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# Host and Feeding Site Preferences of the Horse Flies (Diptera: Tabanidae)

Ferhat ALTUNSOY

Anadolu Universtiy Faculty of Science Biology Department 26470 Tepebaşı Eskişehir, TURKEY
e-mail: ferhataltuns@anadolu.edu.tr

## ABSTRACT

This study observed the preferential host and feeding sites of horse fly species. A total of 2705 samples including 7 genera and 14 species were collected. Eight most abundant species were used in the analysis while *Tabanus lunatus* was ranked first with a rate of 50.55%. As a result of the analysis, eight species (*T. lunatus, T. regularis, T. spodopterus, T. miki, T. bromius, T. bifarius, Silvius alpinus, Haematopoda subcylindrica*) preferred the foot of hosts with a rate of 66.93%, while the back areas were used with a rate of 4.69%. Kruskall-Wallis test analysis showed that horse flies do not randomize their hosts and feeding sides on the hosts.

*Key words:* Tabanidae, horse flies, host preference, feeding sides, Diptera, Insecta.

## INTRODUCTION

Species of the Tabanidae family vary regarding nutritional requirements and host preferences (Jeffrey and Davies, 1986). During the summer months, mature females are abundant in hot and sunny regions; they feed by sucking blood from domestic and wild animals such as cattle, camel, horse, donkey, hinny, pig, reptile and rodent. In previous studies, the feeding sides of horse flies on different rodents, reptiles and mammals were studied (Krcmar, 2006; Gouteux and Noireu, 1986). Krcmar (2006), reported that the feeding site preferences of horse fly species, *Tabanus bromius, T. tergestinus,* and *Philiompyia graeca* on the human body were statistically important. Gouteux and Noireu (1986) reported that species of *Chrysops silacea* and *C. dimidiata* attack humans, rodents, hippopotamus, reptiles, warthogs and lizards. Jeffrey and Davies (1986) indicated that the species of *Hybomitra expollicata* and *Tabanus bromius* especially attack camargue horses. Despite these studies, there is not enough information about host and feeding sites preferences of Tabanidae species.

Female horse flies suck blood from various parts of the host and can suck up to 0.2 $cm^3$ of blood at one feeding. The principle of the host finding mechanism includes vision and olfactory attraction ($CO_2$ and other other attractants) (Chvala *et al*., 1972). As reported in previous studies, tabanids are well known to cause disturbances in their hosts, as well as that they are vectors of different diseases (Olsufjev, 1977; Abu El-Hassan and Bardrawy, 2010; Krcmar, 2006; Gouteux and Noireu, 1986; Chvala *et al*.,1972). Infectious anemia, *Bacillus anthracis, Francisella tularensis* and *Thrypanosoma*

*theileri* are some of these diseases (Mohamed, 1989). Some tabanids (*Chrysops* spp.) are responsible for the spreading of *Loa loa* parasite to people (Mullens, 2009). Kettle (1984), detected that some Tabanidae species mechanically carry the parasite (*Trypanosoma evansi*) which causes sterility, diarrhea, and weight loss in camels.

Due to the disturbance and molestation of the host, horse flies cause decrease in fitness as well as affect milk and meat production (Chvala, 1972). In parallel with these reasons, it is very important to designate host and feeding sites preferences of horse flies.

The purpose of this study is to determine feeding sites of the horse flies on preferred hosts (horse, honkey, cow and human).

## MATERIALS AND METHODS

Female horse fly samples were collected in the Çatacık Forest which is situated at an altitude of 1050 meters above the sea level and at a 27 km distance from Eskişehir town (39° 58' 06" N, 31° 07' 53" E). The field work was carried out from 20 May to 20 June between 8.00-19.00 hours, when activities of adult females were extensive. Çatacık pine forests are dominated with a type of Oceanic climate with "damp" micro thermal (low temperature) climate and moderately deficient water conditions during summer season. These features constitute appropriate conditions for the activity of Tabanidae species.

