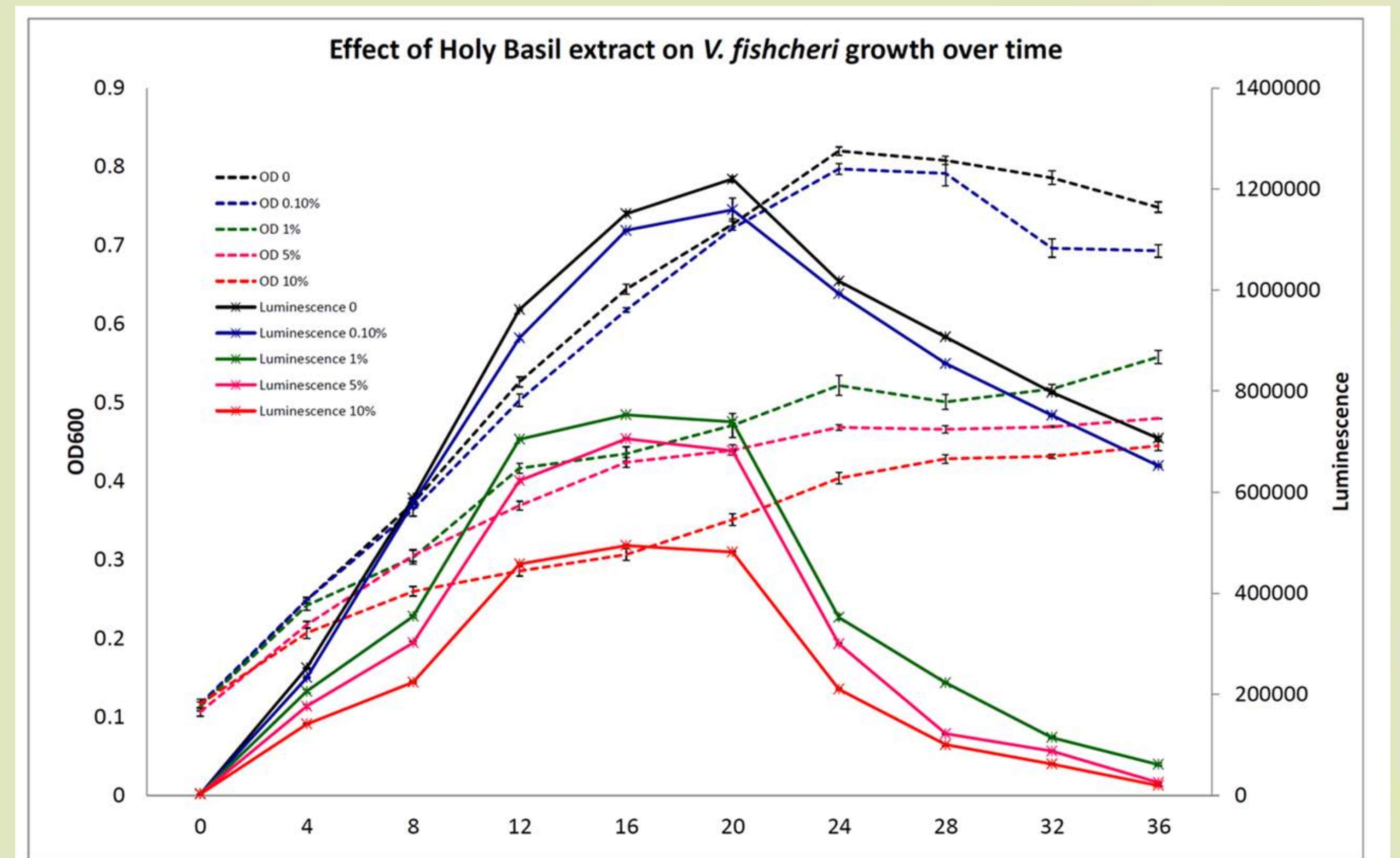


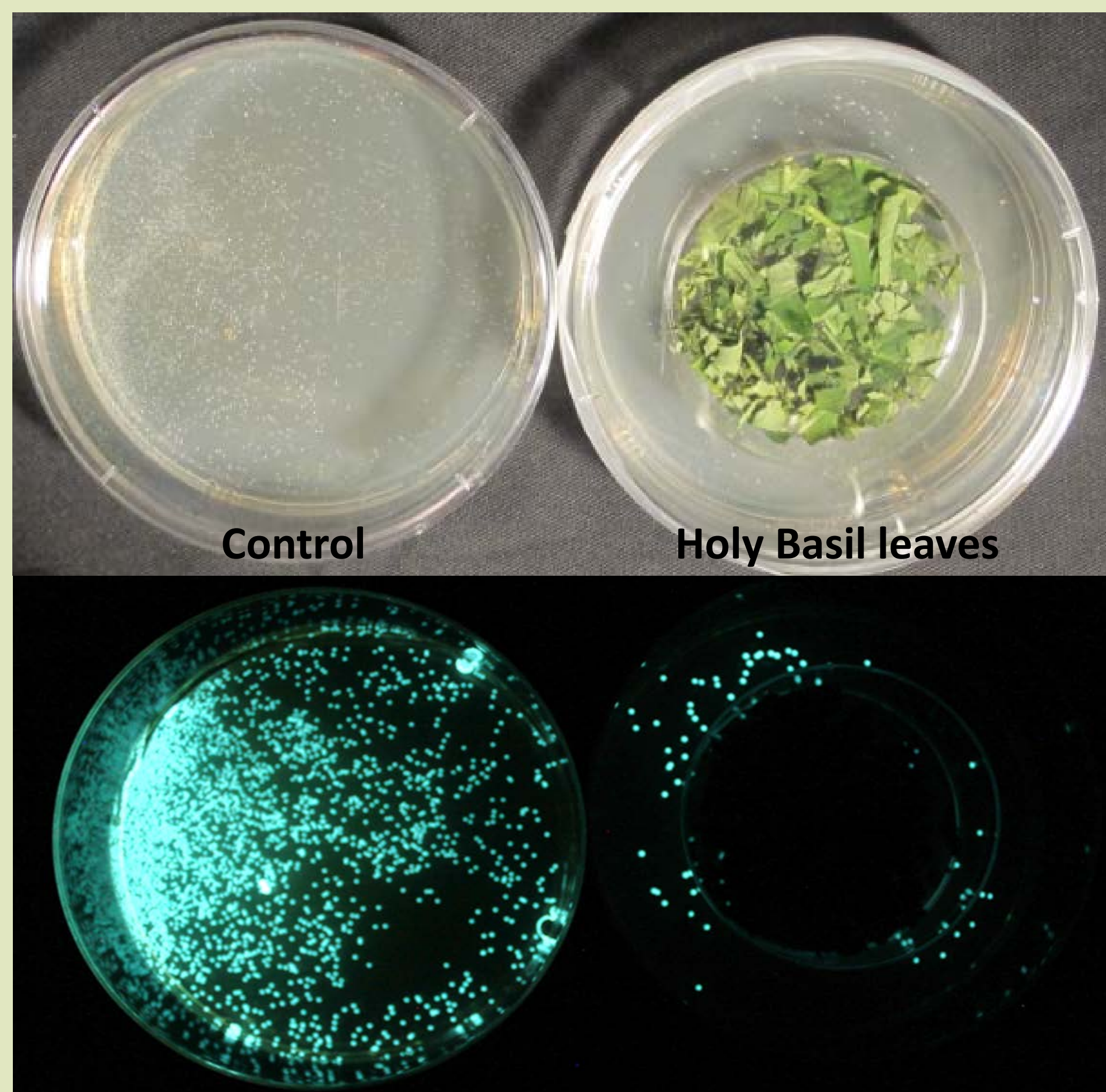
V. fischeri is a rod-shaped, Gram-negative bacterium that bioluminesces because of a mechanism called quorum sensing, which is dependent on its population. Quorum sensing bacteria release signal molecules called autoinducers, and when there are enough of them in a bacterial community, receptor proteins on the bacteria recognize the molecules and express group behavioural genes. These genes control things such as virulence in a variety of bacteria and bioluminescence in *Vibrio fischeri*. Bioluminescence intensity reflects the overall autoinducer production of the bacteria, and bacterial health can be observed depending on the intensity of bioluminescence.

The purpose of this study was to explore the use of bioluminescent bacteria *V. fischeri* as a rapid, accurate and inexpensive method to test the antibacterial properties of herbal plants. The effective herbal plants have the potential to be used as new types of antibiotics for treating infectious diseases such as *Vibrio cholera*.



Out of the six plant extracts tested, Holy Basil extract was most efficient in reducing luminescence of *V. fischeri*.

Volatile effect of Holy Basil leaves on *V. fischeri*



- Freshly chopped leaves of Holy Basil were placed in a small Petri dish, and placed in the centre of a larger Petri plate smeared with bacteria.
- Reduced colony counts and luminescence were observed in the presence of Holy leaves.

