near the middle of the first quarter of head dorsally; C-6 and C-5 located lower the previous hair, single and elongated than C-4; C-10 single and short, close to the outer edge of compound eye.

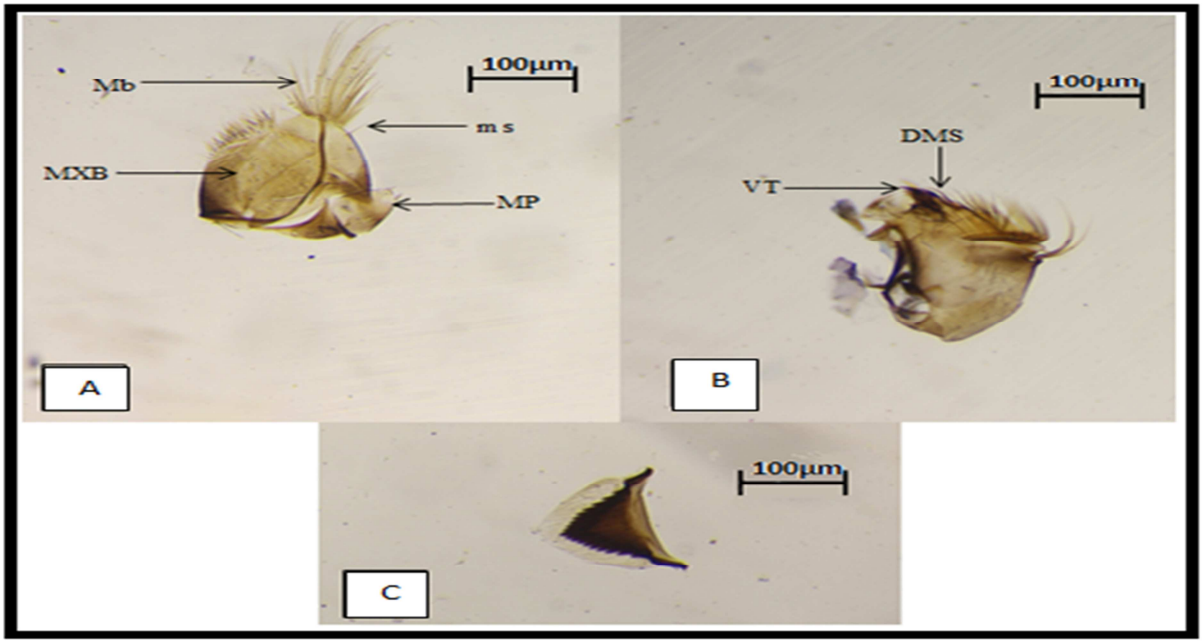

Fig. 6. Mouth parts of *Ae. dorsalis*; A: Maxilla, B: Mandible, C: Prementum.

The complex of abdominal segments VIII+IX with irregular two rows of comb scales; siphon with one tuft that placed at the near of middle, with 6 branches which moderate in length; pectin teeth consist of 20 pairs,each one with five small teeth. The saddle extended to cover the most of the tenth segment, X-1 single and situated at near the apex of saddle part; X-2 composed of 12-16 branches and moderated in length; X-3single and elongated compared with previous hair; X-4 consist of cratal tufts (7 pairs of long hairs), and precratal tufts with 4 pairs of short hairs.