The samples were collected by hand and nets from four different hosts (horse, cow, donkey and human). The horse, donkey, and cow hosts used in the study were solid brown colored with a small amount of white. For the human host, having them wear a grey cloth was preferred. The person chosen as a host was wearing grey clothes and their attraction was increased by exuded clothes when sampling was carried out. The hosts were fastened and immobilized on a plane area among pine and oak trees to which the lake passed close so that there were 50 m between each host. Five hosts from each host type were used same day in this study. Horseflies on the hosts were continually controlled and their position on the host recorded with Canon 60D F-2.8 professional camera. Feeding areas on the hosts were classified as follows: foot, neck-head, back and abdomen (Fig. 1-4). Individuals of feeding horse flies were detected, caught and taken to killing containers. The samples collected during fieldwork were preserved in 70% ethyl alcohol and determined to the species level in the laboratory.

Eight species (*T. bromius, T. miki, T. spodopterus, T. lunatus, T. regularis, T. bifarius, H. subcylindrica and S. alpinus*) constituted 92.13% of all collected samples and their data were used for further statistical analyses. Differences between host preferences of the species and differences between their preferences on feeding sites were evaluated by Kruskall-Wallis test.

## RESULTS

As a result of this study, a total of 2707 samples, including 7 genera and 14 species belonging to Chrysopsinae and Tabaninae subfamilies were collected; *Tabanus miki* Brauer 1880, *Tabanus bifarius* Loew 1858, *Tabanus spodopterus* Meigen 1820,

*Tabanus bromius* Linne 1758, *Tabanus regularis* Jaennicke 1866, *Tabanus lunatus* Fabricius 1794, *Tabanus unifasciatus* Loew 1858, *Tabanus leleani* Austen 1920, *Dasyramphis carbonarius* (Meigen 1820), *Philipomyia graeca* (Fabricus 1794), *Nemorius vitripennis* (Meigen 1820), *Silvius alpinus* (Scopoli 1763), *Haematopoda subcylindrica* Pandelle 1883 and *Chrysops caecutiens* (Linne 1758) (Table 1).

The most common species was *Tabanus lunatus* with a rate of 50.60%, followed with *T. regularis* 21.72%, *T. bromius* 5.57%, *H. subcylindrica* 3.47%, *T. miki* 3.07%, *T. spodopterus* 2.84%, *T. bifarius* 2.43% and *S. alpinus* 2.4%, respectively.

The donkey as a host constituted 44.07% of the collected samples, while 35.61% were from the cow host, 15.40% were from the horse host and only 4.91% was from the human host.

While the most preferred area of the hosts is the leg, with a rate of 66.93%, the least preferred area is the back with a rate of 4.69%. While 8.9% of the samples collected from the horse host were detected in the foot area, 1.10% were detected in the back area. While the most preferred area was the foot for the donkey host with a rate of 29.99%, the least preferred area was the back area with a rate of 1.92%. 24.67% of the samples collected from cow host were detected in the foot area, while 1.32% were detected in back area.

Table 1. List of species and the number of samples collected

| Species | Horse | Donkey | Human | Cow |
|---|---|---|---|---|
| *Tabanus miki* Brauer 1880 | 14 | 35 | 5 | 29 |
| *Tabanus lunatus* Fabricius 1794 | 116 | 659 | 67 | 528 |
| *Tabanus regularis* Fabricius 1794 | 135 | 238 | 24 | 191 |
| *Tabanus spodopterus* Meigen 1820 | 15 | 32 | 4 | 26 |
| *Tabanus bromius* Linne 1758 | 40 | 57 | 8 | 46 |
| *Tabanus unifasciatus* Loew 1858 | 9 | 23 | 3 | 20 |
| *Tabanus leleani* Austen 1920 | 3 | 5 | 1 | 4 |
| *Tabanus bifarius* Loew 1858 | 12 | 27 | 4 | 23 |
| *Silvius alpinus* (Scopoli 1763) | 15 | 26 | 6 | 19 |
| *Haematopota subcylindrica* Pandelle 1883 | 28 | 33 | 6 | 27 |
| *Nemorius vitripennis* (Meigen 1820) | 3 | 5 | 1 | 4 |
| *Chrysops caecutines* (Linnaeus 1758) | 8 | 13 | 1 | 12 |
| *Dasyrhamphis carbonarius* (Meigen 1820) | 7 | 9 | 0 | 9 |
| *Philipomyia graeca* (Fabricius 1794) | 12 | 31 | 3 | 26 |
| Total | 417 | 1193 | 133 | 964 |

