



Prevalence of some species of flies in cowsheds in Mosul city

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Abstract

The flies of different families that the flies which act as the main sources of annoyance to both humans and animals, as well as being direct vectors of many pathogens, its indeed need to do this study to check for the presence of these flies within the animal environment near the sources of food and water, in addition to their presence close to animals or on their bodies. As indicated from the results of the present study of morphological or formal specification for *Musca*, *Lucilia*, *Chrysoma*, *Stomoxys*, and *Parasarchophaga*, which were collected from cowsheds from AL-Saada and Baawyza and Al-Shalalaat areas in Mosul city. The current study focused on the morphological features of flies collected to achieve guideline evidence with images taken under the stereoscopic dissecting microscope. Three families and seven species of dipteran flies' morphological specifications have been revealed in this research with the help of taxonomic keys particularly; wing venation, number of strips on the thorax, color of head, thorax, and abdomen with colored hairy of the flies and antennae, as well as an activity note of flies during the day and peak of this activity in the noon hours, especially in the warm months in which the study took place, like April and May and the daylight time (sunrise at 4:52-5:57 am, the sunset at 6:29-7:17 pm) characterized encouraging for light action of flies families.

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Introduction

Numerous insects are termed flies, like butterflies. And dragonflies, however, apart from insects belonging to the order. Diptera are admitted as "true flies," which include (mosquitoes and flies) (1), also called flies with two wings; dipterans perform as one of the biggest orders of insect, with predicted (240.000) species such as house flies, black flies, sand flies, gnats as well as midges (2,3). Members of the family Calliphoridae, Sarcophagide, and family of Muscidae are carriers of many diseases such as Cholera, typhoid fever, poliomyelitis, and others (4); the family Muscidae establish hygienic affairs during they overpass the gap between bacterium-affluent breeding environments of human habitations (5). Three main families of dipteran initiating myiasis in animals and man (a) Sarcophagidae, (b) Phoridae, and (c) Calliphoridae; many studies dealings to myiasis of

animals, as well as man, were done in the Kingdom of Saudi Arabia (4-7). Many dipteran flies are identical to forensic conservation like the species associated with many family groups, Muscidae, Calliphoridae, and Fanniidae, where they are of greater concern for forensic aspects (8). The risk roles of the pathogenesis of flies to their hosts, particularly the cattle, are the dangers of flies. The infested flies decrease cattle productiveness; furthermore, severely infested animals result in high mortality rates. This administers significant economic debt on cattle producers worldwide; in this instance appraisal illustrate the ectoparasites, especially ticks and flies, attacking Brazil and China farm animals, leading to losses of 7 billion US\$ annually (8,9). Several studies have emerged, focused on treating wounds resulting from flies by using some plant materials, like Aloe vera gel, to improve skin lesions (10,11). Approve the principles of unified pest management to practice unified arthropods management to

alleviate the risk for the development or resistance to external parasiticides while maximizing their endurance the long for as useful tools used rationally with decreased impact on nontargeted species (12). The best insecticide application processes contribute to accomplishing one health by safeguarding animals, public health, and the environment (13). Many cases of dermatosis can be caused by flies, as the family Muscidae, *Musca domestica*, and species of Calliphoridae can transmit mechanically on their bodies and legs, like the genus *Trichophyton* which is responsible for dermatophytosis in sheep in Egypt (14,15). Stable flies (*Stomoxys calcitrans*) can be transmitted the virus mechanically; they can also transmit iatrogenically transfusion with contaminated blood, blood-contaminated needles, and surgical devices used for veterinary purposes (16).

The dissemination of Lentivirus of family Retrovirida, which is affected greatly by the vector related to members of Tabanidae (16), the main aims of the current study were performed to identify the species of the flies in cowsheds and their activities hours in some areas in Mosul city.

Materials and methods

Ethical approve

This study has been approved by the scientific committee of department of Microbiology, Collage of Veterinary Medicine, University of Mosul at the 2nd congress, dated 10/11/2020.

