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RESEARCH

First record of *Haematobia irritans* (L.) (Diptera: Muscidae) infesting cattle in Northeastern Algeria

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Abstract

Haematobia irritans (L.) is a haematophagous ectoparasite considered one of the most economically damaging pests of cattle, as it causes a decrease in milk production, growth retardation in calves due to reduced weaning weight, and weight loss in adult cattle. These flies can also transmit pathogenic agents. This study reports the first record of *H. irritans* in northeastern Algeria, in the wilayas of Mila and Guelma, during the active season of the insect from May to September in 2021 and 2022. A total of 181 cattle of various breeds, sexes, and ages were examined, and 1040 adult *H. irritans* specimens were collected. Among the examined cattle, 64 were found to be infested and were selected for detailed analysis. Adult flies were collected using sweep nets and tubes, pinned, and stored in collection boxes. Detailed data on cattle age, breed, and sex were recorded. Morphological identification was performed under a stereomicroscope confirming all specimens as *H. irritans*. Statistical analysis using the Kruskal-Wallis test revealed no significant differences in infestation according to age, sex, or breed of the cattle. The geographical distribution showed that 60% of the specimens originated from Guelma and 40% from Mila, indicating higher infestation pressure in Guelma. These results provide the first confirmed evidence of *H. irritans* in this region, highlight the potential impact on cattle health, and emphasize the need for further studies and the development of targeted control strategies.

Keywords Haematobia irritans · Cattle · Morphological identification · Ectoparasite · Diptera · Algeria

Introduction

Haematobia irritans (Linnaeus, 1758) is a blood-sucking ectoparasite specific to cattle and is responsible for significant economic and zootechnical losses. In yearlings, infestations can cause weight loss of up to 18% (Haufe 1982), while in cows, milk production decreases, indirectly reducing calf growth. The massive presence of these flies forces cattle into energy-intensive defensive behaviors, leading to increased heart and respiratory rates, reduced grazing time, and lower feed efficiency, ultimately decreasing production performance (Kunz et al. 1991; De Rouen et al. 2003). Reported losses include 27 kg of milk per cow per year in the United States (Kunz et al. 1991), 3.25 kg of weight per animal per year in Brazil (Bianchin and Alves 2002), and 0.028 kg per head per day in Argentina (Guglielmone et al. 2001). Control costs are also substantial, reaching 60 million dollars annually in Nebraska alone (Boxler et al. 2018), with total U.S. dairy losses estimated at 1.75 billion dollars in 2016 (Kunz et al. 1991). Similarly, in Mexico, annual losses due to infestations were estimated at 231.66 million dollars (Rodríguez-Vivas et al. 2017).

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This fly, commonly known as the "horn fly," is specific to cattle, and adult males tend to cluster around the horns of the host. This specificity in cattle is due to compounds naturally detected by specialized olfactory receptor neurons, located on the antennae or maxillary palps of *Haematobia irritans* (Espinoza et al. 2025). It can occur in the thousands, causing dermal lesions particularly near the medial canthus of the eye, as well as along the neck and abdomen (Naseem et al. 2023). Furthermore, horn flies are important vectors of the filarial nematode responsible for skin lesions in cattle (Lui et al. 2023) as well as bacterial diseases such as *Staphylococcus aureus*-associated mastitis. Historically, *H. irritans* was introduced into North America between 1884 and 1886 with cattle imported from Europe. By 1898, it had already spread across the continent, from Canada to Texas and from Massachusetts to the Rocky Mountains. From the United States, *H. irritans* extended its range to the Caribbean, Central America, and several South American countries, including Venezuela, Colombia, Peru, and Chile. It was also accidentally introduced into Africa, from Madagascar to East Africa, and into Hawaii (Zumpt 1973). In North Africa, it is known from Morocco and Tunisia, but not from Libya or Egypt (Pont 1986).

In Algeria, no previous studies have documented the presence of *H. irritans*. The main objective of this study is therefore to confirm, for the first time, the occurrence of *H. irritans* on cattle in northeastern Algeria, specifically in the wilayas of Guelma and Mila, and to generate baseline epidemiological data. These findings will provide essential information for designing effective surveillance and control strategies against this economically significant ectoparasite. Control of these flies resulted in a weight gain of 15.44 kg in adult cows (Smythe et al. 2019).