## Selection of Host

### Horse

The 15.40% of the totally collected samples were comprised of samples coming from the horse host. *Tabanus regularis*, one of the samples from the horse host, was ranked first with a rate of 32.37%.

### Donkey

The samples coming from the donkey host included 44.07% of the horse flies being examined. *Tabanus lunatus*, one of the samples coming from donkey host, was ranked first with a rate of 56.07%.

### Cow

The 35.61% of the total sample was obtained from the cow host were comprised of the cow host. *Tabanus lunatus*, one of the samples from the cow, was ranked first with a rate of 54.77%.

### Human

The person chosen as a host wore grey clothes. The attraction of the person was increased by exuded clothes so sampling was carried out. As a result, 4.91% of the total sample was obtained from the human host. *Tabanus lunatus*, one of the samples from the human, was ranked first at a rate of 50.37%.

## Selection of Feeding Sites

### Horse

The body of the horse was split into 4 body parts (head-neck, abdomen, foot and back) (Fig. 1). Over half (57.79%) of the individuals caught on the horse were collected from the foot. On the other hand, 9.83% preferred the head-neck part of the host (Table 2).

### Donkey

The body of the donkey was split into 4 body parts (head-neck, abdomen, foot and back) (Fig. 2). The foot was the preffered body part of the donkey, where 68.06% of the horse flies were collected. On the other hand, 6.37% preferred the head-neck part of the host (Table 3).

### Cow

The body of the cow was split into 4 body parts (head-neck, abdomen, foot and back) (Fig. 3). While 69.29% of the horse flies coming to the host preferred the foot, 3.73% preferred the back (Table 4).

**Human**

The body of the human was split into 4 body parts (head-neck, abdomen, foot and back) (Fig. 4). 68.42% of the horse flies coming to the human host were collected from foot, while 6.76% of the samples preferred back part. (Table 5)

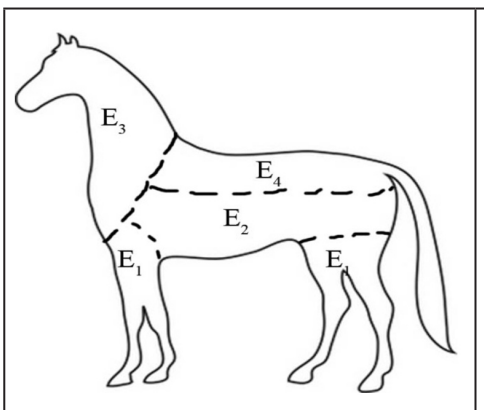


Fig. 1.

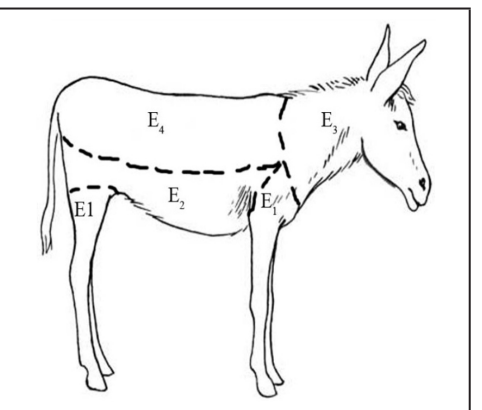


Fig. 2.

