International Journal of Livestock Research, Vol. 11 (8) Aug' 2021
http://www.ijlr.org
eISSN: 2277-1964

Original Research

Prevalence and Age Grading of Two Common Culicoides species, in Farms of Warangal Districts of Telangana State, South India

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How to cite this paper: Banothu, D., D' Souza, P., Udaya Kumar, M., Venkatesan, T., & Murthy, G. (2021). Prevalence and Age Grading of Two Common Culicoides species, in Farms of Warangal Districts of Telangana State, South India. *International Journal of Livestock Research*, 11(8), 40-45. https://dx.doi.org/10.5455/ijlr.20210124095103

Received : Dec 20, 2021
Accepted : Feb 22, 2021
Published : Aug 31, 2021

Abstract

The prevalence and age grading of Culicoides midges from Telangana State, South India was studied considering the species as pests and vectors of Blue tongue virus in sheep and cattle. We investigated their species composition, abundance, host preference and conducted their age grading. The morphological characters were used for specific identification of midges. The midges were collected from two different farms from Warangal rural and urban districts (cattle and sheep) using CDC-UV light trap, for the period of one year (September 2017 to August 2018). A total of 28,000 flies were collected of which 25,000 (83.33%) were female and 3,000 (16.66%) were males. The species included 10,500 (58.33%) C. oxystoma, 7,500 (41.66 %) C. imicola from cattle farms 10,000 flies from sheep farms including C. imicola 6,500 (65%) and C. oxystoma 3,500 (35%). The age grading of Culicoides revealed significant proportion of parous females which play an important role in transmission of Blue Tongue Disease virus.

Keywords: Culicoides species, UV light trap, Age grading, Telangana

Introduction

Culicoides are known as "biting midges" consisting of 1343 species under 31 subgenera worldwide including 64 species under 11 subgenera in India (Borkent, 2016). They are the smallest haematophagous flies measuring about 1-3 mm in size. Female midges are obligatory blood feeders attacking livestock animals and transmits the Bluetongue (BT) disease in sheep (Prasad *et al.,* 1992; Prasad, 2000; Ilango, 2006) and in cattle (Harsha *et al.*, 2020). *C. oxystoma* is the predominant vector (Patel *et al*., 2007 and Dadawala *et al*., 2012) in cattle farms and *C. imicola* in sheep farms (Harsha and Mazumdar, 2015). In addition to the primary effects *Culicoides* act as vector for various viruses (Leta *et al*., 2019) such as Bluetongue disease (Venter *et al*., 1999, Zientara *et al*., 2014 & Foxi, C *et al*., 2016) which is currently of great economic importance in India and is notifiable to the World Organization for Animal Health. The others include African horse sickness. The species are morphologically identified based on wing length, antennal ratio, costal ratio, antennal sensillar pattern, palpal ratio proboscis-head ratio and hind tibial spine, (Wirth & Hubert, 1989). Importance of the present study is to know the abundance of *Culicoides* especially two species viz., *C. oxystoma* and *C. imicola* and to predict the epidemiology of midge borne diseases in cattle and sheep Age grading is done to identify the proportion of parous females in field populations, this is helpful to determine the disease transmission risk involved and to plan effective targeted vector control (Mellor *et al.,* 2000).

Materials and Methods

Study Area and Collection of Flies

The flies were collected from cattle and sheep farms located at Warangal urban and rural districts of Telangana. The collections were made during 6 pm - 6 am (dawn & dusk) using CDC-UV light trap. The collected insects were transported to the laboratory and separated on different sieves and were preserved in 70% ethyl alcohol. In the laboratory they were sorted under stereo zoom microscope for tentative identification of species then followed by detailed examination under binocular microscope based on morphological features Wirth and Marston, 1968, Sen and Dasgupta, 1959 and Wirth and Hubert, 1989. The females were age graded as four different gonotrophic age group categories according to the abdominal pigmentation method (i) unpigmented (nulli parous), (ii) pigmented (parous) (iii) gravid and (iv) engorged (freshly fed) (Dyce, 1969).

Results and Discussion

The biting midges trapped at weekly interval for a period of one year (September 2017 to August 2018) in two different farms were compared and correlated for the abundance of two species viz., *C. imicola* and *C. oxystoma*. The percentage catch of *C. oxystoma* males and females in cattle farm were 10% and 90% respectively, while in sheep farm it was 12% and 88% respectively. In case of *C. imicola* it was 14% and 86% in cattle farm and in 6% and 94% in sheep farm respectively during the same period (Table 1). The age grading of *Culicoides* was done with only female flies (Table 2) (Fig. 1).

Table 1: Total no. of *Culicoides* trapped in cattle & sheep farms during Sept 2017 to Aug 18

Cattle farm		***C. oxystoma***					***C. imicola***					
	M	F	E	P	NP	G	M	F	E	P	NP	G
Number	1,050	9,450	945	3,307	4,725	473	780	6,720	1057	2,288	2,945	430
Percentage	10	90	10	35	50	5	12	88	16	34	44	6
Sheep farm												
Number	210	3,290	493	1,151	1,447	199	900	5,600	592	2,640	2,172	196
Percentage	12	88	12	35	44	6	6	94	11	47	39	4

Age grading of Culicoides: M- male, F- female, E- engorged, P- parous, NP- nulliparous, G- gravid.

