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Seasonal Abundance of Horse Fly (Diptera: Tabanidae) in Western Anatolia

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ABSTRACT

Adult horse flies take blood meals from many mammals including human, so they have known as serious pests wherever they occur and also are known vectors of numerous disease agents. Seasonal abundance of Tabanidae species was monitored during from May to September of 2005, 2006 and 2007 years, in Western Anatolia, Turkey. Totally, 7293 specimens from 52 species belonging to nine genera were collected and identified. Seasonal activities of ten most abundant species, *Dasyrhamphis umbrinus*, *Haematopota subcylindrica, Philipomyia aprica, Tabanus bifarius, Tabanus bromius, Tabanus lunatus, Tabanus portschinskii, Tabanus quatuornotatus, Tabanus rupium* and *Tabanus unifasciatus* were analyzed. *D. umbrinus, T. bifarius, T. quatuornotatus, T. unifasciatus* reached their peak of abundance in June and others species reached their peak of abundance at July. The longest flight period from first week of May to mid-September was determined for the species *Haematopota subcylindrica* and *Tabanus bromius*. Moreover, *Haematopota subcylindrica* was the most abundant with 23.86% and followed by *Tabanus bromius* with 20.65%. The population peak of species, and also vector potential, for each year can be affected from climatic conditions. Nevertheless, results suggest that the time between from the mid-June to the third week of July can be considered as the potentially higher-risk period of mechanical transmission of pathogens by tabanids for the study area.

Key words: Tabanidae, Seasonality, Flight Period, Western Anatolia, Turkey.

INTRODUCTION

Tabanidae family has considerable significance in medical and veterinary entomology. Their importance is associated with both the transmission of diseases and the economic significance of stress resulting directly from bites, or indirect secondary infections such as anemia through blood loss, allergic responses, etc. (Chvala *et al*., 1972; Olsufjev 1977). Worldwide studies are subjected to this family due to the feeding behaviour of female tabanids (Cameron 1926; Mac Creary 1940; Blickle 1955; Bosler *et al*., 1974; Kniepert 1980; Andreeva 1989; Krcmar *et al*., 2005; Krcmar 2006; Andreeva *et al*. 2009; Altunsoy and Kılıç 2010). Numerous studies have investigated the seasonality of Tabanidae species in different regions of the world (Miller 1951; Strickman *et al.,* 1986; Strickler *et al*., 1993; Mc Elligot and Lewis 1998; Krcmar 1999, 2005). Although the animal husbandry is so common in Turkey, the number of studies about distribution and seasonal activity of horse fly species are inadequate.

Seasonal activity patterns of haematophagous insects could help to prevent disease transmission during population peaks of vector species, through proper control strategies. Therefore, improvement the knowledge on the field of seasonality and population dynamics of blood-sucking Tabanidae species will be resulted in the reduction of economic losses in meat and milk industry and quantify the risk of transmission of pathogens by these vectors (Krcmar 1999; 2005).

Chvala *et al*., (1972) indicates that seasonal activity patterns of horse fly species depend on the geographical altitudes and seasonal conditions. Previous studies about seasonal abundance patterns in Europe specify that the first species emerge in the second half of May and last in the middle of September (Chvala *et al*., 1972; Krcmar 1999, 2005). Furthermore, Krcmar (2005, 2006) was reported that populations of the economically important and human-attacking species reach their peak on the July and August. When all these data are evaluated, this study conducted in Turkey for the first time in the beginning of May and continued until the end of September, was repeated for a period of three years.

The primary aim of the study was to monitor the seasonal activity of the horse fly species in the study area, and the secondary objective is the evaluation process of abiotic factors that affect seasonal activity on commonly observed species of Tabanidae family.

MATERIAL AND METHODS

The study was performed in a swampy place, where is the centre of *Quercus* and *Pinus* forest, on the Yarımca Village that is 20 km away from the city centre of Eskişehir (39º 53' 936" K, 30º 37' 747" D). The field of study is chosen on the transition zone between two different climatic conditions; Mediterranean and terrestrial micro-climates. The study was started at the beginning of May and continued until the end of September, when the horse fly species were active, in years 2005, 2006 and 2007.

Temperature values in study area ranged from -18ºC in the winter to 35 ºC in the summer, with a mean annual temperature of 7ºC.

Monthly climate data, including minimum, maximum and mean temperatures and relative humidity (RH) were also obtained for the whole study period from a hygrothermographs (Oregon Scientific OR-BAR208HGA) located on the Malaise traps regularly.

