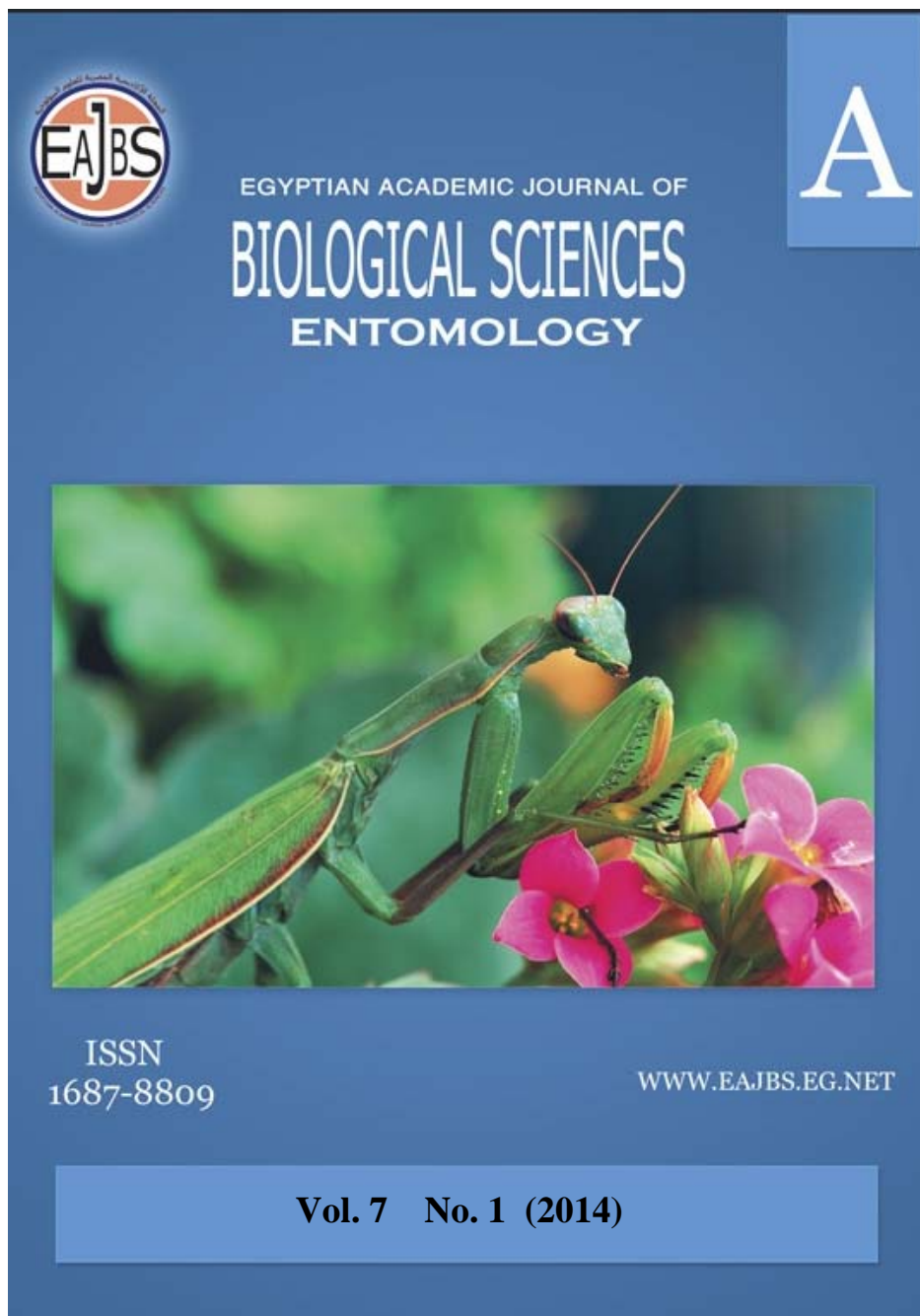


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The Calliphoridae the blow flies (Diptera: Oestroidea) of Kingdom of Saudi Arabia

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ABSTRACT

The identification of adults of the Calliphoridae (Diptera: Oestroidea) or blowflies is important in regard to sanitary biology, medical, veterinary, and forensic entomology. No comprehensive study of the Calliphoridae for the Kingdom of Saudi Arabia is currently available. An examination of 2,211 specimens collected from June 2010-June 2012 and literature records indicated at least 34 species of Calliphoridae are known from Saudi Arabia. Four species represent new country records, *Pericallimyia greatheadi*, *Pollenia hungarica*, *Rhyncomya sinaiensis* and *Rhyncomya zumpti*. Keys and illustrations are presented to allow determination of the adults of the 34 species. Additionally, distribution maps for these species for Saudi Arabia are provided.

Keywords: Diptera, Calliphoridae, Saudi Arabia, new records

INTRODUCTION

The Calliphoridae is a relatively large family included in the superfamily Oestroidea (Pape, 1992), of more than 1,100 species included in about 150 genera worldwide (Grunin, 1988; Rognes, 1991). These flies are cosmopolitan and well distributed on all continents (Triplehorn & Johnson, 2005). About 80% of the species are Old World with Africa being especially diverse (Shewell, 1987), about 250 species occur in the Palearctic (Schumann, 1986) and 335 species occur in the Afrotropical (Pont, 1980). Adults of the Calliphoridae are medium to large sized flies, often metallic blue or metallic green. The more common species are called blue bottle flies and green bottle flies. Morphological characters separating adults of this family from other families of superfamily Oestroidea are summarized by Whitworth (2006). Rognes (1991) presented a comprehensive overview of the morphology of the adults. The Calliphoridae are divided into seven subfamilies mainly based on characters of wings, especially using vestiture on and around base of the wings (Shewell, 1987). McAlpine (1989) divided the Calliphoridae into seven subfamilies (Ameniinae, Calliphorinae, Chrysomyinae, Helicoboscinae, Mesembrinellinae, Polleniinae, and Rhiniinae). Rognes (1991) revised the classification of the family placing the 1,100 species into six subfamilies, Calliphorinae, Chrysomyinae, Helicoboscinae, Luciliinae, Melanomyinae, Polleniinae, and Rhiniinae. This classification scheme is

has been accepted (Pape, 1992; Whitworth, 2010) except for that the Rhiniinae have been elevated to full family rank (Rhiniidae) (Evenhuis *et al.*, 2010; Rognes, 2012). In this treatment, the Rhiniinae will be considered as a subfamily following Rognes (1991). Additionally, the Bengaliinae is considered within the Calliphoridae (Lehrer, 1970; Rognes, 2011). Vargas and Wood (2010) provide an excellent recent synopsis of the higher classification of the Calliphoridae.

The identification of blowfly species is important not only for basic entomology, but also for other fields of science, especially with regard to sanitary biology and veterinary entomology (Mariluis *et al.*, 2008). The Calliphoridae exhibit diverse biology and in general are considered important agents of decomposition (Deeming, 1996; Parmenter & McMahon, 2009). Larvae of most calliphorids are necrophagous, coprophagous, saprophagous, parasitic, hematophagous and produce myiasis (Shewell, 1987; Rognes, 1991; Vargas & Woods, 2010). The larva of Chrysomyinae develop not only on carrion and in wounds of vertebrates (traumatic myiasis), but also in dung. Members of this subfamily, for example *Cochliomyia hominivorax* Coquerel (New World Screw Worm), are carrion breeders, but larvae can develop in the wounds of humans, domestic, and wild animals (Thomas & Mangan, 1989). Larvae of the subfamily Ameniinae are reported to be parasitoids of land snails (Reinhard, 1929). The Polleniinae are known to be parasites of earthworms, potentially impacting earthworm populations associated with agroecosystems (Yahnke & George, 1972). The larvae of Phormiinae, especially species of *Protocalliphora* are hematophagous on nestlings of birds (Sabrosky *et al.*, 1989). The Calliphorinae exhibit the greatest diversity in larval biology (James, 1964). The larvae may be hematophagous, produce myiasis, and are even reported as being associated with fungi and termites depending on the species (Zumpt, 1965; Shewell, 1987; Deeming, 1996). During the warm season, calliphorid flies, especially the genera *Calliphora* and *Lucilia* are usually the first insects attracted to exposed corpses and, are therefore utilized as forensic indicators in criminal investigations (Byrd & Castner, 2002; Greenberg, 2002; Genhard, 2007; Vanin, *et al.*, 2009).

The adults or larval calliphorids are beneficial, 1) as important scavengers, 2) as pollinators (Gabre *et al.*, 2005; Clement *et al.*, 2007), 3) as forensic indicators, 4) for use in specialized surgeries, 5) as food sources for various organisms and 6) as religious symbols such as the “luck spirit” symbol used by Aboriginal tribes of Australia (Heath 1982).

The Calliphoridae in The Kingdom of Saudi Arabia are common components of the insect fauna (Al Ahmadi & Salem, 1999; Al Misned, 2003; Dawah & Abdullah, 2009) and widely distributed throughout the country. Larvae have been frequently reported as being of veterinary concern and important vectors of enteric pathogens (Gabre *et al.*, 2005; Alahmed, 2004).

Thirty-one species were recorded from Saudi Arabia previously by various authors, *Bengalia minor* Malloch, 1927 (Abu Thuraya, 1982), *Calliphora croceipalpis* Jaenicke, 1867 (Abu Zoherah *et al.*, 1993), *Calliphora vicina* Robineau-Desvoidy, 1830, (Büttiker *et al.*, 1979), *Cordylobia anthropophaga* (Blanchard, 1872) (Büttiker *et al.*, 1980), *Chrysomya albiceps* (Wiedemann, 1819) (Shalaby, 1962), *C. bezziana* Villeneuve, 1914 (Ansari & Oertley, 1982), *C. marginalis* (Wiedemann, 1830) (= *C. regalis* Robineau-Desvoidy, 1830) (Büttiker *et al.*, 1979; Dabbour, 1979), *C. megacephala* (Fabricius, 1794) (Ramadan & El Bihari, 1980), *C. putoria* (Wiedemann, 1830) (Büttiker *et al.*, 1979), *Lucilia cuprina* (Wiedemann, 1830) (Büttiker *et al.*, 1979), *L. sericata* (Meigen, 1826) (Walker & Pittaway, 1987), *Pollenia dasypoda* Portschinsky, 1881 (Dabbour, 1979), *P. rudis* (Fabricius, 1794) (Al Misned, 2003), *P.*

pediculata Macquart, 1834 (Dawah & Abdullah, 2009), *Cosmina aenea* Fabricius, 1805 (Abu Thuraya, 1982), *C. arabica* Robineau-Desvoidy, 1830, *C. fuscipennis* Robineau-Desvoidy, 1830, *C. prasina* Brauer & Bergenstamm, 1889 (Dawah & Abdullah, 2009), *C. viridis* Townsend, 1917 (Abu Thuraya, 1982), *Isomyia terminata* Wiedemann, 1830 (Dawah & Abdullah, 2009), *Metalliopsis arabica* Deeming, 2008 (Deeming, 2008), *Rhinia apicalis* Wiedemann, 1930 (Dawah & Abdullah, 2009), *Rhyncomya bullata* Deeming, 1996 (Deeming, 2008), *R. callopis* (Loew, 1856), *R. desertica* Peris, 1951 (= *R. flavipes* Séguy, 1933), (Deeming, 1996), *R. jordanensis* (Peris, 1951), *R. nigripes* (Séguy, 1933), *Stomorhina cribrata* (Bigot, 1874), *S. lunata* (Fabricius, 1805), *S. rugosa* Bigot, 1888 (Dawah & Abdullah, 2009), *Villeneuveilla seguyi* Grunin, 1957 (Deeming, 1996). Additionally, several species on the list above is included in Al Ahmadi and Salem (1999) list. It must be noted that Shalaby (1962), Büttiker et al. (1980), Abu Thuraya (1982), Al Ahmadi and Salem (1999), and Al Misned (2003) listing of certain species could not be confirmed since no voucher material was available for examination.

The specific objectives of this study are to identify new collections of adults of the Calliphoridae from the three recognized zoogeographic realms of Saudi Arabia, the Afrotropical, Oriental, and Palaearctic and to provide comparative species descriptions of the Calliphoridae of Saudi Arabia, including identification keys and comments on the distribution and biological information, if available, on some species.

Literature Review

Blow flies are of considerable importance in nature because of their breeding and feeding habits (Mullen & Durfen, 2009). Larvae are necrophagous, coprophagous, saprophagous, parasitic, and produce myiasis (Kurahashi, 1989; Vargas & Wood, 2010). They are known to be either primary scavengers feeding on carrion, feces, dung, and garbage; or are parasites on insects, earthworms, snails, mammals, or other animals. Some species are particular medical and veterinary importance. Species of *Chrysomya* (Old World Screw Worm) are known to cause myiasis in man and domestic animals (Deeming, 1996; Alahmed *et al.*, 2006). In Saudi Arabia, *C. albiceps* and *C. megacephala* have been implicated as causing myiasis in camels (Gadallah & Bosly, 2006). *Chrysomya albiceps* and *C. bezziana* were recorded as causing myiasis in sheep (Alahmed, 2002, 2004; Alahmed *et al.*, 2006). Several species of *Chrysomya* are important pests of domesticated animals in other countries (James, 1971).

Blow flies were also important in other aspects, especially in forensic entomology. Blow flies are useful indicators in legal investigations. The age of larvae can be used to estimate how long a corpse has been exposed to the environment (Byrd & Castner, 2010). Genhard (2007) listed numerous taxa of various subfamilies of the Calliphoridae that have been used in forensic investigations including *C. vicina* Robineau-Desvoidy, *C. vomitoria* (Linnaeus) and *L. sericata* Meigen which are commonly reported to be attracted to human corpses. *Chrysomya megacephala* was found to be important pollinator of mango in southwestern Saudi Arabi (H. A. Dawah, personal communication).

Several genera of Calliphoridae are associated with Isoptera colonies (termites) including *Bengalia*, *Rhyncomya*, and *Stomorhina* (Pont, 1980; Deeming 1996). Larvae of the genus *Pollenia* are considered parasites of earthworms (Rognes, 1987; 1991).

Adult Characteristics

The terminology of adult characters follows Cumming and Wood (2009). Many common adult blow flies are characterized by shiny metallic color, either blue or green, of the thorax and abdomen such as *Chrysomya* and *Lucilia*. But some of the genera are rather drab, such as *Auchmeromyia*, *Cordylobia*, and *Pollenia*, and covered more or less with pollinosity (Fig. 1) (Kurahashi, 1989; Rognes 1991; Service & Service, 2008). Shewell (1987) and Rognes (1991) reviewed the morphology of the adults. Additionally, Whitworth (2006) provided excellent illustrations of morphological characters that are used for identification. Wing characters are used as primary characters to separate taxa to subfamily, included the presence or absence of row setae on the stem vein (Rognes, 1991; Deeming, 1996).

Currently, the Calliphoridae are represented in Saudi Arabia by five subfamilies: Calliphorinae, Chrysomyinae, Luciliinae, Polleniinae, and Rhiniinae (Deeming; 1996, Al Misned, 2003; Dawah & Abdullah, 2009) following Pont (1980) division.

Subfamily Calliphorinae

The Calliphorinae include species that are of economic and medical importance. They breed on animal carcasses, dung or human excrement (Kurahashi, 1970). Some species of the Calliphorinae have been recorded to cause myiasis in humans, for example *Cordylobia anthropophaga* (Deeming, 1996). The Calliphorinae are characterized by the absence of a row of setae on the dorsal surface of the stem vein, the bristly lower calypter and proepisternal depression, and the supra squamal (upper calypter) region is bare or with only a few scattered bristles (Fig. 2). The thorax is dull and bears fine bristles, and the abdomen is shiny blue (Rognes, 1991; Whitworth, 2006). Four species are listed from Saudi Arabia by various authors *Bengalia minor* (Abu Thuraya, 1982), *Calliphora vicina* (Büttiker *et al.*, 1979), *Calliphora croceipalpis* (Abu Zoherah *et al.*, 1993), and *Cordylobia anthropophaga* (Büttiker *et al.*, 1980). However, Dawah and Abdullah (2009), Al Ahmadi and Salem (1999), and Al Misned (2003) referring this record in species listing. The status of *Bengalia minor* in Saudi Arabia which listed by Abu Thuraya (1982) will discussed later in Discussion Chapter.

Subfamily Chrysomyinae

The Chrysomyinae include the most common species of blow flies occurring in Saudi Arabia. The bright blue or green adults of this subfamily are often seen in large numbers around carcasses of animals and garbage (Deeming, 1996).

Species in this subfamily are characterized by a stem vein with a row of setae on dorsal side of the wing (Fig. 3); coxopleural streak absent; numerous fine setae in a row along the anteroventral edge of posterior spiracle; subcostal sclerite with black setulae; postgonite with more or less distinct process bearing basal setae; and anterior half of sternite 8 in ovipositor unsclerotised or weakly sclerotised (Rognes 1991; Zumpt, 1965). Six species at least have been listed from Saudi Arabia including *Chrysomya albiceps* (Shalaby, 1962), *C. bezziana* (Ansari & Oertley, 1982), *C. chloropyga*, *C. putoria* (Büttiker *et al.*, 1979), *C. marginalis* (Büttiker *et al.*, 1979; Dabbour, 1979), *C. megacephala* (Ramadan & El Bihari, 1980). These species listing mostly are without any specific locality information. Additionally, Dawah and Abdullah (2009) referring this species list with some available specimens including *C. albiceps*, *C. marginalis* and *C. megacephala*. Al Misned (2003) list one other species *C. rufifacies* (Macquart, 1843a), the status of this species and also *C. chloropyga* in Saudi Arabia will be discussed in the Discussion section.

Subfamily Luciliinae

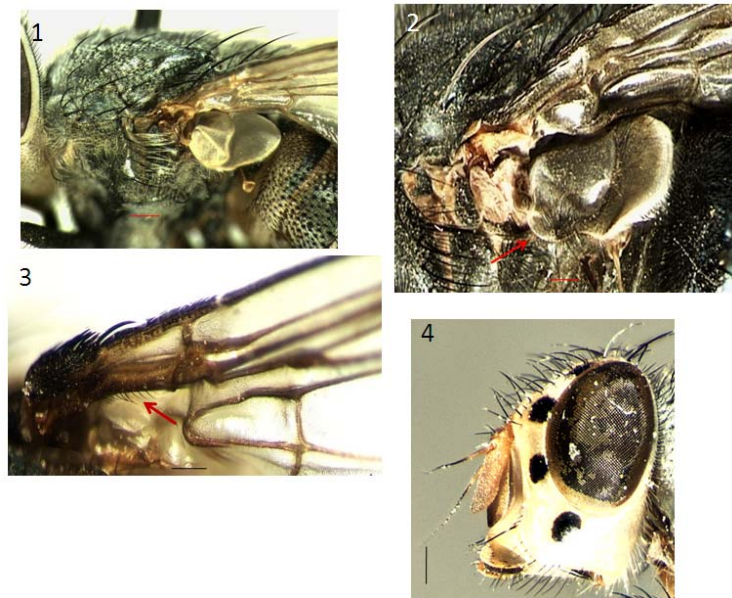
Species of the Luciliinae are of medical and forensic importance (Rueda *et. al*, 2010). Species recorded previously from Saudi Arabia include two cosmopolitan species, *L. cuprina* (Büttiker *et al.*, 1979; Dawah & Abdullah, 2009) and *L. sericata* (Walker & Pittaway, 1987). These two cosmopolitan species also listed by Al Ahmadi and Salem, 1999 and Al Misned, 2003. Both *L. sericata* and *L. cuprina* are reported to commonly cause myiasis especially in sheep (Zumt, 1965). The subfamily Luciliinae is characterized by thorax and abdomen metallic blue-green, bare parafacialia, suprasquamal ridge with a posterior green metallic sclerite with numerous black setae, metakatepisternum hairy in lowermost part; and subcostal sclerites with black setulae (Rognes, 1991; Holloway, 1991).

Subfamily Polleniinae

The larvae of at least some species of Polleniinae are known earthworm parasites (Rognes, 1987; 1991; Deeming, 1996; Whitworth, 2006). Adults of Polleniinae are characterized by being dull colored, gena usually half height of eyes or more, coxapleural streak present, parafacial setose to lower eye margin, facial carina usually present (Whitworth, 2006). The thorax usually has yellow crinkly vestiture and long fine setulae (Dear, 1985). Species previously recorded from Saudi Arabia include *Pollenia dasypoda* (Dabbour, 1979), *P. rudis* (Al Misned, 2003) and *P. pediculata* (Dawah & Abdullah, 2009).

Subfamily Rhiniinae

The Rhiniinae are characterized by a strongly protruding face (Fig. 4), upper half of occiput bare and glossy, stem vein of wing with a row of setae on dorsal surface; and, lower calypter narrow with inner edge diverging from scutellum. In the male the aedeagus has the ventral plates fused into the ring of the distiphallus. The paraphalli are fused and the acrophagus is short (Rognes, 1991).



Figs. 1-4: Fig. 1: The lateral view of thorax of Calliphoridae (scale 2 mm), Fig. 2: Typical Calliphorinae calypter (thoracic squama) (scale 1 mm), Fig. 3: Right Wing of *Chrysomya albiceps* (Chrysomyinae) showing stem-vein setae (scale 1 mm). Fig. 4: Head profile of *Rhyncomya bullata* (scale 0.5 mm).

The Rhiniinae treated here in as a subfamily, includes the largest number of different calliphorid species occurring in Saudi Arabia. Seventeen species at least have been recorded from Saudi Arabia include seven genera: *Cosmina aenea*,

C. viridis (Abu Thuraya, 1982), *Rhyncomya callopis*, *R. desertica*, *Villeneuveilla seguyi* (Deeming, 1996), *Metalliopsis arabica*, *R. bullata* (Deeming, 2008), *C. arabica*, *C. fuscipennis*, *C. prasina*, *Isomyia terminata*, *R. jordanensis*, *R. nigripes*, *Rhinia apicalis*, *Stomorphina cribrata*, *S. lunata*, and *S. rugosa* (Dawah & Abdullah (2009).

Saudi Arabia Zoogeography

Kingdom of Saudi Arabia occupies much of the Arabian Peninsula comprising 1,969,000 km² or 4/5 of that region (Abu Zinada *et al.*, 2001). Following Mattingly and Knight (1956) and Kaszab (1981), Saudi Arabia encompasses three zoogeographical realms, the Palaearctic, Afrotropical, and Oriental regions (Fig. 5). The majority of the fauna of Saudi Arabia reflects close affinities with the Palaearctic Region. This region includes northwestern Saudi Arabia, encompassing Hail, Jawf, a portion of Mecca (Makkah, including Jeddah), Riyadh, Qassim (Bureidah) and Tabuk provinces. The more western and southwestern areas of Saudi Arabia including Asir (Abha), Baha, Jizan and Najran provinces, lie within the extension of the Afrotropical Region. The most eastern areas including the Eastern Province lie within the Oriental Region (Mattingly & Knight, 1956; Kaszab, 1981; Kirk-Spriggs & Stuckenberg, 2009; Alahmed *et al.*, 2011). The political divisions of Al Ghazawi *et al.*, (2003) are used in the material examined localities (Fig. 5).



Fig. 5: Zoogeographical Region of Arabian Peninsula (modified from Mattingly & Knight, 1956; Kaszab, 1981).

MATERIALS AND METHODS

New collections of adult calliphorids were made at 80 sites in the Palaearctic, Afrotropical, and the Oriental influenced regions of Saudi Arabia. Each map in the text includes records that were examined during this study (●) and those taken from the literature that were accepted (+). Adult sampling was conducted from June 2010–June 2012. The collections in Riyadh Province were made at the Al Amariyah Farm (a facility of Animal Production Department, King Saud University), Education Farm at Dierab, Muzahimiyah (Al Khararah) and Rhodet Khorim. Adult flies were mounted immediately whenever possible using #2 and #3 pins (Monarch Brand from www.bioquip.com) or were preserved in 70% ethanol. All flies were labeled including locality, UTM coordinates, date of collection, name of collector (s) and sometimes

elevation. All mounted specimens were deposit in King Saud University Museum of Arthropods (KSMA). The following methods were used to collect the adults.

(1) Malaise Traps (Fig. 6)

Bioquip model 2875A Malaise traps were used with dry type head. The traps were placed over animal carcasses and other baits.

(2) Bait Traps (Fig. 7)

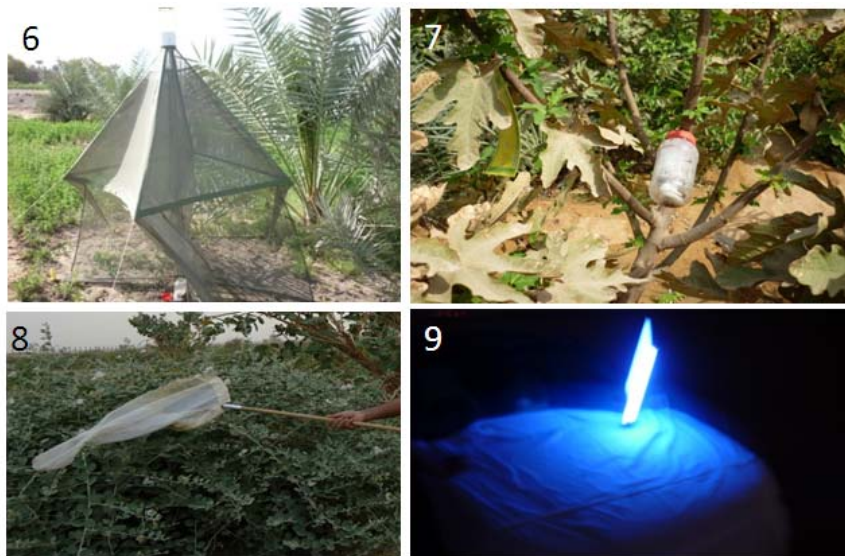
Plastic 500 ml jars with five holes in the lid were baited with beef and fish depending on the location of each Bait trap. Bait, fresh or five days old (exposed five days in sterile room temperature) were used for trapping. Fresh bait was used only in Riyadh Province, whereas in other provinces five day old bait was used. The bait was covered by cotton inside the jar. To prevent drying of bait in the high air temperatures of the region, a small amount of water was added to cotton. Beef was used mainly in the desert areas including Riyadh Province. Fish was used in and near the coastal areas. Traps were collected twice a month in Riyadh Province whereas in other provinces the adult flies were collected daily. In the field the bait traps were hung on the trees at least 1–1.5 m above ground. Adult flies collected were pinned and all larvae were transferred to the laboratory for rearing.

(3) Sweeping (Fig. 8)

Adults collected using heavy duty aerial nets (Bioquip model 7625 HS). All adult were killed using ethyl acetate and mounted immediately.

(4) Light Trap (Fig. 9)

Adults collected using black light (ultra violet) trap (Bioquip model 2805 DC Light). The light trap was installed over 2×2 m square of muslin cloth for 3-4 hours during the field trips. Additionally, the white light trap also use in several time.



Figs. 6-9: Method of adults collection. Fig. 6: Malaise Trap. Fig. 7: Bait Trap. Fig. 8: Sweeping. Fig. 9: Black light trap.

Rearing

Larvae were reared in the laboratory using methods of Singh (1986), “rearing on animal tissue” and maintained under room temperature (25 ± 1 °C) inside an incubator (Binder KB Series model, Binder Company, Germany). The larvae were reared inside 500 ml plastic jars covered by muslin cloth secured by a rubber band. Fresh beef was used for rearing. Each jar was examined until pupation and puparia were removed to a

rearing jar to allow adult emergence. The puparia from each reared fly was mounted on standard circular points with the specimens.

Other abbreviations used in the text: S.N, sweeping net; L.T, light trap; B.T, bait trap; and M.T, malaise trap.

On this study the Sultanate of Oman well referred to Oman, the United Arab Emirates as UAE and Republic of Yemen as Yemen.

Material Examined

The study is based upon the examinations of adult specimens from field collections and the following institutions and individuals:

KSMA - King Saud University Museum of Arthropods, Riyadh, Saudi Arabia

NMWC - National Museum of Wales, Cardiff, United Kingdom

ANMA - Arabian National Museum of Arthropods, Ministry of Agriculture, Riyadh

ZMKSU – Zoology Museum King Saud University, Riyadh, Saudi Arabia

HD - Private collection of Dr. Hassan A. Dawah, Jizan University, Jizan, Saudi Arabia

MH - Private collection of Dr. Magdi Al Hawagry, Al Baha University, Baha, Saudi Arabia

Identification and Genitalia dissection

Adult flies were initially sorted to subfamily, tribe and then genus and species using Rognes (1991 and 2002), Deeming (1996), and Zumpt (1965). Genitalia dissection followed Rognes (1991) and Deeming (1996). Identification of voucher species was verified by Dr. J. C. Deeming, National Museum of Wales, Cardiff, United Kingdom.

Flies were relaxed by placing selected specimens in a container with wet sand for twenty four hours. Abdomens were removed under a dissection stereomicroscope using fine needles. Removed abdomens were heated in 10% KOH for 2-3 minutes (if needed repeated for two or three times) especially for fresh specimens. Older or dried material was left in 10% KOH for 24 hours at room temperature. The cleared abdomen was washed in a Petri dish two or three times to neutralize any remaining KOH solution. After cleaning, each cleared abdomen was left for five minutes under the light to evaporate any fluid and then transferred into glycerin for dissecting. Genitalic dissection was made in glycerin using fine needles. Some genitalia were mounted on temporary slides (in glycerin) for illustrations. Original illustrations were completed in addition to production of digital image using Auto Montage version 1.2 with Micropublisher 5.0 RTV digital camera from Q Imaging Company, Canada installed on Leica microscope type MZ 12.5 (Leica Company, Germany). All figures were enhanced using Adobe Photoshop CS2.

Identification keys and text

New keys to adults were prepared using material studied and after consulting existing publications including Rognes (2002), Deeming (1996, 2008) and Dawah and Abdullah (2009). Illustrated diagnostic keys to genus and species level are presented. Detailed accounts for each species are given including valid names, synonyms, diagnoses, local and world distribution. All synonyms are cited from Pont (1980), Catalogue of Life (Bisby *et al.*, 2012) (<http://www.catalogueoflife.org/>), and several literatures. Biological information for each taxon if available is also given. The map of species distributions were made by DIVA GIS (version 7.5.0) software.

RESULTS

A total 2, 211 specimens were examined during this study including specimen from over Saudi Arabia and a few other countries. A total twenty five species were identified from this material of the thirty four previously recorded taxa from Saudi Arabia (Table 1). Four species represent new country record for Saudi Arabia, *Pericallimya greatheadi* Zumpt, 1971; *Pollenia hungarica* Rognes, 1987; *Rhyncomya sinaiensis* Rognes, 2002; and *Rhyncomya zumpti* Peris, 1952. Some species are noted to be deleted from Saudi Arabia, *Bengalia minor* and *Chrysomya rufifacies*.

Table 1: Original species references for the Calliphoridae recorded from the Kingdom of Saudi Arabia.

No	Species	Reference
1.	<i>Calliphora vicina</i>	Büttiker <i>et al</i> (1979)
2.	<i>Calliphora croceipalpis</i>	Abu Zoherah <i>et al.</i> (1993)
3.	<i>Pericallimya greatheadi</i>	This study
4.	<i>Cordylobia anthropophaga</i>	Büttiker <i>et al.</i> (1980)
5.	<i>Chrysomya albiceps</i>	Shalaby (1962)
6.	<i>Chrysomya bezziana</i>	Ansari & Oertley (1982)
7.	<i>Chrysomya putoria</i>	Büttiker <i>et al.</i> (1979)
8.	<i>Chrysomya marginalis</i>	Büttiker <i>et al.</i> (1979), Dabbour (1979)
9.	<i>Chrysomya megacephala</i>	Ramadan & El Bihari (1980)
10.	<i>Lucilia cuprina</i>	Büttiker <i>et al.</i> (1979)
11.	<i>Lucilia sericata</i>	Walker & Pittaway (1987)
12.	<i>Pollenia dasyпода</i>	Dabbour (1979)
13.	<i>Pollenia hungarica</i>	This study
14.	<i>Pollenia pediculata</i>	Dawah & Abdullah (2009)
15.	<i>Pollenia rudis</i>	Al Misned (2003)
16.	<i>Cosmina aenea</i>	Abu Thuraya (1982)
17.	<i>Cosmina arabica</i>	Dawah & Abdullah (2009)
18.	<i>Cosmina fuscipennis</i>	Dawah & Abdullah (2009)
19.	<i>Cosmina prasina</i>	Dawah & Abdullah (2009)
20.	<i>Cosmina viridis</i>	Abu Thuraya. 1982
21.	<i>Isomyia terminata</i>	Dawah & Abdullah (2009)
22.	<i>Metalliopsis arabica</i>	Deeming (2008)
23.	<i>Rhinia apicalis</i>	Dawah & Abdullah (2009)
24.	<i>Rhyncomya bullata</i>	Deeming (2008)
25.	<i>Rhyncomya callopis</i>	Deeming (1996)
26.	<i>Rhyncomya desertica</i>	Deeming (1996)
27.	<i>Rhyncomya jordanensis</i>	Dawah & Abdullah (2009)
28.	<i>Rhyncomya nigripes</i>	Dawah & Abdullah (2009)
29.	<i>Rhyncomya sinaiensis</i>	This study
30.	<i>Rhyncomya zumpti</i>	This study
31.	<i>Stomorphina cribrata</i>	Dawah & Abdullah (2009)
32.	<i>Stomorphina lunata</i>	Dawah & Abdullah (2009)
33.	<i>Stomorphina rugosa</i>	Dawah & Abdullah (2009)
34.	<i>Villeneuveilla seguyi</i>	Deeming (1996)

Based species recorded from the Arabian Peninsula (Table 2) the following ten species, not yet recorded from Saudi Arabia, but possible are included in the keys. These species included *Bengalia peuhi* Villeneuve, 1914; *Pollenia semicenerea* Villeneuve, 1912; *Cosmina aenea* (Fabricius, 1805); *C. ebejeri* Deeming, 1996; *C. fishelsoni* Rognes, 2002; *Pararhynchomyia cribriformis* Becker, 1910; *Rhinia nigricornis* (Macquart, 1843); *Rhyncomya aravaensis* Rognes, 2002; *R. io* Peris, 1951; *R. tristis* Séguay, 1933; and *R. varifrons* Becker, 1910.

Table 2: List of the Calliphoridae known from Arabian Peninsula. Taken from this study, Deeming (1996, 2008), and Pont (1980).

	Species	Saudi Arabia	U.A.E	Oman	Yemen
1.	<i>Bengalia peuhi</i>	-	X	X	X
2.	<i>Calliphora croceipalpis</i>	X	-	-	X
3.	<i>Calliphora vicina</i>	X	-	-	-
4.	<i>Cordylobia anthropophaga</i>	X	-	-	-
5.	<i>Pericallimya greatheadi</i>	X	-	X	X
6.	<i>Chrysomya putoria</i>	X	-	-	X
7.	<i>Chrysomya albiceps</i>	X	X	X	X
8.	<i>Chrysomya bezziana</i>	X	-	X	-
9.	<i>Chrysomya marginalis</i>	X	X	X	X
10.	<i>Chrysomya megacephala</i>	X	X	X	-
11.	<i>Lucilia cuprina</i>	X	-	-	-
12.	<i>Lucilia sericata</i>	X	-	-	-
13.	<i>Pollenia dasypoda</i>	X	-	-	-
14.	<i>Pollenia hungarica</i>	X	-	-	-
15.	<i>Pollenia pediculata</i>	X	-	-	-
16.	<i>Pollenia rudis</i>	X	-	-	-
17.	<i>Cosmina aenea</i>	X	-	-	-
18.	<i>Cosmina Arabica</i>	X	X	-	X
19.	<i>Cosmina ebejeri</i>	-	-	X	-
20.	<i>Cosmina fishelsoni</i>	-	X	-	-
21.	<i>Cosmina fuscipennis</i>	X	-	X	-
22.	<i>Cosmina prasina</i>	X	-	-	-
23.	<i>Cosmina viridis</i>	X	-	X	X
24.	<i>Isomyia terminate</i>	X	-	X	-
25.	<i>Metalliopsis arabica</i>	X	X	-	-
26.	<i>Pararhyncomyia cribiformis</i>	-	-	X	X
27.	<i>Rhinia apicalis</i>	X	X	X	X
28.	<i>Rhinia nigricornis</i>	-	X	-	-
29.	<i>Rhyncomyia aravaensis</i>	-	X	X	-
30.	<i>Rhyncomyia bullata</i>	X	X	X	-
31.	<i>Rhyncomyia callopis</i>	X	-	-	-
32.	<i>Rhyncomyia desertica</i>	X	X	X	-
33.	<i>Rhyncomyia io</i>	-	-	X	-
34.	<i>Rhyncomyia jordanensis</i>	X	X	X	X
35.	<i>Rhyncomyia nigripes</i>	X	X	X	-
36.	<i>Rhyncomyia sinaiensis</i>	X	-	-	-
37.	<i>Rhyncomyia tristis</i>	-	-	-	X
38.	<i>Rhyncomyia varifrons</i>	-	-	-	X
39.	<i>Rhyncomyia zumpti</i>	X	-	-	-
40.	<i>Stomorphina cribrata</i>	X	X	-	-
41.	<i>Stomorphina lunata</i>	X	-	X	-
42.	<i>Stomorphina rugosa</i>	X	-	-	-
43.	<i>Villeneuveiella seguyi</i>	X	X	X	X

X: recorded, -: not recorded

The Calliphoridae in Saudi Arabia are represented by five subfamilies, the Calliphorinae, Chrysomyinae, Luciliinae, Polleniinae and Rhiniinae. The subfamily Calliphorinae included *Bengalia minor*, *Calliphora vicina*, *C. croceipalpis*, *Pericallimya greatheadi*, and *Cordylobia anthropophaga*. The subfamily Chrysomyinae was represented by a single genus *Chrysomya*, with four species, *C. albiceps*, *C. bezziana*, *C. marginalis*, *C. putoria*, and *C. megacephala*. The subfamily Luciliinae was represented by two common species, *Lucilia cuprina* and *L. sericata*.