Figs. 1-2. Presentation of separated body parts ($E_1$. Foot, $E_2$. Abdomen, $E_3$. Head-neck, $E_4$. Back) 1. The horse host 2. The donkey host.

Table 2. Sample numbers of the majority of species on the horse host according to body parts ($T_1$.*Tabanus lunatus,* $T_2$. *Tabanus regularis*, $T_3$. *Tabanus bromius*, $T_4$. *H. subcylindrica,* $T_5$. *Tabanus miki,* $T_6$. *Tabanus spodopterus,* $T_7$. *Silvius alpinus,* $T_8$. *Tabanus bifarius*).

| Species | Head-Neck | Abdomen | Back | Foot |
|---|---|---|---|---|
| *Tabanus lunatus* Fabricius 1794 | 8 | 27 | 8 | 73 |
| *Tabanus regularis* Fabricius 1794 | 5 | 0 | 3 | 127 |
| *Tabanus bromius* Linne 1758 | 5 | 10 | 5 | 20 |
| *Haematopota subcylindrica* Pandelle 1883 | 15 | 3 | 10 | 0 |
| *Tabanus miki* Brauer 1880 | 1 | 0 | 3 | 10 |
| *Tabanus spodopterus* Meigen 1820 | 1 | 14 | 0 | 0 |
| *Silvius alpinus* (Scopoli 1763) | 6 | 9 | 0 | 0 |
| *Tabanus bifarius* Loew 1858 | 0 | 0 | 1 | 11 |
| Total | 41 | 63 | 30 | 241 |

When the host groups were evaluated in themselves, there was found statistical differences ($X^2$=541.916 P= 0.00 P<0.05). Considering that there is a difference between the hosts, also there was found statistical differences ($X^2$=1611.628 P=0.00 P< 0.05) and at the time differences between the species analyzed ($X^2$=1262.613 P= 0.00 P<0.05), statistically significant difference were found.

Table 3. Sample numbers of the majority of species from the donkey host according to body part ($T_1$. *Tabanus lunatus,* $T_2$. *Tabanus regularis*, $T_3$. *Tabanus bromius*, $T_4$. *H. subcylindrica,* $T_5$. *Tabanus miki,* $T_6$. *Tabanus spodopterus,* $T_7$. *Silvius alpinus,* $T_8$. *Tabanus bifarius*).

| Species | Head-Neck | Abdomen | Back | Foot |
|---|---|---|---|---|
| *Tabanus lunatus* Fabricius 1794 | 29 | 86 | 13 | 531 |
| *Tabanus regularis* Fabricius 1794 | 11 | 9 | 5 | 213 |
| *Tabanus bromius* Linne 1758 | 4 | 12 | 7 | 34 |
| *Haematopota subcylindrica* Pandelle 1883 | 20 | 2 | 11 | 0 |
| *Tabanus miki* Brauer 1880 | 2 | 12 | 5 | 16 |
| *Tabanus spodopterus* Meigen 1820 | 0 | 23 | 9 | 0 |
| *Silvius alpinus* (Scopoli 1763) | 10 | 16 | 0 | 0 |
| *Tabanus bifarius* Loew 1858 | 0 | 7 | 2 | 18 |
| Total | 76 | 365 | 52 | 812 |

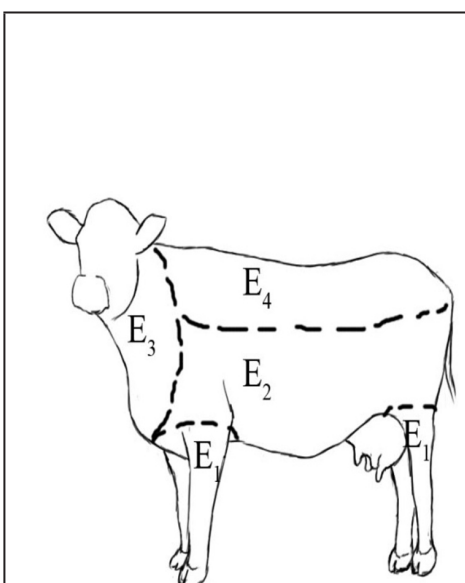


Fig. 3.

