# The Kubic FLOTAC Microscope: a new tool for helminth eggs diagnosis in veterinary and human field

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## INTRODUCTION

In the last decades several studies have been focused on the development of semi-automated and automated systems for assessing Faecal Egg Count (FEC) in the veterinary and human fields (Vercruysse et al., 2018). The use of these new diagnostic technologies is beginning to offer potential solutions to overcome gaps and limitations of FEC techniques (i.e., human errors and time for analysis). In this study a new automated system for diagnosis of helminth eggs in veterinary and human fields is presented, the Kubic FLOTAC Microscope (KFM) (Cringoli et al., 2021).

## MATERIALS AND METHODS

The KFM is a compact and portable digital microscope designed to analyse faecal specimens prepared with the Mini-FLOTAC/FLOTAC (Fig.1) in both field and laboratory settings. This system can be remotely controlled via software by an external device, i.e., smartphone, tablet or PC, or via internet it is possible to transfer the captured pictures to other laboratories, that could be very useful to create a network or to support operators directly in the field. Recently, an Artificial Intelligence (AI) based predictive model was developed to perform a rapid, easy and precise automated recognizing and counting of parasitic elements. For this purpose, a dataset with 18,944 objects (parasitic eggs) was used, including samples of gastrointestinal nematodes (GIN) from large and small ruminants, as well as *Trichuris vulpis* and *Toxocara canis* from dogs and *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Trichuris trichiura* from humans (confirmed by experts).

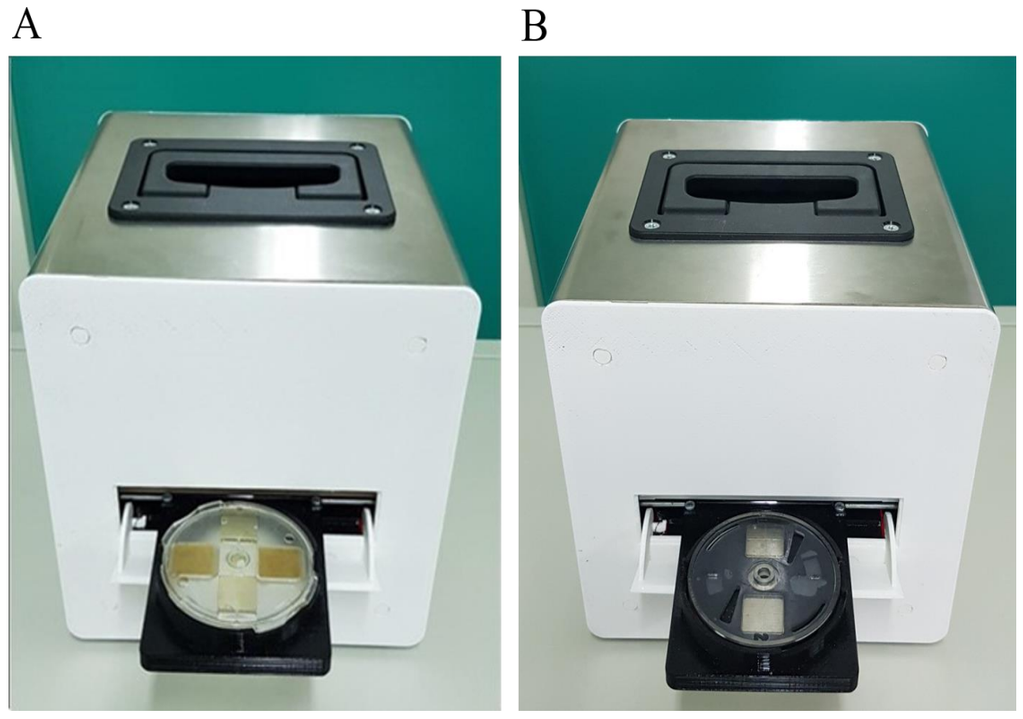


**Figure 1.** The Kubic FLOTAC Microscope (KFM) used with the Mini-FLOTAC (A) and FLOTAC devices (B).

## RESULTS AND CONCLUSIONS

The KFM combines the high sensitivity, accuracy and precision of the Mini-FLOTAC/FLOTAC techniques with a reliable AI system that was able to recognize 99.0% of the eggs analysed. In figures 2-4 are reported the digital imaging of GIN eggs from cattle and *Trichuris vulpis* and *Toxocara canis* from dogs.

