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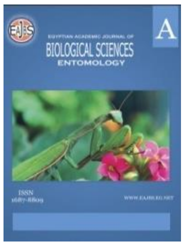

Description of A Parasitoid, *Anisopteromalus calandrae* (Howard, 1881) on *Callosobruchus chinensis* L. for the First Time in Egypt and Using SEM for Morphometric Analysis

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ABSTRACT

Anisopteromalus calandrae (Howard) (Hymenoptera: Pteromalidae) is a parasitoid to several stored product beetles. In this study, this parasitoid was recorded for the first time with density on the cowpea beetle *Callosobruchus chinensis* L, which was prevalent on both Egyptian bean (*Vicia faba* L) and cowpea bean (*Vigna unguiculata*). A full description of this parasitoid and measurements of its body parts were done using a scanning electron microscope. The male and female were differentiated based on the antenna and a set of taxonomic and diagnostic characteristics were found. The current study provides basic information on the external morphology key identification, characteristics and measurements of taxonomically significant portions, backed by micrographs taken with a scanning electron microscope. This description can be used to include them in the taxonomic keys to differentiate them from closely similar species. The present study was carried out at the Atomic Energy Center in Egypt during field observation in small grain stores of cowpea and faba beans where the effectiveness of the parasite to control cowpea beetle, in particular, was observed. This parasitoid was the first time found on cowpea beetle in a high density, which necessitated carrying out an extensive morphological study of *A. calandrae* in order to identify it for future breeding. Additionally, it can be in future widely used in the biological management of pests that attack stored grains in general, and *C. chinensis* in particular

INTRODUCTION

Bruchidae beetles are the major insect pests of legumes kept after harvest. In underdeveloped nations, legumes are frequently the main source of protein for individuals. When Callosobruchus species attack leguminous seeds during storage, there are significant losses in both quantity and quality (Abd El-Gawad and Abd El-Aziz 2004). Cereal grains should be handled and kept in a way that reduces the possibility that stored product pests would cause financial harm. This could be accomplished through proper store design and upkeep, regular inspection and quality control of stored goods, good storage procedures, and the use of effective pest control techniques (El-Lakwah and Abdel-Latif 1998). To stop these post-harvest losses, numerous strategies have been employed. Insecticides made of chemicals are currently used. Additionally, some plant components are utilised as pesticides or repellents. Dynamic trends can affect synthetic pesticides. Some insect insecticides can

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cause target insects to become resistant. This may also encourage the growth of pests that are not the intended targets, turning what was once a minor problem into a significant one with a high tolerance for common pesticides. As a result, additional long-term actions are needed in crop protection techniques to decrease pest recurrence and increase the prevalence of natural enemies (Baker *et al*., 1999). The ecosystem of stored grains is coupled with a complex of parasitoids and predators. The majority of pest insect populations in stored grain are somewhat naturally controlled by these helpful insects. However, the augmentative release is the ideal way to use these natural enemies in grain store pest management programmes. For the majority of the pertinent parasitoids, the best release tactics have not yet been identified. Trichogramma species have been released using tiny cardboard cards containing parasitized eggs. However, adult parasitoids have been discharged directly into storage facilities in the majority of large-scale pilot investigations that have been carried out in whole-grain warehouses. In particular, parasitoids of internal feeders like weevils and borers are affected by this (Ngamo *et al*., 2007). Coleopteran pests including the smaller grain borer, *Rhyzopertha dominica* (F), rice weevil, *Sitophilus oryzae* (L), and legume beetles, *Callosobruchus maculates* (F) and *Callosobruchus chinensis* (L) may be biologically controlled by hymenopteran parasitoids (Ahmed, 1996; Lucas & Riudavets, 2002; Qumruzzaman & Islam, 2005 and Ngamo *et al*., 2007).

The largest subfamily of the Pteromalidae, Pteromalinae, currently has 2,073 living species belonging to 314 genera (Noyes 2016). Pteromalinae is typically classified as members of the superfamily Chalcidoidea because they lack characteristics that distinguish them from other families and because they are challenging to diagnose. The majority of the species in this subfamily parasitize the larvae and pupae of Lepidoptera, Diptera, and Coleoptera. Since 1955, Korea has recorded 46 South Korean Pteromalinae from 30 different taxa (Cho 1955; Paik *et al*. 1981; Paik 1978; Kamijo and Grissell 1982; Kamijo 1983; Ryoo *et al* 1990; Rueda and Roh Ryu 1997; Cho *et al*., 2014; Tselikh *et al*., 2017).

The Coleopterous insect pests, primarily stored grains, are parasitized by wasps of the genus *Anisopteromalus* Ruschka (Pteromalidae) (Noyes, 2013). There are just seven species of this genus known to exist around the globe (Noyes, 2013). India has produced one more species that have been noted (Gupta and Sureshan, 2014). There are a few instances of this genus parasitizing the Plutellidae and Lymantriidae families of Lepidoptera (Herting, 1975, 1977; Beccaloni *et al.*, 2003). This genus can be distinguished by the combination of the following characteristics: tergites 1-3 spanning more than half of the gaster; notauli finer, indicated only anteriorly; clypeus shallowly emarginate; propodeum medially elevated without cross carina; (Sureshan and Narendran, 2004).

Anisopteromalus calandrae is a parasitoid beetle with a global range that is linked to stored grains (Sureshan, 2007). The parasitoid of different stored grain and pulse beetles, including *Stegobium paniceum, Sitophilus oryzae, Sitophilus granarius, Tribolium castaneum, Athesapeuta cyperi, Oryzaephilus surinamensis, Pempherulus affinis, Rhizopertha dominica,* and *Callosobrochus* spp., has been reported from different parts on several food commodities (Sureshan, 2003)., it has also been noted as a biocontrol agent of *C. chinensis* and *C. maculates* (Devi, 1996; Ngamo *et al*., 2007). Currently, *A. calandrae* has been identified as a larval parasitoid of *C. maculates* on chick peas in KPK by Fatima *et al*. (2016) In Pakistan. In this study, a complete morphological description was made on one of the parasitoids of *A. calandrae* on *C. chinensis*, which may play an important role in controlling this pest on stored grains, which was recently abundantly present in cowpeas and faba beans.

MATERIALS AND METHODS

Sampling Procedures:

Samples of Egyptian bean (*Vicia faba* L) and cowpea bean (*Vigna unguiculata*) were obtained from Giza Governorate's nuclear energy centre and kept in little plastic bags. These samples were transferred into the lab of the Plant Protection Department Faculty of Ain Shams University at room temperature. After two weeks, small parasitoid wasps come out *C. chinensis* and *C. maculates* species. An aspirator was used to gather wasp specimens. Some samples were placed in glass vials containing 70% alcohol for future work. By using optical and scanning electron microscopy, specimens were identified using the taxonomic key of its subfamily Pteromalinae (Hymenoptera: Pteromalidae).