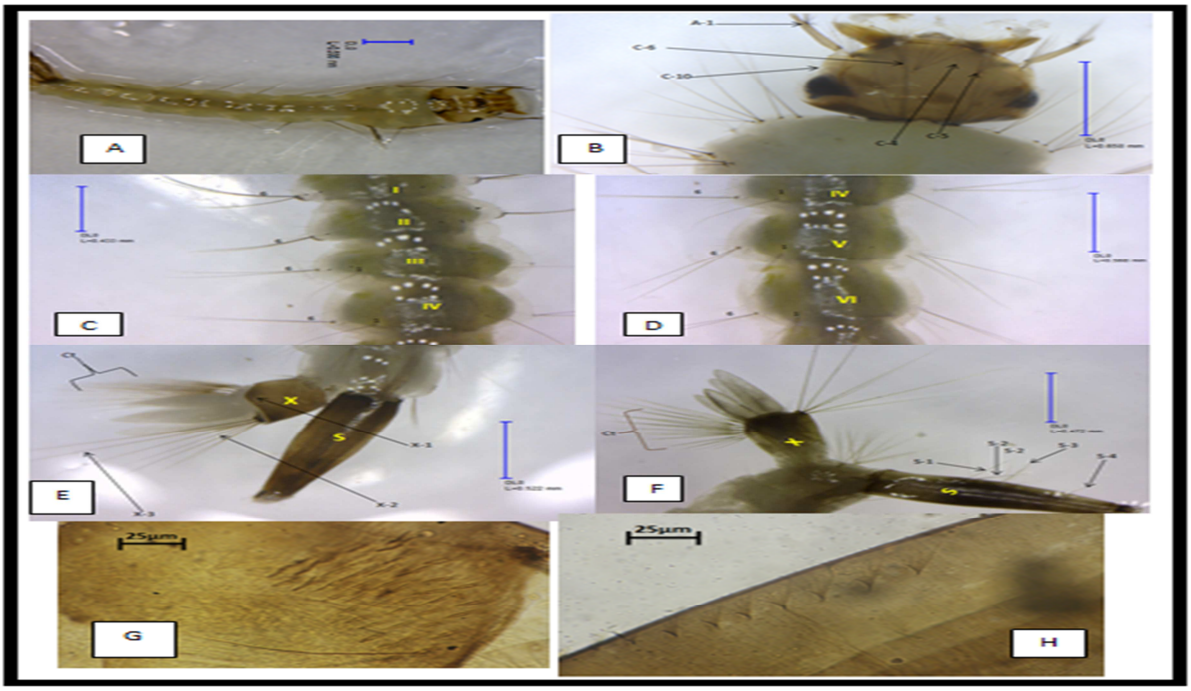

Fig.7. The species of *Cx. quinquefaciatus*; A: Fourth instar larvae, B: Head of larvae, C: Abdominal segment I-IV, D: abdominal segment IV-VI, E: Tenth Abdominal segment and siphon; F: Siphon; G: Comb scales on VIII+IX segment, H: pectin teeth on siphon.

Materials (83 specimens): 23 specimens, 20.II. 2017; 34 specimens, 23.III. 2017; 26 specimens 24.IV. 2017, Al Warka· district, AlMuthnna province.

Distribution:Afghanistan, Algeria, Austria, Bahrain, Belarus, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Djibouti, Egypt, Estonia, Finland, Georgia, Germany, Greece, Hungary, Iran, Ireland, Israel, Jordan, Latvia, Lithuania, Macedonia, Malta, Moldova, Mongolia, Morocco, Pakistan, Poland, Portugal, Portugal, Romania, Russia, Saudi Arabia, Slovakia, Slovenia, Spain, Sweden, Tajikistan, Tunisia, Turkey, Ukraine, United Kingdom, Yemen, Serbia and Montenegro (WRBU, 2018).