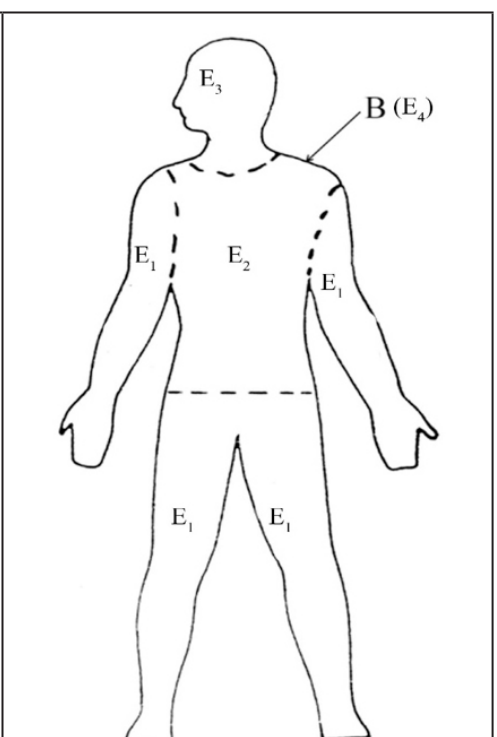


Fig. 4.

Figs. 3-4. Presentation of separated body parts ($E_1$. Foot, $E_2$,Abdomen, $E_3$. Head-neck, $E_4$. Back). 3. The cow host 4. The human host

Table 4. Sample numbers of the majority of species from the cow host according to body parts ($T_1$. *Tabanus lunatus,* $T_2$. *Tabanus regularis*, $T_3$. *Tabanus bromius*, $T_4$. *H. subcylindrica,* $T_5$. *Tabanus miki,* $T_6$. *Tabanus spodopterus,* $T_7$. *Silvius alpinus,* $T_8$. *Tabanus bifarius*).

| Species | Head-Neck | Abdomen | Back | Foot |
|---|---|---|---|---|
| *Tabanus lunatus* Fabricius 1794 | 23 | 69 | 11 | 425 |
| *Tabanus regularis* Fabricius 1794 | 9 | 8 | 4 | 170 |
| *Tabanus bromius* Linne 1758 | 3 | 10 | 6 | 27 |
| *Haematopota subcylindrica* Pandelle 1883 | 16 | 2 | 9 | 0 |
| *Tabanus miki* Brauer 1880 | 2 | 10 | 4 | 13 |
| *Tabanus spodopterus* Meigen 1820 | 2 | 6 | 0 | 18 |
| *Silvius alpinus* (Scopoli 1763) | 8 | 12 | 0 | 0 |
| *Tabanus bifarius* Loew 1858 | 0 | 6 | 2 | 15 |
| Total | 378 | 123 | 36 | 668 |

Table 5. Sample numbers of the majority of species from the human host according to body part ($T_1$. *Tabanus lunatus,* $T_2$. *Tabanus regularis*, $T_3$. *Tabanus bromius*, $T_4$. *H. subcylindrica,* $T_5$. *Tabanus miki,* $T_6$. *Tabanus spodopterus,* $T_7$. *Silvius alpinus,* $T_8$. *Tabanus bifarius*).

| Species | Head-Neck | Abdomen | Back | Foot |
|---|---|---|---|---|
| *Tabanus lunatus* Fabricius 1794 | 3 | 9 | 2 | 53 |
| *Tabanus regularis*Fabricius 1794 | 1 | 1 | 1 | 21 |
| *Tabanus bromius* Linne 1758 | 1 | 2 | 1 | 4 |
| *Haematopota subcylindrica* Pandelle 1883 | 2 | 0 | 2 | 2 |
| *Tabanus miki* Brauer 1880 | 0 | 2 | 1 | 2 |
| *Tabanus spodopterus*Meigen 1820 | 0 | 1 | 0 | 3 |
| *Silvius alpinus* (Scopoli 1763) | 1 | 0 | 2 | 3 |
| *Tabanus bifarius*Loew 1858 | 0 | 1 | 0 | 3 |
| Total | 8 | 16 | 9 | 91 |