Table 2: Age grading of *Culicoides* from cattle farms

Species	**Engorged**	**Parous**	**Nulliparous**	**Gravid.**
C. imicola	1057	2,288	2,845	428
C. oxystoma	945	3,307	4,725	473
Total	2,002	5,595	7,570	901
Percentage	12.45	34.82	47.11	5.60

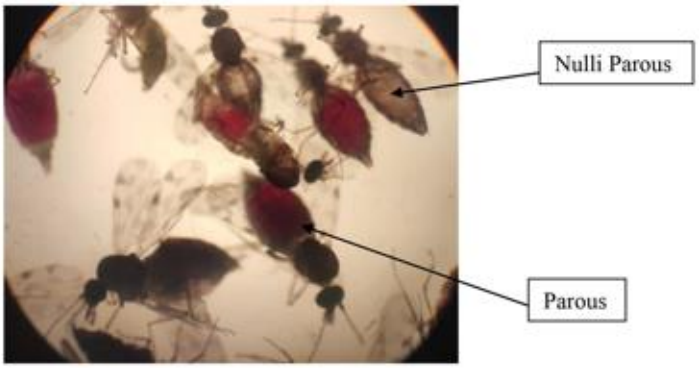

Figure 1: Age grading of *Culicoides* sorted out under stereo-zoom microscope

The percent of parity of *C. oxystoma* was 35% in cattle and 35% in sheep farm and *C. imicola* was 34% in cattle and 47% in sheep farm (Table 1). The number of parous individuals determines the potential vector status of a *Culicoides* population (Venter *et al*., 2009). The overall prevalence of *Culicoides* (Table 3) and the parity of female flies (Fig. 2 and 3) during the above study were found to be more in sheep farm compared to cattle farm (Table 2) (Dyce, 1969). The blood fed culicoides representing the Fig. 2 it was showing that the abdomen is filled with blood it requires for oviposition and egg laying of *culicoides.*

Table 3: Prevalence pattern of *Culicoides* in Warangal districts of Telengana

Species	Male	Female	Total	Percentage
C. imicola	990	11010	12000	42.85
C. oxystoma	1950	14050	16000	57.14

Fig 2: Engorged *C. imicola* female under 10X Microscope

Fig 3: Gravid *C. oxystoma* female under 10X Microscope

Fig. 3 the gravid female flies are ready to lay the eggs after full engorgement from the Definitive host. while engorgement these midges acting as biological vector for various arboviral infection especially blue tongue disease (Leta *et al*., 2019& Foxi, C *et al*., 2016) morphologically identified based on wing markings and head region for antennal hair pattern and for Sensory coeloconica distribution on the antennae and sensory pit present on the third palpal segment (Fig. 4).

Figure 4: Morphological description of *C. oxystoma* and *C. imicola*

Table 4: Age grading of *Culicoides* from sheep farms

Species	Engorged	Parous	Nulliparous	Gravid.
C. imicola	592	2,640	2,172	196
C. oxystoma	493	1,151	1,447	199
Total	1,085	3,791	3,619	395
Percentage	12.2	42.64	40.7	4.44

Culicoides is one of the important animal human and pest which causes severe annoyance to man and animals through their biting attacks with great economic significance and a prime vector for various viruses like *Bluetongue virus, African horse sickness virus, Epizootic hemorrhagic virus, Akabane virus, Bovine ephemeral fever virus, Vesicular stomatitis virus, Equine encephalosis Virus, Schmallenberg Virus et., protozoa like Haemoproteus spp. and Leucocytozoon spp.* in birds, *avian Trypanosomes* in birds, *Plasmodium in lizard* and bird malaria and filarid worms like *Onchocerca cevicalis* in horses, *Dipetalonema* spp, and *Mansonella perstans* and *M. ozzardi* in humans and various filarid worms of birds, mammals (Prasad and Bhatanagar, 2000). Among *Culicoides* sp., *C. imicola* and *C. oxystoma* were the predominant species collected during this study. The data presented herein represents the dominance of *C. oxystoma* in cattle farm and that of *C. imicola* in sheep farm, correlates with the host preference of *C. oxystoma* for cattle and that of *C. imicola* for sheep (Harsha and Mazumdar, 2015). The greater number of parous females prevalent in sheep farm (42.64%) than cattle farm (34.82%) whereas nulliparous is more in cattle farm (47.11%) than sheep farm (40.70%). The age grading of *Culicoides* reveals the significant difference ($P<0.0001$) on parity of female flies hence the present study showed that percent of parity is directly proportional to the transmission of vector borne diseases in farm animals and also effective management strategies of livestock in Telangana, South India.