Materials and methods

Study region

The study was conducted in two regions of northeastern Algeria, Mila and Guelma (Fig. 1), and sampling was carried out from May to September in both 2021 and 2022, during the season when the adult flies are active. Summers in these regions are short, very hot, dry, and mostly clear, whereas winters are long and chilly. In Mila province, the climate ranges from sub-humid in the northern part to semi-arid in the southern areas, with an average annual temperature of about 18 °C and mean annual rainfall of 610 mm (Kateb et al. 2019; Merghadi et al. 2018). Guelma province is characterized by a sub-humid climate in its northern and central parts, while the southern areas are semi-arid (Oulhaci and Attab 2024). Average annual temperatures range from 4 °C in winter to over 35 °C in summer, with an overall mean of approximately 17.3 °C. Precipitation varies considerably

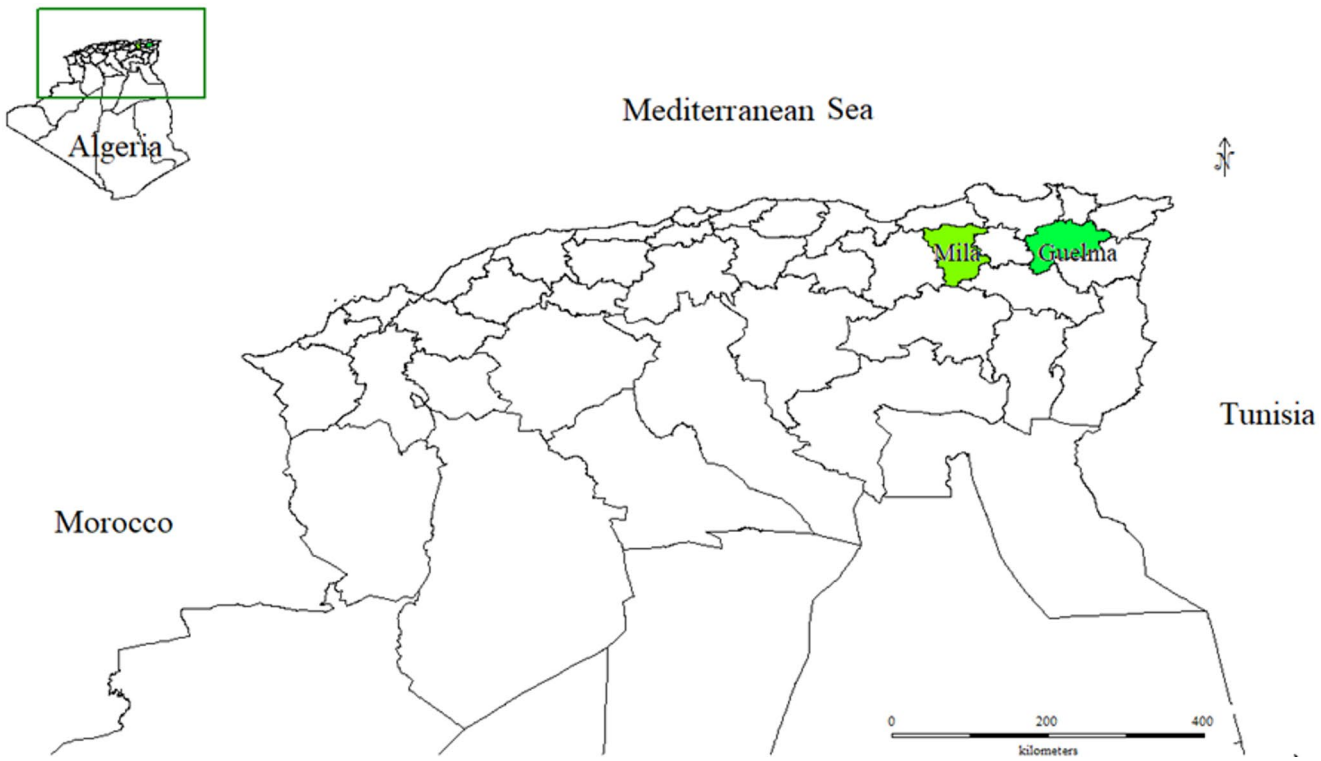

Fig. 1 Geographical location of Guelma, and Mila provinces, northeast Algeria

across the region, from 400 to 500 mm annually in the south to nearly 1,000 mm in the north (Meguini et al. 2018).