Adult horse flies were collected with Malaise trap and water traps, on four days of each week (May to October of 2005, 2006-2007 years).

Collections of adult samples were practiced at every 20 minutes through 08:00 to 19:00. The collected samples were killed in ethyl acetate-containing jars and transferred to the laboratory. Species identification was made based on the literature (Chvala *et al*., 1972; Olsufjev 1977; Yücel 1987; Schacht 1987; Leclercq 1966a, 1966b, 1967a, 1967b).

Seasonal activities were analysed for the species represented by more than 1% of total collected specimens, which are *Dasyrhamphis umbrinus*, *Haematopota*

subcylindrica, *Philipomyia aprica*, *Tabanus bifarius*, *Tabanus bromius*, *Tabanus lunatus*, *Tabanus portschinskii*, *Tabanus quatuornotatus*, *Tabanus rupium* and *Tabanus unifasciatus* (Table 1).

A nonparametric Kendall's correlation coefficient test (SPSS 10.0 for Windows XP) was done to analyse the correlation between the seasonality of horse fly species and the corresponding abiotic factors (mean temperature and relative humidity).

RESULTS

Totally, 7293 samples of 52 Tabanidae species belonging to nine genera were collected and identified over the 3 years study period. The statistical analyses showed that the relative humidity has negative significant effect ($\tau = -0.414$ at $p = 0.0008$) while mean temperature have positive significant effect on the seasonal activity of horse fly species ($\tau = 0.33$ at $p = 0.008$) (Figs. 1-15). Results of three-year study indicate that the *Tabanus* as the most abundant genus with 30 species. *Haematopota* genus with 8 species, *Hybomitra*, 4; *Philipomyia*, *Dasyramphis* and *Chrysops* 2 species for each; *Atylotus, Silvius* and *Therioplectes* genus represented with 1 species, respectively (Table 1). *Haematopota subcylindrica* was the most abundant with 23.86 % followed by *Tabanus bromius* (20.65 %), *Philipomyia aprica* (14.57 %), *Tabanus quatuornotatus* (8.25 %), *Tabanus bifarius* (5.57 %), *Dasyrhamphis umbrinus* (4.80 %), *Tabanus unifasciatus* (4.75 %) *Tabanus lunatus* (3.65 %), *Tabanus portschinskii* (1.65 %) and *Tabanus rupium* (1.52 %). These ten species made up 89.27 % of the horse fly fauna on the study area.

The flight activity occurrence of the most abundant two species *T. bromius* and *H. subcylindrica* were determined as non-corrupted for 3 years long, continuously. *H. subcylindrica* flight activity began in the first week of May and peaked on July in 2005 and 2007; but in 2006, the most intense flight activity observed on June. *T. bromius* also continued the flight activity from first week of May to last week of September during three years. However, population of this species peaked in July for each year (Table 1). On the other hand, activities of these species were not end at slowly raining days, which observed low-temperature and high-relative humidity.

The Research Results are Evaluated by Months

1. Species the most abundant on May are; *D. umbrinus, H. subcylindrica, H. caucasi, H. caucasica, H. pilosa, P. aprica T. bromius, T. quatuornotatus* and *T. unifasciatus*. The analyzes of 3 years study results make it clear that *H.subcylindrica* and *T. quatuornotatus* species are the most active horse fly species for May.

2. Species the most abundant on June are *D. umbrinus, H. subcylindrica, P. aprica, T. bifarius, T. bromius, T. lunatus, T. quatuornotatus, T. rupium* and *T. unifasciatus*. The species *D. umbrinus T. bifarius T. quatuornotatus T. rupium* and *T. unifasciatus* are determined as they peaked on June. Furthermore, *T. rupium* and *T. unifasciatus* have a peak in 2005 on July; *P. aprica* is the only one that has a peak in June 2007.

Table 1. Number of collected horse fly species.