Scanning Electron Microscopy:

Wasps were cleaned with distilled water multiple times before being fixed with 2.5 gluteralhyde in 1M phosphate buffer, pH 7.2, at 4°C for 2 hours to prepare specimens for scanning electron microscopy (SEM) (two changes). dehydration was achieved using an escalating series of ethanol until 100% ethanol, for 10 minutes in each concentration. On aluminum stabs that were wrapped in double-stick solytape, dehydrated specimens were mounted. Using a Ladd sputter-coater, a small layer of carbon was applied to dehydrated specimens before they were coated with a gold-palladium alloy. Coated specimens were analyzed using a JEOL JSM- T300A Scanning EM at the Central Laboratory's Electron Microscopic Unit Cairo University's agricultural faculty.

RESULTS AND DISCUSSION

General Description of Adult Female Insects:

Wasp has 2.83 mm in length, black in colour. Geniculate antennae are present. The antennae's terminal segments are dark brown colour. The other segments are yellow or yellowish-brown, starting with the scape, pedicel, and other four flagellum segments.

Head: The head capsule is oval in shape and resembles a chickpea. It features three ocelli eyes in addition to a pair of dark-reddish compound eyes. The mouthparts have evolved from the chewing type and are yellow in colour.

Thorax:Between the thorax and the abdomen, there is a waist or a distinct envelope. It has three pairs of legs, each with a black or blackish-brown trochanter, femur, and coxa. The tarsus and tibia are yellow.

Abdomen:The abdomen is oval-shaped and has a small, split ovipositor at the end. Its colour is black, and there maybe spots of a vivid green tint scattered throughout (Fig. 1-A, B).

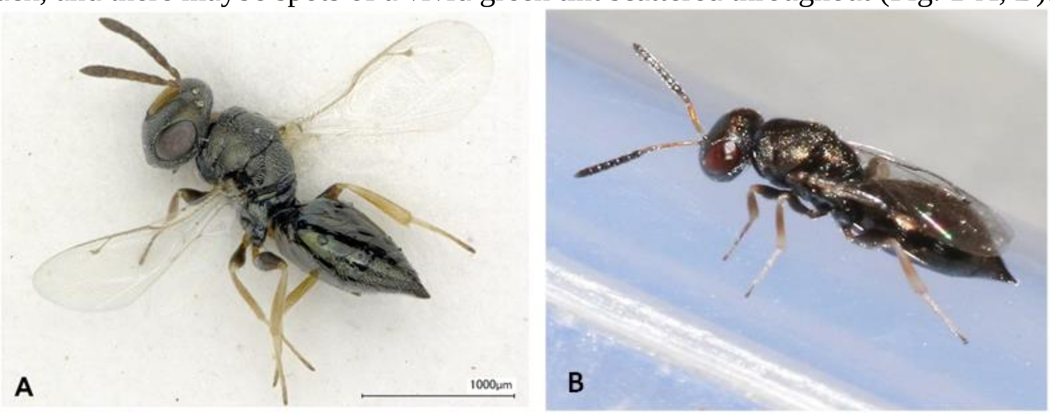

Fig 1: The figure showing the general characteristics of parasitoid *Anisopteromalus calandrae*, (A) the position of extended wings (B) a resting position, wings folded.

Morphology of the Body:

All the different parts of the body and their measurements are shown in the lateral view of *A. calandrae* in Figure 2, a&b by using a scanning electron microscope. As well as the ventral and lateral views of the parasitoid are shown in Figure 2, c& d. According to SEM the length of the body, head capsule, thorax, abdomen, fore wing, fore leg, Middle leg and Hind leg was 2832, 785, 921, 1230,1553, 2003, 1632 and 2331µm, respectively.

For fore leg, the length of the total leg, coxa, trochanter, femur, tibia with one apical spur, tarsus with five segments where it ends with an arolium and a pair of claws was 311, 175, 320, 693, 86, 486 µm, respectively. For middle legs, they are shorter than the first legs. The length of femur, tibia which is shorter than the one in the first leg and it does not end with a spur, tarsus with five segments and ends with an arolium and a pair of claws were 439, 221, 672 µm in length, respectively. The hind legs were the longest. The length of coxa, trochanter, femur, tibia with only one apical short and bent spur, tarsus with five segments and ends with an arolium and a pair of claws were 341, 175, 613, 701, 39 and 501 µm. (Table 1).

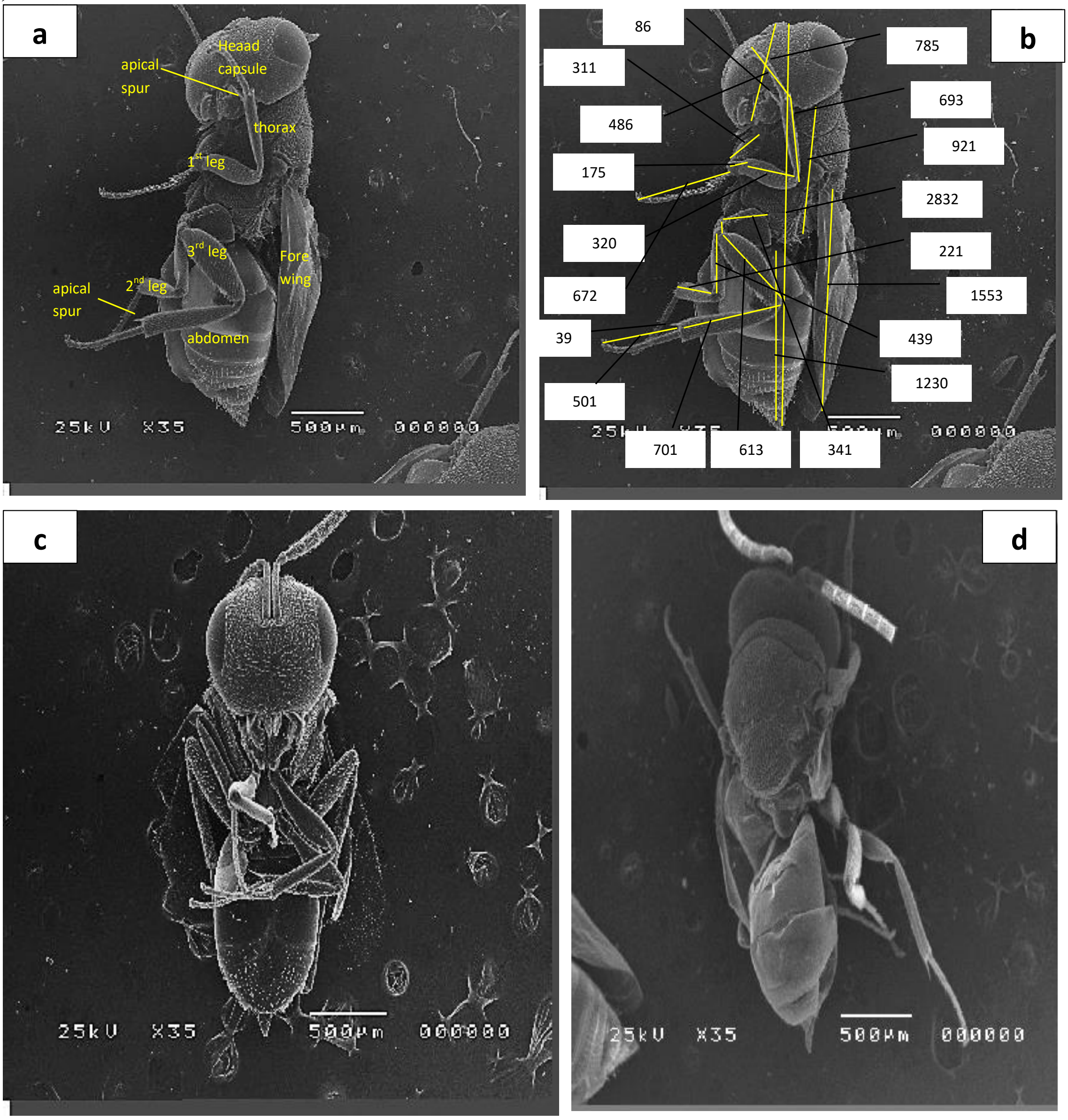

Fig 2: SEM showing the body of parasitoid *Anisopteromalus calandrae* a, different parts of the body are shown in the lateral view, b, measurements of the different body parts in the lateral view, c, ventral view, d, dorsal view.

