Popular Agriculture 2(4) 67-69(July, 2026)
Published at popularagriculture.com

Global E-Magazine
ISSN: 3139-7603

POPULAR ARTICLE

Infrared thermography, a non-invasive tool to detect ectoparasite in dairy cattle

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Manuscript received: June 9, 2026; Decision on manuscript, June 29, 2026; Manuscript accepted: July 12, 2026

Introduction

Cattle raised under field or pasture conditions frequently endure infestations by multiple ectoparasite species simultaneously, which significantly affects livestock health and productivity. Accurate quantification of these infestations is critical for implementing effective control strategies and minimizing the consequential economic losses. Visual counting remains a common method for assessing ectoparasite burdens, yet it presents notable limitations, particularly under conditions of high infestation intensity.

Infrared thermography (IRT)

Infrared thermography (IRT) is a non-invasive technology that enables the remote measurement of an animal's surface temperature by detecting emitted thermal radiation (Sathiyabarathi *et al.*, 2016; Lowe *et al.,* 2019). The discovery of infrared light dates back to 1800 when Sir William Herschel, a German-born astronomer naturalized in England, conducted experiments that led to the identification of thermal radiation, later termed infrared light or infrared radiation. IRT operates by detecting heat emitted from anatomical regions with a high density of near-surface blood vessels, which regulate heat exchange with the environment through blood flow modulation (Mota-Rojas *et al.,* 2021; Bagavathi *et al.*, 2026).

Correlation between the standard visual method and thermographic imaging

Researchers found that there is a strong correlation (0.82) between the standard visual method and thermographic imaging combined with an automatic ectoparasite counting program for detecting horn flies in cattle, regardless of breed. However, visual counting alone can be inaccurate, especially in cases of large infestations, as horn flies frequently move between animals, making it difficult for slower observers to obtain precise counts (de Castro *et al.*, 2026). For tick infestations, errors mainly arise due to challenges

Popular Agriculture **2(4) 67-69(July, 2026)**
Published at popularagriculture.com
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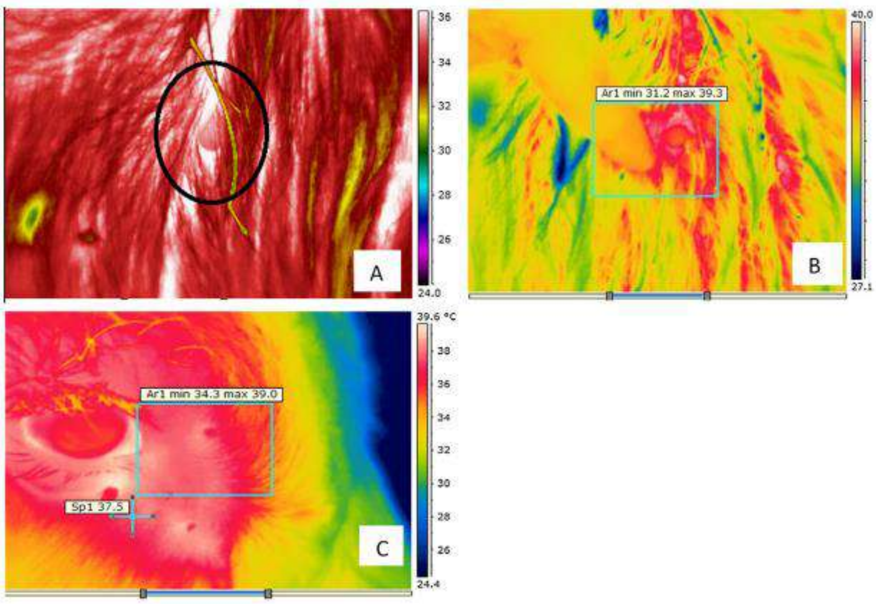
in detecting teleogene ticks smaller than 4 mm in diameter. Additionally, factors such as hair length, as well as skin and hair color, can interfere with accurate visual counts of ticks and horn flies. Research by Cortivo *et al.*, (2016) further demonstrated that video recording provided a more accurate count of flies compared to visual observation, highlighting the advantages of using imaging technologies for ectoparasite monitoring.

Detecting ectoparasites using infrared thermography (IRT)

Thermographic imaging has proven to be a valuable tool in detecting teleogene ticks, even those concealed beneath an animal's thick coat. Fig. 1, demonstrated the thermographic images that revealed hidden teleogene ticks under dense fur (A, B) and an engorged teleogene tick on the animal's face (C). This highlights the advantage of IRT in parasite detection, as it can identify heat signatures of ectoparasites that may be overlooked during standard visual inspections.

Fig 1: Infrared Thermographic image of ectoparasites (teleogene ticks) hidden under dense fur in dairy cattle. (Cortivo *et al.*,2016)



The combination of thermographic imaging and an image analysis program for the automatic counting of ectoparasites offers a significant advantage over traditional methods. This infrared thermography (IRT) technique is effective at any level of infestation, regardless of breed, making it a versatile and reliable tool for parasite detection. The principle behind this method lies in the surface temperature difference between the ectoparasites and the host. Since insects regulate their temperature based on the environment, their body temperature can vary widely, typically ranging between 33.0°C and 34.0°C. The presence of inflammation caused by parasites further increases the temperature contrast between the parasite and the affected area, enhancing detection accuracy. This thermal contrast allows for a more precise identification and counting of ectoparasites using infrared imaging, improving monitoring and control strategies in livestock management. The precision and speed of ectoparasite counting methods are crucial for effective parasite management in livestock management.

Conclusion

Thermographic imaging combined with an automatic counting program offers a fast, objective, and highly accurate alternative to traditional visual counting methods. This approach is easy to implement, verifiable, and minimizes human error, making it a more efficient and reliable tool for monitoring ectoparasite infestations compared to standard visual assessments.

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