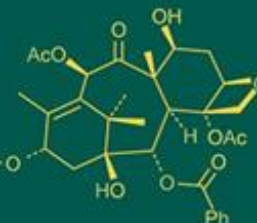
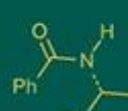
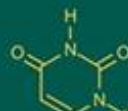
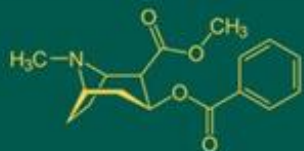


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Morphological Identification and Taxonomic Characterization of Tabanid Flies (*T. indianus*, *T. rubidus*, *T. dorsiger* and *T. brunnipennis*) from Warangal District, Telangana, India

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Abstract

A total of 8,488 tabanid fly specimens were collected from August 2023 to July 2025 across the Warangal district of Telangana, India, using trapping and hand-picking methods. The collected specimens were subjected to detailed morphological examination and identified based on key diagnostic characters, including body size, head morphology, thorax, wings, legs, antennae, and abdominal features. These flies identified on the basis of morphological identification key for the family Tabanidae. Morphological characterization revealed the presence of out of seven here listed and detailed four Tabanid species, namely *Tabanus rubidus*, *Tabanus rubidus*, *Tabanus dorsiger*, and *Tabanus brunnipennis*. this study helps in accurate identification and taxonomic characterization of tabanid flies occurring in the Warangal district and surrounding regions. It enables rapid discrimination of closely related species based on readily observable morphological traits, thereby improving the accuracy of species identification in both field and laboratory investigations.

Keywords: Tabanidae, Morphological identification, *Tabanus rubidus*, *Tabanus dorsiger*, *Tabanus brunnipennis*

Introduction

Family *Tabanidae* contains approximately 4,455 species and subspecies in 144 genera worldwide (Baldacchino *et al.*, 2014a; Morita *et al.*, 2016a) [17]. In India, 247 species, one sub species in 14 genera, six tribes and three sub families have been recorded (Maity *et al.*, 2016b) [12]. Five species of *Tabanidae* have been recorded from Warangal district of Telangana. They belong to three genera viz., *Tabanus*, *Haematopota*, *Chrysops*, in two subfamilies viz., Tabaninae, Chrysopsinae (Kapoor *et al.*, 1990; Veer, 2004; Vasudeva, 2007a) [4, 5, 6, 7].

Tabanids are robust, colorful flies with a brilliant green or pink band coloration of the eyes, males with holoptic and females with dichoptic eyes. Flies have callus spots on the frons which are configured specifically for species. Antenna, horn-like and the genera are differentiated by presence or absence of spur on it. Wings often have infuscations, bands or spots and are held wide apart at rest. Thorax and abdomen are generally striped or banded (Datta, 1985). Adults are diurnal, often most active in sunny weather and generally rest on trees. Males feed on nectar from flowers while females are hematophagous on animals and occasionally humans. Flies are abundant during monsoon, and the density of tabanids is influenced by rainfall (Vasudeva, 2007a) [6, 7]. The females lay eggs in masses on vegetation overhanging in waterbodies. The hatched larvae predate on invertebrates and can spend more than one season. Pupation occurs underground; the pupa being positioned vertically in the substrate. The whole life cycle of tabanids is completed in 4-5 months under favorable conditions.

Materials and methods

The study area included was Deccan plateau, which comprises of semi-arid and red soil as mentioned Table no.1. In this study five mandals of Warangal district were included which consists of sixteen villages (Laknavaram, Chalcwai, Hasanparthi, Geeskonda, Laknepally, Govindrapet, Narsampet, Kazipet, Dharmasagar, Panthini, Singaram, Mamnoor, Bollikunta, Chintagattu,, Mupparam, Pedapendyala of erstwhile district of Warangal, Hanamkonda and Mulugu area. *Morphological* identification of adult flies was carried out by using keys provided by Kapoor *et al.*, (1990) [4]; Veer (2004) [5]; Burton (1978); Stone and Philip (1974) [8]; Burger and Chainey (2000).