Study population

A total of 181 cattle were examined: 119 in Mila and 62 in Guelma. Among these, 64 were infested and selected for detailed analysis. The sample represented various age groups, breeds, sexes, and production types, providing a comprehensive overview of cattle in northeastern Algeria. Both dairy and beef cattle were included to capture potential differences in infestation patterns.

In Mila (N=39; 61%), the sample included 13 males (33%) and 26 females (67%), randomly selected from five small farms: Tadjenanet (N=13; 6♂, 7♀), Bouhatem (N=4; 2♂, 2♀), Chelghoum El Aid (N=13; 3♂, 10♀), El Meridj (N=5; 0♂, 5♀), and Ouled Tbib (N=4; 2♂, 2♀). The cattle belonged to five breeds: Breton Blackfoot (n=16; 41%), Crossbred (n=10; 26%), Plain Redfoot (n=6; 15%), Montbéliard (n=4; 10%), and Holstein (n=3; 8%). Age groups were classified as follows: one year (n=4; 10%), two years (n=6; 15%), three years (n=4; 10%), four years (n=4; 10%), five years (n=3; 8%), six years (n=3; 8%), seven years (n=10; 26%), eight years (n=4; 10%), and nine years (n=1; 3%). Production types included 25 dairy cows (64%) and 14 beef cattle (36%). Herd sizes ranged from 5 to 22 animals per farm, reflecting smallholder and semi-intensive farming systems.

In Guelma (N=25; 39%), the cattle included 8 males (32%) and 17 females (68%) from four localities: Hamam Ouled Ali (N=1; 0♂, 1♀), Nechmaya (N=6; 2♂, 4♀), Boumahra Ahmed (N=7; 3♂, 4♀), and Héliopolis (N=11; 3♂, 8♀). They belonged to four breeds: Breton Blackfoot (n=13; 52%), Plain Redfoot (n=7; 28%), Crossbred (n=3; 12%), and Montbéliard (n=2; 8%). The age distribution included cattle aged 2–4 years (n=4; 16%), 4–8 years (n=14; 56%), and up to 14 years (n=7; 28%). Production types included 15 dairy cows (60%) and 10 beef cattle (40%). Herd sizes were slightly smaller than in Mila, ranging from 4 to 13 animals per farm, reflecting more extensive livestock systems.

A semi-intensive breeding system predominates in Mila, where cattle graze on natural pastures during the day and are housed in stables at night depending on weather conditions. Antiparasitic treatments were irregular and applied sporadically, reflecting limited veterinary management. In contrast, in Guelma, while semi-intensive systems exist, extensive livestock farming predominates. Here, cattle remain outdoors with continuous access to pasture, and veterinary care, including antiparasitic treatments, was applied even more irregularly, reflecting traditional low-input farming practices.

Overall, the study population represented a diverse cross-section of cattle in northeastern Algeria, covering a range of breeds, ages, sexes, production types, herd sizes, and management systems. This diversity allows a comprehensive assessment of *H. irritans* infestation patterns according to demographic, zootechnical, and management factors (Table 1).

Flies' collection and identification

Sampling was carried out using a convenience sampling approach based on the availability of cattle in each farm. All animals present during the field visits were examined visually for the presence of *Haematobia irritans*. Infested and non-infested cattle were recorded, and adult flies were collected directly from infested animals using a sweep net and collection tubes. Each fly was pinned and stored in collection boxes. Detailed data on cattle age, breed, and sex were recorded. Morphological identification of specimens was performed under a stereo microscope Leica EZ4 during a visit by

Table 1 Demographic and zootechnical characteristics of the cattle population examined in Mila and Guelma