Volatile effect of Linalool on encapsulated *V. fischeri* bacteria



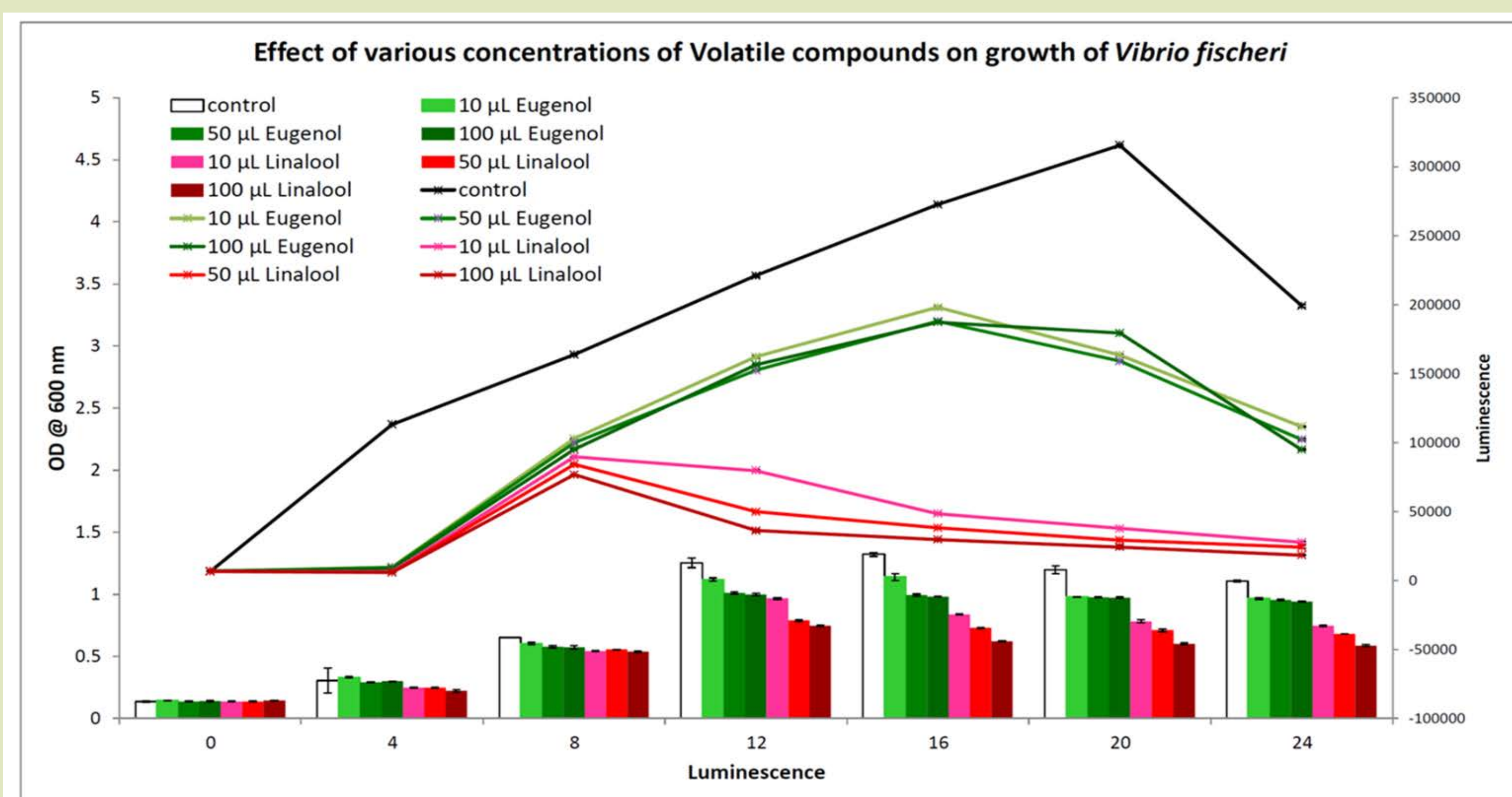
- A new bioassay was created to test the reduction of luminescence in *V. fischeri* bacteria, using sodium alginate beads.
- Due to the presence of Linalool, bacteria encapsulated in the beads were not able to luminesce.

