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Annoyance to sheep by dipteran flies, *Haematopota nathani* and *Stenopogon ambryon* in the pasture area of Kodai hills, Tamil Nadu, India

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Abstract

The present study was carried out to identify the flies creating annoyance to sheep in the grazing area of SRRC, Mannavanur. Two different kinds of flies were caught from the pasture area by graziers during April 2020. With the help of Dept. of Agricultural Entomology, Centre for Plant Protection studies, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India, it was identified that *Haematopota nathani* (Cleg fly) and *Stenopogon ambryon* (Robber fly) were the two dipteran flies causing annoyance and painful bite in sheep and graziers. *H. nathani* is the holotype found in Kodaikanal, Tamil Nadu, India and the identification of *S. ambryon* at SRRC, Mannavanur is the first report. Due to the annoyance of these two flies, the problems such as inadequate grass feeding, allergic reactions and weight loss to some extent were observed among sheep. It is recommended that the usage of the ideal trap methods to catch these Cleg flies and Robber flies, Bush cleaning in the grazing area of SRRC, Mannavanur, the studies on the vector potential of *H. nathani* in the transmission of the infectious diseases such as Bovine Viral Diarrhoea, Anthrax and Brucellosis in sheep and the effects of the salivary secretions of *S. ambryon* on the peripheral blood mononuclear cells of sheep would have been attempted for future prospective aspects of the present study.

Keywords: *Haematopota nathani*, India, Kodai hills, Sheep, *Stenopogon ambryon*, Tamil Nadu

Introduction

The family *Tabanidae*, one of the most important families within the order *Diptera*, is having 137 genera, which contains about 4406 species and subspecies^[1]. The family *Tabanidae* comprises three subfamilies: *Pangoniinae*, *Chrysopsinae* and *Tabaninae*.

Haematopota, one of the genera within the subfamily *Tabaninae*, contains about 160 species in oriental region^[2] and members of this genus are commonly called as "Cleg flies"^[3, 4]. Tabanids are well known for their painful biting habits leading to extreme level of nuisance and loss of blood in animals^[5]. Baldacchino and his team^[6] proposed that huge number of Tabanid flies in a defined geographical area would be having negative effects on outdoor activities, tourism & agriculture as well as production loss among livestock species. Further, members of *Tabanidae* are the potential vectors of viruses (Bovine viral diarrhoea virus), bacteria (*Bacillus anthracis* and *Brucella spp.*) and protozoa (*Trypanosoma evansi*) and thereby causing severe economic loss to the farmers.

The assassin flies or robber flies are classified under the family *Asilidae* within the order *Diptera* and the evolution of these venomous flies is during the Cretaceous era^[7]. The family *Asilidae* is having >7000 species distributed worldwide^[8]. Asilids are famous for the usage of their paralyzing venom in feeding on other insects during hunting. Generally, the composition and bioactivity of the venom of robber flies are similar to that of other such as assassin bugs and heteropteran insects^[9].

It was reported that Asilids would inflict a painful bite to those individuals who were perturbing these predators^[10]. The asilids are known for their predatory feeding habits on other insects. Some of these flies are usually seen wherever the grassland begins i.e. at the border of forests, and occasionally interior of the forests^[11]. ICAR- Central Sheep and Wool Research Institute (ICAR-CSWRI) is having one of its regional centres in Southern India, popularly known as Southern Regional Research Centre (SRRC), which is functioning within the Kodai hills, about 32 kms away from Kodaikanal town.

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SRRC is rearing synthetic breeds of Sheep (Bharat Merino and Avikalin) broiler rabbits (major breeds- White Giant and Soviet Chinchilla) as well [12].

At SRRC, semi intensive system of management is practiced for sheep. Everyday morning, Sheep are taken by graziers into the grassland area nearby reserve forest area and brought back to SRRC around 5pm. During the sunny days of grazing, graziers observed that sheep in the pasture area are being annoyed and bitten by some peculiar flies. Keeping this information in view, the present study was undertaken with the objective of identification of the flies (upto species level) creating nuisance to sheep while grazing in the pasture area of Kodai hills, Tamil Nadu, India.