Parameter	Mila	Guelma	Total
Number of farms	5	4	9
Number of animals per farm	Tadjenanet: 13	Hamam Ouled Ali: 1	
	Bouhatem: 4	Nechmaya: 6	
	Chelghoum El Aid:13	Boumahra Ahmed :7	
	El Meridj: 5	Héliopolis: 11	
	Ouled Tbib: 4		
Animals examined (N)	119	62	181
Animals infested (N)	39	25	64
Sex distribution			
- Males (N, %)	13 (33%)	8 (32%	21 (33%)
- Females (N, %)	26 (67%)	17 (68%)	43 (67%)
Parasitological status			
- Parasitised	39	25	64
- Non-parasitised	80	37	117
Breed composition (N, %)			
- Breton Blackfoot	16 (41%)	13 (52%)	29 (45%)
- Plain Redfoot	6 (15%)	7 (28%)	13 (20%)
- Crossbred	10 (26%)	3 (12%)	13 (20%)
- Montbéliard	4 (10%)	2 (8%)	6 (9%)
- Holstein	3 (8%)		3 (5%)
Age distribution			
− 1–4 years	14 (35%)	4 (16%)	18 (28%)
− 4–8 years	20 (52%)	14 (56%)	34 (53%)
- > 8 years	5 (13%)	7 (28%)	12 (19%)
Production type			
- Dairy	25 (64%)	15 (60%)	40 (62%)
- Beef	14 (36%)	10 (40%)	24 (38%)
Breeding system	Semi-intensive	Predominantly extensive	

the first author to the Natural History Museum, University of Oxford, in direct collaboration with Adrian Pont. Identification was carried out using the key provided by Zumpt (1973), which confirmed that the specimens were *H. irritans*.

The species *H. irritans* belongs to the subfamily Stomoxyinae of the Diptera family Muscidae, all the species of which are characterized by possessing a strongly chitinised, non-retractile proboscis adapted for piercing skin. Adults of all species are obligatory blood feeders. Species of the genus *Haematobia* are characterized by their small size (length 3.0–4.5 mm), a relatively short proboscis that is only slightly longer than the length of the head, large palpi that are almost as long as the proboscis, and an antennal arista with plumes only on the dorsal surface. From other species of *Haematobia*, *H. irritans* can be distinguished by wing-vein A1 extending over half the distance from its base to the wing-margin and, in the male sex, by lacking a brush of short setae on tarsomeres 2–4 of the hind leg (as is present in the closely related buffalo fly, *H. exigua* (Meijere, 1903).

Statistical analysis

All data were exported to Microsoft Excel® for Windows® to calculate species frequency, prevalence, and mean infestation intensity, using epidemiological indicators defined by Bush et al. (1997):

- Infestation incidence (%) = 100 × (number of infested cattle/number of examined cattle).
- Infestation intensity = number of flies/number of infested cattle (Martin and Hine 2015).

All statistical analyses were performed using SPSS (version 20) to analyze the relationship between *Haematobia irritans* counts and different animal-related factors, including sex, breed, and age. The analysis aimed to determine whether these variables had a significant influence on fly abundance.

Non-parametric statistical tests were applied because the distribution of fly counts did not meet normality assumptions. The Kruskal-Wallis test was used to compare fly numbers among the different categories. Significance was set at $p < 0.05$ (Debbarma et al. 2018).

Results

A total of 1040 adult *Haematobia irritans* specimens were collected and identified morphologically from cattle in the Guelma and Mila regions between May and September of 2021 and 2022. The sex ratio was male-biased, with 64% males ($n = 669$) and 36% females ($n = 371$). Regarding geographical distribution, Guelma accounted for 60% ($n = 619$) of the total specimens, while Mila contributed 40% ($n = 421$), indicating a higher infestation pressure in Guelma (Table 2).

The prevalence of *H. irritans* infestation was not significantly different between males and females, as shown by the data from both Mila (Table 2) and Guelma (Table 3) ($p > 0.05$).

Infestation prevalence was slightly higher in males (Mila: 84.62%; Guelma: 87.5%) than in females (Mila: 76.92%; Guelma: 76.5%). Infestation intensity was greater in Guelma (13.38 flies/cow in females; 12.62 flies/cow in males; Table 3) compared to Mila (5.15 flies/cow in females; 5 flies/cow in males; Table 3). Despite these differences, statistical analysis showed no significant variation between sexes ($p = 0.383$).

With respect to breed, the highest prevalence and infestation intensities were recorded in Breton Blackfoot cattle, accounting for 41.02% of infestations in Mila (Table 3) and 52% in Guelma (Table 3), with intensities of 15.37 and 30.08 flies/cow, respectively. Montbéliard and Holstein breeds showed the lowest prevalence and intensities in both regions. However, these differences were not statistically significant ($p = 0.064$).

