

Original papers

Occurrence of *Hippobosca equina* in Polish primitive horses during the grazing season

Rajmund Sokół, Mirosław M. Michalski

Department of Parasitology and Invasive Diseases, Faculty of Veterinary Medicine, University of Warmia and Mazury, Oczapowskiego 13, 10-719 Olsztyn, Poland

Corresponding author: Rajmund Sokół; e-mail: sokol@uwm.edu.pl

ABSTRACT. The presence of *Hippobosca equina* strongly influences the behaviour and health status of horses. The aim of the study was to analyse the invasion dynamics of the forest fly in Polish primitive horses (*Equus caballus gmelini*) in the Popielno Forest Reserve (northeastern Poland). Observations were carried out from May to September, every two weeks for two consecutive years (2012 and 2013) in five study groups: in 11–12-year-old mares with foals, 6–7-year-old leading stallions, 1.5-year-old fillies, 1.5-year-old colts and 9–10-year-old working geldings. Adult *H. equina* were counted in the preferred sites of their occurrence. The highest prevalence was observed from mid-June to the end of July, at average air temperature was 21°C. Forest flies most frequently affected working geldings, leading stallions, and 1.5-year-old colts. The highest intensity of infection was found in working geldings (28 to 34 insects per animal), in 1.5-year-old colts (10 to 16 insects) and in mares with foals (4 to 14 insects).

Key words: Hippoboscidae, *Hippobosca equina*, Polish primitive horses, Konik polski

Introduction

Hippobosca equina Linnaeus, 1758 is an insect from the order Diptera, family Hippoboscidae, commonly known as the forest fly. Its body is 7–9 mm long, brown, dorsoventrally flattened, with light spots or stripes on the head and thorax. The eyes are compound, its piercing-sucking mouthparts are adapted to sucking host blood from several to over ten times a day. Single-segment antennae are positioned in the concavity of the head, with three black bristles on their end. The thorax and abdomen are without pronounced segmentation, and covered with red hairs. It has large, strong, colourless wings on the thorax, usually overlapping and covering the abdomen while the insect is feeding. The limbs are strong, long, and set wide apart, ending with tarsal claws and arolia. Due to its very strong chitin exoskeleton the insect is called the “iron fly”. The forest fly is an ectoparasite of warm-blooded animals. Disturbed adult insects promptly fly away to find a new feeding site. About 5 mm long larvae hatch inside females and are usually deposited in the

cracks of walls, on the ceiling, in mangers and other places in the stable, or outdoors on the ground. Larvae, after a quick pupal metamorphosis, are yellow and white, turn brown after 3–4 days, and are then almost black and glossy. Adult insects (imago) emerge from pupas after 3–6 weeks. Females deposit 10–15 larvae during their life cycle. In temperate climates usually one generation develops per year, and it may winter in the form of pupa or imago [1,2].

H. equina feeds on blood and is active on warm days. It mainly affects horses, but has also been found on cattle, dogs, hares, birds and even humans. In Poland it is known to affect the European bison, deer and elk in Białowieża Forest and Augustowski District and is also reported in Pomerania, Mazurian Lake District, Mazovia, Silesia, Baltic coast and in the Western Beskid, Tatras and Pieniny Mountains [4,5]. In animals, forest flies attack areas with sensitive skin: around the anus and perineum, and the inner surface of the thighs in horses, under the lower part of the vulvar labia in fillies, and on the skin between the tail and ischial tuberosities in cattle.

Adult insects emerge in summer and autumn, and are very agile and fast flyers. Forest fly bites are very painful and disturbing to the host. Attacked animals rub against various objects (stable walls, pasture fencing, tree trunks, etc.), and often wave their tail nervously. Attacked horses, for example, run wild, which often ends with limb fractures [1,5–8]. Studies carried out on the family Hippoboscidae were focused on the role of these insects in ruminants and horses as vectors of *Bartonella* spp., and on the role of *H. equina* in transmitting *Besnoitia besnoiti* (Marotel, 1912) in herds of dairy cattle [3,9]. Data on the occurrence and invasion dynamics of *H. equina* in Poland are relatively limited. Therefore, the aim of this study was to analyse the invasion dynamics/occurrence of *H. equina* in Polish primitive horses during the grazing season based on a two-year-long observation.

