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## Full length article

# Guidelines for user-friendly iconographic description of hematophagous flies' external morphology; application to the identification of *Tabanus rubidus* (Wiedemann, 1821) (Diptera: Tabanidae)

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## ABSTRACT

**Background:** The main hematophagous flies acting as mechanical vectors of pathogens in mammals are tabanids, stomoxiine flies and some hematophagous *Musca* spp. Species-identification using dichotomous keys is based on external morphology of the flies. Their proper use requires specific skills and confirmation by shipment of specimens to specific taxonomic area specialists. Although potentially very high (especially in tabanids: 4400 species), the species-diversity of biting flies in livestock is generally limited in a given area (on average 5–10 species). A quick and user-friendly identification would be useful to veterinary technicians to fill gaps in their knowledge and support any control program.

**Method:** Based on the facilities brought by numeric photography and the most frequent criteria used in the dichotomous entomologic keys, we generated guidelines to easily create a complete illustration of hematophagous flies external morphology, including dorsal, ventral and lateral views of whole body, head, antenna, thorax, wings, abdomen, legs and some other details, when necessary.

**Results:** Application was made through a series of 32 pictures allowing user-friendly description and identification of the female *Tabanus rubidus*, a common mechanical vector of pathogens in Asia.

**Conclusion:** These guidelines will help generating illustrated descriptions of hematophagous flies, which will ease their identification, even at distance. Further on, genotyping of the insects might be a nice complement. Once adopted, these guidelines might be a basis for a better knowledge of the identity, biology and ecology of the hematophagous flies encountered in livestock, and thus, for the development of adapted control measures.

## Background

Biting insects acting as mechanical vectors have been neglected for long, due to the priority given on biological vectors; however, experimental studies, mathematical models and recent reviews on these insects have somehow highlighted their importance as pests and vectors (Blahó et al., 2013; Baldacchino et al., 2014; Baldacchino et al., 2013; Dia, 1997; Desquesnes et al., 2005). These works have demonstrated

that the most important mechanical vectors in animals and humans are the highly abundant hematophagous large biting flies (hematophagous Brachycera flies): tabanids, stomoxiine flies and some hematophagous *Musca* spp. In livestock areas, veterinary and veterinary technicians are facing field situations where it is necessary to identify these insects, in order to propose adapted control measures. In such situation, they need to quickly get the skills and the capacity to identify the most frequent hematophagous insects present in livestock areas.

**Abbreviations:** G, Genus; s, species; g, gender; f, female; m, male; (d), dry; (n), natural color; CD, Complete dorsal view; CV, complete ventral view; CP, complete profile view; HC, head complete facial; HD, head dorsal view; HV, head ventral view; HF, head frons detail; HT, head top detail; HE, head eye detail; HL, head lower view; HP, head profile; HAD, Head, antenna dorsal; HAL, head, antenna lateral; HAM, head, antenna medial; TD, thorax dorsal; TV, thorax ventral; TP, thorax profile; AD, abdomen dorsal; AV, abdomen ventral; AP, abdomen profile; AT, terminal abdomen; WD, wing dorsal; WV, wing ventral; L1M, leg 1 lateral; L1M, leg 1 medial; L2P, leg 2 posterior; L2A, leg 2 anterior; L3M, leg 3 medial; L3L, leg 3 lateral; L2TS, Leg 2 distal tibia spurs; CDBr-BI, complete dorsal view of brown and black specimens; CVBr-BI, complete ventral view of brown and black specimens

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