Morphology of the Head Capsule:

All the different parts and their measurements of the head capsule are shown in the lateral and dorsal views of *A. calandrae* were taken with a scanning electron microscope are shown in Figure 3, a, b, c&d

In the lateral view, SEM showed (Fig.3 a, b) a head capsule with a length of 740 µm: head with two compound eyes and un sinuous margin with a length of 380 and width of 389 µm confined between them front sclerite with a length of 215 µm and width of 505 µm. Also, a pair of geniculate antennae are confined between compound eyes and consist of a scape segment with a length of 338 µm, a pedicel with a length of 83 µm, anelli with a length of 78 µm. It is confined between the bases of the antennae and the eye on each side of its troulus sclerite where antennal radical (rad) is situated between compound eyes invaginated in torulus (tor) length 430 µm and width 135 µm. Clypeus (cly) weakly bilobed length 217 µm and width 201 µm, situated near anterior tentorial pit (atp); labrum (lbr) connected with clypeus; fore leg showed another time from it in the side view of the head capsule, coxa length 310 µm, trochanter length 177 µm, femur 315 µm convergent with the measurements of the first legs in the Figure 2 a, b.

In the dorsal view, SEM showed (Fig.3 c, d) a head capsule with a length of 734 µm and width of 522 µm; a pair of lateral ocelli appear on either side of the bases of the antennae with a length of 15 µm and width of 64 µm; head with two compound eyes and un sinuous margin radius with 103 µm (Table 1).

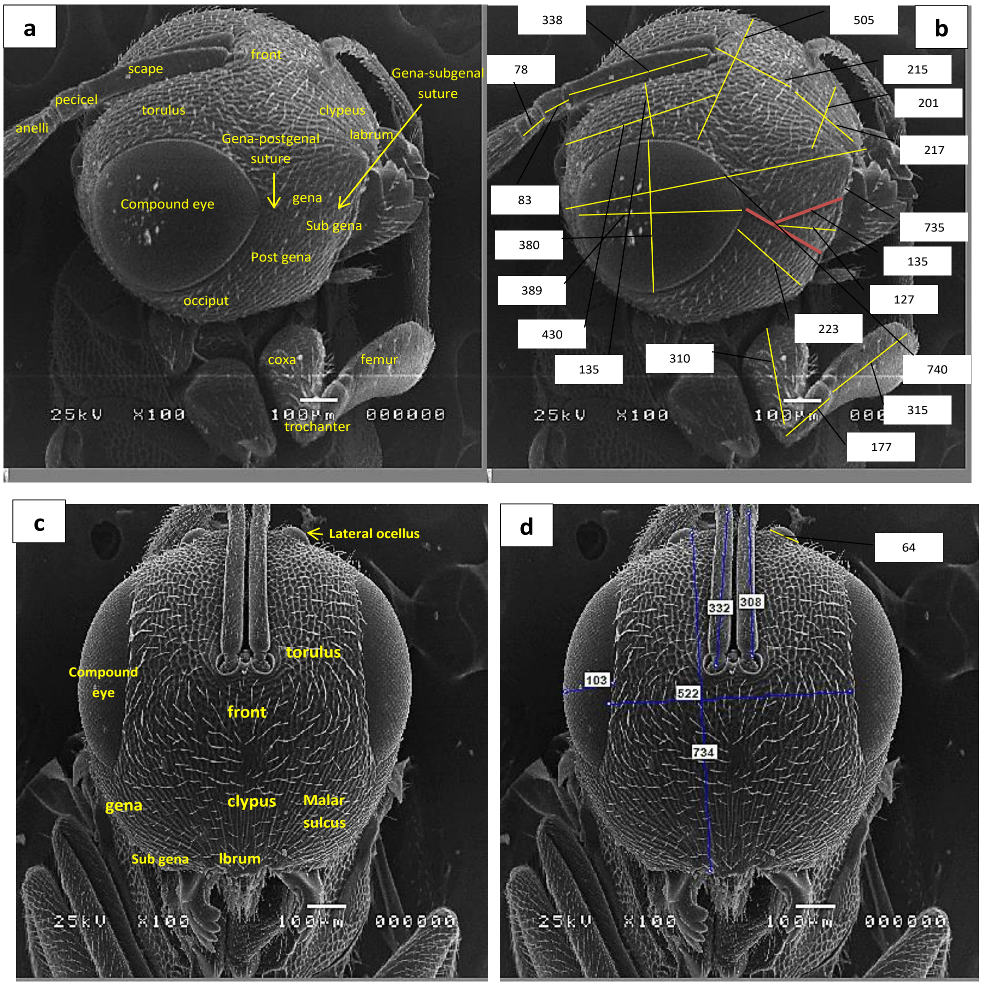

Fig 3: SEM showing the head capsule of parasitoid *A. calandrae* a, different parts shown in the lateral view. b, measurements of the different parts of the head capsule shown in the lateral view. c, different name parts are shown in the dorsal view. d, measurements of the different parts of the head capsule are shown in the dorsal view.

Morphology of the Antenna and Differentiation Between the Two Sexes:

All the different names of a male antenna (radial, scape, and anelli) are shown in the lateral view of the *A. calandrae* in the (Fig.4, a) and all measurements of the male antenna parts (radial, scape, and anelli) in the lateral view of this parasitoid taken with a scanning electron microscope are shown in the (Fig.4, b) as As well as all the different parts and measurements of the male flagellum are shown in the lateral view of *A. calandrae* taken with a scanning electron microscope in Figure 4, c&d.

All the different parts and measurements of the female antenna (radial, scape, and anelli) are shown in the dorsal view of *A. calandrae* in Fig 5 a& b where they are taken with a scanning electron microscope. As well as all the different parts and measurements of the female flagellum are shown in the lateral view of *A. calandrae* in Figure 5, c& d. where they are taken with a scanning electron microscope.

By following up the examination with the scanning electron microscope, antennal toruli is closer to each other than to the inner eye margin. The antennae of the two sexes are of the geniculate type, and there is no clear difference in their length at the level of the radial, scape, and anelli, as shown in Figures 4, a,c and 5, a,c. Their lengths in the case of males were in the order of 338, 76, and 78 µm as in Figure 4, b, while in females, the lengths were in the order of 308, 22 and 24 µm as in Figure 5, b. but the antennae of males differ from that of females, where, the difference at the level of the flagellum segments. The number of segments for the flagellum in both sexes is seven segments, but the first three segments that the nearest to the body are triangular in shape in males, and their lengths were approximately equal. They were in the order of 100, 90, and 88 µm. While for the next three segments, they were almost square in shape, and their lengths were different. They were in the order of 95, 92, and 89 µm. The seventh and last segment is the longest; conical in shape, with a convex tip, and its length was 185 µm, as shown in Figure 4, d.

