

ANALYSIS OF THE BULGARIAN TABANID FAUNA WITH REGARD TO ITS POTENTIAL FOR EPIDEMIOLOGICAL INVOLVEMENT

D. J. GANEVA

Department of Biology, Faculty of Agriculture, Trakia University,
Stara Zagora; Bulgaria

Summary

Ganeva, D. J., 2004. Analysis of the Bulgarian tabanid fauna with regard to its potential for epidemiological involvement. *Bulg. J. Vet. Med.*, 7, No 1, 1–8.

A brief review of literature about the role of tabanids as biological and mechanical vectors of infections on domestic animals is made and the potential of the epidemiological involvement of the Bulgarian tabanid fauna is analysed. It is stated that the commonly distributed in Bulgaria *Chrysops caecutiens* (L.), *Hybomitra ciureai* (Seg.), *Tabanus autumnalis* L., *T. bovinus* L., *T. bromius* L. and *Haematopota pluvialis* (L.) are vectors of all or of some of the following diseases: tularaemia, anthrax, trypanozomiasis, anaplasmosis and brucellosis. The high number of *T. autumnalis*, *T. bromius* and *H. pluvialis*, and *H. ciureai* in some regions, as well as their continuous active period (from 3–4 to 5 months), are a true prerequisite for an active participation in epidemiological process as vectors and spreaders of infectious agents. The high incidence of those species in several regions in Bulgaria is a signal for potential epidemiological foci and the lack of similar studies up to now in Bulgaria motivated our interest in this direction.

Key words: infectious diseases, invasive diseases, potential foci, tabanids, vectors

INTRODUCTION

The blood-sucking insects from the Diptera order (tabanids, mosquitos, black flies, *Stomoxys* spp. etc.) had always been and are a center of attention because of their potential to carry the agents of several infectious and invasive diseases in both animals and humans (Foil and Hogsette, 1994; Dieguez Fernandez *et al.*, 1997; Strother, 1999; Papavero and Guimaraes, 2000; Trentini, 2001). In this respect, the role of tabanids is important. As early as the beginning of the last century, the first hypotheses and assumptions for the possible association of tabanids and transmissible diseases dynamics in animals were announced (Nagorsky, 1902). The

extension of knowledge on fauna, phenology and activity of tabanids contributes to the intensification of studies on their epidemiological involvement. According to Krinsky (1976), tabanids are biological or mechanical vectors of 34 causative agents of viral, bacterial, protozoal or helminthic infections in animals and humans. Polyakov *et al.* (1990) has shown that the role of tabanids as vectors of 27 diseases, including equine infectious anaemia, swine fever, anthrax, pyroplasmidosis, tularaemia, anaplasmosis, brucellosis, trypanozomiasis etc. is experimentally evidenced.

Despite the numerous studies on tabanids involvement in the mechanical transmission of pathogens, Chvala *et al.* (1972) and Foil (1989) has emphasized the necessity of continuation and broadening of studies in this direction.

The aim of the present survey is to make a short overview of literature referring to the role of tabanids as vectors of transmissible diseases and to perform an analysis of the potential of Bulgarian tabanid fauna as an epidemiological process contributor.

TABANIDS AS VECTORS OF PATHOGENIC AGENTS

Tabanids are blood-sucking insects that are fed both on healthy and sick animals, even on fresh cadavers (Olsufjev, 1977). The process of nutrition is often interrupted by the active defensive reactions of the host, so they attack again the same or another host to receive the blood meal needed for the development of eggs. Those biological and ethological features of tabanids are extremely important for their successful involvement in the transmission and spreading of pathogenic organisms. Thus, tabanids are defined as vector organisms according to the criteria of Foil (1989), reporting that they are distinguished by a high mobility, frequently interrupted pattern of feeding and large mouthparts, all being features characterizing those insects as very "good" vectors of pathogenic organisms.

The existing studies on tabanids as potential participants in the epidemiological process are concerned with various aspects of the problem – from the spontaneous or experimental evidences for the involvement of certain tabanid species in the mechanical transportation to studies upon the factors and the details of the

mechanisms of transmission of various pathogens via the variety of tabanid species (4154 known species according to Foil, 1989).