The subfamily Polleniinae was represented by a single genus *Pollenia* with four species, *P. dasypoda*, *P. hungarica*, *P. pediculata*, and *P. rudis*. The subfamily Rhiniinae was represented by seven genera and 19 species, *Cosmina aenea*, *C. arabica*, *C. fuscipennis*, *C. prasina*, *C. viridis*, *I. terminata*, *Metalliopsis arabica*, *Rhinia apicalis*, *Rhyncomya bullata*, *R. callopis*, *R. desertica*, *R. jordanensis*, *R. nigripes*, *R. sinaiensis*, *R. zumpti*, *Stomorhina cribrata*, *S. lunata*, *S. rugosa*, and *Villeneuveilla seguyi*.

Key to subfamily of Calliphoridae known from Saudi Arabia

- 1 Stem-vein of the wing above surface with hair (Fig. 3)..... 2
- Stem vein of the wing bare..... 3
- 2 Basicosta hairy on underside, spread from the base of the wing to point of junction with subcosta (Fig. 41). Subcostal sclerite setose. Face not protruding in lateral view..... **Chrysomyinae**
- Basicosta hairy on underside, present only around junction point with humeral crossvein (Fig. 157). Subcostal sclerite bare. Face protruding in lateral view..... **Rhiniinae**
- 3 Sides of thorax with crinkly yellow hairs (Fig. 96). Nonmetallic body, mostly black ground color. Proepisternum bare..... **Polleniinae**
- Crinkly yellow hair absent. Metallic coloration. Proepisternum setose..... 4
- 4 Green-blue metallic species. Parafacialia bare. Coxopleural streak absent (Fig.72)..... **Luciliinae**
- Dark blue metallic species. Parafacialia setose. Coxopleural streak present (Fig. 21)..... **Calliphorinae**

Subfamily Calliphorinae

Three species of the Calliphorinae were collected during this study, *Calliphora vicina*, *Cordylobia antropophaga*, and *Pericallimyia greatheadi*. Two additional species, *Bengalia minor* and *C. croceipalpis* have been previously recorded from Saudi Arabia but were not collected during this study are included in the following key. *Bengalia peuhi* recorded from neighboring countries may eventually be found in Saudi Arabia is also included in the key. Characters used in the key for the two *Bengalia* species were taken from Rognes (2012).

Key to species of Calliphorinae

- 1 Proboscis short and swollen. Large dull flies..... 2
- Proboscis normally developed and not swollen. Variously colored..... 3
- 2 Sternite 5 a flap short and transverse. Epandrium yellow..... *Bengalia minor*
- Sternite 5 a flap with concave margin posteriorly. Epandrium black or dark brown..... *Bengalia peuhi*
- 3 Parafacialia hairy (Figs. 31, 32). Basicosta yellowish pale (Fig. 29). Body yellow (Fig. 30). First flagellomere yellow..... *Cordylobia antropophaga*
- Parafacialia bare. Basicosta yellowish brown. Body dark blue..... 4
- 4 Thorax and abdomen with long bristles. Scutellum yellowish ½ area to apex. Apex of abdomen bright yellowish. First flagellomere black. Male cerci tapering to an acute apex (Fig. 24). Surstylus apex thin and acute apically (Fig. 25)..... *Pericallimyia greatheadi*
- Bristles of thorax and abdomen not long. Scutellum completely gray-blue or dark. Abdomen dark metallic blue..... 5
- 5 Basicosta yellow. Buccal area yellow with black buccal hair. First flagellomere yellowish brown. Male cerci long and straight (Fig. 15). Surstylus weakly curved with long hairs (Figs. 15, 16)..... *Calliphora vicina*

- Basicosta brown. Buccal area completely black with black hair
*Calliphora croceipalpis*

Genus *Bengalia*

Bengalia peuhi Villeneuve, 1914

Bengalia peuhi Villeneuve, 1914: 253.

Afridigalia peuhi, Lehrer 2005: 61

Bengalia peuhi, Rognes 2005: 443-471, 2012: 14.

Material examined: 2♀.

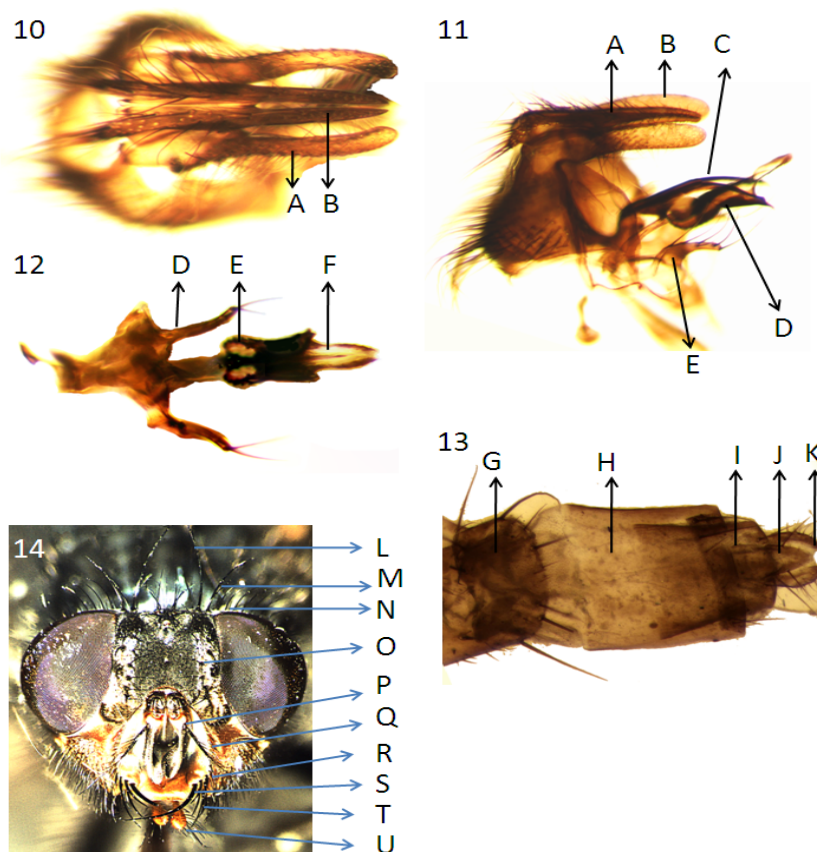
Nigeria, Bauchi Yankari, Game Reserve, 25.III.1980, R. Dransfield, 1♀ (NMWC);
 Bauchi Yankari, Game Reserve, 7-10.II.1981, R. Dransfield, 1♀ (NMWC).

Total female length 10-11 mm.

Head: Proboscis swollen. Parafacialia bare. Pedicel with a bundle long setae and arista hairy.

Thorax: Thorax laterally and humeral callus yellow. Thorax dorsally grayish-black. Anterior spiracle white pale. Lower calypter oval and bare dorsally. Wing infuscated. Basicosta white pale.

Abdomen: Tergites 4 and 5 with robust setae marginally. Sternites with black marginally setae.



Figs. 10-14. Character terminology of Calliphoridae. Fig.10. Cerci (A) and surstylus (B) of *C.vicina*, dorsal view. Fig. 11. Aedeagal, paraphallus (C), Hypophallus (D) and Pregonite (E) of *C.vicina*, lateral view. Fig. 12. Aedeagus, lateral duct (F) of *C.vicina*, ventral view. Fig. 13. Ovipositor, Tergite 6 (G), Tergite 7 (H), Tergite 8 (I), Epiproct (J), and cerci (K) of *L. cuprina*, dorsal view. Fig. 14. Head of *C. vicina*, inner vertical setae (L), Outer vertical setae (M), Postocular setae (N), Frontal setae (O), First flagellomere (P), Arista (Q), Supravibrissal setae (R), Vibrissa (S), Subvibrissal setae (T), Palp (U).

Genitalia: Not dissected (see Rognes, 2012).

Comments: The occurrence of *B. peuhi* in Saudi Arabia was not reconfirmed in this study. Two females from Nigeria were studied to provide the above description. *Bengalia peuhi* is widespread in the Afrotropical and Oriental regions (Rognes, 2009, 2012; Lehrer, 2005). Deeming (1996, 2008) listed this species from Oman, UAE, and Yemen. No doubt that it should occur in Saudi Arabia especially in southwestern and southeastern areas. Lehrer (2005) treatment of *B. peuhi* in the genus *Afridigalia* was rejected by Rognes (2005).

Biology: Rognes (2009) summarized the interesting behavior of the genus, indicating that adult *Bengalia* will “snatch from ants” prey which they are carrying that include “ant pupae, insect larvae, termites” and then “mercerate the prey and suckout their contents”.

***Calliphora croceipalpis* Jaennicke, 1867**

Calliphora croceipalpis Jaennicke, 1867: 376.

Calliphora capensis Brauer & Bergentstamm, 1891: 442, Zumpt, 1956: 95.

Calliphora parasacra Speiser, 1910: 155, Zumpt, 1956: 95.

The description of *Calliphora croceipalpis* is summarized from Zumpt (1965, 1956).

Total length 7-12 mm in both sexes.

Head: Buccae black and with black hairs. In male, the frons narrow, upper facets of the eyes slightly enlarged, frontal strip black, antennal groove with antenna, parafacialia black, parafrontalia silvery dust, palpi orange. Similar in females except frons at vertex about ½ as wide as the eye is long.

Thorax: Blackish blue with pollinosity. Anterior and posterior spiracles yellow. Wing hyaline with basicosta brown. Propleuron depression hairy.

Abdomen: Metallic dark blue with white pollinosity.

Comments: *Calliphora croceipalpis* is tentatively included as potential member of Calliphoridae of Saudi Arabia. Abu Zoherah *et al.* (1993) merely listed this species from Saudi Arabia without any reference to voucher material. *Calliphora croceipalpis* is considered an endemic species of Africa and widely distributed in the Afrotropical Region (Erzinçlioğlu, 1987). Pont (1980) listed this species from Yemen. Adults are very similar to *C. vicina* (Zumpt, 1956) and can be distinguished by above key.

Biology: Erzinçlioğlu (1987) and Zumpt (1956) consider this species a carcass breeder in Africa. Porter (1924) and Zumpt (1956) have indicated that *C. croceipalpis* has been implicated in cases of human myiasis.

***Calliphora vicina* Robineau-Desvoidy, 1830**

Figures 15-23.

Calliphora vicina Robineau-Desvoidy, 1830: 453.

Calliphora littoralis Robineau-Desvoidy, 1830: 435, Rognes, 1991: 63.

Calliphora monspeliaca Robineau-Desvoidy, 1830: 436, Rognes, 1991: 63.

Calliphora musca Robineau-Desvoidy, 1830: 436, Rognes, 1991: 63.

Calliphora nana Robineau-Desvoidy, 1830: 436, Rognes, 1991: 63.

Calliphora spitzbergensis Robineau-Desvoidy, 1830: 435, Rognes, 1991: 63.

Musca thuscia Walker, 1849: 894, Rognes, 1991: 63.

Calliphora rufifacies Macquart, 1851: 216, Rognes, 1991: 63.

Musca aucta Walker, 1853: 334, Rognes, 1991: 63.

Calliphora insidiosa Robineau-Desvoidy, 1863a: 695, Rognes, 1991: 63.

Calliphora thuranica Rohdendorf, 1926: 90, Rognes, 1991: 63.

Material examined: 9♂, 11♀.

Asir, Abha, Wadi Abha, 28.IV.2011, M. Sharaf, H. Setyaningrum, A. Al Ansi, S.N, N 18° 22'03" E 42° 50'82", 1♂, 1♀ (KSMA). **Riyadh**, Deirab, 6.IV.2000, Suud, 5♂, 6♀

(KSMA); Rhodet khorim, 14.I.2012, H. Setyaningrum, N 25°22'986" E 47°16'712" 559m, 3♂, 4♀ (KSMA).

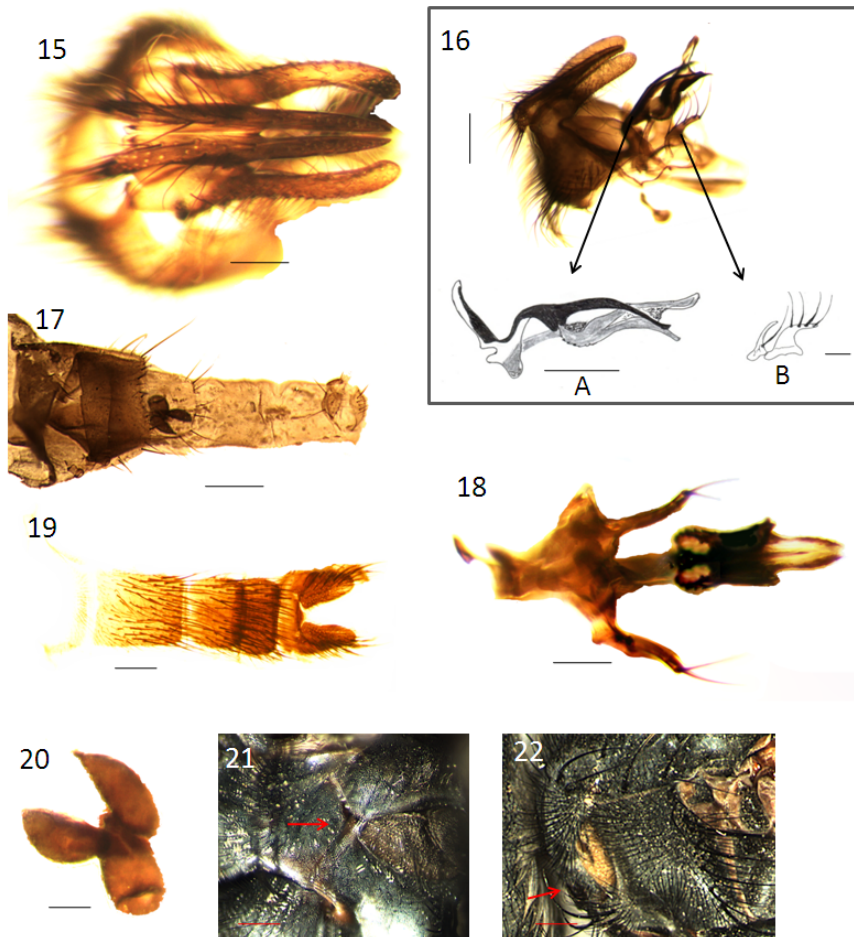
Total length, male 8-9 mm (n= 6), female 9–12 mm (n= 7).

Head: Frons, fronto orbital setulae gray-black, upper of $\frac{1}{2}$ parafacial and posterior of more $\frac{1}{2}$ of the lower part of the face dark. Facial ridges and edges of oral cavity orange. Occiput with pale setulae and gena with black hair. In male, vibrissa setulae robust, long $>\frac{1}{2}$ as wide as facial plate, black.

Thorax: Dorsal setulae irregular in length, longitudinal gray bands on presutural and postsutural areas, anterior spiracle yellow; calypters brown or conspicuously pigmented; upper calypter darkly margined with marginal dark hairs; scutellum blue-black to dark brown at apex. Wing with basicosta yellowish brown.

Abdomen: Metallic blue with silvery dust, covering dense bristles with conspicuous tessellate pattern.

Genitalia: Male, surstylus weakly curved (Fig. 15) with apex rounded, cerci long straight and apex acute; aedeagus (Figs 16, 18) a “two sided blade” apically, paraphallus curved, hypophallus sclerotised apically lacking serrations. Sternites ventrally with dense setae (Fig. 19). Female, ovipositor straight with sternites 6 and 7 narrow (Fig. 17) and spermathecae oval (Fig. 20).



Figs. 15-22. *Calliphora vicina*. Fig. 15. Male cerci and surstylus, dorsal view (Scale 0.2 mm). Fig. 16. Male cerci, aedeagus (A), pre and postgonite (B) lateral view (scale 0.2 mm). Fig. 17. Female ovipositor, dorsal view (scale 0.2 mm). Fig. 18. Male aedeagus, ventral view (scale 0.2 mm). Fig. 19. Male sternite, (scale 0.1 mm). Fig. 20. Female spermathecae, ventral view (scale 0.1 mm). Fig. 21. Coxopleural streak, (scale 1 mm). Fig. 22. Proepisternum (scale 1 mm).

Comments: *Calliphora vicina* is a cosmopolitan species (Kurahashi, 1989; Kaczorowska, 2006; Rognes, 2002; Whitworth, 2006) and apparently introduced into the Afrotropical Region (Erzinçlioğlu, 1987). Regionally, *C. vicina* has been recorded from Egypt (Morsy *et al.*, 1991), Palestine and Syria (Rognes, 2002). Abu Zoherah *et al.* (1993), Büttiker *et al.* (1979) and Al Misned (2003) has listed this species previously from Saudi Arabia. During this survey, *C. vicina* was collected in Asir and Riyadh provinces (Fig. 23).



Fig. 23: Distribution of *Calliphora vicina* in Saudi Arabia.

Biology. Adults of *C. vicina* are attracted to “refuse and decomposing animal matter” (Rognes, 2002). This species is species often used in forensic entomology (Greenberg, 2002). H.A Dawa (personal communication) has reported that in southwestern Saudi Arabia this species is a useful indicator of how long a carcass has been exposed because of its consistent arrival and colonization, especially during winter months (13-24 °C). The adults listed in this study were collected in January and April.

Genus *Pericallimyia*
***Pericallimyia greatheadi* Zumpt, 1971**

Figures 24-28.

Pericallimyia greatheadi Zumpt, 1971: 3.

Material examined: 1♂, 2♀.

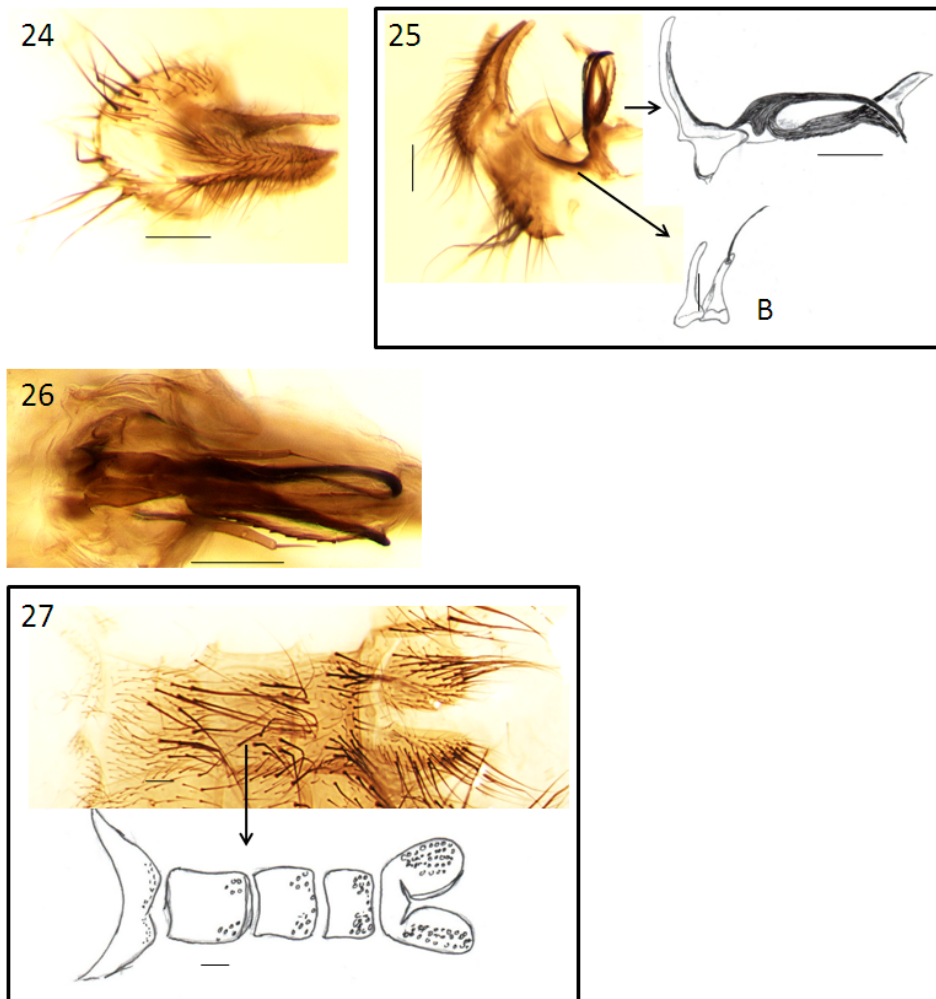
Asir, Abha, Wadi Abha, 28.IV.2011, M. Sharaf, H. Setyaningrum, A. Al Ansi, S.N, N 18° 22' 03" E 42° 50' 82", 1♀ (KSMA). **Baha**, Baha, 20.VIII. 2007, H.Al Dhafer, N 20° 525' E 41° 268', 1♂ (KSMA). Wadi Turubah, 14.X.2010, H.Al Dhafer, B. Kondratieff, H. Fadl, A. El Gharbawy, S.N, N 20° 14' 23" E 41° 14' 53", 1♀ (KSMA). Total length, male 8 mm (n= 1) and female 9-10 mm (n= 2).

Head: Gena and parafacialia gray-black pilose. Vibrissa normal.

Thorax: Shiny gray-black, transverse pattern reaching both anterior and posterior margin, bristles long; scutellum rounded apically, margins gray.

Abdomen: Apically rounded, with gray and black sarcophagid like pattern, abdomen with long bristles, sternite 5 with long marginal setae (Fig. 27).

Genitalia: Male, surstylus slender (Fig. 24); cerci thick with narrowly emarginated at apex, with long dorsal setae. Aedeagus with paraphallus curved at apex, hypophallus sclerotised with lateral serrations (Figs. 25, 26).



Figs. 24-27: *Pericallimya greatheadi*. Fig. 24: Male cerci and surtylus, dorsal view (scale 0.2 mm). Fig. 25: Male cerci, surstylus, aedeagus (A), pre and post gonite (B) lateral view (scale 0.2mm). Fig. 26: Male aedeagus ventral view (scale, 0.1 mm). Fig. 27: Male sternite, ventral view (scale 0.1 mm).

Comments: This species was originally described from Ethiopia and also recorded from Oman (Deeming, 1996). The above specimens represent a new country record for Saudi Arabia, having been collected in Asir and Baha provinces (Fig. 28).



Fig. 28: Distribution of *Pericallimya greatheadi* in Saudi Arabia.

Biology: The adults of *P. greatheadi* were captured during April, August, and October in southwestern of Saudi Arabia. The larvae have been found attacking tree snails (Zumpt, 1971; Deeming, 1996). Deeming (1996) reported the tree snail identified as *Euryptyxis latireflexa* (Reeve), the genus known from Saudi Arabia (Mordan, 1980).

Genus *Cordylobia*

Cordylobia anthropophaga (Blanchard, 1872)

Figures 29-33.

Ochromyia anthropophaga Blanchard, 1872: 127.

Cordylobia gruenbergi Dönitz, 1905: 252, Zumpt, 1965: 70.

Cordylobia murium Dönitz, 1905: 245, Zumpt, 1965: 70.

Material examined: 1♂, 1♀.

Asir, Marabba, 15.X-30.XI.2004, H.A Dawah, M.T, 1♂ (NMWC). **Baha**, Thee Ain, 11.V.2011, H. Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 19° 55' 727" E 41° 26' 426", 754 m, 1♀ (KSMA).

Total length 8-9 mm (1♂, 1♀).

Head: Narrow, yellow-brown, arista with short hair (Fig. 32). In males the frons at narrowest point not more than 2× width of an ocellus. Inner and outer vertical setae well developed.

Thorax: Mesothorax with two longitudinal black stripes, more conspicuous in female.

Abdomen: Black middorsal stripes and lateral bands on tergites 3-5 (Fig. 30), paler in the male.

Comments: *Cordylobia anthropophaga* is well-known African species (Zumpt, 1965), and *C. anthropophaga* has been recorded from Saudi Arabia, Europe (Belgium, United Kingdom, France and Italy) and the United States (Büttiker *et al.*, 1980; Hall & Wall, 1995), probably mostly as adventives. In Saudi Arabia, the two adults of *C. anthropophaga* were collected in southern Saudi Arabia including Baha (above) and Asir as previously reported by Büttiker *et al.* (1980) and Dawah and Abdullah (2009) (Fig. 33). Additionally, Qadri and Al Ahdal (1988) erroneously as *Dermatobia hominis* (Linnaeus), reported seven cases of human cutaneous myiasis referable to *C. anthropophaga* (Akhter *et al.*, 2000) in the Asir Province. Büttiker *et al.*, (1980) also reported five human myiasis cases in Asir Province. This species has apparently established in certain areas in southwestern Saudi Arabia (A. Alahmed personal communication). This species is easily separated from other genera of the subfamily by the stout and compact body, yellowish-brown color with distinctive black pattern, and narrow head.

Biology: The biology of *C. anthropophaga* was described by Zumpt (1965). Adults are active in the early morning and late afternoon, feeding on the plant fluids (Zumpt, 1959). Oviposition occurs mostly in the dry to wet sands often contaminated by urine or feces. In cases of human myiasis, eggs are laid often on damp clothes, and then hatching larvae penetrate the skin forming boil-like tumors (James 1947). The adults known from Saudi Arabia were captured in May, October, and November.



Figs. 29-32: *ordylobia anthrophophaga*. Fig. 29: Basicosta (scale 1 mm). Fig. 30: ody, lateral view (scale 3 mm). Fig. 31: Front head, showing vibrissa, frons, and first flagellomere, frontal view (scale 3 mm). Fig. 32: Head, lateral view (scale 3 mm).



Fig. 33: istribution of *Cordylobia anthropophaga* in Saudi Arabia.

Subfamily Chrysomyinae

Subfamily Chrysomyinae in Saudi Arabia represented only by a single genus *Chrysomya*.

Key to species of Chrysomyinae

- 1 Thorax without proepimeral setae. Metallic green body. Subvibrissal setae black or dark. Abdominal tergites banded posteriorly. Anterior spiracle white. Male, surstylus subequal in width throughout length (Figs. 34, 35). Aedeagus, in lateral view with serrated process (Fig. 37). Female ovipositor with a full length sternite 8 (Fig. 38)..... *Chrysomya albiceps*
- Thorax with proepimeral. Metallic blue body. Subvibrissal setae pale yellowish... 2
- 2 Wings with anterior marginal black band. Male, anal cerci longer than surstylus, surstylus with short process (Fig. 51). Aedeagus curved, hypophallus with serrations (Figs. 52, 53)..... *Chrysomya marginalis*
- Wings without anterior dark band may be infusate at base. Male genitalia otherwise 3
- 3 Anterior spiracle white. Thorax and abdomen with white dusting transverse pattern *Chrysomya putoria*
- Anterior spiracle black or brown..... 4
- 4 Lower calypter smoky brown, with hairs dark (Fig. 56). In the male eyes, facet on upper three quarter sharply demarcated from small facets on lower most quarter (Fig. 55)..... *Chrysomya megacephala*
- Lower calypter white concolorous with upper calypter, distally white-yellow hair (Fig. 49). In the male eyes, uppermost facets not much larger than lowermost facets (Fig. 48)..... *Chrysomya bezziana*

***Chrysomya albiceps* (Wiedemann, 1819)**

Figures 34-42.

Musca albiceps Wiedemann, 1819: 38

Musca bibula Wiedemann, 1830: 672, Zumpt, 1956: 192.

Musca elara Walker, 1949: 870, Zumpt, 1956: 192.

Musca emoda Walker, 1849: 872, Zumpt, 1956: 192.

Musca himella Walker, 1849: 876, Zumpt, 1956: 192.

Lucilia arcuata Macquart, 1851: 220, Zumpt, 1956: 192.

Lucilia testaceifacies Macquart, 1851: 247, Zumpt, 1956: 192.

Musca felix Walker 1853, Bisby *et al.*, 2012.

Somomyia nubiana Bigot, 1877: 38, Zumpt, 1956: 192.

Somomyia annulata Brauer, 1899, Bisby *et al.*, 2012.

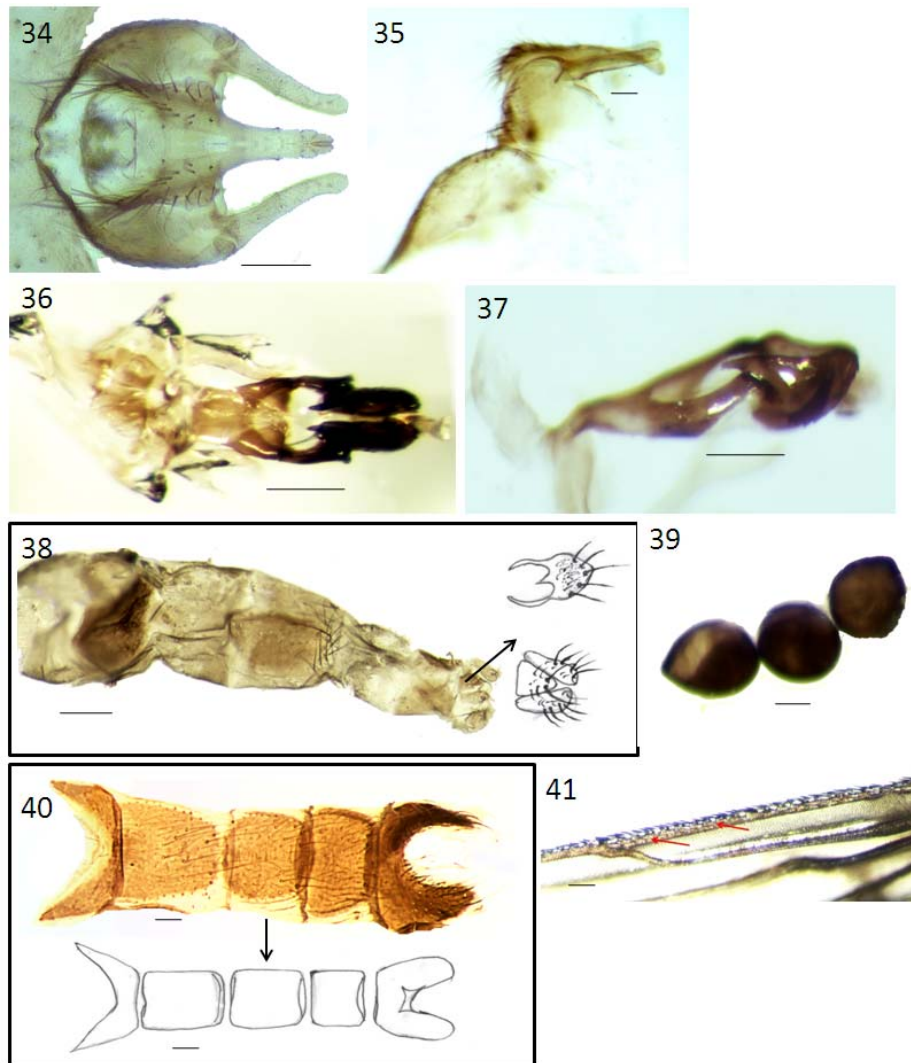
Paracompsomyia verticalis Adams, 1905: 202, Zumpt, 1956: 192.

Chrysmomyia cupronitens Villeneuve, 1913: 367, Zumpt, 1956: 192.

Compsomyia albiceps var. *flaviceps* Séguy, 1928: 142, Zumpt, 1956: 192.

Compsomyia albiceps var. *mascarenhasi* Séguy, 1928: 11, Zumpt, 1956: 192.

Chrysomyia albiceps var. *indica* Patton & Cushing, 1934: 221, Zumpt, 1956: 192.



Figs. 34-41: *Chrysomya albiceps*. Fig. 34: Male epandrium, cerci and surstylus, dorsal view (scale 0.2 mm). Fig 35: Male epandrium, cerci and surstylus, lateral view (scale 0.2 mm). Fig 36: Male aedeagus, dorsal view (scale 0.1 mm). Fig 37: Male aedeagus, lateral view (scale 0.1 mm). Fig 38: Female ovipositor, dorsal view (scale 0.2 mm). Fig 39: Female spermathecae, dorsal view (scale 0.1 mm). Fig 40: Male sternite, ventral view (scale 0.2 mm). Fig 41: Wing underside (scale 0.2 mm).

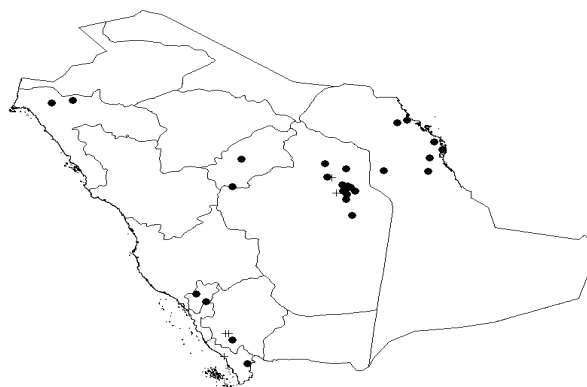


Fig. 42: Distribution of *Chrysomya albiceps* in Saudi Arabia.

Material examined: 267♂, 861♀.

Asir, Abha, Al Areen, 7.II.2011, H. Bil Harits, S.N, 2♀ (KSMA); Wadi Abha, 28.IV.2011, M. Sharaf, H. Setyaningrum, A. Al Ansi, S.N, N 18° 22'3" E 42° 50'82" 1990 m, 1♀ (KSMA). **Baha**, Amadan, 14.X.2010, H.Al Dhafer, B. Kondratieff, H. Fadl, A. El Gharbawy, S.N, N 20° 12' 11" E 41° 13' 43", 2♂, 14♀ (KSMA); Bil jurashi, 17.V.2010, H.Al Dhafer, A El Torkey, S.N, 1♀ (KSMA); Baha, 2006, 2♂, 1♀ (MH); Wadi Tourabah, 9.III.2012, H. Setyaningrum, S.N, N 20° 14'369" E 41° 15'234", 6♂, 1 ♀ (KSMA); Wadi Baqrah, 13.III.2012, H. Fadhallah, H. Setyaningrum, L.T, N 18° 47'476" E 41° 56'310", 1♀ (KSMA); Baha, Wadi Khat, 13.III.2012, M. Abdeldayem, A. El Torkey, Beating, N 19° 05'374" E 41° 58'367" 490 m, 1♂ (KSMA). **Eastern**, Abuhadriyah, Abuhadriyah (Dammam Road), Kholidiyah Farm, 3.III.2011, H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 26° 38' 46" E 49° 48' 30" 3m, 6♂, 9♀ (KSMA). Abqaiq, Abqaiq, 3.III.2011, H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 25°57'44" E 49°38'49.7" 70 m, 1♀ (KSMA). Ahsa, Ahsa, 4.III.2011, H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 25° 57' 44" E 49° 38' 49.8" 70 m, M.Isa Farm, 2♀ (KSMA). Al Ahsa, 4.III.2011, H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 25° 16' 11.7" E 49°37'34.5", weeds, 1♂; Al Ahsa, Buhadi Farm, 4.III.2011, H. H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 25° 19' 27" E 49° 38' 34.8", Alfalfa, 27♂, 10♀ (KSMA). Dammam, Dammam, 15.XI.2007, S. Al Bahrani, S Al Salman, S.N, 1♂ (KSMA). Dammam (Riyadh-Dammam Road), 250 km before Riyadh, 5.III.2011, H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 25° 50' 00" E 48° 50'23", Corn plant, 3♀; Dammam (Riyadh-Dammam Road), 150 km before Riyadh, 5.III.2011, H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 25° 24 '59" E 47° 58' 36" 424m, 1♀; Dammam (Riyadh-Dammam Road), 120 km before Riyadh, 5.III.2011, H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 25° 9'12" E 37° 34'45" 432 m, 1♂; (all KSMA). Hofuf, Hofuf, 10.VI.1979, Talhouk, Sheep Wound, 1♂ (ANMA); Hofuf, 10.VI.1979, A. Taher, 1♀ (ANMA). An Nuayriyah, An Nuayriyah, Al Faisoliyah Farm, 2.III.2011, H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 27° 26'24" E 48° 26'41.3" 60m, 17♂, 23♀; An Nuayriyah, Ornamental plant, 1.III.2011, H. H. Al Dhafer. Setyaningrum, A. Al Ansi, L.T, N 27° 28'4.7" E 48° 28'16.6" 64m, 2♂, 3♀; An Nuayriyah, 2.III.2011, H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 27°25'25.7" E 48°27'19.6" 67m, 16♂, 13♀; An Nuayriyah (Dammam Road), 3.III.2011, H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 27° 34'31" E 48° 50' 52" 15m, 1♂; (all KSMA). Al Mulaidja, Al Mulaidja, Al Wadhani Farm, 2.III.2011, H. H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, 1♀ (KSMA). Jubayl, Jubayl (Dammam Road), Al Yousif Farm, 3.III.2011, H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 24 24'21" E 48 50'52", 15m, Weeds, 1♂, 3♀ (KSMA); Dammam, 29.XI.1990, M. Amoudi, 4♀ (ZMKSU). **Jizan**, Fifa, 4.VI.1974, Abu Zoherah , 1♀ (ANMA). **Najran**, Hubuna, Wadhi Hubuna, 14.I.2013, A. Ansi, I. Rasool, S. Khan, S.N, N 17 50'411" E 44 02'286" 1309 m, 2♀ (KSMA). **Riyadh**, Deirab, 6.XII.2009, H. Al Dhafer, A.Al Gharbawy, emerged at 19.XII.2009, Nabk; 3♂, 115♀; Deirab, 20.XII.2009, H. Al Dhafer, A.Al Gharbawy, A.Al Torkey, B.T, Nabk, 7♀; Deirab, 3.III.2010, H. Al Dhafer, A.Al Gharbawy, A.Al Torkey, Emerged at 17.III.2010, Nabk, 1♀; Deirab, 3.I.2010, H. Al Dhafer, A.Al Gharbawy, A. Al Torkey, Emerged 27.I.2010, Nabk, 2♂, 4♀; Deirab, 17.I.2010, H. Al Dhafer, A.Al Gharbawy, A. Al Torkey, 1♂; Deirab, 1.XI.2009, H. Al Dhafer, A.Al Gharbawy, A. Al Torkey, S.T, Grapes, 2♂, 1♀; Deirab, 6.XII.2009, H.Al Dhafer, A.Al Gharbawy, S.T, Nabk, 5♂, 3♀; Deirab, 15.XI.2010, H. Al Dhafer, A. Al Gharbawy, S.T, Nabk, 2♂, 1♀; Deirab, 14.III.2010, H. Al Dhafer, A.Al Gharbawy, S.T, Pomegranate, 1♂; Deirab, 2.I.2011 H. Al Dhafer, A. Al Gharbawy, B.T, Fig, 21♀; Deirab, 6.XII.2009, H. Al Dhafer, A.