While for the antennae of females, the first six segments that the nearest to the body was square in shape and they were almost equal in length. They were arranged in the order of 95, 95.6, 82.3, 90.9, 79.7 and 97.3 µm. while the seventh and last one, was the longest, conical and pointed at the end, and its length was 170 µm as shown in Figure 5, d, The difference both male and female antennae on the diagnostic characteristics can be based on the difference between the two sexes (Table 1).

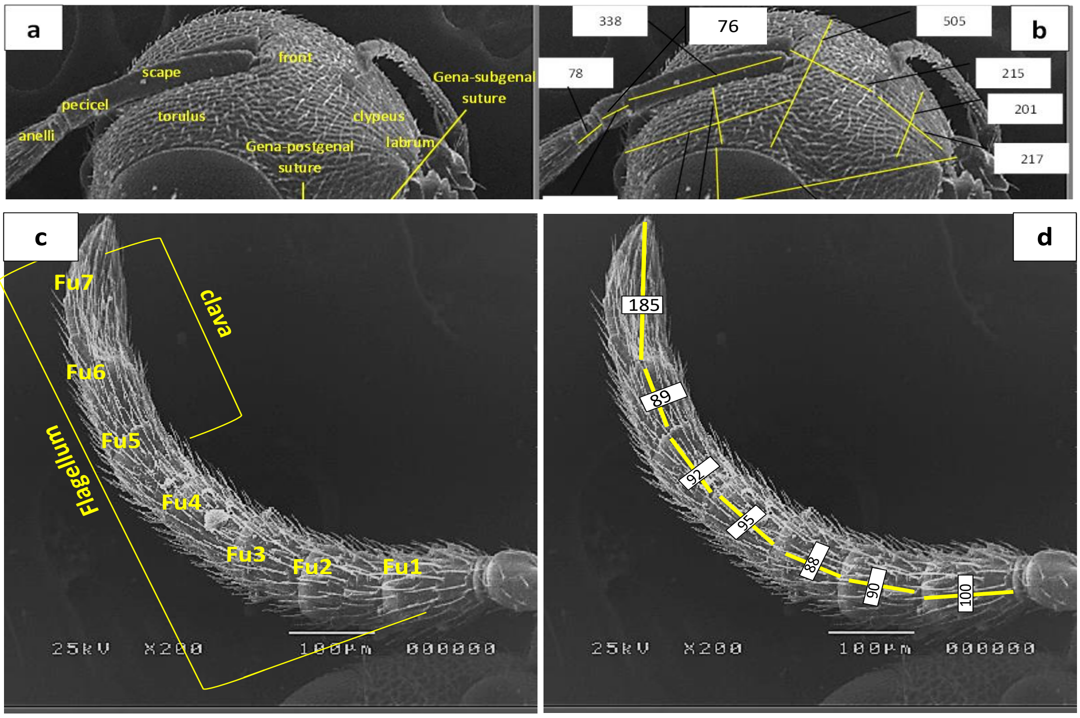

Fig 4: SEM showing the male antenna of parasitoid *A. calandrae* a, different name parts of the male antenna (radial, scape, and anelli) in the lateral view. b, measurements of the male antenna parts (radial, scape, and anelli) in the lateral view. c, different names of parts of the male flagellum shown in the lateral view. d, measurements of the male flagellum parts in the lateral view.

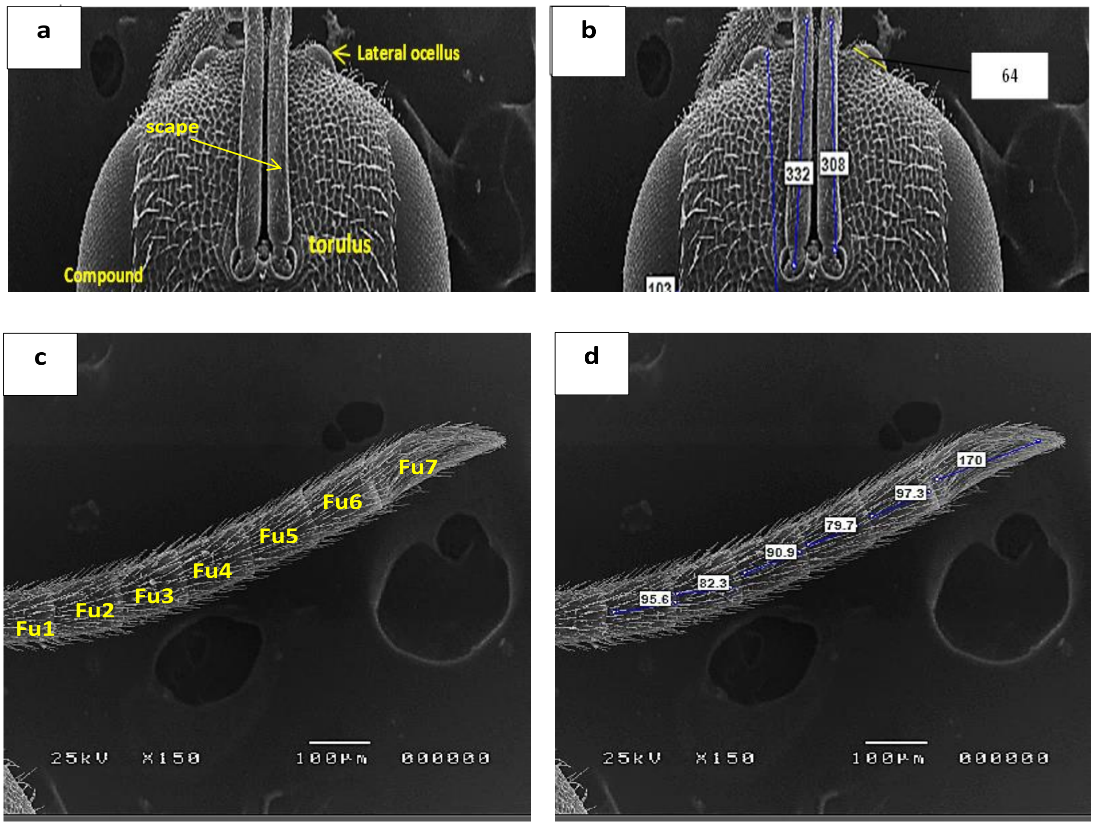

Fig 5: SEM showing the female antenna of parasitoid *A. calandrae* a, different name parts shown in the female antenna (radial, scape, and anelli) in the dorsal view. b, measurements of the female antenna parts (radial, scape, and anelli) in the dorsal view. c, different name parts of the female flagellum are shown in the lateral view. d, measurements of the female flagellum parts in the lateral view

Morphology of the Mouth Parts:

All the different parts and measurements of upper mouthparts are shown in the dorsal view of *A. calandrae* in Fig.6, a&b where they were taken with a scanning electron microscope. As well as, all the different parts and measurements of lower mouthparts are shown in the ventral view of this parasitoid in fig.6 c&d where they were taken with a scanning electron microscope

SEM showing in the dorsal view (fig.3 a, b)**,** the upper mouthparts of *A. calandrae* adult consists of a small labrum (average length was 42 µm and width 88 µm), a big mandible with an average length of 229 µm Which represents as a result of the three dimensions of the mandible (upper dimension 64 µm and lower dimension 165 µm) and with a width of 170 µm. The mean length of the third dimension which represents the distance between the head capsule and the biting and grinding edge was 33 µm, while the average length of the biting and grinding edge was 172µm. The mean length of maxillary palp was 157µm and width of 27µm, while hypopharynx was with an average length of 43µm and width of 24µm (Fig. 6 b)

SEM showing in the ventral view (Fig.6 c, d) the lower mouthparts of *A. calandrae* adult consists of a big labium (average length was 400 µm and width was 293 µm), maxilla appears with big cardo and an average length of 101µm and also big stipes with an average length of 177µm. The average length of labial palp was 115µm and the width of 17µm (Table 1).

