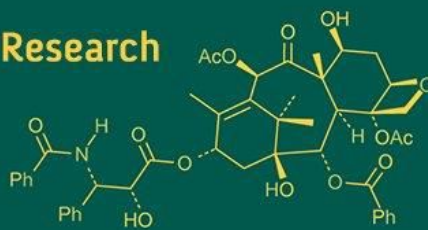
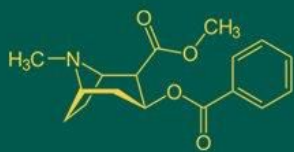


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Dr. S Ramesh Bhumaiyya
Ph.D., Scholar Presently,
Assistant Professor, VPA, CVSc.,
Korutla, PVNRTVU,
Hyderabad, Telangana, India

Dr. H Dhanalakshami
Associate Professor and Vety.
Parasitology Veterinary College
Hebbal, Bangalore, Karnataka,
India

Dr. Murthy GSS
Professor and University Head,
Department of Vety. Paras,
CVSc, R'nagar, Hyderabad,
PVNRTVU, Hyderabad,
Telangana, India

Dr. Atanu Naskar
Senior Scientist, Incharge
Dipteran Section, Zoological
Survey of India, (ZSI), Kolkata,
West Bengal, India

Dr. R Gracy Gandhi
Senior Scientist, ICAR-NBAIR,
Hebbal, Bangalore, Karnataka,
India

Dr. Manjunath Reddy GB
Senior Scientist, ICAR-NIVEDI,
Yelhanka, Bengaluru,
Karnataka, India

Dr. Rathnamma D
Director, IAH & VB, Hebbal
Bangalore, Karnataka, India

Dr. Krishnamurthy CM
Associate Professor and Head,
Department of Paras, Veterinary
College Hassan, Karnataka,
India

Dr. Ananda KJ
Head, Department of Vety.
Parasitology Veterinary College
Hebbal, Bangalore, KVAFSU,
Bidar, Karnataka, India

Corresponding Author:
Dr. S Ramesh Bhumaiyya
Ph.D., Scholar presently Assistant
Professor, VPA, CVSc., Korutla,
PVNRTVU, Hyderabad,
Telangana, India

Species composition, Agro-climatic and geographical features of horsefly (Diptera: Tabanidae) in Warangal district of central Telangana zone

S Ramesh Bhumaiyya, H Dhanalakshami, Murthy GSS, Atanu Naskar, R Gracy Gandhi, Manjunath Reddy GB, Rathnamma D, Krishnamurthy CM and Ananda KJ

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Abstract

Telangana State is known for its rich heritage in biological diversity distributed in 9 agro climatic regions. Present study is based on seasonal diversity, species composition, zoogeographical aspects of horse flies fauna flies in Warangal district, Tabanids are true flies causing serious nuisance to livestock, and mechanically transmit several significant animal pathogens. A study was carried out From June 2023 to August 2025; a total number of 5626 flies were collected from five mandals of 16 villages of Warangal district in Telangana state, by using Nzi traps with bait of cow urine. More tabanids flies were captured during the wet 63.27% (3560/5626) compared to the dry season 36.72% (2066/5626). From each site at weekly intervals time period these *Tabanids* were collected with the help Nzi traps method and Seeping net and these flies were identified by a binocular stereomicroscope by using morphological identification keys. The results of this study stated that, the major *Tabanids* were found in marsh areas, ponds and forest area. Climatic interference and urbanization of city are also affecting the diversity and *tabanids* species. This study indicates the abundance of *tabanid* fauna in the Warangal district of Central Telangana zone and clearly establishes that diversity of these flies and regional climatic interferences.