Table 1: Comparison of different plant extracts based on average Luminescence

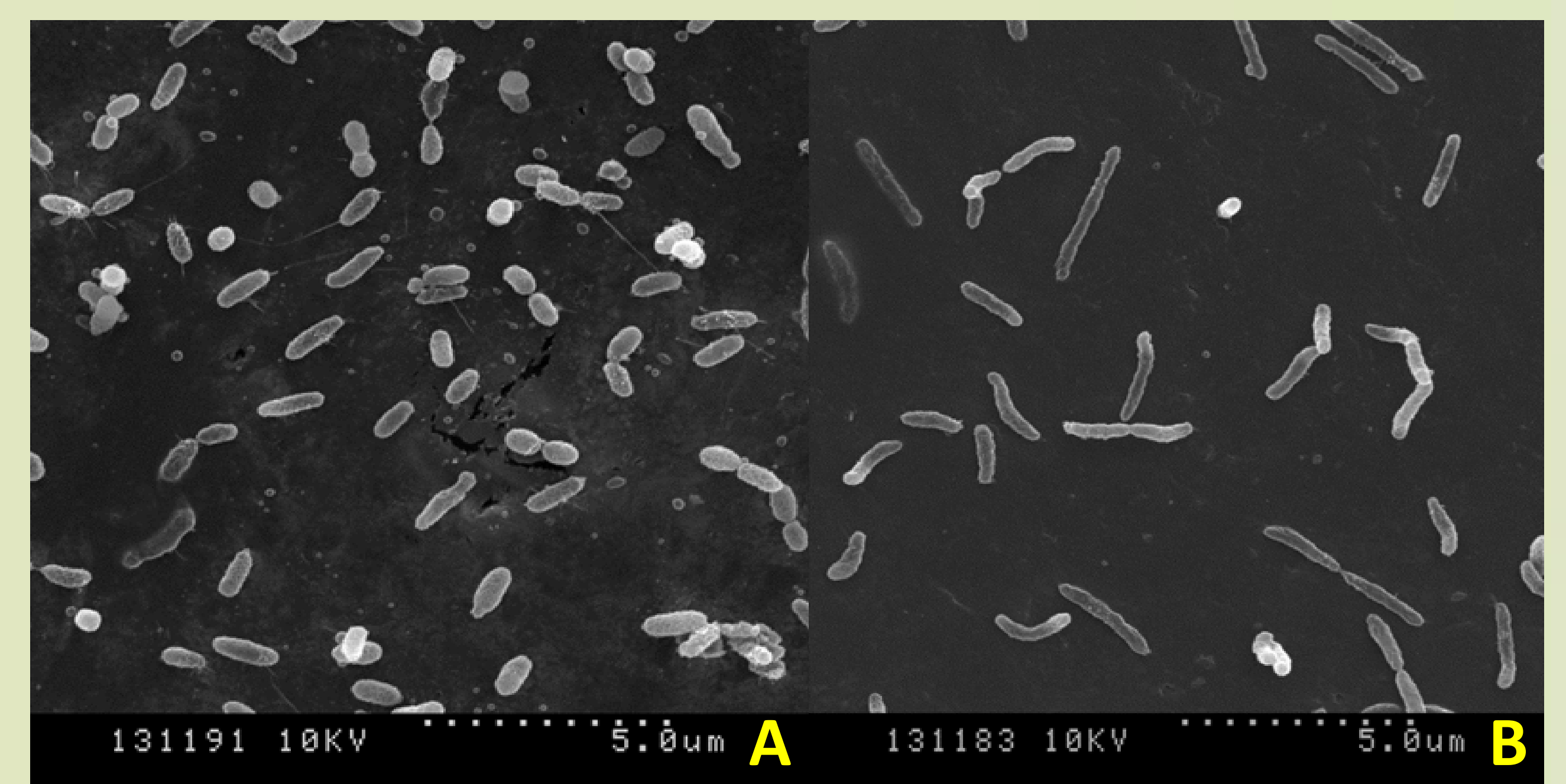
Plant Extract	Average Luminescence*
Nutmeg	704883.4 ^a
Coriander	699523.5 ^a
Cumin	697174.9 ^a
Turmeric	507168.2 ^{ab}
Artemisia	499782.9 ^{ab}
Holy basil	472644.2 ^b

*Levels not connected by same letter are significantly different according to Tukey's T test at $\alpha=0.05$

Volatile effect of Eugenol and Linalool on *V. fischeri* growth



- Different concentrations of Eugenol and Linalool (10, 50, 100 μM) were used to see their volatile effect on luminescence and OD values of *V. fischeri*.
- Eugenol and Linalool lowered the luminescence and OD readings without contact, with the bacteria however Linalool was significantly more effective than Eugenol for all concentrations.
- The volatile effect of Linalool was the optimum treatment, as there was significant reduction in luminescence and OD readings, dependent on doses.



- SEM images of *V. fischeri* bacteria – untreated (A) and treated with linalool 50 μM (B) without contact.
- Linalool may be an effective osmotic stress agent as observed through an SEM

Measuring luminescence of *V. fischeri* bacteria due to the addition of medicinal plants extract is an efficient and fast way to test their antimicrobial properties, as it was proven that volatile effect of Linalool is an effective antibacterial agent without contact.

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