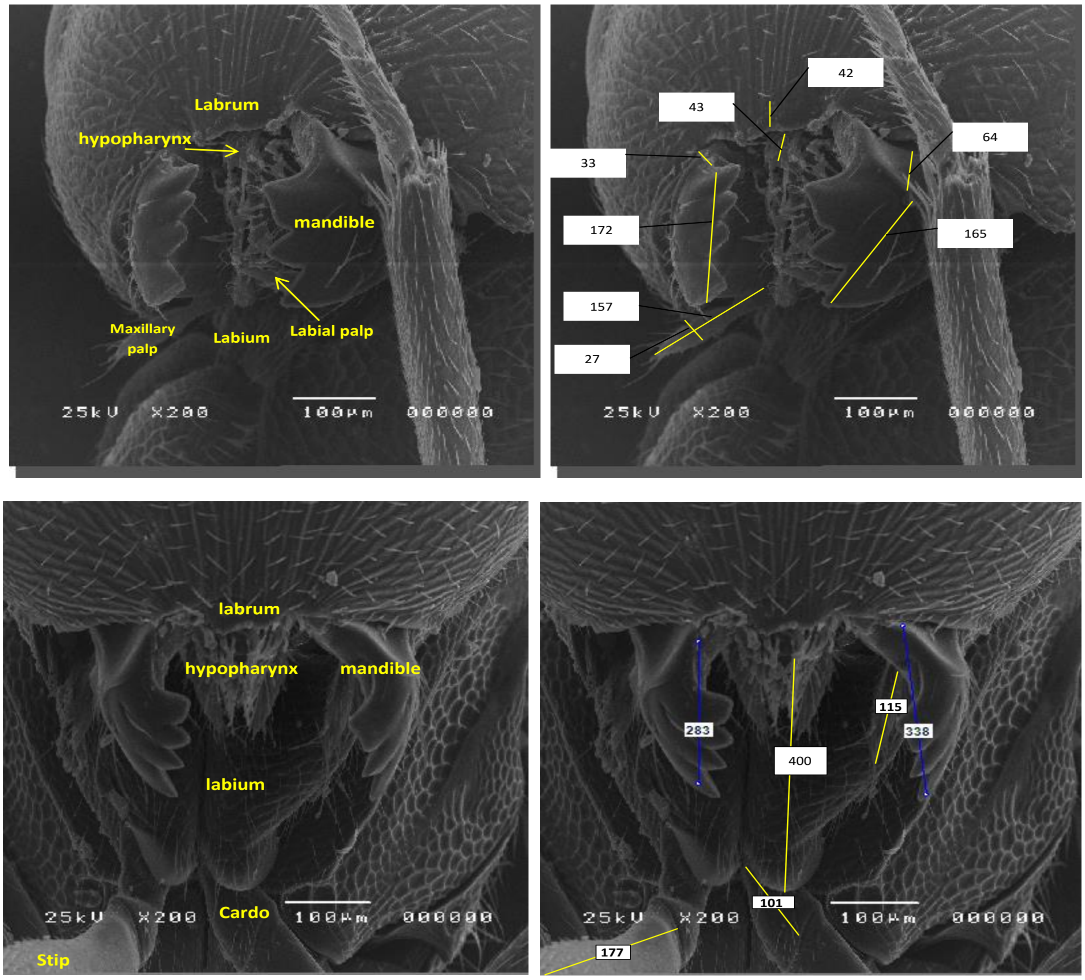

Fig 6: SEM showing of *A. calandrae* mouthparts a, different name parts of upper mouthparts are shown in the dorsal view. b, measurements of the different upper mouthparts are shown in the dorsal view. c, different name parts of lower mouthparts are shown in the ventral view. d, measurements of the different lower mouthparts are shown in the ventral view.

Morphology of the Thorax:

All the different parts and measurements of the occiput and thorax are shown in the dorsal view of *A. calandrae* in Figure7, a&b taken by a scanning electron microscope. As well as all the different parts and measurements of thorax are shown in the lateral view of this parasitoid in Figure 7 c&d taken by a scanning electron microscope.

SEM showing in the dorsal view of occiput and thorax (Fig.7, a,b): Three ocelli appear before the occiput area, one of them is medial (ao) and the others are lateral (lo). The length of the distance confined between them was 171 µm. As for the occipital region, it is wide, extending to the area below the compound eyes (average length was 225 µm and width was 622 µm); Mesosoma elongates (average length was 921 µm and width was 722 µm); pronotum (pro) narrow at the middle of the body around the neck, where the area of both outer sides is symmetry, broad and the longest side than the middle part of pronotum. The mean length in the middle was 42 µm while the mean length of the outer side was 185 µm and its width was 823 µm. Mesoscutum (mlm) is without a median line and the outer rim of 1st spiracle (sprl) is located at the anterior outer margin of the lateral margin of mesocutum with a length of 527 µm and width of 722 µm; scutellum (sct) with sub median and sub lateral lines (suctoscutellar suture (sss)) which separate between mesoscutum and scutellum (average length of 423 µm and width of 401 µm); lateral submedian groove (smg) separated between axillus (ax) (average length of 161 µm and width of 401 µm)and scutellum (sct). Dorsellum (dor) somewhat elongates medially as long as the propodeum, with a raised lobe of callus (cal) partially overhanging the outer rim of 2nd spiracle (spr2), spiracular depression open to the anterior margin of dorsellum.

SEM showing the Lateral view of Mesosoma (Fig.7, c,d), the pronotum region extends towards the lower parts of the mouth to be more extensive with a length of 220 µm. Segmentation between the pronotum and mesoscutum is clear; The mesoscutum region extends towards the lower parts of the pronotum to be less extensive (narrow). The lateral lobe of mesoscutum (llm) length was 231 µm; Tegula (tgl) length was 133 µm articulated with axillus (ax) with a length of 183 µm and scrobe (scr) with a length of 133 µm as long as tegula. Dorsellum (dor) somewhat is elongate medially longer than propodeum (410 µm) with a raised lobe of callus (cal) partially overhanging the outer rim of 2nd spiracle (spr2) with a length of 101 µm. Spiracular depression opens to the anterior margin dorsellum. Metasoma fused with 1st abdominal segment forming propodeum (ppd), segmentation between scutellum and frenum (fre) is obvious, the suture between frenum and dorsellum (dor) occurred, coxa articulated with supra coxal flange (scf) with a length of 132 µm, the rim of 2nd spiracle (spr2) situated on the raised lobe of callus near dorsellum and supra coxal flange. (Table 1).