Al Gharbawy, S.T, Grapes, 2♂, 3♀; King Saud University, 28.I.2009, A.Widyawan, S.N, 1♀; Deirab, 29.VI.1998, A. Al Sohibany, 34♀ (all KSMA); Riyadh, 15.II.1981, A. Talhouk, 4♂, 1♀; Riyadh, 15.II.1981, Abu Zoherah, 1♀; Riyadh, 18.III.1978, A. El Madi, 1♂; Riyadh, 8.I.1985, A. Talhouk, S. Tilkian, R. Abu Zoherah, M. Al Taher, A. Klaudi, 2♂; Al Kharj, 25.III.1983, A. Talhouk, 1♀; Al Kharj, 17.V.1981, Tilkian, 1♂; Al Kharj, 17.V.1981, Abu Zoherah, 1♂; Riyadh, 2.V.1981, A. El Madi, 1♀; Al Kharj, 5.V.1993, A. Aziz, Cauliflower, 1♀; Riyadh, 14.V.1978, A. Talhouk, 1♀; Riyadh, 18.III.1978, A. Taher, 1♀; Riyadh, 12.XII.1978, A. Taher, 1♂; Riyadh, 24.VII.1977, Abu Zoherah, 1♀; Riyadh, 18.III.1978, A. Talhouk, 1♀, 1♂; Riyadh, 15.II.1981, A. El Madi, 1♂; Riyadh, 15.II.1981, A. Taher, 1♂ (all ANMA); Oryga (Riyadh), 18.II.1989, Alfalfa, 1♂; Ibex Reserve, Hutet Bani Tamim, 15.XII.2007, Y. Al Dryhim, H.Al Dhafer, M. Al Motairy, A. El Gharbawy, B.T, 27♂, 102♀; Ibex Reserve, Hutet Bani Tamim, 11.I.2008, Y. Al Dryhim, H.Al Dhafer, M. Al Motairy, A. El Gharbawy, B.T, 2♂, 39♀; Ibex Reserve, Hutet Bani Tamim, 17.XI.2007, Y. Al Dryhim, H.Al Dhafer, M. Al Motairy, A. El Gharbawy, B.T, 9♀; Ibex Reserve, Hutet Bani Tamim, 1.XII.2007, Y. Al Dryhim, H.Al Dhafer, M. Al Motairy, A. El Gharbawy, B.T, 16♀; Ibex Reserve, Hutet Bani Tamim, 20.X.2007, Y. Al Dryhim, H.Al Dhafer, M. Al Motairy, A. El Gharbawy, S.N, 1♀; Ibex Reserve, Hutet Bani Tamim, 7.III.2008, Y. Al Dryhim, H.Al Dhafer, M. Al Motairy, A. El Gharbawy, B.T, 2♀; Ibex Reserve, Hutet Bani Tamim, 28.XII.2007, Y. Al Dryhim, H.Al Dhafer, M. Al Motairy, A. El Gharbawy, BT, 31♀; Ibex Reserve, Hutet Bani Tamim, 2.XII.2007, Y. Al Dryhim, H.Al Dhafer, M. Al Motairy, A. El Gharbawy, B.T, 9♂, 75♀; Ibex Reserve, Hutet Bani Tamim, 3.XI.2007, Y. Al Dryhim, H.Al Dhafer, M. Al Motairy, A. El Gharbawy, B.T, 16♀; Hutet Bani Tamim, Wadi Matam, 8.X.2010, H. Al Dhafer, M. Sharaf, S.N, N 23° 27'120" E 46° 41'318" 644 m, 5♂, 12 ♀; Deirab, 6.VI.2010, H. Al Dhafer, A. El Gharbawy, A. El Torkey, M.T, Desert, 2♀; Deirab, 5.XII.2010, H. Al Dhafer. Setyaningrum, B.T. Pomegranate, 1♀; Deirab, 27.XI. 2010, H. Al Dhafer. Setyaningrum, B.T, Pomegranate, 4♀; Deirab, 2.I.2011, H. Al Dhafer. Setyaningrum, B.T, Nabk, 4♀; Al Obaitah, 6.VI.2007, Al Ayedh H, H. Al Dhafer, L.T, 1♀; Tumayr, 10.II.2010, H. Al Dhafer, Al Husein F, M.T, N 25° 42'36" E 45° 52'11", 1♂; Deirab, 5.XII.2010, H. Al Dhafer. Setyaningrum, B.T, Grapes, 1♀; Deirab, 2.I.2011, H. Al Dhafer. Setyaningrum, B.T, Grapes, 1♀; Deirab, 30.XII.2010, H.Setyaningrum, S.N, Grass, 2♂; Al Amariyah, 7.IV.2010, A. Al Othman, S.N, Al Dar Farm, 1♂; Deirab, 30.XII.2009, A. Soffan, S.N, Al Mossa Farm, 4♂, 1♀; Al Uyaynah, 10.III.2010, A. Othman, S.N, 1♀; Boaiteran, 24.II.2011, H.Al Dhafer, B. Kondratieff, H. Fadl, A. El Gharbawy, S.N, N 25° 9'24" E 45° 56'34", Al Salem Farm, 1♀; Riyadh nursery, 13.XI.2007, H. Al Dhafer, A, El Gharbawy, S.N, 1♂, 4♀; Deirab, 5.XII.2010, Al Dhafer, H. Setyaningrum, S.T, 1♂; Diriyah, 30.XII.2010, H.Setyaningrum, S.N, Grass, 1♀; Deirab, 19.XII.2010, H. Al Dhafer. Setyaningrum, B.T, Fig, 81♀; Deirab, 19.XII.2010, H. Al Dhafer. Setyaningrum, B.T, Grapes, 2♂, 16♀; Deirab, 19.XII.2010, H. Al Dhafer. Setyaningrum, B.T, Nabk, 11♀; Deirab, 19.XII.2010, H. Al Dhafer. Setyaningrum, S.T, Grapes, 1♀; Deirab, 17.XII.2010, H. Al Dhafer. Setyaningrum, S.T, Pomegranate, 3♂; Tumayr, 8.II.2010, H.Al Dhafer, F. A Husein, M.T, N 25° 42'36" E 45° 52'11", 2♀; Deirab, 29.XI.1988, Amru, Weeds, 1♀; Tumayr, 1.II.2010, H. Al Dhafer, F. A Husein, M.T, N 25° 42'36" E 45° 52'11", 1♂, 3♀; Tumayr, 26.II.2010, H. Al Dhafer, F. A Husein, M.T, N 25° 42'36" E 45° 52'11", 5♀; Al Wasiel, 19.V.2010, H. Mureed, 1♀; Tumayr, 2.I.2010, H. Al Dhafer, F. A Husein, M.T, N 25° 42'36" E 45° 52'11", 1♂; Tumayr, 25.I.2010, H.Al Dhafer, F. A Husein, M.T, N 25 42'36" E 45 52'11", 3♂; Al Kharj, 18.XI.2009, Y. Al Dryhim, H. Al Dhafer, A. El Torkey, *Calatrophis*, 1♂; Deirab, 2.I.2010, H. Al Dhafer.

Setyaningrum, S.T, Grapes, 1♂, 1♀; Deirab, 31.XII.2010, H. Al Dhafer. Setyaningrum, S.T, Fig, 6♂; Deirab, 31.XII.2010, H. Al Dhafer. Setyaningrum, S.T, Grapes, 1♂; Tumayr, 24.IV.2010, H. Al Dhafer, F. A Husein, M.T, N 25° 42'36" E 45° 52'11", 2♂, 1♀; Deirab, 17.X.2010, H. Al Dhafer, Setyaningrum, S.T, Fig, 1♂; Deirab, 31.XII.2010, H. Al Dhafer. Setyaningrum, S.T, Pomegranate, 2♂; Al Hair, 18.XI.2010, N. Al Abdul Mohsen, S.N, 3♀; Western slaughter, 11.I.2011, Al Husein F, S.N, 1♂, 10♀; Al Maseef, 3.I.2010, Alhamady, S.N, 1♀; Oryga, 27.XII.2010, Alhamady, S.N, 2♂, 2♀; Oryga, 27.XII.2010, Al Wajaan, S.N, 1♂, 2♀; Al Maseef, 3.I.2010, Al Wajaan, S.N, 1♂; Al Amariyah, 13.X.2010, L. Al Dhahabani, S.N, Pussley, 1♂; Diriyah (Agriculture Farm KSU), 19.I.2011, H. Setyaningrum, B.T, 16♀; Diriyah (Nursery), 19.I.2011, H. Setyaningrum, B.T, 1♀; Diriyah, 27.XI.2010, H. Setyaningrum, B.T, 1♀; Deirab, 9.V.2010, Osama, H. Al Dhafer, A. El Gharbawy, A. El Torkey, Water Trap, 1♂; Al Hair, 18.XI.2010, Al Gunaim, S.N, 4♀; Al Uyaynah, 29.I.2011, Al Gunaim, S.N, 1♀; Al Uyaynah, 1.XII.2010, Al Gunaim, S.N, Al Hadlaq Farm, 1♀; Al Uyaynah, 30.XI.2010, H. Al Dhafer, A. Al Ansi, S.N, N 24° 90'63" E 46° 37'16", Corn, 8♂, 11♀; Al Diriyah, 11.XI.2010, Abdel Gayed. A, S.N, 2♂, 3♀; Al Uyaynah, 5.II.2011, S. Al Harbi, S.N, Ad Dhahan Farm, 8♂, 5♀; Al Uyaynah, 1.XII.2010, A. Al Ghunaim, S.N, Al Hadlaq Farm, 1♀; Al Uyaynah, 29.I.2011, A. Al Ghunaim, S.N, 1♀; Western slaughter, 25.XI.2010, A. Motairy, S.N, 3♂, 3♀; Wadi Hanifah, 16.II.2011, H. Setyaningrum, S.N, 5♂, 3♀; Rhodet Khorim A, 13.XI.2011, H. Setyaningrum, B.T, N 25° 22'58" E 47° 16'44", 5♂; Rhodet Khorim A, 19.II.2012, H. Setyaningrum, B.T, N 25° 22'986" E 47° 16'712" 559 m, 3♂, 15♀; Rhodet Khorim B, 19.II.2012, H. Setyaningrum, B.T, N 25° 25'943" E 47° 13'863" 572 m, 1♀; Rhodet Khorim A, 14.I.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 1♂, 1♀; Rhodet Khorim A, 19.I.2012, A. Al Ansi, S.N, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim A, 17.III.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, *Rhazya steicta*, 1♂, 1♀; Rhodet Khorim A, 17.III.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim A, 14.IV.2012, H. Setyaningrum, B.T, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim A, 28.IV.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 2♀; Rhodet Khorim B, 26.XI.2011, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♀; Rhodet Khorim B, 18.II.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 2♀; Rhodet Khorim B, 17.III.2012, H. Setyaningrum, Pitfall Trap, N 25° 25'943" E 47° 13'863" 572 m, *Lycium shawii*, 1♂; Rhodet Khorim B, 14.I.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 6♀; Rhodet Khorim B, 15.I.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♂, 7♀; Rhodet Khorim B, 4.II.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♀; Rhodet Khorim B, 17.III.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, *Rhazya steicta*, 1♂, 2♀; Rhodet Khorim B, 17.III.2012, H. Setyaningrum, Pitfall Trap, N 25° 25'943" E 47° 13'863" 572 m, *Acacia ehrenbergiana*, 1♂; Rhodet Khorim B, 24.III.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 3♀; Rhodet Khorim B, 29.IV.2012, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 1♂; Rhodet Khorim B, 31.III.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 3♂; Rhodet Khorim B, 31.III.2012, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 1♂; Rhodet Khorim B, 1.XI.2012, H. Setyaningrum, Sucking trap, N 25° 25'943" E 47° 13'863" 572 m, *Calatrophis procera*, 1♀; Rhodet Khorim B, 1.XI.2012, H. Setyaningrum, Sucking trap, N 25° 25'943" E 47° 13'863" 572 m, *Rhazya steicta*, 1♂; Rhodet Khorim, 11.IV.2011, Y. Al Dryhim, H. Al Dhafer, A. El Gharbawy, H. Setyaningrum, A. Al Ansi, S.N, N 25° 05'730" E 47° 38'270",

1♂; As Sajr, 17.XI.2011, H. Setyaningrum, S.N, N 25.155 E 44.64, 13♂, 2 ♀; (all KSMA). **Qassim**, Qassim, 8.XII.1989, Alfalfa, 1♀ (KSMA). **Tabuk**, Madinah road, 14.IX.2011, H.Setyaningrum, A. Ansi, S.N, N 28° 25'671" E 36° 47'378" 797 m, 1♂ (KSMA); Duba Road, 15.IX.2011, H.Setyaningrum, A. Ansi, S.N, N 28° 18'389" E 36° 02'874" 824 m, 1♀ (KSMA).

Total length, male 4-9 mm (n= 267), female 6–10 (n= 861).

Head: Genae silvery to yellow covered with fine white hair. Frons mostly white. Ocelli equal in size.

Thorax: Yellowish blue, shiny with little pollinosity. Posterior thoracic spiracle white with fine hairs in the edge in lateral view. Lower calypter pale white, covered with fine white hairs on upper surface.

Abdomen: Metallic green with black posterior tergal bands.

Genitalia: Surstylus subequal in width throughout length, cerci slender elongated with the tip notched (Figs. 34, 35). Aedeagus with serrated process (Figs. 36, 37). Male, sternites 5 rounded apically (Fig. 40). Ovipositor long, sternite 8 sclerotised (Fig. 38). The spermathecae oval and smooth (Fig. 39).

Comments: *Chrysomya albiceps* is almost cosmopolitan, recorded from the Palaearctic, Oriental, Afrotropical regions and recently introduced into the Neotropics and also the Nearctic (Baumgartner & Greenber, 1985; Rognes, 2002; Schumann, 1986; Vanin *et al.*, 2009; Vargas and Wood, 2010). In Saudi Arabia, this species is widespread, known at least from eight provinces (Fig. 42). This species is important in causing cases of myiasis. Additionally, *C. albiceps* is a useful forensic indicator. Studies by H. A Dawah (personal communication) has shown it to be the first species attracted to carrion in southwestern Saudi Arabia, apparently having the ability to detect carrion up to 16 km away. The metallic green coloration of *C. albiceps* easily distinguishes this species from two other confirmed Saudi Arabian species, *C. bezziana* and *C. marginalis*.

Biology: Baumgartner and Greenberg (1985) present aspects on the biology of *C. albiceps* and Erzinçlioğlu and Whitcombe (1983) reported larvae of this species feeding on dung and causing myiasis in Oman. Alahmed (2004) also reported that about 9% of all Diptera larvae removed from 73 sheep were *C. albiceps*.

Chrysomya bezziana Villeneuve, 1914

Figures 43-50.

Chrysomya bezziana Villeneuve 1914: 430.

Pycnosoma bezzianum, Roubaud, 1914: 20, Zumpt, 1965: 99.

Material examined: 8♂, 3♀.

Eastern, Dammam, Abu Hadriyah-Dammam Road, 2.III.2011, H. Al Dhafer, H. Setyaningrum, A. Al Ansi, S.N, N 26 38' 46" E 49 48' 30" 3 m, Isa farm, 2♂, (KSMA); Hofuf, Hofuf, 5.VI.1979, K. Al Taher, 1♀, 1♂; Hofuf, 5.VI.1979, K. El Madi, 1♀, 4♂; Hofuf, 4.VI.1979, K. El Madi, 1♂;(all ANMA). **Riyadh**, Deirab, 3.I.2010, H. Al Dhafer, A. El Gharbawy, A. El Torkey, B.T, emerged at 27.I.2010, 1♀ (KSMA).

Total length male 6-8 mm (n= 8), female 4-7 mm (n= 3).

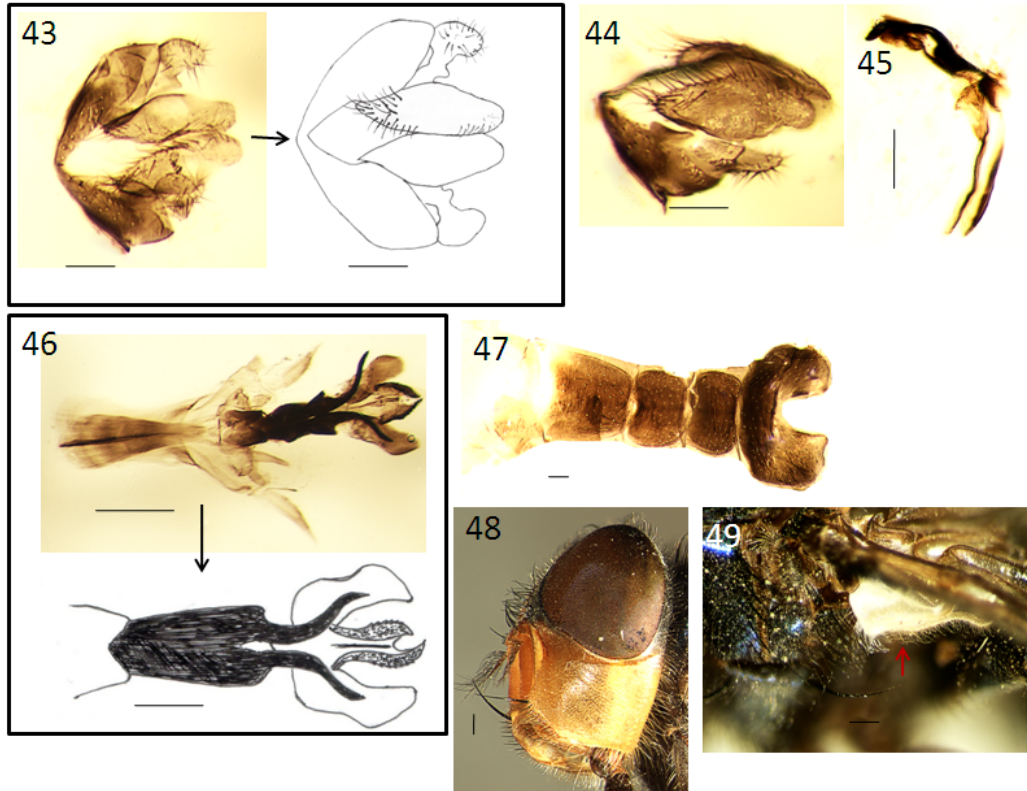
Head: Compound eyes not contiguous, upper facets not separated from lower ones. Gena yellow orange with yellowish hairs.

Thorax: Wings hyaline basally infusate, calypters white with distally whitish-yellow hair.

Abdomen: Metallic blue with tergites having darker posterior reflections. Sternite 5 extending outward horizontally and curved (Fig. 47)

Genitalia: Surstylus short and oval, cerci shorter than in *C. marginalis* and extending forward (Figs. 43, 44). Aedeagus long, hypophallus with sclerotised apically (Fig. 45), in dorsal view paraphallus curved, divergent from base (Fig. 46).

Comments: *Chrysomya bezziana* is widespread in the Afrotropical, Oriental and Australasia regions (James, 1971). In Saudi Arabia, *C. bezziana* was collected from Eastern (Dammam and Hofuf) and Riyadh provinces (Fig. 50).



Figs 43-49: *Chrysomya bezziana*. Fig. 43: Male epandrium, cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 44: Male epandrium, cerci and surstylus, lateral view (scale 0.2mm). Fig. 45: Male aedeagus, lateral view (scale 0.1 mm). Fig. 46: Male aedeagus, dorsal view (scale 0.1 mm). Fig. 47: Male sternites (scale 0.2 mm). Fig. 48: Male head, lateral view (scale 2 mm). Fig. 49: Calypter, lateral view (scale 1 mm).



Fig. 50: Distribution of *Chrysomya bezziana* in Saudi Arabia.

Biology: *Chrysomya bezziana* known also as the Old World Screwworm is an obligatory parasite of mammals during the larval stages. Additionally Ansari and Oertley (1982) reports on a case of human nasal myiasis for this species. Also, numerous cases of myiasis of sheep has been reported for Saudi Arabia by Alahmed (2002, 2004) and Alahmed *et al.* (2006). This species has been also implicated in myiasis of man and domesticated animals, especially in Africa and some areas of Oriental regions (Zumpt, 1965; James, 1947, 1971).

***Chrysomya marginalis* (Wiedemann, 1830)**

Figures 51-54.

Musca marginalis Wiedemann, 1830: 395.

Phamosia tessellata Bigot, 1878: 31, Zumpt, 1956: 187.

Paracompsomyia nigripennis Hough, 1898: 184, Zumpt, 1956: 187.

Chrysomya regalis Robineau-Desvoidy, 1830: 449, Rognes, 2002:13.

Pycnosoma marginalis Séguy, 1928: 104, Rognes, 2002:13.

Chrysomya marginalis Buxton, 1924: 322, Rognes, 2002:13.

Material examined: 44♂, 58♀.

Asir, Abha, Wadi Bin Hasbal, 26.IV.2011, M. Sharaf, H. Setyaningrum, A. Al Ansi, S.N, N 18° 35' 44" E 42° 39'01", 1892 m, 1♀ (KSMA). **Baha**, Amadhan, 14.X.2010, H. Al Dhafer, B. Kondratieff, H. Fadl, A. El Gharbawy, S.N, N 20°12'11" E 41°13'43", 4♂, 3♀; Wadi Turubah, 10.V.2011, H. Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20°12'610" E 41°17'56", 918m, 1♂; Wadi Turubah, 14.V.2011, H. Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20°12' 610" E 41°17'56" 918m, 1♂; Wadi Gala, 16.V.2011, H. Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20°08' 79" E 41°20'561" 1900m, 1♂, 2♀; Thee Ain, 11.V.2011, H. Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 19°55'727" E 41°26'426" 754 m, 1♂; Wadi Bawa, 8.XI.2012. H. Fadl, Beating, N 20° 44.976' E 41° 14.846', 3♀, 1♂; (all KSMA). **Eastern**, Ahsa, Ahsa, 4.III.2011, H. H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 25° 16' 11.7" E 49° 37'34.5", Weeds, Buhadi Farm, 1♀ (KSMA). Dammam, Abu Hadriyah-Dammam Road, 2.III.2011, H. H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 27 34' 21" E 48 50'52.8" A 15m, Al Iba Farm, 2♀, 2♂; Dammam Road, 5.III.2011, H. H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 25° 50' 00" E 48° 59'23", 1♂; Abu Hadriyah-Dammam Road, 2.III.2011, H. H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 26° 38'46" E 49° 48'30" 3 m, Isa Farm, 2♀; (all KSMA). Hofuf, Hofuf, 15.II.1983, R. Abu Zoherah, 1♂ (ANMA). Jubayl, Jubayl-Dammam Road, 3.III.2011, H. H. Al Dhafer. Setyaningrum, A. Al Ansi, S.N, N 24° 24' 21" E 48° 50'52"15 m, Weeds, 1♂ (KSMA). **Jizan**, Fifa, Fifa, 15.II.1981, A. El Madi, 1♂; Fifa, 31.X.1984, A. Talhouk, S. Tilkian, R. Abu Zoherah, K. Al Taher , A. Klaudi, 1♀; Fifa, 15.II.1981, A. Talhouk, 1♀; (all ANMA). Jizan, Jizan, 25.XII.1980, A. Talhouk, 4♀, 1♂; Jizan, 25.XII.1980, A. El Madi, 3♀; Jizan, 1.II.1983, K. Al Taher, 3♂,1♀; Jizan, 22.XII.1980, A. Talhouk, 2♂,1♀; Jizan, 22.XII.1980, K. Al Taher, 1♂; Jizan, 1.II.1983, R. Abu Zoherah, 2♀; Jizan, 1.II.1983, A. Talhouk, 3♂, 1♀; Jizan, 25.XII.1980, K. Al Taher, 1♂; Jizan, 1.II.1983, K. Tilkian, 2♂; Jizan, 22.XII.1980, A. El Madi, 1♀; Jizan, 22.XII.1980, R. Abu Zoherah, 1♀; Jizan, 1.II.1983, A. El Madi, 1♀; Jizan, 1.II.1983, A. El Madi, 1♂ (all ANMA). **Mecca**, Qilwah Adhom, 9.XI.2012. H. Al Dhafer, L.T, N 20° 29.78' E 40° 48.946', 1♀; Qilwah Adhom, 9.XI.2012. M. Abdel dayem, L.T, N 20° 29.78' E 40° 48.946', 1♀, 1♂; Qilwah Adhom, 9.XI.2012. H. Fadl, L.T, N 20° 29.78' E 40° 48.946', 1♀, 1♂; (all KSMA). **Riyadh**, Riyadh, 18.III.1978, R. Abu Zoherah, 1♂; Wadi Hanifah, 30.I.1976, W. Büttiker, 1♂; Riyadh, 18.III.1978, K. Al Taher, 2♂; Riyadh, 8.I.1985, A. Talhouk, S. Tilkian, R. Abu Zoherah, K. Al Taher, A. Klaudi, 1♀; Riyadh, 7.IV.1981,

A. El Madi, 1♀ 2♂; Riyadh, 7.IV.1981, R. Abu Zoherah, 1♀; Riyadh, 1.XI.1980, A.El Madi, 1♂; Riyadh, 2.V.1981, A. Talhouk, 1♂; Riyadh, 18.III.1978, A. Talhouk, 1♀; Riyadh, 1.VI.1980, A.El Madi, 1♂; Riyadh, 1.XI.1980, K.Al Taher, 1♀; (all ANMA). Deirab, 6.IV.2000, Suud, 7♂6♀; Deirab, IV-V.1998, A. Sohaibani, 1♀; (KSMA). Riyadh, 9.X.1991, M. Amoudi, 3♂, 1♀ (ZMKSU).

Total length, male 6-10 mm (n= 44), female 6-12 mm (n= 58).

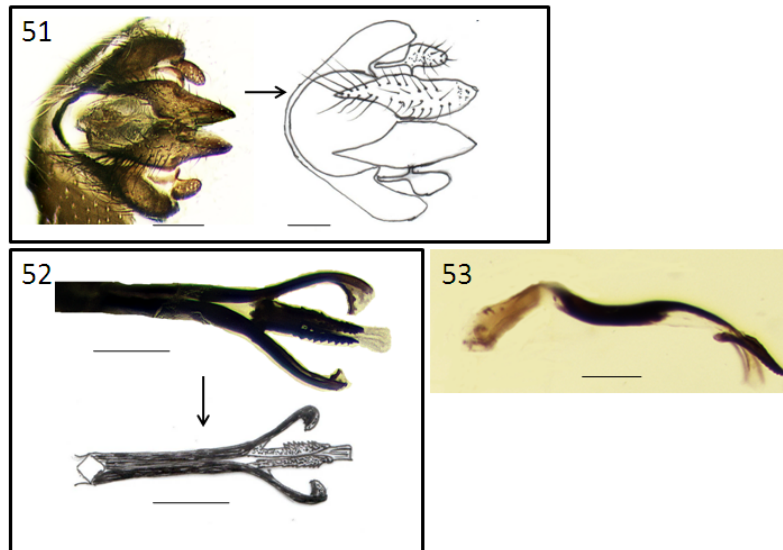
Head: In male compound eyes contiguous, upper facets larger. Frons yellowish-orange.

Thorax: Dark blue with pollinosity especially in presutural area, anterior postsutural area blackish-blue. Anterior margin of wing strongly infuscated with black. Lower calypter black covered with black hair.

Abdomen: Dark blue with narrow posterior black margins.

Genitalia: Surstylus reduced to small lobes, cerci compact short, broadly emarginated (Fig. 51). Aedeagus long, hypophallic lobe serrated, and paraphalus curved (Figs. 52, 53).

Comments: Widespread in the Afrotropical Region and also recorded from Egypt, Palestine, Syria, and Pakistan (Rognes, 2002). *Chrysomya marginalis* is also known from the Oriental Region (Zumpt, 1965). In Saudi Arabia this species has been collected from Asir, Baha, Eastern, Jizan, Mecca and Riyadh provinces (Fig. 54).



Figs. 51-53: *Chrysomya marginalis*. Fig. 51: Male epandrium, cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 52: Male aedeagus, dorsal view (scale 0.2 mm). Fig. 53: Male aedeagus, lateral view (scale 0.2 mm).

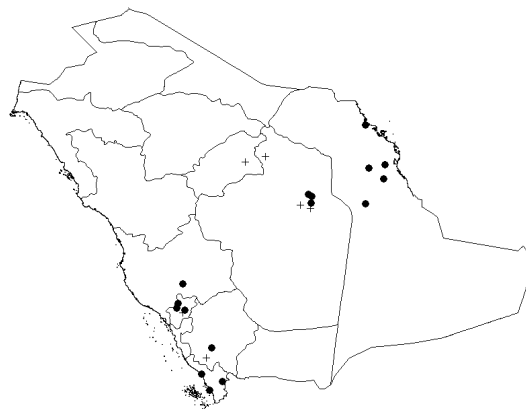


Fig. 54: Distribution of *Chrysomya marginalis* in Saudi Arabia.

Additionally, Al Misned (2003) also provide a record of this species from Asir, Baha, Riyadh and Qassim provinces. Adults of *C. marginalis* can be easily distinguished by the anterior margin of the wing strongly infuscated with black. Biology: Larvae of *C. marginalis* are usually associated with carrion (Morsy *et al.*, 1991). Zumpt (1965) notes that larvae of this species not usually attack living animals but restricted to feeding on carrion.

***Chrysomya megacephala* (Fabricius, 1794)**

Figures 55-57.

Musca megacephala Fabricius, 1794: 317.

Musca dux Eschscholtz, 1822: 144, Zumpt 1965: 97.

Musca flavipes Macquart, 1843c: 145, Zumpt 1965: 97.

Chrysomyia megacephala Patton, 1922: 556, Zumpt 1965: 97.

Material examined: 1♂.

UAE, North of Ajman, 21.IX-25.X.2007, Water trap, A. Van Harten, 1♂ (NMWC).

Total male length 9.5 mm.

Head: Eyes, upper facet larger than the lower one. Parafacialia yellow. First flagellomer brown with arista hairy. Palpi yellow.

Thorax: Metallic greenish blue. Anterior spiracle dark brown and lower calypter black hairy. Wing. Basicosta black. Legs black.

Abdomen: Metallic greenish blue. Tergites with black marking posteriorly.

Comments: *Chrysomya megacephala*, known as the Latrine-fly is well-known from the Oriental, Palearctic, and also the Australasian regions (Zumpt, 1965). Deeming (1996, 2008) recorded it from Oman and UAE. Williams and Villet (2006) provided records from South Africa. This species has been introduced into Nearctic (Wells, 1991) and also into Brazil (Pont, 1980). Ramadan and El Bihari (1980) and Dawah and Abdullah (2009) report the presence of this species in Saudi Arabia (Fig. 57). No additional specimens were collected during this study. This species is important because of its tendency to produce high population densities, its high degrees of synanthropy, and potential to produce myiasis in human and animals (Carvalho & Von Zuben, 2006).



Figs. 55-56: *Chrysomya megacephala* Fig. 55: Male eye, lateral view (scale 2 mm). Fig. 56: Calypter, lateral view (scale 1 mm).



Fig. 57: Distribution of *Chrysomya megacephala* in Saudi Arabia.

Biology: Ramadan and El Bihari (1980) indicated that *C. megacephala* was the most common species associated with dermal myiasis in at least six different types of domesticated animals in Eastern Province (Hofuf) of Saudi Arabia. This species feeds and breeds on human and animal feces, carrion, and is a potential vector of viruses and bacteria (Greenberg, 2002).

***Chrysomya putoria* (Wiedemann, 1830)**

Musca putoria Wiedemann, 1830: 403.

Chrysomyia chloropyga forma *putoria* Wiedemann, 1830, Zumpt, 1956: 187.

Somomyia punctifera Bigot, 1877: 256, Zumpt, 1956: 187.

Pycnosoma putoria var. *adoxa* Séguy, 1928: 109, Zumpt, 1956: 187.

Pycnosoma putoria var. *cyanea* Séguy, 1928: 109, Zumpt, 1956: 187.

Pycnosoma putoria var. *pulchra* Séguy, 1928: 110, Zumpt, 1956: 187.

Somomyia cuprinitens Rondani, 1873: 36, Rognes & Paterson, 2005: 53.

Somomyia taeniata Bigot, 1877: 36, Rognes & Paterson, 2005: 53.

Chrysomya putoria Rognes & Paterson, 2005: 53

Material examined: 1♀.

Republic of Kenya, Laikipia, Mpala Research Centre, 31.V.2005, K. Baldock, *Acacia brevispica*, 1♀ (NMWC).

Total female length 9 mm.

Head: Frons dark. Parafacialia silvery dusted. Antenna, arista hairy and first flagellomer grays brown. Palpi yellowish brown. Eyes, upper facets slightly bigger than the lower one.

Thorax: Thorax laterally and dorsally metallic blue. Anterior spiracle white. Lower and upper calypter white. Thorax dorsally with white dusting transverse pattern.

Abdomen: Metallic blue. Tergites 3 and 4 with dark pattern posteriorly. Sternites with dense fine hairs.

Comments: Rognes and Paterson (2005) have clarified the taxonomic status of *C. chloropyga* (Wiedemann, 1818) and *C. putoria* and importantly commented on the distribution of the two species. No confirmed records are available for *C. putoria* from the Arabian Peninsula. It may be possible that Büttiker *et al.* (1979) and Abu Zoherah *et al.* (1993) records of *C. chloropyga* forma *putoria* may be valid. Rognes and Paterson (2005) have commented on the remarkable dispersal abilities of the adults of *C. putoria*. However, further collecting is required to verify the occurrence of the species in Saudi Arabia.

Biology: *Chrysomya putoria* is often considered a pest because of its habit of breeding in poultry dung and pit latrines (Rognes & Paterson, 2005). This species is considered a eusynantropic fly (Baumgartner & Greenberg, 1984).

Subfamily Luciliinae

Only the genus *Lucilia* including two similar species, is known from Saudi Arabia.

Key to species of *Lucilia*

- 1 Occiput with 1-2 small paraverticlar setae (Fig. 61). Femur of front legs metallic green. Male, sternites densely covered with long setae. Surstylus elongate, not curved, tapering to apex (Figs. 58, 59). Hypophallus sclerotized, serrated (Figs. 60, 62). Female ovipositor, epiproct apex narrowly rounded (Fig. 63) ...*Lucilia cuprina*
- Occiput with 3-8 small paraverticlar setae (Fig. 71). Femur of front legs bluish black. Sternites not densely covered with long setae. Surstylus curved (Figs. 66, 67). Hypophallus lacking serrations (Fig. 68). Female ovipositor, epiproct apex broadly rounded (Fig. 69) *Lucilia sericata*

Genus *Lucilia* Robineau-Desvoidy 1830

Lucilia cuprina (Wiedemann, 1830)

Figures 58-65.

Musca cuprina Wiedemann, 1830: 654.

Lucilia dorsalis Robineau-Desvoidy, 1830: 453, Zumpt, 1956: 74.

Lucilia amica Robineau-Desvoidy, 1830: 453, Zumpt, 1956: 74.

Lucilia elegans Robineau-Desvoidy, 1830: 458, Zumpt, 1956: 74.

Lucilia argyrocephala Macquart, 1846: 326, Zumpt, 1956: 74.

Musca fucina Walker, 1849: 883, Zumpt, 1956: 74.

Musca serenissima Walker, 1852: 340, Zumpt, 1956: 74.

Musca temperata Walker, 1852: 340, Zumpt, 1956: 74.

Lucilia leucodes Frauenfeldt, 1867: 453, Zumpt, 1956: 74.

Strongyloneura nigricornis Senior-White, 1924: 115, Zumpt, 1956: 74.

Somomyia pallifrons Bigot, 1877: 257, Zumpt, 1956: 74.

Lucilia pallescens Shannon, 1924: 78, Zumpt, 1956: 74.

Lucilia sericata Smit, 1931: 299, Zumpt, 1956: 74.

Lucilia cuprina Holloway, 1991: 413.

Phoenicia cuprina Kano and Sato, 1951: 413, Rognes, 2002: 14.

Material examined: 36♂, 30♀.