Collection of samples

The flies from different cowshed areas were collected in Mosul, AL-Saada and Baawya, and Al-Shalalaat areas. The observation was done from September 2021 to May 2022. Nearly all the assemblage was done by sticky traps near the cow places or by insect sweeping nets. Collecting samples from the corners of cow's houses and around the animals flying insects. Also, samples were collected from the backs and faces of animals where the flies were present; the traps with sticky material were also used on the ground beside the cow's food and drink.

Identification of flies by using taxonomy keys

The flies collected were directed toward the Parasites Laboratory of Veterinary Medicine College at the University of Mosul. Identification of morphological characteristics. All the flies must be conserved in the refrigerator for 30-35 minutes to paralyze the flies. Keys of taxonomy were of utmost importance in describing species simultaneously as different research programmers. There are many taxonomic keys to detect flies of veterinary importance and public health in many areas or regions. For this reason, an attempt has been made to arrange a soft key for short and definite descriptions of the flies with photos owned by them to aid entomologists and field workers in public health.

Identification of morphology achieved by applying dichotomous key (17,18).

Results

Musca domestica

The thoracic region and abdomen are dull. The thoracic region has 4 blackish strips. Two sides of the abdominal region are often pale. Three segmented antennae with arista are plumose up to the tip. Wing with subcostal vein meeting coastal one, approximately at a straight angle. Vein R₂ branched, Al + CuA₂ and A₂ in distinct configuration curve, not sigmoid curve. The vein A₂ was not ending up at the wing margin. Posterior legs without firm seta at the lower base of anterior tarsomere. The fourth wing vein is angled with disc-like, subapical, and anal cells (Figure 1).

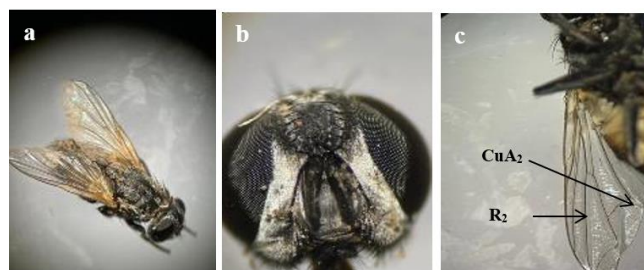


Figure 1: *Musca domestica* (a) Adult, (b) Head, and (c) Wing. 210x.

Musca sorbens

Generally called grime fly or face fly described by the thoracic region has two dark 'y' formed bands. The fly was gray-colored and frequently grown to reach 5.8 mm long. Wings have disc-like cells, subapical cells as well as closed anal cells. This fly plays an important role as a vector of pathogens in man and animals, biologically or mechanically. Yellow abdomen (Figure 2).

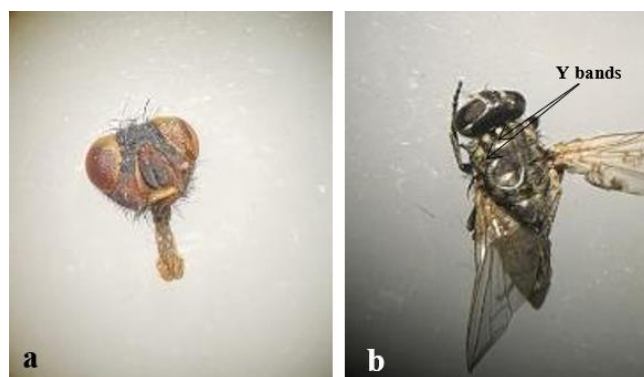


Figure 2: *Musca sorbens* (a) Head, and (b) Thorax with wing. 210x.