From the whole range of data on tabanids as vectors of pathogenic organisms, those confirming the relationship between this group of blood-sucking flies and domestic animal diseases, seen on the territory of Bulgaria, are of a particular interest. The anthrax, tularaemia, bovine leukosis, equine infectious anaemia, trypanozomiasis, the classical swine fever etc. are infections that are not only prevalent in Bulgaria, but the commonest subject of studies worldwide from the point of view of tabanids involvement in their incidence.

Anthrax bacilli

Nagorsky (1902) has directed the attention to tabanids as a primary vector in the transmission of anthrax bacillus (*B. anthracis*) on animals in the taiga and forest regions. With this regard, Olsufjev and Lelep (1935) observed that the peaks in the number of diseased and dead animals corresponded to the time of the peak activity of tabanids with a delay of about 10 days, that was highly indicative for their involvement in anthrax transmission. Moreover, the authors reported that *B. anthracis* could reside in tabanid proboscis between 5 and 7 days. Krinsky (1976) reported that the epizootics of skin anthrax were very frequently related to tabanids whereas Knowles Ralph (2002) discussed the role of interrupted feeding of tabanids in the transmission of the anthrax agent.

Those data combined with the biological features of tabanids, evidence the real potential of this family of insects to

influence the epizooties, caused by the *B. anthracis*.

Experimentally, 21 tabanid species from 5 genera were proven to be involved as vectors of anthrax: *Chrysops* (2 species), *Tabanus* (9 species), *Hybomitra* (6 species), *Atylotus* (1 species) and *Haematopota* (3 species) (Chvala *et al.*, 1972; Olsufjev, 1977). Among them, widely distributed in Bulgaria are *Chrysops caecutiens* (L), *Tabanus autumnalis* L., *T. bovinus* L., *T. bromius* L., *Hybomitra ciureai* (Seg.) and *Haematopota pluvialis* (L).

Tularaemia infection

Tabanids carry out the mechanical transmission of the tularaemia agent (*Franciscella tularensis*) as well (Soboleva, 1974; Olsufjev, 1977; Foil, 1989; Polyakov *et al.*, 1990). Olsufjev (1977) reported that they could transmit *Franciscella tularensis* up to 2–3 days after their contamination. Philip and Jellison (1986, cited after Foil, 1989) succeeded however to infect guinea pigs via *Chrysops noctifer pertinax* 26 days after sucking infected blood. The studies on tabanids in connection with tularaemia showed that the species *Chrysops relictus* Mg., *C. italicus* Mg., *T. autumnalis*, *T. bromius*, *Atylotus flavoguttatus* Szil. and *H. pluvialis* were naturally infected with *Franciscella tularensis* (Olsufjev, 1977), while 22 species from the *Chrysops*, *Tabanus*, *Hybomitra*, *Atylotus* and *Haematopota* genera were experimentally shown to be vectors of the disease (Chvala *et al.*, 1972). Nine from the species nominated by Chvala *et al.* (1972) and Olsufjev (1977) are encountered in Bulgaria, amongst them being the most abundant species *T. autumnalis*, *T. bromius*, *H. pluvialis*, and in some regions – *Hybomitra ciureai* (Ganeva, 1998).

Bovine leukosis virus

Some species of the *Tabanus* genus are successfully implicated into the transmission of a widely distributed animal disease – bovine leukosis. For the first time, Oshima *et al.* (1981, cited after Foil, 1989) succeeded to confirm the transmission of bovine leukosis virus from a cow with a permanent lymphocytosis to 2 sheep via *T. nipponicus* Murd.&Tak. Various aspects of the relationship between tabanids and the mechanisms of transmission of the disease are studies by Buxton *et al.* (1985), Foil *et al.* (1988a; 1989), Manet *et al.* (1989), Perino *et al.* (1990), Hasselschwert *et al.* (1993), Ishida *et al.* (1997), using species from the *Tabanus* and *Chrysops* genera. Foil *et al.* (1988a) and Foil (1989) not only proved the involvement of tabanids in the mechanical transmission of the virus, but also confirmed their role in the horizontal transmission of the disease. The results of their experiment are particularly indicative for the ability of tabanids, even in low counts, to transmit the bovine leukosis virus following feeding on a seropositive cow with permanent lymphocytosis. Manet *et al.* (1989) have also investigated the potential role of tabanids in the horizontal transmission of the disease. They observed a significant positive correlation between the level of disease incidence from one part and the activity and the density of tabanid populations on the other. These facts allowed them to suggest the extremely important role played by tabanids in the natural transmission of bovine leukosis.