Asir, Abha, Madinah Ameer Sultan, 25.II-25.V.2002, H.A. Dawah, 1♂ (HD); Wadi Abha, 28.IV.2011, M. Sharaf, H. Setyaningrum, A. Al Ansi, S.N, N 18° 22'03" E 42° 50'82", 13♂, 17♀ (KSMA); Al Areen, 7.II.2010, H. Bil Hareth, S.N, 1♀ (KSMA); Khamis Mushayt, Wadi Bisha, 27.IV.2011, M. Sharaf, H. Setyaningrum, A. Al Ansi, S.N, N 18° 20' 01" E 42° 42'129", 1♀ (KSMA). **Baha**, Mandaq, Wadi Turubah, 14.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 12' 610" E 41° 17'56"; 2♂, 5♀; Wadi Turubah, 10.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 12'610" E 41° 17'56", 4♀; Wadi Gala, 16.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 12'610" E 41° 17'56", 1♀; Raghdan, 16.V.2010, A. El Torkey H. Al Dhafer, S.N, N 20° 00' 575" E 41° 26'574", 1♂; Raghdan, 19.V.2010, A. El Torkey H. Al Dhafer, S.N, N 20° 00'575" E 41° 26'574", 1♀; Amadan, 14.X.2010, H. Al. Dhafer, B. Kondratieff, H. Al Fadly, A. El Gharbawy, S.N, N 20° 12'11" E 41° 13'43", 3♂, 7♀; Baha, 14.X.2007, H. Al Dhafer, S.N, N 20° 525' E 41° 268', 1♂, 2♀; Thee Ain, 13.X.2010, H. Al. Dhafer, B. Kondratieff, H. Al Fadly, A. El Gharbawy, S.N, N 19°

55' 54" E 41° 26'29", 1♂1♀; (all KSMA). **Mecca**, Taif, Shafa, 11.X.2010, H. Al. Dhafer, B. Kondratieff, H. Al Fadly, A. El Gharbawy, S.N, N 21° 4'33" E 40° 18'5'34", 1♂ (KSMA). **Riyadh**, Tumayr, 10.II.2010, H. Al Dhafer and F. Al Husein, S.N, N 25° 42'26" E 45° 52'11", 2♂, 1♀ (KSMA).

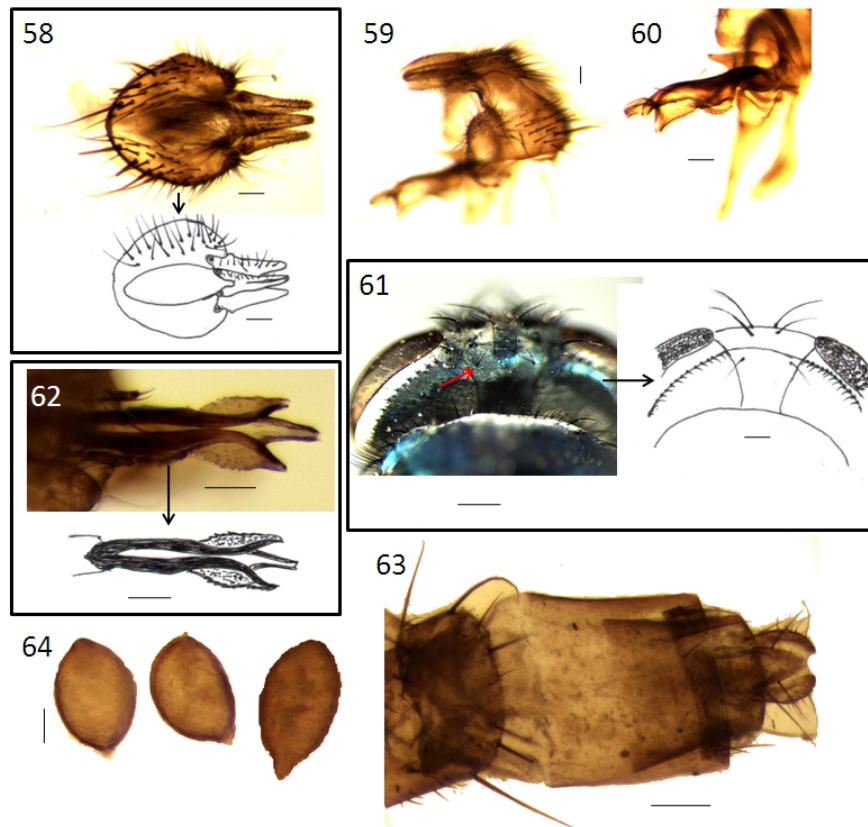
Total body length, male 5-8mm (n= 36), female 4-9 mm (n= 30).

Head: 1-2 small paraverticlar setae (Fig. 61). Postocular strip of vertex with sharply defined junction, mostly "V" shaped, occasionally truncate. Distance of preverticals and outer vertical setae approximately equal from inner vertical setae, triangle formed by joining lines of basal socket of setae right-angled at inner setae.

Thorax: Dorsal surface of the scutellum with few hairs, uniformly distributed.

Abdomen: Male, sternites densely covered with long setae. Female, ovipositor tergite 7 with separate conspicuous mid-dorsal sclerotisation in posterior half, abdominal segment 7 pleural membrane with microtrichia only on posterior 1/6.

Genitalia: Male, surstylus elongate, not curved, tapering to apex (Figs. 58, 59). Hypophallus well-developed, sclerotized, serrated (Figs. 60, 62). Female ovipositor, epiproct apex narrowly rounded (Fig. 63), spermathecae elongate oval, smooth (Fig. 64).



Figs. 58-64. *Lucilia cuprina*. Fig. 58: Cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 59: Cerci and surstylus, lateral view (scale 0.2 mm). Fig. 60: Aedeagus, lateral view (scale 0.1mm). Fig. 61: Paraverticlar setae (scale 2mm). Fig. 62: Aedeagus, dorsal view (scale, 0.1mm). Fig. 63: Female ovipositor, dorsal view (scale 0.2 mm). Fig. 64: Spermathecae, dorsal view (scale 0.1 mm).

Comments: *Lucilia cuprina* is widely distributed throughout the World, including the southern Palaearctic, Afrotropical and Oriental regions (Tourle *et al.*, 2008); and from Australia and New Zealand (Holloway, 1991). In Saudi Arabia this species was

collected in Asir (Abha and Khamis Mushayt), Baha, and Mecca (Taif) provinces also in the Riyadh Province associated with urbanized areas (Fig. 65). Previously Büttiker *et al.* (1979) and Dawah and Abdullah (2009) record this species from Saudi Arabia. Both *L. cuprina* and *L. sericata* are bluish-green metallic species and similar in general habitus. In the male, *L. cuprina* can be distinguished readily from *L. sericata* by the presence of 1-2 small paraverticlar setae and the abdominal sternites densely covered with long setae (Rognes, 1993, 2002). Females of *L. cuprina* are usually distinguished by occiput with 1-2 small paraverticlar setae rather than the 3-8 from *L. sericata*.

Biology: Larvae of *L. cuprina* are commonly associated with carrion (Rognes, 1963) and considered a serious pest of livestock and has been recorded causing myiasis in humans (Zumt, 1965), especially producing myiasis in sheep in Australia (Catts & Mullen, 2002).



Fig. 65: Distribution of *Lucilia cuprina* in Saudi Arabia.

***Lucilia sericata* (Meigen, 1826)**

Figures 66-74.

Musca sericata Meigen, 1826: 53.

Musca nobilis Meigen, 1826: 46, Zumt, 1956: 72.

Musca tegularia Wiedemann, 1830: 655, Zumt, 1956: 72.

Chrysomya capensis Robineau-Desvoidy, 1830: 451, Zumt, 1956:72.

Lucilia modesta Robineau-Desvoidy, 1830: 454, Zumt, 1956:72.

Lucilia pubescens Robineau-Desvoidy, 1830: 454, Zumt, 1956:72.

Lucilia calida Robineau-Desvoidy, 1830: 464, Zumt, 1956:72.

Musca pruinosa Meigen, 1830: 294, Zumt, 1956:72.

Musca chloris Haliday, 1833: 165, Zumt, 1956:72.

Lucilia pruniosa Meigen, 1838, Bisby *et al.*, 2012

Lucilia flavipennis Macquart, 1843a: 139, Zumt, 1956:72.

Lucilia basalis Macquart, 1843a: 148: Zumt, 1956:72.

Musca lagyra Walker, 1849: 885, Zumt, 1956:72.

Lucilia latifrons Schiner, 1862: 590, Zumt, 1956:72.

Phaenicia concinna Robineau-Desvoidy, 1863b, Bisby *et al.*, 2012.

Lucilia sayi Jaennicke, 1867: 375, Zumt, 1956:72.

Lucilia frontalis Brauer & Bergenstamm, 1891, Bisby *et al.*, 2012

Lucilia barberi Townsend, 1908: 121, Zumt, 1956:72.

Lucilia giraulti Townsend, 1908: 121, Zumt, 1956:72.

Lucilia sericata Buxton, 1924: 322, Rognes, 2002: 14

Lucilia sericata Rognes, 2002: 14.

Material examined: 168♂, 182♀.

Asir, Abha, Al Areen, 7.II.2010, H. Bil Hareth, S.N, 1♀ (KSMA). **Eastern**, Al Ahsa, 4.III.2011, H. Al Dhafer. Setyaningrum; A. Al Ansi, B.T, N 25° 57'44" E 49° 38'49", Al Wadhani Farm, 1♀ (KSMA). Dammam, Dammam-Riyadh Road, 5.III.2011, H. Al Dhafer. Setyaningrum and A. Al Ansi, S.N, N 25° 9'12" E 37° 34'45", 2♀; Dammam-Riyadh Road, 5.III.2011, H. Al Dhafer. Setyaningrum; A. Al Ansi, S.N, N 25° 24'59" E 47° 58'36", 1♂, 1♀; Dammam-Riyadh Road, 5.III.2011, H. Al Dhafer. Setyaningrum; A. Al Ansi, S.N, N 25° 50'00" E 48° 50'23", Corn, 2♀; (all KSMA); Nuayriyah, Nuayriyah, 1.III.2011, H. Al Dhafer. Setyaningrum; A. Al Ansi, L.T, N 27° 08'04" E 48° 28'16.6", Ornamental plant, 88♂, 94♀ (KSMA); Jubayl, Jubayl-Dammam Road, 3.III.2011, H. Al Dhafer. Setyaningrum; A. Al Ansi, S.N, N 18° 22'03" E 42° 50'82", Weeds, 1♀ (KSMA). **Jizan**, Jizan, 1.II.1983, R. Abu Zoherah, 1♀ (ANMA). **Riyadh**, Ibex Reserve National Park, Hutet Bani Tamim, 22.II.2008, Y. Dryhim, H. Al Dhafer, M. Motairy; A. El Gharbawy, B.T, 3♀, 9♂; Rhodet Khorim, 6.IV.2011, Y. Dryhim, H. Al Dhafer. Fadl; A. El Gharbawy, S.N, N 25° 22'58" E 47° 16'44", 1♀; Rhodet Khorim, 11.IV.2011, Y. Dryhim, H. Al Dhafer. Setyaningrum; A. El Gharbawy, S.N, N 25° 05'730" E 47° 38'270", 8♂, 11♀; Rhodet Khorim, 19.IV.2011, Y. Dryhim, H. Al Dhafer. Fadl, A. El Gharbawy, S.N, N 25° 22'58" E 47° 16'44", 1♀, Ghilana, 19.IV.2011, Y. Dryhim, H. Al Dhafer. Fadl and A. El Gharbawy, M.T, 1♂; Rhodet Khorim A, 14.I.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 6♂, 19♀; Rhodet Khorim B, 18.I.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♂, 1♀; Rhodet Khorim B, 4.II.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 2♀; Rhodet Khorim B, 15.I.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♂; Rhodet Khorim A, 19.II.2012, H. Setyaningrum, B.T, N 25° 22'986" E 47° 16'712" 559 , 1♀; Rhodet Khorim B, 8.I.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♀; Rhodet Khorim B, 17.III.2012, H. Setyaningrum, Pitfall trap, N 25° 25'943" E 47° 13'863" 572 m, 1♂, 2♀; Rhodet Khorim B, 17.III.2012, H. Setyaningrum, Pitfall trap, N 25° 25'943" E 47° 13'863" 572 m, 2♀; Rhodet Khorim A, 17.III.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 1♂; Rhodet Khorim B, 17.III.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♂; Rhodet Khorim B, 17.III.2012, H. Setyaningrum, Pitfall trap, N 25° 25'943" E 47° 13'863" 572 m, 4♀; Rhodet Khorim B, 24.III.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♂, 3♀; Rhodet Khorim A, 1.IV.2012, H. Setyaningrum, B.T, N 25° 22'986" E 47° 16'712" 559 m, 2♀; Rhodet Khorim B, 15.IV.2012, H. Setyaningrum, M.T, N 25° 25'943" E 47° 13'863" 572 m, 1♂; Rhodet Khorim A, 14.IV.2012, H. Setyaningrum, B.T, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim B, 14.IV.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 2♀; Rhodet Khorim A, 28.IV.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 2♂; Rhodet Khorim A, 28.IV.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 5♂, 1♀; Rhodet Khorim B, 31.III.2012, H. Setyaningrum, B.T, N 25° 25'943" E 47° 13'863" 572 m, 2♂, 1♀; Rhodet Khorim B, 15.IV.2012, emerged at 10.V.2012, H. Setyaningrum, B.T, N 25° 25'943" E 47° 13'863" 572 m, 10♂, 5♀; Rhodet Khorim B, 6.III.2012, emerged at 1.IV.2012, H. Setyaningrum, B.T, N 25° 25'943" E 47° 13'863" 572 m, 29♂, 13♀; Rhodet Khorim A, 1.IV.2012, H. Setyaningrum, B.T, N 25° 22'986" E 47° 16'712" 559 m, 2♀ (all KSMA).

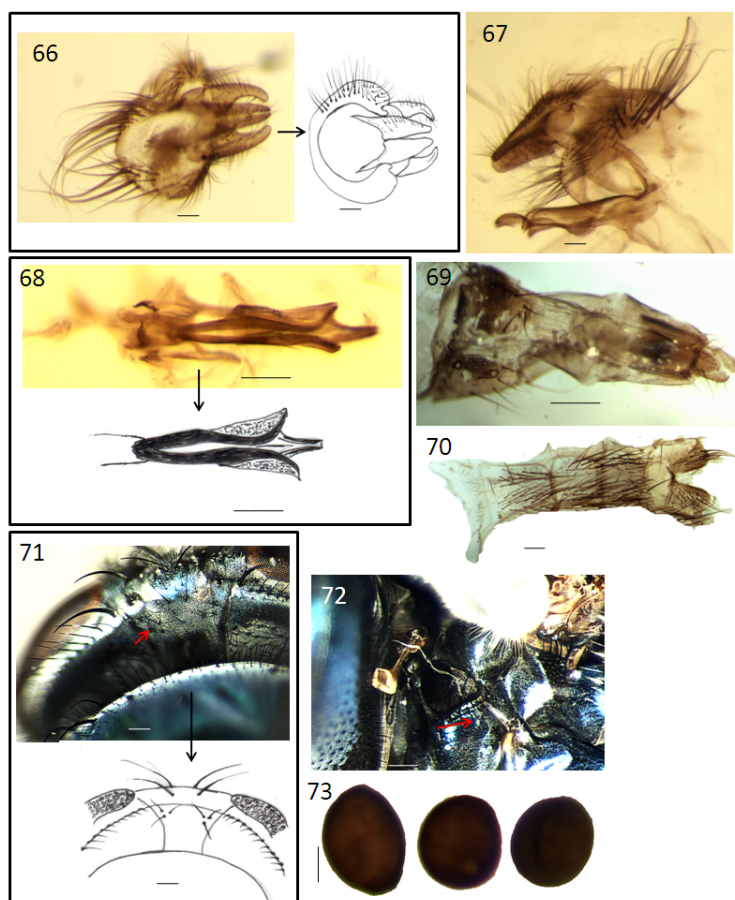
Total body length, male 7-9 mm (n= 168), female 8-11 mm (n= 182).

Head: 3-8 small paraverticlar setae (Fig. 71). Postocular strip of vertex junction irregularly defined the direction of pile oblique across the strip. Distance of preverticals and outer vertical setae 0.5-0.7× from inner vertical setae, angle of inner verticals obtuse.

Thorax: Dorsal surface of the scutellum densely covered hairs, uniformly distributed.

Abdomen: Male sternites with short setae, not dense (Fig. 70). Tergite 7 of ovipositor without separate mid-dorsal sclerotization in posterior half, pleural membrane 7 with microtrichia only posterior 5/6.

Genitalia: Male, surstylus curved (Figs. 66, 67). Hypophallus lacking serrations (Fig. 68). Female ovipositor, epiproct broadly rounded at apex (Fig. 69). Spermathecae oval, surface smooth (Fig. 73).



Figs. 66-73: *Lucilia sericata*. Fig. 66: Cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 67: Cerci, surstylus and aedeagus, lateral view (scale 0.2 mm). Fig. 68: Aedeagus, dorsal view (scale 0.2 mm). Fig. 69: Ovipositor, dorsal view (scale 0.2 mm). Fig. 70: Male sternites, ventral view (scale 0.2 mm). Fig. 71: Paraverticlar setae (scale 2 mm). Fig. 72: Katapimeron, without coxopleural streak (scale 2 mm). Fig. 73: Female spermathecae (scale 0.1 mm).

Comments: This species is almost cosmopolitan in distribution except for the Arctic regions (Rognes, 1991, 2002). Widespread in urbanized areas of Saudi Arabia, having been collected from Asir, Eastern, and Jizan provinces also the Riyadh Province (Fig. 74). Previously Walker and Pittaway (1987) and Dawah and Abdullah (2009) listed this species from Saudi Arabia. *Lucilia sericata* known as the European Blow Fly (Rognes, 1963) or Sheep Blow Fly (Byrd & Castner, 2010) and can be distinguished from the similar *L. cuprina* by characters given under that species. See Rognes (1963)

for excellent comparisons of these two taxa. *L. sericata* can cause serious livestock impacts and is a common species in forensic investigations (Cazander *et al.*, 2009)

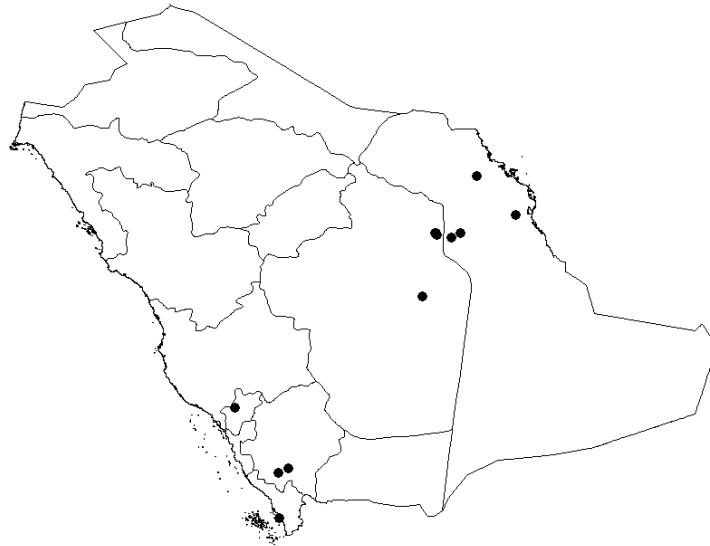


Fig. 74: Distribution of *Lucilia sericata* in Saudi Arabia.

Biology: Rognes (1991) reviews the biology of *L. sericata*. Byrd and Castner (2010) review cases where *L. sericata* was of forensic importance. During this study, under room temperatures (25±1°C), eggs hatched usually within 24 hours, larva reached the 3rd instar in 12-13 days. Duration of the pupal stage was 10-11 days.

Subfamily Polleniinae

This subfamily in Saudi Arabia is represented by only the genus *Pollenia*, which includes more than 100 species (Rognes 1988), and five of these have been collected or occur in Saudi Arabia. As a group, the genus can be readily distinguished by the crinkly yellow hair of the thorax. Male genitalia are important in species identification. Recently Jewiss-Gaines *et al.* (2012) provided useful review of many of the characters used for identification. Rognes (2008) speculated on the phylogeny of the recognized species groups of *Pollenia*. Species of this genus are known as Cluster Flies due to their seasonal habit of entering buildings in large numbers in the fall (Rognes, 1988; Jewiss-Gaines *et al.*, 2012). The larvae of *Pollenia* are considered to be earthworm parasites, at least for the *P. rudis* species group (Rognes, 1987). Rognes (1991) discussed the distribution of *Pollenia* based on possible earthworm introductions. This may also be a possibility in Saudi Arabia in regard to relatively recent intensive agricultural conversion of arid landscapes in many areas of the country.

Key to species of *Pollenia*

(Modified from Rognes 1991, 2002)

1. Node at junction of humeral crossvein and subcosta underside with a bundle of pale hair (Fig. 95). Male, anal cerci and surstylus almost straight (Figs. 92, 93). Aedeagus, paraphallus truncate apically (Figs. 93, 94) *Pollenia pediculata*
- Node at junction of humeral crossvein and subcosta underside without a bundle of pale hairs, may have a few pale or black hairs. Male genitalia otherwise 2
2. Basicosta black or blackish brown (Fig. 83) 3
- Basicosta yellow to brownish (Fig. 89) 4

3. Abdomen black with bluish sheen. Node at junction of humeral crossvein and subcosta underside with a few pale or black hairs. Male, hind leg tarsi shorter than tibia.....*Pollenia semicinerea*
- Abdomen gray, without bluish sheen. Node at junction of humeral crossvein and subcosta underside without pale or black hairs. Male, hind leg tarsi longer than tibia (Fig. 82).....*Pollenia dasypoda*
4. Middle and hind femora with yellowish posteroventral hairs (Fig. 90). Palpi blackish apically. Male, aedeagus (Figs. 86, 87), tip of paraphallus with minute denticles. Female, spermathecae elongate-oval, constricted at base
Pollenia hungarica
- Middle and hind femora with black posteroventral hairs (Fig. 104). Palpi yellowish brown apically. Male, aedeagus, tip of paraphallus lacking minute denticles. Female, Spermathecae oval, not constricted at base (Fig. 105)
.....*Pollenia rudis*

Genus *Pollenia*

Pollenia dasypoda Portschinsky, 1881

Figures 75-84.

Pollenia dasypoda Portschinsky, 1881:143.

Pollenia alajensis Rohdendorf, 1926, Bisby *et al.*, 2012.

Dasympollenia landrocki Jacentkovsky, 1941, Bisby *et al.*, 2012.

Material examined: 5♂, 2♀.

Riyadh, Al Amariyah, 23.III.2011, H. Setyaningrum, S.N, 2♂; Al Amariyah, 7.IV.2010, A. Al Motairy, S.N, Al Mossa Farm, 1♂; Tumayr, 26.II.2010, H. Al Dhafer; F. Al Husein, M.T, N 26 °42'36" E 45° 52'11", 1♂ 1♀; Al Amariyah, 1.XII.2010, R. Singl Aref, S.N, ex. rocket, 1♀; (all KSMA); Zulfi, Zulfi Street, 18.XII.1975, 1♂ (KSMA).

Total length, male 4-8 mm (n= 5), female 8–9 mm (n= 2).

Head: Facial keel conspicuous, rounded along summit ridge. Genae and parafacialia black (Fig. 75).

Thorax: Calypter creamy white (Fig. 76). Katepisternal setulae yellow. Node junction of humeral crossvein and vein subcosta without hairs underside. Foretibia with single posteroventral setae, hind tibia with numerous setae (Fig. 79), hind tarsus shorter than tibia (Fig. 82).

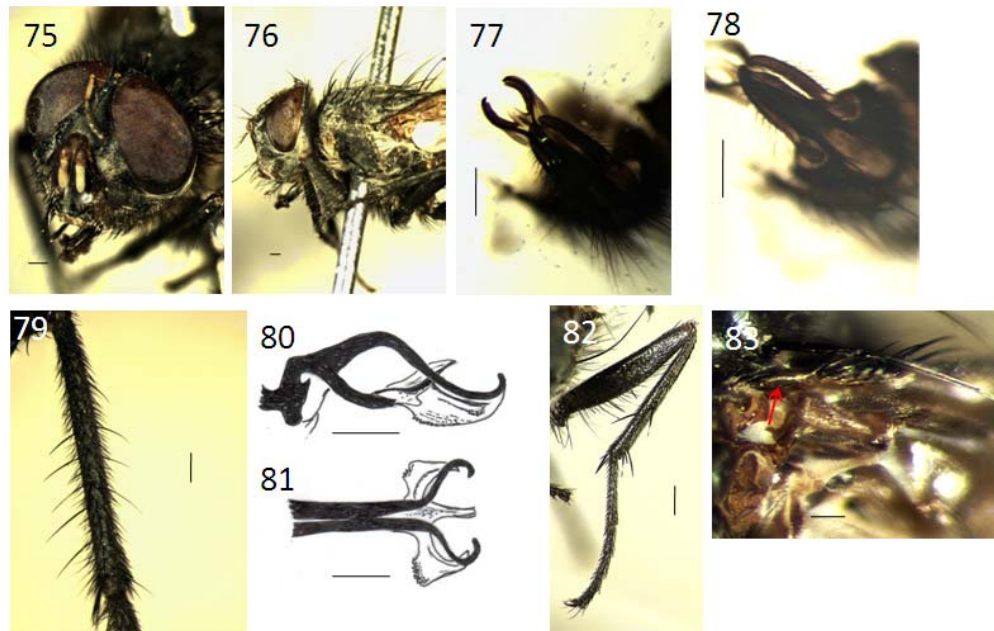
Abdomen: Dark gray with black spot on marginal sides of tergites and without bluish sheen.

Genitalia: Surstylus curved inward apically, cerci straight and sharp apically (Fig. 78). Aedeagus curved, sclerotised with few serrations and swollen at apex (Figs. 77, 80), paraphallus curved and flip curved at apex point (Fig. 81).

Comments: Rognes (2002) has indicated a primarily Palaearctic distribution for this taxon, including Egypt, Palestine, and Syria. In Saudi Arabia *P. dasypoda* is currently known from the Riyadh Province suggesting that this species is a Palearctic element perhaps an introduction (Fig. 84). Previously Dabbour (1979) report this species from Saudi Arabia. *Pollenia dasypoda* is included in the *tenuiforceps* species group (Rognes 1988, 1992), primarily characterized in the male by the inwardly curving paraphallic process (Rognes 2002).

Biology: Details of biological study of *P. dasypoda* is represented by Tawfik and El Hussein (1971) which noted that the larvae are parasites of the earthworm species,

Allolobophora caliginosa (Sav.). In this study *P. dasypoda* was strongly associated with irrigated agricultural areas.



Figs. 75-83: *Pollenia dasypoda*. Fig. 75: Male head front (scale 1 mm). Fig. 76: Male body, lateral view (scale 1 mm). Fig. 77: Male aedeagus, dorsal view (scale 0.1 mm). Fig. 78: Male cerci and surtylus, dorsal view (scale 0.1 mm). Fig. 79: Male hind tibia (scale 1 mm). Fig. 80: Male aedeagus, lateral view (scale 0.1 mm). Fig. 81: Male aedeagus profile, dorsal view (scale 0.1 mm). Fig. 82: Male hind legs (scale 1 mm). Fig. 83: Basicosta (scale 1 mm).



Fig. 84. Distribution of *Pollenia dasypoda* in Saudi Arabia.

***Pollenia hungarica* Rognes, 1987**

Figures 85-91.

Pollenia hungarica Rognes, 1987: 483.

Material examined: 2♂, 3♀.

Baha, Wadi Turubah, 14.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf & H. Setyaningrum, S.N, N 20° 12'610" E 41° 17'056" 918m, 3♀ (KSMA). **Riyadh**, Al Amariyah, 15.III.2011, H. Setyaningrum, S.N, Weeds, 1♂; Deirab, 2.X.1989, Habib, Wheat, 1♂; (all KSMA).

Total body length, male 3-5 (n= 2) and female 4-6 mm (n= 3).

Head: Facial keel conspicuous, palpi black.

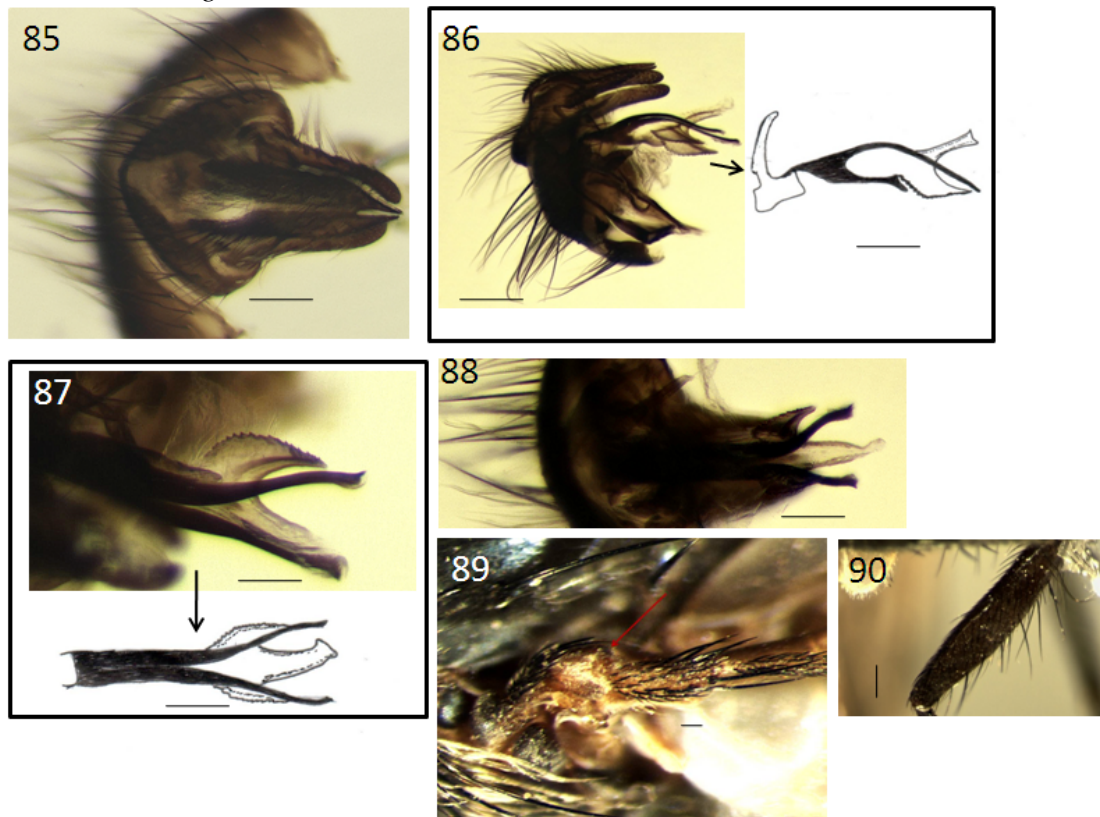
Thorax: Basicosta yellow (Fig. 89). Post humeral setae present. Middle and hind femora with yellowish posteroventral hairs (Fig. 90), foretibia with 2 posteroventral setae.

Abdomen: Gray often with much pollinosity, diffuse black spots laterally.

Genitalia: Male anal cerci straight. Surstylus weakly curved and slightly swollen at apex (Figs. 85, 86). Aedeagus of *rudis* type, curved, hypophallus with distal sclerotisation, paraphallus long, apex with minute denticles (Figs. 86, 87, 88). Female, spermathecae elongate-oval, constricted at base.

Comments: *Pollenia hungarica* is a Palaearctic species (Rognes, 1987, 2002) that apparently reaches its southern distribution in Saudi Arabia, representing a new country record. The distribution in Saudi Arabia is of interest, the southern province of Baha has strong affinities with the Afrotropical Region, whereas Riyadh Province (Fig. 91) has a typical Palaearctic species composition. This distributional disjunction may be the result of introductions. *Pollenia hungarica* may be eventually found in other countries of the Arabian Peninsula. Apparently, among the known Saudi species of *Pollenia*, the combination of middle and hind femora with yellowish posteroventral hairs, the blackish apex of the palps and the tip of the paraphallus of the aedeagus possessing minute denticles distinguishes this species, especially from its close congener, *P. rudis*.

Biology: Rognes (1987) suggested that earthworm, *Eienia rosea* (Savigny) is a host of larvae of *P. hungarica*.



Figs. 85-90: *Pollenia hungarica*. Fig. 85: Male cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 86: Male cerci and surstylus, lateral view (scale 0.2 mm). Fig. 87: Male aedeagus, dorsal view (scale 0.1 mm). Fig. 88: Male aedeagus, ventral view (scale 0.1 mm). Fig. 89: Basicosta (scale 1 mm). Fig. 90: Middle femora (scale 2 mm).



Fig. 91: Distribution of *Pollenia hungarica* in Saudi Arabia.

Pollenia pediculata Macquart, 1834

Figures 92-98.

Pollenia pediculata Macquart, 1834: 155.

Pollenia pseudorudis Rognes, 1985: 90.

Pollenia obscura Bigot, 1888: 597, Rognes, 2002: 18.

Pollenia pediculata Rognes, 2002: 18.

Material examined: 72 ♂, 58 ♀.

Asir, Abha, Wadi Abha, 28.IV.2011, M. Sharaf, A. Al Ansi, H. Setyaningrum, S.N, N 18° 22'08" E 42° 50'82", 1990m, , 4♂, 2♀ (KSMA); Asir, 3.VI.2001, H.A Dawah, M.T, 1♂ (HD); Khamis Mushayt, Wadi Bisha, 27.IV.2011, M. Sharaf, A. Al Ansi, H. Setyaningrum, S.N, N 18° 20'01.1" E 42° 42'12.9", 1990m, 2♂ (KSMA). **Baha**, Wadi Turubah, 14.X.2010, H. Al Dhafer, B. Kondratieff, H. Fadl, A. El Gharbawy, N 20° 14'23" E 41° 14'53", 1♀; Wadi Turubah, 14.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 12'610" E 41° 17'056", 918m, 7♂, 5♀; Wadi Turubah, 14.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, M.T, N 20° 12'610" E 41° 17'056" 918m, 1♀; Wadi Turubah, 10.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 12'610" E 41° 17'056", 918m, 4♂, 6♀; Wadi Gala, 16.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 08'079" E 41°20'561", 1900m, 1♂, 3♀; Ragadhan, 13.V.2011, M. Sharaf, A. Al Ansi, H. Setyaningrum, S.N, N 20° 34'254" E41° 45'110", 1♀; (all KSMA). **Eastern**, Jubayl, Ras Al Ghar, 16.IV.2010, H.AIDhafer, L.T, N 26° 15'34" E 61° 52'01", 1♂ (KSMA). **Najran**, Rijla, Wadi Najran, 15.I.2013, A. Al Ansi, I. Rasool, S. Khan, S.N, N 17 31'555" E 44 13'653" 1257 m, 4♂ (KSMA); Najran, Wadi Shuaib Barran, 16.I.2013, A. Al Ansi, I. Rasool, S. Khan, S.N, N 17 28'944" E 44 05'515" 1325m, 2♂ (KSMA). **Riyadh**, Al Amariyah, 23.III.2011, H. Setyaningrum, S.N, 1♀; Ad Dilam, 5.I.2007, A. Dawood, 1♂; Al Amariyah, 1.I.2010, A. Al Ansi, S.N, Rocket, Al Zorigya Farm, 2♂2♀; Al Amariyah, 7.IV.2010, A. Al Motairy, S.N, Al Mossa, 2♂; Al Amariyah, 28.I.2008, B. Valenza, 1♀, 1♂; Al Amariyah, 28.I.2008, A. Soffan, S.N, 1♀; Al Amariyah, 15.III.2011, H. Setyaningrum, S.N, 2♂; Al Amariyah, 30.III.2011, H. Setyaningrum, S.N, 2♂, 1♀; Al Amariyah, 23.III.2011, H. Setyaningrum, M.T, 1♂; Al Hair, 13.V.2009, S.N, 1♀; Al Kharj, 24.III.2010, A. Al Motairy, S.N, 1♂, 1♀; Al Kharj, VIII.1988, alfalfa, 1♀; Al Kharj, VIII.1989, 1♂; Al Magma Street, 26.XI.1975, 1♀; Al Uyaynah, 3.X.2010, A. Ghunaim, S.N, Saad Al

Shaleh Farm, 1♂; Al Uyaynah, 3.X.2010, H. Raweh, S.N, 1♂; Al Uyaynah, 10.III.2010, A. Al Othman, S.N, 1♂; Al Uyaynah, 30.XI.2010, H. Al Dhafer, A. Al Ansi, N24° 90'05" E46° 37'16", 1♀; Al Uyaynah, 12.V.2010, A. Al Hashel, S.N, 3♂, 4♀; Al Uyaynah, 10.III.2010, B. Al Salem, S.N, 1♂; Al Uyaynah, 10.III.2010, A. Al Yousef, S.N, 1♀; Al Uyaynah, 10.III.2010, A. Al Otaibi, S.N, 1♂; Al Uyaynah, 28.IV.2010, T. Hazazi, S.N, 1♂, 1♀; Al Uyaynah, 28.IV.2010, A. Al Hashel, S.N, 2♂; Al Uyaynah, 10.III.2010, A. Al Motairy, S.N, Al Mossa farm, 1♂; Al Uyaynah, 7.IV.2010, A. Al Othman, S.N, 1♀; Al Uyaynah, 12.V.2010, A. Al Yousef, S.N, 1♀; Al Waseel, 21.XI.2009, A. Al Ansi, S.N, alfalfa, Al Biir Farm, 1♂; Al Waseel, 21.XI.2009, S.A Rgab, S.N, Al Beer Farm, 1♂; Deirab, 2.X.1989, Wheat, 1♂; Deirab, 8.XII.1989, Alfalfa, 1♂, 1♀; Deirab, 14.XI.1989, mint, 1♂; Dierab, 29.IV.1989, Alfalfa, 1♂; Diriyah, 29.X.1989, Alfalfa, 2♂; Diriyah, 11.XII.1989, Alfalfa, 1♂, 1♀; Diriyah, 17.VII.1989, Parsely, 2♂; Diriyah, 29.X.1989, 1♀; Diriyah, 29.X.1989, Parsely, 1♂; Huraymila, 8.XII.1989, Grasses, 1♂; Huraymila, 28.XII.1989, Grasses, 1♀; Muzahimmyah, Khararah, 17.VII.2011, Y.Al Dryahim, H. Al Dhafer, L.T, N 24° 23'01" E 46° 14'14", 1♂; Riyadh, 12.III.1999; 1♂ Riyadh, VIII.1989, Weeds, 1♂; Tumayr, 8.II.2010, H. Al Dhafer, F.Al Husein, M.T, N 26° 42'36" E 45° 52'11", 3♂, 2♀; Tumayr, 26.II.2010, H. Al Dhafer, F. Al Husein, M.T, N 26° 42'36" E 45° 52'11", 2♂, 3♀; Tumayr, 15. II.2010, H. Al Dhafer, F. Al Husein, M.T, N 26° 42'36" E 45° 52'11", 2♂, 1♀; Tumayr, 10.II.2010, H. Al Dhafer, F. Al Husein, M.T, N 26° 42'36" E 45° 52'11", 2♂, 1♀; Tumayr, 24.II.2010, H. Al Dhafer, F. Al Husein, M.T, N 26° 42'36" E 45° 52'11", 2♂, 2♀; (all KSMA); Riyadh, 14.V.1978, A. Talhouk, 1♂ (ANMA).