## DISCUSSION

Detection of host preferences of horse flies is of capital importance in terms of prevention of diseases carried by vector organisms and for prevention of the economic loss they may cause (Chvala *et al*., 1972; Foil, 1989; Vazzeille-Falcoz *et al*., 1997; Thomson and Connor 2000; Barros, 2001; Barros *et al*., 2007). While *Tabanus sp.* rarely attack humans, it is known that *Haematopota sp.* and *Chrysops sp*. attack humans more frequently Likewise, it is known that some species are specific to other hosts. The fact that each species does not have the same disease factor has been reported in many articles and studies (Chvala *et al*., 1972; Kettle, 1984; Olsufjev, 1977; Gouteux and Noireu, 1986).

Based on the collected sample humans as horse fly host were least preferred in this study. *T. leleani, N. vitripennis, D. carbonarius* were not collected from human hosts. It is assumed that all species, except *T. lunatus* and *T. regularis,* are found on human host incidentally because the total number of each species does not exceed six individuals. A statistically important difference between host preferences of species was detected.

Donkeys and cows were more preferred hosts that horses and humans. It is thought that the reason the donkey host is preferred among these hosts is due to natural attractants that they release into nature . As reported by Krcmar (2006), it is known that $CO_2$ and urine of domestic animals are natural attractants for tabanidae members. It is also thought that these natural attractants are released in excess.

Although there were no major differences between hosts in terms of color and Fig., *T. lunatus* and *T. regularis* species were detected as the majority from the donkey host.

As a result of the comparison of feeding sites on hosts, a statistically important difference was seen.

While six horse fly species showed preference to leg/arm parts, some species showed preference for other parts of the body. For example, *H. subcylindrica* had preference for head/neck area, while *S. alpinus* and *T. spodopterus* showed clear preference for feeding on the animal's abdomen.

Similar results were obtained in studies carried out on feeding sites of tabanidaes in domestic animals and humans (Chavala *et al*., 1972, Krcmar, 2006; Müllen, 1979; Ferreira *et al*., 2002; Ferreira and Rafael, 2004, Gouteux and Noireu, 1986). All detected species were common in the area of the leg. In studies carried out by Hribar *et al*. (1992) and Perich *et al*. (1986), it was reported that tabanidae members especially chose legs. In his study Krcmar (2006) reported that all but one, out of 22 species, attacked the leg, arm and abdomen areas of the human body. Likewise, in this study it was determined that *T. lunatus* and *T. regularis* species commonly prefer the leg and arm area of the human body.

The results of the study show that tabanidae species have considerable host preferences. It is thought that host skin, pheromones, and chemicals released by the host and natural attractants play an important role (Phelps and Holloway 1992). On the other hand, as indicated in previous studies, tabanidae species are selective in terms of feeding sides on humans and domestic animals. Although horse flies should be considered vector organisms in order to prevent insect oriented diseases and economic loss caused by these species, there are few studies that have been carried out on host and feeding sides preferences of tabanidae species. In this study host preference and feeding sides of a total of 8 species on four hosts were evaluated. Even so, it is necessary to carry out similar studies on different hosts and different species.

## REFERENCES

Abu El-Hassan, G. M. M., Badrawy, H. B. M., Mohammad, S. K., Hassan, H. F., 2010, Cladistic analysis of Egyptian horse flies (Diptera: Tabanidae) based on morphological data. *Egyptian Academy and Journal of Biological Science*, 3: 51-62.