Analysis by age group revealed that older cattle were more heavily infested. In Mila, the highest prevalence (25.6%) occurred in animals aged 7–8 years, with infestation intensity reaching 23.7.

flies/cow in cattle aged 8–9 years (Table 2). In Guelma, the highest prevalence (30%) was observed in cattle aged 7–8 years, with intensity reaching 45.7 flies/cow (Table 4).

In contrast, young animals (1–2 years) had only light infestations (prevalence: 5.1% in Mila; 6.3% in Guelma), and calves younger than one year were free of infestation in both regions. Very old cattle (> 12 years) also showed minimal prevalence and low infestation levels. Despite these trends, statistical analysis revealed no significant differences in prevalence ($p = 0.160$) or intensity by age.

Overall, the Kruskal-Wallis test confirmed no statistically significant differences in *H. irritans* infestation with respect to sex ($p = 0.383$), age ($p = 0.160$), or breed ($p = 0.064$). However, descriptive data indicated slightly higher infestations in females (Fig. 2), a tendency for increased infestation with age, especially in 7-year-old cattle (Fig. 3), and higher median fly counts in Breton Blackfoot cattle compared to other breeds (Fig. 4).

Discussion

This study represents the first documented observation of *Haematobia irritans* on cattle in northeastern Algeria, specifically in the regions of Guelma and Mila. It highlights the establishment of this ectoparasite in Algeria and underlines the need

Table 2 Prevalence and intensity of *Haematobia irritans* infestation according to breed, sex, and age of cattle in Northeast Algeria

Cattle	Mila				Guelma			
Age (years)	Number	Flies number	Prevalence %	Intensity (flies/cow)	Number	Flies number	Prevalence %	Intensity (flies/cow)
(0–1)	0	0	0	0	0	0	0	0
(1–2)	4	16	3.36	4	0	0	0	0
(2–3)	6	25	5.04	4.2	3	31	4.84	10.3
(3–4)	4	38	3.36	9.5	1	10	1.61	10
(4–5)	4	32	3.36	8	4	119	6.45	29.8
(5–6)	3	22	2.52	7.3	0	0	0	0
(6–7)	3	41	2.52	13.7	2	30	3.23	15
(7–8)	10	140	8.40	14	8	366	12.9	45.8
(8–9)	4	95	3.36	23.8	1	4	1.61	4.0
(9–10)	1	12	0.84	12	1	21	1.61	21
(10–11)	0	0	0	0	0	0	0	0
(11–12)	0	0	0	0	3	17	4.84	5.7
(12–13)	0	0	0	0	1	14	1.61	14
(13–14)	0	0	0	0	0	0	0	0
(14–15)	0	0	0	0	1	7	1.61	7.0
Sex								
Female	26	328	21.85	12.6	17	462	27.42	27.2
Male	13	93	10.92	7.2	8	157	12.90	19.6
Breed								
Crossbred	10	49	8.40	4.9	3	33	4.84	11
Montbéliard	4	49	3.36	12.3	2	14	3.23	7
Holstein	3	29	2.52	9.7	0	0	0	
Plain Redfoot	6	48	5.04	8	7	181	11.29	25.9
Breton Blackfoot	16	246	13.45	15.4	13	391	20.97	30.1
Total	**39**	**421**	**32.77**	**10.8**	**25**	**619**	**40.32**	**24.8**

Table 3 Adult of *Haematobia irritans* infestation rate according to cattle age, sex and breed in Mila. Northeast Algeria

Cattle	Prevalence %					Intensity (flies/cow)		
	Cattle Number	Flies	Females	Males	Flies	Females	Males	Sex ratio
Age (years)								
(0–1)	0	0	0	0	0	0	0	0
(1–2)	4	10.3	5.13	10.3	4	2.5	2.75	0.45
(2–3)	6	15.4	10.3	10.3	4.2	2	4.25	0.5
(3–4)	4	10.3	7.7	7.7	9.5	5	5.7	0.65
(4–5)	4	10.3	10.3	10.3	8	2	6.5	0.23
(5–6)	3	7.7	7.7	7.7	7.33	3	4.33	0.7
(6–7)	3	7.7	5.13	7.7	13.7	12	5.6	1.41
(7–8)	10	25.6	20.51	20.51	14	5.22	10.3	0.50
(8–9)	4	10.3	12.82	10.3	23.7	6.7	17	0.4
(9–10)	1	2.6	0	2.6	12	0	12	0
Sex								
Female	26	66.7	76.92	92.30	17.8	5.15	22.5	0.46
Male	13	33.3	76.92	84.62	12.1	3.8	5	0.69
Breed								
Crossbred	10	25.6	20.5	23.08	4.9	2.25	3.44	0.58
Montbéliard	4	10.3	5.13	10.3	12.25	8.5	8	0.53
Holstein	3	7.7	7.7	7.7	9.66	2.33	7.33	0.32
Plain Redfoot	6	15.4	12.82	12.82	8	2.8	6.8	0.41
Breton Blackfoot	16	41.02	30.8	35.9	15.37	7.08	11.5	0.53