Equine infectious anaemia virus

The role of tabanids in the epidemiology of equine infectious anaemia is not less important (Soboleva, 1974; Kemen *et al.*,

1978; Foil *et al.*, 1988b; Foil, 1989; Polyakov *et al.*, 1990; Green *et al.*, 1996). According to Polyakov *et al.* (1990) *Tabanus maculicornis* Zett and *Hybomitra borealis* Fabr. /= *lapponica* (Vanh.) are vectors of the equine infectious anaemia virus and under experimental conditions, the species of the *Chrysops*, *Atylotus*, *Hybomitra*, *Tabanus* and *Haematopota* genera could also exhibit a potential of vectors. Foil *et al.* (1988b) and Foil (1989) reported that those blood-sucking flies could realize the virus transfer from febrile, afebrile and inapparent donors. The species from the *Tabanus*, *Hybomitra* and *Chrysops* genera were among the commonest vectors. The authors discussed not only the differences in the sensitivity of the different age groups to the tabanid attack, but also the potential of the various tabanid species to move from one host to another during feeding and thus to transmit the pathogens. The tabanid cenosis in one pasture is represented by species differing in size, ingested amount of blood, endurance in host pursuit, saliva toxicity etc. that determine their various epidemiological involvement. The differences in the potential of the various tabanid species to transmit pathogens, stated by Foil *et al.* (1988b) and Foil (1989), encourage the future studies in this direction.

Causative agents of other diseases

Literature data show undoubtedly the participation of tabanids in the transmission also of other diseases such as trypanosomiasis (Soboleva, 1974; Olsufjev, 1977; Böse *et al.*, 1987a; Böse *et al.*, 1987b; Foil, 1989; Polyakov *et al.*, 1990; Dirie *et al.*, 1990; Solano and Amaleer-Delafosse, 1995; Kashiwazaki *et al.*, 1998; Quieroz *et al.*, 2000), anaplasmosis (Soboleva, 1974; Foil, 1989; Polyakov *et al.*, 1990),

spiroplasmoses (Le Goff *et al.*, 1991; Vazeille-Falkoz *et al.*, 1997; Helias *et al.*, 1998; Moulder *et al.*, 2002), swine fever (Olsufjev, 1977; Polyakov *et al.*, 1990), loiasis (Olsufjev, 1977; Chippaux *et al.*, 2000; Cheke *et al.*, 2003) etc.

The information about the role and the specificity of the performance of several arthropods (tabanids, mosquitos, ticks etc.) as vectors of both human and animal diseases attract the attention of specialists to the creation of information system for control of arthropod vectors (Thomson and Conor, 2000).

The brief review of existing studies confirms the importance of the Tabanidae family from the point of view of veterinary medicine and also points out the unsolved problems related to tabanids involvement in the transmission of infections on domestic animals.

POTENTIAL OF THE BULGARIAN TABANID FAUNA FOR EPIDEMIOLOGICAL INVOLVEMENT

The Bulgarian tabanid fauna is represented by 72 species and subspecies (Ganeva, 1998; Ganeva, 2000). According to the literature data, 16 species out of them, are natural or experimentally revealed vectors of various pathogenic organisms. They belong to 5 genera: *Chrysops* (4), *Atylotus* (2), *Hybomitra* (2), *Tabanus* (6) and *Haematopota* (2). The *C. caecutiens*, *H. ciureai*, *T. bovinus*, *T. autumnalis*, *T. bromius* and *H. pluvialis* species are widely distributed in Bulgaria (Drensky, 1929; Triphonov *et al.*, 1964; Ganeva, 1998), whereas the last three species are characterized by their numerous populations. The number of *H. ciureai* (Ganeva, 1998) and *T. bovinus* (Triphonov *et al.*, 1964) species in some regions are also great. With the exception of *T.*

bovinus, all other species are reported to be vectors of tularaemia and anthrax at the same time (Chvala *et al.*, 1972; Olsufjev, 1977). Besides in the transmission of anthrax (Chvala *et al.*, 1972), *T. bovinus* is known to participate in the spread of anaplasmosis (Soboleva, 1974), trypanozomiasis (Olsufjev, 1977), emphysematous carbuncle and brucellosis (Polyakov *et al.*, 1990). Vectors of brucellosis are also *T. glaucopsis* Mg. and *H. pluvialis* (Polyakov *et al.*, 1990). In the biotopes of the region of Stara Zagora that meet the ecological requirements, *T. glaucopsis* fly populations are numerous that is especially important with regard to the participation of the species in pathogen transmission (Ganeva, 1998).