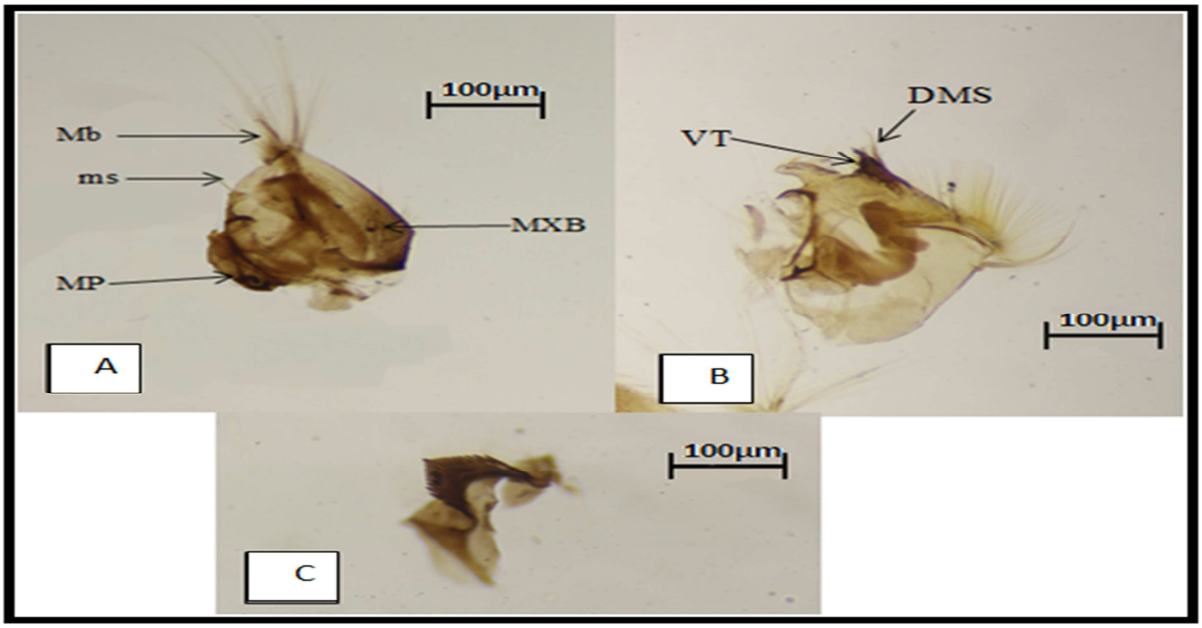

Fig. 8. Mouth parts of *Cx. quinquefaciatus*; A: Maxilla; B: Mandible; C: Prementum.

Aedesdorsalis Meigen, 1830
= *Aedesgrahami* Ludlow, 1919
Morphology(Fig. 5, 6): siphonal index:3.9-3.4, dorsal mandibular seta located at the upper of teeth; maxilla with single setae; maxillary palp with two node; prementum with 19 teeth; antenna spinous, A-1 with 5-9 short setae; C-4 with 2-3 branches and short hairsthat situated at near the middle of the first quarter of head dorsally; C-5, 6 placed below C-4, both hairs have 2-3 branches; C-10 single and short that placed at close to the outer edge of the compound eye.

Complex of the abdominal segments VIII+IX contain comb scales that composed of irregular rows. siphon with a single tuft that placed at middle part, consist of 5-6 branches and moderate in length; pectin teeth consist of 20-25 pairs,each one contains from five small teeth.

The saddle part not covering most of the segment X, X-1 single and medium hair, located at near of the apex of saddle; X-2 with 20 branches and medium in length; X-3situated close to X-2, it single and longer than previous, X-4 consist of cratal tufts (7 pairs of long hairs), and precratal tufts with 3 pairs of short hairs.

Materials: (88 specimens): 58 specimens 17.I. 2017, 20.II. 2017, 23.III. 2017, 24.IV. 2017, 26.V. 2017, 18.VI. 2017, Warka·, AlMuthanna province; 7 specimens, 17.I. 2017, 13 specimens, 20.II,2017, 10 specimens, 23.III. 2017, Hamza district, Diwaniya province.

Distribution: This species registered in Iraq by Khalaf (1962); North American, Northern Europe and Asia (Rees and Nielsen, 1947).