Table 4 Adult of *Haematobia irritans* infestation rate according to cattle age, sex and breed in Guelma. Northeast Algeria

Cattle	Prevalence %				Intensity (flies/cow)			
	Cattle Number	Flies	Females	Males	Flies	Females	Males	Sex ratio
Age (years)								
(0–1)	0	0	0	0	0	0	0	0
(1–2)	0	0	0	0	0	0	0	0
(2–3)	3	12	12	12	10.3	3.7	6.7	0.55
(3–4)	1	4	0	4	10	0	10	0
(4–5)	4	16	16	16	29.7	7.5	22.25	0.34
(5–6)	0	0	0	0	0	0	0	0
(6–7)	2	8	8	8	10	7	8	0.87
(7–8)	8	32	32	32	45.7	20.12	25.62	0.78
(8–9)	1	4	4	4	4	2	20	1
(9–10)	1	4	4	4	21	9	120	0.75
(10–11)	0	0	0	0	0	0	0	0
(11–12)	3	12	4	12	5.6	3	4.66	0.21
(12–13)	1	4	0	4	14	0	14	0
(13–14)	0	0	0	0	0	0	0	0
(14–15)	1	4	0	4	7	1	7	0
Sex								
Female	17	68	76.5	100	19.3	13.38	16.94	0.60
Male	8	32	87.5	100	11.6	8	12.62	0.55
Breed								
Crossbred	3	12	8	12	11	7	6.33	0.74
montbéliard	2	8	8	8	7	2.5	4.5	0.55
Plain Redfoot	7	28	24	28	25.8	10.33	17	0.52
Breton Blackfoot	13	52	40	52	30.08	14.9	18.61	0.61

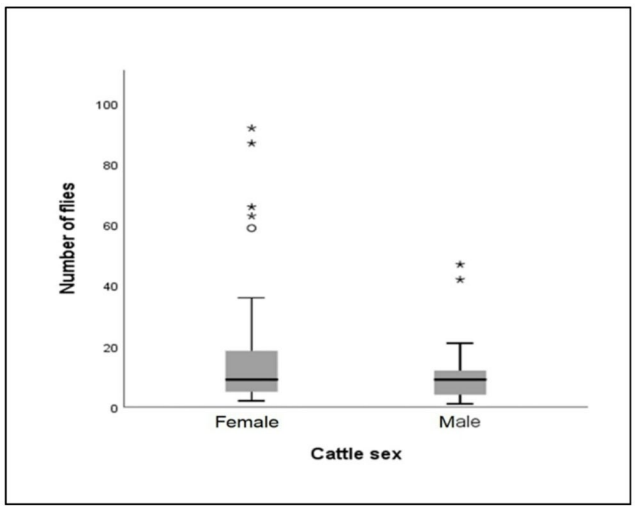

Fig. 2 Distribution of *Haematobia irritans* according to cattle sex (Kruskal–Wallis test)

for continuous monitoring, given its considerable economic impact. These findings confirm the status of *H. irritans* as one of the most harmful parasites affecting cattle worldwide.

Our results differ from some studies conducted elsewhere. For example, in the United States, infestations of *H. irritans* in mixed-breed Black Angus and Charolais cattle were found to be, on average, four times higher in black-coated cattle compared to white-coated cattle (Scasta and Smith 2018). According to Pont (1986), *H. irritans* was not reported in Algeria in the *Catalogue of Palaearctic Diptera*. Our collections therefore represent a new record for the country. Since then, very few studies have focused on these biting flies in North Africa. Although the species has also been reported in Morocco, the most recent published data dates back to 1930 (Kettani et al. 2022).