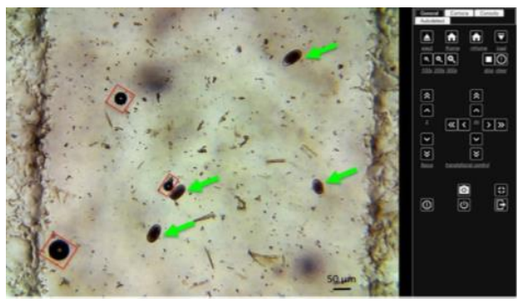

**Figure 2.** An image of a part of a Mini-FLOTAC chamber, captured by PC connected with the microscope that shows GIN eggs (green arrows) and air bubbles (red squares).

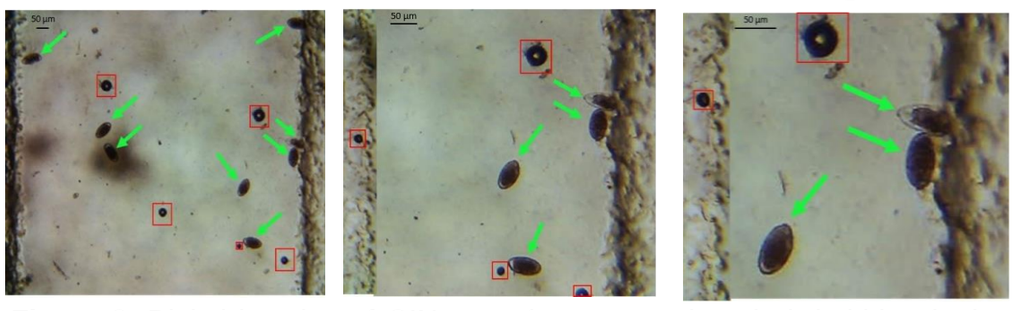


**Figure 3.** Digital imaging of GIN eggs (green arrow) and air bubbles (red square) using the KFM with a digital zoom 100X (A) 200X (B) and 300X (C).

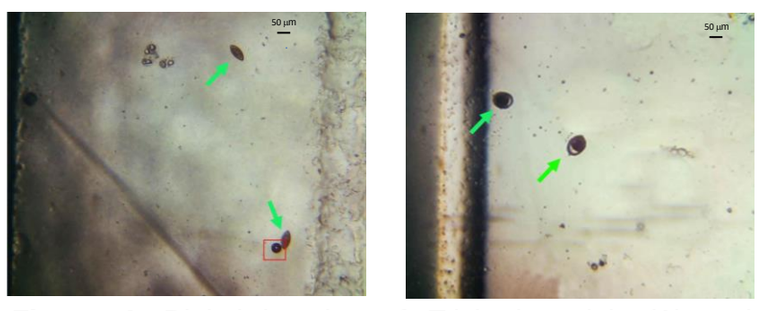


**Figure 4.** Digital imaging of *Trichuris vulpis* (A) and *Toxocara canis* (B) (green arrow) and air bubbles (red square) using the KFM with a digital zoom 100X.

Based on results obtained from first validations, the KFM is a promising automated system for a rapid and accurate assessment of FEC to improve the diagnosis of veterinary and human parasitic infections.

**References-** Cringoli G, Amadesi A, Maurelli MP, Celano B, Piantedosi G., Bosco A, Ciuca L., Cesarelli M, Bifuco P, Montresor A, Rinaldi L (2021) The Kubic FLOTAC microscope (KFM): a new compact digital microscope for helminth egg counts. *Parasitology* 148(4):427-434; Vercruysse J, Charlier J, Van Dijk J, Morgan ER, Geary T, von Samson-Himmelstjerna G, Claerebout E (2018) Control of helminth ruminant infections by 2030. *Parasitology* 145, 1655–1664.