***Stomoxys calcitrans* (Stable flies)**

Adult stable flies have a grey abdominal region and thorax aside with an arrangement. The thoracic region had 4 long dorsal stripes, of which the two furthest stripes were shorter. This fly was further admitted by their arched fourth wing vein. The proboscis is longer than the maxillary palps. The abdominal region had a diversified pattern, 1 middle spot and 2 parallel round spots, on the dorsal side of the 2nd and 3rd segment. There is a little angled fourth wing vein (Figure 3).

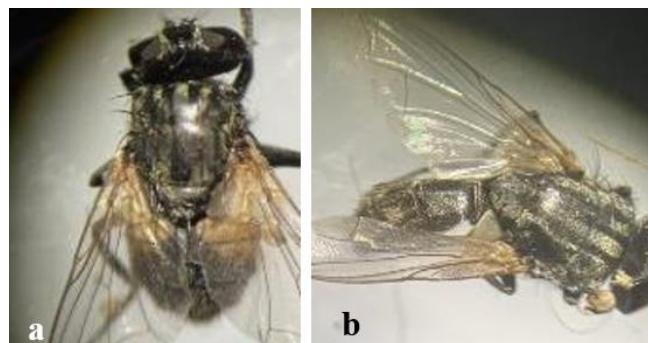


Figure 3: *Stomoxys calcitrans* (a) Thorax, and (b) Wing. 210x.

General characterization of Calliphoridae family

The body of this fly is metallic green, blue, or brown-yellowish, sometimes bronze in color. Lack of darkened stripes at the thorax of the fly. Colored abdomen. The antennae consist of three segments. The wing vein M is strongly curved. R_2 is a branched vein. Thoracic have complete transverse sutures. There are cramped, dark boundaries on the postern edge of the abdomen. The head of the fly is white or silver-colored with many white hairs.

Chrysoma albiceps

This fly is characterized by stem vein of the wing with a row of dorsal setae. Metallic green with the cramped darkened line on the rear edge of abdominal segments. Head with white or silver hairs. Anterior thoracic spiracle white or pale-yellow (Figure 4).

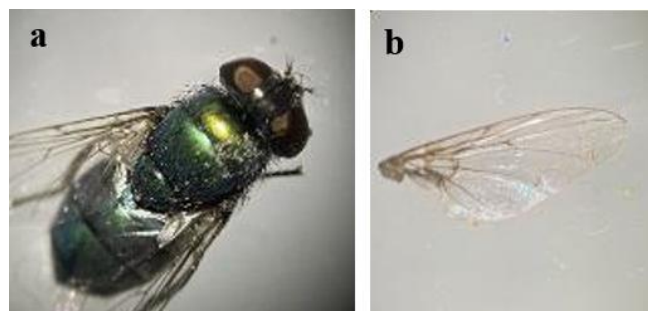


Figure 4: *Chrysoma albiceps* (a) Adult, and (b) Wing. 210x.

Chrysoma megacephala

Bucca and genial dilation have gold to orange setae. Plumose arista. Black to brown thoracic anterior stigmata (Figure 5).



Figure 5: *Chrysoma megacephala*. 210x.

Lucilia sericata

This fly is characterized by the following morphological features the parts of the mouth are yellowish. The head is small, and the cheeks of the fly are silvery and smooth. The femora of the prothoracic leg are dark and metallic blue to black. Three pairs of acrostic bristles on the mesothorax (Figure 6).

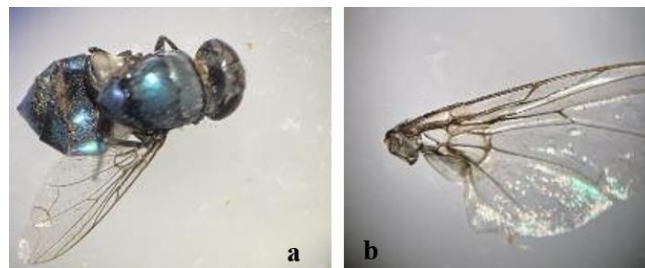


Figure 6: *Lucilia sericata* (a) Adult, and (b) Wing. 210x.