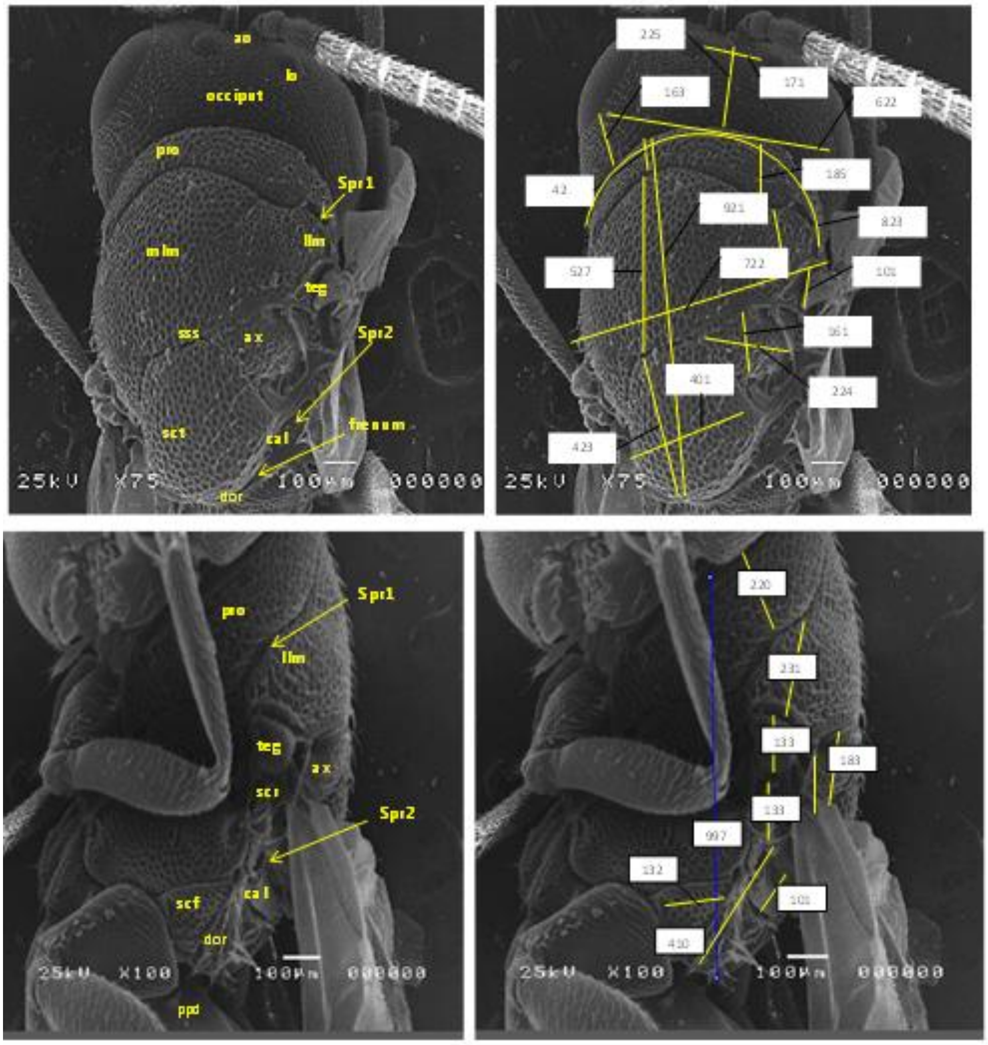

Fig 7: SEM Photograph showing (a) Dorsum of mesosoma, cal., callus; dor., dorsellum; fre., frenum; Ilm., lateral lobe of mesoscutum; mlm., midlobe of mesoscutum; pro., pronotum; nod., nodus; not., notaulus; sct., scutellum; sss., scutoscutellar suture; tgl., tegula; spr., spiracle; spr2., spiracle2. (b) measurements of the thorax in the dorsal view of this parasitoid taken with a scanning electron microscope. (c) Lateral view of mesosoma, ax., axillus ; cal., callus ; dor., dorsellum; fre., frenum; Ilm., lateral lobe of mesoscutum ; not., notaulus; pro., pronotum ; ppd., propodeum; sct., scutum ; scr.,scrobe; smg., sub median groove; scf., supra coxal flange; spr., spiracle; spr2., spiracle 2; tgl., tegula. (d) measurements of the thorax in the lateral view of this parasitoid taken with a scanning electron microscope.

Morphology of the Forewing:

All the different parts and measurements of the forewing are shown in the dorsal view of *A. calandrae* in Figure 8 a&b where they are taken with a scanning electron microscope. Microscopic photography shows Fore wings margin with at most one vein, Anterior margin of the forewing is divided into a submarginal vein (smv) that carries one row of dorsal seta with a length of 519 µm, marginal vein (mv) without dorsal setae, post marginal vein (pmv) without seta with a length of 523 µm, stigma (stg) at the end of stigmal vein **(stv)** with a length of 226 µm; the length of post marginal vein, was as long as the length of stigmal vein approximately; outer margin of forewing without marginal hairs (mh). Wing venation was reduced while there two triangular areas are present in the forewing. Triangular area -1 as an equilateral triangle, approximately the length of each side was 236 µm defined with a single row of bristles on its edges. Triangular area -2 down towards the body, also is an equilateral triangle, approximately with the length of each side of 224 µm without a single row of bristles on its edges. Hind wing smaller than forewing, with only marginal vein. Outer margin bordered with long hairs. Hind wing its membrane extending to the base of the fore wing; wings with short marginal setae (Table 1).

The most important part that can be diagnosed in the thorax region is the pronotum where it does not reach the tegula, fore- and hind wings without any closed cells but a triangular area delimited by a single row of bristles appears at the base of the fore wing; Metasoma petiolate, hence it distinctly constricted anteriorly.