Keywords: Telangana, Warangal, tabanids species, regional climatic interferences

Introduction

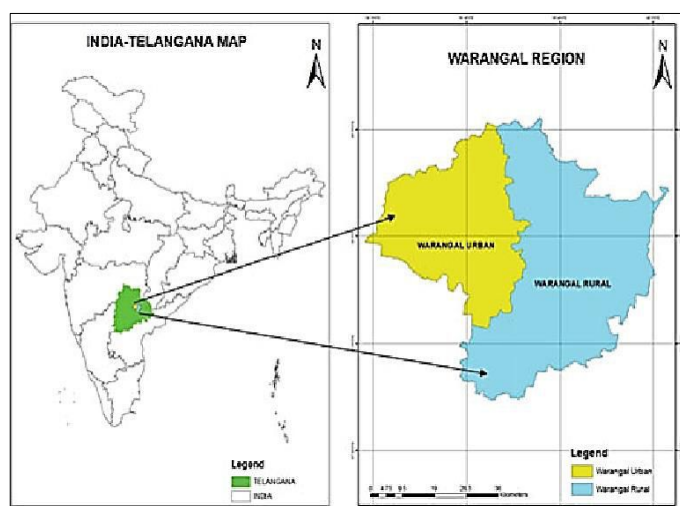
The family Tabanidae belongs to the suborder Brachycera and infraorder Tabanomorpha. Members of this family are commonly known as horse flies (*Tabanus*), deer flies (*Chrysops*), and clegs (Haematopota). Adult Tabanid flies are large with broad bodies and bulging eyes. Sexes are easily differentiated on the basis of eyes; they are contiguous in males and widely separated in females. The antennae are porrect and horn-like. Wings are transparent or clouded, banded or striped or with mottled infuscations. The thorax and abdomen are usually striped or banded with various colors. Veer (2004) [60] reviewed studies carried out on the family Tabanidae from the Indian Sub region with a few additions to Indian fauna by Mitra, *et al.* (2007), bringing the number of known species /subspecies from India to 244 species /subspecies under 15 genera.

Tabanid flies attack on domestic animals has caused a loss of 40 million dollars to the livestock industry USA in 1965 (Steelman, 1976) [51]. However, there is no such estimate from this region but it is certainly quite higher. The abundance of tabanids is usually found higher during monsoon, especially in sunlight after rain (Datta, 1998) [17]. Occurrence of trypanosomosis high during monsoon, the higher load of flies causes severe mortality in animals. Among the carnivores, tigers are more susceptible to surra disease (Acharjyo, 2000) [1]. In India first case report of trypanosomosis in a human was reported in a farmer from Nagpur, Maharashtra (Joshi *et al.*, 2005) [26].

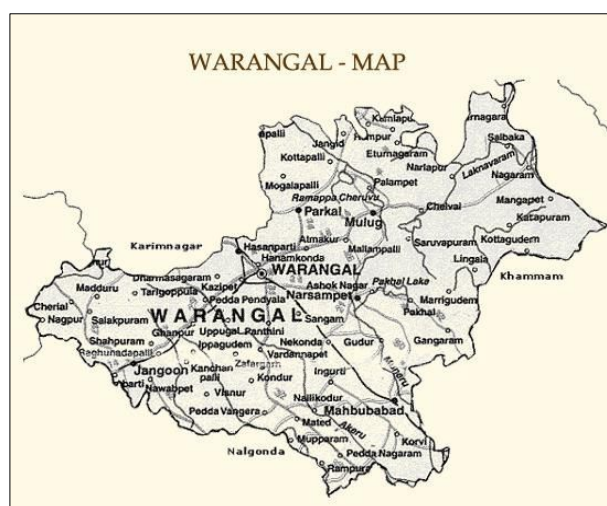
In the temperate zone, horseflies are active only on warm, sunny days, generally during the summer (Chvala and Jezek 1997) [14]. Climatic conditions, such as temperature, humidity, atmospheric pressure, wind speed, and cloud coverage of the sky, strongly influence the daily activity of adult horseflies (Baldacchino *et al.*, 2014b) [3]. Higher air temperature generally accelerates flight activity, while higher wind speed reduces (Baldacchino *et al.*, 2013) [4].

Furthermore, low ($< 18^{\circ}\text{C}$) temperature may be a limiting factor for tabanid flight (Amano 1985) [2]. The present work reports about the zoogeographical and seasonal diversity,

meteorological parameters influencing tabanid catches in Warangal district of Central Telangana Zone.