Total length, male 4-8 mm (n= 72), female 5-9 mm (n= 58).

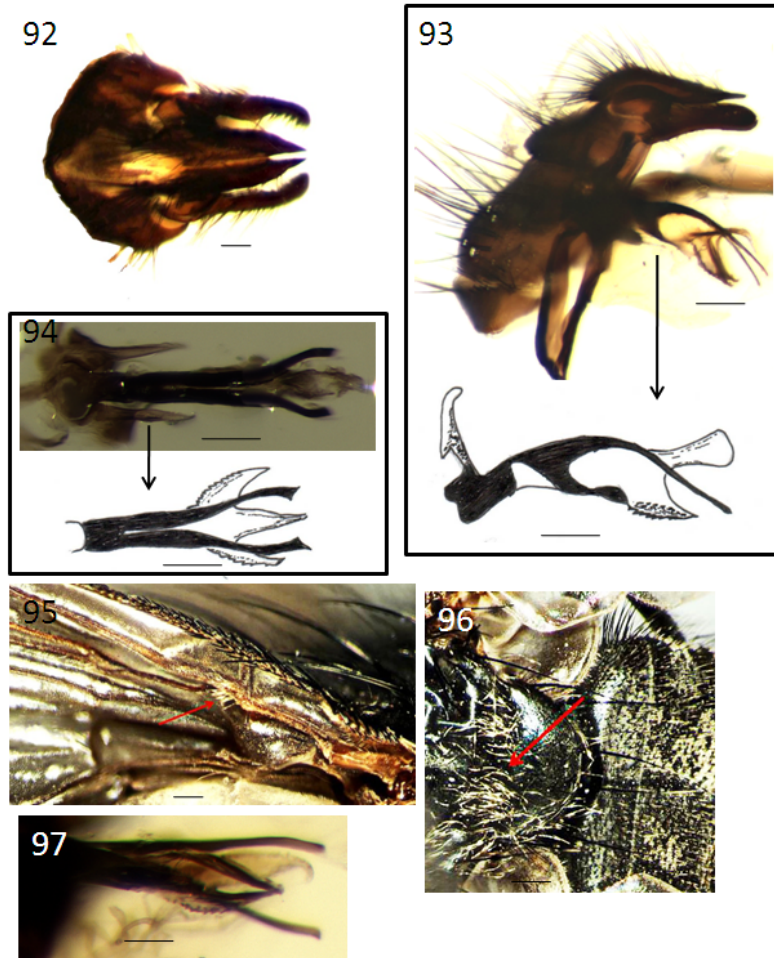
Head: Facial keel variable, narrow to broad. Antenna usually dark. Palpi black.

Thorax: Basicosta yellow, occasionally paler. Fore tibia with 2 posteroventral setae. Post humeral setulae present. Node at junction of humeral crossvein and subcosta with a bundle of fine pale hair at underside.

Abdomen: Black, tergites with diffuse black spots laterally.

Genitalia: Surstylus curved weakly, margins subparallel (Figs. 92, 93). Aedeagus with weakly curved angle between paraphallus and hypophallus junction, sclerotised with serration, paraphallus expanded apically truncate (Figs. 93, 94, 97).

Comments: *Pollenia pediculata* is a common, widespread Holarctic species (Rognes, 1991; Whitworth, 2006; Jewiss-Gaines *et al.*, 2012). First reported from Saudi Arabia by Dawah and Abdullah (2009) from Asir Province, numerous additional records are now available from Baha, Eastern, and Riyadh provinces (Fig. 98). Adults of *P. pediculata* are easily distinguished from the other known Saudi *Pollenia* species by the bundle of pale hairs at underside of the node at junction of humeral crossvein and subcosta (Fig. 95). As with the other *Pollenia* species, *P. pediculata* adults were primarily collected from areas of irrigated agricultural production. Rognes (1991) has recorded the earthworm *Eienia rosea* (Savigny) as a host for *P. pediculata* larvae.



Figs. 92-97: *Pollenia pediculata*. Fig. 92: Male cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 93: Male cerci and surstylus, lateral view (scale 0.2 mm). Fig. 94: Male aedeagus, dorsal view (scale 0.1 mm). Fig. 95: Wing, underside (scale 1mm). Fig. 96: Thorax, dorsal view (scale 3 mm). Fig. 97: Male aedeagus, ventral view (scale 0.1 mm).



Fig. 98: Distribution of *Pollenia pediculata* in Saudi Arabia.

***Pollenia rudis* (Fabricius, 1794)**

Figures 99-106.

Musca rudis Fabricius, 1794: 314.*Musca obscura* Fabricius, 1794: 315, Rognes, 2002: 19.*Musca familiaris* Harris, 1869: 336, Rognes, 1991: 235.*Musca varia* Meigen, 1826: 66, Rognes, 1991: 235.*Pollenia varia* Kurahashi, Mihara & Takahashi, 1988: Rognes, 2002: 19.*Pollenia rudis* Rognes, 2002: 19.

Material examined: 7♂, 9♀.

Baha, Wadi Turubah, 14.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 12'610" E 41° 17'056", 918m, 1♂2♀; Wadi Turubah, 10.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 12'610" E 41° 17'056", 918m, 2♂; Thee Ain, 11.V.2011, H. Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 19° 55'727" E 41° 26'426", 754 m, 1♂; Wadi Gala, 16.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 08'079" E 41° 20'561", 1900m, 2♀; (all KSMA). **Riyadh**, Tumayr, 10.II.2010, H. Al Dhafer, F. Al Husein, M.T, N 26° 42'36" E 45° 52'11", 1♀; Tumayr, 24.IV.2010; H. Al Dhafer, F. Al Husein, M.T, N 26° 42'36" E 45° 52'11", 1♂; Al Uyaynah, 28.IV.2010, T. Hazazi, S.N, 1♀; Al Amariyah, 23.III.2011, H. Setyaningrum, M.T, 1♂; Al Amariyah, 30.III.2011, H. Setyaningrum, S.N, 1♀; Al Amariyah, 7.IV.2010, B. Al Salem, S.N, Al Mossa farm, 1♀; Al Amariyah, 7.IV.2010, M. Al Hory, S.N, Al Mossa farm, 1♀; Al Amariyah, 10.III.2010, A. Al Motairy, S.N, Al Salem Farm, 1♀; (all KSMA).

Total length, male 3–9 mm (n= 7), female 5-9 mm (n= 9).

Head: Facial keel well-developed, sharp. Palpi black.

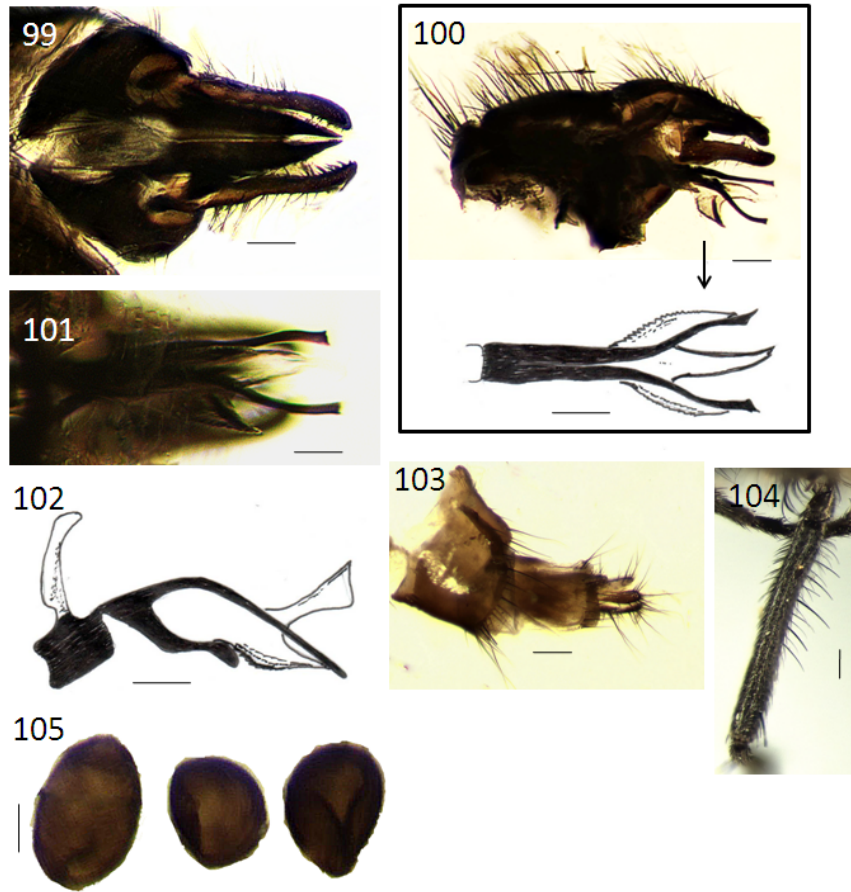
Thorax: Fore tibia with 1-2 posteroventral setae. Wing lacking bundle hairs underside at junction of humeral crossvein and basicosta, basicosta yellow to brown.

Abdomen: Dark black, without pattern.

Genitalia: Surstylus weakly curved and margins subparallel, cerci narrowed apically (Figs. 99, 100). Male, Aedeagus, tip of paraphallus lacking minute denticles (Figs. 100, 101, 102). Spermathecae oval, not constricted at base (Fig. 105).

Comments: *Pollenia rudis* can be usually distinguished from the most similar species, *P. hungarica* by the middle and hind femora with black posteroventral hairs (Fig. 104), palpi yellowish brown apically, and in the aedeagus of the male, the paraphallus tip lacks minute denticles. Additionally, in the female the spermathecae are oval and not constricted at the base. *Pollenia rudis* is a common and widespread Holarctic species (Rognes 1987; Whitworth, 2006). It also occurs in New Zealand and even Hawaii (Rognes, 1991). First reported from Saudi Arabia by Al Misned (2003) from Riyadh province also it has been collected in Asir (Dawah & Abdullah, 2009) and Baha provinces (Fig. 106).

Biology: As other adult *Pollenia*, *P. rudis* was associated with irrigated areas, especially active agricultural sites, where presumably the larval earthworm host is present. Rognes (1991) has recorded the earthworm *Eienia rosea* (Savigny) as a larval host for *P. rudis*, but also indicated the lepidopteran, *Chondrostegia maghrebica* Joan. as a host for this species.



Figs. 99-105: *Pollenia rudis*. Fig. 99: Male cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 100: Male cerci and surstylus lateral view, aedeagus dorsal view (scale 0.2 mm). Fig. 101: Male aedeagus, ventral view (scale 0.1 mm). Fig. 102: Profile aedeagus lateral view (scale 0.2 mm). Fig. 103: Female ovipositor, dorsal view (scale 0.1 mm). Fig. 104: Middle femora (scale 1 mm). Fig. 105: Female spermathecae (scale 0.1 mm).



Fig. 106: Distribution of *Pollenia rudis* in Saudi Arabia.

Pollenia semicinerea* Villeneuve, 1912Pollenia semicinerea* Villeneuve, 1912: 51*Pollenia semicinerea* Rognes, 1988: 331.

The description below is modified from Rognes (1988).

Total length, male 6.9-10 mm and female 6.1-9.8 mm.

Head: Facial carina conspicuous. Antenna, pedicel yellow. Paracalia hairy. In male, hind tarsus with decumbent vestiture.

Thorax: Dorsally, black with little dust. Lower calypter white or weakly infuscated.

Abdomen: Yellowish to bluish.

Genitalia: In male tergites 5 (T5) tip not curved whereas in female, cerci without basal microtrichiae.

Comments: *Pollenia semicinerea*, a species of the *semicinerea* group (Rognes, 1988, 2002), which is reported to be widespread in the Middle East, Caucasus, and Eastern Europe (Rognes, 2002), and recorded regionally from Palestine, Lebanon, and Syria (Rognes, 1988). The occurrence of *P. semicinerea* in Saudi Arabia was not confirmed during this study, but eventually may be found. The male of *P. semicinerea* is similar to *P. dasypoda* can be distinguished in the above key. Further information about *P. semicinerea* group is available in Rognes (1988).

Biology: Unknown.

Subfamily Rhiniinae**Key to genera and species of Rhiniinae known from Saudi Arabia**

Modified from Peris (1952), Zumpt (1958), and Rognes (2002)

The following treatment basically follows Rognes (2002), especially modifying the generic key. Peris (1952) and Zumpt (1958) were followed for those genera not included by Rognes (2002). The subfamily is characterized in the adult by the occiput without setulae in the upper half, lower portion of the face protruding well in the front of vibrissal corners, and the subcostal sclerite bare.

- 1 Anterior spiracle bristle present 2
- Anterior spiracle bristle absent *Pararhyncomyia cribriformis*
- 2 Mouthpart greatly reduced (Fig. 186). Body large and dull (Fig. 185). Arista bare .
..... *Villeneuveilla seguyi*
- Mouthpart normal. Body variable. Body vary 3
- 3 Arista pectinate..... 4
- Arista bare, plumose, or pubescent (Fig. 161) 5
- 4 Cell 4+5 with long stalk *Rhinia*
- Cell 4+5 open or closed..... *Stomorhina*
- 5 Arista bare or pubescent..... 6
- Arista plumose 7
- 6 Proepisternal depression hairy (Fig. 128). Male, cerci fused into a single rod-like structure. Black spot of parafacial absent. Humeral callus yellow. Tergites margined with black posteriorly (Fig. 129). Posterior half of hind femora brown-black *Metalliopsis arabica*
- Proepisternal depression bare (Saudi species) (Fig. 140). Parafacial with or without black spot. Humeral callus olivaceous green or other..... *Rhyncomyia*
- 7 Presutural acrotischal bristles develop (Fig. 126). Arista ventrally hairy only the upper portion (Fig. 124). Tibia black. Basicosta yellowish-brown. Costal spine short (Fig. 125)..... *Isomyia terminata*
- Presutural acrotischal bristles not develop or weakly develop. Arista ventrally hairy throughout length (Fig. 119). Tibia yellow or yellowish-brown. Basicosta

coloration variable. Costal spine long or if short very close to surrounding spines (Fig. 121)..... *Cosmina*

Key to *Cosmina* species

- 1 Propleuron depression with fine hairs (Fig. 122)..... 2
- Propleuron depression bare 5
- 2 Basicostal pale yellow (Fig. 120). Abdomen olivaceous to green metallic. Male, cerci curved at apex. Surstylus with lateral processa, tip outcurved apically (Figs. 113. 114) *Cosmina viridis*
- Basicosta reddish-brown or black 3
- 3 Basicosta black. Costal vein strongly darkened..... *Cosmina aenea*
- Basicosta reddish-brown. Costal vein slightly darkened 4
- 4 Male genitalia, cerci with very narrow apically and slightly curved, surstylus with notched marginally and straight *Cosmina prasina*
- Male genitalia, cerci truncate apically and straight, surstylus curved without notched *Cosmina fishelsoni*
- 5 Wing margin darkly infuscated. Abdomen black..... *Cosmina fuscipennis*
- Wing slightly infuscated (Fig. 107). 6
- 6 Eyes in the lower part almost same with the above one *Cosmina ebejeri*
- Eyes in the lower part smaller than the above one. Basicosta reddish-brown to black. Abdomen brown *Cosmina arabica*

Key to *Rhinia* species

- 1 Mesonotum and scutellum with short setulosity. Female frontal stripe about as broad as one parafrontalia. Male sternites 5 long..... *Rhinia nigricornis*
- Mesonotum and scutellum with long setulosity. Female frontal stripe about twice as broad as one parafrontalia. Male sternites 5 short *Rhinia apicalis*

Key to *Rhyncomya* species

- 1 Body dark 2
- Body pale 7
- 2 Parafacialia setulose. Mesopleura yellow. Thorax without dorsal vittae..... *Rhyncomya varifrons*
- Parafacialia not setulose 3
- 3 Arista pubescent. Two rows setulae present between the acrostichal setae..... *Rhyncomya tristis*
- Arista bare 4
- 4 Width scutellum at the base 1.5× of the length. Calypter lobulate 5
- Width scutellum almost as wide as long. Calypter not lobulate .. *Rhyncomya zumpti*
- 5 Male sternites 5 with "earlets", surstylus very short..... *Rhyncomya aravaensis*
- Male sternites 5 without "earlets", surstylus normal 6
- 6 In male, sternites 5 with short setulae innerly. In female, frontal setae develop only in lower third of the front *Rhyncomya jordanensis*
- In male, sternites 5 without short setulae innerly. In female, frontal setae well developed on the whole part of the front *Rhyncomya io*
- 7 Lower part of parafacialia without black spot..... *Rhyncomya callopis*
- Lower part of parafacialia with black spot..... 8
- 8 The lower spot on parafacialia larger than upper one. Scutellum olivaceous green 9
- The lower spot on parafacialia smaller than upper one. Posterior portion of scutellum yellow 10

- 9 Male and female parafacialia with 2 black spots (Fig. 159). Tarsus black and covered dense black bristles (Fig. 160).....*Rhyncomya sinaiensis*
 - Male parafacialia with 3 black spots, female parafacialia with 4 large black spots (Fig. 139). Tarsus yellow (Fig. 138) and covered with relatively few black bristles *Rhyncomya bullata*
- 10 Ventrally abdomen with numerous black bristles (Fig. 156). Male, surstylus incurved, basally with numerous long inner hairs (Fig. 150). Female, ovipositor with numerous hairs on epiproct and cercus (Fig. 154)*Rhyncomya nigripes*
 - Underside of abdomen lacking black bristles (Fig. 148). Male, surstylus not curved, basally with numerous outer hairs (Fig. 142). Female, ovipositor with relatively fewer hairs on epiproct and cercus (Fig. 146).....
*Rhyncomya desertica*

Key to *Stomorhina* species

- 1 Cell r 4+5 open at wing tip (Fig. 174). Anepisternum and katepisternum with black piliferous spots. Wing lacking apical black spot (Fig. 174).....
*Stomorhina lunata*
 - Cell r 4+5 closed and petiolate (Fig. 178). Anepisternum and katepisternum without with black piliferous spots. Wing with apical black spot (Fig. 178) 2
- 2 Abdomen black with lateral yellow markings*Stomorhina cribrata*
 - Abdomen completely glossy black (Fig. 177). Aedeagus compact with short hypophallus and paraphallus swollen apically (Figs. 181, 182, 183).
*Stomorhina rugosa*

Genus *Cosmina*

Cosmina aenea (Fabricius, 1805)

Dictya aenea Fabricius, 1805: 1805.

Idiopsis aenea Zumpt, 1958: 66.

Musca punctulata Wiedemann, 1819: 30, Peris, 1952: 131.

Idia seriepunctata Loew, 1852: 660, Zumpt, 1958: 66.

Cosmina depressa Karsch, 1887: 377, Zumpt, 1958: 66.

Cosmina punctulata Malloch, 1926: 517, Zumpt, 1958: 66.

Cosmina punctulata var. *microps* Malloch, 1926: 518, Zumpt, 1958: 66.

The description below is modified from Zumpt (1958) and Peris (1952).

Total length 6-10 both sexes.

Head: Frons black with pollinosity, in male frons at narrowest point as broad as anterior ocelli whereas in female frons at vertex about half the length of the eyes. Antennal groove black, arista with long hairs, pedicel reddish. Vibrissa long and thick.

Thorax: Olivaceous with pollinosity and black setigerous spots. Anterior spiracle yellowish dark and posterior spiracle blackish brown. Wings with the anterior margin broadly infuscated, basicosta blackish, costal spine distinct. Calypter oval.

Abdomen: Olivaceous and longer than broad.

Genitalia: Cerci and surstylus straight, surstylus inner margin with long hairs (Zumpt, 1958).

Comments: *Cosmina aenea* can be recognized from other Saudi *Cosmina* by the white head, the large bronze unspotted abdomen that is flattened. Additionally, *C. aenea* can be distinguished from the most similar species, *C. prasina*, by having the basicosta black and a darkened costal vein. Dawah and Abdullah (2009) recorded this species from Asir Province. No specimens were examined during this study.

Fabricius (1805) apparently described this species from England. *Cosmina aenea* is reported to have a widespread distribution in the Afrotropical and Palearctic regions (Peris, 1952, Zumpt, 1958).

Biology: Unknown.

***Cosmina arabica* Robineau-Desvoidy, 1830**

Figures 107-112.

Cosmina arabica Robineau-Desvoidy, 1830: 424.

Material examined: 6♂, 4♀.

Asir, Maraba, 1-17.VI.2003, H.A. Dawah, M.T, 1♂ (NMWC). **Baha**, Thee Ain, 15.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 19° 55'727" E 41° 26'462", 754m, 1♂; Wadi Gala, 16.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 08'07" E 41° 20'561", 1900m, 2♀; Wadi Turubah, 10.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 12'610" E 41° 17'056", 918m, 1♂, 2♀; (all KSMA). **Jizan**, Jizan Road, Ahad Al Masareha, 11.III.2010, H.Al Dhafer, A. El Gharbawy, L.T, N 17° 2'28" E 42° 52'38", 1♂ (KSMA); Jizan, Sabya-Hurub Road, 25.V.2012, A. Al Ansi, S. N, N 17° 16'936" E 42° 71'536", 1♂ (KSMA); Jizan, Aiban Sabya Road, H. Fadl, Beating, N 17° 15'248" E 42° 57'960", 1♂ (KSMA).

Total length male 7–8 mm (n= 6), female 7–9 mm (n= 4).

Head: Frons wide, basal hair of the frons blackish.

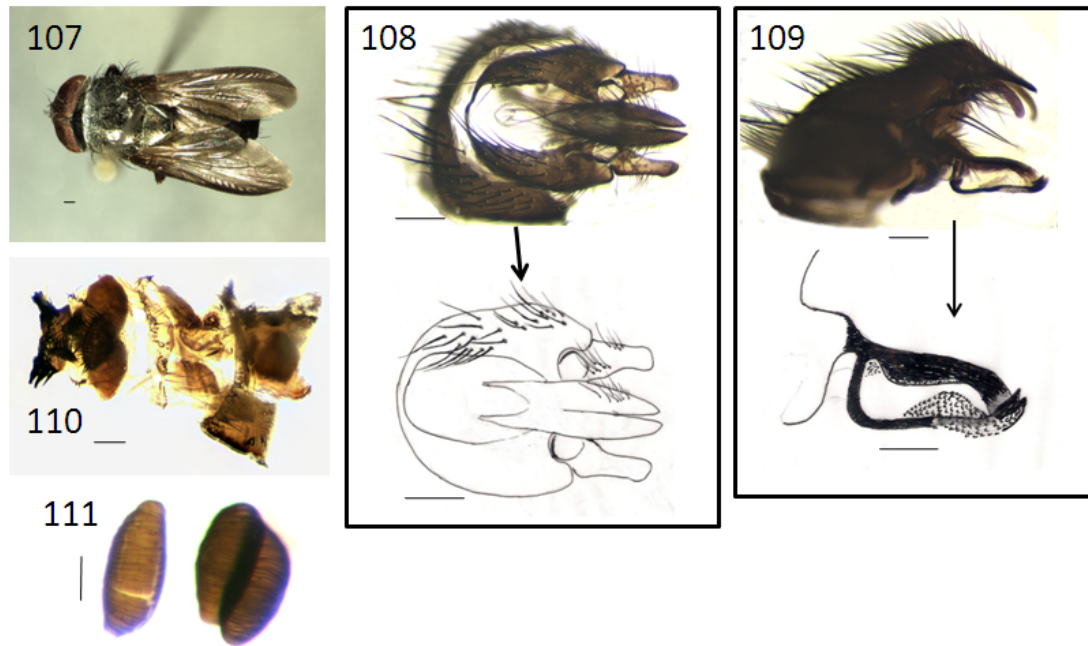
Thorax: Bright green–brown metallic. Propleuron depression bare. Calypter of white colour with marginal fine hair. Tibia greenish and normal setae. Tarsus yellow to brown. Wings brown smoky (Fig. 107), basicosta reddish to brown.

Abdomen: Dark brown, without banded tergites.

Genitalia: Surstylus straight and parallel, surstylus distally rounded, cerci slender and conspicuous pointed apically (Fig. 108). Aedeagus with paraphallus swollen basally, hypophallus sclerotised with minute serration (Figs. 109). Female ovipositor with very strong spines on epiproct (Fig. 110). Spermathecae oval with surface pattern (Fig. 111).

Comments: Robineau-Desvoidy (1830) described this species from 'Arabie' presumably from the Arabian Peninsula and has been recorded from Yemen, Oman, and UAE (Peris, 1952; Deeming, 1996). The first report of this species in Saudi Arabia was by Dawah and Abdullah (2009). This species it has been collected from southwestern Saudi Arabia including Asir, Baha and Jizan provinces (Fig. 112).

Biology: Unknown.



Figs. 107-111: *Cosmina arabica* Fig. 107: Body, dorsal view (scale 2 mm). Fig. 108: Male cerci and surstylus dorsal view (scale 0.1 mm). Fig. 109: Male aedeagus, lateral view (scale 0.2 mm). Fig. 110: Female ovipositor, dorsal view (scale 0.1 mm). Fig. 111: Female spermathecae (scale 0.1 mm).

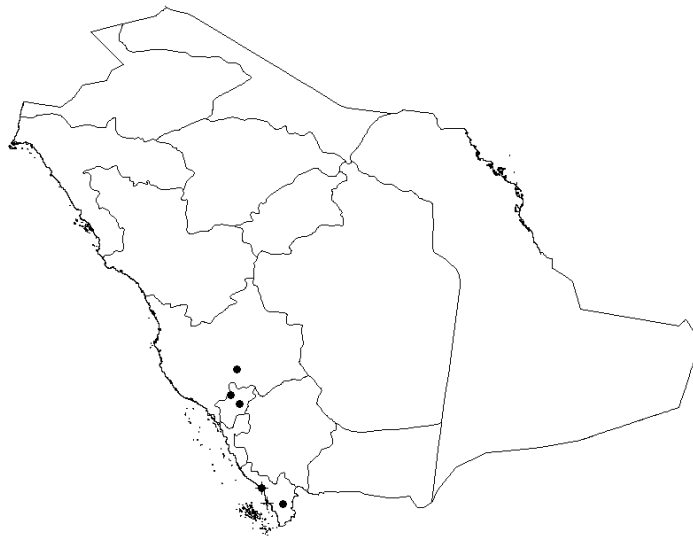


Fig. 112: Distribution of *Cosmina arabica* in Saudi Arabia.

***Cosmina ebejeri* Deeming, 1996**

Cosmina ebejeri Deeming, 1996: 268-269.

The description is summarized from Deeming (1996).

The total male length 6 mm.

Head: Parafacialia yellow, silvery dusting with metallic spot near to vibrissa. Palpi yellow. Arista pubescent.

Thorax: Mesonotum and scutellum with subshining spot in the base of seta, setae mostly black, in male the setae longer than female. Wing brownish hyaline in the base, with basicosta brownish, cell r 4+5 open. Calypter twice as long as alar and rounded.

Abdomen: Black with dusting silvery.

Genitalia: Cerci and surstylus straight, aedeagus with hypophallus sclerotised with serration.

Comments: *Cosmina ebejeri* firstly described from Oman by Deeming (1996). This species is not known from Saudi Arabia but may eventually found, especially in the eastern area of the country. This is a black species similar with *C. arabica* and can be distinguished by above key.

Biology: Unknown.

***Cosmina fishelsohni* Rognes, 2002**

Cosmina fishelsohni Rognes, 2002: 21-24.

The description is summarized from Rognes (2002).

Total length, male 7-8 mm, female 8-9 mm.

Head: Male, frons at narrowest point 0.013-0.032 times head width, upper part of parafacialia yellowish, eye facets in some part enlarged, vibrissa large, genal dilation metallic black, palpi black. Female, the frons at vertex about 0.314-0.336 times head width, eye facets uniformly small.

Thorax: Black with green metallic sheen. Proepisterna depression hairy. Anterior spiracle larger in male and smaller in female. Coxopleural streak absent. Wing yellowish brown with basicosta brownish. Legs mostly brown.

Abdomen: Black with green metallic sheen.

Genitalia: Male, dorsally cerci straight and surstylus curved apically, aedeagus with hypophallus sclerotised with serration. Female, epiroct flattened and cercus slightly curved.

Comments: *Cosmina fishelsohni* described originally from Palestine by Rognes (2002) and recorded regionally from UAE (Deeming, 2008). This species can be distinguish from other *Cosmina* species by above key and may eventually found in Saudi Arabia.

Biology: Unknown.

***Cosmina fuscipennis* Robineau-Desvoidy, 1830**

Cosmina fuscipennis Robineau-Desvoidy, 1830: 423.

Cosmina punctulata Wiedemann, 1819: 21, Pont, 1980: 780

Cosmina aethiopissa Séguy, 1958: 176, Pont, 1980: 780.

Cosmina cuprina Bigot, 1860: 539, Pont, 1980: 780.

The description below is adopted from Zumpt (1958).

Total length 8-11 mm both sexes.

Head: Parafacialia silvery with pollinosity, lower part with black spot. In male, frons at narrowest point 1 to 2× width of anterior ocelli. In female, frons at vertex about ½ eye length. Antenna groove metallic black, arista with long hairs in both sides. Vibrissa short and thick.

Thorax: Blackish coppery. Presutural acrostichal bristle not developed. Costal region of wings strongly infuscated, basicosta blackish and costal spine indistinct. Calypter smoky. Legs black.

Abdomen: Blackish coppery, dorsally and ventrally with short black hairs.

Genitalia: Cerci straight, surstylus slightly curved with inner margin hairy (Zumpt 1958).

Comments: Dawah and Abdullah (2009) listed this taxon from Saudi Arabia (Asir Province, Tanoma City), and these specimens were not available for study. No specimens were examined from Saudi Arabia for this study. *Cosmina fuscipennis* is blackish coppery species, apparently widespread in the Afrotropical Region (Peris, 1952).

Biology: Unknown.

***Cosmina prasina* (Brauer & Bergenstamm, 1889)**

Idiopsis prasina Brauer & Bergenstamm, 1889: 171.

Pollenia viridicon Hough, 1898: 178, Zumpt, 1958: 73, Pont, 1980: 781.

Material examined: 1♀.

Yemen, Sana'a, II.1992, A. Van Harten, 1♀ (NMWC).

Female body length 9 mm.

Head: Fronto orbital plate with black circular at the base of setulae. Parafacialia bare. Palpi yellowish grey. Antenna, arista hairy and pectinate.

Thorax: Olivaceous. Propleuron depression hairy. Wing slightly infuscated and basicosta testaceous.

Abdomen: Olivaceous without marking.

Genitalia: In male, cerci pointed and surstylus rounded apically (Zumpt, 1958).

Comments: Dawah and Abdullah (2009) listed this species from Saudi Arabia (Asir Province), and these specimens were not available for study. No additional material was collected during this study. *Cosmina prasina* was originally described by Brauer and Bergenstamm (1889) as *Idiopsis prasina* from Egypt. Peris (1952) was treated *C. prasina* and *C. pseudoprasina* Becker, 1912 as valid species and noted similarities. *Cosmina prasina* is widely distributed throughout the Afrotropical, Palaearctic, and Oriental regions (Peris, 1952; Zumpt, 1958). This species can be separated from the most similar species, *C. viridis* by having a testaceous basicosta.

Biology: Unknown.

***Cosmina viridis* (Townsend, 1917)**

Figures 113-123.

Synamphoneuris viridis Townsend, 1917: 199.

Idiopsis viridis Zumpt, 1958:71

Material examined: 25♂, 35♀.

Asir, Abha, Habalah, 25.IV.2011, M. Sharaf, H. Setyaningrum, A. Al Ansi, S.N, N 20° 08'79" E 41° 20'561", 1900m, 1♀ (KSMA). **Baha**, Wadi Gala, 16.V.2011, H. Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 08'79" E 41° 20'561", 1900 m, 2♀ 4♂; Wadi Ghanuna, 11.V.2011, H. Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 19 25' 341" E 41 36'329", 366 m, 5♀ 7♂; Thee Ain, 15.V.2011, H. Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 19° 55' 727" E 41° 26'426", 754 m, 3♀; Thee Ain, 11.V.2011, H. Fadl, A. El Torkey, M. Sharaf, , H. Setyaningrum, S.N, N 19° 55'727" E 41° 26'426", 754 m, 1♀; (all KSMA). **Jizan**, Jizan, 15.IV.1979, S. Tilkian, 1♂ (ANMA); Jizan, 15.IV.197, El Madi, 1♀ (ANMA);

Fifa, 31.X.1984, A. Talhouk, S.Tilkian, R.Abousouhayroh, M.Al Taher, A.Klaudi, 3♂ (ANMA). **Riyadh**, Deirab, 28.II.2010, H. Al Dhafer, A. El Gharbawy, A. El Torkey, M.T, 2♀; Muzahimiyah, Khararah, 30.III.2011, Y. Al Dryhim, H. Al Dhafer, A. El Gharbawy, H. Setyaningrum, A. Al Ansi, S.N, N 24° 24'21" E 46° 14'40", 1♂; Muzahimiyah, Khararah, 30.III.2011, Y. Al Dryhim, H. Al Dhafer, A. El Gharbawy, H. Setyaningrum, A. Al Ansi, L. T, N 24° 24'21" E 46° 14'40", 1♂2♀; Muzahimiyah, Khararah, 13.IV.2011, Y. Al Dryhim, H. Al Dhafer, A. El Gharbawy, H. Setyaningrum, A. Al Ansi, L. T, N 24° 24'21" E 46° 14'40", 7♀ 1♂; Deirab, 23.V.2010, H. Al Dhafer, A. El Gharbawy, A. El Torkey, B.T, 1♀; Deirab, 30.XII.2009, H.Setyaningrum, S.N, Grasses, 1♀; Deirab, 28.III.2010, H. Al Dhafer, A. El Gharbawy, A. El Torkey, M.T, 1♀; Al Kharj, 16.XI.2005, A. Salhabi, 1♀; Deirab, 20.VI.2010, H. Al Dhafer, A. El Gharbawy, A. El Torkey, M.T, 1♂; Rhodet Khorim B, 28.IV.2012, H. Setyaningrum, Pitfall trap, N 25° 25'943" E 47° 13'863" 572 m, *Calatropis procera*, 1♂; Rhodet Khorim B, 14.IV.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♂; Rhodet Khorim B, 17.III.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♂; Rhodet Khorim A, 5.III.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim B, 18.II.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♂; Rhodet Khorim A, 27.V.2012, H. Setyaningrum, M.T, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim A, 18.II.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim A, 17.XI.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim A, 27.VII.2012, H. Setyaningrum, Pitfall trap, N 25° 22'986" E 47° 16'712" 559 m, *Calatropis procera*, 1♂; Rhodet Khorim A, 26.V.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim B, 15.V.2012, H. Setyaningrum, L. T, N 25° 25'943" E 47° 13'863" 572 m, 1♂; Rhodet Khorim B, 28.IV.2012, H. Setyaningrum, Pitfall trap, N 25° 25'943" E 47° 13'863" 572 m, *Calatropis procera*, 1♂; Rhodet Khorim B, 18.II.2012, H. Setyaningrum, M.T, N 25° 25'943" E 47° 13'863" 572 m, 1♂ (all KSMA).

Total length male 7–9 mm (n= 17), female 7–10 mm (n= 30).

Head: Frons slightly expanded, light brown. A shiny brown spot near parafacilia. Antenna and palpi reddish brown.

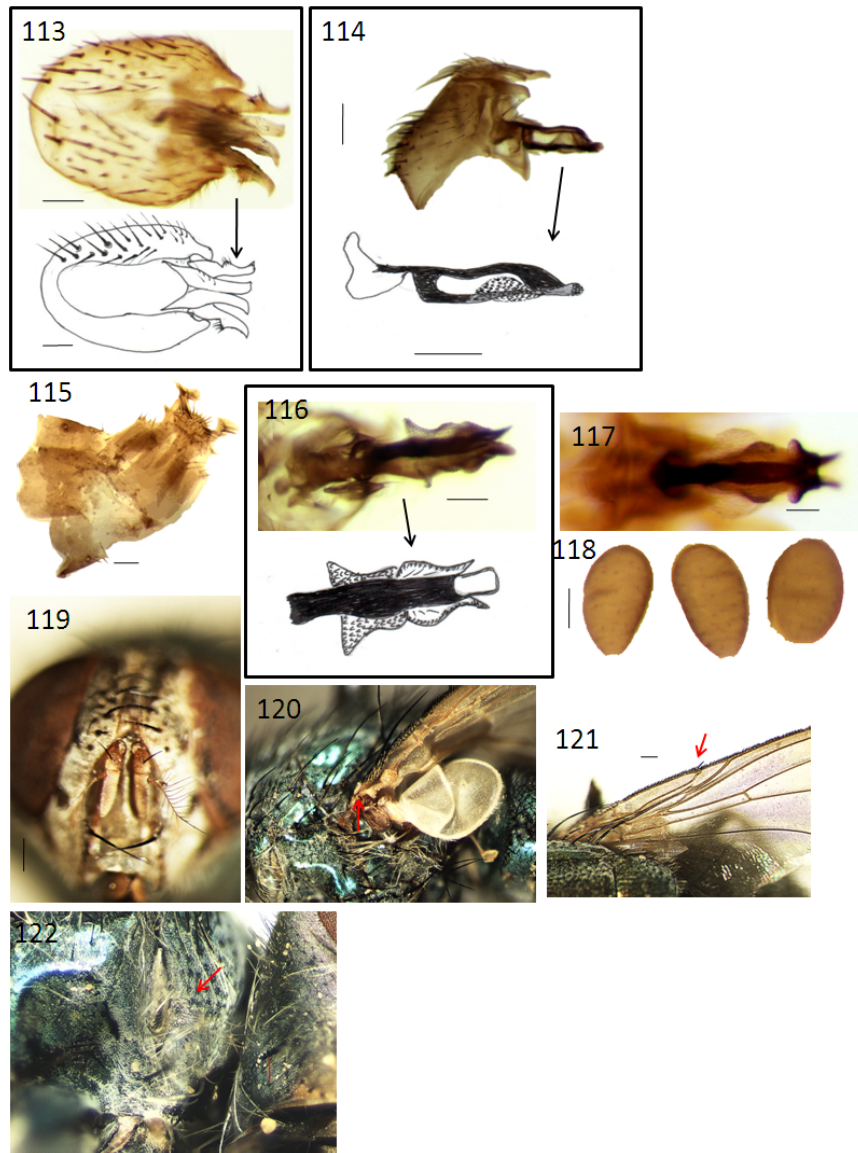
Thorax: Legs mostly brownish, fore femur greenish black metallic. Wings and tegulae yellowish.