Materials and Methods

The study was carried out on Polish primitive horses, also known as the Konik polski (*Equus caballus gmelini* Antonius, 1912, form *silvatica* Vet.) in the Popielno Forest Reserve, northeastern Poland. The Konik polski is a Polish breed that was back-selected from primitive horses to restore the wild-type conformation, coat and behaviour of wild Tarpan horses, crossed in the 17th century with local equine populations [2]. This is a late-maturing horse breed which is resistant to diseases and difficult environmental conditions. Observations were carried out in 5 groups kept in a conservative breeding herd: 11–12-year-old mares with foals, 6–7-year-old leading stallions, 1.5-year-old fillies, 1.5-year-old colts and 9–10-year-old working geldings. The study was carried out from May to September every two weeks for two consecutive grazing seasons (in the years 2012 and 2013). Forest flies were counted each time for 30 min starting at 11.00 a.m. When counting the flies, horses were kept in a limited and fenced area. Feed was provided in a feeding rack to limit animal mobility, and the distance to animals from a disguised observation post allowed for the identification of insects. Forest flies were counted in the preferred sites of their occurrence, i.e. around the anus and perineum. Air temperature was also recorded on each observation day. A few Hippoboscidae flies were collected and taxonomically identified under a stereo microscope [4,10]. The number of *H. equina* identified on

horses is presented in Tables 1 and 2.

Results and Discussion

In the first study year the invasion of *H. equina* was observed in all analysed groups from the first week of June. The prevalence in the group of mares with foals was 6.2% to 31.2%, and 14.3% to 71.4% in leading stallions, 6.7% to 26.7% in 1.5-year-old fillies, 5.3% to 26.3% in 1.5-year-old colts and 14.3% to 85.7% in working geldings. The invasion of forest flies lasted for the longest time in 1.5-year-old fillies (until 20 August) and working geldings (until 10 September), and for the shortest time in leading stallions (until the end of July). The highest intensity of infection of forest flies in all animal groups was observed for the temperature range of 20°C to 25°C between the end of June and end of July. From 1 to 4 forest flies were recorded on mares with foals and leading stallions, and from 1 to 34 flies on working geldings. In working geldings the highest intensity of *H. equina* was found on 30 June (4 to 34 insects) and on 10 July (2 to 28 insects), and in 1.5-year-old colts on 28 July (1 to 16 insects) (Table 1).

In the second study year the infestation with *H. equina* was observed early in mares with foals and in working geldings (from 20 May), but later (from 13 June) in other analysed groups. The infestation period was the longest in working geldings (until 2 and 18 September) and in leading stallions (until 18 September, with no infestation in early September). The prevalence was 6.2% to 31.2% in mares with foals, 14.3% to 28.6% in leading stallions, 6.2% to 31.2% in 1.5-year-old fillies, 14.3% to 57.1% in 1.5-year-old colts and 42.8% to 100% in working geldings. The highest intensity of infection of the forest fly in all animal groups was observed from mid-June to the end of July for the temperature range of 19°C to 30°C. The most intensive infection was found in working geldings (1 to 28 insects), 1.5-year-old colts (1 to 10 insects) and mares with foals (1 to 14 insects). The lowest intensity was found in 1.5-year-old fillies (1 to 4 insects) (Table 2).

Because of the very limited information in the available literature on the invasion dynamics of *H. equina* in Polish primitive horses our findings cannot be compared with those of other authors. Kadulski [11] started the observations at 11.00 a.m. and demonstrated high diurnal motoric activity of *Lipoptena cervi* (Linnaeus, 1758) (Hippoboscidae) on roe-deer.