The current detection of *H. irritans* in the two studied regions thus makes a valuable contribution to knowledge of its geographic distribution. While specific studies on horn fly populations in Algeria are lacking, the species is known to have an almost cosmopolitan distribution, occurring in temperate and subtropical regions of the Northern Hemisphere, including Europe, Asia Minor, and North Africa (Espinoza et al. 2025). In the present study, *H. irritans* was recorded on several cattle breeds (Crossbred, Holstein, Montbéliard, Breton Blackfoot, and Plain Redfoot), with significant infestations in both areas.

Our findings are consistent with reports from regions that share climatic similarities with Guelma and Mila. For example, in Aguascalientes, Mexico, a dairy study conducted between March 1999 and March 2001 showed that *H. irritans* abundance peaked in late summer and autumn. Fly population fluctuations were strongly correlated with temperature (correlation coefficients ~ 0.80–0.85), moderately with relative humidity, and not with rainfall

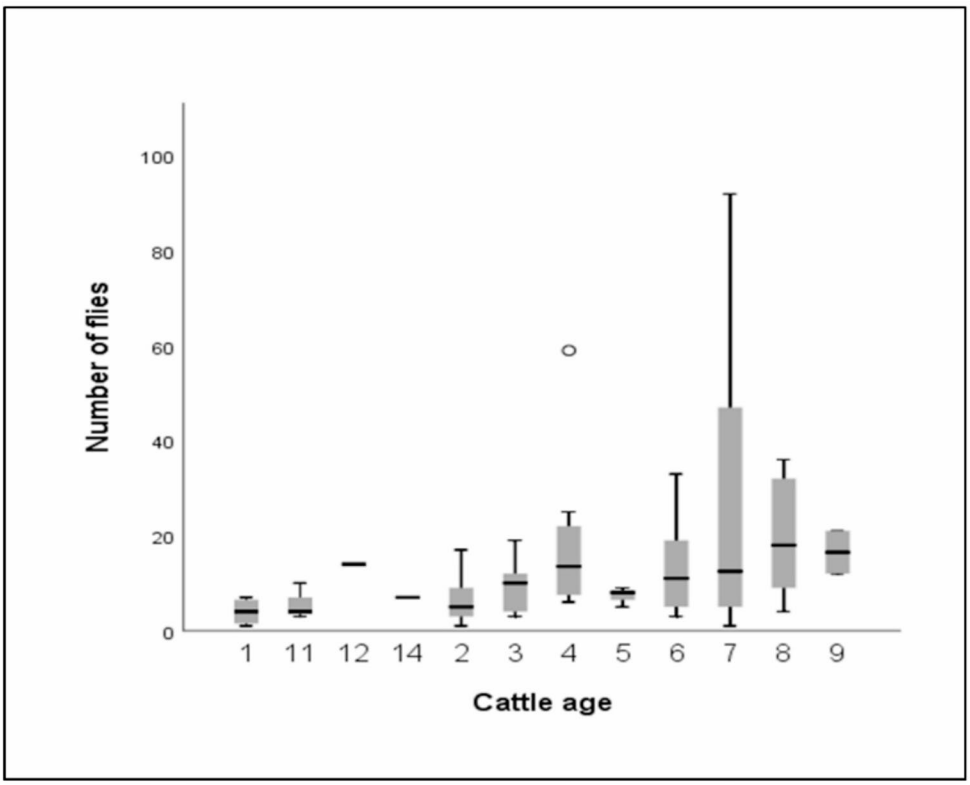

Fig. 3 Distribution of *Haematobia irritans* according to cattle age (Kruskal-Wallis test)