Adapted from google source



Adapted from google source

Central Telangana Zone and Metrological aspects of Warangal district

This zone comprises the 187 mandals distributed in 11 districts viz., Sangareddy, Medak, Siddipet, Jangaon, Warangal Urban, Warangal Rural, Mahabubabad, Jayashankar Bhupalpally, Mulugu, Bhadrachari Kothagudem and Khammam. The total geographical area of the zone is 38746.57 sq. km with an annual average rainfall of 978 mm. Rainfall range from 779 mm to 1213 mm and major contribution is from southwest monsoon season with 758 mm (77%). Remaining rainfall receives from North East season 121 mm (13%) winter season 24mm (2%) and summer season 75 mm (8%). The annual mean maximum temperature of the zone ranges from 32.80°C to 33.70°C , minimum temperature ranges from 20.40°C to 22.40°C and mean temperature ranges from 26.80°C to 27.90°C . The mean

minimum temperature during the winter season ranges from 16.60°C to 18.70°C and the mean maximum temperature during the summer season ranges from 37.20°C to 38.90°C . The dependable rainfall i.e., rainfall at 75% probability from June to October is ranged between 250mm and 766 mm. Warangal district lies between 17° to 19° & 18° to 36° N latitude and 78° to 49° & 80° to 43° E longitude and the topography of the district consists of isolated hills, rainfed tanks, lakes and shrubby forests. The geological formation of the district mainly developed from the granite and genesis of arachean period and dharwars of Precambrian period. Prevailing climatic condition of Warangal district was very hot in Summers even mercury sometimes touching 50°C and in winter's temperature, it dips to 13°C in during the months of December and January. This district receives annual rainfall of 994 mm.



Adapted from SKLTHU website



Nzi traps for collection of Tabanid flies



Collection of flies in box

Materials and Methods

The study area included the study area included Deccan platu comprises of with semi erid and red soil as mentioned Table 1. Monthly collections were made during three different seasons, viz., summer season (March, April and May) rainy season (south-west monsoon: June, July, August and September: north-west monsoon: October, November and December) and winter season (January, February) during 2023 to 2025 from different locations viz., five Mandals (Govindraopet, Dharmasagar, Narsampet, Khilla Warangal, Hanamkonda) and Fifteen villages (Laknavaram, Chalcwai, Hasanparthi, Geeskonda, Laknepalle, Govindraopet, Narsampet, Kazipet, Dharmasagar, Panthini, Singaram, Mamnoor, Bollikunta, Chintagattu,, Mupparam, Pedapendyala of erstwhile district of Warangal, Hanamkonda and Mulugu area and Flies were collected by handpicking while feeding on domestic cattle, buffalos. During peak season, Flies were also collected during dusk while moving using sweep net.

Collected flies were placed in killing jar containing cotton soaked in ether as a narcotizing agent. Flies were pinned using entomological pin and kept in the collection box and preserved for further identification. All specimens were labelled with the location of the sampling along with date and time of collection. The label having the details of the date of collection, season, species and region of collection and collector's name. Pinned specimens were preserved carefully by keeping them in a wooden box with 1, 4-Dichlorobenzene or D-L camphor and cotton at hollow spaces inside and the cotton ball dipped in carbolic acid at bottom of the box. Then pinned specimens were identified following taxonomic keys of Kapoor *et al.*, 1990^[27]; Veer, 2004^[60]; Burton, 1978^[11]; Stone and Philip, 1974^[52]; Burger and Chainey, 2000^[10].