Abdomen: Green cupreous, slightly shiny, fine yellowish hairs present ventrally.

Genitalia: Surstylus slender and parallel, surstylus with swelling in distally, cerci slender and notched on apically (Figs. 113, 114). Aedeagus with paraphallus swollen apically, hypophallus sclerotised with minute serration (Figs. 114, 116, 117). Female ovipositor with epiproct curved and cerci rounded (Fig. 115). Spermathecae oval and smooth (Fig. 118).

Comments: *Cosmina viridis* can be distinguished from other species of the genus occurring in Saudi Arabia by yellow pale basicosta (Fig. 120). Originally described from India, and recently recorded from Ethiopia, Iran, Oman, and Yemen (Dawah & Abdullah, 2009). *Cosmina viridis* appears relatively common in Saudi Arabia, with specimens collected from Asir, Baha, and Jizan, and Riyadh provinces (Fig. 123).

Biology: Unknown.



Figs. 113-122: *Cosmina viridis*. Fig. 113: Male cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 114: Male cerci and surstylus lateral view, aedeagus lateral view (scale 0.2 mm). Fig. 115: Female ovipositor, dorsal view (scale 0.1 mm). Fig. 116: Male aedeagus, dorsal view (scale 0.1 mm). Fig. 117: Male aedeagus, ventral view (scale 0.1 mm). Fig. 118: Female spermathecae (scale 0.1 mm). Fig. 119: Antenna, front view (scale 1 mm). Fig. 120: Basicosta (scale 1 mm). Fig. 121: Costal spine, dorsal view (scale 1 mm). Fig. 122: Propleuron depression (scale 1 mm).

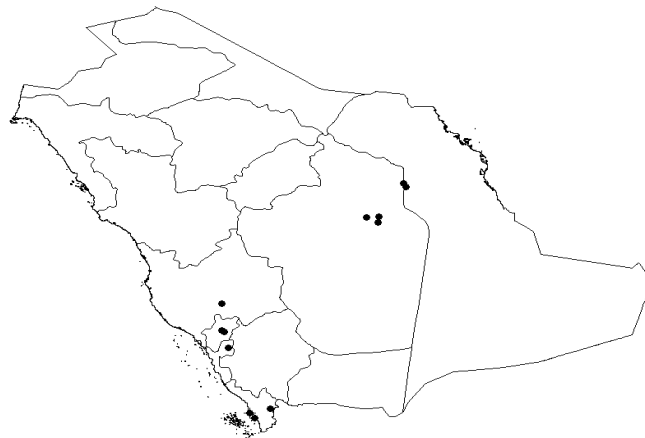


Fig. 123: Distribution of *Cosmina viridis* in Saudi Arabia.

Genus *Isomyia*
***Isomyia terminata* (Wiedemann, 1830)**
Figures 124-127.

Musca terminata Wiedemann, 1830: 414.

Strongyloneura nigrohirta Malloch, 1928: 487, Zumpt, 1958: 53.

Thelychaeta obumbrata Villeneuve, 1935: 416, Zumpt, 1958: 53.

Material examined: 2♂.

Asir, Abha, Madenate Ameer Sultan, 25.II–25.V. 2002, H. A Dawah, 1♂ (NMWC).

Baha, Wadi Turubah, 10.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 12'610" E 41° 17'056" 918m, 1♂(KSMA).

Total male length 7–9 mm (n= 2).

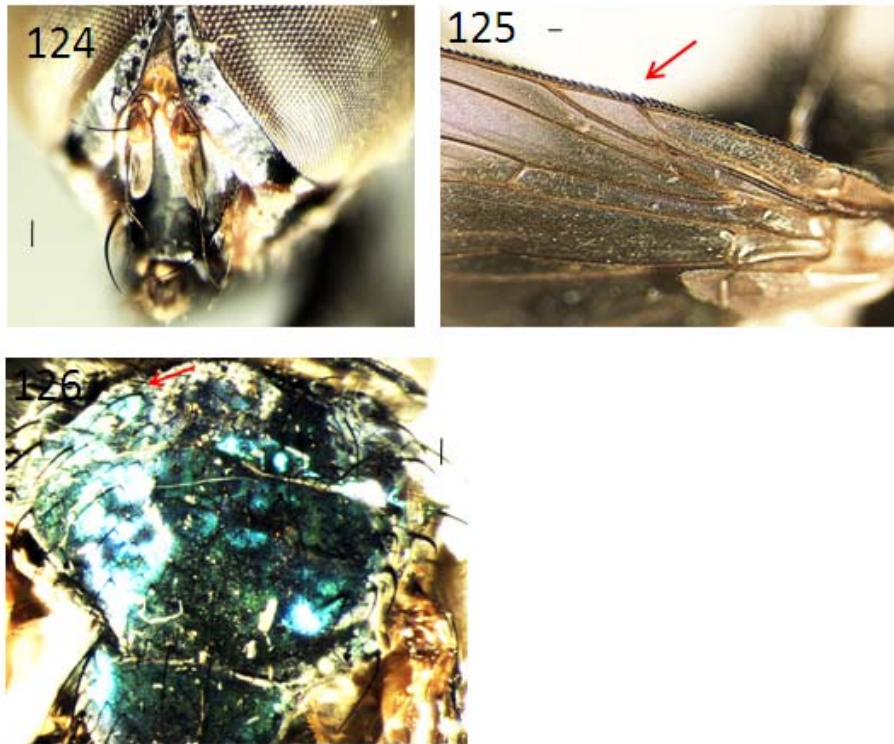
Head: Head slightly depressed in lateral view, frons wide.

Thorax: Metallic greenish blue (Fig. 126). Anterior cross vein with ventral hairs.

Abdomen: Green cupreous, without anterior black band.

Comments: This species was originally described from Sierra Leone, Africa, and reported from West Africa to the Democratic Republic of the Congo, Nigeria, and Uganda (Zumpt, 1958; Deeming, 1996). Dawah and Abdullah (2009) reported the first records for Saudi Arabia and also mentioned the Oman and Yemen. All available records from Saudi Arabia are from southwestern provinces of Asir and Baha suggesting affinities with the Afrotropical region of the country (Fig. 127).

Biology: Unknown.



Figs. 124-126: *Isomyia terminata*. Fig. 124: Head, frontal view (scale 2 mm). Fig. 125: Right wing, dorsal view (scale 1 mm). Fig. 126: Thorax, dorsal view (scale 2 mm).



Fig. 127: Distribution of *Isomyia terminata* in Saudi Arabia.

Genus *Metalliopsis*
***Metalliopsis arabica* Deeming, 2008**

Figures 128-130.

Metalliopsis arabica Deeming, 2008.

Material examined: 1♀.

Riyadh, Deirab, 28.III.2010, H. Al Dhafer, A. El Gharbawy, A. El Torkey, M.T, desert area, 1♀ (KSMA).

Total female length 7mm (n=1).

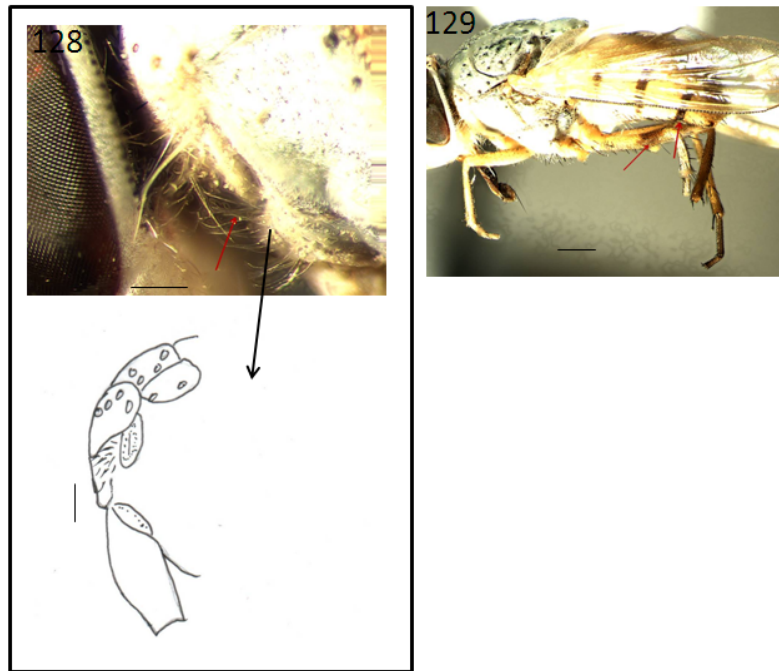
Head: Yellowish. Occiput black. Frons at narrowest point as wide as anterior ocellus.

Thorax: Olivaceous-gray. Propleuron bare (Fig. 128). Legs yellow, mid and hind tibia infuscate (Fig. 129).

Abdomen: Yellow with distinct posterior lateral and middorsal black markings (Fig. 129).

Comments: *Metalliopsis arabica* was recently described from the UAE by Deeming (2008) listing a Saudi paratype from Asir Province (Fig. 130). Deeming (2008) tentatively placed this taxon in the genus *Metalliopsis*. Apparently, the only generic character that can be used to distinguish *Metalliopsis* and all species included in the closely related *Rhyncomya*, is the fused male cerci into a single narrow rod-like structure (Rognes, 2002). The phylogenetic relationships of *Rhyncomya* and *Metalliopsis* will have to be resolved before final generic placement. This species is easily distinguished by the distinctive abdominal tergal pattern.

Biology: Unknown.



Figs. 128-129: *Metalliopsis Arabica*. Fig. 128: Proepisternal depression (scale 1 mm). Fig. 129: Body, lateral view (scale 2 mm).



Fig. 130: Distribution of *Metalliopsis arabica* in Saudi Arabia.

Genus *Pararhyncomyia*

***Pararhyncomyia cribriformis* Becker, 1910**

Pararhyncomyia cribriformis Becker, 1910: 143.

Pararhyncomyia cribriformis Zumpt, 1958: 195, Pont, 1980:

Material examined: 1♂.

Republic of Kenya, Laikipia, Mpala Research Centre, 25.VI.2005, K. Baldock, *Acacia nilotica*, 1♂ (NMWC).

Total male length 6 mm.

Head: Bucca white silvery with piliferous black spot. Antenna, first flagellomere blackish brown, pedicel metallic black, and arista bare. Palpi black.

Thorax: White silvery. Dorsally with five dark transverse pattern. Wings slightly smoky, cell r 4+5 closed and petiolate. Calypter smoky. Anterior spiracle white silvery. Legs, femora white silvery and tibia blackish.

Abdomen: White silvery with piliferous spot, ventrally with white hairs.

Genitalia: Not examined.

Comments: *Pararhyncomyia cribriformis* was listed from Saudi Arabia by Abu Zoherah *et al.* (1993) without any specific locality information. It noted that Abu Zoherah *et al.* (1993) species listing often could not be confirmed since no voucher material was available for examination. This species originally was described from the archipelago Socotra, Yemen. Deeming (1996) additionally recorded it from Oman. No specimens from Saudi Arabia of this rare species were available for study.

Biology: Unknown.

Genus *Rhinia*

***Rhinia apicalis* (Wiedemann, 1830)**

Figures 131-137.

Idia apicallis Wiedemann, 1830: 354.

Rhinia testacea Robineau-Desvoidy, 1830: 423, Zumpt, 1958: 112.

Idia flavipennis Macquart, 1843b: 125, Zumpt, 1958: 112.

Idia simulatrix Loew, 1852: 660, Zumpt, 1958: 112.

Idia punctata Bigot, 1858: 24, Zumpt, 1958: 112.

Idia bigoti Coquerel, 1862, Bisby *et al.*, 2012.

Idia pleuralis Thompson, 1869: 542, Zumpt, 1958: 113.

Beccarimyia glossina Rondani, 1873: 287, Zumpt, 1958: 113.

Rhinia fulvipes Bigot, 1874: 239, Zumpt, 1958: 113.

Rhinia pallidiventris Brauer, 1899: 22, Zumpt, 1958: 113.

Idiella trineuriformis Speiser, 1910: 153, Zumpt, 1958: 113.

Material examined: 10♂.

Baha, Thee Ain, 15.V.2011, H. Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 19° 54'727" E 41° 26'462", 754m, 2♂ (KSMA); Thee Ain, 9.XI.2012, H. Fadl, A. S.N, N 19° 54'727" E 41° 26'462", 754m, 1♂ (KSMA), Wadi Gala, 16.V.2011, H. Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 09'79" E 41° 20'561"A 1900m, 4♂ (KSMA). **Mecca**, Taif, Shafa, Shafa road, 12.X.2010, H. Al Dhafer, B. Kondratieff, H. Fadl, A. El Gharbawy, S.N, N 21° 08'21" E 40° 21'05", 3♂(KSMA).

Total male length, 3–9 mm (n= 10). Zumpt (1958) stated the total length both sexes 4–8 mm (n= 68).

Head: Protruding, antenna hairy (Fig. 136), palpi black. Frons wide with black and white patches.

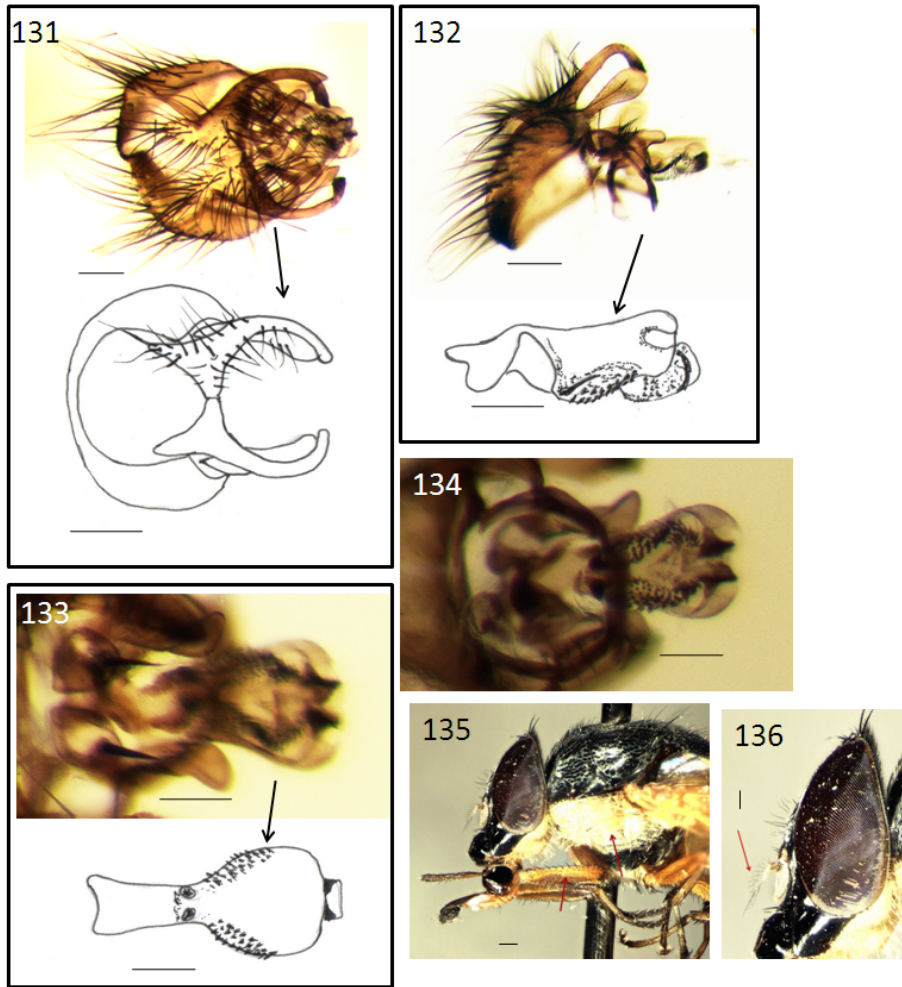
Thorax: Metallic greenish dorsally, laterally covered with dense bright yellow bristles (Fig. 135). Legs black, with tarsus yellow to brown.

Abdomen: Yellow, with lateral black spot, dorsally with piliferous small black spot.

Genitalia: Surstylus and cerci attached forming a “ring” shape in dorsal view, almost parallel length and wide. Cerci wide emarginated apically and curved (Figs. 131, 132). Aedeagus short, hypophallus with sclerotised serrations, paraphallus short and curved (Figs. 132, 133, 134).

Comments: *Rhinia apicalis* is a widespread Afrotropical species (Zumpt, 1958) and common in the subtropics of the Old World. Deeming (1996, 2008) reported it from Oman and UAE. In Saudi Arabia, *R. apicalis* has been collected from Asir, Baha, and Mecca (Taif) provinces (Dawah and Abdullah, 2009) (Fig. 137). *Rhinia apicalis* can be readily identified in the field by its yellow black spotted abdomen.

Biology: The larvae of *R. apicalis* have been found associated with the nests of Driver Ants (*Dorylus* sp.) and sand wasps (Sphecidae) (Cuthbertson, 1938).



Figs. 131-136: *Rhinia apicalis*. Fig. 131: Male cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 132: Male cerci and surstylus lateral view, aedeagus lateral view (scale 0.2 mm). Fig. 133: Male aedeagus, dorsal view (scale 0.1 mm). Fig. 134: Male aedeagus, ventral view (scale 0.1 mm). Fig. 135: Thorax, lateral view (scale 2 mm). Fig. 136: Antenna (scale 1 mm).

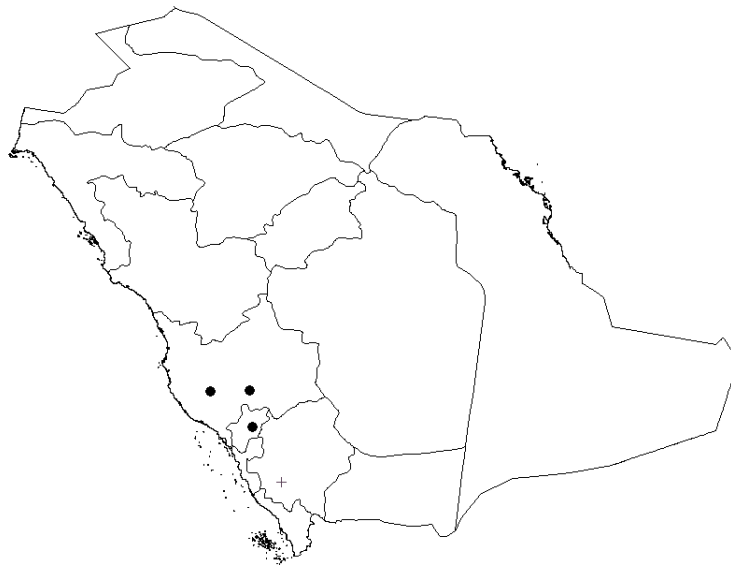


Fig. 137: Distribution of *Rhinia apicalis* in Saudi Arabia.

***Rhinia nigricornis* (Macquart, 1843a)**

Idia nigricornis Macquart, 1843a: 124.

Rhinia winthemi Villeneuve, 1915: 204, Zumpt, 1958: 115.

Rhinia apicalis Malloch, 1926: 503, Zumpt, 1958: 115.

The description below adopted from Zumpt (1958).

Head: Frontal stripe reddish brown, in female darker than male. Parafrontalia yellowish with stigerous spots.

Thorax: Male mesonotum and scutellum with short hairs, in female the hairs shorter than male.

Abdomen: Yellow.

Genitalia: Basically almost same with the *R. apicalis*, except in the sternite 5 which have longer and bigger “teeth” structure.

Comments: *Rhinia nigricornis* is a yellow species which is apparently close to *R. apicalis*, but can be distinguished by above key. This species widespread in Afrotropical region (Peris, 1952; Zumpt, 1958), regionally recorded from UAE (Deeming, 2008). This species may eventually found in Saudi Arabia especially in eastern area of the country.

Biology: Unknown.

Genus *Rhyncomya****Rhyncomya aravaensis* Rognes, 2002**

Rhyncomya aravaensis Rognes, 2002: 35-37.

The description summarized from Rognes (2002).

Total length, male 8-9.5 mm, female 8-9.1 mm.

Head: Male, frons at narrowest point 0.0057-0.0083 times of head width, parafacialia bare and yellow, frontall vita reddish, pedicel with single setae, first flagellomere dark, palpi yellow, arista pubescent. Female almost same with male except, frons at vertex 0.222-0.258 times of head width and the setae in pedicel absent.

Thorax: Scutellum black. Metathoracic spiracle yellow. Leg, femora black and tibia yellowish brown.

Abdomen: Yellow with black median stripe and black band posteriorly on tergites.

Genitalia: Male, dorsally surstylus very short and slightly curved outward direction, cerci straight and narrow apically, sternites 5 with “earlets”, aedeagus with paraphallus swollen apically and hypophallus sclerotised. Female, epiproct rounded and cercus slightly curved, spermathecae oval.

Comments: *Rhyncomya aravaensis* is a pale grey species without black spots on head, described from Palestine by Rognes (2002). This species regionally is recorded from UAE by Deeming (2008) and may eventually found in Saudi Arabia. The distribution indicates Palearctic and Oriental affinities.

Biology: Unknown.

***Rhyncomya bullata* Deeming, 1996**

Figures 138-141.

Rhyncomya bullata Deeming, 1996: 270-272.

Material examined: 5♀.

Riyadh, Ibex Reserve National Park, Hutet Bani Tamim, 7.III.2008, Y. Al Dryhim, H. Al Dhafer, M. Motairy, A. El Gharbawy, S.T, 2♀; Ibex Reserve National Park, Hutet Bani Tamim, 19.IV.2008, Y. Al Dryhim, H. Al Dhafer, M. Motairy, A. El Gharbawy, S.T, 1♀; Ibex Reserve National Park, Hutet Bani Tamim, 25.I.2008, Y. Al Dryhim, H. Al Dhafer, M. Motairy, A. El Gharbawy, S.T, 1♀; Ibex Reserve National

Park, Hutet Bani Tamim, 15.12.2007, Y. Al Dryhim, H. Al Dhafer, M. Motairy, A. El Gharbawy, S.T, 1♀; (all KSMA).

Total female length 6–8 mm (n=5), male length 6-7 mm from total 2 male paratypes (Deeming 1996).

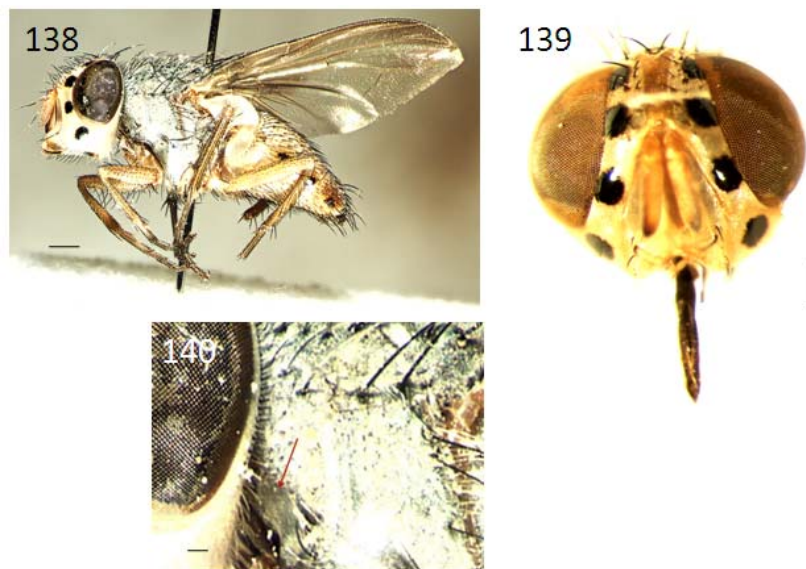
Head: Protruding, in male with three pairs of shiny black spots and female four spots (Figs. 138, 139), parafacialia and jowls respectively. Parafacialia and parafrontalia silvery dusted (Fig. 139)

Thorax: Grayish-green. Proepisternal depression bare (Fig. 140). Legs yellow–black. Calypter elongated oval. Wings hyaline with veins brown

Abdomen: Yellow bright, with black the marginal spots.

Comments: *Rhyncomya bullata* was originally described from Oman (Deeming, 1996), Dawah and Abdullah (2009) listed it from Saudi Arabia. This species has been collected in Riyadh Province of Saudi Arabia (Fig. 141).

Biology: Unknown.



Figs. 138-140: *Rhyncomya bullata*. Fig. 138: Body, lateral view (scale 2 mm). Fig. 139: Head, frontal view (scale 1 mm). Fig. 140: Proepisternal depression (scale 1 mm).



Fig. 141: Distribution of *Rhyncomya bullata* in Saudi Arabia.

***Rhyncomya callopis* (Loew, 1856)**

Idia callopis Loew, 1856: 49.

Rhyncomyia callopis, Peris, 1952: 102.

Rhyncomya callopis, Zumpt & Tsacas, 1976: 348.

Rhyncomya koschewnikovi Rohdendorf, 1930: 177-178, Rognes, 2002: 37.

The description below adopted from Rognes (2002).

Total length 7-9 mm both sexes.

Head: In male, frons at narrowest point 0.017-0.054 times of head width, whereas in female, frons at vertex 0.308-0.347 times of head width.

Thorax: Humeral callus in male darker than female. Scutellum in male yellow distally and female totally yellow.

Abdomen: Tergites 5 black.

Genitalia: Male sternite 5 with dense spine-like setae medially, cerci straight and surstylus slightly curved apically. In female, sclerites weakly sclerotised, epiproct large and flattened, and cerci slightly curved.

Comments: *Rhyncomya callopis* was described from Egypt and also recorded from Saudi Arabia (Riyadh, Wadi Mizbil) (Deeming, 1996). No material was available for examination that was collected in Saudi Arabia.

Biology: Unknown.

***Rhyncomya desertica* Peris, 1951**

Figures 142-149.

Rhyncomyia flavipes Séguéy, 1933: 70 [as var. of *callopis*]. Junior primary homonym, preoccupied by *Rhyncomya flavipes* Robineau-Desvoidy, 1830. Rognes, 2002: 42.

Rhyncomya [sic] *flavipes*, Zumpt & Tsacas, 1976: 347-349, Rognes, 2002: 42.

Rhyncomya flavipes, Deeming, 1996: 266, Rognes, 2002: 42.

Rhyncomya desertica Peris, 1951: 243-244, Rognes, 2002: 42.

Rhyncomyia desertica, Peris, 1952: 226, Rognes, 2002: 42.

Rhyncomya desertica, Schumann, 1986: 54, Rognes, 2002: 42.

Material examined: 10♂, 19♀.

Eastern, Jubayl, Ras Al Ghar, 16.IV.2010, H. Al Dhafer, L.T, N 26° 15'34" E 49° 52'01", 10♀ 1♂, (KSMA). **Mecca**, Taif, Qilwah Adhom, 9.XI.2012. H. Al Dhafer, L.T, N 20° 29.78' E 40° 48.946', 1♂ (KSMA). **Riyadh**, Amariyah, 26.IV.2006, H.Rushdi, S.N, 3♀, 1♂; Deirab, 3.I.2010, H. Al Dhafer, A. El Gharbawy, A. El Torkey, M.T, 1♂; King Saud University (Diriyah), 11.XII.2006, 1♀; Muzahimiyah, Khararah, 26.IV.2011, Y. Al Dryhim, H. Al Dhafer, A. Al Gharbawy, M, Al Harbi, L.T, N 24° 24'21" E 46° 14'40", 4♀, 3♂; Muzahimiyah, Khararah, 17.X.2011, Y. Al Dryhim, H. Al Dhafer, A. Al Gharbawy, M, Al Harbi, L.T, N 24° 24'21" E 46° 14'40", 2♀, 3♂; (all KSMA).

Total length, male 5-8 (n = 10), female 4-10 mm (n= 19).

Head: Strongly protruding. Male with two shiny spots and female with 1-3 bullatae.

Thorax: Gray pollinosity. Humeral callus black.

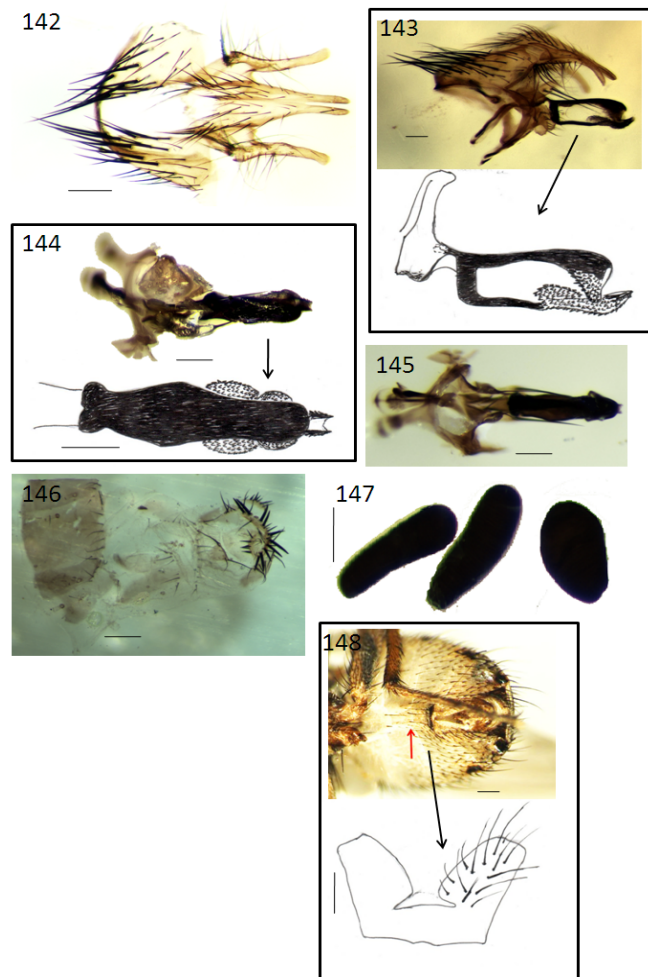
Abdomen: Whitish-yellow. Male lacking dense hairs ventrally (Fig. 148).

Genitalia: Surstylus weakly curved and shorter than cerci, node closed to junction of cerci and surstylus, apex rounded. Cerci slender elongated (Figs. 142, 143). Aedeagus sclerotized apically, distinct serrations on hypophallus apex (Figs. 143, 144, 145).

Female ovipositor short, with thick short bristless, cercus and epiproct short (Fig. 146). Spermathecae elongated oval, smooth (Fig. 147).

Comments: *Rhyncomya desertica* was first recorded from Saudi Arabia by Deeming (1996). Additionally, this species has been recorded from Chad, Egypt, Palestine, Libya, Oman, Republic of Mauritania, Niger, Tunisia, Morocco, and western Sahara (Rognes, 2002; Deeming, 1996). In Saudi Arabia *R. desertica* has been collected from the Eastern (Jubayl), Mecca, and Riyadh provinces (Fig. 149). Additionally, Peris (1952) provided a record from the Eastern Province (Rub Al Khali/Empty Quarter). *Rhyncomya desertica* previously was treated by various authors as *R. flavipes* (Rognes, 2002).

Biology: Unknown.



Figs. 142-148: *Rhyncomya desertica*. Fig. 142: Male cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 143: Male cerci and surstylus lateral view, aedeagus lateral view (scale 0.2 mm). Fig. 144: Male aedeagus, dorsal view (scale 0.1 mm). Fig. 145: Male aedeagus, ventral view (scale 0.1 mm). Fig. 146: Female ovipositor, dorsal view (scale 0.2 mm). Fig. 147: Female spermathecae (scale 0.1 mm). Fig. 148: Abdomen, ventral view (scale 2 mm).



Fig. 149: Distribution of *Rhyncomya desertica* in Saudi Arabia.

***Rhyncomya io* Peris, 1951**

Rhyncomya io Peris, 1951: 214.

The description below modified from Zumpt (1958) and Deeming (1996).

Total female length 9-10 mm.

Head: In female, frons at vertex about $1/3 \times$ of eye width, paracalia with pollinosity, occiput black, antenna with flat carina and bare arista, palpi yellow. Male similar to female except frons at narrowest point $1.5 \times$ as broad as anterior ocelli.

Thorax: Metallic green with blue pruinosity. Scutellum green with 3 long marginal discal bristles. Anterior and posterior spiracle yellow. Wings hyaline and costal spine distinct. Calypter white. Legs mostly yellow with the tip of femora and tibiae dark.

Abdomen: Yellow dark, tergite 3 with a triangular black median vitta and a lateral black pattern posteriorly.

Genitalia: Cerci pointed point and slightly curved apically, surstylus curved with rounded apically. Aedeagus constricted apically and posterior surface concave.

Comments: *Rhyncomya io* was described from Kenya by Peris (1951) and regionally recorded from Oman by Deeming (1996) and may eventually found in Saudi Arabia especially in eastern region of the country.

Biology: Unknown.

***Rhyncomya jordanensis* Peris, 1951**

Rhyncomya jordanensis Peris, 1951: 242.

Material examined: 1♂, 1♀.

UAE, Al Ajban, 9.XI-7.XII. 2005, L.T., A. Van Harten, 1♀ (NMWC); Wadi Maidaq, 26.XII.2005-2.I.2006, A. Van Harten, 1♂ (NMWC).

Total length, male 6 mm (n= 1) and female 6.5 mm (n=1).

Head: In male, parafacialia bare, palpi yellow, arista and pedicel bare. In female, pedicel with a bundle of short hairs.

Thorax: Olivaceous with dense pruinosity. Humeral callus and scutellum olivaceous.

Legs. Femora darkish brown.

Abdomen: Yellow and tergites 3-5 with black stripe posteriorly.

Genitalia: Aedeagus, cerci straight, surstylus slender, paraphallus swollen apically and sclerotised serration, hypophallus straight with serration.

Comments: *Rhyncomya jordanensis* was described by Peris (1951) from Jordan. Rognes (2002) reviews this species and provides excellent illustrations of the male genitalia. *Rhyncomya jordanensis* can be distinguished from similar species, especially *R. zumpti*, by the width of scutellum at base $1\frac{1}{2} \times$ as long and the calypter being lobulate This species is known from Egypt, Palestine, Pakistan (Baluchistan), Palestine, Oman, Yemen (Deeming, 1996; Rognes, 2002), and Saudi Arabia (Asir province) (Dawah & Abdullah, 2009).

Biology: Unknown.

***Rhyncomya nigripes* Séguy, 1933**

Figures 150-158.

Rhyncomya callopis var *nigripes* Séguy, 1933: 71 [as var. of *callopis*]

Rhyncomya minima Peris, 1951: 243, Rognes 2002:46.

Rhyncomya nigripes Zumpt & Tsacas, 1976: 347, Deeming, 1996:273, Rognes 2002: 46.

Material examined: 100♂, 99♀.