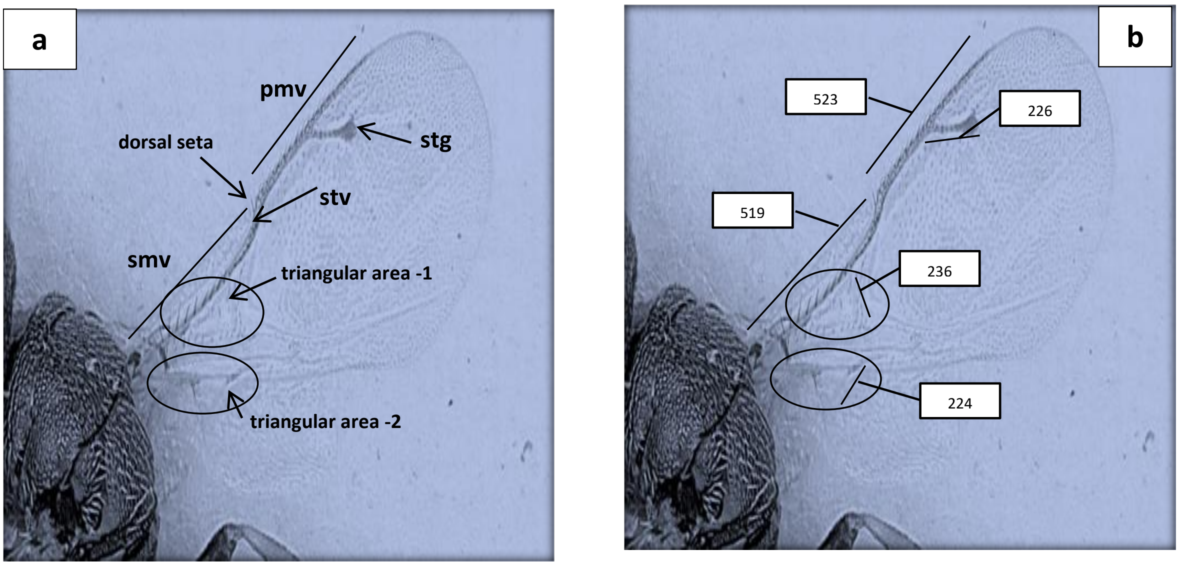

Fig 8: Fore and hind wings, a, mv., marginal vein; pmv., post marginal vein; smv., submarginal vein; stv., stigmas vein; stg., stigma. b, all measurements of the fore wing parts in the dorsal view of this parasitoid taken with a scanning electron microscope.

Morphology of the Abdomen and Ovipositor:

All the different parts and measurements of the abdomen are shown in the dorsal view of *A. calandrae* in Figure 9, a&b, which were taken with a scanning electron microscope. As well as all the different parts and measurements of the ovipositor are shown in the dorsal view of *A. calandrae* in Figure 9, c&d which were taken with a scanning electron microscope.

SEM showed dorsal view of Abdomen with a constriction between the first and second abdominal segments; Gaster is seven segments; segmentation between abdominal segments is clear from dorsal view; gaster with tergites 1-3 covering more than half of it; atrium of last abdominal spiracle (spr) is located at pleura between gastral tergum (Gt7) and gastral sternum (Gs7); ovipositor (ovp) is located at the end of the body. The length of the abdomen is 1855 µm and the length of the ovipositor is 323 µm.

SEM depicting the ventral Ovipositor perspective. It is consists of three pairs of shutters or valves and has a tiny triangular shape. The upper pair of fused valves, each measuring 165 mm in length, is the longest. The egg guide appears as a scar that ends in a pustule and extends 34 mm from the dorsal side and a pair of long sensory hairs on the ventral side. There are two lower valves on the ventral side that resemble leaves and end in a 67 mm-long, unique sensory hair. The oviduct canal, which is located in the middle of this pair and measures 63 mm in length, closes when the egg-laying process begins and is confined between the upper and lower pairs of valves. The pair of lateral valves also resembles a tree leaf but is wider than the lower valve and measures 50 mm in length (Table 1).

The inter-relationships of the parts of ovipositor can be seen in a schematic realization of an idealised part of the middle region of an ovipositor (Fig. 4). The upper valve is interlocked with both of the lower valves by means of a 'T'-section, longitudinal ridge, the rhachis, which runs within a corresponding groove, the aulax, on the lower valve. The combination of rhachis and aulax is known as the olis.

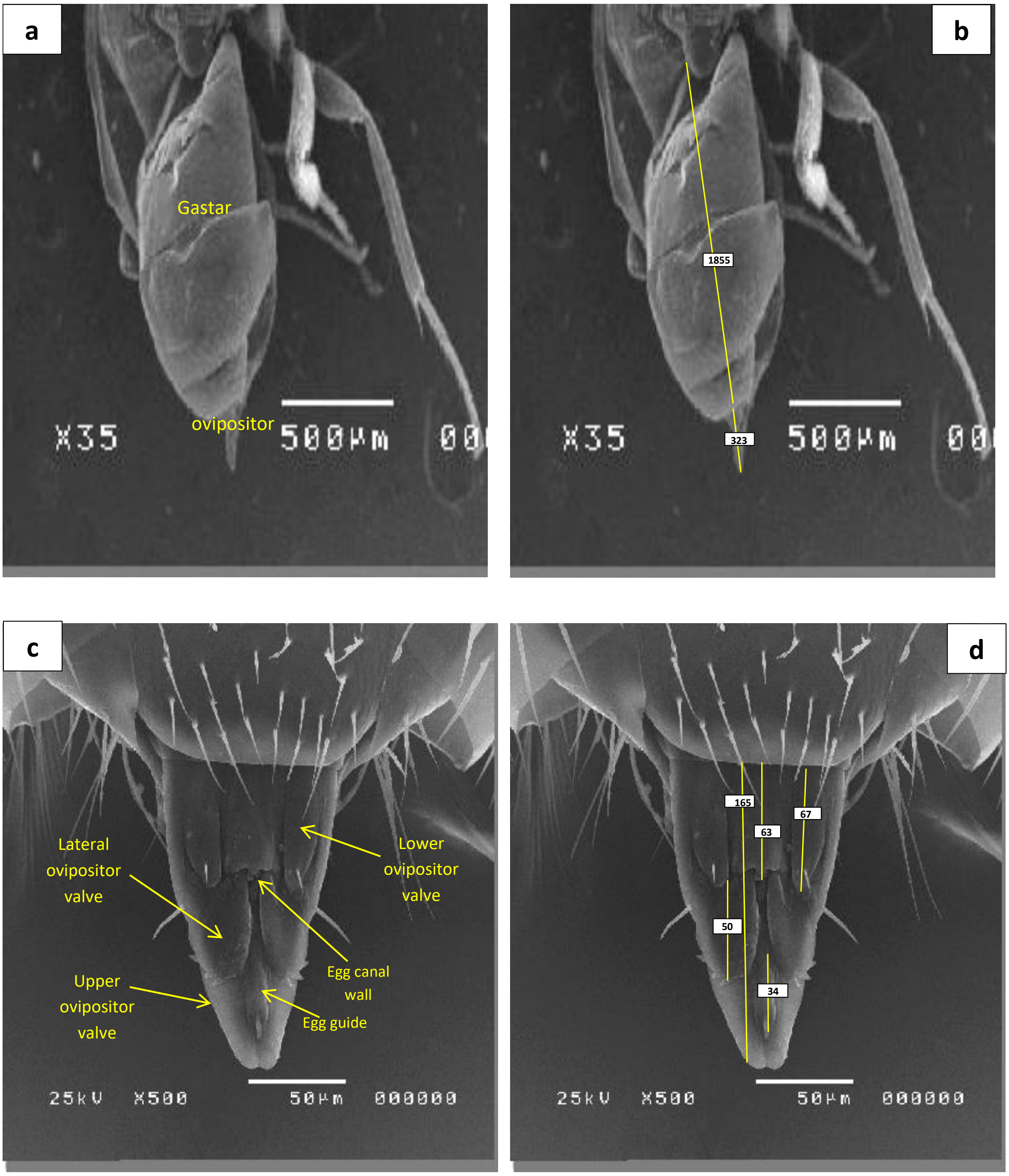

Fig 9: SEM showing abdomen and ovipositor: a,b different parts and measurements of the abdomen are shown in the dorsal view. taken with a scanning electron microscope. c,d all the different parts and measurements of the ovipositor are shown in the ventral view. taken with a scanning electron microscope.