Results and Discussion

Species composition

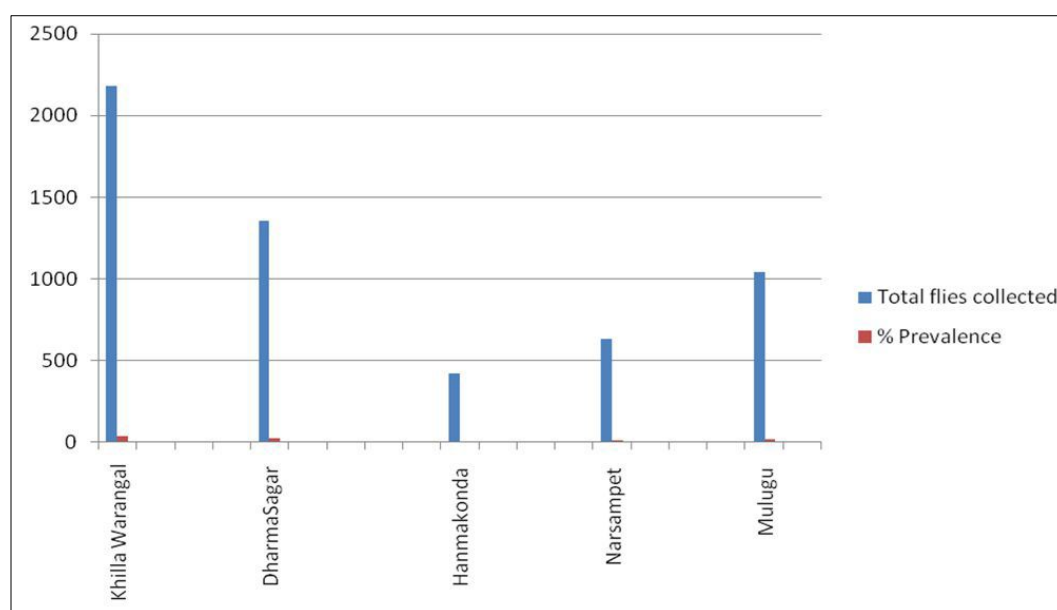
Five different species were identified morphologically using the standard taxonomic keys: namely *Tabanus dorsiger*, *Tabanus rubudus*, *Tabanus indianus*, *Tabanus brunnipenis*, *Tabanus occidentalis*. The highest number of flies were collected from, Khilla Warangal, 38.71% (2178/5626) and 24.03% (1353/5626) from Dharmasagar mandal followed by 7.4% (419/5626) from Hanamkonda, 11.2% (632/5626) from Narsampet and 18.55% (1044/5626) from Govindraopet (Mulugu). The mandals were covered by habitats including moist deciduous, evergreen forests, with habitats including plains, dry and moist deciduous forests, agricultural flatland and least number of flies were collected from Hanamkonda with their habitat including urbanization. *Tabanus* was the most dominant genus recorded in all this mandals. The highest number of flies was collected from Khilla Warangal. The highest number of species was recorded from Dharmasagar Mandal.

A total of 5626 flies were collected from 16 villages under 5 Mandals. During present study it was observed that the flies were easily caught by hand picking method from the animal body, only female flies were collected, because they require blood meal for egg laying. The sweep net was not convenient to collect flies from grazing animals, but it was useful for collection of flies which were resting on grass blades, tree trunks and on vegetation.

The flies collected during the study included 05 species of tabanids. Composition of mandal wise a table no. The highest number (3 species out of 05 species) were recorded from Mamnoor, Singaram Panthini, Mupparam, Dharmasagar Pedapendyala, villages which was Chalcwai, Laknavaram, Govindraopet, Laknepalle, Geeskonda, Narsampet with 2 species each followed by other villages in decreasing order, Bollikunta, Chintagattu, Hasanparthi and Kazipet with 1 species each,

Table 1: Showing Mandal and Village level wise number of flies collected, prevalence Agro-climatic data and species composition From June 2023 to August 2025 Warangal district of Telangana

Sr. No.	Mandals (Villages)	Season	Collection of flies Season wise	Total flies collected	% Prevalence	Agro climatic condition	Species composition
1	Khilla Warangal (Bollikunta, Singaram Panthani Mamnoor)	Hot Summer (March-June)	328	2178	38.71	Tropical, mostly hot and dry, semi-arid red soils (shallow gravelly and clayey) and black soils	<i>Tabanus dorsiger</i> , <i>Tabanus rubudus</i> , <i>Tabanus brunnipenis</i>
		Rainy Monsoon (July-Sept.)	1125				
		Winter (Oct-Feb.)	725				
2	DharmaSagar (Mupparam, Dharماسagar Pedapendyala)	Hot Summer (March-June)	130	1353	24.03	Semi-arid red soils (shallow gravelly and clayey) and black soils	<i>Tabanus dorsiger</i> , <i>Tabanus rubudus</i> , <i>Tabanus occidentalis</i> <i>Tabanus brunnipenis</i>
		Rainy Monsoon (July-Sept)	764				
		Winter (Oct-Feb.)	459				
3	Hanmakonda (Kazipet Hasanparthy Chintagattu)	Hot Summer (March-June)	68	419	7.4	Dry soils (shallow gravelly and clayey) and black cotton soils and some part is Urbanized	<i>Tabanus dorsiger</i> <i>Tabanus rubudus</i> ,
		Rainy Monsoon (July-Sept.)	241				
		Winter (Oct-Feb.)	110				
4	Narsampet (Lakeenapally, Narsampet Geeskonda)	Hot Summer (March-June)	102	632	11.2	hot and dry, semi-arid red soils (including red shallow gravelly and red clayey soils), black soil	<i>Tabanus dorsiger</i> , <i>Tabanus rubudus</i>
		Rainy Monsoon (July-Sept)	335				
		Hot Summer (March-June)	195				
5	Mulugu (Chalwai, Lakkanavaram Govindraopet)	Hot Summer (March-June)	124	1044	18.55	hot, semi-arid, and sub-humid tropical climatered soils (shallow gravelly and clayey) and black soil	<i>Tabanus dorsiger</i> , <i>Tabanus rubudus</i> ,
		Rainy Monsoon (July-Sept.)	592				
		Hot Summer (March-June)	328				