Species	2005					2006					2007				
	May	June	July	August	Sept.	May	June	July	August	Sept.	May	June	July	August	Sept.
Atylotus fulvus Meigen	0	0	25	8	0	0	0	2	0	0	0	11	8	0	0
Chrysops caecutiens L.	0	3	8	1	0	0	0	5	2	0	0	15	16	2	0
Chrysops viduatus F.	0	1	2	1	0	0	0	2	0	0	0	3	5	1	0
Silvius alpinus Scopoli	0	0	6	0	0	0	0	5	0	0	0	0	4	0	0
Dasyrhamphis carbonarius Meigen	0	1	0	0	0	0	2	0	0	0	0	2	0	0	0
Dasyrhamphis umbrinus Meigen	10	157	22	0	0	7	26	0	0	0	9	116	0	0	0
Haematopota bigoti Gobert	0	2	1	0	0	0	0	0	0	0	0	0	1	0	0
Haematopota crassicornis Wahlberg	0	1	4	0	0	0	0	0	0	0	0	0	1	0	0
Haematopota grandis Meigen	0	0	2	0	0	0	0	1	0	0	0	0	1	0	0
Haematopota longantennata Olsufjev	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0
Haematopota ocelligera Kröber	0	7	0	0	0	0	4	0	0	0	0	0	0	0	0
Haematopota pluvialis L.	0	18	13	0	0	0	16	8	0	0	0	2	0	0	0
Haematopota scutellata Olsufjev, Moucha & Chvala	0	6	0	0	0	0	6	0	0	0	0	3	0	0	0
Haematopota subcylindrica Pandelle	12	434	686	68	10	7	76	61	30	10	15	117	204	8	0
Hybomitra caucasi Szilady	3	0	0	0	0	1	3	0	0	0	0	5	0	0	0
Hybomitra caucasica Enderlein	7	3	0	0	0	5	4	0	0	0	6	4	0	0	0
Hybomitra ciureai Seguy	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0
Hybomitra pilosa Loew	0	3	0	0	0	1	0	0	0	0	0	2	0	0	0
Philipomyia aprica Meigen	0	15	204	22	5	0	15	34	12	3	3	257	484	7	0
Philipomyia zizaniae Leclercq	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0
Tabanus armeniacus Kröber	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0
Tabanus autumnalis L.	0	32	12	0	0	0	0	4	0	0	0	7	3	0	0
Tabanus bifarius Loew	0	44	29	8	0	0	8	6	2	0	0	277	29	3	0
Tabanus briani Leclercq	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0
Tabanus bromius L.	1	138	513	85	12	3	35	76	53	15	2	143	376	52	10
Tabanus cordiger Meigen	0	13	0	0	0	0	6	6	0	0	0	4	5	0	0
Tabanus cuculus Szilady	0	0	1	0	0	0	0	0	1	0	0	0	2	0	0
Tabanus eggeri Schiner	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0
Tabanus exclusus Pandelle	0	5	30	8	0	0	0	5	6	0	0	8	6	0	0

Table 1. (Contunied)

Species	2005					2006					2007				
	May	June	July	August	Sept.	May	June	July	August	Sept.	May	June	July	August	Sept.
Tabanus glaucopis Meigen	0	0	11	14	2	0	0	2	8	2	0	0	10	15	3
Tabanus golovi Olsufjev	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Tabanus indrae Hausser	0	0	0	0	0	0	0	3	3	0	0	0	2	0	0
Tabanus laetetinctus Becker	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0
Tabanus leleani Austen	0	2	0	0	0	0	0	8	0	0	0	5	0	0	0
Tabanus lunatus F.	0	3	35	3	0	0	0	25	10	2	0	11	162	13	2
Tabanus maculicornis Zetterstedt	0	4	1	0	0	0	0	0	0	0	0	0	1	0	0
Tabanus martini Kröber	0	0	0	7	1	0	0	0	0	2	0	0	0	5	2
Tabanus miki Brauer	0	0	20	3	0	0	0	6	4	0	0	6	10	7	0
Tabanus portschinskii Olsufjev	0	0	32	10	0	0	0	11	12	0	0	0	42	8	0
Tabanus prometheus Szilady	0	0	9	0	0	0	0	2	0	0	0	0	14	0	0
Tabanus quatuornotatus Meigen	8	385	8	0	0	8	96	0	0	0	6	87	3	0	0
Tabanus regularis Jaennicke	0	8	0	0	0	0	3	0	0	0	0	2	0	0	0
Tabanus rupium Brauer	0	46	2	0	0	0	16	18	0	0	0	25	3	0	0
Tabanus spodopteroides Olsufjev, Moucha & Chvala	0	0	2	0	0	0	0	2	0	0	0	0	1	0	0
Tabanus spodopterus Meigen	0	0	25	1	0	0	0	6	4	0	0	0	8	3	0
Tabanus sudeticus Zeller	0	2	2	3	0	0	0	0	0	0	0	0	0	1	0
Tabanus spectabilis Loew	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Tabanus tergestinus Egger	0	0	6	0	0	0	0	1	0	0	0	0	5	0	0
Tabanus terterjani Dolin & Andreeva	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Tabanus tinctus Walker	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0
Tabanus unifasciatus Loew	3	145	35	8	3	3	18	27	15	3	4	68	0	5	10
Therioplectes tricolor Zeller	0	12	0	0	0	0	0	8	0	0	0	6	0	0	0
Total	44	1490	1759	250	33	35	334	335	164	37	45	1187	1421	132	27