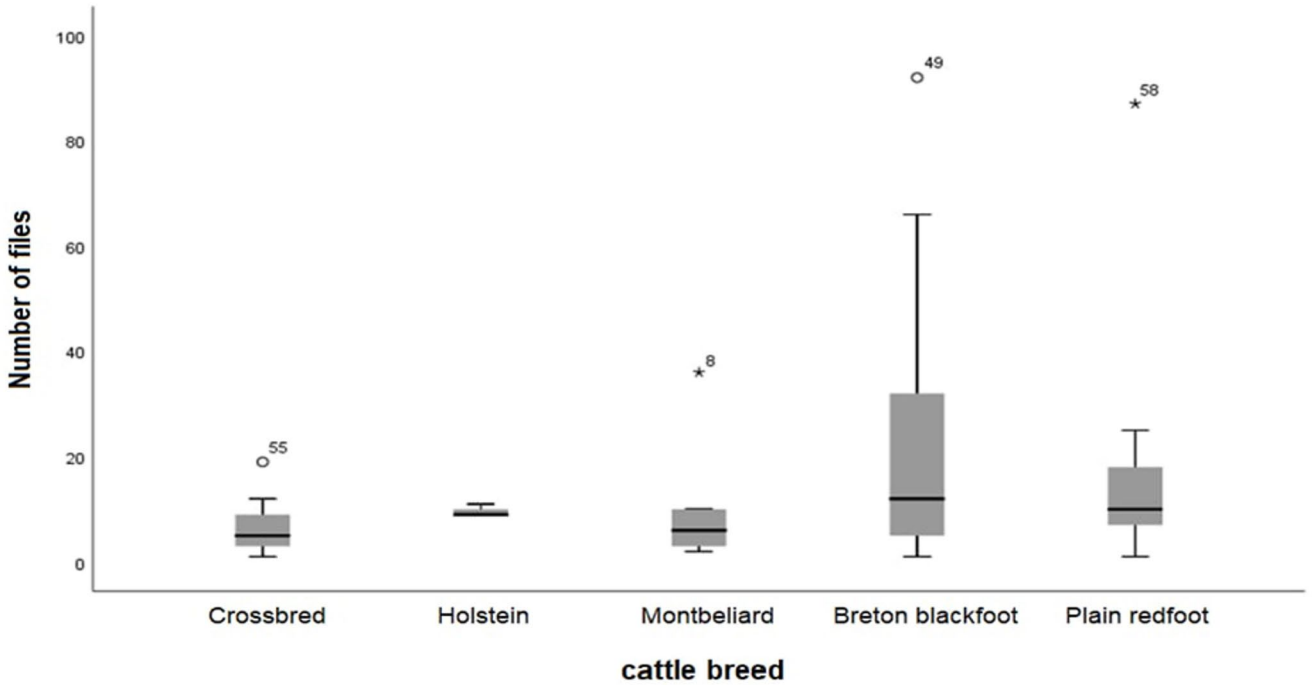

Fig. 4 Distribution of *Haematobia irritans* according to cattle breed (Kruskal–Wallis test)

(Rodríguez-Vivas et al. 2001). Although Aguascalientes has a semi-arid climate distinct from the strictly Mediterranean conditions of Guelma and Mila, both regions share the characteristic of hot summers. This similarity supports the comparison, as temperature rather than rainfall appears to be the primary factor driving horn fly abundance.

Our observations also confirm the characteristic behavior of horn flies, which tend to cluster around the horns of

cattle. According to the Merck Veterinary Manual (2025), horn flies typically concentrate at the base of the horns when ambient temperatures are below 21 °C, while in warmer conditions they aggregate in even larger numbers around this area. This behavior reflects both feeding preferences and host anatomy.

Although sex did not appear to influence infestation levels in our study, other research has reported variations by breed and age. In our case, environmental factors, particularly hot and dry summers, probably favored *H. irritans* abundance. This aligns with previous observations that horn fly emergence and season duration are strongly linked to higher temperatures and longer summers (Scasta and Engle 2017). The irregular application of antiparasitic treatments may also have contributed to the persistence of infestations. Similarly, in Oklahoma, Scasta and Engle (2017) demonstrated that management practices, such as patch-burn grazing, significantly influenced horn fly loads, highlighting the importance of adopting effective control strategies to regulate fly populations.

Conclusion

The results of this study indicate that the level of *Haematobia irritans* infestation varies according to biotic factors, including the sex, age, and breed of cattle. Variations were also observed between male and female flies. However, these findings are limited to the studied areas and sampling period, and do not account for seasonal variation, environmental factors, or management practices. Further studies covering additional regions of Algeria are therefore required to better characterize infestation patterns. The data generated in this study contribute to the georeferenced documentation of *H. irritans* and may support the development of appropriate monitoring and control strategies under local conditions.

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Author contributions All authors contributed to the study design. BH, DL, AC.P and KK wrote the main manuscript. BH and DL collected the flies and drafted the manuscript. AC.P, KK planned the research and carried out species identification.

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Data availability All Data are provided within the manuscript and in the supplementary files.

Declarations

Ethics and consent to participate Not applicable.

Competing interests The authors declare no competing interests.

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