Parasarcophaga ruficarnis

Characterized by gray abdomen with black checkerboard. Yellowish antennae tend to be orange to red in color. The fourth vein of the wings with a sharp angle. Under the eyes, there were white hairs on the genre (Figure 7).

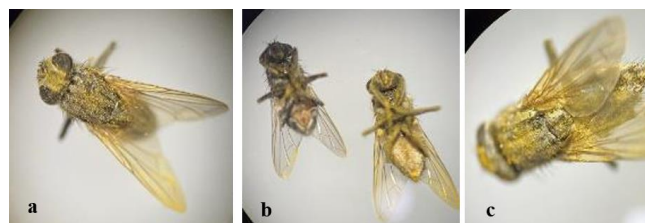


Figure 7: *Parasarcophaga ruficarnis* (a) Adult, (b) Wing, and (c) Head and thorax (dorsal view). 210x.

Flies' prevalence

The number of the genus *Musca* is up to 89%, where they are dominants on cows. Lesser number of genera *Lucilia*, *Chrysoma* also, genus *parasacrophaga*, and genus *Stomoxys* at 5, 2, 2, and 2%, respectively. The activity of insects like the family Muscidae was highly dependent on weather and seasonal conditions; also, it depended on the duration of the daylight hours and dark hours without light. The daylight time (Sunrise at 4:52-5:57 am, the sunset at 6:29-7:17 pm) represented a favorable for flight activities of the family Muscidae, Calliphoridae, and Sarcophagidae. The temperature was recorded at 7 am with the peak at 2pm (14-23°C and 28-38°C, respectively) in April and May. On a sunny day, the increase in the attack and activity of Muscidae, Calliphoridae, and Sarcophagidae flies on animals was recorded in earlier studies. The result of the present study revealed that fly attack and their determination were detected on warmed sun animals' parts of the body with higher flies' infestation than on non-warmed body parts of cows. This fact explains that the peculiarity of poikilothermic features of flies helps to find them in the cows. Gradually flies moved to the dorsal surface of thoracic parts, especially on the area behind the scapula, particularly during the increasing temperature of air until 1 pm. Flies were found on the front of the animal's head by feeding with secretion and tears from the eyes belonging to the Muscidae family members. The flies appeared regularly for bloodsucking only, mainly localized on animals' legs. The fly's attacks on cows continued all over the golden period of the day with the bias to increase their activities until 6pm, as long as a certain fixation of animals during milking. Also, the presence of a significant quantity of insects on one area of the animal's body, the absence of a dull movement, and the opportunity of avoiding the attack of flies due to temporary fixation were represented as very important factors in the prevalence of flies on cowsheds and cow's places.

Discussion

This study investigated the spreading of flies that attack and the preponderance of flies of the family Muscidae in cows. The highest prevalence of flies was 89% for the family Muscidae, which is very close to the results Rochon *et al.* (19) and Klong-Klaew *et al.* (20). Investigation of the flies was more commonplace in cowsheds showing the members of families Muscidae, Calliphoridae, and Sarcophagidae, which agree with the outcomes of Alikhan *et al.* (21). The house flies medium-sized Diptera, with a body length of 5 to 12 mm, especially when the flies are adults. The house flies disturb livestock while feeding and standing; dispersal areas differ depending on food availability and/or the number of advancement stations confronted by flies as they transport through their environments because the members of the family Muscidae aggregate in large numbers on grain feed

used in the feeding of cows, and this result agree with Geden *et al.* (22) and Ghosh and Zurek (23).

One of the main causes of the high percentage of house flies in cowsheds is the fed on food which represents higher attraction for foraging flies than the clean ones due to mechanisms like excretory fluids from the fly, metabolic output criteria (exalted temperature, carbon dioxide, and relative humidity) making the feces of the flies, especially feeding flies and regurgitation do attract foraging flies, as Holl and Gries (24) mentioned, also the house flies, *Musca domestica* L. is most common insects in cowsheds, the main cause of high ratio of *Musca domestica* may be attributed to the high leveled of resistance to insecticides indicated by Kustiati *et al.* (25).