The characters for morphological identification of fly included color of fly; length of fly; eyes and eye banding pattern; frons length and width ratio; shape, size, color of basal callus, median callus and sub callus; antennal shape, size, color, tomentum and number of annulations of flagellum; basic ota with or without setae, color of veins, structure and number of apical band, number of rosettes or pale transverse streaks, presence or absence of appendix and color of the ptero stigma of wing; abdomen and thorax with spots, stripes or bands of various shape and size either median, submedi or both, which are also taxonomically very much significant in various species of *Tabanus*. Colors of scutellum, presence of hair or tomentum are additional important characters. All the specimens were identified using binocular microscope with help of Department of Entomology, ICAR-NBAIR, Bangalore and representative samples were deposited to the designated repository of National Zoological collection, Diptera section, Zoological survey of India, Kolkata, Photographs were captured in Leica Stereo zoom Microscope M205A. Also, part of the identified specimen was stored in 70 % alcohol at -20° C for molecular work.

Results

Morphological identification:

The characters for morphological identification of fly included color of fly; length of fly; eyes and eye banding pattern; antennal shape, size, color, number of annulations of flagellum; basi costa with or without setae, color of veins, structure and number of apical band.

The collected flies were grouped into large, medium and small flies based on the body size. The size of the fly was variable, small (about 10 mm long or less), medium (about 15-18 mm long or less), large (18-20 mm long more).

1. *Tabanus rubidus*

Details of the fly collected from:

INDIA Telangana Chalcwai, 18° 12' 32" N 80° 5' 26" E 250, A cattle (*Bos indicus*) buffalo (*Bubalis bubalis*), Laknavaram 18.15044° N, 80.06960° E, 536 A cattle (*Bos indicus*) buffalo (*Bubalis bubalis*), Govindraopet 18.25° N, 80.15° E, 200 A buffalo (*Bubalis bubalis*)



Fig 1A: *Tabanus rubidus* adult fly



Fig 1B: *Tabanus rubidus* lateral view



Fig 1C: *Tabanus rubidus* head

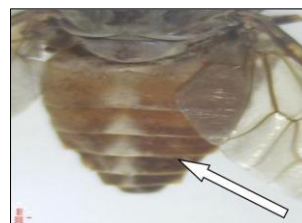


Fig 1D: *Tabanus rubidus* Abdomen Triangular white haired spots on abdomen

Identification

A large fly species, about 20–22 mm long, with a reddish-brown body. The head is broader than the thorax. The forehead is covered with yellowish-brown dust-like hairs and scattered black setae. The frontal callus is lance-shaped, does not touch the eyes, and has a long narrow extension. The face is coated in white dusting, and the beard is white. The palpi are elongated, blunt at the tip, thicker at the base, yellow in color with dense black hairs. The eyes appear black in preserved specimens and are wider than the thorax; ocelli are absent. The antennal scape and pedicel are brown with black hairs, while the flagellum is brown at the base and darker towards the tip, bearing a tall dorsal tooth with short black pubescence. The thorax is covered with grey dusting and black hairs; the scutellum is dark brown to black with a mix of short, black and longer white hairs. The wings are 17.8–18.5 mm long, faintly tinted, with the leading edge and some veins yellowishbrown; the pterostigma is yellowish, and veins are brown. The first posterior cell is slightly narrowed at its opening, and the basicosta is evenly covered with black setulae. The halteres are brown with grey tips. The legs have brown coxae, black to dark brown femora, and white tibiae with the apical quarter black; all tarsi are black. The abdomen is reddish-brown, marked with median triangular white-haired patches on tergites II to V.

Host: Cattle (*Bos indicus*) and buffalo (*Bubalus bubalis*).

Observation

This is one of the large species prevalent during April to June in the Warangal district. This species is closely related to *Tabanus tenebrosus* but can be differentiated by the presence of triangular white-haired spots/patches on abdominal tergites II to V (Fig. 1A).

2. *Tabanus rubidus*

Details of the fly collected from:

INDIA, Telangana the fly was found dominant in all 16 villages of Warangal district it is dominant. cattle (*Bos indicus*) buffalo (*Bubalis bubalis*).

Identification

Medium sized (16–17 mm long), brownish species (Fig. 2A, B, C). Frons length to width ratio, 4.9; divergence index 1.4 tomentum yellowish, yellowish-brown when viewed from

below; frontal callus reddish brown acuminate, truncated below, dorsal extension spindle shaped. Subcallus and upper cheek corners white; face and beard white with white hairs.