Materials and Methods

Area of the study

SRRC is located in a farming village popularly known as Mannavanur and this village possesses about 1500 families coming under Mannavanur Panchayat, Dindigul district, Tamil Nadu, India. Mannavanur is located about 35 kms away in the west direction from Kodaikanal (one of the famous tourist hill stations in southern India) at an altitude of 2030 metres. The Coordinates for this farming village are 10°12'45"N and 77°20'38"E.

Flies

During the summer month i.e. April 2020, sheep (maintained by SRRC) taken by graziers were annoyed and bitten by two different kinds of flies. Even the graziers were also occasionally received a painful bite by these flies. A total number of eight flies, four in each category, were caught by graziers manually and brought to the lab of SRRC, Mannavanur. A total number of two flies in each category were immediately preserved in 70% alcohol; the remaining two flies, in each category were stored in the freezer portion of the refrigerator for DNA barcoding analysis. The fly specimens preserved in 70% alcohol were sent to the Dept. of Agricultural Entomology, Centre for Plant Protection studies, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India, for their identification upto species level using conventional entomological techniques.

Identification of the flies

Identification of the flies in the present study was carried out by the Dept. of Agricultural Entomology, Centre for Plant Protection studies, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India.

The Cleg flies upto the level of species in the present study were identified using the keys described by earlier [2]. On the other hand, identification of robber flies in the present study, up to the level of species was confirmed by using the keys described by earlier [13].

Results and Discussion

The present study is aimed to find out the flies annoying sheep while grazing in the pasture area of SRRC, Mannavanur. These flies were making a painful bite even among the graziers. The area of the present study, i.e., SRRC, Mannavanur is a subtemperate region placed about 2030 metres above mean sea level and is well known for its annual rainfall of 1055 mm throughout the year. The grazing area of sheep is rich in grass species such as Kikuyu (*Pennisetum clandestinum*) and speargrass (*Heteropogon contortus*) [14]. In addition to these grass species, the grazing area is having the

population of Mexican poppy, common lantana and pteridophytes such as ferns (Fig.1).

It was observed that two different categories of flies were creating nuisance to animals. Based on the gross morphology, both the categories of flies annoying sheep and human beings were the true flies. i.e. Dipteran flies. Both categories of the flies were identified by the experts from the Dept. of Agricultural Entomology, Centre for Plant Protection studies, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India,

The first category of fly is the Cleg fly i.e., *Haematopota nathani* (Fig.2) and is classified under the family *Tabanidae* in the order *Diptera*. *H. nathani* was identified by using the following keys described by earlier [2].



Fig 1: Sheep grazing area of SRRC, Mannavanur



Fig 2: *Haematopota nathani*

Haematopota nathani

Holotype, female, Kodaikanal, Pulney Hills, India, 6,500 ft. May 22, 1953, P. S. Nathan (CU). Paratypes: 2♀, 1♂, same data as holotype; 4♀, Kadamparai, Anamalai Hills, Madras State, India, 3,500 ft. May 1963, T. R. S. Nathan; 5♀, Naduvatam, Nilgiri Hills, India, 1958 (2 labeled April), P. S. Nathan; 1♀, same but 6,000 ft. May 1950; 1♀, Cinchona, Anamalai Hills, 3,500 ft, May 1968, Nathan; 1♀, same, 1,066 m, April 1964; 1♀, Trichonopoly, Inde Méridionale, 1911, F. Caius. (BM, CU, LZG, MNHP, UCR, USNM)

Femalae.—Length 9-11.5 mm; wing 8-10 mm; antenna 2-2.5 mm. Frons nearly two-thirds as wide at vertex as high, distinctly widened below, dark gray, paler at eye margin above and bordering frontal spots; midfrontal spot large, black, vertical; paired spots quadrate, touching eyes broadly, separated from callus; callus black, about 3.5 times as wide as high, touching eyes slightly depressed and irregular centrally, upper and lower margins nearly straight or with small middorsal triangular projection; subcallar area dull black