The most abundant species *T. bromius* and *H. pluvialis* together with *Hybomitra micans* (Mg) and *Haematopota italica* Mg., also elements of our fauna, are reported to be vectors of *Trypanosoma theileri* in Germany (Böse *et al.*, 1987a). *T. glaucopsis* is also successfully involved in the transmission of *T. theileri* (Soboleva, 1974). Five species of Bulgarian fauna, including the dominating *T. bromius* and *H. pluvialis*, are experimentally proven to be vectors of anaplasmosis in ruminants (Soboleva, 1974).

Therefore, the widely distributed and most abundant tabanid species in Bulgaria are reported to be vectors of anthrax, tularaemia, brucellosis, trypanozomiasis etc.

From the point of view of tabanid involvement in epidemiology, the most abundant species *T. autumnalis*, *T. bromius* and *H. pluvialis* as well as the species with numerous populations in some regions in Bulgaria – *T. bovinus* (Triphonov *et al.*, 1964), *T. glaucopsis* and *H. ciureai* (Ganeva, 1998) are of particular interest. The ability of those species to transmit effectively several infectious agents is a

very serious signal for their potential for active participation in the epidemiology of transmissible diseases, especially in the peak period of the seasonal activity of tabanids. The data from previous studies of ours (Ganeva, 1998) show that during the peak in the seasonal activity of tabanids in the region of Stara Zagora, between 210 and 445 flies were trapped per hour from one experimental animal in the pastures of Kanchevo and Oryahovitsa. The fact that only on one leg of a cow, about 32-40 flies, primarily from the *Tabanus* species could be counted, is highly indicative for the abundance of populations.

Six species of this genus are known as vectors of pathogenic organisms, including the most abundant *T. autumnalis* and *T. bromius*. The *Tabanus* species are characterized with a high efficacy in the transmission of infectious agents. The data summarized by Foil *et al.* (1988b) about the transfer of the equine infectious anaemia virus show that it needs between 1–6 flies whereas the bovine leukosis virus – between 50–131 flies depending on the clinical status of the donor.

In conclusion, the potential of tabanids in Bulgaria for participation in the epidemiological process is considerable. The presence of foci of tularaemia, anthrax, bovine leukosis, swine brucellosis etc., from one part and the high number of tabanids and their efficacy in the transfer of pathogens from the other as well as the lack of studies in this connection in our country are a prerequisite for future investigations.

REFERENCES

- Böse, R., K. Friedhoff, S. Olbrich, G. Buscher and I. Domeyer, 1987a. Transmission of *Trypanosoma theile-*