Fig 2A: *Tabanus rubidus* adult fly (Abdomen showing 3 white strips with lateral strips only on tergite II to V)

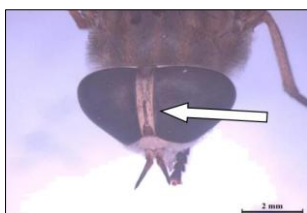


Fig 2B: *Tabanus rubidus* head (Frontal callus acuminate)



Fig 2C: *Tabanus rubidus* antenna

The fly has a creamy-white basal segment of the palpus with a few black hairs, while the apical segment is white-haired with scattered black hairs. The eyes are black and broader than the thorax, and the ocelli are not clearly visible. The antennal scape is reddish with a mix of white and black hairs; the pedicel is narrow with a sharp dorsal tooth, and the flagellum is entirely black except for an orange-tinged base. The thorax is brownish grey on the dorsum, bearing a mixture of black and orange hairs in the central area. Indistinct patches of lighter, woolly covering give it a faint striped appearance. The pleuron is grey and covered with long white hairs. The scutellum is two-toned, dark at the base and orange, brown toward the tip. The wings are 12.5–13.6 mm long, clear and evenly setulose, with brown veins. The haltere has a yellow stalk and a pale yellowish-white knob. The coxae are grey with white hairs. The fore femur is orange brown on the inner side and whitish to grey externally with white hairs; the middle and hind femora are orange brown with white hairs. The fore tibia is white with a dark apex, while the middle and hind tibiae are pale with pale hairs on the inner surface and black hairs externally. All tarsi are black. The abdomen ranges from brown to black and shows three white stripes: a median stripe running across tergites one to six as connected narrow triangular marks, and lateral stripes present on tergites two to five. The underside of the abdomen is dull orange (Fig. 2A, B, C).

Host: cattle, buffalo, bullocks and other herbivorous animals.

Observation: This fly is predominant during March to April and May to July and December to February. Preferably feed on fetlock region of cattle and Buffalo. It is closely related to *Tabanus triceps* but can be differentiate by presence of median

stripe of pale tomentum on tergite I to VI, which appear as a series of connected narrow triangles on abdomen.

3. *Tabanus dorsiger*

Details of the fly collected from:

INDIA, Telangana in all 16 villages of Warangal district. Collected from Cattle (*Bos indicus*) buffalo (*Bubalis bubalis*).

Identification

The adult fly is relatively large, measuring about 14–16 mm in length, and is bigger than the other two trivittate species, *Tabanus striatus* and *Tabanus tenens*. Its head is slightly broader toward the top. The frontal callus is narrow and positioned close to the eye margins, while the median callus is spindle-shaped and narrowly connected to the upper extension of the frontal callus. The abdomen shows a three-striped (trivittate) pattern. On the second abdominal segment, the central dorsal stripe is broad and continuous, and the pale sublateral stripes have a distinct step-like appearance. The underside of the abdomen is uniformly covered with greyish fine hairs. The fore femur and fore tibia are orange to brown in color, becoming darker towards the tips. The thorax has clearly defined stripes. In males, the costal cell of the wing appears yellowish. This species was earlier identified as *Tabanus triceps* but was later synonymized with *Tabanus dorsiger*, because both share similar frontal callus structures and a comparable abdominal pattern with step-like sublateral stripes (Fig.3 A, B).



Fig 3A: *Tabanus dorsiger* adult fly (Trivittate pattern on the abdomen)

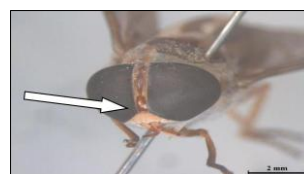


Fig 3B: *Tabanus dorsiger* head (Narrow frontal callus, spindle shape median callus)

4. *Tabanus brunnipenis*

Details of the fly collected from:

India, Telangana , Warangal District Bollikunta 7° 53' 30" N, 79° 36' 54" E, 280 A , Panthani, 17.9° N 79.6° E, 270 A Mamnoor, 17.93800° N 79.52370° E, 285 Muppam, 18° 00' 17.50"N, 79° 23' 32.00" E, 353A Kazipet 7° 58' 0" N (17.9667°), 79° 30' 0" E (79.5000°) 304 A, Laknepally, 17° 56' 33" N , 79° 49' 58" E , 302 A Geeskonda , 17°57'53"N, 79°41'50"E, 266A .