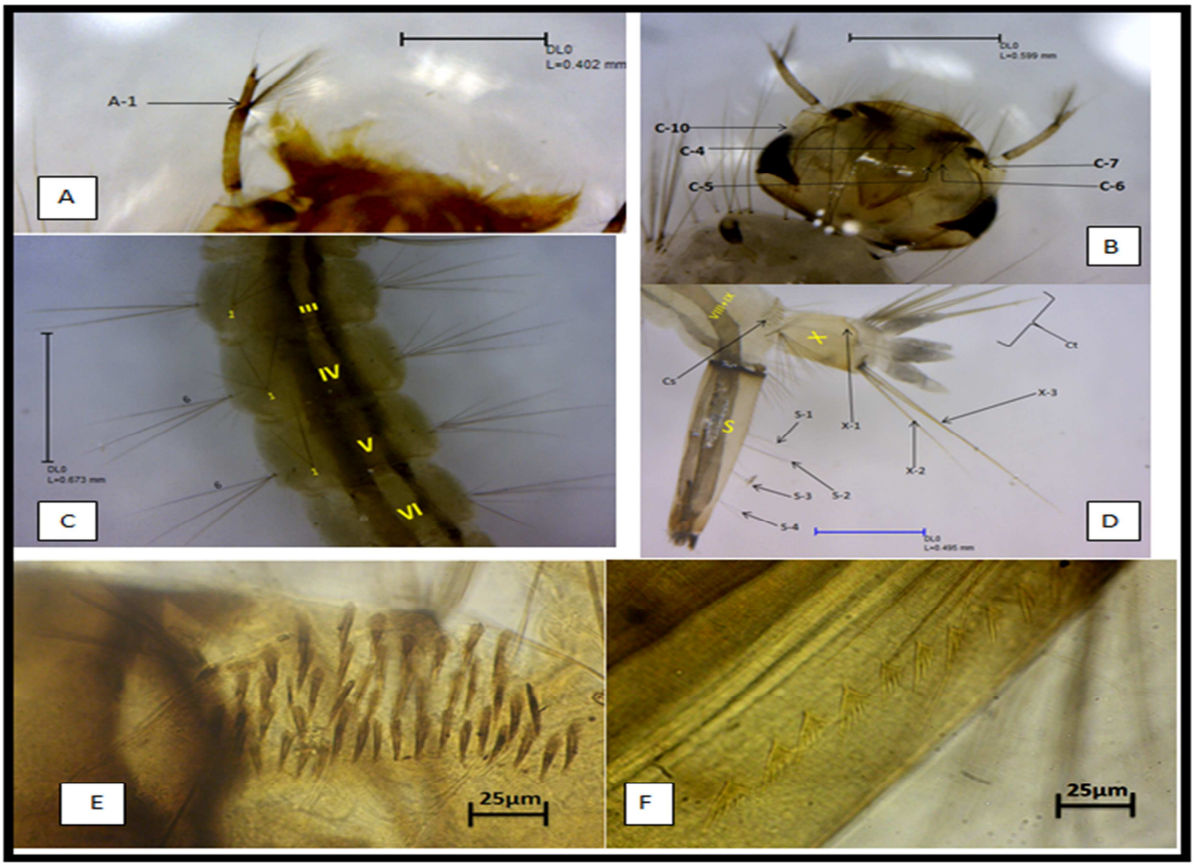

Fig. 9. Fourth instar larva of *Culexpipiens*; A: Antenna, B: Head, C: Abdominal segment III-VI, D: Abdominal segment VIII+IX , Siphon and tenth abdominal segment, E: Comb scales on siphon; F: Pectin teeth on siphon.

Culexquin quefaciatus Say, 1823
Culexfatigans Wiedemann, 1828

Morphology(Fig.7, 8): Siphonal index:4.6-4.8, dorsal mandibular seta situated at the upper of teeth; maxilla with single seta; maxillary palp with three node,the middle node is smaller; prementum with 19 teeth; antenna spinous, A-1 with 15-25 short setae; C-4 single and short hairs, situated at near the middle of the first quarter of the head dorsally, C-5,6 with 4-5 long branches that consist of triangle with pervious seta, C-10 double hairs and short, placed at near the outer edge of the compound eye.

Abdominal segment complex VIII+IX with a scattered comb scales that composed of 3-4 irregular rows; siphon with 4 pairs of tuft hairs, S-1 and S-2 consist of 6-9 branches and medium in length, they located at near of middle part; S-3 and S-4 consist of 2-3 branches and similar to length of the previous tufts, located near to the apical end of the siphon; pectin teeth consist of 10-13 pairs, isolated by diverse spaced, each of them has 4 of secondary teeth.

TheSaddle covering the whole tenth segment; X-1 single and short seta, placed at near the apical part of saddle; X-2 double setae and different in length, situated opposite to X-4; X-3single and longer than X-2; X-4 consist of cratal tufts only (6-7 pair of long hairs).