3. Species the most abundant on July are *H. subcylindrica, P.aprica, T. bromius, T. lunatus* and *T. portschinskii.* For each year, given species have a peak of population on July. However rare species; *T. prometheus, T. spodopteroides* and *T. spectabilis* are determined as they have a peak on July.

4. Species the most abundant on August are *H. subcylindrica, P.aprica* ve *T. bromius*. Furthermore, species those have a late activity behaviour *T. glaucopis, T. terterjani* and *T. martini* peaked on August.

5. Species the most abundant on September are *H. subcylindrica, P.aprica, T. bromius* and *T. unifasciatus.* Although the activity end is determined for *H. subcylindrica* and *P. aprica* on September 2007, *T. lunatus* is determined as active on September 2006.

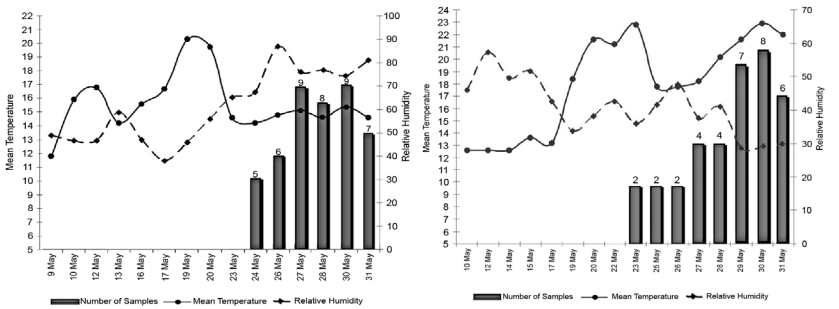
DISCUSSION

There is no effective method for control of horse fly species and prevent the economic losses in cattle caused by tabanids. In some regions, attractant traps using for tried to reducing attacks of tabanids to the livestock and human (Lehane, 2005). However, the only effective method is to stay away from regions where the intense activity of horse fly species shows in. The identification of horse fly activity peaks is fundamentally important information required to develop control strategies and the pathogens it vectors.

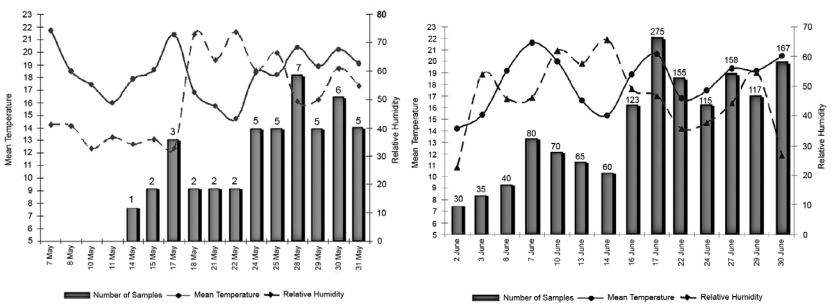
Different studies in the literature were conducted all over the world about seasonality of horsefly species, gonotrophic cycle and changes of flight activity of Tabanidae species by climatic factors (Roberts 1971; Barros 2001; Hribar *et al*., 2003; Krćmar 1999, 2005; Krćmar *et al*., 2002; Al-Talafha 2005). The studies of the seasonal abundance of horse fly are very important for the standpoint of medical and veterinary parasitology, because some species of tabanids participate in the transmission of agents of various diseases and cause economic losses in meat and milk industry (Chvala *et al*., 1972; Foil 1989; Vazzeille-Falcoz *et al*., 1997; Thomson and Connor, 2000).