Riyadh, Ibex Reserve National Park, Hutet Bani Tamim, 28.VII.2007, Y. Al Dryhim, H. Al Dhafer, M. Motairy, A. El Gharbawy, S.N, 1♂; Ibex Reserve National Park, Hutet Bani Tamim, 19.V.2007, Y. Al Dryhim, H. Al Dhafer, M. Motairy, A. El Gharbawy, S.N, 1♂; Ibex Reserve National Park, Hutet Bani Tamim, 15.XII.2007, Y. Al Dryhim, H. Al Dhafer, M. Motairy, A. El Gharbawy, S.T, 1♀; Ibex Reserve National Park, Hutet Bani Tamim, 4.IV.2008, Y. Al Dryhim, H. Al Dhafer, M. Motairy, A. El Gharbawy, S.N, 1♂; Muzahimiyah, Khararah, 30.III.2011, Y. Al Dryhim, H. Al Dhafer, A. El Gharbawy, H. Setyaningrum, A. Al Ansi, S.N, N 24° 24'21" E 46° 14'40", 1♀; Muzahimiyah, Khararah, 30.III.2011, Y. Al Dryhim, H. Al Dhafer, A. El Gharbawy, H. Setyaningrum, A. Al Ansi, L. T, N 24° 24'21" E 46° 14'40", 7♀ 1♂; (all KSMA); Riyadh, 28.X.1981, A. Talhouk, S.Tilkian, R. Abu Zoherah, M.Al Taher, A.Klaudi, 1♂; Riyadh, 14.V.1978, A. Talhouk, S.Tilkian, R.Abousouhayroh, M.Al Taher, A.Klaudi, 1♂; Riyadh, 15.II.1981, A. Talhouk, 1♂; Riyadh, 15.V.1977, A. Talhouk, S. Tilkian, R. Abu Zoherah, K. Al Taher, A. Klaudi, 1♂; (all ANMA); Rhodet Khorim, 1.IX.2011, H. AlDhafer, L. T, N 25° 22'58" E 47° 16'44", 1♂, 5♀; Rhodet Khorim A, 16.X.2011, H. Al Fadl, A. El Gharbawy, A. Al Ansi, L.T, N 25° 22'58" E 47° 16'44", 10♂, 4♀; Rhodet Khorim A, 13.XI.2011, H. Al Fadl, A. El Gharbawy, A. Al Ansi, L.T, N 25° 22'58" E 47° 16'44", 1♂, 2♀; Rhodet Khorim A, 18.II.2012, H. Setyaningrum, S.N, N 25° 22'58" E 47° 16'44", 1♀; Rhodet Khorim A, 30.X.2011, H. Setyaningrum, L.T, N 25° 22'986" E 47° 16'712" 559 m, 3♀; Rhodet Khorim B, 16.X.2011, A. El Torkey, L.T, N 25° 25'943" E 47° 13'863" 572 m, 13♂, 4♀; Rhodet Khorim B, 13.XI.2011, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 3♂, 1♀; Rhodet Khorim B, 27.XI.2011, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 1♂, 1♀; Rhodet Khorim B, 30.X.2011, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 1♂, 1♀; Rhodet Khorim B, 18.I.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 14♂, 3♀; Rhodet Khorim B, 26.XI.2011, H. Setyaningrum, Pitfall trap, N 25° 25'943" E 47° 13'863" 572 m, 2♀; Rhodet Khorim A, 10.VI.2012, H. Setyaningrum, L.T, N 25° 22'986" E 47° 16'712" 559 m, 1♂; Rhodet Khorim B, 18.II.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 18♂, 5♀; Rhodet Khorim A, 5.III.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 1♂; Rhodet Khorim B, 6.III.2012, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, *Nitraria retusa*, 1♀; Rhodet Khorim B, 14.VI.2012, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 4♂, 9♀; Rhodet Khorim B, 1.I.2012, H. Setyaningrum, Pitfall trap, N 25° 25'943" E 47° 13'863" 572 m, *Calatropis procera*, 1♀; Rhodet Khorim B, 17.III.2012, H. Setyaningrum, Pitfall trap, N 25° 25'943" E 47° 13'863" 572 m, *Rhazya steicta*, 2♂; Rhodet Khorim B, 17.III.2012, H. Setyaningrum, S.N, N 25° 25'943" E 47° 13'863" 572 m, 1♂; Rhodet Khorim B, 29.IV.2012, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 2♂, 1♀; Rhodet Khorim A, 28.IV.2012, H. Setyaningrum, L.T, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim A, 10.VI.2012, H. Setyaningrum, L.T, N 25° 22'986" E 47° 16'712" 559 m, 2♂, 8♀; Rhodet Khorim A, 10.VI.2012, H. Setyaningrum, M.T, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim A, 25.V.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, 1♂; Rhodet Khorim A, 24.VI.2012, H. Setyaningrum, L.T, N 25° 22'986" E 47° 16'712" 559 m, 1♂; Rhodet Khorim B, 27.V.2012, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 6♂, 3♀; Rhodet Khorim A, 27.V.2012, H. Setyaningrum, L.T, N 25° 22'986" E 47° 16'712" 559 m, 2♂, 7♀; Rhodet Khorim A, 18.II.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, *Rhazya steicta*, 1♀; Rhodet Khorim A, 18.II.2012, H. Setyaningrum, S.N, N 25° 22'986" E

47° 16'712" 559 m, *Calatropis procera*, 1♀; Rhodet Khorim B, 15.V.2012, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 3♂, 2♀; Rhodet Khorim A, 15.V.2012, H. Setyaningrum, L.T, N 25° 22'986" E 47° 16'712" 559 m, 4♀; Rhodet Khorim B, 7.X.2012, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 2♂; Rhodet Khorim B, 24.IX.2012, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 1♂, 1♀; Rhodet Khorim A, 9.IX.2012, H. Setyaningrum, L.T, N 25° 22'986" E 47° 16'712" 559 m, 1♂; Rhodet Khorim A, 30.VI.2012, H. Setyaningrum, Sucking Trap, N 25° 22'986" E 47° 16'712" 559 m, *Acacia ehrenbergiana*, 1♂; Rhodet Khorim A, 30.VI.2012, H. Setyaningrum, Sucking Trap, N 25° 22'986" E 47° 16'712" 559 m, *Nitraria retusa*, 1♀; Rhodet Khorim A, 1.VII.2012, H. Setyaningrum, L.T, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim A, 30.VI.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, *Rhazya steicta*, 1♀; Rhodet Khorim A, 14.X.2012, H. Setyaningrum, L.T, N 25° 22'986" E 47° 16'712" 559 m, 3♂, 9♀; Rhodet Khorim B, 14.X.2012, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 2♂; Rhodet Khorim A, 7.X.2012, H. Setyaningrum, L.T, N 25° 22'986" E 47° 16'712" 559 m, 1♀; Rhodet Khorim B, 7.X.2012, H. Setyaningrum, L.T, N 25° 25'943" E 47° 13'863" 572 m, 1♀; Rhodet Khorim A, 17.XI.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, *Calatropis procera*, 1♂; Rhodet Khorim A, 1.XII.2012, H. Setyaningrum, S.N, N 25° 22'986" E 47° 16'712" 559 m, *Calatropis procera*, 1♂ (all KSMA).

Total length male, 6-9 mm (n=100), female 5-8 mm (n= 99).

Head: Strongly protruding.

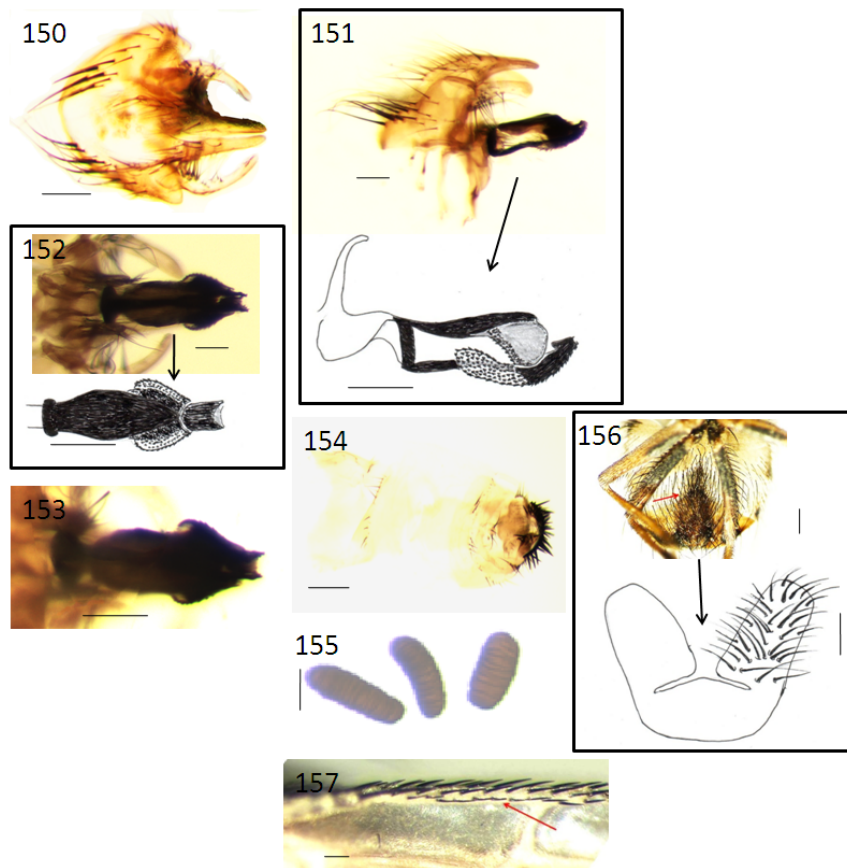
Thorax: Dorsally green cupreous. Scutellum yellow apically. Femora yellowish.

Abdomen: Male, ventrally setae dense (Fig. 156).

Genitalia: Surstylus and cerci short compact, surstlyus curved, node close to junction of surstylus; cerci small and slightly flattened. Cerci short obtuse apically (Figs. 150, 151). Aedeagus, sclerotisation of hypophallus elongated to the angle of junction hypophallus and paraphallus, with apical serration; paraphallus rounded apically (Figs. 151, 152, 153). Female ovipositor short, with dense short, thick hairs apically (Fig. 154). Spermathecae elongated oval, with surface pattern (Fig. 155).

Comments: This specie is widespread in northern Africa and the Middle East including the Arabian Peninsula, but also Mauritania (Rognes, 2002; Deeming, 1996). *Rhyncomya nigripes* has been abundantly collected in the Riyadh Province (Fig. 158). *Rhyncomya nigripes* originally was described as a subspecies of *R. callopis*. Zumpt & Tsacas (1976) treated it as *R nigripes* and recognized it as *R. minima* Peris, 1951. Zumpt & Tsacas (1976) has discussed the three species of *R. callopis*-group, *R. callopis*, *R. nigripes* and *R. desertica*. Females of those three species are difficult to separate. The above female specimens are tentatively associated with males collected at the same time and locality.

Biology: Unknown.



Figs. 150-157: *Rhyncomya nigripes*. Fig. 150: Male cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 151: Male cerci and surstylus lateral view, aedeagus lateral view (scale 0.2 mm). Fig. 152: Male aedeagus, ventral view (scale 0.1 mm). Fig. 153: Male aedeagus, dorsal view (scale 0.1 mm). Fig. 154: Female ovipositor, dorsal view (scale 0.3 mm). Fig. 155: Female spermathecae (scale 0.1 mm). Fig. 156: Abdomen, ventral view (scale 2 mm). Fig. 157: Wing under side (scale 1 mm).

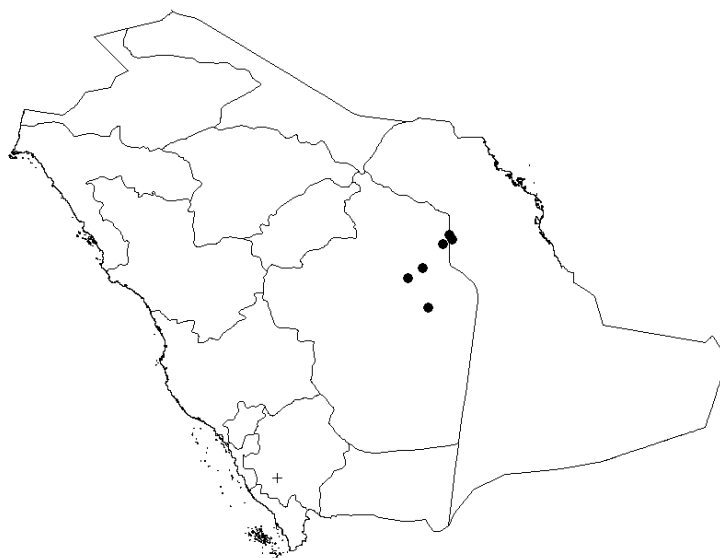


Fig. 158. Distribution of *Rhyncomya nigripes* in Saudi Arabia.

***Rhyncomya sinaiensis* Rognes, 2002**

Figures 159-162.

Rhyncomya sinaiensis Rognes, 2002

Material examined: 1♂.

Riyadh, Ibex Reserve National Park, Hutet Bani Tamim, 7.III.2008, Y. Al Dryhim, H. Al Dhafer, M. Motairy, A. El Gharbawy, S.T, 1♂ (KSMA).

Total male length 7 mm (n= 1), female 5-7 mm from 12 types examined (Rognes, 2002).

Head: Protruding. Parafacial and gena densely pollinose. Parafacial with shiny black bullatae spot (Fig. 159). Arista pubescent (Fig. 161)

Thorax: Green metallic. Thorax with black setulae. Pleuron mostly pale yellow. Scutellum black. Wing hyaline and veins pale yellow. Leg predominantly yellow (Fig. 160)

Abdomen: Yellow. Sternites 7-8 black.

Comments: This species was originally described from Egypt (Sinai) and also reported from Palestine (Rognes, 2002). The above collection from Riyadh Province represents a new country record for Saudi Arabia (Fig. 162). *Rhyncomya sinaiensis* generally similar to other *Rhyncomya*, with definite determination based examination of male genitalia. The detail figures of genitalia were reported by Rognes (2002).

Biology: Unknown.



Figs. 159-161: *Rhyncomya sinaiensis*. Fig. 159: Head, frontal view (scale 1 mm). Fig. 160: Hind leg (scale 1 mm). Fig. 161: Antenna (scale 1 mm).



Fig. 162: Distribution of *Rhyncomya sinaiensis* in Saudi Arabia.

***Rhyncomya tristis* Séguy, 1933**

Rhyncomya tristis Séguy, 1933: 65.

Rhyncomyia tristis Peris, 1952: 115.

Rhyncomya tristis Zumpt, 1958: 170.

The description below adopted from Zumpt (1958) and Peris (1952).

Head: Parafacialia setulose. In male, parfrontalia without pollinosity, in female with setigerous spots. Antenna, arista pubescent.

Thorax: Black violaceous. Posteriorly with three dark longitudinal stripes.

Abdomen: Reddish. Tergites 3-4 with three apical blackish green spots, in male the spots are brighter than female.

Genitalia: Not described.

Comments: *Rhyncomya tristis* was originally described from Mozambique by Séguy (1933). This species was listed by Abu Zoherah *et al.* (1993) from Saudi Arabia without any indicating locality information or deposition of material. Additionally Pont (1980) listed this species from Yemen. However, it may be eventually found, especially in southwestern Saudi Arabia. No material was available for examination.

Biology: Unknown.

***Rhyncomya varifrons* Becker, 1910**

Rhyncomya varifrons Becker, 1910: 141.

Rhyncomyia varifrons Peris, 1952: 106.

Rhyncomya varifrons Zumpt, 1958: 177.

The description below adopted from Zumpt (1958).

Total length 5-7 mm both sexes.

Head: Eyes bare, upper facets slightly larger than lower one. Parafacialia and parfrontalia white pollinosity with black glossy spot, in male two spots clearly whereas in female three spots.

Thorax: Metallic cupreous black with dense white pollinosity. Anterior spiracle white and posterior yellow. Wing hyaline and costal spine long. Calypter almost oval, whitish yellow. Legs, femora black, tibia and tarsi reddish brown.

Abdomen: Yellow with metallic black pattern.

Genitalia: No description available.

Comments: *Rhyncomya varifrons* was originally described from archipelago Socotra, Yemen by Becker (1910). This species may eventually found in Saudi Arabia, especially in southwestern Afrotropical influenced region of the country.

Biology: Unknown.

***Rhyncomya zumpti* Peris, 1952**

Figures 163-168.

Rhyncomya zumpti Peris, 1952: 113-115.

Rhyncomya zumpti Zumpt, 1958; 174.

Material examined: 16♂, 14♀.

Eastern, Jubayl, Ras Al Ghar, 16.IV.2010, H. Al Dhafer, L.T, N 26° 15'34" E 49° 52'01", 1♂, 1♀ (KSMA). **Mecca**, Qilwah Adhom, 9.XI.2012. H. Al Dhafer, L.T, N 20° 29'78" E 40° 48'946", 1♂ (KSMA). **Jizan**, Abu Aresh, Al Mahrag Village, 1.II - 3.IV.2011, H. A Dawah, N 16.972413 E 42.82982, 2♂ (HDJU); Ahad Al Masareha, 11.III.2010, H.Al Dhafer & A. El Gharbawy , L.T, N 17 2'28" E 42 52'38", 2♂ (KSMA). **Riyadh**, Amariyah, 26.IV.2006, H.Rushdi, S.N, 3♀, 1♂; Deirab, 3.I.2010, H. Al Dhafer, A. El Gharbawy, A. El Torkey, M.T,1♂; King Saud University

(Diriyah), 11.XII.2006, 1♀; Muzahimiyah, Khararah, 26.IV.2011, Y. Al Dryhim, H. Al Dhafer, A. Al Gharbawy, M, Al Harbi, L.T, N 24° 24'21" E 46° 14'40", 3♂, 4♀; Muzahimiyah, Khararah, 17.X.2011, Y. Al Dryhim, H. Al Dhafer, A. Al Gharbawy, M, Al Harbi, L.T, N 24° 24'21" E 46° 14'40", 3♂, 2♀; Rhodet Khorim B, 30.X.2011, H. Setyaningrum, L.T, N 25 25'943" E 47 13'863" 572 m, 2♀; Rhodet Khorim B, 18.II.2012, H. Setyaningrum, S.N, N 25 25'943" E 47 13'863" 572 m, 2♂, 2♀; Rhodet Khorim B, 15.V.2012, H. Setyaningrum, L.T, N 25 25'943" E 47 13'863" 572 m, 1♀; Rhodet Khorim A, 28.IV.2012, H. Setyaningrum, L.T, N 25 22'986" E 47 16'712" 559 m, 1♀; (all KSMA).

Total length male 4 -8 mm (n= 16), female 7-8 mm (n= 14)

Head: Protruding, frons of male at narrowest point as wide as anterior ocellus. Palpi yellow spatulate. Face completely yellow, pollinose.

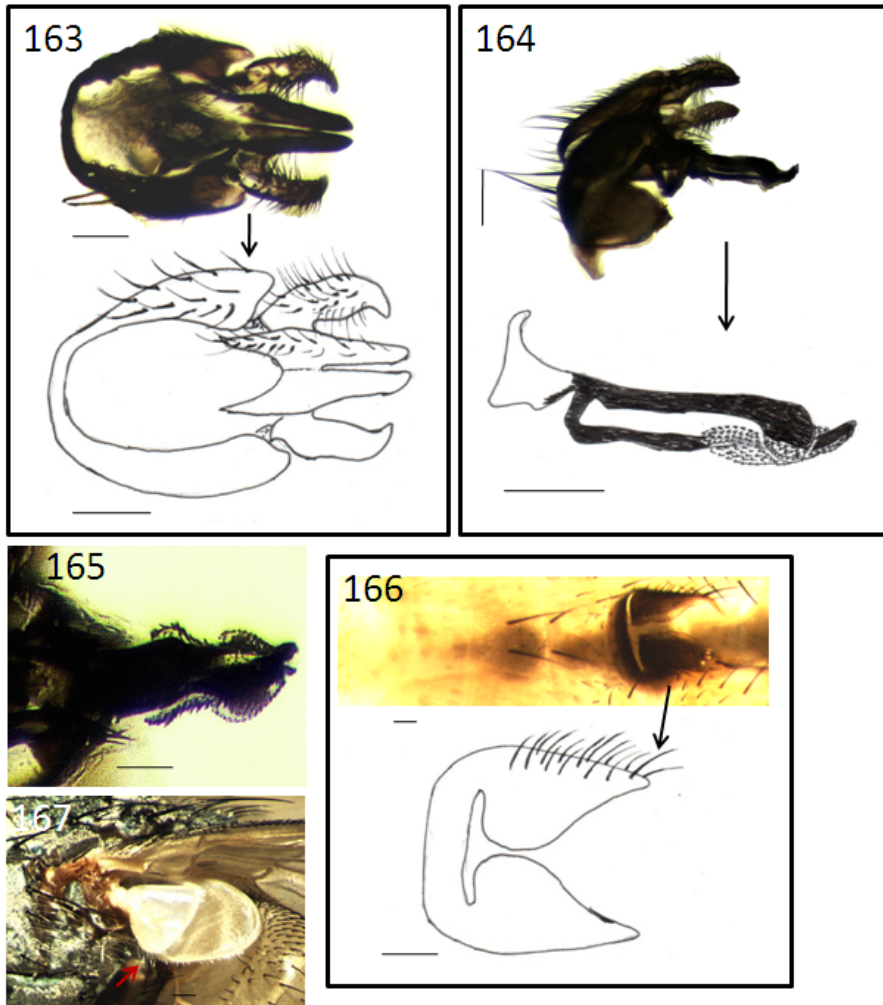
Thorax: Bristles long. Scutellum slightly broader than long. Calypter oval, elongated (Fig. 167). Legs dark brown.

Abdomen: Yellow, tergites with black spots laterally. Sternites 3-4 with single setae each side, sternite 5 curved (Fig. 166).

Genitalia: Surstylus weak emarginated and slightly sharp apically. Cerci thin, slender acute apically, hairs on inner and outer sides (Figs. 163, 164). Aedeagus, hypophallus enlarged as compared to paraphallus, with small serrations (Figs. 164, 165).

Comments: *Rhyncomya zumpti* has been reported from Mozambique, Republic of Zambia and Botswana (Bechuana) (Deeming, 2008). The above records represent a new country record for Saudi Arabia. It was collected from Eastern, Mecca, Jizan and Riyadh provinces (Fig. 168). *Rhyncomya zumpti* is a smaller fly as compared to other *Rhyncomya* known from Saudi Arabia.

Biology: Unknown.



Figs. 163-167: *Rhyncomya zumpti*. Fig. 163: Male cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 164: Male cerci and surstylus lateral view, aedeagus lateral view (scale 0.2 mm). Fig. 165: Male aedeagus, ventral view (scale 0.1 mm). Fig. 166: Male sternites, ventral view (scale 1 mm). Fig. 167: Calypter, lateral view (scale 1 mm).



Fig. 168: Distribution of *Rhyncomya zumpti* in Saudi Arabia.

Genus *Stomorhina****Stomorhina cribrata* (Bigot, 1874)**

Rhinia cribrata Bigot, 1874: 239.

Rhinia vertebrata Bigot, 1891: 378, Zumpt, 1958: 105.

Rhinia tricincta Bigot, 1891: 379, Zumpt, 1958: 105.

Rhinia striata Becker, 1912: 626, Zumpt, 1958: 105.

Material examined: 1♂.

UAE, Wadi Bih Dam, 9.III.2010, 1♂ (NMWC).

Total length, in male 6 mm.

Head: Eyes bare and contiguous, upper facets moderately enlarged. Parafrontalia and facialia metallic black. Antenna, first flagellomer brown and pedicel black without hair. Arista bare and palpi black.

Thorax: Cupreous with pollinosity and black piliferous spots. Wing with brown spot apically, basicosta brown, cell r 4+5 closed and petiolate. Legs brownish black.

Abdomen: As long as wide with black piliferous spots and yellow markings.

Genitalia: Not examined.

Comments: The single male examined was from the UAE (Wadi Bih Dam). Zumpt (1958) redescription of the female indicated that the frons are black, parafrontalia and parafacialia with yellow pollinosity, and the thorax dorsally without long hairs. The only record for this species for Saudi Arabia (Asir Province) was reported by Dawah and Abdullah (2009). Their material was not available for study. *Stomorhina cribrata* is widely distributed throughout the Afrotropical Region (Zumpt, 1958).

Biology: Unknown.

***Stomorhina lunata* (Fabricius, 1805)**

Figures 169-176.

Musca lunata Fabricius, 1805: 292.

Idia rostrata Wiedemann, 1820: 22, Rognes, 2002: 60.

Idia fasciata Meigen, 1826: 9, Zumpt, 1958: 95.

Idia cinerea Robineau-Desvoidy, 1830: 422, Zumpt, 1958: 95.

Idia syrphoidea Robineau-Desvoidy, 1830: 421, Rognes, 2002: 60.

Stomatorrhina maculata Rondani, 1865: 228, Zumpt, 1958: 95.

Stomorhina melanorrhina Bigot, 1888: 592, Zumpt, 1958: 95.

Stomorhina selgae Lehrer, 1979: 82, Rognes, 2002: 60.

Stomorhina muscoidea Brauer, 1899: 22, Zumpt, 1958: 95.

Stomorhina lunata Zumpt, 1958: 95, Rognes, 2002: 60.

Material examined: 2♂, 6♀.

Asir, Abha, Madenat Ameer Sultan, 25.II.2002, H. A Dawah, 1♂ (HD); Wadi Abha, 28.IV.2011, M. Sharaf, A. Al Ansi, H. Setyaningrum, S.N, N 18° 22'08" E 42° 50'82", 1990m, 2♀ (KSMA). **Baha**, Wadi Turubah, 14.V.2011, H. Al Fadl, A. El Torkey, M. Sharaf, H. Setyaningrum, S.N, N 20° 12'610" E 41° 17'56", 1♂, 4♀ (KSMA).

Total length, male 5-6 mm (n= 2), female 7-8 mm (n= 6).

Head: Eyes male bare, not contiguous, upper facets slightly larger than lower, ocellar triangle black. Parafrontalia black. Parafacialia yellow pollinose in upper half. Vibrissa long. Palpi black. In female parafrontalia and parafacialia slightly paler.

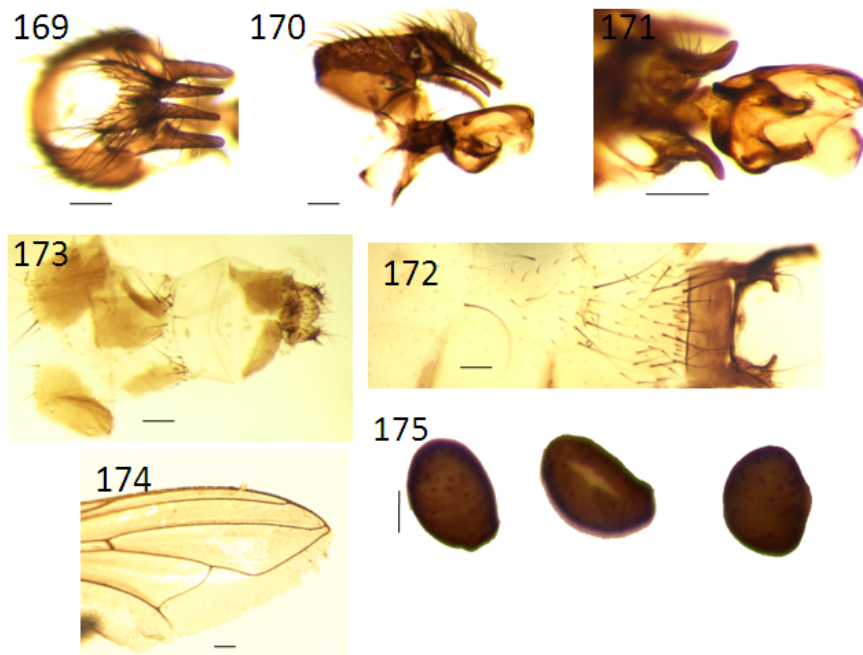
Thorax: Black-olivaceous, piliferous black spots small. Setae dorsally black. Pleuron with yellow hairs and white pollinose.

Abdomen: Dorsally brownish, abdomen as long as wide, broad lateral spot on tergites 3, 4, 5, ventral and laterally yellow. Sternites with a few hairs, sternite 5 short and lobed (Fig. 172)

Genitalia: Surstylus straight with rounded apically. Cerci straight deep emarginate (Figs. 169, 170). Aedeagus compact with short hypophallus, hypophallus apex irregularly serrated, paraphallus curved apically (Figs. 170, 171). Female ovipositor short with small cercus and large epiproct (Fig. 173). Spermathecae ovally with spot pattern on surface (Fig. 175).

Comments: This species is known from the Palaearctic, Oriental, and Afrotropical regions (Zumpt, 1958), also previously reported from Saudi Arabia (Abdullah & Dawah, 2009). In Saudi Arabia *S. lunata* has been collected from the Asir and Baha provinces (Fig. 176). *Stomorphina lunata* is medium sized species, recognizable from other similar *Stomorphina* species by cell r 4+5 being open at wing tip and wing lacking an apical black spot (Fig. 174).

Biology: Larvae of *S. lunata* are well-known as predators of eggs of the Desert Locust, *Schistocerca gregaria* (Forsk.) Details of biology *S. lunata* were reported by Greathead (1962).



Figs. 169-175: *Stomorhina lunata*. Fig. 169: Male cerci and surstylus, dorsal view (scale 0.1 mm). Fig. 170: Male cerci and surstylus lateral view, aedeagus lateral view (scale 0.1 mm). Fig. 171: Male aedeagus, ventral view (scale 0.2 mm). Fig. 172: Female ovipositor, dorsal view (scale 0.1mm). Fig. 173: Male sternites, ventral view (scale 0.7 mm). Fig. 174: Wing, right (scale 1 mm). Fig. 175: Female spermathecae (scale 0.1 mm).



Fig. 176 Distribution of *Stomorhina lunata* in Saudi Arabia.

Stomorhina rugosa (Bigot, 1887)

Figures 177-184.

Rhinia rugosa Bigot, 1887: 591.

Rhinia hyphena Séguy, 1958, Bisby *et al.*, 2012.

Stomorhina mitis Curran, 1931: 18, Zumpt, 1958: 103.

Material examined: 2♂, 3♀.

Asir, Abha, Madenate Ameer Sultan, 25.II-25.V.2002, H. A Dawah, 1♂ (NMWC);

Baha, Wadi Turubah, 15.V.2011, H. Al Fadly, A. El Torkey, M. Sharaf & H.

Setyaningrum, S.N, N 20° 12'610" E 41° 17'056", 918m, 1♂, 1♀ (KSMA); Wadi

Turubah, 9.III.2012, H. Setyaningrum, S.N, N 20° 14'369" E 41° 15'234", 1757m, 1♀

(KSMA); Thee Ain, 15.V.2011, N 19° 55'727" E 41° 26'462", 1♀ (KSMA).

Total length male 2.5-3 mm (n=2) and female 4-5 mm (n=3).

Head: Eyes bare and contiguous, upper facets enlarged but not demarcated from lower ones. Parafrontalia and parafacilia glossy black. Parafacialia bare. Antenna broadly separated (Fig. 179).

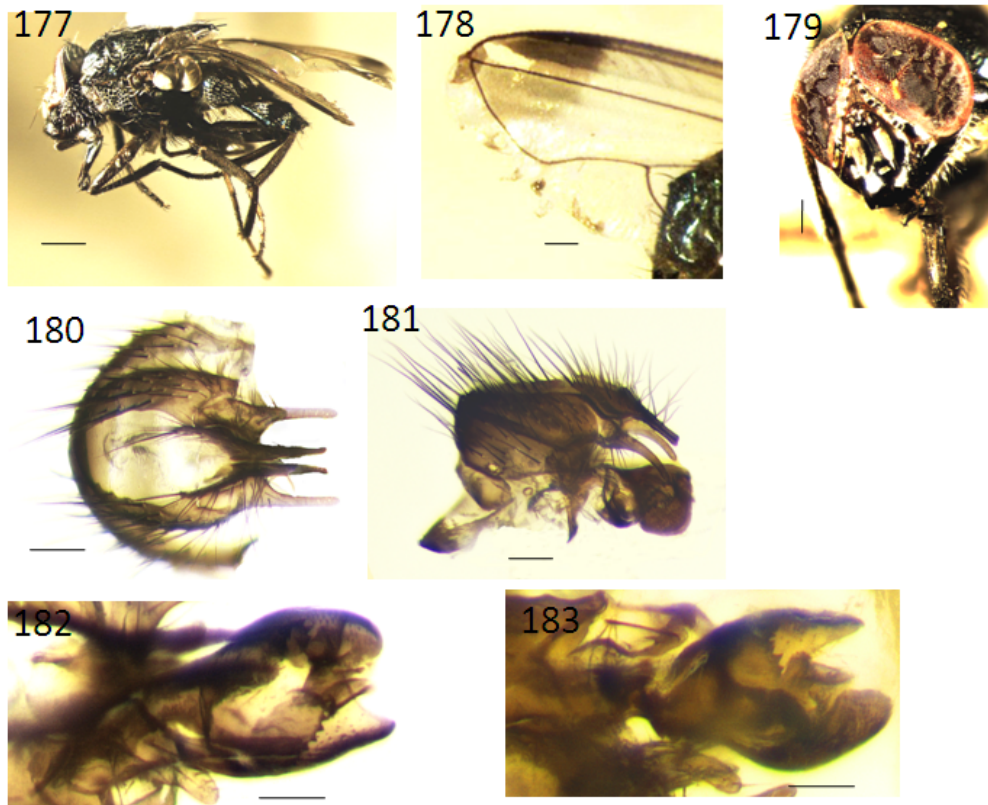
Thorax: Blue-black metallic with gray pollinosity and piliferous spots. Mesonotum and scutellum with long, yellow hair.

Abdomen: Black shiny (Fig. 177), approximately as long as broad. Tergite 1-2 with two lateral yellow stripes. Sternites 1-3 yellow.

Genitalia: Surstylus straight and slender with rounded apically. Cerci straight deeply emarginate (Figs. 180, 181). Aedeagus compact with short hypophallus, hypophallus apex with irregularly serrated, paraphallus swollen apically (Figs. 181, 182, 183).

Comments: This species is widespread in Afrotropical regions, and occurring in Palestine and Iran (Deeming, 1996), and also previously reported from Saudi Arabia (Dawah & Abdullah, 2009). In Saudi Arabia, this species is reported from Asir and Baha provinces suggesting that this species has affinities with the Afrotropical Region (Figure 184). *Stomorhina rugosa* is smaller than *S. cribrata* and *S. lunata* in size and can be distinguished from the most similar species, especially *S. cribrata* by the abdomen being completely glossy black (Fig. 184).

Biology: Unknown.



Figs. 177-183: *Stomorhina rugosa*. Fig. 177: Body, lateral view (scale 1 mm). Fig. 178: Wing, left (scale 0.3 mm). Fig. 179: Head, front view (scale 1 mm). Fig. 180: Male cerci and surstylus, dorsal view (scale 0.2 mm). Fig. 181: Male cerci and surstylus, aedeagus dorsal view (scale 0.2 mm). Fig. 182: Male aedeagus, dorsal view (scale 0.2 mm). Fig. 183: Male aedeagus ventral view (scale 0.2 mm).



Fig. 184: Distribution of *Stomorhina rugosa* in Saudi Arabia.

Genus *Villeneuveilla*
***Villeneuveilla seguyi* Grunin, 1957**
Figures 185-187.

Villeneuveilla seguyi Grunin, 1957: 543.

Material examined: 3♀.

Riyadh, Deirab, 28.XI.1985, L.T, 3♀ (KSMA).

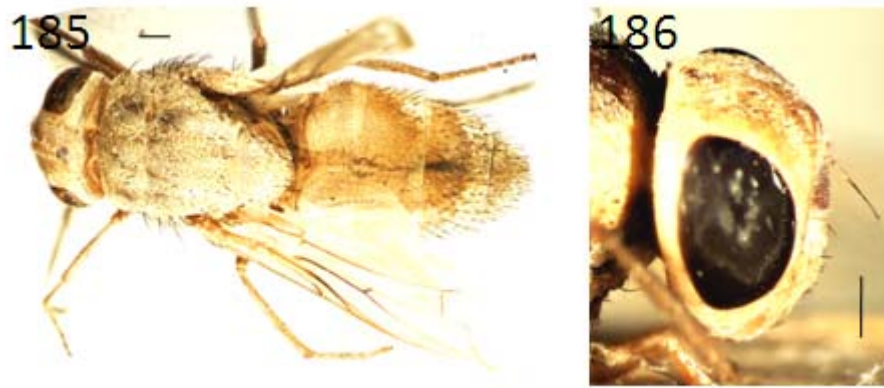
Total body length female 13–18 mm (n = 3).

Head: Mouthparts greatly reduced (Fig. 186). Arista long bare.

Thorax: Dull, elongated 2× long as wide, tergites lacking dark marking (Fig. 185).

Calypter oval with hair on upper surface. Legs yellow.

Comments: Descriptions of both sexes are provided by (Deeming, 1996, 2008; Rognes, 1991, 2002). *Villeneuveilla seguyi* has been reported by Deeming (1996) from Iran, Yemen, Oman, and Saudi Arabia. It is known presently only from the Riyadh Province (Fig. 187). The sarcophagid-like appearance of *V. seguyi* and its large size and reduced mouthparts, easily distinguishes this species from all other calliphorids known from Saudi Arabia.



Figs. 185-186: *Villeneuveilla seguyi* Fig. 185: Body, dorsal view (scale 1 mm). Fig. 186: Head, lateral view (scale 2 mm).



Fig. 187: Distribution of *Villeneuveilla seguyi* in Saudi Arabia.

DISCUSSION

At least forty-three calliphorid species have been recorded from the Arabian Peninsula (Table 2), including 34 species from Saudi Arabia (Table 1), twenty-one named species from Oman (Deeming, 1996, 2008), sixteen named species from UAE (Deeming, 2008) and fourteen species from Yemen (Pont, 1980; Al Misned, 2003; Deeming, 1996, 2008). In this study at least 34 of these species are recorded from Saudi Arabia (Table 1), four of these, *Pericallimya greatheadi* (previously known from Oman and Yemen), *Pollenia hungarica* (previously known from Hungary), *Rhyncomya sinaiensis* (previously known from Egypt), and *Rhyncomya zumpti* (previously known from Mozambique) represented new country records for Saudi Arabia.

At least ten species may be eventually found in Saudi Arabia including *Bengalia peuhi*, *Cosmina ebejeri*, *C. fishelsoni*, *Pollenia semicinerea*, *Pararhyncomya cribiformis*, *Rhyncomya io*, *R. aravaensis*, *R. tristis*, *R. varifrons* and *Rhinia nigricornis* which previously recorded by various authors from neighboring countries.

Doubtful Calliphoridae records for Saudi Arabia.

Bengalia minor was originally described from Mali, Rognes (2012) included Saudi Arabia referring to Dawah and Abdullah (2009) listing, but the latter paper merely includes Abu Thuraya (1982) original record of the species from Saudi Arabia. Abu Thuraya (1982) is only a list of species names without any reference to a source of material examined. Additionally, there are no records of this species from the Arabian Peninsula (Pont, 1980). During this study no specimens referable to *B. minor* were collected or located in any collections examined. Whereas, *B. peuhi*, another species of the *B. peuhi* species group (Rognes, 2012) is much more likely since it has been reported from Oman, Yemen, and UAE (Deeming, 1996, 2008; Rognes, 2012), and was included in this study.

Al Misned (2003) listed *Chrysomya rufifacies* (Macquart, 1843a) from Abha, Saudi Arabia. This single female could not be located in the collection of the Zoology Department, King Saud University, Riyadh. *Chrysomya rufifacies* is considered an Old World species native to Australian Region, but now widespread in the Nearctic and Neotropical regions (Baumgartner, 1993). No regional records are currently available for this species (Pont, 1980; Schumann, 1986; Table 2) and the above record is considered doubtful.