Table 1. The occurrence of infection of *H. equina* in Polish primitive horses during the grazing season (the first study year)

Group animals	May		June				July				August		September	
	Terms of research													
	The temperature (C°) at 11.30 a.m.													
	18°	21°	21°	20°	20°	20°	25°	18°	20°	20°	18°			
Mares with foals n=16	–	3(18.7%) ¹ (1-4) ²	1(6.2%) (1)	2(12.5%) (1)	2(12.5%) (1)	4(25%) (1-4)	5(31.2%) (1-2)	1(6.2%) (1)	–	–	–	–	–	
Leading stallions n=7	–	1(14.3%) (1)	1(14.3%) (1)	2(28.6%) (1-2)	5(71.4%) (1-4)	3(42.8%) (2-5)	3(42.8%) (1-3)	–	–	–	–	–	–	
1.5-year-old fillies n=15	–	1(6.7%) (1)	2(13.3%) (1)	4(26.7%) (1-2)	3(20%) (1-4)	1(6.7%) (1)	1(6.7%) (1)	3(20%) (2-4)	1(6.7%) (1)	–	–	–	–	
1.5-year-old colts n=19	–	1(5.3%) (1)	5(26.3%) (1-2)	5(26.3%) (1-2)	2(10.5%) (2-3)	1(5.3%) (3)	5(26.3%) (1-16)	2(10.5%) (2-9)	–	–	–	–	–	
Working geldings n=7	–	1(14.3%) (3)	6(85.7%) (2-7)	5(71.4%) (4-3-4)	5(71.4%) (2-28)	2(28.6%) (5-6)	2(28.6%) (1-6)	2(28.6%) (1-2)	1(14.3%) (1)	2(28.6%) (1-3)	–	–	–	

Explanations: ¹number of infested hosts in the study group (prevalence %), ²intensity range

Table 2. The occurrence of infection of *H. equina* in Polish primitive horses during the grazing season (the second study year)

	May		June			July			August		September	
	Terms of research											
	30	13	26	30	6	21	31	11	20	2	18	
Group animals	The temperature (C°) at 11.30 a.m.											
	20°	18°	19°	16°	18°	20°	30°	22°	20°	25°	18°	
Mares with foals n=16	1(6.2%) (2)	4(25%) (1-2)	4(25%) (1-3)	5(31.2%) (2-3)	1(6.2%) (1)	1(6.2%) (3)	2(12.5%) (5-7)	5(31.2%) (1-14)	4(25%) (1-3)	-	-	
Leading stallions n=7	-	1(14.3%) (1)	1(14.3%) (2)	1(14.3%) (3)	1(14.3%) (2)	2(28.6%) (1)	1(14.3%) (5)	1(14.3%) (5)	1(14.3%) (6)	-	1(14.3%) (1)	
1.5-year-old fillies n=16	-	1(6.2%) (1)	1(6.2%) (1)	1(6.2%) (1)	1(6.2%) (1)	5(31.2%) (1-4)	4(25%) (1-2)	-	-	-	-	
1.5-year-old colts n=7	-	1(14.3%) (1)	1(14.3%) (1)	4(57.1%) (2-3)	4(57.1%) (3)	21(28.6%) (2-8)	21(28.6%) (5-10)	1(14.3%) (10)	1(14.3%) (9)	-	-	
Working geldings n=7	6(85.7%) (1-7)	7(100%) (1-12)	7(100%) (1-28)	7(100%) (3-20)	6(85.7%) (1-9)	7(100%) (1-9)	3(42.8%) (1-9)	3(57.1%) (1-5)	4(14.3%) (1-6)	3(42.8%) (1-9)	3(42.8%) (1-12)	

In the first year of our observation the highest prevalence of *H. equina* was found in Polish primitive horses between 17 June and 28 July in working geldings and leading stallions (85.7% and 71.4%, respectively). The highest number of forest flies per animal was noted for working geldings (34 insects) and 1.5-year-old colts (16 insects).

In the second year of observation the highest prevalence of *H. equina* was found in all study groups between 13 June and 10 August. Infestation with forest flies was observed in mares with foals and working geldings as early as at the end of May. High rates of infestation with forest flies were also noted in September. The highest prevalence were found in working geldings and leading stallions (100%) and 1.5-year-old colts (57.1%). The highest number of forest flies per animal was noted also for working geldings (28 insects) and mares with foals (14 insects). In the two study groups (leading stallions and 1.5-year-old fillies) a relatively stable rate of infested animals was observed as compared to the previous year (14.3% for leading stallions and 6.2% for 1.5-year-old fillies on most observation dates). Air temperature influenced on the intensity of infection of Polish primitive horses with the forest fly, and the highest prevalence was observed from mid-June to the end of July, at an average air temp. of 21°C. This corresponds with data reported by Romaniuk et al. [12], who indicated the highest activity of the forest fly in the afternoon, at an air temperature of 25–30°C.