**Graph 1:** Showing Mandal and Village wise percentage prevalence of tabanid flies in Warangal district of Central Agro-climatic zone

Tabanid flies are holometabolous insects continuation needs an encouraging environment which would support all stages of their life cycle viz., egg, larva, pupa and adult. Suitable substrates for eggs, banks of water bodies for the larval and pupal development, proper adult resting sites, nectar sources for the survival of adult flies and blood sources for egg development are the elementary necessities. Egg laying was seen on grasses and even on fallen bamboo/tree branches, nearby water sources. Larvae need sufficient food sources in the form of other Dipteran larvae, earthworms, snails, small fishes etc. Tabanids feed on nectar of flowers (Leprince and Lewis, 1983) ^[34] and flowering plant species of the forest must have been the main nectar sources for male and female

flies. A rich density of hosts must have provided blood sources for adult flies. Thus, different stage of tabanid life cycle is well supported by flora, fauna and edaphic factors of these areas and other natural factors like temperature; humidity and rainfall; along with the said factors offer a suitable and conducive environment for the survival and continuation of these flies in this area.

These tabanids were collected from different parts of the study area. *Tabanus* was the most diverse genus at all of this Warangal dist. The rainfall is necessary for all stages of tabanid cycle and probably would have played a key role in deciding tabanid abundance. Humidity was another environmental parameter that was positively correlated with

tabanid abundance in study areas. Humidity affects development and survivorship of insects, which must keep body water content within certain limits and that is influenced by the degree of cuticle permeability (Raghu *et al.*, 2004)^[47].

High relative humidity favours most metabolic processes in vectors like tabanids. So, a high humidity will tend to prolong survival, although increased susceptibility to fungal and bacterial pathogens may offset this to a variable degree. Low humidity causes a decrease in the daily survival rates of many arthropod vectors including tabanids. Because of dehydration, in some cases it may also cause an increase in the blood feeding rate, in an attempt to compensate for the high levels of water loss (Mellor and Leake, 2003)^[43]. Hence, lesser number of tabanids and their activity could be attributed to both low temperature (McElligott and Galloway, 1991)^[42] and less humidity.

Temperature is another important environmental parameter affecting insect populations. Increase in the temperature decreases the interval between blood-meal and oviposition (Roberts, 1980)^[49]. In a laboratory experiment, Hafez *et al.*, (1970)^[23] have shown a reduction in larval and pupal duration with an increase in temperature, clearly indicating the role of temperature in tabanid development. Lower temperature is also known to reduce activity and density of tabanids (Thibault and Harper, 1983)^[56]. Besides rainfall, humidity and temperature, many other factors have been shown to be responsible for abundance of tabanids. Flowering plants acting as the main source of energy in the form of nectar, flowers support and decide the duration of tabanid life cycle (Leprince and Poulin, 1990)^[35]. Carbohydrates of flowers have been reported as important dietary components for tabanids (Magnarelli, 1981)^[37] apparently to restore depleted energy reserves during flight.

Numerous studies have investigated the effects of meteorological factors on seasonal abundance of tabanids all over the world (Roberts 1971; Strickman and Hagan 1986; Leprince *et al.*, 1991; Strickler and Walker, 1993; McElligott and Lewis 1998; Krcmar 1999; Barros 2001; Hribar *et al.*, 2003; Krcmar 2005)^[50, 54, 36, 53, 41, 30, 6, 25, 31]. The studies of the seasonal abundance of tabanids are very important from the standpoint of medical and veterinary parasitology, because some species of tabanids participate in the transmission of agents of various diseases (Foil 1989; Vazzeille-Falcoz *et al.*, 1997; Thomson and Connor 2000)^[20, 59, 57].