centrally; face and parafacials gray, upper parafacial dark brown with transverse grayish band containing dark speckles; beard nearly white. Antenna black; scape and pedicel with black hair; scape stout, subshiny, cylindrical, 2.5-3 times as long as thick; pedicel with strong dorsal projection; flagellum subequal to scape in length, first flagellomere moderately slender, style rather thick; palpus basally pale with some pale hair, distally darker gray with black hair. Scutum dark brown with distinct paler markings consisting of pair of slender sublateral stripes reaching from anterior margin to transverse suture followed by pair of strong white spots behind suture, and pair of widely separated crescentic marks on posterior margin; scutellum dark; pleuron gray above with white hairs, dark below. Wing brown with small and moderately large pale spots in usual pattern; subapical band sinuous, reaching wing margin at end of vein Rs but rather broadly broken in cell R4; large triangles at wing margin in posterior cells 3 and 5 and basal hind margin of axillary cell broadly pale. Halter with dark knob. Legs dark with white as follows: Subbasal third of fore tibia; two bands on midtibia; basal two-fifths of hind tibia; small indistinct spot subapically on hind tibia; base of midtarsus and hind tarsus. Abdomen black with gray incisions above and below.

Male: Eye densely hairy; large and small facets of eye not sharply differentiated; scape shiny with long black hair, very swollen, its length about 1.5 greatest thickness, longer than flagellum; upper parafacial nearly black but brownish in certain lights; palpus brown, very swollen; hair of head and palpus very long, dark; anterior white stripes of scutum slender and incomplete; white spots behind transverse suture very strong; pleural hairs all dark; white subbasal bands of tibiae narrower than in female; subapical bands of midtibia and hind tibia scarcely visible. Otherwise essentially as in female.

The second category of fly is the Robber fly, i.e., *Stenopogon ambryon* (Fig.3) and is classified under the family *Asilidae* in the order *Diptera*. *S.ambryon* was confirmed by the use of the following keys described by earlier [13].

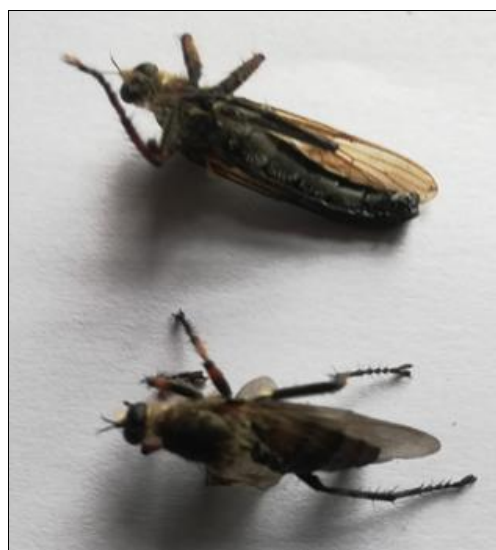


Fig 3: *Stenopogon ambryon*

Stenopogon ambryon

Body ferruginous; head much narrower than the chest, covered with dull pale yellow down, thickly clothed with pale yellow hairs behind, and with whitish hairs beneath; crown

covered with dark tawny down, and beset on each side with black bristles; clypeus armed with many long pale yellow spines; eyes black; fore part slightly convex, its facets very little larger than those elsewhere on the eyes; lip black, ferruginous, and clothed with short yellow hairs at the tip; palpi black, clothed with pale yellow hairs; feelers piceous; first and second joints beset with short black bristles; second joint much shorter than the first; third joint spindle-shaped, much longer than the first and the second; fourth joint black, like a spine, about one-fourth of the length of the third; neck with a ruff of black and yellow bristles; chest covered with dark tawny down, thinly clothed with short black hairs, beset on each side and behind with longer pale yellow hairs, and with some very long black and yellow bristles; breast paler tawny, covered with a slight hoary bloom, clothed here and there with white hairs; abdomen narrower than the chest, and nearly thrice its length, clothed with short yellow hairs, and on each side at the base with some longer hairs and with a few black and yellow bristles; tapering from the base to the tip, which is clothed with some black hairs and armed with a circlet of black spines: first and second segments short; third and following segments long, and of nearly equal length; eighth and ninth segments piceous, shining; legs very dark ferruginous, almost piceous, clothed with short pale yellow hairs, and beset with black spines; shanks and feet of fore and middle legs paler; claws black, ferruginous at the base; foot-cushions dark tawny; fore shanks unarmed; wings brown, paler along the borders of the veins, reaching, when closed, to two-thirds of the length of the abdomen; wing-ribs and veins piceous, the latter ferruginous along the fore half of the wing; poisers yellow. Length of the body 14 lines; of the wings 16 lines. In the present study, the population of both Cleg flies and Robber flies was abundant during April month of the year and at SRRRC, Mannavanur, April is the summer month. In most areas, tabanid activity is largely seasonal in majority of the areas; during summer months, the activity of tabanids is abundant in the temperate climatic zones [15, 16]. Since the area of the study is within the reserve forest area, one could expect the presence of robber flies in the sheep grazing area of SRRRC, Mannavanur. According to the earlier report [11], a few number of robber flies could be present wherever the grassland begins i.e. at the border of forests, and rarely inside of the forests.