Materials: (155 specimens): 53 specimens, 17. I.2017, Al Warka, district; 11 specimens, 20 .II.2017, 6 specimens, 23. III. 2017, 17 specimens, 24 .IV.2017, 5 specimens, 26. V. 2017, 10 specimens,18.VI.2017, Samawa, Al Muthnna province. 19 specimens 17. I. 2017, 4 specimens, 20. IV. 2017, Um Alkheel district, Diwaniya; 18 specimens, 20.II.2017, 22 specimens, 23.III 2017, Al-Digara district, Diwaniya province.

Distribution: Iraq (Khalaf, 1955); Cosmopolitan (Bartholomay *et al*., 2010).

Culexpipiens Linnaeus, 1758
=*Cx. erectus* Iglisch, 1977
Note: According to Trari *et al*. (2017), the species of *Cx. molestus* Forskål, 1775 is a recent synonym to *Cx.pipiens*.

Morphology (Fig.9, 10): Siphonal index: 4.8-5.3, dorsal mandibular seta located at the upper of teeth; maxilla with single setae; maxillary palp with three node,the middle node is smaller; prementum with 21 teeth; antenna spinous, A-1 with 15-20 short setae; C-4 single and short hairslocated at near the middle of the first quarter of the head dorsally; C-5,6 with 4-5 long hair branches that consist of triangle with pervious seta; C-10 double and short that placed at near of the outer edge of the compound eye.

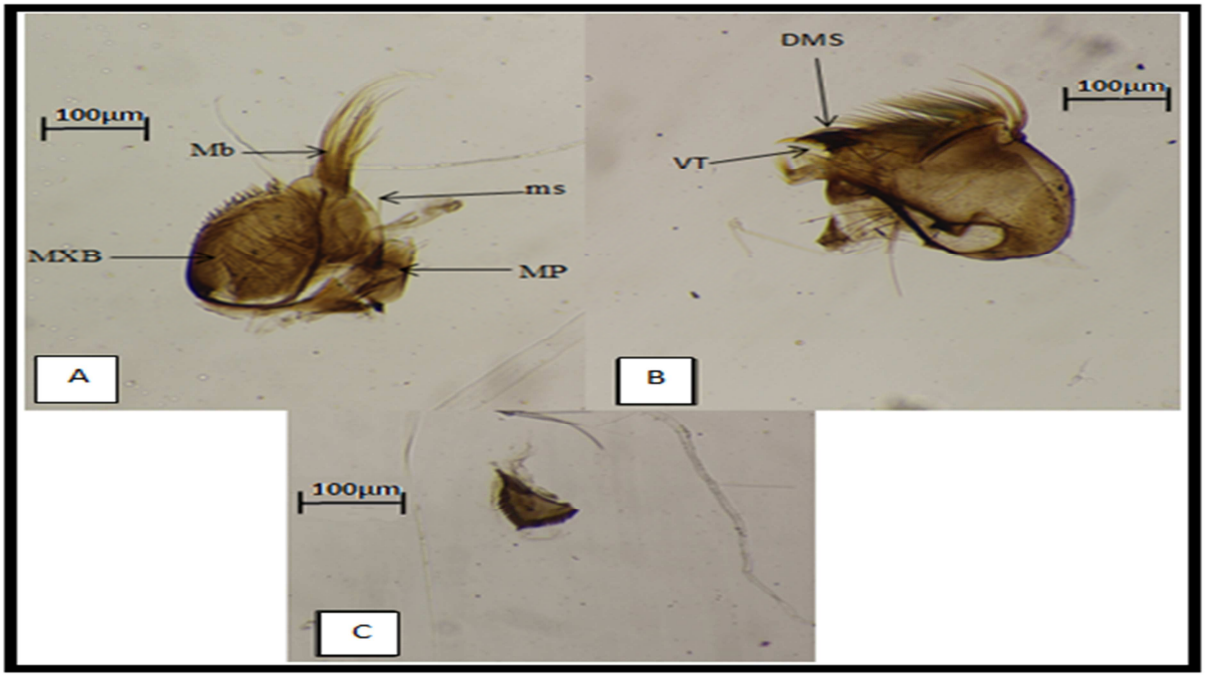

Fig. 10. Mouth parts of *Cx. pipiens*; A: Maxilla, B: Mandible; C:Prementum.