Barros, A. T. M., 2001, Seasonality and relative abundance of Tabanidae (Diptera) captured on horses in the Pantanal, Brazil. *Memórias do Instituto Oswaldo Cruz*, 96: 917-923.

Barros, A. T. M., Foil, L. D., 2007, The influence of distance on movement of tabanids (Diptera: Tabanidae) between horses. *Veterinary Parasitology,* 144: 380-384.

Chvala, M., Lyneborg, L. and Moucha, J., 1972, The Horse Flies of Europe (Diptera, Tabanidae), *Entomological Society of Copenhagen*, Copenhagen, 500 pp.

Ferreira, R. L. M., Henriques, A. L., Rafael, J. A., 2002, Activity of Tabanids (Insecta: Diptera: Tabanidae) Attacking the Reptiles *Caiman crocodilus* (Linn.) (Alligatoridae) and *Eunectes murinus* (Linn.) (Boidae), in Central Amazon, Brazil. *Memórias do Instituto Oswaldo Cruz,* 97(1): 133-136.

Ferreira, R. L. M., Rafael, J. A., 2004, Activity of tabanids (Diptera,Tabanidae) attacking a domestic duck - *Cairina moschata* Linnaeus (Aves, Anatidae), introduced in a forest area in the Central Amazon, Manaus, Brazil. *The Revista Brasileira de Entomologia,* 48:283-286.

Foil, L. D., 1989, Tabanids as Vectors of Disease Agents. *Parasitol Today,* 5(3): 88-96.

Gouteux, J. P., Noireu, F., 1989, The Host Preferences of *Chrysops silacea* and *C. Dimidiata* (Diptera: Tabanidae) in an Endemic area of *Loa Zoa* in the Congo. *Annals ofTropical Medicine and Parasitology*, 83(2): 167-172.

Hribar, L. J., Leprince, D. J., Foil, L. D., 1992, Ammonia as an Attractant for Adult Hybomitra lasiophthalma (Diptera:Tabanidae). *Journal of Medical Entomology,* 29: 346-348.

Jeffrey, K. W., Davies, C. R., 1986, Host Mediated competition in a bloodsucking insect community. *Journal of Animal Ecology*, 55:171-180.

Kettle, D. S., 1984, Insecticide resistance and cross-resistance in the house fly (Diptera: Muscidae). *Medical and Veterinary Entomology*, Croom Helin London, 229-231.

Krcmar, S., Hribar, L.J., Kopi, M., 2005, Response of Tabanidae (Diptera) to natural and synthetic olfactory attractants. *Journal of Vector Ecology*, 30: 133-136.

Krcmar, S., 2006, Analysis of the feeding sites for some horse flies (Diptera, Tabanidae) on a human in Croatia. *Collegium Antropologicum,* 30(4): 901-904.

Mohamed. F., Wallbanks, K.R., Aden Abdi, A., Bornstein, S., Ibrahim, M. D., 1989, Camel trypanosomiasis and its vectors in Somalia, *Veterinary Parasitology,* 32(4): 285-291.

Mullens, B. A., Gerhardt, R. R., 1979, Feeding behaviour of some Tennessee Tabanidae. *Environmental Entomology*, 8: 1047-1051.

Mullens, B. A., 2009, *Medical and Veterinary Entomology*, 2nd edition, Edit*.,* 254-265.

Olsufjev, N. G., 1977, Faune de 1'URSS *İnsectes* Dipteres, VII, 2: Tabanidae, *Russian Academy of Science and Travia Biology*, 113: 1-434.

Thomson, M. C., Connor, S. J., 2000, Environmental information systems for the control of arthropod vectors of disease. *Medical and Veterinary Entomology,* 3: 227-244.

Vazzeille-Falcoz, M. C., Helias, F., Goff, L., Rodhain, F., Chastel, C., 1997, Three spiroplasmas isolated from *Haematopota* sp. (Diptera: Tabanidae) in France. *Journal of Medical Entomology,* 34: 238-241.

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