The carried out observations revealed that the infestation of animals with *H. equina* between May and September differed depending on the horse's breeding group and sex. There were also differences in the number of forest flies found on the horse's body on subsequent observation days. Insects most frequently infested working geldings, leading stallions, 1.5-year-old colts and mares with foals. Studies carried out by Romaniuk et al. [12] in the last ten days of July demonstrated, however, that *H. equina* most frequently affects 3-8-year-old mares, 1.5-2-year-old fillies and colts, and, the least frequently, sucking foals. Their study also demonstrated the highest prevalence in 1.5-2-year-old fillies (73.3%) and 1.5-2-year-old colts (66.7%), and in 3-18-year-old mares (26.6%). The mean number of insects per animal was 1.4 in mares, 5.4 in colts and 5.3 in fillies. In our study the highest intensity was found in working geldings (28 to 34 insects per animal), in 1.5-year-old colts (10 to 16 insects) and in mares with foals (4 to 14 insects).

The studies provided evidence for the presence of *H. equina* in herds of Polish primitive horses in Poland, and the identified invasion dynamics indicate a quite considerable prevalence and intensity of infection in animals during the grazing season. Infestation of Polish primitive horses with the forest fly impairs animal health, which is manifested, for example, by skin inflammation in the area of the anus and vulvar labia, and considerable pain.

References

- [1] Furmaga S. 1985. Choroby pasożytnicze zwierząt domowych. PWRiL, Warszawa.
- [2] Górecka-Bruzda A., Suwała M., Palme R., Jaworski Z., Jastrzębska E., Boroń M., Jezierski T. 2015. Events around weaning in semi-feral and stable-reared Konik polski foals: Evaluation of short-term physiological and behavioural responses. *Applied Animal Behaviour Science* 163: 122-134.
- [3] Liénard E., Salem A., Grisez C., Prévot F., Bergeaud J. P., Franc M., Gottstein B., Alzieu J. P., Lagalisse Y., Jacquet P. 2011. A longitudinal study of *Besnoitia besnoiti* infections and seasonal abundance of *Stomoxys calcitrans* in a dairy cattle farm of southwest France. *Veterinary Parasitology* 177: 20-27.
- [4] Kadulski S. 1975. Ectoparasites of Polish artiodactylous game animals. *Acta Parasitologica Polonica* 23: 493-535.
- [5] Piotrowski F. 1980. Pasożyty zewnętrzne przeżuwaczy domowych i łownych. Monografie Parazytologiczne. PWN, Warszawa.
- [6] Gundlach J. L., Sadzikowski A. B. 2004. Parazytologia i parazytozy zwierząt. PWRiL, Warszawa.
- [7] Kadulski S. 1970. Materiały do znajomości Hippoboscidae (Diptera-Pupipara) ssaków użytkowych Polski. *Wiadomości Parazytologiczne* 16: 473-477.
- [8] Kazimierczak K., Górski P. 2007. Narzępikowate w Polsce – biologia i znaczenie. *Życie Weterynaryjne* 82: 51-52.
- [9] Halos L., Jamal T., Maillard R., Girard B., Guillot J., Chomel B., Vayssier-Taussat M., Boulouis H-J. 2004. Role of Hippoboscidae flies as potential vectors of *Bartonella* spp. infecting wild and domestic ruminants. *Applied and Environmental Microbiology* 70: 6302-6305.
- [10] Borowiec L. 1984. Klucze do oznaczania owadów Polski. Część XXVIII. Muchówki – Diptera. Zeszyt 77, Wpleszczowate – Hippoboscidae. PWN, Warszawa.
- [11] Kadulski S. 1989. Dobowa aktywność ruchowa *Lipoptena cervi* (L.) (Hippoboscidae: Diptera). *Wiadomości Parazytologiczne* 35: 603-605.
- [12] Romaniuk K., Gad K., Kiszka W. 2007.

Występowanie muchówki *Hippobosca equina* u koników polskich. *Medycyna Weterynaryjna* 63: 1100-1101.

Received 26 April 2015

Accepted 29 May 2015