Table.1: Morphometric analysis of components of each part of the body *A. calandrae*, using the unit of measurement in micrometers.

Parts of body	Components of each part of the body	length	width	Parts of body	Antenna parts of both sexes *A. calandrae*	Male antenna Length	Female antenna Length
body	body	2832	---	antanna	radial	338	308
	head capsule	785	---		scape	76	22
	thorax	921	---		anelli	78	24
	abdomen	1230	---		Fu1	100	95
	fore wing	1553	---		Fu2	90	95.6
	fore leg	2003	---		Fu3	88	82.3
	Middle leg	1632	---		Fu4	95	90.9
	Hind leg	2331	---		Fu5	92	79.7
fore leg	coxa	311	---		Fu6	89	97.3
	trochanter	175	---		Fu7	185	170
	femur	320	---		---	---	---
	tibia	693	---	**---**	**Components of each part of the body**	**length**	**width**
	apical spur	86	---	Mouth parts	Labrum	42	88
	tarsus	486	---		Mandible	229	170
Middle leg	coxa	---	---		Stipes	177	---
	trochanter	---	---		cardo	101	---
	femur	439	---		Maxillary palp	157	27
	tibia	221	---		Labium	400	---
	apical spur	---	---		Labial palp	115	---
	tarsus	672	---		hypopharynx	43	---
Hind leg	coxa	341	---	occiput and Thorax dorsal view	distance confined between lateral ocelli	171	---
	trochanter	175	---		space extending below the compound eyes	225	622
	femur	613	---		Mesosoma	921	722
	tibia	701	---		pronotum	185	823
	apical spur	39	---		mesoscutum	527	722
	tarsus	501	---		scutellum	423	401
Head capsule	Head capsule	734- 785	522		lateral submedian groove	161	401
	compound eyes	380	389	Lateral view of Mesosoma	pronotum	220	------
	front	215	505		mesoscutum	231	------
	scape segment	338	---		Tegula	133	------
	pedicel	83	---		axillus	183	------
	anelli	78	---		scrobe	133	------
	troulus sclerite	430	135		dorsellum	410	------
	Clypeus	217	201		outer rime of 2nd spiracle	101	------
	lateral ocelli	15	64		supra coxal flange	132	------
Abdo-men	abdomen	1855	---	Fore wings	submarginal vein	519	------
	ovipositor	323	---		postmarginal vein	523	------
	upper valve	165	---		stigmal vein	226	------
	pustule	34	---		length of the side of triangular area -1	236	------
	lower valve	67	---		length of the side of triangular area -2	224	------
	Plate covers the oviduct	63	---	------	------	------	------
	lateral valve	50	---	------	------	------	------

Infestations with insects pose the biggest challenge to growing and storing cowpeas Youdeowei(1989) The quality, quantity, commercial value, and agronomic utility of the product are all particularly negatively impacted by insect damage, according to Singh and Allen (1980). Generally, insect larvae that feed on grains which have been stored do so by tunnelling into the grain and selecting to eat the protein- and vitamin-rich germ first. In tropical countries, faba beans (*Vicia faba* L.) and cowpeas (*Vigna unguilata* (Walp.)) are important sources of protein. Cowpea and faba beans are particularly susceptible to insect attacks from the weevils of *Callosobruchus maculatus* (Fab.) and *Callosobruchus chinensis* L (Coleoptera: Bruchidae) in the northern part of Egypt, where 81% of farmers cultivate them (Kitch *et al.*, 1992; Boeke *et al.*, 2001; Boeke *et al.*, 2004 and Dal Bello *et al*,2001).

To stop these post-harvest losses, numerous strategies have been employed.

Currently, several plant compounds are employed as insecticides or repellents along with chemical pesticides (Amatobi, 1995; Boeke, 2002). Dynamic trends can affect synthetic pesticides. Target insects can become resistant to a single insecticide (Boeke, 2002) or to the agent's residual effects and unfavourable effects on people and the environment. This may also encourage the growth of pests that are not the intended targets, turning what was once a minor problem into a significant one with a high tolerance for common pesticides. In order to decrease pest recurrence and increase the prevalence of natural enemies in crop protection techniques, more sustainable measures are therefore needed.

According to several studies, the parasitoid Hymenoptera could act as a biological control agent for the rice weevil species *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae), *Prostephanus truncatus* (Horn) (Coleoptera: Bostrichidae), and *Sitophilus zeamais* (Helbig, 1998). The parasitoid *Anisopteromalus calandrae* (Hymenoptera: Pteromalidae) now parasitizes *C. maculatus* and *C. chinensis* in northern Egypt. The current study was carried out at the Atomic Energy Center in Egypt while fielding observation in small grain stores, cowpea and faba bean, and observing the effectiveness of the parasite to control the cowpea beetle in particular. This was the first time to put the light on it with intensity, Where the parasitoid was formerly uncommon, the ecosystem has now changed for the better and is more suitable, as evidence by the fact that it has been found in high density on grain beetles that have been recently stored. which made it necessary to carry out an extensive morphological study of *A. calandrae* in order to define it for upcoming breeding. Additionally, it is widely used in the biological management of pests that attack stored grains in general, and *C. chinensis* in particular

Finally, a female diagnosis is conceivable. Olive-green with faint bronze tinges on the head and mesosoma; hardly perceptible setae. Gena close to the mouth edge is terete rather than carinate. The first funicular segment has a subconical shape, is somewhat wider at the base than the third anellus, and bears one to two rows of longitudinal sensilla on the flagellum, which is obviously clavate. In lateral view, the scutellum is slightly curved and protrudes at the level of the anterior edge of the dorsellum. Setae on the forewing's dark wing disc. bare, distal and proximal speculums that are just partially closed. The front plica of the propodeum is brief, consistently curved, and occasionally connects to an obscure costula. The posterior edge of the first gastral tergite is well-developed and curved backward.

The quickest way to recognize female *A. calandrae* is to look for the characteristics indicated in the key and diagnosis. The species most closely resembles *A. cornis* sp. In this study, it was refered to each species' a description of information on the forewing's pilosity, which further sets it apart from *A. quinarius* sp. n. To ascertain the taxonomic status of *A. calandrae,* attention must be given to the other widespread species, *A. quinarius* sp. n. Both species are frequently observed in human-owned dwellings, and they have historically been confused with one another. These species often occupy somewhat distinct habitats because they have diverse host preferences (Gokhman & Timokhov, 2002; Timokhov & Gokhman, 2003): Homes and warehouses (like those used to store tobacco or fruit) are frequent habitats of *A. quinarius* sp., which is frequently accompanied by Stegobium or Lasioderma beetles.

A.calandrae can be found in mills and grain bins, where it frequently coexists with *Sitophilus* species. The discovery of *A. quinarius* sp. n. was somewhat hampered, in our judgement, by these discrepancies. Another problem is that the male holotype of A. calandrae no longer exists, as recently confirmed by M. Gates, curator of the Chalcidoidea collections at the USNM (Peck, 1963).. As it was already mentioned, in this study, it was able to tell those males and female apart based on their antennae.

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