Musca sorbens flies, characterized by a grayish color, also sometimes grow to reach 5.5mm in length, reaching 6 mm occasionally. The yellowish abdomen is one of the most characteristic features of these flies, as Alikhan *et al.* (21) mentioned. *Stomoxys calcitrans* came out to be similar to *Musca domestica* in its size of 5-7 mm, but this fly was recognized by a moderate bend of the fourth wing vein, similar to the study done Makhahlela *et al.* (26). The number of the *Stomoxys calcitrans* was 2%, and this is commensurate with the results of Klaew *et al.* (20) in which they indicated that the high temperature at cowsheds might have appeared as low activities by these flies; also, the fly had a limited demand for water as whished – up water grass for reproducing. Also, Solórzano *et al.* (27) mentioned that identical with elevated pineapple production has been increasing in stable fly percentage, *Stomoxys calcitrans*, it attracted to, and oviposit in the decaying, cleave pineapple debris, due to the ratio of moisturizing in this fruit.

Small numbers emigrate from cow's congregation places in search of other hosts and oviposition predominantly within < 1.5km. For instance, local movement occurs by flight~90cm above the ground (28). In our study, we got acquainted with the specifications and morphology of the family Calliphoridae, species *Chrysoma albiceps* and *Chrysoma megacephala*, as mentioned Alikhan *et al.* (21) and EL-Ashram *et al.* (29) the greenish, shiny abdomen, with yellowish anterior thoracic spiracle with hairs, silver or white in color for the *C. albiceps* and black body with head in red color for *C. megacephala* The infestation percentage and prevalence of *Lucilia sericata* in our study was 5% came very close to the result of AlHayali and Mohammed (30) which mentioned that the percentage of *L. sericata* 4.2%, while *chrysoma spp.* was 2% percentage only which agree with Hu *et al.* (31) who indicated that *Chrysoma megacephala* and other *Chrysoma* species where the dominant species of decomposing carcass and decaying corpses, while very low percentage of these insects were flying around animals.

The fly *Parasarcophaga ruficornis* showed a low percentage of 2% which agree with Fakoorziba *et al.* (32) due to the highest number of the fly caught in the decay stage

of body decomposition, and the same characteristic features came in Alikhan *et al.* (21) results. *Musca domestica* Linnaeus, 1758, the common name is House fly the synonyms: *Musca continua* Walker, 1853 *M. multi-spin* Awati, 1916, *M. soror* Robineau-Des-void, 1830, while the fly *Musca sorbens* Wiedemann, 1830, common name: Bazaar fly, Eye seeking fly. Synonyms: *Musca dichotoma* Bezzi, 1911; also *Byomya alba* Malloch, 1929. *Chrysoma albiceps* Wiedemann 1819, the common name: Hairy maggot blowfly, the synonyms: *Musca albiceps* Wiedemann, 1819 also *Compsomyia flaviceps* Séguy, 1927.

Chrysoma magacephala (Fabricius, 1794), the common name: Oriental blue fly, Oriental latrine fly, and the synonyms: *Chrysoma duvaucelii* Robineau - Devoidy, 1830 *Musca bata* Walker, 1849. The fly *Lucilia scricata* (Meigen, 1826), Common name of this fly is green battle fly, sheep blowfly. The synonyms: *Lucilia barberi* Townsend, 1908, also *Lucilia capensis* Robineau - Desvoidy, 1830; the last fly was *parasarcophaga ruficornis fabricius*, 1794 the common name: Red homed meat fly, as mentioned by Augul *et al.* (33). The high percentage of the genus *Musca* is due to low insecticide exposure (34). The nuisance of flies may cause marked economic losses to the cow in its cowshed and house due to discharge from food. The policy of appropriate consolidation of pain management, antipathogenic agents like antimicrobials, also the use of suitable insecticides for fly controlling (35) will help reduce the bad influences of these flies on animals like fly infestation in cattle; then *Staphylococcus aureus* was isolated as well as detected from various infested regions with larvae of these flies; also the percentage of *Escherichia coli* isolated from flies was 76% from the dairy farms in Nineveh governorate (36,37), but on the contrary, prepupae of some flies like a black soldier can be used as an antibacterial using its active substance counter to aerolysin and hemolysin (38).