Acknowledgement

The provision of CDC-UV light trap for the Research work by Dr. Y. Narasimha Reddy, former Dean of PVNRTVU is gratefully acknowledged and the lab facilities provided by the Department of Parasitology PVNRTVU. This paper is a part of the Ph.D thesis by the first author of the KVAFSU, Bidar.

Conflict of Interests

There is no conflict of interest.

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References

1. Borkent, A. (2016). World species of biting midges (Diptera: Ceratopogonidae) *http:// wwx.inhs.illinois.edu/files/4514/6410/0252/Ceratopogonidae Catalog.pdf.*
2. Dadawala, A.I., S.K. Biswas, W. Rehman, K. Chand, A. De, B.S. Mathapati, P. Kumar, H.C. Chauhan, B.S. Chandel and B. Mondal. (2012). Isolation of Bluetongue virus serotype 1 from *Culicoides* vector captured in livestock farm and sequence analysis of the viral genome segment 2. *Transboundary and Emerging Diseases* 59: 361–368.
3. Dyce, A.L. (1969). The recognition of nulliparous and parous *Culicoides* (Diptera: Ceratopogonidae) without dissection. *Journal of Australian Entomological Society* 8: 11–15.
4. Foxi Cipriano, Gavino Delrio, Giovanni Falchi, Maria Giovanna Marche, Giuseppe Satta and Luca Ruiu. (2016). Role of different *Culicoides* vectors (Diptera: Ceratopogonidae) in bluetongue virus transmission and overwintering in Sardinia (Italy). *Parasites & Vectors* volume 9: 440.
5. Harsha, R. and Mazumdar, A. (2015). Prevalence and Age Grading of *Culicoides* spp. (Diptera: Ceratopogonidae), Potent Vectors of Bluetongue Disease of Farm Animals in Bikaner, Rajasthan. *Proc Zool Soc* 12595-014-0110-y.
6. Harsha, R., Mazumdar, S. M. and Mazumdar A. (2020). Abundance, diversity and temporal activity of adult *Culicoides* spp. associated with cattle in West Bengal, India. *Medical and Veterinary entomology.* 34(3): 327-343.
7. Ilango, K. (2006). Bluetongue virus outbreak in Tamil Nadu southern India: Need to study the Indian biting midge vectors, *Culicoides* Latreille (Diptera: Ceratopogonidae). *Current Science*. 90(2): 163–167.
8. Leta, S., Fetene, E., Mulatu, T., Amenu, K., Jaleta, M.B., Beyene, T. J. (2019). Modeling the global distribution of *Culicoides imicola*: an Ensemble approach. *Scientific Reports.* 9(1):1–9. pmid:30626917.
9. Mellor, P.S., Boorman, J. and Baylis, M. (2000). Culicoides Biting Midges: their role as Arbovirus vectors. *Ann. Rev. Entomol*., 45: pp. 307-340.
10. Patel, A.R., B.S. Chandel, H.C. Chauhan, D.W. Pawar, N.R. Bulbule, S.D. Bhalodia, and N.K. Kher. (2007). Prevalence of potential vectors of BT in Gujarat. *Indian Veterinary Journal* 3: 33–36.
11. Prasad, G. (2000). Whither bluetongue research in India. *Indian Journal of Microbiology* 40: 163–175.
12. Prasad, G., N.C. Jain and Y. Gupta. (1992). Bluetongue virus infection in India: A review. *Revue scientifique et technique (International Office of Epizootics)* 11: 699–711.
13. Prasad, G. and Bhatnagar P.K. (2000). Acarines and insects of veterinary and medical importance. Bangalore: V National Training programme Centre of Advanced Studies, Department of Parasitology, Veterinary College; *Culicoides*: *biology and transmission of viruses*; pp. 34–38.
14. Sen, P. and S.K. Dasgupta. (1959). Studies on Indian *Culicoides* (Ceratopogonidae: Diptera). *Annales of Entomological Society of America* 52: 617–630.
15. Venter, G.J., Paweska, J.T., van Dijk, A.A., Mellor, P.S. and Tabachnick, W.J. (1998). Vector competence of Culicoides South African bluetongue virus serotypes 1, 3 and 4. *Med Vet Entomol*, 12, 101-108.
16. Venter, G. J., K. Labuschange, K. G. Hermanides, S.N.B. Boikanyo, D.M. Majatladi and L. Morey. (2009). Comparison of the efficiency of five suction light traps under field conditions in South Africa for the collection of *Culicoides* species. *Veterinary Parasitology* 166: 299–307.
17. Wirth, W.W. and Hubert, A.A. (1989). The *Culicoides* of South East Asia (Diptera: Ceratopogonidae*). Memoirs of American Entomological Institute* 44: 1–508.

18. Wirth, W.W. and Marston, N. (1968). A method of mounting small insects on microscopic slides in Canada balsam. *Annales of Entomological Society of America* 61: 783–784.
19. Zientara, S., Sailleau, C., Viarouge, C., Hoper, D., Beer, M., Jenckel, M. (2014). Novel bluetongue virus in goats, Corsica, France, *Emerg Infect Dis*. 2014;20 (12) : 2123–25.

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