Generally animals are being attacked by tabanids during 4-5 month among a year. Adult female tabanids are obligated blood-suckers and in a need of blood-feeding before every hatching period (Auroi 1982; Krcmar *et al*., 2002). Perich *et al*., (1986) were reported that an average of 0.1 kg daily loss on bovine animal products, which was attacked by mean of 66 tabanids daily. A study on 500 cattle that are in use for animal husbandry at Lousiana clearly reports the daily yield loss of %1-2 percentage because the tabanid attacks (Foil *et al*., 1991; Leprince *et al*., 1992).

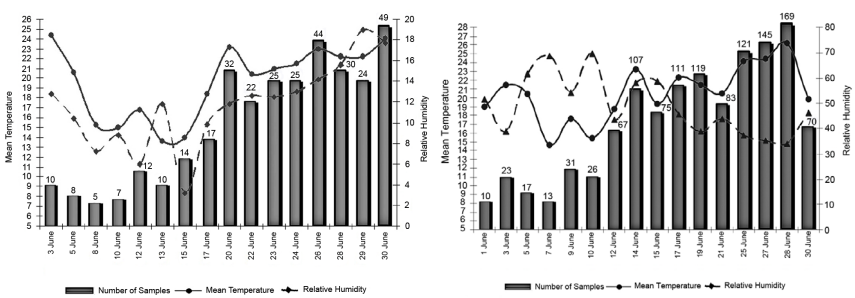
This study presents the first featured report about seasonal activities of Tabanidae species for Turkey, which provides a large part of economic income from livestock sources. After a period of three years of study, seasonality of Tabanidae species spreading in the city of Eskişehir were observed and evaluated (Table 1). The similar results with previously studies, about seasonal abundance of horse fly species, were obtained in this study (Hribar *et al*., 2003; Krcmar 1999, 2005; Al-Talafha 2005).



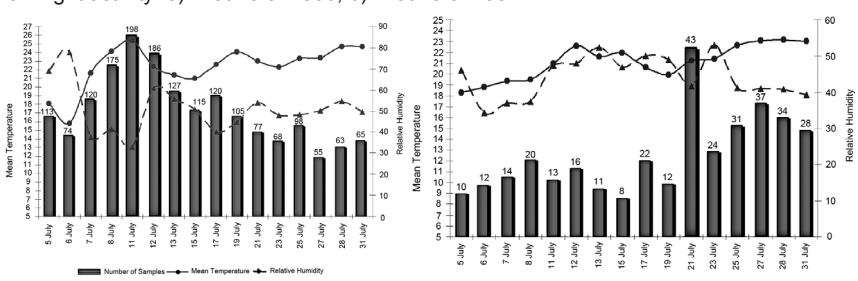
Figs. 1-2. Flight activity; 1) in May of 2005, 2) in May of 2006.



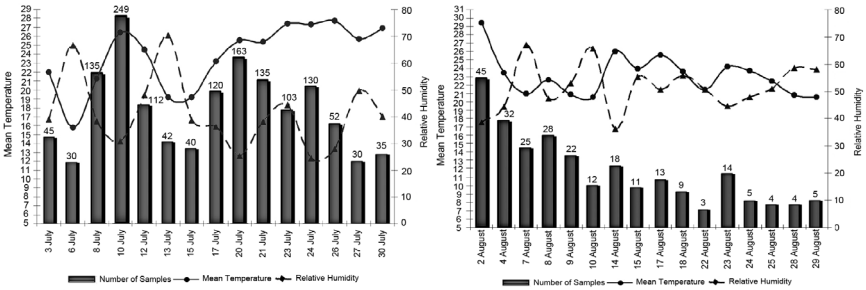
Figs. 3-4. Flight activity; 3) in May of 2007, 4) in June of 2005.



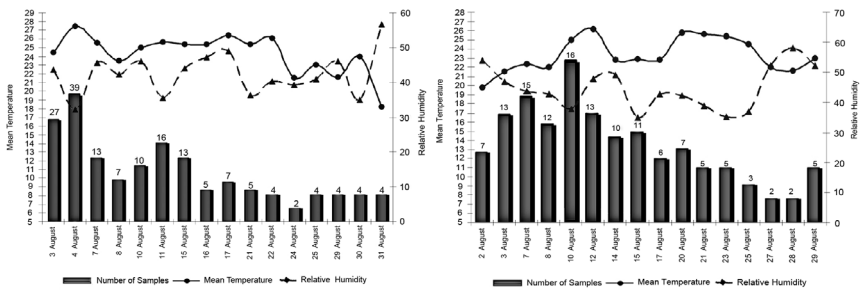
Figs. 5-6. Flight activity: 5) in June of 2006, 6) in June of 2007.