Rhyncomya peusi (Zumpt, 1956) was listed by Al Misned (2003) referring to Deeming (1996). However, Deeming (1996) clearly indicated that the single male from Kushm Al Buwaybiyat (Riyadh Province) differed from available descriptions of that species, and was listed as "*Rhyncomya* sp. ? *peusi*". *Rhyncomya peusi* was originally described from the Greek Islands and available records for this species are generally north of Saudi Arabia (Deeming, 1996). Until further evidence become available the inclusion of this species as part of the fauna of Saudi Arabia is not confirmed.

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REFERENCES

- Abu Thuraya, N. H. (1982). A general survey of agriculture pest in Saudi Arabia. Riyadh. Kingdom of Saudi Arabia. Ministry of Agriculture and Water, Research Department. 80pp.
- Abu Zinada, A. H.; Robinson, E.R.; Nader, I.A. and Al Wetaid, Y.I. (2001). First Saudi Arabian national report of the convention on biological diversity. 1st ed. The National Commission for Wildlife Conservation and Development, Riyadh Kingdom of Saudi Arabia. 131 pp.
- Abu Zoherah, R., Khaled, A. and Sarko, T. (1993). List of insects recorded from Saudi Arabia. Ministry of Agriculture and Water, National Agriculture and Water Research Center. Riyadh, Kingdom of Saudi Arabia. 394 pp.
- Adams, C.F. (1905). Diptera Africana. *The Kansas University Science Bulletin* 3: 146-208.
- Akhter, J., Qadri, S.M, and Imam, A.M. (2000). Cutaneous myiasis due to *Dermatobia hominis* in Saudis. *Saudi Medical Journal* 21: 689-691.
- Al Ahmadi, A.Z. and Salem, M.M. (1999). Entomofauna of Saudi Arabia. Part I Checklist of insect. Academic Publishing & Press, King Saud University. Riyadh. Kingdom of Saudi Arabia. 240 pp.
- Al Ghazawi, A.M., Dawood, N.A., Al Walaii, A.N., and Rashid, M.A. (2003). Encyclopedia of the names of places in the Kingdom of Saudi Arabia. Part I (arabic edition). King Abdulaziz Foundation for the Saudi Geological Survey, Riyadh. Kingdom of Saudi Arabia. 585pp.
- Al Misned, F. A.M. (2003). New record of cluster fly *Pollenia rudis* (Fabricus) with distribution of all known Blowflies (Diptera: Calliphoridae) in Saudi Arabia. *Journal of the Egyptian Society of Parasitology* 33:1-12.
- Alahmed, A. M., Sallam, M.F., Khuriji, M. A., Kheir, S. M, and Azari-Hamidian, S. (2011). Checklist and pictorial key to fourth-instar larvae of mosquitoes (Diptera: Culicidae) of Saudi Arabia. *Journal of Medical Entomology* 48:717-737.
- Alahmed, A. M. (2002). Incidence of myiasis in sheep caused by *Chrysomya bezziana* in Saudi Arabia. *Journal of King Saud University*. 14: 109–112.
- Alahmed, A.M. (2004). Myiasis in sheep farm in Riyadh region, Saudi Arabia. *Journal of the Egyptian Society of Parasitology* 34: 153–160.
- Alahmed, A.M., Al Dawood, A.S., and Kheir, S.M. (2006). Seasonal activity of flies causing myiasis in livestock animals using sticky traps baited with swormlure-4 in Riyadh region, Saudi Arabia. *Scientific Journal of King Faisal University (Basic and Applied Sciences)* 7: 107–119.

- Ansari, M.A and Oertley, R.E. (1982). Nasal myiasis due to Bezzis blow fly (screw-worm): case report. *Saudi Medical Journal* 3: 275-278.
- Baumgartner, D.L and Greenberg, C. (1984). The genus *Chrysomya* (Diptera: Calliphoridae) in the new world. *Journal of Medical Entomology* 21: 105-113.
- Baumgartner, D.L. (1993). Review of *Chrysomya rufifacies* (Diptera: Calliphoridae). *Journal of Medical Entomology* 30: 338-352.
- Baumgartner, D.L. and Greenberg, B. (1985). Distribution and medical ecology of blow flies (Diptera: Calliphoridae) of Peru. *Annals of the Entomological Society of America* 78: 565-587.
- Becker, Th. (1910). Dipteren aus südarabien un von der insel Sokotra. *Denkschriften Akademie der Wissenschaften in Wien* 70: 131-160.
- Becker, Th. (1912). Perische Dipteren von den expedition der Herrn N. Zarudny 1898 und 1901. *Annal Museum Zoology and Academy of Science*. St. Petersburg. 17: 303-654.
- Bigot, J.M.F. (1858). Insects dipteres pour server a la faune du Gabon. *Archive de Entomologia* 2. 131 pp.
- Bigot, J.M.F. (1860). Dipteres de Madagascar (suite et fin). Troisieme partie. *Annales de la Société Entomologique de France* 7: 533-558.
- Bigot, J.M.F. (1877). Dipteres nouveaux ou peu connus. 8e partie 10. Genre *Somomya* (Rondani), *Calliphora*, *Melinda*, *Mufetia*, *Lucilia*, *Chrysomyia*. *Annals Society Entomology of France* 7: 243-259.
- Bigot, J.M.F. (1878). Dipeteres nouveaux ou peu connus. *Annales de la Societe Entomologique de France* 8: 31-48.
- Bigot, J.M.F. (1887). Diptères nouveaux ou peu connus. Muscidi (J.B). *Bulletin of the Zoological Society of France* 12: 581-617.
- Bigot, J.M.F. (1888). Dipeteres nouveaux ou peu connus. Muscidi (J.B). *Bulletin de le Societe Zoologique de France* 12: 581-617.
- Bigot, J.M.F. (1891). Voyage de M. Ch. Alluaud dans le territoire d' Assinie 3e mem. *Annales de la Societe Entomologique de France*: 365-386.
- Bigot. J.M.F. (1874). Diptères nouveaux ou peu connus. *Extrait des Annales de la Société entomologique de France* 2: 235-242.
- Bisby, F., Roskov, Y., Culham, A.; Orrell, T., Nicolson, D., Paglinawan, L., Bailly, N., Appeltans, W., Kirk, P., Bourgoin, T., Baillargeon, G. and Ouvrard, D., Eds. (2012). *The Catalogue of Life* (<http://www.catalogueoflife.org/>), released 15th March 2012. accessed 25 March 2012.
- Blanchard, É. (1872). In Larrey, M.L.B. Extrait d'un travail manuscrit que lui a adressé M.Bérenger-Féraud, médecin en chef de la Marine, au Sénégal Comptes Rendus de l. *Academie des Sciences. Sciences de la Vie Paris* 75: 1133-1134.
- Brauer, F and Bergenstamm, J.E. (1891). Die Zweiflügler des Kaiserlichen Museums zu Wien. V. Vorarbeiten zu einer Monographie der Muscaria Schizometopa (exclusive Anthomyidae). Pars II. *Denkschriften Akademie der Wissenschaften in Wien* 58: 305-446.
- Brauer, F. (1899). Beitrag zur kenntnis der Muscaria Schizometopa I. Bemerkungen zu den Original exemplaren der von Bigot, Macquart und Robineau-Desvoidy beschriebenen Muscaria Schizometopa aus der Sammlung des Hern. G.H. Verall. *Baierische Akademie der Wissenschaften Wien* 108: 495-529.
- Brauer, F.M. and Bergenstamm, J.E. (1889). Muscaria Schizometopa (exclusive Anthomyidae) *Die Zweiflügler des Kaiserlichen Museums zu Wien* 4: 59-180.

- Büttiker, W., Habayeh, S., and Zumpt, F. (1980). Medical and applied zoology in Saudi Arabia, first record of the Tumbu Fly (*Cordylobia anthropophaga* [Blanchard]), (Diptera: Fam. Calliphoridae). *Fauna of Saudi Arabia* 2: 440-443.
- Büttiker, W., Attiah, M.D., and Pont, A.C. (1979). Insect of Saudi Arabia, Diptera: synanthropic flies. *Fauna of Saudi Arabia* 1: 352-367.
- Buxton, P. A. (1924). Applied entomology of Palestine, being report to the Palestine Government. *Bulletin of Entomological Research* 14: 284-340.
- Byrd, J.H and Castner, J.L. (2010). Insect of Forensic Importance. In Forensic Entomology The Utility of Arthropod in Legal Investigations. 2nd ed. CRC Press. New York USA. 708 pp.
- Carvalho, M.H. and Von Zuben, C.J. (2006). Demographic aspect of *Chrysomya megacephala* (Diptera, Calliphoridae) adults maintained under experimental conditions and reproductive rate estimated. *Brazilian Archives of Biology and Technology* 49: 457-461.
- Catts, E.P. and Mullen, G.R. (2002). Myiasis (Muscoidea, Oestroidea). In *Medical and Veterinary Entomology*: 341-591. Elsevier Science. USA. 591 pp.
- Cazander, G., Veen K.E, Bernards A.T, and Jukema G.N. (2009). Do maggots have an influence on bacterial growth? A study on the susceptibility of strains of five different bacterial species to maggots of *Lucilia sericata* and their excretions/secretions. *Journal of Tissue Viability*. 18: 80-87.
- Clement, S.L., Hellier, B.C., Elberson, L.R., Staska, R.T., and Evans, M.A. (2007). Flies (Diptera: Muscidae: Calliphoridae) are Efficient Pollinators of *Allium ampeloprasum* L. (Alliaceae) in Field Cages. *Journal of Economic Entomology* 100: 131-135.
- Coquerel, M. (1862). Note sur des larves de diptères développées dans des tumeurs d'apparence furunculose. *Annales de la Société Entomologique de France*. 1862: 95-103.
- Cumming, J.M. and Wood, D.M. (2009). Morphology and terminology. In: Brown, B.V. et al. (Eds.), *Manual of Central American Diptera*. Volume 1. NRC Research Press, Ottawa: 9-50.
- Curran, C.H. (1931). New African Calliphoridae. *American Museum Novitates*. 506pp.
- Cuthbertson, A. (1938). Biological notes on some Diptera in Southern Rhodesia. *Transactions of the Rhodesia Scientific Association* 36: 115-130.
- Dabbour, A.I. (1979). Short note on dipterous flies in western and central regions of Saudi Arabia: *Journal of Agricultural Research, Faculty of Agriculture, Riyadh University* 4: 81-83.
- Dawah, H.A and Abdullah, M. (2009). The Calliphoridae (Diptera: Cyclorrhapha) of South-Western Saudi Arabia. *Fauna of Arabia* 24: 359-371.
- Dear, J.P. (1985). Calliphoridae (Insecta: Diptera). *Fauna of New Zealand* 8: 1-92.
- Deeming, J.C. (1996). The Calliphoridae (Diptera: Cyclorrhapha) of Oman. *Fauna Arabia* 15: 264-279.
- Deeming, J.C. 2008. Order Diptera, family Calliphoridae. *Arthropod Fauna of UAE*. 1: 724-731.
- Dönitz, W. (1905). Ueber eine neue afrikanische Fliege mit parasitisch in der Haut von Ratten lebenden Larven, *Cordylobia murium* Dö. S.B. *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin*: 245-252.
- Erzinçlioğlu, Y.Z. (1987). The larval instars of the african blowfly, *Calliphora croceipalpis* Jaenicke, with a key to the genera of the third instars of african

- carrion-breeding Calliphoridae (Diptera). *Bulletin of Entomological Research* 77: 575-580.
- Erzinçlioğlu, Y.Z. and Whitcombe, R.P. (1983). *Chrysomya albiceps* (Wiedemann) (Dipt., Calliphoridae) in dung and causing myiasis in Oman. *Entomologist's Monthly Magazine* 119: 51-52.
- Eschscholtz, J.F. (1822). *Entomographien. Erster Lieferung. Reimer, Berlin*. 128 pp.
- Evenhuis, N.L., O'Hara, J.E., Pape, T. and Pont, A.C. (2010). Nomenclatural Studies Toward a World List of Diptera Genus-Group Names. Part I: André-Jean-Baptiste Robineau-Desvoidy. *Zootaxa* 2373: 1–265.
- Fabricius, J.C. (1794). Secundum classes, ordines, genera, species, adjectis synonymis, locis, observationibus, descriptionibus. *Entomologia systematica emendata et aucta*. 4. 472pp.
- Fabricius, J.C. (1805). *Systema antliatorum secundum ordines, genera, species adiectis synonymis, locis, observationibus, descriptionibus*: 15-372.
- Frauenfeldt, G.V. (1867). Zoologische Miscellen. XI. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien* 17: 425-502.
- Gabre, R.M., Adham, F.K., and Chi, H. (2005). Life table of *Chrysomya megacephala* (Fabricius) (Diptera:Calliphoridae). *Acta Oecologica* 27: 179–183.
- Gadallah, N.S. and Bosly, H.A. (2006). Diptera associated with camels in the Jeddah region, western Saudi Arabia. *Fauna of Arabia* 21: 339-350.
- Genhard, D.E. (2007). *Forensic Entomology, An Introduction*. John Wiley & Sons. London. 221 pp.
- Greathead, D. J. (1962). The biology of *Stomorhina lunata* (Fabricius) (Diptera: Calliphoridae), a predator of the eggs of Acrididae. *Proceedings of the Zoological Society of London* 139: 139-180.
- Greenberg, B. (2002). *Entomology and the law: flies as forensic indicators*. Cambridge University Press, Cambridge, United Kingdom. 356 pp.
- Grunin, K. Ya. (1988). Family Calliphoridae . *Key to the Insect of the European part of the USSR* 5. Diptera and Siphonaptera 2: 995-1020.
- Grunin, K.Ya. (1957). Neue Arten der Gattung *Villeneuveiella* Austen (*Rhynchoestrus* Séguy) aus UdSSR und Iran (Diptera, Calliphoridae). *Entomologicheskoe Óbozrenie* 36: 538-546.
- Haliday, A.H. (1833). Catalogue of the Diptera occurring about Holywood in Downshire. *Entomological Magazine* 1: 147-180.
- Hall, M and Wall, R. (1995). Myiasis of humans and homestic animals. *Advances in Parasitology* 35: 257–334.
- Harris, T.W. (1869). Descriptions of insect selected from the manuscripts of Dr. Harris. In Scuder, S.H (ed.). *Entomological correspondence of T. W Harris. Occasional Papers of the Boston Society of Natural History* 1: 1-375.
- Heath, A.C.G. (1982). Beneficial aspects of Blowflies (Diptera: Calliphoridae). *New Zealand Entomologist* 7: 343-348.
- Holloway, B.A. (1991). Morphological characters to identify adult *Lucilia sericata* (Meigen, 1826) and *L. cuprina* (Wiedemann, 1830) (Diptera: Calliphoridae). *New Zealand Journal of Zoology* 18: 413-420.
- Hough, G.N.M.D. (1898). The Muscidae collected by Dr. A. Donaldson Smith in Somaliland. *Proceeding of the Academy of Natural Sciences of Philadelphia* 50: 165-188.
- Jacentkovsky, D. (1941). *Pollenia mayeri* n.sp (Calliphoridae, Tachinoidea) nova kuclice Z. Moravy. *Entomologické listy* 4: 14-146.

- Jaenicke, F. (1867). Neue exotische Dipteren. *Senckenbergischen Naturforschenden Gesellschaft Abhandlungen* 6: 311-408.
- James, M. T. (1964). The Blow flies (Diptera: Calliphoridae), Diptera from Nepal. *Bulletin of The British Museum (Natural History) Entomology* 15: 145-179.
- James, M.T. (1947). The flies that cause myiasis in man. *United States Department of Agriculture Miscellaneous Publication* 631. 181pp.
- James, M.T. (1971). Genus *Chrysomya* in New Guinea (Diptera: Calliphoridae). *Pacific Insects* 13: 361-369.
- Jewiss-Gaines, A., Marshall, S.A., and Whitworth, T.L. (2012). Cluster Flies (Calliphoridae: Polleniinae: *Pollenia*) of North America. *Canadian Journal of Arthropod Identification* 19: 1-19.
- Kaczorowska, E. (2006). Blowflies (Diptera: Calliphoridae) in the saline habitats of the Polish Baltic coast. *Polish Journal of Entomology*. 75: 11-27.
- Kano, R. and Sato, K. (1951). Notes on the flies of medical importance in Japan 5, Classification of Japanese female blowflies by the characters of tergites and sternites. *The Japanese Journal of Experimental Medicine* 21: 229-241.
- Karsch, F. (1887). Bericht über die durch Herrn Lieutenant Dr. Carl Wilhelm Scmit on Ost-Afrika gessammelten und von der zoologischen Abtheilung des Königlichen Museum für Naturkunde in Berlin erworbenen Dipteren. *Berliner Entomologische Zeitschrift* 31: 367-382.
- Kaszab, Z. (1981). Insect of Saudi Arabia, Coleoptera: Fam. Tenebrionidae (Part 2). *Fauna of Saudi Arabia* 3: 276-401.
- Kirk-Spriggs, A.H. and Stuckenberg, B.R. (2009). Afrotropical Diptera – Rich savannas, poor rainforests. In: Bickel, D.J., Pape, T., Meier, R., eds, *Diptera Diversity: Status, Challenges and Tools*. Leiden, The Netherlands. Brill Academic Publishers. 155-196.
- Kurahashi, H. (1970). Tribe Calliphorini from Australian and Oriental regions, *Melinda*-group (Diptera: Calliphoridae). *Pacific Insects* 12: 509-532.
- Kurahashi, H. (1989). Family Calliphoridae, pp.702-718. In Catalog of the Diptera of Australasian and Oceanian Regions. Bishop Museum Press. 1155 pp.
- Kurahashi, H., Mihara, M. and Takahashi, E. (1988). New record of *Pollenia varia* (Miegen) (Diptera, Calliphoridae) from Japan. *Kontyû* 56: 240.
- Lehrer, A.Z. (1970). Consideration on the phylogenetic and taxonomic family Calliphoridae (Diptera). *Annotationes Zoologicae et Botanicae, Bratislava* 61: 1-50.
- Lehrer, A.Z. (1979). *Stomorhina lunata* (Fabricius) et *S. selgae* nom. nov. (Dipt. Calliphoridae) *Eos* 53: 81-90.
- Lehrer, A. Z. (2005). Bengaliidae du Monde (Insecta, Diptera). Pensoft Publishers, Sofia, Moscow. 192 pp.
- Loew, H. (1852). Hr. Peters legte diagnosen und abbildungen der von ihn in Mossambique neue entdeckten Dipteren. *Monatsber Akademie der Wissenschaften zu Berlin*: 658-661.
- Loew, H. (1856). *Neue Beiträge zur Kenntniss der Dipteren*, Vierter Beitrag. Berlin, Mittler u Sohn: 1-57.
- Macquart, J. (1834). Insectes Dipteres du Nord de la France Athéricères: Créophiles, Oestrides, Myopaires, Conopsaires, Scénopines, Céphalopsides. *Memoires de la Societe Royale des Sciences de l'Agriculture et des Arts* Lille: 137-368.
- Macquart, J. (1843a). *Diptères Exotiques Nouveaux ou Peu Connus*. Paris, Roret. 3. 460pp.

- Macquart, J. (1843b). *Diptères Exotiques Nouveaux ou Peu Connus*. Paris, Roret 2: 269-330.
- Macquart, J. (1843c). Histoire naturelle des insectes Diptères. *Librairie Encyclopédique de Roret* Paris 1: 1-710.
- Macquart, J. (1846). Dipteres exotique nouveaux ou peu connus. Suite du 1e supplement. *Memoires de la Societe Royale des Sciences de l'Agriculture et des Arts* Lille. 198.
- Macquart, J. (1851). Dipteres exotique nouveaux ou peu connus. Suite du 4e supplement. *Memoires de la Societe Royale des Sciences de l'Agriculture et des Arts* Lille: 134-294.
- Malloch, J.R. 1926. Exotic Muscaridae (Diptera) XIX. *The Annals and Magazine of Natural History* 19: 468-494.
- Malloch, J. R. (1927). Exotic Muscaridae (Diptera) XI. *The Annals and Magazine of Natural History* 20: 385-424.
- Malloch, J. R. (1928). Exotic Muscaridae (Diptera) XXI. *The Annals and Magazine of Natural History* 10: 249-280.
- Mariluis, J.C., Schnack, J.A., Mulieri, P.P., and Patitucci, L.D. (2008). Calliphoridae (Diptera) from wild, suburban, and urban sites at three Southeast Patagonian localities. *Revista de la Sociedad Entomológica Argentina* 67: 107-114.
- Mattingly, P. F., and K. L. Knight. (1956). The mosquito of Arabia I. *Bulletin of The British Museum (Natural History. Entomology* 4: 89-141.
- McAlpine, J.F. (1989). Phylogeny and classification of the Muscomorpha. In J.F. McAlpine and D.M. Wood, eds., *Manual of Nearctic Diptera* 3. Ottawa: Research Branch Agriculture Canada: 1397-1508.
- Meigen, J.W. (1826). *Systematische Beschreibung der Bekannten Europäischen Zweifflugeligen Insekten* 5:1-412.
- Meigen, J.W. (1830). *Systematische Beschreibung der Bekannten Europäischen Zweifflugeligen Insekten* 6: 1-401.
- Meigen, J.W. (1938). *Systematische Beschreibung der Bekannten Europäischen Zweifflugeligen Insekten* 7: 1-433.
- Mordan, P.B. (1980). Molluscs of Saudi Arabia, land molluscs. *Fauna of Saudi Arabia* 2: 359-367.
- Morsy, T.A., Fayad, M.E., Salama, M.M.I., Sabry, A. A., El Serougi, A.O.M., and Abdallah, K.F. (1991). Some myiasis producers in Cairo and Giza Abattoirs. *Journal of the Egyptian Society of Parasitology* 21: 539-536.
- Mullen, G. R. and Durfen, L. A. (2009). Medical and veterinary entomology. 2nd ed. Elsevier, Amsterdam, Netherlands. 637 pp.
- Pape, T. (1992). Phylogeny of the Tachinidae family group (Diptera: Calyprate) *Tijdschrift voor Entomologie* 135: 43-80.
- Parmenter, R. R. and MacMahon, J. A. (2009). Carrion decomposition and nutrient cycling in a semiarid shrub-steppe ecosystem. *Ecological Monographs* 79: 637-661.
- Patton, W.S. (1922). Some notes on Indian Calliphorinae III *Chrysomya megacephala* Fabr. (dux Esch.), the common Indian bluebottle, whose larvae occasionally cause cutaneous myiasis in animals and *Chrysomya nigriceps* sp. nov. the common bluebottle of the Nilgiris. *Indian Journal of Medical Research* 9: 555p.
- Patton, W.S. and Cushing, E.C. (1934). Studies on the Higher Diptera of medical and veterinary importance: a revision of the genera of the subfamily Calliphorinae based on a comparative study of the male and female terminalia. The genus

- Chrysomya* Robineau-Desvoidy. *Annals of Tropical Medicine and Parasitology* 28: 123-130.
- Peris, S.V. (1951). Descripciones preliminares de nuevos Rhiniini (Diptera: Calliphoridae). *Eos. Revista Espanola de Entomologia* 27: 237-247.
- Peris, S.V. (1952). La subfamilia Rhiniinae (Diptera: Calliphoridae). *Annales de la Estacion Experimental de Aula Dei* 3: 1-224.
- Pont, A. C. (1980). Calliphoridae. In *Catalogue of the Diptera of the Afrotropical Region*. British Museum (Natural History). 1235 pp.
- Porter, A. (1924). Notes on some insect larvae that may occur in man in South Africa. *South Africa Journal of Science* 21: 373-377.
- Portschinsky, J.A. (1881). Diptera europaea et asiatica nova aut minus cognita. Pars I. *Horae Societatis Entomologicae Rossicae* 16: 135-145.
- Qadri, S. M. H., and Al-Ahdal, M. N. (1988). Cutaneous myiasis due to *Dermatobia hominis*: report of a case. *Annals of Saudi Medicine* 8: 286-287.
- Ramadan, R. O and El-Bihari, S. (1980). Dermal myiasis in farm animals in Hofuf area. *Saudi Biological Society, 4th Symposium on Biological Aspect of Saudi Arabia*: 305-314.
- Reinhard, H. J. (1929). Notes on the Muscoid flies of the genera *Opelousia* and *Opsodexia* with descriptions of three new species. *Proceedings of the United States National Museum* 76: 1-9.
- Robineau-Desvoidy, A.J.B. (1830). Essai sur les Myodaires. *Mémoires présentés par divers Savans à l'Académie Royale des Sciences de l'Institut de France*. 2: 1-813.
- Robineau-Desvoidy, A.J.B. (1863a). *Histoire naturelle des diptères des environs de Paris*. 1. 1143pp.
- Robineau-Desvoidy, A.J.B. (1863b). *Histoire naturelle des diptères des environs de Paris*. 2. 920pp.
- Rognes, K and Paterson, H.E.W. (2005). *Chrysomya chloropyga* (Wiedemann, 1818) and *C. putoria* (Wiedemann, 1830) (Diptera: Calliphoridae) are two different species. *African Entomology* 13: 49-70.
- Rognes, K. (1963). Synanthropy of Blowflies (Dipt., Calliphoridae) in Finland. *Annual Entomologica Fennoscandia*, 29: 1- 49.
- Rognes, K. (1985). A check-list of Norwegian blow-flies (Dipt., Calliphoridae). *Fauna Norvegica Series B* 32: 89-93.
- Rognes, K. (1987). The taxonomy of the *Pollenia rudis* species group in the Holarctic region (Diptera: Calliphoridae). *Systematic Entomology* 12: 475-502.
- Rognes, K. (1988). The taxonomy and phylogenetic relationships of *Pollenia semicenerea* species group (Diptera: Calliphoridae). *Systematic Entomology* 13: 315-345.
- Rognes, K. (1991). Blowflies (Diptera, Calliphoridae) of Fennoscandia and Denmark. *Fauna Entomologica Scandinavica* 24. 272 pp.
- Rognes, K. (1992). Revision of the cluster flies *Pollenia venturii* species group, with cladistic analysis of Palearctic species *Pollenia* Robineau-Desvoidy (Diptera: Calliphoridae). *Entomologica Scandinavica* 22: 233-248.
- Rognes, K. (1993). First record of the sheep Greenbottle fly *Lucilia cuprina* (Wiedemann, 1830) from Europe (Diptera: Calliphoridae) with additional Spanish records of Calliphoridae, Muscidae and Sarcophagidae. *Eos* 69: 41-44.
- Rognes, K. (2002). Blowflies (Diptera:Calliphoridae) of Israel and adjacent areas, including a new species of from Tunisia. *Entomologica Scanddinavica Supplement* 59: 1-148.

- Rognes, K. (2005). Bengalomania – A review of Andy Z. Lehrer’s book on *Bengalia* Robineau-Desvoidy, 1830 and related works (Diptera, Calliphoridae). *Studia Dipterologica* 12: 447-671.
- Rognes, K. (2008). The taxonomy of the *Pollenia rudis* species-group in the Holarctic Region (Diptera: Calliphoridae). *Systematic Entomology* 12: 457-502.
- Rognes, K. (2009). Revision of the Oriental species of the *Bengalia peuhi* species-group (Diptera, Calliphoridae). *Zootaxa* 2250: 1-76.
- Rognes, K. (2011). A review of the monophyly and composition of the Bengaliinae with the description of a new genus and species, and new evidence for the presence of Melanomyiinae in the Afrotropical Region (Diptera, Calliphoridae). *Zootaxa* 2964:1–60.
- Rognes, K. (2012). Revision of the Afrotropical species of the *Bengalia peuhi* species-group, including a species reassigned to the *B. spinifemorata* species-group (Diptera, Calliphoridae), with notes on the identity of *Ochromyia petersiana* Loew, 1852 (Diptera, Rhiniidae). *Zootaxa* 3553: 1-79.
- Rohdendorf, B.B. (1926). Morphologische stadium an äusseren genitalorganen der Calliphorinen (Diptera). *Russkii Zoologicheskii Zhurnal* 6: 83-128.
- Rohdendorf, B.B. (1930). Calliphorinen-Studien III (Dipt.). *Zoologischer Anzeiger*. 88: 176-178.
- Rondani, C. (1865). Dipteral italic non vel minus cognita decripta vel annotate Fasc.II Muscidae. *Atti della Societa Italiana di Scienze Naturali e del Museo Civico di Storia Naturali*. 7:193-231.
- Rondani, C. (1873). Muscaria exotica Musei Civici Januensis Fragmentum I. *Genova Annali del Museo Civico di Storia Naturale* 4: 282-294.
- Roubaud, E. (1914). Les producteurs de myiases et agents similaires chez l’homme et les animaux. *Etudes sur la Fauna Parasitaire de l’Afrique Occidentale Francaise* I. 250 pp.
- Rueda, L.C., Ortega, L.G., Segura, N.A., Acero, V. M., and Bello, F. (2010). *Lucilia sericata* strain from Colombia: Experimental colonization, life tables and evaluation of two artificial diets of the Blowfly *Lucilia sericata* (Meigen) (Diptera: Calliphoridae), Bogotá, Colombia Strain. *Biological Research* 43: 197-203.
- Sabrosky, C.W., G. F. Bennett., and Whitworth, T. L. (1989). Bird blow flies (*Protocalliphora*) in North America (Diptera: Calliphoridae) with notes on the Palearctic species. Smithsonian Institution Press, Washington, D.C. 312 pp.
- Schiner, J.R. (1862). *Fauna austriaca. Die Fliegen (Diptera)* I Theil: 1-674.
- Schumann, H. (1986). Family Calliphoridae. In: A. Soos & L. Papp (Eds.), *Catalog of Palearctic Diptera, Calliphoridae- Sarcophagidae*, Budapest, pp. 11-58.
- Séguy, E. (1928). Études sur les mouches parasites. I Conopides, Oestrides et Calliphorines de l'Europe occidentale. *Encyclopedia Entomologie* 9. 251pp
- Séguy, E. (1933). Contributions à l'étude de la faune du Mozambique. Voyage de M.M. Lesne (1928-1929) 13e note. Diptères (2e partie). *Memorias e Estudos do Museu Zoologico da Universidade de Coimbra* 67: 5-80.
- Séguy, E. (1958). Les Calliphores africaines du Museum (Dipteres). *Bulletin de l'Institut Français d'Afrique Noire* 20: 142-192.
- Senior-White, R. (1924). New and little known Oriental Tachinidae. *Spolia Zeylan*. 13: 103-119.
- Service, M. and Service, M.W. (2008). Medical entomology for students. Cambridge University Press, Cambridge, United Kingdom. 289 pp

- Shalaby, F. (1962). Contribution to the insect fauna of Saudi Arabia. *Bulletin of the Entomological Society of Egypt* 46: 339-342.
- Shannon, R.C. (1924). Nearctic Calliphoridae, Luciliini (Diptera). *Insecutor inscitiae Mentruius* 12: 67-81.
- Shewell, G. E. (1987). Calliphoridae. Pp 1133-1145. In Manual of Nearctic Diptera Vol. 2. Research Branch, Agriculture Canada. *Monograph* 29. 1332 pp.
- Singh, P. (1986). Rearing Calliphoridae. Pp. 19-20. In: Calliphoridae (Insecta: Diptera) Dear, J. P. (eds). *Fauna of New Zealand* 8: 1-86.
- Smit, B. (1931). A study of the sheep blowflies of South Africa. *Onderstepoort Journal of Veterinary Research* 1: 299-421.
- Speiser, P. (1910). *Orthorrhapha in Sjösteds Kilimandjaro Meru Expedition*. Stockholm 10: 31-112.
- Tawfik, M. F. S. and El Husseini, M. M. (1971). Life-history of *Pollenia dasypoda* Portochisky, a parasite of the earth worm, *Allolobophora caliginosa* (Sav.) (Diptera: Calliphoridae). *Bulletin de la Societe Entomologique d' Egypte* 55: 275-287.
- Thomas, D.B. and Mangan, R.L. (1989). Oviposition and wound-visiting behavior of the screwworm fly, *Cochliomyia hominivorax* (Diptera: Calliphoridae). *Annals of the Entomological Society of America* 82: 526-534.
- Thompson, C.G. (1869). Diptera part. 12. *Eugenies Resa, Stockohlm*: 443-614.
- Tourle, R., Downie, D.A., and Villet, M.H. (2008). Flies in the ointment: a morphological and molecular comparison of *Lucilia cuprina* and *Lucilia sericata* (Diptera: Calliphoridae) in South Africa. *Medical and Veterinary Entomology* 23: 6-14.
- Townsend, C.H.T. (1908). The taxonomy of Muscoidean flies, including description of new genera and species. *Smithsonian miscellaneous Collins* 51: 1-138.
- Townsend, C.H.T. (1917). Indian flies of the subfamily Rhiniinae. *Records of the Indian Museum* 13: 185-202.
- Triplehorn, C.A and Johnson, N. F. (2005). Borror and DeLong's introduction to the study of insect. 7th ed. Thomson Brooks/Cole. Belmont, California. 864 pp.
- Vanin, S., Caenazzo, L., Arseni, A., Cecchetto, G., Cattaneo, C., and Turchetto, M. (2009). Records of *Chrysomya albiceps* in Northern Italy, an ecological and forensic perspective. *Memórias do Instituto Oswaldo Cruz Rio de Janeiro* 104: 555-557.
- Vargas, J. and Wood, D. M. (2010). Calliphoridae (Blowflies). Pp. 1297-1442. In: *Manual of Central American Diptera*. Volume 2. B. V. Brown, A. Borkent, J. M. Cumming, D. M. Wood, N. E. Woodley, and M. A. Zumbado (eds.). National Research Council of Canada Press, Ottawa, Ontario, Canada. 728 pp.
- Villeneuve, J. (1912). Dipteres nouveaux recueillis en Syrie par M. Henri Gadeau de Kerville et decrits. *Bulletin de la Societe des amis des Sciences Naturelles de Rouen* 47: 40-55.
- Villeneuve, J. (1913). Nouvelles diptérologiques. *Bulletin de la Société Entomologique de France* 15: 367.
- Villeneuve, J. (1914). Descriptions de nouveaux Calliphorinae africains (Diptera). *Bulletin de la Société Entomologique de France*: 305-308.
- Villeneuve, J. (1915). Myodaires superieurs recuils a Madagascar. *Revue de Zoologie et Africaines* 4: 191-209.
- Villeneuve, J. (1935). Un Myodaire nouveau de Congo. *Revue de Zoologie et Africaines* 26. 416pp.

- Walker, D.H and Pittaway, A.R. (1987). Insect of Eastern Saudi Arabia. Mcmillan Publ. London. 75 pp.
- Walker, F. (1849). List of the specimens of dipterous insects in the collection of the British Museum, 4: 689-1172.
- Walker, F. (1852). Diptera 1. In: Saunders, W.W. (Ed.). *Insecta Saundersiana*: 157-252.
- Walker, F. (1853). Diptera 1. In: Saunders, W.W. (Ed.). *Insecta Saundersiana*: 253-414.
- Wells, J.D. (1991). *Chrysomya megacephala* (Diptera: Calliphoridae) has reached the continental United States: review of its biology, pest status, and spread around the world. *Journal of Medical Entomology* 28: 471–473.
- Whitworth, T. (2006). Keys to the genera and species of blow flies (Diptera: Calliphoridae) of America North of Mexico. *Proceedings of the Entomological Society of Washington* 108: 689-725.
- Whitworth, T. (2010). Keys to the genera and species of Blowflies (Diptera: Calliphoridae) of the West Indies and description of a new species of *Lucilia* Robineau-Desvoidy. *Zootaxa* 2663: 1–35.
- Wiedemann, C.R.W. (1818). Neue Insecten vom Vorgebirge der guten. *Hoffnung. Zoogisches Magazin* Kiel 1: 40–48.
- Wiedemann, C.R.W. (1819). Beschreibung neuer Zweiflugler aus Ostindien und Afrika. *Zoogisches Magazin* Kiel 1: 1-39.
- Wiedemann, C.R.W. (1820). *Nova Dipterorum Genera Kiliae Holsatorum*. 244pp.
- Wiedemann, C.R.W. (1830). *Aussereuropäische Zweiflügelige Insekten/beschrieben von Christ. Rud. Wilh. Wiedemann; als Fortsetzung des Meigenischen Werkes* 2. 864 pp.
- Williams, K.A. and Villet, M.H. (2006). A new and earlier record of *Chrysomya megacephala* in South Africa, with notes on another exotic species, *Calliphora vicina* (Diptera: Calliphoridae). *African Invertebrates* 47: 347–350.
- Yahnke, W. and George, J. A. (1972). Rearing and immature stages of the cluster fly (*Pollenia rudis*) (Diptera: Calliphoridae) in Ontario. *Canadian Entomologist* 104: 567-576.
- Zumpt, F. (1956). Calliphoridae (Diptera: Cyclorrapha) Part I: Calliphorinae and Chrysomyinae. *Exploration du Parc National Albert Mission G. F. de Witte (1933–1935) Fascicule* 87. 199 pp.
- Zumpt, F. (1958). Calliphoridae (Diptera: Cyclorrapha) Part II: Rhiniini. *Exploration du Parc National Albert Mission G. F. de Witte (1933–1935) Fascicule* 92: 207 pp.
- Zumpt, F. (1959). The tumbu fly, *Cordylobia anthropophaga* (Blanchard), in Southern Africa. *South Africa Medical Journal* 33: 862-865.
- Zumpt, F. (1965). Myiasis in human and animals in the old world. London Butterworths, London, United Kingdom Publ. 267 pp.
- Zumpt, F. (1971). Description of three new species of Calliphorinae from Ethiopian Geographical region (Diptera: Sarcophagidae). *Novos taxa entomológicos* 99: 1-9.
- Zumpt, F. and Tsacas, L. (1976). The *Ryhncomya callopiis* group sensu Séguéy (Diptera, Calliphoridae). *Journal of Natural History* 10: 347-349.