The present study showed that the flies attacked warmed sun animal's part of the body with higher flies infestation than on non-warmed body's part of cows; this result agrees with what Zahn and Gerry (39) mentioned, who indicated that male and female flies activity started at dawn and generally increased to a peak of activity during the late morning and in the early afternoon where they are located on the animal's body (39). Our study showed that the daylight time (sunrise at 5:57 am, the sunset at 7:17 pm) represented a favorable for flight activities of the family Muscidae, Calliphoridae, and Sarcophagidae; this is consistent with what Ferdousi and Sultana (40) indicated.

Conclusions

The identification key analysis and morphological characteristics showed that the highest ratio or percentage of Genus *Musca* was found on those cowsheds and the bodies of cows. The result showed that the genus *Musca* was the dominant genus among all the flies. The Muscidae,

Calliphoridae, and Sarcophagidae activity rose on sunny days, especially at 1 pm, on animal parts of the body. The daylight time (sunrise at 5:57am, sunset at 7:17 pm) was favorable for fly flight activity.

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Conflict of interest

The authors declare that there are no combats of interest regarding the publication of this manuscript.

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انتشار بعض أنواع الذباب في حظائر الأبقار في مدينة الموصل

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الخلاصة

يعد الذباب من مختلف العوائل التي ينتمي لها من مصادر الإزعاج الرئيسية للإنسان والحيوان على حد سواء فضلاً عن كونها ناقلات مباشرة للعديد من مسببات المرضية، لذا كان لابد من إجراء هذه الدراسة للوقوف على تواجد هذه العوائل من الذباب ضمن بيئة الحيوان بالقرب من مصادر غذائه وماءه فضلاً عن تواجدها بالقرب من جسم الحيوان أو متواجدة عليه، إذ أشارت نتائج هذه الدراسة إلى المواصفات الشكلية لكل من أجناس الذباب مثل: الذباب المنزلي و ذباب الخشف و ذباب السرور و ذباب الاسطبل فضلاً عن جنس ذباب اللحم التي تم جمعها من حظائر الأبقار في منطقة السادة وبعويزة ومنطقة الشلالات في مدينة الموصل. إذ ركزت هذه الدراسة على التعرف على الخصائص المظهرية للذباب الذي تم جمعه لغرض الفحص بالمجهر التشريحي المجسم. ثلاث عوائل وسبعة أنواع من الذباب ثنائي الأجنحة تم الكشف عن مواصفاتها في هذا البحث، وذلك من خلال الاستعانة بمفاتيح

الأشهر الدافئة التي تمت فيها الدراسة كشهر نيسان وأيار وفترة الإضاءة في النهار (شروق الشمس ٤:٥٢-٥:٥٧ صباحاً وحتى الغروب من الساعة ٦:٢٩-٧:١٧ مساءً) تمثل الفترة المفضلة للنشاط الضوئي لعوائل الذباب.

التشخيص وتحديد المفاتيح ثنائية التفرع كتعريف الجناح وعدد الأشرطة على منطقة الصدر ولون الرأس والصدر والبطن والرأس ذو الشعر الملون وقرون الاستشعار للذباب فضلاً عن ملاحظة فترات نشاط الذباب خلال اليوم الواحد وذروة هذا النشاط في ساعات الظهيرة، وخاصة في