Further, the annoyance and biting behaviour of tabanids among sheep and graziers were observed in the area of the present study. i.e. SRRRC, Mannavanur, which is located at high altitude about 2030 metres above mean sea level. Baldacchino and his team [17] concluded that there is no correlation between the landscape structure and biting behaviour of tabanids. This could be due to the huge affinity of the animal herd and large dispersal ability of tabanids. There was a strong correlation between the biting behaviour of tabanids and weather variables, in addition to the altitude. Further, animal could not escape from the annoyance by tabanids during summer days, in spite of the strong immune system of the animals towards the blood sucking habits of tabanids. Surprisingly, *Haematopota nathani* is the holotype found in Kodaikanal, Tamil Nadu, India. Further, the report of *Stenopogon ambryon* in Kodaikanal, Tamil Nadu, India is also first of its kind.

Biting of tabanids among sheep and human beings is not new information. But, the annoyance to sheep and graziers by robber flies is a peculiar observation in the present study.

This could be explained as follows; In order to feed on other

flies such as Cleg flies and muscid flies (which are creating annoyance to sheep), robber flies could fly over the flock of sheep in the present study. This would have been observed by graziers as sheep got bitten by robber flies. Eventually, graziers would have tried to chase the robber flies; so that, graziers also would have got bitten by these assassin flies. As per the University of Kentucky, Entomology, USA, it is known that in spite of the predatory habits, robber flies seldom feed on other animals, including spiders, birds, and larger predatory insects like assassin bugs, praying mantids, and even other robber flies. Robber flies are neither pests nor blood feeders. They seldom make a painful bite in humans, on accident or if provoked (<https://www.uky.edu/Ag/CritterFiles/casefile/insects/flies/robber/robber.htm>).

Due to the annoyance to sheep by the above said two dipteran flies in the grazing area of SRRC, Mannavanur, Sheep were facing the problems such as improper grass feeding, allergic reactions and weight loss to some extent. The said problems among sheep were usually rectified by feeding the sheep with concentrated pellet feed and treating the hypersensitive animals with suitable medication.

In the grazing area of SRRC, Mannavanur, cattle, buffaloes and horses are also grazing along with sheep. Further, the area of the present study is well known for wild animals such as Indian Guar, Deer, Wild pig and red dogs. Due to the richness of wild fauna and bovine species, there could be a chance for the transmission of the infectious diseases such as Bovine Viral Diarrhoea, Anthrax, Brucellosis to sheep by cleg fly, *Haematopota nathani*.

As per the review by the earlier report ^[6], it is well known that *Haematopota species* are the potential vectors for the diseases of sheep such as Bovine Viral Diarrhoea, Anthrax, Brucellosis. Based on the observations in the present study, the following recommendations are submitted for the future prospective studies.

1. Suitable trap methods to catch Cleg flies and Robber flies need to be devised.
2. Bush cleaning in the grazing area of SRRC, Mannavanur should be attempted in order to avoid the breeding places for the flies.
3. The vector potential of *Haematopota nathani* in the transmission of the infectious diseases such as Bovine Viral Diarrhoea, Anthrax and Brucellosis in sheep, common bovine species, horses and wild animals at Kodai hills, Tamil Nadu, India needs to be studied.
4. The immunological effects of the venom produced by *Stenopogon ambryon* on the peripheral blood mononuclear cells of sheep needs to be elucidated.

Conclusions

It is concluded that *Haematopota nathani* (Cleg fly) and *Stenopogon ambryon* (Robber fly) were the two dipteran flies causing annoyance and painful bite among sheep and graziers in the pasture area of SRRC, Mannavanur, Kodai hills, Tamil Nadu, India. *H. nathani* is the holotype found in Kodaikanal, Tamil Nadu, India and the identification of *S. ambryon* at SRRC, Mannavanur is the first report.

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Compliance with ethical standards

Conflict of interest

The author declares that he has no conflict of interest

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