Abdominal segment complex VIII+IX, with scattered comb scales, that composed of three irregular rows; siphon has 4 pair tufts, S-1 and S-2 with 5-7 branches and located at near the middle; S-3 and S-4 with 2-3 branches and placed at near of the apical part of siphon; pectin teeth consist of 5-8 pairs,each tooth has 5-6 secondary teeth.

The saddle covering whole tenth abdominal segment; X-1 single and short hair, and situated at near the apical margin of saddle; X-2 double and variable in length; X-3single and long; X-4 consist of cratal tufts (4-7 pairs of long hairs), and precratal tufts absent.
Materials: (150 specimens): 95 specimens: 17.I.2017, 20.II.2017, 23.III.2017, 24.IV.2017, Hamza district, Diwaniya province; 35 specimens: 17.I, 20. II, 23. III, 24. IV Hay Al Bkaa, Al Shatraa district, Di Qar province.

Distribution: Iraq (Khattat,1955); Argentina, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Egypt, France, Germany, Greece, Hungary, Iran, Ireland, Israel, Italy, Japan, Jordan, South Korea, Latvia, Lebanon, Lithuania, Luxembourg, Morocco, Pakistan, Poland, Portugal, Romania, Russia, Saudi Arabia, Serbia, Slovakia, Spain, Sweden, Tajikistan, Tunisia, Turkey, UK, United States, Uruguay, Netherlands and Montenegro(Kim *et al*., 2005).

Abbreviations

According to Harbach (1988), the abbreviations which are used in our study as follow:

A: antenna
C: head
Cs: comb scale
Ct: cratal tufts
DMS: dorsal mandibular seta
Mb: maxillary brush
Mp: maxillary palpus
Ms: maxillary seta
MXB: maxillary body
Pct; precratal tufts
Pt: pectin teeth
S: siphon
S-1, 2...etc : Sub-ventral tuft 1, 2, etc.
X: tenth abdominal segment
X1: saddle hair
X2: upper caudal seta
X3: lower caudal seta
X4: ventral tuft
VT: ventral teeth

References

Abdel Malek AA.1960. The Culicine mosquitoes of the northern region of the United Arab Republic. Bulletin de la Société Entomlogiqued'Egypte**44**, 111-128.

AbulHab J. 1968. Larvae of culicine mosquitoes of Iraq with a key for their identification. Bulletin of Endemic Disease (Baghdad) **10(1-4)**, 343-356.

Al-Murayati YA.1956. A brief note on the occurrence of Aedesaegypti in the city of Baghdad. Bulletin of Endemic Disease (Baghdad) **1(4),** 311.

Azri-Hamidian S, Harbach RE. 2009. Keys to the adult females and fourth-instar larvae of the mosquito of Iran (Dipetra:Culicidae). Zootaxa **2078 (1)**, 1-33.

BarraudPJ. 1920. Notes on some Culicidae collected in lower Mesopotamia. Bulletin of Entomological Research **10 (3)**, 323-325.

Bartholomay LC, Waterhouse RM, Mayhew GF, Campbell CL, Michel K. 2010. Pathogenomics of Culex quinquefasciatus and meta-analysis of infection responses to diverse pathogens. Science **330 (6000)**, 88-90.

Christopher SR, Shortt HE. 1921. Malaria in Mesopotamia 1916 -1919. Indian Journal of Medical Research **8(3),** 508-552.

Crosskey RW. 1988. Old Tools and New Taxonomic Problems in Bloodsucking Insects. In Biosystematics of Haematophagous Insects, edited by Service, M. W. Oxford: Clarendon Press, 1-18 p.

Dehghan H, Sadraei J, Moosa-Kazemi SH, Abolghasemi E, Solimani H, Jaffari-Nodoshan A,Najafi MH. 2016. A pictorial Key for Culexpipiens Complex (Dipetra:Culicidae) In Iran, J Arthropod-Borne Disease **10(3)**, 291-302.

Eiras AE. 2005. Culicidae. In: Human Parasitology, 11th ed., edited by Neves, D., Melo, A., Linardi, P. M., and Vitor, R. São Paulo: Atheneu, 355-67. (in Portuguese).