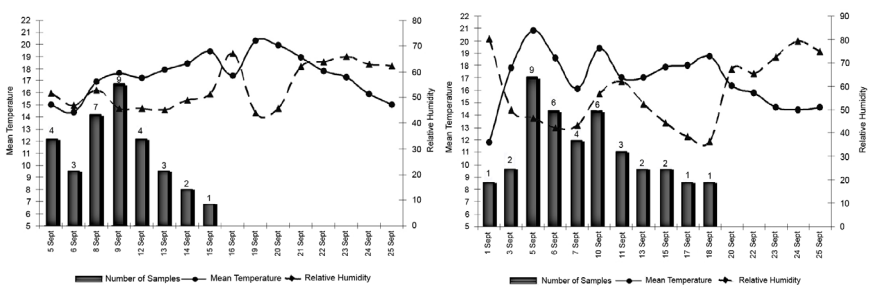
Figs. 7-8. Flight activity; 7) in July of 2005, 8) in July of 2006.



Figs. 9-10. Flight activity; 9) in July of 2007, 10) in August of 2005.



Figs. 11-12. Flight activity; 11) in August of 2006, 12) in August of 2007.



Figs. 13-14. Flight activity; 13) in September of 2005, 14) in September of 2006.

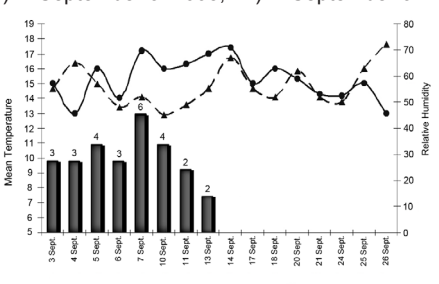


Fig. 15. Flight activity in September of 2007.

In the study area, tabanids were the most abundant during the summer season from the second half of May through the third week of September (Figs. 1-15). First emerged species were belonging to *Hybomitra* genus, which are *H. caucasi* and *H. caucasica* and later *H. subcylindrica*, *T. unifasciatus* and *T. bromius* and also last emerged species were *T. sudeticus* and *T. martini*. On the other hand, as previous studies have reported, it has been identified that the most intense activity and the maximum diversity of species occurs in July. The lowest activity and species diversity encountered in September. Populations of species *H. subcylindrica, T. bromius* and *P. aprica*, which are known as human attacking species, were peaked on July (Chvala *et al*., 1972; Krcmar, 2006). The results of this study have provided important information that can be used to develop more effective control strategies for horse flies not only in Turkey, but also neighbour countries. For example, the seasonal activity data from this study when linked livestock activities will help determine the most appropriate times for using control strategies for these important vectors.

Seasonal abundance and activity vary depending on the diet and habitat preferences of species, and these variances affected by biotic and physical factors. However, evaluation of submitted results of this study and previous studies, significant difference in activity under different ecological conditions is observed for some species (Krcmar 1999, 2005). Especially, the wide spreading and the most intense two species in Europe; *T. bromius* and *H. subcylindrica* are reported as they show similar seasonal activity even under different ecological conditions In addition, these two species were collected even in rainy and low-temperature observed days.

Based on the results of study, it can be clearly seen that some species are only active for certain months. The results indicate that *Therioplectes tricolor*, *D. carbonarius, Haematopota ocelligera, Hybomitra pilosa, T. cordiger*, *T. leleani T. regularis* are active on June, *Haematopota crassicornis, H. longantennata, Hybomitra ciureai, T. cuculus, T. eggeri, T. laetetictus, T. prometheus, T. spodopteroides* on July and *T. terterjani* on August only. Previous studies also reported the limited flight periods of these species (Chvala *et al.,* 1972; Olsufjev 1977; Krcmar, 1999, 2005).

Seasonal variation of average temperature and relative humidity vary from year to year. By implication of seasonal variance of abiotic factors, peak periods of populations and seasonal activity of Tabanidae species vary each year. As it can be seen in results, high values of rainfall and humidity, also low average temperature among the session in 2006 affected the collected individual numbers. It is reported by the comparison results that the degradation of collected samples in 2006, %74.7 according to 2005 year and %68.1 according to 2007 year (Table 1). We suggest that, seasonal activities of horse fly species also can be vary in different altitude or different places in Turkey. Consequently, we suggest that further studies should be conducted about geographic spreads and seasonal activities of species in different parts of Turkey.

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