In the present study highest number of flies were collected from the study area covered Tropical, mostly hot and dry, semi-arid red soils (Shallow gravelly and clayey) and black soils. These findings were in concurrence with Barros (2001)^[6] who reported higher number of tabanids in the wooded habitat than in grassland. Whereas number of flies caught in study area covered by plains with dry and moist deciduous forests, agricultural flatland was less than the Sahyadri Mountains with moist deciduous, evergreen forests and more than the coastline with evergreen and moist deciduous forests. Tabanid flies were known to be abundant in different habitats (Harley, 1965; Mavoungou *et al.*, 2012; Bitome Essono *et al.*, 2015; Suh *et al.*, 2015)^[24, 40, 8, 55]. Seasonal meteorological variability that occurs periodically from one year to another has a significant influence on the duration of tabanid flight activity, on their emergence, and on their peaks of abundance. For instance, when temperature conditions were more favourable during spring (May),

higher numbers of tabanids were caught in the pasture habitat than in the wooded habitat (Krcmar, 2005)^[31].

In the present study highest number of flies were collected from the study area covered by tropical and semi-arid hot climate red soils with deciduous, evergreen some forests area and higher mean temperature and relative humidity. Mean temperature and relative humidity along with rainfall may be critical for the activity of flight of horse flies, as determined by Cardenas *et al.*, (2012)^[12]. Thus, the richness and abundance may be increased more than two and a half times if there is an increase of 2 °C in mean temperature and of 8% in mean relative humidity. This increase in mean temperature and relative humidity in the region could lead to an increased abundance of horse flies, which could lead to increased richness or expansion of the range of annual occurrence of species that are rare and of intermediate abundance Kruger and Krolow (2015)^[33], Korner (2007)^[29], precipitation, wind velocity and seasonality are not altitudinal-related because gradients can go in any direction depending on local topography and climatic conditions, but they may affect species distribution due to intraspecific adaptations to such conditions at precise sites and periods of the year. As indicated by Kettle (1995)^[28], the activity and dispersion of adult tabanids is influenced by meteorological factors, principally luminosity and temperature.

As a consequence of the global climate change (global warming), an increase in the annual average air temperature and a decrease in the average amount of precipitation can be expected during the summer seasons of the next few decades. This climatic change may contribute to the appearance of new tabanid species in study area and changes in the seasonal and daily activities and abundance of horseflies. The geographical distribution and the temporal activity of many vectors (e.g., mosquitos, ticks) have been influenced by the effects of climate change (Garza *et al.*, 2014; Ogden *et al.*, 2014)^[21, 46]. Like other parasites, tabanids can also appear and establish their populations in formerly uninfected areas, and they may introduce non-indigenous pathogens. Climate change may alter the host-vector interaction too. Tabanids are more active at higher air temperatures spending more time with blood sucking. For these reasons, females will lay more eggs and probably bigger populations of horseflies will attack animals and humans during the swarming periods. An increased frequency of bloodsucking gives a higher chance for the transmission of causative agents. This may cause not only economical losses and health problems of livestock but also public health consequences, depending on the pathogens.

Climate change also alters the composition of plant ecosystems (Gehring *et al.*, 2014)^[22] serving food for herbivores. This may influence the persistence of tabanid hosts. A rainier weather, for example, results in more ponds, puddles, and mud, so the egg-laying areas of horseflies increase considerably. The follow-up study of the complex effects of the climate change on the activity and pathogen-transmission ability of tabanid flies could be performed by worldwide research teams.

Conclusion,

The highest abundance of flies was observed in the area covered with Tropical, mostly hot and dry, semi-arid red soils (shallow gravelly and clayey) and black soils, least abundance was observed in the Urban areas where lacking of deciduous with higher mean temperature and relative

humidity. Also the research revealed the flies were abundance during wet season and summer decline during drier seasons. The during this study also check the vector potentiality and *Trypanosoma theileri* species found During this period the disease outbreak were found LSD, PPR,FD also shows rainfall, air temperature, were the most important factors influencing the number of tabanids. Our data may serve as a reference for further investigations to study the effect of climate change on the tabanid activity in the Warangal district of Telangana India.

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