- ri* to cattle by Tabanidae. *Parasitology Research*, **73**, No 5, 421–424.
- Böse, R., K.Friedhoff and S. Olbrich, 1987b. Transmission of *Megatrypanum* trypanosomes to *Cervus dama* by Tabanidae. *The Journal of Protozoology (USA)*, **34**, No 1, 110–113.
- Buxton, B. A., N. C. Hinkle and R. D. Schultz, 1985. Role of insects in the transmission of bovine leucosis virus: Potential for transmission by stable flies, horn flies and tabanids. *American Journal of Veterinary Research*, **46**, No 1, 123–126.
- Cheke, R., J. Mas and J. Chainey, 2003. Potential vectors of loiasis and other tabanids on the island of Bioko, Equatorial Guinea. *Medical and Veterinary Entomology*, **17**, No 2, 221–223.
- Chippaux, J., B. Bouchite, M. Demanou, I. Morlais and G. Le Goff, 2000. Density and dispersal of the loiasis vector *Chrysops dimidiata* in Southern Cameroon. *Medical and Veterinary Entomology*, **14**, No 3, 339–344.
- Chvala, M., L. Lyneborg and J. Mouha, 1972. The Horse Flies of Europe (Diptera, Tabanidae). Copenhagen, pp. 500.
- Dieguez Fernandez, L., L. Rodriguez Gonzalez and C. Sanchez Alonso, 1997. New report of insects of medical importance for the north-eastern island chain of Camaguey. Preliminary report. *Revista Cubana de Medicina Tropical*, **49**, No 2, 139–141.
- Dirie, M. F., S. Bornstein, K. R. Wallbanks, J. K. Stiles and D. H. Molyneux, 1990. Zymogram and life-history studies on trypanosomes of the subgenus *Megatrypanum*. *Parasitology Research*, **76**, No 8, 669–674.
- Drensky, P., 1929. Blood-sucking flies of fam.Tabanidae (obody) in Bulgaria. *Bulletin of the Royal Institutes of Natural Sciences*, No 2, 55–128 (BG).
- Foil, L. D., 1989. Tabanids as vectors of disease agents. *Parasitology Today*, **5**, No 3, 88–96.
- Foil, L. D., L. C. Seger, D. D. French, C. J. Issel, J. M. McManus, C. L. Ohrberg and R. T. Ramsey, 1988a. Mechanical transmission of bovine leukemia virus by horse flies /Diptera: Tabanidae/. *Journal of Medical Entomology*, **25**, No 5, 374–376.
- Foil, L. D., W. V. Adams, J. M. McManus and C. J. Issel, 1988b. Quantifying the role of horse flies as vectors of equine infectious anemia. In: Equine Infectious Diseases V, Proceedings of the Fifth International Conference, University Press of Kentucky, pp. 189–195.
- Foil, L. D., D. D. French, P. G. Hoyt, C. J. Issel, D. J. Leprince, J. M. McManus and C. L. Seger, 1989. Transmission of bovine leukemia virus by *Tabanus fuscicostatus*. *American Journal of Veterinary Research*, **50**, No 10, 1771–1773.
- Foil, L. D. and J. A. Hogsette, 1994. Biology and control of tabanids, stable flies and horn flies. *Revue Scientifique et Technique de l'Office International des Epizooties*, **13**, No 4, 1125–1158.
- Ganeva, D., 1998. Fauna, phenology and activity of blood sucking tabanids (Tabanidae, Diptera) in Stara Zagora region. PhD thesis, Trakia University, Stara Zagora, 1–215 (BG).
- Ganeva, D., 2000. New data about the tabanids (Diptera: Tabanidae) from Bulgaria. *Travaux du Museum Natio-*

- nal d'Histoire Naturelle "G. Antipa", XLII, 133–142.
- Green, B., L. Foil, S. Hagius and C. Issel, 1996. Stability of equine infectious anemia virus in *Aedes aegypti* (Diptera: Culicidae), *Stomoxys calcitrans* (Diptera: Muscidae) and *Tabanus fuscicostatus* (Diptera: Tabanidae) stored at –70 degrees C. *Journal of American Mosquitous Control Association*, **12**, No 2, 334–336.
- Hassenschwert, D. L., D. D. French, L. J. Hribar, D. G. Luther, D. J. Leprince, M. J. Van der Maaten, C. A. Whetstone and L. D. Foil, 1993. Relative susceptibility of beef and dairy calves to infection by bovine leukemia virus via tabanid (Diptera: Tabanidae) feeding. *Journal of Medical Entomology*, **30**, 472–473.
- Helias, C., M. Vazeille-Falcoz, F. Le Goff, M. L. Abalain-Colloc, F. Rodhain, P. Carle, R. F. Whitcomb, D. L. Williamson, J. G. Tully, J. M. Bove and C. Chastel, 1998. *Spiroplasma tauronicum* sp. nov. from Haematopota horse flies (Diptera: Tabanidae) in France. *International Journal of Systematic Bacteriology*, **48**, No 2, 457–461.
- Ishida, H., N. Wakabayashi, H. Honma, R. Higuchi, T. Watanabe, M. Nabeya and J. Toriya, 1997. Isolation of bovine leukemia virus from *Tabanus trigeminus* sucking blood of BLV-seropositive cattle. *Journal of the Japan Veterinary Medical Association*, **50**, No 9, 519–522.
- Kashiwazaki, Y., M. Pholpark, C. Polsar and S. Pholpark, 1998. Haemoparasite infections in newly introduced dairy cattle in Loei Province, Thailand: *Trypanosoma evansi* antigen levels by ELISA referring to abortion. *Veterinary Parasitology*, **80**, No 2, 99–109.
- Kemen, M. J., D. S. McClain and J. G. Malthysse, 1978. Role of horse flies in transmission of equine infectious anemia from carrier ponies. *Journal of the American Veterinary Medical Association*, **172**, 360–362.
- Knowles Ralph, C., 2002. Anthrax affects everyone. [Online.] www.xcode-sing.com (20.04.2003 date last accessed).
- Krinsky, W. L., 1976. Animal disease agents transmitted by horse flies and deer flies (Diptera: Tabanidae). *Journal of Medical Entomology*, **13**, No 3, 225–275.
- Manet, G., X. Guilbert, A. Roux, A. Vuillaume and A. L. Parodi, 1989. Natural mode of horizontal transmission of bovine leukemia virus (BLV): the potential role of tabanids (*Tabanus* spp.). *Veterinary Immunology and Immunopathology*, **22**, No 3, 255–263.
- Moulder, R. W., F. E. French and C. J. Chang, 2002. Simplified media for spiroplasmas associated with tabanid flies. *Canadian Journal of Microbiology*, **48**, No 1, 1–6.
- Le Goff, F., I. Humphery-Smith, M. Leclercq and C. Chastel, 1991. Spiroplasmas from European Tabanidae. *Medical and Veterinary Entomology*, **5**, No 1, 143–144.
- Nagorsky, V., 1902. The experience of epizootology as a science of reasons and processes of infectious animal disease's epidemiology. Anthrax. *Archives of Veterinary Science*, **7**, 1–48, (Ru).
- Olsufjev, N., 1977. Tabanidae. In: Fauna SSSR. **7**, No 2, 1–434, Nauka, Leningrad (RU).