Gwannon. 2013. Culiseta subochrea. Provided by GBIF, DBPedia, Ubio, WABI, EOL, ARKIVE, natureserve and Flickr. Available at: http://www.gwannon.com/species/Culisetasubochrea.

Hantosh HA, Hassan HM, Ahmad B, Al-Fatlawy A. 2012. Mosquito species geographical distribution in Iraq 2009. Journal Vector Borne Disease **49**, 33–35.

Harbach RE. 1985. Pictorial keys to the genera of mosquitoes, subgenera of Culex and the species of Culex (Culex) occurring in southwestern Asia and

Egypt, with a note on the subgeneric placement of Culex deserticola (Diptera: Culicidae). Mosquito Systematics**17(2)**, 83-107.

Harbach RE, Knight KL. 1980. Taxonomists' glossary of mosquito anatomy. Plexus Publishing, Inc., Marlton, New Jersey, 415 p.

Harbach RE, Knight KL. 1982. Corrections and additions to Taxonomists' Glossary of Mosquito Anatomy. Mosquito Systematics **13 (2)**, 201–217.

Harbach RE, Howard TM. 2007. Index of currently recognized mosquito species (Diptera: Culicidae). European Mosquito Bulletin **23,** 1–66.

Hasson RH. 2017. Mosquitos· Species of Diyala Province, Iraq. International Journal of Environment, Agriculture and Biotechnology **2(4),** 2121- 2126.

Hudson JE, Abul Hab J. 1987. A key to the species of adult culicine (Diptera, Culicidae) mosquitoes of Iraq. Bulletin of Endemic Disease **28(1)**, 53-59.

Ibrahim IT, Samarrae YM, Zaini MA, Kassal S. 1983. Identification Key of Iraqi Culicinae Mosquito larvae (Diptera; Culicidae). Bulletin of Endemic Disease (Baghdad) **22-25 (1-4)**, 89-113.

Khatat FH. 1955. An account of the taxonomy and biology of the larvae of culicine mosquitoes in Iraq. Bulletin of Endemic Disease (Baghdad) **1(2)**, 156-184.

Khalaf KT. 1962. Handbook of the Mosquitoes Recorded from Iraq. Shafik Press, Baghdad, 62 p.

Kim HC, Wilkerson RC, Pecor JE, Lee WJ, Lee JS, O'Guinn ML, Klein TA. 2005. New records and reference collection of mosquitoes (Diptera: Culicidae) on Jeju Island, Republic of Korea. Entomological Research **35**, 56-65.

Mattingly PF, Knight KL. 1956. The mosquitoes of Arabia, I. Bulletin of the British Museum (Natural History), London, Entomology **4 (3)**, 91-141.

Ouda NA, Al-Chalabi B. 1986**.** Laboratory studies on the suitability of various source of field water rearing places for Culex quinquefasciatus Say (Diptera: Culicidae). Journal of Biological Sciences Research (Baghdad) **17(1)**, 199 - 208.

Pringle G.1952.The Identification of the Larvae of Anopheles stephensi Liston and Anopheles superpictus Grassi in Iraq. Bulletin of Entomological Research **42(4)**, 779-783.

Pringle G. 1954. The Identification of the Adult Anopheline Mosquitoes of Iraq and Neighbouring Territories. Bulletin of Endemic Diseases **1(1**), 53-76.

Rees DM, Nielsen LT. 1947. On the biology and control of Aedes dorsalis (Meigen) in Utah. Proceedings of the annual meeting of the New Jersey Mosquito Extermination Association **34**, 160-165.

Snell AE. 2005 Identification keys to larval and adult female mosquitoes (Diptera: Culicidae) of New Zealand. New Zealand Journal of Zoology **32(2)**, 99-110.

Upton MS. 1991. Methods for collecting, preserving, and studying insects and allied forms.4th edition. Brisbane, Queensland, Australian Entomological Society, v + 86pp.

Walker KA, Crosby TA. 1988. The preparation and curation of insects. Auckland, New Zealand, Department of Scientific and Industrial Research, 92p.

WRBU, 2018.Aedes (Och.) caspius.

Zaim M, Cranston PS. 1986. Checklist and keys to the Culicinae of Iran (Diptera: Culicidae). Mosquito Systematics **18**, 233-245.