Identification:

A small, brown fly-like insect is described as a very distinct grey stripe running along the middle of its abdomen and two grey spots on the second abdominal segment. Its legs and antennae are reddish in color. The wings are greyish with a brownish tint along the front edge extending up to the second longitudinal vein. Unlike some related forms, the cross-veins in

the wings are not shaded, and the front margin shows a clearly defined colored band. The face is covered with a whitish-grey dust-like coating and has a few scattered white hairs. The beard is white. The palpi are yellow, fairly thick at the base, covered with many black hairs, and taper to a blunt tip. The antennae are reddish; the first segment appears paler due to whitish dusting and fine black hair, while the third segment is slender, slightly toothed, and darkened at the tip. The forehead is uniformly wide, covered with yellowish-brown dusting and a few black hairs, and is about six times longer than it is wide. A shiny reddish-brown, club-shaped frontal callus is present; it does not reach the eyes and extends as a narrow projection ending in a point slightly beyond the middle of the forehead. In some specimens it appears larger, possibly due to loss of surface covering. A shallow groove is present on each side of the upper part of the callus, converging toward the top of the head. Thorax blackish (Then denuded reddish), covered with greyish tomentum and black pubescence, indistinct grey stripes apparent, with traces of yellowish pubescence anteriorly, sides grey with white hairs, shoulders reddish with black hairs, breast covered with grey tomentum and white pubescence. Scutellum reddish with grey tomentum and black hairs, white hairs on borders. Abdomen dark reddish brown, usually redder on the anterior segments, covered with dense but short black pubescence on the stripe and spots with short white hairs; the spots are situated one on each side of the second segment, small and round, indications of one on the third segment are present, the stripe measuring nearly 1 mm. at its broadest from the first to sixth segment, sides straight; under side paler, reddish, with white and yellowish pubescence. Legs reddish, apices of fore tibiae and tarsi darker, femora with grey tomentum and chiefly white pubescence, tibiae and tarsi with chiefly black pubescence. Wings with the dark coloring very noticeable reaching the apex (Fig.4A).



Fig 4A: *Tabanus brunnipenis* adult fly

Host: Cattle, buffalo, bullocks and other herbivorous animals.

Observation: This fly is predominant during March to April and May to July and December to February. Preferably feed on fetlock region of cattle and Buffalo.

Discussion

In the present study, a total of 7 species belonging five genera were identified but here only 4 were mentioned and found to be prevalent in Warangal district viz., *T. indianus*, *T. rubidus*, *T. dorsiger*, *T. brunnipenis*.

The morphological characters of *T. indianus* was in concurrence with Ricardo (1911)^[9]; Kapoor *et al.*, (1990)^[4]; Veer (2004)^[5] and Vasudeva *et al.*, (2007b)^[7]. Similarly, the morphological identification of *T. brunnipenis* was in concurrence with Kapoor *et al.*, (1988); Veer (2004)^[5]; *T. rubidus* were in concurrence with Ricardo (1911)^[9]; Burton (1978); Kapoor *et al.*, (1990)^[4]; Veer (2004)^[5]; Vasudeva *et al.* (2007b)^[7]. Whereas *Tabanus dorsiger* had character in accordance with Banerjee *et al.*,

(2015) reported Maity *et al.*, (2016d) Maity *et al.*, (2017b)^[10] Maity *et al.*, (2017c)^[11], Maity *et al.*, (2020)^[12] from West Bengal. *Tabanus brunnipenis* was reported Sen *et al.*, (1962), Datta *et al.*, (1985), Kapoor *et al.*, (1990) from Punjab, Veer *et al* (2004)^[5], and Maity *et al.*, (2016)^[1,2]. *Tabanus occidentalis* was reported by Marques *et al.*, (2025) was reported in Brazil., Chávez *et al.*, (2024) from Mexico, Zamarchi *et al.*, (2023).

Conclusion

The availability of this region-specific identification key represents a valuable resource for entomologists, veterinarians, and vector biologists engaged in surveillance and biodiversity assessments. Furthermore, it will facilitate future ecological and epidemiological studies by supporting the accurate recognition of medically and veterinary important tabanid species. Given the role of tabanid flies as mechanical vectors of several pathogens, including parasitic and viral agents affecting livestock, the findings of this study contribute to a better understanding of their distribution and vector potential. Consequently, the identification key will serve as an important reference for monitoring tabanid populations, assessing disease risk, and implementing effective vector surveillance and control strategies in Telangana and other comparable agro-climatic regions.

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