- Olsufjev, N. and P. Lelep, 1935. Role of tabanids in distribution of anthrax. In: Parasites, Vectors and Poisonous Animals, Moskow, 145–197 (Ru).
- Papavero, N. and J. H. Guimaraes, 2000. The taxonomy of Brazilian insects vectors of transmissible diseases (1900–2000) – then and now. *Memory of the Institute Oswaldo Cruz*, **95**, Suppl. 1, 109–118.
- Perino, L. J., R. E. Wright, K. L. Hoppe and R. W. Fulton, 1990. Bovine leukosis virus transmission with mouthparts from *Tabanus abactor* after interrupted feeding. *American Journal of Veterinary Research*, **51**, No 8, 1167–1169.
- Polyakov, V. A., V. Anisimovich, U. Uzakov and G. Veselkin, 1990. Tabanidae. In: Veterinary Entomology and Arachnology, Agropromizdat, Moscow, 14–19.
- Quiroz, A. O., N. S. Nehme-Russell, A. Brandao and A. M. Jansen, 2000. Homogeneity of *Trypanosoma evansi* isolates from domestic and sylvatic mammals from the Pantanal of Mato Grosso. *Microbios*, **103**, No 404, 27–30.
- Soboleva, R., 1974. Tabanids /Diptera, Tabanidae/ in the South Maritime Region. Nauka, Novosibirsk, pp. 230 (RU).
- Solano, P. and S. Amaleer-Delafosse, 1995. *Trypanosoma congolese* in different species of horse flies (Diptera: Tabanidae) in Burkina Faso. *Révue d'Élevage et de Médecine Vétérinaire des Pays Tropicaux*, **48**, No 2, 145–146.
- Strother, S., 1999. Tabanids (Horseflies). *Dermatology Online Journal*, **5**, No 2, 6.
- Thomson, M. and S. Connor, 2000. Environmental information systems for the control of arthropod vectors of diseases. *Medical and Veterinary Entomology*, **14**, No 3, 227–244.
- Trentini, M., 2001. Diptera Brachycera horse parasites in a stable/manege in northern Italy. *Parassitologia*, **43**, No 4, 169–171.
- Triphonov, T., S. Pachev and S. Meshkov, 1964. Species composition, seasonal dynamics and distribution of Tabanidae in South-Eastern Bulgaria. *Veterinary Medicine (Sofia)*, **1**, No 3, 47–60 (BG).
- Vazeille-Falcoz, M., C. Haelias, F. Le Goff, F. Rodhain and C. Chastel, 1997. Three spiroplasmas isolated from *Haematopota* sp. (Diptera: Tabanidae) in France. *Journal of Medical Entomology*, **34**, No 2, 238–241.

Paper received 15.05.2003; accepted for publication 04.02.2004

Correspondence:

Dr. D. J. Ganeva
Dept. of Biology,
Faculty of Agriculture,
Trakia University,
6000 Stara Zagora, Bulgaria